WATER-BASED FIRE PROTECTION SPRINKLER SYSTEM PRELIMINARY CALCULATIONS
PROJECT:NPS HOSP
PROJECT NUMBER: 10445000

SCENARIO DESCRIPTION: 2 HEAD NFPA 13D CALC FOR DUPLEX

SPRINKLER SYSTEM SUMMARY:

LT =	ESTIMATED UNDERGROUND PIPING FRICTION LOSSES	13.48	PSI
HT =	ESTIMATED ELEVATION HEAD LOSS	15.17	PSI
ΔPBLDG =	ESTIMATED BUILDING PIPE FRICTION LOSSES (5 TO 10 PSI)	10.00	PSI
ΔPS =	SPRINKLER PRESSURE LOSS = $(QP/K)^2$, (MINIMUM RESIDUAL >= 7 PSIG)	25.00	PSI
ΔPB =	BACKFLOW PREVENTER ASSEMBLY PRESSURE LOSSES	5.00	PSI
ΔPT =	SYSTEM PRESSURE LOSS (LT + HT + ΔPBLDG + ΔPS + ΔPB) =	**68.65**	**PSI**

THE ESTIMATED SPRINKLER SYSTEM DEMAND REQUIRED IS: **54 GPM AT 68.7 PSI**

SUPPORTING CALCULATIONS:

I. ESTIMATED SPRINKLER SYSTEM FLOW REQUIREMENTS:

HAZARD CLASSIFICATION: NFPA 13D

AREA OF SPRINKLER OPERATION	800	SFT
FLOW DENSITY (USE BOTTOM OF NFPA 13 (2016) Fig. 11.2.3.1.1 CURVE IF NOT SPECIFIED IN BY AHJ)	0.05	GPM/SFT
AREA ADJUSTMENT IF APPLICABLE (< PROVIDE BASIS HERE IF APPLICABLE >)	0.00%	%
MAXIMUM FT^2 LIMITATION PER SPRINKLER (SEE NFPA 13 (2016) §8.6.2)	400	SFT
REVISED AREA OF SPRINKLER OPERATION	800	SFT
MINIMUM NUMBER OF SPRINKLERS	2	
AREA DENSITY CURVE VALUE = GPM/SFT X SFT	40	GPM
35% IMBALANCE	14	GPM
AREA DENSITY CURVE VALUE + 35% IMBALANCE	54	GPM
TOTAL COMBINED INSIDE AND OUTSIDE HOSE STREAM DEMAND (SEE NFPA 13 (2016) TABLE 11.2.3.1.2)	0	GPM
TOTAL DEMAND	54	GPM
DURATION OF SUPPLY	10	MINUTES
TOTAL WATER SUPPLY	540	GALLONS
QP = MINIMUM FLOW AT THE HYDRAULICALLY MOST DEMANDING SPRINKLER	20	GPM
PENDENT K-FACTOR, ORIFICE SIZE	4.0	$(GPM / PSI)^{0.}$

II. HYDRANT FLOW TEST DATA:

	HYDRANT FLOW (GPM)	PSI		
A. LOCAL HYDRANT FLOW TEST DATA (REF.):				
B. TEST HYDRANT STATIC PRESSURE (CLOSEST TO BUILDING)	0	97	97	PSIG
C. FLOW HYDRANT RESIDUAL PRESSURE	839	54	54	PSIG
D. PROJECTED FLOW RATE AT RESIDUAL PRESSURE (FIRE FLOW)	1,149	20	839	GPM
		TEST DATE:	12/10/25	

CREATE A SEMI-LOG GRAPH Q VS. DP (N = 1.85)
(NOTE: TYPICAL MINIMUM CITY RESIDUAL PRESSURE IS 20 PSI)

III. ESTIMATED UNDERGROUND PIPING FRICTION LOSSES FROM CITY MAIN TO FIRE SERVICE ENTRANCE:

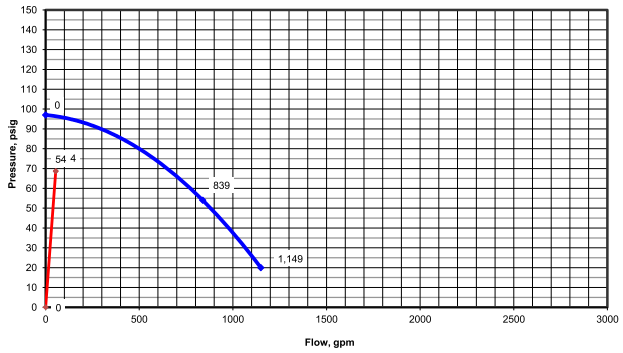
HAZEN WILLIAMS FORMULA: **HF = (10.44 * L * Q^1.85) / [(C^1.85) * (D^4.87)]**

		BASE OF RISER TO FIRE MAIN	
D_NOM =	NOMINAL SIZE (IN)	2	IN.
D =	PIPE DIAMETER (< INSERT PIPE SIZE, MATERIAL HERE >)	1.500	IN.
C =	HAZEN-WILLIAMS COEFFICIENT (SEE NFPA 13 (2016) TABLE 23.4.4.8.1)	140	
Q =	FLOW RATE	54	GPM
V =	PIPE VELOCITY	9.81	FT/SEC
μ =	KINEMATIC VISCOSITY, 50°F WATER	0.0000141	FT^2/SEC
R =	REYNOLDS NUMBER, R = (D / 12) * V / μ	86,971	
LP =	ESTIMATED PIPE LENGTH	100	FT.
LF =	ESTIMATED EQUIV. LENGTH FITTING/VALVES (SEE NFPA 13 (2016) §23.4)	25	FT.
L =	TOTAL ESTIMATED EQUIVALENT LENGTH	125	FT.
LT =	FRICTION LOSSES	31.09	FT.

IV. ESTIMATED ELEVATION HEAD LOSS:

		Elevation	
HF =	ELEVATION 1 - STARTING REFERENCE	0.00	FT.
H1 =	ELEVATION 2 - HIGHEST ELEVATION	35.00	FT.
HT =	ELEVATION HEAD LOSS (H1-HF)	35.00	FT.

NOTES:
1. < INSERT NOTES HERE AS-NEEDED >

2. < INSERT NOTES HERE AS-NEEDED >

3. GRAPH SHOWN IS FOR VISUALIZATION ONLY AND IS NOT A TRUE N^1.85 GRAPH.