FIRE PROTECTION HYDRAULIC CALCUTIONS

BODY HOLDING

GOOD SAMARITAN HOSPITAL

401 15th AVE SE
PUYALLUP, WA 98372

JOB NUMBER: 122775-001

SUBMITTED BY: BROOKE McDANIELS

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

WASHINGTON STATE
CERTIFICATE OF COMPETENCY
FIRE PROTECTION SPRINKLER SYSTEMS

Rory C. Leckband
3514-0419-C Level 3
McKinstry Company, L.L.C.
MCKINCL942DW

Digitally signed by Rory C. Leckband
DN: C=US, E=RoryL@Mckinstry.com, O="McKinstry Co., LLC", OU=Fire Protection, CN=Rory C. Leckband
Location: 5005 3RD AVE S, SEATTLE, WA 98134
Reason: I have reviewed this document
Contact Info: (206) 552-3160
Date: 2022.09.09 09:06:16-07'00'

Signature **Date** **Expires 12/31/21**

McKinstry
For The Life Of Your Building

Seattle:
5005 3rd Avenue South
Seattle, WA 98124
206.762.3311

Portland:
400 NE Columbia Blvd.
Portland, OR 97218
503.331.0234

Spokane:
850 E Spokane Falls Blvd.
Spokane, WA 99202
509.747.3389

Hydraulic Overview

Job Number: 122775-001
Report Description: Ordinary Group II

Job

Job Number: 122775-001	Design Engineer: BROOKE McDANIELS
Job Name: BODY HOLDING	Phone: 360-912-9183 / FAX:
Address 1: GOOD SAMARITAN HOSPITAL	State Certification/License Number: MCKINCL942DW
Address 2: 401 15TH AVE SE	AHJ: CITY OF PUYALLUP
Address 3: PUYALLUP, WA 98372	Job Site/Building: GOOD SAMARITAN HOSPITAL

System

Density: 0.20gpm/ft²	Area of Application: 1500ft² (Actual 352ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 36.00 at 41.327	Hose Streams: 250.00
Coverage Per Sprinkler: 120ft²	Number Of Sprinklers Calculated: 6 0
System Pressure Demand: 63.970	System Flow Demand: 220.15
Total Demand: 470.15 @ 63.970	Pressure Result: +18.767 (22.7%)

Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	350.00	250.00	100.000	90.000

Check Point Gauges

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

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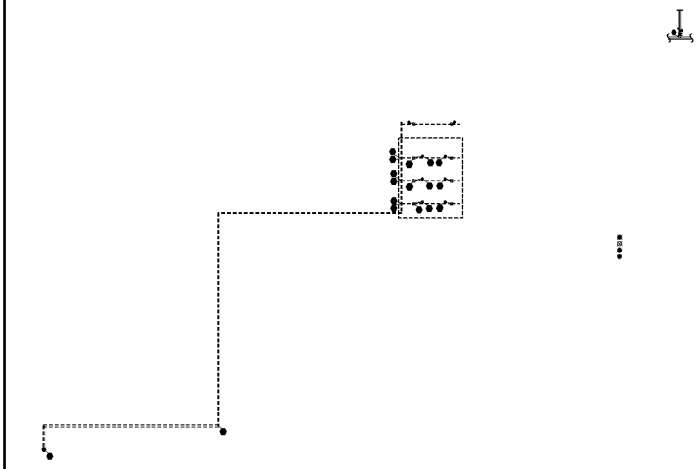
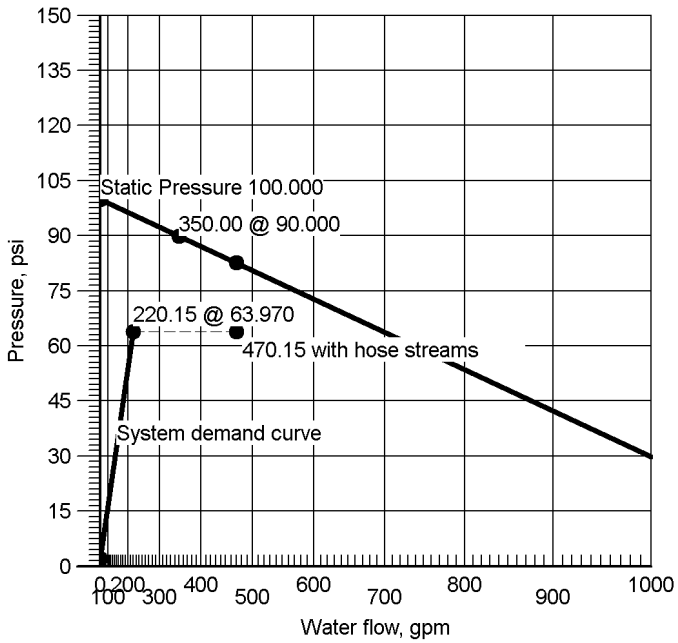
122775 GSH Body Holding



