McKinstry Fire Protection
5005 3RD Avenue South
Seattle, WA 98124

HYDRAULIC CALCULATIONS FOR

KPP
6TH and Central
Kirkland, WA

DRAWING NUMBER: FP-L5 DATE: 1-18-2016

-DESIGN DATA-

REMOTE AREA NUMBER: TWO REMOTE AREA LOCATION: 5th Floor Office
OCCUPANCY CLASSIFICATION: Light Hazard
DENSITY: .10 gpm/sq. ft.
AREA OF APPLICATION: 1500 sq. ft.

COVERAGE PER SPRINKLER: 196 MAX sq. ft. Calculated
TYPE OF SPRINKLERS CALCULATED: 5.6k Q.R.
NUMBER OF SPRINKLERS CALCULATED: 11

*IN-RACK SPRINKLER DEMAND: NA gpm
HOSE-STREAM DEMAND: 100 gpm
TOTAL WATER REQUIRED (INCLUDING HOSE): 339.8 gpm
FLOW AND PRESSURE (AT NODE BOR, BOR): 239.8 gpm @ 67.8 psi

INSTALLING CONTRACTOR
Name: McKinstry Fire Protection

AUTHORITY HAVING JURISDICTION: City of Seattle, Fire Dept.

NOTES: NA
Calculations performed by HASS under license # 50091140 ,
granted by HRS SYSTEMS, INC.
(Notes continue after pipe calculations results.)

WASHINGTON STATE
CERTIFICATE OF COMPENTENCY
FIRE PROTECTION SPRINKLER SYSTEMS

J. Scott Spitzer, Sr.
5763-1094-C Level 3
McKinstry Company, L.L.C.
MCKINCL942DW

Date

Expires
12/31/16

Signature

DATE: 1/18/2016 C:\HASS DATA\15186-OFFICES.SDF

JOB TITLE: 5th floor KPP

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	@ FLOW (GPM)	AVAIL. PRESS. (PSI)	@ TOTAL DEMAND (GPM)	REQ'D PRESS. (PSI)
SRC	86.7	20.0	1953.0	84.1	339.8	74.3

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	339.8 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	100.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	239.8 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
1	122.5	K= 5.49	12.7	19.6
2	122.5	K= 5.36	14.4	20.3
3	122.5	K= 5.60	16.4	22.7
4	122.5	- - - -	17.9	- - -
5	122.5	- - - -	17.9	- - -
6	122.5	K= 5.41	15.9	21.6
7	122.5	K= 5.41	16.6	22.0
8	122.5	- - - -	18.6	- - -
9	122.5	K= 5.41	15.3	21.1
10	122.5	K= 5.32	16.0	21.3
11	122.5	K= 5.32	17.0	21.9
12	122.5	- - - -	18.7	- - -
13	122.5	K= 5.33	17.0	22.0
14	122.5	K= 5.33	17.3	22.2
15	122.5	- - - -	22.6	- - -
16	122.5	K= 5.35	22.1	25.1
17	122.5	- - - -	25.2	- - -
18	122.5	- - - -	26.6	- - -
19	122.5	- - - -	34.7	- - -
TOP2	122.5	- - - -	37.4	- - -
BOP2	112.5	- - - -	42.7	- - -
TOR	68.0	- - - -	63.2	- - -
BOR	60.0	- - - -	67.8	- - -
UG	57.0	- - - -	74.1	- - -
UG1	57.0	- - - -	74.2	- - -
UG2	57.0	- - - -	74.2	- - -
BF1	60.0	- - - -	67.8	- - -
BF2	60.0	- - - -	72.8	- - -
SRC	57.0	SOURCE	74.3	239.8

DATE: 1/18/2016 C:\HASS DATA\15186-OFFICES.SDF
JOB TITLE: 5th floor KPP

PIPE DATA

PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT		LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 1					-19.6	1.049	PL	8.00	PF	1.7
1	122.5	5.5	12.7	19.6	7.3	100	FTG	E	PE	0.0
2	122.5	5.4	14.4	20.3		0.176	TL	9.43	PV	
Pipe: 2					-39.9	1.380	PL	11.50	PF	2.0
2	122.5	5.4	14.4	20.3	8.6	100	FTG	----	PE	0.0
3	122.5	5.6	16.4	22.7		0.172	TL	11.50	PV	
Pipe: 3					-62.6	1.610	PL	2.58	PF	1.5
3	122.5	5.6	16.4	22.7	9.9	100	FTG	T	PE	0.0
5	122.5	0.0	17.9	0.0		0.187	TL	8.29	PV	
Pipe: 4					-21.6	1.380	PL	11.50	PF	0.6
6	122.5	5.4	15.9	21.6	4.6	100	FTG	----	PE	0.0
7	122.5	5.4	16.6	22.0		0.055	TL	11.50	PV	
Pipe: 5					-43.6	1.610	PL	8.58	PF	1.4
7	122.5	5.4	16.6	22.0	6.9	100	FTG	T	PE	0.0
5	122.5	0.0	17.9	0.0		0.096	TL	14.29	PV	
Pipe: 6					0.0	2.469	PL	1.00	PF	0.0
4	122.5	0.0	17.9	0.0	0.0	100	FTG	----	PE	0.0
5	122.5	0.0	17.9	0.0		0.000	TL	1.00	PV	
Pipe: 7					-106.2	2.469	PL	11.25	PF	0.7
5	122.5	0.0	17.9	0.0	7.1	100	FTG	----	PE	0.0
8	122.5	0.0	18.6	0.0		0.062	TL	11.25	PV	
Pipe: 8					-21.1	1.380	PL	10.50	PF	0.7
9	122.5	5.4	15.3	21.1	4.5	100	FTG	E	PE	0.0
10	122.5	5.3	16.0	21.3		0.053	TL	12.64	PV	
Pipe: 9					-42.4	1.610	PL	11.50	PF	1.0
10	122.5	5.3	16.0	21.3	6.7	100	FTG	----	PE	0.0
11	122.5	5.3	17.0	21.9		0.091	TL	11.50	PV	
Pipe: 10					-64.3	1.610	PL	2.58	PF	1.6
11	122.5	5.3	17.0	21.9	10.1	100	FTG	T	PE	0.0
8	122.5	0.0	18.6	0.0		0.197	TL	8.29	PV	
Pipe: 11					-22.0	1.610	PL	11.50	PF	0.3
13	122.5	5.3	17.0	22.0	3.5	100	FTG	----	PE	0.0
14	122.5	5.3	17.3	22.2		0.027	TL	11.50	PV	
Pipe: 12					-44.1	1.610	PL	8.58	PF	1.4
14	122.5	5.3	17.3	22.2	7.0	100	FTG	T	PE	0.0
12	122.5	0.0	18.7	0.0		0.098	TL	14.29	PV	

