

Hydraulic Calculations

Phase II addition to:

THE SUMMIT

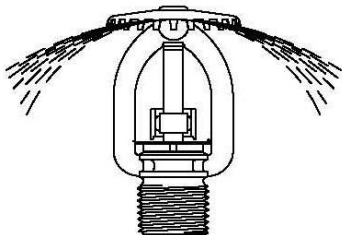
3381 NW Chipman Road

Lee's Summit, MO 64081

07-06-20

Calculated by: Paul C. Link, P.E.

Area Summary:				
Area	Description	GPM	PSI	Demand Location
Area #1	Chapel	227	79.6	at conn. to street main
Area #2	Office Area	246	96.7	at conn. to street main



ALPHA Fire Protection, LLC

P.O. Box 50

Independence, Missouri 64051

PHONE (816) 257-2260

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Fire Sprinkler Solutions, Inc.

1704 NE 82nd Terrace, Kansas City, MO 64118
phone: 816-260-4897 * fax: 816-468-5633

**City of Lee's Summit
Water Utilities Operation Division
Fire Flow Test**

Project Name: The Summit Church			
Address / Location: 3381 NW Chipman Rd			
Requested By: Ed Herrington			
Phone: 816-257-2260		Fax Number: 816-257-9912	
Mailing Address:			
Today's Date:		Date Meet Required:	
Date of Test: 6/4/2020		Time of Test - Start:	
		Stop:	
Hydrant #1 Static:		Residual	
117 PSI		80 PSI	
Hydrant I.D. # 027-002 FH			
Coefficient - Muller .7 Waterous .8 Kennedy .9			
Hydrant #2 Static:		Pitot	
112 PSI		62 PSI	
Hydrant I.D. # 027-001 FH		Gage Flow Reading	
		1900 GPM	
Flow Nozzle Size 4.5 Inches		Number of Nozzles Flowing:	
		1	
Hydrant #3 Static:		Pitot	
PSI		PSI	
Hydrant I.D. #		Gage Flow Reading	
		GPM	
Flow Nozzle Size Inches		Number of Nozzles Flowing:	
Location Map			
System Information:			

Hydraulic Design Information Sheet

Name - Summit Church - Area #1 Date - 07-06-20
Location - chapel
Building - Summit Church - phase 2
Contractor - Alpha Fire Protection System No. - wet
Calculated By - Paul C. Link, P.E. Contract No. -
Construction: () Combustible (X) Non-Combustible Drawing No. - 1
Occupancy - church Ceiling Height - varies

S (X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve

S Other

T Specific Ruling

Made By

Date

M	Area of Sprinkler Operation - 1024	System Type	Sprinkler/Nozzle
	Density - 0.10	(X) Wet	Make Viking
D	Area Per Sprinkler - 170	() Dry	Model VK300
E	Elevation at Highest Outlet - 14'6	() Deluge	Size 1/2"
S	Hose Allowance - Inside -	() Preaction	K-Factor 5.6
I	Rack Sprinkler Allowance -	() Other	Temp.Rat.155
G	Hose Allowance - Outside - 100		

N Note

Calculation Flow Required - 227 Press Required - 79.6 conn to city main
Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 06-04-20		Cap. -
T	Time of Test -	Rated Cap.-	Elev.-
E	Static Press - 117	@ Press -	
R	Residual Press - 80	Elev. -	Well
	Flow - 1900		Proof Flow
S	Elevation - 0		

U
P Location - pressure hydrant: #027-002, NW CHIPMAN ROAD, WEST OF SITE
P flow hydrant: #027-001, NW CHIPMAN ROAD, EAST OF SITE
L Source of Information - City of Lee's Summit - water utilities oper. division
Y

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method:	%	Palletized % Rack
M	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf
O			
R	K Flue Spacing	Clearance:Storage to Ceiling	
A	Longitudinal	Transverse	
G			
E	Horizontal Barriers Provided:		

