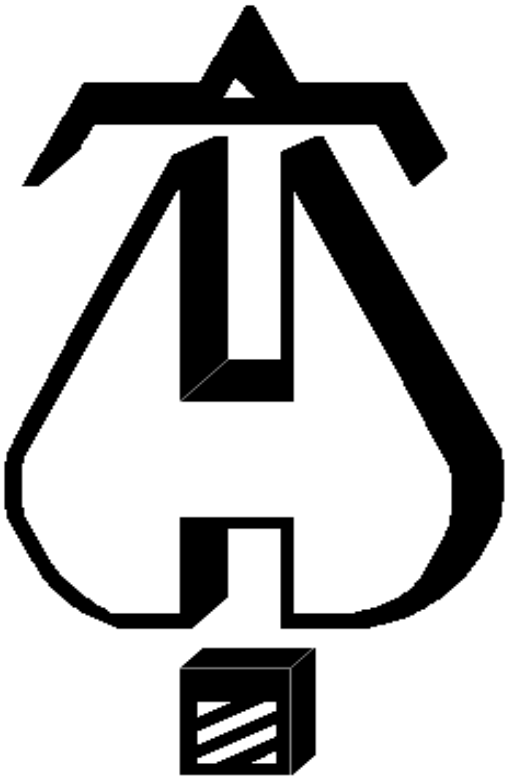


. . . Fire Protection by Computer Design

HIGH TECH FIRE PROTECTION
84 HACKETT MILLS ROAD
P.O. BOX 156
POLAND, ME 04274
207-998-2551

Job Name	:	16 MIDDLE STREET PARKING GARAGE #4
Drawing	:	FP-01
Location	:	1ST FLOOR
Remote Area	:	#4
Contract	:	062216-2
Data File	:	PARKING GARAGE.WXF

HYDRAULIC CALCULATIONS
for

Project name: 16 MIDDLE STREET 1ST EXTERIOR DRIVE THRU
Location: 1ST FLOOR
Drawing no: FP-01
Date: 7/26/17

Design

Remote area number: #4
Remote area location: 1ST FLOOR THROUGH BUILDING DRIVE WAY
Occupancy classification: ORDINARY HAZARD GROUP 1
Density: .15 - Gpm/SqFt
Area of application: 1950 - SqFt
Coverage per sprinkler: 120 - SqFt
Type of sprinklers calculated: QUICK RESPONSE DRY PENDENTS
No. of sprinklers calculated: 19
In-rack demand: N/A - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 662 - GPM @ 71 - Psi
Type of system: DRY NFPA 13
Volume of dry or preaction system: 220 - Gal

Water supply information

Date: 10-14-2016
Location: CORNER OF THAMES AND INDIA STREET
Source: PORTLAND WATER DISTRICT

Name of contractor: HIGH TECH FIRE PROTECTION
Address: 84 HACKETT MILLS ROAD / P.O. BOX 156 / POLAND, ME 04274
Phone number: 207-998-2551
Name of designer: ED POULIN
Authority having jurisdiction: STATE OF MAINE / CITY OF PORTLAND
Notes: (Include peaking information or gridded systems here.)