Water Supply at Node 1 (350.00, 0.00, 100.000, 90.000)



Hydraulic Summary

Job Number: 122775-001
Report Description: Ordinary Group II

Job

Job Number: 122775-001	Design Engineer: BROOKE McDANIELS
Job Name: BODY HOLDING	State Certification/License Number: MCKINCL942DW
Address 1: GOOD SAMARITAN HOSPITAL	AHJ: CITY OF PUYALLUP
Address 2: 401 15TH AVE SE	Job Site/Building: GOOD SAMARITAN HOSPITAL
Address 3: PUYALLUP, WA 98372	Drawing Name: 122775 GSH Body Holding

System

Most Demanding Sprinkler Data: 5.6 K-Factor 36.00 at 41.327

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)
220.15	470.15

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 27.25 between nodes 7 and 9

Maximum Velocity Under Ground	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
228.38gal	

Remote Area(s)

Occupancy	Job Suffix
Ordinary Group II	

Density	Area of Application
0.20gpm/ft²	1500ft² (Actual 352ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
6	0	120ft²

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

Left: 63.970 Right: 63.970

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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	100.000	90.000 @ 350.00	82.737 @ 470.15	63.970	18.767

Contractor

	Contractor Number	Contact Name	Contact Title
	MCKINCL942DW	BROOKE McDANIELS	DESIGNER

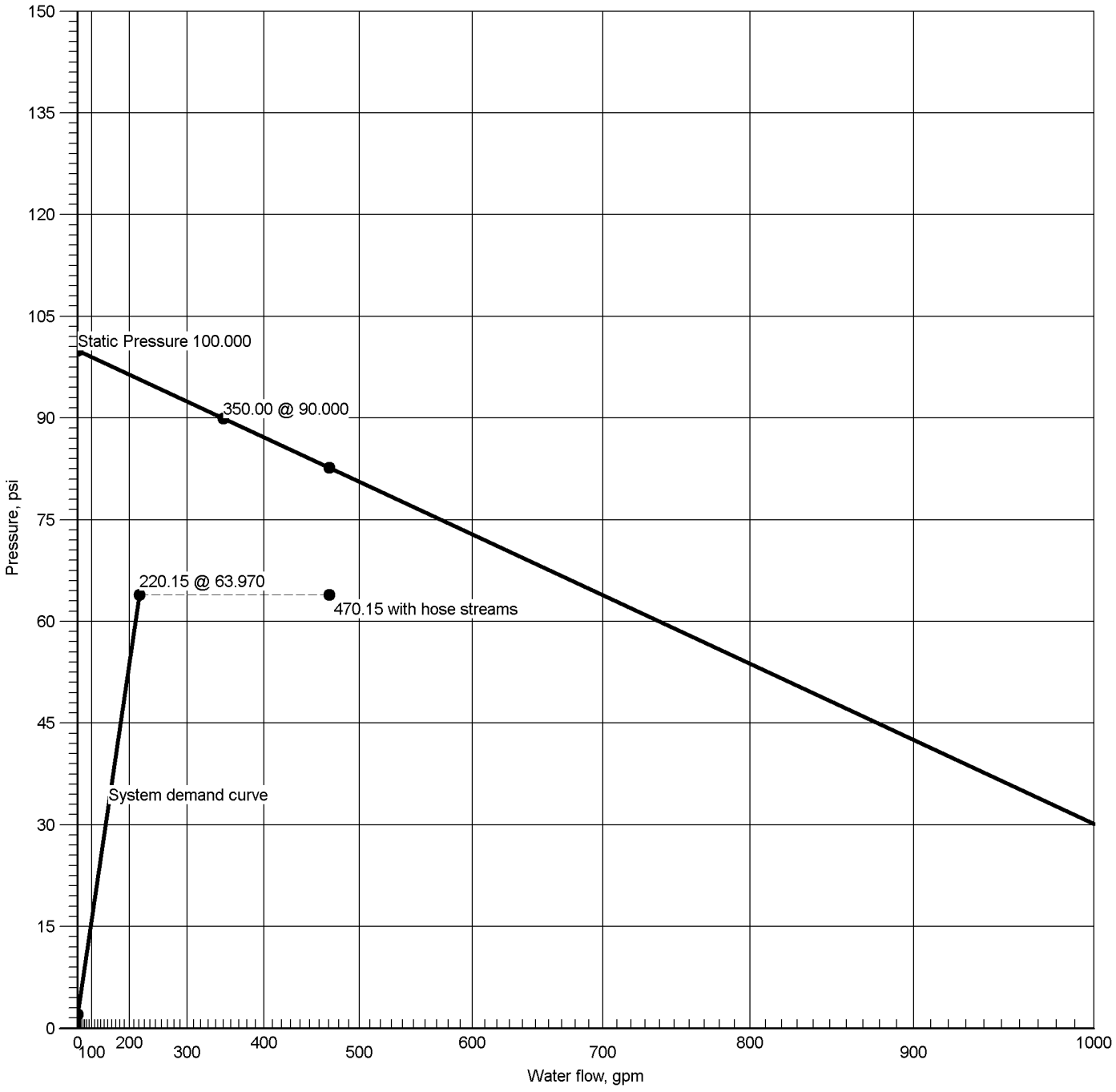
Name of Contractor:	Phone	Extension
McKINSTRY FIRE PROTECTION	360-912-9183	