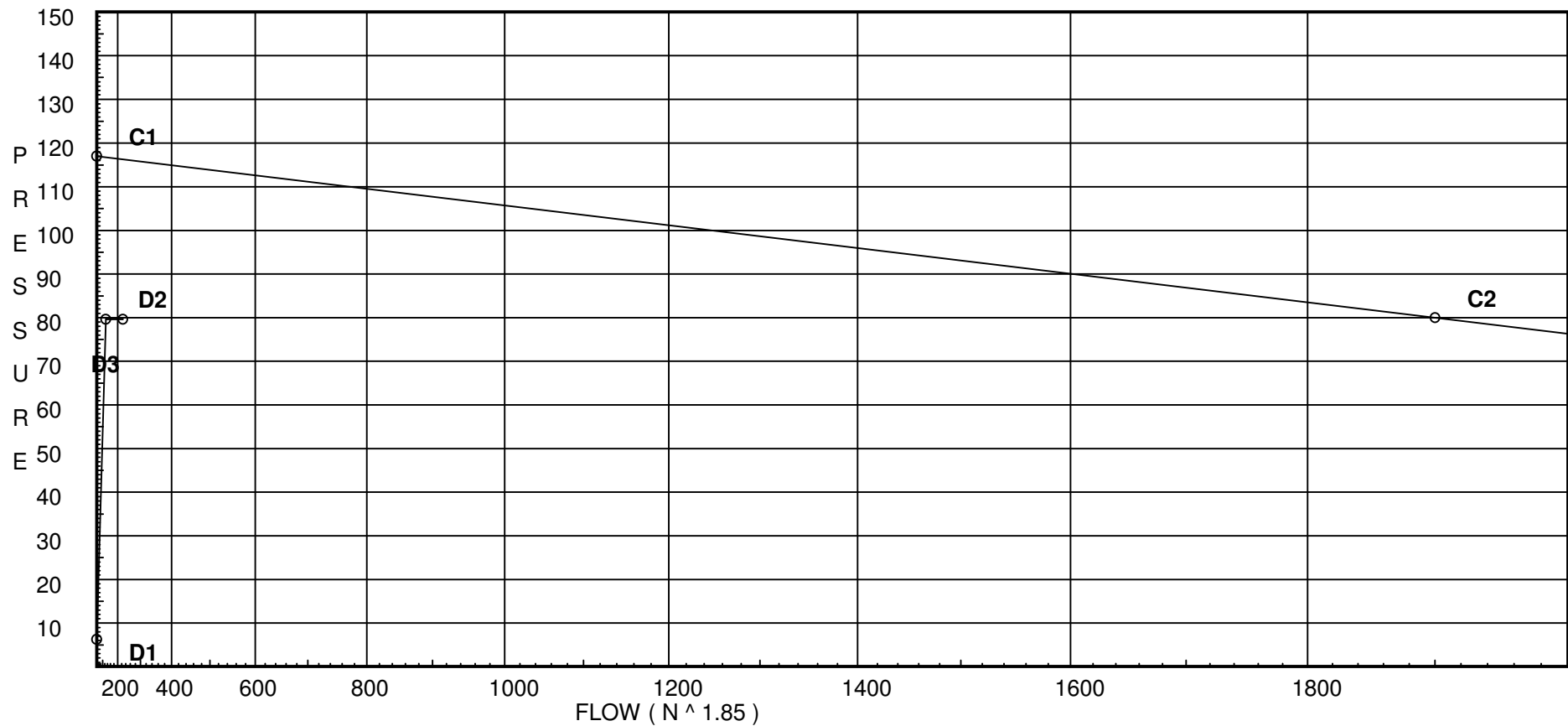
Water Supply Curve C

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #1

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City Water Supply:
C1 - Static Pressure : 117
C2 - Residual Pressure: 80
C2 - Residual Flow : 1900

Demand:
D1 - Elevation : 6.280
D2 - System Flow : 127.03
D2 - System Pressure : 79.626
Hose (Demand) : 100
D3 - System Demand : 227.03
Safety Margin : 36.648



Fittings Used Summary

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Fitting Legend																					
Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	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
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

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 2007

Fire Sprinkler Solutions, Inc.
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SUPPLY ANALYSIS

<i>Node at Source</i>	<i>Static Pressure</i>	<i>Residual Pressure</i>	<i>Flow</i>	<i>Available Pressure</i>	<i>Total Demand</i>	<i>Required Pressure</i>
TST	117.0	80	1900.0	116.273	227.03	79.626

NODE ANALYSIS

<i>Node Tag</i>	<i>Elevation</i>	<i>Node Type</i>	<i>Pressure at Node</i>	<i>Discharge at Node</i>	<i>Notes</i>
101	14.5	5.6	9.22	17.0	
102	14.5	5.6	9.49	17.25	
103	14.5	5.6	10.5	18.15	
104	14.5		14.06		
105	13.0		16.78		
106	13.0		16.89		
107	13.0		17.29		
108	13.0		19.5		
109	13.0		25.3		
110	13.0		25.5		
111	30.0		21.23		
112	30.0		21.26		
113	30.0		21.38		
114	23.33		25.02		
115	23.33		25.08		
116	25.42		26.51		
117	25.42		61.05		
118	24.5		63.45		
119	24.5		63.51		
120	24.5		63.79		
TR2	11.0		70.6		
BOR	5.0		73.29		
FLG	1.0		75.24		
HOS	0.0		75.73	100.0	
BFP	0.0		79.54		
TST	0.0		79.63		
121	14.5	5.6	9.28	17.06	
122	14.5	5.6	9.56	17.31	
123	14.5	5.6	10.57	18.21	
124	14.5		14.15		
125	14.5	5.6	15.5	22.05	
126	14.5		16.22		
127	30.0		21.23		
128	30.0		21.23		
129	30.0		21.23		
130	30.0		21.23		
131	30.0		21.23		
132	13.0		28.59		
133	13.0		28.59		

Flow Summary - NFPA 2007

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NODE ANALYSIS (cont.)

<i>Node Tag</i>	<i>Elevation</i>	<i>Node Type</i>	<i>Pressure at Node</i>	<i>Discharge at Node</i>	<i>Notes</i>
134	13.0		28.6		
135	13.0		28.6		
136	30.0		21.24		
137	30.0		21.24		
138	30.0		21.24		
139	30.0		21.24		
140	30.0		21.24		
141	30.0		21.24		
142	30.0		21.24		
143	32.08		20.34		
144	32.08		20.47		
145	32.08		20.33		
146	32.08		20.34		
147	32.08		20.33		
148	32.08		20.34		
149	32.08		20.33		
150	32.08		20.34		
151	32.08		20.33		
152	32.08		20.34		
153	32.08		20.33		
154	32.08		20.34		
155	32.08		20.34		
156	32.08		20.36		
157	25.42		26.46		
158	25.42		61.1		

Final Calculations - Hazen-Williams - 2007

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #1

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
101 to 102	14.5 14.5	5.60	17.00 17.0	1.25 1.442	0.0 0.0	13.500 0.0	120 0.0204	9.216 0.0 0.276		Vel = 3.34	
102 to 103	14.5 14.5	5.60	17.25 34.25	1.25 1.442	0.0 0.0	13.500 0.0	120 0.0747	9.492 0.0 1.009		Vel = 6.73	
103 to 104	14.5 14.5	5.60	18.15 52.4	1.25 1.442	0.0 0.0	21.670 0.0	120 0.1641	10.501 0.0 3.557		Vel = 10.29	
104 to 105	14.5 13		0.0 52.4	1.25 1.442	E T 3.716 7.432	1.500 11.148	120 0.1641	14.058 0.650 2.076		Vel = 10.29	
105 to 106	13 13		0.0 52.4	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0087	16.784 0.0 0.109		Vel = 3.08	
106 to 107	13 13		52.58 104.98	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0315	16.893 0.0 0.394		Vel = 6.18	
107 to 108	13 13		22.05 127.03	2.5 2.635	E 0.0 0.0	8.237 8.237 49.407	120 0.0448	17.287 0.0 2.215		Vel = 7.47	
108 to 109	13 13		0.0 127.03	2.5 2.635	3E T 24.711 16.474	88.080 41.185	120 0.0448	19.502 0.0 5.797		Vel = 7.47	
109 to 110	13 13		0.0 127.03	2.5 2.635	0.0 0.0	4.420 0.0	120 0.0448	25.299 0.0 0.198		Vel = 7.47	
110 to 111	13 30		0.0 127.03	2.5 2.635	E T 8.237 16.474	44.330 24.711	120 0.0448	25.497 -7.363 3.096		Vel = 7.47	
111 to 112	30 30		-4.07 122.96	3 3.26	0.0 0.0	2.170 0.0	120 0.0152	21.230 0.0 0.033		Vel = 4.73	
112 to 113	30 30		1.14 124.1	3 3.26	0.0 0.0	7.830 0.0	120 0.0152	21.263 0.0 0.119		Vel = 4.77	
113 to 114	30 23.33		2.93 127.03	3 3.26	3E 0.0	28.223 28.223	120 0.0159	21.382 2.889 0.745		Vel = 4.88	
114 to 115	23.33 23.33		-63.57 63.46	3 3.26	0.0 0.0	13.920 0.0	120 0.0045	25.016 0.0 0.062		Vel = 2.44	
115 to 116	23.33 25.42		0.0 63.46	1.25 1.38	T 0.0	2.080 6.000	120 0.2897	25.078 -0.905 2.341		Vel = 13.61	

