

... Fire Protection by Computer Design

EASTERN FIRE PROTECTION
170 KITTYHAWK AVE.
P.O. BOX 1390
AUBURN, MAINE 04210
207-784-1507

Job Name : 1000 RIVERSIDE
Drawing : 2 OF 3
Location : PORTLAND
Remote Area : 1
Contract : 5125
Data File : PRE ACTION CALC.WXF

HYDRAULIC CALCULATIONS
for

Project name: 1000 RIVERSIDE ST.
Location: PORTLAND
Drawing no: 2 OF 3
Date: 3/10/14

Design

Remote area number: 1
Remote area location: LIBRARY STORAGE
Occupancy classification: OH II
Density: .2 - Gpm/SqFt
Area of application: 1552 - SqFt
Coverage per sprinkler: 118 - SqFt
Type of sprinklers calculated: TYCO TY-FRB BRASS UPRIGHT 5.6K 200
No. of sprinklers calculated: 13
In-rack demand: - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 580.409 - GPM @ 73.161 - Psi
Type of system: WET
Volume of dry or preaction system: - Gal

Water supply information

Date: 9/25/08
Location: HYDRANT # 1714 ON EVERGREEN ST.
Source: PORTLAND WATER DISTRICT

Name of contractor: EASTERN FIRE PROTECTION
Address: 170 KITTYHAWK AVE. / P.O. BOX 1390 / AUBURN, MAINE 04210
Phone number: 207-784-1507
Name of designer: ROBERT PETERS
Authority having jurisdiction: STATE FIRE MARSHAL
Notes: (Include peaking information or gridded systems here.)

