

CALCULATION SUMMARY

Project Name : Johnsonville Elementary

Project Location: 18495 NC-27

Drawing No. : PM9192

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
			(ft ²)	(gpm)	(psi)	(gpm/ft ²)	(psi)	(gpm)	#	(gpm)	(psi)
1	Demand (HW)	LH	900	241.6	Required 49.3	0.1	10	17.7	7	100	26.9

HYDRAULIC CALCULATIONS for

Job Information

Project Name : Johnsonville Elementary

Contract No. : PM9192

City: Cameron, NC 28326

Project Location: 18495 NC-27

Date: 10/29/2021

Contractor Information

Name of Contractor: VSC Fire & Security, Inc.

Address: 263 Hein Drive

City: Garner, NC 27529

Phone Number: 919-645-5880

E-mail: @vscfire.com

Name of Designer: MB

Authority Having Jurisdiction:

Design

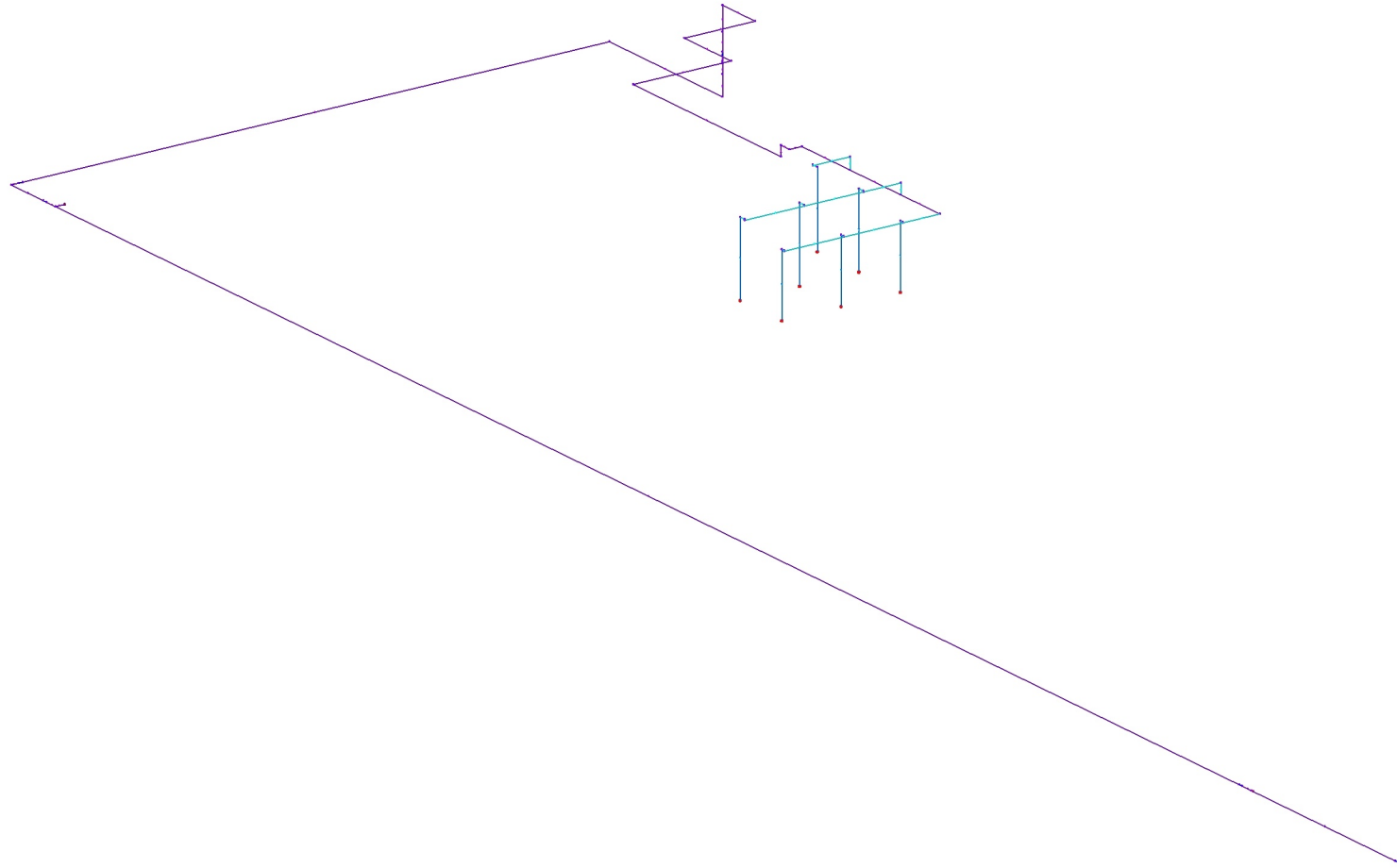
Remote Area Name	1
Remote Area Location	CAF
Occupancy Classification	LH
Density (gpm/ft ²)	0.1
Area of Application (ft ²)	900
Coverage per Sprinkler (ft ²)	177
Number of Calculated Sprinklers	7
In-Rack Demand (gpm)	0
Special Heads	
Hose Streams (gpm)	100
Total Water Required (incl. Hose Streams) (gpm)	241.6
Required Pressure at Source (psi)	49.3
Type of System	Wet
Volume - Entire System (gal)	1516.1 gal

Water Supply Information

Date	10/15/2021
Location	Hwy 24 & Hwy 27 In front of Self Storage
Source	TEST

Notes

Diagram for Design Area : 1 (Optimized Hvdraulic Simplified)



Hydraulic Analysis for : 1

Calculation Info

Calculation Mode	Demand
Hydraulic Model	Hazen-Williams
Fluid Name	Water @ 60F (15.6C)
Fluid Weight, (lb/ft ³)	N/A for Hazen-Williams calculation.
Fluid Dynamic Viscosity, (lb-s/ft ²)	N/A for Hazen-Williams calculation.