Final Calculations - Hazen-Williams

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #1

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
116 to 117	25.42 25.42		0.0 63.46	1.25 1.38	2T 0.0	12.0 12.000	120 0.2898	26.514 0.0			
117 to 118	25.42 24.5		0.0 63.46	1.25 1.38	T 0.0	6.0 6.000	120 0.2899	61.048 2.006		Vel = 13.61	
118 to 119	24.5 24.5		0.0 63.46	3 3.26	0.0 0.0	13.920 13.920	120 0.0044	63.452 0.061		Vel = 2.44	
119 to 120	24.5 24.5		63.57 127.03	3 3.26	E 0.0	9.408 9.408	120 0.0159	63.513 0.0		Vel = 4.88	
120 to TR2	24.5 11		0.0 127.03	4 4.26	7E 0.0	92.17 92.170	120 0.0043	63.789 5.847		Vel = 2.86	
TR2 to BOR	11 5		0.0 127.03	4 4.26	B 0.0	15.8 15.800	120 0.0043	70.600 2.599		Vel = 2.86	
BOR to FLG	5 1		0.0 127.03	4 4.26	B S 0.0	15.8 28.968 48.768	120 0.0043	73.293 1.732 0.211		Vel = 2.86	
FLG to HOS	1 0		0.0 127.03	6 6.16	E T 0.0	20.084 43.037 113.121	140 0.0005	75.236 0.433 0.061		Vel = 1.37	
HOS to BFP	0 0	H100	100.00 227.03	6 6.16	0.0 0.0	510.000 0.0	140 0.0016	75.730 3.000 0.805		* * Fixed Loss = 3 Vel = 2.44	
BFP to TST	0 0		0.0 227.03	6 6.16	T G 0.0	43.037 4.304 57.341	140 0.0016	79.535 0.0 0.091		Vel = 2.44	
TST			0.0 227.03					79.626		K Factor = 25.44	
121 to 122	14.5 14.5	5.60	17.06 17.06	1.25 1.442	0.0 0.0	13.500 13.500	120 0.0206	9.280 0.0 0.278		Vel = 3.35	
122 to 123	14.5 14.5	5.60	17.31 34.37	1.25 1.442	0.0 0.0	13.500 13.500	120 0.0753	9.558 0.0 1.016		Vel = 6.75	
123 to 124	14.5 14.5	5.60	18.21 52.58	1.25 1.442	0.0 0.0	21.670 21.670	120 0.1652	10.574 0.0 3.580		Vel = 10.33	
124 to 106	14.5 13		0.0 52.58	1.25 1.442	E T 0.0	3.716 7.432 12.648	120 0.1652	14.154 0.650 2.089		Vel = 10.33	
			0.0								

Final Calculations - Hazen-Williams

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
106			52.58					16.893		K Factor = 12.79	
125 to 126	14.5 14.5	5.60	22.05	1.25	0.0	21.670	120	15.502			
					0.0	0.0		0.0			
			22.05	1.442	0.0	21.670	0.0331	0.717		Vel = 4.33	
126 to 107	14.5 13		0.0	1.25	E T	3.716 7.432	1.500 11.148	120	16.219 0.650		
			22.05	1.442	0.0	12.648	0.0330	0.418		Vel = 4.33	
107			0.0 22.05					17.287		K Factor = 5.30	
111 to 127	30 30		4.07	3	0.0	8.830	120	21.230			
					0.0	0.0		0.0			
			4.07	3.26	0.0	8.830	0	0.0		Vel = 0.16	
127 to 128	30 30		-0.63	3	0.0	13.920	120	21.230			
					0.0	0.0		0.0			
			3.44	3.26	0.0	13.920	0.0001	0.001		Vel = 0.13	
128 to 129	30 30		-0.60	3	0.0	14.000	120	21.231			
					0.0	0.0		0.0			
			2.84	3.26	0.0	14.000	0	0.0		Vel = 0.11	
129 to 130	30 30		-0.59	3	0.0	14.000	120	21.231			
					0.0	0.0		0.0			
			2.25	3.26	0.0	14.000	0	0.0		Vel = 0.09	
130 to 131	30 30		-0.57	3	0.0	11.670	120	21.231			
					0.0	0.0		0.0			
			1.68	3.26	0.0	11.670	0	0.0		Vel = 0.06	
131 to 132	30 13		-0.50	3	4E	37.631	52.840	120	21.231		
					0.0	37.631		7.363			
			1.18	3.26	0.0	90.471	0	0.0		Vel = 0.05	
132 to 133	13 13		-0.63	3	0.0	17.250	120	28.594			
					0.0	0.0		0.0			
			0.55	3.26	0.0	17.250	0	0.0		Vel = 0.02	
133 to 134	13 13		0.0	1.25	2T 4E	12.0 12.0	88.850 24.000	120	28.594 0.0		
			0.55	1.38	0.0	112.850	0	0.005		Vel = 0.12	
134 to 135	13 13		0.0	3	0.0	17.250	120	28.599			
					0.0	0.0		0.0			
			0.55	3.26	0.0	17.250	0	0.0		Vel = 0.02	
135 to 136	13 30		0.63	3	5E	47.038	63.590	120	28.599		
					0.0	47.038		-7.363			
			1.18	3.26	0.0	110.628	0	0.001		Vel = 0.05	
136 to 137	30 30		0.50	3	0.0	28.500	120	21.237			
					0.0	0.0		0.0			
			1.68	3.26	0.0	28.500	0	0.0		Vel = 0.06	
137 to 138	30 30		0.57	3	0.0	14.000	120	21.237			
					0.0	0.0		0.0			
			2.25	3.26	0.0	14.000	0	0.0		Vel = 0.09	