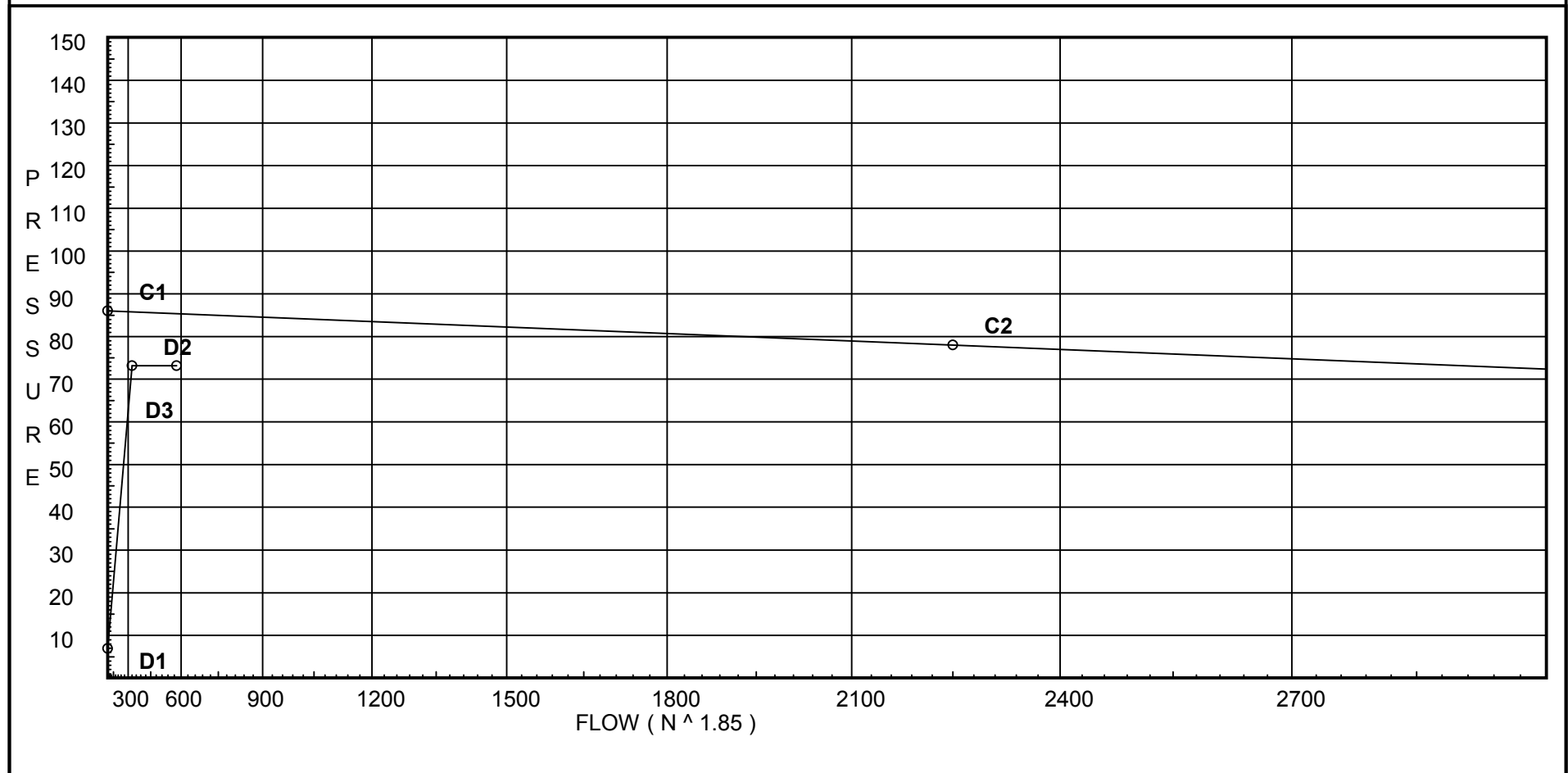
Water Supply Curve C

EASTERN FIRE PROTECTION
1000 RIVERSIDE

Page 2
Date 3/5/14

City Water Supply:
C1 - Static Pressure : 86
C2 - Residual Pressure: 78
C2 - Residual Flow : 2250

Demand:
D1 - Elevation : 6.930
D2 - System Flow : 330.409
D2 - System Pressure : 73.161
Hose (Demand) : 250
D3 - System Demand : 580.409
Safety Margin : 12.187



Fittings Used Summary

EASTERN FIRE PROTECTION
1000 RIVERSIDE

Page 3
Date 3/5/14

Fitting Legend		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
Abbrev.	Name																				
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
I	90° Grvd-Vic Elbow #10	0	0	2	3	4	3.5	6	5	8	7	8.5	10	13	17	20	23	25	33	36	40
J	90° Tee-Branch Grv Vic #20	0	0	4.5	6	8	8.5	10.8	13	17	16	21	25	33	41	50	65	78	88	98	120
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.

SUPPLY ANALYSIS

Node at Source	Static Pressure	Residual Pressure	Flow	Available Pressure	Total Demand	Required Pressure
TEST	86.0	78	2250.0	85.348	580.41	73.161

NODE ANALYSIS

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
1	116.0	5.6	17.76	23.6	
2	116.0	5.6	18.07	23.8	
3	114.0	5.6	20.05	25.08	
4	114.0	5.6	22.5	26.56	
5	116.0	5.6	17.79	23.62	
6	116.0	5.6	18.1	23.82	
7	114.0	5.6	20.08	25.09	
8	114.0	5.6	22.52	26.58	
9	116.0	5.6	17.85	23.66	
10	116.0	5.6	18.16	23.86	
11	114.0	5.6	20.15	25.14	
12	114.0	5.6	22.61	26.63	
13	114.0	5.6	34.65	32.97	
A	110.833		37.32		
B	110.833		37.36		
C	110.833		37.49		
CC	110.833		37.78		
PRV	110.542		45.38		
HDR	103.0		52.0		
E	117.958		49.72		
F	117.958		49.82		
100	117.958		49.95		
101	117.958		50.98		
102	117.958		51.8		
103	117.958		52.61		
104	117.958		53.35		
105	117.958		54.03		
106	117.958		54.68		
107	117.958		55.3		
108	117.958		55.94		
109	117.958		56.62		
110	117.958		57.35		
111	117.958		58.15		
112	117.958		59.01		
113	117.958		61.44		
114	117.958		53.89		
115	117.958		53.92		
116	117.958		53.98		
117	117.958		54.12		

NODE ANALYSIS (cont.)