Water Supply Parameters

Supply 1 : TEST

Flow (gpm)	Pressure (psi)
0	77
840	69

Supply Analysis

Node at Source	Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm)	Available Pressure (psi)	Total Demand (gpm)	Required Pressure (psi)
TEST	77	69	840	76.2	241.6	49.3

Hoses

Inside Hose Flow / Standpipe Demand (gpm)	100
Outside Hose Flow (gpm)	0
Additional Outside Hose Flow (gpm)	
Other (custom defined) Hose Flow (gpm)	0
Total Hose Flow (gpm)	100

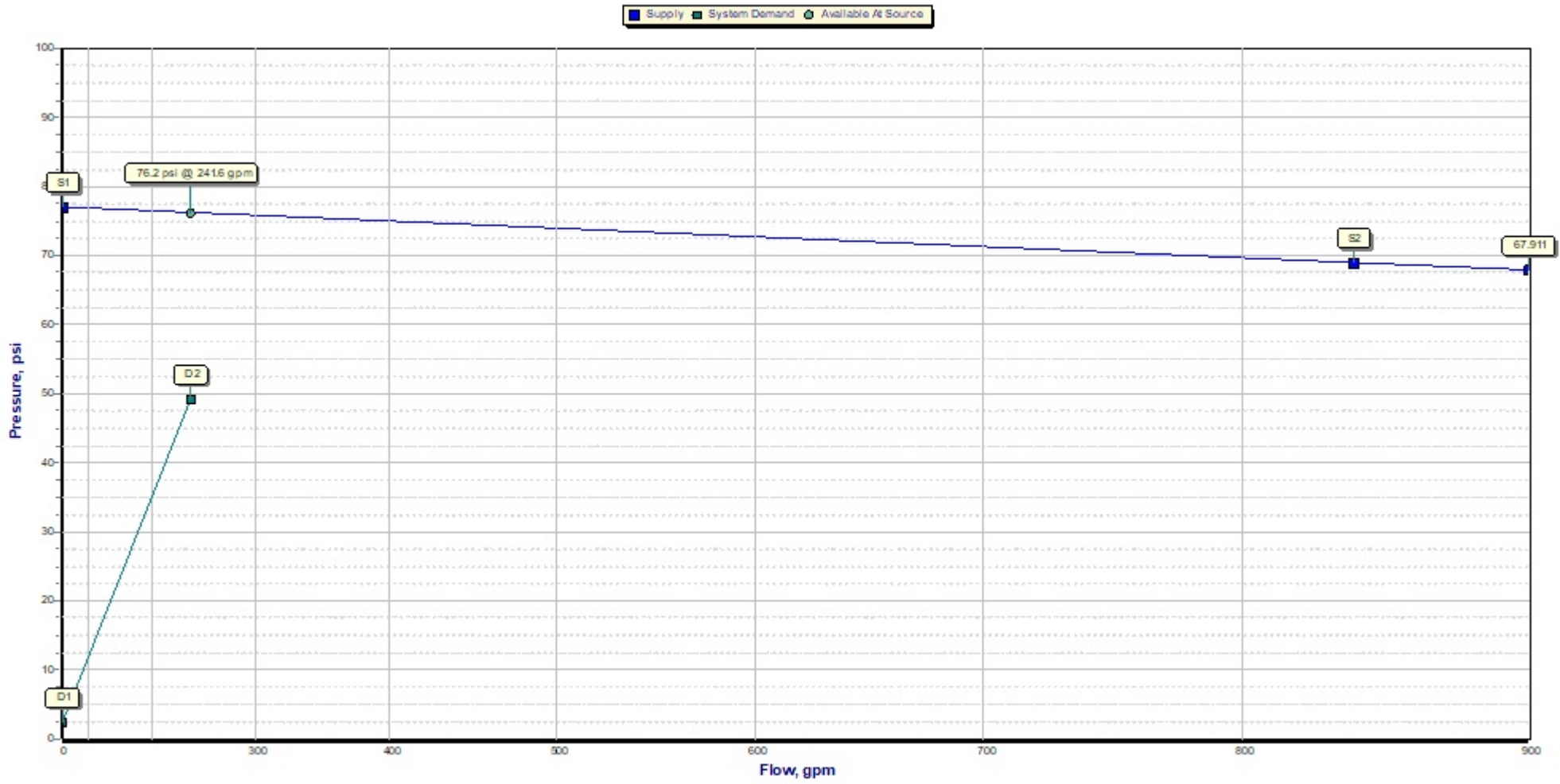
Sprinklers

Ovehead Sprinkler Flow (gpm)	141.6
InRack Sprinkler Flow (gpm)	0
Other (custom defined) Sprinkler Flow (gpm)	0
Total Sprinkler Flow (gpm)	141.6

Other

Required Margin of Safety (psi)	0
TEST - Pressure (psi)	49.3
TEST - Flow (gpm)	241.6
Demand w/o System Pump(s)	N/A

Hydraulic Analysis for : 1



Hydraulic Analysis for : 1

Graph Labels

Label	Description	Values	
		Flow (gpm)	Pressure (psi)
S1	Supply point #1 - Static	0	77
S2	Supply point #2 - Residual	840	69
D1	Elevation Pressure	0	2.5
D2	System Demand	241.6	49.3

Curve Intersections & Safety Margins

Curve Name	Intersection		Safety Margin	
	Pressure (psi)	Flow (gpm)	Pressure (psi)	@ Flow (gpm)
Supply	75.8	307.7	26.9	241.6

Open Heads

Head Ref.	Head Type	Coverage	K-Factor	Required			Calculated		
				Density	Flow	Pressure	Density	Flow	Pressure
		(ft ²)	(gpm/psi ^{1/2})	(gpm/ft ²)	(gpm)	(psi)	(gpm/ft ²)	(gpm)	(psi)
C100	Overhead Sprinkler	177	5.6	0.1	17.7	10	0.105	18.6	11
C101	Overhead Sprinkler	150	5.6	0.1	15	7.2	0.129	19.3	11.9
C102	Overhead Sprinkler	150	5.6	0.1	15	7.2	0.15	22.4	16.1
C103	Overhead Sprinkler	177	5.6	0.1	17.7	10	0.1	17.7	10
C104	Overhead Sprinkler	150	5.6	0.1	15	7.2	0.122	18.4	10.7
C105	Overhead Sprinkler	150	5.6	0.1	15	7.2	0.142	21.3	14.5
C106	Overhead Sprinkler	150	5.6	0.1	15	7.2	0.16	23.9	18.3