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
138 to 139	30 30		0.59 2.84	3 3.26		14.000 14.000	120 0	21.237 0.0			
									Vel =	0.11	
139 to 140	30 30		0.60 3.44	3 3.26		13.920 13.920	120 0.0001	21.237 0.001			
									Vel =	0.13	
140 to 141	30 30		0.63 4.07	3 3.26		11.000 11.000	120 0	21.238 0.0			
									Vel =	0.16	
141 to 142	30 30		-1.15 2.92	3 3.26		7.750 7.750	120 0	21.238 0.0			
									Vel =	0.11	
142 to 143	30 32.08		0.0 2.92	1.25 1.38	T	2.080 6.000 8.080	120 0.0010	21.238 -0.901 0.008			
									Vel =	0.63	
143 to 144	32.08 32.08		0.0 2.92	1.25 1.38	4E T	110.330 18.000 128.330	120 0.0010	20.345 0.0 0.125			
									Vel =	0.63	
144 to 113	32.08 30		0.0 2.92	1.25 1.38	E T	2.080 9.000 11.080	120 0.0010	20.470 0.901 0.011			
									Vel =	0.63	
113			0.0 2.92					21.382		K Factor =	0.63
127 to 145	30 32.08		0.63 0.63	1.25 1.38	E T	2.080 9.000 11.080	120 0.0001	21.230 -0.901 0.001			
									Vel =	0.14	
145 to 146	32.08 32.08		0.0 0.63	1.25 1.38		101.750 0.0 101.750	120 0.0001	20.330 0.0 0.006			
									Vel =	0.14	
146 to 140	32.08 30		0.0 0.63	1.25 1.38	E T	2.080 9.000 11.080	120 0.0001	20.336 0.901 0.001			
									Vel =	0.14	
140			0.0 0.63					21.238		K Factor =	0.14
128 to 147	30 32.08		0.60 0.6	1.25 1.38	E T	2.080 9.000 11.080	120 0	21.231 -0.901 0.0			
									Vel =	0.13	
147 to 148	32.08 32.08		0.0 0.6	1.25 1.38		101.750 0.0 101.750	120 0.0001	20.330 0.0 0.006			
									Vel =	0.13	
148 to 139	32.08 30		0.0 0.6	1.25 1.38	E T	2.080 9.000 11.080	120 0	20.336 0.901 0.0			
									Vel =	0.13	
139			0.0 0.60					21.237		K Factor =	0.13

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
129 to 149	30 32.08		0.58 0.58	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	21.231 -0.901 0.001		Vel = 0.12	
149 to 150	32.08 32.08		0.0 0.58	1.25 1.38	0.0 0.0 0.0	101.750 0.0 101.750	120 0	20.331 0.0 0.005		Vel = 0.12	
150 to 138	32.08 30		0.0 0.58	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0	20.336 0.901 0.0		Vel = 0.12	
138			0.0 0.58					21.237		K Factor = 0.13	
130 to 151	30 32.08		0.57 0.57	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	21.231 -0.901 0.001		Vel = 0.12	
151 to 152	32.08 32.08		0.0 0.57	1.25 1.38	0.0 0.0 0.0	101.750 0.0 101.750	120 0	20.331 0.0 0.005		Vel = 0.12	
152 to 137	32.08 30		0.0 0.57	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0	20.336 0.901 0.0		Vel = 0.12	
137			0.0 0.57					21.237		K Factor = 0.12	
131 to 153	30 32.08		0.51 0.51	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	21.231 -0.901 0.001		Vel = 0.11	
153 to 154	32.08 32.08		0.0 0.51	1.25 1.38	2E 6.0 0.0	118.590 6.000 124.590	120 0	20.331 0.0 0.005		Vel = 0.11	
154 to 136	32.08 30		0.0 0.51	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0	20.336 0.901 0.0		Vel = 0.11	
136			0.0 0.51					21.237		K Factor = 0.11	
141 to 155	30 32.08		1.14 1.14	1.25 1.38	T 6.0 0.0	2.080 6.000 8.080	120 0.0001	21.238 -0.901 0.001		Vel = 0.24	
155 to 156	32.08 32.08		0.0 1.14	1.25 1.38	T 4E 6.0 12.0 0.0	107.750 18.000 125.750	120 0.0002	20.338 0.0 0.022		Vel = 0.24	
156 to 112	32.08 30		0.0 1.14	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0002	20.360 0.901 0.002		Vel = 0.24	
112			0.0 1.14					21.263		K Factor = 0.25	
114 to 157	23.33 25.42		63.57 63.57	1.25 1.38	T 6.0 0.0	2.080 6.000 8.080	120 0.2907	25.016 -0.905 2.349		Vel = 13.64	

Final Calculations - Hazen-Williams

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #1

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
157 to 158	25.42 25.42		0.0 63.57	1.25 1.38	2T 0.0	12.0 12.000	120 0.2907	26.460 0.0		Vel = 13.64	
158 to 119	25.42 24.5		0.0 63.57	1.25 1.38	T 0.0	6.0 6.000	120 0.2908	61.103 0.398		Vel = 13.64	
119			0.0 63.57					63.513		K Factor = 7.98	
132 to 135	13 13		0.62 0.62	1.25 1.38	2T 0.0	12.0 12.000	120 0.0001	28.594 0.0		Vel = 0.13	
135			0.0 0.62					28.599		K Factor = 0.12	

Hydraulic Design Information Sheet

Name - Summit Church - Area #2 Date - 07-06-20
Location - office area
Building - Summit Church - phase 2
Contractor - Alpha Fire Protection System No. - wet
Calculated By - Paul C. Link, P.E. Contract No. -
Construction: () Combustible (X) Non-Combustible Drawing No. - 1
Occupancy - church Ceiling Height - varies

