Hydraulic Overview

Job Number: 22-3688
Report Description: Ordinary Group I (1)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.15 gpm/ft²	Area of Application: 1500 ft² (Actual 922 ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 14.85 at 7.032	Hose Streams: 250.00
Coverage Per Sprinkler: 99 ft²	Number Of Sprinklers Calculated: 19 / Number Of Nozzles Calculated: 0
System Pressure Demand: 43.250	System Flow Demand: 313.54
Total Demand: 563.54 @ 43.250	Pressure Result: +16.323 (27.4%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	250.00	64.000	20.000

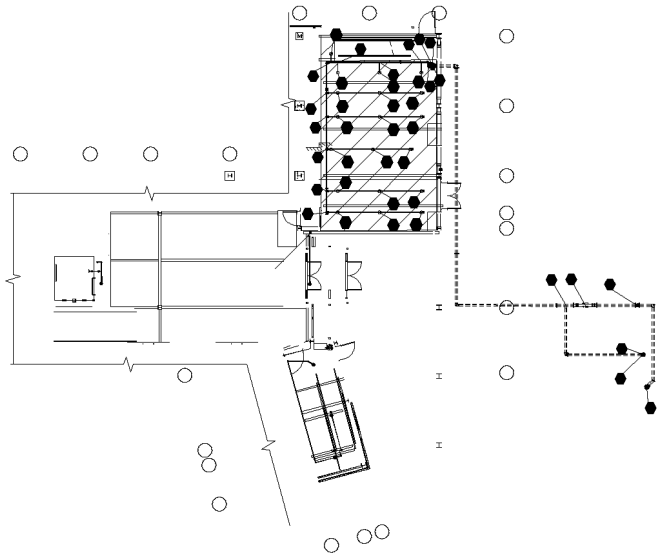
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
Signature
03/26/2024
Date
Expires 12/31/24

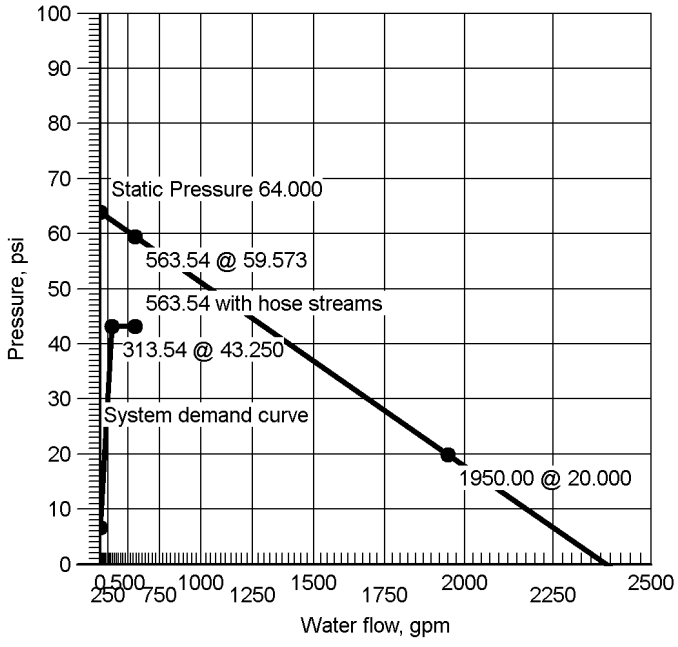
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

22-3688_PeirceSTEM-L00-Asbuilt



Water Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L00-Asbuilt

System

Most Demanding Sprinkler Data: 5.6 K-Factor 14.85 at 7.032

Hose Allowance At Source: 250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
313.54	563.54

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 18.45 between nodes 101 and 102

Maximum Velocity Under Ground	
3.19 between nodes 6 and 7	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
308.62 gal	

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group I	

Density	Area of Application
0.15 gpm/ft²	1500 ft² (Actual 922 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
19	0	99 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Right: 43.250

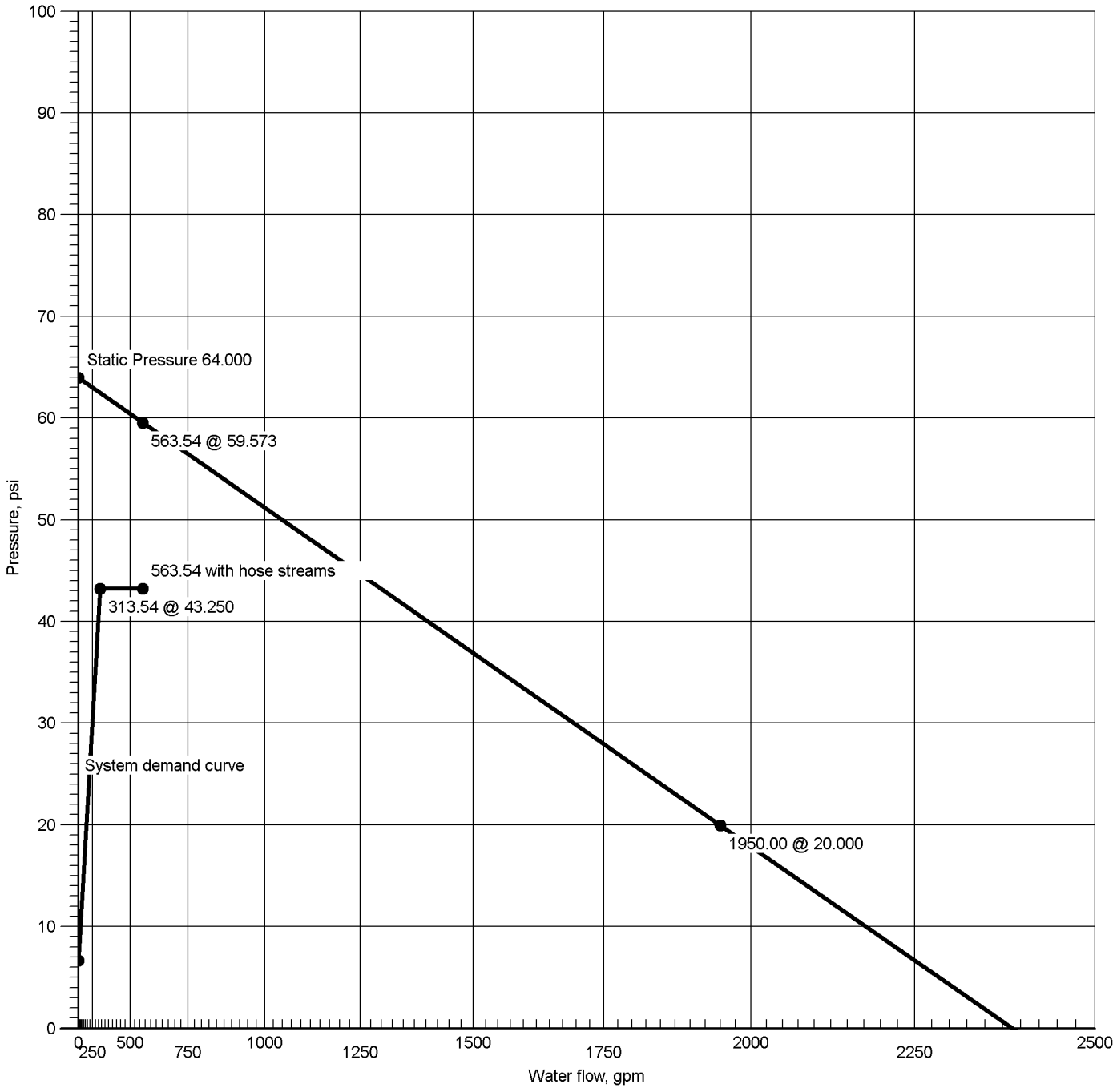
Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	250.00	64.000	20.000 @ 1950.00	59.573 @ 563.54	43.250	16.323

Contractor

	Contractor Number: 01	Contact Name: Ben Bernard	Contact Title: Engineer/PM
Name of Contractor: SHINN FIRE PROTECTION		Phone: 425-204-3945	Extension:
Address 1: 18802 80TH AVE S		FAX:	
Address 2: KENT WA98032		E-mail:	
Address 3:		Web-Site:	

Water Supply at Node 1



Hydraulic Graph
Water Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
59.573 @ 563.54

Required Pressure at System Demand
43.250 @ 313.54

Required Pressure at System Demand (Including Hose Allowance at Source)
43.250 @ 563.54

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Ordinary Group I (1)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	1000	22.33	14.85	5.6	15.895			
Sprinkler	1001	21.11	14.85	5.6	14.208			
Sprinkler	1002	15.73	14.85	5.6	7.886			
Sprinkler	1003	15.82	14.85	5.6	7.979			
Sprinkler	1004	15.35	14.85	5.6	7.512			
Sprinkler	1005	15.44	14.85	5.6	7.602			
Sprinkler	1006	15.14	14.85	5.6	7.312			
Sprinkler	1007	19.79	14.85	5.6	12.483			
Sprinkler	1008	15.23	14.85	5.6	7.393			
Sprinkler	1009	20.01	14.85	5.6	12.771			
Sprinkler	1010	16.15	14.85	5.6	8.316			
Sprinkler	1011	14.87	14.85	5.6	7.051			
Sprinkler	1012	14.96	14.85	5.6	7.135			
Sprinkler	1013	15.76	14.85	5.6	7.924			
Sprinkler	**1014**	**14.85**	**14.85**	**5.6**	**7.032**			
Sprinkler	1015	14.94	14.85	5.6	7.115			
Sprinkler	1016	15.55	14.85	5.6	7.711			
Sprinkler	1017	15.27	14.85	5.6	7.439			
Sprinkler	1018	15.25	14.85	5.6	7.416			

⇨ Most Demanding Sprinkler Data

Node Analysis

Job Number: 22-3688
Report Description: Ordinary Group I (1)

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	-15'-0	S	43.250	313.54	
1000	0'-5	Spr(-15.895)	15.895	22.33	
1001	0'-5	Spr(-14.208)	14.208	21.11	
1002	0'-4½	Spr(-7.886)	7.886	15.73	
1003	0'-4½	Spr(-7.979)	7.979	15.82	
1004	0'-4	Spr(-7.512)	7.512	15.35	
1005	0'-4	Spr(-7.602)	7.602	15.44	
1006	0'-4	Spr(-7.312)	7.312	15.14	
1007	0'-2½	Spr(-12.483)	12.483	19.79	
1008	0'-4	Spr(-7.393)	7.393	15.23	
1009	0'-4½	Spr(-12.771)	12.771	20.01	
1010	0'-4½	Spr(-8.316)	8.316	16.15	
1011	0'-3½	Spr(-7.051)	7.051	14.87	
1012	0'-3½	Spr(-7.135)	7.135	14.96	
1013	0'-4	Spr(-7.924)	7.924	15.76	
1014	0'-3½	Spr(-7.032)	7.032	14.85	
1015	0'-3½	Spr(-7.115)	7.115	14.94	
1016	0'-4	Spr(-7.711)	7.711	15.55	
1017	0'-3½	Spr(-7.439)	7.439	15.27	
1018	0'-3½	Spr(-7.416)	7.416	15.25	
2	-15'-0	PIV(-2.000)	43.110		
3	-15'-0	BFP(-1.275)	41.082		
6	-15'-0	PO(20'-0)	39.797		
7	-8'-9½		36.721		
8	-8'-2	St(-0.221)	36.450		
100	-7'-0	PO(20'-2)	35.723		
101	-4'-9½		25.221		
102	-1'-5	PO(5'-0)	18.459		
103	-1'-4	PO(5'-0)	16.554		
104	-1'-3	PO(5'-0)	14.898		
105	-1'-3	PO(5'-0)	14.669		
106	-0'-3	PO(8'-0)	9.750		
107	-0'-3½	PO(8'-0)	9.306		
108	-0'-3½	PO(8'-0)	8.959		
109	-0'-4	PO(8'-0)	8.757		
110	-0'-4	PO(8'-0)	8.733		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
BL	1.6100	14.85	2.34	120		0.009313	9'-0	Pf 0.084
1014	0'-3½	14.85	5.6	7.032		Sprinkler		Pe -0.001
1015	0'-3½			7.115			9'-0	Pv
BL	1.6100	29.79	4.69	120		0.033757	8'-11½	Pf 0.303
1015	0'-3½	14.94	5.6	7.115		Sprinkler		Pe -0.001
1018	0'-3½			7.416			8'-11½	Pv
BL	1.6100	45.04	7.10	120		0.072531	2'-5	Pf 1.046
1018	0'-3½	15.25	5.6	7.416		Sprinkler,	12'-0	Pe 0.271
110	-0'-4			8.733		E(4'-0), PO(8'-0)	14'-5	Pv
FR	2.6350	45.04	2.65	120		0.006585	4'-6½	Pf 0.030
110	-0'-4			8.733				Pe -0.006
109	-0'-4			8.757			4'-6½	Pv
FR	2.6350	90.14	5.30	120		0.023771	9'-0	Pf 0.214
109	-0'-4	45.10		8.757		Flow (q) from Route 2		Pe -0.012
108	-0'-3½			8.959			9'-0	Pv
FR	2.6350	136.06	8.00	120		0.050915	7'-0	Pf 0.356
108	-0'-3½	45.92		8.959		Flow (q) from Route 3		Pe -0.009
107	-0'-3½			9.306			7'-0	Pv
FR	2.6350	182.61	10.74	120		0.087757	5'-1½	Pf 0.450
107	-0'-3½	46.55		9.306		Flow (q) from Route 4		Pe -0.007
106	-0'-3			9.750			5'-1½	Pv
FR	2.6350	230.31	13.55	120		0.134808	8'-7½	Pf 4.491
106	-0'-3	47.69		9.750		Flow (q) from Route 5	24'-8½	Pe 0.428
105	-1'-3			14.669		3E(8'-3)	33'-4	Pv
FR	2.6350	250.09	14.71	120		0.157012	1'-5	Pf 0.224
105	-1'-3	19.79		14.669		Flow (q) from Route 6		Pe 0.005
104	-1'-3			14.898			1'-5	Pv
FR	2.6350	270.10	15.89	120		0.181042	8'-11½	Pf 1.625
104	-1'-3	20.01		14.898		Flow (q) from Route 7		Pe 0.031
103	-1'-4			16.554			8'-11½	Pv
FR	2.6350	291.21	17.13	120		0.208083	9'-0	Pf 1.874
103	-1'-4	21.11		16.554		Flow (q) from Route 8		Pe 0.031
102	-1'-5			18.459			9'-0	Pv
FR	2.6350	313.54	18.45	120		0.238554	5'-8½	Pf 5.294
102	-1'-5	22.33		18.459		Flow (q) from Route 9	16'-5½	Pe 1.468
101	-4'-9½			25.221		2E(8'-3)	22'-2½	Pv
CM	3.2600	313.54	12.05	120		0.084610	40'-7	Pf 9.538
101	-4'-9½			25.221			36'-8½	Pe 0.964
100	-7'-0			35.723		f(-3.000), sCV(7'-1½), E(9'-5), PO(20'-2)	77'-3½	Pv
CM	6.3570	313.54	3.17	120		0.003273	1'-2	Pf 0.224
100	-7'-0			35.723				Pe 0.503
8	-8'-2			36.450		St(-0.221)	1'-2	Pv
DY	6.3400	313.54	3.19	140		0.002493	0'-0	Pf 0.000
8	-8'-2			36.450				Pe 0.271
7	-8'-9½			36.721			0'-0	Pv
UG	6.3400	313.54	3.19	140		0.002493	86'-3½	Pf 0.388
7	-8'-9½			36.721			69'-4	Pe 2.688
6	-15'-0			39.797		3E(23'-1½)	155'-7½	Pv
UG	6.3400	313.54	3.19	140		0.002493	4'-1½	Pf 1.285
6	-15'-0			39.797				Pe
3	-15'-0			41.082		BFP(-1.275)	4'-1½	Pv
UG	6.3400	313.54	3.19	140		0.002493	11'-2½	Pf 2.028
3	-15'-0			41.082				Pe
2	-15'-0			43.110		PIV(-2.000)	11'-2½	Pv
UG	6.3400	313.54	3.19	140		0.002493	21'-7	Pf 0.140
2	-15'-0			43.110			34'-8	Pe
1	-15'-0			43.250		E(23'-1½), EE(11'-6½), S	56'-3	Pv
		250.00				Hose Allowance At Source		
1		563.54						
• • • • • Route 2 • • • • •								
BL	1.6100	14.87	2.34	120		0.009337	9'-0	Pf 0.084
1011	0'-3½	14.87	5.6	7.051		Sprinkler		Pe 0.000
1012	0'-3½			7.135			9'-0	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.6100	29.83	4.70	120		0.033844	8'-11½	Pf 0.304
1012	0'-3½	14.96	5.6	7.135		Sprinkler		Pe 0.000
1017	0'-3½			7.439			8'-11½	Pv
BL	1.6100	45.10	7.11	120		0.072725	2'-5	Pf 1.048
1017	0'-3½	15.27	5.6	7.439		Sprinkler,	12'-0	Pe 0.270
109	-0'-4			8.757		E(4'-0), PO(8'-0)	14'-5	Pv
• • • • • Route 3 • • • • •								
BL	1.6100	15.14	2.39	120		0.009656	8'-0	Pf 0.077
1006	0'-4	15.14	5.6	7.312		Sprinkler		Pe 0.004
1008	0'-4			7.393			8'-0	Pv
BL	1.6100	30.37	4.79	120		0.034987	8'-11½	Pf 0.314
1008	0'-4	15.23	5.6	7.393		Sprinkler		Pe 0.004
1016	0'-4			7.711			8'-11½	Pv
BL	1.6100	45.92	7.24	120		0.075180	1'-0	Pf 0.977
1016	0'-4	15.55	5.6	7.711		Sprinkler,	12'-0	Pe 0.271
108	-0'-3½			8.959		E(4'-0), PO(8'-0)	13'-0	Pv
• • • • • Route 4 • • • • •								
BL	1.6100	15.35	2.42	120		0.009900	9'-0	Pf 0.089
1004	0'-4	15.35	5.6	7.512		Sprinkler		Pe 0.000
1005	0'-4			7.602			9'-0	Pv
BL	1.6100	30.79	4.85	120		0.035887	8'-11½	Pf 0.322
1005	0'-4	15.44	5.6	7.602		Sprinkler		Pe 0.000
1013	0'-4			7.924			8'-11½	Pv
BL	1.6100	46.55	7.34	120		0.077109	2'-5	Pf 1.112
1013	0'-4	15.76	5.6	7.924		Sprinkler,	12'-0	Pe 0.271
107	-0'-3½			9.306		E(4'-0), PO(8'-0)	14'-5	Pv
• • • • • Route 5 • • • • •								
BL	1.6100	15.73	2.48	120		0.010355	9'-0	Pf 0.093
1002	0'-4½	15.73	5.6	7.886		Sprinkler		Pe 0.000
1003	0'-4½			7.979			9'-0	Pv
BL	1.6100	31.54	4.97	120		0.037534	8'-11½	Pf 0.337
1003	0'-4½	15.82	5.6	7.979		Sprinkler		Pe 0.000
1010	0'-4½			8.316			8'-11½	Pv
BL	1.6100	47.69	7.52	120		0.080642	2'-5	Pf 1.163
1010	0'-4½	16.15	5.6	8.316		Sprinkler,	12'-0	Pe 0.271
106	-0'-3			9.750		E(4'-0), PO(8'-0)	14'-5	Pv
• • • • • Route 6 • • • • •								
SP	1.0490	19.79	7.34	120		0.127557	3'-2½	Pf 1.560
1007	0'-2½	19.79	5.6	12.483		Sprinkler,	9'-0	Pe 0.627
105	-1'-3			14.669		2E(2'-0), PO(5'-0)	12'-2½	Pv
• • • • • Route 7 • • • • •								
FR	1.0490	20.01	7.43	120		0.130278	3'-10½	Pf 1.417
1009	0'-4½	20.01	5.6	12.771		Sprinkler,	7'-0	Pe 0.710
104	-1'-3			14.898		E(2'-0), PO(5'-0)	10'-10½	Pv
• • • • • Route 8 • • • • •								
FR	1.0490	21.11	7.84	120		0.143787	4'-0	Pf 1.582
1001	0'-5	21.11	5.6	14.208		Sprinkler,	7'-0	Pe 0.764
103	-1'-4			16.554		E(2'-0), PO(5'-0)	11'-0	Pv
• • • • • Route 9 • • • • •								
FR	1.0490	22.33	8.29	120		0.159511	4'-1	Pf 1.767
1000	0'-5	22.33	5.6	15.895		Sprinkler,	7'-0	Pe 0.797
102	-1'-5			18.459		E(2'-0), PO(5'-0)	11'-1	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: Ordinary Group II (2)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.20 gpm/ft²	Area of Application: 1500 ft² (Actual 1032 ft²)
Most Demanding Sprinkler Data: 5.63 K-Factor 26.00 at 21.336	Hose Streams: 250.00
Coverage Per Sprinkler: 100 ft²	Number Of Sprinklers Calculated: 15 / Number Of Nozzles Calculated: 0
System Pressure Demand: 48.659	System Flow Demand: 382.76
Total Demand: 632.76 @ 48.659	Pressure Result: +10.708 (18.0%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	250.00	64.000	20.000

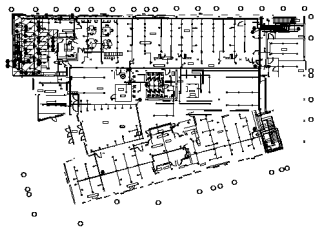
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

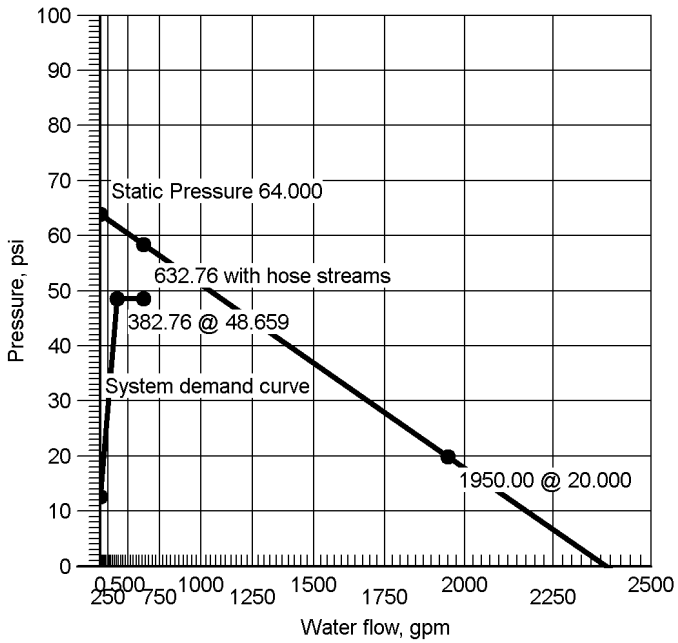
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
03/26/2024
Signature Date
Expires 12/31/24

22-3688_PeirceSTEM-L01-Asbuilt



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L01-Asbuilt

System

Most Demanding Sprinkler Data: 5.63 K-Factor 26.00 at 21.336	
Hose Allowance At Source: 250.00	
Additional Hose Supplies: Node / Flow(gpm)	
Total Hose Streams: 250.00	
System Flow Demand: 382.76	Total Water Required (Including Hose Allowance): 632.76
Maximum Pressure Unbalance In Loops: 0.000	
Maximum Velocity Above Ground: 10.91 between nodes 209 and 208	
Maximum Velocity Under Ground: 3.89 between nodes 6 and 7	Volume capacity of Antifreeze/Other Pipes: 27.88 gal
Volume capacity of Wet Pipes: 1916.30 gal	Volume capacity of Dry Pipes:

Remote Area(s)

Occupancy: Ordinary Group II		Job Suffix:
Density: 0.20 gpm/ft²		Area of Application: 1500 ft² (Actual 1032 ft²)
Number Of Sprinklers Calculated: 15	Number Of Nozzles Calculated: 0	Coverage Per Sprinkler: 100 ft²
AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area		

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	250.00	64.000	20.000 @ 1950.00	59.367 @ 632.76	48.659	10.708

Darcy-Weisbach Calculation

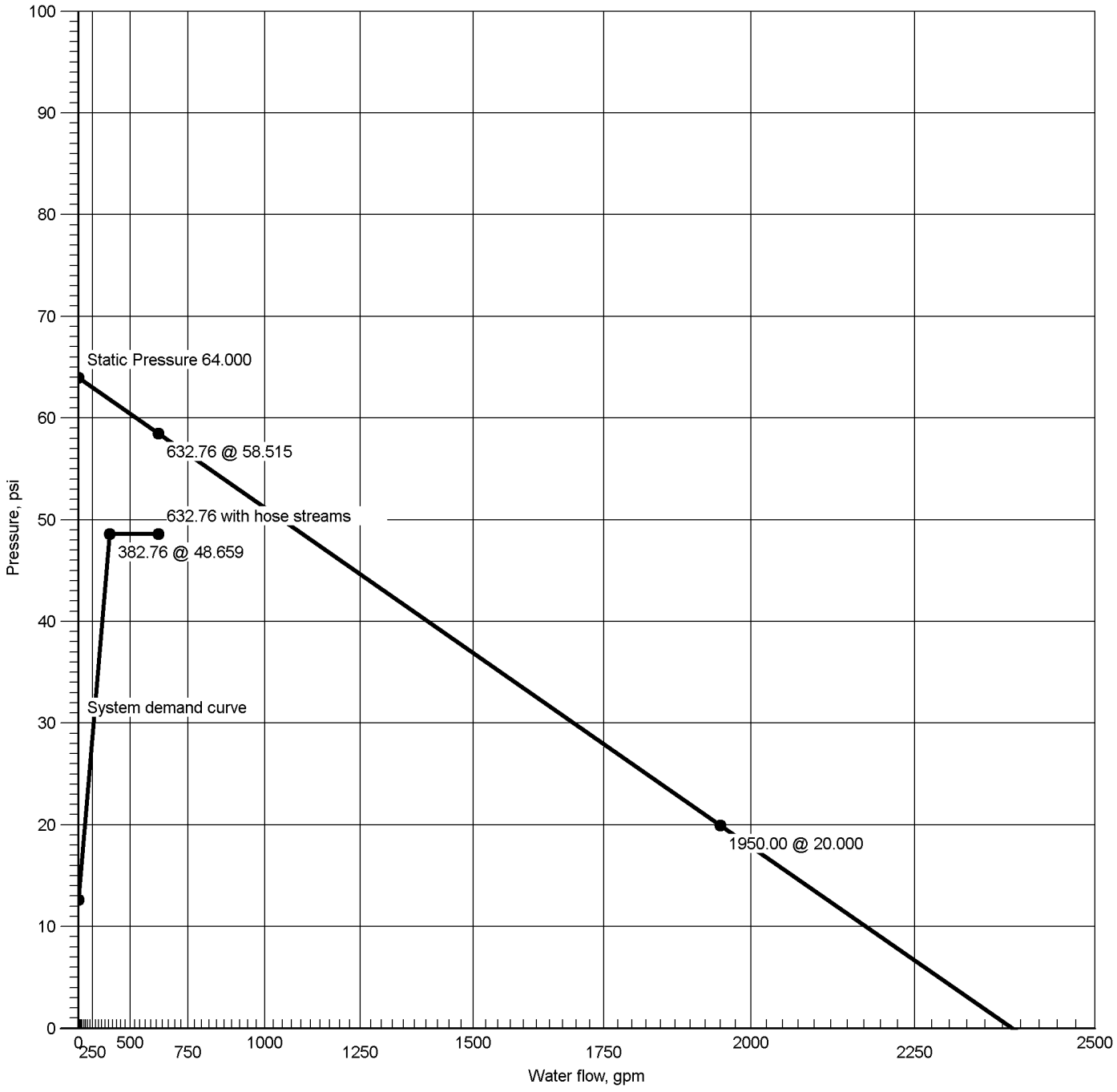
Darcy-Weisbach equations are being used because the system requires special design considerations. The Darcy-Weisbach formula used in this hydraulic calculation to determine fluid/agent friction loss is: P = 0.000216 fLp(Q^2)/(d^5)
Friction Loss factors are derived from the Moody Diagram.
Reynolds Number is calculated using: Re=Q/d/k
Relative Roughness of Pipe is: e/D
K-Factors for Sprinkler Heads are adjusted based on the density of the fluid being discharged (Bernoulli-based formula).
C-Factors are not relevant to this type of calculation. These are replaced with the Roughness e-value for the pipe.

Description: Water/Antifreeze @ 20°F/-7°C, 10% Glycerine (C.P. or U.S.P. 96.5%) by weight
Product Name:
Antifreeze solution in pipes within or passing through:
Cold Areas: Density: 69.000 lb/ft³ Viscosity: 25.000 cP
Warm Areas: Density: 63.808 lb/ft³ Viscosity: 1.310 cP
NFPA Suggested Aged Pipe Roughness is being applied.

