

Crossroads Fire Protection
809 South Market Street
P.O. Box 926
Benson, NC 27504
919-207-3855

Job Name : Johnsonville Elementary School
Drawing : FP2
Location : 18495 NC-27
Remote Area : 1
Contract : CC-10164
Data File : Johnsonville Area 1.WXF

HYDRAULIC CALCULATIONS
for

JOB NAME Johnsonville Elementary School
Location 18495 NC-27
Drawing # FP2
Contract # CC-10164
Date 5-10-2023

DESIGN

Remote area # 1
Remote area location Corridor 317
Occupancy classification Light
Density .1 - Gpm/SqFt
Area of application 1246 - SqFt
Coverage/sprinkler 18X18 - SqFt
Type of sprinkler calculated EC 11.2 Conc. PD
Sprinklers calculated 5
In-rack demand N/A - GPM
Hose streams 100 - GPM
Total water required (including hose streams) 277.264 - GPM @ 60.0562 - Psi
Type of system Wet
Volume of system (dry or pre-action) N/A - Gal

WATER SUPPLY INFORMATION

Test date 9-22-2022
Location 18495 NC-27
Source of info Contract Documents

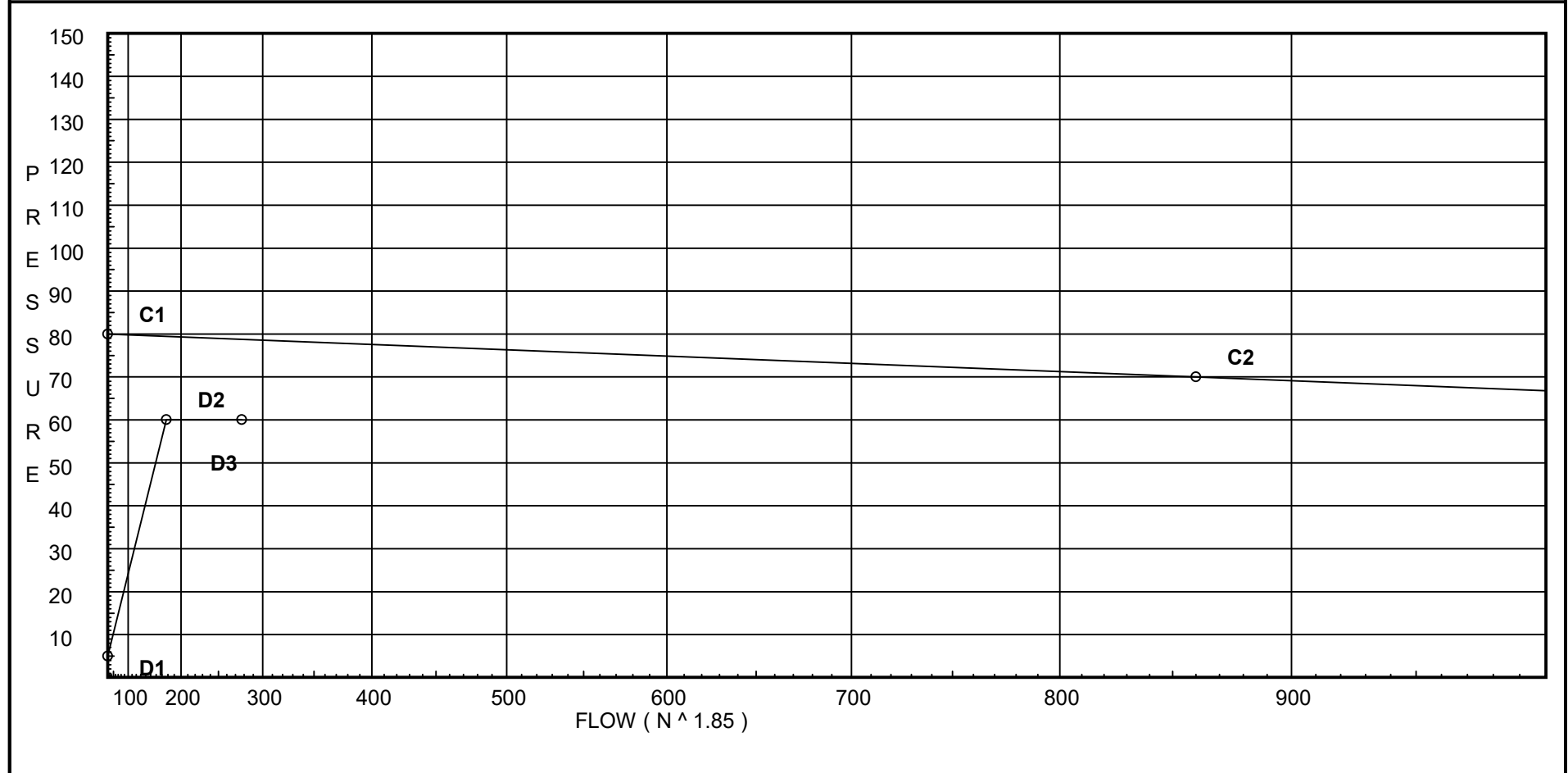
CONTRACTOR INFO Crossroads Fire Protection
Address 809 South Market Street / P.O. Box 926 / Benson, NC 27504
Phone # 919-207-3855
Name of designer DLN
Authority having jurisdiction Harnett County
NOTES:

text1(35) - invisible

Water Supply Curve

City Water Supply:
C1 - Static Pressure : 80
C2 - Residual Pressure: 70
C2 - Residual Flow : 860

Demand:
D1 - Elevation : 5.015
D2 - System Flow : 177.264
D2 - System Pressure : 60.056
Hose (Demand) : 100
D3 - System Demand : 277.264
Safety Margin : 18.712



Fittings Used Summary

Crossroads Fire Protection
Johnsonville Elementary School

Page 3
Date 5-10-2023

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
F	NFPA 13 45' Elbow	1	1	1	1	2	2	3	3	3	4	5	7	9	11	13	17	19	21	24	28
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
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
Zim	Wilkins 375ADA	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

