

. . . 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 : 3
Contract : 5125
Data File : WET SYSTEM STORAGE.WXF

HYDRAULIC CALCULATIONS
for

Project name: 1000 RIVERSIDE ST.
Location: PORTLAND
Drawing no: 2 OF 3
Date: 3/5/14

Design

Remote area number: 3
Remote area location: WET SYSTEM STORAGE
Occupancy classification: OH II
Density: .2 - Gpm/SqFt
Area of application: 1104 - SqFt
Coverage per sprinkler: 68/109 - SqFt
Type of sprinklers calculated: TYCO TY-FRB BRASS UPRIGHT 5.6K 200
No. of sprinklers calculated: 11
In-rack demand: - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 522.396 - GPM @ 62.865 - 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.)
REMOTE AREA REDUCED PER NFPA 13 (2013) SECTION 11.2.3.2.3.1

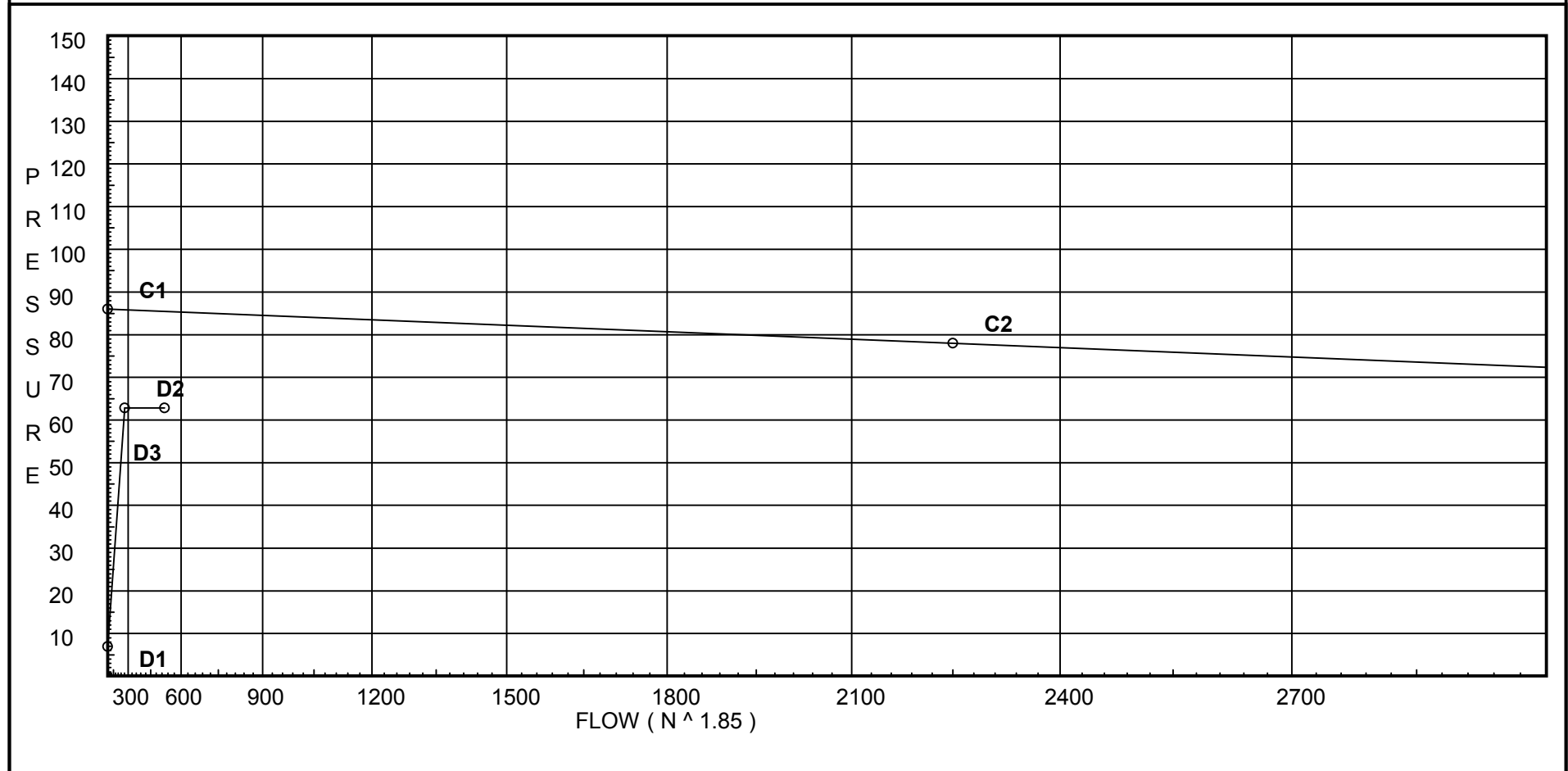
Water Supply Curve C

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

Demand:
D1 - Elevation : 6.930
D2 - System Flow : 272.396
D2 - System Pressure : 62.865
Hose (Demand) : 250
D3 - System Demand : 522.396
Safety Margin : 22.598



Fittings Used Summary

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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	85.463	522.4	62.865

NODE ANALYSIS

