SPRINX FIRE PROTECTION

2709 Jahn Ave NW, Suite H2, Gig Harbor WA 98335

Ph. (253) 853-7780– www.SprinxFire.com

EST. 1999

Hydraulic Calculations

SPRINX FIRE PROTECTION INC.
2709 JAHN AVE NW SUITE H2
GIG HARBOR, WA 98335
253-853-7780

Job Name	: ETC Building A Area 1
Drawing	: FP-3.0
Location	: 2902 E PIONEER PUYALLUP, WA 98372
Remote Area	: RA#1
Contract	: 24-093CM
Data File	: ETC Building A Area 1.WXF

HYDRAULIC CALCULATIONS
for

JOB NAME   East Town Crossing Building A
Location   2902 E PIONEER PUYALLUP, WA 98372
Drawing #   FP-3.0
Contract #   24-093CM
Date   8/20/2025

DESIGN
    Remote area #   RA#1
    Remote area location   UNIT 301 - LIVING ROOM
    Occupancy classification RESIDENTIAL NFPA 13R
    Density   0.05 - Gpm/SqFt
    Area of application   256 - SqFt
    Coverage/sprinkler   256 16'X16' - SqFt
    Type of sprinkler calculated VIKING VK468 RESIDENTIAL PENDENT K=4.9
    # Sprinklers calculated   4
    In-rack demand   N/A - GPM
    Hose streams   N/A - GPM
    Total water required (including hose streams)   53.8947 - GPM   @   32.0799 - Psi
    Type of system   WET-CPVC
    Volume of system (dry or pre-action) N/A - Gal

WATER SUPPLY INFORMATION
    Test date   4/16/2024
    Location   2902 E PIONEER
    Source of info   CITY OF PUYALLUP WATER DIVISON

CONTRACTOR INFO   SPRINX FIRE PROTECTION
Address   2709 JAHN AVE. / SUITE H2 / GIG HARBOR
Phone #   253-853-7780
Name of designer   ALEXANDER J PARADIS
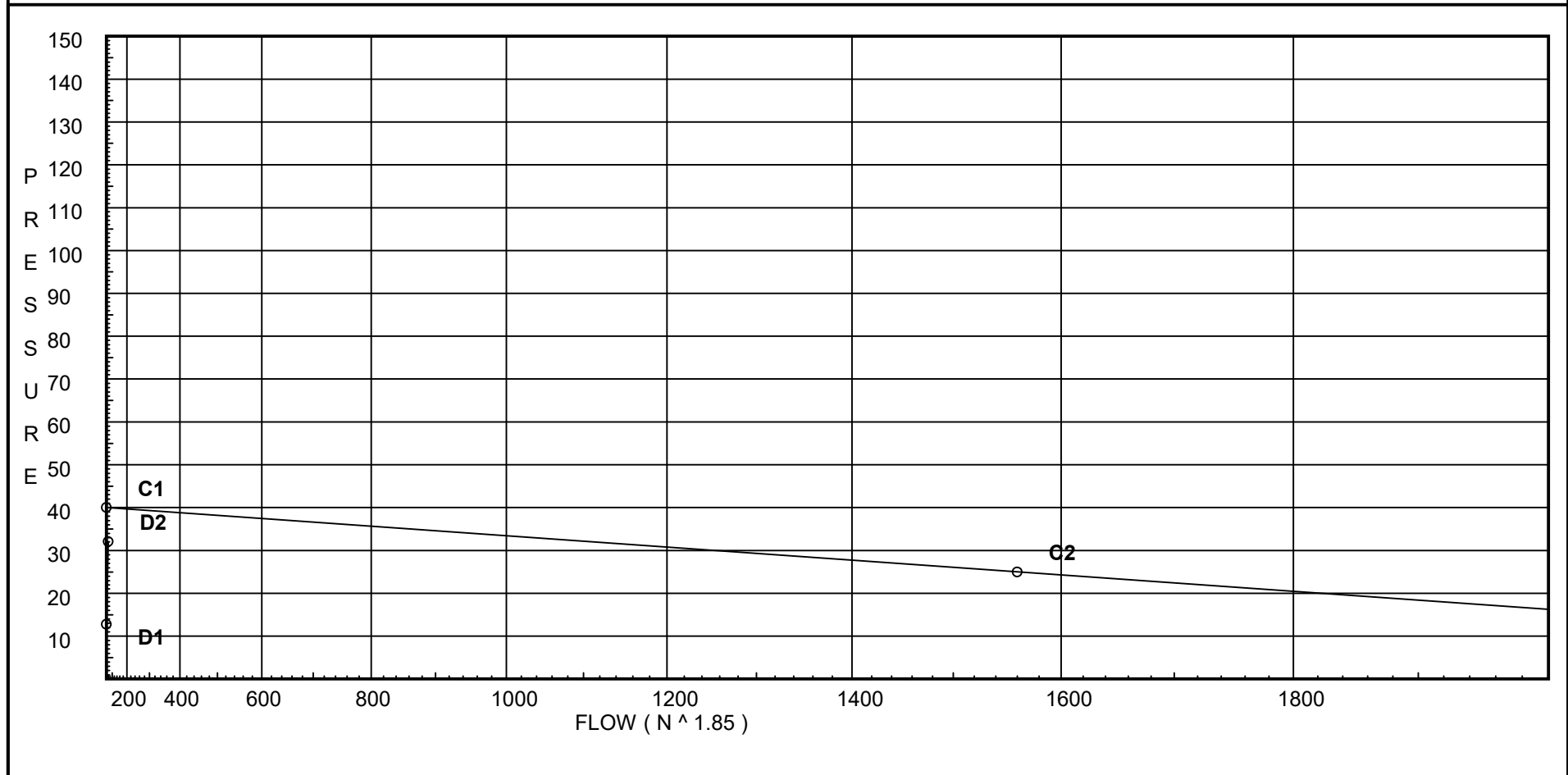**Authority having jurisdiction** CITY OF PUYALLUP
NOTES:

Water Supply Curve

City Water Supply:
- C1 - Static Pressure   : 40
- C2 - Residual Pressure: 25
- C2 - Residual Flow   : 1560
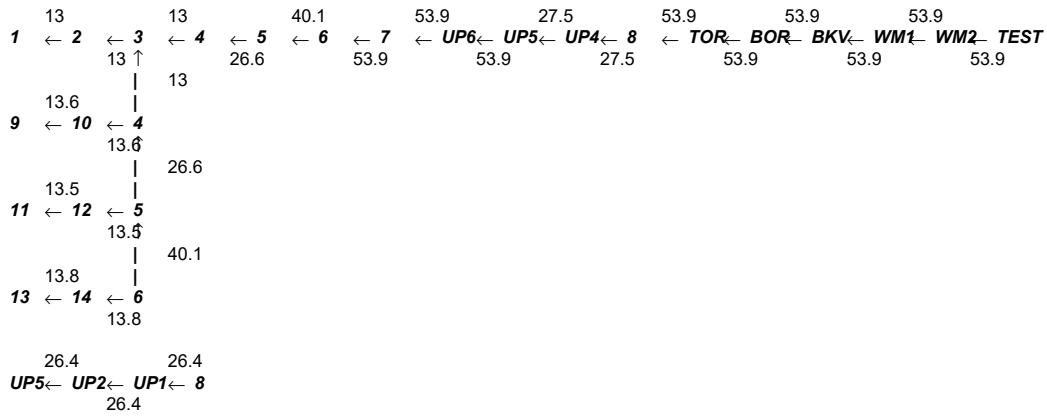
Demand:
- D1 - Elevation   : 12.776
- D2 - System Flow   : 53.895
- D2 - System Pressure   : 32.080
- Hose (Demand)   : _____
- D3 - System Demand   : 53.895
- Safety Margin   : 7.890

Pressure (y-axis) vs FLOW (N ^ 1.85) (x-axis)

Points plotted: C1 (~40), D2 (~32), D1 (~12), C2 (~25 at 1560)

Flow Diagram

```
      13           13           40.1         53.9         27.5         53.9         53.9         53.9
  1  ← 2   ← 3   ← 4   ← 5   ← 6   ← 7   ← UP6← UP5← UP4← 8   ← TOR← BOR← BKV← WM1← WM2← TEST
                 13 ↑        26.6         53.9         53.9         27.5         53.9         53.9         53.9
                  |    13
      13.6         |
  9  ← 10  ← 4
      13.6
                  |    26.6
      13.5         |
 11  ← 12  ← 5
      13.5
                  |    40.1
      13.8         |
 13  ← 14  ← 6
      13.8

      26.4         26.4
 UP5← UP2← UP1← 8
      26.4
```

Fittings Used Summary

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	NFPA 13 Butterfly Valve	0	0	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
N *	CPVC 90'Ell Harvel-Spears		7	7	8	9	11	12	13	0	0	0	0	0	0	0	0	0	0	0	0
O *	CPVC Tee - Branch	3	3	5	6	8	10	12	15	0	0	0	0	0	0	0	0	0	0	0	0
R *	CPVC Coupling Tee - Run	1	1	1	1	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
S	NFPA 13 Swing Check	0	0	5	7	9	11	14	16	19	22	27	32	45	55	65					
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
Ziw	Wilkins 350AST	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Flow Summary - NFPA

SUPPLY ANALYSIS

Node at Source	Static Pressure	Residual Pressure	Flow	Available Pressure	Total Demand	Required Pressure
TEST	40.0	25	1560.0	39.97	53.89	32.08

NODE ANALYSIS

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node		Notes
1	106.5	4.9	7.04	13.0	0.05	256
2	107.0		7.05			
3	107.0		7.41			
4	107.0		7.73			
5	107.0		7.92			
6	107.0		8.16			
7	107.0		8.38			
UP6	107.0		8.99			
UP5	96.75		13.69			
UP4	86.5		18.26			
8	86.5		19.05			
TOR	86.5		20.93			
BOR	80.0		24.47			
BKV	77.0		32.07			
WM1	77.0		32.08			
WM2	77.0		32.08			
TEST	77.0		32.08			
9	105.5	4.9	7.7	13.6	0.05	256
10	107.0		7.3			
11	106.5	4.9	7.61	13.52	0.05	256
12	107.0		7.61			
13	106.5	4.9	7.91	13.78	0.05	256
14	107.0		7.95			
UP2	96.75		14.41			
UP1	86.5		18.98			

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	******* Notes ******
1 to 2	106.500 107	4.90	13.00 13.0	1 1.101	N	7.0	0.500 7.000 7.500	150 0.0307	7.040 -0.217 0.230	Vel = 4.38
2 to 3	107 107		0.0 13.0	1 1.101	O	5.0	6.580 5.000 11.580	150 0.0307	7.053 0.0 0.356	Vel = 4.38
3 to 4	107 107		0.0 13.0	1 1.101	2R	2.0	8.580 2.000 10.580	150 0.0306	7.409 0.0 0.324	Vel = 4.38
4 to 5	107 107		13.60 26.6	1.25 1.394	R	1.0	4.170 1.000 5.170	150 0.0366	7.733 0.0 0.189	Vel = 5.59
5 to 6	107 107		13.52 40.12	1.25 1.394	R	1.0	2.080 1.000 3.080	150 0.0782	7.922 0.0 0.241	Vel = 8.43
6 to 7	107 107		13.77 53.89	2 2.003	2R	2.0	7.250 2.000 9.250	150 0.0230	8.163 0.0 0.213	Vel = 5.49
7 to UP6	107 107		0.0 53.89	2 2.003	2N	22.0	4.500 22.000 26.500	150 0.0231	8.376 0.0 0.612	Vel = 5.49
UP6 to UP5	107 96.750		0.0 53.89	2 2.003	R	1.0	10.250 1.000 11.250	150 0.0232	8.988 4.439 0.261	Vel = 5.49
UP5 to UP4	96.750 86.500		-26.35 27.54	2 2.003	O	10.0	10.250 10.000 20.250	150 0.0067	13.688 4.439 0.135	Vel = 2.80
UP4 to 8	86.500 86.500		0.0 27.54	2 2.003	2N 14R O	22.0 14.0 10.0	71.580 46.000 117.580	150 0.0067	18.262 0.0 0.784	Vel = 2.80
8 to TOR	86.500 86.500		26.35 53.89	2 2.003	6R O 3N	6.0 10.0 33.0	32.670 49.000 81.670	150 0.0231	19.046 0.0 1.886	Vel = 5.49
TOR to BOR	86.500 80		0.0 53.89	2 2.203	B S	8.183 15.003	9.500 23.186 32.686	120 0.0220	20.932 2.815 0.718	Vel = 4.54
BOR to BKV	80 77		0.0 53.89	6 6.16	T 3E Ziw	43.037 60.252 0.0	75.000 103.289 178.289	140 0.0001	24.465 7.581 0.020	* * Fixed Loss = 6.281 Vel = 0.58
BKV to WM1	77 77		0.0 53.89	6 6.16	T G	43.037 4.304	55.000 47.341 102.341	140 0.0001	32.066 0.0 0.011	Vel = 0.58
WM1 to WM2	77 77		0.0 53.89	8 8.27	T	55.354	35.000 55.354 90.354	140 0	32.077 0.0 0.002	Vel = 0.32
WM2 to TEST	77 77		0.0 53.89	8 8.27			25.000 25.000	140 0	32.079 0.0 0.001	Vel = 0.32