Crossroads Fire Protection
Johnsonville Elementary School

Page 4
Date 5-10-2023

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
H1	13.58	11.2	8.7	na	33.04	0.1	1	8.7
H2	13.58	11.2	8.83	na	33.28	0.1	1	8.7
H3	13.58	11.2	9.29	na	34.15	0.1	1	8.7
H4	13.58	11.2	10.31	na	35.96	0.1	1	8.7
H5	13.58	11.2	13.3	na	40.84	0.1	1	8.7
1	13.917		12.01	na				
2	13.917		12.19	na				
3	13.917		12.82	na				
4	13.917		14.21	na				
L1	13.917		18.11	na				
5	13.917		18.27	na				
L2	13.917		22.64	na				
M3	11.75		38.3	na				
M2	11.75		38.66	na				
104	11.75		38.78	na				
105	11.75		39.56	na				
M1	10.5		41.44	na				
TOR	10.5		42.01	na				
BOR	1.5		47.48	na				
UG1	-3.0		49.57	na				
BF	-3.0		49.84	na				
UG2	-3.0		62.15	na				
UG3	-3.0		62.15	na				
TEST	2.0		60.06	na	100.0			

The maximum velocity is 15.56 and it occurs in the pipe between nodes 5 and L2

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 5
Date 5-10-2023

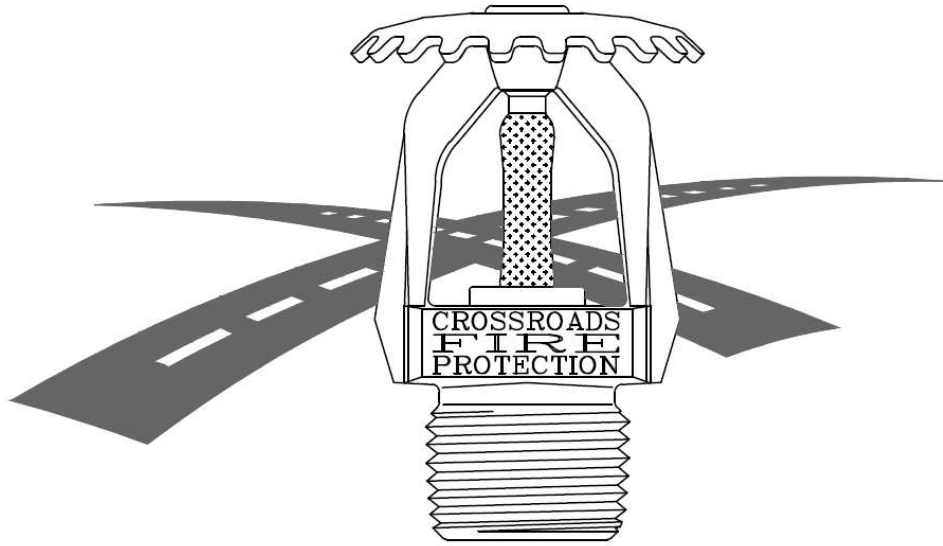
Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
*HEADS												
H1 to 1	13.580 13.917	11.20	33.04 33.04	1 1.049	2E T	4.0 5.0	1.500 9.000 10.500	120 0.3293	8.700 -0.146 3.458		Vel = 12.27	
1			0.0 33.04						12.012		K Factor = 9.53	
H2 to 2	13.580 13.917	11.20	33.28 33.28	1 1.049	2E T	4.0 5.0	1.500 9.000 10.500	120 0.3338	8.830 -0.146 3.505		Vel = 12.35	
2			0.0 33.28						12.189		K Factor = 9.53	
H3 to 3	13.580 13.917	11.20	34.15 34.15	1 1.049	2E T	4.0 5.0	1.500 9.000 10.500	120 0.3501	9.294 -0.146 3.676		Vel = 12.68	
3			0.0 34.15						12.824		K Factor = 9.54	
H4 to 4	13.580 13.917	11.20	35.96 35.96	1 1.049	2E T	4.0 5.0	1.500 9.000 10.500	120 0.3853	10.310 -0.146 4.046		Vel = 13.35	
4			0.0 35.96						14.210		K Factor = 9.54	
H5 to 5	13.580 13.917	11.20	40.84 40.84	1 1.049	2E T	4.0 5.0	1.500 9.000 10.500	120 0.4875	13.297 -0.146 5.119		Vel = 15.16	
5			0.0 40.84						18.270		K Factor = 9.55	
*LINES												
1 to 2	13.917 13.917		33.04 33.04	2 2.157			18.000 18.000	120 0.0098	12.012 0.0 0.177		Vel = 2.90	
2 to 3	13.917 13.917		33.28 66.32	2 2.157			17.792 17.792	120 0.0357	12.189 0.0 0.635		Vel = 5.82	
3 to 4	13.917 13.917		34.14 100.46	2 2.157			18.000 18.000	120 0.0770	12.824 0.0 1.386		Vel = 8.82	
4 to L1	13.917 13.917		35.96 136.42	2 2.157	T	12.307	16.458 12.307 28.765	120 0.1356	14.210 0.0 3.901		Vel = 11.98	
L1 to 5	13.917 13.917		0.0 136.42	2 2.157			1.167 1.167	120 0.1362	18.111 0.0 0.159		Vel = 11.98	
5 to L2	13.917 13.917		40.84 177.26	2 2.157	T	12.307	7.542 12.307 19.849	120 0.2202	18.270 0.0 4.370		Vel = 15.56	
L2			0.0 177.26						22.640		K Factor = 37.25	

