

Fire Protection Hydraulic Calculations

for

PSE Operational Training Facility
325 Todd Road NW
Puyallup, WA 98371



Job #11-2418

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MEMORANDUM

TO: BRIAN JOHNSON, WATER SYSTEM
SPECIALIST
FROM: KERRI SIDEBOTTOM, P.E.
DATE: JULY 12, 2018
SUBJECT: 300 BLOCK TODD ROAD NW FIRE FLOW
AVAILABILITY
CITY OF PUYALLUP, PIERCE COUNTY,
WASHINGTON
G&O #16474.07

Per your request, I have analyzed the request for available fire flow at the 300 block of Todd Road NW. The following assumptions were entered into the hydraulic model to determine the static pressure and available fire flow:

- The available fire flows and pressures are measured at Nodes J1539 and J1533, corresponding to the west end and midpoint of the proposed main, as shown on the attached figure.
- Water system demands are based on projected 2030 demands and reservoirs are depleted of fire suppression and equalizing storage, as established in the 2011 Water System Plan approved by the Department of Health.
- All pump stations are idle, and the Salmon Springs source is operating at 1,100 gpm.

The proposed development is located in Zone 1, which is supplied by the Maplewood Springs and 15th Avenue SE Reservoirs. The developer has proposed installing a dead-end 12-inch pipe along Todd Road NW from Spencer Street North to 4th Street NW, as shown on the attached figure produced by the City.

Under 2030 peak hour demands, approximately 45 psi is available at the site. Table 1 shows model results based on the proposed piping connecting to the City's existing system at Spencer Street North with 2030 maximum day water system demands and fire flow. The results represent the available flow at Nodes J1539 and J1533 while maintaining a minimum system pressure of 20 psi and a maximum flow velocity of 10 fps.



TABLE 1
Fire Flow Availability

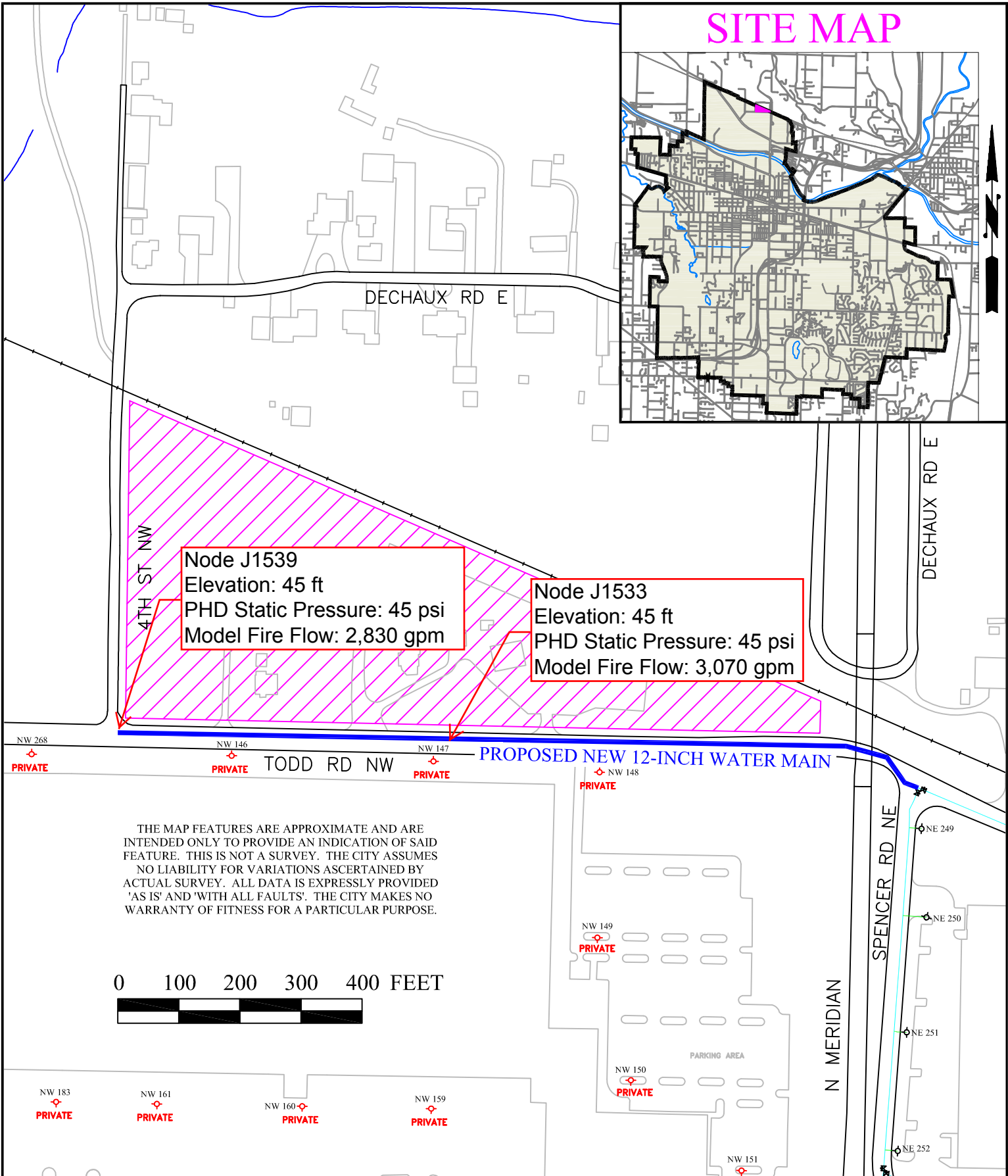
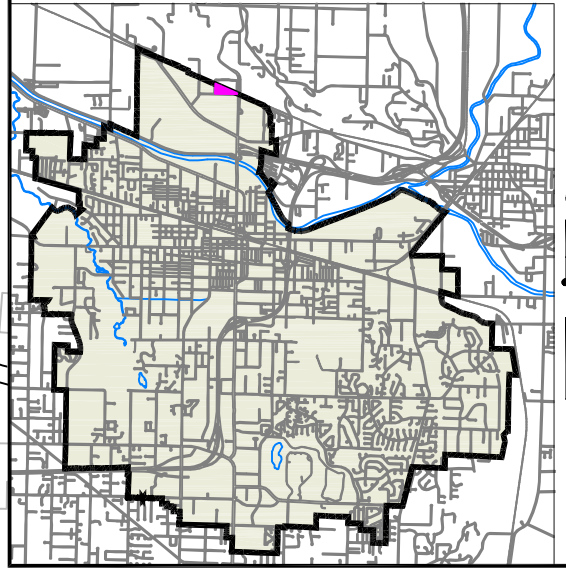
Node	Residual Pressure at Required Fire Flow (psi)	Available Fire Flow (gpm)⁽¹⁾	Minimum System Pressure at Available Fire Flow (gpm)
J1533	20	3,070	20
J1539	20	2,830	20

(1) Lower of the available flow at 20 psi or 10 fps.

The Department of Health and City standards for water distribution systems are to meet the peak hourly demand of the system while providing a minimum pressure of 30 psi system-wide. Under peak daily demand with a fire flow, the system is designed to maintain a minimum pressure of 20 psi system-wide. Although the peak hourly demand pressure may currently be higher than these standards, the developer must recognize that the City may not provide pressure higher than 30 psi in the future. The developer may design their sprinkler system for whatever pressure they wish; however, they must recognize and be responsible for conditions when the pressure may be less than what currently exists.

KS/hh
Encl.

SITE MAP



CITY OF PUYALLUP
PUBLIC WORKS
WATER DIVISION

HYDRAULIC MODEL FOR THE 300 BLOCK OF TODD ROAD NW

SCALE AS SHOWN

07/10/2018

F:\YARDS\WATER\S_MAINT\PDF\QSEC\PG081\MODEL FOR TODD RD NW 7-2018

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HYDRAULIC CALCULATIONS

FOR

**PSE OTC
COVERED AREA DRY SYSTEM**

**FILE NUMBER: 2418 L1 COVERED AREA
DATE: NOV 3, 2024**

-DESIGN DATA-

OCCUPANCY CLASSIFICATION:	ORDINARY GROUP II
DENSITY:	.20gpm/sq. ft.
AREA OF APPLICATION:	1950sq. ft.
COVERAGE PER SPRINKLER:	VARIABLES 130 SQ FT MAX
NUMBER OF SPRINKLERS CALCULATED:	21 sprinklers
TOTAL SPRINKLER WATER FLOW REQUIRED:	499.4 gpm
TOTAL WATER REQUIRED (including hose):	749.4 gpm
FLOW AND PRESSURE (@ PD):	499gpm @ 90psi
SPRINKLER ORIFICE SIZE:	5.6K
NAME OF CONTRACTOR:	PATRIOT FIRE PROTECTION INC.
DESIGN/LAYOUT BY:	RON SHEARER
AUTHORITY HAVING JURISDICTION:	CITY OF PUYALLUP

DATE: 11/3/2024 IN CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 COVERED AREA.SDF

JOB TITLE:

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
CITY	45.0	20.0	3070.0	43.2	749.4	20.0

Available pressure is 23.2 psi (54%) greater than required pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	749.4 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	0.0 GPM
OTHER HOSE STREAM ALLOWANCES	250.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	499.4 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
S41	21.4	K= 5.60	13.7	20.8
S42	21.3	K= 5.60	14.1	21.1
S43	21.3	K= 5.60	15.5	22.0
S44	21.2	K= 5.60	18.4	24.0
S45	21.9	K= 5.60	18.0	23.8
S46	21.9	K= 5.60	18.1	23.8
S47	21.8	K= 5.60	18.5	24.1
S48	21.8	K= 5.60	19.2	24.5
S49	21.8	K= 5.60	21.6	26.0
S50	21.7	K= 5.60	23.5	27.1
S51	22.1	K= 5.60	13.3	20.5
S52	22.0	K= 5.60	13.6	20.7
S53	22.0	K= 5.60	14.5	21.3
S54	22.0	K= 5.60	16.4	22.6
S55	22.3	K= 5.60	13.4	20.5
S56	22.2	K= 5.60	13.6	20.7
S57	22.2	K= 5.60	14.5	21.3
S58	22.1	K= 5.60	16.4	22.7
S59	22.1	K= 5.60	23.0	26.9
S60	22.0	K= 5.60	25.0	28.0
S61	22.3	K= 5.60	43.7	37.0
101	22.1	- - - -	22.6	- - -
T	20.1	- - - -	44.7	- - -
U	20.1	- - - -	44.7	- - -
V	20.1	- - - -	45.1	- - -
W	20.0	- - - -	46.2	- - -
X	14.8	- - - -	54.1	- - -
Y	13.8	- - - -	70.8	- - -
TOR	12.2	- - - -	80.0	- - -
DRY	4.0	- - - -	85.8	- - -
MANI	3.0	- - - -	88.6	- - -
PS	1.3	- - - -	8.5	- - -
PD	1.3	- - - -	90.4	- - -
PD1	1.3	- - - -	90.4	- - -

DATE: 11/3/2024 ING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 COVERED AREA.SDF
 JOB TITLE:

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
BF1	1.0	- - - -	16.8	- - -
BF2	1.0	- - - -	8.8	- - -
FLG	0.5	- - - -	17.0	- - -
UG	-5.0	HOSE STREAM	19.4	250.0
CITY	-5.0	SOURCE	20.0	749.4

DATE: 11/3/2024 ING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 COVERED AREA.SDF

JOB TITLE:

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.		
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.		
									(PSI)		
	Pipe: 1					-20.8	1.610	PL	15.00	PF	0.4
S41	21.4	5.6	13.7	20.8	3.3	100	FTG	----	PE	0.0	
S42	21.3	5.6	14.1	21.1		0.024	TL	15.00	PV		
	Pipe: 2					-41.8	1.610	PL	15.00	PF	1.3
S42	21.3	5.6	14.1	21.1	6.6	100	FTG	----	PE	0.0	
S43	21.3	5.6	15.5	22.0		0.089	TL	15.00	PV		
	Pipe: 3					-63.9	1.610	PL	15.00	PF	2.9
S43	21.3	5.6	15.5	22.0	10.1	100	FTG	----	PE	0.0	
S44	21.2	5.6	18.4	24.0		0.194	TL	15.00	PV		
	Pipe: 4					-87.9	1.610	PL	62.21	PF	25.8
S44	21.2	5.6	18.4	24.0	13.9	100	FTG	2T	PE	0.5	
T	20.1	0.0	44.7	0.0		0.350	TL	73.63	PV		
	Pipe: 5					-23.8	2.067	PL	10.00	PF	0.1
S45	21.9	5.6	18.0	23.8	2.3	100	FTG	----	PE	0.0	
S46	21.9	5.6	18.1	23.8		0.009	TL	10.00	PV		
	Pipe: 6					-47.6	2.067	PL	10.00	PF	0.3
S46	21.9	5.6	18.1	23.8	4.6	100	FTG	----	PE	0.0	
S47	21.8	5.6	18.5	24.1		0.033	TL	10.00	PV		
	Pipe: 7					-71.7	2.067	PL	10.00	PF	0.7
S47	21.8	5.6	18.5	24.1	6.9	100	FTG	----	PE	0.0	
S48	21.8	5.6	19.2	24.5		0.071	TL	10.00	PV		
	Pipe: 8					-96.2	2.067	PL	11.79	PF	2.3
S48	21.8	5.6	19.2	24.5	9.2	100	FTG	2E	PE	0.0	
S49	21.8	5.6	21.6	26.0		0.123	TL	18.93	PV		
	Pipe: 9					-122.2	2.067	PL	10.00	PF	1.9
S49	21.8	5.6	21.6	26.0	11.7	100	FTG	----	PE	0.0	
S50	21.7	5.6	23.5	27.1		0.191	TL	10.00	PV		
	Pipe: 10					-149.4	2.067	PL	59.96	PF	20.5
S50	21.7	5.6	23.5	27.1	14.3	100	FTG	2T	PE	0.7	
U	20.1	0.0	44.7	0.0		0.277	TL	74.23	PV		
	Pipe: 11					-20.5	1.610	PL	10.00	PF	0.2
S51	22.1	5.6	13.3	20.5	3.2	100	FTG	----	PE	0.0	
S52	22.0	5.6	13.6	20.7		0.024	TL	10.00	PV		
	Pipe: 12					-41.1	1.610	PL	10.00	PF	0.9
S52	22.0	5.6	13.6	20.7	6.5	100	FTG	----	PE	0.0	
S53	22.0	5.6	14.5	21.3		0.086	TL	10.00	PV		
	Pipe: 13					-62.4	1.610	PL	10.00	PF	1.9
S53	22.0	5.6	14.5	21.3	9.8	100	FTG	----	PE	0.0	
S54	22.0	5.6	16.4	22.6		0.186	TL	10.00	PV		

SPRINKLER SYSTEM HYDRAULIC ANALYSIS

DATE: 11/3/2024 ING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 COVERED AREA.SDF
 JOB TITLE:

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.	
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.	(PSI)
	Pipe: 14					-85.1	1.610	PL	11.96	PF 6.3
S54	22.0	5.6	16.4	22.6	13.4	100	FTG	TL	PE	-0.1
101	22.1	0.0	22.6	0.0		0.330	TL	19.10	PV	
	Pipe: 15					-20.5	1.610	PL	10.00	PF 0.2
S55	22.3	5.6	13.4	20.5	3.2	100	FTG	----	PE	0.0
S56	22.2	5.6	13.6	20.7		0.024	TL	10.00	PV	
	Pipe: 16					-41.1	1.610	PL	10.00	PF 0.9
S56	22.2	5.6	13.6	20.7	6.5	100	FTG	----	PE	0.0
S57	22.2	5.6	14.5	21.3		0.086	TL	10.00	PV	
	Pipe: 17					-62.5	1.610	PL	10.00	PF 1.9
S57	22.2	5.6	14.5	21.3	9.8	100	FTG	----	PE	0.0
S58	22.1	5.6	16.4	22.7		0.186	TL	10.00	PV	
	Pipe: 18					-85.1	1.610	PL	11.63	PF 6.2
S58	22.1	5.6	16.4	22.7	13.4	100	FTG	TL	PE	0.0
101	22.1	0.0	22.6	0.0		0.330	TL	18.77	PV	
	Pipe: 19					-170.2	2.469	PL	2.83	PF 0.4
101	22.1	0.0	22.6	0.0	11.4	100	FTG	----	PE	0.0
S59	22.1	5.6	23.0	26.9		0.148	TL	2.83	PV	
	Pipe: 20					-197.1	2.469	PL	10.00	PF 1.9
S59	22.1	5.6	23.0	26.9	13.2	100	FTG	----	PE	0.0
S60	22.0	5.6	25.0	28.0		0.194	TL	10.00	PV	
	Pipe: 21					-225.1	2.469	PL	60.25	PF 19.2
S60	22.0	5.6	25.0	28.0	15.1	100	FTG	2T	PE	0.9
V	20.1	0.0	45.1	0.0		0.248	TL	77.38	PV	
	Pipe: 22					-37.0	2.067	PL	60.54	PF 1.6
S61	22.3	5.6	43.7	37.0	3.5	100	FTG	2T	PE	1.0
W	20.0	0.0	46.2	0.0		0.021	TL	74.81	PV	
	Pipe: 23					-87.9	4.026	PL	7.00	PF 0.0
T	20.1	0.0	44.7	0.0	2.2	100	FTG	----	PE	0.0
U	20.1	0.0	44.7	0.0		0.004	TL	7.00	PV	
	Pipe: 24					-237.3	4.026	PL	13.00	PF 0.3
U	20.1	0.0	44.7	0.0	6.0	100	FTG	----	PE	0.0
V	20.1	0.0	45.1	0.0		0.025	TL	13.00	PV	
	Pipe: 25					-462.4	4.026	PL	13.00	PF 1.1
V	20.1	0.0	45.1	0.0	11.7	100	FTG	----	PE	0.0
W	20.0	0.0	46.2	0.0		0.087	TL	13.00	PV	
	Pipe: 26					-499.4	4.026	PL	42.87	PF 5.6
W	20.0	0.0	46.2	0.0	12.6	100	FTG	3L	PE	2.3
X	14.8	0.0	54.1	0.0		0.100	TL	55.72	PV	

DATE: 11/3/2024\ING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 COVERED AREA.SDF

JOB TITLE:

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.
	NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	(FT)	SUM.
							FL/FT		(PSI)
	Pipe: 27					-499.4	4.026	PL 150.08	PF 16.3
X		14.8	0.0	54.1	0.0	12.6	100	FTG 3L	PE 0.4
Y		13.8	0.0	70.8	0.0		0.100	TL 162.93	PV
	Pipe: 28					-499.4	4.026	PL 71.67	PF 8.5
Y		13.8	0.0	70.8	0.0	12.6	100	FTG 3L	PE 0.7
TOR		12.2	0.0	80.0	0.0		0.100	TL 84.52	PV
	Pipe: 29					-499.4	4.026	PL 8.13	PF 2.2
TOR		12.2	0.0	80.0	0.0	12.6	100	FTG D	PE 3.5
DRY		4.0	0.0	85.8	0.0		0.100	TL 22.40	PV
	Pipe: 30					-499.4	4.026	PL 1.04	PF 2.4
DRY		4.0	0.0	85.8	0.0	12.6	120	FTG TB	PE 0.5
MANI		3.0	0.0	88.6	0.0		0.072	TL 33.04	PV
	Pipe: 31					-499.4	6.065	PL 7.92	PF 1.0
MANI		3.0	0.0	88.6	0.0	5.5	120	FTG T3LCB	PE 0.8
PD1		1.3	0.0	90.4	0.0		0.010	TL 106.92	PV
	Pipe: 32					-499.4	6.065	PL 0.01	PF 0.0
PD1		1.3	0.0	90.4	0.0	5.5	120	FTG ----	PE 0.0
PD		1.3	0.0	90.4	0.0		0.010	TL 0.01	PV
	Pipe: 33								
				FIRE PUMP			Rating:	1000.0 gpm @ 90.0 psi	
PS		1.3	0.0	8.5	0.0		Avail.:	499.2 gpm @ 104.0 psi	
PD		1.3	0.0	90.4	0.0		Req'd.:	499.2 gpm @ 81.9 psi	
	User Defined Pump Curve:								
				gpm	psi		gpm	psi	
				0.0	105.0		1250.0	78.0	
				500.0	104.0		1500.0	62.0	
				1000.0	90.0				
	Pipe: 34					-499.4	7.981	PL 25.25	PF 0.2
PS		1.3	0.0	8.5	0.0	3.2	120	FTG 4LG	PE 0.1
BF2		1.0	0.0	8.8	0.0		0.003	TL 81.25	PV
	Pipe: 35							FIXED PRESSURE LOSS DEVICE	
BF1		1.0	0.0	16.8	0.0			8.0 psi, 499.4 gpm	
BF2		1.0	0.0	8.8	0.0				
	Pipe: 36					-499.4	7.981	PL 0.50	PF 0.0
BF1		1.0	0.0	16.8	0.0	3.2	120	FTG ----	PE 0.2
FLG		0.5	0.0	17.0	0.0		0.003	TL 0.50	PV
	Pipe: 37					-499.4	8.390	PL 5.50	PF 0.0
FLG		0.5	0.0	17.0	0.0	2.9	140	FTG ----	PE 2.4
UG		-5.0	H.S.	19.4	250.0		0.002	TL 5.50	PV
	Pipe: 38					-749.4	8.390	PL 90.00	PF 0.6
UG		-5.0	H.S.	19.4	250.0	4.3	140	FTG TLG	PE 0.0
CITY		-5.0	SRCE	20.0	(N/A)		0.003	TL 178.00	PV

DATE: 11/3/2024 ING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 COVERED AREA.SDF
 JOB TITLE:

NOTES (HASS):