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
LINE	0.0	5.6	9.0	16.8	
30	116.0	5.6	17.05	23.12	
31	116.0	5.6	17.18	23.21	
32	115.0	5.6	18.17	23.87	
33	114.0	5.6	19.83	24.94	
34	113.0	5.6	22.87	26.78	
35	116.0	5.6	15.15	21.8	
36	115.0	5.6	15.71	22.19	
37	114.0	5.6	16.65	22.85	
38	113.0	5.6	18.2	23.89	
39	112.0	5.6	23.38	27.08	
40	112.0	5.6	34.02	32.67	
J	110.833		34.78		
K	110.833		34.92		
L	110.833		35.44		
TOW	110.833		39.96		
HDR	103.0		47.67		
E	117.958		44.13		
F	117.958		44.2		
100	117.958		44.29		
101	117.958		45.01		
102	117.958		45.58		
103	117.958		46.15		
104	117.958		46.67		
105	117.958		47.15		
106	117.958		47.6		
107	117.958		48.03		
108	117.958		48.48		
109	117.958		48.96		
110	117.958		49.47		
111	117.958		50.02		
112	117.958		50.63		
113	117.958		52.33		
114	117.958		47.05		
115	117.958		47.06		
116	117.958		47.11		
117	117.958		47.2		
118	117.958		47.34		
119	117.958		47.52		

NODE ANALYSIS (cont.)

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
120	117.958		47.73		
121	117.958		47.95		
122	117.958		48.17		
123	117.958		48.35		
124	117.958		48.49		
125	117.958		48.6		
126	117.958		48.65		
G	117.833		52.4		
TOR	117.833		52.7		
BASE	102.0		60.63		
TEST	100.0		62.86	250.0	