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
118	117.958		54.31		
119	117.958		54.57		
120	117.958		54.86		
121	117.958		55.19		
122	117.958		55.49		
123	117.958		55.75		
124	117.958		55.96		
125	117.958		56.1		
126	117.958		56.19		
G	117.833		61.52		
TOR	117.833		61.95		
BASE	102.0		70.34		
TEST	100.0		73.16	250.0	

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
1000 RIVERSIDE

Page 6
Date 3/5/14

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	*****
1 to 2	116 116	5.60	23.60	1.5		0.0	12.375	100	17.760			
						0.0	0.0		0.0		Vel = 3.41	
2 to 3	116 114	5.60	23.80	1.5		0.0	12.375	100	18.068			
						0.0	0.0		0.866		Vel = 6.84	
3 to 4	114 114	5.60	25.08	1.5		0.0	12.375	100	20.051			
						0.0	0.0		0.0		Vel = 10.47	
4 to A	114 110.833	5.60	26.56	1.5	I J	3.533 7.065	27.500 10.599	100	22.502 1.372			
			99.04	1.682		0.0	38.099	0.3529	13.444		Vel = 14.30	
A			0.0 99.04						37.318		K Factor = 16.21	
5 to 6	116 116	5.60	23.62	1.5		0.0	12.333	100	17.788			
						0.0	0.0		0.0		Vel = 3.41	
6 to 7	116 114	5.60	23.82	1.5		0.0	12.333	100	18.095			
						0.0	0.0		0.866		Vel = 6.85	
7 to 8	114 114	5.60	25.09	1.5		0.0	12.333	100	20.076			
						0.0	0.0		0.0		Vel = 10.47	
8 to B	114 110.833	5.60	26.58	1.5	I J	3.533 7.065	27.500 10.599	100	22.522 1.372			
			99.11	1.682		0.0	38.099	0.3533	13.461		Vel = 14.31	
B			0.0 99.11						37.355		K Factor = 16.22	
9 to 10	116 116	5.60	23.66	1.5		0.0	12.375	100	17.851			
						0.0	0.0		0.0		Vel = 3.42	
10 to 11	116 114	5.60	23.86	1.5		0.0	12.375	100	18.160			
						0.0	0.0		0.866		Vel = 6.86	
11 to 12	114 114	5.60	25.14	1.5		0.0	12.375	100	20.149			
						0.0	0.0		0.0		Vel = 10.49	
12 to C	114 110.833	5.60	26.63	1.5	I J	3.533 7.065	27.500 10.599	100	22.611 1.372			
			99.29	1.682		0.0	38.099	0.3545	13.507		Vel = 14.34	
C			0.0 99.29						37.490		K Factor = 16.22	
13 to CC	114 110.833	5.60	32.97	1.5	I J	3.533 7.065	27.500 10.599	100	34.654 1.372			
			32.97	1.682		0.0	38.099	0.0461	1.756		Vel = 4.76	