Contractor

Contractor Number: 01		Contact Name: Ben Bernard	Contact Title: Engineer/PM
Name of Contractor: SHINN FIRE PROTECTION		Phone: 425-204-3945	Extension:
Address 1: 18802 80TH AVE S		FAX:	
Address 2: KENT WA98032		E-mail:	
Address 3:		Web-Site:	

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
59.367 @ 632.76

Required Pressure at System Demand
48.659 @ 382.76

Required Pressure at System Demand (Including Hose Allowance at Source)
48.659 @ 632.76

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Ordinary Group II (2)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	2200	26.09	20.00	5.63	21.484			
Sprinkler	2201	26.06	20.00	5.63	21.432			
Sprinkler	2202	25.38	20.00	5.63	20.337			
Sprinkler	2203	25.06	20.00	5.63	19.820			
Sprinkler	2204	24.65	20.00	5.63	19.184			
Sprinkler	2205	24.58	20.00	5.63	19.075			
Sprinkler	2206	24.56	20.00	5.63	19.039			
Sprinkler	2207	25.67	20.00	5.63	20.799			
Sprinkler	2208	25.43	20.00	5.63	20.406			
Sprinkler	2209	25.52	20.00	5.63	20.558			
Sprinkler	2210	27.10	26.00	5.63	23.187			
Sprinkler	2211	25.32	20.00	5.63	20.232			
Sprinkler	2212	25.27	20.00	5.63	20.158			
Sprinkler	2213	26.05	26.00	5.63	21.425			
Sprinkler	**2214**	**26.00**	**26.00**	**5.63**	**21.336**			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
222	112'-0	PO(5'-0)	22.307		
223	112'-0	E(2'-0)	22.419		
224	112'-0	PO(5'-0)	21.247		
225	112'-0	T(9'-11)	21.470		
226	112'-0	PO(5'-0)	21.172		
1	84'-6½	S	48.659	382.76	
2200	113'-9½	Spr(-21.484)	21.484	26.09	
2201	113'-9½	Spr(-21.432)	21.432	26.06	
2202	113'-9½	Spr(-20.337)	20.337	25.38	
2203	113'-9½	Spr(-19.820)	19.820	25.06	
2204	113'-9½	Spr(-19.184)	19.184	24.65	
2205	113'-9	Spr(-19.075)	19.075	24.58	
2206	113'-9	Spr(-19.039)	19.039	24.56	
2207	113'-9½	Spr(-20.799)	20.799	25.67	
2208	113'-9½	Spr(-20.406)	20.406	25.43	
2209	113'-9½	Spr(-20.558)	20.558	25.52	
2210	108'-7½	Spr(-23.187), fd	23.187	27.10	
2211	113'-9½	Spr(-20.232)	20.232	25.32	
2212	113'-9½	Spr(-20.158)	20.158	25.27	
2213	108'-7½	Spr(-21.425), fd	21.425	26.05	
2214	108'-7½	Spr(-21.336), fd	21.336	26.00	
2	84'-6½	PIV(-2.000)	48.446		
3	84'-6½	BFP(-1.831)	46.403		
6	84'-6½	PO(20'-0)	44.556		
7	90'-9		41.278		
8	91'-4½	St(-0.378)	41.008		
9	102'-6½	PO(20'-2)	35.604		
200	111'-5	PO(20'-2)	25.161		
201	112'-5½		24.671		
202	113'-2	E(8'-3)	23.977		
203	111'-5	PO(16'-5½)	24.563		
204	112'-2	PO(12'-3½)	24.660		
205	112'-0	PO(12'-3½)	24.176		
206	112'-0	PO(5'-0)	23.708		
207	112'-0	PO(5'-0)	23.666		
208	112'-0	PO(5'-0)	22.485		
209	112'-0	PO(12'-3½)	24.148		
210	112'-0	PO(5'-0)	21.934		
211	112'-0	PO(5'-0)	21.269		
212	112'-0	PO(5'-0)	21.127		
213	112'-0	PO(5'-0)	21.088		
214	112'-0	PO(5'-0)	23.337		
215	112'-0	PO(20'-2)	24.138		
216	112'-0		23.198		
217	112'-0	PO(5'-0)	22.977		
218	112'-0	PO(9'-11)	22.676		
219	112'-0	PO(5'-0)	22.558		
220	112'-0	PO(5'-0)	22.373		
221	112'-0	PO(9'-11)	22.317		

Hydraulic Overview

Job Number: 22-3688
Report Description: Light Hazard (3)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.10 gpm/ft²	Area of Application: 1500 ft² (Actual 1099 ft²)
Most Demanding Sprinkler Data: 5.63 K-Factor 14.89 at 7.000	Hose Streams: 100.00
Coverage Per Sprinkler: 100 ft²	Number Of Sprinklers Calculated: 22 / Number Of Nozzles Calculated: 0
System Pressure Demand: 49.807	System Flow Demand: 394.50
Total Demand: 494.50 @ 49.807	Pressure Result: +11.364 (18.6%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	100.00	64.000	20.000

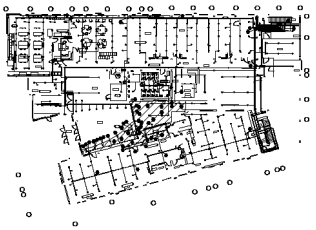
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

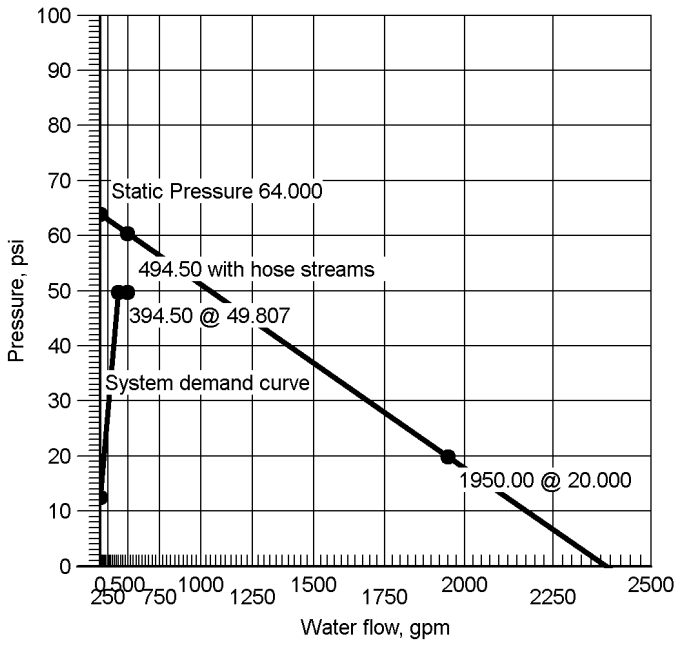
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
Signature 03/26/2024 Date
Expires 12/31/24

22-3688_PeirceSTEM-L01-Asbuilt



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job Number: 22-3688
Report Description: Light Hazard (3)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L01-Asbuilt

System

Most Demanding Sprinkler Data: 5.63 K-Factor 14.89 at 7.000	
Hose Allowance At Source: 100.00	
Additional Hose Supplies: Node / Flow(gpm)	
Total Hose Streams: 100.00	
System Flow Demand: 394.50	Total Water Required (Including Hose Allowance): 494.50
Maximum Pressure Unbalance In Loops: 0.000	
Maximum Velocity Above Ground: 12.86 between nodes 317 and 318	
Maximum Velocity Under Ground: 4.01 between nodes 6 and 7	Volume capacity of Antifreeze/Other Pipes: 27.88 gal
Volume capacity of Wet Pipes: 1916.30 gal	Volume capacity of Dry Pipes:

Remote Area(s)

Occupancy: Light Hazard		Job Suffix:
Density: 0.10 gpm/ft²		Area of Application: 1500 ft² (Actual 1099 ft²)
Number Of Sprinklers Calculated: 22	Number Of Nozzles Calculated: 0	Coverage Per Sprinkler: 100 ft²
AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area		

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	100.00	64.000	20.000 @ 1950.00	61.170 @ 494.50	49.807	11.364

Darcy-Weisbach Calculation

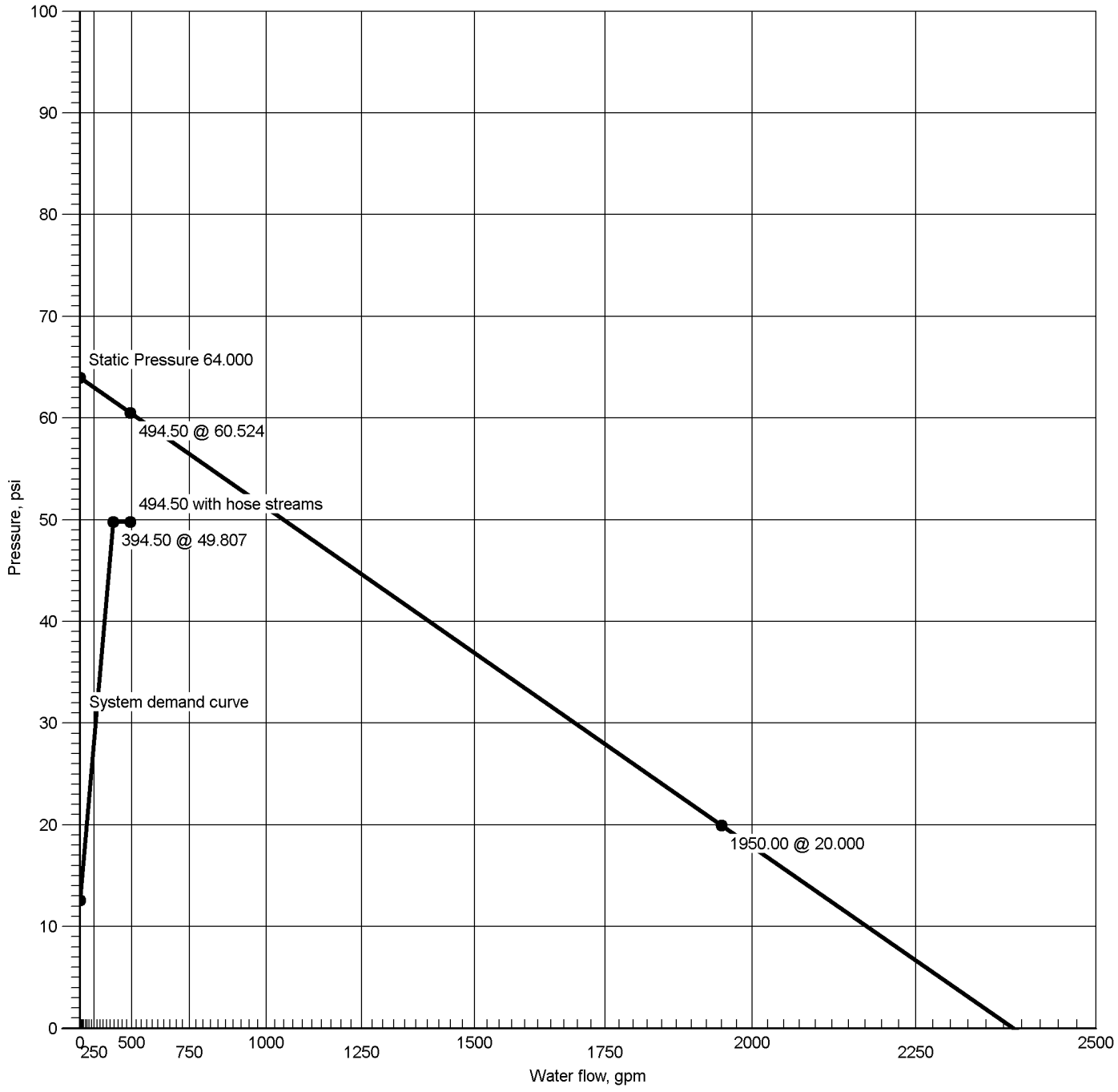
Darcy-Weisbach equations are being used because the system requires special design considerations. The Darcy-Weisbach formula used in this hydraulic calculation to determine fluid/agent friction loss is: P = 0.000216 fLp(Q^2)/(d^5)
Friction Loss factors are derived from the Moody Diagram.
Reynolds Number is calculated using: Re=Q/d/k
Relative Roughness of Pipe is: e/D
K-Factors for Sprinkler Heads are adjusted based on the density of the fluid being discharged (Bernoulli-based formula).
C-Factors are not relevant to this type of calculation. These are replaced with the Roughness e-value for the pipe.

Description: Water/Antifreeze @ 20°F/-7°C, 10% Glycerine (C.P. or U.S.P. 96.5%) by weight
Product Name:
Antifreeze solution in pipes within or passing through:
Cold Areas: Density: 69.000 lb/ft³ Viscosity: 25.000 cP
Warm Areas: Density: 63.808 lb/ft³ Viscosity: 1.310 cP
NFPA Suggested Aged Pipe Roughness is being applied.

Contractor

Contractor Number: 01		Contact Name: Ben Bernard	Contact Title: Engineer/PM
Name of Contractor: SHINN FIRE PROTECTION		Phone: 425-204-3945	Extension:
Address 1: 18802 80TH AVE S		FAX:	
Address 2: KENT WA98032		E-mail:	
Address 3:		Web-Site:	

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
61.170 @ 494.50

Required Pressure at System Demand
49.807 @ 394.50

Required Pressure at System Demand (Including Hose Allowance at Source)
49.807 @ 494.50

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Light Hazard (3)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	3200	27.52	14.89	5.63	23.905			
Sprinkler	3201	19.47	14.89	5.63	11.965			
Sprinkler	3202	19.24	14.89	5.63	11.681			
Sprinkler	3203	19.39	14.89	5.63	11.869			
Sprinkler	3204	19.14	14.89	5.63	11.563			
Sprinkler	3205	18.62	14.89	5.63	10.937			
Sprinkler	3206	16.40	14.89	5.63	8.492			
Sprinkler	3207	18.32	14.89	5.63	10.598			
Sprinkler	3208	18.06	14.89	5.63	10.293			
Sprinkler	3209	17.69	14.89	5.63	9.880			
Sprinkler	3210	17.71	14.89	5.63	9.897			
Sprinkler	3211	17.56	14.89	5.63	9.728			
Sprinkler	3212	16.71	14.89	5.63	8.817			
Sprinkler	3213	15.65	14.89	5.63	7.728			
Sprinkler	3214	15.30	14.89	5.63	7.391			
Sprinkler	**3215**	**14.89**	**14.89**	**5.63**	**7.000**			
Sprinkler	3216	17.92	14.89	5.63	10.130			
Sprinkler	3217	16.71	14.89	5.63	8.817			
Sprinkler	3218	16.86	14.89	5.63	8.975			
Sprinkler	3219	16.98	14.89	5.63	9.098			
Sprinkler	3220	17.06	14.89	5.63	9.187			
Sprinkler	3221	17.30	14.89	5.63	9.442			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	84'-6½	S	49.807	394.50	
3200	113'-2½	Spr(-23.905)	23.905	27.52	
3201	113'-4½	Spr(-11.965)	11.965	19.47	
3202	113'-3½	Spr(-11.681)	11.681	19.24	
3203	113'-4½	Spr(-11.869)	11.869	19.39	
3204	113'-3½	Spr(-11.563)	11.563	19.14	
3205	109'-11½	Spr(-10.937), fd	10.937	18.62	
3206	113'-3	Spr(-8.492)	8.492	16.40	
3207	113'-6	Spr(-10.598)	10.598	18.32	
3208	113'-6	Spr(-10.293)	10.293	18.06	
3209	113'-6½	Spr(-9.880)	9.880	17.69	
3210	112'-7½	Spr(-9.897)	9.897	17.71	
3211	113'-6	Spr(-9.728)	9.728	17.56	
3212	109'-11½	Spr(-8.817), fd	8.817	16.71	
3213	112'-10	Spr(-7.728)	7.728	15.65	
3214	113'-7½	Spr(-7.391)	7.391	15.30	
3215	112'-10	Spr(-7.000)	7.000	14.89	
3216	109'-11½	Spr(-10.130), fd	10.130	17.92	
3217	113'-2	Spr(-8.817)	8.817	16.71	
3218	113'-2	Spr(-8.975)	8.975	16.86	
3219	113'-2	Spr(-9.098)	9.098	16.98	
3220	113'-2	Spr(-9.187)	9.187	17.06	
3221	113'-2	Spr(-9.442)	9.442	17.30	
2	84'-6½	PIV(-2.000)	49.581		
3	84'-6½	BFP(-1.945)	47.536		
6	84'-6½	PO(20'-0)	45.574		
7	90'-9		42.261		
8	91'-4½	St(-0.408)	41.990		
9	102'-6½	PO(20'-2)	36.545		
200	111'-5	PO(20'-2)	26.066		
201	112'-5½		22.929		
202	113'-2	E(6'-2)	13.303		
203	111'-5	PO(16'-5½)	25.852		
204	112'-2	PO(12'-3½)	12.385		
300	111'-5	PO(16'-5½)	25.917		
301	112'-9½	PO(8'-0)	25.110		
302	111'-10½	E(4'-0)	18.243		
303	113'-4½	E(4'-11½)	12.268		
304	112'-10	PO(8'-0)	12.915		
305	111'-5	PO(10'-0)	25.874		
306	112'-8½	PO(5'-0)	11.578		
307	112'-7½	PO(5'-0)	10.405		
308	112'-8½	PO(5'-0)	11.255		
309	112'-2	PO(8'-0)	13.740		
310	112'-7½	PO(5'-0)	9.987		
311	112'-8½	PO(5'-0)	10.830		
312	112'-8½	PO(5'-0)	10.657		
313	113'-2	T(5'-0)	8.378		
314	112'-10	T(5'-0)	7.781		
315	113'-2	PO(6'-0)	9.750		
316	113'-2	PO(5'-0)	9.715		
317	112'-8½	PO(5'-0)	11.083		
318	111'-11½	T(5'-0)	9.263		
319	112'-2	PO(8'-0)	12.691		
320	113'-2	PO(5'-0)	9.715		
321	113'-2	PO(5'-0)	9.726		
322	113'-2	PO(5'-0)	9.771		
323	113'-2	PO(12'-3½)	10.065		
324	113'-2	PO(5'-0)	10.031		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •							
BL	1.0490	14.89	5.53	0.004"	0.072309	5'-9½	Pf 0.781
3215	112'-10	14.89	5.63 (adj)	7.000	Sprinkler,	5'-0	Pe
314	112'-10			7.781	T(5'-0)	10'-9½	Pv
BL	1.3800	30.54	6.55	0.004"	0.070455	4'-6½	Pf 0.742
314	112'-10	15.65		7.781	Flow (q) from Route 3	6'-0	Pe -0.145
313	113'-2			8.378	2E(3'-0)	10'-6½	Pv
BL	1.3800	45.84	9.83	0.004"	0.155244	2'-10	Pf 1.372
313	113'-2	15.30		8.378	Flow (q) from Route 2	6'-0	Pe
315	113'-2			9.750	PO(6'-0)	8'-10	Pv
CM	2.1570	65.04	5.71	0.004"	0.030564	10'-10½	Pf 0.709
315	113'-2	19.20		9.750	Flow (q) from Route 6	12'-3½	Pe 0.199
312	112'-8½			10.657	2E(6'-2)	23'-2½	Pv
CM	2.1570	82.60	7.25	0.004"	0.048559	3'-6½	Pf 0.173
312	112'-8½	17.56		10.657	Flow (q) from Route 11		Pe 0.000
311	112'-8½			10.830		3'-6½	Pv
CM	2.1570	100.29	8.81	0.004"	0.070849	6'-0	Pf 0.425
311	112'-8½	17.69		10.830	Flow (q) from Route 12		Pe 0.000
308	112'-8½			11.255		6'-0	Pv
CM	2.1570	118.35	10.39	0.004"	0.097898	3'-3½	Pf 0.323
308	112'-8½	18.06		11.255	Flow (q) from Route 15		Pe 0.000
306	112'-8½			11.578		3'-3½	Pv
CM	2.1570	136.67	12.00	0.004"	0.129779	2'-6	Pf 1.924
306	112'-8½	18.32		11.578	Flow (q) from Route 16	12'-3½	Pe -0.199
202	113'-2			13.303	2E(6'-2)	14'-10	Pv
CM	2.6350	136.67	8.04	0.004"	0.046104	128'-2½	Pf 11.797
202	113'-2			13.303		127'-8	Pe 0.752
203	111'-5			25.852	4PO(16'-5½), 5E(8'-3), T(16'-5½), EE(4'-1½)	255'-10½	Pv
CM	6.3570	136.67	1.38	0.004"	0.000534	40'-7½	Pf 0.022
203	111'-5			25.852			Pe
305	111'-5			25.874		40'-7½	Pv
CM	6.3570	213.91	2.16	0.004"	0.001236	34'-9½	Pf 0.043
305	111'-5	77.24		25.874	Flow (q) from Route 18		Pe
300	111'-5			25.917		34'-9½	Pv
CM	6.3570	241.44	2.44	0.004"	0.001554	60'-11½	Pf 0.149
300	111'-5	27.52		25.917	Flow (q) from Route 20	35'-2½	Pe
200	111'-5			26.066	2E(17'-7)	96'-2	Pv
CM	6.3570	394.50	3.99	0.004"	0.003964	68'-8	Pf 6.630
200	111'-5	153.07		26.066	Flow (q) from Route 4	90'-2	Pe 3.849
9	102'-6½			36.545	2E(17'-7), sCV(-6.000), sCV(17'-2½), PO(37'-8½)	158'-10	Pv
CM	6.3570	394.50	3.99	0.004"	0.003964	20'-5	Pf 0.609
9	102'-6½			36.545		30'-2	Pe 4.836
8	91'-4½			41.990	BV(12'-7), E(17'-7), St(-0.408)	50'-7	Pv
DY	6.3400	394.50	4.01	0.004"	0.004018	0'-0	Pf 0.000
8	91'-4½			41.990			Pe 0.271
7	90'-9			42.261		0'-0	Pv
UG	6.3400	394.50	4.01	0.004"	0.004018	86'-3½	Pf 0.625
7	90'-9			42.261		69'-4	Pe 2.688
6	84'-6½			45.574	3E(23'-1½)	155'-7½	Pv
UG	6.3400	394.50	4.01	0.004"	0.004018	4'-1½	Pf 1.962
6	84'-6½			45.574			Pe
3	84'-6½			47.536	BFP(-1.945)	4'-1½	Pv
UG	6.3400	394.50	4.01	0.004"	0.004018	11'-2½	Pf 2.045
3	84'-6½			47.536			Pe
2	84'-6½			49.581	PIV(-2.000)	11'-2½	Pv
UG	6.3400	394.50	4.01	0.004"	0.004018	21'-7	Pf 0.226
2	84'-6½			49.581		34'-8	Pe
1	84'-6½			49.807	E(23'-1½), EE(11'-6½), S	56'-3	Pv
		100.00			Hose Allowance At Source		
1		494.50					
• • • • • Route 2 • • • • •							
SP	1.0490	15.30	5.68	0.004"	0.076196	3'-2½	Pf 0.779
3214	113'-7½	15.30	5.63 (adj)	7.391	Sprinkler,	7'-0	Pe 0.208
313	113'-2			8.378	E(2'-0), T(5'-0)	10'-2½	Pv
• • • • • Route 3 • • • • •							

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.3800	15.65	3.36	0.004"	0.019518	2'-9	Pf 0.053
3213	112'-10	15.65	5.63 (adj)	7.728	Sprinkler		Pe
314	112'-10			7.781		2'-9	Pv
• • • • • Route 4 • • • • •							
BL	1.0490	16.40	6.09	0.004"	0.087122	7'-0	Pf 1.219
3206	113'-3	16.40	5.63 (adj)	8.492	Sprinkler,	7'-0	Pe 0.277
310	112'-7½			9.987	E(2'-0), PO(5'-0)	14'-0	Pv
BL	1.6100	34.11	5.38	0.004"	0.039465	2'-6½	Pf 0.417
310	112'-7½	17.71		9.987	Flow (q) from Route 13	8'-0	Pe 0.000
307	112'-7½			10.405	PO(8'-0)	10'-6½	Pv
BL	1.6100	52.73	8.31	0.004"	0.091776	14'-2	Pf 3.137
307	112'-7½	18.62		10.405	Flow (q) from Route 17	20'-0	Pe 0.198
309	112'-2			13.740	2PO(8'-0), E(4'-0)	34'-2	Pv
CM	2.6350	153.07	9.01	0.004"	0.057495	71'-6½	Pf 9.323
309	112'-2	100.34		13.740	Flow (q) from Route 5	90'-7½	Pe -0.134
201	112'-5½			22.929	5E(8'-3), PO(16'-5½), C(16'-5½), T(16'-5½)	162'-2	Pv
CM	3.2600	153.07	5.88	0.004"	0.019242	81'-5	Pf 2.678
201	112'-5½			22.929		57'-9½	Pe 0.459
200	111'-5			26.066	4E(9'-5), PO(20'-2)	139'-2½	Pv
• • • • • Route 5 • • • • •							
BL	1.0490	16.71	6.20	0.004"	0.090342	9'-6½	Pf 1.314
3212	109'-11½	16.71	5.63 (adj)	8.817	Sprinkler,	5'-0	Pe -0.867
318	111'-11½			9.263	T(5'-0), fd	14'-6½	Pv
BL	1.0490	34.63	12.86	0.004"	0.373400	0'-9½	Pf 2.158
318	111'-11½	17.92		9.263	Flow (q) from Route 14	5'-0	Pe -0.338
317	112'-8½			11.083	PO(5'-0)	5'-9½	Pv
BL	1.6100	34.63	5.46	0.004"	0.040630	13'-7½	Pf 1.365
317	112'-8½			11.083		20'-0	Pe 0.242
319	112'-2			12.691	2PO(8'-0), E(4'-0)	33'-7½	Pv
CM	2.6350	100.34	5.90	0.004"	0.025307	25'-0	Pf 1.049
319	112'-2	65.71		12.691	Flow (q) from Route 7	16'-5½	Pe -0.000
309	112'-2			13.740	2E(8'-3)	41'-5½	Pv
• • • • • Route 6 • • • • •							
BL	1.0490	16.71	6.20	0.004"	0.090344	4'-11½	Pf 0.899
3217	113'-2	16.71	5.63 (adj)	8.817	Sprinkler,	5'-0	Pe
316	113'-2			9.715	PO(5'-0)	9'-11½	Pv
CM	2.1570	19.20	1.69	0.004"	0.003015	11'-4	Pf 0.034
316	113'-2	2.49		9.715	Flow (q) from Route 21		Pe
315	113'-2			9.750		11'-4	Pv
• • • • • Route 7 • • • • •							
BL	1.0490	16.86	6.26	0.004"	0.091910	3'-0½	Pf 0.740
3218	113'-2	16.86	5.63 (adj)	8.975	Sprinkler,	5'-0	Pe
320	113'-2			9.715	PO(5'-0)	8'-0½	Pv
CM	2.1570	14.38	1.26	0.004"	0.001765	6'-0½	Pf 0.011
320	113'-2			9.715			Pe
321	113'-2			9.726		6'-0½	Pv
CM	2.1570	31.35	2.75	0.004"	0.007568	5'-11½	Pf 0.045
321	113'-2	16.98		9.726	Flow (q) from Route 8		Pe
322	113'-2			9.771		5'-11½	Pv
CM	2.1570	48.42	4.25	0.004"	0.017315	4'-8	Pf 0.294
322	113'-2	17.06		9.771	Flow (q) from Route 9	12'-3½	Pe
323	113'-2			10.065	PO(12'-3½)	17'-0	Pv
CM	2.1570	65.71	5.77	0.004"	0.031174	17'-7½	Pf 1.893
323	113'-2	17.30		10.065	Flow (q) from Route 10	43'-1	Pe 0.427
204	112'-2			12.385	3E(6'-2), 2PO(12'-3½)	60'-8½	Pv
CM	2.6350	65.71	3.87	0.004"	0.011207	27'-3½	Pf 0.306
204	112'-2			12.385			Pe 0.000
319	112'-2			12.691		27'-3½	Pv
• • • • • Route 8 • • • • •							
BL	1.0490	16.98	6.30	0.004"	0.093124	1'-9	Pf 0.628
3219	113'-2	16.98	5.63 (adj)	9.098	Sprinkler,	5'-0	Pe
321	113'-2			9.726	PO(5'-0)	6'-9	Pv
• • • • • Route 9 • • • • •							
BL	1.0490	17.06	6.33	0.004"	0.094008	1'-2½	Pf 0.584
3220	113'-2	17.06	5.63 (adj)	9.187	Sprinkler,	5'-0	Pe
322	113'-2			9.771	PO(5'-0)	6'-2½	Pv
• • • • • Route 10 • • • • •							

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.0490	17.30	6.42	0.004"	0.096525	1'-1½	Pf 0.589
3221	113'-2	17.30	5.63 (adj)	9.442	Sprinkler,	5'-0	Pe
324	113'-2			10.031	PO(5'-0)	6'-1½	Pv
CM	2.1570	17.30	1.52	0.004"	0.002484	1'-4	Pf 0.034
324	113'-2			10.031		12'-3½	Pe
323	113'-2			10.065	PO(12'-3½)	13'-7½	Pv
• • • • • Route 11 • • • • •							
RN	1.0490	17.56	6.52	0.004"	0.099353	0'-10	Pf 0.577
3211	113'-6	17.56	5.63 (adj)	9.728	Sprinkler,	5'-0	Pe 0.352
312	112'-8½			10.657	PO(5'-0)	5'-10	Pv
• • • • • Route 12 • • • • •							
RN	1.0490	17.69	6.57	0.004"	0.100862	0'-10	Pf 0.588
3209	113'-6½	17.69	5.63 (adj)	9.880	Sprinkler,	5'-0	Pe 0.361
311	112'-8½			10.830	PO(5'-0)	5'-10	Pv
• • • • • Route 13 • • • • •							
BL	1.6100	17.71	2.79	0.004"	0.011283	8'-0½	Pf 0.091
3210	112'-7½	17.71	5.63 (adj)	9.897	Sprinkler		Pe -0.000
310	112'-7½			9.987		8'-0½	Pv
• • • • • Route 14 • • • • •							
DY	1.0490	17.92	6.65	0.004"	0.103331	0'-0	Pf 0.000
3216	109'-11½	17.92	5.63 (adj)	10.130	Sprinkler,		Pe -0.867
318	111'-11½			9.263	, fd	0'-0	Pv
• • • • • Route 15 • • • • •							
RN	1.0490	18.06	6.70	0.004"	0.104937	0'-10	Pf 0.610
3208	113'-6	18.06	5.63 (adj)	10.293	Sprinkler,	5'-0	Pe 0.352
308	112'-8½			11.255	PO(5'-0)	5'-10	Pv
• • • • • Route 16 • • • • •							
RN	1.0490	18.32	6.80	0.004"	0.107947	0'-10	Pf 0.627
3207	113'-6	18.32	5.63 (adj)	10.598	Sprinkler,	5'-0	Pe 0.352
306	112'-8½			11.578	PO(5'-0)	5'-10	Pv
• • • • • Route 17 • • • • •							
BL	1.0490	18.62	6.91	0.004"	0.111291	0'-8	Pf 0.629
3205	109'-11½	18.62	5.63 (adj)	10.937	Sprinkler,	5'-0	Pe -1.162
307	112'-7½			10.405	PO(5'-0), fd	5'-8	Pv
• • • • • Route 18 • • • • •							
BL	1.6100	19.14	3.02	0.004"	0.013072	9'-0	Pf 0.118
3204	113'-3½	19.14	5.63 (adj)	11.563	Sprinkler		Pe
3202	113'-3½			11.681		9'-0	Pv
BL	1.6100	38.38	6.05	0.004"	0.049551	12'-11	Pf 1.036
3202	113'-3½	19.24	5.63 (adj)	11.681	Sprinkler,	8'-0	Pe 0.199
304	112'-10			12.915	2E(4'-0)	20'-11	Pv
BL	1.6100	77.24	12.17	0.004"	0.193527	13'-4½	Pf 4.912
304	112'-10	38.86		12.915	Flow (q) from Route 19	12'-0	Pe 0.415
302	111'-10½			18.243	3E(4'-0)	25'-4½	Pv
BL	2.0670	77.24	7.39	0.004"	0.053095	84'-11½	Pf 7.432
302	111'-10½			18.243		55'-0	Pe 0.199
305	111'-5			25.874	7E(5'-0), 2PO(10'-0)	139'-11½	Pv
• • • • • Route 19 • • • • •							
BL	1.6820	19.39	2.80	0.004"	0.010735	9'-0	Pf 0.097
3203	113'-4½	19.39	5.63 (adj)	11.869	Sprinkler		Pe
3201	113'-4½			11.965		9'-0	Pv
BL	1.6820	38.86	5.61	0.004"	0.040541	2'-6	Pf 0.302
3201	113'-4½	19.47	5.63 (adj)	11.965	Sprinkler,	4'-11½	Pe
303	113'-4½			12.268	E(4'-11½)	7'-5½	Pv
DY	1.6100	38.86	6.12	0.004"	0.050768	0'-0	Pf 0.406
303	113'-4½			12.268		8'-0	Pe 0.242
304	112'-10			12.915	PO(8'-0)	8'-0	Pv
• • • • • Route 20 • • • • •							
BL	1.6100	27.52	4.34	0.004"	0.026122	11'-7½	Pf 1.035
3200	113'-2½	27.52	5.63 (adj)	23.905	Sprinkler,	28'-0	Pe 0.169
301	112'-9½			25.110	5E(4'-0), PO(8'-0)	39'-7½	Pv
CM	2.6350	27.52	1.62	0.004"	0.002168	54'-2½	Pf 0.207
301	112'-9½			25.110		41'-2	Pe 0.600
300	111'-5			25.917	3E(8'-3), PO(16'-5½)	95'-4½	Pv
• • • • • Route 21 • • • • •							
CM	2.1570	2.49	0.22	0.004"	0.000074	5'-8½	Pf 0.000
320	113'-2	14.38		9.715	Flow (q) from Route 7		Pe
316	113'-2			9.715		5'-8½	Pv