Node Data

Node# Elev	Type Hgroup	K-Fact. Open/Closed	Discharge Overdischarge	Coverage Density	Tot. Pres. Elev. Pres.	Req. Pres. Req. Discharge
ft		gpm/psi½	gpm gpm	ft² gpm/ft²	psi psi	psi gpm
C103 0	Overhead Sprinkler HEAD	5.6 Open	17.7 0	177 0.1	10 -2.5	10 17.7
C100 0	Overhead Sprinkler HEAD	5.6 Open	18.6 0.9	177 0.105	11 -2.5	10 17.7
C104 0	Overhead Sprinkler HEAD	5.6 Open	18.4 3.4	150 0.122	10.7 -2.5	7.2 15
C101 0	Overhead Sprinkler HEAD	5.6 Open	19.3 4.3	150 0.129	11.9 -2.5	7.2 15
C105 0	Overhead Sprinkler HEAD	5.6 Open	21.3 6.3	150 0.142	14.5 -2.5	7.2 15
C102 0	Overhead Sprinkler HEAD	5.6 Open	22.4 7.4	150 0.15	16.1 -2.5	7.2 15
C106 0	Overhead Sprinkler HEAD	5.6 Open	23.9 8.9	150 0.16	18.3 -2.5	7.2 15
267 14.58	Node NODE				7.2 -8.8	
004 12.5	Node NODE				9.2 -7.9	
266 14.58	Node NODE				11.9 -8.8	
005 12.5	Node NODE				14.3 -7.9	
247 14.83	Node NODE				16.5 -8.9	
006 12.5	Node NODE				17.8 -7.9	
008 12.5	Node NODE				18 -7.9	
009 12.5	Node NODE				18.5 -7.9	
091 5.76	Node NODE				31.8 -4.9	
093-O 2.29	Node NODE				33.3 -3.4	
093-I 1.49	Node NODE				33.8 -3.1	
094-O 0.6	Node NODE				34.2 -2.7	
094-I 0.21	Node NODE				34.4 -2.5	
095 -1.67	Node NODE				35.2 -1.7	
098-O -5.67	Node NODE				37 0	
098-I -5.67	Node NODE				37 0	
H100 -5.67	Inside Hose HOSE		100		37.1 0	100
099 -5.67	Node NODE				37.1 0	

Node Data

Node# Elev	Type Hgroup	K-Fact. Open/Closed	Discharge Overdischarge	Coverage Density	Tot. Pres. Elev. Pres.	Req. Pres. Req. Discharge
ft		gpm/psi ^{1/2}	gpm gpm	ft ² gpm/ft ²	psi psi	psi gpm
100-O -5.67	Node NODE				37.1 0	
100-I -5.67	Node NODE				37.1 0	
101 -5.67	Node NODE				37.1 0	
102-O -5.67	Node NODE				37.2 0	
102-I -5.67	Node NODE				37.2 0	
104-O -5.67	Node NODE				37.2 0	
104-I -5.67	Node NODE				49.3 0	
106-O -5.67	Node NODE				49.3 0	
106-I -5.67	Node NODE				49.3 0	
TEST -5.67	Supply SUPPLY		-241.6		49.3 0	

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/psi ^{1/2})	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	

Path No: 1

C103 267	0 14.58	5.6	17.7 17.7	1 1.049	3x(vsc.90)= 6	28.25 6 34.25	120 0.1034	10 -6.3 3.5	
267 266	14.58 14.58		18.4 36.1	1 1.049		12 0 12	120 0.3861	7.2 0 4.6	
266 008	14.58 12.5		21.3 57.4	1.25 1.38	2x(vsc.Tee-Br)= 12	9.62 12 21.62	120 0.24	11.9 0.9 5.2	
008 009	12.5 12.5		60.3 117.7	2.5 2.635		14.67 0 14.67	120 0.0389	18 0 0.6	
009 091	12.5 5.76		23.9 141.6	2.5 2.635	1x(coupling)= 1.37 8x(vsc.90)= 47.23 1x(vsc.Tee-Br)= 14.83	125.43 63.43 188.85	120 0.0548	18.5 2.9 10.4	
091 093-0	5.76 2.29		0 141.6	6 6.357	1x(coupling)= 1.26	3.47 1.26 4.73	120 0.0008	31.8 1.5 0	
093-0 093-I	2.29 1.49		0 141.6	6 0		0.8 0 0.8	0 0.1828	33.3 0.3 0.1	Vic717 Check ***
093-I 094-0	1.49 0.6		0 141.6	6 6.357	1x(coupling)= 1.26	0.89 1.26 2.15	120 0.0008	33.8 0.4 0	
094-0 094-I	0.6 0.21		0 141.6	6 0		0.39 0 0.39	0 0.0771	34.2 0.2 0.0	Vic705W Btfly ***
094-I 095	0.21 -1.67		0 141.6	6 6.357	1x(coupling)= 1.26	1.88 1.26 3.14	120 0.0008	34.4 0.8 0	
095 098-0	-1.67 -5.67		0 141.6	6 6.4	1x(coupling)= 1.73 2x(UG.90)= 38.02	155.28 39.75 195.02	140 0.0005	35.2 1.7 0.1	
098-0 098-I	-5.67 -5.67		0 141.6	6 0		0.88 0 0.88	0 0.0112	37 0 0	OS&Y Valve ***
098-I 099	-5.67 -5.67		0 141.6	6 6.4	1x(UG.Tee-Br)= 51.84	1.45 51.84 53.29	140 0.0005	37 0 0.0	
099 100-0	-5.67 -5.67		0 141.6	8 8.55	1x(coupling)= 3.72	9.26 3.72 12.98	140 0.0001	37.1 0 0	
100-0 100-I	-5.67 -5.67		0 141.6	8 0		0.96 0 0.96	0 0.0055	37.1 0 0	OS&Y Valve ***
100-I 101	-5.67 -5.67		0 141.6	8 8.55		2.6 0 2.6	140 0.0001	37.1 0 0	

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/psi ^{1/2})	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	

Path No: 1

101 102-0	-5.67 -5.67		100 241.6	8 8.55	1x(coupling)= 3.72	341.83 3.72 345.55	140 0.0004	37.1 0 0.1	
102-0 102-I	-5.67 -5.67		0 241.6	8 0		0.96 0 0.96	0 0.0094	37.2 0 0	OS&Y Valve ***
102-I 104-0	-5.67 -5.67		0 241.6	8 8.55	1x(coupling)= 3.72	2.57 3.72 6.29	140 0.0004	37.2 0 0	
104-0 104-I	-5.67 -5.67		0 241.6	8 0		0.5 0 0.5	0 24.1454	37.2 0 12.1	Watts909 RPZ ***
104-I 106-0	-5.67 -5.67		0 241.6	8 8.55	1x(coupling)= 3.72	41.06 3.72 44.78	140 0.0004	49.3 0 0.0	
106-0 106-I	-5.67 -5.67		0 241.6	8 0		0.96 0 0.96	0 0.0094	49.3 0 0	OS&Y Valve ***
106-I TEST	-5.67 -5.67		0 241.6	8 8.55		1.32 0 1.32	140 0.0004	49.3 0 0	
TEST								49.3	

Path No: 2

C100 004	0 12.5	5.6	18.6 18.6	1 1.049	3x(vsc.90)= 6	25.5 6 31.5	120 0.1132	11 -5.4 3.6	
004 005	12.5 12.5		19.3 37.9	1 1.049		12 0 12	120 0.423	9.2 0 5.1	
005 006	12.5 12.5		22.4 60.3	1.25 1.38	1x(vsc.Tee-Br)= 6	7.54 6 13.54	120 0.2634	14.3 0 3.6	
006 008	12.5 12.5		0 60.3	2.5 2.635		11.33 0 11.33	120 0.0113	17.8 0 0.1	
008								18	