Final Calculations : Hazen-Williams

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*******	Notes	******
			0.0									
TEST			53.89						32.080	K Factor = 9.51		
9 to	105.500	4.90	13.60	1	N	7.0	0.500	150	7.700			
							7.000		-0.650			
10	107		13.6	1.101			7.500	0.0333	0.250	Vel = 4.58		
10 to	107		0.0	1	2O	10.0	3.000	150	7.300			
							10.000		0.0			
4	107		13.6	1.101			13.000	0.0333	0.433	Vel = 4.58		
			0.0									
4			13.60						7.733	K Factor = 4.89		
11 to	106.500	4.90	13.52	1	O	5.0	1.500	150	7.611			
							5.000		-0.217			
12	107		13.52	1.101			6.500	0.0331	0.215	Vel = 4.56		
12 to	107		0.0	1	O	5.0	4.500	150	7.609			
							5.000		0.0			
5	107		13.52	1.101			9.500	0.0329	0.313	Vel = 4.56		
			0.0									
5			13.52						7.922	K Factor = 4.80		
13 to	106.500	4.90	13.78	1	N	7.0	0.500	150	7.907			
							7.000		-0.217			
14	107		13.78	1.101			7.500	0.0343	0.257	Vel = 4.64		
14 to	107		0.0	1	O	5.0	1.330	150	7.947			
							5.000		0.0			
6	107		13.78	1.101			6.330	0.0341	0.216	Vel = 4.64		
			0.0									
6			13.78						8.163	K Factor = 4.82		
UP5 to	96.750		26.36	2	2N	22.0	71.580	150	13.688			
					14R	14.0	46.000		0.0			
UP2	96.750		26.36	2.003	O	10.0	117.580	0.0061	0.723	Vel = 2.68		
UP2 to	96.750		0.0	2	N	11.0	10.250	150	14.411			
							11.000		4.439			
UP1	86.500		26.36	2.003			21.250	0.0061	0.130	Vel = 2.68		
UP1 to	86.500		0.0	2	O	10.0	0.670	150	18.980			
							10.000		0.0			
8	86.500		26.36	2.003			10.670	0.0062	0.066	Vel = 2.68		
			0.0									
8			26.36						19.046	K Factor = 6.04		

2709 Jahn Ave NW, Suite H2, Gig Harbor WA 98335

Ph. (253) 853-7780– www.SprinxFire.com

Hydraulic Calculations

SPRINX FIRE PROTECTION INC.
2709 JAHN AVE NW SUITE H2
GIG HARBOR, WA 98335
253-853-7780

Job Name	:	ETC Building A Area 2
Drawing	:	FP-3.0
Location	:	2902 E PIONEER PUYALLUP, WA 98372
Remote Area	:	RA#2
Contract	:	24-093CM
Data File	:	ETC Building A Area 2.WXF

HYDRAULIC CALCULATIONS
for

JOB NAME   East Town Crossing Building A
Location   2902 E PIONEER PUYALLUP, WA 98372
Drawing #   FP-3.0
Contract #   24-093CM
Date   8/20/2025

DESIGN

> **Remote area #**   RA#2
> **Remote area location**   UNIT 301 - BEDROOM
> **Occupancy classification**   RESIDENTIAL NFPA 13R
> **Density**   0.05 - Gpm/SqFt
> **Area of application**   324 - SqFt
> **Coverage/sprinkler**   324 18'X18 - SqFt
> **Type of sprinkler calculated**   VIKING VK468 RESIDENTIAL PENDENT K=4.9
> **# Sprinklers calculated**   1
> **In-rack demand**   N/A - GPM
> **Hose streams**   N/A - GPM
> **Total water required (including hose streams)**   17.0024 - GPM   @   33.7653 - Psi
> **Type of system**   WET-CPVC
> **Volume of system (dry or pre-action)** N/A - Gal

WATER SUPPLY INFORMATION

> **Test date**   4/16/2024
> **Location**   2902 E PIONEER
> **Source of info**   CITY OF PUYALLUP WATER DIVISON

CONTRACTOR INFO   SPRINX FIRE PROTECTION
Address   2709 JAHN AVE. / SUITE H2 / GIG HARBOR
Phone #   253-853-7780
Name of designer   ALEXANDER J PARADIS
Authority having jurisdiction CITY OF PUYALLUP
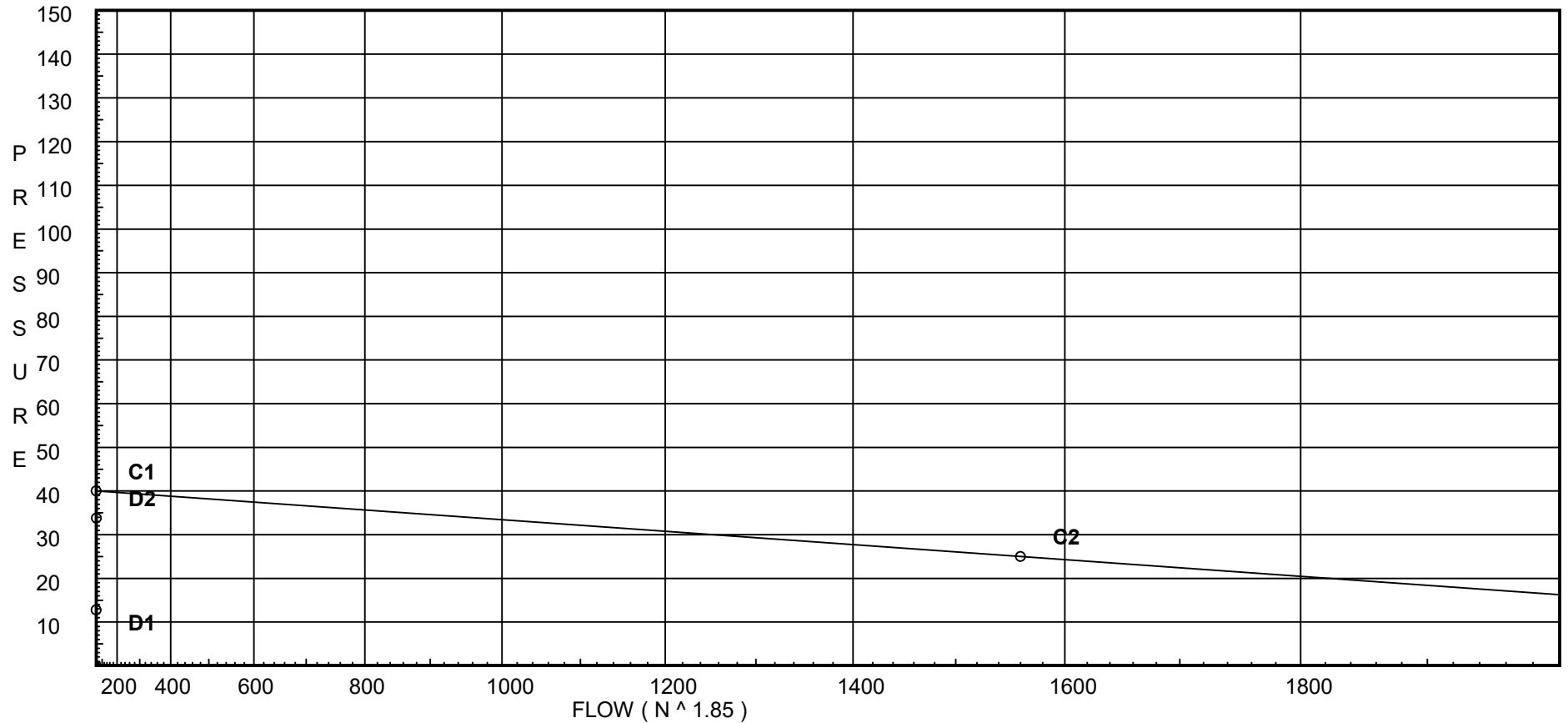**NOTES:**