Final Calculations - Hazen-Williams

EASTERN FIRE PROTECTION
1000 RIVERSIDE

Page 7
Date 3/5/14

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	*****
CC			0.0 32.97					37.782		K Factor =	5.36
A to B	110.833 110.833		99.04 99.04	4 4.26	0.0 0.0	9.583 0.0	100 0.0039	37.318 0.037		Vel =	2.23
B to C	110.833 110.833		99.11 198.15	4 4.26	0.0 0.0	9.792 0.0	100 0.0138	37.355 0.135		Vel =	4.46
C to CC	110.833 110.833		99.29 297.44	4 4.26	0.0 0.0	10.000 10.000	100 0.0292	37.490 0.292		Vel =	6.70
CC to PRV	110.833 110.542		32.97 330.41	4 4.26	2I 0.0	13.156 13.157	197.471 210.628	100 0.0355	37.782 7.476		Vel = 7.44
PRV to HDR	110.542 103		0.0 330.41	4 4.26	2B T 0.0	22.554 18.795	7.833 30.071	100 0.0355	45.384 5.266	** Fixed Loss = 2	Vel = 7.44
HDR to E	103 117.958		0.0 330.41	4 4.26	4I J 0.0	36.868 21.067	107.958 57.935	120 0.0253	51.996 4.202		Vel = 7.44
E to F	117.958 117.958		0.0 330.41	4 4.26	0.0 0.0	3.833 0.0	120 0.0256	49.720 0.098		Vel =	7.44
F to 100	117.958 117.958		0.0 330.41	3 3.26	0.0 0.0	1.458 1.458	120 0.0926	49.818 0.135		Vel =	12.70
100 to 114	117.958 117.958		-307.74 22.67	1.25 1.442	4J 0.0	29.728 29.728	83.333 113.061	120 0.0348	49.953 3.940		Vel = 4.45
114			0.0 22.67					53.893		K Factor =	3.09
101 to 115	117.958 117.958		19.36 19.36	1.25 1.442	4J 0.0	29.728 29.728	83.333 113.061	120 0.0260	50.975 2.941		Vel = 3.80
115			0.0 19.36					53.916		K Factor =	2.64
102 to 116	117.958 117.958		16.49 16.49	1.25 1.442	4J 0.0	29.728 29.728	83.333 113.061	120 0.0193	51.796 2.186		Vel = 3.24
116			0.0 16.49					53.982		K Factor =	2.24
103 to 117	117.958 117.958		13.48 13.48	1.25 1.442	4J 0.0	29.728 29.728	83.333 113.061	120 0.0133	52.609 1.506		Vel = 2.65
			0.0								

Final Calculations - Hazen-Williams

EASTERN FIRE PROTECTION
1000 RIVERSIDE

Page 8
Date 3/5/14

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	*****
117			13.48						54.115		K Factor = 1.83	
104 to 118	117.958 117.958		10.59	1.25	4J	29.728	83.333	120	53.349			
						0.0	29.728		0.0			
			10.59	1.442		0.0	113.061	0.0085	0.962		Vel = 2.08	
118			0.0						54.311		K Factor = 1.44	
105 to 119	117.958 117.958		7.71	1.25	4J	29.728	83.333	120	54.033			
						0.0	29.728		0.0			
			7.71	1.442		0.0	113.061	0.0047	0.536		Vel = 1.51	
119			0.0						54.569		K Factor = 1.04	
106 to 120	117.958 117.958		4.31	1.25	4J	29.728	83.333	120	54.679			
						0.0	29.728		0.0			
			4.31	1.442		0.0	113.061	0.0016	0.182		Vel = 0.85	
120			0.0						54.861		K Factor = 0.58	
107 to 121	117.958 117.958		-3.38	1.25	4J	29.728	83.333	120	55.303			
						0.0	29.728		0.0			
			-3.38	1.442		0.0	113.061	-0.0010	-0.117		Vel = 0.66	
121			0.0						55.186		K Factor = -0.45	
108 to 122	117.958 117.958		-7.05	1.25	4J	29.728	83.333	120	55.944			
						0.0	29.728		0.0			
			-7.05	1.442		0.0	113.061	-0.0040	-0.454		Vel = 1.38	
122			0.0						55.490		K Factor = -0.95	
109 to 123	117.958 117.958		-10.01	1.25	4J	29.728	83.333	120	56.620			
						0.0	29.728		0.0			
			-10.01	1.442		0.0	113.061	-0.0077	-0.868		Vel = 1.97	
123			0.0						55.752		K Factor = -1.34	
110 to 124	117.958 117.958		-12.91	1.25	4J	29.728	83.333	120	57.348			
						0.0	29.728		0.0			
			-12.91	1.442		0.0	113.061	-0.0123	-1.389		Vel = 2.54	
124			0.0						55.959		K Factor = -1.73	
111 to 125	117.958 117.958		-15.89	1.25	4J	29.728	83.333	120	58.146			
						0.0	29.728		0.0			
			-15.89	1.442		0.0	113.061	-0.0181	-2.042		Vel = 3.12	
125			0.0						56.104		K Factor = -2.12	
112 to 126	117.958 117.958		-18.95	1.25	4J	29.728	83.333	120	59.015			
						0.0	29.728		0.0			
			-18.95	1.442		0.0	113.061	-0.0250	-2.829		Vel = 3.72	
			0.0									

