

. . . Fire Protection by Computer Design

DEAN & ALLYN, INC.
116 LEWISTON ROAD
GRAY, MAINE 04039
207-657-5646

Job Name : C1211 MMC LEVEL 02
Drawing : 3
Location : PORTLAND, MAINE
Remote Area : LEVEL 02.WX1
Contract : C141211
Data File : C1211 MMC LEVEL 02.WX1

HYDRAULIC CALCULATIONS
for

Project name: MMC BEAN 2 EXPANSION
Location: PORTLAND, MAINE
Drawing no: 3
Date: 11-03-2014

Design

Remote area number: LEVEL 02.WX1
Remote area location: LEVEL 02
Occupancy classification: LIGHT HAZARD
Density: 0.10 - Gpm/SqFt
Area of application: 1500 - SqFt
Coverage per sprinkler: 148 - SqFt
Type of sprinklers calculated: K=5.6
No. of sprinklers calculated: 27
In-rack demand: 0 - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 820.177 - GPM @ 155.829 - Psi
Type of system: WET
Volume of dry or preaction system: N/A - Gal

Water supply information

Date: 09-19-2013
Location: BEAN FIRE PUMP
Source: ANNUAL PUMP TEST-DEAN & ALLYN, INC.

Name of contractor: DEAN & ALLYN, INC.
Address: 116 LEWISTON ROAD / / GRAY, MAINE 04039
Phone number: 207-657-5646
Name of designer: TED CLARKE
Authority having jurisdiction: MAINE STATE FIRE MARSHAL'S OFFICE
Notes: (Include peaking information or gridded systems here.) SAFETY MARGIN: 43.9 PSI

Fittings Used Summary

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Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Bvca	B Fly Vic 705						6	6	7		8	12	14	16	18	19						
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	
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
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	
Y	Mechanical Tee	2	4	5	6	8	10.5	12.5	15.5	0	22	0	0	0	0	0	0	0	0	0	0	

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

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
DP11	177.08	5.6	7.0	na	14.82	0.1	148	7.0
EQ11	178.08		6.79	na				
DP13	176.83	5.6	7.0	na	14.82	0.1	148	7.0
EQ13	177.83		6.79	na				
DP05	187.0	5.6	7.0	na	14.82	0.1	148	7.0
EQ05	188.0		7.02	na				
DP01	175.0	5.6	7.0	na	14.82	0.1	148	7.0
EQ01	176.0		6.79	na				
DP12	176.08	5.6	7.0	na	14.82	0.1	148	7.0
EQ12	177.08		6.79	na				
DP06	174.62	5.6	7.0	na	14.82	0.1	148	7.0
EQ06	175.62		6.79	na				
DP04	187.0	5.6	7.0	na	14.82	0.1	148	7.0
EQ04	188.0		6.79	na				
DP07	174.12	5.6	7.0	na	14.82	0.1	148	7.0
EQ07	175.12		6.79	na				
DP02	174.0	5.6	7.0	na	14.82	0.1	148	7.0
EQ02	175.0		6.79	na				
DP03	176.0	5.6	7.0	na	14.82	0.1	148	7.0
EQ03	177.0		6.79	na				
DP10	174.42	5.6	7.0	na	14.82	0.1	148	7.0
EQ10	175.42		6.79	na				
DP08	176.67	5.6	7.0	na	14.82	0.1	148	7.0
EQ08	177.67		6.79	na				
DP09	175.12	5.6	7.0	na	14.82	0.1	148	7.0
EQ09	176.12		6.79	na				
244	189.0	5.6	7.0	na	14.82	0.1	148	7.0
245	189.0		7.59	na				
246	188.0		9.42	na				
247	188.0	K = K @ EQ05	9.5	na	17.24			
248	188.0		10.37	na				
249	188.0		11.56	na				
249A	187.5		12.47	na				
250	178.08		19.12	na				
251	178.08		19.47	na				
252	177.0		20.95	na				
225	177.0		21.29	na				
224	177.0		21.7	na				
223	177.0		21.86	na				
222	177.0		22.89	na				
221	176.0		25.54	na				
218	176.0		26.47	na				
209	176.0		26.53	na				
203	176.0		26.87	na				
204	176.0		28.83	na				
205	175.5		33.03	na				
206	174.42		43.24	na				
207	174.42		99.81	na				
SP	174.42		118.6	na	250.0			
TEST	112.0		155.83	na				
253	189.0	5.6	7.51	na	15.35	0.1	148	7.0
254	188.0	K = K @ EQ04	8.76	na	16.83			
255	188.0	K = K @ EQ04	7.8	na	15.88			
256	188.0	K = K @ EQ05	8.32	na	16.13			
257	188.0		9.57	na				
258	187.5		11.5	na				
259	187.5		11.6	na				
260	188.0	K = K @ EQ04	8.6	na	16.67			
261	188.0	K = K @ EQ05	9.07	na	16.85			
262	188.0		10.4	na				
263	187.5		11.47	na				
264	188.0	K = K @ EQ04	7.78	na	15.86			

Flow Summary - Standard

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
265	188.0	K = K @ EQ05	8.39	na	16.21			
266	188.0		9.67	na				
267	177.08	K = K @ EQ12	13.85	na	21.16			
268	178.08		15.92	na				
269	178.08	K = K @ EQ11	14.99	na	22.01			
270	177.0	K = K @ EQ03	14.88	na	21.93			
271	177.0		16.94	na				
272	177.0	K = K @ EQ03	15.85	na	22.64			
273	189.0	5.6	8.21	na	16.05	0.1	148	7.0
274	189.0	5.6	9.43	na	17.19	0.1	148	7.0
275	177.33		29.93	na				
200	177.33		31.84	na				
214	175.5		33.71	na				
239	177.0	K = K @ EQ03	19.81	na	25.31			
240	177.0	K = K @ EQ03	20.22	na	25.56			
231	176.0	K = K @ EQ01	17.49	na	23.78			
232	175.5		20.44	na				
233	175.5		23.28	na				
211	176.0		26.76	na				
276	175.62		27.41	na				
277	175.62		27.73	na				
278	175.62		27.99	na				
212	174.92		30.32	na				
213	175.5		32.53	na				
234	175.0	K = K @ EQ02	19.09	na	24.84			
279	177.67	K = K @ EQ08	17.64	na	23.88			
280	175.62		22.36	na				
281	176.12	K = K @ EQ09	20.49	na	25.74			
282	175.12	K = K @ EQ07	19.1	na	24.85			
283	175.62		22.14	na				
284	175.12	K = K @ EQ07	20.5	na	25.74			
285	175.62	K = K @ EQ06	26.05	na	29.02			
210	176.0		26.7	na				
286	174.92		30.34	na				
287	177.33		29.47	na				
288	177.83	K = K @ EQ13	26.1	na	29.05			
289	175.42	K = K @ EQ10	27.12	na	29.61			

The maximum velocity is 21.92 and it occurs in the pipe between nodes 206 and 207

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	*****
DP11 to EQ11	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	
	0.0 14.82						6.791		K Factor = 5.69	
DP13 to EQ13	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	
	0.0 14.82						6.791		K Factor = 5.69	
DP05 to EQ05	14.82	1.049 120.0 0.0747	T	5.0 0.0 0.0	1.000 5.000 6.000	7.000 -0.433 0.448			K Factor = 5.60	
	0.0 14.82						7.015		K Factor = 5.60	
DP01 to EQ01	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	
	0.0 14.82						6.791		K Factor = 5.69	
DP12 to EQ12	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	
	0.0 14.82						6.791		K Factor = 5.69	
DP06 to EQ06	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	
	0.0 14.82						6.791		K Factor = 5.69	
DP04 to EQ04	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	
	0.0 14.82						6.791		K Factor = 5.69	
DP07 to EQ07	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	
	0.0 14.82						6.791		K Factor = 5.69	
DP02 to EQ02	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	
	0.0 14.82						6.791		K Factor = 5.69	
DP03 to EQ03	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	

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	*****
	0.0 14.82					6.791			K Factor = 5.69	
DP10 to EQ10	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	Vel = 5.50
	0.0 14.82					6.791			K Factor = 5.69	
DP08 to EQ08	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	Vel = 5.50
	0.0 14.82					6.791			K Factor = 5.69	
DP09 to EQ09	14.82	1.049 120.0 0.0747	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 -0.433 0.224			K Factor = 5.60	Vel = 5.50
	0.0 14.82					6.791			K Factor = 5.69	
244 to 245	14.82	1.049 120.0 0.0747		0.0 0.0 0.0	7.940 0.0 7.940	7.000 0.0 0.593			K Factor = 5.60	Vel = 5.50
245 to 246	15.34	1.38 120.0 0.0732	2T E	12.0 3.0 0.0	3.990 15.000 18.990	7.593 0.433 1.390				Vel = 6.47
246 to 247	16.83	1.61 120.0 0.0783		0.0 0.0 0.0	1.060 0.0 1.060	9.416 0.0 0.083				Vel = 7.41
247 to 248	17.24	1.61 120.0 0.1400	E	4.0 0.0 0.0	2.250 4.000 6.250	9.499 0.0 0.875			K Factor @ node EQ05	Vel = 10.12
248 to 249	0.0	1.61 120.0 0.1398	T	8.0 0.0 0.0	0.500 8.000 8.500	10.374 0.0 1.188				Vel = 10.12
249 to 249A	97.59	2.635 120.0 0.0702	E	8.237 0.0 0.0	1.667 8.237 9.904	11.562 0.217 0.695				Vel = 9.52
249A to 250	0.0	2.635 120.0 0.0702	3I	24.711 0.0 0.0	11.843 24.711 36.554	12.474 4.080 2.565				Vel = 9.52
250 to 251	43.17	2.635 120.0 0.1087		0.0 0.0 0.0	3.230 0.0 3.230	19.119 0.0 0.351				Vel = 12.06
251 to 252	0.0	2.635 120.0 0.1086	I	8.237 0.0 0.0	1.080 8.237 9.317	19.470 0.468 1.012				Vel = 12.06
252 to 225	44.57	2.635 120.0 0.1564		0.0 0.0 0.0	2.180 0.0 2.180	20.950 0.0 0.341				Vel = 14.68

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	*****
225 to 224	25.31 274.87	3.26 120.0 0.0664		0.0 0.0 0.0	6.220 0.0 6.220	21.291 0.0 0.413			Vel = 10.57	
224 to 223	25.57 300.44	3.26 120.0 0.0780		0.0 0.0 0.0	2.000 0.0 2.000	21.704 0.0 0.156			Vel = 11.55	
223 to 222	0.0 300.44	3.26 120.0 0.0782	I	6.72 0.0 0.0	6.510 6.720 13.230	21.860 0.0 1.035			Vel = 11.55	
222 to 221	0.0 300.44	3.26 120.0 0.0782	3I	20.159 0.0 0.0	8.110 20.159 28.269	22.895 0.433 2.210			Vel = 11.55	
221 to 218	0.0 300.44	3.26 120.0 0.0782		0.0 0.0 0.0	11.960 0.0 11.960	25.538 0.0 0.935			Vel = 11.55	
218 to 209	0.0 300.44	3.26 120.0 0.0776		0.0 0.0 0.0	0.760 0.0 0.760	26.473 0.0 0.059			Vel = 11.55	
209 to 203	-92.11 208.33	3.26 120.0 0.0397		0.0 0.0 0.0	8.530 0.0 8.530	26.532 0.0 0.339			Vel = 8.01	
203 to 204	0.0 208.33	3.26 120.0 0.0397		0.0 0.0 0.0	49.380 0.0 49.380	26.871 0.0 1.961			Vel = 8.01	
204 to 205	0.0 208.33	3.26 120.0 0.0397	2J 3I	34.943 20.159 0.0	45.150 55.102 100.252	28.832 0.217 3.981			Vel = 8.01	
205 to 206	112.93 321.26	3.26 120.0 0.0885	2J 2I	34.943 13.44 0.0	61.670 48.383 110.053	33.030 0.468 9.740			Vel = 12.35	
206 to 207	248.92 570.18	3.26 120.0 0.2558	6I J	40.319 17.471 0.0	163.360 57.790 221.150	43.238 0.0 56.570			Vel = 21.92	
207 to SP	0.0 570.18	3.26 120.0 0.2558	Bvca Y Fsp S	9.408 20.831 0.0 21.503	10.000 51.742 61.742	99.808 3.000 15.794		** Fixed Loss = 3	Vel = 21.92	
SP to TEST	250.00 820.18	6.357 120.0 0.0194	10I	125.734 0.0 0.0	400.000 125.734 525.734	118.602 27.034 10.193		Qa = 250	Vel = 8.29	
	0.0 820.18					155.829			K Factor = 65.70	
253 to 245	15.35 15.35	1.049 120.0 0.0792		0.0 0.0 0.0	1.060 0.0 1.060	7.509 0.0 0.084			K Factor = 5.60	Vel = 5.70
	0.0 15.35					7.593			K Factor = 5.57	
254 to 246	16.83 16.83	1.049 120.0 0.0946		0.0 0.0 0.0	6.900 0.0 6.900	8.763 0.0 0.653			K Factor @ node EQ04	Vel = 6.25

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftnng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 16.83					9.416			K Factor = 5.48	
255 to 256	15.88	1.049 120.0		0.0	6.130 0.0	7.797 0.0			K Factor @ node EQ04	
256 to 257	15.88	0.0850		0.0	6.130	0.521			Vel = 5.90	
256 to 257	16.13	1.049 120.0	E	2.0	2.040 2.000	8.318 0.0			K Factor @ node EQ05	
257 to 258	32.01	0.3104		0.0	4.040	1.254			Vel = 11.88	
257 to 258	0.0	1.049 120.0	T	5.0	0.500 5.000	9.572 0.217				
258 to 259	32.01	0.3107		0.0	5.500	1.709			Vel = 11.88	
258 to 259	33.51	2.635 120.0		0.0	8.080 0.0	11.498 0.0				
259 to 249	65.52	0.0131		0.0	8.080	0.106			Vel = 3.85	
259 to 249	32.07	2.635 120.0		0.0	6.360 0.0	11.604 -0.217				
249	97.59	0.0275		0.0	6.360	0.175			Vel = 5.74	
	0.0 97.59					11.562			K Factor = 28.70	
260 to 261	16.67	1.049 120.0		0.0	5.100 0.0	8.595 0.0			K Factor @ node EQ04	
261 to 262	16.67	0.0929		0.0	5.100	0.474			Vel = 6.19	
261 to 262	16.84	1.049 120.0	E	2.0	1.950 2.000	9.069 0.0			K Factor @ node EQ05	
262 to 263	33.51	0.3382		0.0	3.950	1.336			Vel = 12.44	
262 to 263	0.0	1.049 120.0	E	2.0	0.500 2.000	10.405 0.217				
263 to 258	33.51	0.3380		0.0	2.500	0.845			Vel = 12.44	
263 to 258	0.0	2.635 120.0		0.0	8.080 0.0	11.467 0.0				
258	33.51	0.0038		0.0	8.080	0.031			Vel = 1.97	
	0.0 33.51					11.498			K Factor = 9.88	
264 to 265	15.86	1.049 120.0		0.0	7.180 0.0	7.784 0.0			K Factor @ node EQ04	
265 to 266	15.86	0.0847		0.0	7.180	0.608			Vel = 5.89	
265 to 266	16.21	1.049 120.0	E	2.0	2.110 2.000	8.392 0.0			K Factor @ node EQ05	
266 to 267	32.07	0.3117		0.0	4.110	1.281			Vel = 11.91	
266 to 259	0.0	1.049 120.0	T	5.0	0.500 5.000	9.673 0.217				
259	32.07	0.3116		0.0	5.500	1.714			Vel = 11.91	
	0.0 32.07					11.604			K Factor = 9.41	
267 to 268	21.16	1.049 120.0	2E	4.0	13.370 4.000	13.846 -0.433			K Factor @ node EQ12	
268	21.16	0.1444		0.0	17.370	2.508			Vel = 7.86	