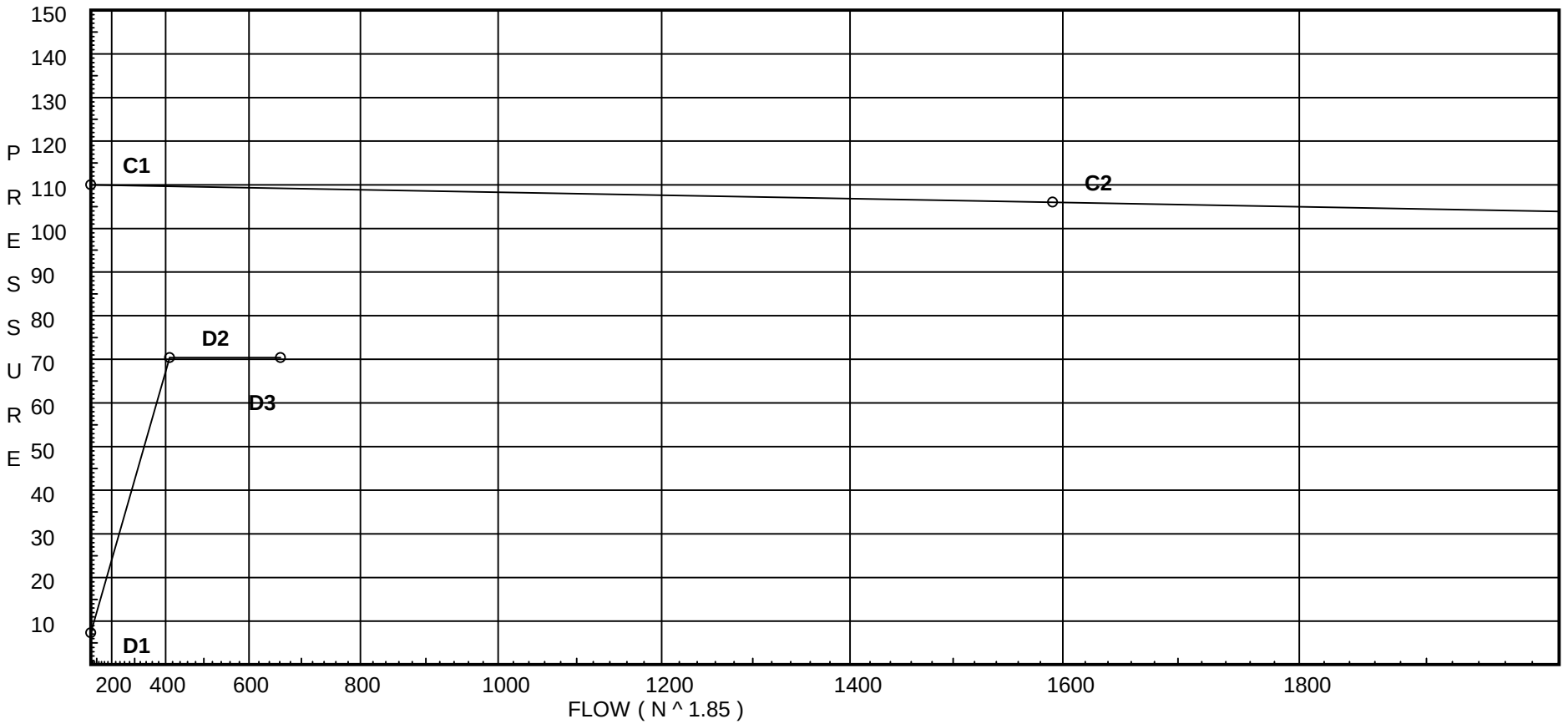
Water Supply Curve (C)

HIGH TECH FIRE PROTECTION
16 MIDDLE STREET PARKING GARAGE #4

Date 7/26/17

City Water Supply:
- C1 - Static Pressure : 110
- C2 - Residual Pressure: 106
- C2 - Residual Flow : 1591

Demand:
- D1 - Elevation : 7.363
- D2 - System Flow : 411.589
- D2 - System Pressure : 70.397
- Hose (Demand) : 250
- D3 - System Demand : 661.589
- Safety Margin : 38.814



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
Dge	Dry Reliable EX						3.1	4.3	9		10		20.9	38.1							
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	1	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
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
V	90' Ell Firelock #001	0	0	0	0	3.5	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
X	90'Tee-BranchFirelock002	0	0	0	0	8	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Zib	Wilkins 350A	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.

Pressure / Flow Summary - STANDARD

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
DP1	-1.0	5.6	12.13	na	19.5	0.15	130	7.0
10	11.0	K = K @ EQ01	13.11	na	19.5			
11	11.0	K = K @ EQ01	13.32	na	19.66			
12	11.0	K = K @ EQ01	14.08	na	20.21			
13	11.0		15.42	na				
14	11.0		15.98	na				
15	11.0	K = K @ EQ01	16.29	na	21.74			
20	11.0	K = K @ EQ01	13.27	na	19.62			
21	11.0	K = K @ EQ01	13.48	na	19.78			
22	11.0	K = K @ EQ01	14.25	na	20.33			
23	11.0		15.61	na				
24	11.0		16.17	na				
25	11.0	K = K @ EQ01	16.49	na	21.87			
30	11.0	K = K @ EQ01	13.93	na	20.1			
31	11.0	K = K @ EQ01	14.15	na	20.26			
32	11.0	K = K @ EQ01	14.96	na	20.83			
33	11.0		16.37	na				
34	11.0		16.97	na				
35	11.0	K = K @ EQ01	17.3	na	22.4			
40	11.0	K = K @ EQ01	15.67	na	21.32			
41	11.0	K = K @ EQ01	15.92	na	21.49			
42	11.0	K = K @ EQ01	16.81	na	22.08			
43	11.0		18.39	na				
44	11.0		19.05	na				
45	11.0	K = K @ EQ01	19.43	na	23.74			
51	11.0	K = K @ EQ01	21.75	na	25.12			
52	11.0	K = K @ EQ01	22.08	na	25.31			
53	11.0		23.07	na				
54	11.0		23.49	na				
55	11.0	K = K @ EQ01	23.72	na	26.23			
DA	10.0		18.6	na				
DB	10.0		18.81	na				
DC	10.0		19.71	na				
DD	10.0		22.06	na				
DE	10.0		25.84	na				
DF	10.0		41.09	na				
TOD	10.0		48.95	na				
BOD	4.0		59.88	na				
BASE	0.0		65.8	na				
H1	0.0		66.81	na				
H2	0.0		67.39	na				
H3	0.0		67.46	na	250.0			
TEST	-6.0		70.4	na				