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 6
Date 5-10-2023

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
*MAINS											
L2 to M3	13.917 11.750		177.26	2.5	5E 41.186	136.000 41.186	120	22.640 0.939			
			177.26	2.635		177.186	0.0831	14.717	Vel =	10.43	
M3 to M2	11.750 11.750		0.0	3	E 9.408	3.000 9.408	120	38.296 0.0			
			177.26	3.26		12.408	0.0294	0.365	Vel =	6.81	
M2 to 104	11.750 11.750		0.0	3		3.875	120	38.661 0.0			
			177.26	3.26		3.875	0.0294	0.114	Vel =	6.81	
104 to 105	11.750 11.750		0.0	3		26.792	120	38.775 0.0			
			177.26	3.26		26.792	0.0295	0.790	Vel =	6.81	
105 to M1	11.750 10.500		0.0	3	2E T 18.815 20.159	6.375 38.974	120	39.565 0.541			
			177.26	3.26		45.349	0.0295	1.336	Vel =	6.81	
M1 to TOR	10.500 10.500		0.0	3	E 9.408	9.833 9.408	120	41.442 0.0			
			177.26	3.26		19.241	0.0295	0.567	Vel =	6.81	
TOR to BOR	10.500 1.500		0.0	3	E S 9.408 21.503	9.000 44.351	120	42.009 3.898			
			177.26	3.26	B 13.44	53.351	0.0294	1.571	Vel =	6.81	
BOR			0.0 177.26					47.478	K Factor =	25.73	
*UNDERGROUND											
BOR to UG1	1.500 -3		177.26	6		146.500	140	47.478 1.949			
			177.26	6.16		146.500	0.0010	0.147	Vel =	1.91	
UG1 to BF	-3 -3		0.0	8	2E T 56.936 55.354	909.000 189.786	140	49.574 0.0			
			177.26	8.27	G 5F 6.326 71.17	1098.786	0.0002	0.261	Vel =	1.06	
BF to UG2	-3 -3		0.0	8	T 2E 55.354 56.936	26.417 118.616	140	49.835 12.280	** Fixed Loss =	12.28	
			177.26	8.27	G Zim 6.326 0.0	145.033	0.0002	0.035	Vel =	1.06	
UG2 to UG3	-3 -3		0.0	20	2G 45.186	190.417 45.186	140	62.150 0.0			
			177.26	20.57		235.603	0	0.001	Vel =	0.17	
UG3 to TEST	-3 2		0.0	6	T E 43.037 20.084	3.500 67.425	140	62.151 -2.166			
			177.26	6.16	G 4.304	70.925	0.0010	0.071	Vel =	1.91	
TEST			100.00 277.26					60.056	Qa =	100.00	
									K Factor =	35.78	



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809 South Market Street
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Job Name : Johnsonville Elementary School
Drawing : FP2
Location : 18495 NC-27
Remote Area : 2
Contract : CC-10164
Data File : Johnsonville Area 2.WXF

HYDRAULIC CALCULATIONS
for

JOB NAME Johnsonville Elementary School
Location 18495 NC-27
Drawing # FP2
Contract # CC-10164
Date 5-10-2023

DESIGN

Remote area # 2
Remote area location Classroom 8
Occupancy classification Light
Density .1 - Gpm/SqFt
Area of application 1115 - SqFt
Coverage/sprinkler 20x20 - SqFt
Type of sprinkler calculated EC 11.2 Conc. PD
Sprinklers calculated 5
In-rack demand N/A - GPM
Hose streams 100 - GPM
Total water required (including hose streams) 310.579 - GPM @ 54.6469 - Psi
Type of system Wet Grid
Volume of system (dry or pre-action) N/A - Gal

WATER SUPPLY INFORMATION

Test date 9-22-2022
Location 18495 NC-27
Source of info Contract Documents

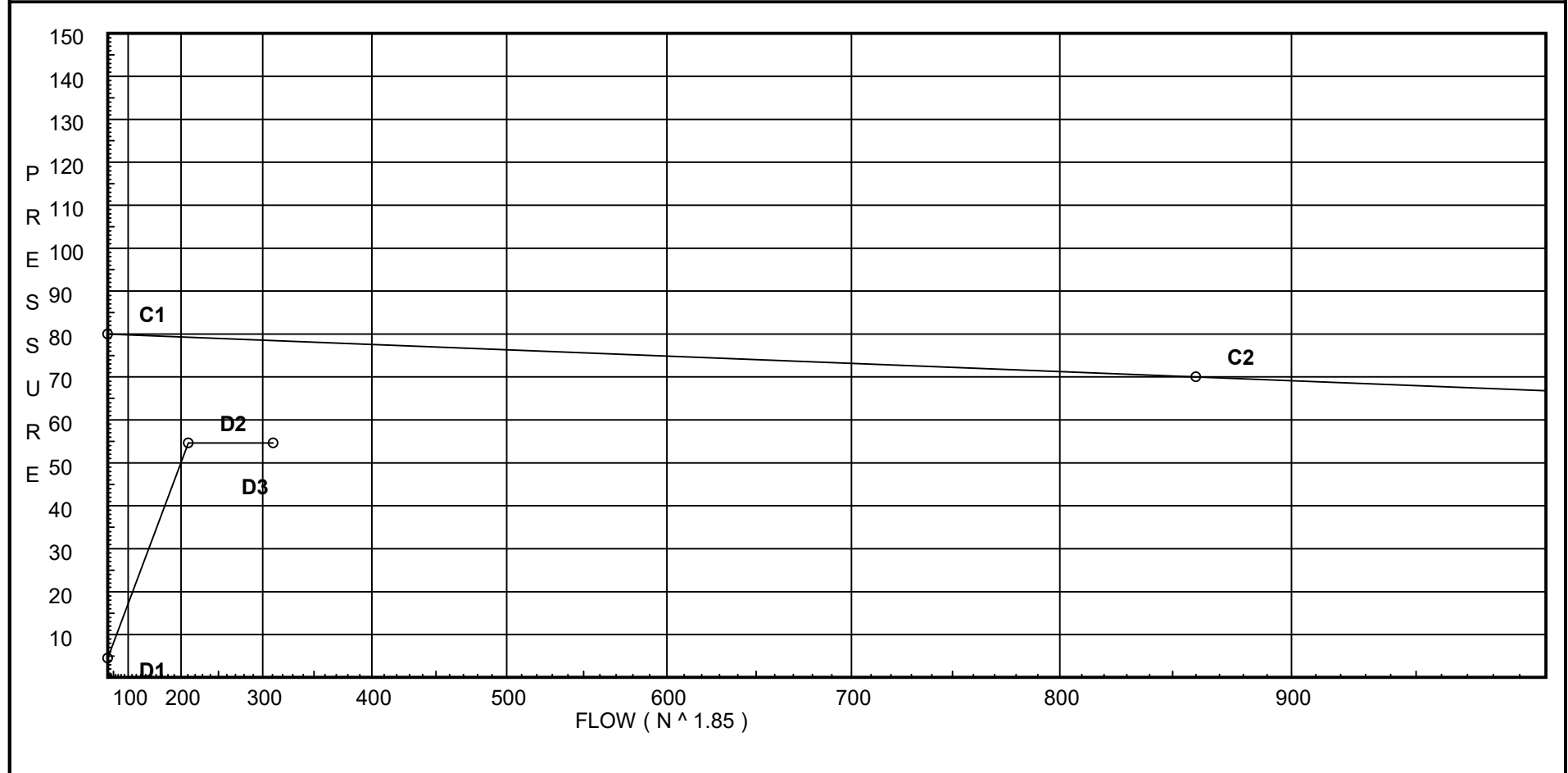
CONTRACTOR INFO Crossroads Fire Protection
Address 809 South Market Street / P.O. Box 926 / Benson, NC 27504
Phone # 919-207-3855
Name of designer DLN
Authority having jurisdiction Harnett County
NOTES:

text1(35) - invisible

Water Supply Curve

City Water Supply:
C1 - Static Pressure : 80
C2 - Residual Pressure: 70
C2 - Residual Flow : 860

Demand:
D1 - Elevation : 4.493
D2 - System Flow : 210.579
D2 - System Pressure : 54.647
Hose (Demand) : 100
D3 - System Demand : 310.579
Safety Margin : 23.834



Fittings Used Summary

Crossroads Fire Protection
Johnsonville Elementary School

Page 3
Date 5-10-2023

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
F	NFPA 13 45' Elbow	1	1	1	1	2	2	3	3	3	4	5	7	9	11	13	17	19	21	24	28
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
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
Zim	Wilkins 375ADA	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

Crossroads Fire Protection
Johnsonville Elementary School

Page 4
Date 5-10-2023

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
H6	12.375	11.2	12.88	na	40.2	0.1	1	12.8
H7	12.375	11.2	12.8	na	40.07	0.1	1	12.8
H8	12.375	11.2	13.46	na	41.1	0.1	1	12.8
H9	11.542	11.2	15.93	na	44.7	0.1	1	12.8
H10	11.542	11.2	15.8	na	44.51	0.1	1	12.8
201	13.0		24.06	na				
6	13.0		17.4	na				
7	13.0		17.29	na				
8	13.0		18.19	na				
202	13.0		24.64	na				
9	13.0		21.81	na				
10	13.0		21.81	na				
203	11.75		27.24	na				
204	11.75		28.2	na				
205	11.75		28.37	na				
206	23.25		23.48	na				
M4	11.75		28.19	na				
101	13.0		24.64	na				
102	13.0		25.19	na				
103	11.75		29.13	na				
M3	11.75		31.32	na				
106	23.25		26.52	na				
M2	11.75		31.52	na				
104	11.75		31.9	na				
105	11.75		32.71	na				
M1	10.5		35.09	na				
TOR	10.5		35.87	na				
BOR	1.5		41.93	na				
UG1	-3.0		44.08	na				
BF	-3.0		44.44	na				
UG2	-3.0		56.71	na				
UG3	-3.0		56.71	na				
TEST	2.0		54.65	na	100.0			

The maximum velocity is 16.59 and it occurs in the pipe between nodes H9 and 9

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 5
Date 5-10-2023

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
*HEADS												
H6 to 6	12.375 13	11.20	40.20 40.2	1 1.049	2E T	4.0 5.0	1.125 9.000 10.125	120 0.4735	12.881 -0.271 4.794		Vel = 14.92	
6			0.0 40.20						17.404		K Factor = 9.64	
H7 to 7	12.375 13	11.20	40.07 40.07	1 1.049	2E T	4.0 5.0	1.125 9.000 10.125	120 0.4707	12.800 -0.271 4.766		Vel = 14.88	
7			0.0 40.07						17.295		K Factor = 9.64	
H8 to 8	12.375 13	11.20	41.10 41.1	1 1.049	2E T	4.0 5.0	1.125 9.000 10.125	120 0.4932	13.463 -0.271 4.994		Vel = 15.26	
8			0.0 41.10						18.186		K Factor = 9.64	
H9 to 9	11.542 13	11.20	44.70 44.7	1 1.049	2E T	4.0 5.0	2.292 9.000 11.292	120 0.5762	15.932 -0.631 6.506		Vel = 16.59	
9			0.0 44.70						21.807		K Factor = 9.57	
H10 to 10	11.542 13	11.20	44.51 44.51	1 1.049	2E T	4.0 5.0	2.625 9.000 11.625	120 0.5717	15.795 -0.631 6.646		Vel = 16.52	
10			0.0 44.51						21.810		K Factor = 9.53	
*LINES												
201 to 6	13 13		-60.67 -60.67	1.5 1.682	T	9.9	55.500 9.900 65.400	120 -0.1017	24.055 0.0 -6.651		Vel = 8.76	
6 to 7	13 13		40.20 -20.47	1.5 1.682			8.000 8.000	120 -0.0136	17.404 0.0 -0.109		Vel = 2.96	
7 to 8	13 13		40.07 19.6	1.5 1.682	T	9.9	60.958 9.900 70.858	120 0.0126	17.295 0.0 0.891		Vel = 2.83	
8 to 101	13 13		41.10 60.7	1.5 1.682	2E T	9.9 9.9	43.583 19.800 63.383	120 0.1018	18.186 0.0 6.452		Vel = 8.76	
101			0.0 60.70						24.638		K Factor = 12.23	
202 to 9	13 13		-41.80 -41.8	1.5 1.682			55.500 55.500	120 -0.0511	24.641 0.0 -2.834		Vel = 6.04	
9 to 10	13 13		44.70 2.9	1.5 1.682			8.000 8.000	120 0.0004	21.807 0.0 0.003		Vel = 0.42	

