CALCULATION SUMMARY

Project Name : Johnsonville Elementary School Phase 2

Project Location: 18495 NC-27

Contract No. : 173-NC22

City: Cameron, NC 28326

Design Areas

Design Area Name	Calc. Mode (Model)	Occupancy	Area of Application	Total Water	Pressure @ Source	Min. Density	Min. Pressure	Min. Flow	Calculated Heads	Hose Streams	Margin To Source
			(ft²)	(gpm)	(psi)	(gpm/ft²)	(psi)	(gpm)	#	(gpm)	(psi)
3	Demand (HW)	Light Hazard	1451	312.3	Required 49.8	0.1	8.7	33	6	100	28.7

HYDRAULIC CALCULATIONS
for

Job Information

Project Name : Johnsonville Elementary School Phase 2

Contract No. : 173-NC22

City: Cameron, NC 28326

Project Location: 18495 NC-27

Date: 10/14/2022

Contractor Information

Name of Contractor: A & B Fire Services Inc.

Address: 113 North Ln.

City: Bluefield, WV 24605

Phone Number: 540-521-5776

E-mail: croseberry@aandbfire.com

Name of Designer: C.J. Roseberry

Authority Having Jurisdiction: Harnett Co.

Design

Remote Area Name	3
Remote Area Location	Corridor 2
Occupancy Classification	Light Hazard
Density (gpm/ft²)	0.1
Area of Application (ft²)	1451
Coverage per Sprinkler (ft²)	330
Number of Calculated Sprinklers	6
In-Rack Demand (gpm)	0
Special Heads	
Hose Streams (gpm)	100
Total Water Required (incl. Hose Streams) (gpm)	312.3
Required Pressure at Source (psi)	49.8
Type of System	Wet
Volume - Entire System (gal)	3950.2 gal