The maximum velocity is 24.22 and it occurs in the pipe between nodes DE and DF

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
DP1	19.50	1.049	2T	7.137	1.000	12.125		K Factor = 5.60
to		100.0		0.0	7.137	-0.433		
EQ01	19.5	0.1740		0.0	8.137	1.416		Vel = 7.24
	0.0							
	19.50					13.108		K Factor = 5.39
10	19.50	1.682		0.0	12.000	13.108		K Factor @ node EQ01
to		100.0		0.0	0.0	0.0		
11	19.5	0.0174		0.0	12.000	0.209		Vel = 2.82
11	19.66	1.682		0.0	12.000	13.317		K Factor @ node EQ01
to		100.0		0.0	0.0	0.0		
12	39.16	0.0634		0.0	12.000	0.761		Vel = 5.65
12	20.20	1.682	1V	3.091	6.700	14.078		K Factor @ node EQ01
to		100.0		0.0	3.091	0.0		
13	59.36	0.1369		0.0	9.791	1.340		Vel = 8.57
13	0.0	1.682	1V	3.091	1.000	15.418		
to		100.0		0.0	3.091	0.0		
14	59.36	0.1369		0.0	4.091	0.560		Vel = 8.57
14	0.0	1.682		0.0	2.300	15.978		
to		100.0		0.0	0.0	0.0		
15	59.36	0.1370		0.0	2.300	0.315		Vel = 8.57
15	21.74	1.682	1T	7.065	0.600	16.293		K Factor @ node EQ01
to		100.0		0.0	7.066	0.433		
DA	81.1	0.2439		0.0	7.666	1.870		Vel = 11.71
	0.0							
	81.10					18.596		K Factor = 18.81
20	19.62	1.682		0.0	12.000	13.270		K Factor @ node EQ01
to		100.0		0.0	0.0	0.0		
21	19.62	0.0177		0.0	12.000	0.212		Vel = 2.83
21	19.78	1.682		0.0	12.000	13.482		K Factor @ node EQ01
to		100.0		0.0	0.0	0.0		
22	39.4	0.0641		0.0	12.000	0.769		Vel = 5.69
22	20.33	1.682	1V	3.091	6.700	14.251		K Factor @ node EQ01
to		100.0		0.0	3.091	0.0		
23	59.73	0.1384		0.0	9.791	1.355		Vel = 8.62
23	0.0	1.682	1V	3.091	1.000	15.606		
to		100.0		0.0	3.091	0.0		
24	59.73	0.1386		0.0	4.091	0.567		Vel = 8.62
24	0.0	1.682		0.0	2.300	16.173		
to		100.0		0.0	0.0	0.0		
25	59.73	0.1383		0.0	2.300	0.318		Vel = 8.62
25	21.87	1.682	1T	7.065	0.600	16.491		K Factor @ node EQ01
to		100.0		0.0	7.066	0.433		
DB	81.6	0.2467		0.0	7.666	1.891		Vel = 11.78
	0.0							
	81.60					18.815		K Factor = 18.81
30	20.10	1.682		0.0	12.000	13.930		K Factor @ node EQ01
to		100.0		0.0	0.0	0.0		
31	20.1	0.0184		0.0	12.000	0.221		Vel = 2.90