Address 1	FAX
5005 3RD AVENUE S	

Address 2	E-mail
SEATTLE, WA 98124	BROOKEM@MCKINSTRY.COM

Address 3	Web-Site

Water Supply at Node 1



Hydraulic Graph
Water Supply at Node 1

Static: Pressure
100.000

Residual: Pressure
90.000 @ 350.00

Available Pressure at System Demand
82.737 @ 470.15

Required Pressure at System Demand
63.970 @ 220.15

Required Pressure at System Demand (Including Hose Allowance at Source)
63.970 @ 470.15

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Summary Of Outflowing Devices

Job Number: 122775-001
Report Description: Ordinary Group II

Device	Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Sprinkler 100	37.39	36.00	5.6	44.572		
Sprinkler 101	36.01	36.00	5.6	41.357		
Sprinkler 102	37.38	36.00	5.6	44.547		
Sprinkler 103	36.00	36.00	5.6	41.333		
Sprinkler 104	37.37	36.00	5.6	44.540		
Sprinkler 105	**36.00**	**36.00**	**5.6**	**41.327**		

Most Demanding Sprinkler Data

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Node Analysis

Job Number: 122775-001
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Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	3'-1½	S	63.970	220.15	
100	8'-0	Spr(-44.572)	44.572	37.39	
101	8'-0	Spr(-41.357)	41.357	36.01	
102	8'-0	Spr(-44.547)	44.547	37.38	
103	8'-0	Spr(-41.333)	41.333	36.00	
104	8'-0	Spr(-44.540)	44.540	37.37	
105	8'-0	Spr(-41.327)	41.327	36.00	
5	10'-6	E(13'-2)	60.590		
6	10'-6	PO(8'-0)	58.842		
7	11'-0	E(2'-0)	57.104		
8	10'-6	PO(8'-0)	58.808		
9	11'-0	T(5'-0)	49.627		
10	11'-0	E(2'-0)	57.071		
11	11'-0	T(5'-0)	49.597		
12	10'-6	PO(8'-0)	58.799		
13	11'-0	E(2'-0)	57.061		
14	11'-0	T(5'-0)	49.589		