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 6
Date 5-10-2023

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Equiv Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
10 to 102	13 13		44.52 47.42	1.5 1.682	T 9.9	42.583 9.900 52.483	120 0.0645	21.810 0.0 3.384		Vel = 6.85	
102			0.0 47.42					25.194		K Factor = 9.45	
203 to 103	11.750 11.750		19.58 19.58	1.5 1.682	2T 19.799	130.250 19.799 150.049	120 0.0126	27.243 0.0 1.884		Vel = 2.83	
103			0.0 19.58					29.127		K Factor = 3.63	
204 to 104	11.750 11.750		26.66 26.66	1.5 1.682	2E 2T 9.9 19.799	136.708 29.699 166.407	120 0.0222	28.203 0.0 3.699		Vel = 3.85	
104			0.0 26.66					31.902		K Factor = 4.72	
205 to 105	11.750 11.750		30.81 30.81	1.5 1.682	2T 19.799	129.583 19.799 149.382	120 0.0290	28.373 0.0 4.339		Vel = 4.45	
105			0.0 30.81					32.712		K Factor = 5.39	
206 to 106	23.250 23.250		25.41 25.41	1.5 1.682	2T 19.799	129.542 19.799 149.341	120 0.0203	23.480 0.0 3.036		Vel = 3.67	
106			0.0 25.41					26.516		K Factor = 4.93	
*MAINS											
201 to 202	13 13		60.67 60.67	2 2.157		19.333 19.333	120 0.0303	24.055 0.0 0.586		Vel = 5.33	
202 to 203	13 11.750		41.80 102.47	2 2.157	2E 12.307	13.500 12.307 25.807	120 0.0799	24.641 0.541 2.061		Vel = 9.00	
203 to M4	11.750 11.750		-19.59 82.88	2 2.157		17.583 17.583	120 0.0540	27.243 0.0 0.949		Vel = 7.28	
M4 to 204	11.750 11.750		-25.40 57.48	2 2.157		0.417 0.417	120 0.0264	28.192 0.0 0.011		Vel = 5.05	
204 to 205	11.750 11.750		-26.67 30.81	2 2.157		19.667 19.667	120 0.0086	28.203 0.0 0.170		Vel = 2.71	
205			0.0 30.81					28.373		K Factor = 5.78	
206 to M4	23.250 11.750		-25.41 -25.41	2 2.157	E T 6.153 12.307	26.000 18.460 44.460	120 -0.0061	23.480 4.981 -0.269		Vel = 2.23	
			0.0								

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 7
Date 5-10-2023

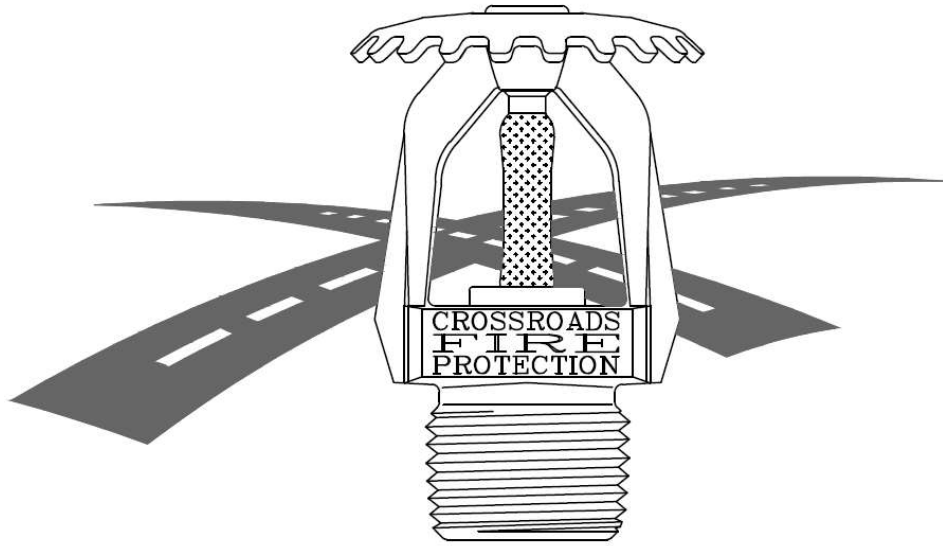
Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
M4			-25.41						28.192		K Factor = -4.79	
101 to 102	13 13		60.70 60.7	2 2.157			18.333 18.333	120 0.0303	24.638 0.0 0.556		Vel = 5.33	
102 to 103	13 11.750		47.41 108.11	2 2.157	3E	18.46	20.000 18.460 38.460	120 0.0882	25.194 0.541 3.392		Vel = 9.49	
103 to M3	11.750 11.750		19.58 127.69	2 2.157	T	12.307	6.000 12.307 18.307	120 0.1200	29.127 0.0 2.197		Vel = 11.21	
M3 to M2	11.750 11.750		0.0 127.69	3 3.26	E	9.408	3.000 9.408 12.408	120 0.0161	31.324 0.0 0.200		Vel = 4.91	
M2			0.0 127.69						31.524		K Factor = 22.74	
106 to M2	23.250 11.750		25.41 25.41	3 3.26	E T	9.408 20.159	3.000 29.567 32.567	120 0.0008	26.516 4.981 0.027		Vel = 0.98	
M2 to 104	11.750 11.750		127.69 153.1	3 3.26			16.833 16.833	120 0.0225	31.524 0.0 0.378		Vel = 5.88	
104 to 105	11.750 11.750		26.67 179.77	3 3.26			26.792 26.792	120 0.0302	31.902 0.0 0.810		Vel = 6.91	
105 to M1	11.750 10.500		30.81 210.58	3 3.26	2E T	18.815 20.159	6.375 38.974 45.349	120 0.0405	32.712 0.541 1.837		Vel = 8.09	
M1 to TOR	10.500 10.500		0.0 210.58	3 3.26	E	9.408	9.833 9.408 19.241	120 0.0405	35.090 0.0 0.780		Vel = 8.09	
TOR to BOR	10.500 1.500		0.0 210.58	3 3.26	E S B	9.408 21.503 13.44	9.000 44.351 53.351	120 0.0405	35.870 3.898 2.161		Vel = 8.09	
BOR			0.0 210.58						41.929		K Factor = 32.52	
*UNDERGROUND												
BOR to UG1	1.500 -3		210.58 210.58	6 6.16			146.500 146.500	140 0.0014	41.929 1.949 0.201		Vel = 2.27	
UG1 to BF	-3 -3		0.0 210.58	8 8.27	2E T G 5F	56.936 55.354 6.326 71.17	909.000 189.786 1098.786	140 0.0003	44.079 0.0 0.360		Vel = 1.26	
BF to UG2	-3 -3		0.0 210.58	8 8.27	T 2E G Zim	55.354 56.936 6.326 0.0	26.417 118.616 145.033	140 0.0003	44.439 12.228 0.047		** Fixed Loss = 12.228 Vel = 1.26	
UG2 to UG3	-3 -3		0.0 210.58	20 20.57	2G	45.186	190.417 45.186 235.603	140 0	56.714 0.0 0.001		Vel = 0.20	