Pipe Type	Diameter	Flow	Velocity	HWC/Roughness		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

$$\Delta P = 0.000216 f \frac{l \rho Q^2}{d^5}$$

K-Factor conversion formula:

$$K_A = 7.94 K_W \sqrt{\frac{1}{\gamma_A}}$$

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: Light Hazard (4)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.10 gpm/ft²	Area of Application: 1500 ft² (Actual 1045 ft²)
Most Demanding Sprinkler Data: 5.63 K-Factor 14.89 at 7.000	Hose Streams: 100.00
Coverage Per Sprinkler: 125 ft²	Number Of Sprinklers Calculated: 12 / Number Of Nozzles Calculated: 0
System Pressure Demand: 40.356	System Flow Demand: 191.57
Total Demand: 291.57 @ 40.356	Pressure Result: +22.660 (36.0%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	100.00	64.000	20.000

Check Point Gauges

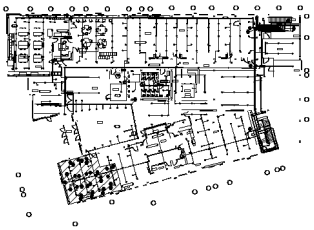
Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

FPET NICET #106245 LEVEL IV,MSME

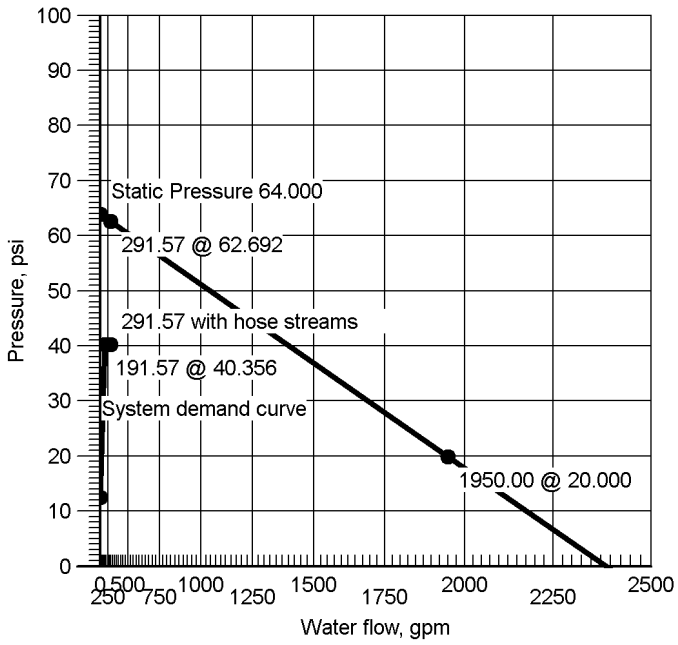
WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP

Signature: Sam
Date: 03/26/2024
Expires: 12/31/24

22-3688_PeirceSTEM-L01-Asbuilt



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L01-Asbuilt

System

Most Demanding Sprinkler Data: 5.63 K-Factor 14.89 at 7.000

Hose Allowance At Source: 100.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 100.00

System Flow Demand	Total Water Required (Including Hose Allowance)
191.57	291.57

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 9.45 between nodes 415 and 414

Maximum Velocity Under Ground	Volume capacity of Antifreeze/Other Pipes
1.95 between nodes 6 and 7	27.88 gal

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
1916.30 gal	

Remote Area(s)

Occupancy	Job Suffix
Light Hazard	

Density	Area of Application
0.10 gpm/ft²	1500 ft² (Actual 1045 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
12	0	125 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	100.00	64.000	20.000		1950.00	63.016		291.57	40.356	22.660

Darcy-Weisbach Calculation

Darcy-Weisbach equations are being used because the system requires special design considerations. The Darcy-Weisbach formula used in this hydraulic calculation to determine fluid/agent friction loss is: P = 0.000216 fLp(Q^2)/(d^5)
Friction Loss factors are derived from the Moody Diagram.
Reynolds Number is calculated using: Re=Q/d/k
Relative Roughness of Pipe is: e/D
K-Factors for Sprinkler Heads are adjusted based on the density of the fluid being discharged (Bernoulli-based formula).
C-Factors are not relevant to this type of calculation. These are replaced with the Roughness e-value for the pipe.

Description: Water/Antifreeze @ 20°F/-7°C, 10% Glycerine (C.P. or U.S.P. 96.5%) by weight
Product Name:
Antifreeze solution in pipes within or passing through:

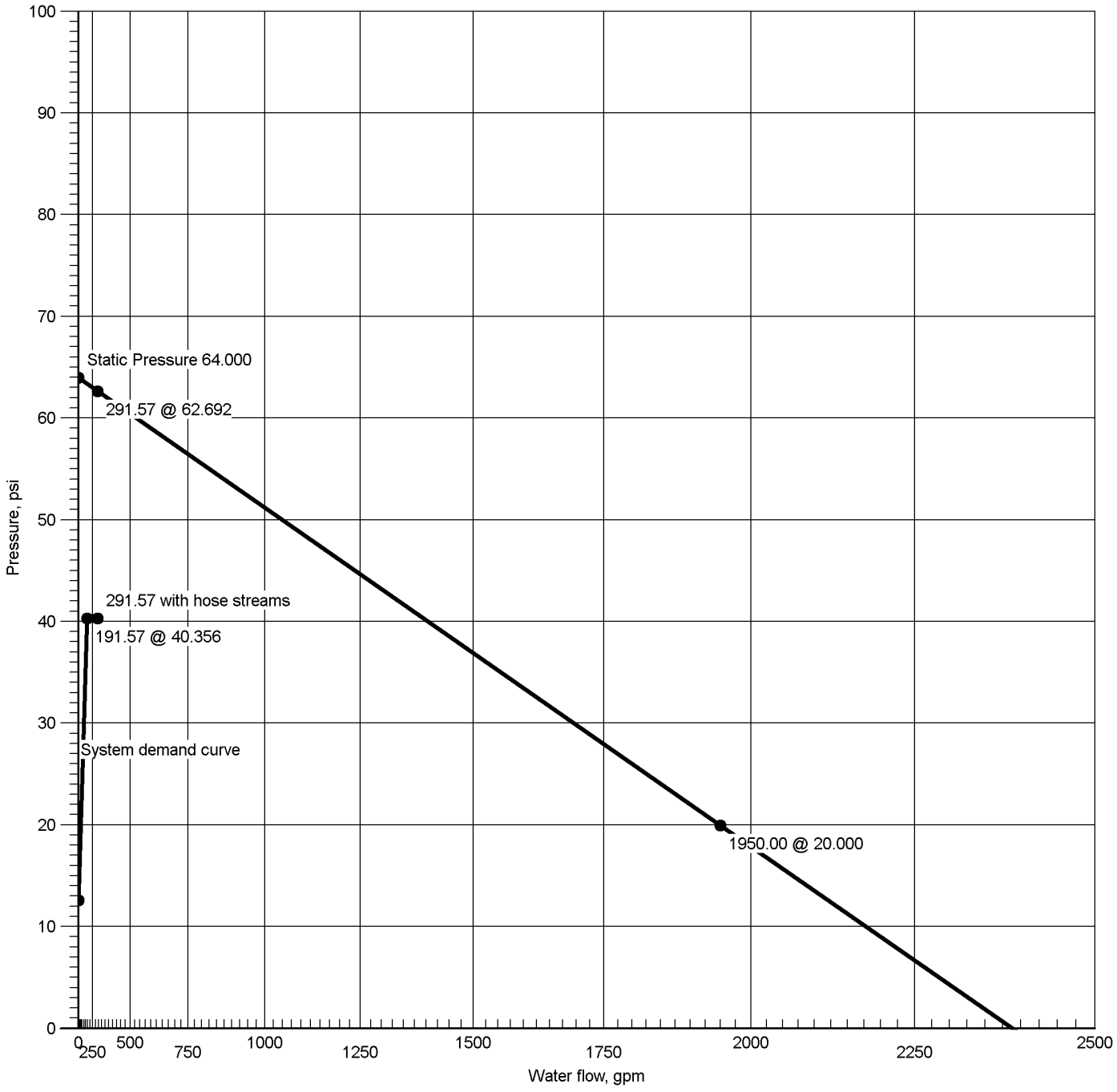
Cold Areas:	Warm Areas:
Density: 69.000 lb/ft³	Density: 63.808 lb/ft³
Viscosity: 25.000 cP	Viscosity: 1.310 cP

NFPA Suggested Aged Pipe Roughness is being applied.

Contractor

	Contractor Number: 01	Contact Name: Ben Bernard	Contact Title: Engineer/PM
Name of Contractor: SHINN FIRE PROTECTION		Phone: 425-204-3945	Extension:
Address 1: 18802 80TH AVE S		FAX:	
Address 2: KENT WA98032		E-mail:	
Address 3:		Web-Site:	

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
63.016 @ 291.57

Required Pressure at System Demand
40.356 @ 191.57

Required Pressure at System Demand (Including Hose Allowance at Source)
40.356 @ 291.57

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Light Hazard (4)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	4000	16.54	14.89	5.63	8.631			
Sprinkler	4001	16.45	14.89	5.63	8.539			
Sprinkler	4002	17.36	14.89	5.63	9.514			
Sprinkler	4003	17.16	14.89	5.63	9.296			
Sprinkler	4004	15.87	14.89	5.63	7.950			
Sprinkler	4005	17.15	14.89	5.63	9.283			
Sprinkler	4006	15.08	14.89	5.63	7.173			
Sprinkler	4007	15.67	14.89	5.63	7.747			
Sprinkler	4008	15.43	14.89	5.63	7.511			
Sprinkler	4009	14.91	14.89	5.63	7.021			
Sprinkler	4010	15.06	14.89	5.63	7.162			
Sprinkler	**4011**	**14.89**	**14.89**	**5.63**	**7.000**			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	84'-6½	S	40.356	191.57	
4000	113'-8½	Spr(-8.631)	8.631	16.54	
4001	113'-8½	Spr(-8.539)	8.539	16.45	
4002	113'-8½	Spr(-9.514)	9.514	17.36	
4003	113'-8½	Spr(-9.296)	9.296	17.16	
4004	113'-8	Spr(-7.950)	7.950	15.87	
4005	113'-8	Spr(-9.283)	9.283	17.15	
4006	113'-8½	Spr(-7.173)	7.173	15.08	
4007	113'-8½	Spr(-7.747)	7.747	15.67	
4008	113'-8½	Spr(-7.511)	7.511	15.43	
4009	113'-6	Spr(-7.021)	7.021	14.91	
4010	113'-8	Spr(-7.162)	7.162	15.06	
4011	113'-6	Spr(-7.000)	7.000	14.89	
2	84'-6½	PIV(-2.000)	40.299		
3	84'-6½	BFP(-0.459)	38.287		
6	84'-6½	PO(20'-0)	37.824		
7	90'-9		34.978		
8	91'-4½	St(-0.059)	34.707		
9	102'-6½	PO(20'-2)	29.762		
200	111'-5	PO(20'-2)	19.753		
201	112'-5½		17.739		
202	113'-2	E(6'-2)	15.168		
203	111'-5	PO(16'-5½)	19.722		
204	112'-2	PO(12'-3½)	10.384		
400	112'-8½	PO(5'-0)	9.585		
401	112'-2	PO(8'-0)	10.579		
402	112'-8½	PO(5'-0)	9.487		
403	112'-8½	PO(5'-0)	10.542		
404	112'-8½	PO(12'-3½)	10.296		
405	112'-8½	PO(5'-0)	10.289		
406	112'-8½	PO(5'-0)	8.852		
407	112'-8½	PO(5'-0)	10.262		
408	112'-8½	PO(8'-0)	9.013		
409	112'-8½	PO(5'-0)	8.737		
410	112'-2	PO(8'-0)	10.134		
411	112'-8½	PO(5'-0)	8.648		
412	112'-8½	PO(5'-0)	8.040		
413	112'-8½	PO(5'-0)	8.107		
414	112'-8½	PO(8'-0)	8.403		
415	112'-2	PO(8'-0)	10.059		
416	112'-8½	PO(5'-0)	8.084		
417	112'-8½	PO(5'-0)	8.018		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •							
BL	1.0490	14.89	5.53	0.004"	0.072309	3'-3	Pf 0.741
4011	113'-6	14.89	5.63 (adj)	7.000	Sprinkler,	7'-0	Pe 0.343
416	112'-8½			8.084	E(2'-0), PO(5'-0)	10'-3	Pv
BL	1.6100	29.96	4.72	0.004"	0.030738	2'-4½	Pf 0.319
416	112'-8½	15.06		8.084	Flow (q) from Route 3	8'-0	Pe
414	112'-8½			8.403	PO(8'-0)	10'-4½	Pv
DY	1.6100	59.95	9.45	0.004"	0.117868	0'-0	Pf 1.414
414	112'-8½	29.99		8.403	Flow (q) from Route 2	12'-0	Pe 0.242
415	112'-2			10.059	E(4'-0), PO(8'-0)	12'-0	Pv
CM	2.6350	59.95	3.53	0.004"	0.009404	8'-0	Pf 0.075
415	112'-2			10.059			Pe
410	112'-2			10.134		8'-0	Pv
CM	2.6350	106.91	6.29	0.004"	0.028612	8'-8½	Pf 0.249
410	112'-2	46.96		10.134	Flow (q) from Route 5		Pe
204	112'-2			10.384		8'-8½	Pv
CM	2.6350	82.47	4.85	0.004"	0.017332	11'-3½	Pf 0.196
204	112'-2			10.384			Pe
401	112'-2			10.579		11'-3½	Pv
CM	2.6350	115.45	6.79	0.004"	0.033211	112'-6½	Pf 7.294
401	112'-2	32.98		10.579	Flow (q) from Route 8	107'-1	Pe -0.134
201	112'-5½			17.739	7E(8'-3), PO(16'-5½), C(16'-5½), T(16'-5½)	219'-7½	Pv
CM	3.2600	115.45	4.44	0.004"	0.011170	81'-5	Pf 1.555
201	112'-5½			17.739		57'-9½	Pe 0.459
200	111'-5			19.753	4E(9'-5), PO(20'-2)	139'-2½	Pv
CM	6.3570	191.57	1.94	0.004"	0.001004	68'-8	Pf 6.160
200	111'-5	76.12		19.753	Flow (q) from Route 10	90'-2	Pe 3.849
9	102'-6½			29.762	2E(17'-7), sCV(-6.000), sCV(17'-2½), PO(37'-8½)	158'-10	Pv
CM	6.3570	191.57	1.94	0.004"	0.001004	20'-5	Pf 0.110
9	102'-6½			29.762		30'-2	Pe 4.836
8	91'-4½			34.707	BV(12'-7), E(17'-7), St(-0.059)	50'-7	Pv
DY	6.3400	191.57	1.95	0.004"	0.001018	0'-0	Pf 0.000
8	91'-4½			34.707			Pe 0.271
7	90'-9			34.978		0'-0	Pv
UG	6.3400	191.57	1.95	0.004"	0.001018	86'-3½	Pf 0.158
7	90'-9			34.978		69'-4	Pe 2.688
6	84'-6½			37.824	3E(23'-1½)	155'-7½	Pv
UG	6.3400	191.57	1.95	0.004"	0.001018	4'-1½	Pf 0.463
6	84'-6½			37.824			Pe
3	84'-6½			38.287	BFP(-0.459)	4'-1½	Pv
UG	6.3400	191.57	1.95	0.004"	0.001018	11'-2½	Pf 2.011
3	84'-6½			38.287			Pe
2	84'-6½			40.299	PIV(-2.000)	11'-2½	Pv
UG	6.3400	191.57	1.95	0.004"	0.001018	21'-7	Pf 0.057
2	84'-6½			40.299		34'-8	Pe
1	84'-6½			40.356	E(23'-1½), EE(11'-6½), S	56'-3	Pv
		100.00			Hose Allowance At Source		
1		291.57					
• • • • • Route 2 • • • • •							
BL	1.0490	14.91	5.54	0.004"	0.072515	3'-3	Pf 0.743
4009	113'-6	14.91	5.63 (adj)	7.021	Sprinkler,	7'-0	Pe 0.343
413	112'-8½			8.107	E(2'-0), PO(5'-0)	10'-3	Pv
BL	1.6100	29.99	4.73	0.004"	0.030804	1'-7½	Pf 0.296
413	112'-8½	15.08		8.107	Flow (q) from Route 4	8'-0	Pe
414	112'-8½			8.403	PO(8'-0)	9'-7½	Pv
• • • • • Route 3 • • • • •							
BL	1.0490	15.06	5.59	0.004"	0.073922	0'-11½	Pf 0.440
4010	113'-8	15.06	5.63 (adj)	7.162	Sprinkler,	5'-0	Pe 0.415
417	112'-8½			8.018	PO(5'-0)	5'-11½	Pv
BL	1.6100	15.06	2.37	0.004"	0.008318	8'-0	Pf 0.067
417	112'-8½			8.018			Pe
416	112'-8½			8.084		8'-0	Pv
• • • • • Route 4 • • • • •							

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
AO	1.0490	15.08	5.60	0.004"	0.074035	0'-11½	Pf 0.443
4006	113'-8½	15.08	5.63 (adj)	7.173	Sprinkler,	5'-0	Pe 0.424
412	112'-8½			8.040	PO(5'-0)	5'-11½	Pv
BL	1.6100	15.08	2.38	0.004"	0.008330	8'-0	Pf 0.067
412	112'-8½			8.040			Pe
413	112'-8½			8.107		8'-0	Pv
• • • • • Route 5 • • • • •							
BL	1.0490	15.43	5.73	0.004"	0.077394	3'-4½	Pf 0.802
4008	113'-8½	15.43	5.63 (adj)	7.511	Sprinkler,	7'-0	Pe 0.424
409	112'-8½			8.737	E(2'-0), PO(5'-0)	10'-4½	Pv
BL	1.6100	31.09	4.90	0.004"	0.033019	0'-4½	Pf 0.276
409	112'-8½	15.67		8.737	Flow (q) from Route 6	8'-0	Pe
408	112'-8½			9.013	PO(8'-0)	8'-4½	Pv
DY	1.6100	46.96	7.40	0.004"	0.073279	0'-0	Pf 0.879
408	112'-8½	15.87		9.013	Flow (q) from Route 7	12'-0	Pe 0.242
410	112'-2			10.134	E(4'-0), PO(8'-0)	12'-0	Pv
• • • • • Route 6 • • • • •							
BL	1.0490	15.67	5.82	0.004"	0.079732	0'-11½	Pf 0.477
4007	113'-8½	15.67	5.63 (adj)	7.747	Sprinkler,	5'-0	Pe 0.424
411	112'-8½			8.648	PO(5'-0)	5'-11½	Pv
BL	1.6100	15.67	2.47	0.004"	0.008955	10'-0	Pf 0.090
411	112'-8½			8.648			Pe
409	112'-8½			8.737		10'-0	Pv
• • • • • Route 7 • • • • •							
BL	1.0490	15.87	5.89	0.004"	0.081746	0'-11½	Pf 0.487
4004	113'-8	15.87	5.63 (adj)	7.950	Sprinkler,	5'-0	Pe 0.415
406	112'-8½			8.852	PO(5'-0)	5'-11½	Pv
BL	1.6100	15.87	2.50	0.004"	0.009175	9'-7½	Pf 0.162
406	112'-8½			8.852		8'-0	Pe
408	112'-8½			9.013	PO(8'-0)	17'-7½	Pv
• • • • • Route 8 • • • • •							
BL	1.0490	16.45	6.11	0.004"	0.087588	0'-11½	Pf 0.524
4001	113'-8½	16.45	5.63 (adj)	8.539	Sprinkler,	5'-0	Pe 0.424
402	112'-8½			9.487	PO(5'-0)	5'-11½	Pv
BL	1.6100	16.45	2.59	0.004"	0.009815	10'-0	Pf 0.098
402	112'-8½			9.487			Pe
400	112'-8½			9.585		10'-0	Pv
BL	1.6100	32.98	5.20	0.004"	0.036994	0'-4½	Pf 0.753
400	112'-8½	16.54		9.585	Flow (q) from Route 9	20'-0	Pe 0.242
401	112'-2			10.579	2PO(8'-0), E(4'-0)	20'-4½	Pv
• • • • • Route 9 • • • • •							
BL	1.0490	16.54	6.14	0.004"	0.088506	0'-11½	Pf 0.529
4000	113'-8½	16.54	5.63 (adj)	8.631	Sprinkler,	5'-0	Pe 0.424
400	112'-8½			9.585	PO(5'-0)	5'-11½	Pv
• • • • • Route 10 • • • • •							
SP	1.0490	17.15	6.37	0.004"	0.094959	0'-11½	Pf 0.565
4005	113'-8	17.15	5.63 (adj)	9.283	Sprinkler,	5'-0	Pe 0.414
407	112'-8½			10.262	PO(5'-0)	5'-11½	Pv
CM	2.1570	17.15	1.51	0.004"	0.002445	10'-0	Pf 0.024
407	112'-8½			10.262			Pe 0.002
405	112'-8½			10.289		10'-0	Pv
CM	2.1570	34.31	3.01	0.004"	0.008977	0'-5	Pf 0.004
405	112'-8½	17.16		10.289	Flow (q) from Route 11		Pe 0.004
404	112'-8½			10.296		0'-5	Pv
CM	2.1570	58.75	5.16	0.004"	0.025118	9'-7	Pf 0.241
404	112'-8½	24.44		10.296	Flow (q) from Route 13		Pe 0.006
403	112'-8½			10.542		9'-7	Pv
CM	2.1570	76.12	6.68	0.004"	0.041435	67'-1½	Pf 4.821
403	112'-8½	17.36		10.542	Flow (q) from Route 12	49'-2½	Pe -0.195
202	113'-2			15.168	6E(6'-2), PO(12'-3½)	116'-4	Pv
CM	2.6350	76.12	4.48	0.004"	0.014856	128'-2½	Pf 3.801
202	113'-2			15.168		127'-8	Pe 0.752
203	111'-5			19.722	4PO(16'-5½), 5E(8'-3), T(16'-5½), EE(4'-1½)	255'-10½	Pv
CM	6.3570	76.12	0.77	0.004"	0.000182	136'-5	Pf 0.031
203	111'-5			19.722		35'-2½	Pe
200	111'-5			19.753	2E(17'-7)	171'-7½	Pv
• • • • • Route 11 • • • • •							

Hydraulic Analysis

Job Number: 22-3688
Report Description: Light Hazard (4)

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.0490	17.16	6.37	0.004"	0.095081	1'-0	Pf 0.569
4003	113'-8½	17.16	5.63 (adj)	9.296	Sprinkler,	5'-0	Pe 0.424
405	112'-8½			10.289	PO(5'-0)	6'-0	Pv
• • • • • Route 12 • • • • •							
BL	1.0490	17.36	6.45	0.004"	0.097245	1'-0	Pf 0.585
4002	113'-8½	17.36	5.63 (adj)	9.514	Sprinkler,	5'-0	Pe 0.442
403	112'-8½			10.542	PO(5'-0)	6'-0	Pv
• • • • • Route 13 • • • • •							
CM	2.1570	24.44	2.15	0.004"	0.004733	0'-11	Pf 0.150
204	112'-2			10.384	PO(12'-3½)	30'-9	Pe -0.238
404	112'-8½			10.296	E(6'-2), PO(12'-3½)	31'-8	Pv

$$\Delta P = 0.000216 f \frac{l \rho Q^2}{d^5}$$

K-Factor conversion formula:

$$K_A = 7.94 K_W \sqrt{\frac{1}{\gamma_A}}$$

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: Light Hazard (5)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.10 gpm/ft²	Area of Application: 1500 ft² (Actual 1335 ft²)
Most Demanding Sprinkler Data: 5.63 K-Factor 14.89 at 7.000	Hose Streams: 100.00
Coverage Per Sprinkler: 120 ft²	Number Of Sprinklers Calculated: 14 / Number Of Nozzles Calculated: 0
System Pressure Demand: 32.093	System Flow Demand: 220.32
Total Demand: 320.32 @ 32.093	Pressure Result: +30.719 (48.9%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	100.00	64.000	20.000

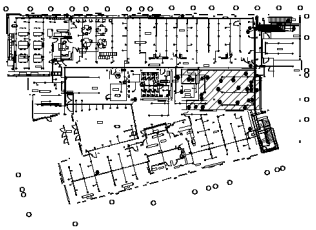
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

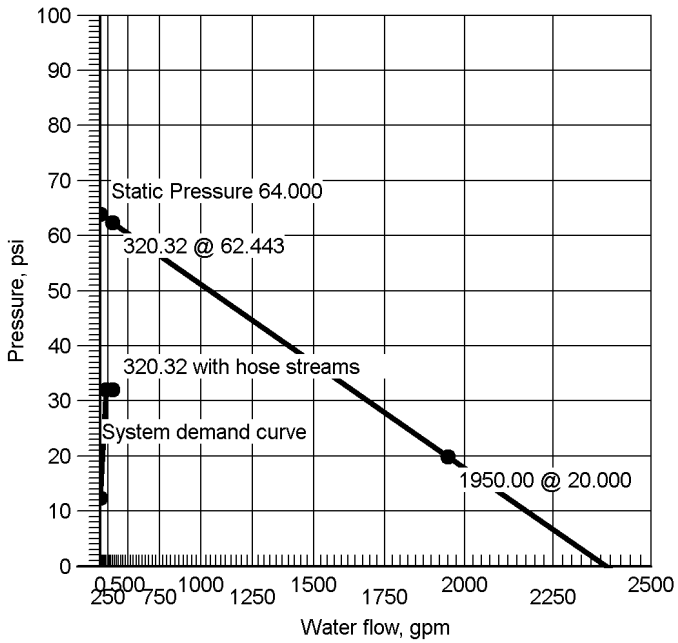
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
Signature 03/26/2024 Date
Expires 12/31/24

22-3688_PeirceSTEM-L01-Asbuilt



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L01-Asbuilt

System

Most Demanding Sprinkler Data: 5.63 K-Factor 14.89 at 7.000

Hose Allowance At Source: 100.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 100.00

System Flow Demand	Total Water Required (Including Hose Allowance)
220.32	320.32

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 7.60 between nodes 501 and 500

Maximum Velocity Under Ground	Volume capacity of Antifreeze/Other Pipes
2.24 between nodes 6 and 7	27.88 gal

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
1916.30 gal	

Remote Area(s)

Occupancy	Job Suffix
Light Hazard	

Density	Area of Application
0.10 gpm/ft²	1500 ft² (Actual 1335 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
14	0	120 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	100.00	64.000	20.000 @ 1950.00	62.813 @ 320.32	32.093	30.719

Darcy-Weisbach Calculation

Darcy-Weisbach equations are being used because the system requires special design considerations. The Darcy-Weisbach formula used in this hydraulic calculation to determine fluid/agent friction loss is: P = 0.000216 fLp(Q^2)/(d^5)
Friction Loss factors are derived from the Moody Diagram.
Reynolds Number is calculated using: Re=Q/d/k
Relative Roughness of Pipe is: e/D
K-Factors for Sprinkler Heads are adjusted based on the density of the fluid being discharged (Bernoulli-based formula).
C-Factors are not relevant to this type of calculation. These are replaced with the Roughness e-value for the pipe.