Final Calculations - Hazen-Williams - 2007

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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	*****
LINE to DRP	0 0	5.60	16.80 16.8	1 1.049	T 0.0	5.0 0.0 7.000	120 0.0943	9.000 0.0 0.660		Vel = 6.24	
DRP			0.0 16.80					9.660		K Factor = 5.41	
30 to 31	116 116	5.60	23.12 23.12	1.5 1.682	0.0 0.0	7.708 0.0 7.708	120 0.0171	17.047 0.0 0.132		Vel = 3.34	
31 to 32	116 115	5.60	23.21 46.33	1.5 1.682	0.0 0.0	9.042 0.0 9.042	120 0.0618	17.179 0.433 0.559		Vel = 6.69	
32 to 33	115 114	5.60	23.87 70.2	1.5 1.682	0.0 0.0	9.208 0.0 9.208	120 0.1333	18.171 0.433 1.227		Vel = 10.14	
33 to 34	114 113	5.60	24.94 95.14	1.5 1.682	0.0 0.0	11.167 0.0 11.167	120 0.2338	19.831 0.433 2.611		Vel = 13.74	
34 to J	113 110.833	5.60	26.78 121.92	1.5 1.682	E T 0.0	4.95 9.9 29.642	14.792 14.850 0.3699	120 0.939 10.965		Vel = 17.60	
J			0.0 121.92					34.779		K Factor = 20.67	
35 to 36	116 115	5.60	21.80 21.8	1.5 1.682	0.0 0.0	7.708 0.0 7.708	120 0.0154	15.154 0.433 0.119		Vel = 3.15	
36 to 37	115 114	5.60	22.19 43.99	1.5 1.682	0.0 0.0	9.042 0.0 9.042	120 0.0561	15.706 0.433 0.507		Vel = 6.35	
37 to 38	114 113	5.60	22.85 66.84	1.5 1.682	0.0 0.0	9.208 0.0 9.208	120 0.1217	16.646 0.433 1.121		Vel = 9.65	
38 to 39	113 112	5.60	23.89 90.73	1.5 1.682	2E 0.0	9.9 9.900 22.150	120 0.2141	18.200 0.433 4.743		Vel = 13.10	
39 to K	112 110.833	5.60	27.08 117.81	1.5 1.682	E T 0.0	4.95 9.9 31.808	16.958 14.850 0.3472	120 0.505 11.043		Vel = 17.01	
K			0.0 117.81					34.924		K Factor = 19.94	
40 to L	112 110.833	5.60	32.67 32.67	1.5 1.682	E T 0.0	4.95 9.9 28.225	13.375 14.850 0.0324	120 0.505 0.914		Vel = 4.72	
L			0.0 32.67					35.444		K Factor = 5.49	
J to K	110.833 110.833		121.92 121.92	3 3.26	0.0 0.0	9.833 0.0 9.833	120 0.0147	34.779 0.0 0.145		Vel = 4.69	

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	*****
K	110.833		117.81	3	0.0	10.083	120	34.924			
to					0.0	0.0		0.0			
L	110.833		239.73	3.26	0.0	10.083	0.0516	0.520	Vel =	9.21	
L	110.833		32.67	3	2E	18.815	120	35.444			
to					0.0	18.815		0.0			
TOW	110.833		272.4	3.26	0.0	69.315	0.0652	4.520	Vel =	10.47	
TOW	110.833		0.0	3	S	15.347	100	39.964			
to					B	9.592		3.392			
HDR	103		272.4	3.26	T	14.388	0.0914	4.311	Vel =	10.47	
HDR	103		0.0	4	4I	36.868	120	47.667			
to					J	21.067		-6.478			
E	117.958		272.4	4.26	0.0	165.893	0.0177	2.940	Vel =	6.13	
E	117.958		0.0	4	0.0	3.833	120	44.129			
to					0.0	0.0		0.0			
F	117.958		272.4	4.26	0.0	3.833	0.0175	0.067	Vel =	6.13	
F	117.958		0.0	3	0.0	1.458	120	44.196			
to					0.0	0.0		0.0			
100	117.958		272.4	3.26	0.0	1.458	0.0658	0.096	Vel =	10.47	
100	117.958		-253.71	1.25	4J	29.728	120	44.292			
to					0.0	29.728		0.0			
114	117.958		18.69	1.442	0.0	113.061	0.0244	2.756	Vel =	3.67	
114			0.0								
114			18.69					47.048	K Factor =	2.72	
101	117.958		15.96	1.25	4J	29.728	120	45.006			
to					0.0	29.728		0.0			
115	117.958		15.96	1.442	0.0	113.061	0.0182	2.058	Vel =	3.14	
115			0.0								
115			15.96					47.064	K Factor =	2.33	
102	117.958		13.59	1.25	4J	29.728	120	45.581			
to					0.0	29.728		0.0			
116	117.958		13.59	1.442	0.0	113.061	0.0135	1.529	Vel =	2.67	
116			0.0								
116			13.59					47.110	K Factor =	1.98	
103	117.958		11.12	1.25	4J	29.728	120	46.150			
to					0.0	29.728		0.0			
117	117.958		11.12	1.442	0.0	113.061	0.0093	1.054	Vel =	2.18	
117			0.0								
117			11.12					47.204	K Factor =	1.62	
104	117.958		8.73	1.25	4J	29.728	120	46.667			
to					0.0	29.728		0.0			
118	117.958		8.73	1.442	0.0	113.061	0.0060	0.674	Vel =	1.72	
118			0.0								
118			8.73					47.341	K Factor =	1.27	
105	117.958		6.36	1.25	4J	29.728	120	47.146			
to					0.0	29.728		0.0			
119	117.958		6.36	1.442	0.0	113.061	0.0033	0.375	Vel =	1.25	