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 8
Date 5-10-2023

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
UG3 to TEST	-3 2		0.0 210.58	6 6.16	T E G	43.037 20.084 4.304	3.500 67.425 70.925	140 0.0014	56.715 -2.166 0.098		Vel = 2.27	
			100.00								Qa = 100.00	
TEST			310.58						54.647		K Factor = 42.01	



Crossroads Fire Protection
809 South Market Street
P.O. Box 926
Benson, NC 27504
919-207-3855

Job Name : Johnsonville Elementary School
Drawing : FP2
Location : 18495 NC-27
Remote Area : 3
Contract : CC-10164
Data File : Johnsonville Area 3.WXF

HYDRAULIC CALCULATIONS
for

JOB NAME Johnsonville Elementary School
Location 18495 NC-27
Drawing # FP2
Contract # CC-10164
Date 5-10-2023

DESIGN

Remote area # 3
Remote area location Mechanical Loft
Occupancy classification Ordinary II
Density .2 - Gpm/SqFt
Area of application 7 Sprinklers - SqFt
Coverage/sprinkler 130 Max - SqFt
Type of sprinkler calculated 5.6K Upright
Sprinklers calculated 7
In-rack demand N/A - GPM
Hose streams 250 - GPM
Total water required (including hose streams) 434.887 - GPM @ 65.8101 - Psi
Type of system Wet Grid
Volume of system (dry or pre-action) N/A - Gal

WATER SUPPLY INFORMATION

Test date 9-22-2022
Location 18495 NC-27
Source of info Contract Documents

CONTRACTOR INFO

Crossroads Fire Protection
Address 809 South Market Street / P.O. Box 926 / Benson, NC 27504
Phone # 919-207-3855
Name of designer DLN
Authority having jurisdiction Harnett County

NOTES: Single Line Calculation
Per 11.2.3.4.2

text1(35) - invisible

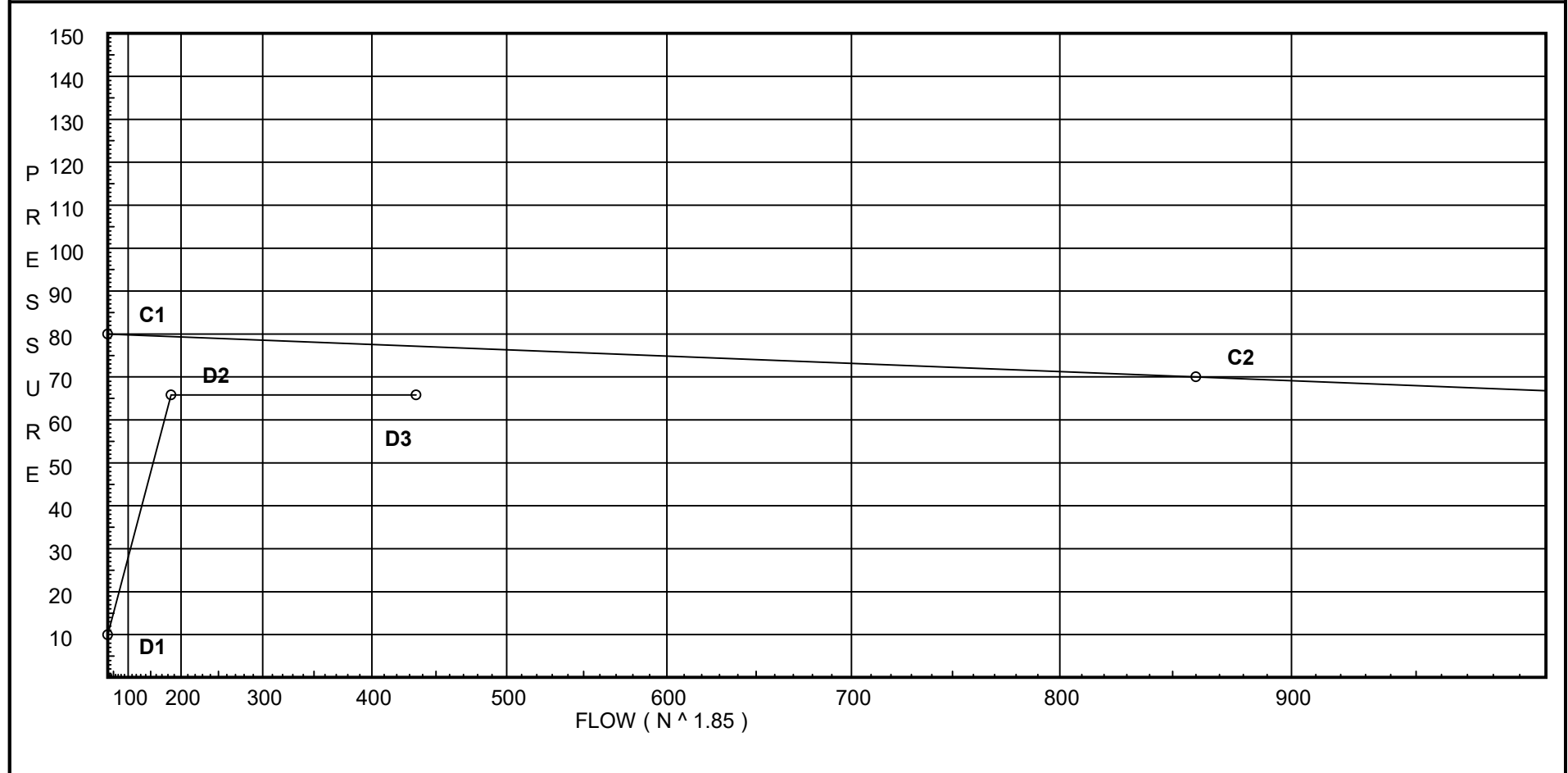
Water Supply Curve

Crossroads Fire Protection
Johnsonville Elementary School

Page 2
Date 5-10-2023

City Water Supply:
C1 - Static Pressure : 80
C2 - Residual Pressure: 70
C2 - Residual Flow : 860