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	*****
268 to 250	22.01 43.17	1.049 120.0 0.5402	T	5.0 0.0 0.0	0.920 5.000 5.920	15.921 0.0 3.198				Vel = 16.03
	0.0 43.17						19.119			K Factor = 9.87
269 to 268	22.01 22.01	1.049 120.0 0.1553	T	5.0 0.0 0.0	1.000 5.000 6.000	14.989 0.0 0.932				K Factor @ node EQ11 Vel = 8.17
	0.0 22.01						15.921			K Factor = 5.52
270 to 271	21.93 21.93	1.049 120.0 0.1544	E	2.0 0.0 0.0	11.350 2.000 13.350	14.884 0.0 2.061				K Factor @ node EQ03 Vel = 8.14
271 to 252	22.64 44.57	1.049 120.0 0.5730	T	5.0 0.0 0.0	1.990 5.000 6.990	16.945 0.0 4.005				Vel = 16.55
	0.0 44.57						20.950			K Factor = 9.74
272 to 271	22.64 22.64	1.049 120.0 0.1636	T	5.0 0.0 0.0	1.680 5.000 6.680	15.852 0.0 1.093				K Factor @ node EQ03 Vel = 8.40
	0.0 22.64						16.945			K Factor = 5.50
273 to 274	16.05 16.05	1.049 120.0 0.0866		0.0 0.0 0.0	14.000 0.0 14.000	8.214 0.0 1.213				K Factor = 5.60 Vel = 5.96
274 to 275	17.19 33.24	1.049 120.0 0.3332	3E 2T	6.0 10.0 0.0	30.360 16.000 46.360	9.427 5.054 15.445				K Factor = 5.60 Vel = 12.34
275 to 200	94.95 128.19	3.26 120.0 0.0162	3I J	20.159 17.471 0.0	80.875 37.630 118.505	29.926 0.0 1.916				Vel = 4.93
200 to 214	0.0 128.19	3.26 120.0 0.0162	2I J	13.44 17.471 0.0	35.625 30.911 66.536	31.842 0.793 1.076				Vel = 4.93
214 to 206	120.73 248.92	3.26 120.0 0.0552	6I 2J	40.319 34.943 0.0	88.840 75.262 164.102	33.711 0.468 9.059				Vel = 9.57
	0.0 248.92						43.238			K Factor = 37.86
239 to 225	25.31 25.31	1.049 120.0 0.2011	T	5.0 0.0 0.0	2.340 5.000 7.340	19.815 0.0 1.476				K Factor @ node EQ03 Vel = 9.40
	0.0 25.31						21.291			K Factor = 5.49
240 to 224	25.56 25.56	1.049 120.0 0.2050	T	5.0 0.0 0.0	2.260 5.000 7.260	20.216 0.0 1.488				K Factor @ node EQ03 Vel = 9.49

Final Calculations - Hazen-Williams

DEAN & ALLYN, INC.
C1211 MMC LEVEL 02

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftn'g's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 25.56					21.704		K Factor = 5.49	
231 to 232	23.78	1.049 120.0	2E 0.0	4.0 0.0	11.250 4.000	17.489 0.217		K Factor @ node EQ01	
	23.78	0.1791	0.0	0.0	15.250	2.732		Vel = 8.83	
232 to 233	24.84	1.049 120.0	E 0.0	2.0 0.0	2.220 2.000	20.438 0.0			
	48.62	0.6730	0.0	0.0	4.220	2.840		Vel = 18.05	
233 to 211	0.0	1.049 120.0	T 0.0	5.0 0.0	0.500 5.000	23.278 -0.217			
	48.62	0.6731	0.0	0.0	5.500	3.702		Vel = 18.05	
211 to 276	92.10	3.26 120.0	2I 0.0	13.44 0.0	11.380 13.440	26.763 0.165			
	140.72	0.0192	0.0	0.0	24.820	0.477		Vel = 5.41	
276 to 277	49.62	3.26 120.0	0.0 0.0	0.0 0.0	9.720 0.0	27.405 0.0			
	190.34	0.0336	0.0	0.0	9.720	0.327		Vel = 7.32	
277 to 278	50.60	3.26 120.0	0.0 0.0	0.0 0.0	4.980 0.0	27.732 0.0			
	240.94	0.0520	0.0	0.0	4.980	0.259		Vel = 9.26	
278 to 212	29.01	3.26 120.0	I J	6.72 17.471	7.340 24.191	27.991 0.303			
	269.95	0.0641	0.0	0.0	31.531	2.022		Vel = 10.38	
212 to 213	-36.29	3.26 120.0	3E 0.0	28.223 0.0	22.000 28.223	30.316 -0.251			
	233.66	0.0491	0.0	0.0	50.223	2.467		Vel = 8.98	
213 to 214	-112.93	3.26 120.0	J 0.0	17.471 0.0	64.000 17.471	32.532 0.0			
	120.73	0.0145	0.0	0.0	81.471	1.179		Vel = 4.64	
	0.0 120.73					33.711		K Factor = 20.79	
234 to 232	24.84	1.049 120.0	E T	2.0 5.0	1.070 7.000	19.087 -0.217		K Factor @ node EQ02	
	24.84	0.1943	0.0	0.0	8.070	1.568		Vel = 9.22	
	0.0 24.84					20.438		K Factor = 5.49	
279 to 280	23.88	1.049 120.0	4E 0.0	8.0 0.0	13.210 8.000	17.640 0.888		K Factor @ node EQ08	
	23.88	0.1806	0.0	0.0	21.210	3.831		Vel = 8.86	
280 to 276	25.74	1.049 120.0	T 0.0	5.0 0.0	2.220 5.000	22.359 0.0			
	49.62	0.6989	0.0	0.0	7.220	5.046		Vel = 18.42	
	0.0 49.62					27.405		K Factor = 9.48	
281 to 280	25.74	1.049 120.0	E T	2.0 5.0	0.940 7.000	20.495 0.217		K Factor @ node EQ09	
	25.74	0.2074	0.0	0.0	7.940	1.647		Vel = 9.56	

Final Calculations - Hazen-Williams

DEAN & ALLYN, INC.
C1211 MMC LEVEL 02

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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	*****
	0.0 25.74						22.359		K Factor = 5.44	
282 to 283	24.85	1.049 120.0	2E	4.0 0.0	12.710 4.000	19.105 -0.217			K Factor @ node EQ07	
283 to 277	24.85 25.75 50.6	0.1945 1.049 120.0		0.0 5.0 0.0	16.710 2.720 5.000	3.250 22.138 0.0			Vel = 9.22	
	0.0 50.60						27.732		K Factor = 9.61	
284 to 283	25.74	1.049 120.0	E T	2.0 5.0	1.920 7.000	20.503 -0.217			K Factor @ node EQ07	
	25.74	0.2076		0.0	8.920	1.852			Vel = 9.56	
	0.0 25.74						22.138		K Factor = 5.47	
285 to 278	29.02	1.049 120.0	T	5.0 0.0	2.510 5.000	26.045 0.0			K Factor @ node EQ06	
	29.02	0.2591		0.0	7.510	1.946			Vel = 10.77	
	0.0 29.02						27.991		K Factor = 5.49	
209 to 210	92.11	3.26 120.0	J	17.471 0.0	2.090 17.471	26.532 0.0				
210 to 211	92.11 0.0 92.11	0.0088 3.26 120.0		0.0 0.0 0.0	19.561 6.760 0.0	0.172 26.704 0.0			Vel = 3.54	
	92.11	0.0087		0.0	6.760	0.059			Vel = 3.54	
	0.0 92.11						26.763		K Factor = 17.80	
212 to 286	36.29	3.26 120.0		0.0 0.0	13.560 0.0	30.316 0.0				
286 to 287	36.29	0.0016		0.0	13.560	0.022			Vel = 1.39	
286 to 287	29.61	3.26 120.0	3I	20.159 0.0	17.780 20.159	30.338 -1.044				
	65.9	0.0047		0.0	37.939	0.179			Vel = 2.53	
287 to 275	29.04	3.26 120.0	3I J	20.159 17.471	11.160 37.630	29.473 0.0				
	94.94	0.0093		0.0	48.790	0.453			Vel = 3.65	
	0.0 94.94						29.926		K Factor = 17.36	
213 to 205	112.93	3.26 120.0		0.0 0.0	39.000 0.0	32.532 0.0				
	112.93	0.0128		0.0	39.000	0.498			Vel = 4.34	
	0.0 112.93						33.030		K Factor = 19.65	
288 to 287	29.05	1.049 120.0	2E T	4.0 5.0	3.160 9.000	26.100 0.217			K Factor @ node EQ13	
	29.05	0.2595		0.0	12.160	3.156			Vel = 10.78	

Final Calculations - Hazen-Williams

DEAN & ALLYN, INC.
C1211 MMC LEVEL 02

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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	*****
	0.0 29.05					29.473		K Factor = 5.35	
289 to 286	29.61	1.049 120.0 0.2688	2E T	4.0 5.0 0.0	2.170 9.000 11.170	27.118 0.217 3.003		K Factor @ node EQ10 Vel = 10.99	
	0.0 29.61					30.338		K Factor = 5.38	

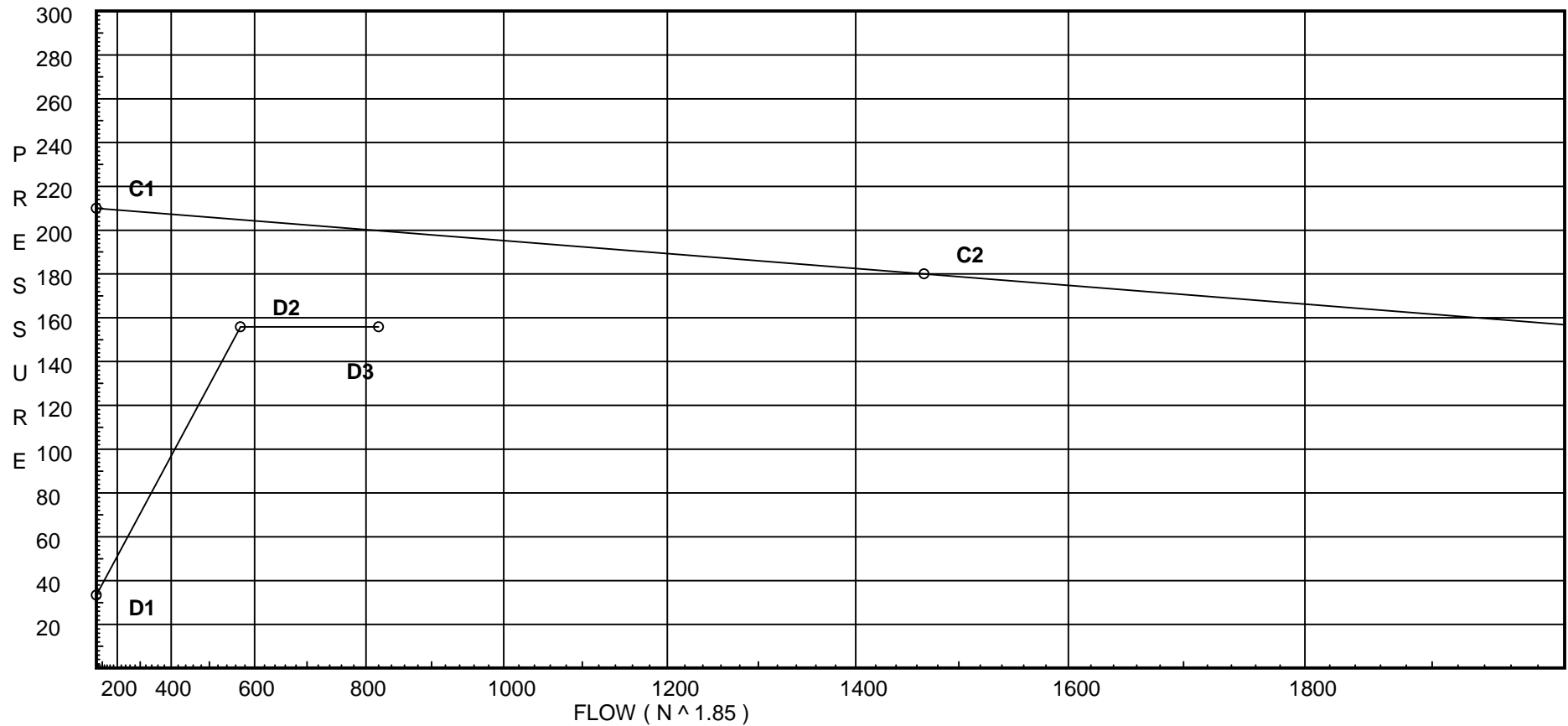
Water Supply Curve C

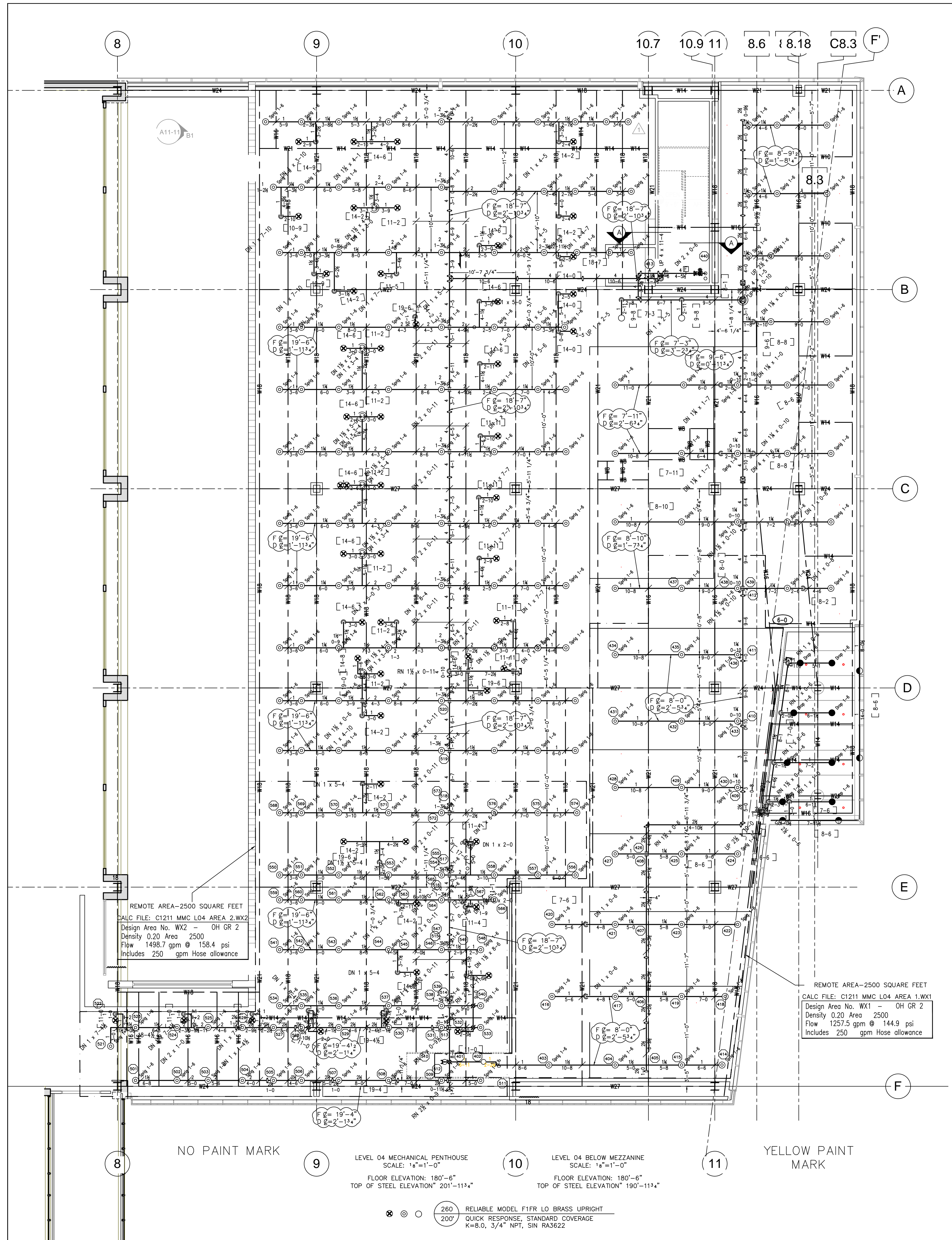
DEAN & ALLYN, INC.
C1211 MMC LEVEL 02

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City Water Supply:
C1 - Static Pressure : 210
C2 - Residual Pressure: 180
C2 - Residual Flow : 1467

Demand:
D1 - Elevation : 33.349
D2 - System Flow : 570.177
D2 - System Pressure : 155.829
Hose (Demand) : 250
D3 - System Demand : 820.177
Safety Margin : 43.939