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	*****
			0.0 6.36						47.521		K Factor = 0.92	
106 to 120	117.958 117.958		3.55 3.55	1.25 1.442	4J	29.728 0.0	83.333 29.728	120	47.598 0.0		Vel = 0.70	
			0.0 3.55						47.725		K Factor = 0.51	
107 to 121	117.958 117.958		-2.79 -2.79	1.25 1.442	4J	29.728 0.0	83.333 29.728	120	48.034 0.0		Vel = 0.55	
			0.0 -2.79						47.953		K Factor = -0.40	
108 to 122	117.958 117.958		-5.81 -5.81	1.25 1.442	4J	29.728 0.0	83.333 29.728	120	48.483 0.0		Vel = 1.14	
			0.0 -5.81						48.165		K Factor = -0.84	
109 to 123	117.958 117.958		-8.25 -8.25	1.25 1.442	4J	29.728 0.0	83.333 29.728	120	48.956 0.0		Vel = 1.62	
			0.0 -8.25						48.348		K Factor = -1.19	
110 to 124	117.958 117.958		-10.64 -10.64	1.25 1.442	4J	29.728 0.0	83.333 29.728	120	49.466 0.0		Vel = 2.09	
			0.0 -10.64						48.493		K Factor = -1.53	
111 to 125	117.958 117.958		-13.10 -13.1	1.25 1.442	4J	29.728 0.0	83.333 29.728	120	50.023 0.0		Vel = 2.57	
			0.0 -13.10						48.595		K Factor = -1.88	
112 to 126	117.958 117.958		-15.63 -15.63	1.25 1.442	4J	29.728 0.0	83.333 29.728	120	50.631 0.0		Vel = 3.07	
			0.0 -15.63						48.652		K Factor = -2.24	
113 to 127	117.958 0		-21.78 -21.78	1.25 1.442	4J	29.728 0.0	83.333 29.728	120	52.330 51.088		Vel = 4.28	
			0.0 -21.78						99.761		K Factor = -2.18	
114 to 115	117.958 117.958		18.69 18.69	2.5 2.635		0.0 0.0	12.500 0.0	120	47.048 0.0		Vel = 1.10	
						0.0	12.500	0.0013	0.016			

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	*****
115 to 116	117.958 117.958		15.96 34.65	2.5 2.635	0.0 0.0	11.333 0.0	120 0.0041	47.064 0.0			
									Vel =	2.04	
116 to 117	117.958 117.958		13.59 48.24	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0075	47.110 0.0			
									Vel =	2.84	
117 to 118	117.958 117.958		11.12 59.36	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0110	47.204 0.0			
									Vel =	3.49	
118 to 119	117.958 117.958		8.72 68.08	2.5 2.635	0.0 0.0	12.750 0.0	120 0.0141	47.341 0.0			
									Vel =	4.01	
119 to 120	117.958 117.958		6.36 74.44	2.5 2.635	0.0 0.0	12.250 0.0	120 0.0167	47.521 0.0			
									Vel =	4.38	
120 to 121	117.958 117.958		3.56 78.0	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0182	47.725 0.0			
									Vel =	4.59	
121 to 122	117.958 117.958		-2.79 75.21	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0170	47.953 0.0			
									Vel =	4.42	
122 to 123	117.958 117.958		-5.81 69.4	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0146	48.165 0.0			
									Vel =	4.08	
123 to 124	117.958 117.958		-8.26 61.14	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0116	48.348 0.0			
									Vel =	3.60	
124 to 125	117.958 117.958		-10.64 50.5	2.5 2.635	0.0 0.0	12.500 0.0	120 0.0082	48.493 0.0			
									Vel =	2.97	
125 to 126	117.958 117.958		-13.10 37.4	2.5 2.635	0.0 0.0	12.250 0.0	120 0.0047	48.595 0.0			
									Vel =	2.20	
126 to 127	117.958 0		-15.62 21.78	2.5 2.635	0.0 0.0	12.167 0.0	120 0.0017	48.652 51.088			
									Vel =	1.28	
127			0.0 21.78					99.761		K Factor =	2.18
100 to 101	117.958 117.958		253.70 253.7	3 3.26	0.0 0.0	12.500 0.0	120 0.0571	44.292 0.0			
									Vel =	9.75	
101 to 102	117.958 117.958		-15.95 237.75	3 3.26	0.0 0.0	11.333 0.0	120 0.0507	45.006 0.0			
									Vel =	9.14	
102 to 103	117.958 117.958		-13.60 224.15	3 3.26	0.0 0.0	12.500 0.0	120 0.0455	45.581 0.0			
									Vel =	8.62	