Demand:
D1 - Elevation : 9.961
D2 - System Flow : 184.887
D2 - System Pressure : 65.810
Hose (Demand) : 250
D3 - System Demand : 434.887
Safety Margin : 11.357



Fittings Used Summary

Crossroads Fire Protection
Johnsonville Elementary School

Page 3
Date 5-10-2023

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
F	NFPA 13 45' Elbow	1	1	1	1	2	2	3	3	3	4	5	7	9	11	13	17	19	21	24	28
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
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
Zim	Wilkins 375ADA	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

Crossroads Fire Protection
Johnsonville Elementary School

Page 4
Date 5-10-2023

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
H11	25.0	5.6	23.37	na	27.07	0.2	130	7.0
H12	25.0	5.6	22.11	na	26.33	0.2	130	7.0
H13	25.0	5.6	21.62	na	26.04	0.2	130	7.0
H14	25.0	5.6	21.56	na	26.0	0.2	130	7.0
H15	25.0	5.6	21.62	na	26.04	0.2	130	7.0
H16	25.0	5.6	22.11	na	26.33	0.2	130	7.0
H17	25.0	5.6	23.38	na	27.08	0.2	130	7.0
206	23.25		34.02	na				
11	23.25		26.8	na				
12	23.25		25.41	na				
13	23.25		24.87	na				
14	23.25		24.8	na				
15	23.25		24.87	na				
16	23.25		25.41	na				
17	23.25		26.82	na				
201	13.0		41.91	na				
6	13.0		42.19	na				
7	13.0		42.23	na				
8	13.0		42.54	na				
202	13.0		41.89	na				
9	13.0		41.97	na				
10	13.0		42.17	na				
203	11.75		42.23	na				
204	11.75		41.92	na				
205	11.75		42.03	na				
M4	11.75		41.91	na				
101	13.0		42.82	na				
102	13.0		42.84	na				
103	11.75		43.68	na				
M3	11.75		44.01	na				
106	23.25		36.75	na				
M2	11.75		44.04	na				
104	11.75		44.36	na				
105	11.75		45.01	na				
M1	10.5		46.99	na				
TOR	10.5		47.61	na				
BOR	1.5		53.2	na				
UG1	-3.0		55.31	na				
BF	-3.0		55.59	na				
UG2	-3.0		67.9	na				
UG3	-3.0		67.9	na				
TEST	2.0		65.81	na	250.0			

The maximum velocity is 13.36 and it occurs in the pipe between nodes 17 and 106

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 5
Date 5-10-2023

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
*HEADS												
H11 to 11	25 23.250	5.60	27.07	1	2E T	4.0 5.0	2.750 9.000 11.750	120	23.369 0.758 2.677		Vel = 10.05	
11			0.0 27.07						26.804		K Factor = 5.23	
H12 to 12	25 23.250	5.60	26.33	1	2E T	4.0 5.0	2.750 9.000 11.750	120	22.105 0.758 2.543		Vel = 9.77	
12			0.0 26.33						25.406		K Factor = 5.22	
H13 to 13	25 23.250	5.60	26.04	1	2E T	4.0 5.0	2.750 9.000 11.750	120	21.619 0.758 2.491		Vel = 9.67	
13			0.0 26.04						24.868		K Factor = 5.22	
H14 to 14	25 23.250	5.60	26.00	1	2E T	4.0 5.0	2.750 9.000 11.750	120	21.556 0.758 2.484		Vel = 9.65	
14			0.0 26.00						24.798		K Factor = 5.22	
H15 to 15	25 23.250	5.60	26.04	1	2E T	4.0 5.0	2.750 9.000 11.750	120	21.621 0.758 2.491		Vel = 9.67	
15			0.0 26.04						24.870		K Factor = 5.22	
H16 to 16	25 23.250	5.60	26.33	1	2E T	4.0 5.0	2.750 9.000 11.750	120	22.110 0.758 2.544		Vel = 9.77	
16			0.0 26.33						25.412		K Factor = 5.22	
H17 to 17	25 23.250	5.60	27.08	1	2E T	4.0 5.0	2.750 9.000 11.750	120	23.380 0.758 2.678		Vel = 10.05	
17			0.0 27.08						26.816		K Factor = 5.23	
*LINES												
206 to 11	23.250 23.250		-92.36	1.5	T	9.9	22.708 9.900 32.608	120	34.021 0.0 -7.217		Vel = 13.34	
11 to 12	23.250 23.250		27.07	1.5			12.000	120	26.804 0.0			
12 to 13	23.250 23.250		-65.29	1.682			12.000	-0.1165	-1.398		Vel = 9.43	
12 to 13	23.250 23.250		26.33	1.5			12.000	120	25.406 0.0			
13 to 14	23.250 23.250		-38.96	1.682			12.000	-0.0448	-0.538		Vel = 5.63	
13 to 14	23.250 23.250		26.04	1.5			12.000	120	24.868 0.0			
14			-12.92	1.682			12.000	-0.0058	-0.070		Vel = 1.87	