FLOOR CONTROL STATION
 4" VIC 705 BUTTERFLY VALVE WITH TAMPER SWITCH
 4" VIC 717 CHECK VALVE
 4" FLOW SWITCH POTTER VSR

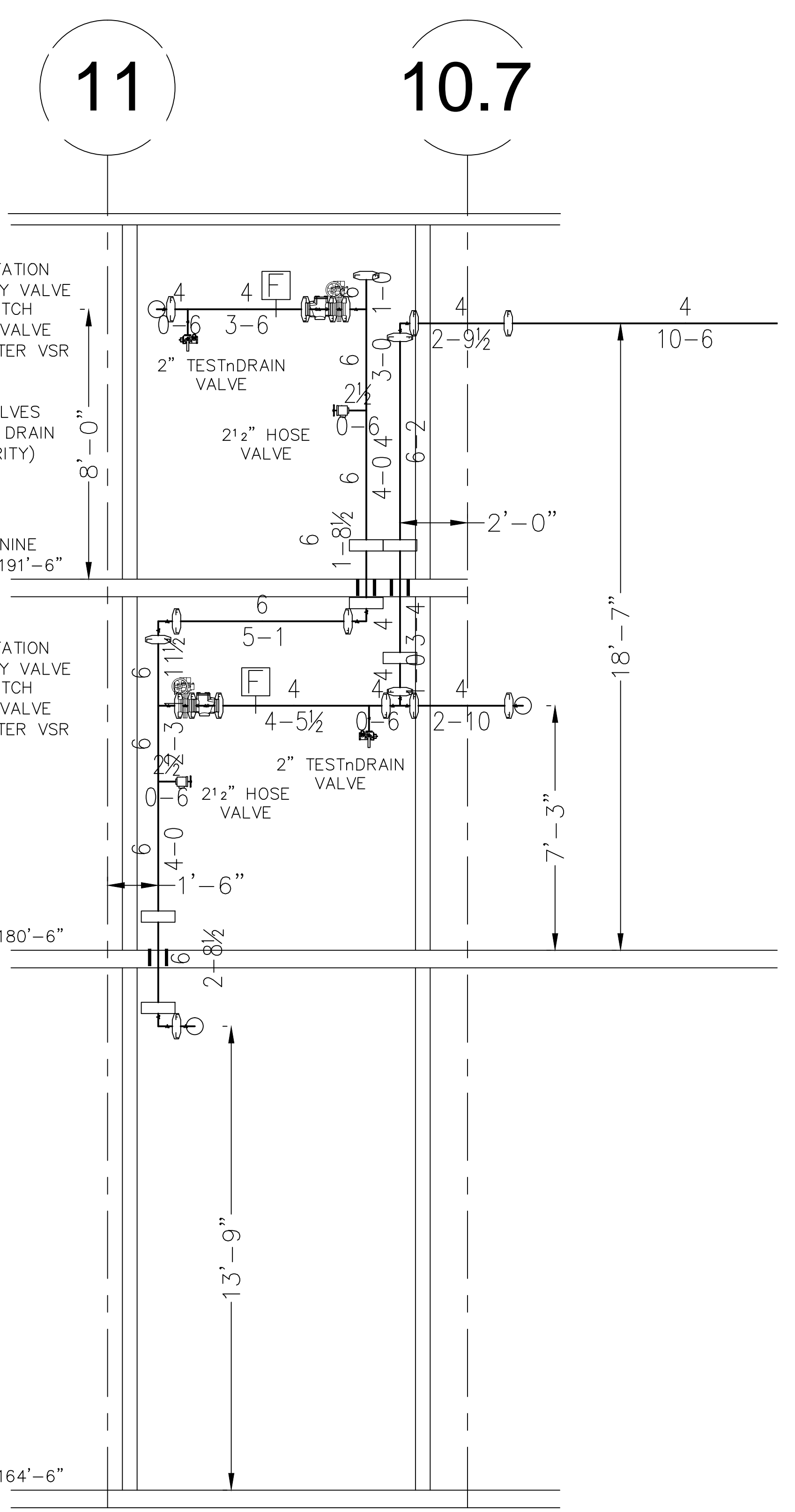
NOTE: THE 2" TEST/DRAIN VALVES WILL BE CONNECTED TO A 2 1/2" DRAIN RISER (NOT SHOWN FOR CLARITY)

LEVEL 04 MEZZANINE
 FLOOR ELEVATION: 191'-6"

FLOOR CONTROL STATION
 4" VIC 705 BUTTERFLY VALVE WITH TAMPER SWITCH
 4" VIC 717 CHECK VALVE
 4" FLOW SWITCH POTTER VSR

LEVEL 04
 FLOOR ELEVATION: 180'-6"

LEVEL 02
 FLOOR ELEVATION: 164'-6"



SECTION A-A
 RISER DETAIL
 SCALE: 3/8" = 1'-0"

LEGEND:

- UPRIGHT SPRINKLER ON A BRANCH LINE
 - ⊙ UPRIGHT SPRINKLER ON A 1" SPRIG
 - ⊗ UPRIGHT SPRINKLER BELOW DUCTWORK
 - ⊙ RECESSED PENDENT SPRINKLER ON A 1" DROP
 - CONCEALED PENDENT SPRINKLER ON A 1" DROP
 - SEISMIC BRACE
 - ↑ RISE OR DROP
 - GROOVED RIGID COUPLING
 - GROOVED FLEXIBLE COUPLING
 - ⊗ HYDRAULIC REFERENCE POINT
 - ⊙ CEILING HEIGHT
 - HANGER
- F ℄ = X'-X" FINISHED FLOOR TO PIPE CENTERLINE
 TS ℄ = X'-X" TOP OF STEEL BEAM TO PIPE CENTERLINE
 BB ℄ = X'-X" BOTTOM OF BEAM TO PIPE CENTERLINE
 C ℄ = X'-X" CEILING TO PIPE CENTERLINE
 D ℄ = X'-X" CONCRETE DECK TO PIPE CENTERLINE
 CTE CONNECT TO EXISTING
 FHV FIRE HOSE VALVE

GENERAL NOTES:

ALL 1" TO 2" PIPE IS TO BE SCH. 40 BLACK STEEL U/N.
 ALL 2 1/2" TO 6" PIPE IS TO BE SCH. 10 BLACK STEEL U/N.
 ALL THREADED PIPE FITTINGS ARE TO BE BLACK CAST IRON, CLASS 125 U/N.
 DIMENSIONS SHOWN ON THREADED PIPE ARE CENTER TO CENTER U/N.
 DIMENSIONS SHOWN ON GROOVED PIPE ARE "CUT" LENGTHS U/N.
 PENDENT SPRINKLERS IN ACOUSTIC TILE CEILINGS ARE TO BE CENTERED IN CEILING TILES.
 SUFFICIENT HEAT TO PREVENT FREEZING OF THE WET PIPE SPRINKLER SYSTEM IS REQUIRED TO BE FURNISHED BY THE BUYER/OWNER.

SYSTEM CLASSIFICATION:

THE WET PIPE SYSTEM OF AUTOMATIC SPRINKLERS IS DESIGNED IN ACCORDANCE WITH NFPA-13, STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS, 2007 EDITION.
 -LIGHT HAZARD OCCUPANCY FOR OFFICES, PATIENT AREAS AND PUBLIC AREAS, HYDRAULICALLY CALCULATED TO PROVIDE A DENSITY OF 0.10 GPM PER SQUARE FOOT OVER THE MOST REMOTE 1500 SQUARE FEET WITH A HOSE ALLOWANCE OF 250 GPM.
 -ORDINARY HAZARD, GROUP 2 FOR GENERAL STORAGE AREAS, MECHANICAL EQUIPMENT ROOMS, BUILDING SERVICE AREAS AND ELECTRICAL EQUIPMENT ROOMS, HYDRAULICALLY CALCULATED TO PROVIDE A DENSITY OF 0.20 GPM PER SQUARE FOOT OVER THE MOST REMOTE 2500 SQUARE FEET WITH A HOSE ALLOWANCE OF 250 GPM.
 THE STANDPIPE SYSTEM IS DESIGNED IN ACCORDANCE WITH NFPA-14, STANDARD FOR THE INSTALLATION OF STANDPIPE, PRIVATE HYDRANTS, AND HOSE SYSTEMS, 2007 EDITION, FOR CLASS I AUTOMATIC WET TYPE.

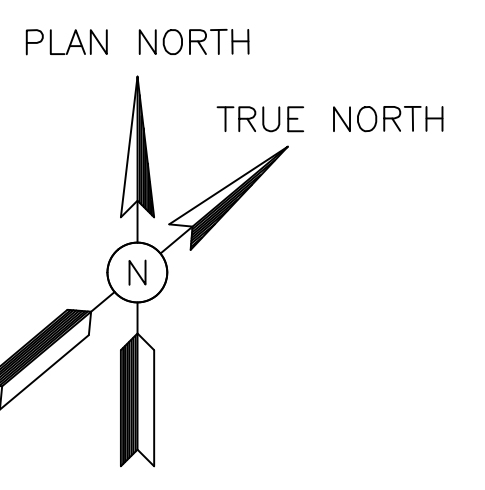
SCOPE OF WORK:

DESIGN AND INSTALL A COMBINED STANDPIPE AND SPRINKLER SYSTEM IN THE NEW BEAN 2 EXPANSION AREA.

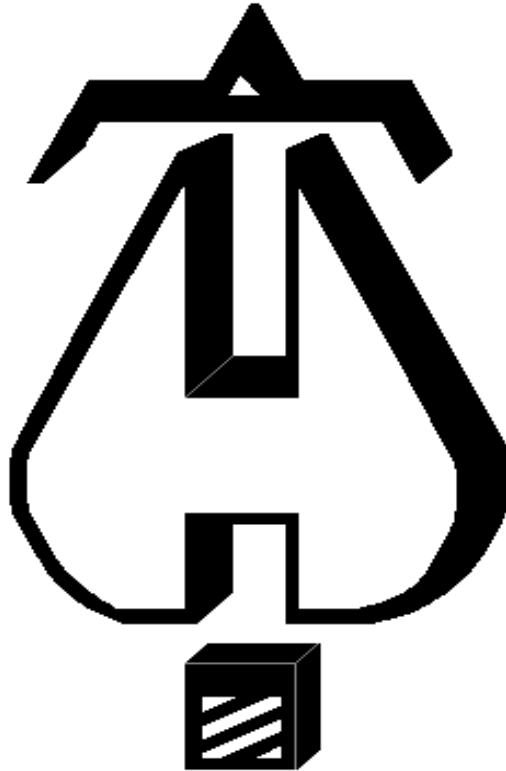
FIRE PROTECTION SUBCONTRACTOR: DEAN & ALLYN, INC.
 STATE OF MAINE CONTRACTOR'S LICENSE NUMBER 262
 EXPIRATION DATE: JUNE 30, 2015

WORKING DRAWINGS PREPARED BY:
 THEODORE E. CLARKE
 NICET LEVEL IV
 CERTIFICATION #71654
 STATE OF MAINE RMS LICENSE NUMBER 208
 EXPIRATION DATE: JUNE 30, 2015

DEAN & ALLYN, INC.
 FIRE PROTECTION • SPECIAL HAZARD
 116 LEWISTON ROAD, GRAY, MAINE 04039
 (207)657-5646 FAX:(207)657-5647



3/16" = 1'-0"	1/8" = 1'-0"	1/4" = 1'-0"	1/2" = 1'-0"	DANA A. STEWART NICET IV - #064544	DRAWING TITLE: LEVEL 04 PENTHOUSE LAYOUT	REV. 0
APPROVED BY	DATE	SURVEYED BY	PLAN	JOB:	MCM BEAN 2 EXPANSION 22 BRAMHALL STREET PORTLAND, MAINE 04102	NO. OF SPRINKLERS SHOWN ON THIS SHEET 260 LATER
		DRAWN BY	TEC 10/10/14			
		CHECKED BY	DAS			
		AT DEAN & ALLYN, INC				
① SUBMIT FOR APPROVAL 10/16/14				SCALE 1/8"=1'-0" U/N	CONTRACT WITH: SUFFOLK CONSTRUCTION COMPANY 99 CONIFER HILL DRIVE, DANVERS, MA 01923	CONTRACT NO. C141211
REVISIONS				DATE		



. . . Fire Protection by Computer Design

DEAN & ALLYN, INC.
116 LEWISTON ROAD
GRAY, MAINE 04039
207-657-5646

Job Name : C1211 MMC LEVEL 04 AREA 1
Building : 1
Location : PORTLAND, MAINE
System : AREA 1.WX1
Contract : C141211
Data File : C1211 MMC L04 Area 1.WX1

HYDRAULIC CALCULATIONS
for

Project name: MMC BEAN 2 EXPANSION
Location: PORTLAND, MAINE
Drawing no: 1
Date: 10-09-2014

Design

Remote area number: AREA 1.WX1
Remote area location: LEVEL 04 PENTHOUSE MECHANICAL ROOM
Occupancy classification: ORDINARY HAZARD-GROUP 2
Density: 0.20 - Gpm/SqFt
Area of application: 2500 - SqFt
Coverage per sprinkler: 125 - SqFt
Type of sprinklers calculated: K=8.0
No. of sprinklers calculated: 28
In-rack demand: 0 - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 1257.5 - GPM @ 144.9 - Psi
Type of system: WET
Volume of dry or preaction system: N/A - Gal

Water supply information

Date: 09-19-2013
Location: BEAN FIRE PUMP
Source: ANNUAL PUMP TEST-DEAN & ALLYN, INC.

Name of contractor: DEAN & ALLYN, INC.
Address: 116 LEWISTON ROAD / / GRAY, MAINE 04039
Phone number: 207-657-5646
Name of designer: TED CLARKE
Authority having jurisdiction: MAINE STATE FIRE MARSHAL'S OFFICE
Notes: (Include peaking information or gridded systems here.) SAFETY MARGIN: 42.5 PSI

Fittings Used Summary

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04 AREA 1

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Date 10-09-2014

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Bvca	B Fly Vic 705						6	6	7		8	12	14	16	18	19						
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	
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
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.