Path No: 3

C104 267	0 14.58	5.6	18.4 18.4	1 1.049	1x(vsc.Tee-Br)= 5 2x(vsc.90)= 4	16.25 9 25.25	120 0.1106	10.7 -6.3 2.8	
267								7.2	

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/psi ^{1/2})	(gpm)	(in)	(ft)	(ft)	(psi)	(psi)	

Path No: 4

C101	0	5.6	19.3	1	1x(vsc.Tee-Br)= 5	13.5	120	11.9	
004	12.5		19.3	1.049	2x(vsc.90)= 4	9	0.1212	-5.4	
						22.5		2.7	
								9.2	

Path No: 5

C105	0	5.6	21.3	1	1x(vsc.Tee-Br)= 5	16.25	120	14.5	
266	14.58		21.3	1.049	2x(vsc.90)= 4	9	0.1459	-6.3	
						25.25		3.7	
								11.9	

Path No: 6

C102	0	5.6	22.4	1	1x(vsc.Tee-Br)= 5	13.5	120	16.1	
005	12.5		22.4	1.049	2x(vsc.90)= 4	9	0.1604	-5.4	
						22.5		3.6	
								14.3	

Path No: 7

C106	0	5.6	23.9	1	1x(vsc.Tee-Br)= 5	16.5	120	18.3	
247	14.83		23.9	1.049	2x(vsc.90)= 4	9	0.1809	-6.4	
						25.5		4.6	
247	14.83		0	1.25	2x(vsc.Tee-Br)= 12	9.87	120	16.5	
009	12.5		23.9	1.38		12	0.0476	1	
						21.87		1	
								18.5	

Path No: 8

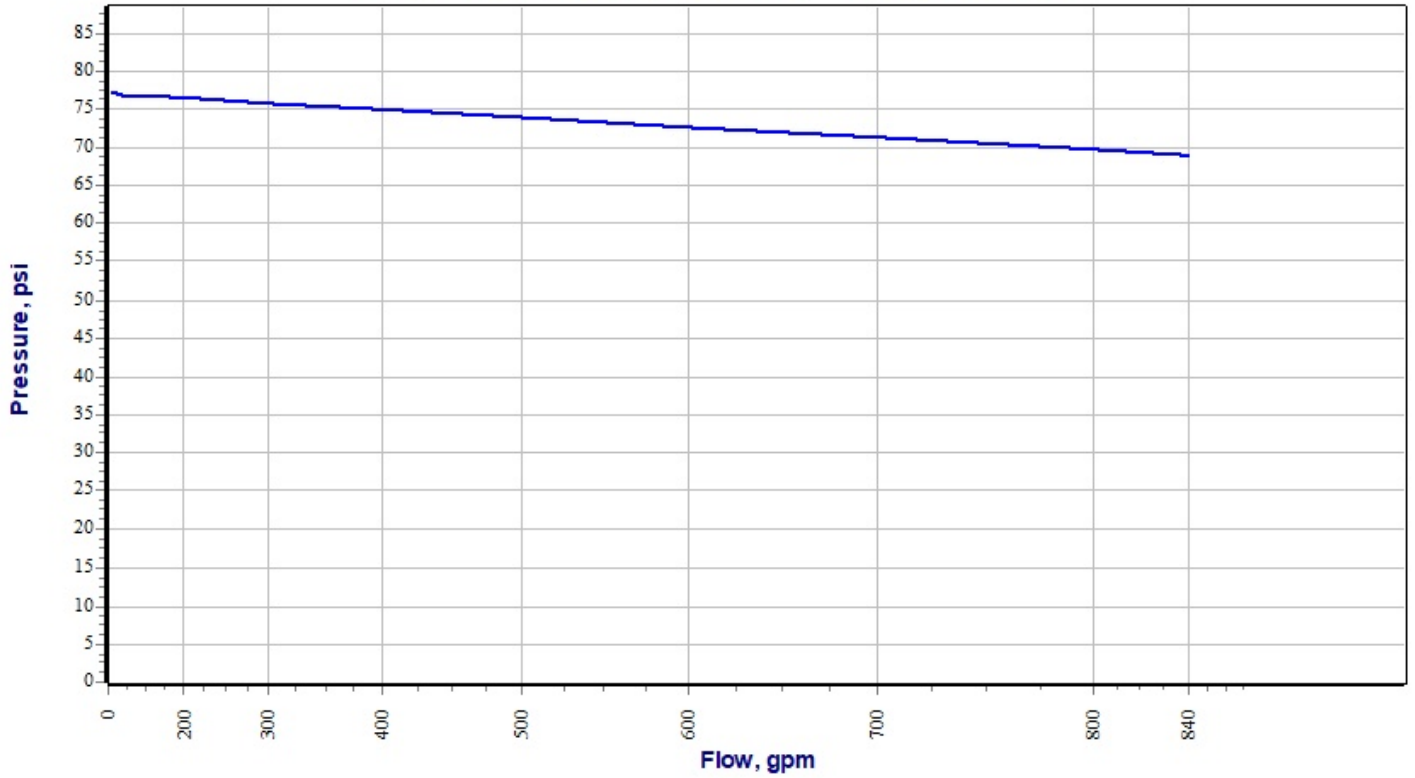
H100	-5.67		100	6	1x(UG.Tee-Br)= 51.84	1.84	140	37.1	
101	-5.67		100	6.4		51.84	0.0003	0	
						53.68		0.0	
								37.1	