- (1) Calculations were performed by the HASS 2023 D computer program in accordance with NFPA (2020) under license no. 65839843 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 0.010 gpm and a maximum imbalance at any node of 0.186 gpm.
- (3) Total pressure at each node is used in balancing the system. Maximum water velocity is 15.1 ft/sec at pipe 21.
- (4) The Minimum pump suction pressure under maximum calculated demand is 8.51 (psi)

(5) PIPE FITTINGS TABLE

HASS Pipe Table Name: standard

PAGE: A MATERIAL: S40 HWC: 120

Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NTee

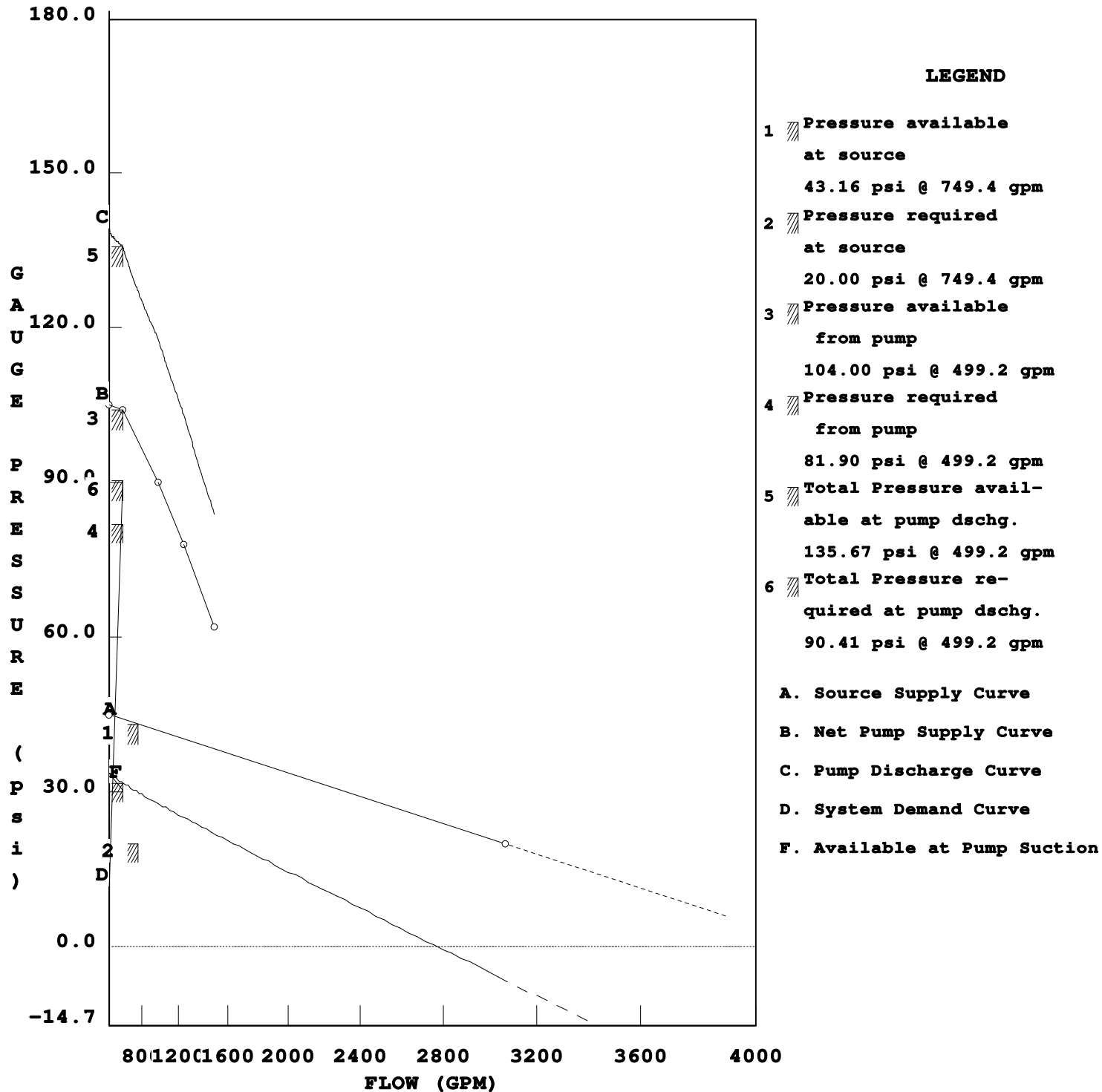
	F								
	F45E11								
1.610	4.00	8.00	2.00	9.00	6.00	1.00	10.00	10.00	8.00
	2.00								
2.067	5.00	10.00	3.00	11.00	6.00	1.00	10.00	10.00	10.00
	2.50								
2.469	6.00	12.00	4.00	14.00	7.00	1.00	10.00	10.00	12.00
	3.00								
4.026	10.00	20.00	6.00	22.00	12.00	2.00	20.00	20.00	20.00
	5.00								
6.065	14.00	30.00	9.00	32.00	10.00	3.00	28.00	28.00	30.00
	7.00								
7.981	18.00	35.00	13.00	45.00	12.00	4.00	31.00	31.00	35.00
	9.00								

PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet							
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	N NPTee	F F45E11
8.390	31.00	59.00	22.00	76.00	20.00	7.00	59.00	15.50

WATER SUPPLY ANALYSIS

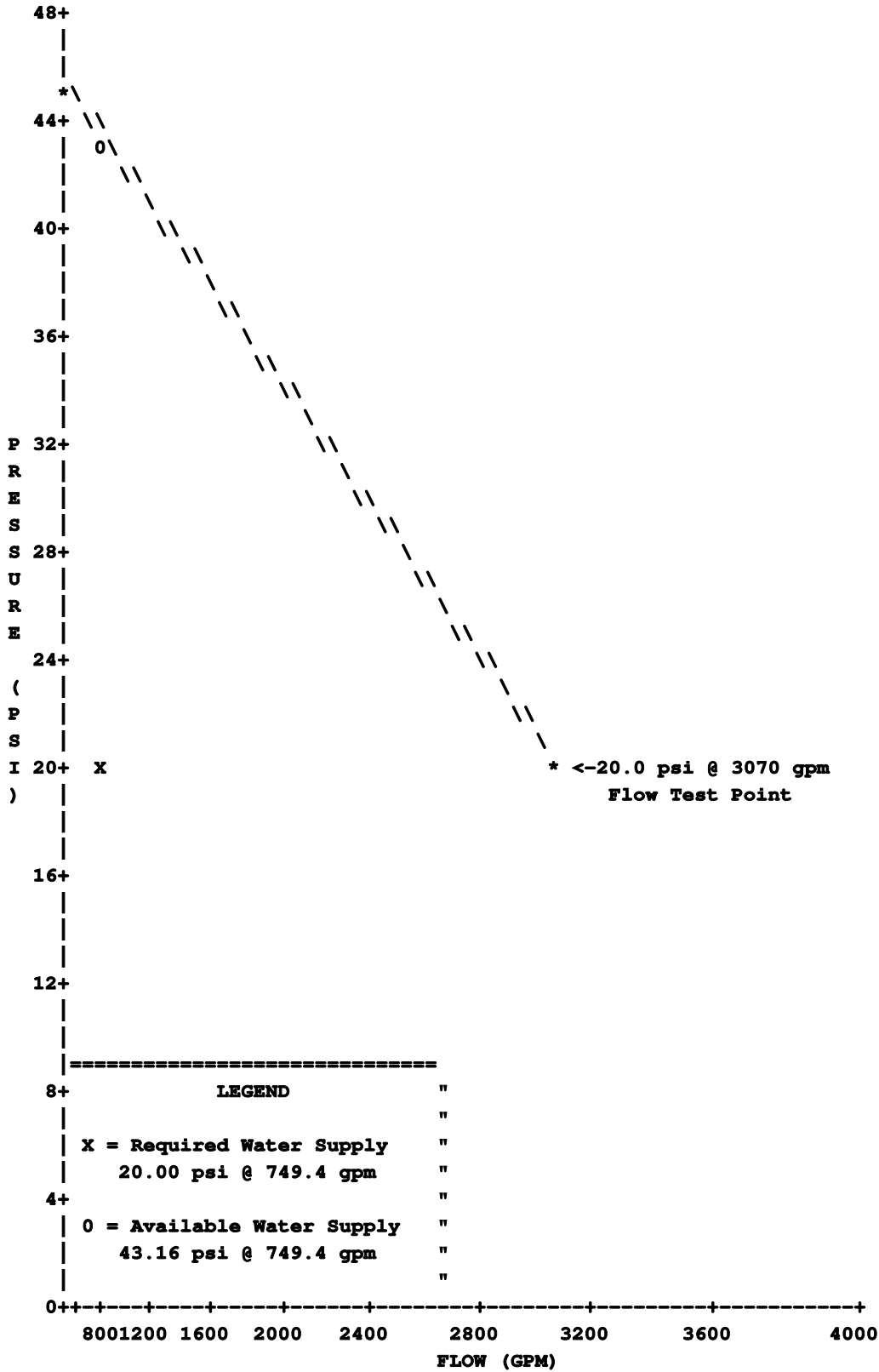
Static: 45.00 psi Resid: 20.00 psi Flow: 3070.0 gpm



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

JOB TITLE:

WATER SUPPLY CURVE



Intentionally Blank

HYDRAULIC CALCULATIONS

FOR

**PSE OTC
FITTING & INSTALL LAB**

FILE NUMBER: 2418 INSTALL FITTING LAB

DATE: NOV 3, 2024

-DESIGN DATA-

OCCUPANCY CLASSIFICATION:	ORDINARY GROUP II
DENSITY:	.20gpm/sq. ft.
AREA OF APPLICATION:	1500sq. ft.
COVERAGE PER SPRINKLER:	VARIABLES 130 SQ FT MAX
NUMBER OF SPRINKLERS CALCULATED:	12 sprinklers
TOTAL SPRINKLER WATER FLOW REQUIRED:	332.7 gpm
TOTAL WATER REQUIRED (including hose):	582.7 gpm
FLOW AND PRESSURE (@ PD):	333gpm @ 74psi
SPRINKLER ORIFICE SIZE:	5.6K
NAME OF CONTRACTOR:	PATRIOT FIRE PROTECTION INC.
DESIGN/LAYOUT BY:	RON SHEARER

DATE: 11/3/2024TER\DOCUMENTS\HYDRAULIC CALCS\2418 INSTALL FITTING LAB.SDF
 JOB TITLE:

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
CITY	45.0	20.0	3070.0	43.8	582.7	20.0