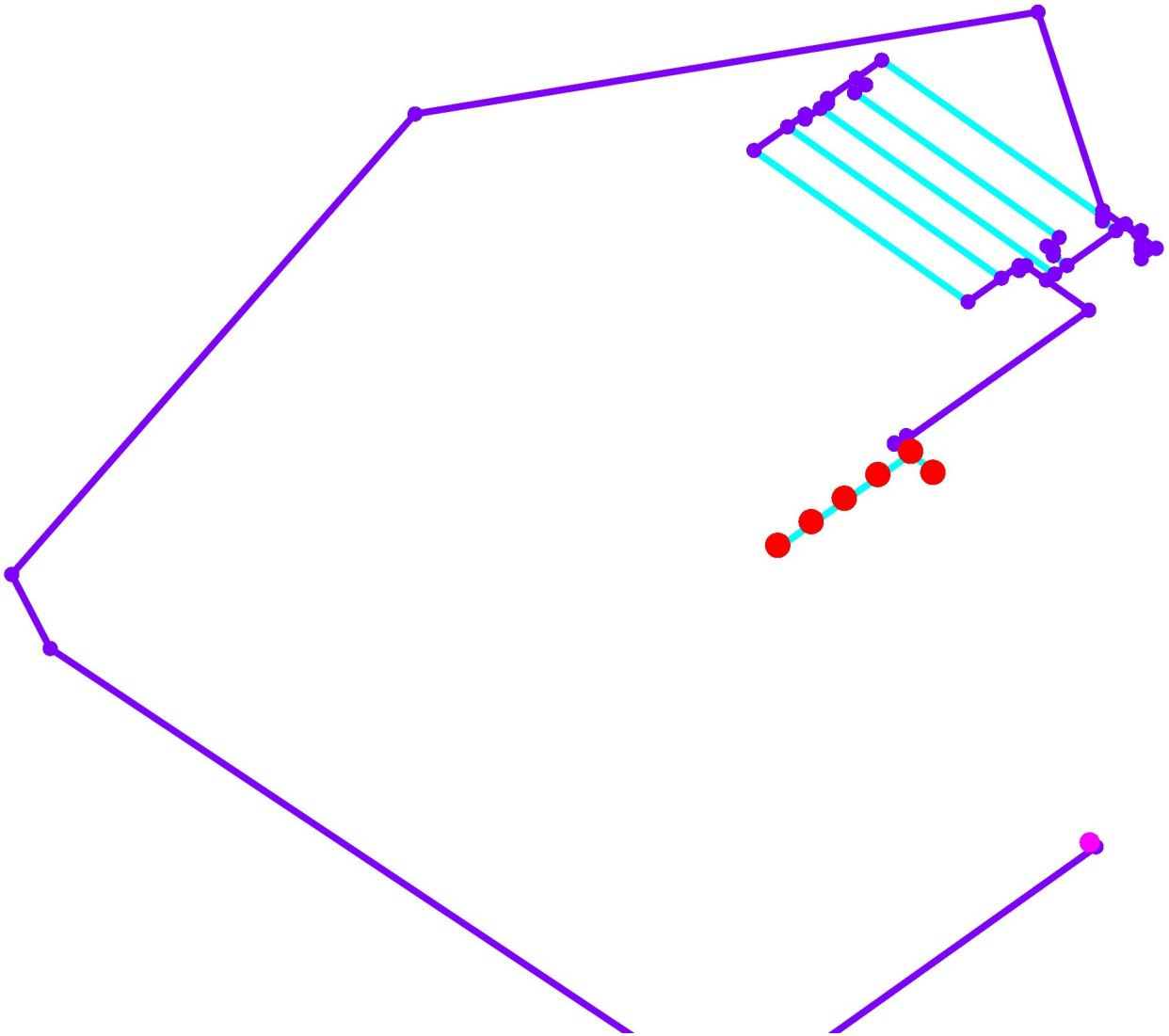
Water Supply Information

Date	09/27/2022
Location	Fire Hydrant 996G
Source	W1

Notes

Node Labels: Off
Pipe Labels: Off

Diagram for Design Area : 3
(Optimized Hydraulic Simplified)



Hydraulic Analysis for : 3

Calculation Info

Calculation Mode	Demand
Hydraulic Model	Hazen-Williams
Fluid Name	Water @ 60F (15.6C)
Fluid Weight, (lb/ft³)	N/A for Hazen-Williams calculation.
Fluid Dynamic Viscosity, (lb·s/ft²)	N/A for Hazen-Williams calculation.

Water Supply Parameters

Supply 1 : W1

Flow (gpm)	Pressure (psi)
0	80
860	70

Supply Analysis

Node at Source	Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm)	Available Pressure (psi)	Total Demand (gpm)	Required Pressure (psi)
W1	80	70	860	78.5	312.3	49.8

Hoses

Inside Hose Flow / Standpipe Demand (gpm)	
Outside Hose Flow (gpm)	
Additional Outside Hose Flow (gpm)	100
Other (custom defined) Hose Flow (gpm)	
Total Hose Flow (gpm)	100

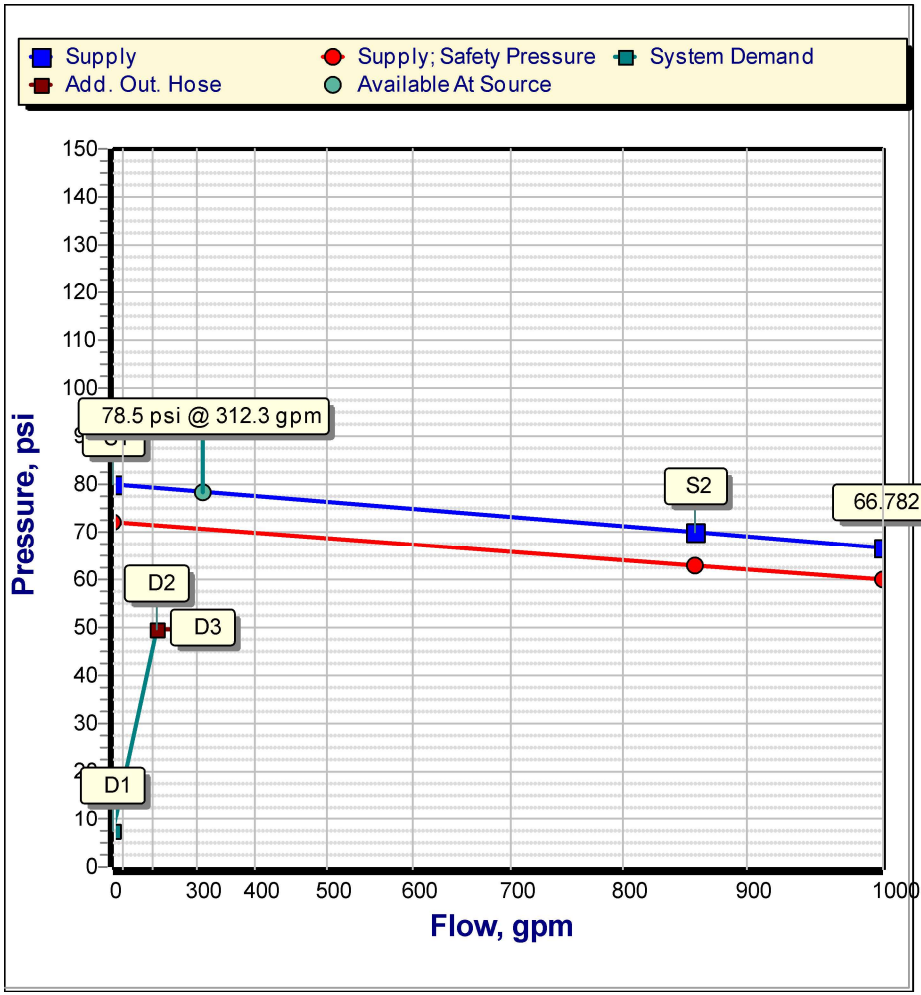
Sprinklers

Ovehead Sprinkler Flow (gpm)	212.3
InRack Sprinkler Flow (gpm)	0
Other (custom defined) Sprinkler Flow (gpm)	0
Total Sprinkler Flow (gpm)	212.3

Other

Required Margin of Safety (%)	10
W1 - Pressure (psi)	49.8
W1 - Flow (gpm)	212.3
Demand w/o System Pump(s)	N/A

Hydraulic Analysis for : 3



Hydraulic Analysis for : 3

Graph Labels

Label	Description	Values	
		Flow (gpm)	Pressure (psi)
S1	Supply point #1 - Static	0	80
S2	Supply point #2 - Residual	860	70
D1	Elevation Pressure	0	7.7
D2	System Demand	212.3	49.8
D3	System Demand + Add.Out.Hose	312.3	49.8

Curve Intersections & Safety Margins

Curve Name	Intersection		Safety Margin	
	Pressure (psi)	Flow (gpm)	Pressure (psi)	@ Flow (gpm)
Supply	78.7	281.8	28.7	312.3
Supply; Safety Pressure	71	264.7	20.9	312.3

Open Heads

Head Ref.	Head Type	Coverage	K-Factor	Required			Calculated		
				Density	Flow	Pressure	Density	Flow	Pressure
		(ft²)	(gpm/psi½)	(gpm/ft²)	(gpm)	(psi)	(gpm/ft²)	(gpm)	(psi)
C1	Overhead Sprinkler	330	11.2	0.1	33	8.7	0.104	34.2	9.3
C2	Overhead Sprinkler	330	11.2	0.1	33	8.7	0.1	33	8.7
C3	Overhead Sprinkler	330	11.2	0.1	33	8.7	0.102	33.6	9
C4	Overhead Sprinkler	330	11.2	0.1	33	8.7	0.106	34.9	9.7
C5	Overhead Sprinkler	330	11.2	0.1	33	8.7	0.115	38.1	11.6
C6	Overhead Sprinkler	330	11.2	0.1	33	8.7	0.116	38.4	11.8

Node Data

Node# Type	Hgroup Fitting	K-Fact. Stat. Pres.	Elev Coverage	X Y
		gpm/psi½ psi	ft ft²	ft ft
C2 Overhead Sprinkler	HEAD	11.2	14.25 330	6631.73 393.05
C3 Overhead Sprinkler	HEAD	11.2	14.25 330	6649.52 393.05
C1 Overhead Sprinkler	HEAD	11.2	14.25 330	6613.73 393.05
C4 Overhead Sprinkler	HEAD	11.2	14.25 330	6667.52 393.05
C5 Overhead Sprinkler	HEAD	11.2	14.25 330	6683.14 379.07
C6 Overhead Sprinkler	HEAD	11.2	14.25 330	6685.14 393.05
300 Node	NODE coupling		14.25	6613.73 391.88
299 Node	NODE us.Tee		14.25	6631.73 391.88
298 Node	NODE us.Tee		14.25	6649.52 391.88
297 Node	NODE us.Tee		14.25	6667.52 391.88
002 Node	NODE us.Tee		14.25	6683.98 379.07
006 Node	NODE us.Tee		14.25	6683.98 391.88
007 Node	NODE us.Tee		14.25	6683.98 393.05
010 Node	NODE us.Tee		13.58	6683.98 400.6
009 Node	NODE us.Tee		14.25	6775.38 434.42
005 Node	NODE us.Tee		14.25	6757.38 434.42
127 Node	NODE us.Tee		14.25	6757.38 549.42
126 Node	NODE us.Tee		14.25	6775.38 549.42
118 Node	NODE us.Tee		14.25	6812.31 549.42
117 Node	NODE us.Tee		14.25	6825.98 549.42
027 Node	NODE us.Tee		11.67	6788.48 423.49
122 Node	NODE us.Tee		11.67	6792.98 549.42
053 Node	NODE us.Tee		11.67	6792.98 423.49
054 Node	NODE us.Tee		11.67	6799.69 423.49
057 Node	NODE us.Tee		11.67	6825.98 423.49

Node Data

Node# Type	Hgroup Fitting	K-Fact. Stat. Pres.	Elev Coverage	X Y
		gpm/psi½ psi	ft ft²	ft ft
073-O Node	NODE		4.49	6832.76 416.66
073-I Node	NODE		3.69	6832.76 416.66
074-O Node	NODE		2.92	6832.76 416.66
074-I Node	NODE		2.54	6832.76 416.66
075 Node	NODE		1.08	6832.76 416.66
079 Node	NODE us.Tee		-3.42	6898.73 538.18
086-O Node	NODE		-3.42	6406.78 235.51
086-I Node	NODE		-3.42	6406.78 231.35
W1 Supply	SUPPLY		-3.42	6597.2 208.85

PIPE INFORMATION

Node 1 Node 2	Elev 1 Elev 2	K-Factor 1 K-Factor 2	Flow added (q) Total flow (Q)	Nominal ID Actual ID	Fittings quantity x (name) = length	L F T	C Factor Pf per ft	total (Pt) elev (Pe) frict (Pf)	NOTES
	(ft)	(gpm/psi½)	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	
Path No: 1									
C2	14.25	11.2	33	1	1x(us.Tee-Br)=5	24	120	8.7	Flex-48"
299	14.25		33	1.049		5	0.3284	0	
						29		9.5	
299	14.25		34.2	2		17.79	120	18.2	
298	14.25		67.2	2.157		0	0.0365	0	
						17.79		0.7	
298	14.25		33.6	2		18	120	18.9	
297	14.25		100.8	2.157		0	0.0775	0	
						18		1.4	
297	14.25		34.9	2	1x(us.Tee-Br)=12.31	16.46	120	20.3	
006	14.25		135.8	2.157		12.31	0.1344	0	
						28.77		3.9	
006	14.25		38.1	2		1.17	120	24.1	
007	14.25		173.8	2.157		0	0.2125	0	
						1.17		0.2	
007	14.25		38.4	2	1x(us.Tee-Br)=12.31	8.22	120	24.4	
010	13.58		212.3	2.157	1x(us.90)=6.15	18.46	0.3077	0.3	
						26.68		8.2	
010	13.58		0	4	3x(us.90)=39.5	129.31	120	32.9	
027	11.67		212.3	4.26		39.5	0.0112	0.8	
						168.81		1.9	
027	11.67		-23.9	4	1x(us.Tee-Br)=26.33	4.5	120	35.6	
053	11.67		188.4	4.26		26.33	0.009	0	
						30.83		0.3	
053	11.67		4.1	4		6.71	120	35.9	
054	11.67		192.5	4.26		0	0.0093	0	
						6.71		0.1	
054	11.67		5.4	4		26.29	120	35.9	
057	11.67		197.9	4.26		0	0.0098	0	
						26.29		0.3	
057	11.67		14.4	4	2x(us.90)=26.33	20.79	120	36.2	
073-O	4.49		212.3	4.26	1x(us.Tee-Br)=26.33	52.67	0.0112	3.1	
						73.46		0.8	
073-O	4.49		0	4		0.8		40.1	CV-1 FR
073-I	3.69		212.3	0		0	0.653	0.3	Check
						0.8		0.5	***
073-I	3.69		0	4		0.77	120	41	
074-O	2.92		212.3	4.26		0	0.0112	0.3	
						0.77		0	
074-O	2.92		0	4		0.38		41.3	BFV-N
074-I	2.54		212.3	0		0	0.3352	0.2	***
						0.38		0.1	
074-I	2.54		0	4		1.46	120	41.6	
075	1.08		212.3	4.26		0	0.0112	0.6	
						1.46		0.0	
075	1.08		0	6	1x(us.Tee-Br)=51.84	150.64	140	42.3	
079	-3.42		212.3	6.4	1x(us.45)=12.1	112.32	0.0012	1.9	
					2x(us.90)=48.39	262.96		0.3	

PIPE INFORMATION

Node 1 Node 2	Elev 1 Elev 2	K-Factor 1 K-Factor 2	Flow added (q) Total flow (Q)	Nominal ID Actual ID	Fittings quantity x (name) = length	L F T	C Factor Pf per ft	total (Pt) elev (Pe) frict (Pf)	NOTES
	(ft)	(gpm/psi½)	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	
Path No: 1									
079	-3.42		0	8	3x(us.45)=47.55	904.76	140	44.5	
086-O	-3.42		212.3	8.55	1x(elbow.22.5)=7.93	87.18	0.0003	0	
					1x(us.90)=31.7	991.94		0.3	
086-O	-3.42		0	8		4.17		44.8	Ames3000SS
086-I	-3.42		212.3	0		0	1.1626	0	***
						4.17		4.8	
086-I	-3.42		0	8	1x(us.90)=31.7	220.28	140	49.7	
W1	-3.42		212.3	8.55	1x(us.Tee-Br)=61.64	93.34	0.0003	0	
						313.62		0.1	
W1								**49.8**	
Path No: 2									
C3	14.25	11.2	33.6	1	1x(us.Tee-Br)=5	24	120	9	Flex-48"
298	14.25		33.6	1.049		5	0.3397	0	
						29		9.9	
298								**18.9**	
Path No: 3									
C1	14.25	11.2	34.2	1	1x(coupling)=1	24	120	9.3	Flex-48"
300	14.25		34.2	1.049		1	0.3494	0	
						25		8.7	
300	14.25		0	2		18	120	18	
299	14.25		34.2	2.157		0	0.0104	0	
						18		0.2	
299								**18.2**	
Path No: 4									
C4	14.25	11.2	34.9	1	1x(us.Tee-Br)=5	24	120	9.7	Flex-48"
297	14.25		34.9	1.049		5	0.3639	0	
						29		10.6	
297								**20.3**	
Path No: 5									
C5	14.25	11.2	38.1	1	1x(us.Tee-Br)=5	24	120	11.6	Flex-48"
002	14.25		38.1	1.049		5	0.4277	0	
						29		12.4	
002	14.25		0	2		12.81	120	24	
006	14.25		38.1	2.157		0	0.0128	0	
						12.81		0.2	
006								**24.1**	
Path No: 6									
C6	14.25	11.2	38.4	1	1x(us.Tee-Br)=5	24	120	11.8	Flex-48"
007	14.25		38.4	1.049		5	0.4348	0	
						29		12.6	
007								**24.4**	

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PIPE INFORMATION

Node 1 Node 2	Elev 1 Elev 2	K-Factor 1 K-Factor 2	Flow added (q) Total flow (Q)	Nominal ID Actual ID	Fittings quantity x (name) = length	L F T	C Factor Pf per ft	total (Pt) elev (Pe) frict (Pf)	NOTES
	(ft)	(gpm/psi½)	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	
Path No: 7									
027	11.67		0	4	1x(us.Tee-Br)=26.33	26.61	120	35.6	
009	14.25		23.9	4.26	2x(us.90)=26.33	52.67	0.0002	-1.1	
						79.28		0.0	
009	14.25		-11.8	4	1x(us.Tee-Br)=26.33	18	120	34.5	
005	14.25		12.1	4.26		26.33	0.0001	0	
						44.33		0	
005	14.25		0	2	1x(us.Tee-Br)=12.31	115	120	34.5	
127	14.25		12.1	2.157		12.31	0.0015	0	
						127.3		0.2	
127	14.25		0	3		18	120	34.7	
126	14.25		12.1	3.26		0	0.0002	0	
						18		0	
126	14.25		11.8	3	2x(us.90)=18.82	20.18	120	34.7	
122	11.67		23.9	3.26		18.82	0.0007	1.1	
						39		0.0	
122	11.67		-4.1	3	2x(us.90)=18.82	21.92	120	35.8	
118	14.25		19.8	3.26		18.82	0.0005	-1.1	
						40.73		0.0	
118	14.25		-5.4	3	1x(us.Tee-Br)=20.16	13.67	120	34.7	
117	14.25		14.4	3.26		20.16	0.0003	0	
						33.83		0	
117	14.25		0	2	1x(us.Tee-Br)=12.31	128.51	120	34.8	
057	11.67		14.4	2.157	2x(us.90)=12.31	24.61	0.0021	1.1	
						153.12		0.3	
057								**36.2**	
Path No: 8									
009	14.25		0	2	2x(us.Tee-Br)=24.61	115	120	34.5	
126	14.25		11.8	2.157		24.61	0.0014	0	
						139.61		0.2	
126								**34.7**	
Path No: 9									
122	11.67		0	2	2x(us.Tee-Br)=24.61	125.93	120	35.8	
053	11.67		4.1	2.157		24.61	0.0002	0	
						150.54		0.0	
053								**35.9**	
Path No: 10									
118	14.25		0	2	3x(us.Tee-Br)=36.92	141.14	120	34.7	
054	11.67		5.4	2.157	5x(us.90)=30.77	67.69	0.0003	1.1	
						208.82		0.1	
054								**35.9**	

PIPE INFORMATION

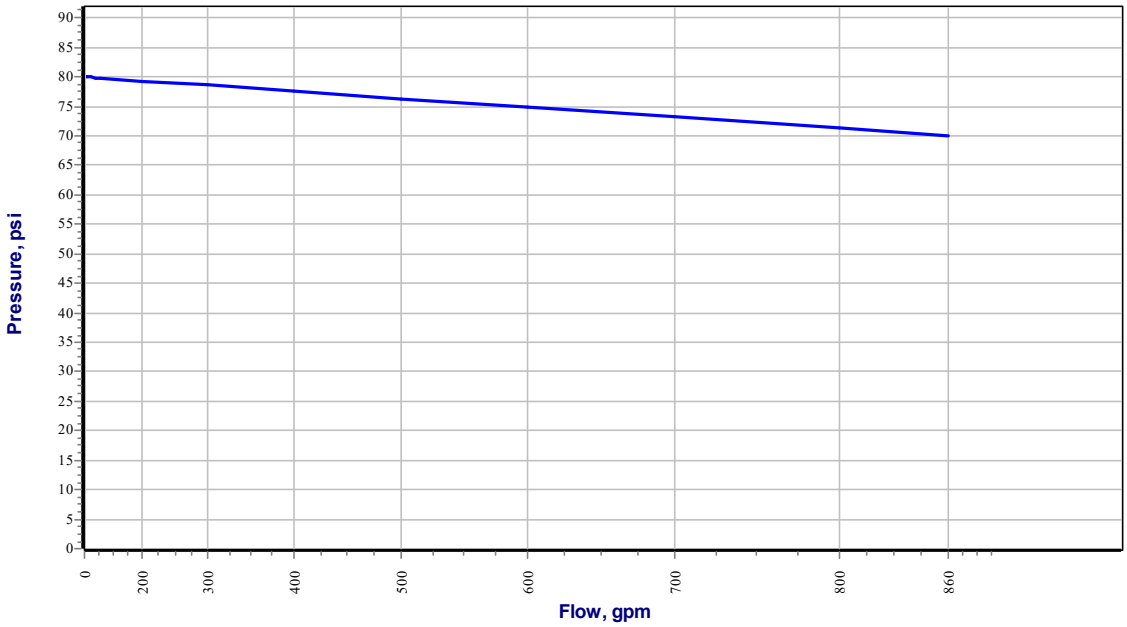
Node 1 Node 2	Elev 1 Elev 2	K-Factor 1 K-Factor 2	Flow added (q) Total flow (Q)	Nominal ID Actual ID	Fittings quantity x (name) = length	L F T	C Factor Pf per ft	total (Pt) elev (Pe) frict (Pf)	NOTES
	(ft)	(gpm/psi½)	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	

* Pressures are balanced to a high degree of accuracy. Values may vary by 0.1 psi due to display rounding.

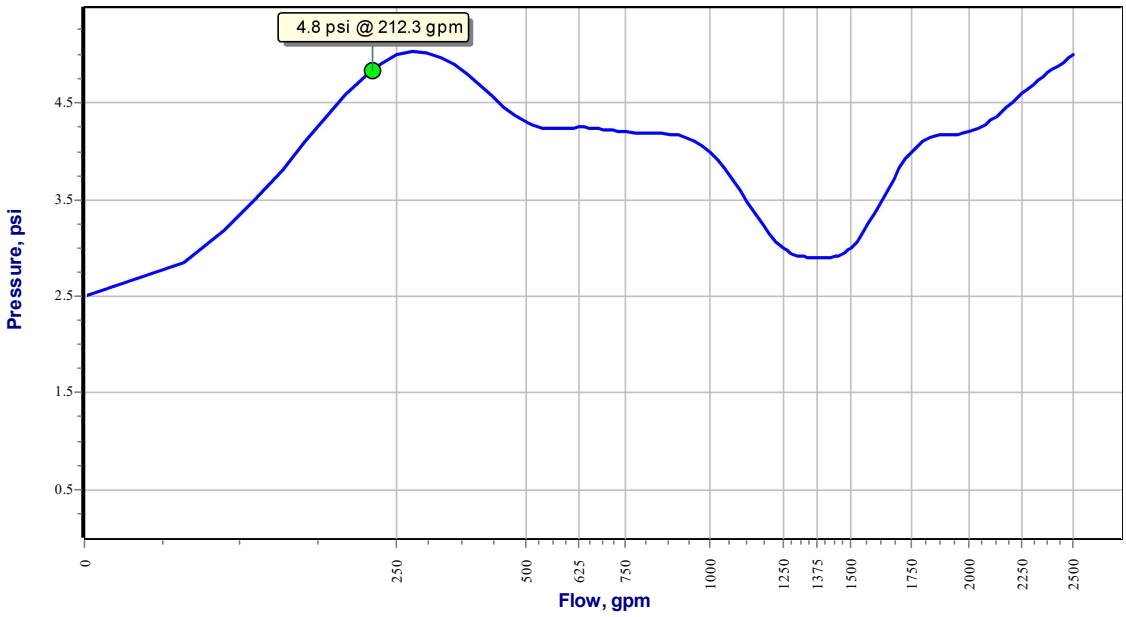
* Maximum Velocity of 18.64 ft/s occurs in the following pipe(s): (010-007)

*** Device pressure loss (gain in the case of pumps) is calculated from the device's curve. If the device curve is printed with this report, it will appear below. The length of the device as shown in the table above comes from the CAD drawing. The friction loss per unit of length is calculated based upon the length and the curve-based loss/gain value. Internal ID and C Factor values are irrelevant as the device is not represented as an addition to any pipe, but is an individual item whose loss/gain is based solely on the curve data.

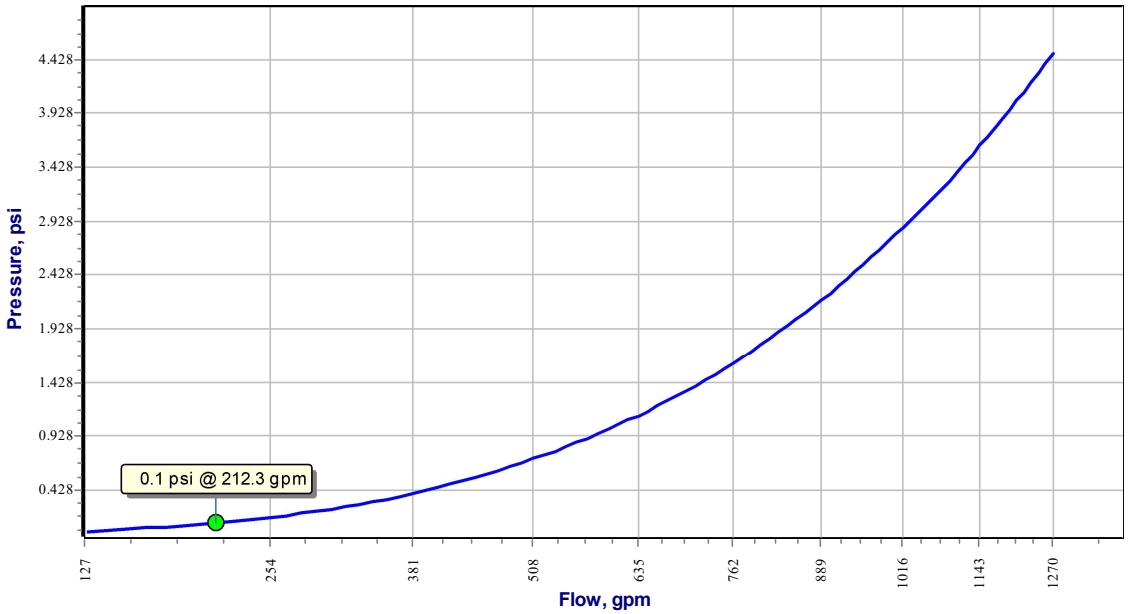
Pressure vs. Flow Function
Design Area: 3; Supply Ref.: W1; Supply Name:W1



Pressure Loss Function
Design Area: 3; BFP Ref.: 349 (Ames3000SS, Size = 8); Inlet Node: 086-I; Outlet Node: 086-O



Pressure Loss Function
Design Area: 3; Valve Ref.: 347 (BFV-N, Size = 4); Inlet Node: 074-I; Outlet Node: 074-O



Pressure Loss Function
Design Area: 3; Valve Ref.: 348 (CV-1 FR Check, Size = 4); Inlet Node: 073-I; Outlet Node: 073-O