DATE: 1/18/2016 C:\HASS DATA\15186-OFFICES.SDF
JOB TITLE: 5th floor KPP

PIPE TAG END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT		LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 13					-170.6	2.469	PL	0.50	PF	0.1
8	122.5	0.0	18.6	0.0	11.4	100	FTG	----	PE	0.0
12	122.5	0.0	18.7	0.0		0.149	TL	0.50	PV	
Pipe: 14					-214.7	2.469	PL	17.08	PF	3.9
12	122.5	0.0	18.7	0.0	14.4	100	FTG	----	PE	0.0
15	122.5	0.0	22.6	0.0		0.228	TL	17.08	PV	
Pipe: 15					-25.1	1.380	PL	2.58	PF	0.5
16	122.5	5.3	22.1	25.1	5.4	100	FTG	T	PE	0.0
15	122.5	0.0	22.6	0.0		0.073	TL	6.87	PV	
Pipe: 16					-239.8	2.469	PL	0.67	PF	2.6
15	122.5	0.0	22.6	0.0	16.1	100	FTG	T	PE	0.0
17	122.5	0.0	25.2	0.0		0.279	TL	9.23	PV	
Pipe: 17					-122.8	2.469	PL	13.75	PF	1.5
17	122.5	0.0	25.2	0.0	8.2	100	FTG	E	PE	0.0
18	122.5	0.0	26.6	0.0		0.081	TL	18.03	PV	
Pipe: 18					-122.8	2.469	PL	95.17	PF	8.1
18	122.5	0.0	26.6	0.0	8.2	100	FTG	E	PE	0.0
19	122.5	0.0	34.7	0.0		0.081	TL	99.45	PV	
Pipe: 19					-117.0	2.469	PL	119.83	PF	9.5
17	122.5	0.0	25.2	0.0	7.8	100	FTG	2E	PE	0.0
19	122.5	0.0	34.7	0.0		0.074	TL	128.40	PV	
Pipe: 20					-239.8	3.068	PL	7.50	PF	2.7
19	122.5	0.0	34.7	0.0	10.4	100	FTG	2ET	PE	0.0
TOP2	122.5	0.0	37.4	0.0		0.097	TL	28.20	PV	
Pipe: 21					-239.8	4.026	PL	10.00	PF	1.0
TOP2	122.5	0.0	37.4	0.0	6.0	120	FTG	ETB	PE	4.3
BOP2	112.5	0.0	42.7	0.0		0.018	TL	52.00	PV	
Pipe: 22					-239.8	4.026	PL	44.50	PF	1.2
BOP2	112.5	0.0	42.7	0.0	6.0	120	FTG	T	PE	19.3
TOR	68.0	0.0	63.2	0.0		0.018	TL	64.50	PV	
Pipe: 23					-239.8	4.026	PL	8.00	PF	1.1
TOR	68.0	0.0	63.2	0.0	6.0	120	FTG	ETC	PE	3.5
BOR	60.0	0.0	67.8	0.0		0.018	TL	60.00	PV	
Pipe: 24					-239.8	4.026	PL	2.00	PF	0.0
BOR	60.0	0.0	67.8	0.0	6.0	120	FTG	----	PE	0.0
BF1	60.0	0.0	67.8	0.0		0.018	TL	2.00	PV	
Pipe: 25					FIXED PRESSURE LOSS DEVICE					
BF2	60.0	0.0	72.8	0.0	5.0 psi, 239.8 gpm					
BF1	60.0	0.0	67.8	0.0						

DATE: 1/18/2016 C:\HASS DATA\15186-OFFICES.SDF
JOB TITLE: 5th floor KPP

PIPE TAG END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT	LENGTH (FT)	PRESS. SUM. (PSI)
Pipe: 26					-239.8	8.380 PL	4.00	PF 0.0
BF2	60.0	0.0	72.8	0.0	1.4	140 FTG	L	PE 1.3
UG	57.0	0.0	74.1	0.0		0.000 TL	25.93	PV
Pipe: 27					-239.8	8.380 PL	66.00	PF 0.1
UG	57.0	0.0	74.1	0.0	1.4	140 FTG	TG	PE 0.0
UG1	57.0	0.0	74.2	0.0		0.000 TL	131.78	PV
Pipe: 28					-239.8	8.380 PL	66.00	PF 0.1
UG1	57.0	0.0	74.2	0.0	1.4	140 FTG	TG	PE 0.0
UG2	57.0	0.0	74.2	0.0		0.000 TL	131.78	PV
Pipe: 29					-239.8	8.380 PL	165.00	PF 0.1
UG2	57.0	0.0	74.2	0.0	1.4	140 FTG	TG	PE 0.0
SRC	57.0	SRCE	74.3	(N/A)		0.000 TL	230.78	PV

NOTES (HASS):

(1) Calculations were performed by the HASS 8.5 computer program under license no. 50091140 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 0.095 gpm.

(3) Total pressure at each node is used in balancing the system. Maximum water velocity is 16.1 ft/sec at pipe 16.

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

are automatically transferred from the calculation report.

(5) Available pressure at source node SRC under full flow conditions is 83.67 psi compared to the minimum required pressure of 20.00 psi.