Available pressure is 23.8 psi (54%) greater than required pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	582.7 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	0.0 GPM
OTHER HOSE STREAM ALLOWANCES	250.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	332.7 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
S71	22.7	K= 5.60	20.9	25.6
S72	22.7	K= 5.60	21.1	25.7
S73	22.7	K= 5.60	22.0	26.2
S74	22.7	K= 5.60	23.7	27.3
S75	22.7	K= 5.60	26.9	29.0
S76	22.7	K= 5.60	31.8	31.6
S77	23.0	K= 5.60	21.4	25.9
S78	23.0	K= 5.60	21.6	26.0
S79	23.0	K= 5.60	22.4	26.5
S80	23.0	K= 5.60	24.3	27.6
S81	23.0	K= 5.60	27.4	29.3
S82	23.0	K= 5.60	32.4	31.9
Q	21.3	- - - -	48.1	- - -
R	21.3	- - - -	49.5	- - -
T	21.3	- - - -	63.0	- - -
A	21.3	- - - -	63.0	- - -
B	21.3	- - - -	63.0	- - -
C	21.3	- - - -	63.1	- - -
D	21.3	- - - -	63.3	- - -
E	13.7	- - - -	66.7	- - -
F	13.7	- - - -	67.4	- - -
QQ	22.7	- - - -	39.8	- - -
RR	23.0	- - - -	40.7	- - -
TOR	12.3	- - - -	68.4	- - -
WET	3.0	- - - -	72.7	- - -
101	3.0	- - - -	72.8	- - -
PS	1.3	- - - -	8.8	- - -
PD	1.3	- - - -	73.9	- - -
PD1	1.3	- - - -	73.9	- - -
BF1	1.0	- - - -	17.0	- - -
BF2	1.0	- - - -	9.0	- - -
FLG	0.5	- - - -	17.2	- - -
UG	-5.0	HOSE STREAM	19.6	250.0
CITY	-5.0	SOURCE	20.0	582.7

DATE: 11/3/2024 TER\DOCUMENTS\HYDRAULIC CALCS\2418 INSTALL FITTING LAB.SDF

JOB TITLE:

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.		
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	(FT)	SUM.	(PSI)		
Pipe: 1											
S71		22.7	5.6	20.9	25.6	-25.6 4.0	1.610 120	PL FTG	9.00 ----	PF PE	0.2 0.0
S72		22.7	5.6	21.1	25.7		0.025	TL	9.00	PV	
Pipe: 2											
S72		22.7	5.6	21.1	25.7	-51.3 8.1	1.610 120	PL FTG	9.00 ----	PF PE	0.8 0.0
S73		22.7	5.6	22.0	26.2		0.092	TL	9.00	PV	
Pipe: 3											
S73		22.7	5.6	22.0	26.2	-77.6 12.2	1.610 120	PL FTG	9.00 ----	PF PE	1.8 0.0
S74		22.7	5.6	23.7	27.3		0.198	TL	9.00	PV	
Pipe: 4											
S74		22.7	5.6	23.7	27.3	-104.9 16.5	1.610 120	PL FTG	9.00 ----	PF PE	3.1 0.0
S75		22.7	5.6	26.9	29.0		0.346	TL	9.00	PV	
Pipe: 5											
S75		22.7	5.6	26.9	29.0	-133.9 21.1	1.610 120	PL FTG	9.00 ----	PF PE	4.9 0.0
S76		22.7	5.6	31.8	31.6		0.544	TL	9.00	PV	
Pipe: 6											
S76		22.7	5.6	31.8	31.6	-165.5 26.1	1.610 120	PL FTG	2.00 T	PF PE	8.1 0.0
QQ		22.7	0.0	39.8	0.0		0.805	TL	10.00	PV	
Pipe: 7											
QQ		22.7	0.0	39.8	0.0	-165.5 26.1	1.610 120	PL FTG	1.46 T	PF PE	7.6 0.6
Q		21.3	0.0	48.1	0.0		0.805	TL	9.46	PV	
Pipe: 8											
S77		23.0	5.6	21.4	25.9	-25.9 4.1	1.610 120	PL FTG	9.00 ----	PF PE	0.2 0.0
S78		23.0	5.6	21.6	26.0		0.026	TL	9.00	PV	
Pipe: 9											
S78		23.0	5.6	21.6	26.0	-51.9 8.2	1.610 120	PL FTG	9.00 ----	PF PE	0.8 0.0
S79		23.0	5.6	22.4	26.5		0.094	TL	9.00	PV	
Pipe: 10											
S79		23.0	5.6	22.4	26.5	-78.4 12.4	1.610 120	PL FTG	9.00 ----	PF PE	1.8 0.0
S80		23.0	5.6	24.3	27.6		0.202	TL	9.00	PV	
Pipe: 11											
S80		23.0	5.6	24.3	27.6	-106.0 16.7	1.610 120	PL FTG	9.00 ----	PF PE	3.2 0.0
S81		23.0	5.6	27.4	29.3		0.353	TL	9.00	PV	
Pipe: 12											
S81		23.0	5.6	27.4	29.3	-135.3 21.3	1.610 120	PL FTG	9.00 ----	PF PE	5.0 0.0
S82		23.0	5.6	32.4	31.9		0.555	TL	9.00	PV	
Pipe: 13											
S82		23.0	5.6	32.4	31.9	-167.2 26.4	1.610 120	PL FTG	2.00 T	PF PE	8.2 0.0
RR		23.0	0.0	40.7	0.0		0.821	TL	10.00	PV	

SPRINKLER SYSTEM HYDRAULIC ANALYSIS

DATE: 11/3/2024 TER\DOCUMENTS\HYDRAULIC CALCS\2418 INSTALL FITTING LAB.SDF

JOB TITLE:

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.		
	NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	(FT)	SUM.		
							FL/FT		(PSI)		
	Pipe: 14					-167.2	1.610	PL	1.79	PF	8.0
RR		23.0	0.0	40.7	0.0	26.4	120	FTG	T	PE	0.8
R		21.3	0.0	49.5	0.0		0.821	TL	9.79	PV	
	Pipe: 15					-165.5	2.469	PL	14.00	PF	1.4
Q		21.3	0.0	48.1	0.0	11.1	120	FTG	----	PE	0.0
R		21.3	0.0	49.5	0.0		0.100	TL	14.00	PV	
	Pipe: 16					-332.7	2.469	PL	37.00	PF	13.5
R		21.3	0.0	49.5	0.0	22.3	120	FTG	----	PE	0.0
T		21.3	0.0	63.0	0.0		0.365	TL	37.00	PV	
	Pipe: 17					-332.7	6.065	PL	1.79	PF	0.0
T		21.3	0.0	63.0	0.0	3.7	120	FTG	----	PE	0.0
A		21.3	0.0	63.0	0.0		0.005	TL	1.79	PV	
	Pipe: 18					-332.7	6.065	PL	8.00	PF	0.0
A		21.3	0.0	63.0	0.0	3.7	120	FTG	----	PE	0.0
B		21.3	0.0	63.0	0.0		0.005	TL	8.00	PV	
	Pipe: 19					-332.7	6.065	PL	8.00	PF	0.0
B		21.3	0.0	63.0	0.0	3.7	120	FTG	----	PE	0.0
C		21.3	0.0	63.1	0.0		0.005	TL	8.00	PV	
	Pipe: 20					-332.7	6.065	PL	47.71	PF	0.3
C		21.3	0.0	63.1	0.0	3.7	120	FTG	L	PE	0.0
D		21.3	0.0	63.3	0.0		0.005	TL	56.71	PV	
	Pipe: 21					-332.7	6.065	PL	7.58	PF	0.1
D		21.3	0.0	63.3	0.0	3.7	120	FTG	L	PE	3.3
E		13.7	0.0	66.7	0.0		0.005	TL	16.58	PV	
	Pipe: 22					-332.7	6.065	PL	102.67	PF	0.7
E		13.7	0.0	66.7	0.0	3.7	120	FTG	ET	PE	0.0
F		13.7	0.0	67.4	0.0		0.005	TL	146.67	PV	
	Pipe: 23					-332.7	6.065	PL	75.21	PF	0.5
F		13.7	0.0	67.4	0.0	3.7	120	FTG	3L	PE	0.6
TOR		12.3	0.0	68.4	0.0		0.005	TL	102.21	PV	
	Pipe: 24					-332.7	6.065	PL	9.25	PF	0.2
TOR		12.3	0.0	68.4	0.0	3.7	120	FTG	TB	PE	4.0
WET		3.0	0.0	72.7	0.0		0.005	TL	49.25	PV	
	Pipe: 25					-332.7	6.065	PL	2.42	PF	0.1
WET		3.0	0.0	72.7	0.0	3.7	120	FTG	T	PE	0.0
101		3.0	0.0	72.8	0.0		0.005	TL	32.42	PV	
	Pipe: 26					-332.7	6.065	PL	7.42	PF	0.4
101		3.0	0.0	72.8	0.0	3.7	120	FTG	3LCB	PE	0.8
PD1		1.3	0.0	73.9	0.0		0.005	TL	76.42	PV	

DATE: 11/3/2024TER\DOCUMENTS\HYDRAULIC CALCS\2418 INSTALL FITTING LAB.SDF
 JOB TITLE:

PIPE TAG	Q (GPM)	DIA (IN)	LENGTH	PRESS.
END ELEV. NOZ. PT DISC. VEL (FPS) HW (C) (FT) SUM.				
NODES (FT) (K) (PSI) (GPM) FL/FT (PSI)				
Pipe: 27	-332.7	6.065	PL 0.01	PF 0.0
PD1 1.3 0.0 73.9 0.0 3.7 120 FTG			----	PE 0.0
PD 1.3 0.0 73.9 0.0 0.005 TL			0.01	PV
Pipe: 28	FIRE PUMP	Rating: 1000.0 gpm @ 90.0 psi		
PS 1.3 0.0 8.8 0.0	Avail.: 332.7 gpm @ 104.3 psi			
PD 1.3 0.0 73.9 0.0	Req'd.: 332.7 gpm @ 65.1 psi			
User Defined Pump Curve:	gpm psi	gpm psi		
	0.0 105.0	1250.0 78.0		
	500.0 104.0	1500.0 62.0		
	1000.0 90.0			
Pipe: 29	-332.7	7.981	PL 25.25	PF 0.1
PS 1.3 0.0 8.8 0.0 2.1 120 FTG			4LG	PE 0.1
BF2 1.0 0.0 9.0 0.0 0.001 TL			81.25	PV
Pipe: 30			FIXED PRESSURE LOSS DEVICE	
BF1 1.0 0.0 17.0 0.0	8.0 psi,	332.7 gpm		
BF2 1.0 0.0 9.0 0.0				
Pipe: 31	-332.7	7.981	PL 0.50	PF 0.0
BF1 1.0 0.0 17.0 0.0 2.1 120 FTG			----	PE 0.2
FLG 0.5 0.0 17.2 0.0 0.001 TL			0.50	PV
Pipe: 32	-332.7	8.390	PL 5.50	PF 0.0
FLG 0.5 0.0 17.2 0.0 1.9 140 FTG			----	PE 2.4
UG -5.0 H.S. 19.6 250.0 0.001 TL			5.50	PV
Pipe: 33	-582.7	8.390	PL 90.00	PF 0.4
UG -5.0 H.S. 19.6 250.0 3.4 140 FTG			ETG	PE 0.0
CITY -5.0 SRCE 20.0 (N/A) 0.002 TL			187.00	PV

NOTES (HASS):