S (X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve

S Other

T Specific Ruling

Made By

Date

E
M Area of Sprinkler Operation - 900 System Type Sprinkler/Nozzle
Density - 0.10 (X) Wet Make Viking
D Area Per Sprinkler - varies () Dry Model VK302
E Elevation at Highest Outlet - 9' () Deluge Size 1/2"
S Hose Allowance - Inside () Preaction K-Factor 5.6
I Rack Sprinkler Allowance - () Other Temp.Rat.155
G Hose Allowance - Outside - 100

N
Note

Calculation Flow Required - 246 Press Required - 96.7 conn to city main
Summary C-Factor Used: 120 Overhead 140 Underground

W Water Flow Test: Pump Data: Tank or Reservoir:
A Date of Test - 06-04-20 Cap. -
T Time of Test - Rated Cap.- Elev.-
E Static Press - 117 @ Press -
R Residual Press - 80 Elev. - Well
Flow - 1900 Proof Flow
S Elevation - 0

U
P Location - pressure hydrant: #027-002, NW CHIPMAN ROAD, WEST OF SITE
P flow hydrant: #027-001, NW CHIPMAN ROAD, EAST OF SITE
L Source of Information - City of Lee's Summit - water utilities oper. division
Y

C Commodity Class Location
O Storage Ht. Area Aisle W.
M Storage Method: Solid Piled % Palletized % Rack
M
S R () Single Row () Conven. Pallet () Auto. Storage () Encap.
T A () Double Row () Slave Pallet () Solid Shelf () Non
O C () Mult. Row () Open Shelf
R K Flue Spacing Clearance:Storage to Ceiling
A Longitudinal Transverse
G
E Horizontal Barriers Provided:

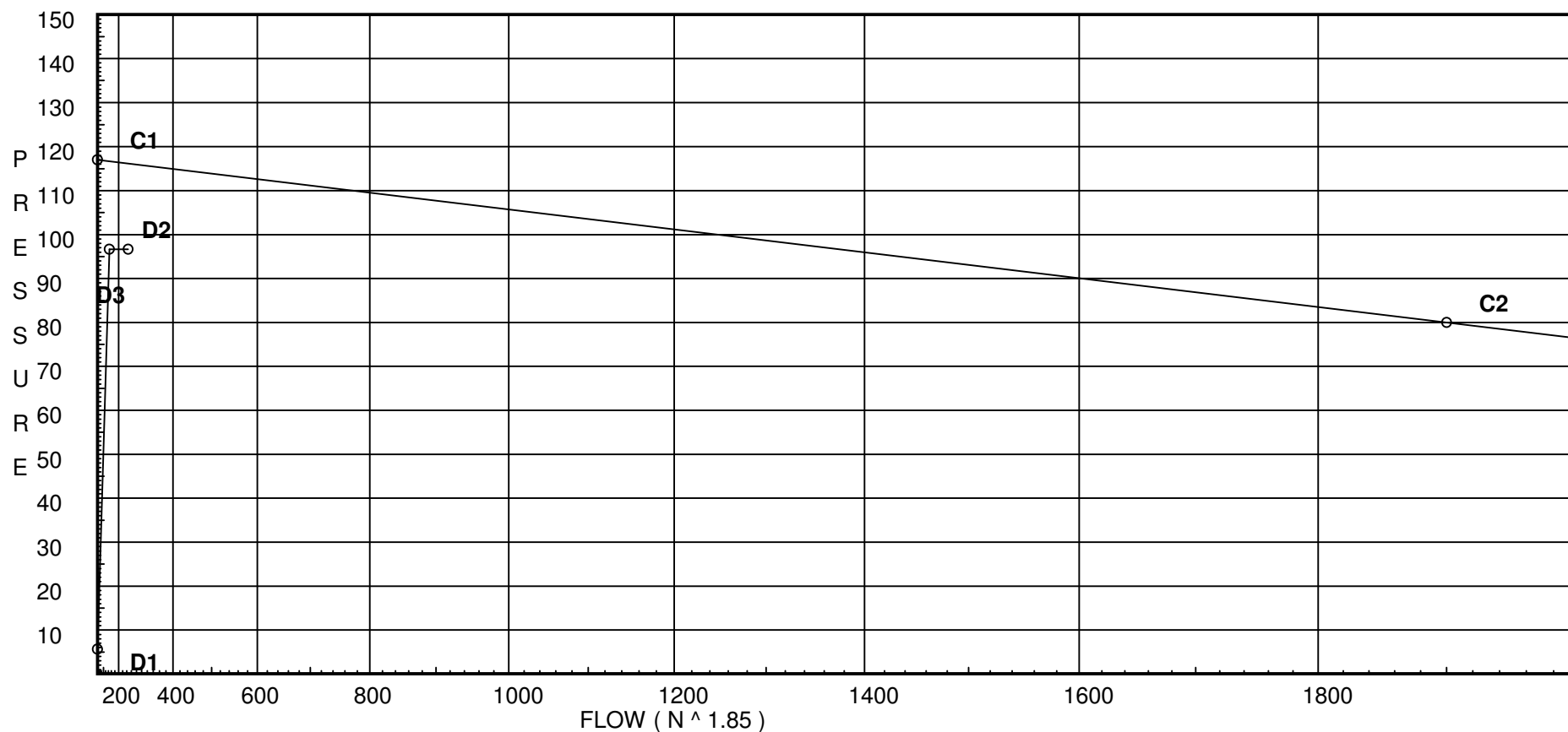
Water Supply Curve C

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #2

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City Water Supply:
C1 - Static Pressure : 117
C2 - Residual Pressure: 80
C2 - Residual Flow : 1900

Demand:
D1 - Elevation : 5.630
D2 - System Flow : 146.584
D2 - System Pressure : 96.650
Hose (Demand) : 100
D3 - System Demand : 246.584
Safety Margin : 19.504



Fittings Used Summary

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #2

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Fitting Legend																					
Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	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
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

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 2007

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #2

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SUPPLY ANALYSIS

<i>Node at Source</i>	<i>Static Pressure</i>	<i>Residual Pressure</i>	<i>Flow</i>	<i>Available Pressure</i>	<i>Total Demand</i>	<i>Required Pressure</i>
TST	117.0	80	1900.0	116.153	246.58	96.65