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

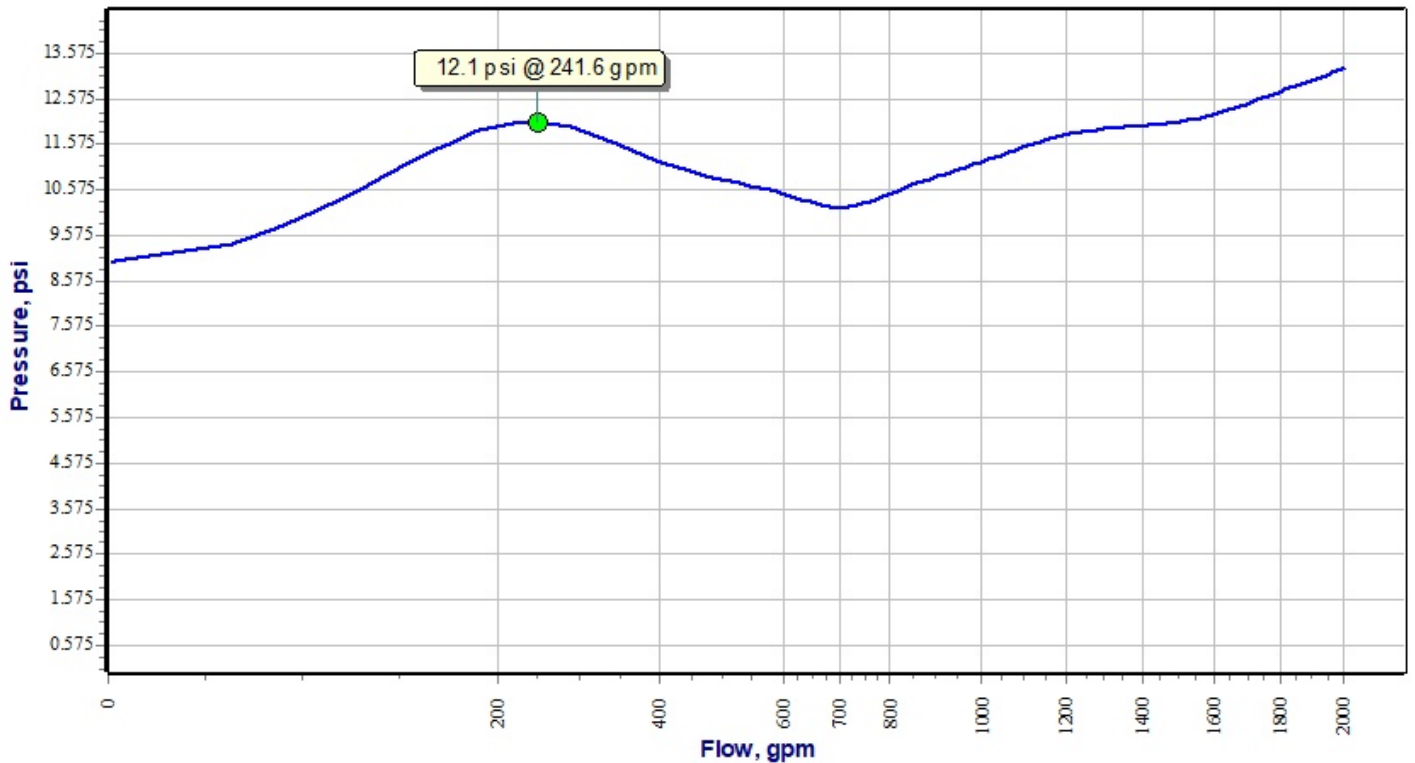
* Maximum Velocity of 14.06 ft/s occurs in the following pipe(s): (005-004)

*** 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: 1; Supply Ref.: TEST; Supply Name:TEST

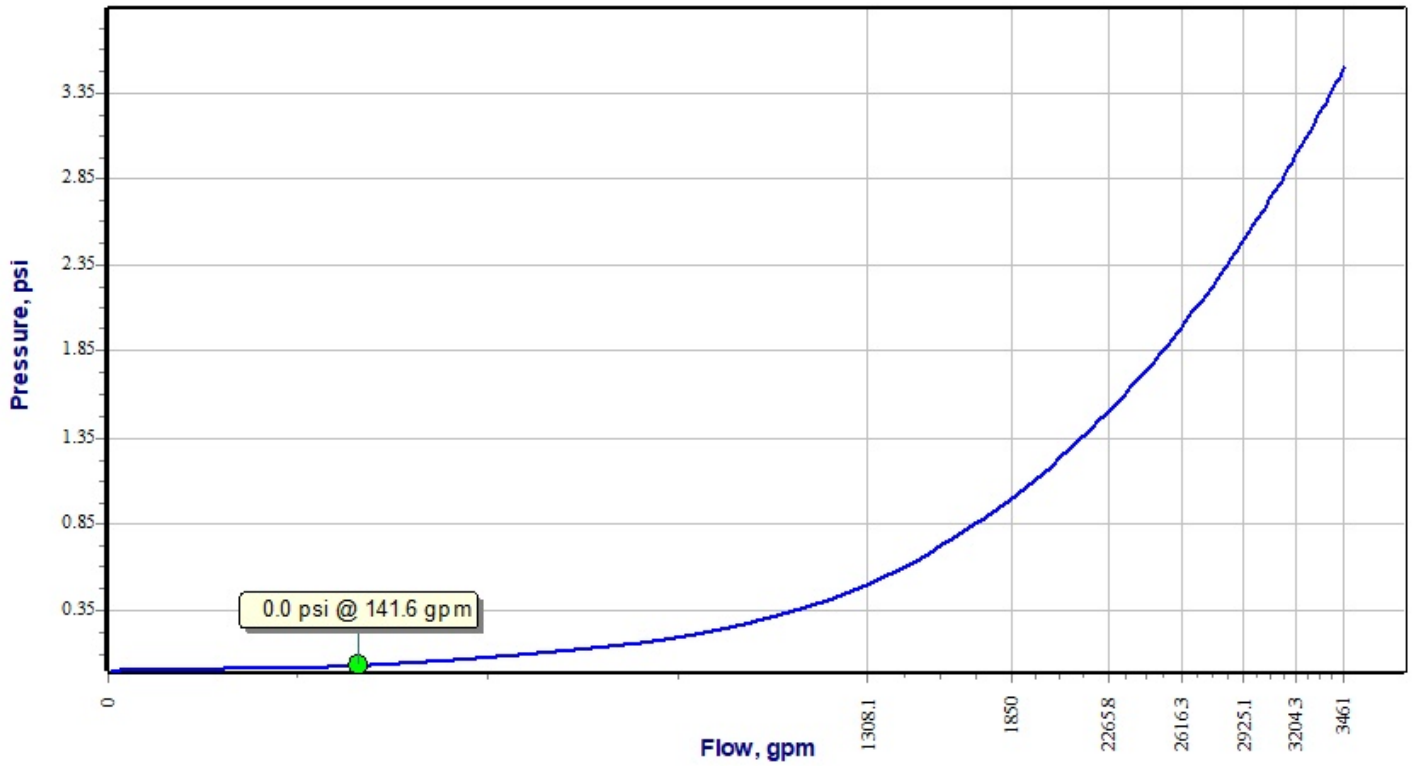


Pressure Loss Function
Design Area: 1; BFP Ref.: 406 (Watts909 RPZ, Size = 8); Inlet Node: 104-I; Outlet Node: 104-O