- Calculations were performed by the HASS 2023 D computer program in accordance with NFPA (2020) under license no. 65839843 granted by HRS Systems, Inc. 208 Southside Square Petersburg, TN 37144 (931) 659-9760
- The system has been calculated to provide an average imbalance at each node of 0.004 gpm and a maximum imbalance at any node of 0.060 gpm.
- Total pressure at each node is used in balancing the system. Maximum water velocity is 26.4 ft/sec at pipe 13.
- The Minimum pump suction pressure under maximum calculated demand is 8.82 (psi)

DATE: 11/3/2024TER\DOCUMENTS\HYDRAULIC CALCS\2418 INSTALL FITTING LAB.SDF
 JOB TITLE:

(5) PIPE FITTINGS TABLE

HASS Pipe Table Name: standard

PAGE: A MATERIAL: S40 HWC: 120

Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NTee

	F								
	F45Ell								
1.610	4.00	8.00	2.00	9.00	6.00	1.00	10.00	10.00	8.00
	2.00								
2.469	6.00	12.00	4.00	14.00	7.00	1.00	10.00	10.00	12.00
	3.00								
6.065	14.00	30.00	9.00	32.00	10.00	3.00	28.00	28.00	30.00
	7.00								
7.981	18.00	35.00	13.00	45.00	12.00	4.00	31.00	31.00	35.00
	9.00								

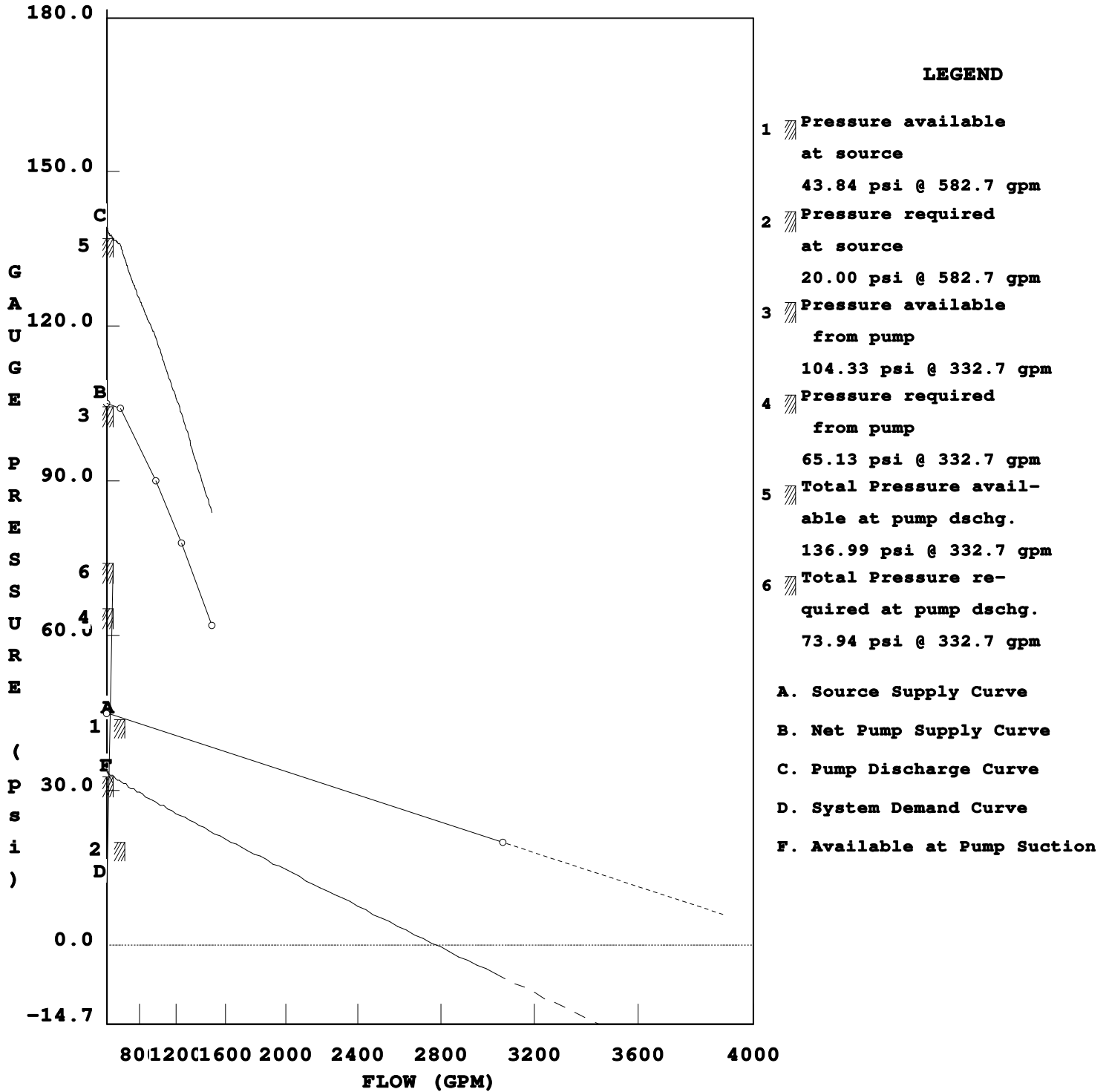
PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet							
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	N NP Tee	F F45Ell
8.390	31.00	59.00	22.00	76.00	20.00	7.00	59.00	15.50

DATE: 11/3/2024 TER\DOCUMENTS\HYDRAULIC CALCS\2418 INSTALL FITTING LAB.SDF
 JOB TITLE:

WATER SUPPLY ANALYSIS

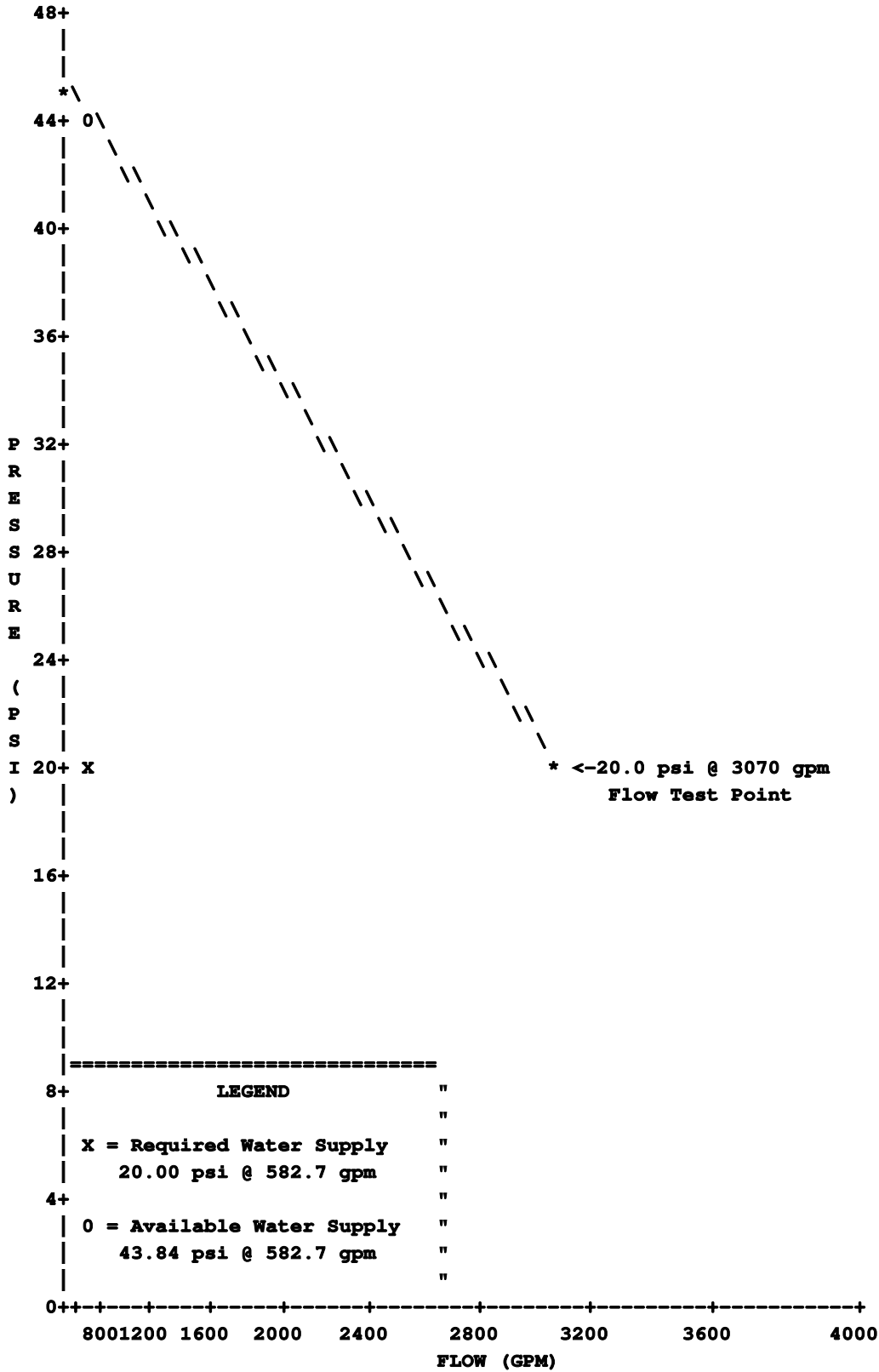
Static: 45.00 psi Resid: 20.00 psi Flow: 3070.0 gpm



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

JOB TITLE:

WATER SUPPLY CURVE



HYDRAULIC CALCULATIONS

FOR

**PSE OTC
ESFR NORTH**

FILE NUMBER: 2418 ESFR NORTH

DATE: NOV 3, 2024

-DESIGN DATA-

OCCUPANCY CLASSIFICATION:	CLASS I - IV STORAGE
DENSITY:	12 HEADS @ 35 PSI
AREA OF APPLICATION:	12 SPRINKLERS
COVERAGE PER SPRINKLER:	VARIABLES 100 SQ FT MAX
NUMBER OF SPRINKLERS CALCULATED:	12 sprinklers
TOTAL SPRINKLER WATER FLOW REQUIRED:	1255.2 gpm
TOTAL WATER REQUIRED (including hose):	1505.2 gpm
FLOW AND PRESSURE (@ PD):	1255gpm @ 85psi
SPRINKLER ORIFICE SIZE:	16.8K
NAME OF CONTRACTOR:	PATRIOT FIRE PROTECTION INC.
DESIGN/LAYOUT BY:	RON SHEARER

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESRF NORTH.SDF
 JOB TITLE:

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
CITY	45.0	20.0	3070.0	38.3	1505.2	20.0