Pressure / Flow Summary - STANDARD

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04 AREA 1

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Date 10-09-2014

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
SP05	190.5	8	9.77	na	25.0	0.2	125	7.0
EQ05	189.0		11.69	na				
SP02	190.0	8	9.77	na	25.0	0.2	125	7.0
EQ02	188.5		11.1	na				
SP03	190.0	8	9.77	na	25.0	0.2	125	7.0
EQ03	188.5		11.69	na				
SP04	190.5	8	9.77	na	25.0	0.2	125	7.0
EQ04	189.0		11.1	na				
SP01	190.83	8	9.77	na	25.0	0.2	125	7.0
EQ01	189.33		11.69	na				
SP06	189.5	8	9.77	na	25.0	0.2	125	7.0
EQ06	188.0		11.1	na				
401	184.51	8	7.27	na	21.57	0.2	100	7.0
402	187.53	8	7.0	na	21.17	0.2	100	7.0
403	188.5	K = K @ EQ03	13.39	na	26.75			
404	188.5	K = K @ EQ03	15.11	na	28.42			
405	188.5		19.08	na				
406	188.5		19.8	na				
407	188.5		21.94	na				
408	188.5		26.11	na				
409	188.5		49.4	na				
410	188.5		52.62	na				
411	188.5		57.29	na				
412	188.5		59.04	na				
413	187.75		87.58	na				
440	187.75		105.1	na	100.0			
PUMP	112.0		144.9	na	150.0			
414	188.5	K = K @ EQ02	14.57	na	28.64			
415	188.5	K = K @ EQ03	16.21	na	29.44			
416	188.0	K = K @ EQ06	13.79	na	27.86			
417	188.5	K = K @ EQ03	17.1	na	30.23			
418	188.5	K = K @ EQ02	15.02	na	29.08			
419	188.5	K = K @ EQ03	16.84	na	30.0			
420	188.0	K = K @ EQ06	15.3	na	29.35			
421	188.5	K = K @ EQ03	18.96	na	31.84			
422	188.5	K = K @ EQ02	16.21	na	30.2			
423	188.5	K = K @ EQ03	18.72	na	31.63			
424	189.0	K = K @ EQ04	16.23	na	30.22			
425	189.0	K = K @ EQ05	18.74	na	31.65			
427	189.0	K = K @ EQ04	18.77	na	32.51			
426	189.0		21.97	na				
428	188.5	K = K @ EQ02	31.43	na	42.06			
429	188.5	K = K @ EQ03	36.92	na	44.42			
430	188.5	K = K @ EQ03	41.54	na	47.12			
431	188.5	K = K @ EQ02	33.54	na	43.45			
432	188.5	K = K @ EQ03	39.38	na	45.88			
433	188.5	K = K @ EQ03	44.28	na	48.65			
434	188.5	K = K @ EQ02	36.61	na	45.4			
435	188.5	K = K @ EQ03	42.94	na	47.91			
436	188.5	K = K @ EQ03	48.26	na	50.79			
437	189.33	K = K @ EQ01	44.96	na	49.02			
438	189.33	K = K @ EQ01	51.11	na	52.26			
439	189.33		55.81	na				

The maximum velocity is 30.91 and it occurs in the pipe between nodes 436 and 411

Final Calculations - Hazen-Williams - 2007

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04 AREA 1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftnng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
SP05 to EQ05	25.00 25.0	1.049 120.0 0.1965	T 5.0 0.0 0.0	1.500 5.000 6.500	9.766 0.650 1.277		K Factor = 8.00 Vel = 9.28		
	0.0 25.00					11.693	K Factor = 7.31		
SP02 to EQ02	25.00 25.0	1.049 120.0 0.1966	E 2.0 0.0 0.0	1.500 2.000 3.500	9.766 0.650 0.688		K Factor = 8.00 Vel = 9.28		
	0.0 25.00					11.104	K Factor = 7.50		
SP03 to EQ03	25.00 25.0	1.049 120.0 0.1965	T 5.0 0.0 0.0	1.500 5.000 6.500	9.766 0.650 1.277		K Factor = 8.00 Vel = 9.28		
	0.0 25.00					11.693	K Factor = 7.31		
SP04 to EQ04	25.00 25.0	1.049 120.0 0.1966	E 2.0 0.0 0.0	1.500 2.000 3.500	9.766 0.650 0.688		K Factor = 8.00 Vel = 9.28		
	0.0 25.00					11.104	K Factor = 7.50		
SP01 to EQ01	25.00 25.0	1.049 120.0 0.1965	T 5.0 0.0 0.0	1.500 5.000 6.500	9.766 0.650 1.277		K Factor = 8.00 Vel = 9.28		
	0.0 25.00					11.693	K Factor = 7.31		
SP06 to EQ06	25.00 25.0	1.049 120.0 0.1966	E 2.0 0.0 0.0	1.500 2.000 3.500	9.766 0.650 0.688		K Factor = 8.00 Vel = 9.28		
	0.0 25.00					11.104	K Factor = 7.50		
401 to 402	21.57 21.57	1.049 120.0 0.1496		6.930 0.0 6.930	7.271 -1.308 1.037		K Factor = 8.00 Vel = 8.01		
402 to 403	21.17 42.74	1.049 120.0 0.5302	2E 4.0 0.0 0.0	8.840 4.000 12.840	7.000 -0.420 6.808		K Factor = 8.00 Vel = 15.87		
403 to 404	26.75 69.49	1.61 120.0 0.1618		10.670 0.0 10.670	13.388 0.0 1.726		K Factor @ node EQ03 Vel = 10.95		
404 to 405	28.42 97.91	1.61 120.0 0.3052	T 8.0 0.0 0.0	5.000 8.000 13.000	15.114 0.0 3.967		K Factor @ node EQ03 Vel = 15.43		
405 to 406	58.07 155.98	2.635 120.0 0.0655		11.000 0.0 11.000	19.081 0.0 0.721		Vel = 9.18		
406 to 407	117.16 273.14	2.635 120.0 0.1848		11.580 0.0 11.580	19.802 0.0 2.140		Vel = 16.07		

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftnng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
407	123.02	2.635		0.0	11.330	21.942				
to		120.0		0.0	0.0	0.0				
408	396.16	0.3678		0.0	11.330	4.167		Vel = 23.31		
408	94.38	2.635	2E	16.474	26.180	26.109				
to		120.0		0.0	16.474	0.0				
409	490.54	0.5460		0.0	42.654	23.289		Vel = 28.86		
409	133.60	3.26		0.0	10.670	49.398				
to		120.0		0.0	0.0	0.0				
410	624.14	0.3023		0.0	10.670	3.226		Vel = 23.99		
410	137.98	3.26		0.0	10.670	52.624				
to		120.0		0.0	0.0	0.0				
411	762.12	0.4376		0.0	10.670	4.669		Vel = 29.29		
411	144.08	4.26		0.0	10.670	57.293				
to		120.0		0.0	0.0	0.0				
412	906.2	0.1638		0.0	10.670	1.748		Vel = 20.40		
412	101.29	4.26	5I	46.085	74.460	59.041				
to		120.0	J	21.067	67.152	0.325				
413	1007.49	0.1993		0.0	141.612	28.217		Vel = 22.68		
413	0.0	4.26	Bvca	10.534	7.000	87.583				
to		120.0	S	28.968	65.836	3.000		** Fixed Loss = 3		
440	1007.49	0.1993	T	26.334	72.836	14.514		Vel = 22.68		
			Fsp	0.0						
440	100.00	6.357	6I	75.44	100.000	105.097		Qa = 100		
to		120.0	J	31.433	106.873	32.807				
PUMP	1107.49	0.0338		0.0	206.873	6.991		Vel = 11.20		
	150.00							Qa = 150.00		
	1257.49					144.895		K Factor = 104.47		
414	28.64	1.049		0.0	6.500	14.568		K Factor @ node EQ02		
to		120.0		0.0	0.0	0.0				
415	28.64	0.2528		0.0	6.500	1.643		Vel = 10.63		
415	29.43	1.38	T	6.0	5.670	16.211		K Factor @ node EQ03		
to		120.0		0.0	6.000	0.0				
405	58.07	0.2459		0.0	11.670	2.870		Vel = 12.46		
	0.0									
	58.07					19.081		K Factor = 13.29		
416	27.86	1.049	2E	4.0	10.670	13.788		K Factor @ node EQ06		
to		120.0		0.0	4.000	-0.217				
417	27.86	0.2403		0.0	14.670	3.525		Vel = 10.34		
417	30.23	1.38	T	6.0	5.000	17.096		K Factor @ node EQ03		
to		120.0		0.0	6.000	0.0				
406	58.09	0.2460		0.0	11.000	2.706		Vel = 12.46		
	0.0									
	58.09					19.802		K Factor = 13.05		
418	29.08	1.049		0.0	7.000	15.019		K Factor @ node EQ02		
to		120.0		0.0	0.0	0.0				
419	29.08	0.2601		0.0	7.000	1.821		Vel = 10.80		
419	30.00	1.38	T	6.0	5.670	16.840		K Factor @ node EQ03		
to		120.0		0.0	6.000	0.0				
406	59.08	0.2538		0.0	11.670	2.962		Vel = 12.67		

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftn'g's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 59.08					19.802		K Factor = 13.28	
420 to 421	29.35	1.049 120.0	2E 0.0	4.0 0.0	10.670 4.000	15.299 -0.217		K Factor @ node EQ06	
421 to 407	29.35	0.2646 1.38 120.0		0.0	14.670	3.881		Vel = 10.90	
421 to 407	31.83	1.38 120.0	T 0.0	6.0 0.0	5.000 6.000	18.963 0.0		K Factor @ node EQ03	
	61.18	0.2708		0.0	11.000	2.979		Vel = 13.12	
	0.0 61.18					21.942		K Factor = 13.06	
422 to 423	30.20	1.049 120.0		0.0 0.0	9.000 0.0	16.208 0.0		K Factor @ node EQ02	
423 to 407	30.2	0.2790 1.38 120.0		0.0	9.000	2.511		Vel = 11.21	
423 to 407	31.64	1.38 120.0	T 0.0	6.0 0.0	5.670 6.000	18.719 0.0		K Factor @ node EQ03	
	61.84	0.2762		0.0	11.670	3.223		Vel = 13.26	
	0.0 61.84					21.942		K Factor = 13.20	
424 to 425	30.22	1.049 120.0		0.0 0.0	9.000 0.0	16.227 0.0		K Factor @ node EQ04	
425 to 426	30.22	0.2792 1.38 120.0		0.0	9.000	2.513		Vel = 11.22	
425 to 426	31.65	1.38 120.0	T 0.0	6.0 0.0	5.670 6.000	18.740 0.0		K Factor @ node EQ05	
	61.87	0.2765		0.0	11.670	3.227		Vel = 13.27	
	0.0 61.87					21.967		K Factor = 13.20	
427 to 426	32.51	1.049 120.0	T 0.0	5.0 0.0	5.000 5.000	18.771 0.0		K Factor @ node EQ04	
426 to 408	32.51	0.3196 1.38 120.0		0.0	10.000	3.196		Vel = 12.07	
426 to 408	61.87	1.38 120.0	T 0.0	6.0 0.0	0.500 6.000	21.967 0.217			
	94.38	0.6038		0.0	6.500	3.925		Vel = 20.24	
	0.0 94.38					26.109		K Factor = 18.47	
428 to 429	42.06	1.049 120.0		0.0 0.0	10.670 0.0	31.425 0.0		K Factor @ node EQ02	
429 to 430	42.06	0.5148 1.38 120.0		0.0	10.670	5.493		Vel = 15.61	
429 to 430	44.42	1.38 120.0		0.0	9.000	36.918		K Factor @ node EQ03	
430 to 409	86.48	0.5137 1.38 120.0		0.0	9.000	4.623		Vel = 18.55	
430 to 409	47.12	1.38 120.0	T 0.0	6.0 0.0	0.840 6.000	41.541 0.0		K Factor @ node EQ03	
	133.6	1.1487		0.0	6.840	7.857		Vel = 28.66	
	0.0 133.60					49.398		K Factor = 19.01	
431 to 432	43.45	1.049 120.0		0.0 0.0	10.670 0.0	33.542 0.0		K Factor @ node EQ02	
	43.45	0.5468		0.0	10.670	5.834		Vel = 16.13	

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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	*****
432	45.88	1.38		0.0	9.000	39.376			K Factor @ node EQ03	
to		120.0		0.0	0.0	0.0				
433	89.33	0.5454		0.0	9.000	4.909			Vel = 19.16	
433	48.65	1.38	T	6.0	0.840	44.285			K Factor @ node EQ03	
to		120.0		0.0	6.000	0.0				
410	137.98	1.2192		0.0	6.840	8.339			Vel = 29.60	
	0.0									
	137.98					52.624			K Factor = 19.02	
434	45.40	1.049		0.0	10.670	36.611			K Factor @ node EQ02	
to		120.0		0.0	0.0	0.0				
435	45.4	0.5929		0.0	10.670	6.326			Vel = 16.85	
435	47.90	1.38		0.0	9.000	42.937			K Factor @ node EQ03	
to		120.0		0.0	0.0	0.0				
436	93.3	0.5911		0.0	9.000	5.320			Vel = 20.01	
436	50.79	1.38	T	6.0	0.840	48.257			K Factor @ node EQ03	
to		120.0		0.0	6.000	0.0				
411	144.09	1.3211		0.0	6.840	9.036			Vel = 30.91	
	0.0									
	144.09					57.293			K Factor = 19.04	
437	49.02	1.049		0.0	9.000	44.956			K Factor @ node EQ01	
to		120.0		0.0	0.0	0.0				
438	49.02	0.6833		0.0	9.000	6.150			Vel = 18.20	
438	52.26	1.38	T	6.0	0.840	51.106			K Factor @ node EQ01	
to		120.0		0.0	6.000	0.0				
439	101.28	0.6882		0.0	6.840	4.707			Vel = 21.72	
439	0.0	1.61	T	8.0	0.830	55.813				
to		120.0		0.0	8.000	0.359				
412	101.28	0.3249		0.0	8.830	2.869			Vel = 15.96	
	0.0									
	101.28					59.041			K Factor = 13.18	

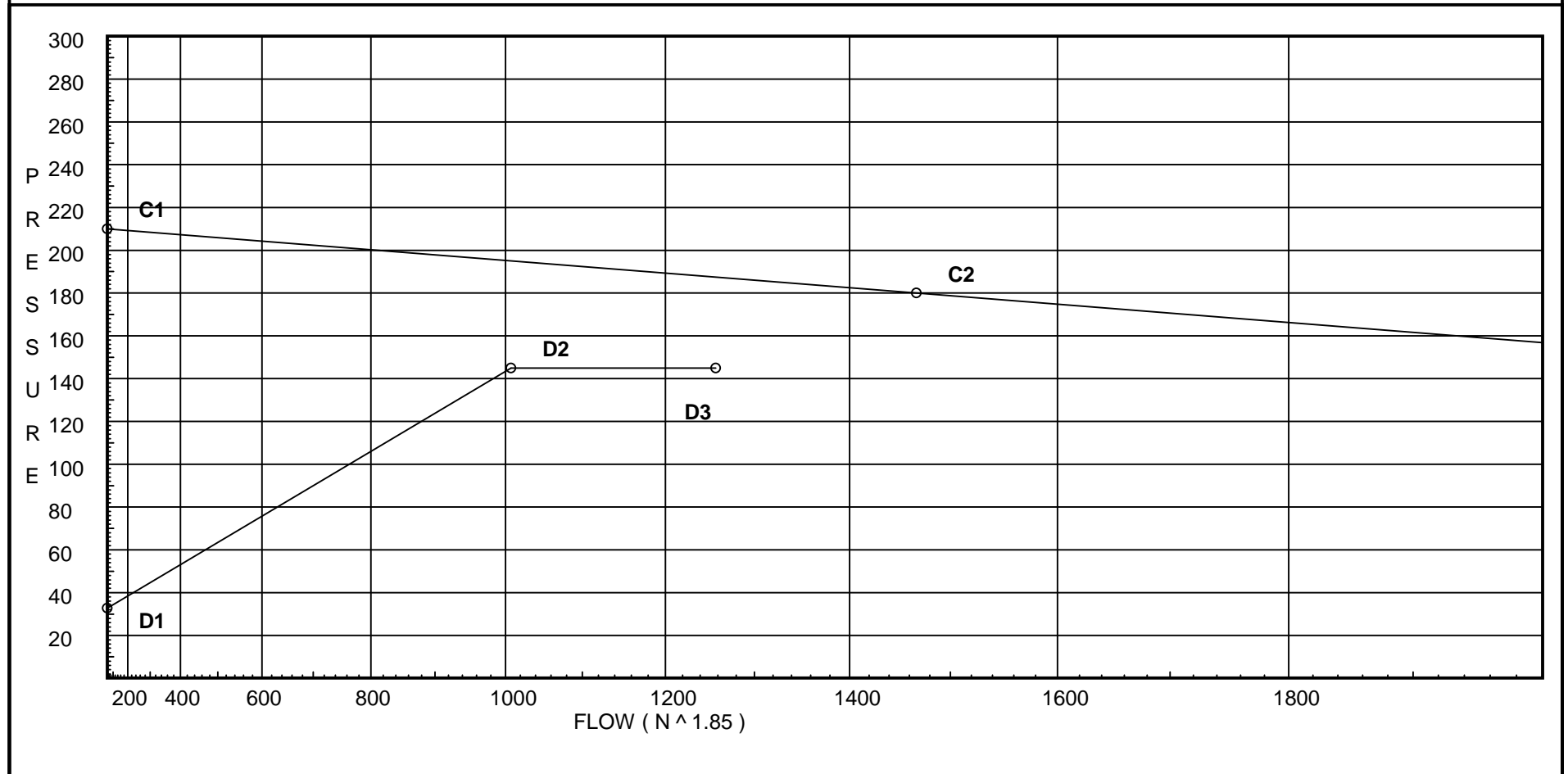
Water Supply Curve C

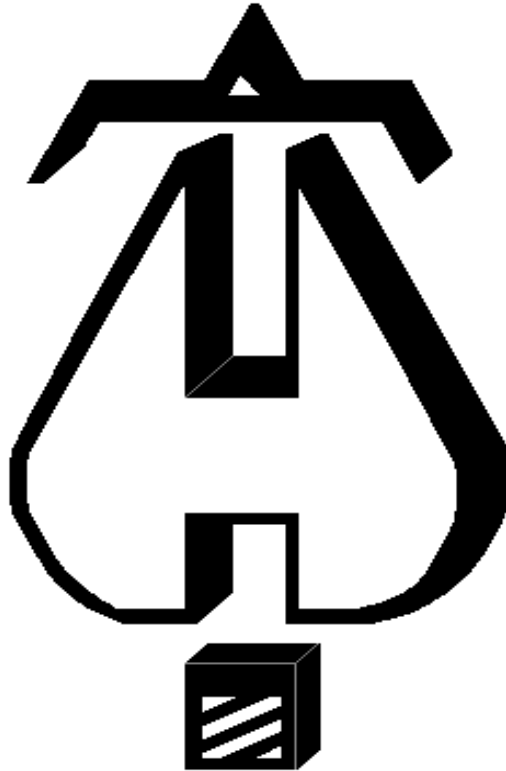
DEAN & ALLYN, INC.
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City Water Supply:
C1 - Static Pressure : 210
C2 - Residual Pressure: 180
C2 - Residual Flow : 1467

Demand:
D1 - Elevation : 32.712
D2 - System Flow : 1007.49
D2 - System Pressure : 144.895
Hose (Demand) : 250
D3 - System Demand : 1257.49
Safety Margin : 42.547





. . . Fire Protection by Computer Design

DEAN & ALLYN, INC.
116 LEWISTON ROAD
GRAY, MAINE 04039
207-657-5646

Job Name : C1211 MMC BEAN 2 L04
Building : 1
Location : PORTLAND, MAINE
System : AREA 2.WX2
Contract : C141211
Data File : C1211 MMC BEAN 2 L04 Area 2.WX2

HYDRAULIC CALCULATIONS
for

Project name: MMC BEAN 2 EXPANSION
Location: PORTLAND, MAINE
Drawing no: 1
Date: 10-09-2014

Design

Remote area number: AREA 2.WX2
Remote area location: LEVEL 04 PENTHOUSE MECHANICAL ROOM
Occupancy classification: ORDINARY HAZARD-GROUP 2
Density: 0.20 - Gpm/SqFt
Area of application: 2500 - SqFt
Coverage per sprinkler: 105 - SqFt
Type of sprinklers calculated: K=8.0
No. of sprinklers calculated: 52
In-rack demand: 0 - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 1498.74 - GPM @ 158.447 - Psi
Type of system: WET
Volume of dry or preaction system: N/A - Gal

Water supply information

Date: 09-19-2013
Location: BEAN FIRE PUMP
Source: ANNUAL PUMP TEST-DEAN & ALLYN, INC.