(6) PIPE FITTINGS TABLE

Pipe Table Name: STANDARD.PIP

DATE: 1/18/2016 C:\HASS DATA\15186-OFFICES.SDF
JOB TITLE: 5th floor KPP

PAGE: * 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 NPTee
8.380	22.83	44.39	16.49	57.07	15.22	5.07	39.31	39.31	44.39

PAGE: A MATERIAL: S40 HWC: 120

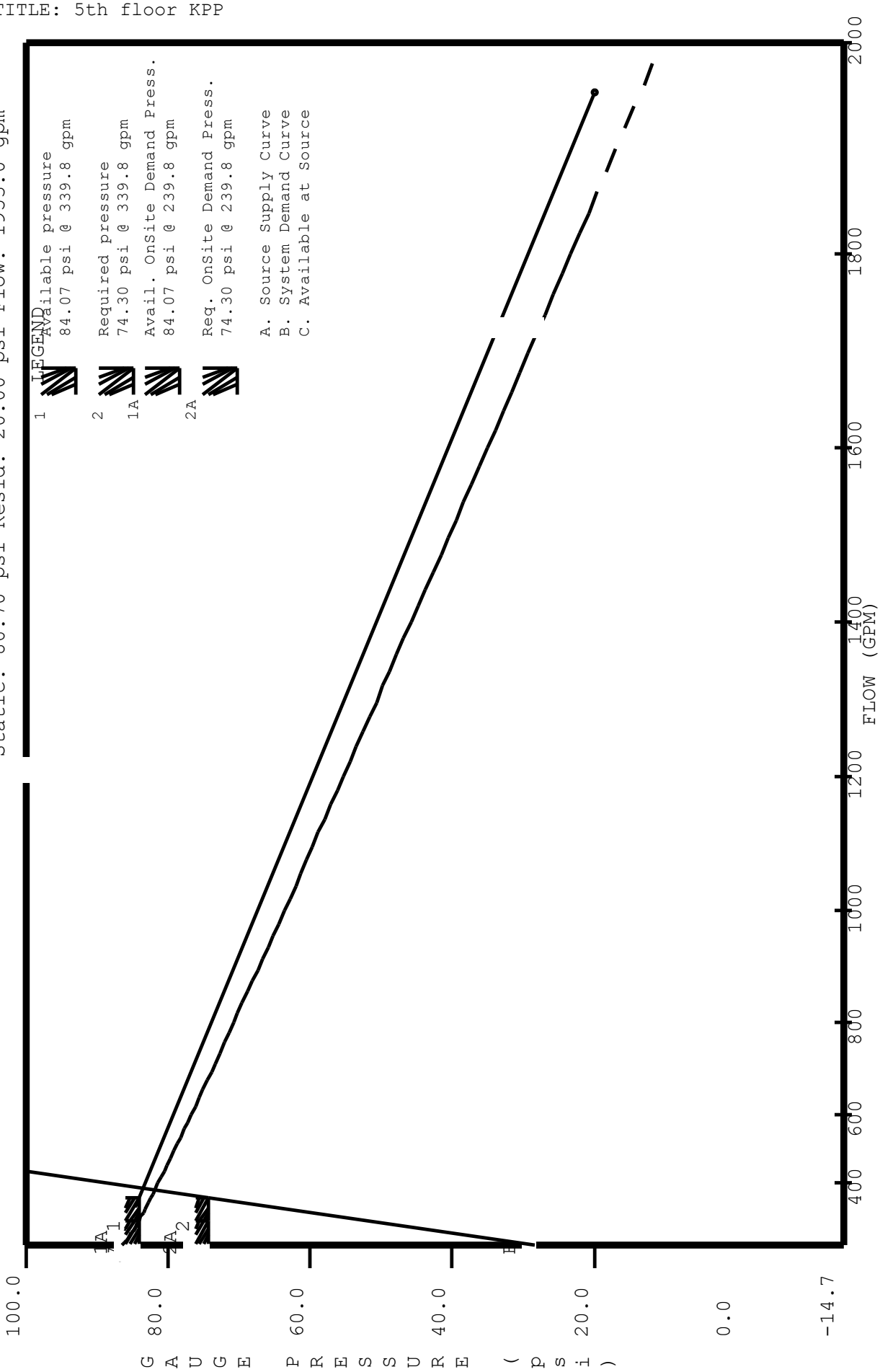
Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
1.049	2.00	5.00	2.00	5.00	6.00	1.00	10.00	2.00	5.00
1.380	3.00	6.00	2.00	7.00	6.00	1.00	10.00	10.00	6.00
1.610	4.00	8.00	2.00	9.00	6.00	1.00	10.00	10.00	8.00
2.469	6.00	12.00	4.00	14.00	7.00	1.00	10.00	10.00	12.00
3.068	7.00	15.00	5.00	16.00	10.00	1.00	13.00	13.00	15.00
4.026	10.00	20.00	6.00	22.00	12.00	2.00	20.00	20.00	20.00