Available pressure is 18.3 psi (48%) greater than required pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	1505.2 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	0.0 GPM
OTHER HOSE STREAM ALLOWANCES	250.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	1255.2 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
S1	23.8	K=16.80	35.0	99.4
S2	23.8	K=16.80	35.4	99.9
S3	23.8	K=16.80	36.6	101.7
S4	23.8	K=16.80	39.4	105.5
S5	23.6	K=16.80	35.1	99.6
S6	23.6	K=16.80	35.5	100.1
S7	23.6	K=16.80	36.8	101.9
S8	23.6	K=16.80	39.6	105.7
S9	23.4	K=16.80	42.1	108.9
S10	23.4	K=16.80	42.5	109.5
S11	23.4	K=16.80	44.0	111.5
S12	23.4	K=16.80	44.1	111.6
A	21.3	- - - -	52.1	- - -
B	21.3	- - - -	52.2	- - -
C	21.3	- - - -	52.4	- - -
D	21.3	- - - -	55.4	- - -
E	13.7	- - - -	59.6	- - -
F	13.7	- - - -	65.5	- - -
AA	23.8	- - - -	45.0	- - -
BB	23.6	- - - -	45.2	- - -
CC	23.4	- - - -	44.5	- - -
TOR	12.3	- - - -	72.8	- - -
WET	3.0	- - - -	78.3	- - -
101	3.0	- - - -	80.0	- - -
PS	1.3	- - - -	8.0	- - -
PD	1.3	- - - -	84.9	- - -
PD1	1.3	- - - -	84.9	- - -
BF1	1.0	- - - -	15.3	- - -
BF2	1.0	- - - -	9.3	- - -
FLG	0.5	- - - -	15.5	- - -
UG	-5.0	HOSE STREAM	17.9	250.0
CITY	-5.0	SOURCE	20.0	1505.2

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESRF NORTH.SDF

JOB TITLE:

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.		
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.		
									(PSI)		
	Pipe: 1					-99.4	2.469	PL	9.00	PF	0.4
S1	23.8	16.8	35.0	99.4	6.7	120	FTG	----	PE	0.0	
S2	23.8	16.8	35.4	99.9		0.039	TL	9.00	PV		
	Pipe: 2					-199.3	2.469	PL	9.00	PF	1.3
S2	23.8	16.8	35.4	99.9	13.4	120	FTG	----	PE	0.0	
S3	23.8	16.8	36.6	101.7		0.142	TL	9.00	PV		
	Pipe: 3					-301.0	2.469	PL	9.25	PF	2.8
S3	23.8	16.8	36.6	101.7	20.2	120	FTG	----	PE	0.0	
S4	23.8	16.8	39.4	105.5		0.304	TL	9.25	PV		
	Pipe: 4					-406.4	2.469	PL	10.58	PF	5.6
S4	23.8	16.8	39.4	105.5	27.2	120	FTG	----	PE	0.0	
AA	23.8	0.0	45.0	0.0		0.529	TL	10.58	PV		
	Pipe: 5					-406.4	3.068	PL	2.54	PF	6.0
AA	23.8	0.0	45.0	0.0	17.6	120	FTG	2T	PE	1.1	
A	21.3	0.0	52.1	0.0		0.184	TL	32.54	PV		
	Pipe: 6					-99.6	2.469	PL	9.00	PF	0.4
S5	23.6	16.8	35.1	99.6	6.7	120	FTG	----	PE	0.0	
S6	23.6	16.8	35.5	100.1		0.039	TL	9.00	PV		
	Pipe: 7					-199.6	2.469	PL	9.00	PF	1.3
S6	23.6	16.8	35.5	100.1	13.4	120	FTG	----	PE	0.0	
S7	23.6	16.8	36.8	101.9		0.142	TL	9.00	PV		
	Pipe: 8					-301.5	2.469	PL	9.25	PF	2.8
S7	23.6	16.8	36.8	101.9	20.2	120	FTG	----	PE	0.0	
S8	23.6	16.8	39.6	105.7		0.305	TL	9.25	PV		
	Pipe: 9					-407.2	2.469	PL	10.58	PF	5.6
S8	23.6	16.8	39.6	105.7	27.3	120	FTG	----	PE	0.0	
BB	23.6	0.0	45.2	0.0		0.531	TL	10.58	PV		
	Pipe: 10					-407.2	3.068	PL	2.33	PF	6.0
BB	23.6	0.0	45.2	0.0	17.7	120	FTG	2T	PE	1.0	
B	21.3	0.0	52.2	0.0		0.184	TL	32.33	PV		
	Pipe: 11					-108.9	2.469	PL	9.25	PF	0.4
S9	23.4	16.8	42.1	108.9	7.3	120	FTG	----	PE	0.0	
S10	23.4	16.8	42.5	109.5		0.046	TL	9.25	PV		
	Pipe: 12					-218.4	2.469	PL	9.25	PF	1.6
S10	23.4	16.8	42.5	109.5	14.6	120	FTG	----	PE	0.0	
S11	23.4	16.8	44.0	111.5		0.168	TL	9.25	PV		
	Pipe: 13					-329.9	2.469	PL	1.37	PF	0.5
S11	23.4	16.8	44.0	111.5	22.1	120	FTG	----	PE	0.0	
CC	23.4	0.0	44.5	0.0		0.360	TL	1.37	PV		

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESRF NORTH.SDF
 JOB TITLE:

PIPE TAG	Q (GPM)	DIA (IN)	LENGTH	PRESS.
END ELEV. NOZ. PT DISC. VEL (FPS) HW (C) (FT) SUM.				
NODES (FT) (K) (PSI) (GPM) FL/FT (PSI)				
	1000.0	90.0		
Pipe: 27	-1255.2	7.981	PL 25.25	PF 1.1
PS 1.3 0.0 8.0 0.0 8.0		120	FTG 4LG	PE 0.1
BF2 1.0 0.0 9.3 0.0		0.014	TL 81.25	PV
Pipe: 28			FIXED PRESSURE LOSS DEVICE	
BF1 1.0 0.0 15.3 0.0		6.0	psi, 1255.2 gpm	
BF2 1.0 0.0 9.3 0.0				
Pipe: 29	-1255.2	7.981	PL 0.50	PF 0.0
BF1 1.0 0.0 15.3 0.0 8.0		120	FTG ----	PE 0.2
FLG 0.5 0.0 15.5 0.0		0.014	TL 0.50	PV
Pipe: 30	-1255.2	8.390	PL 5.50	PF 0.0
FLG 0.5 0.0 15.5 0.0 7.3		140	FTG ----	PE 2.4
UG -5.0 H.S. 17.9 250.0		0.008	TL 5.50	PV
Pipe: 31	-1505.2	8.390	PL 90.00	PF 2.1
UG -5.0 H.S. 17.9 250.0 8.7		140	FTG TLG	PE 0.0
CITY -5.0 SRCE 20.0 (N/A)		0.012	TL 178.00	PV

NOTES (HASS):

- Calculations were performed by the HASS 2023 D computer program in accordance with NFPA (2020) under license no. 65839843 granted by HRS Systems, Inc. 208 Southside Square Petersburg, TN 37144 (931) 659-9760
- The system has been calculated to provide an average imbalance at each node of 0.001 gpm and a maximum imbalance at any node of 0.001 gpm.
- Total pressure at each node is used in balancing the system. Maximum water velocity is 27.3 ft/sec at pipe 9.
- The Minimum pump suction pressure under maximum calculated demand is 8.03 (psi)
- PIPE FITTINGS TABLE

HASS Pipe Table Name: standard

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESFR NORTH.SDF
 JOB TITLE:

PAGE: A MATERIAL: S40 HWC: 120

Diameter (in)	Equivalent Fitting Lengths in Feet									
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NTee	F F45Ell
2.469	6.00	12.00	4.00	14.00	7.00	1.00	10.00	10.00	12.00	3.00
3.068	7.00	15.00	5.00	16.00	10.00	1.00	13.00	13.00	15.00	3.50
6.065	14.00	30.00	9.00	32.00	10.00	3.00	28.00	28.00	30.00	7.00
7.981	18.00	35.00	13.00	45.00	12.00	4.00	31.00	31.00	35.00	9.00

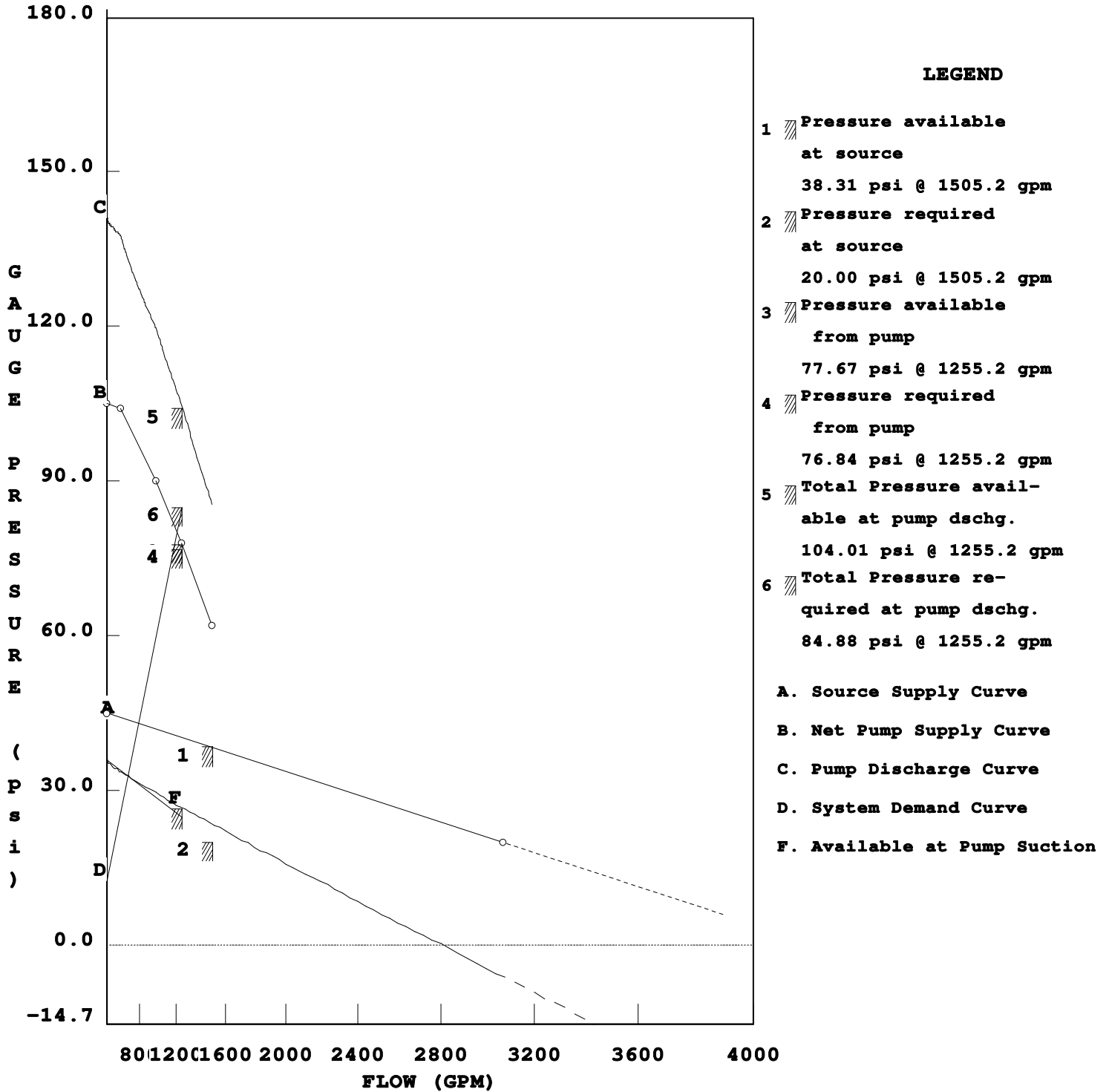
PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	N NPTee	F F45Ell	
8.390	31.00	59.00	22.00	76.00	20.00	7.00	59.00	15.50	