Name of contractor: DEAN & ALLYN, INC.
Address: 116 LEWISTON ROAD / / GRAY, MAINE 04039
Phone number: 207-657-5646
Name of designer: TED CLARKE
Authority having jurisdiction: MAINE STATE FIRE MARSHAL'S OFFICE
Notes: (Include peaking information or gridded systems here.) SAFETY MARGIN: 20.3 PSI

Fittings Used Summary

DEAN & ALLYN, INC.
C1211 MMC BEAN 2 L04

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Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Bvca	B Fly Vic 705						6	6	7		8	12	14	16	18	19						
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	
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
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.

Pressure / Flow Summary - STANDARD

DEAN & ALLYN, INC.
C1211 MMC BEAN 2 L04

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
SP01	201.5	8	7.0	na	21.17	0.2	105	7.0
EQ01	200.0		8.59	na				
SP02	201.5	8	7.0	na	21.17	0.2	105	7.0
EQ02	200.0		8.16	na				
501	200.0	K = K @ EQ02	8.47	na	21.56			
502	200.0	K = K @ EQ01	8.59	na	21.17			
503	200.0	K = K @ EQ01	8.69	na	21.29			
504	200.0	K = K @ EQ01	8.91	na	21.56			
505	200.0	K = K @ EQ01	9.27	na	21.98			
506	200.0	K = K @ EQ01	9.41	na	22.16			
507	200.0	K = K @ EQ01	9.69	na	22.49			
508	200.0	K = K @ EQ01	10.19	na	23.06			
509	200.0	K = K @ EQ01	10.89	na	23.83			
511	200.0	K = K @ EQ02	10.49	na	24.0			
510	200.0		12.71	na				
512	199.08		15.32	na				
513	199.08		15.43	na				
514	199.08		15.61	na				
515	199.08		16.34	na				
516	199.08		17.3	na				
517	199.08		17.96	na				
518	199.08		20.32	na				
519	199.08		23.29	na				
520	199.08		25.66	na				
413	187.75		92.32	na				
440	187.75		116.91	na	100.0			
PUMP	112.0		159.78	na	150.0			
521	200.0	K = K @ EQ02	8.17	na	21.19			
522	200.0		9.18	na				
523	200.0	K = K @ EQ01	9.22	na	21.93			
524	200.0	K = K @ EQ01	9.66	na	22.45			
525	200.0	K = K @ EQ01	9.88	na	22.7			
526	200.0	K = K @ EQ01	10.29	na	23.16			
527	200.0	K = K @ EQ01	10.46	na	23.36			
528	200.0	K = K @ EQ01	10.69	na	23.61			
529	200.0	K = K @ EQ01	11.09	na	24.06			
530	200.0	K = K @ EQ01	11.8	na	24.8			
531	200.0	K = K @ EQ01	12.74	na	25.78			
533	200.0	K = K @ EQ02	11.38	na	25.0			
532	200.0		13.79	na				
534	200.0	K = K @ EQ02	8.51	na	21.62			
535	200.0	K = K @ EQ01	9.19	na	21.89			
536	200.0	K = K @ EQ01	10.05	na	22.9			
537	200.0	K = K @ EQ01	11.24	na	24.22			
538	200.0	K = K @ EQ01	11.91	na	24.92			
540	200.0	K = K @ EQ02	10.97	na	24.55			
539	200.0		13.29	na				
541	200.0	K = K @ EQ02	8.92	na	22.14			
542	200.0	K = K @ EQ01	9.63	na	22.41			
543	200.0	K = K @ EQ01	10.53	na	23.44			
544	200.0	K = K @ EQ01	11.77	na	24.78			
545	200.0		11.89	na				
546	200.0	K = K @ EQ01	12.47	na	25.5			
548	200.0	K = K @ EQ02	12.46	na	26.17			
549	200.0		13.42	na				
547	200.0		13.91	na				
550	200.0	K = K @ EQ02	9.1	na	22.36			
551	200.0	K = K @ EQ01	9.82	na	22.63			
552	200.0	K = K @ EQ01	10.74	na	23.67			
553	200.0	K = K @ EQ01	12.01	na	25.03			
554	200.0	K = K @ EQ01	12.72	na	25.76			
556	200.0	K = K @ EQ02	9.47	na	22.81			

Flow Summary - Standard

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
557	200.0	K = K @ EQ01	10.51	na	23.41			
558	200.0	K = K @ EQ01	11.64	na	24.64			
555	200.0		14.19	na				
559	200.0	K = K @ EQ02	9.27	na	22.57			
560	200.0	K = K @ EQ01	10.0	na	22.84			
561	200.0	K = K @ EQ01	10.94	na	23.89			
562	200.0	K = K @ EQ01	12.23	na	25.25			
563	200.0		12.69	na				
564	200.0	K = K @ EQ01	13.27	na	26.31			
566	200.0	K = K @ EQ02	13.56	na	27.29			
567	200.0		14.45	na				
565	200.0		14.78	na				
568	200.0		15.84	na				
569	200.0		15.84	na				
570	200.0	K = K @ EQ01	15.84	na	28.74			
571	200.0	K = K @ EQ01	16.09	na	28.97			
572	200.0	K = K @ EQ01	17.07	na	29.84			
574	200.0	K = K @ EQ02	14.29	na	28.01			
575	200.0		15.71	na				
576	200.0	K = K @ EQ01	16.18	na	29.05			
573	200.0		17.89	na				
577	200.0		22.89	na				
578	200.0		22.89	na				
579	200.0		22.89	na				
580	200.0		22.89	na				
581	200.0		22.89	na				
583	200.0		22.89	na				
584	200.0		22.89	na				
585	200.0		22.89	na				
582	200.0		22.89	na				
586	200.0		25.26	na				
587	200.0		25.26	na				
588	200.0		25.26	na				
589	200.0		25.26	na				
590	200.0		25.26	na				
591	200.0		25.26	na				
593	200.0		25.26	na				
594	200.0		25.26	na				
595	200.0		25.26	na				
592	200.0		25.26	na				

The maximum velocity is 28.11 and it occurs in the pipe between nodes 518 and 519

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	*****
SP01 to EQ01	21.17	1.049 120.0 0.1445	T	5.0 0.0 0.0	1.500 5.000 6.500	7.000 0.650 0.939			K Factor = 8.00 Vel = 7.86	
	0.0 21.17					8.589			K Factor = 7.22	
SP02 to EQ02	21.17	1.049 120.0 0.1443	E	2.0 0.0 0.0	1.500 2.000 3.500	7.000 0.650 0.505			K Factor = 8.00 Vel = 7.86	
	0.0 21.17					8.155			K Factor = 7.41	
501 to 502	21.56	1.61 120.0 0.0186		0.0 0.0 0.0	6.670 0.0 6.670	8.465 0.0 0.124			K Factor @ node EQ02 Vel = 3.40	
502 to 503	21.17	2.067 120.0 0.0194		0.0 0.0 0.0	5.000 0.0 5.000	8.589 0.0 0.097			K Factor @ node EQ01 Vel = 4.09	
503 to 504	21.29	2.067 120.0 0.0413		0.0 0.0 0.0	5.500 0.0 5.500	8.686 0.0 0.227			K Factor @ node EQ01 Vel = 6.12	
504 to 505	21.56	2.067 120.0 0.0704		0.0 0.0 0.0	5.000 0.0 5.000	8.913 0.0 0.352			K Factor @ node EQ01 Vel = 8.18	
505 to 506	21.98	2.635 120.0 0.0329		0.0 0.0 0.0	4.500 0.0 4.500	9.265 0.0 0.148			K Factor @ node EQ01 Vel = 6.33	
506 to 507	22.16	2.635 120.0 0.0468		0.0 0.0 0.0	6.010 0.0 6.010	9.413 0.0 0.281			K Factor @ node EQ01 Vel = 7.63	
507 to 508	22.49	2.635 120.0 0.0626		0.0 0.0 0.0	8.000 0.0 8.000	9.694 0.0 0.501			K Factor @ node EQ01 Vel = 8.96	
508 to 509	23.05	2.635 120.0 0.0813		0.0 0.0 0.0	8.500 0.0 8.500	10.195 0.0 0.691			K Factor @ node EQ01 Vel = 10.31	
509 to 510	23.83	2.635 120.0 0.1030	T	16.474 0.0 0.0	1.280 16.474 17.754	10.886 0.0 1.828			K Factor @ node EQ01 Vel = 11.71	
	0.0 199.09					12.714			K Factor = 55.84	
511 to 510	24.00	1.049 120.0 0.1823	T	5.0 0.0 0.0	7.220 5.000 12.220	10.486 0.0 2.228			K Factor @ node EQ02 Vel = 8.91	
510 to 512	199.09	2.635 120.0 0.1272	T	16.474 0.0 0.0	0.920 16.474 17.394	12.714 0.398 2.212			Vel = 13.13	
512 to 513	0.0	4.26 120.0 0.0122		0.0 0.0 0.0	8.500 0.0 8.500	15.324 0.0 0.104			Vel = 5.02	

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftn'g's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
513	258.04	4.26		0.0	3.500	15.428				
to 514	481.13	120.0 0.0506		0.0	0.0	0.0				
514	140.09	4.26		0.0	9.000	15.605				
to 515	621.22	120.0 0.0814		0.0	0.0	0.0			Vel = 10.83	
515	144.44	4.26		0.0	8.000	16.338				
to 516	765.66	120.0 0.1200		0.0	0.0	0.0				
516	148.15	4.26		0.0	4.000	17.298				
to 517	913.81	120.0 0.1662		0.0	0.0	0.0				
517	190.31	4.26		0.0	10.000	17.963				
to 518	1104.12	120.0 0.2361		0.0	0.0	0.0				
518	144.62	4.26		0.0	10.000	20.324				
to 519	1248.74	120.0 0.2964		0.0	0.0	0.0				
519	0.0	4.26		0.0	8.000	23.288				
to 520	1248.74	120.0 0.2964		0.0	0.0	0.0				
520	0.0	4.26	2T	52.668	116.170	25.659				
to 413	1248.74	120.0 0.2964	3E	39.501	92.169	4.907				
413	0.0	4.26	Bvca	10.534	7.000	92.321				
to 440	1248.74	120.0 0.2964	S	28.968	65.836	3.000			** Fixed Loss = 3	
			T	26.334	72.836	21.589			Vel = 28.11	
			Fsp	0.0						
440	100.00	6.357	6I	75.44	100.000	116.910			Qa = 100	
to PUMP	1348.74	120.0 0.0487	J	31.433	106.873	32.807			Vel = 13.63	
	150.00								Qa = 150.00	
	1498.74					159.784			K Factor = 118.57	
521	21.19	1.049	E	2.0	4.960	8.172			K Factor @ node EQ02	
to 522	21.19	120.0 0.1447		0.0	2.000	0.0				
522	0.0	1.61		0.0	2.040	9.179				
to 523	21.19	120.0 0.0181		0.0	0.0	0.0				
523	21.92	1.61		0.0	6.670	9.216				
to 524	43.11	120.0 0.0669		0.0	0.0	0.0				
524	22.45	2.067		0.0	5.000	9.662				
to 525	65.56	120.0 0.0430		0.0	0.0	0.0				
525	22.70	2.067		0.0	5.500	9.877				
to 526	88.26	120.0 0.0747		0.0	0.0	0.0				
				0.0	5.500	0.411			Vel = 8.44	

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftn'g's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
526	23.16	2.635		0.0	5.000	10.288			K Factor @ node EQ01	
to		120.0		0.0	0.0	0.0				
527	111.42	0.0352		0.0	5.000	0.176			Vel = 6.56	
527	23.37	2.635		0.0	4.500	10.464			K Factor @ node EQ01	
to		120.0		0.0	0.0	0.0				
528	134.79	0.0500		0.0	4.500	0.225			Vel = 7.93	
528	23.61	2.635		0.0	6.010	10.689			K Factor @ node EQ01	
to		120.0		0.0	0.0	0.0				
529	158.4	0.0674		0.0	6.010	0.405			Vel = 9.32	
529	24.05	2.635		0.0	8.000	11.094			K Factor @ node EQ01	
to		120.0		0.0	0.0	0.0				
530	182.45	0.0876		0.0	8.000	0.701			Vel = 10.73	
530	24.81	2.635		0.0	8.500	11.795			K Factor @ node EQ01	
to		120.0		0.0	0.0	0.0				
531	207.26	0.1109		0.0	8.500	0.943			Vel = 12.19	
531	25.77	3.26	T	20.159	1.280	12.738			K Factor @ node EQ01	
to		120.0		0.0	20.159	0.0				
532	233.03	0.0488		0.0	21.439	1.047			Vel = 8.96	
	0.0									
	233.03					13.785			K Factor = 62.76	
533	25.00	1.049	T	5.0	7.220	11.382			K Factor @ node EQ02	
to		120.0		0.0	5.000	0.0				
532	25.0	0.1966		0.0	12.220	2.403			Vel = 9.28	
532	233.04	3.26	T	20.159	0.920	13.785				
to		120.0		0.0	20.159	0.398				
513	258.04	0.0591		0.0	21.079	1.245			Vel = 9.92	
	0.0									
	258.04					15.428			K Factor = 65.69	
534	21.62	1.049		0.0	4.500	8.509			K Factor @ node EQ02	
to		120.0		0.0	0.0	0.0				
535	21.62	0.1504		0.0	4.500	0.677			Vel = 8.03	
535	21.89	1.38		0.0	6.010	9.186			K Factor @ node EQ01	
to		120.0		0.0	0.0	0.0				
536	43.51	0.1441		0.0	6.010	0.866			Vel = 9.33	
536	22.90	1.61		0.0	8.000	10.052			K Factor @ node EQ01	
to		120.0		0.0	0.0	0.0				
537	66.41	0.1488		0.0	8.000	1.190			Vel = 10.47	
537	24.21	2.067		0.0	8.500	11.242			K Factor @ node EQ01	
to		120.0		0.0	0.0	0.0				
538	90.62	0.0784		0.0	8.500	0.666			Vel = 8.66	
538	24.92	2.067	T	10.0	1.280	11.908			K Factor @ node EQ01	
to		120.0		0.0	10.000	0.0				
539	115.54	0.1227		0.0	11.280	1.384			Vel = 11.05	
	0.0									
	115.54					13.292			K Factor = 31.69	
540	24.55	1.049	T	5.0	7.220	10.969			K Factor @ node EQ02	
to		120.0		0.0	5.000	0.0				
539	24.55	0.1901		0.0	12.220	2.323			Vel = 9.11	

