



**... Fire Protection by Computer Design**

EASTERN FIRE  
170 KITTYHAWK AVE. / P.O. BOX  
AUBURN, ME , 04210  
207-784-1507

Job Name : IMMUCELL  
Building : 1 OF 2  
Location : PORTLAND  
System : 4  
Contract : 5568  
Data File : Immucell system #1 below mezzanine.WXF

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**HYDRAULIC CALCULATIONS**  
**for**

**Project name:** IMMUCELL  
**Location:** PORTLAND  
**Drawing no:** 1 OF 2  
**Date:** 2/28/17

**Design**

**Remote area number:** 4  
**Remote area location:** LEVEL 1 MEZZANINE  
**Occupancy classification:** OH2  
**Density:** 0.2 - Gpm/SqFt  
**Area of application:** 7 HEADS - SqFt  
**Coverage per sprinkler:** 110 - SqFt  
**Type of sprinklers calculated:** 5.6K BRASS UPRIGHT  
**No. of sprinklers calculated:** 7  
**In-rack demand:** - GPM  
**Hose streams:** 250 - GPM  
**Total water required (including hose streams):** 408.38 - GPM @ 46.16 - Psi  
**Type of system:** WET  
**Volume of dry or preaction system:** - Gal

**Water supply information**

**Date:** 07-12-16  
**Location:** FLOW HYDRANT LOCATED ON WELCH ST. & CADDIE ST.  
**Source:** EASTERN FIRE

**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:** RJP  
**Authority having jurisdiction:** STATE FIRE MARSHAL  
**Notes: (Include peaking information or gridded systems here.)**  
REMOTE AREA PER NFPA 13 SECTION 11.2.3.4.2

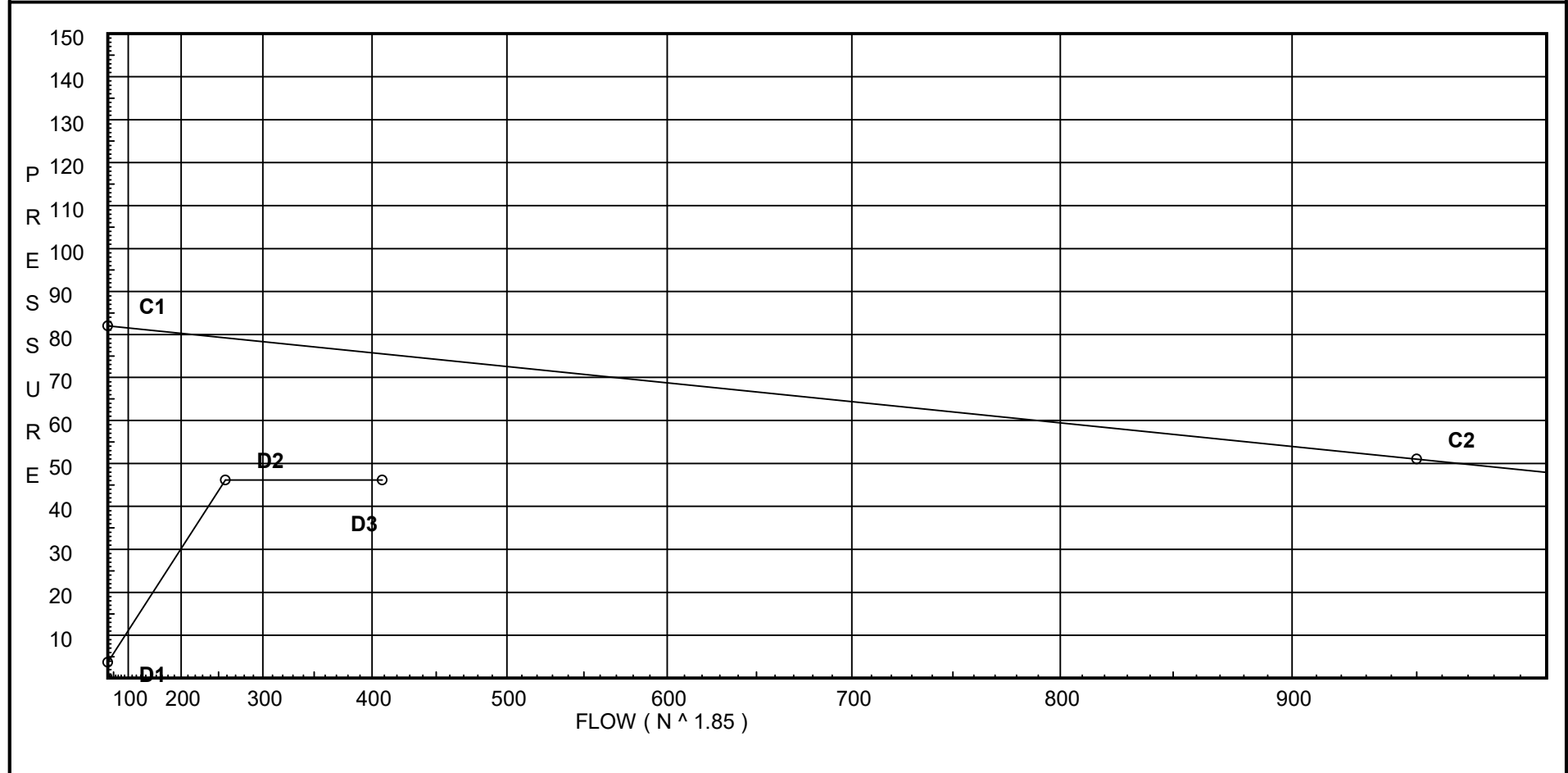
# Water Supply Curve C

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City Water Supply:  
C1 - Static Pressure : 82  
C2 - Residual Pressure: 51  
C2 - Residual Flow : 950