DATE: 1/18/2016 C:\HASS DATA\15186-OFFICES.SDF

JOB TITLE: 5th floor KPP

WATER SUPPLY ANALYSIS

Static: 86.70 psi Resid: 20.00 psi Flow: 1953.0 gpm

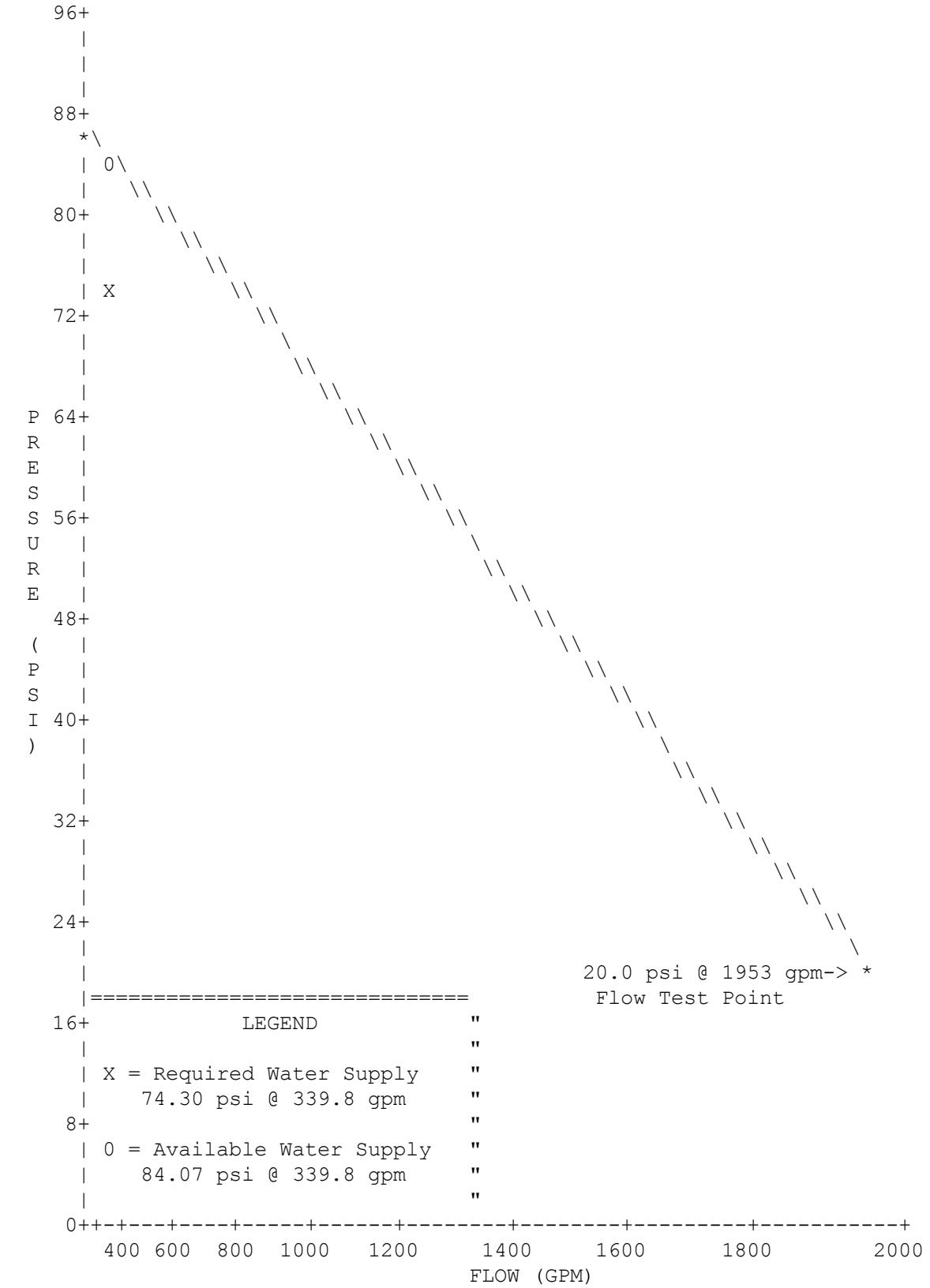


Note: (1) Dashed Lines indicate extrapolated values from Test Results

(2) On Site pressures are based on hose stream deduction at the source

DATE: 1/18/2016 C:\HASS DATA\15186-OFFICES.SDF
JOB TITLE: 5th floor KPP

WATER SUPPLY CURVE



Utility Report:

Equivalent K-Factor Calculator

Node Name	Sprinkler K-Factor	Pres. (psi)	Dia. (in)	Pipe Len.(ft)	Ftgs.	Total Len.(ft)	H-W coef.	Equivalent K-factor
1	5.60	12.20	1.049	2.00	E	4.00	120.00	5.49
2	5.60	13.90	1.049	2.00	ET	9.00	120.00	5.36
3	5.60	15.40	1.049	2.00	ET	9.00	120.00	5.36

Equivalent K-Factor Calculator

Node Name	Sprinkler K-Factor	Pres. (psi)	Dia. (in)	Pipe Len.(ft)	Ftgs.	Total Len.(ft)	H-W coef.	Equivalent K-factor
6	5.60	15.20	1.049	2.00	T	7.00	120.00	5.41
7	5.60	15.60	1.049	2.00	T	7.00	120.00	5.41
9	5.60	14.50	1.049	2.00	T	7.00	120.00	5.41
10	5.60	15.00	3.833	2.00	ET	38.42	120.00	5.60
10	5.60	15.00	1.049	3.83	ET	10.83	120.00	5.32
11	5.60	15.70	1.049	3.83	ET	10.83	120.00	5.32
13	5.60	15.90	1.049	3.33	ET	10.33	120.00	5.33
14	5.60	16.10	1.049	3.33	ET	10.33	120.00	5.33
16	5.60	19.70	1.049	2.50	ET	9.50	120.00	5.35

McKinstry Fire Protection
5005 3RD Avenue South
Seattle, WA 98124

HYDRAULIC CALCULATIONS FOR

KPP
6TH and Central
Kirkland, WA

DRAWING NUMBER: FP-L5 DATE: 1-18-2016

-DESIGN DATA-

REMOTE AREA NUMBER: TWO REMOTE AREA LOCATION: Penthouse Mech. RM.

OCCUPANCY CLASSIFICATION: Ordinary Hazard Group II
DENSITY: .20 gpm/sq. ft.
AREA OF APPLICATION: 1500 sq. ft.

COVERAGE PER SPRINKLER: 99 MAX sq. ft. Calculated
TYPE OF SPRINKLERS CALCULATED: 5.6k S.R.
NUMBER OF SPRINKLERS CALCULATED: 17

*IN-RACK SPRINKLER DEMAND: NA gpm
HOSE-STREAM DEMAND: 250 gpm
TOTAL WATER REQUIRED (INCLUDING HOSE): 640.6 gpm
FLOW AND PRESSURE (AT NODE BOR, BOR): 390.5 gpm @ 70.3 psi

INSTALLING CONTRACTOR
Name: McKinstry Fire Protection

AUTHORITY HAVING JURISDICTION: City of Seattle, Fire Dept.

NOTES: NA
Calculations performed by HASS under license # 50091140 ,
granted by HRS SYSTEMS, INC.
(Notes continue after pipe calculations results.)