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESFR NORTH.SDF
 JOB TITLE:

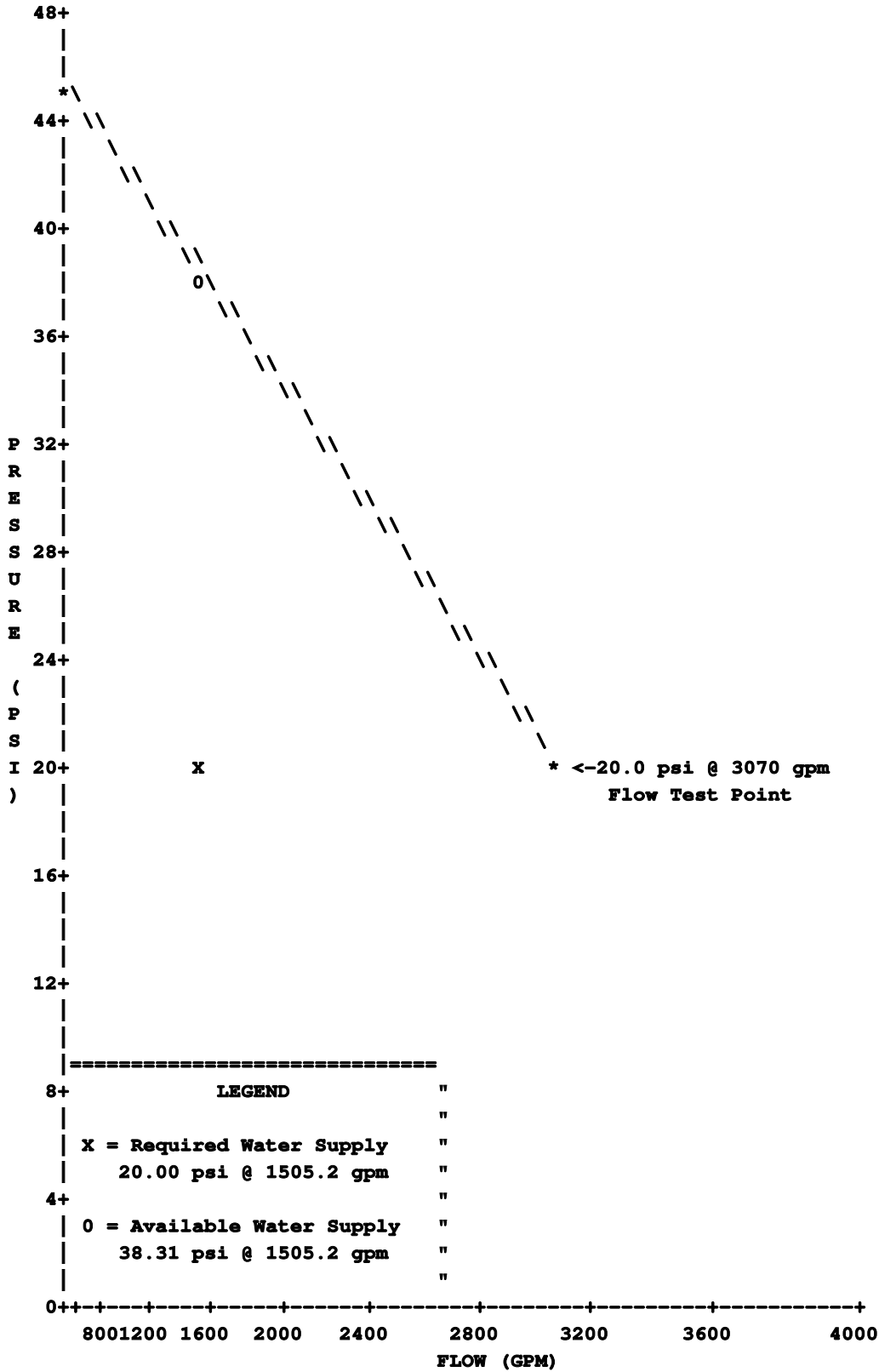
WATER SUPPLY ANALYSIS

Static: 45.00 psi Resid: 20.00 psi Flow: 3070.0 gpm



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

WATER SUPPLY CURVE



HYDRAULIC CALCULATIONS

FOR

**PSE OTC
ESFR SOUTH**

FILE NUMBER: 2418 ESFR SOUTH

DATE: NOV 3, 2024

-DESIGN DATA-

OCCUPANCY CLASSIFICATION:	CLASS I - IV STORAGE
DENSITY:	12 HEADS @ 35 PSI
AREA OF APPLICATION:	12 SPRINKLERS
COVERAGE PER SPRINKLER:	VARIABLES 100 SQ FT MAX
NUMBER OF SPRINKLERS CALCULATED:	12 sprinklers
TOTAL SPRINKLER WATER FLOW REQUIRED:	1220.7 gpm
TOTAL WATER REQUIRED (including hose):	1470.7 gpm
FLOW AND PRESSURE (@ PD):	1221gpm @ 80psi
SPRINKLER ORIFICE SIZE:	16.8K
NAME OF CONTRACTOR:	PATRIOT FIRE PROTECTION INC.
DESIGN/LAYOUT BY:	RON SHEARER

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESFR SOUTH.SDF
 JOB TITLE:

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
CITY	45.0	20.0	3070.0	38.6	1470.7	20.0

Available pressure is 18.6 psi (48%) greater than required pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	1470.7 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	0.0 GPM
OTHER HOSE STREAM ALLOWANCES	250.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	1220.7 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
S21	14.9	K=16.80	35.2	99.7
S22	14.9	K=16.80	36.0	100.7
S23	14.9	K=16.80	39.4	105.4
S24	15.3	K=16.80	35.0	99.4
S25	15.3	K=16.80	35.8	100.5
S26	15.3	K=16.80	39.1	105.1
S27	15.3	K=16.80	35.0	99.4
S28	15.3	K=16.80	35.7	100.4
S29	15.3	K=16.80	39.1	105.1
S30	15.6	K=16.80	35.0	99.4
S31	15.6	K=16.80	35.7	100.4
S32	15.6	K=16.80	39.1	105.1
JJ	14.9	- - - -	43.5	- - -
KK	15.2	- - - -	43.3	- - -
LL	15.3	- - - -	43.2	- - -
MM	15.6	- - - -	43.2	- - -
F	13.7	- - - -	61.5	- - -
J	13.7	- - - -	52.4	- - -
K	13.7	- - - -	52.4	- - -
L	13.7	- - - -	52.6	- - -
M	13.7	- - - -	52.9	- - -
N	13.7	- - - -	56.9	- - -
TOR	12.3	- - - -	68.4	- - -
WET	3.0	- - - -	73.8	- - -
101	3.0	- - - -	75.5	- - -
PS	1.3	- - - -	8.2	- - -
PD	1.3	- - - -	80.1	- - -
PD1	1.3	- - - -	80.1	- - -
BF1	1.0	- - - -	15.4	- - -
BF2	1.0	- - - -	9.4	- - -
FLG	0.5	- - - -	15.6	- - -
UG	-5.0	HOSE STREAM	18.0	250.0
CITY	-5.0	SOURCE	20.0	1470.7

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESFR SOUTH.SDF

JOB TITLE:

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.		
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.		
									(PSI)		
	Pipe: 1					-99.7	2.067	PL	8.00	PF	0.7
S21	14.9	16.8	35.2	99.7	9.5	120	FTG	----	PE	0.0	
S22	14.9	16.8	36.0	100.7		0.093	TL	8.00	PV		
	Pipe: 2					-200.4	2.067	PL	10.00	PF	3.4
S22	14.9	16.8	36.0	100.7	19.2	120	FTG	----	PE	0.0	
S23	14.9	16.8	39.4	105.4		0.340	TL	10.00	PV		
	Pipe: 3					-305.8	2.067	PL	2.54	PF	4.1
S23	14.9	16.8	39.4	105.4	29.2	120	FTG	L	PE	0.0	
JJ	14.9	0.0	43.5	0.0		0.743	TL	5.54	PV		
	Pipe: 4					-305.8	2.067	PL	1.25	PF	8.4
JJ	14.9	0.0	43.5	0.0	29.2	120	FTG	T	PE	0.5	
J	13.7	0.0	52.4	0.0		0.743	TL	11.25	PV		
	Pipe: 5					-99.4	2.067	PL	8.00	PF	0.7
S24	15.3	16.8	35.0	99.4	9.5	120	FTG	----	PE	0.0	
S25	15.3	16.8	35.8	100.5		0.093	TL	8.00	PV		
	Pipe: 6					-199.9	2.067	PL	10.00	PF	3.4
S25	15.3	16.8	35.8	100.5	19.1	120	FTG	----	PE	0.0	
S26	15.3	16.8	39.1	105.1		0.338	TL	10.00	PV		
	Pipe: 7					-305.0	2.067	PL	2.54	PF	4.1
S26	15.3	16.8	39.1	105.1	29.2	120	FTG	L	PE	0.0	
KK	15.2	0.0	43.3	0.0		0.739	TL	5.54	PV		
	Pipe: 8					-305.0	2.067	PL	1.50	PF	8.5
KK	15.2	0.0	43.3	0.0	29.2	120	FTG	T	PE	0.6	
K	13.7	0.0	52.4	0.0		0.739	TL	11.50	PV		
	Pipe: 9					-99.4	2.067	PL	8.00	PF	0.7
S27	15.3	16.8	35.0	99.4	9.5	120	FTG	----	PE	0.0	
S28	15.3	16.8	35.7	100.4		0.093	TL	8.00	PV		
	Pipe: 10					-199.8	2.067	PL	10.00	PF	3.4
S28	15.3	16.8	35.7	100.4	19.1	120	FTG	----	PE	0.0	
S29	15.3	16.8	39.1	105.1		0.338	TL	10.00	PV		
	Pipe: 11					-304.9	2.067	PL	2.54	PF	4.1
S29	15.3	16.8	39.1	105.1	29.2	120	FTG	L	PE	0.0	
LL	15.3	0.0	43.2	0.0		0.739	TL	5.54	PV		
	Pipe: 12					-304.9	2.067	PL	1.67	PF	8.6
LL	15.3	0.0	43.2	0.0	29.2	120	FTG	T	PE	0.7	
L	13.7	0.0	52.6	0.0		0.739	TL	11.67	PV		
	Pipe: 13					-99.4	2.067	PL	8.00	PF	0.7
S30	15.6	16.8	35.0	99.4	9.5	120	FTG	----	PE	0.0	
S31	15.6	16.8	35.7	100.4		0.093	TL	8.00	PV		

