

**... 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 : 6  
Contract : 5568  
Data File : Immucell level 1 foam system.WXF

**HYDRAULIC CALCULATIONS**  
**for**

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

**Design**

**Remote area number:** 6  
**Remote area location:** LEVEL 1 XP PURIFICATION  
**Occupancy classification:** SPECIAL HAZARD  
**Density:** .3 - Gpm/SqFt  
**Area of application:** 567 - SqFt  
**Coverage per sprinkler:** 98 - SqFt  
**Type of sprinklers calculated:** TYCO TY4251 8.0K PENDENT  
**No. of sprinklers calculated:** 6  
**In-rack demand:** - GPM  
**Hose streams:** 500 - GPM  
**Total water required (including hose streams):** 678.08 - GPM @ 59.92 - 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 PROTECTION

**Name of contractor:** EASTERN FIRE  
**Address:** 170 KITTYHAWK AVE. / P.O. BOX  
**Phone number:** 207-784-1507  
**Name of designer:** RJP  
**Authority having jurisdiction:** STATE FIRE MARSHAL  
**Notes: (Include peaking information or gridded systems here.)**

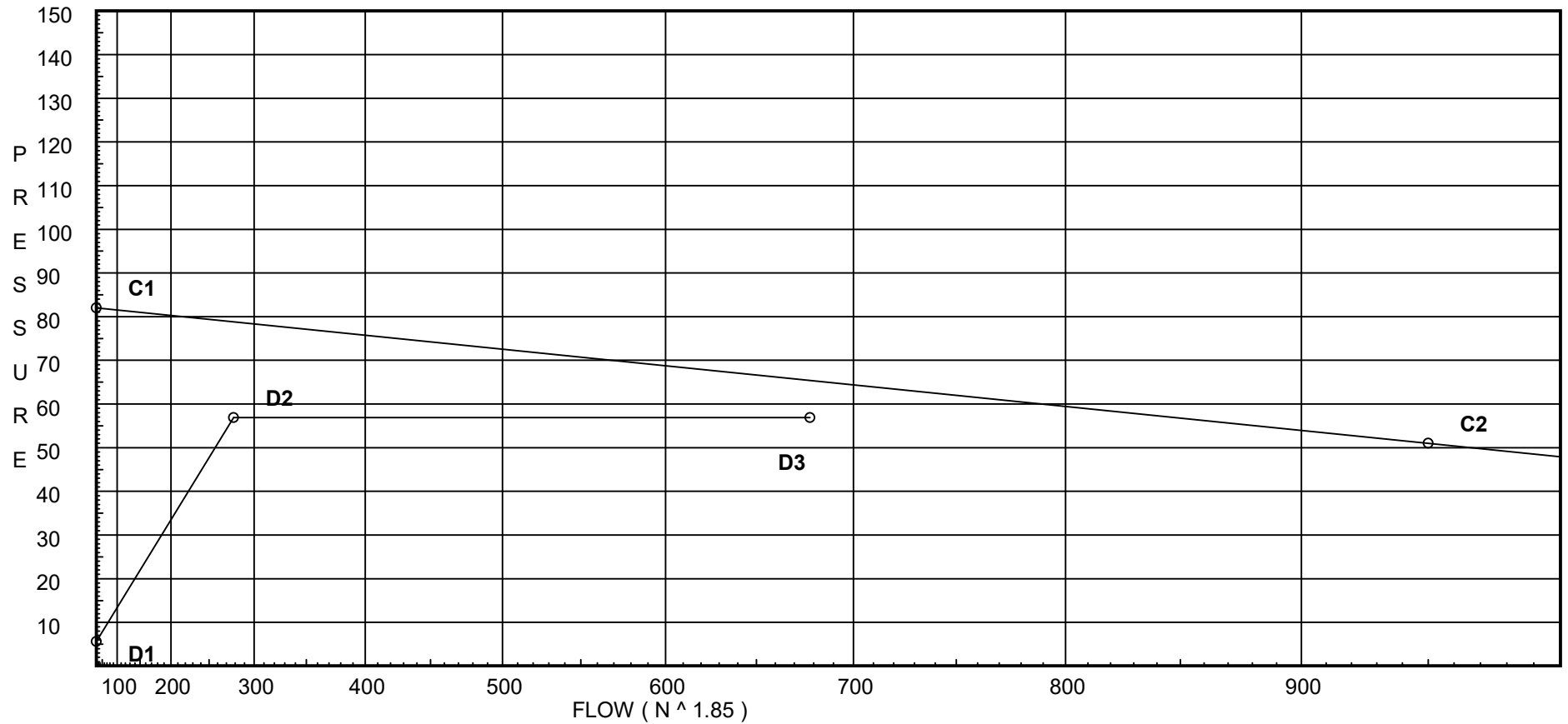
# Water Supply Curve C

EASTERN FIRE  
IMMUCELL

Page 2  
Date 2/28/17

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

Demand:  
D1 - Elevation : 5.630  
D2 - System Flow : 278.081  
D2 - System Pressure : 56.921  
Hose ( Demand ) : 400  
D3 - System Demand : 678.081  
Safety Margin : 8.466



# Fittings Used Summary

EASTERN FIRE  
IMMUCELL

Page 3  
Date 2/28/17

## 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	
A	Alarm Rel E1 & E3						6	7.7	21.5		17		27	29								
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	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	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	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	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	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	121
Zca	Colt C200 Horz Butt	Fitting generates a Fixed Loss Based on Flow																				
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

EASTERN FIRE  
IMMUCELL

Page 4  
Date 2/28/17

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
DP02	0.0	8	13.51	na	29.4	0.3	98	7.0
EQ02	0.0		15.1	na				
DP01	0.0	8	13.51	na	29.4	0.3	98	7.0
EQ01	0.0		14.3	na				
100	113.0	K = K @ EQ01	14.37	na	29.47			
101	113.0	K = K @ EQ02	15.1	na	29.4			
102	113.0		17.52	na				
103	113.0		17.65	na				
104	113.0		18.5	na				
TOF	113.0		29.69	na				
ALV	105.0		38.94	na				
FED	102.0		50.32	na	50.0			
41	111.0		46.56	na				
TOR1	107.0		48.97	na				
HDR1	107.0		50.02	na				
BFP	102.0		52.36	na	50.0			
BASE	100.0		56.27	na				
TEST	100.0		56.92	na	400.0			
105	113.0	K = K @ EQ01	14.48	na	29.58			
106	113.0	K = K @ EQ02	15.21	na	29.51			
107	113.0	K = K @ EQ01	14.99	na	30.1			
108	113.0	K = K @ EQ02	15.75	na	30.02			
109	113.0		18.27	na				

The maximum velocity is 12.9 and it occurs in the pipe between nodes 108 and 109

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE  
IMMUCELL

Page 5  
Date 2/28/17

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftg's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
DP02 to EQ02	29.40 29.4 0.0 29.40	1.049 120.0 0.2653	T 5.0 0.0 0.0	1.000 5.000 6.000	13.506 0.0 1.592		K Factor = 8.00 Vel = 10.91		
						15.098	K Factor = 7.57		
DP01 to EQ01	29.40 29.4 0.0 29.40	1.049 120.0 0.2653	E 2.0 0.0 0.0	1.000 2.000 3.000	13.506 0.0 0.796		K Factor = 8.00 Vel = 10.91		
						14.302	K Factor = 7.77		
100 to 101	29.47 29.47	1.38 120.0 0.0701		0.0 0.0 0.0	10.380 0.0 10.380	14.370 0.0 0.728	K Factor @ node EQ01 Vel = 6.32		
101 to 102	29.40 58.87	1.38 120.0 0.2522	T 6.0 0.0 0.0	3.620 6.000 9.620	15.098 0.0 2.426		K Factor @ node EQ02 Vel = 12.63		
102 to 103	0.0 58.87	2.469 120.0 0.0149		0.0 0.0 0.0	8.670 0.0 8.670	17.524 0.0 0.129	Vel = 3.94		
103 to 104	59.09 117.96	2.469 120.0 0.0537	J 10.8 0.0 0.0	5.050 10.800 15.850	17.653 0.0 0.851		Vel = 7.90		
104 to TOF	60.12 178.08	2.469 120.0 0.1150	5I 30.0 0.0 0.0	67.260 30.000 97.260	18.504 0.0 11.185		Vel = 11.93		
TOF to ALV	0.0 178.08	2.469 120.0 0.1150	4B 28.0 0.0 0.0	8.542 7.000 15.542	29.689 7.465 1.787		* Fixed Loss = 4 Vel = 11.93		
ALV to FED	0.0 178.08	2.469 120.0 0.1150	3I 18.0 J 10.8 A 7.7 Zca 0.0	10.333 36.500 46.833	38.941 5.996 5.386		* Fixed Loss = 4.697 Vel = 11.93		
FED to 41	50.00 228.08	4.026 120.0 0.0169		0.0 0.0 0.0	7.833 0.0 7.833	50.323 -3.898 0.132	Qa = 50.00 Vel = 5.75		
41 to TOR1	0.0 228.08	4.26 120.0 0.0128	2I 18.434 0.0 0.0	35.000 18.434 53.434	46.557 1.732 0.682		Vel = 5.13		
TOR1 to HDR1	0.0 228.08	4.26 120.0 0.0128	B 15.8 S 28.968 T 26.334 I 9.217	2.000 80.319 82.319	48.971 0.0 1.051		Vel = 5.13		
HDR1 to BFP	0.0 228.08	4.26 120.0 0.0127	I 9.217 0.0 0.0	4.000 9.217 13.217	50.022 2.166 0.168		Vel = 5.13		
BFP to BASE	50.00 278.08	4.26 120.0 0.0184	Zma 0.0 I 9.217 0.0	2.000 9.217 11.217	52.356 3.705 0.206		Qa = 50.00 * Fixed Loss = 2.838 Vel = 6.26		

# Final Calculations - Hazen-Williams

EASTERN FIRE  
IMMUCELL

Page 6  
Date 2/28/17

Hyd. Ref. Point	Qa  Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BASE to TEST	0.0 278.08	6.16 140.0 0.0023	3I J G EqI	43.037 35.864 4.304 1.435	200.000 84.640 284.640	56.267 0.0 0.654			Vel = 2.99	
	400.00 678.08					56.921			Qa = 400.00 K Factor = 89.88	
105 to 106	29.58 29.58	1.38 120.0 0.0706		0.0 0.0 0.0	10.380 0.0 10.380	14.477 0.0 0.733			K Factor @ node EQ01 Vel = 6.34	
106 to 103	29.51 59.09	1.38 120.0 0.2540	T	6.0 0.0 0.0	3.620 6.000 9.620	15.210 0.0 2.443			K Factor @ node EQ02 Vel = 12.67	
	0.0 59.09					17.653			K Factor = 14.06	
107 to 108	30.10 30.1	1.38 120.0 0.0729		0.0 0.0 0.0	10.380 0.0 10.380	14.989 0.0 0.757			K Factor @ node EQ01 Vel = 6.46	
108 to 109	30.02 60.12	1.38 120.0 0.2622	T	6.0 0.0 0.0	3.620 6.000 9.620	15.746 0.0 2.522			K Factor @ node EQ02 Vel = 12.90	
109 to 104	0.0 60.12	2.469 120.0 0.0155	J	10.8 0.0 0.0	4.460 10.800 15.260	18.268 0.0 0.236			Vel = 4.03	
	0.0 60.12					18.504			K Factor = 13.98	