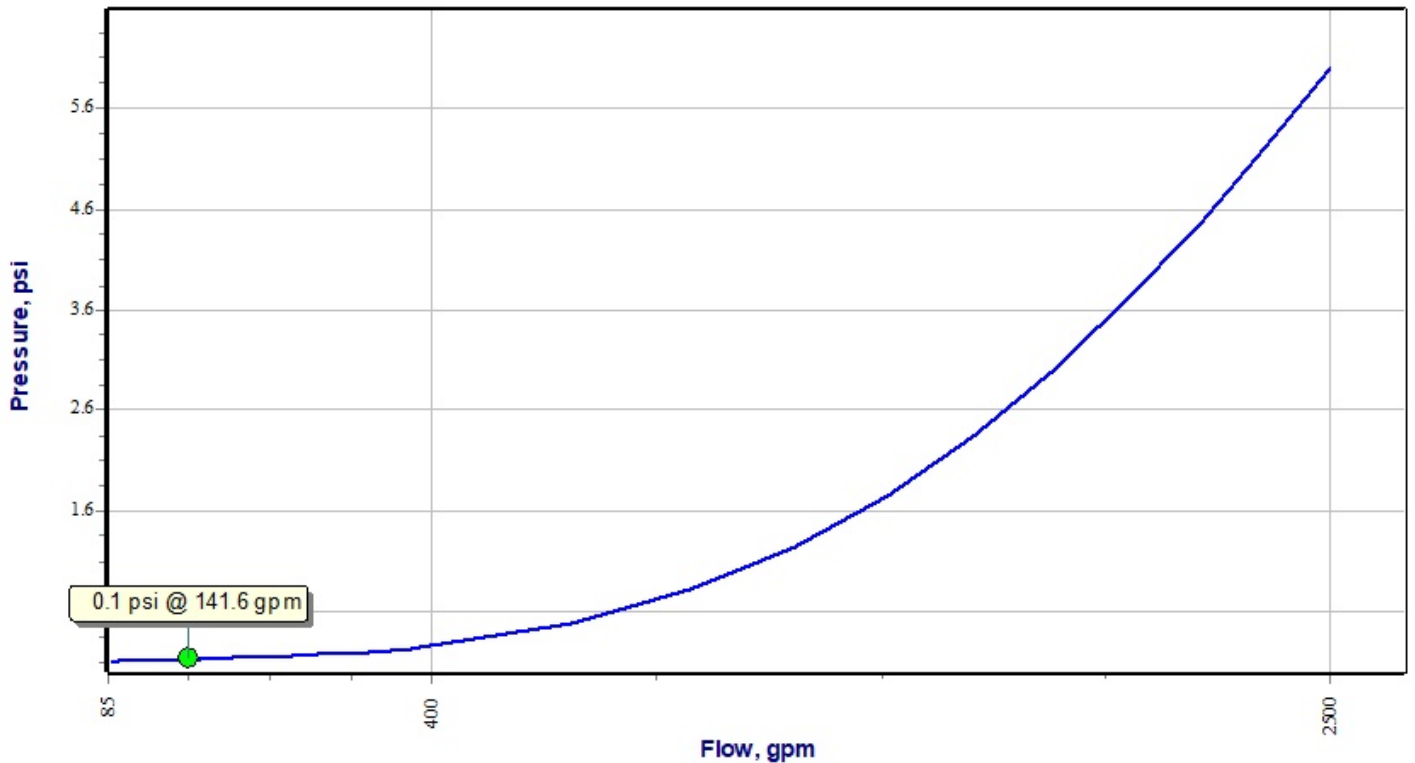
Pressure Loss Function

Design Area: 1; Valve Ref.: 401 (Vic705W Btfly, Size = 6); Inlet Node: 094-I; Outlet Node: 094-O



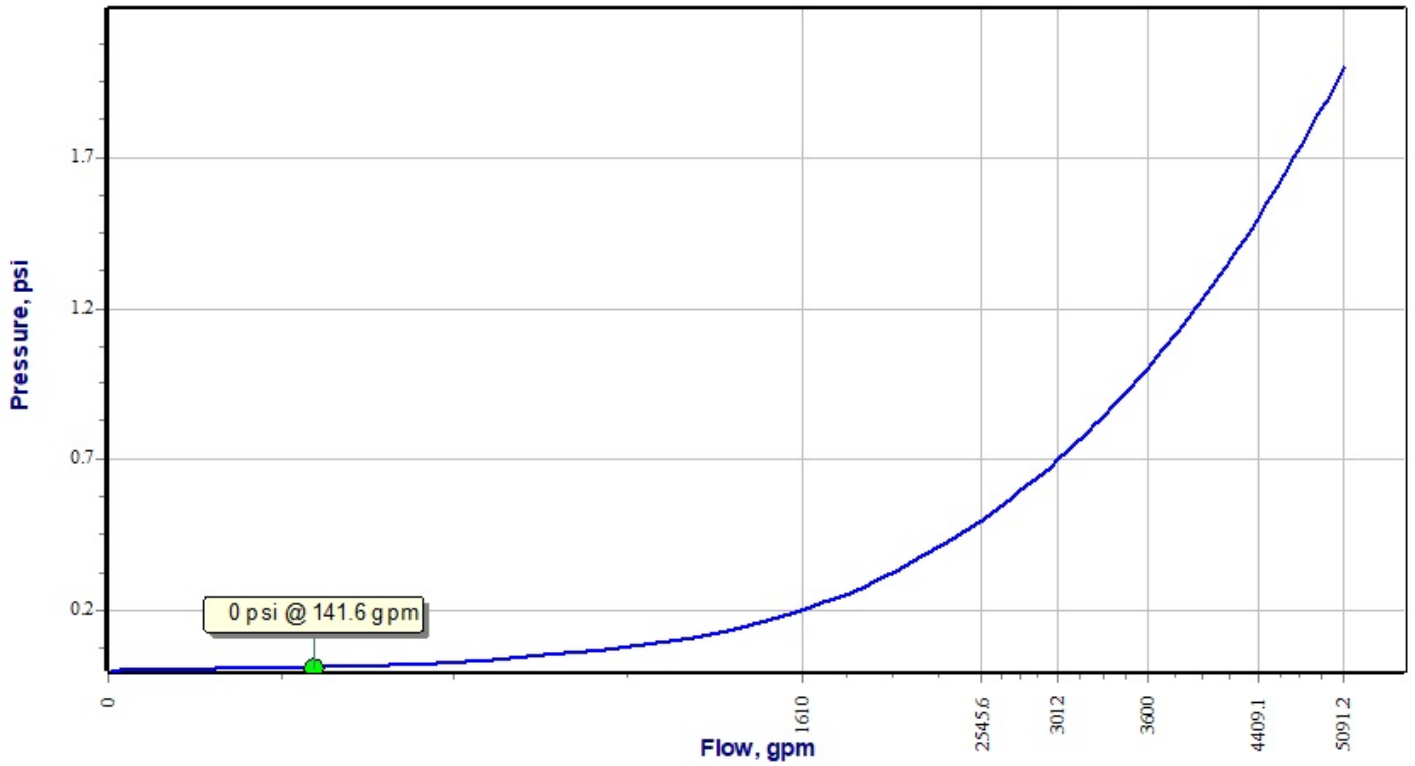
Pressure Loss Function

Design Area: 1; Valve Ref.: 402 (Vic717 Check, Size = 6); Inlet Node: 093-I; Outlet Node: 093-O