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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	36.00	13.36	120		0.386043	15'-9½	Pf 9.563
105	8'-0	36.00	5.6	41.327		Sprinkler,	9'-0	Pe -1.301
14	11'-0			49.589		2E(2'-0), T(5'-0)	24'-9½	Pv
BL	1.0490	73.37	27.24	120		1.441191	3'-2	Pf 7.472
14	11'-0	37.37		49.589		Flow (q) from Route 4	2'-0	Pe
13	11'-0			57.061		E(2'-0)	5'-2	Pv
BL	1.6100	73.37	11.56	120		0.178919	0'-6	Pf 1.521
13	11'-0			57.061			8'-0	Pe 0.217
12	10'-6			58.799		PO(8'-0)	8'-6	Pv
BL	4.2600	73.37	1.65	120		0.001566	6'-0	Pf 0.009
12	10'-6			58.799				Pe
8	10'-6			58.808			6'-0	Pv
BL	4.2600	146.75	3.30	120		0.005644	6'-0	Pf 0.034
8	10'-6	73.38		58.808		Flow (q) from Route 2		Pe
6	10'-6			58.842			6'-0	Pv
BL	4.2600	220.15	4.96	120		0.011953	106'-8½	Pf 1.747
6	10'-6	73.40		58.842		Flow (q) from Route 3	39'-6	Pe
5	10'-6			60.590		3E(13'-2)	146'-2½	Pv
BL	6.3570	220.15	2.23	120		0.001702	59'-6	Pf 0.183
5	10'-6			60.590			47'-9½	Pe 3.198
1	3'-1½			63.970		2E(17'-7), BV(12'-7), S	107'-3½	Pv
		250.00				Hose Allowance At Source		
1		470.15						
• • • • • Route 2 • • • • •								
DR	1.0490	36.00	13.37	120		0.386101	15'-9½	Pf 9.565
103	8'-0	36.00	5.6	41.333		Sprinkler,	9'-0	Pe -1.301
11	11'-0			49.597		2E(2'-0), T(5'-0)	24'-9½	Pv
BL	1.0490	73.38	27.24	120		1.441407	3'-2	Pf 7.473
11	11'-0	37.38		49.597		Flow (q) from Route 5	2'-0	Pe
10	11'-0			57.071		E(2'-0)	5'-2	Pv
BL	1.6100	73.38	11.56	120		0.178946	0'-6	Pf 1.521
10	11'-0			57.071			8'-0	Pe 0.217
8	10'-6			58.808		PO(8'-0)	8'-6	Pv
• • • • • Route 3 • • • • •								
DR	1.0490	36.01	13.37	120		0.386304	15'-9½	Pf 9.571
101	8'-0	36.01	5.6	41.357		Sprinkler,	9'-0	Pe -1.301
9	11'-0			49.627		2E(2'-0), T(5'-0)	24'-9½	Pv
BL	1.0490	73.40	27.25	120		1.442162	3'-2	Pf 7.477
9	11'-0	37.39		49.627		Flow (q) from Route 6	2'-0	Pe
7	11'-0			57.104		E(2'-0)	5'-2	Pv
BL	1.6100	73.40	11.57	120		0.179039	0'-6	Pf 1.522
7	11'-0			57.104			8'-0	Pe 0.217
6	10'-6			58.842		PO(8'-0)	8'-6	Pv
• • • • • Route 4 • • • • •								
DR	1.0490	37.37	13.87	120		0.413727	6'-4	Pf 6.350
104	8'-0	37.37	5.6	44.540		Sprinkler,	9'-0	Pe -1.301
14	11'-0			49.589		2E(2'-0), T(5'-0)	15'-4	Pv
• • • • • Route 5 • • • • •								
DR	1.0490	37.38	13.88	120		0.413789	6'-4	Pf 6.351
102	8'-0	37.38	5.6	44.547		Sprinkler,	9'-0	Pe -1.301
11	11'-0			49.597		2E(2'-0), T(5'-0)	15'-4	Pv
• • • • • Route 6 • • • • •								
DR	1.0490	37.39	13.88	120		0.414006	6'-4	Pf 6.355
100	8'-0	37.39	5.6	44.572		Sprinkler,	9'-0	Pe -1.301
9	11'-0			49.627		2E(2'-0), T(5'-0)	15'-4	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

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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
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

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