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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	*****
539 to 514	115.54 140.09	2.067 120.0 0.1754	T	10.0 0.0	0.920 10.000 10.920	13.292 0.398 1.915				Vel = 13.39
	0.0 140.09						15.605			K Factor = 35.46
541 to 542	22.14	1.049 120.0 0.1569		0.0 0.0	4.500 0.0	8.920 0.0				K Factor @ node EQ02 Vel = 8.22
542 to 543	22.40 44.54	1.38 120.0 0.1506		0.0 0.0	6.010 0.0	9.626 0.0				K Factor @ node EQ01 Vel = 9.55
543 to 544	23.44 67.98	1.61 120.0 0.1554		0.0 0.0	8.000 0.0	10.531 0.0				K Factor @ node EQ01 Vel = 10.71
544 to 545	24.78 92.76	2.067 120.0 0.0819		0.0 0.0	1.440 0.0	11.774 0.0				K Factor @ node EQ01 Vel = 8.87
545 to 546	0.0 92.76	2.067 120.0 0.0817		0.0 0.0	7.060 0.0	11.892 0.0				Vel = 8.87
546 to 547	25.50 118.26	2.067 120.0 0.1281	T	10.0 0.0	1.280 10.000 11.280	12.469 0.0 1.445				K Factor @ node EQ01 Vel = 11.31
	0.0 118.26						13.914			K Factor = 31.70
548 to 549	26.17	1.049 120.0 0.2141		0.0 0.0	4.480 0.0	12.464 0.0				K Factor @ node EQ02 Vel = 9.71
549 to 547	0.0 26.17	1.38 120.0 0.0562	T	6.0 0.0	2.740 6.000 8.740	13.423 0.0 0.491				Vel = 5.61
547 to 515	118.26 144.43	2.067 120.0 0.1855	T	10.0 0.0	0.920 10.000 10.920	13.914 0.398 2.026				Vel = 13.81
	0.0 144.43						16.338			K Factor = 35.73
550 to 551	22.36	1.049 120.0 0.1600		0.0 0.0	4.500 0.0	9.102 0.0				K Factor @ node EQ02 Vel = 8.30
551 to 552	22.63 44.99	1.38 120.0 0.1534		0.0 0.0	6.010 0.0	9.822 0.0				K Factor @ node EQ01 Vel = 9.65
552 to 553	23.68 68.67	1.61 120.0 0.1582		0.0 0.0	8.000 0.0	10.744 0.0				K Factor @ node EQ01 Vel = 10.82
553 to 554	25.03 93.7	2.067 120.0 0.0833		0.0 0.0	8.500 0.0	12.010 0.0				K Factor @ node EQ01 Vel = 8.96

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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	*****
554 to 555	25.75 119.45	2.067 120.0 0.1305	T	10.0 0.0 0.0	1.280 10.000 11.280	12.718 0.0 1.472			K Factor @ node EQ01 Vel = 11.42	
	0.0 119.45						14.190		K Factor = 31.71	
556 to 557	22.81 22.81	1.049 120.0 0.1659		0.0 0.0 0.0	6.250 0.0 6.250	9.472 0.0 1.037			K Factor @ node EQ02 Vel = 8.47	
557 to 558	23.41 46.22	1.38 120.0 0.1611		0.0 0.0 0.0	7.000 0.0 7.000	10.509 0.0 1.128			K Factor @ node EQ01 Vel = 9.91	
558 to 555	24.64 70.86	1.61 120.0 0.1677	T	8.0 0.0 0.0	7.220 8.000 15.220	11.637 0.0 2.553			K Factor @ node EQ01 Vel = 11.17	
555 to 517	119.45 190.31	2.067 120.0 0.3091	T	10.0 0.0 0.0	0.920 10.000 10.920	14.190 0.398 3.375			Vel = 18.20	
	0.0 190.31						17.963		K Factor = 44.90	
559 to 560	22.57 22.57	1.049 120.0 0.1627		0.0 0.0 0.0	4.500 0.0 4.500	9.270 0.0 0.732			K Factor @ node EQ02 Vel = 8.38	
560 to 561	22.84 45.41	1.38 120.0 0.1561		0.0 0.0 0.0	6.010 0.0 6.010	10.002 0.0 0.938			K Factor @ node EQ01 Vel = 9.74	
561 to 562	23.88 69.29	1.61 120.0 0.1609		0.0 0.0 0.0	8.000 0.0 8.000	10.940 0.0 1.287			K Factor @ node EQ01 Vel = 10.92	
562 to 563	25.26 94.55	1.61 120.0 0.2863		0.0 0.0 0.0	1.610 0.0 1.610	12.227 0.0 0.461			K Factor @ node EQ01 Vel = 14.90	
563 to 564	0.0 94.55	2.067 120.0 0.0848		0.0 0.0 0.0	6.890 0.0 6.890	12.688 0.0 0.584			Vel = 9.04	
564 to 565	26.31 120.86	2.067 120.0 0.1333	T	10.0 0.0 0.0	1.280 10.000 11.280	13.272 0.0 1.504			K Factor @ node EQ01 Vel = 11.56	
	0.0 120.86						14.776		K Factor = 31.44	
566 to 567	27.29 27.29	1.049 120.0 0.2314		0.0 0.0 0.0	3.850 0.0 3.850	13.559 0.0 0.891			K Factor @ node EQ02 Vel = 10.13	
567 to 565	0.0 27.29	1.61 120.0 0.0287	T	8.0 0.0 0.0	3.370 8.000 11.370	14.450 0.0 0.326			Vel = 4.30	
565 to 516	120.86 148.15	2.067 120.0 0.1945	T	10.0 0.0 0.0	0.920 10.000 10.920	14.776 0.398 2.124			Vel = 14.16	

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftn'g's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 148.15					17.298		K Factor = 35.62	
568 to 569	0.0	1.049 120.0	0.0	4.500	15.838 0.0				
569 to 570	0.0	0.0 1.38 120.0	0.0	4.500	0.0	15.838		Vel = 0	
570 to 571	28.74	1.61 120.0	0.0	8.000	15.838 0.0			K Factor @ node EQ01	
571 to 572	28.74	0.0316 1.61 120.0	0.0	8.000	0.253	16.091		Vel = 4.53	
572 to 573	28.97	0.1147 2.067 120.0	0.0	8.500	0.975	17.066		K Factor @ node EQ01	
	57.71	0.0735	T 10.0	1.280	17.066 0.0			Vel = 9.09	
	29.84			10.000	0.829			K Factor @ node EQ01	
	87.55			11.280				Vel = 8.37	
	0.0 87.55					17.895		K Factor = 20.70	
574 to 575	28.01	1.049 120.0	0.0	5.880	14.286 0.0			K Factor @ node EQ02	
575 to 576	28.01	0.2429 1.38 120.0	0.0	5.880	1.428	15.714		Vel = 10.40	
576 to 573	0.0	0.0638 1.61 120.0	0.0	7.370	0.470	16.184		Vel = 6.01	
	29.06		T 8.0	7.220	17.111			K Factor @ node EQ01	
	57.07	0.1124		8.000				Vel = 8.99	
573 to 518	87.55	2.067 120.0	T 10.0	0.920	17.895 0.398				
	144.62	0.1860		10.920	2.031			Vel = 13.83	
	0.0 144.62					20.324		K Factor = 32.08	
577 to 578	0.0	1.049 120.0	0.0	4.500	22.889 0.0				
578 to 579	0.0	0.0 1.38 120.0	0.0	4.500	0.0	22.889		Vel = 0	
579 to 580	0.0	0.0 1.61 120.0	0.0	6.010	0.0	22.889		Vel = 0	
	0.0			8.000	0.0				
580 to 581	0.0	0.0 2.067 120.0	0.0	8.000	0.0	22.889		Vel = 0	
581 to 582	0.0	0.0 2.067 120.0	0.0	8.500	0.0	22.889		Vel = 0	
	0.0		T 10.0	1.280					
	0.0	0.0		10.000	0.0			Vel = 0	
	0.0			11.280	0.0				

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftn'g's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0									
	0.0					22.889			K Factor = 0	
583 to 584	0.0	1.049 120.0		0.0	6.250 0.0	22.889 0.0				
584 to 585	0.0	1.38 120.0		0.0	7.000 0.0	22.889 0.0			Vel = 0	
585 to 582	0.0	1.61 120.0	T	8.0	7.220 8.000	22.889 0.0				Vel = 0
582 to 519	0.0	2.067 120.0	T	10.0	0.920 10.000	22.889 0.398				Vel = 0
	0.0	0.0001		0.0	10.920	0.001				
	0.0									
	0.0					23.288			K Factor = 0	
586 to 587	0.0	1.049 120.0		0.0	4.500 0.0	25.261 0.0				
587 to 588	0.0	1.38 120.0		0.0	6.010 0.0	25.261 0.0			Vel = 0	
588 to 589	0.0	1.61 120.0		0.0	3.760 0.0	25.261 0.0				Vel = 0
589 to 590	0.0	1.61 120.0		0.0	4.240 0.0	25.261 0.0				Vel = 0
590 to 591	0.0	2.067 120.0		0.0	8.500 0.0	25.261 0.0				Vel = 0
591 to 592	0.0	2.067 120.0	T	10.0	1.280 10.000	25.261 0.0				Vel = 0
	0.0	0.0		0.0	11.280	0.0				
	0.0									
	0.0					25.261			K Factor = 0	
593 to 594	0.0	1.049 120.0		0.0	6.250 0.0	25.261 0.0				
594 to 595	0.0	1.38 120.0		0.0	7.000 0.0	25.261 0.0			Vel = 0	
595 to 592	0.0	1.61 120.0	T	8.0	7.220 8.000	25.261 0.0				Vel = 0
592 to 520	0.0	2.067 120.0	T	10.0	0.920 10.000	25.261 0.398				Vel = 0
	0.0	0.0		0.0	10.920	0.0				

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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	*****
	0.0								
	0.0				25.659			K Factor = 0	