Water Supply Curve

City Water Supply:
    C1 - Static Pressure   : 40
    C2 - Residual Pressure: 25
    C2 - Residual Flow   : 1560

Demand:
    D1 - Elevation   : 12.776
    D2 - System Flow   : 17.002
    D2 - System Pressure : 33.765
    Hose (Demand)   : _____
    D3 - System Demand   : 17.002
    Safety Margin   : 6.231

Pressure axis (vertical): 150, 140, 130, 120, 110, 100, 90, 80, 70, 60, 50, 40, 30, 20, 10

Data points: C1, D2, C2, D1

FLOW (N ^ 1.85)

Flow axis (horizontal): 200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800

Flow Diagram

```
      17          17          17          17        8.7         17          17          17
16 ← 17 ← 3 ← 4 ← 5 ← 6 ← 7 ← UP6← UP5← UP4← 8 ← TOR← BOR← BKV← WM1← WM2← TEST
      17          17          17          17        8.7         17          17          17

      8.3
UP5← UP2← UP1   7
      8.3
```

Fittings Used Summary

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	NFPA 13 Butterfly Valve	0	0	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
N *	CPVC 90'Ell Harvel-Spears		7	7	8	9	11	12	13	0	0	0	0	0	0	0	0	0	0	0	0
O *	CPVC Tee - Branch	3	3	5	6	8	10	12	15	0	0	0	0	0	0	0	0	0	0	0	0
R *	CPVC Coupling Tee - Run	1	1	1	1	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
S	NFPA 13 Swing Check	0	0	5	7	9	11	14	16	19	22	27	32	45	55	65					
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
Ziw	Wilkins 350AST	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters.
Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors
of 120 except as noted with *. The fittings marked with a * show equivalent lengths values
supplied by manufacturers based on specific pipe diameters and CFactors and they require no
adjustment. All values for fittings not marked with a * will be adjusted in the calculation
for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

SUPPLY ANALYSIS

Node at Source	Static Pressure	Residual Pressure	Flow	Available Pressure	Total Demand	Required Pressure
TEST	40.0	25	1560.0	39.996	17.0	33.765

NODE ANALYSIS

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node		Notes
16	106.5	4.9	12.04	17.0	0.05	324
17	107.0		12.2			
3	107.0		12.78			
4	107.0		13.32			
5	107.0		13.4			
6	107.0		13.45			
7	107.0		13.47			
UP6	107.0		13.55			
UP5	96.75		18.02			
UP4	86.5		22.47			
8	86.5		22.57			
TOR	86.5		22.79			
BOR	80.0		25.69			
BKV	77.0		33.76			
WM1	77.0		33.76			
WM2	77.0		33.77			
TEST	77.0		33.77			
UP2	96.75		18.1			
UP1	86.5		22.56			

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	******* Notes ******
16 to 17	106.500 107	4.90	17.00 17.0	1 1.101	N	7.0	0.500 7.000 7.500	150 0.0504	12.040 -0.217 0.378	Vel = 5.73
17 to 3	107 107		0.0 17.0	1 1.101	O	5.0	6.580 5.000 11.580	150 0.0504	12.201 0.0 0.584	Vel = 5.73
3 to 4	107 107		0.0 17.0	1 1.101	2R	2.0	8.580 2.000 10.580	150 0.0504	12.785 0.0 0.533	Vel = 5.73
4 to 5	107 107		0.0 17.0	1.25 1.394	R	1.0	4.170 1.000 5.170	150 0.0159	13.318 0.0 0.082	Vel = 3.57
5 to 6	107 107		0.0 17.0	1.25 1.394	R	1.0	2.080 1.000 3.080	150 0.0162	13.400 0.0 0.050	Vel = 3.57
6 to 7	107 107		0.0 17.0	2 2.003	2R	2.0	7.250 2.000 9.250	150 0.0027	13.450 0.0 0.025	Vel = 1.73
7 to UP6	107 107		0.0 17.0	2 2.003	2N	22.0	4.500 22.000 26.500	150 0.0027	13.475 0.0 0.072	Vel = 1.73
UP6 to UP5	107 96.750		0.0 17.0	2 2.003	R	1.0	10.250 1.000 11.250	150 0.0028	13.547 4.439 0.031	Vel = 1.73
UP5 to UP4	96.750 86.500		-8.31 8.69	2 2.003	O	10.0	10.250 10.000 20.250	150 0.0008	18.017 4.439 0.017	Vel = 0.88
UP4 to 8	86.500 86.500		0.0 8.69	2 2.003	2N 14R O	22.0 14.0 10.0	71.580 46.000 117.580	150 0.0008	22.473 0.0 0.092	Vel = 0.88
8 to TOR	86.500 86.500		8.31 17.0	2 2.003	6R O 3N	6.0 10.0 33.0	32.670 49.000 81.670	150 0.0027	22.565 0.0 0.224	Vel = 1.73
TOR to BOR	86.500 80		0.0 17.0	2 2.203	B S	8.183 15.003	9.500 23.186 32.686	120 0.0026	22.789 2.815 0.085	Vel = 1.43
BOR to BKV	80 77		0.0 17.0	6 6.16	T 3E Ziw	43.037 60.252 0.0	75.000 103.289 178.289	140 0	25.689 8.073 0.002	* * Fixed Loss = 6.773 Vel = 0.18
BKV to WM1	77 77		0.0 17.0	6 6.16	T G	43.037 4.304	55.000 47.341 102.341	140 0	33.764 0.0 0.001	Vel = 0.18
WM1 to WM2	77 77		0.0 17.0	8 8.27	T	55.354	35.000 55.354 90.354	140 0	33.765 0.0 0.0	Vel = 0.10
WM2 to TEST	77 77		0.0 17.0	8 8.27			25.000 25.000	140 0	33.765 0.0 0.0	Vel = 0.10