SPRINKLER SYSTEM HYDRAULIC ANALYSIS

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESFR SOUTH.SDF

JOB TITLE:

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.		
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.	(PSI)	
	Pipe: 14					-199.8	2.067	PL	10.00	PF	3.4
S31	15.6	16.8	35.7	100.4	19.1	120	FTG	----	PE	0.0	
S32	15.6	16.8	39.1	105.1		0.338	TL	10.00	PV		
	Pipe: 15					-304.9	2.067	PL	2.54	PF	4.1
S32	15.6	16.8	39.1	105.1	29.2	120	FTG	L	PE	0.0	
MM	15.6	0.0	43.2	0.0		0.739	TL	5.54	PV		
	Pipe: 16					-304.9	2.067	PL	1.92	PF	8.8
MM	15.6	0.0	43.2	0.0	29.2	120	FTG	T	PE	0.8	
M	13.7	0.0	52.9	0.0		0.739	TL	11.92	PV		
	Pipe: 17					-305.8	6.065	PL	10.00	PF	0.0
J	13.7	0.0	52.4	0.0	3.4	120	FTG	----	PE	0.0	
K	13.7	0.0	52.4	0.0		0.004	TL	10.00	PV		
	Pipe: 18					-610.8	6.065	PL	10.00	PF	0.1
K	13.7	0.0	52.4	0.0	6.8	120	FTG	----	PE	0.0	
L	13.7	0.0	52.6	0.0		0.014	TL	10.00	PV		
	Pipe: 19					-915.7	6.065	PL	10.00	PF	0.3
L	13.7	0.0	52.6	0.0	10.2	120	FTG	----	PE	0.0	
M	13.7	0.0	52.9	0.0		0.030	TL	10.00	PV		
	Pipe: 20					-1220.7	6.065	PL	49.17	PF	4.0
M	13.7	0.0	52.9	0.0	13.6	120	FTG	T	PE	0.0	
N	13.7	0.0	56.9	0.0		0.051	TL	79.17	PV		
	Pipe: 21					-1220.7	6.065	PL	90.17	PF	4.6
N	13.7	0.0	56.9	0.0	13.6	120	FTG	----	PE	0.0	
F	13.7	0.0	61.5	0.0		0.051	TL	90.17	PV		
	Pipe: 22					-1220.7	6.065	PL	75.21	PF	6.3
F	13.7	0.0	61.5	0.0	13.6	120	FTG	T2L	PE	0.6	
TOR	12.3	0.0	68.4	0.0		0.051	TL	123.21	PV		
	Pipe: 23					-1220.7	6.065	PL	9.25	PF	1.4
TOR	12.3	0.0	68.4	0.0	13.6	120	FTG	LB	PE	4.0	
WET	3.0	0.0	73.8	0.0		0.051	TL	28.25	PV		
	Pipe: 24					-1220.7	6.065	PL	2.50	PF	1.7
WET	3.0	0.0	73.8	0.0	13.6	120	FTG	T	PE	0.0	
101	3.0	0.0	75.5	0.0		0.051	TL	32.50	PV		
	Pipe: 25					-1220.7	6.065	PL	7.42	PF	3.9
101	3.0	0.0	75.5	0.0	13.6	120	FTG	3LCB	PE	0.8	
PD1	1.3	0.0	80.1	0.0		0.051	TL	76.42	PV		
	Pipe: 26					-1220.7	6.065	PL	0.01	PF	0.0
PD1	1.3	0.0	80.1	0.0	13.6	120	FTG	----	PE	0.0	
PD	1.3	0.0	80.1	0.0		0.051	TL	0.01	PV		

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESFR SOUTH.SDF

JOB TITLE:

PIPE TAG	Q (GPM)	DIA (IN)	LENGTH	PRESS.				
END ELEV. NOZ. PT DISC. VEL (FPS) HW (C) (FT) SUM. (PSI)								
NODES (FT) (K) (PSI) (GPM) FL/FT								
Pipe: 27								
	FIRE PUMP		Rating:	1000.0 gpm @ 90.0 psi				
PS	1.3	0.0	8.2	0.0	Avail.:	1220.7 gpm @ 79.4 psi		
PD	1.3	0.0	80.1	0.0	Req'd.:	1220.7 gpm @ 71.9 psi		
User Defined Pump Curve:								
			gpm	psi	gpm	psi		
			0.0	105.0	1250.0	78.0		
			500.0	104.0	1500.0	62.0		
			1000.0	90.0				
Pipe: 28								
				-1220.7	7.981 PL	25.25 PF	1.1	
PS	1.3	0.0	8.2	0.0	7.8	120 FTG	4LG PE	0.1
BF2	1.0	0.0	9.4	0.0		0.013 TL	81.25 PV	
Pipe: 29								
					FIXED PRESSURE LOSS DEVICE			
BF1	1.0	0.0	15.4	0.0	6.0 psi, 1220.7 gpm			
BF2	1.0	0.0	9.4	0.0				
Pipe: 30								
				-1220.7	7.981 PL	0.50 PF	0.0	
BF1	1.0	0.0	15.4	0.0	7.8	120 FTG	---- PE	0.2
FLG	0.5	0.0	15.6	0.0		0.013 TL	0.50 PV	
Pipe: 31								
				-1220.7	8.390 PL	5.50 PF	0.0	
FLG	0.5	0.0	15.6	0.0	7.1	140 FTG	---- PE	2.4
UG	-5.0	H.S.	18.0	250.0		0.008 TL	5.50 PV	
Pipe: 32								
				-1470.7	8.390 PL	90.00 PF	2.0	
UG	-5.0	H.S.	18.0	250.0	8.5	140 FTG	TLG PE	0.0
CITY	-5.0	SRCE	20.0	(N/A)		0.011 TL	178.00 PV	

NOTES (HASS):

- (1) Calculations were performed by the HASS 2023 D computer program in accordance with NFPA (2020) under license no. 65839843 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 0.001 gpm and a maximum imbalance at any node of 0.002 gpm.
- (3) Total pressure at each node is used in balancing the system. Maximum water velocity is 29.2 ft/sec at pipe 4.
- (4) The Minimum pump suction pressure under maximum calculated demand is 8.18 (psi)

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESR SOUTH.SDF
 JOB TITLE:

(5) PIPE FITTINGS TABLE

HASS Pipe Table Name: standard

PAGE: A MATERIAL: S40 HWC: 120

Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NTee

	F								
	F45Ell								
2.067	5.00	10.00	3.00	11.00	6.00	1.00	10.00	10.00	10.00
	2.50								
6.065	14.00	30.00	9.00	32.00	10.00	3.00	28.00	28.00	30.00
	7.00								
7.981	18.00	35.00	13.00	45.00	12.00	4.00	31.00	31.00	35.00
	9.00								

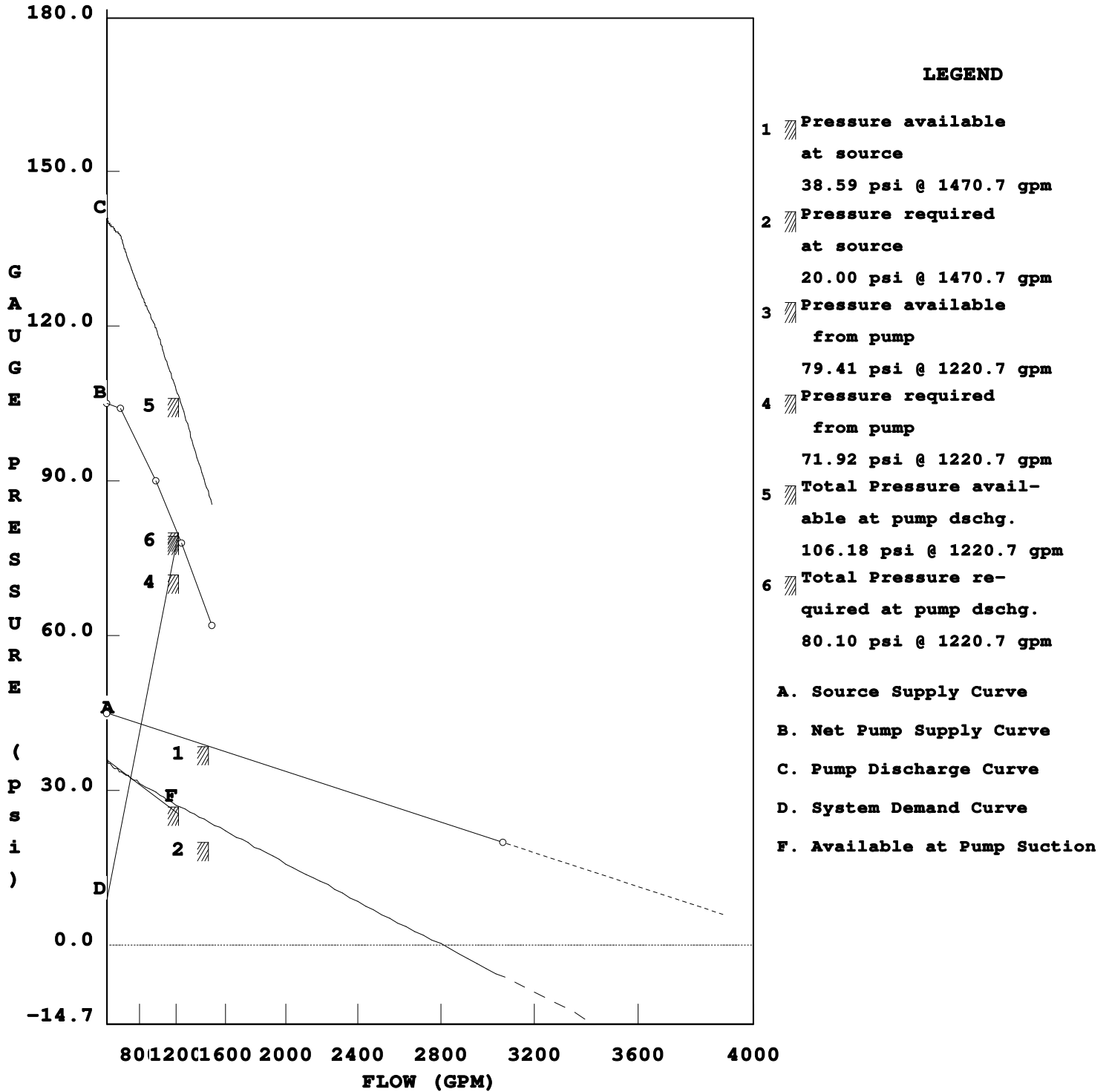
PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet							
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	N NP Tee	F F45Ell
8.390	31.00	59.00	22.00	76.00	20.00	7.00	59.00	15.50

DATE: 11/3/2024 INING CENTER\DOCUMENTS\HYDRAULIC CALCS\2418 ESFR SOUTH.SDF
 JOB TITLE:

WATER SUPPLY ANALYSIS

Static: 45.00 psi Resid: 20.00 psi Flow: 3070.0 gpm



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

JOB TITLE:

WATER SUPPLY CURVE