WASHINGTON STATE
CERTIFICATE OF COMPENTENCY
FIRE PROTECTION SPRINKLER SYSTEMS

J. Scott Spitzer, Sr.
5763-1094-C Level 3
McKinstry Company, L.L.C.
MCKINCL942DW

Date

Expires
12/31/16

Signature

DATE: 1/18/2016 C:\HASS DATA\15186-PENT.SDF

JOB TITLE: PENTHOUSE KPP

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	@ FLOW (GPM)	AVAIL. PRESS. (PSI)	@ TOTAL DEMAND (GPM)	REQ'D PRESS. (PSI)
SRC	86.7	20.0	1953.0	78.2	640.6	77.2

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	640.6 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	250.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	390.6 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
1	135.0	K= 5.60	15.9	22.3
2	135.0	K= 5.60	16.6	22.8
3	135.0	K= 5.60	15.6	22.1
4	135.0	K= 5.60	16.1	22.4
5	135.0	K= 5.60	17.7	23.6
6	135.0	- - - -	17.8	- - -
7	134.0	- - - -	20.8	- - -
8	134.0	- - - -	19.8	- - -
9	139.8	- - - -	14.4	- - -
10	139.8	K= 5.60	12.8	20.1
11	139.8	K= 5.60	13.4	20.5
12	139.8	K= 5.60	12.5	19.8
13	139.8	K= 5.60	12.9	20.1
14	135.0	K= 5.60	16.3	22.6
15	134.0	- - - -	19.3	- - -
16	139.8	- - - -	14.9	- - -
17	139.8	K= 5.60	13.3	20.4
18	139.8	K= 5.60	13.9	20.9
19	139.8	K= 5.60	14.1	21.0
20	139.8	K= 5.60	14.9	21.6
21	134.0	- - - -	19.2	- - -
22	135.0	- - - -	17.1	- - -
23	135.0	K= 5.60	15.3	21.9
24	135.0	K= 5.60	15.9	22.4
25	135.0	K= 5.60	16.4	22.7
26	134.0	K= 5.60	17.4	23.4
27	135.0	- - - -	24.5	- - -
28	134.0	- - - -	26.0	- - -
29	135.0	- - - -	25.5	- - -
30	134.0	- - - -	26.0	- - -
31	135.0	- - - -	25.5	- - -
32	135.0	- - - -	25.5	- - -
33	135.0	- - - -	25.5	- - -

DATE: 1/18/2016 C:\HASS DATA\15186-PENT.SDF
JOB TITLE: PENTHOUSE KPP

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)
34	134.0	- - - -	26.0	- - -
35	135.0	- - - -	25.5	- - -
36	135.0	- - - -	25.5	- - -
TOP1	134.0	- - - -	29.6	- - -
BOP1	124.0	- - - -	36.3	- - -
TOR	68.0	- - - -	64.1	- - -
BOR	60.0	- - - -	70.3	- - -
UG	57.0	- - - -	76.7	- - -
UG1	57.0	- - - -	76.8	- - -
UG2	57.0	- - - -	77.0	- - -
BF1	60.0	- - - -	70.4	- - -
BF2	60.0	- - - -	75.4	- - -
SRC	57.0	SOURCE	77.2	390.6

DATE: 1/18/2016 C:\HASS DATA\15186-PENT.SDF
JOB TITLE: PENTHOUSE KPP

PIPE DATA

PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT		LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 1					-22.3	1.380	PL	12.00	PF	0.7
1	135.0	5.6	15.9	22.3	4.8	100	FTG	----	PE	0.0
2	135.0	5.6	16.6	22.8		0.059	TL	12.00	PV	
Pipe: 2					-45.2	1.610	PL	11.83	PF	1.2
2	135.0	5.6	16.6	22.8	7.1	100	FTG	----	PE	0.0
6	135.0	0.0	17.8	0.0		0.102	TL	11.83	PV	
Pipe: 3					-22.1	1.380	PL	8.00	PF	0.5
3	135.0	5.6	15.6	22.1	4.7	100	FTG	----	PE	0.0
4	135.0	5.6	16.1	22.4		0.058	TL	8.00	PV	
Pipe: 4					-44.6	1.610	PL	10.67	PF	1.6
4	135.0	5.6	16.1	22.4	7.0	100	FTG	2E	PE	0.0
5	135.0	5.6	17.7	23.6		0.100	TL	16.38	PV	
Pipe: 5					-68.1	1.610	PL	0.58	PF	0.1
5	135.0	5.6	17.7	23.6	10.7	100	FTG	----	PE	0.0
6	135.0	0.0	17.8	0.0		0.219	TL	0.58	PV	
Pipe: 6					-113.3	2.067	PL	1.00	PF	2.5
6	135.0	0.0	17.8	0.0	10.8	100	FTG	2T	PE	0.4
7	134.0	0.0	20.8	0.0		0.166	TL	15.27	PV	
Pipe: 7					277.2	3.068	PL	8.25	PF	1.0
7	134.0	0.0	20.8	0.0	12.0	100	FTG	----	PE	0.0
8	134.0	0.0	19.8	0.0		0.127	TL	8.25	PV	
Pipe: 8					103.1	2.067	PL	5.83	PF	2.8
8	134.0	0.0	19.8	0.0	9.9	100	FTG	2T	PE	-2.5
9	139.8	0.0	14.4	0.0		0.139	TL	20.11	PV	
Pipe: 9					-20.1	1.380	PL	12.00	PF	0.6
10	139.8	5.6	12.8	20.1	4.3	100	FTG	----	PE	0.0
11	139.8	5.6	13.4	20.5		0.048	TL	12.00	PV	
Pipe: 10					-40.6	1.610	PL	12.00	PF	1.0
11	139.8	5.6	13.4	20.5	6.4	100	FTG	----	PE	0.0
9	139.8	0.0	14.4	0.0		0.084	TL	12.00	PV	
Pipe: 11					-19.8	1.380	PL	8.00	PF	0.4
12	139.8	5.6	12.5	19.8	4.2	100	FTG	----	PE	0.0
13	139.8	5.6	12.9	20.1		0.047	TL	8.00	PV	
Pipe: 12					-39.9	1.610	PL	10.67	PF	1.3
13	139.8	5.6	12.9	20.1	6.3	100	FTG	2E	PE	2.1
14	135.0	5.6	16.3	22.6		0.081	TL	16.38	PV	