Final Calculations - Hazen-Williams

EASTERN FIRE PROTECTION
1000 RIVERSIDE

Page 9
Date 3/5/14

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	*****
126			-18.95						56.186		K Factor = -2.53	
113 to 127	117.958 0		-26.41	1.25	4J	29.728	83.333	120	61.442			
						0.0	29.728		51.088			
			-26.41	1.442		0.0	113.061	-0.0462	-5.226		Vel = 5.19	
127			0.0						107.304		K Factor = -2.55	
114 to 115	117.958 117.958		22.67	2.5		0.0	12.500	120	53.893			
						0.0	0.0		0.0			
			22.67	2.635		0.0	12.500	0.0018	0.023		Vel = 1.33	
115 to 116	117.958 117.958		19.36	2.5		0.0	11.333	120	53.916			
						0.0	0.0		0.0			
			42.03	2.635		0.0	11.333	0.0058	0.066		Vel = 2.47	
116 to 117	117.958 117.958		16.49	2.5		0.0	12.500	120	53.982			
						0.0	0.0		0.0			
			58.52	2.635		0.0	12.500	0.0106	0.133		Vel = 3.44	
117 to 118	117.958 117.958		13.48	2.5		0.0	12.500	120	54.115			
						0.0	0.0		0.0			
			72.0	2.635		0.0	12.500	0.0157	0.196		Vel = 4.24	
118 to 119	117.958 117.958		10.58	2.5		0.0	12.750	120	54.311			
						0.0	0.0		0.0			
			82.58	2.635		0.0	12.750	0.0202	0.258		Vel = 4.86	
119 to 120	117.958 117.958		7.72	2.5		0.0	12.250	120	54.569			
						0.0	0.0		0.0			
			90.3	2.635		0.0	12.250	0.0238	0.292		Vel = 5.31	
120 to 121	117.958 117.958		4.31	2.5		0.0	12.500	120	54.861			
						0.0	0.0		0.0			
			94.61	2.635		0.0	12.500	0.0260	0.325		Vel = 5.57	
121 to 122	117.958 117.958		-3.38	2.5		0.0	12.500	120	55.186			
						0.0	0.0		0.0			
			91.23	2.635		0.0	12.500	0.0243	0.304		Vel = 5.37	
122 to 123	117.958 117.958		-7.05	2.5		0.0	12.500	120	55.490			
						0.0	0.0		0.0			
			84.18	2.635		0.0	12.500	0.0210	0.262		Vel = 4.95	
123 to 124	117.958 117.958		-10.01	2.5		0.0	12.500	120	55.752			
						0.0	0.0		0.0			
			74.17	2.635		0.0	12.500	0.0166	0.207		Vel = 4.36	
124 to 125	117.958 117.958		-12.91	2.5		0.0	12.500	120	55.959			
						0.0	0.0		0.0			
			61.26	2.635		0.0	12.500	0.0116	0.145		Vel = 3.60	
125 to 126	117.958 117.958		-15.89	2.5		0.0	12.250	120	56.104			
						0.0	0.0		0.0			
			45.37	2.635		0.0	12.250	0.0067	0.082		Vel = 2.67	
126 to 127	117.958 0		-18.96	2.5		0.0	12.167	120	56.186			
						0.0	0.0		51.088			
			26.41	2.635		0.0	12.167	0.0025	0.030		Vel = 1.55	

Final Calculations - Hazen-Williams

EASTERN FIRE PROTECTION
1000 RIVERSIDE

Page 10
Date 3/5/14

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	*****
			0.0 26.41					107.304		K Factor =	2.55
100 to 101	117.958 117.958		307.74	3	0.0 0.0	12.500 0.0	120	49.953 0.0			
101 to 102	117.958 117.958		307.74	3.26	0.0 0.0	12.500 0.0	0.0818	1.022		Vel =	11.83
101 to 102	117.958 117.958		-19.36	3	0.0 0.0	11.333 0.0	120	50.975 0.0			
102 to 103	117.958 117.958		288.38	3.26	0.0 0.0	11.333 0.0	0.0724	0.821		Vel =	11.08
102 to 103	117.958 117.958		-16.49	3	0.0 0.0	12.500 0.0	120	51.796 0.0			
103 to 104	117.958 117.958		271.89	3.26	0.0 0.0	12.500 0.0	0.0650	0.813		Vel =	10.45
103 to 104	117.958 117.958		-13.48	3	0.0 0.0	12.500 0.0	120	52.609 0.0			
104 to 105	117.958 117.958		258.41	3.26	0.0 0.0	12.500 0.0	0.0592	0.740		Vel =	9.93
104 to 105	117.958 117.958		-10.59	3	0.0 0.0	12.500 0.0	120	53.349 0.0			
105 to 106	117.958 117.958		247.82	3.26	0.0 0.0	12.500 0.0	0.0547	0.684		Vel =	9.53
105 to 106	117.958 117.958		-7.71	3	0.0 0.0	12.500 0.0	120	54.033 0.0			
106 to 107	117.958 117.958		240.11	3.26	0.0 0.0	12.500 0.0	0.0517	0.646		Vel =	9.23
106 to 107	117.958 117.958		-4.31	3	0.0 0.0	12.500 0.0	120	54.679 0.0			
107 to 108	117.958 117.958		235.8	3.26	0.0 0.0	12.500 0.0	0.0499	0.624		Vel =	9.06
107 to 108	117.958 117.958		3.38	3	0.0 0.0	12.500 0.0	120	55.303 0.0			
108 to 109	117.958 117.958		239.18	3.26	0.0 0.0	12.500 0.0	0.0513	0.641		Vel =	9.19
108 to 109	117.958 117.958		7.05	3	0.0 0.0	12.500 0.0	120	55.944 0.0			
109 to 110	117.958 117.958		246.23	3.26	0.0 0.0	12.500 0.0	0.0541	0.676		Vel =	9.46
109 to 110	117.958 117.958		10.01	3	0.0 0.0	12.500 0.0	120	56.620 0.0			
110 to 111	117.958 117.958		256.24	3.26	0.0 0.0	12.500 0.0	0.0582	0.728		Vel =	9.85
110 to 111	117.958 117.958		12.91	3	0.0 0.0	12.500 0.0	120	57.348 0.0			
111 to 112	117.958 117.958		269.15	3.26	0.0 0.0	12.500 0.0	0.0638	0.798		Vel =	10.35
111 to 112	117.958 117.958		15.89	3	0.0 0.0	12.250 0.0	120	58.146 0.0			
112 to G	117.958 117.833		285.04	3.26	0.0 0.0	12.250 20.159	0.0709	0.869		Vel =	10.96
112 to G	117.958 117.833		18.96	3	T 0.0	20.159 20.159	120	59.015 0.054			
G	117.833		304.0	3.26	0.0	30.617	0.0799	2.446		Vel =	11.68
G			0.0 304.00					61.515		K Factor =	38.76
113 to G	117.958 117.833		26.41	3	T 0.0	20.159 20.159	120	61.442 0.054			
G	117.833		26.41	3.26	0.0	21.867	0.0009	0.019		Vel =	1.02

Final Calculations - Hazen-Williams

EASTERN FIRE PROTECTION
1000 RIVERSIDE

Page 11
Date 3/5/14

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	*****
G to TOR	117.833 117.833		304.00 330.41	4 4.26	I	9.217 0.0	8.083 9.217	120	61.515 0.0			
						0.0	17.300	0.0254	0.439	Vel =	7.44	
TOR to BASE	117.833 102		0.0 330.41	4 4.26	B S	15.8 28.968	15.708 44.768	120	61.954 6.857			
						0.0	60.476	0.0253	1.532	Vel =	7.44	
BASE to TEST	102 100		0.0 330.41	6 6.16	G 2E T	4.304 40.168 43.037	530.000 87.509 617.509	140	70.343 0.866 1.952			
								0.0032		Vel =	3.56	
TEST			250.00 580.41							Qa =	250.00	
									73.161	K Factor =	67.86	