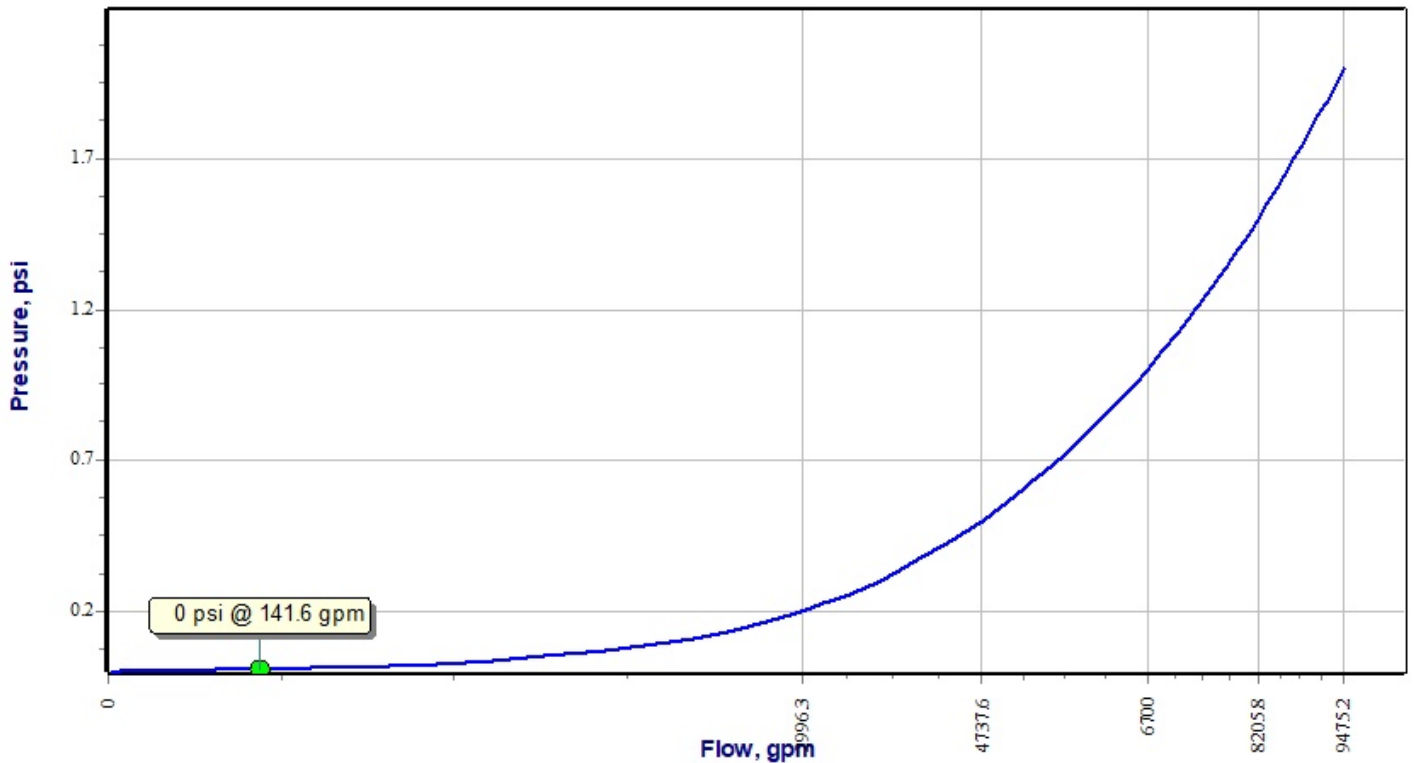
Pressure Loss Function

Design Area: 1; Valve Ref.: 403 (OS&Y Valve, Size = 6); Inlet Node: 098-I; Outlet Node: 098-O



