Gray & Osborne, Inc.
CONSULTING ENGINEERS

MEMORANDUM

TO:	BRIAN JOHNSON, WATER SYSTEM SPECIALIST
FROM:	KERRI SIDEBOTTOM, P.E.
DATE:	MAY 14, 2024
SUBJECT:	304 2ND STREET NE, FIRE FLOW AVAILABILITY CITY OF PUYALLUP, PIERCE COUNTY, WASHINGTON G&O #21415.20

Per your request, I have analyzed the available fire flow at the proposed McDonald's development at 304 2nd Street NE, located in the central part of the City's water service area. The Developer has proposed to install a new dead-end 8-inch water main extending from the existing 12-inch main on 2nd Street NE to provide water to the site, which has been analyzed in this memo. The setup of the hydraulic model and the assumptions used to determine the static pressure and available fire flow are noted as follows.

- The available fire flows and pressures are measured at two nodes corresponding to one existing hydrant and one proposed hydrant within and near to the development, shown in the attached figure.

- Water system demands are based on projected 2038 demands and reservoirs are depleted of fire suppression and equalizing storage, as established in the *2019 Water System Plan* (WSP), approved by the Department of Health (DOH). The City's water model was updated in 2021 to reflect additional system improvements since the WSP was developed.

- All pump stations are idle, and the Salmon Springs source is operating at 1,100 gallons per minute (gpm).

The development is located in Zone 1, which is supplied by Maplewood Springs and the 15th Avenue SE Reservoirs. The system was modeled with the proposed piping indicated on the attached figure.

The available pressure under 2038 peak hour demands at the hydrants is included in Table 1.

TABLE 1

Peak Hour Pressure

Node	Hydrant	Elevation, feet	Peak Hour Pressure, psi
J1330	NE002	44	51
J2284	Proposed	45	51

Available fire flow was modeled at one existing hydrant and at one proposed hydrant. The existing hydrant is located on the 12-inch pipe along 2nd Street NE, while the proposed hydrant will be located on a dead-end, 8-inch main extending from the 12-inch pipe. The results of this modeling are included in Table 2. The modeled fire flow is available at either hydrant individually, but not simultaneously.

TABLE 2

Modeled Fire Flow Availability

Node	Hydrant	Modeled Fire Flow, gpm	Residual Pressure at Modeled Fire Flow, psi	Minimum System Pressure at Available Fire Flow, psi
J1330	NE002	6,870(1)	20	20
J2284	Proposed	1,560(2)	39	28

(1) Limited by minimum system-wide pressure at service locations of 20 psi.
(2) Limited by maximum system-wide velocity of 10 feet per second (fps).

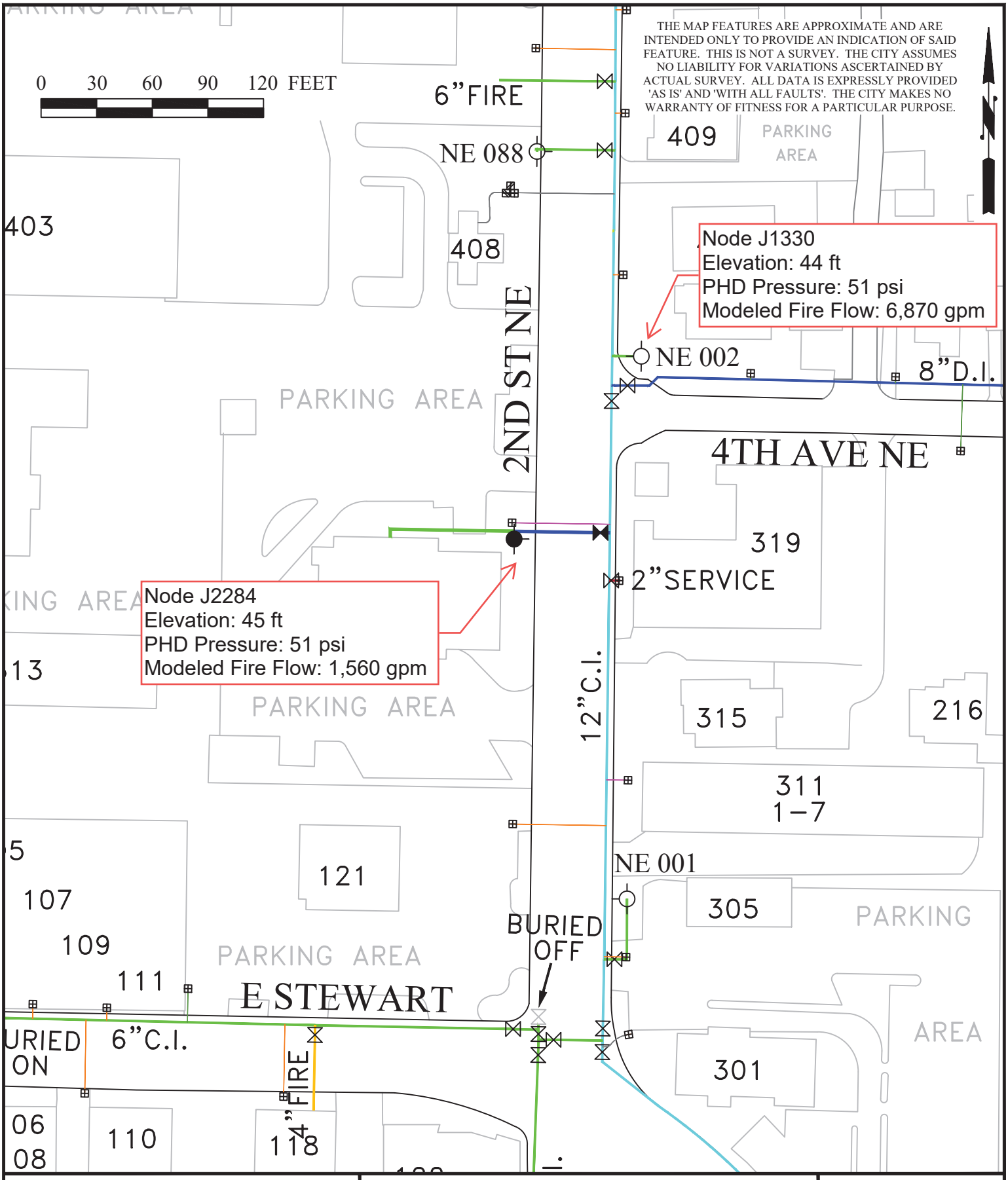
Fire flow to the proposed hydrant is limited by the 10-fps maximum velocity through the proposed 8-inch pipe, while flow to the existing hydrant is limited by the 20-psi minimum pressure.

It should be noted that the dead-end, 8-inch main within the proposed site can only provide 1,560 gpm, due to the City's 10-fps velocity limitation considered for the fire flow analysis. Therefore, if 1,500 gpm is required at the hydrant located on a dead-end main, there is essentially no additional flow available for the sprinkler system supplied by the same dead-end main, unless a larger pipe is installed.

The Department of Health and City Standards for water distribution systems are to meet the peak hourly demand of the system while providing a minimum pressure of 30 psi, system-wide. Under peak daily demand with a fire flow, the system is designed to maintain a minimum pressure of 20-psi, system-wide. Although the peak hourly demand

pressure may currently be higher than these standards, the Developer must recognize that the City may not provide pressure higher than 30 psi in the future. The flows and pressures determined in this memo are based on the approximate hydrant elevation at ground level. The Developer may design their sprinkler system for whatever pressure they wish; however, they must recognize and be responsible for conditions when the pressure may be less than currently exists.

KS/sr



CITY OF PUYALLUP
PUBLIC WORKS
WATER DIVISION

HYDRAULIC MODEL FOR 304 2ND ST NE

SCALE AS SHOWN

05/08/2024

COP\PW\WATER\S_MAINT\PDF\QSEC\PG106\MODEL FOR 304 2ND ST NE

Hydraulic Overview

Job Number: B080124
Report Description: Light Hazard

Job

Job Number: B080124	Design Engineer: Reliance Fire Protection
Job Name: MCDONALDS PUYALLUP REMODEL	Phone: 206-682-6636 / FAX:
Address 1: 304 2nd STREET NE, PUYALLUP, WA 98372	State Certification/License Number: RELIAFP102L1
Address 2:	AHJ: CITY OF PUYALLUP
Address 3:	Job Site/Building: MCDONALDS PUYALLUP REMODEL

System

Density: 0.100gpm/ft²	Area of Application: 1500.00ft² (Actual 1568.10ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 14.82 at 7.000	Hose Streams: 250.00
Coverage Per Sprinkler: 121.00ft²	Number Of Sprinklers Calculated: 19
System Pressure Demand: 42.480	System Flow Demand: 337.38
Total Demand: 587.38 @ 42.480	Pressure Result: +6.551 (13.4%)

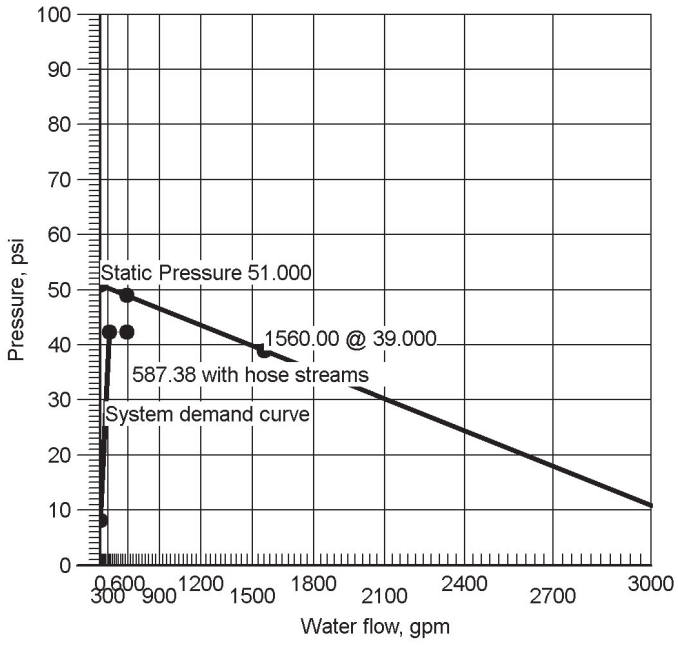
Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1560.00	250.00	51.000	39.000

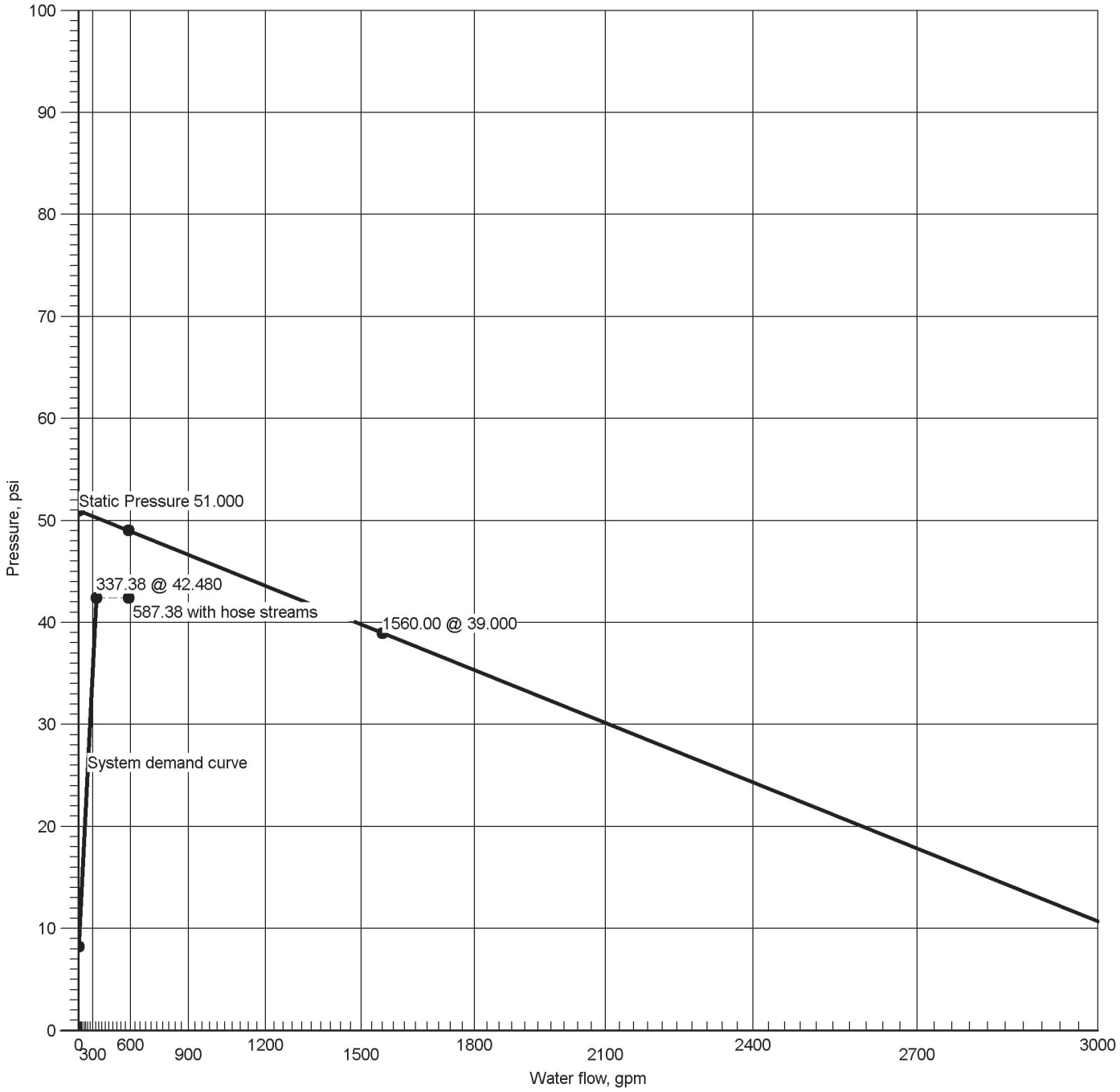
Check Point Gauges

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

Water Supply at Node 1 (1560.00, 250.00, 51.000, 39.000)



Water Supply at Node 1



Hydraulic Graph
Water Supply at Node 1

Static: Pressure
51.000

Residual: Pressure
39.000 @ 1560.00

Available Pressure at Time of Test
49.030 @ 587.38

System Demand
42.480 @ 337.38

System Demand (Including Hose Allowance at Source)
42.480 @ 587.38

Summary Of Outflowing Devices

Job Number: B080124
Report Description: Light Hazard

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Sprinkler	415	20.45	12.10	5.6	13.334		
Sprinkler	430	19.69	12.10	5.6	12.357		
Sprinkler	447	19.33	12.10	5.6	11.916		
Sprinkler	475	17.35	12.10	5.6	9.601		
Sprinkler	515	19.15	12.10	5.6	11.699		
Sprinkler	516	19.18	12.10	5.6	11.727		
Sprinkler	517	19.38	12.10	5.6	11.973		
Sprinkler	532	18.01	12.10	5.6	10.347		
Sprinkler	533	18.03	12.10	5.6	10.365		
Sprinkler	534	18.22	12.10	5.6	10.583		
Sprinkler	552	17.34	12.10	5.6	9.588		
Sprinkler	553	17.35	12.10	5.6	9.600		
Sprinkler	554	17.53	12.10	5.6	9.802		
Sprinkler	570	17.03	12.10	5.6	9.249		
Sprinkler	571	17.04	12.10	5.6	9.255		
Sprinkler	572	17.22	12.10	5.6	9.450		
Sprinkler	**586**	**14.82**	**12.10**	**5.6**	**7.000**		
Sprinkler	587	15.04	12.10	5.6	7.216		
Sprinkler	588	15.23	12.10	5.6	7.398		

⇨ Most Demanding Sprinkler Data

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	1.0490	14.82	5.50	120		0.074703	1'-7½	Pf 0.644
586	16'-1½	14.82	5.6	7.000		Sprinkler,	7'-0	Pe 0.267
374	15'-6			7.911		E(2'-0), PO(5'-0)	8'-7½	Pv
BL	1.6820	14.82	2.14	120		0.007495	9'-8½	Pf 0.110
374	15'-6			7.911		2E(2'-5½)	4'-11½	Pe 1.228
570	12'-8			9.249			14'-8	Pv
BL	1.6820	31.85	4.60	120		0.030871	11'-0	Pf 0.340
570	12'-8	17.03	5.6	9.249		Sprinkler		Pe
552	12'-8			9.588			11'-0	Pv
BL	1.6820	49.19	7.10	120		0.068994	11'-0	Pf 0.759
552	12'-8	17.34	5.6	9.588		Sprinkler		Pe
532	12'-8			10.347			11'-0	Pv
BL	1.6820	67.20	9.70	120		0.122893	11'-0	Pf 1.352
532	12'-8	18.01	5.6	10.347		Sprinkler		Pe
515	12'-8			11.699			11'-0	Pv
BL	1.6820	86.36	12.47	120		0.195442	3'-10	Pf 3.169
515	12'-8	19.15	5.6	11.699		Sprinkler,	12'-4½	Pe 0.723
136	11'-0			15.591		E(2'-5½), PO(9'-11)	16'-2½	Pv
CM	3.2600	86.36	3.32	120		0.007788	6'-0	Pf 0.047
136	11'-0			15.591				Pe
139	11'-0			15.638			6'-0	Pv
CM	3.2600	172.99	6.65	120		0.028160	11'-0	Pf 0.310
139	11'-0	86.64		15.638		Flow (q) from Route 2		Pe
144	11'-0			15.947			11'-0	Pv
CM	3.2600	260.57	10.02	120		0.060080	11'-0	Pf 0.661
144	11'-0	87.57		15.947		Flow (q) from Route 3		Pe
150	11'-0			16.608			11'-0	Pv
CM	3.2600	337.38	12.97	120		0.096897	76'-3½	Pf 12.082
150	11'-0	76.82		16.608		Flow (q) from Route 4	48'-4½	Pe 3.468
4	3'-0			32.158		fT(20'-2), 3fE(9'-5)	124'-8	Pv
CM	4.2600	337.38	7.59	120		0.026330	2'-0	Pf 5.185
4	3'-0			32.158		BFP(-5.132)		Pe 0.867
3	1'-0			38.210			2'-0	Pv
UG	4.2200	337.38	7.74	140		0.020728	82'-5	Pf 2.471
3	1'-0			38.210		2E(16'-8½), PIV(3'-4)	36'-9½	Pe 1.734
2	-3'-0			42.415			119'-2½	Pv
UG	8.3900	337.38	1.96	140		0.000730	51'-0	Pf 0.064
2	-3'-0			42.415		GV(6'-9½), S, E(30'-6½)	37'-4	Pe
1	-3'-0			42.480			88'-4	Pv
		250.00				Hose Allowance At Source		
1		587.38						
• • • • • Route 2 • • • • •								
BL	1.0490	15.04	5.58	120		0.076829	0'-7½	Pf 0.431
587	16'-1½	15.04	5.6	7.216		Sprinkler,	5'-0	Pe 0.267
375	15'-6			7.914		PO(5'-0)	5'-7½	Pv
BL	1.6820	15.04	2.17	120		0.007708	9'-8½	Pf 0.113
375	15'-6			7.914		2E(2'-5½)	4'-11½	Pe 1.228
571	12'-8			9.255			14'-8	Pv
BL	1.6820	32.08	4.63	120		0.031289	11'-0	Pf 0.344
571	12'-8	17.04	5.6	9.255		Sprinkler		Pe
553	12'-8			9.600			11'-0	Pv
BL	1.6820	49.43	7.14	120		0.069624	11'-0	Pf 0.766
553	12'-8	17.35	5.6	9.600		Sprinkler		Pe
533	12'-8			10.365			11'-0	Pv
BL	1.6820	67.46	9.74	120		0.123768	11'-0	Pf 1.361
533	12'-8	18.03	5.6	10.365		Sprinkler		Pe
516	12'-8			11.727			11'-0	Pv
BL	1.6820	86.64	12.51	120		0.196619	3'-10	Pf 3.188
516	12'-8	19.18	5.6	11.727		Sprinkler,	12'-4½	Pe 0.723
139	11'-0			15.638		E(2'-5½), PO(9'-11)	16'-2½	Pv
• • • • • Route 3 • • • • •								
BL	1.0490	15.23	5.65	120		0.078621	0'-7½	Pf 0.442
588	16'-1½	15.23	5.6	7.398		Sprinkler,	5'-0	Pe 0.267
376	15'-6			8.106		PO(5'-0)	5'-7½	Pv
BL	1.6820	15.23	2.20	120		0.007888	9'-8½	Pf 0.116
376	15'-6			8.106		2E(2'-5½)	4'-11½	Pe 1.228
572	12'-8			9.450			14'-8	Pv
BL	1.6820	32.45	4.68	120		0.031955	11'-0	Pf 0.352
572	12'-8	17.22	5.6	9.450		Sprinkler		Pe
554	12'-8			9.802			11'-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	1.6820	49.98	7.22	120		0.071061	11'-0	Pf 0.782
554	12'-8	17.53	5.6	9.802		Sprinkler		Pe
534	12'-8			10.583			11'-0	Pv
BL	1.6820	68.20	9.85	120		0.126283	11'-0	Pf 1.389
534	12'-8	18.22	5.6	10.583		Sprinkler		Pe
517	12'-8			11.973			11'-0	Pv
BL	1.6820	87.57	12.64	120		0.200572	3'-10	Pf 3.252
517	12'-8	19.38	5.6	11.973		Sprinkler,	12'-4½	Pe 0.723
144	11'-0			15.947		E(2'-5½), PO(9'-11)	16'-2½	Pv
• • • • • Route 4 • • • • •								
BL	1.0490	17.35	6.44	120		0.100062	0'-7½	Pf 0.562
475	16'-1½	17.35	5.6	9.601		Sprinkler,	5'-0	Pe 0.267
359	15'-6			10.430		PO(5'-0)	5'-7½	Pv
BL	1.6820	17.35	2.51	120		0.010039	20'-8½	Pf 0.258
359	15'-6			10.430		2E(2'-5½)	4'-11½	Pe 1.228
447	12'-8			11.916			25'-8	Pv
BL	1.6820	36.68	5.30	120		0.040099	11'-0	Pf 0.441
447	12'-8	19.33	5.6	11.916		Sprinkler		Pe
430	12'-8			12.357			11'-0	Pv
BL	1.6820	56.37	8.14	120		0.088776	11'-0	Pf 0.977
430	12'-8	19.69	5.6	12.357		Sprinkler		Pe
415	12'-8			13.334			11'-0	Pv
BL	1.6820	76.82	11.09	120		0.157389	3'-10	Pf 2.552
415	12'-8	20.45	5.6	13.334		Sprinkler,	12'-4½	Pe 0.723
150	11'-0			16.608		E(2'-5½), PO(9'-11)	16'-2½	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
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