Description: Water/Antifreeze @ 20°F/-7°C, 10% Glycerine (C.P. or U.S.P. 96.5%) by weight
Product Name:
Antifreeze solution in pipes within or passing through:

Cold Areas:	Warm Areas:
Density: 69.000 lb/ft³	Density: 63.808 lb/ft³
Viscosity: 25.000 cP	Viscosity: 1.310 cP

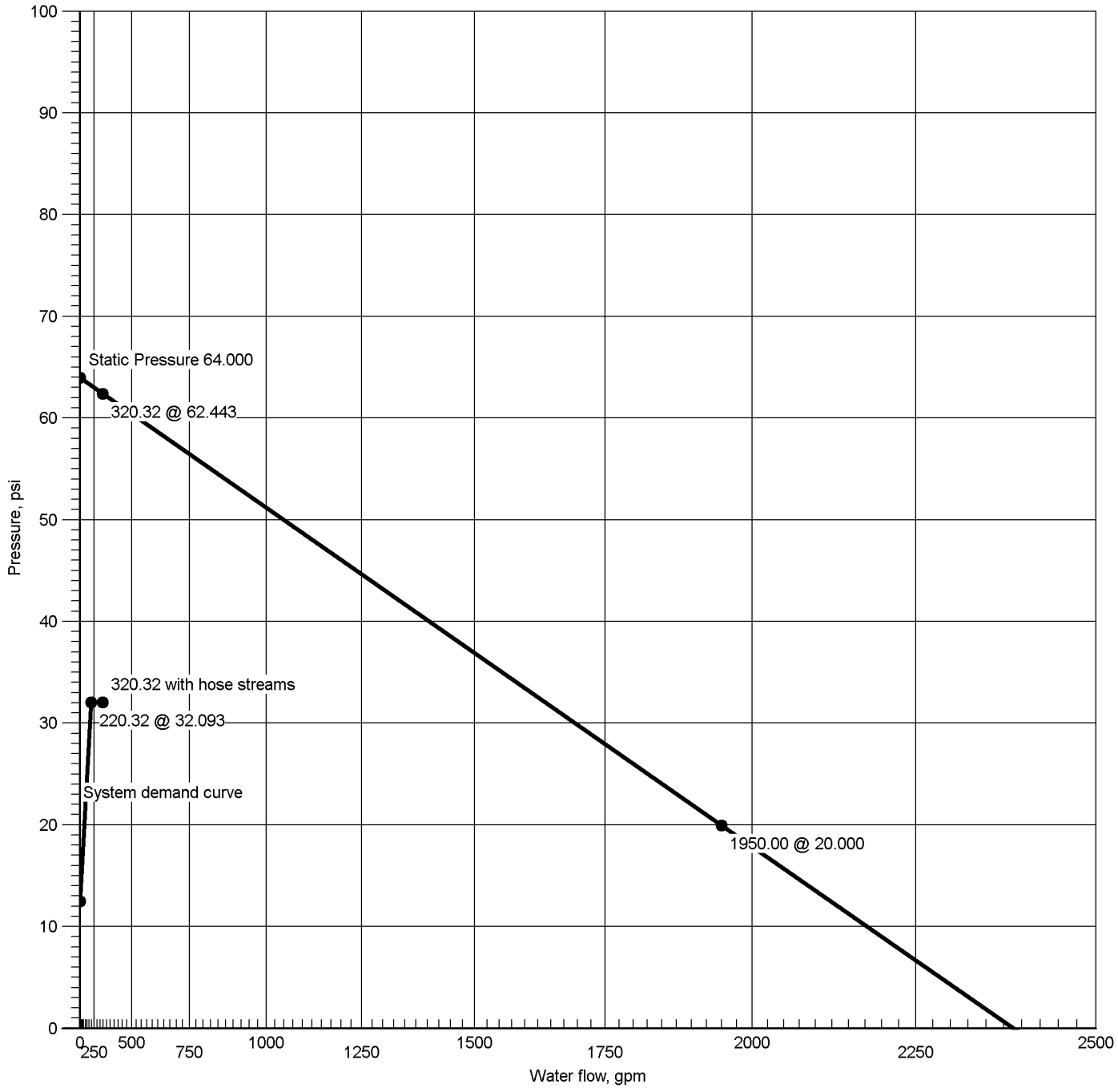
NFPA Suggested Aged Pipe Roughness is being applied.

Contractor

	Contractor Number	Contact Name	Contact Title
	01	Ben Bernard	Engineer/PM

Name of Contractor:	Phone	Extension
SHINN FIRE PROTECTION	425-204-3945	
Address 1: 18802 80TH AVE S	FAX:	
Address 2: KENT WA98032	E-mail:	
Address 3:	Web-Site:	

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
62.813 @ 320.32

Required Pressure at System Demand
32.093 @ 220.32

Required Pressure at System Demand (Including Hose Allowance at Source)
32.093 @ 320.32

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Light Hazard (5)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	5600	16.27	14.89	5.63	8.353			
Sprinkler	5601	16.01	14.89	5.63	8.089			
Sprinkler	5602	16.22	14.89	5.63	8.305			
Sprinkler	5603	15.95	14.89	5.63	8.026			
Sprinkler	5604	15.96	14.89	5.63	8.042			
Sprinkler	5605	15.72	14.89	5.63	7.798			
Sprinkler	5606	15.90	14.89	5.63	7.980			
Sprinkler	5607	15.47	14.89	5.63	7.551			
Sprinkler	5608	14.96	14.89	5.63	7.066			
Sprinkler	5609	15.41	14.89	5.63	7.492			
Sprinkler	**5610**	**14.89**	**14.89**	**5.63**	**7.000**			
Sprinkler	5611	16.76	14.89	5.63	8.860			
Sprinkler	5612	15.37	14.89	5.63	7.458			
Sprinkler	5613	15.44	14.89	5.63	7.526			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	84'-6½	S	32.093	220.32	
5600	113'-2½	Spr(-8.353)	8.353	16.27	
5601	113'-2½	Spr(-8.089)	8.089	16.01	
5602	113'-2½	Spr(-8.305)	8.305	16.22	
5603	113'-2½	Spr(-8.026)	8.026	15.95	
5604	113'-2½	Spr(-8.042)	8.042	15.96	
5605	113'-2½	Spr(-7.798)	7.798	15.72	
5606	113'-2½	Spr(-7.980)	7.980	15.90	
5607	113'-2½	Spr(-7.551)	7.551	15.47	
5608	113'-5	Spr(-7.066)	7.066	14.96	
5609	113'-2½	Spr(-7.492)	7.492	15.41	
5610	113'-5	Spr(-7.000)	7.000	14.89	
5611	110'-0	Spr(-8.860), fd	8.860	16.76	
5612	113'-2½	Spr(-7.458)	7.458	15.37	
5613	113'-2½	Spr(-7.526)	7.526	15.44	
2	84'-6½	PIV(-2.000)	32.019		
3	84'-6½	BFP(-0.607)	30.004		
6	84'-6½	PO(20'-0)	29.392		
7	90'-9		26.498		
8	91'-4½	St(-0.078)	26.227		
9	102'-6½	PO(20'-2)	21.247		
200	111'-5	PO(20'-2)	11.190		
201	112'-5½		9.963		
202	113'-2	E(6'-2)	10.191		
203	111'-5	PO(16'-5½)	11.164		
204	112'-2	PO(16'-5½)	10.282		
300	111'-5	PO(16'-5½)	11.165		
301	112'-9½	PO(8'-0)	9.260		
500	113'-2½	E(4'-11½)	8.942		
501	111'-5	PO(8'-0)	10.467		
502	113'-2½	E(4'-11½)	8.890		
503	111'-5	PO(8'-0)	10.411		
504	113'-2½	E(4'-11½)	8.350		
505	111'-5	PO(8'-0), C(8'-0)	10.403		
506	112'-9½	PO(5'-0)	7.740		
507	112'-9½	PO(5'-0)	7.670		
508	112'-9½	PO(5'-0)	8.141		
509	113'-2½		7.513		
510	112'-9½	PO(5'-0)	9.294		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •							
SP	1.0490	14.89	5.53	0.004"	0.072309	0'-7½	Pf 0.406
5610	113'-5	14.89	5.63 (adj)	7.000	Sprinkler,	5'-0	Pe 0.265
507	112'-9½			7.670	PO(5'-0)	5'-7½	Pv
BL	1.6820	14.89	2.15	0.004"	0.006531	10'-7½	Pf 0.069
507	112'-9½			7.670			Pe
506	112'-9½			7.740		10'-7½	Pv
BL	1.6820	29.85	4.31	0.004"	0.024413	11'-6	Pf 0.401
506	112'-9½	14.96		7.740	Flow (q) from Route 2	4'-11½	Pe
508	112'-9½			8.141	E(4'-11½)	16'-5	Pv
BL	1.6820	46.61	6.73	0.004"	0.057625	10'-1	Pf 1.152
508	112'-9½	16.76		8.141	Flow (q) from Route 7	9'-11	Pe
510	112'-9½			9.294	PO(9'-11)	20'-0	Pv
CM	2.6350	77.42	4.56	0.004"	0.015350	41'-7½	Pf 1.271
510	112'-9½	30.81		9.294	Flow (q) from Route 3	41'-2	Pe 0.600
300	111'-5			11.165	3E(8'-3), PO(16'-5½)	82'-9½	Pv
CM	6.3570	94.09	0.95	0.004"	0.000268	60'-11½	Pf 0.026
300	111'-5	16.66		11.165	Flow (q) from Route 8	35'-2½	Pe
200	111'-5			11.190	2E(17'-7)	96'-2	Pv
CM	6.3570	220.32	2.23	0.004"	0.001307	68'-8	Pf 6.208
200	111'-5	126.23		11.190	Flow (q) from Route 4	90'-2	Pe 3.849
9	102'-6½			21.247	2E(17'-7), sCV(-6.000), sCV(17'-2½), PO(37'-8½)	158'-10	Pv
CM	6.3570	220.32	2.23	0.004"	0.001307	20'-5	Pf 0.144
9	102'-6½			21.247		30'-2	Pe 4.836
8	91'-4½			26.227	BV(12'-7), E(17'-7), St(-0.078)	50'-7	Pv
DY	6.3400	220.32	2.24	0.004"	0.001325	0'-0	Pf 0.000
8	91'-4½			26.227			Pe 0.271
7	90'-9			26.498		0'-0	Pv
UG	6.3400	220.32	2.24	0.004"	0.001325	86'-3½	Pf 0.206
7	90'-9			26.498		69'-4	Pe 2.688
6	84'-6½			29.392	3E(23'-1½)	155'-7½	Pv
UG	6.3400	220.32	2.24	0.004"	0.001325	4'-1½	Pf 0.612
6	84'-6½			29.392			Pe
3	84'-6½			30.004	BFP(-0.607)	4'-1½	Pv
UG	6.3400	220.32	2.24	0.004"	0.001325	11'-2½	Pf 2.015
3	84'-6½			30.004			Pe
2	84'-6½			32.019	PIV(-2.000)	11'-2½	Pv
UG	6.3400	220.32	2.24	0.004"	0.001325	21'-7	Pf 0.075
2	84'-6½			32.019		34'-8	Pe
1	84'-6½			32.093	E(23'-1½), EE(11'-6½), S	56'-3	Pv
		100.00			Hose Allowance At Source		
1		320.32					
• • • • • Route 2 • • • • •							
SP	1.0490	14.96	5.55	0.004"	0.072964	0'-7½	Pf 0.409
5608	113'-5	14.96	5.63 (adj)	7.066	Sprinkler,	5'-0	Pe 0.265
506	112'-9½			7.740	PO(5'-0)	5'-7½	Pv
• • • • • Route 3 • • • • •							
BL	1.6820	15.37	2.22	0.004"	0.006931	7'-11	Pf 0.055
5612	113'-2½	15.37	5.63 (adj)	7.458	Sprinkler		Pe
509	113'-2½			7.513		7'-11	Pv
BL	1.6100	15.37	2.42	0.004"	0.008641	1'-6	Pf 0.013
509	113'-2½			7.513			Pe 0.000
5613	113'-2½			7.526		1'-6	Pv
BL	1.6100	30.81	4.86	0.004"	0.032452	20'-2½	Pf 1.564
5613	113'-2½	15.44	5.63 (adj)	7.526	Sprinkler,	28'-0	Pe 0.170
301	112'-9½			9.260	5E(4'-0), PO(8'-0)	48'-2½	Pv
CM	2.6350	30.81	1.81	0.004"	0.002676	12'-7	Pf 0.034
301	112'-9½			9.260			Pe -0.000
510	112'-9½			9.294		12'-7	Pv
• • • • • Route 4 • • • • •							
BL	1.6820	15.41	2.22	0.004"	0.006960	8'-4½	Pf 0.058
5609	113'-2½	15.41	5.63 (adj)	7.492	Sprinkler		Pe
5607	113'-2½			7.551		8'-4½	Pv
BL	1.6820	30.87	4.46	0.004"	0.026037	9'-6	Pf 0.248
5607	113'-2½	15.47	5.63 (adj)	7.551	Sprinkler		Pe
5605	113'-2½			7.798		9'-6	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.6820	46.59	6.73	0.004"	0.057584	4'-7½	Pf 0.552
5605	113'-2½	15.72	5.63 (adj)	7.798	Sprinkler,	4'-11½	Pe
504	113'-2½			8.350	E(4'-11½)	9'-7	Pv
RN	1.6100	46.59	7.34	0.004"	0.072159	1'-9½	Pf 1.283
504	113'-2½			8.350		16'-0	Pe 0.770
505	111'-5			10.403	PO(8'-0), C(8'-0)	17'-9½	Pv
CM	3.2600	29.93	1.15	0.004"	0.000879	9'-0	Pf 0.008
505	111'-5			10.403			Pe
503	111'-5			10.411		9'-0	Pv
CM	3.2600	78.01	3.00	0.004"	0.005280	10'-7½	Pf 0.056
503	111'-5	48.08		10.411	Flow (q) from Route 5		Pe
501	111'-5			10.467		10'-7½	Pv
CM	3.2600	126.23	4.85	0.004"	0.013263	34'-5	Pf 0.724
501	111'-5	48.22		10.467	Flow (q) from Route 6	20'-2	Pe
200	111'-5			11.190	PO(20'-2)	54'-7	Pv
• • • • • Route 5 • • • • •							
BL	1.6820	15.90	2.30	0.004"	0.007384	8'-4½	Pf 0.062
5606	113'-2½	15.90	5.63 (adj)	7.980	Sprinkler		Pe
5604	113'-2½			8.042		8'-4½	Pv
BL	1.6820	31.86	4.60	0.004"	0.027660	9'-6	Pf 0.263
5604	113'-2½	15.96	5.63 (adj)	8.042	Sprinkler		Pe
5602	113'-2½			8.305		9'-6	Pv
BL	1.6820	48.08	6.94	0.004"	0.061210	4'-7½	Pf 0.586
5602	113'-2½	16.22	5.63 (adj)	8.305	Sprinkler,	4'-11½	Pe
502	113'-2½			8.890	E(4'-11½)	9'-7	Pv
RN	1.6100	48.08	7.58	0.004"	0.076711	1'-9½	Pf 0.750
502	113'-2½			8.890		8'-0	Pe 0.770
503	111'-5			10.411	PO(8'-0)	9'-9½	Pv
• • • • • Route 6 • • • • •							
BL	1.6820	15.95	2.30	0.004"	0.007425	8'-4½	Pf 0.062
5603	113'-2½	15.95	5.63 (adj)	8.026	Sprinkler		Pe
5601	113'-2½			8.089		8'-4½	Pv
BL	1.6820	31.96	4.61	0.004"	0.027815	9'-6	Pf 0.265
5601	113'-2½	16.01	5.63 (adj)	8.089	Sprinkler		Pe
5600	113'-2½			8.353		9'-6	Pv
BL	1.6820	48.22	6.96	0.004"	0.061558	4'-7½	Pf 0.589
5600	113'-2½	16.27	5.63 (adj)	8.353	Sprinkler,	4'-11½	Pe
500	113'-2½			8.942	E(4'-11½)	9'-7	Pv
BL	1.6100	48.22	7.60	0.004"	0.077148	1'-9½	Pf 0.754
500	113'-2½			8.942		8'-0	Pe 0.770
501	111'-5			10.467	PO(8'-0)	9'-9½	Pv
• • • • • Route 7 • • • • •							
BL	1.0490	16.76	6.22	0.004"	0.090775	0'-5½	Pf 0.495
5611	110'-0	16.76	5.63 (adj)	8.860	Sprinkler,	5'-0	Pe -1.214
508	112'-9½			8.141	PO(5'-0), fd	5'-5½	Pv
• • • • • Route 8 • • • • •							
CM	2.6350	16.66	0.98	0.004"	0.000860	128'-2½	Pf 0.220
202	113'-2	16.66		10.191	Flow (q) from Route 9	127'-8	Pe 0.752
203	111'-5			11.164	4PO(16'-5½), 5E(8'-3), T(16'-5½), EE(4'-1½)	255'-10½	Pv
CM	6.3570	16.66	0.17	0.004"	0.000012	75'-5½	Pf 0.001
203	111'-5			11.164			Pe
300	111'-5			11.165		75'-5½	Pv
• • • • • Route 9 • • • • •							
DY	2.1570	16.66	1.46	0.004"	0.002318	77'-7½	Pf 0.337
204	112'-2	16.66		10.282	Flow (q) from Route 10	67'-8	Pe -0.427
202	113'-2			10.191	7E(6'-2), 2PO(12'-3½)	145'-3½	Pv
• • • • • Route 10 • • • • •							
CM	2.6350	16.66	0.98	0.004"	0.000860	123'-10	Pf 0.184
201	112'-5½	16.66		9.963	Flow (q) from Route 11	90'-7½	Pe 0.134
204	112'-2			10.282	T(16'-5½), 7E(8'-3), PO(16'-5½)	214'-5	Pv
• • • • • Route 11 • • • • •							
CM	3.2600	16.66	0.64	0.004"	0.000303	27'-4½	Pf 0.020
505	111'-5	29.93		10.403	Flow (q) from Route 4	37'-7½	Pe -0.459
201	112'-5½			9.963	4E(9'-5)	65'-0	Pv

$$\Delta P = 0.000216 f \frac{l \rho Q^2}{d^5}$$

K-Factor conversion formula: $K_A = 7.94 K_W \sqrt{\frac{1}{\gamma_A}}$

Pipe Type	Diameter	Flow	Velocity	HWC/Roughness		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: Ordinary Group II (6)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.20 gpm/ft²	Area of Application: 1500 ft² (Actual 1042 ft²)
Most Demanding Sprinkler Data: 8.04 K-Factor 26.00 at 10.455	Hose Streams: 250.00
Coverage Per Sprinkler: 110 ft²	Number Of Sprinklers Calculated: 10 / Number Of Nozzles Calculated: 0
System Pressure Demand: 45.561	System Flow Demand: 268.37
Total Demand: 518.37 @ 45.561	Pressure Result: +15.329 (25.2%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	250.00	64.000	20.000

Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

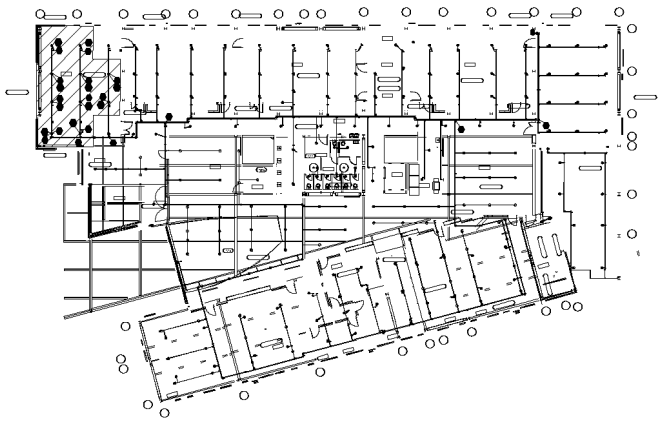
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP

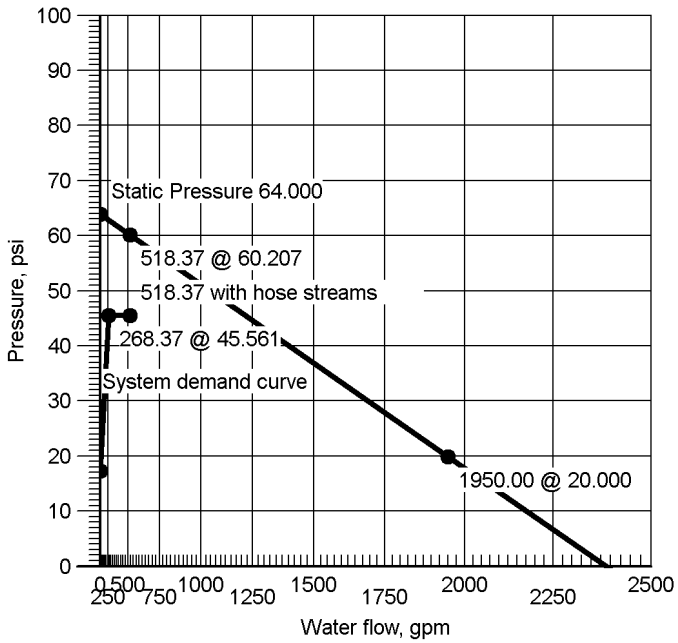
Signature 03/26/2024 Date

Expires 12/31/24

22-3688_PeirceSTEM-L02-Asbuilt



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L02-Asbuilt

System

Most Demanding Sprinkler Data: 8.04 K-Factor 26.00 at 10.455

Hose Allowance At Source: 250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
268.37	518.37

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 10.45 between nodes 603 and 6000

Maximum Velocity Under Ground	Volume capacity of Antifreeze/Other Pipes
2.73 between nodes 6 and 7	64.00 gal

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
2500.50 gal	

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	

Density	Area of Application
0.20 gpm/ft²	1500 ft² (Actual 1042 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
10	0	110 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	250.00	64.000	20.000 @ 1950.00	60.891 @ 518.37	45.561	15.329

Darcy-Weisbach Calculation

Darcy-Weisbach equations are being used because the system requires special design considerations. The Darcy-Weisbach formula used in this hydraulic calculation to determine fluid/agent friction loss is: P = 0.000216 fLp(Q^2)/(d^5)
Friction Loss factors are derived from the Moody Diagram.
Reynolds Number is calculated using: Re=Q/d/k
Relative Roughness of Pipe is: e/D
K-Factors for Sprinkler Heads are adjusted based on the density of the fluid being discharged (Bernoulli-based formula).
C-Factors are not relevant to this type of calculation. These are replaced with the Roughness e-value for the pipe.

Description: Water/Antifreeze @ 0°F/-18°C, 10% Glycerine (C.P. or U.S.P. 96.5%) by weight
Product Name: FreezeMaster By Lubrizol
Antifreeze solution in pipes within or passing through:

Cold Areas:	Warm Areas:
Density: 69.400 lb/ft³	Density: 67.900 lb/ft³
Viscosity: 55.000 cP	Viscosity: 6.000 cP

NFPA Suggested Aged Pipe Roughness is being applied.

Contractor

	Contractor Number	Contact Name	Contact Title
	01	Ben Bernard	Engineer/PM

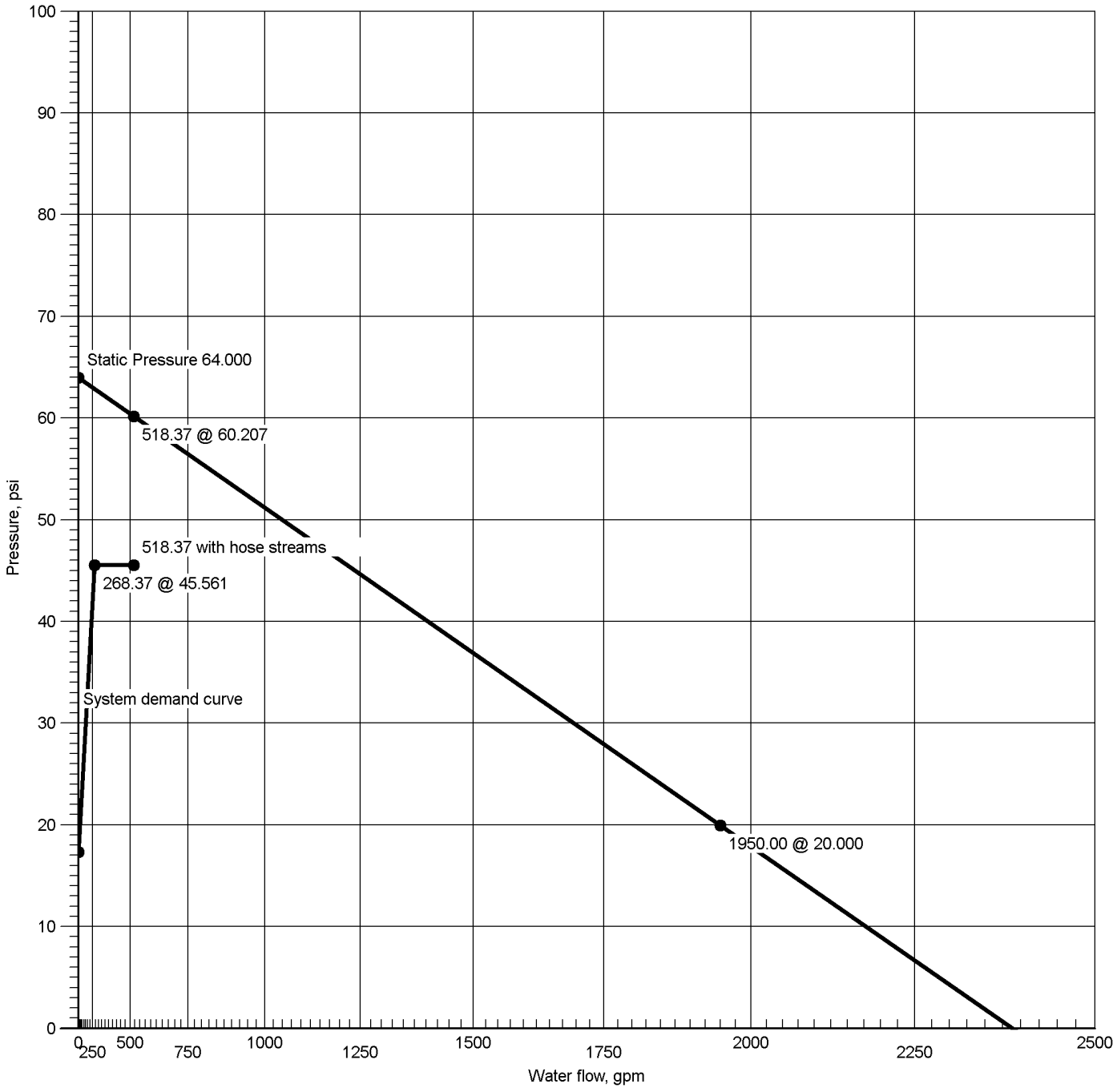
Name of Contractor:	Phone	Extension
SHINN FIRE PROTECTION	425-204-3945	

Address 1	FAX
18802 80TH AVE S	

Address 2	E-mail
KENT WA98032	

Address 3	Web-Site

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
60.891 @ 518.37

Required Pressure at System Demand
45.561 @ 268.37

Required Pressure at System Demand (Including Hose Allowance at Source)
45.561 @ 518.37