NODE ANALYSIS

<i>Node Tag</i>	<i>Elevation</i>	<i>Node Type</i>	<i>Pressure at Node</i>	<i>Discharge at Node</i>	<i>Notes</i>
DP02	9.0	5.6	7.17	15.0	
EQ02	13.0		5.75		
DP01	9.0	5.6	7.17	15.0	
EQ01	13.0		6.13		
DP03	9.0	5.6	9.77	17.5	
EQ03	13.0		8.44		
201	13.0	6.02	8.44	17.5	K=K @ EQ03
202	13.0		9.33		
203	13.0	6.06	10.27	19.41	K=K @ EQ01
204	13.0	6.06	11.7	20.72	K=K @ EQ01
205	13.0		17.35		
106	13.0		17.42		
107	13.0		18.15		
108	13.0		21.03		
109	13.0		28.59		
110	13.0		28.85		
111	30.0		25.52		
112	30.0		25.56		
113	30.0		25.72		
114	23.33		29.58		
115	23.33		29.66		
116	25.42		31.8		
117	25.42		76.81		
118	24.5		79.82		
119	24.5		79.9		
120	24.5		80.26		
TR2	11.0		87.37		
BOR	5.0		90.09		
FLG	1.0		92.09		
HOS	0.0		92.61	100.0	
BFP	0.0		96.54		
TST	0.0		96.65		
206	13.0	6.26	8.19	17.91	K=K @ EQ02
207	13.0		9.04		
208	13.0	6.06	7.72	16.84	K=K @ EQ01
209	13.0	6.06	7.93	17.06	K=K @ EQ01
210	13.0	6.06	8.62	17.78	K=K @ EQ01
211	13.0	6.06	10.22	19.36	K=K @ EQ01
212	13.0		17.19		

Flow Summary - NFPA 2007

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #2

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NODE ANALYSIS (cont.)

<i>Node Tag</i>	<i>Elevation</i>	<i>Node Type</i>	<i>Pressure at Node</i>	<i>Discharge at Node</i>	<i>Notes</i>
127	30.0		25.52		
128	30.0		25.52		
129	30.0		25.52		
130	30.0		25.52		
131	30.0		25.52		
132	13.0		32.88		
133	13.0		32.88		
134	13.0		32.89		
135	13.0		32.89		
136	30.0		25.53		
137	30.0		25.53		
138	30.0		25.53		
139	30.0		25.53		
140	30.0		25.53		
141	30.0		25.53		
142	30.0		25.53		
143	32.08		24.64		
144	32.08		24.8		
145	32.08		24.62		
146	32.08		24.63		
147	32.08		24.62		
148	32.08		24.63		
149	32.08		24.62		
150	32.08		24.63		
151	32.08		24.62		
152	32.08		24.63		
153	32.08		24.62		
154	32.08		24.63		
155	32.08		24.63		
156	32.08		24.66		
157	25.42		31.73		
158	25.42		76.88		

Final Calculations - Hazen-Williams - 2007

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #2

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
DP02 to EQ02	9 13	5.60	15.00 15.0	1 1.049	0.0 0.0 0.0	4.000 0.0 4.000	120 0.0762	7.175 -1.732 0.305		Vel = 5.57	
EQ02			0.0 15.00					5.748		K Factor = 6.26	
DP01 to EQ01	9 13	5.60	15.00 15.0	1 1.049	T 5.0 0.0 0.0	4.000 5.000 9.000	120 0.0763	7.175 -1.732 0.687		Vel = 5.57	
EQ01			0.0 15.00					6.130		K Factor = 6.06	
DP03 to EQ03	9 13	5.60	17.50 17.5	1 1.049	0.0 0.0 0.0	4.000 0.0 4.000	120 0.1015	9.766 -1.732 0.406		Vel = 6.50	
EQ03			0.0 17.50					8.440		K Factor = 6.02	
201 to 202	13 13	6.02	17.50 17.5	1 1.049	E T 2.0 5.0 0.0	1.750 7.000 8.750	120 0.1016	8.440 0.0 0.889		K = K @ EQ03 Vel = 6.50	
202 to 203	13 13		17.91 35.41	1.25 1.442	0.0 0.0 0.0	11.830 0.0 11.830	120 0.0795	9.329 0.0 0.941		Vel = 6.96	
203 to 204	13 13	6.06	19.41 54.82	1.25 1.442	0.0 0.0 0.0	8.000 0.0 8.000	120 0.1785	10.270 0.0 1.428		K = K @ EQ01 Vel = 10.77	
204 to 205	13 13	6.06	20.72 75.54	1.25 1.442	T 7.432 0.0 0.0	10.080 7.432 17.512	120 0.3229	11.698 0.0 5.655		K = K @ EQ01 Vel = 14.84	
205 to 106	13 13		71.04 146.58	2.5 2.635	0.0 0.0 0.0	1.080 0.0 1.080	120 0.0583	17.353 0.0 0.063		Vel = 8.62	
106 to 107	13 13		0.0 146.58	2.5 2.635	0.0 0.0 0.0	12.500 0.0 12.500	120 0.0585	17.416 0.0 0.731		Vel = 8.62	
107 to 108	13 13		0.0 146.58	2.5 2.635	E 8.237 0.0 0.0	41.170 8.237 49.407	120 0.0584	18.147 0.0 2.887		Vel = 8.62	
108 to 109	13 13		0.0 146.58	2.5 2.635	3E T 24.711 16.474 0.0	88.080 41.185 129.265	120 0.0584	21.034 0.0 7.554		Vel = 8.62	
109 to 110	13 13		0.0 146.58	2.5 2.635	0.0 0.0 0.0	4.420 0.0 4.420	120 0.0586	28.588 0.0 0.259		Vel = 8.62	
110 to 111	13 30		0.0 146.58	2.5 2.635	E T 8.237 16.474 0.0	44.330 24.711 69.041	120 0.0584	28.847 -7.363 4.035		Vel = 8.62	