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*******	Notes	******
			0.0									
TEST			17.00						33.765	K Factor = 2.93		
UP5	96.750		8.31	2	2N	22.0	71.580	150	18.017			
to					14R	14.0	46.000		0.0			
UP2	96.750		8.31	2.003	O	10.0	117.580	0.0007	0.086	Vel = 0.85		
UP2	96.750		0.0	2	N	11.0	10.250	150	18.103			
to							11.000		4.439			
UP1	86.500		8.31	2.003			21.250	0.0008	0.016	Vel = 0.85		
UP1	86.500		0.0	2	O	10.0	0.670	150	22.558			
to							10.000		0.0			
8	86.500		8.31	2.003			10.670	0.0007	0.007	Vel = 0.85		
			0.0									
8			8.31						22.565	K Factor = 1.75		
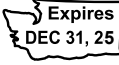
2709 Jahn Ave NW, Suite H2, Gig Harbor WA 98335

Ph. (253) 853-7780– www.SprinxFire.com

Hydraulic Calculations

SPRINX FIRE PROTECTION INC.
2709 JAHN AVE NW SUITE H2
GIG HARBOR, WA 98335
253-853-7780

Job Name	: ETC Building A Area 3
Drawing	: FP-3.0
Location	: 2902 E PIONEER PUYALLUP, WA 98372
Remote Area	: RA#3
Contract	: 24-093CM
Data File	: ETC Building A Area 3.WXF

HYDRAULIC CALCULATIONS
for

JOB NAME   East Town Crossing Building A
Location   2902 E PIONEER PUYALLUP, WA 98372
Drawing #   FP-3.0
Contract #   24-093CM
Date   8/20/2025

DESIGN
      Remote area #   RA#3
      Remote area location   STAIRWELL
      Occupancy classification   LIGHT HAZARD
      Density   0.10 - Gpm/SqFt
      Area of application   273 - SqFt
      Coverage/sprinkler   4 HEADS - SqFt
      Type of sprinkler calculated   VIKING VK178 QR CHROME DRY HORIZONTAL SIDEWALL
      # Sprinklers calculated   4
      In-rack demand   N/A - GPM
      Hose streams   N/A - GPM
      Total water required (including hose streams)   62.99 - GPM   @   33.4712 - Psi
      Type of system   WET-CPVC
      Volume of system (dry or pre-action)   N/A - Gal

WATER SUPPLY INFORMATION
      Test date   4/16/2024
      Location   2902 E PIONEER
      Source of info   CITY OF PUYALLUP WATER DIVISON

CONTRACTOR INFO   SPRINX FIRE PROTECTION
Address   2709 JAHN AVE. / SUITE H2 / GIG HARBOR
Phone #   253-853-7780
Name of designer   ALEXANDER J PARADIS
Authority having jurisdiction CITY OF PUYALLUP
NOTES:

Water Supply Curve
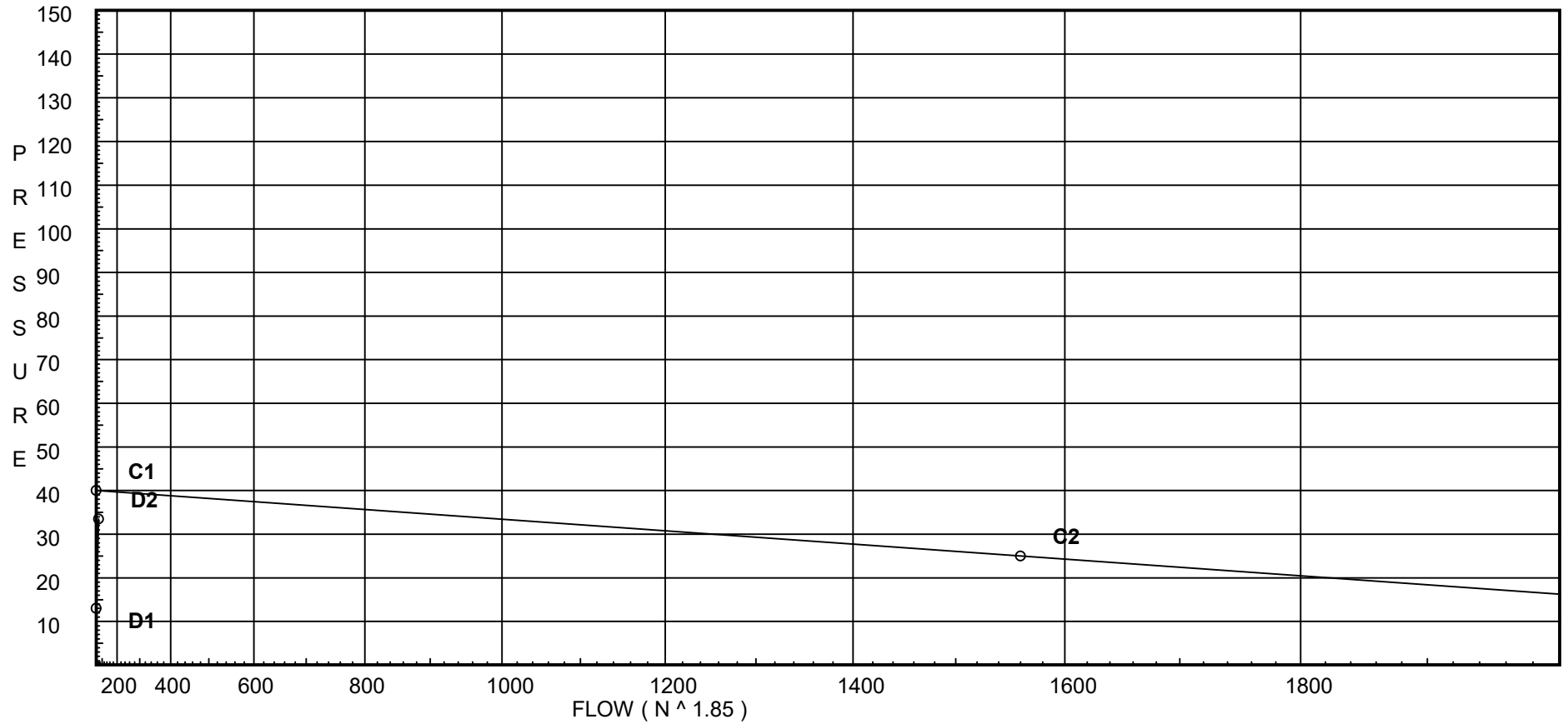
City Water Supply:
    C1 - Static Pressure   : 40
    C2 - Residual Pressure: 25
    C2 - Residual Flow   : 1560