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Ordinary Group II (6)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	6000	28.16	26.00	8.04	12.266			
Sprinkler	6001	28.10	26.00	8.04	12.210			
Sprinkler	6002	26.27	26.00	8.04	10.674			
Sprinkler	6003	27.68	26.00	8.04	11.849			
Sprinkler	6004	26.05	26.00	8.04	10.493			
Sprinkler	**6005**	**26.00**	**26.00**	**8.04**	**10.455**			
Sprinkler	6006	26.29	26.00	8.04	10.686			
Sprinkler	6007	26.06	26.00	8.04	10.505			
Sprinkler	6008	27.75	26.00	8.04	11.910			
Sprinkler	6009	26.01	26.00	8.04	10.466			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	84'-6½	S	45.561	268.37	
6000	124'-8	Spr(-12.266), fd	12.266	28.16	
6001	124'-8	Spr(-12.210), fd	12.210	28.10	
6002	124'-8	Spr(-10.674), fd	10.674	26.27	
6003	124'-0	Spr(-11.849), fd	11.849	27.68	
6004	124'-8	Spr(-10.493), fd	10.493	26.05	
6005	124'-8	Spr(-10.455), fd	10.455	26.00	
6006	124'-8	Spr(-10.686), fd	10.686	26.29	
6007	124'-8	Spr(-10.505), fd	10.505	26.06	
6008	124'-0	Spr(-11.910), fd	11.910	27.75	
6009	124'-8	Spr(-10.466), fd	10.466	26.01	
2	84'-6½	PIV(-2.000)	45.453		
3	84'-6½	BFP(-0.900)	43.432		
6	84'-6½	PO(20'-0)	42.523		
7	90'-9		39.536		
8	91'-4½	St(-0.132)	39.265		
9	102'-6½	PO(20'-2)	34.201		
600	126'-6	PO(12'-3½)	17.283		
601	126'-6	PO(16'-5½)	16.475		
602	126'-7	PO(16'-5½)	14.451		
603	126'-8	PO(5'-0)	12.645		
604	126'-9	PO(5'-0)	13.630		
605	126'-8	PO(5'-0)	12.583		
606	126'-9	PO(5'-0)	10.859		
607	127'-5	PO(5'-0)	11.571		
608	126'-9	PO(12'-3½)	13.538		
609	126'-9	PO(5'-0)	10.660		
610	126'-9	PO(5'-0)	10.617		
611	126'-9	PO(5'-0)	10.872		
612	127'-5	PO(5'-0)	11.639		
613	126'-9	PO(12'-3½)	13.513		
614	126'-9	PO(5'-0)	10.673		
615	126'-9	PO(5'-0)	10.630		
801	101'-6	T(14'-4½)	34.201		
802	111'-0	E(6'-8½)	34.201		
803	111'-6½	E(6'-8½)	34.201		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •							
DY	1.0490	26.00	9.65	0.004"	0.213138	0'-0	Pf 1.066
6005	124'-8	26.00	8.04 (adj)	10.455	Sprinkler,	5'-0	Pe -0.903
610	126'-9			10.617	PO(5'-0), fd	5'-0	Pv
BL	2.1570	26.00	2.28	0.004"	0.005316	8'-0	Pf 0.043
610	126'-9			10.617			Pe
609	126'-9			10.660		8'-0	Pv
BL	2.1570	52.05	4.57	0.004"	0.019894	10'-0	Pf 0.199
609	126'-9	26.05		10.660	Flow (q) from Route 3		Pe
606	126'-9			10.859		10'-0	Pv
BL	2.1570	78.32	6.88	0.004"	0.043794	10'-7	Pf 1.002
606	126'-9	26.27		10.859	Flow (q) from Route 5	12'-3½	Pe -0.289
607	127'-5			11.571	2E(6'-2)	22'-10½	Pv
BL	2.1570	106.00	9.31	0.004"	0.078928	2'-9½	Pf 1.678
607	127'-5	27.68		11.571	Flow (q) from Route 7	18'-5½	Pe 0.289
608	126'-9			13.538	E(6'-2), PO(12'-3½)	21'-3	Pv
CM	4.2600	212.11	4.77	0.004"	0.009204	10'-0	Pf 0.092
608	126'-9	106.11		13.538	Flow (q) from Route 2		Pe
604	126'-9			13.630		10'-0	Pv
CM	4.2600	268.37	6.04	0.004"	0.014500	25'-4	Pf 0.749
604	126'-9	56.26		13.630	Flow (q) from Route 9	26'-4	Pe 0.072
602	126'-7			14.451	2E(13'-2)	51'-8	Pv
CM	4.2600	230.78	5.19	0.004"	0.010830	104'-6	Pf 1.987
602	126'-7			14.451		79'-0	Pe 0.036
601	126'-6			16.475	6E(13'-2)	183'-6	Pv
CM	4.2600	268.37	6.04	0.004"	0.014500	29'-4	Pf 0.807
601	126'-6	37.59		16.475	Flow (q) from Route 11	26'-4	Pe
600	126'-6			17.283	PO(26'-4)	55'-8	Pv
CM	6.3570	268.37	2.71	0.004"	0.001899	118'-8½	Pf 6.530
600	126'-6			17.283		160'-6½	Pe 10.388
9	102'-6½			34.201	6E(17'-7), sCV(-6.000), sCV(17'-2½), PO(37'-8½)	279'-3½	Pv
CM	6.3570	268.37	2.71	0.004"	0.001899	20'-5	Pf 0.228
9	102'-6½			34.201		30'-2	Pe 4.836
8	91'-4½			39.265	BV(12'-7), E(17'-7), St(-0.132)	50'-7	Pv
DY	6.3400	268.37	2.73	0.004"	0.001925	0'-0	Pf 0.000
8	91'-4½			39.265			Pe 0.271
7	90'-9			39.536		0'-0	Pv
UG	6.3400	268.37	2.73	0.004"	0.001925	86'-3½	Pf 0.300
7	90'-9			39.536		69'-4	Pe 2.688
6	84'-6½			42.523	3E(23'-1½)	155'-7½	Pv
UG	6.3400	268.37	2.73	0.004"	0.001925	4'-1½	Pf 0.908
6	84'-6½			42.523			Pe
3	84'-6½			43.432	BFP(-0.900)	4'-1½	Pv
UG	6.3400	268.37	2.73	0.004"	0.001925	11'-2½	Pf 2.022
3	84'-6½			43.432			Pe
2	84'-6½			45.453	PIV(-2.000)	11'-2½	Pv
UG	6.3400	268.37	2.73	0.004"	0.001925	21'-7	Pf 0.108
2	84'-6½			45.453		34'-8	Pe
1	84'-6½			45.561	E(23'-1½), EE(11'-6½), S	56'-3	Pv
		250.00			Hose Allowance At Source		
1		518.37					
• • • • • Route 2 • • • • •							
DY	1.0490	26.01	9.66	0.004"	0.213373	0'-0	Pf 1.067
6009	124'-8	26.01	8.04 (adj)	10.466	Sprinkler,	5'-0	Pe -0.903
615	126'-9			10.630	PO(5'-0), fd	5'-0	Pv
BL	2.1570	26.01	2.28	0.004"	0.005321	8'-0	Pf 0.043
615	126'-9			10.630			Pe
614	126'-9			10.673		8'-0	Pv
BL	2.1570	52.08	4.57	0.004"	0.019916	10'-0	Pf 0.199
614	126'-9	26.06		10.673	Flow (q) from Route 4		Pe
611	126'-9			10.872		10'-0	Pv
BL	2.1570	78.36	6.88	0.004"	0.043842	11'-9½	Pf 1.056
611	126'-9	26.29		10.872	Flow (q) from Route 6	12'-3½	Pe -0.289
612	127'-5			11.639	2E(6'-2)	24'-1	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	2.1570	106.11	9.32	0.004"	0.079096	1'-7	Pf 1.586
612	127'-5	27.75		11.639	Flow (q) from Route 8	18'-5½	Pe 0.289
613	126'-9			13.513	E(6'-2), PO(12'-3½)	20'-0½	Pv
CM	4.2600	106.11	2.39	0.004"	0.002454	10'-0	Pf 0.025
613	126'-9			13.513			Pe
608	126'-9			13.538		10'-0	Pv
• • • • • Route 3 • • • • •							
DY	1.0490	26.05	9.67	0.004"	0.213907	0'-0	Pf 1.070
6004	124'-8	26.05	8.04 (adj)	10.493	Sprinkler,	5'-0	Pe -0.903
609	126'-9			10.660	PO(5'-0), fd	5'-0	Pv
• • • • • Route 4 • • • • •							
DY	1.0490	26.06	9.68	0.004"	0.214143	0'-0	Pf 1.071
6007	124'-8	26.06	8.04 (adj)	10.505	Sprinkler,	5'-0	Pe -0.903
614	126'-9			10.673	PO(5'-0), fd	5'-0	Pv
• • • • • Route 5 • • • • •							
DY	1.0490	26.27	9.75	0.004"	0.217506	0'-0	Pf 1.088
6002	124'-8	26.27	8.04 (adj)	10.674	Sprinkler,	5'-0	Pe -0.903
606	126'-9			10.859	PO(5'-0), fd	5'-0	Pv
• • • • • Route 6 • • • • •							
DY	1.0490	26.29	9.76	0.004"	0.217746	0'-0	Pf 1.089
6006	124'-8	26.29	8.04 (adj)	10.686	Sprinkler,	5'-0	Pe -0.903
611	126'-9			10.872	PO(5'-0), fd	5'-0	Pv
• • • • • Route 7 • • • • •							
DY	1.0490	27.68	10.28	0.004"	0.240838	0'-0	Pf 1.204
6003	124'-0	27.68	8.04 (adj)	11.849	Sprinkler,	5'-0	Pe -1.481
607	127'-5			11.571	PO(5'-0), fd	5'-0	Pv
• • • • • Route 8 • • • • •							
DY	1.0490	27.75	10.30	0.004"	0.242051	0'-0	Pf 1.210
6008	124'-0	27.75	8.04 (adj)	11.910	Sprinkler,	5'-0	Pe -1.481
612	127'-5			11.639	PO(5'-0), fd	5'-0	Pv
• • • • • Route 9 • • • • •							
DY	1.0490	28.10	10.43	0.004"	0.248015	0'-0	Pf 1.240
6001	124'-8	28.10	8.04 (adj)	12.210	Sprinkler,	5'-0	Pe -0.867
605	126'-8			12.583	PO(5'-0), fd	5'-0	Pv
BL	2.1570	28.10	2.47	0.004"	0.006152	10'-0	Pf 0.062
605	126'-8			12.583			Pe
603	126'-8			12.645		10'-0	Pv
BL	2.1570	56.26	4.94	0.004"	0.023106	13'-5½	Pf 1.022
603	126'-8	28.16		12.645	Flow (q) from Route 10	30'-9	Pe -0.036
604	126'-9			13.630	3E(6'-2), PO(12'-3½)	44'-2½	Pv
• • • • • Route 10 • • • • •							
DY	1.0490	28.16	10.45	0.004"	0.249126	0'-0	Pf 1.246
6000	124'-8	28.16	8.04 (adj)	12.266	Sprinkler,	5'-0	Pe -0.867
603	126'-8			12.645	PO(5'-0), fd	5'-0	Pv
• • • • • Route 11 • • • • •							
CM	2.6350	37.59	2.21	0.004"	0.003885	363'-4	Pf 1.987
602	126'-7			14.451	PO(16'-5½)	148'-3	Pe 0.036
601	126'-6			16.475	2Ee1(4'-1½), 10E(8'-3), T(16'-5 ½), 2EE(4'-1½), PO(16'-5½)	511'-7	Pv

$$\Delta P = 0.000216 f \frac{l \rho Q^2}{d^5}$$

K-Factor conversion formula: $K_A = 7.94 K_W \sqrt{\frac{1}{\gamma_A}}$

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC/Roughness		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: Light Hazard (7)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.10 gpm/ft²	Area of Application: 1500 ft² (Actual 1032 ft²)
Most Demanding Sprinkler Data: 5.63 K-Factor 19.60 at 12.125	Hose Streams: 100.00
Coverage Per Sprinkler: 196 ft²	Number Of Sprinklers Calculated: 8 / Number Of Nozzles Calculated: 0
System Pressure Demand: 45.340	System Flow Demand: 157.37
Total Demand: 257.37 @ 45.340	Pressure Result: +17.893 (28.3%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	100.00	64.000	20.000

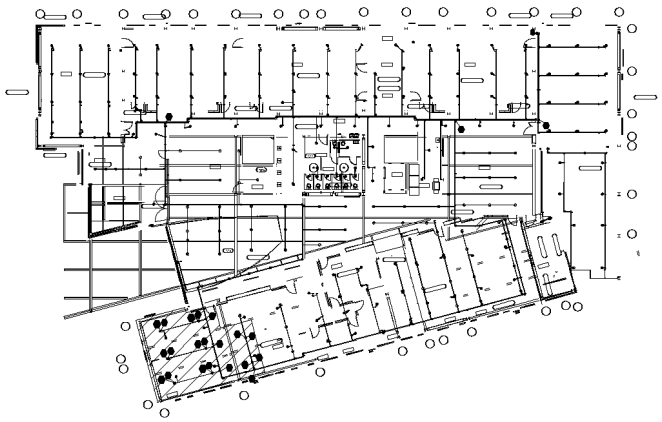
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

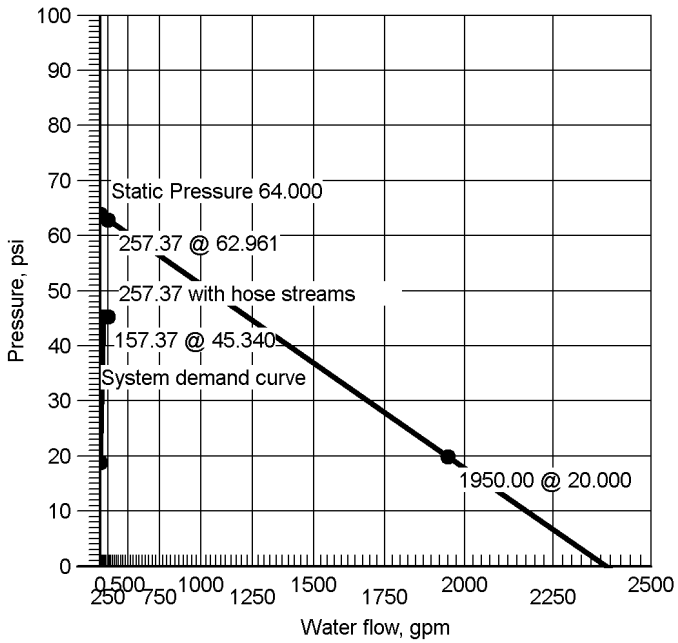
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
03/26/2024
Signature Date
Expires 12/31/24

22-3688_PeirceSTEM-L02-Asbuilt



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job Number: 22-3688
Report Description: Light Hazard (7)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L02-Asbuilt

System

Most Demanding Sprinkler Data: 5.63 K-Factor 19.60 at 12.125

Hose Allowance At Source: 100.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 100.00

System Flow Demand	Total Water Required (Including Hose Allowance)
157.37	257.37

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 7.33 between nodes 701 and 7200

Maximum Velocity Under Ground	Volume capacity of Antifreeze/Other Pipes
1.60 between nodes 6 and 7	64.00 gal

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
2500.50 gal	

Remote Area(s)

Occupancy	Job Suffix
Light Hazard	

Density	Area of Application
0.10 gpm/ft²	1500 ft² (Actual 1032 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
8	0	196 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	100.00	64.000	20.000 @ 1950.00	63.234 @ 257.37	45.340	17.893

Darcy-Weisbach Calculation

Darcy-Weisbach equations are being used because the system requires special design considerations. The Darcy-Weisbach formula used in this hydraulic calculation to determine fluid/agent friction loss is: P = 0.000216 fLp(Q^2)/(d^5)
Friction Loss factors are derived from the Moody Diagram.
Reynolds Number is calculated using: Re=Q/d/k
Relative Roughness of Pipe is: e/D
K-Factors for Sprinkler Heads are adjusted based on the density of the fluid being discharged (Bernoulli-based formula).
C-Factors are not relevant to this type of calculation. These are replaced with the Roughness e-value for the pipe.

Description: Water/Antifreeze @ 0°F/-18°C, 10% Glycerine (C.P. or U.S.P. 96.5%) by weight
Product Name: FreezeMaster By Lubrizol
Antifreeze solution in pipes within or passing through:

Cold Areas:	Warm Areas:
Density: 69.400 lb/ft³	Density: 67.900 lb/ft³
Viscosity: 55.000 cP	Viscosity: 6.000 cP

NFPA Suggested Aged Pipe Roughness is being applied.

Contractor

	Contractor Number	Contact Name	Contact Title
	01	Ben Bernard	Engineer/PM

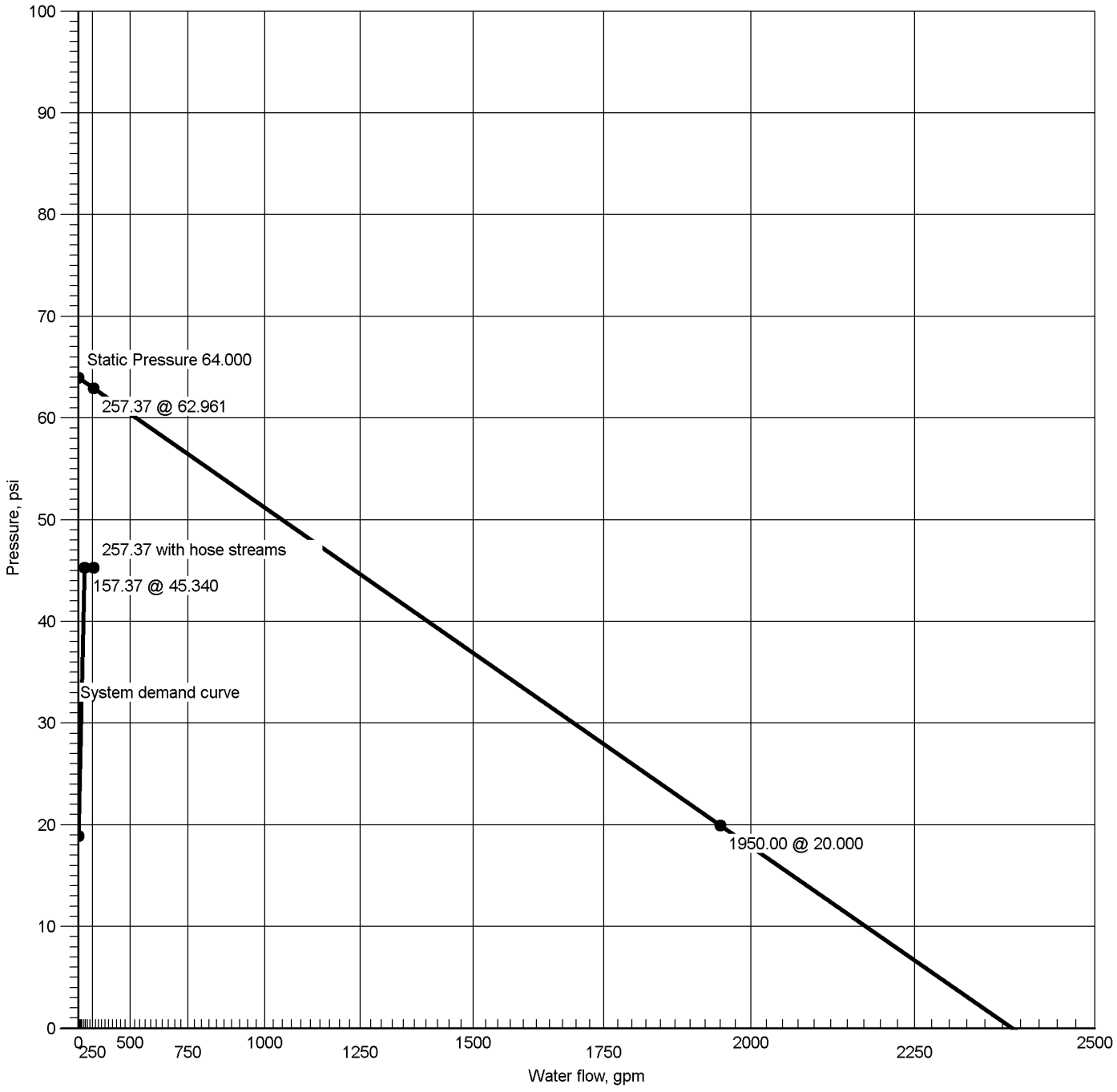
Name of Contractor:	Phone	Extension
SHINN FIRE PROTECTION	425-204-3945	

Address 1	FAX
18802 80TH AVE S	

Address 2	E-mail
KENT WA98032	

Address 3	Web-Site

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
63.234 @ 257.37

Required Pressure at System Demand
45.340 @ 157.37

Required Pressure at System Demand (Including Hose Allowance at Source)
45.340 @ 257.37

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Light Hazard (7)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	7200	19.75	19.60	5.63	12.309			
Sprinkler	7201	19.64	19.60	5.63	12.178			
Sprinkler	7202	19.71	19.60	5.63	12.267			
Sprinkler	7203	19.63	19.60	5.63	12.166			
Sprinkler	7204	19.60	19.60	5.63	12.125			
Sprinkler	7205	19.71	19.60	5.63	12.267			
Sprinkler	7206	19.72	19.60	5.63	12.272			
Sprinkler	**7207**	**19.60**	**19.60**	**5.63**	**12.125**			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	84'-6½	S	45.340	157.37	
7200	128'-3	Spr(-12.309)	12.309	19.75	
7201	128'-3	Spr(-12.178)	12.178	19.64	
7202	128'-3	Spr(-12.267)	12.267	19.71	
7203	128'-3	Spr(-12.166)	12.166	19.63	
7204	128'-3	Spr(-12.125)	12.125	19.60	
7205	128'-3	Spr(-12.267)	12.267	19.71	
7206	128'-3	Spr(-12.272)	12.272	19.72	
7207	128'-3	Spr(-12.125)	12.125	19.60	
2	84'-6½	PIV(-2.000)	45.301		
3	84'-6½	BFP(-0.310)	43.293		
6	84'-6½	PO(20'-0)	42.980		
7	90'-9		40.183		
8	91'-4½	St(-0.040)	39.912		
9	102'-6½	PO(20'-2)	35.001		
600	126'-6	PO(12'-3½)	18.419		
601	126'-6	PO(16'-5½)	18.130		
602	126'-7	PO(16'-5½)	17.827		
700	127'-7	PO(9'-11)	13.820		
701	127'-7	PO(5'-0)	13.293		
702	127'-8	PO(5'-0)	13.109		
703	127'-7	PO(9'-11)	13.774		
704	127'-7	PO(5'-0)	13.249		
705	127'-7	PO(5'-0)	13.143		
706	127'-7	PO(5'-0)	13.099		
707	127'-8	PO(5'-0)	13.208		
708	127'-7	PO(9'-11)	13.774		
709	127'-7	PO(5'-0)	13.249		
710	127'-0½	PO(9'-11)	14.114		
711	127'-7	PO(5'-0)	13.099		
801	101'-6	T(14'-4½)	35.001		
802	111'-0	E(6'-8½)	35.001		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •							
BL	1.0490	19.60	7.28	0.004"	0.122989	0'-8	Pf 0.694
7207	128'-3	19.60	5.63 (adj)	12.125	Sprinkler,	5'-0	Pe 0.280
711	127'-7			13.099	PO(5'-0)	5'-8	Pv
BL	1.6820	19.60	2.83	0.004"	0.010954	13'-8½	Pf 0.150
711	127'-7			13.099			Pe
709	127'-7			13.249		13'-8½	Pv
BL	1.6820	39.31	5.68	0.004"	0.041457	2'-9	Pf 0.524
709	127'-7	19.71		13.249	Flow (q) from Route 5	9'-11	Pe
708	127'-7			13.774	PO(9'-11)	12'-8	Pv
CM	2.6350	37.65	2.22	0.004"	0.003896	14'-7½	Pf 0.105
708	127'-7			13.774		12'-4½	Pe 0.235
710	127'-0½			14.114	E(8'-3), EE(4'-1½)	27'-0	Pv
CM	2.6350	77.01	4.53	0.004"	0.015193	183'-0	Pf 3.781
710	127'-0½	39.36		14.114	Flow (q) from Route 4	65'-11	Pe 0.235
601	126'-6			18.130	5E(8'-3), Ee1(4'-1½), EE(4'-1½), PO(16'-5½)	248'-10½	Pv
CM	4.2600	157.37	3.54	0.004"	0.005191	29'-4	Pf 0.289
601	126'-6	80.36		18.130	Flow (q) from Route 2	26'-4	Pe
600	126'-6			18.419	PO(26'-4)	55'-8	Pv
CM	6.3570	157.37	1.59	0.004"	0.000695	118'-8½	Pf 6.194
600	126'-6			18.419		160'-6½	Pe 10.388
9	102'-6½			35.001	6E(17'-7), sCV(-6.000), sCV(17'-2½), PO(37'-8½)	279'-3½	Pv
CM	6.3570	157.37	1.59	0.004"	0.000695	20'-5	Pf 0.075
9	102'-6½			35.001		30'-2	Pe 4.836
8	91'-4½			39.912	BV(12'-7), E(17'-7), St(-0.040)	50'-7	Pv
DY	6.3400	157.37	1.60	0.004"	0.000704	0'-0	Pf 0.000
8	91'-4½			39.912			Pe 0.271
7	90'-9			40.183		0'-0	Pv
UG	6.3400	157.37	1.60	0.004"	0.000704	86'-3½	Pf 0.110
7	90'-9			40.183		69'-4	Pe 2.688
6	84'-6½			42.980	3E(23'-1½)	155'-7½	Pv
UG	6.3400	157.37	1.60	0.004"	0.000704	4'-1½	Pf 0.312
6	84'-6½			42.980			Pe
3	84'-6½			43.293	BFP(-0.310)	4'-1½	Pv
UG	6.3400	157.37	1.60	0.004"	0.000704	11'-2½	Pf 2.008
3	84'-6½			43.293			Pe
2	84'-6½			45.301	PIV(-2.000)	11'-2½	Pv
UG	6.3400	157.37	1.60	0.004"	0.000704	21'-7	Pf 0.040
2	84'-6½			45.301		34'-8	Pe
1	84'-6½			45.340	E(23'-1½), EE(11'-6½), S	56'-3	Pv
		100.00			Hose Allowance At Source		
1		257.37					
• • • • • Route 2 • • • • •							
BL	1.0490	19.60	7.28	0.004"	0.122989	0'-8	Pf 0.694
7204	128'-3	19.60	5.63 (adj)	12.125	Sprinkler,	5'-0	Pe 0.280
706	127'-7			13.099	PO(5'-0)	5'-8	Pv
BL	1.6820	19.60	2.83	0.004"	0.010954	13'-8½	Pf 0.150
706	127'-7			13.099			Pe
704	127'-7			13.249		13'-8½	Pv
BL	1.6820	39.31	5.68	0.004"	0.041457	2'-9	Pf 0.524
704	127'-7	19.71		13.249	Flow (q) from Route 6	9'-11	Pe
703	127'-7			13.774	PO(9'-11)	12'-8	Pv
CM	2.6350	40.98	2.41	0.004"	0.004570	10'-0	Pf 0.046
703	127'-7	1.67		13.774	Flow (q) from Route 9		Pe
700	127'-7			13.820		10'-0	Pv
CM	2.6350	80.36	4.73	0.004"	0.016490	146'-8½	Pf 3.574
700	127'-7	39.38		13.820	Flow (q) from Route 3	70'-0	Pe 0.434
602	126'-7			17.827	T(16'-5½), 4E(8'-3), Ee1(4'-1½), PO(16'-5½)	216'-8½	Pv
CM	4.2600	80.36	1.81	0.004"	0.001455	104'-6	Pf 0.267
602	126'-7			17.827		79'-0	Pe 0.036
601	126'-6			18.130	6E(13'-2)	183'-6	Pv
• • • • • Route 3 • • • • •							

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.0490	19.63	7.29	0.004"	0.123395	0'-7½	Pf 0.697
7203	128'-3	19.63	5.63 (adj)	12.166	Sprinkler,	5'-0	Pe 0.280
705	127'-7			13.143	PO(5'-0)	5'-8	Pv
BL	1.6820	19.63	2.83	0.004"	0.010989	13'-8½	Pf 0.151
705	127'-7			13.143			Pe
701	127'-7			13.293		13'-8½	Pv
BL	1.6820	39.38	5.69	0.004"	0.041593	2'-9	Pf 0.526
701	127'-7	19.75		13.293	Flow (q) from Route 8	9'-11	Pe
700	127'-7			13.820	PO(9'-11)	12'-8	Pv
• • • • • Route 4 • • • • •							
BL	1.0490	19.64	7.29	0.004"	0.123512	0'-7	Pf 0.687
7201	128'-3	19.64	5.63 (adj)	12.178	Sprinkler,	5'-0	Pe 0.244
702	127'-8			13.109	PO(5'-0)	5'-7	Pv
BL	1.6820	19.64	2.84	0.004"	0.010999	9'-0	Pf 0.099
702	127'-8			13.109			Pe
707	127'-8			13.208		9'-0	Pv
BL	1.6820	39.36	5.68	0.004"	0.041552	2'-11	Pf 0.635
707	127'-8	19.72		13.208	Flow (q) from Route 7	12'-4½	Pe 0.271
710	127'-0½			14.114	EE(2'-5½), PO(9'-11)	15'-3½	Pv
• • • • • Route 5 • • • • •							
BL	1.0490	19.71	7.32	0.004"	0.124387	0'-7½	Pf 0.702
7205	128'-3	19.71	5.63 (adj)	12.267	Sprinkler,	5'-0	Pe 0.280
709	127'-7			13.249	PO(5'-0)	5'-8	Pv
• • • • • Route 6 • • • • •							
BL	1.0490	19.71	7.32	0.004"	0.124388	0'-7½	Pf 0.702
7202	128'-3	19.71	5.63 (adj)	12.267	Sprinkler,	5'-0	Pe 0.280
704	127'-7			13.249	PO(5'-0)	5'-8	Pv
• • • • • Route 7 • • • • •							
BL	1.0490	19.72	7.32	0.004"	0.124435	0'-7	Pf 0.692
7206	128'-3	19.72	5.63 (adj)	12.272	Sprinkler,	5'-0	Pe 0.244
707	127'-8			13.208	PO(5'-0)	5'-7	Pv
• • • • • Route 8 • • • • •							
BL	1.0490	19.75	7.33	0.004"	0.124798	0'-8	Pf 0.705
7200	128'-3	19.75	5.63 (adj)	12.309	Sprinkler,	5'-0	Pe 0.280
701	127'-7			13.293	PO(5'-0)	5'-8	Pv
• • • • • Route 9 • • • • •							
CM	2.6350	1.67	0.10	0.004"	0.000009	9'-0	Pf 0.000
708	127'-7	37.65		13.774	Flow (q) from Route 1		Pe
703	127'-7			13.774		9'-0	Pv

$$\Delta P = 0.000216 f \frac{l \rho Q^2}{d^5}$$

K-Factor conversion formula: $K_A = 7.94 K_W \sqrt{\frac{1}{\gamma_A}}$

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC/Roughness		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: Light Hazard (8)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.10 gpm/ft²	Area of Application: 1500 ft² (Actual 1091 ft²)
Most Demanding Sprinkler Data: 5.34 K-Factor 14.12 at 7.000	Hose Streams: 100.00
Coverage Per Sprinkler: 130 ft²	Number Of Sprinklers Calculated: 8 / Number Of Nozzles Calculated: 0
System Pressure Demand: 38.341	System Flow Demand: 119.76
Total Demand: 219.76 @ 38.341	Pressure Result: +25.100 (39.6%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	100.00	64.000	20.000

Check Point Gauges

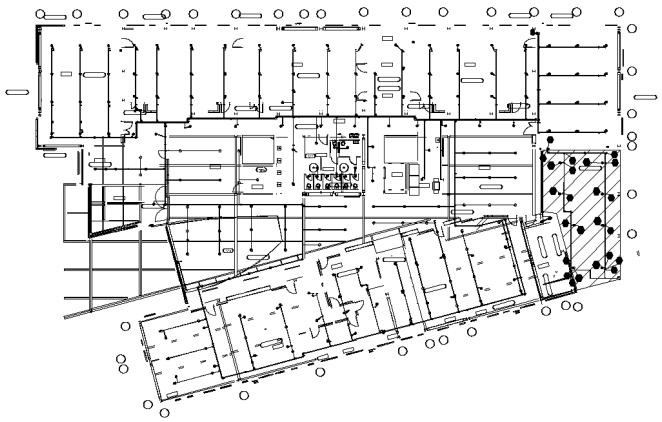
Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
Signature 03/26/2024 Date
Expires 12/31/24

22-3688_PeirceSTEM-L02-Asbuilt

ANTI-FREEZE SYSTEM



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)

Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L02-Asbuilt

System

Most Demanding Sprinkler Data: 5.34 K-Factor 14.12 at 7.000

Hose Allowance At Source: 100.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 100.00

System Flow Demand	Total Water Required (Including Hose Allowance)
119.76	219.76

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 8.71 between nodes 810 and 811

Maximum Velocity Under Ground	Volume capacity of Antifreeze/Other Pipes
1.22 between nodes 6 and 7	64.00 gal

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
2500.50 gal	

Remote Area(s)

Occupancy	Job Suffix
Light Hazard	

Density	Area of Application
0.10 gpm/ft²	1500 ft² (Actual 1091 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
8	0	130 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area: Left: 34.959

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	100.00	64.000	20.000 @ 1950.00	63.441 @ 219.76	38.341	25.100

Darcy-Weisbach Calculation

Darcy-Weisbach equations are being used because the system requires special design considerations. The Darcy-Weisbach formula used in this hydraulic calculation to determine fluid/agent friction loss is: P = 0.000216 fLp(Q^2)/(d^5)
Friction Loss factors are derived from the Moody Diagram.
Reynolds Number is calculated using: Re=Q/d/k
Relative Roughness of Pipe is: e/D
K-Factors for Sprinkler Heads are adjusted based on the density of the fluid being discharged (Bernoulli-based formula).
C-Factors are not relevant to this type of calculation. These are replaced with the Roughness e-value for the pipe.