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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	*****
103 to 104	117.958 117.958		-11.11 213.04	3 3.26	0.0 0.0	12.500 0.0	120 0.0414	46.150 0.0 0.517			Vel = 8.19
104 to 105	117.958 117.958		-8.73 204.31	3 3.26	0.0 0.0	12.500 0.0	120 0.0383	46.667 0.0 0.479			Vel = 7.85
105 to 106	117.958 117.958		-6.36 197.95	3 3.26	0.0 0.0	12.500 0.0	120 0.0362	47.146 0.0 0.452			Vel = 7.61
106 to 107	117.958 117.958		-3.55 194.4	3 3.26	0.0 0.0	12.500 0.0	120 0.0349	47.598 0.0 0.436			Vel = 7.47
107 to 108	117.958 117.958		2.79 197.19	3 3.26	0.0 0.0	12.500 0.0	120 0.0359	48.034 0.0 0.449			Vel = 7.58
108 to 109	117.958 117.958		5.81 203.0	3 3.26	0.0 0.0	12.500 0.0	120 0.0378	48.483 0.0 0.473			Vel = 7.80
109 to 110	117.958 117.958		8.25 211.25	3 3.26	0.0 0.0	12.500 0.0	120 0.0408	48.956 0.0 0.510			Vel = 8.12
110 to 111	117.958 117.958		10.64 221.89	3 3.26	0.0 0.0	12.500 0.0	120 0.0446	49.466 0.0 0.557			Vel = 8.53
111 to 112	117.958 117.958		13.10 234.99	3 3.26	0.0 0.0	12.250 12.250	120 0.0496	50.023 0.0 0.608			Vel = 9.03
112 to G	117.958 117.833		15.63 250.62	3 3.26	T 0.0	20.159 20.159 30.617	120 0.0559	50.631 0.054 1.712			Vel = 9.63
G			0.0 250.62					52.397			K Factor = 34.62
113 to G	117.958 117.833		21.78 21.78	3 3.26	T 0.0	20.159 20.159 21.867	120 0.0006	52.330 0.054 0.013			Vel = 0.84
G to TOR	117.833 117.833		250.62 272.4	4 4.26	I 0.0	9.217 9.217 17.300	120 0.0177	52.397 0.0 0.307			Vel = 6.13
TOR to BASE	117.833 102		0.0 272.4	4 4.26	B S	15.8 28.968 0.0	120 0.0177	52.704 6.857 1.072			Vel = 6.13
BASE to TEST	102 100		0.0 272.4	6 6.16	G 2E T	4.304 40.168 43.037	530.000 87.509 617.509	140 0.0022	60.633 0.866 1.366		Vel = 2.93
			250.00								Qa = 250.00

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Node1	Elev1	K	Qa	Nom	Fitting		Pipe	CFact	Pt			
to					or		Ftng's		Pe	*****	Notes	*****
Node2	Elev2	Fact	Qt	Act	Eqv.	Ln.	Total	Pf/Ft	Pf			
TEST			522.40						62.865		K Factor =	65.89