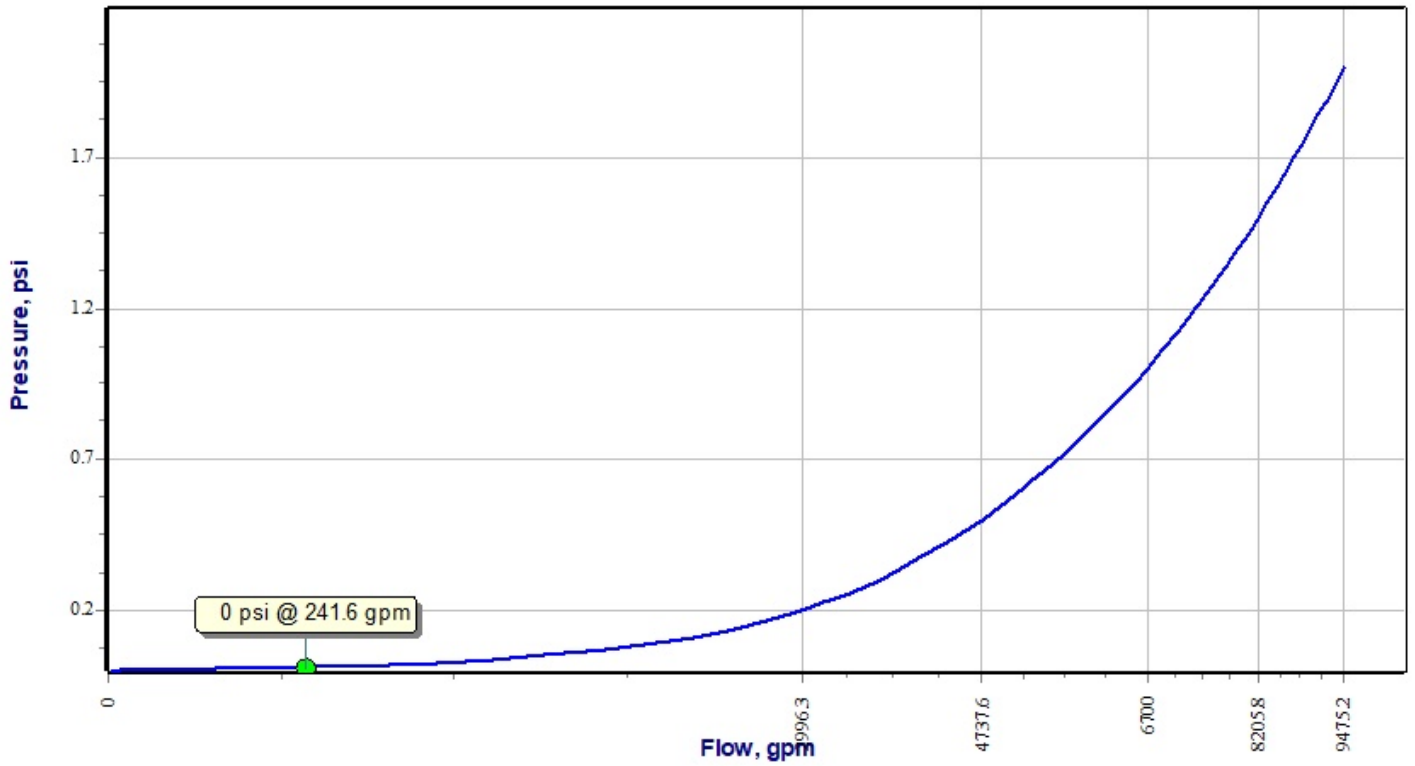
Pressure Loss Function

Design Area: 1; Valve Ref.: 404 (OS&Y Valve, Size = 8); Inlet Node: 100-I; Outlet Node: 100-O



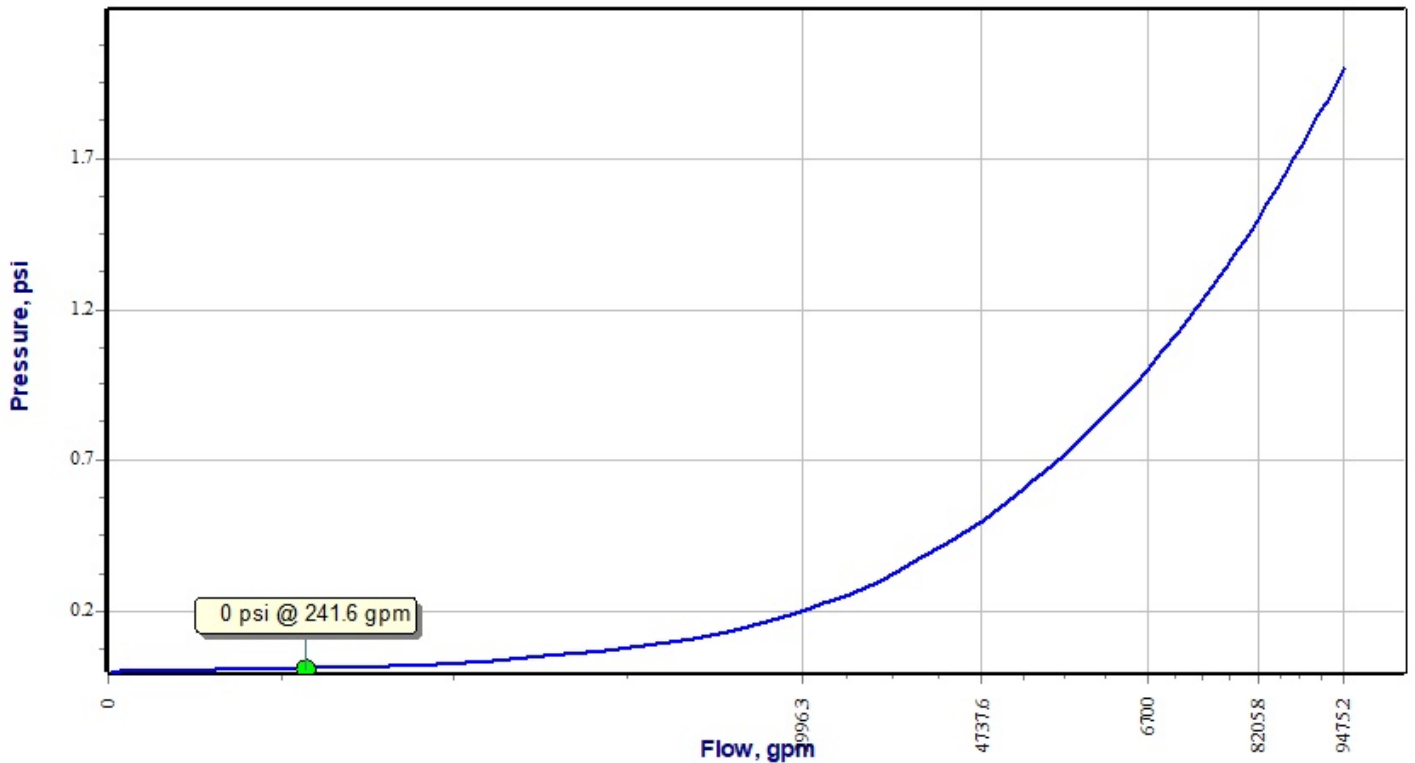
Pressure Loss Function

Design Area: 1; Valve Ref.: 405 (OS&Y Valve, Size = 8); Inlet Node: 102-I; Outlet Node: 102-O



Pressure Loss Function

Design Area: 1; Valve Ref.: 407 (OS&Y Valve, Size = 8); Inlet Node: 106-I; Outlet Node: 106-O





LKC Engineering, PLLC
 140 Aqua Shed Court
 Aberdeen, NC 28315
 PH: (910) 420-1437
 FAX: (910) 637-0096
 License #P-1095

FIRE FLOW TEST RESULTS:

Test Number 1
 Test Date & Time 12/1/2020 - 10:30
 Client _____
 Location Johnsonville Elementary School
 Performed by J Maples, Logan willams
Sam Tracy

Static Pressure	<u>77</u>	psi	Location: <u>Hwy 24 & Hwy 27 Infront of Self Storage</u>
Residual Pressure	<u>69</u>	psi	Location: _____
Nozzle inside Diameter	_____	inches	(measure nozzle used)
Pitot Tube Pressure	<u>24</u>	psi	Location: <u>Infront of School (hydrant #18,495)</u>
Discharge rate (measured)	<u>840</u>	gpm	Flow Measuring Device: <u>PollardWater Pitot Gauge</u>
Required Residual Pressure	<u>30</u>	psi	(varies - 20psi minimum)

Formula: $Q_R = Q_F \times \left(\frac{H_R}{H_F}\right)^{0.54}$

- Q(R) = Rated Capacity (in gpm) at 20 psi residual
- Q(F) = Total test flow (gpm) from at pitot pressure
- H(R) = Static Pressure - 20psi
- H(F) = Static Pressure - Residual Pressure

Q(R) =

<u>840</u>	<u>47</u>	<u>8</u>
Q(F)	H(R)	H(F)

Available Fire Flow Q(R) =	2,185	gpm at 30 psi residual
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Performed By: Jackson Maples _____ Date: 12/1/2020

Certified By: _____ Date: _____

Notes: Residual hydrant #19,590 (hydrant #'s taken from Harnett County GIS)