Description: Water/Antifreeze @ 0°F/-18°C, 10% Glycerine (C.P. or U.S.P. 96.5%) by weight
Product Name: FreezeMaster By Lubrizol
Antifreeze solution in pipes within or passing through:

Cold Areas:	Warm Areas:
Density: 69.400 lb/ft³	Density: 67.900 lb/ft³
Viscosity: 55.000 cP	Viscosity: 6.000 cP

NFPA Suggested Aged Pipe Roughness is being applied.

Contractor

	Contractor Number	Contact Name	Contact Title
	01	Ben Bernard	Engineer/PM

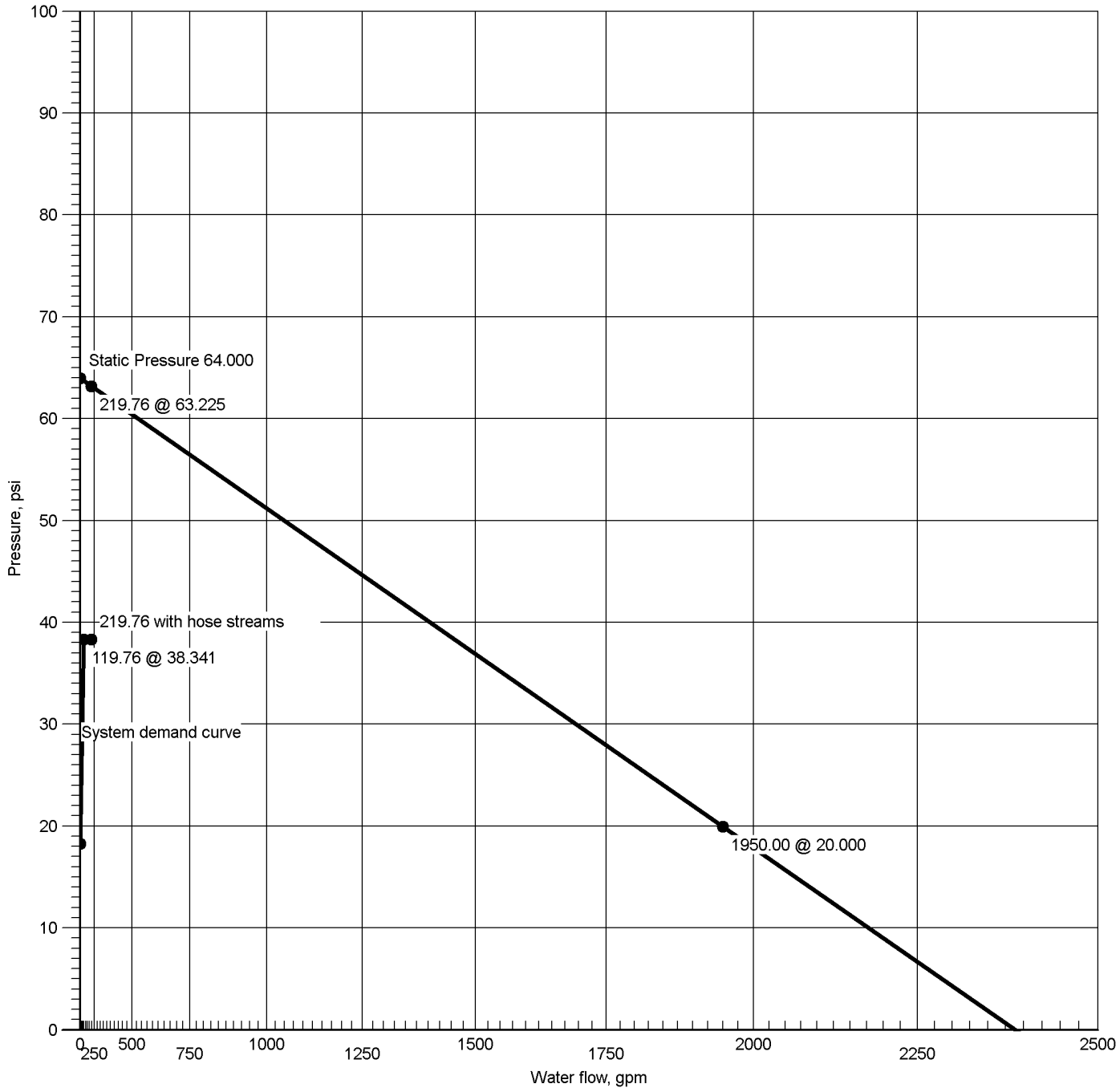
Name of Contractor:	Phone	Extension
SHINN FIRE PROTECTION	425-204-3945	

Address 1	FAX
18802 80TH AVE S	

Address 2	E-mail
KENT WA98032	

Address 3	Web-Site

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
63.441 @ 219.76

Required Pressure at System Demand
38.341 @ 119.76

Required Pressure at System Demand (Including Hose Allowance at Source)
38.341 @ 219.76

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Light Hazard (8)

Device	Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler 8400	16.03	13.00	5.34	9.015			
Sprinkler 8401	15.88	13.00	5.34	8.853			
Sprinkler 8402	15.30	13.00	5.34	8.217			
Sprinkler 8403	15.12	13.00	5.34	8.025			
Sprinkler 8404	14.46	13.00	5.34	7.339			
Sprinkler 8405	14.61	13.00	5.34	7.489			
Sprinkler 8406	14.25	13.00	5.34	7.123			

⇨ Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	84'-6½	S	38.341	119.76	
8400	126'-9½	Spr(-9.015)	9.015	16.03	
8401	126'-9½	Spr(-8.853)	8.853	15.88	
8402	126'-9½	Spr(-8.217)	8.217	15.30	
8403	126'-9½	Spr(-8.025)	8.025	15.12	
8404	126'-9½	Spr(-7.339)	7.339	14.46	
8405	126'-9½	Spr(-7.489)	7.489	14.61	
8406	126'-9½	Spr(-7.123)	7.123	14.25	
8407	126'-9½	Spr(-7.000)	7.000	14.12	
2	84'-6½	PIV(-2.000)	38.318		
3	84'-6½	BFP(-0.179)	36.313		
6	84'-6½	PO(20'-0)	36.132		
7	90'-9		33.378		
8	91'-4½	St(-0.023)	33.107		
9	102'-6½	PO(20'-2)	28.227		
801	101'-6	T(5'-0)	26.863		
802	111'-0	E(6'-8½)	22.205		
803	111'-6½	E(6'-8½)	21.852		
805	115'-4		18.787		
806	127'-0½	E(5'-10½)	13.426		
807	127'-0½	PO(7'-0½)	12.318		
808	127'-0½	PO(3'-7)	11.144		
809	127'-0½	PO(3'-7)	10.248		
810	127'-0½	PO(7'-0½)	12.045		
811	127'-0½	PO(3'-7)	10.854		
812	127'-0½	PO(3'-7)	9.164		
813	127'-0½	PO(3'-7)	9.938		
814	127'-0½	PO(3'-7)	9.333		
815	105'-4		25.873		
816	127'-0½	PO(3'-7)	8.780		
817	127'-0½	PO(3'-7)	8.920		
818	127'-0½	E(3'-6½)	8.780		
819	127'-0½		8.919		
820	127'-0½		8.780		
821	127'-0½		8.919		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •							
DR	1.0490	14.12	5.24	0.015"	0.175030	2'-2½	Pf 1.881
8407	126'-9½	14.12	5.34 (adj)	7.000	Sprinkler,	8'-6½	Pe -0.101
816	127'-0½			8.780	T(3'-7), E(1'-5), PO(3'-7)	10'-9	Pv
BL	1.6820	13.66	1.97	0.015"	0.025616	15'-0	Pf 0.384
816	127'-0½			8.780			Pe
812	127'-0½			9.164		15'-0	Pv
BL	1.6820	28.12	4.06	0.015"	0.052730	13'-6	Pf 1.084
812	127'-0½	14.46		9.164	Flow (q) from Route 3	7'-0½	Pe
809	127'-0½			10.248	2E(3'-6½)	20'-6½	Pv
BL	1.6820	43.42	6.27	0.015"	0.081419	11'-0	Pf 0.896
809	127'-0½	15.30		10.248	Flow (q) from Route 6		Pe
808	127'-0½			11.144		11'-0	Pv
BL	1.6820	59.45	8.58	0.015"	0.111468	3'-5½	Pf 1.174
808	127'-0½	16.03		11.144	Flow (q) from Route 8	7'-0½	Pe
807	127'-0½			12.318	PO(7'-0½)	10'-6½	Pv
CM	2.6350	119.76	7.05	0.015"	0.058243	7'-3½	Pf 1.108
807	127'-0½	60.31		12.318	Flow (q) from Route 2	11'-9	Pe
806	127'-0½			13.426	2E(5'-10½)	19'-0½	Pv
CM	3.0680	119.76	5.20	0.015"	0.023584	11'-8½	Pf 0.277
806	127'-0½			13.426			Pe 5.084
805	115'-4			18.787		11'-8½	Pv
CM	3.2600	119.76	4.60	0.015"	0.016627	52'-10½	Pf 1.437
805	115'-4			18.787		33'-6½	Pe 1.629
803	111'-6½			21.852	5E(6'-8½)	86'-5	Pv
DY	3.2600	119.76	4.60	0.015"	0.016124	0'-0	Pf 0.108
803	111'-6½			21.852		6'-8½	Pe 0.244
802	111'-0			22.205	E(6'-8½)	6'-8½	Pv
CM	3.2600	119.76	4.60	0.015"	0.016627	11'-5	Pf 0.541
802	111'-0			22.205		21'-1	Pe 4.117
801	101'-6			26.863	E(6'-8½), T(14'-4½)	32'-6	Pv
CM	3.2600	119.76	4.60	0.015"	0.016124	8'-8	Pf 0.670
801	101'-6			26.863		32'-10½	Pe -1.659
815	105'-4			25.873	sCV(5'-1), 2E(6'-8½), T(14'-4½)	41'-6½	Pv
CM	3.2600	119.76	4.60	0.004"	0.011985	40'-7	Pf 1.147
815	105'-4			25.873		55'-1	Pe 1.207
9	102'-6½			28.227	f(-0.000), sCV(21'-6), BV(13'-5 ½), PO(20'-2)	95'-8	Pv
CM	6.3570	119.76	1.21	0.004"	0.000418	20'-5	Pf 0.044
9	102'-6½			28.227		30'-2	Pe 4.836
8	91'-4½			33.107	BV(12'-7), E(17'-7), St(-0.023)	50'-7	Pv
DY	6.3400	119.76	1.22	0.004"	0.000424	0'-0	Pf 0.000
8	91'-4½			33.107			Pe 0.271
7	90'-9			33.378		0'-0	Pv
UG	6.3400	119.76	1.22	0.004"	0.000424	86'-3½	Pf 0.066
7	90'-9			33.378		69'-4	Pe 2.688
6	84'-6½			36.132	3E(23'-1½)	155'-7½	Pv
UG	6.3400	119.76	1.22	0.004"	0.000424	4'-1½	Pf 0.181
6	84'-6½			36.132			Pe
3	84'-6½			36.313	BFP(-0.179)	4'-1½	Pv
UG	6.3400	119.76	1.22	0.004"	0.000424	11'-2½	Pf 2.005
3	84'-6½			36.313			Pe
2	84'-6½			38.318	PIV(-2.000)	11'-2½	Pv
UG	6.3400	119.76	1.22	0.004"	0.000424	21'-7	Pf 0.024
2	84'-6½			38.318		34'-8	Pe
1	84'-6½			38.341	E(23'-1½), EE(11'-6½), S	56'-3	Pv
		100.00			Hose Allowance At Source		
1		219.76					
• • • • • Route 2 • • • • •							
DR	1.0490	14.25	5.29	0.015"	0.176565	2'-2½	Pf 1.897
8406	126'-9½	14.25	5.34 (adj)	7.123	Sprinkler,	8'-6½	Pe -0.101
817	127'-0½			8.920	T(3'-7), E(1'-5), PO(3'-7)	10'-9	Pv
BL	1.6820	14.71	2.12	0.015"	0.027575	15'-0	Pf 0.414
817	127'-0½	0.46		8.920	Flow (q) from Route 9		Pe
814	127'-0½			9.333		15'-0	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC/Roughness Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	1.6820	29.31	4.23	0.015"	0.054964	11'-0	Pf 0.605
814	127'-0½	14.61		9.333	Flow (q) from Route 4		Pe
813	127'-0½			9.938		11'-0	Pv
BL	1.6820	44.43	6.42	0.015"	0.083316	11'-0	Pf 0.916
813	127'-0½	15.12		9.938	Flow (q) from Route 5		Pe
811	127'-0½			10.854		11'-0	Pv
BL	1.6820	60.31	8.71	0.015"	0.113094	3'-5½	Pf 1.191
811	127'-0½	15.88		10.854	Flow (q) from Route 7	7'-0½	Pe
810	127'-0½			12.045	PO(7'-0½)	10'-6½	Pv
CM	2.6350	60.31	3.55	0.015"	0.018777	14'-6	Pf 0.272
810	127'-0½			12.045			Pe
807	127'-0½			12.318		14'-6	Pv
• • • • • Route 3 • • • • •							
DR	1.0490	14.46	5.37	0.015"	0.179221	2'-2½	Pf 1.926
8404	126'-9½	14.46	5.34 (adj)	7.339	Sprinkler,	8'-6½	Pe -0.101
812	127'-0½			9.164	T(3'-7), E(1'-5), PO(3'-7)	10'-9	Pv
• • • • • Route 4 • • • • •							
DR	1.0490	14.61	5.42	0.015"	0.181039	2'-2½	Pf 1.945
8405	126'-9½	14.61	5.34 (adj)	7.489	Sprinkler,	8'-6½	Pe -0.101
814	127'-0½			9.333	T(3'-7), E(1'-5), PO(3'-7)	10'-9	Pv
• • • • • Route 5 • • • • •							
DR	1.0490	15.12	5.61	0.015"	0.187408	2'-2½	Pf 2.014
8403	126'-9½	15.12	5.34 (adj)	8.025	Sprinkler,	8'-6½	Pe -0.101
813	127'-0½			9.938	T(3'-7), E(1'-5), PO(3'-7)	10'-9	Pv
• • • • • Route 6 • • • • •							
DR	1.0490	15.30	5.68	0.015"	0.189631	2'-8½	Pf 2.132
8402	126'-9½	15.30	5.34 (adj)	8.217	Sprinkler,	8'-6½	Pe -0.101
809	127'-0½			10.248	T(3'-7), E(1'-5), PO(3'-7)	11'-3	Pv
• • • • • Route 7 • • • • •							
DR	1.0490	15.88	5.90	0.015"	0.196835	2'-2	Pf 2.111
8401	126'-9½	15.88	5.34 (adj)	8.853	Sprinkler,	8'-6½	Pe -0.110
811	127'-0½			10.854	T(3'-7), E(1'-5), PO(3'-7)	10'-8½	Pv
• • • • • Route 8 • • • • •							
DR	1.0490	16.03	5.95	0.015"	0.198628	2'-8½	Pf 2.237
8400	126'-9½	16.03	5.34 (adj)	9.015	Sprinkler,	8'-6½	Pe -0.108
808	127'-0½			11.144	T(3'-7), E(1'-5), PO(3'-7)	11'-3	Pv
• • • • • Route 9 • • • • •							
BL	1.6820	0.46	0.07	0.015"	0.000863	0'-7½	Pf 0.001
816	127'-0½	13.66		8.780	Flow (q) from Route 1		Pe
820	127'-0½			8.780		0'-7½	Pv
DY	1.6820	0.46	0.07	0.015"	0.000016	0'-0	Pf 0.000
820	127'-0½			8.780		3'-6½	Pe
818	127'-0½			8.780	E(3'-6½)	3'-6½	Pv
BL	1.0490	0.46	0.17	0.015"	0.005705	17'-11	Pf 0.139
818	127'-0½			8.780		6'-5	Pe
821	127'-0½			8.919	2E(1'-5), T(3'-7)	24'-4	Pv
DY	1.6820	0.46	0.07	0.015"	0.000016	0'-0	Pf 0.000
821	127'-0½			8.919			Pe
819	127'-0½			8.919		0'-0	Pv
BL	1.6820	0.46	0.07	0.015"	0.000863	0'-7	Pf 0.000
819	127'-0½			8.919			Pe
817	127'-0½			8.920		0'-7	Pv

$$\Delta P = 0.000216 f \frac{l \rho Q^2}{d^5}$$

K-Factor conversion formula: $K_A = 7.94 K_W \sqrt{\frac{1}{\gamma_A}}$

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC/Roughness		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: Ordinary Group II (9)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.20 gpm/ft²	Area of Application: 1500 ft² (Actual 949 ft²)
Most Demanding Sprinkler Data: 8 K-Factor 26.00 at 10.563	Hose Streams: 250.00
Coverage Per Sprinkler: 130 ft²	Number Of Sprinklers Calculated: 10 / Number Of Nozzles Calculated: 0
System Pressure Demand: 50.006	System Flow Demand: 267.91
Total Demand: 517.91 @ 50.006	Pressure Result: +10.207 (17.0%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	250.00	64.000	20.000

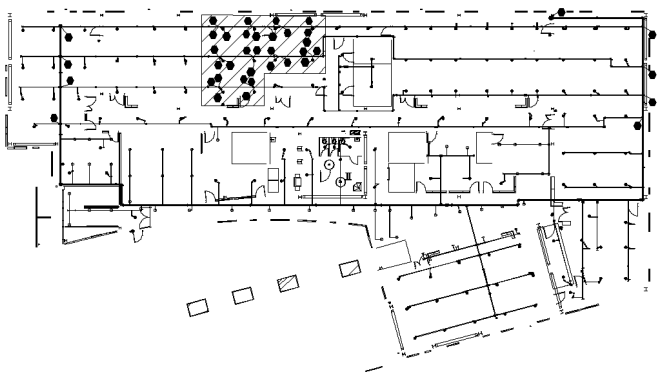
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

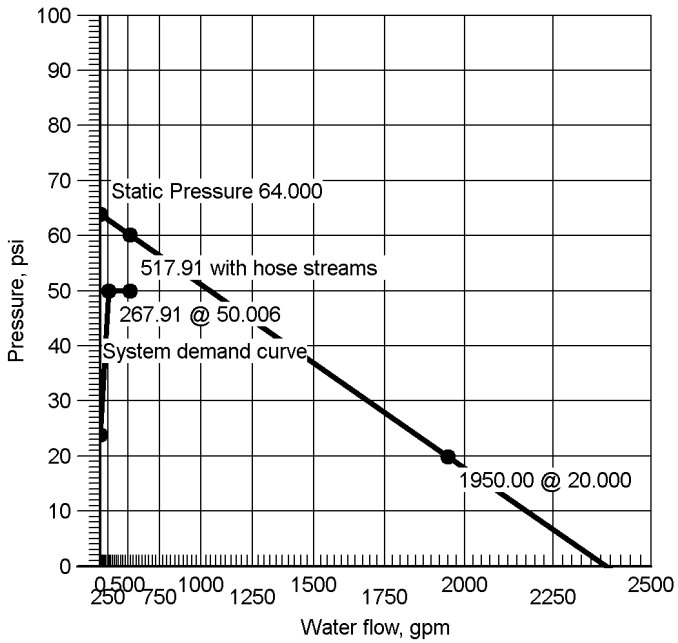
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
03/26/2024
Signature Date
Expires 12/31/24

22-3688_PeirceSTEM-L03-Asbuilt



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L03-Asbuilt

System

Most Demanding Sprinkler Data: 8 K-Factor 26.00 at 10.563

Hose Allowance At Source: 250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
267.91	517.91

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 10.37 between nodes 918 and 9006

Maximum Velocity Under Ground	
2.72 between nodes 6 and 7	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
3128.85 gal	

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	

Density	Area of Application
0.20 gpm/ft²	1500 ft² (Actual 949 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
10	0	130 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Right: 49.909

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	250.00	64.000	20.000 @ 1950.00	60.213 @ 517.91	50.006	10.207

Contractor

	Contractor Number	Contact Name	Contact Title
	01	Ben Bernard	Engineer/PM

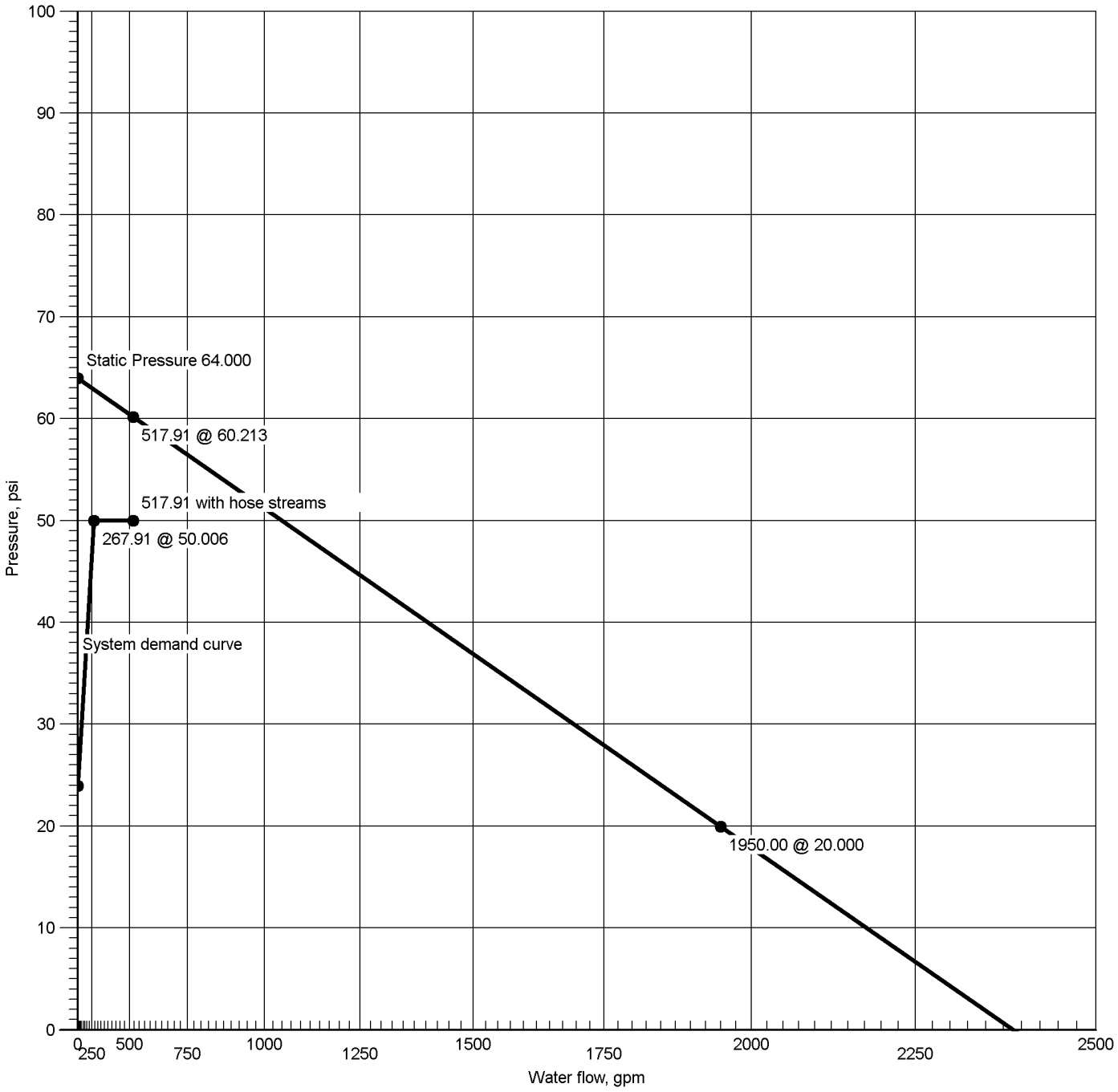
Name of Contractor:	Phone	Extension
SHINN FIRE PROTECTION	425-204-3945	

Address 1	FAX
18802 80TH AVE S	

Address 2	E-mail
KENT WA98032	

Address 3	Web-Site

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
60.213 @ 517.91

Required Pressure at System Demand
50.006 @ 267.91

Required Pressure at System Demand (Including Hose Allowance at Source)
50.006 @ 517.91