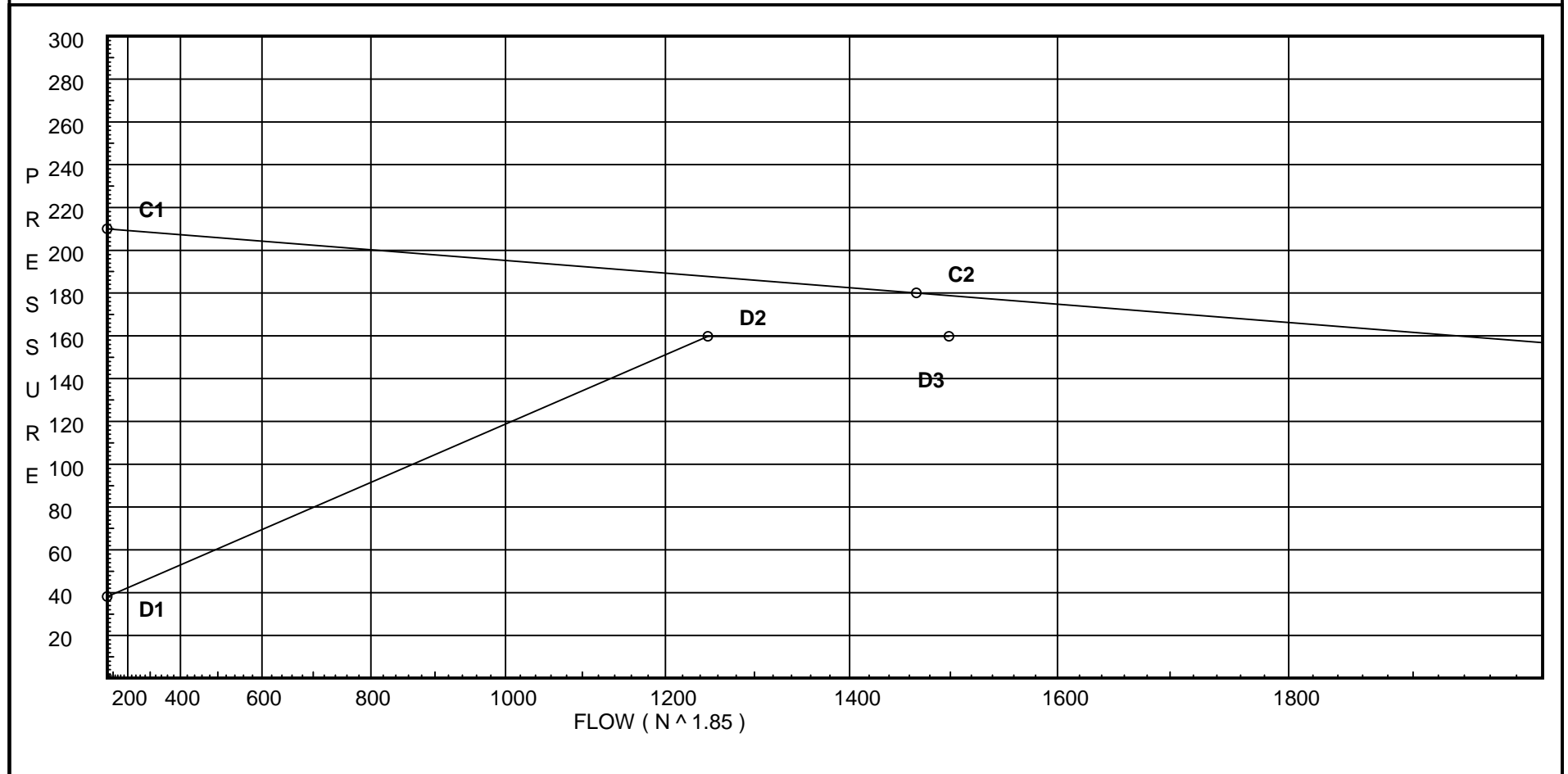
Water Supply Curve C

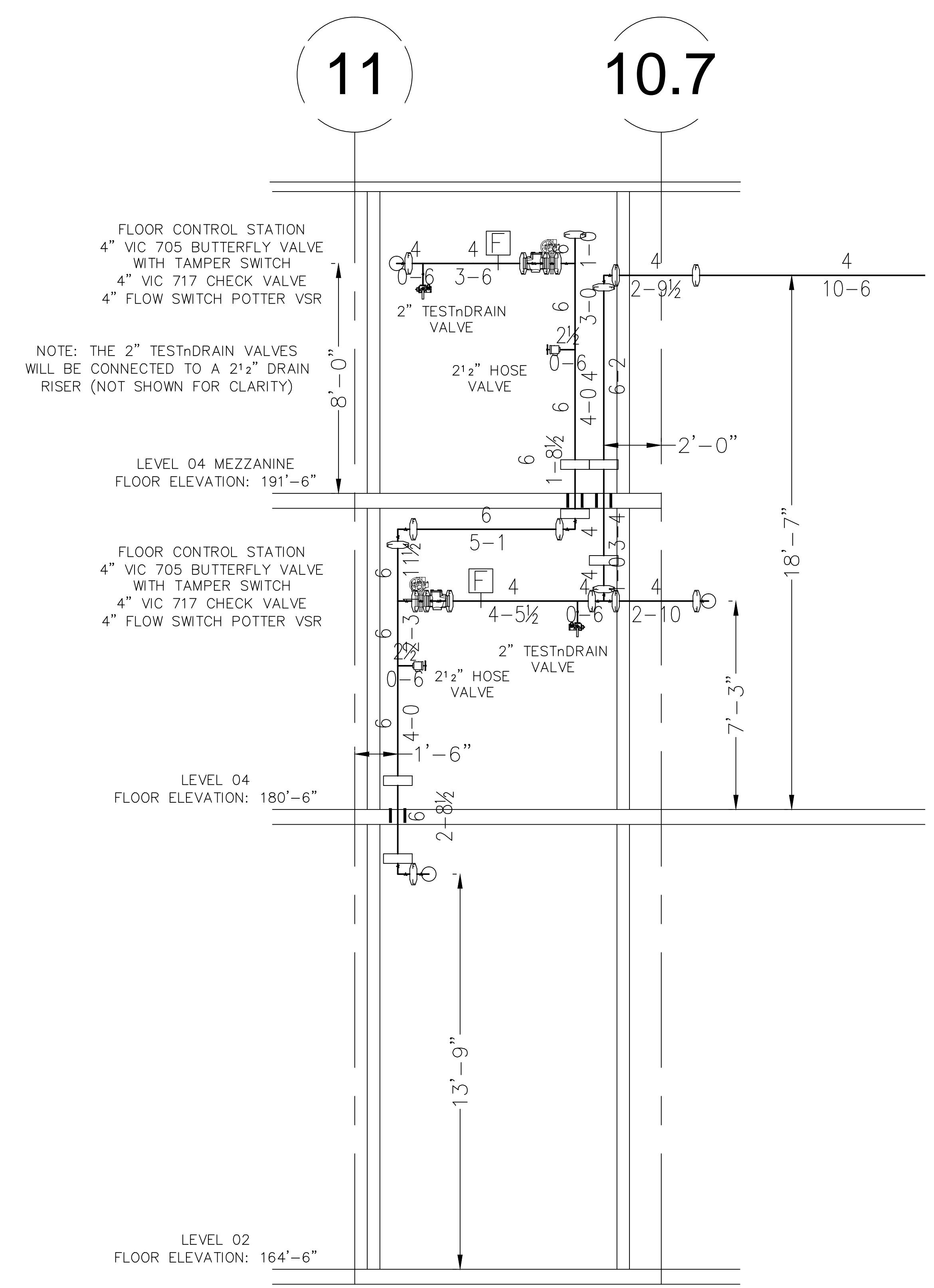
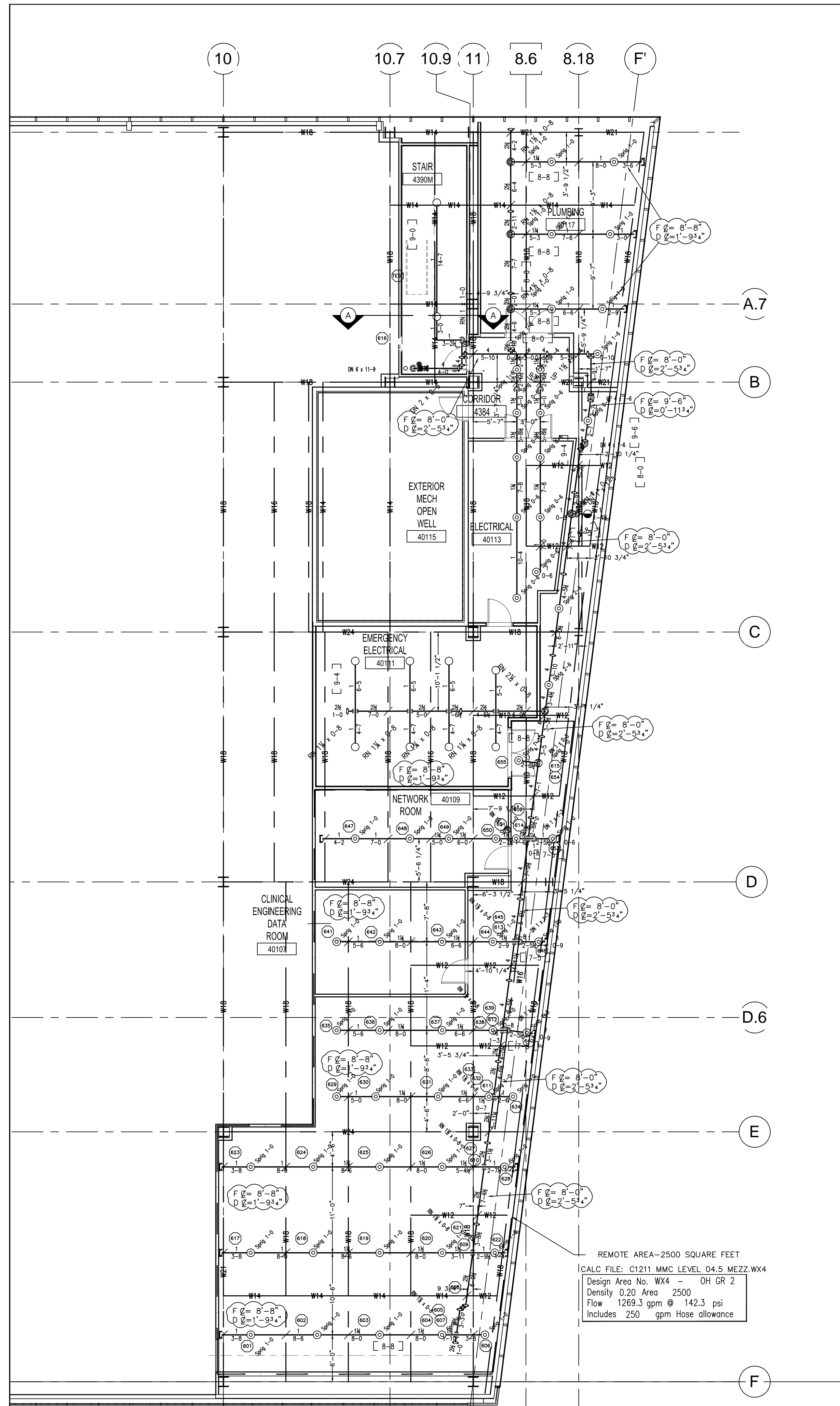
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City Water Supply:
C1 - Static Pressure : 210
C2 - Residual Pressure: 180
C2 - Residual Flow : 1467

Demand:
D1 - Elevation : 38.113
D2 - System Flow : 1248.74
D2 - System Pressure : 159.784
Hose (Demand) : 250
D3 - System Demand : 1498.74
Safety Margin : 19.004





SECTION A-A
RISER DETAIL
SCALE: 3/8"=1'-0"

- LEGEND:**
- UPRIGHT SPRINKLER ON A BRANCH LINE
 - ⊙ UPRIGHT SPRINKLER ON A 1" SPRIG
 - ⊗ UPRIGHT SPRINKLER BELOW DUCTWORK
 - ⊙ RECESSED PENDENT SPRINKLER ON A 1" DROP
 - CONCEALED PENDENT SPRINKLER ON A 1" DROP
 - ⊥ SEISMIC BRACE
 - ↑ RISE OR DROP
 - GROOVED RIGID COUPLING
 - GROOVED FLEXIBLE COUPLING
 - ⊙ HYDRAULIC REFERENCE POINT
 - ⊙ CEILING HEIGHT
 - HANGER
- F ℄= X'-X" FINISHED FLOOR TO PIPE CENTERLINE
 TS ℄= X'-X" TOP OF STEEL BEAM TO PIPE CENTERLINE
 BB ℄= X'-X" BOTTOM OF BEAM TO PIPE CENTERLINE
 C ℄= X'-X" CEILING TO PIPE CENTERLINE
 D ℄= X'-X" CONCRETE DECK TO PIPE CENTERLINE
 CTE CONNECT TO EXISTING
 FHV FIRE HOSE VALVE

GENERAL NOTES:

ALL 1" TO 2" PIPE IS TO BE SCH. 40 BLACK STEEL U/N.
 ALL 2 1/2" TO 6" PIPE IS TO BE SCH. 10 BLACK STEEL U/N.
 ALL THREADED PIPE FITTINGS ARE TO BE BLACK CAST IRON, CLASS 125 U/N.
 DIMENSIONS SHOWN ON THREADED PIPE ARE CENTER TO CENTER U/N.
 DIMENSIONS SHOWN ON GROOVED PIPE ARE "CUT" LENGTHS U/N.
 PENDENT SPRINKLERS IN ACOUSTIC TILE CEILINGS ARE TO BE CENTERED IN CEILING TILES.
 SUFFICIENT HEAT TO PREVENT FREEZING OF THE WET PIPE SPRINKLER SYSTEM IS REQUIRED TO BE FURNISHED BY THE BUYER/OWNER.

SYSTEM CLASSIFICATION:

THE WET PIPE SYSTEM OF AUTOMATIC SPRINKLERS IS DESIGNED IN ACCORDANCE WITH NFPA-13, STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS, 2007 EDITION.

—LIGHT HAZARD OCCUPANCY FOR OFFICES, PATIENT AREAS AND PUBLIC AREAS, HYDRAULICALLY CALCULATED TO PROVIDE A DENSITY OF 0.10 GPM PER SQUARE FOOT OVER THE MOST REMOTE 1500 SQUARE FEET WITH A HOSE ALLOWANCE OF 250 GPM.

—ORDINARY HAZARD, GROUP 2 FOR GENERAL STORAGE AREAS, MECHANICAL EQUIPMENT ROOMS, BUILDING SERVICE AREAS AND ELECTRICAL EQUIPMENT ROOMS, HYDRAULICALLY CALCULATED TO PROVIDE A DENSITY OF 0.20 GPM PER SQUARE FOOT OVER THE MOST REMOTE 2500 SQUARE FEET WITH A HOSE ALLOWANCE OF 250 GPM.

THE STANDPIPE SYSTEM IS DESIGNED IN ACCORDANCE WITH NFPA-14, STANDARD FOR THE INSTALLATION OF STANDPIPE, PRIVATE HYDRANTS, AND HOSE SYSTEMS, 2007 EDITION, FOR CLASS I AUTOMATIC WET TYPE.

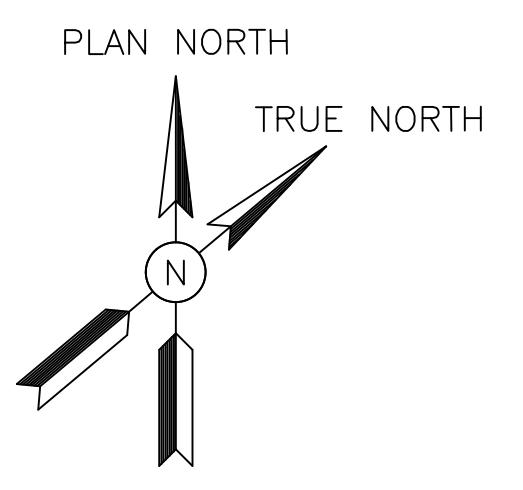
SCOPE OF WORK:

DESIGN AND INSTALL A COMBINED STANDPIPE AND SPRINKLER SYSTEM IN THE NEW BEAN 2 EXPANSION AREA.

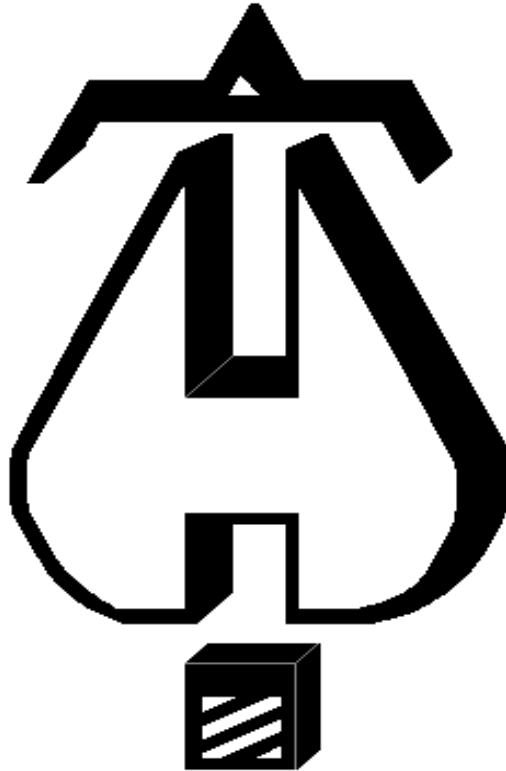
FIRE PROTECTION SUBCONTRACTOR: DEAN & ALLYN, INC.
 STATE OF MAINE CONTRACTOR'S LICENSE NUMBER 262
 EXPIRATION DATE: JUNE 30, 2015

WORKING DRAWINGS PREPARED BY:
 THEODORE E. CLARKE
 NICET LEVEL IV
 CERTIFICATION #71654
 STATE OF MAINE RMS LICENSE NUMBER 208
 EXPIRATION DATE: JUNE 30, 2015

DEAN & ALLYN, INC.
 FIRE PROTECTION • SPECIAL HAZARD
 116 LEWISTON ROAD, GRAY, MAINE 04039
 (207)657-5646 FAX:(207)657-5647



3/16" = 1'-0"	1/8" = 1'-0"	1/4" = 1'-0"	1/2" = 1'-0"	DANA A. STEWART NICET IV - #064544	DRAWING TITLE: LEVEL 04.5 MEZZANINE LAYOUT	REV. 0
APPROVED BY	DATE	SURVEYED BY	PLAN	JOB:	MCM BEAN 2 EXPANSION 22 BRAMHALL STREET PORTLAND, MAINE 04102	NO. OF SPRINKLERS SHOWN ON THIS SHEET 280
		DRAWN BY	TEC	10/10/14		NO. OF SPRINKLERS NOT SHOWN LATER
		CHECKED BY	DAS			
		AT DEAN & ALLYN, INC				
Ⓢ SUBMIT FOR APPROVAL	10/16/14	SCALE	1/8"=1'-0" U/N	CONTRACT WITH:	SUFFOLK CONSTRUCTION COMPANY	CONTRACT NO. C141211
REVISIONS	DATE	SHEET NO.	2 OF 4	99 CONIFER HILL DRIVE, DANVERS, MA 01923		



. . . Fire Protection by Computer Design

DEAN & ALLYN, INC.
116 LEWISTON ROAD
GRAY, MAINE 04039
207-657-5646

Job Name : C1211 MMC LEVEL 04.5 MEZZ
Building : 1
Location : PORTLAND, MAINE
System : .WX4
Contract : C141211
Data File : C1211 MMC LEVEL 04.5 MEZZ.WX4

HYDRAULIC CALCULATIONS
for

Project name: MMC BEAN 2 EXPANSION
Location: PORTLAND, MAINE
Drawing no: 1
Date: 10-09-2014

Design

Remote area number: .WX4
Remote area location: LEVEL 04.5 PENTHOUSE MEZZANINE
Occupancy classification: ORDINARY HAZARD-GROUP 2
Density: 0.20 - Gpm/SqFt
Area of application: 2500 - SqFt
Coverage per sprinkler: 100 - SqFt
Type of sprinklers calculated: K=8.0
No. of sprinklers calculated: 37
In-rack demand: 0 - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 1269.3 - GPM @ 142.3 - Psi
Type of system: WET
Volume of dry or preaction system: N/A - Gal

Water supply information

Date: 09-19-2013
Location: BEAN FIRE PUMP
Source: ANNUAL PUMP TEST-DEAN & ALLYN, INC.

Name of contractor: DEAN & ALLYN, INC.
Address: 116 LEWISTON ROAD / / GRAY, MAINE 04039
Phone number: 207-657-5646
Name of designer: TED CLARKE
Authority having jurisdiction: MAINE STATE FIRE MARSHAL'S OFFICE
Notes: (Include peaking information or gridded systems here.) SAFETY MARGIN: 44.7 PSI

Fittings Used Summary

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04.5 MEZZ

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Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Bvca	B Fly Vic 705						6	6	7		8	12	14	16	18	19						
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	
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
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.