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 6
Date 5-10-2023

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Equiv Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
14 to 15	23.250 23.250		26.00 13.08	1.5 1.682		12.000 12.000	120 0.0060	24.798 0.0 0.072			Vel = 1.89
15 to 16	23.250 23.250		26.04 39.12	1.5 1.682		12.000 12.000	120 0.0452	24.870 0.0 0.542			Vel = 5.65
16 to 17	23.250 23.250		26.33 65.45	1.5 1.682		12.000 12.000	120 0.1170	25.412 0.0 1.404			Vel = 9.45
17 to 106	23.250 23.250		27.08 92.53	1.5 1.682	T 9.9	34.833 9.900 44.733	120 0.2221	26.816 0.0 9.934			Vel = 13.36
106			0.0 92.53					36.750			K Factor = 15.26
201 to 6	13 13		11.02 11.02	1.5 1.682	T 9.9	55.500 9.900 65.400	120 0.0043	41.911 0.0 0.283			Vel = 1.59
6 to 7	13 13		0.0 11.02	1.5 1.682		8.000 8.000	120 0.0044	42.194 0.0 0.035			Vel = 1.59
7 to 8	13 13		0.0 11.02	1.5 1.682	T 9.9	60.958 9.900 70.858	120 0.0043	42.229 0.0 0.307			Vel = 1.59
8 to 101	13 13		0.0 11.02	1.5 1.682	T 9.9	55.500 9.900 65.400	120 0.0043	42.536 0.0 0.283			Vel = 1.59
101			0.0 11.02					42.819			K Factor = 1.68
202 to 9	13 13		17.92 17.92	1.5 1.682		8.000 8.000	120 0.0106	41.886 0.0 0.085			Vel = 2.59
9 to 10	13 13		0.0 17.92	1.5 1.682		18.375 18.375	120 0.0107	41.971 0.0 0.196			Vel = 2.59
10 to 102	13 13		0.0 17.92	1.5 1.682	2E T 9.9	43.583 19.800 63.383	120 0.0107	42.167 0.0 0.676			Vel = 2.59
102			0.0 17.92					42.843			K Factor = 2.74
203 to 103	11.750 11.750		17.01 17.01	1.5 1.682	2T 19.799	130.250 19.799 150.049	120 0.0097	42.229 0.0 1.451			Vel = 2.46
103			0.0 17.01					43.680			K Factor = 2.57
204 to 104	11.750 11.750		21.29 21.29	1.5 1.682	2E 2T 19.799	136.708 29.699 166.407	120 0.0147	41.918 0.0 2.438			Vel = 3.07

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 7
Date 5-10-2023

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
104			0.0 21.29						44.356		K Factor = 3.20	
205 to 105	11.750 11.750		25.12 25.12	1.5 1.682	2T	19.799	129.583 19.799 149.382	120 0.0199	42.034 0.0 2.974		Vel = 3.63	
105			0.0 25.12						45.008		K Factor = 3.74	
*MAINS												
201 to 202	13 13		-11.02 -11.02	2 2.157			19.333 19.333	120 -0.0013	41.911 0.0 -0.025		Vel = 0.97	
202 to 203	13 11.750		-17.92 -28.94	2 2.157	2E	12.307	13.500 12.307 25.807	120 -0.0077	41.886 0.541 -0.198		Vel = 2.54	
203 to M4	11.750 11.750		-17.01 -45.95	2 2.157			17.583 17.583	120 -0.0181	42.229 0.0 -0.319		Vel = 4.03	
M4 to 204	11.750 11.750		92.36 46.41	2 2.157			0.417 0.417	120 0.0192	41.910 0.0 0.008		Vel = 4.07	
204 to 205	11.750 11.750		-21.29 25.12	2 2.157			19.667 19.667	120 0.0059	41.918 0.0 0.116		Vel = 2.21	
205			0.0 25.12						42.034		K Factor = 3.87	
206 to M4	23.250 11.750		92.36 92.36	2 2.157	E T	6.153 12.307	25.666 18.460 44.126	120 0.0659	34.021 4.981 2.908		Vel = 8.11	
M4			0.0 92.36						41.910		K Factor = 14.27	
101 to 102	13 13		11.02 11.02	2 2.157			18.333 18.333	120 0.0013	42.819 0.0 0.024		Vel = 0.97	
102 to 103	13 11.750		17.92 28.94	2 2.157	3E	18.46	20.000 18.460 38.460	120 0.0077	42.843 0.541 0.296		Vel = 2.54	
103 to M3	11.750 11.750		17.01 45.95	2 2.157	T	12.307	6.000 12.307 18.307	120 0.0181	43.680 0.0 0.332		Vel = 4.03	
M3 to M2	11.750 11.750		0.0 45.95	3 3.26	E	9.408	3.000 9.408 12.408	120 0.0024	44.012 0.0 0.030		Vel = 1.77	
M2			0.0 45.95						44.042		K Factor = 6.92	
106 to M2	23.250 11.750		92.53 92.53	2 2.157	E T	6.153 12.307	16.499 18.460 34.959	120 0.0661	36.750 4.981 2.311		Vel = 8.12	

Final Calculations : Hazen-Williams

Crossroads Fire Protection
Johnsonville Elementary School

Page 8
Date 5-10-2023

Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
M2 to 104	11.750 11.750		45.95 138.48	3 3.26			16.833 16.833	120 0.0187	44.042 0.0 0.314		Vel = 5.32	
104 to 105	11.750 11.750		21.29 159.77	3 3.26			26.792 26.792	120 0.0243	44.356 0.0 0.652		Vel = 6.14	
105 to M1	11.750 10.500		25.12 184.89	3 3.26	2E T	18.815 20.159	6.375 38.974 45.349	120 0.0318	45.008 0.541 1.444		Vel = 7.11	
M1 to TOR	10.500 10.500		0.0 184.89	3 3.26	E	9.408	9.833 9.408 19.241	120 0.0319	46.993 0.0 0.613		Vel = 7.11	
TOR to BOR	10.500 1.500		0.0 184.89	3 3.26	E S B	9.408 21.503 13.44	9.000 44.351 53.351	120 0.0318	47.606 3.898 1.699		Vel = 7.11	
BOR			0.0 184.89						53.203		K Factor = 25.35	
*UNDERGROUND												
BOR to UG1	1.500 -3		184.89 184.89	6 6.16			146.500 146.500	140 0.0011	53.203 1.949 0.158		Vel = 1.99	
UG1 to BF	-3 -3		0.0 184.89	8 8.27	2E T G	56.936 55.354 6.326	909.000 189.786 1098.786	140 0.0003	55.310 0.0 0.282		Vel = 1.10	
BF to UG2	-3 -3		0.0 184.89	8 8.27	T 2E G	55.354 56.936 6.326	26.417 118.616 145.033	140 0.0003	55.592 12.268 0.038		** Fixed Loss = 12.268 Vel = 1.10	
UG2 to UG3	-3 -3		0.0 184.89	20 20.57	2G	45.186	190.417 45.186 235.603	140 0	67.898 0.0 0.001		Vel = 0.18	
UG3 to TEST	-3 2		0.0 184.89	6 6.16	T E G	43.037 20.084 4.304	3.500 67.425 70.925	140 0.0011	67.899 -2.166 0.077		Vel = 1.99	
TEST			250.00 434.89						65.810		Qa = 250.00 K Factor = 53.61	