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
31	20.26	1.682		0.0	12.000	14.151		K Factor @ node EQ01
to		100.0		0.0	0.0	0.0		
32	40.36	0.0671		0.0	12.000	0.805		Vel = 5.83
32	20.83	1.682	1V	3.091	6.700	14.956		K Factor @ node EQ01
to		100.0		0.0	3.091	0.0		
33	61.19	0.1448		0.0	9.791	1.418		Vel = 8.84
33	0.0	1.682	1V	3.091	1.000	16.374		
to		100.0		0.0	3.091	0.0		
34	61.19	0.1447		0.0	4.091	0.592		Vel = 8.84
34	0.0	1.682		0.0	2.300	16.966		
to		100.0		0.0	0.0	0.0		
35	61.19	0.1448		0.0	2.300	0.333		Vel = 8.84
35	22.40	1.682	1T	7.065	0.600	17.299		K Factor @ node EQ01
to		100.0		0.0	7.066	0.433		
DC	83.59	0.2579		0.0	7.666	1.977		Vel = 12.07
	0.0							
	83.59					19.709		K Factor = 18.83
40	21.32	1.682		0.0	12.000	15.669		K Factor @ node EQ01
to		100.0		0.0	0.0	0.0		
41	21.32	0.0206		0.0	12.000	0.247		Vel = 3.08
41	21.49	1.682		0.0	12.000	15.916		K Factor @ node EQ01
to		100.0		0.0	0.0	0.0		
42	42.81	0.0748		0.0	12.000	0.898		Vel = 6.18
42	22.08	1.682	1V	3.091	6.700	16.814		K Factor @ node EQ01
to		100.0		0.0	3.091	0.0		
43	64.89	0.1614		0.0	9.791	1.580		Vel = 9.37
43	0.0	1.682	1V	3.091	1.000	18.394		
to		100.0		0.0	3.091	0.0		
44	64.89	0.1613		0.0	4.091	0.660		Vel = 9.37
44	0.0	1.682		0.0	2.300	19.054		
to		100.0		0.0	0.0	0.0		
45	64.89	0.1613		0.0	2.300	0.371		Vel = 9.37
45	23.74	1.682	1T	7.065	0.600	19.425		K Factor @ node EQ01
to		100.0		0.0	7.066	0.433		
DD	88.63	0.2874		0.0	7.666	2.203		Vel = 12.80
	0.0							
	88.63					22.061		K Factor = 18.87
51	25.12	1.682		0.0	12.000	21.748		K Factor @ node EQ01
to		100.0		0.0	0.0	0.0		
52	25.12	0.0278		0.0	12.000	0.334		Vel = 3.63
52	25.31	1.682	1V	3.091	6.700	22.082		K Factor @ node EQ01
to		100.0		0.0	3.091	0.0		
53	50.43	0.1013		0.0	9.791	0.992		Vel = 7.28
53	0.0	1.682	1V	3.091	1.000	23.074		
to		100.0		0.0	3.091	0.0		
54	50.43	0.1012		0.0	4.091	0.414		Vel = 7.28
54	0.0	1.682		0.0	2.300	23.488		
to		100.0		0.0	0.0	0.0		
55	50.43	0.1013		0.0	2.300	0.233		Vel = 7.28

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
55	26.23	1.682	1T	7.065	0.600	23.721		K Factor @ node EQ01
to		100.0		0.0	7.066	0.433		
DE	76.66	0.2197		0.0	7.666	1.684		Vel = 11.07
	0.0							
	76.66					25.838		K Factor = 15.08
DA	81.10	2.635		0.0	8.000	18.596		
to		100.0		0.0	0.0	0.0		
DB	81.1	0.0274		0.0	8.000	0.219		Vel = 4.77
DB	81.61	2.635		0.0	9.000	18.815		
to		100.0		0.0	0.0	0.0		
DC	162.71	0.0993		0.0	9.000	0.894		Vel = 9.57
DC	83.59	2.635		0.0	11.000	19.709		
to		100.0		0.0	0.0	0.0		
DD	246.3	0.2138		0.0	11.000	2.352		Vel = 14.49
DD	88.63	2.635		0.0	10.000	22.061		
to		100.0		0.0	0.0	0.0		
DE	334.93	0.3777		0.0	10.000	3.777		Vel = 19.71
DE	76.66	2.635	1X	10.582	17.000	25.838		
to		100.0		0.0	10.582	0.0		
DF	411.59	0.5530		0.0	27.582	15.252		Vel = 24.22
DF	0.0	2.635	1V	4.213	10.000	41.090		
to		100.0		0.0	4.213	0.0		
TOD	411.59	0.5529		0.0	14.213	7.859		Vel = 24.22
TOD	0.0	2.635	1B	6.859	4.000	48.949		
to		100.0	1Dge	4.213	11.072	2.599		
BOD	411.59	0.5529		0.0	15.072	8.334		Vel = 24.22
BOD	0.0	4.26	1Zib	0.0	3.000	59.882		
to		120.0		0.0	0.0	5.803		* Fixed loss = 4.071
BASE	411.59	0.0380		0.0	3.000	0.114		Vel = 9.26
BASE	0.0	6.16	2E	40.168	125.000	65.799		
to		140.0	1T	43.037	87.509	0.0		
H1	411.59	0.0047	1G	4.304	212.509	1.009		Vel = 4.43
H1	0.0	8.27	1T	55.354	460.000	66.808		
to		140.0		0.0	55.354	0.0		
H2	411.59	0.0011		0.0	515.354	0.582		Vel = 2.46
H2	0.0	12.34	1T	93.767	360.000	67.390		
to		140.0		0.0	93.767	0.0		
H3	411.59	0.0002		0.0	453.767	0.073		Vel = 1.10
H3	250.00	6.16	1E	20.084	5.000	67.463		Qa = 250
to		140.0	1G	4.304	24.388	2.599		
TEST	661.59	0.0114		0.0	29.388	0.335		Vel = 7.12
	0.0							
	661.59					70.397		K Factor = 78.85