Final Calculations - Hazen-Williams

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #2

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
111 to 112	30 30		-4.69 141.89	3 3.26		0.0 0.0 2.170	120 0.0194	25.519 0.0 0.042		Vel = 5.45	
112 to 113	30 30		1.32 143.21	3 3.26		0.0 0.0 7.830	120 0.0199	25.561 0.0 0.156		Vel = 5.50	
113 to 114	30 23.33		3.37 146.58	3 3.26	3E 28.223	18.670 0.0 28.223 46.893	120 0.0207	25.717 2.889 0.971		Vel = 5.63	
114 to 115	23.33 23.33		-73.35 73.23	3 3.26		0.0 0.0 13.920	120 0.0057	29.577 0.0 0.080		Vel = 2.81	
115 to 116	23.33 25.42		0.0 73.23	1.25 1.38	T	6.0 0.0 2.080 6.000 8.080	120 0.3777	29.657 -0.905 3.052		Vel = 15.71	
116 to 117	25.42 25.42		0.0 73.23	1.25 1.38	2T 12.0	107.170 0.0 12.000 119.170	120 0.3777	31.804 0.0 45.006		Vel = 15.71	
117 to 118	25.42 24.5		0.0 73.23	1.25 1.38	T	6.0 0.0 0.920 6.000 6.920	120 0.3777	76.810 0.398 2.614		Vel = 15.71	
118 to 119	24.5 24.5		0.0 73.23	3 3.26		0.0 0.0 13.920 13.920	120 0.0057	79.822 0.0 0.080		Vel = 2.81	
119 to 120	24.5 24.5		73.35 146.58	3 3.26	E	9.408 0.0 9.408 17.328	120 0.0208	79.902 0.0 0.360		Vel = 5.63	
120 to TR2	24.5 11		0.0 146.58	4 4.26	7E 92.17	131.000 0.0 92.170 223.170	120 0.0056	80.262 5.847 1.256		Vel = 3.30	
TR2 to BOR	11 5		0.0 146.58	4 4.26	B	15.8 0.0 6.000 15.800 21.800	120 0.0056	87.365 2.599 0.123		Vel = 3.30	
BOR to FLG	5 1		0.0 146.58	4 4.26	B S	15.8 28.968 4.000 44.768 48.768	120 0.0056	90.087 1.732 0.275		Vel = 3.30	
FLG to HOS	1 0		0.0 146.58	6 6.16	E T	20.084 43.037 63.121 113.121	140 0.0007	92.094 0.433 0.079		Vel = 1.58	
HOS to BFP	0 0	H100	100.00 246.58	6 6.16		0.0 0.0 510.000 0.0 510.000	140 0.0018	92.606 3.000 0.938	* * Fixed Loss = 3	Vel = 2.65	
BFP to TST	0 0		0.0 246.58	6 6.16	T G	43.037 4.304 47.341 57.341	140 0.0018	96.544 0.0 0.106		Vel = 2.65	

Final Calculations - Hazen-Williams

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #2

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
TST			0.0 246.58					96.650		K Factor = 25.08	
206 to 207	13 13	6.26	17.91	1	E T	2.0 5.0	1.000 7.000	120	8.193 0.0	K = K @ EQ02	
207 to 202	13 13		17.91	1.049		0.0	8.000	0.1061	0.849	Vel = 6.65	
207 to 202	13 13		0.0	1.25		0.0	12.750 0.0	120	9.042 0.0		
202	13		17.91	1.442		0.0	12.750	0.0225	0.287	Vel = 3.52	
202			0.0 17.91					9.329		K Factor = 5.86	
208 to 209	13 13	6.06	16.84	1.25		0.0 0.0	10.000 0.0	120	7.724 0.0	K = K @ EQ01	
209 to 210	13 13		16.84	1.442		0.0	10.000	0.0201	0.201	Vel = 3.31	
209 to 210	13 13	6.06	17.05	1.25		0.0 0.0	9.420 0.0	120	7.925 0.0	K = K @ EQ01	
210	13		33.89	1.442		0.0	9.420	0.0734	0.691	Vel = 6.66	
210 to 211	13 13	6.06	17.79	1.25		0.0 0.0	10.000 0.0	120	8.616 0.0	K = K @ EQ01	
211 to 212	13 13		51.68	1.442		0.0	10.000	0.1600	1.600	Vel = 10.15	
211 to 212	13 13	6.06	19.36	1.25	T	7.432 0.0	16.750 7.432	120	10.216 0.0	K = K @ EQ01	
212	13		71.04	1.442		0.0	24.182	0.2882	6.970	Vel = 13.96	
212 to 205	13 13		0.0	2.5		0.0 0.0	10.920 0.0	120	17.186 0.0		
205	13		71.04	2.635		0.0	10.920	0.0153	0.167	Vel = 4.18	
205			0.0 71.04					17.353		K Factor = 17.05	
111 to 127	30 30		4.69	3		0.0 0.0	8.830 0.0	120	25.519 0.0		
127 to 128	30 30		4.69	3.26		0.0	8.830	0	0.0	Vel = 0.18	
127 to 128	30 30		-0.72	3		0.0 0.0	13.920 0.0	120	25.519 0.0		
128	30		3.97	3.26		0.0	13.920	0.0001	0.001	Vel = 0.15	
128 to 129	30 30		-0.70	3		0.0 0.0	14.000 0.0	120	25.520 0.0		
129	30		3.27	3.26		0.0	14.000	0	0.0	Vel = 0.13	
129 to 130	30 30		-0.67	3		0.0 0.0	14.000 0.0	120	25.520 0.0		
130	30		2.6	3.26		0.0	14.000	0	0.0	Vel = 0.10	
130 to 131	30 30		-0.66	3		0.0 0.0	11.670 0.0	120	25.520 0.0		
131	30		1.94	3.26		0.0	11.670	0	0.0	Vel = 0.07	
131 to 132	30 13		-0.58	3	4E	37.631 0.0	52.840 37.631	120	25.520 7.363		
132	13		1.36	3.26		0.0	90.471	0	0.0	Vel = 0.05	