Pressure / Flow Summary - STANDARD

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04.5 MEZZ

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
SP02	201.17	8	7.0	na	21.17	0.2	100	7.0
EQ02	200.17		7.87	na				
SP03	201.17	8	7.0	na	21.17	0.2	100	7.0
EQ03	200.17		8.3	na				
SP01	199.92	8	7.0	na	21.17	0.2	100	7.0
EQ01	198.92		7.87	na				
601	200.17	K = K @ EQ02	7.87	na	21.17			
602	200.17	K = K @ EQ03	9.1	na	22.16			
603	200.17	K = K @ EQ03	10.24	na	23.51			
604	200.17	K = K @ EQ03	11.44	na	24.85			
606	200.17	K = K @ EQ02	12.22	na	26.38			
605	200.17		14.1	na				
607	199.5		18.13	na				
608	199.5		18.59	na				
609	199.5		19.22	na				
610	199.5		20.82	na				
611	199.5		23.66	na				
612	199.5		28.53	na				
613	199.5		29.54	na				
614	199.5		31.29	na				
615	199.5		33.13	na				
616	199.5		79.04	na				
660	199.5		96.86	na	100.0			
PUMP	112.0		142.3	na	150.0			
617	200.17	K = K @ EQ02	8.08	na	21.46			
618	200.17	K = K @ EQ03	9.34	na	22.46			
619	200.17	K = K @ EQ03	10.52	na	23.83			
620	200.17	K = K @ EQ03	11.75	na	25.19			
622	200.17	K = K @ EQ02	13.23	na	27.45			
621	200.17		15.05	na				
623	200.17	K = K @ EQ02	8.6	na	22.13			
624	200.17	K = K @ EQ03	9.93	na	23.15			
625	200.17	K = K @ EQ03	11.17	na	24.56			
626	200.17	K = K @ EQ03	12.48	na	25.95			
628	200.17	K = K @ EQ02	14.47	na	28.71			
627	200.17		16.4	na				
629	200.17	K = K @ EQ02	11.26	na	25.33			
630	200.17	K = K @ EQ03	12.47	na	25.95			
631	200.17	K = K @ EQ03	14.04	na	27.52			
632	200.17	K = K @ EQ03	15.26	na	28.7			
634	200.17	K = K @ EQ02	16.26	na	30.43			
633	200.17		18.38	na				
635	200.17	K = K @ EQ02	13.55	na	27.78			
636	200.17	K = K @ EQ03	14.98	na	28.44			
637	200.17	K = K @ EQ03	16.83	na	30.14			
638	200.17	K = K @ EQ03	18.41	na	31.52			
640	198.92	K = K @ EQ01	18.63	na	32.57			
639	200.17		22.38	na				
641	200.17	K = K @ EQ02	13.8	na	28.04			
642	200.17	K = K @ EQ03	15.14	na	28.59			
643	200.17	K = K @ EQ03	17.02	na	30.31			
644	200.17	K = K @ EQ03	18.61	na	31.69			
646	198.92	K = K @ EQ01	19.38	na	33.22			
645	200.17		23.29	na				
647	200.17	K = K @ EQ02	12.38	na	26.55			
648	200.17	K = K @ EQ03	13.92	na	27.41			
649	200.17	K = K @ EQ03	14.99	na	28.44			
650	200.17	K = K @ EQ03	16.32	na	29.68			
651	200.17	K = K @ EQ03	17.35	na	30.6			
653	198.92	K = K @ EQ01	19.29	na	33.14			
652	200.17		23.18	na				
654	200.17		32.01	na				

Flow Summary - Standard

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04.5 MEZZ

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
655	200.17	K = K @ EQ02	28.44	na	40.24			

The maximum velocity is 29.47 and it occurs in the pipe between nodes 611 and 612

Final Calculations - Hazen-Williams - 2007

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04.5 MEZZ

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftnng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
SP02 to EQ02	21.17	1.049 120.0 0.1447	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 0.433 0.434			K Factor = 8.00 Vel = 7.86	
	0.0 21.17					7.867			K Factor = 7.55	
SP03 to EQ03	21.17	1.049 120.0 0.1445	T	5.0 0.0 0.0	1.000 5.000 6.000	7.000 0.433 0.867			K Factor = 8.00 Vel = 7.86	
	0.0 21.17					8.300			K Factor = 7.35	
SP01 to EQ01	21.17	1.049 120.0 0.1447	E	2.0 0.0 0.0	1.000 2.000 3.000	7.000 0.433 0.434			K Factor = 8.00 Vel = 7.86	
	0.0 21.17					7.867			K Factor = 7.55	
601 to 602	21.17	1.049 120.0 0.1445		0.0 0.0 0.0	8.500 0.0 8.500	7.867 0.0 1.228			K Factor @ node EQ02 Vel = 7.86	
602 to 603	22.15	1.38 120.0 0.1430		0.0 0.0 0.0	8.000 0.0 8.000	9.095 0.0 1.144			K Factor @ node EQ03 Vel = 9.29	
603 to 604	23.51	1.61 120.0 0.1505		0.0 0.0 0.0	8.000 0.0 8.000	10.239 0.0 1.204			K Factor @ node EQ03 Vel = 10.53	
604 to 605	24.85	1.61 120.0 0.2702	T	8.0 0.0 0.0	1.840 8.000 9.840	11.443 0.0 2.659			K Factor @ node EQ03 Vel = 14.45	
	0.0 91.68					14.102			K Factor = 24.41	
606 to 605	26.38	1.049 120.0 0.2172	T	5.0 0.0 0.0	3.660 5.000 8.660	12.221 0.0 1.881			K Factor @ node EQ02 Vel = 9.79	
605 to 607	91.68	1.61 120.0 0.4314	T	8.0 0.0 0.0	0.670 8.000 8.670	14.102 0.290 3.740			Vel = 18.61	
607 to 608	0.0	2.635 120.0 0.0392	I	8.237 0.0 0.0	3.580 8.237 11.817	18.132 0.0 0.463			Vel = 6.95	
608 to 609	0.0	2.635 120.0 0.0392	I	8.237 0.0 0.0	7.770 8.237 16.007	18.595 0.0 0.627			Vel = 6.95	
609 to 610	120.38	2.635 120.0 0.1437		0.0 0.0 0.0	11.100 0.0 11.100	19.222 0.0 1.595			Vel = 14.03	
610 to 611	124.50	2.635 120.0 0.3127		0.0 0.0 0.0	9.080 0.0 9.080	20.817 0.0 2.839			Vel = 21.35	
611 to 612	137.93	2.635 120.0 0.5675		0.0 0.0 0.0	8.580 0.0 8.580	23.656 0.0 4.869			Vel = 29.47	

Final Calculations - Hazen-Williams

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04.5 MEZZ

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftn'g's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
612	150.44	4.26		0.0	11.430	28.525				
to		120.0		0.0	0.0	0.0				
613	651.31	0.0890		0.0	11.430	1.017		Vel = 14.66		
613	151.85	4.26		0.0	13.310	29.542				
to		120.0		0.0	0.0	0.0				
614	803.16	0.1310		0.0	13.310	1.743		Vel = 18.08		
614	175.83	4.26		0.0	9.770	31.285				
to		120.0		0.0	0.0	0.0				
615	978.99	0.1890		0.0	9.770	1.847		Vel = 22.04		
615	40.24	4.26	7E	92.17	80.650	33.132				
to		120.0	2T	52.668	144.838	0.0				
616	1019.23	0.2036		0.0	225.488	45.904		Vel = 22.94		
616	0.0	4.26	Bvca	10.534	7.000	79.036				
to		120.0	S	28.968	65.836	3.000		* * Fixed Loss = 3		
660	1019.23	0.2036	T	26.334	72.836	14.828		Vel = 22.94		
			Fsp	0.0						
660	100.00	6.357	6I	75.44	112.000	96.864		Qa = 100		
to		120.0	J	31.433	106.873	37.896				
PUMP	1119.23	0.0345		0.0	218.873	7.542		Vel = 11.31		
	150.00							Qa = 150.00		
	1269.23					142.302		K Factor = 106.40		
617	21.46	1.049		0.0	8.500	8.085		K Factor @ node EQ02		
to		120.0		0.0	0.0	0.0				
618	21.46	0.1482		0.0	8.500	1.260		Vel = 7.97		
618	22.46	1.38		0.0	8.000	9.345		K Factor @ node EQ03		
to		120.0		0.0	0.0	0.0				
619	43.92	0.1466		0.0	8.000	1.173		Vel = 9.42		
619	23.82	1.61		0.0	8.000	10.518		K Factor @ node EQ03		
to		120.0		0.0	0.0	0.0				
620	67.74	0.1544		0.0	8.000	1.235		Vel = 10.68		
620	25.19	1.61	T	8.0	3.920	11.753		K Factor @ node EQ03		
to		120.0		0.0	8.000	0.0				
621	92.93	0.2770		0.0	11.920	3.302		Vel = 14.65		
	0.0									
	92.93					15.055		K Factor = 23.95		
622	27.45	1.049	T	5.0	2.810	13.229		K Factor @ node EQ02		
to		120.0		0.0	5.000	0.0				
621	27.45	0.2338		0.0	7.810	1.826		Vel = 10.19		
621	92.93	1.61	T	8.0	0.670	15.055				
to		120.0		0.0	8.000	0.290				
609	120.38	0.4472		0.0	8.670	3.877		Vel = 18.97		
	0.0									
	120.38					19.222		K Factor = 27.46		
623	22.13	1.049		0.0	8.500	8.597		K Factor @ node EQ02		
to		120.0		0.0	0.0	0.0				
624	22.13	0.1569		0.0	8.500	1.334		Vel = 8.22		
624	23.15	1.38		0.0	8.000	9.931		K Factor @ node EQ03		
to		120.0		0.0	0.0	0.0				
625	45.28	0.1551		0.0	8.000	1.241		Vel = 9.71		

Final Calculations - Hazen-Williams

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04.5 MEZZ

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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	*****
625 to 626	24.56 69.84	1.61 120.0 0.1634		0.0 0.0 0.0	8.000 0.0 8.000	11.172 0.0 1.307			K Factor @ node EQ03 Vel = 11.01	
626 to 627	25.95 95.79	1.61 120.0 0.2930	T	8.0 0.0 0.0	5.390 8.000 13.390	12.479 0.0 3.923			K Factor @ node EQ03 Vel = 15.10	
	0.0 95.79					16.402			K Factor = 23.65	
628 to 627	28.71 28.71	1.049 120.0 0.2540	T	5.0 0.0 0.0	2.610 5.000 7.610	14.469 0.0 1.933			K Factor @ node EQ02 Vel = 10.66	
627 to 610	95.78 124.49	1.61 120.0 0.4758	T	8.0 0.0 0.0	0.670 8.000 8.670	16.402 0.290 4.125			Vel = 19.62	
	0.0 124.49					20.817			K Factor = 27.29	
629 to 630	25.33 25.33	1.049 120.0 0.2015		0.0 0.0 0.0	6.000 0.0 6.000	11.264 0.0 1.209			K Factor @ node EQ02 Vel = 9.40	
630 to 631	25.94 51.27	1.38 120.0 0.1954		0.0 0.0 0.0	8.000 0.0 8.000	12.473 0.0 1.563			K Factor @ node EQ03 Vel = 11.00	
631 to 632	27.53 78.8	1.61 120.0 0.2042		0.0 0.0 0.0	6.000 0.0 6.000	14.036 0.0 1.225			K Factor @ node EQ03 Vel = 12.42	
632 to 633	28.70 107.5	1.61 120.0 0.3627	T	8.0 0.0 0.0	0.600 8.000 8.600	15.261 0.0 3.119			K Factor @ node EQ03 Vel = 16.94	
	0.0 107.50					18.380			K Factor = 25.07	
634 to 633	30.43 30.43	1.049 120.0 0.2830	T	5.0 0.0 0.0	2.480 5.000 7.480	16.263 0.0 2.117			K Factor @ node EQ02 Vel = 11.30	
633 to 611	107.50 137.93	1.61 120.0 0.5751	T	8.0 0.0 0.0	0.670 8.000 8.670	18.380 0.290 4.986			Vel = 21.74	
	0.0 137.93					23.656			K Factor = 28.36	
635 to 636	27.78 27.78	1.049 120.0 0.2388		0.0 0.0 0.0	6.000 0.0 6.000	13.548 0.0 1.433			K Factor @ node EQ02 Vel = 10.31	
636 to 637	28.43 56.21	1.38 120.0 0.2316		0.0 0.0 0.0	8.000 0.0 8.000	14.981 0.0 1.853			K Factor @ node EQ03 Vel = 12.06	
637 to 638	30.15 86.36	1.61 120.0 0.2418		0.0 0.0 0.0	6.500 0.0 6.500	16.834 0.0 1.572			K Factor @ node EQ03 Vel = 13.61	

Final Calculations - Hazen-Williams

DEAN & ALLYN, INC.
C1211 MMC LEVEL 04.5 MEZZ

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftn'g's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
638 to 639	31.51 117.87	1.61 120.0 0.4301	T	8.0 0.0 0.0	1.240 8.000 9.240	18.406 0.0 3.974			K Factor @ node EQ03 Vel = 18.58	
	0.0 117.87					22.380			K Factor = 24.92	
640 to 639	32.57 32.57	1.049 120.0 0.3208	2E T	4.0 5.0 0.0	4.390 9.000 13.390	18.626 -0.541 4.295			K Factor @ node EQ01 Vel = 12.09	
639 to 612	117.87 150.44	1.61 120.0 0.6753	T	8.0 0.0 0.0	0.670 8.000 8.670	22.380 0.290 5.855			Vel = 23.71	
	0.0 150.44					28.525			K Factor = 28.17	
641 to 642	28.04 28.04	1.049 120.0 0.2431		0.0 0.0 0.0	5.500 0.0 5.500	13.805 0.0 1.337			K Factor @ node EQ02 Vel = 10.41	
642 to 643	28.59 56.63	1.38 120.0 0.2348		0.0 0.0 0.0	8.000 0.0 8.000	15.142 0.0 1.878			K Factor @ node EQ03 Vel = 12.15	
643 to 644	30.31 86.94	1.61 120.0 0.2448		0.0 0.0 0.0	6.500 0.0 6.500	17.020 0.0 1.591			K Factor @ node EQ03 Vel = 13.70	
644 to 645	31.69 118.63	1.61 120.0 0.4352	T	8.0 0.0 0.0	2.760 8.000 10.760	18.611 0.0 4.683			K Factor @ node EQ03 Vel = 18.70	
	0.0 118.63					23.294			K Factor = 24.58	
646 to 645	33.22 33.22	1.049 120.0 0.3327	2E T	4.0 5.0 0.0	4.390 9.000 13.390	19.380 -0.541 4.455			K Factor @ node EQ01 Vel = 12.33	
645 to 613	118.63 151.85	1.61 120.0 0.6872	T	8.0 0.0 0.0	0.670 8.000 8.670	23.294 0.290 5.958			Vel = 23.93	
	0.0 151.85					29.542			K Factor = 27.94	
647 to 648	26.55 26.55	1.049 120.0 0.2197		0.0 0.0 0.0	7.000 0.0 7.000	12.378 0.0 1.538			K Factor @ node EQ02 Vel = 9.86	
648 to 649	27.41 53.96	1.38 120.0 0.2148		0.0 0.0 0.0	5.000 0.0 5.000	13.916 0.0 1.074			K Factor @ node EQ03 Vel = 11.57	
649 to 650	28.44 82.4	1.61 120.0 0.2217		0.0 0.0 0.0	6.000 0.0 6.000	14.990 0.0 1.330			K Factor @ node EQ03 Vel = 12.99	
650 to 651	29.68 112.08	1.61 120.0 0.3920		0.0 0.0 0.0	2.620 0.0 2.620	16.320 0.0 1.027			K Factor @ node EQ03 Vel = 17.66	
651 to 652	30.60 142.68	1.61 120.0 0.6123	T	8.0 0.0 0.0	1.530 8.000 9.530	17.347 0.0 5.835			K Factor @ node EQ03 Vel = 22.49	

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	*****
	0.0 142.68						23.182		K Factor = 29.63	
653 to 652	33.14	1.049 120.0	2E T	4.0 5.0	4.390 9.000	19.288 -0.541			K Factor @ node EQ01	
	33.14	0.3312		0.0	13.390	4.435			Vel = 12.30	
652 to 614	142.68	1.61 120.0	T	8.0 0.0	0.670 8.000	23.182 0.290				
	175.82	0.9012		0.0	8.670	7.813			Vel = 27.71	
	0.0 175.82						31.285		K Factor = 31.43	
615 to 654	-40.24	1.38 120.0	T	6.0 0.0	0.670 6.000	33.132 -0.290				
	-40.24	-0.1249		0.0	6.670	-0.833			Vel = 8.63	
	0.0 -40.24						32.009		K Factor = -7.11	
655 to 654	40.24	1.049 120.0	T	5.0 0.0	2.530 5.000	28.437 0.0			K Factor @ node EQ02	
	40.24	0.4744		0.0	7.530	3.572			Vel = 14.94	
	0.0 40.24						32.009		K Factor = 7.11	

Water Supply Curve C

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City Water Supply:

C1 - Static Pressure : 210
C2 - Residual Pressure: 180
C2 - Residual Flow : 1467

Demand:

D1 - Elevation : 38.186
D2 - System Flow : 1019.23
D2 - System Pressure : 142.302
Hose (Demand) : 250
D3 - System Demand : 1269.23
Safety Margin : 44.748