Demand:  
D1 - Elevation : 3.755  
D2 - System Flow : 258.371  
D2 - System Pressure : 46.156  
Hose ( Demand ) : 150  
D3 - System Demand : 408.371  
Safety Margin : 29.343



# 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
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
Zma	Maxim M200 Horz Butt	Fitting generates a Fixed Loss Based on Flow																			

## Unit 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

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
30	108.67	5.6	15.43	na	22.0	0.2	110	7.0
31	108.67	5.6	15.48	na	22.03	0.2	110	7.0
32	108.67	5.6	15.65	na	22.15	0.2	110	7.0
33	108.67	5.6	16.0	na	22.4	0.2	110	7.0
34	108.67	5.6	16.61	na	22.83	0.2	110	7.0
35	108.67		17.45	na				
36	108.67	5.6	18.9	na	24.34	0.2	110	7.0
37	108.67		21.88	na				
38	108.67		24.52	na				
40	111.0		28.39	na				
40A	111.0		35.29	na				
41	111.0		36.18	na	50.0			
TOR1	107.0		38.49	na				
HDR1	107.0		39.32	na	50.0			
BFP	102.0		41.74	na				
BASE	100.0		45.59	na				
TEST	100.0		46.16	na	150.0			
39	108.67	5.6	16.31	na	22.62	0.2	110	7.0

The maximum velocity is 13.9 and it occurs in the pipe between nodes 36 and 37

Final Calculations - Hazen-Williams - 2007

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
30 to 31	22.00 22.0	2.157 120.0 0.0046		0.0 0.0 0.0	10.000 0.0 10.000	15.434 0.0 0.046		K Factor = 5.60		
31 to 32	22.03 44.03	2.157 120.0 0.0168		0.0 0.0 0.0	10.000 0.0 10.000	15.480 0.0 0.168		K Factor = 5.60		
32 to 33	22.15 66.18	2.157 120.0 0.0355		0.0 0.0 0.0	10.000 0.0 10.000	15.648 0.0 0.355		K Factor = 5.60		
33 to 34	22.41 88.59	2.157 120.0 0.0610		0.0 0.0 0.0	10.000 0.0 10.000	16.003 0.0 0.610		K Factor = 5.60		
34 to 35	22.82 111.41	2.157 120.0 0.0933		0.0 0.0 0.0	9.000 0.0 9.000	16.613 0.0 0.840		K Factor = 5.60		
35 to 36	22.62 134.03	2.157 120.0 0.1312		0.0 0.0 0.0	11.000 0.0 11.000	17.453 0.0 1.443				Vel = 11.77
36 to 37	24.34 158.37	2.157 120.0 0.1787	E	6.153 0.0 0.0	10.530 6.153 16.683	18.896 0.0 2.982		K Factor = 5.60		
37 to 38	0.0 158.37	2.157 120.0 0.1788	E	6.153 0.0 0.0	8.620 6.153 14.773	21.878 0.0 2.641				Vel = 13.90
38 to 40	0.0 158.37	2.157 120.0 0.1787	2E T	12.307 12.307 0.0	2.667 24.614 27.281	24.519 -1.009 4.876				Vel = 13.90
40 to 40A	0.0 158.37	2.635 120.0 0.0674	3I J	24.711 14.827 0.0	62.875 39.538 102.413	28.386 0.0 6.905				Vel = 9.32
40A to 41	0.0 158.37	4.26 120.0 0.0065	3I J	27.651 21.067 0.0	88.000 48.718 136.718	35.291 0.0 0.889				Vel = 3.56
41 to TOR1	50.00 208.37	4.26 120.0 0.0108	2I	18.434 0.0 0.0	35.000 18.434 53.434	36.180 1.732 0.577		Qa = 50.00		
TOR1 to HDR1	0.0 208.37	4.26 120.0 0.0108	B S J	15.8 28.968 21.067	2.000 75.052 77.052	38.489 0.0 0.832				Vel = 4.69
HDR1 to BFP	50.00 258.37	4.26 120.0 0.0160	I G	9.217 2.633 0.0	4.000 11.850 15.850	39.321 2.166 0.254		Qa = 50.00		Vel = 5.82
BFP to BASE	0.0 258.37	4.26 120.0 0.0161	Zma I	0.0 9.217 0.0	2.000 9.217 11.217	41.741 3.666 0.181				* Fixed Loss = 2.8 Vel = 5.82
BASE to TEST	0.0 258.37	6.16 140.0 0.0020	3I J G	43.037 35.864 4.304	200.000 83.205 283.205	45.588 0.0 0.568				Vel = 2.78

# Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa  Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	150.00 408.37								Qa = 150.00 K Factor = 60.11	
39 to 35	22.62	1.049 120.0 0.1634	T	5.0 0.0 0.0	2.000 5.000 7.000	16.309 0.0 1.144			K Factor = 5.60 Vel = 8.40	
	0.0 22.62								K Factor = 5.41	