Demand:
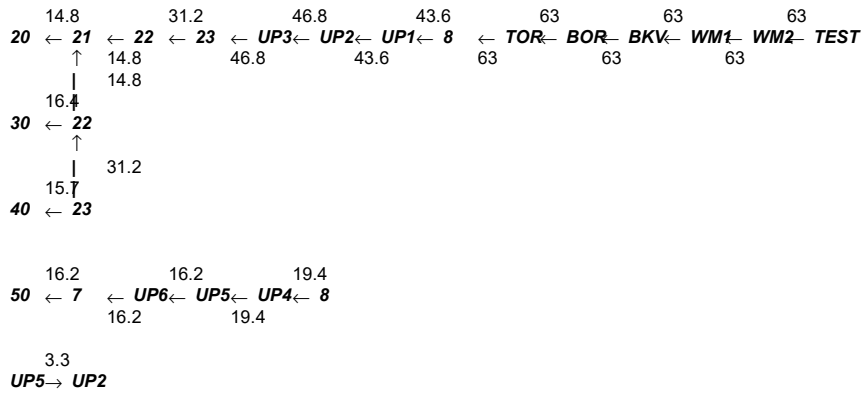   D1 - Elevation   : 12.993
    D2 - System Flow   : 62.99
    D2 - System Pressure   : 33.471
    Hose (Demand)   : _____
    D3 - System Demand   : 62.99
    Safety Margin   : 6.489

Pressure vs. FLOW (N ^ 1.85)

```
     14.8        31.2        46.8       43.6        63        63        63
20 ← 21  ← 22  ← 23  ← UP3← UP2← UP1← 8   ← TOR← BOR← BKV← WM1← WM2← TEST
     ↑    14.8            46.8       43.6       63        63        63
     |    14.8
    16.4
30 ← 22
     ↑
     |    31.2
    15.7
40 ← 23


     16.2        16.2       19.4
50 ← 7   ← UP6← UP5← UP4← 8
          16.2       19.4


     3.3
UP5→ UP2
```

Fittings Used Summary

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	NFPA 13 Butterfly Valve	0	0	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
N *	CPVC 90'Ell Harvel-Spears		7	7	8	9	11	12	13	0	0	0	0	0	0	0	0	0	0	0	0
O *	CPVC Tee - Branch	3	3	5	6	8	10	12	15	0	0	0	0	0	0	0	0	0	0	0	0
R *	CPVC Coupling Tee - Run	1	1	1	1	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
S	NFPA 13 Swing Check	0	0	5	7	9	11	14	16	19	22	27	32	45	55	65					
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
Ziw	Wilkins 350AST	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters.
Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors
of 120 except as noted with *. The fittings marked with a * show equivalent lengths values
supplied by manufacturers based on specific pipe diameters and CFactors and they require no
adjustment. All values for fittings not marked with a * will be adjusted in the calculation
for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Flow Summary - NFPA

SUPPLY ANALYSIS

Node at Source	Static Pressure	Residual Pressure	Flow	Available Pressure	Total Demand	Required Pressure
TEST	40.0	25	1560.0	39.96	62.99	33.471

NODE ANALYSIS

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node		Notes
20	107.0	5.6	7.0	14.82	0.1	140
21	107.0		9.46			
22	107.0		9.52			
23	107.0		9.63			
UP3	107.0		10.1			
UP2	96.75		14.74			
UP1	86.5		19.51			
8	86.5		19.68			
TOR	86.5		22.19			
BOR	80.0		25.97			
BKV	77.0		33.45			
WM1	77.0		33.47			
WM2	77.0		33.47			
TEST	77.0		33.47			
30	107.0	5.6	8.52	16.35	0.1	140
40	107.0	5.6	7.83	15.67	0.1	140
50	107.0	5.6	8.32	16.15	0.1	140
7	107.0		10.22			
UP6	107.0		10.29			
UP5	96.75		14.76			
UP4	86.5		19.27			

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	******* Notes ******
20 to 21	107 107	5.60	14.82 14.82	1 1.101	5N 4R	35.0 4.0	24.000 39.000 63.000	150 0.0391	7.000 0.0 2.461	Vel = 4.99
21 to 22	107 107		0.0 14.82	1.25 1.394	R	1.0	4.170 1.000 5.170	150 0.0124	9.461 0.0 0.064	Vel = 3.12
22 to 23	107 107		16.35 31.17	2 2.003	3R	3.0	9.330 3.000 12.330	150 0.0084	9.525 0.0 0.103	Vel = 3.17
23 to UP3	107 107		15.67 46.84	2 2.003	2N	22.0	4.500 22.000 26.500	150 0.0178	9.628 0.0 0.472	Vel = 4.77
UP3 to UP2	107 96.750		0.0 46.84	2 2.003	R	1.0	10.250 1.000 11.250	150 0.0179	10.100 4.439 0.201	Vel = 4.77
UP2 to UP1	96.750 86.500		-3.28 43.56	2 2.003	N	11.0	10.250 11.000 21.250	150 0.0156	14.740 4.439 0.331	Vel = 4.44
UP1 to 8	86.500 86.500		0.0 43.56	2 2.003	O	10.0	0.670 10.000 10.670	150 0.0156	19.510 0.0 0.166	Vel = 4.44
8 to TOR	86.500 86.500		19.43 62.99	2 2.003	6R O 3N	6.0 10.0 33.0	32.670 49.000 81.670	150 0.0308	19.676 0.0 2.518	Vel = 6.41
TOR to BOR	86.500 80		0.0 62.99	2 2.203	B S	8.183 15.003	9.500 23.186 32.686	120 0.0293	22.194 2.815 0.957	Vel = 5.30
BOR to BKV	80 77		0.0 62.99	6 6.16	T 3E Ziw	43.037 60.252 0.0	75.000 103.289 178.289	140 0.0002	25.966 7.459 0.027	* * Fixed Loss = 6.16 Vel = 0.68
BKV to WM1	77 77		0.0 62.99	6 6.16	T G	43.037 4.304	55.000 47.341 102.341	140 0.0001	33.452 0.0 0.015	Vel = 0.68
WM1 to WM2	77 77		0.0 62.99	8 8.27	T	55.354	35.000 55.354 90.354	140 0	33.467 0.0 0.003	Vel = 0.38
WM2 to TEST	77 77		0.0 62.99	8 8.27			25.000 25.000	140 0	33.470 0.0 0.001	Vel = 0.38
TEST			0.0 62.99						33.471	K Factor = 10.89
30 to 22	107 107	5.60	16.35 16.35	1 1.101	N	7.0	14.330 7.000 21.330	150 0.0469	8.525 0.0 1.000	Vel = 5.51
22			0.0 16.35						9.525	K Factor = 5.30
40 to 23	107 107	5.60	15.67 15.67	1 1.101	4N R O	28.0 1.0 5.0	7.500 34.000 41.500	150 0.0433	7.830 0.0 1.798	Vel = 5.28