Final Calculations - Hazen-Williams

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #2

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
132 to 133	13 13		-0.72 0.64	3 3.26		0.0 0.0 17.250	120 0	32.883 0.0 0.0			
133 to 134	13 13		0.0 0.64	1.25 1.38	2T 4E 12.0 0.0	88.850 24.000 112.850	120 0.0001	32.883 0.0 0.007		Vel = 0.02	
134 to 135	13 13		0.0 0.64	3 3.26		0.0 0.0 17.250	120 0	32.890 0.0 0.0		Vel = 0.02	
135 to 136	13 30		0.72 1.36	3 3.26	5E 47.038 0.0	63.590 47.038 110.628	120 0	32.890 -7.363 0.0		Vel = 0.05	
136 to 137	30 30		0.58 1.94	3 3.26		0.0 0.0 28.500	120 0	25.527 0.0 0.001		Vel = 0.07	
137 to 138	30 30		0.66 2.6	3 3.26		0.0 0.0 14.000	120 0	25.528 0.0 0.0		Vel = 0.10	
138 to 139	30 30		0.67 3.27	3 3.26		0.0 0.0 14.000	120 0	25.528 0.0 0.0		Vel = 0.13	
139 to 140	30 30		0.70 3.97	3 3.26		0.0 0.0 13.920	120 0	25.528 0.0 0.0		Vel = 0.15	
140 to 141	30 30		0.72 4.69	3 3.26		0.0 0.0 11.000	120 0.0001	25.528 0.0 0.001		Vel = 0.18	
141 to 142	30 30		-1.31 3.38	3 3.26		0.0 0.0 7.750	120 0	25.529 0.0 0.0		Vel = 0.13	
142 to 143	30 32.08		0.0 3.38	1.25 1.38	T 6.0 0.0	2.080 6.000 8.080	120 0.0012	25.529 -0.901 0.010		Vel = 0.73	
143 to 144	32.08 32.08		0.0 3.38	1.25 1.38	4E T 12.0 6.0	110.330 18.000 128.330	120 0.0013	24.638 0.0 0.164		Vel = 0.73	
144 to 113	32.08 30		0.0 3.38	1.25 1.38	E T 3.0 6.0	2.080 9.000 11.080	120 0.0013	24.802 0.901 0.014		Vel = 0.73	
113			0.0 3.38					25.717		K Factor = 0.67	
127 to 145	30 32.08		0.73 0.73	1.25 1.38	E T 3.0 6.0	2.080 9.000 11.080	120 0.0001	25.519 -0.901 0.001		Vel = 0.16	
145 to 146	32.08 32.08		0.0 0.73	1.25 1.38		0.0 0.0 101.750	120 0.0001	24.619 0.0 0.008		Vel = 0.16	

Final Calculations - Hazen-Williams

Fire Sprinkler Solutions, Inc.
Summit Church Phase 2 - Area #2

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
146 to 140	32.08 30		0.0 0.73	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0	24.627 0.901 0.0		Vel = 0.16	
140			0.0 0.73					25.528		K Factor = 0.14	
128 to 147	30 32.08		0.70 0.7	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	25.520 -0.901 0.001		Vel = 0.15	
147 to 148	32.08 32.08		0.0 0.7	1.25 1.38	0.0 0.0 0.0	101.750 0.0 101.750	120 0.0001	24.620 0.0 0.006		Vel = 0.15	
148 to 139	32.08 30		0.0 0.7	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	24.626 0.901 0.001		Vel = 0.15	
139			0.0 0.70					25.528		K Factor = 0.14	
129 to 149	30 32.08		0.67 0.67	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	25.520 -0.901 0.001		Vel = 0.14	
149 to 150	32.08 32.08		0.0 0.67	1.25 1.38	0.0 0.0 0.0	101.750 0.0 101.750	120 0.0001	24.620 0.0 0.006		Vel = 0.14	
150 to 138	32.08 30		0.0 0.67	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	24.626 0.901 0.001		Vel = 0.14	
138			0.0 0.67					25.528		K Factor = 0.13	
130 to 151	30 32.08		0.66 0.66	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	25.520 -0.901 0.001		Vel = 0.14	
151 to 152	32.08 32.08		0.0 0.66	1.25 1.38	0.0 0.0 0.0	101.750 0.0 101.750	120 0.0001	24.620 0.0 0.006		Vel = 0.14	
152 to 137	32.08 30		0.0 0.66	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	24.626 0.901 0.001		Vel = 0.14	
137			0.0 0.66					25.528		K Factor = 0.13	
131 to 153	30 32.08		0.59 0.59	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0.0001	25.520 -0.901 0.001		Vel = 0.13	
153 to 154	32.08 32.08		0.0 0.59	1.25 1.38	2E 0.0 0.0	118.590 6.000 124.590	120 0	24.620 0.0 0.006		Vel = 0.13	
154 to 136	32.08 30		0.0 0.59	1.25 1.38	E T 3.0 6.0 0.0	2.080 9.000 11.080	120 0	24.626 0.901 0.0		Vel = 0.13	

Final Calculations - Hazen-Williams

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
136			0.0 0.59					25.527		K Factor = 0.12	
141 to 155	30 32.08		1.32	1.25	T 0.0	6.0 6.000	120	25.529 -0.901			
155 to 156	32.08 32.08		1.32	1.38		0.0 8.080	0.0002	0.002		Vel = 0.28	
155 to 156	32.08 32.08		0.0	1.25	T 4E 12.0	6.0 107.750 18.000	120	24.630 0.0			
156 to 112	32.08 30		1.32	1.38		0.0 125.750	0.0002	0.028		Vel = 0.28	
156 to 112	32.08 30		0.0	1.25	E T 6.0	3.0 2.080 9.000	120	24.658 0.901			
112			1.32	1.38		0.0 11.080	0.0002	0.002		Vel = 0.28	
112			0.0 1.32					25.561		K Factor = 0.26	
114 to 157	23.33 25.42		73.35	1.25	T 0.0	6.0 6.000	120	29.577 -0.905			
157 to 158	25.42 25.42		73.35	1.38		0.0 8.080	0.3788	3.061		Vel = 15.73	
157 to 158	25.42 25.42		0.0	1.25	2T 0.0	12.0 107.170 12.000	120	31.733 0.0			
158 to 119	25.42 24.5		73.35	1.38		0.0 119.170	0.3789	45.149		Vel = 15.73	
158 to 119	25.42 24.5		0.0	1.25	T 0.0	6.0 0.920 6.000	120	76.882 0.398			
119			73.35	1.38		0.0 6.920	0.3789	2.622		Vel = 15.73	
119			0.0 73.35					79.902		K Factor = 8.21	
132 to 135	13 13		0.72	1.25	2T 0.0	12.0 79.500 12.000	120	32.883 0.0			
135			0.72	1.38		0.0 91.500	0.0001	0.007		Vel = 0.15	
135			0.0 0.72					32.890		K Factor = 0.13	