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Ordinary Group II (9)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	9000	26.82	26.00	8	11.237			
Sprinkler	9001	26.31	26.00	8	10.816			
Sprinkler	9002	26.73	26.00	8	11.163			
Sprinkler	9003	26.26	26.00	8	10.772			
Sprinkler	9004	26.73	26.00	8	11.163			
Sprinkler	**9005**	**26.00**	**26.00**	**8**	**10.563**			
Sprinkler	9006	27.95	26.00	8	12.204			
Sprinkler	9007	26.37	26.00	8	10.869			
Sprinkler	9008	26.80	26.00	8	11.223			
Sprinkler	9009	27.95	26.00	8	12.203			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	84'-6½	S	50.006	267.91	
9000	139'-10½	Spr(-11.237), fd	11.237	26.82	
9001	139'-10½	Spr(-10.816), fd	10.816	26.31	
9002	139'-10½	Spr(-11.163), fd	11.163	26.73	
9003	139'-10½	Spr(-10.772), fd	10.772	26.26	
9004	139'-10½	Spr(-11.163), fd	11.163	26.73	
9005	139'-10½	Spr(-10.563), fd	10.563	26.00	
9006	139'-10½	Spr(-12.204), fd	12.204	27.95	
9007	139'-10½	Spr(-10.869), fd	10.869	26.37	
9008	139'-10½	Spr(-11.223), fd	11.223	26.80	
9009	139'-10½	Spr(-12.203), fd	12.203	27.95	
2	84'-6½	PIV(-2.000)	49.901		
3	84'-6½	BFP(-0.953)	47.880		
6	84'-6½	PO(20'-0)	46.920		
7	90'-9		43.942		
8	91'-4½	St(-0.132)	43.671		
9	102'-6½	PO(20'-2)	38.580		
801	101'-6	T(14'-4½)	38.580		
802	111'-0	E(6'-8½)	38.580		
803	111'-6½	E(6'-8½)	38.580		
900	144'-9	E(13'-2)	13.725		
901	144'-9	PO(12'-3½)	12.716		
902	144'-9	PO(12'-3½)	12.572		
903	144'-9	PO(12'-3½)	12.508		
904	144'-9	PO(12'-3½)	12.474		
905	140'-6		10.551		
906	141'-6		10.538		
907	144'-9	PO(6'-0)	9.673		
908	144'-9	PO(6'-0)	9.291		
909	144'-9	PO(6'-0)	9.597		
910	144'-9	PO(6'-0)	9.244		
911	141'-6		10.464		
912	140'-6		10.506		
913	140'-6		10.297		
914	141'-6		10.464		
915	144'-9	PO(6'-0)	9.596		
916	144'-9	PO(6'-0)	9.247		
917	144'-9	PO(6'-0)	10.748		
918	140'-6		11.939		
919	144'-9	PO(6'-0)	9.345		
920	141'-6		10.524		
921	140'-6		10.591		
922	144'-9	PO(6'-0)	10.746		
923	144'-9	PO(6'-0)	9.659		
924	140'-6		11.937		
925	144'-9	PO(12'-3½)	11.072		
926	144'-9	PO(12'-3½)	11.112		
927	144'-9	PO(12'-3½)	11.080		
928	144'-9	PO(12'-3½)	11.168		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
DY	1.0490	26.00	9.65	120		0.211435	0'-0	Pf 0.000
9005	139'-10½	26.00	8	10.563		Sprinkler,		Pe -0.266
913	140'-6			10.297		, fd	0'-0	Pv
DR	1.3800	26.00	5.58	120		0.055609	5'-3	Pf 0.792
913	140'-6			10.297			9'-0	Pe -1.842
916	144'-9			9.247		E(3'-0), PO(6'-0)	14'-3	Pv
BL	2.1570	31.21	2.74	120		0.008857	11'-1	Pf 0.098
916	144'-9	5.21		9.247		Flow (q) from Route 14		Pe
919	144'-9			9.345			11'-1	Pv
BL	2.1570	57.59	5.06	120		0.027504	50'-9	Pf 1.735
919	144'-9	26.37		9.345		Flow (q) from Route 4	12'-3½	Pe
927	144'-9			11.080		PO(12'-3½)	63'-1	Pv
CM	4.2600	109.11	2.46	120		0.003262	9'-10½	Pf 0.032
927	144'-9	51.53		11.080		Flow (q) from Route 7		Pe
926	144'-9			11.112			9'-10½	Pv
CM	4.2600	133.94	3.01	120		0.004767	11'-9½	Pf 0.056
926	144'-9	24.83		11.112		Flow (q) from Route 11		Pe
928	144'-9			11.168			11'-9½	Pv
CM	4.2600	112.42	2.53	120		0.003448	244'-4½	Pf 1.306
928	144'-9			11.168			134'-3½	Pe 0.000
904	144'-9			12.474		9E(13'-2), 2EE(5'-3), Ee2(5'-3)	378'-8	Pv
CM	4.2600	133.94	3.01	120		0.004767	7'-2½	Pf 0.034
904	144'-9	21.52		12.474		Flow (q) from Route 12		Pe
903	144'-9			12.508			7'-2½	Pv
CM	4.2600	165.01	3.71	120		0.007012	9'-2	Pf 0.064
903	144'-9	31.07		12.508		Flow (q) from Route 9		Pe
902	144'-9			12.572			9'-2	Pv
CM	4.2600	212.36	4.78	120		0.011182	12'-10	Pf 0.144
902	144'-9	47.36		12.572		Flow (q) from Route 2		Pe
901	144'-9			12.716			12'-10	Pv
CM	4.2600	267.91	6.03	120		0.017187	32'-4½	Pf 1.009
901	144'-9	55.55		12.716		Flow (q) from Route 5	26'-4	Pe
900	144'-9			13.725		2E(13'-2)	58'-8½	Pv
FR	6.3570	267.91	2.71	120		0.002447	103'-5½	Pf 6.560
900	144'-9			13.725			125'-4½	Pe 18.295
9	102'-6½			38.580		4E(17'-7), sCV(-6.000), sCV(17'-2½), PO(37'-8½)	228'-9½	Pv
CM	6.3570	267.91	2.71	120		0.002447	20'-5	Pf 0.255
9	102'-6½			38.580			30'-2	Pe 4.836
8	91'-4½			43.671		BV(12'-7), E(17'-7), St(-0.132)	50'-7	Pv
DY	6.3400	267.91	2.72	140		0.001864	0'-0	Pf 0.000
8	91'-4½			43.671				Pe 0.271
7	90'-9			43.942			0'-0	Pv
UG	6.3400	267.91	2.72	140		0.001864	86'-3½	Pf 0.290
7	90'-9			43.942			69'-4	Pe 2.688
6	84'-6½			46.920		3E(23'-1½)	155'-7½	Pv
UG	6.3400	267.91	2.72	140		0.001864	4'-1½	Pf 0.961
6	84'-6½			46.920				Pe
3	84'-6½			47.880		BFP(-0.953)	4'-1½	Pv
UG	6.3400	267.91	2.72	140		0.001864	11'-2½	Pf 2.021
3	84'-6½			47.880				Pe
2	84'-6½			49.901		PIV(-2.000)	11'-2½	Pv
UG	6.3400	267.91	2.72	140		0.001864	21'-7	Pf 0.105
2	84'-6½			49.901			34'-8	Pe
1	84'-6½			50.006		E(23'-1½), EE(11'-6½), S	56'-3	Pv
		250.00				Hose Allowance At Source		
1		517.91						
• • • • • Route 2 • • • • •								
DY	1.0490	26.26	9.75	120		0.215309	0'-0	Pf 0.000
9003	139'-10½	26.26	8	10.772		Sprinkler,		Pe -0.266
912	140'-6			10.506		, fd	0'-0	Pv
DR	1.3800	26.26	5.63	120		0.056628	4'-3	Pf 0.580
912	140'-6			10.506			6'-0	Pe -1.842
910	144'-9			9.244		PO(6'-0)	10'-3	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	2.1570	21.05	1.85	120		0.004272	10'-11½	Pf 0.047
910	144'-9			9.244				Pe
908	144'-9			9.291			10'-11½	Pv
BL	2.1570	47.36	4.16	120		0.019153	122'-1	Pf 3.281
908	144'-9	26.31		9.291		Flow (q) from Route 3	49'-2½	Pe
902	144'-9			12.572		6E(6'-2), PO(12'-3½)	171'-4	Pv
• • • • • Route 3 • • • • •								
DY	1.0490	26.31	9.77	120		0.216132	0'-0	Pf 0.000
9001	139'-10½	26.31	8	10.816		Sprinkler,		Pe -0.266
905	140'-6			10.551		, fd	0'-0	Pv
DR	1.3800	26.31	5.64	120		0.056844	4'-3	Pf 0.583
905	140'-6			10.551			6'-0	Pe -1.842
908	144'-9			9.291		PO(6'-0)	10'-3	Pv
• • • • • Route 4 • • • • •								
DY	1.0490	26.37	9.79	120		0.217111	0'-0	Pf 0.000
9007	139'-10½	26.37	8	10.869		Sprinkler,		Pe -0.278
921	140'-6			10.591		, fd	0'-0	Pv
DR	1.3800	26.37	5.66	120		0.057101	4'-2½	Pf 0.584
921	140'-6			10.591			6'-0	Pe -1.830
919	144'-9			9.345		PO(6'-0)	10'-2½	Pv
• • • • • Route 5 • • • • •								
DY	1.0490	26.73	9.92	120		0.222530	0'-0	Pf 0.000
9004	139'-10½	26.73	8	11.163		Sprinkler,		Pe -0.699
914	141'-6			10.464		, fd	0'-0	Pv
DR	1.3800	26.73	5.73	120		0.058527	3'-3	Pf 0.541
914	141'-6			10.464			6'-0	Pe -1.409
915	144'-9			9.596		PO(6'-0)	9'-3	Pv
BL	2.1570	2.00	0.18	120		0.000055	9'-2	Pf 0.001
915	144'-9			9.596				Pe
909	144'-9			9.597			9'-2	Pv
BL	2.1570	28.73	2.52	120		0.007599	10'-1	Pf 0.077
909	144'-9	26.73		9.597		Flow (q) from Route 6		Pe
907	144'-9			9.673			10'-1	Pv
BL	2.1570	55.55	4.88	120		0.025730	105'-11½	Pf 3.042
907	144'-9	26.82		9.673		Flow (q) from Route 8	12'-3½	Pe
901	144'-9			12.716		PO(12'-3½)	118'-3	Pv
• • • • • Route 6 • • • • •								
DY	1.0490	26.73	9.92	120		0.222539	0'-0	Pf 0.000
9002	139'-10½	26.73	8	11.163		Sprinkler,		Pe -0.699
911	141'-6			10.464		, fd	0'-0	Pv
DR	1.3800	26.73	5.73	120		0.058529	3'-3	Pf 0.541
911	141'-6			10.464			6'-0	Pe -1.409
909	144'-9			9.597		PO(6'-0)	9'-3	Pv
• • • • • Route 7 • • • • •								
DY	1.0490	26.80	9.95	120		0.223636	0'-0	Pf 0.000
9008	139'-10½	26.80	8	11.223		Sprinkler,		Pe -0.699
920	141'-6			10.524		, fd	0'-0	Pv
DR	1.3800	26.80	5.75	120		0.058818	3'-3	Pf 0.544
920	141'-6			10.524			6'-0	Pe -1.409
923	144'-9			9.659		PO(6'-0)	9'-3	Pv
BL	2.1570	51.53	4.52	120		0.022392	50'-9½	Pf 1.413
923	144'-9	24.73		9.659		Flow (q) from Route 13	12'-3½	Pe
925	144'-9			11.072		PO(12'-3½)	63'-1½	Pv
CM	4.2600	51.53	1.16	120		0.000814	9'-6½	Pf 0.008
925	144'-9			11.072				Pe
927	144'-9			11.080			9'-6½	Pv
• • • • • Route 8 • • • • •								
DY	1.0490	26.82	9.96	120		0.223891	0'-0	Pf 0.000
9000	139'-10½	26.82	8	11.237		Sprinkler,		Pe -0.699
906	141'-6			10.538		, fd	0'-0	Pv
DR	1.3800	26.82	5.75	120		0.058885	3'-3	Pf 0.545
906	141'-6			10.538			6'-0	Pe -1.409
907	144'-9			9.673		PO(6'-0)	9'-3	Pv
• • • • • Route 9 • • • • •								
DY	1.0490	27.95	10.37	120		0.241641	0'-0	Pf 0.000
9009	139'-10½	27.95	8	12.203		Sprinkler,		Pe -0.266
924	140'-6			11.937		, fd	0'-0	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
DR	1.3800	27.95	5.99	120	0.063553	4'-3	Pf 0.651
924	140'-6			11.937		6'-0	Pe -1.842
922	144'-9			10.746	PO(6'-0)	10'-3	Pv
BL	2.1570	3.12	0.27	120	0.000125	11'-0½	Pf 0.001
922	144'-9			10.746			Pe
917	144'-9			10.748		11'-0½	Pv
BL	2.1570	31.07	2.73	120	0.008781	138'-11½	Pf 1.760
917	144'-9	27.95		10.748	Flow (q) from Route 10	61'-6½	Pe -0.000
903	144'-9			12.508	8E(6'-2), PO(12'-3½)	200'-5½	Pv
• • • • • **Route 10** • • • • •							
DY	1.0490	27.95	10.37	120	0.241665	0'-0	Pf 0.000
9006	139'-10½	27.95	8	12.204	Sprinkler,		Pe -0.266
918	140'-6			11.939	, fd	0'-0	Pv
DR	1.3800	27.95	5.99	120	0.063559	4'-3	Pf 0.651
918	140'-6			11.939		6'-0	Pe -1.842
917	144'-9			10.748	PO(6'-0)	10'-3	Pv
• • • • • **Route 11** • • • • •							
BL	2.1570	24.83	2.18	120	0.005800	50'-9	Pf 0.366
922	144'-9	3.12		10.746	Flow (q) from Route 9	12'-3½	Pe
926	144'-9			11.112	PO(12'-3½)	63'-0½	Pv
• • • • • **Route 12** • • • • •							
BL	2.1570	21.52	1.89	120	0.004451	194'-10	Pf 1.306
928	144'-9			11.168	PO(12'-3½)	98'-5½	Pe
904	144'-9			12.474	10E(6'-2), T(12'-3½), PO(12'-3½)	293'-3½	Pv
• • • • • **Route 13** • • • • •							
BL	2.1570	24.73	2.17	120	0.005757	10'-10½	Pf 0.063
915	144'-9	2.00		9.596	Flow (q) from Route 5		Pe
923	144'-9			9.659		10'-10½	Pv
• • • • • **Route 14** • • • • •							
BL	2.1570	5.21	0.46	120	0.000323	8'-0½	Pf 0.003
910	144'-9	21.05		9.244	Flow (q) from Route 2		Pe
916	144'-9			9.247		8'-0½	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: Ordinary Group II (10)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.20 gpm/ft²	Area of Application: 1500 ft² (Actual 924 ft²)
Most Demanding Sprinkler Data: 8 K-Factor 26.00 at 10.563	Hose Streams: 250.00
Coverage Per Sprinkler: 130 ft²	Number Of Sprinklers Calculated: 9 / Number Of Nozzles Calculated: 0
System Pressure Demand: 50.062	System Flow Demand: 237.30
Total Demand: 487.30 @ 50.062	Pressure Result: +10.555 (17.4%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	250.00	64.000	20.000

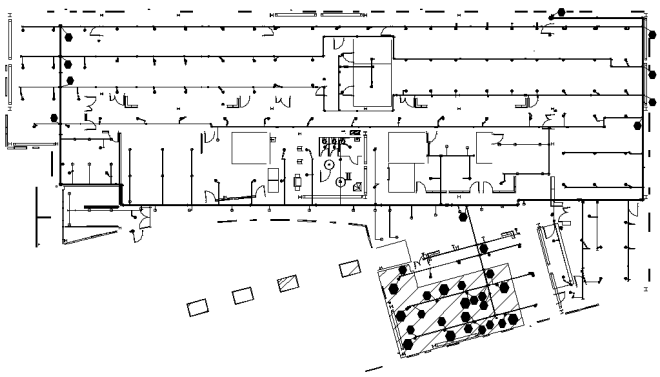
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

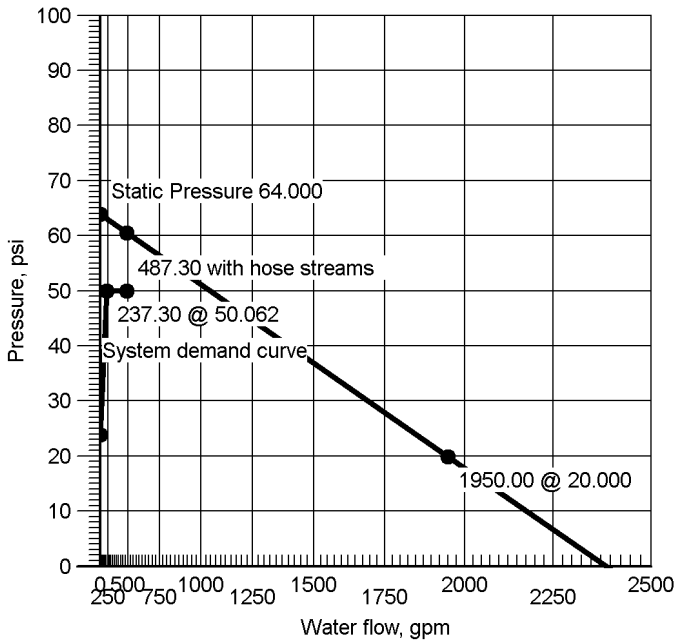
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
03/26/2024
Signature Date
Expires 12/31/24

22-3688_PeirceSTEM-L03-Asbuilt



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L03-Asbuilt

System

Most Demanding Sprinkler Data: 8 K-Factor 26.00 at 10.563

Hose Allowance At Source: 250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
237.30	487.30

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 9.96 between nodes 1021 and 10200

Maximum Velocity Under Ground: 2.41 between nodes 6 and 7

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
3128.85 gal	

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	

Density	Area of Application
0.20 gpm/ft²	1500 ft² (Actual 924 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
9	0	130 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Left: 50.062 Right: 50.062

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	250.00	64.000	20.000 @ 1950.00	60.617 @ 487.30	50.062	10.555

Contractor

	Contractor Number	Contact Name	Contact Title
	01	Ben Bernard	Engineer/PM

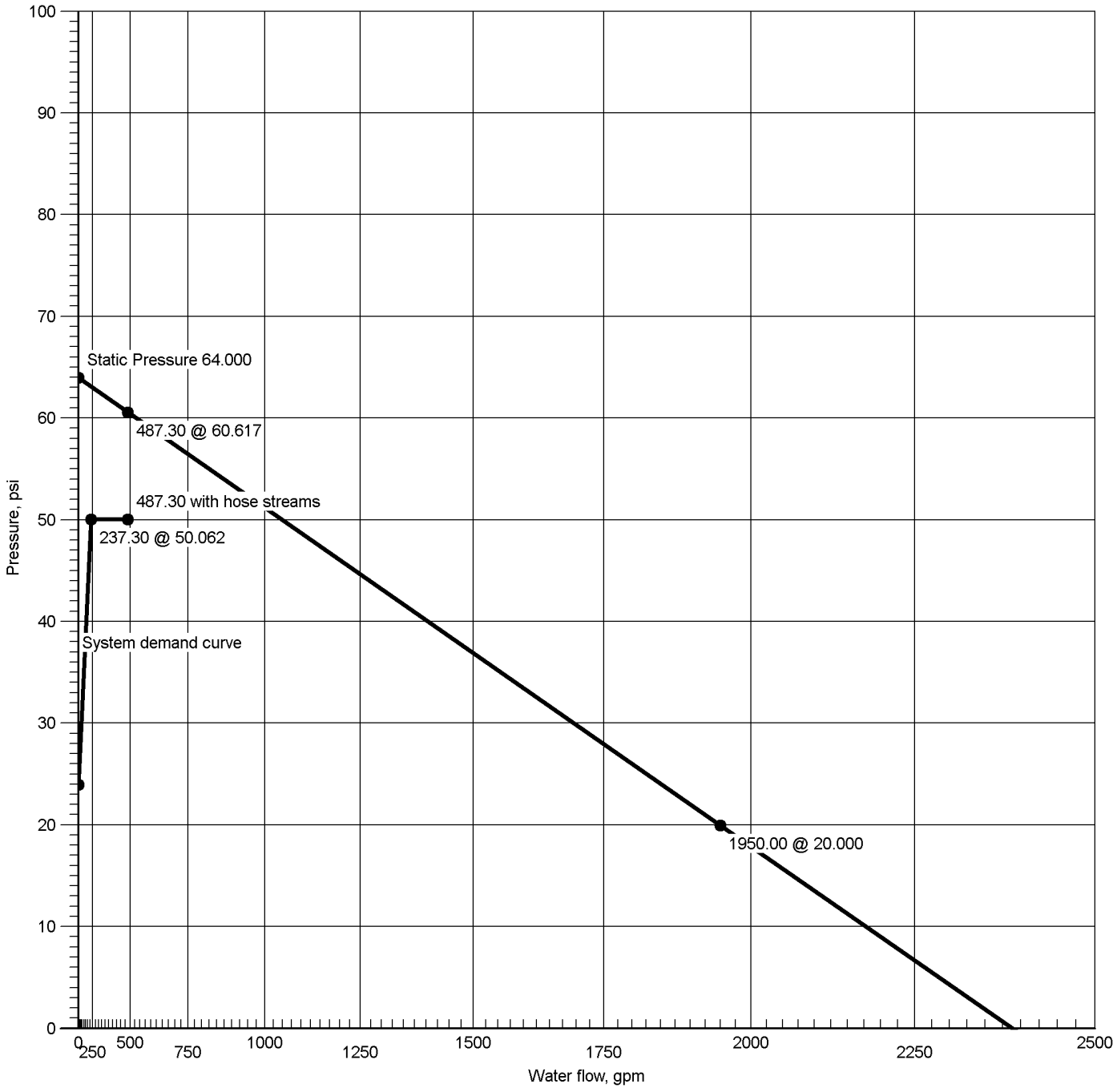
Name of Contractor:	Phone	Extension
SHINN FIRE PROTECTION	425-204-3945	

Address 1	FAX
18802 80TH AVE S	

Address 2	E-mail
KENT WA98032	

Address 3	Web-Site

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
60.617 @ 487.30

Required Pressure at System Demand
50.062 @ 237.30

Required Pressure at System Demand (Including Hose Allowance at Source)
50.062 @ 487.30

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Ordinary Group II (10)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	10200	26.84	26.00	8	11.255			
Sprinkler	10201	26.23	26.00	8	10.747			
Sprinkler	10202	26.50	26.00	8	10.969			
Sprinkler	10203	26.75	26.00	8	11.181			
Sprinkler	10204	26.40	26.00	8	10.894			
Sprinkler	10205	26.27	26.00	8	10.783			
Sprinkler	10206	26.19	26.00	8	10.715			
Sprinkler	**10207**	**26.00**	**26.00**	**8**	**10.563**			
Sprinkler	10208	26.12	26.00	8	10.663			

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	84'-6½	S	50.062	237.30	
10200	139'-10	Spr(-11.255), fd	11.255	26.84	
10201	139'-10	Spr(-10.747), fd	10.747	26.23	
10202	139'-10	Spr(-10.969), fd	10.969	26.50	
10203	139'-10	Spr(-11.181), fd	11.181	26.75	
10204	139'-10	Spr(-10.894), fd	10.894	26.40	
10205	139'-10	Spr(-10.783), fd	10.783	26.27	
10206	139'-10	Spr(-10.715), fd	10.715	26.19	
10207	139'-10	Spr(-10.563), fd	10.563	26.00	
10208	139'-10	Spr(-10.663), fd	10.663	26.12	
2	84'-6½	PIV(-2.000)	49.978		
3	84'-6½	BFP(-0.761)	47.962		
6	84'-6½	PO(20'-0)	47.194		
7	90'-9		44.275		
8	91'-4½	St(-0.091)	44.004		
9	102'-6½	PO(20'-2)	38.978		
801	101'-6	T(14'-4½)	38.978		
802	111'-0	E(6'-8½)	38.978		
803	111'-6½	E(6'-8½)	38.978		
900	144'-9	E(13'-2)	14.236		
901	144'-9	PO(12'-3½)	13.430		
902	144'-9	PO(12'-3½)	13.282		
903	144'-9	PO(12'-3½)	13.192		
904	144'-9	PO(12'-3½)	13.132		
925	144'-9	PO(12'-3½)	12.483		
926	144'-9	PO(12'-3½)	12.477		
927	144'-9	PO(12'-3½)	12.482		
928	144'-9	PO(12'-3½)	12.466		
1019	145'-8	PO(26'-4)	11.726		
1020	146'-4½	PO(12'-3½)	10.634		
1021	146'-4½	PO(5'-0)	10.443		
1022	146'-4½	PO(5'-0)	10.065		
1023	146'-4½	PO(16'-5½)	10.536		
1024	146'-4½		10.528		
1025	146'-4½	PO(5'-0)	10.404		
1026	146'-4½		10.092		
1027	146'-4½	PO(16'-5½)	10.447		
1028	146'-4½	PO(5'-0)	9.850		
1029	146'-4½	PO(5'-0)	10.346		
1030	146'-4½		10.008		
1031	146'-4½	PO(5'-0)	10.012		
1032	146'-4½	PO(5'-0)	9.804		
1033	146'-4½	PO(5'-0)	9.802		
1034	146'-4½	PO(5'-0)	9.743		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
DR	1.0490	26.00	9.65	120		0.211435	4'-9½	Pf 2.070
10207	139'-10	26.00	8	10.563		Sprinkler,	5'-0	Pe -2.831
1033	146'-4½			9.802		PO(5'-0), fd	9'-9½	Pv
BL	2.1570	26.00	2.28	120		0.006317	7'-7	Pf 0.048
1033	146'-4½			9.802				Pe
1028	146'-4½			9.850			7'-7	Pv
BL	2.1570	52.23	4.59	120		0.022956	9'-4½	Pf 0.215
1028	146'-4½	26.23		9.850		Flow (q) from Route 4		Pe
1022	146'-4½			10.065			9'-4½	Pv
BL	2.1570	78.72	6.91	120		0.049044	0'-6½	Pf 0.027
1022	146'-4½	26.50		10.065		Flow (q) from Route 7		Pe
1026	146'-4½			10.092			0'-6½	Pv
BL	2.6350	78.72	4.63	120		0.018502	7'-6½	Pf 0.444
1026	146'-4½			10.092			16'-5½	Pe -0.000
1023	146'-4½			10.536		PO(16'-5½)	24'-0	Pv
CM	4.2600	211.03	4.75	120		0.011052	10'-1	Pf 0.112
1023	146'-4½	105.46 + 26.84		10.536		Flow (q) from Route 2 and 9		Pe -0.014
1020	146'-4½			10.634			10'-1	Pv
CM	4.2600	237.30	5.34	120		0.013731	16'-7½	Pf 0.770
1020	146'-4½	26.27		10.634		Flow (q) from Route 5	39'-6	Pe 0.321
1019	145'-8			11.726		E(13'-2), PO(26'-4)	56'-1½	Pv
CM	4.2600	167.18	3.76	120		0.007183	85'-1½	Pf 1.009
1019	145'-8			11.726			55'-3½	Pe 0.397
904	144'-9			13.132		3E(13'-2), 2EE(5'-3), Ee2(5'-3)	140'-5	Pv
CM	4.2600	182.13	4.10	120		0.008416	7'-2½	Pf 0.061
904	144'-9	14.95		13.132		Flow (q) from Route 12		Pe
903	144'-9			13.192			7'-2½	Pv
CM	4.2600	198.24	4.46	120		0.009845	9'-2	Pf 0.090
903	144'-9	16.11		13.192		Flow (q) from Route 11		Pe
902	144'-9			13.282			9'-2	Pv
CM	4.2600	215.71	4.86	120		0.011510	12'-10	Pf 0.148
902	144'-9	17.47		13.282		Flow (q) from Route 13		Pe
901	144'-9			13.430			12'-10	Pv
CM	4.2600	237.30	5.34	120		0.013731	32'-4½	Pf 0.806
901	144'-9	21.59		13.430		Flow (q) from Route 10	26'-4	Pe
900	144'-9			14.236		2E(13'-2)	58'-8½	Pv
FR	6.3570	237.30	2.40	120		0.001955	103'-5½	Pf 6.447
900	144'-9			14.236			125'-4½	Pe 18.295
9	102'-6½			38.978		4E(17'-7), sCV(-6.000), sCV(17'-2½), PO(37'-8½)	228'-9½	Pv
CM	6.3570	237.30	2.40	120		0.001955	20'-5	Pf 0.190
9	102'-6½			38.978			30'-2	Pe 4.836
8	91'-4½			44.004		BV(12'-7), E(17'-7), St(-0.091)	50'-7	Pv
DY	6.3400	237.30	2.41	140		0.001489	0'-0	Pf 0.000
8	91'-4½			44.004				Pe 0.271
7	90'-9			44.275			0'-0	Pv
UG	6.3400	237.30	2.41	140		0.001489	86'-3½	Pf 0.232
7	90'-9			44.275			69'-4	Pe 2.688
6	84'-6½			47.194		3E(23'-1½)	155'-7½	Pv
UG	6.3400	237.30	2.41	140		0.001489	4'-1½	Pf 0.767
6	84'-6½			47.194				Pe
3	84'-6½			47.962		BFP(-0.761)	4'-1½	Pv
UG	6.3400	237.30	2.41	140		0.001489	11'-2½	Pf 2.017
3	84'-6½			47.962				Pe
2	84'-6½			49.978		PIV(-2.000)	11'-2½	Pv
UG	6.3400	237.30	2.41	140		0.001489	21'-7	Pf 0.084
2	84'-6½			49.978			34'-8	Pe
1	84'-6½			50.062		E(23'-1½), EE(11'-6½), S	56'-3	Pv
		250.00				Hose Allowance At Source		
1		487.30						
• • • • • Route 2 • • • • •								
DR	1.0490	26.12	9.70	120		0.213289	3'-11½	Pf 1.911
10208	139'-10	26.12	8	10.663		Sprinkler,	5'-0	Pe -2.831
1034	146'-4½			9.743		PO(5'-0), fd	8'-11½	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	2.1570	26.12	2.29	120		0.006372	9'-7	Pf 0.061
1034	146'-4½			9.743				Pe
1032	146'-4½			9.804			9'-7	Pv
BL	2.1570	52.31	4.59	120		0.023024	8'-10	Pf 0.204
1032	146'-4½	26.19		9.804		Flow (q) from Route 3		Pe
1030	146'-4½			10.008			8'-10	Pv
BL	2.6350	52.31	3.08	120		0.008686	0'-6	Pf 0.004
1030	146'-4½			10.008				Pe
1031	146'-4½			10.012			0'-6	Pv
BL	2.6350	78.71	4.63	120		0.018499	7'-0½	Pf 0.435
1031	146'-4½	26.40		10.012		Flow (q) from Route 6	16'-5½	Pe
1027	146'-4½			10.447		PO(16'-5½)	23'-6	Pv
CM	3.2600	105.46	4.05	120		0.011273	7'-2½	Pf 0.081
1027	146'-4½	26.75		10.447		Flow (q) from Route 8		Pe
1024	146'-4½			10.528			7'-2½	Pv
CM	4.2600	105.46	2.37	120		0.003063	2'-8½	Pf 0.008
1024	146'-4½			10.528				Pe
1023	146'-4½			10.536			2'-8½	Pv
• • • • • Route 3 • • • • •								
BL	1.0490	26.19	9.72	120		0.214260	3'-11½	Pf 1.919
10206	139'-10	26.19	8	10.715		Sprinkler,	5'-0	Pe -2.831
1032	146'-4½			9.804		PO(5'-0), fd	8'-11½	Pv
• • • • • Route 4 • • • • •								
BL	1.0490	26.23	9.74	120		0.214849	4'-0	Pf 1.934
10201	139'-10	26.23	8	10.747		Sprinkler,	5'-0	Pe -2.831
1028	146'-4½			9.850		PO(5'-0), fd	9'-0	Pv
• • • • • Route 5 • • • • •								
BL	1.0490	26.27	9.75	120		0.215519	6'-4½	Pf 2.452
10205	139'-10	26.27	8	10.783		Sprinkler,	5'-0	Pe -2.831
1025	146'-4½			10.404		PO(5'-0), fd	11'-4½	Pv
BL	2.1570	26.27	2.31	120		0.006439	25'-7	Pf 0.244
1025	146'-4½			10.404			12'-3½	Pe -0.014
1020	146'-4½			10.634		PO(12'-3½)	37'-10½	Pv
• • • • • Route 6 • • • • •								
BL	1.0490	26.40	9.80	120		0.217562	3'-11½	Pf 1.949
10204	139'-10	26.40	8	10.894		Sprinkler,	5'-0	Pe -2.831
1031	146'-4½			10.012		PO(5'-0), fd	8'-11½	Pv
• • • • • Route 7 • • • • •								
BL	1.0490	26.50	9.84	120		0.218958	3'-9½	Pf 1.928
10202	139'-10	26.50	8	10.969		Sprinkler,	5'-0	Pe -2.832
1022	146'-4½			10.065		PO(5'-0), fd	8'-9½	Pv
• • • • • Route 8 • • • • •								
BL	1.0490	26.75	9.93	120		0.222856	3'-11½	Pf 1.996
10203	139'-10	26.75	8	11.181		Sprinkler,	5'-0	Pe -2.831
1029	146'-4½			10.346		PO(5'-0), fd	8'-11½	Pv
BL	2.1570	26.75	2.35	120		0.006658	2'-9½	Pf 0.100
1029	146'-4½			10.346			12'-3½	Pe
1027	146'-4½			10.447		PO(12'-3½)	15'-1	Pv
• • • • • Route 9 • • • • •								
BL	1.0490	26.84	9.96	120		0.224228	4'-0	Pf 2.018
10200	139'-10	26.84	8	11.255		Sprinkler,	5'-0	Pe -2.831
1021	146'-4½			10.443		PO(5'-0), fd	9'-0	Pv
BL	2.1570	26.84	2.36	120		0.006699	1'-8½	Pf 0.094
1021	146'-4½			10.443			12'-3½	Pe -0.000
1023	146'-4½			10.536		PO(12'-3½)	14'-0	Pv
• • • • • Route 10 • • • • •								
CM	4.2600	55.17	1.24	120		0.000924	11'-9½	Pf 0.011
928	144'-9	70.12		12.466		Flow (q) from Route 14		Pe
926	144'-9			12.477			11'-9½	Pv
CM	4.2600	39.06	0.88	120		0.000488	9'-10½	Pf 0.005
926	144'-9			12.477				Pe
927	144'-9			12.482			9'-10½	Pv
CM	4.2600	21.59	0.49	120		0.000163	9'-6½	Pf 0.002
927	144'-9			12.482				Pe
925	144'-9			12.483			9'-6½	Pv
BL	2.1570	21.59	1.90	120		0.004477	186'-10½	Pf 0.947
925	144'-9			12.483		PO(12'-3½)	24'-7½	Pe
901	144'-9			13.430		PO(12'-3½)	211'-6	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • **Route 11** • • • • •								
BL	2.1570	16.11	1.41	120		0.002606	200'-8½	**Pf** 0.715
926	144'-9			12.477		PO(12'-3½)	73'-10	**Pe** -0.000
903	144'-9			13.192		8E(6'-2), PO(12'-3½)	274'-7	**Pv**
• • • • • **Route 12** • • • • •								
BL	2.1570	14.95	1.31	120		0.002269	194'-10	**Pf** 0.666
928	144'-9	70.12		12.466		PO(12'-3½), Flow (q) from Route 14	98'-5½	**Pe**
904	144'-9			13.132		10E(6'-2), T(12'-3½), PO(12'-3½)	293'-3½	**Pv**
• • • • • **Route 13** • • • • •								
BL	2.1570	17.47	1.53	120		0.003028	202'-11	**Pf** 0.801
927	144'-9			12.482		PO(12'-3½)	61'-6½	**Pe**
902	144'-9			13.282		6E(6'-2), PO(12'-3½)	264'-5½	**Pv**
• • • • • **Route 14** • • • • •								
CM	4.2600	70.12	1.58	120		0.001440	159'-3½	**Pf** 0.343
1019	145'-8	167.18		11.726		Flow (q) from Route 1	79'-0	**Pe** 0.397
928	144'-9			12.466		6E(13'-2)	238'-3½	**Pv**