Final Calculations : Hazen-Williams

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	******* Notes ******
23			0.0 15.67						9.628	K Factor = 5.05
50 to 7	107 107	5.60	16.15 16.15	1 1.101	4N R O	28.0 1.0 5.0	7.500 34.000 41.500	150 0.0458	8.320 0.0 1.902	Vel = 5.44
7 to UP6	107 107		0.0 16.15	2 2.003	2N	22.0	4.500 22.000 26.500	150 0.0025	10.222 0.0 0.066	Vel = 1.64
UP6 to UP5	107 96.750		0.0 16.15	2 2.003	R	1.0	10.250 1.000 11.250	150 0.0025	10.288 4.439 0.028	Vel = 1.64
UP5 to UP4	96.750 86.500		3.28 19.43	2 2.003	O	10.0	10.250 10.000 20.250	150 0.0035	14.755 4.439 0.071	Vel = 1.98
UP4 to 8	86.500 86.500		0.0 19.43	2 2.003	2N 14R O	22.0 14.0 10.0	71.580 46.000 117.580	150 0.0035	19.265 0.0 0.411	Vel = 1.98
8			0.0 19.43						19.676	K Factor = 4.38
UP5 to UP2	96.750 96.750		-3.27 -3.27	2 2.003	2N 14R O	22.0 14.0 10.0	71.580 46.000 117.580	150 -0.0001	14.755 0.0 -0.015	Vel = 0.33
UP2			0.0 -3.27						14.740	K Factor = -0.85

MEMORANDUM

TO: BRIAN JOHNSON, WATER SYSTEM SPECIALIST
FROM: KERRI SIDEBOTTOM, P.E.
DATE: APRIL 16, 2024
SUBJECT: EAST TOWN CROSSING ADDITIONAL FIRE FLOW AVAILABILITY
CITY OF PUYALLUP, PIERCE COUNTY, WASHINGTON
G&O #21415.19

Per your request, I have analyzed the available fire flow at the proposed East Town Crossing development, in the central part of the City's water service area. Fire flow at this location was previously analyzed in a memo from Gray & Osborne, dated February 14, 2024. The Developer has proposed a Revised Water Piping Plan for the site, which has been analyzed in this memo. The setup of the hydraulic model and the assumptions used to determine the static pressure and available fire flow are noted as follows.

- The available fire flows and pressures are measured at 14 nodes, corresponding to the proposed hydrants within the development, as shown in the attached figure.

- Water system demands are based on projected 2038 demands and reservoirs are depleted of fire suppression and equalizing storage, as established in the *2019 Water System Plan* (WSP), approved by the Department of Health (DOH). The City's water model was updated in 2021 to reflect additional system improvements since the WSP was developed.

- All pump stations are idle, and the Salmon Springs source is operating at 1,100 gallons per minute (gpm).

The development is located in Zone 1, which is supplied by Maplewood Springs and the 15th Avenue SE Reservoirs. The system was modeled as-is, with the proposed piping indicated on the attached figure. The model was run for two different scenarios, all of which include new 8-inch piping. The new piping for Scenario 1 includes the Phase 1 piping shown on the attached figure in pink. Scenario 2 includes additional piping for Phase 2 of the development is shown in orange on the attached figure.

The available pressure under 2038 peak hour demands at the hydrants is included in Table 1.

TABLE 1

Peak Hour Pressure

Node	Hydrant	Elevation, feet	Peak Hour Pressure, psi
J2238	J	71	41
J2240	L	72	41
J2242	M	72	40
J2244	N	76	39
J2246	H	76	39
J2248	I	76	41
J2250	F	73	40
J2252	D	69	42
J2254	C	67	43
J2256	B	66	43
J2258	A	66	43
J2260	E	72	41
J2274	G	75	39
J2276	K	71	41

The peak hour pressures within the development are essentially the same under either of the proposed scenarios, and the looping does not appreciably impact the pressures.

SCENARIO 1

Scenario 1 includes the piping planned for Phase 1, shown in pink on the attached figure. The piping includes 8-inch mains, mostly dead-ends, extending from the existing 8-inch main running from north to south through the site, as well as a connection to the 16-inch main on Shaw Road, to the west. Part of the existing 8-inch main will be replaced during construction of the development.

Available fire flow was modeled at 12 of the proposed hydrants in the development; Hydrants A through L. The hydrants are located on 8-inch pipes throughout the development, many of which are dead-ends. The results of this modeling are included in Table 2. The modeled fire flow is available at any hydrant individually, but not simultaneously.

TABLE 2

Modeled Fire Flow Availability, Scenario 1

Node	Hydrant	Available Fire Flow, gpm	Residual Pressure at Available Fire Flow, psi	Minimum System Pressure at Available Fire Flow, psi
J2238	J	2,140[1]	25	25
J2240	L	1,560[1]	23	23
J2246	H	1,560[1]	22	22
J2248	I	2,580[1]	23	23
J2250	F	1,560[1]	25	25
J2252	D	2,170[1]	28	28
J2254	C	1,920[1]	29	28
J2256	B	2,230[1]	26	26
J2258	A	1,560[1]	28	28
J2260	E	1,560[1]	23	23
J2274	G	1,560[1]	25	25
J2276	K	1,560[1]	27	27

(1)   Limited by maximum system-wide velocity of 10 feet per second.

Fire flow to all of the hydrants is limited by the 10-fps maximum velocity through the existing and proposed 8-inch pipes in this scenario.

SCENARIO 2

Scenario 2 includes the piping indicated for Phases 1 and 2, shown in pink and orange on the attached figure. The piping includes 8-inch pipes extending from the existing 8-inch main running from north to south through the site, a connection to the existing 16-inch main on Shaw Road to the west, and improved looping as compared with Scenario 1.

Available fire flow was measured at the 14 proposed hydrants in the development; Hydrants A through N. The hydrants are located on 8-inch pipes throughout the development. The results of this modeling are included in Table. The modeled fire flow is available at any hydrant individually, but not simultaneously.

TABLE 3

Modeled Fire Flow Availability, Scenario 2

Node	Hydrant	Available Fire Flow, gpm	Residual Pressure at Available Fire Flow, psi	Minimum System Pressure at Available Fire Flow, psi
J2238	J	2,430[1]	25	25
J2240	L	2,340[1]	21	21
J2242	M	2,320[2]	20	20
J2244	N	2,120[2]	20	20
J2246	H	2,330[1]	20	20
J2248	I	2,540[1]	24	24
J2250	F	1,560[1]	26	26
J2252	D	2,230[1]	28	28
J2254	C	1,980[1]	29	28
J2256	B	2,340[1]	26	26
J2258	A	1,560[1]	38	38
J2260	E	1,560[1]	23	23
J2274	G	1,980[1]	25	25
J2276	K	2,040[1]	25	25

(1)   Limited by maximum system-wide velocity of 10 fps.
(2)   Limited by minimum system-wide pressure of 20 psi at all service locations.

Fire flow to the hydrants is limited by the 10-fps maximum velocity through the existing and proposed 8-inch pipes.

It should be noted that the dead-end 8-inch mains within the proposed site can only provide 1,560 gpm, due to the City's 10-fps velocity limitation considered for the fire flow analysis. Therefore, if 1,500 gpm is required at the hydrant, located on a dead-end main, there is essentially no additional flow available for the sprinkler system supplied by the same dead-end main. This impacts Hydrants A, E, and F in both scenarios, and additionally Hydrants G and H in Scenario 1 only.

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
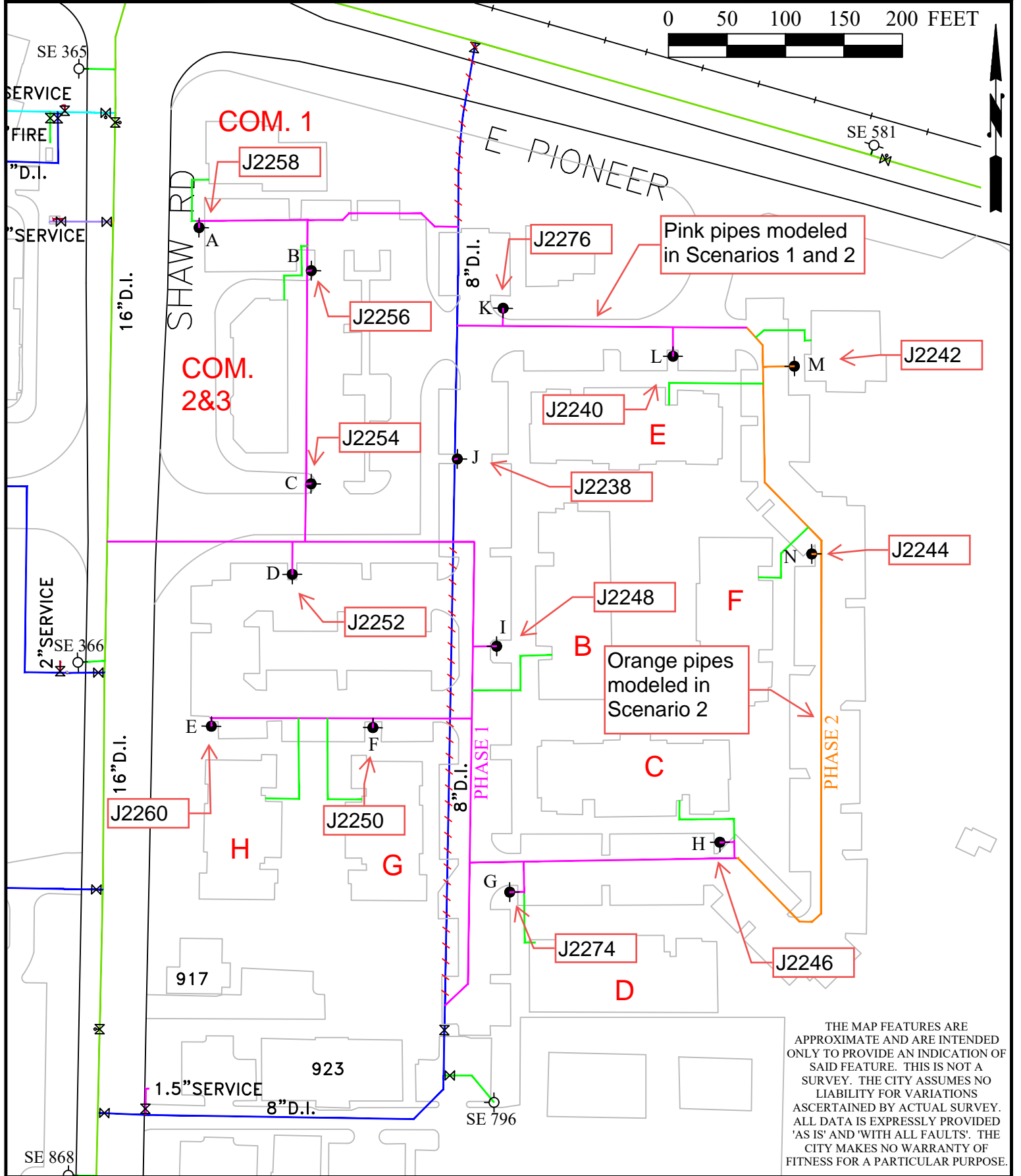
the City may not provide pressure higher than 30 psi in the future. The flows and pressures determined in this memo are based on the approximate hydrant elevation at ground level. The Developer may design their sprinkler system for whatever pressure they wish, however they must recognize and be responsible for conditions when the pressure may be less than currently exists.

KS/sr

0   50   100 150 200 FEET

COM. 1

E PIONEER

SE 365

SE 581

SERVICE

"FIRE

"D.I.

J2258

A

B

SHAW RD

16"D.I.

"SERVICE

J2256

COM.
2&3

8"D.I.

J2276

K

Pink pipes modeled
in Scenarios 1 and 2

L

J2240

E

M

J2242

J2254

C

J

J2238

2"SERVICE

SE 366

16"D.I.

D

J2252

I

J2248

B

N

F

J2244

Orange pipes
modeled in
Scenario 2

C

E

F

PHASE 1

J2260

J2250

8"D.I.

H

G

PHASE 2

H

G

J2274

J2246

D

917

923

1.5"SERVICE

8"D.I.

SE 796

SE 868

THE MAP FEATURES ARE
APPROXIMATE AND ARE INTENDED
ONLY TO PROVIDE AN INDICATION OF
SAID FEATURE. THIS IS NOT A
SURVEY. THE CITY ASSUMES NO
LIABILITY FOR VARIATIONS
ASCERTAINED BY ACTUAL SURVEY.
ALL DATA IS EXPRESSLY PROVIDED
'AS IS' AND 'WITH ALL FAULTS'. THE
CITY MAKES NO WARRANTY OF
FITNESS FOR A PARTICULAR PURPOSE.

CITY OF PUYALLUP
PUBLIC WORKS
WATER DIVISION

HYDRAULIC MODEL FOR
EAST TOWN CROSSING

SCALE AS SHOWN

04/10/2024

COP\PW\WATER\S_MAINT\PDF\QSEC\
PG104\MODEL EAST TOWN CROSSING