DATE: 1/18/2016 C:\HASS DATA\15186-PENT.SDF
JOB TITLE: PENTHOUSE KPP

PIPE TAG / END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT		LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 13					-62.5	1.610	PL	1.17	PF	0.2
14	135.0	5.6	16.3	22.6	9.9	100	FTG	----	PE	-2.1
9	139.8	0.0	14.4	0.0		0.186	TL	1.17	PV	
Pipe: 14					174.2	3.068	PL	7.50	PF	0.4
8	134.0	0.0	19.8	0.0	7.6	100	FTG	----	PE	0.0
15	134.0	0.0	19.3	0.0		0.054	TL	7.50	PV	
Pipe: 15					83.8	2.067	PL	5.83	PF	1.9
15	134.0	0.0	19.3	0.0	8.0	100	FTG	2T	PE	-2.5
16	139.8	0.0	14.9	0.0		0.095	TL	20.10	PV	
Pipe: 16					-20.4	1.380	PL	12.00	PF	0.6
17	139.8	5.6	13.3	20.4	4.4	100	FTG	----	PE	0.0
18	139.8	5.6	13.9	20.9		0.050	TL	12.00	PV	
Pipe: 17					-41.3	1.610	PL	12.00	PF	1.0
18	139.8	5.6	13.9	20.9	6.5	100	FTG	----	PE	0.0
16	139.8	0.0	14.9	0.0		0.086	TL	12.00	PV	
Pipe: 18					-21.0	1.380	PL	11.00	PF	0.8
19	139.8	5.6	14.1	21.0	4.5	100	FTG	2E	PE	0.0
20	139.8	5.6	14.9	21.6		0.052	TL	15.28	PV	
Pipe: 19					-42.6	1.610	PL	0.58	PF	0.1
20	139.8	5.6	14.9	21.6	6.7	100	FTG	----	PE	0.0
16	139.8	0.0	14.9	0.0		0.092	TL	0.58	PV	
Pipe: 20					90.3	3.068	PL	8.25	PF	0.1
15	134.0	0.0	19.3	0.0	3.9	100	FTG	----	PE	0.0
21	134.0	0.0	19.2	0.0		0.016	TL	8.25	PV	
Pipe: 21					90.3	2.067	PL	1.00	PF	1.7
21	134.0	0.0	19.2	0.0	8.6	100	FTG	2T	PE	-0.4
22	135.0	0.0	17.1	0.0		0.109	TL	15.27	PV	
Pipe: 22					-21.9	1.380	PL	12.00	PF	0.7
23	135.0	5.6	15.3	21.9	4.7	100	FTG	----	PE	0.0
24	135.0	5.6	15.9	22.4		0.057	TL	12.00	PV	
Pipe: 23					-44.2	1.610	PL	12.00	PF	1.2
24	135.0	5.6	15.9	22.4	7.0	100	FTG	----	PE	0.0
22	135.0	0.0	17.1	0.0		0.098	TL	12.00	PV	
Pipe: 24					-22.7	1.380	PL	10.00	PF	0.6
25	135.0	5.6	16.4	22.7	4.9	100	FTG	----	PE	0.4
26	134.0	5.6	17.4	23.4		0.061	TL	10.00	PV	
Pipe: 25					-46.1	1.610	PL	1.00	PF	0.1
26	134.0	5.6	17.4	23.4	7.3	100	FTG	----	PE	-0.4
22	135.0	0.0	17.1	0.0		0.106	TL	1.00	PV	

DATE: 1/18/2016 C:\HASS DATA\15186-PENT.SDF
JOB TITLE: PENTHOUSE KPP

PIPE TAG END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT		LENGTH (FT)		PRESS. SUM. (PSI)
Pipe: 26					-390.5	3.068	PL	12.25	PF	4.1
7	134.0	0.0	20.8	0.0	16.9	100	FTG	E	PE	-0.4
27	135.0	0.0	24.5	0.0		0.239	TL	17.25	PV	
Pipe: 27					-390.5	3.068	PL	4.42	PF	1.1
27	135.0	0.0	24.5	0.0	16.9	100	FTG	----	PE	0.4
28	134.0	0.0	26.0	0.0		0.239	TL	4.42	PV	
Pipe: 28					0.0	3.068	PL	8.58	PF	0.0
28	134.0	0.0	26.0	0.0	0.0	100	FTG	----	PE	-0.4
29	135.0	0.0	25.5	0.0		0.000	TL	8.58	PV	
Pipe: 29					0.0	2.469	PL	1.00	PF	0.0
30	134.0	0.0	26.0	0.0	0.0	100	FTG	2T	PE	-0.4
31	135.0	0.0	25.5	0.0		0.000	TL	18.13	PV	
Pipe: 30					0.0	1.380	PL	10.00	PF	0.0
32	135.0	0.0	25.5	0.0	0.0	100	FTG	----	PE	0.0
33	135.0	0.0	25.5	0.0		0.000	TL	10.00	PV	
Pipe: 31					0.0	1.610	PL	0.58	PF	0.0
33	135.0	0.0	25.5	0.0	0.0	100	FTG	----	PE	0.0
31	135.0	0.0	25.5	0.0		0.000	TL	0.58	PV	
Pipe: 32					0.0	3.068	PL	8.25	PF	0.0
30	134.0	0.0	26.0	0.0	0.0	100	FTG	----	PE	0.0
34	134.0	0.0	26.0	0.0		0.000	TL	8.25	PV	
Pipe: 33					0.0	2.469	PL	5.83	PF	0.0
34	134.0	0.0	26.0	0.0	0.0	100	FTG	2T	PE	-0.4
35	135.0	0.0	25.5	0.0		0.000	TL	22.96	PV	
Pipe: 34					0.0	1.380	PL	0.58	PF	0.0
36	135.0	0.0	25.5	0.0	0.0	100	FTG	----	PE	0.0
35	135.0	0.0	25.5	0.0		0.000	TL	0.58	PV	
Pipe: 35					0.0	3.068	PL	24.50	PF	0.0
34	134.0	0.0	26.0	0.0	0.0	100	FTG	E	PE	-0.4
29	135.0	0.0	25.5	0.0		0.000	TL	29.50	PV	
Pipe: 36					-390.5	4.026	PL	22.00	PF	3.7
28	134.0	0.0	26.0	0.0	9.8	100	FTG	3ET	PE	0.0
TOP1	134.0	0.0	29.6	0.0		0.064	TL	57.68	PV	
Pipe: 37					-390.5	4.026	PL	10.00	PF	2.4
TOP1	134.0	0.0	29.6	0.0	9.8	120	FTG	ETB	PE	4.3
BOP1	124.0	0.0	36.3	0.0		0.045	TL	52.00	PV	
Pipe: 38					-390.5	4.026	PL	56.00	PF	3.5
BOP1	124.0	0.0	36.3	0.0	9.8	120	FTG	T	PE	24.3
TOR	68.0	0.0	64.1	0.0		0.045	TL	76.00	PV	

DATE: 1/18/2016 C:\HASS DATA\15186-PENT.SDF

JOB TITLE: PENTHOUSE KPP

PIPE TAG END NODES	ELEV. (FT)	NOZ. (K)	PT (PSI)	DISC. (GPM)	Q(GPM) VEL(FPS)	DIA(IN) HW(C) FL/FT	LENGTH (FT)	PRESS. SUM. (PSI)
Pipe: 39					-390.5	4.026 PL	8.00	PF 2.7
TOR	68.0	0.0	64.1	0.0	9.8	120 FTG	ETC	PE 3.5
BOR	60.0	0.0	70.3	0.0		0.045 TL	60.00	PV
Pipe: 40					-390.5	4.026 PL	2.00	PF 0.1
BOR	60.0	0.0	70.3	0.0	9.8	100 FTG	----	PE 0.0
BF1	60.0	0.0	70.4	0.0		0.064 TL	2.00	PV
Pipe: 41					FIXED PRESSURE LOSS DEVICE			
BF2	60.0	0.0	75.4	0.0	5.0 psi, 390.5 gpm			
BF1	60.0	0.0	70.4	0.0				
Pipe: 42					-390.5	8.380 PL	4.00	PF 0.0
BF2	60.0	0.0	75.4	0.0	2.3	140 FTG	L	PE 1.3
UG	57.0	0.0	76.7	0.0		0.001 TL	25.93	PV
Pipe: 43					-390.5	8.380 PL	66.00	PF 0.1
UG	57.0	0.0	76.7	0.0	2.3	140 FTG	TG	PE 0.0
UG1	57.0	0.0	76.8	0.0		0.001 TL	131.78	PV
Pipe: 44					-390.5	8.380 PL	66.00	PF 0.1
UG1	57.0	0.0	76.8	0.0	2.3	140 FTG	TG	PE 0.0
UG2	57.0	0.0	77.0	0.0		0.001 TL	131.78	PV
Pipe: 45					-390.6	8.380 PL	165.00	PF 0.2
UG2	57.0	0.0	77.0	0.0	2.3	140 FTG	TG	PE 0.0
SRC	57.0	SRCE	77.2	(N/A)		0.001 TL	230.78	PV

NOTES (HASS):

(1) Calculations were performed by the HASS 8.5 computer program under license no. 50091140 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 0.002 gpm and a maximum imbalance at any node of 0.105 gpm.

(3) Total pressure at each node is used in balancing the system. Maximum water velocity is 16.9 ft/sec at pipe 26.

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

are automatically transferred from the calculation report.

(5) Available pressure at source node SRC under full flow conditions is 78.10 psi compared to the minimum required pressure of 20.00 psi.

(6) PIPE FITTINGS TABLE

Pipe Table Name: STANDARD.PIP

PAGE: * MATERIAL: S40 HWC: 120

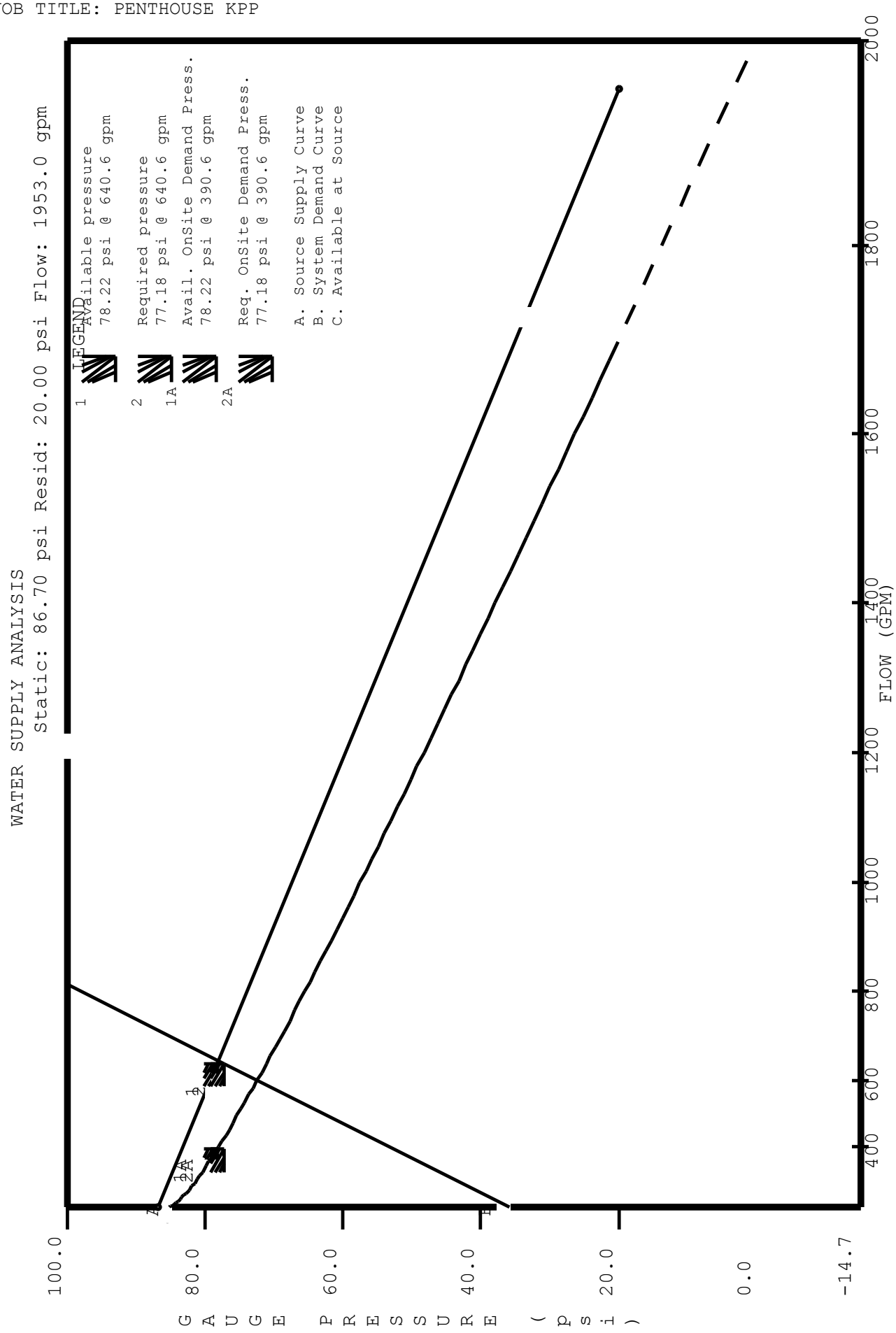
Diameter (in)	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
8.380	22.83	44.39	16.49	57.07	15.22	5.07	39.31	39.31	44.39

PAGE: A MATERIAL: S40 HWC: 120

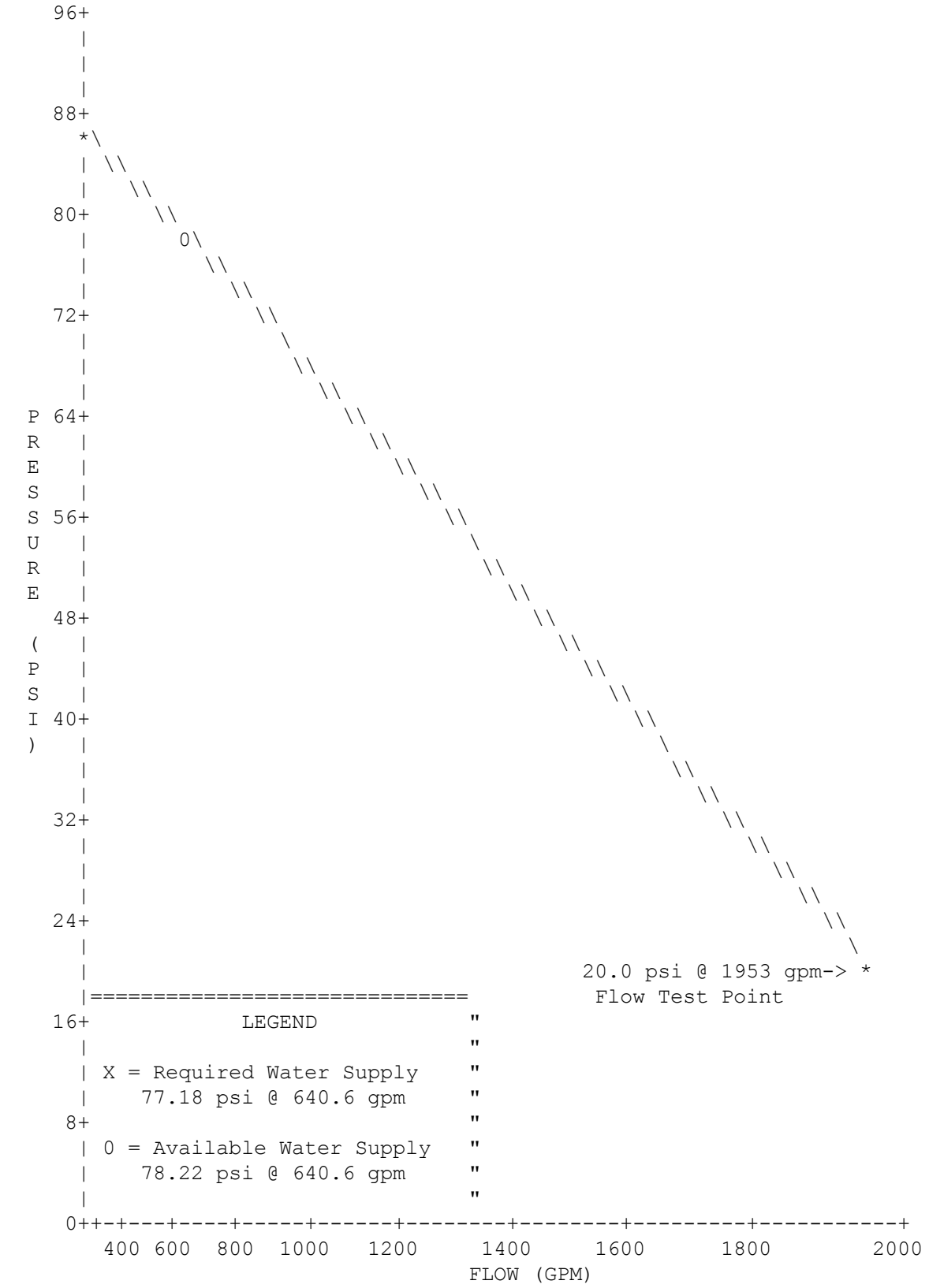
Diameter (in)	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NPTee
1.380	3.00	6.00	2.00	7.00	6.00	1.00	10.00	10.00	6.00
1.610	4.00	8.00	2.00	9.00	6.00	1.00	10.00	10.00	8.00
2.067	5.00	10.00	3.00	11.00	6.00	1.00	10.00	10.00	10.00
2.469	6.00	12.00	4.00	14.00	7.00	1.00	10.00	10.00	12.00
3.068	7.00	15.00	5.00	16.00	10.00	1.00	13.00	13.00	15.00
4.026	10.00	20.00	6.00	22.00	12.00	2.00	20.00	20.00	20.00

DATE: 1/18/2016 C:\HASS DATA\15186-PENT.SDF

JOB TITLE: PENTHOUSE KPP



Note: (1) Dashed Lines indicate extrapolated values from Test Results
(2) On Site pressures are based on hose stream deduction at the source

DATE: 1/18/2016 C:\HASS DATA\15186-PENT.SDF
JOB TITLE: PENTHOUSE KPP

WATER SUPPLY CURVE