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PRV	Pressure Reducing Valve
PrV	Pressure Relief Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: Ordinary Group I (12)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.15 gpm/ft²	Area of Application: 418 ft² (Actual 418 ft²)
Most Demanding Sprinkler Data: 2.8 K-Factor 7.41 at 7.000	Hose Streams: 250.00
Coverage Per Sprinkler: 112 ft²	Number Of Sprinklers Calculated: 4 / Number Of Nozzles Calculated: 0
System Pressure Demand: 47.292	System Flow Demand: 29.78
Total Demand: 279.78 @ 47.292	Pressure Result: +15.496 (24.7%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1950.00	250.00	64.000	20.000

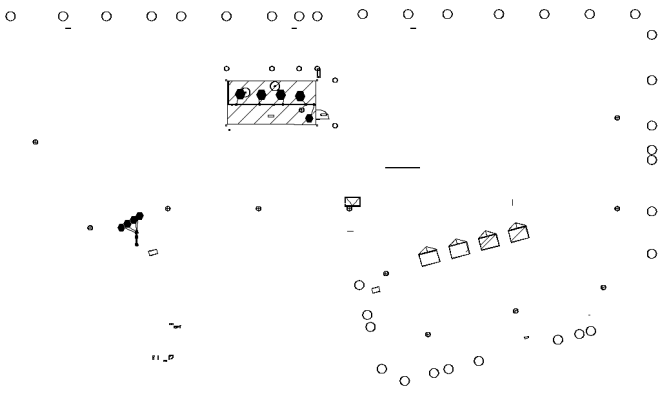
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

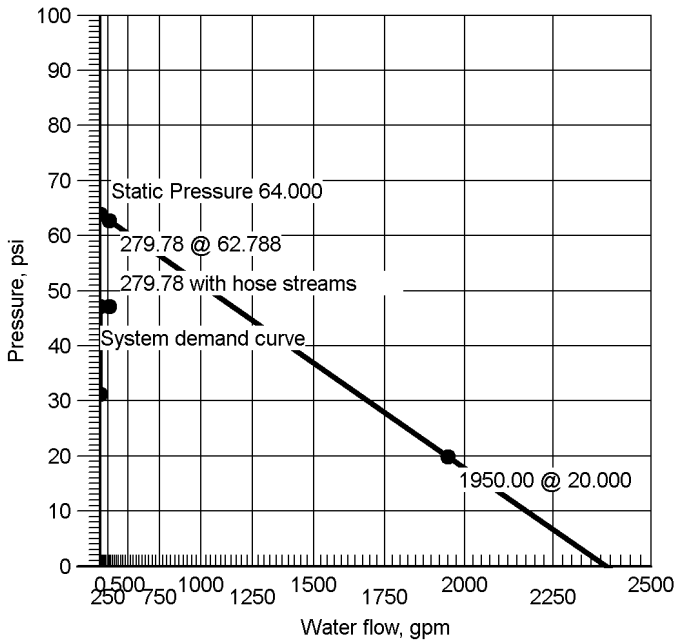
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
03/26/2024
Signature Date
Expires 12/31/24

22-3688_PeirceSTEM-L04-Asbuilt



Supply at Node 1 (1950.00, 0.00, 64.000, 20.000)



Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L04-Asbuilt

System

Most Demanding Sprinkler Data: 2.8 K-Factor 7.41 at 7.000

Hose Allowance At Source: 250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand	Total Water Required (Including Hose Allowance)
29.78	279.78

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 4.30 between nodes 1100 and 11001

Maximum Velocity Under Ground	
0.30 between nodes 6 and 7	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
3150.39 gal	

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group I	

Density	Area of Application
0.15 gpm/ft²	418 ft² (Actual 418 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
4	0	112 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	250.00	64.000	20.000 @ 1950.00	62.788 @ 279.78	47.292	15.496

Contractor

	Contractor Number	Contact Name	Contact Title
	01	Ben Bernard	Engineer/PM

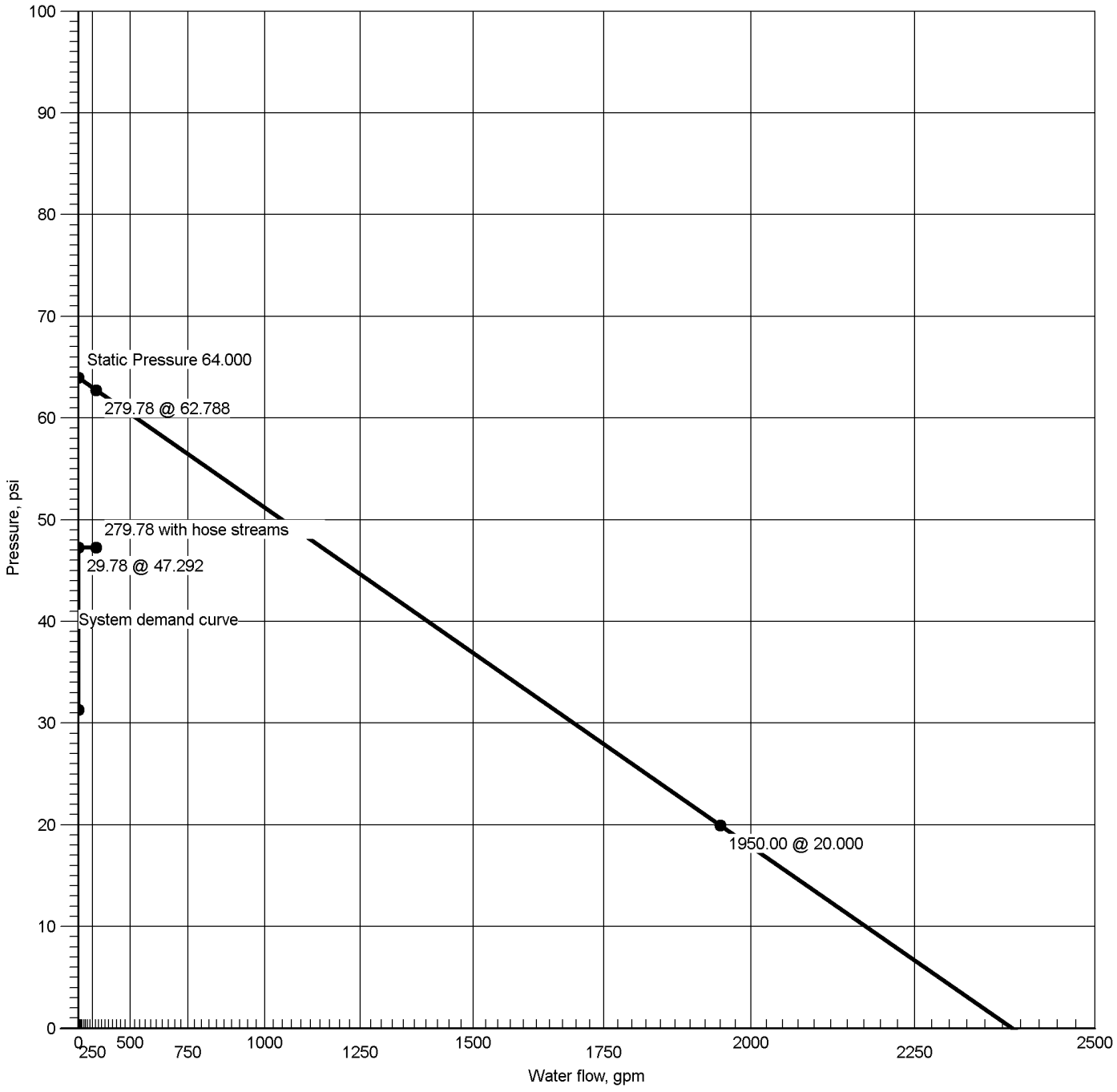
Name of Contractor:	Phone	Extension
SHINN FIRE PROTECTION	425-204-3945	

Address 1	FAX
18802 80TH AVE S	

Address 2	E-mail
KENT WA98032	

Address 3	Web-Site

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static: Pressure
64.000

Residual: Pressure
20.000 @ 1950.00

Available Flow @ 20 PSI:
0.00

Available Pressure at System Demand
62.788 @ 279.78

Required Pressure at System Demand
47.292 @ 29.78

Required Pressure at System Demand (Including Hose Allowance at Source)
47.292 @ 279.78

Summary Of Outflowing Devices

Job Number: 22-3688
Report Description: Ordinary Group I (12)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler	11000	7.45	7.41	2.8	7.074			
Sprinkler	11001	7.51	7.41	2.8	7.196			
Sprinkler	11002	7.42	7.41	2.8	7.016			
Sprinkler	**11003**	**7.41**	**7.41**	**2.8**	**7.000**			

Most Demanding Sprinkler Data

Node Analysis

Job Number: 22-3688
Report Description: Ordinary Group I (12)

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	84'-6½	S	47.292	29.78	
11000	156'-10	Spr(-7.074)	7.074	7.45	
11001	156'-10	Spr(-7.196)	7.196	7.51	
11002	156'-10	Spr(-7.016)	7.016	7.42	
11003	156'-10	Spr(-7.000)	7.000	7.41	
2	84'-6½	PIV(-2.000)	47.290		
3	84'-6½	BFP(-0.016)	45.290		
6	84'-6½	PO(20'-0)	45.274		
7	90'-9		42.581		
8	91'-4½	St(-0.002)	42.310		
9	102'-6½	PO(20'-2)	37.470		
788	144'-9	T(12'-3½)	12.848		
801	101'-6	T(14'-4½)	37.470		
802	111'-0	E(6'-8½)	37.470		
803	111'-6½	E(6'-8½)	37.470		
900	144'-9	E(13'-2)	13.166		
901	144'-9	PO(12'-3½)	13.148		
902	144'-9	PO(12'-3½)	13.145		
903	144'-9	PO(12'-3½)	13.143		
904	144'-9	PO(12'-3½)	13.143		
925	144'-9	PO(12'-3½)	13.127		
926	144'-9	PO(12'-3½)	13.127		
927	144'-9	PO(12'-3½)	13.127		
928	144'-9	PO(12'-3½)	13.127		
1100	156'-10	E(4'-11½)	7.406		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
BL	1.6820	7.41	1.07	120		0.002079	7'-8½	Pf 0.016
11003	156'-10	7.41	2.8	7.000		Sprinkler		Pe 0.000
11002	156'-10			7.016			7'-8½	Pv
BL	1.6820	14.82	2.14	120		0.007502	7'-8	Pf 0.058
11002	156'-10	7.42	2.8	7.016		Sprinkler		Pe 0.000
11000	156'-10			7.074			7'-8	Pv
BL	1.6820	22.27	3.22	120		0.015930	7'-8½	Pf 0.123
11000	156'-10	7.45	2.8	7.074		Sprinkler		Pe 0.000
11001	156'-10			7.196			7'-8½	Pv
BL	1.6820	29.78	4.30	120		0.027272	2'-9	Pf 0.209
11001	156'-10	7.51	2.8	7.196		Sprinkler,	4'-11½	Pe 0.000
1100	156'-10			7.406		E(4'-11½)	7'-8	Pv
BL	2.1570	29.78	2.61	120		0.008122	12'-1	Pf 0.198
1100	156'-10			7.406			12'-3½	Pe 5.244
788	144'-9			12.848		T(12'-3½)	24'-5	Pv
BL	2.1570	12.54	1.10	120		0.001638	118'-8½	Pf 0.295
788	144'-9			12.848			61'-6½	Pe -0.000
903	144'-9			13.143		8E(6'-2), PO(12'-3½)	180'-3	Pv
CM	4.2600	24.72	0.56	120		0.000209	9'-2	Pf 0.002
903	144'-9	12.19		13.143		Flow (q) from Route 2		Pe
902	144'-9			13.145			9'-2	Pv
CM	4.2600	26.99	0.61	120		0.000246	12'-10	Pf 0.003
902	144'-9	2.27		13.145		Flow (q) from Route 6		Pe
901	144'-9			13.148			12'-10	Pv
CM	4.2600	29.78	0.67	120		0.000295	32'-4½	Pf 0.017
901	144'-9	2.79		13.148		Flow (q) from Route 3	26'-4	Pe
900	144'-9			13.166		2E(13'-2)	58'-8½	Pv
FR	6.3570	29.78	0.30	120		0.000042	103'-5½	Pf 6.010
900	144'-9			13.166			125'-4½	Pe 18.295
9	102'-6½			37.470		4E(17'-7), sCV(-6.000), sCV(17'-2½), PO(37'-8½)	228'-9½	Pv
CM	6.3570	29.78	0.30	120		0.000042	20'-5	Pf 0.004
9	102'-6½			37.470			30'-2	Pe 4.836
8	91'-4½			42.310		BV(12'-7), E(17'-7), St(-0.002)	50'-7	Pv
DY	6.3400	29.78	0.30	140		0.000032	0'-0	Pf 0.000
8	91'-4½			42.310				Pe 0.271
7	90'-9			42.581			0'-0	Pv
UG	6.3400	29.78	0.30	140		0.000032	86'-3½	Pf 0.005
7	90'-9			42.581			69'-4	Pe 2.688
6	84'-6½			45.274		3E(23'-1½)	155'-7½	Pv
UG	6.3400	29.78	0.30	140		0.000032	4'-1½	Pf 0.017
6	84'-6½			45.274				Pe
3	84'-6½			45.290		BFP(-0.016)	4'-1½	Pv
UG	6.3400	29.78	0.30	140		0.000032	11'-2½	Pf 2.000
3	84'-6½			45.290				Pe
2	84'-6½			47.290		PIV(-2.000)	11'-2½	Pv
UG	6.3400	29.78	0.30	140		0.000032	21'-7	Pf 0.002
2	84'-6½			47.290			34'-8	Pe
1	84'-6½			47.292		E(23'-1½), EE(11'-6½), S	56'-3	Pv
		250.00				Hose Allowance At Source		
1		279.78						
• • • • • Route 2 • • • • •								
CM	4.2600	12.19	0.27	120		0.000057	7'-2½	Pf 0.000
904	144'-9	10.23 + 1.96		13.143		Flow (q) from Route 4 and 5		Pe
903	144'-9			13.143			7'-2½	Pv
• • • • • Route 3 • • • • •								
CM	4.2600	5.06	0.11	120		0.000011	9'-10½	Pf 0.000
926	144'-9			13.127				Pe
927	144'-9			13.127			9'-10½	Pv
CM	4.2600	2.79	0.06	120		0.000004	9'-6½	Pf 0.000
927	144'-9			13.127				Pe
925	144'-9			13.127			9'-6½	Pv
BL	2.1570	2.79	0.24	120		0.000102	186'-10½	Pf 0.021
925	144'-9			13.127		PO(12'-3½)	24'-7½	Pe
901	144'-9			13.148		PO(12'-3½)	211'-6	Pv
• • • • • Route 4 • • • • •								

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary	
BL	2.1570	17.25	1.51	120		0.002956	82'-0	Pf	0.279
788	144'-9	12.54		12.848		Flow (q) from Route 1	12'-3½	Pe	
926	144'-9			13.127		PO(12'-3½)	94'-3½	Pv	
CM	4.2600	12.19	0.27	120		0.000057	11'-9½	Pf	0.001
926	144'-9	5.06		13.127		Flow (q) from Route 3		Pe	
928	144'-9			13.127			11'-9½	Pv	
CM	4.2600	10.23	0.23	120		0.000041	244'-4½	Pf	0.015
928	144'-9			13.127			134'-3½	Pe	0.000
904	144'-9			13.143		9E(13'-2), 2EE(5'-3), Ee2(5'-3)	378'-8	Pv	
• • • • • Route 5 • • • • •									
BL	2.1570	1.96	0.17	120		0.000053	194'-10	Pf	0.015
928	144'-9			13.127		PO(12'-3½)	98'-5½	Pe	
904	144'-9			13.143		10E(6'-2), T(12'-3½), PO(12'-3½)	293'-3½	Pv	
• • • • • Route 6 • • • • •									
BL	2.1570	2.27	0.20	120		0.000069	202'-11	Pf	0.018
927	144'-9			13.127		PO(12'-3½)	61'-6½	Pe	
902	144'-9			13.145		6E(6'-2), PO(12'-3½)	264'-5½	Pv	

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Hydraulic Overview

Job Number: 22-3688
Report Description: ROOF TOP HOSE FLOW (ROOF TOP HOSE FLOW)

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	Phone: 425.204.3945 / FAX:
Address 1: 1601 39th AVE SE	State Certification/License Number:
Address 2: Puyallup, WA 98374	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: PIERCE COLLEGE PUYALLUP

System

Density: 0.10 gpm/ft²	Area of Application: 1500 ft² (Actual 1340 ft²)
Most Demanding Sprinkler Data: K-Factor at	Hose Streams: 750.00
Coverage Per Sprinkler: 130 ft²	Number Of Sprinklers Calculated: 0 / Number Of Nozzles Calculated: 0
System Pressure Demand: 157.569	System Flow Demand: 750.00
Total Demand: 750.00 @ 157.569	Pressure Result: +0.431 (0.3%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
4	Water Supply	750.00		158.000	158.000

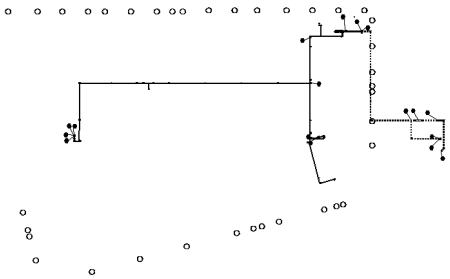
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

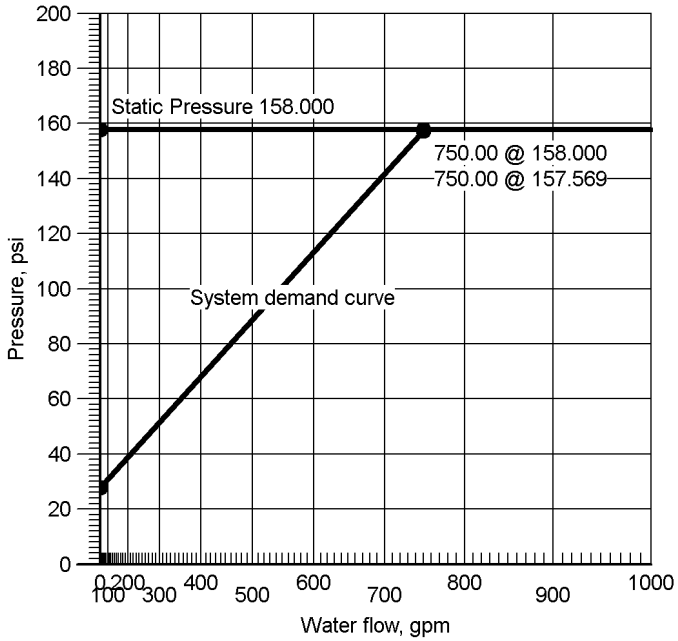
FPET NICET #106245 LEVEL IV,MSME

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS
Hussein A. A. Huballa
8321-1119-C Level 3
Shinn Mechanical, Inc.
SHINNMI060QP
03/26/2024
Signature Date
Expires 12/31/24

22-3688_PeirceSTEM-L10-R041-Standpipe



Water Supply at Node 4 (750.00, 0.00, 158.000, 158.000)



Hydraulic Summary

Job

Job Number: 22-3688	Designer: Ben Bernard
Job Name: PIERCE COLLEGE PUYALLUP NEW STEM BUILDING	State Certification/License Number:
Address 1: 1601 39th AVE SE	AHJ: CITY OF PUYALLUP
Address 2: Puyallup, WA 98374	Job Site/Building: PIERCE COLLEGE PUYALLUP
Address 3:	Drawing Name: 22-3688_PeirceSTEM-L10-R041-Standpipe

System

Most Demanding Sprinkler Data: K-Factor at

Hose Allowance At Source: 0.00

Additional Hose Supplies

Node	Flow(gpm)
Hose At Node 17	250.00
Hose At Node 19	250.00
Hose At Node 15	250.00

Total Hose Streams: 750.00

System Flow Demand	Total Water Required (Including Hose Allowance)
750.00	750.00

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 18.90 between nodes 4 and 6

Maximum Velocity Under Ground	
7.62 between nodes 6 and 7	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
899.33 gal	

Remote Area(s)

Occupancy	Job Suffix
ROOF TOP HOSE FLOW	

Density	Area of Application
0.10 gpm/ft²	1500 ft² (Actual 1340 ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
0	0	130 ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
4	Water Supply		158.000	158.000		750.00	158.000		750.00	157.569	0.431

Contractor

	Contractor Number	Contact Name	Contact Title
	01	Ben Bernard	Engineer/PM

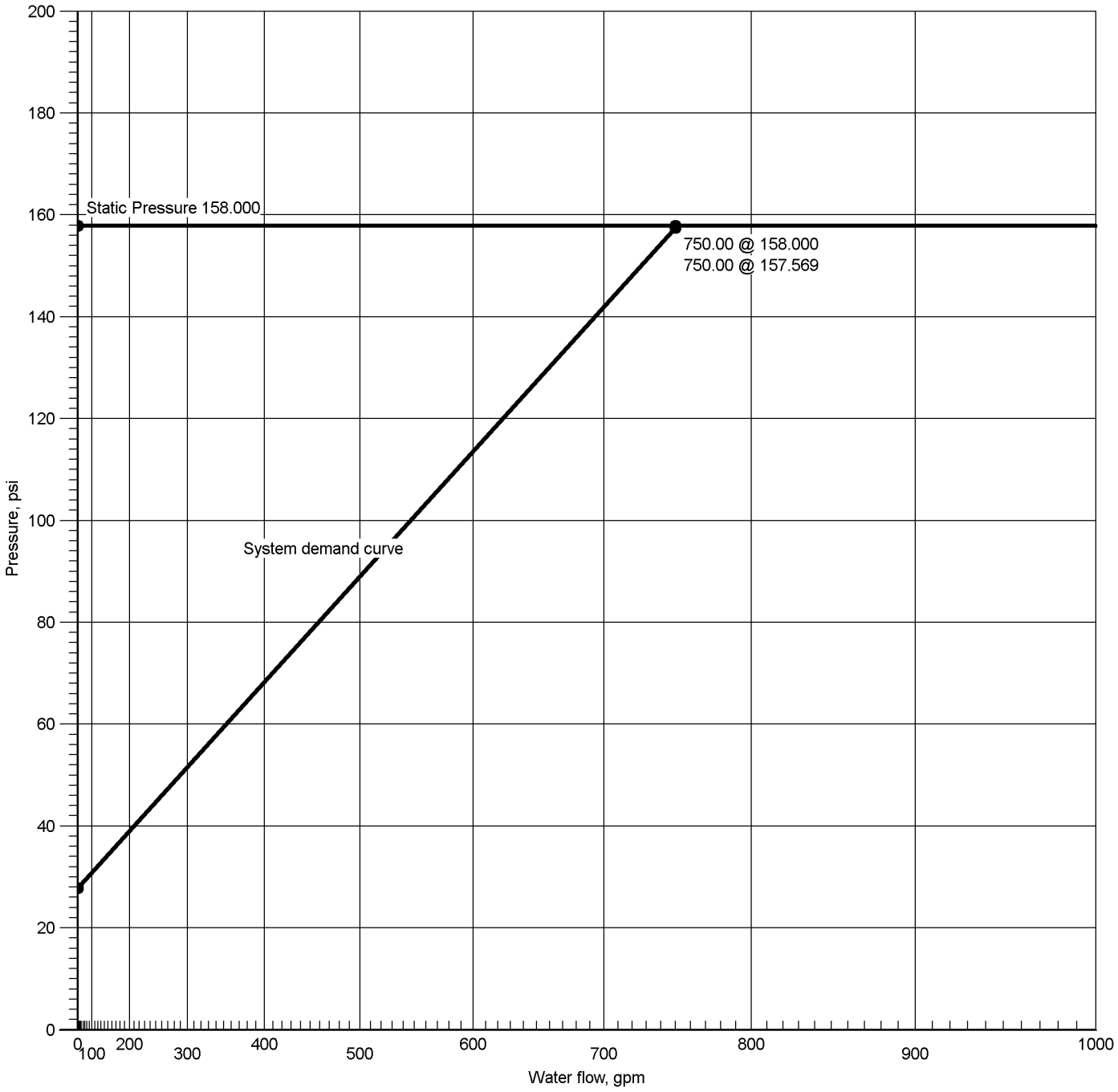
Name of Contractor:	Phone	Extension
SHINN FIRE PROTECTION	425-204-3945	

Address 1	FAX
18802 80TH AVE S	

Address 2	E-mail
KENT WA98032	

Address 3	Web-Site

Water Supply at Node 4



Hydraulic Graph
Water Supply at Node 4

Static: Pressure
158.000

Residual: Pressure
158.000 @ 750.00

Available Flow @ 20 PSI:
inf

Available Pressure at System Demand
158.000 @ 750.00

Required Pressure at System Demand
157.569 @ 750.00

Required Pressure at System Demand (Including Hose Allowance at Source)
157.569 @ 750.00

Summary Of Outflowing Devices

Device	Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Hose 15	250.00	250.00	28.87	101.709			
Hose 17	250.00	250.00	28.87	75.211			
Hose 19	250.00	250.00	28.87	74.987			

⇨ Most Demanding Sprinkler Data

Node Analysis

Job Number: 22-3688
Report Description: ROOF TOP HOSE FLOW (ROOF TOP HOSE FLOW)

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
4	-21'-0	S	157.569	750.00	
15	22'-10	Hose(-74.987)(31'-0)	101.709	250.00	
17	42'-10	Hose(-74.987)(31'-0)	75.211	250.00	
19	43'-4	Hose(-74.987)(31'-0)	74.987	250.00	
6	-25'-0	PO(49'-6)	151.515		
7	-18'-2½		146.003		
8	-16'-2	St(-1.691)	145.080		
9	-7'-5½	PO(20'-2)	139.021		
12	1'-3½		130.027		
13	-0'-3½	T(26'-4)	124.435		
14	22'-10	PO(12'-0), f(-0.000)	110.971		
16	42'-10	PO(12'-0)	84.474		

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •							
DY	2.4690	250.00	16.75	120	0.215409	0'-0	Pf 9.263
19	43'-4	250.00		74.987	Hose(-74.987)(31'-0)	43'-0	Pe
18	43'-4			84.250	PO(12'-0)	43'-0	Pv
FR	4.2600	250.00	5.63	120	0.015122	0'-6	Pf 0.008
18	43'-4			84.250			Pe 0.217
16	42'-10			84.474		0'-6	Pv
FR	4.2600	500.00	11.25	120	0.054516	216'-6	Pf 21.279
16	42'-10	250.00		84.474	Flow (q) from Route 2	173'-9½	Pe 18.682
13	-0'-3½			124.435	7E(13'-2), PIV(2'-7½), 2T(26'-4), BV(15'-9½), 2EE(5'-3)	390'-4	Pv
ST	4.2600	750.00	16.88	120	0.115423	28'-1	Pf 6.279
13	-0'-3½	250.00		124.435	Flow (q) from Route 3	26'-4	Pe -0.687
12	1'-3½			130.027	2E(13'-2)	54'-5	Pv
CM	6.3570	750.00	7.58	120	0.016432	30'-4½	Pf 5.193
12	1'-3½			130.027		103'-1	Pe 3.801
9	-7'-5½			139.021	3E(17'-7), f(-3.000), BV(12'-7), PO(37'-8½)	133'-5½	Pv
CM	6.3570	750.00	7.58	120	0.016432	18'-5	Pf 2.282
9	-7'-5½			139.021		17'-7	Pe 3.777
8	-16'-2			145.080	E(17'-7), St(-1.691)	36'-0	Pv
CM	6.3570	750.00	7.58	120	0.016432	2'-0½	Pf 0.034
8	-16'-2			145.080			Pe 0.889
7	-18'-2½			146.003		2'-0½	Pv
UG	6.3400	750.00	7.62	140	0.012517	86'-10½	Pf 2.575
7	-18'-2½			146.003		118'-10	Pe 2.937
6	-25'-0			151.515	3E(23'-1½), PO(49'-6)	205'-8½	Pv
BL	4.0260	750.00	18.90	120	0.151978	31'-3	Pf 7.788
6	-25'-0			151.515		20'-0	Pe -1.734
4	-21'-0			157.569	2E(10'-0), S	51'-3	Pv
		0.00			Hose Allowance At Source		
4		750.00					
• • • • • Route 2 • • • • •							
DY	2.4690	250.00	16.75	120	0.215409	0'-0	Pf 9.263
17	42'-10	250.00		75.211	Hose(-74.987)(31'-0)	43'-0	Pe
16	42'-10			84.474	PO(12'-0)	43'-0	Pv
• • • • • Route 3 • • • • •							
DY	2.4690	250.00	16.75	120	0.215409	0'-0	Pf 9.263
15	22'-10	250.00		101.709	Hose(-74.987)(31'-0)	43'-0	Pe
14	22'-10			110.971	PO(12'-0), f(-0.000)	43'-0	Pv
FR	4.2600	250.00	5.63	120	0.015122	67'-1	Pf 3.444
14	22'-10			110.971		160'-7½	Pe 10.020
13	-0'-3½			124.435	7E(13'-2), 2T(26'-4), BV(15'-9½)	227'-8½	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap