



AMERICAN
FIRE SPRINKLER

MCC AUTOMOTIVE INSTITUTE

500 SW LONGVIEW RD.
LEE'S SUMMIT, MO 64081

HYDRAULIC CALCULATIONS INDEX

LEVEL 1 AREA 1
LEVEL 1 AREA 2
LEVEL 1 AREA 3
LEVEL 2 AREA 4

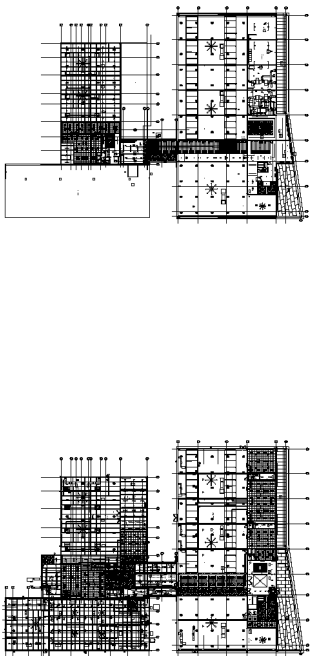
**LEVEL 1 AREA 5 PAINT BOOTH
(FUTURE SUBMITTAL)**





Hydraulic Overview

Job Number: 4352CK - COLLISION CENTER
Report Description: Ordinary Group II - AREA 1 -

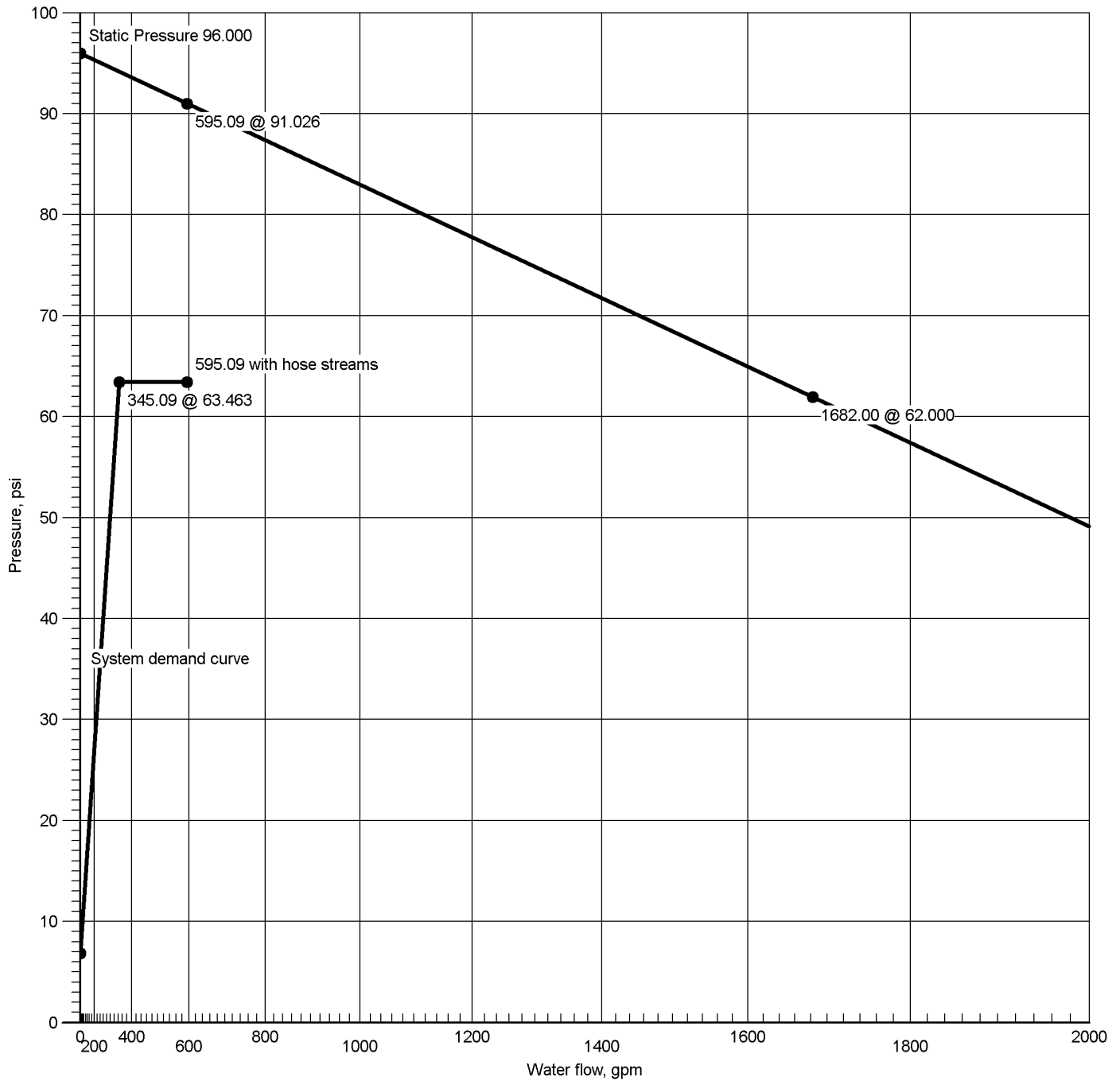
Job									
Job Number 4352CK					Designer				
Job Name: MCC AUTO SHOP					Phone			FAX	
Address 1 500 SW LONGVIEW RD					State Certification/License Number				
Address 2 LEE'S SUMMIT, MO 64081					AHJ				
Address 3					Job Site/Building				
System									
Density 0.20gpm/ft ²					Area of Application 1500ft ² (Actual 1546ft ²)				
Most Demanding Sprinkler Data 5.6 K-Factor 24.00 at 18.367					Hose Streams 250.00				
Coverage Per Sprinkler 120ft ²					Number Of Sprinklers Calculated 14			Number Of Nozzles Calculated 0	
System Pressure Demand 63.463					System Flow Demand 345.09				
Total Demand 595.09 @ 63.463					Pressure Result +27.564 (30.3%)				
Supplies						Check Point Gauges			
<u>Node</u>	<u>Name</u>	<u>Flow(gpm)</u>	<u>Hose Flow(gpm)</u>	<u>Static(psi)</u>	<u>Residual(psi)</u>	<u>Identifier</u>	<u>Pressure(psi)</u>	<u>K-Factor(K)</u>	<u>Flow(gpm)</u>
1	Water Supply	1682.00	250.00	96.000	62.000	BOR (4)	55.243	46.43	345.09
4352CK MCC AUTO SHOP.cad						Supply at Node 1 (1682.00, 250.00, 96.000, 62.000)			
									



Report Description: Ordinary Group II - AREA 1 -



Supply at Node 1



Hydraulic Graph

Supply at Node 1

Static: Pressure
96.000

Residual: Pressure
62.000 @ 1682.00

Available Flow @ 20 PSI:
2596.97

Available Pressure at System Demand
91.026 @ 595.09

Required Pressure at System Demand
63.463 @ 345.09

Required Pressure at System Demand (Including Hose Allowance at Source)
63.463 @ 595.09



Summary Of Outflowing Devices

Job Number: 4352CK - COLLISION CENTER
Report Description: Ordinary Group II - AREA 1 -

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
➡ Sprinkler	300	24.00	24.00	5.6	18.367			
Sprinkler	301	24.00	24.00	5.6	18.369			
Sprinkler	302	24.11	24.00	5.6	18.537			
Sprinkler	303	24.48	24.00	5.6	19.104			
Sprinkler	304	25.22	24.00	5.6	20.286			
Sprinkler	305	24.08	24.00	5.6	18.490			
Sprinkler	306	24.46	24.00	5.6	19.078			
Sprinkler	307	24.63	24.00	5.6	19.347			
Sprinkler	308	24.73	24.00	5.6	19.494			
Sprinkler	309	25.07	24.00	5.6	20.037			
Sprinkler	310	25.79	24.00	5.6	21.201			
Sprinkler	311	24.63	24.00	5.6	19.347			
Sprinkler	312	24.73	24.00	5.6	19.503			
Sprinkler	313	25.17	24.00	5.6	20.206			

➡ Most Demanding Sprinkler Data



Node Analysis

Job Number: 4352CK - COLLISION CENTER
Report Description: Ordinary Group II - AREA 1 -

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	3'-0	S	63.463	345.09
300	18'-10½	Spr(-18.367)	18.367	24.00
301	18'-10½	Spr(-18.369)	18.369	24.00
302	18'-10½	Spr(-18.537)	18.537	24.11
303	18'-10½	Spr(-19.104)	19.104	24.48
304	18'-10½	Spr(-20.286)	20.286	25.22
305	18'-10½	Spr(-18.490)	18.490	24.08
306	18'-10½	Spr(-19.078)	19.078	24.46
307	17'-7½	Spr(-19.347)	19.347	24.63
308	17'-7½	Spr(-19.494)	19.494	24.73
309	17'-7½	Spr(-20.037)	20.037	25.07
310	17'-7½	Spr(-21.201)	21.201	25.79
311	17'-7½	Spr(-19.347)	19.347	24.63
312	17'-7½	Spr(-19.503)	19.503	24.73
313	17'-7½	Spr(-20.206)	20.206	25.17
2	-6'-0	E(22'-1)	67.336	
3	-6'-0		62.998	
4	1'-4	BOR	55.243	
2000	14'-2	PO(9'-11)	43.125	
2001	14'-2	PO(9'-11)	43.167	
2002	18'-10½	PO(9'-11)	19.323	
2003	17'-7½	PO(9'-11)	20.464	
2004	16'-4½	PO(9'-11)	23.294	
2005	15'-1½	PO(9'-11)	24.463	
2006	14'-2	PO(9'-11)	43.226	
2007	14'-2	PO(9'-11)	43.248	
4008	14'-2	fT(21'-1)	43.423	



Hydraulic Analysis

Job Number: 4352CK - COLLISION CENTER
Report Description: Ordinary Group II - AREA 1 -

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	1.6820	2.07	0.30	120		0.000197	7'-11"	Pf 0.002
300	18'-10½"	24.00	5.6	18.367		Sprinkler		Pe -0.000
301	18'-10½"			18.369			7'-11"	Pv
BL	1.6820	26.07	3.76	120		0.021322	7'-11"	Pf 0.169
301	18'-10½"	24.00	5.6	18.369		Sprinkler		Pe -0.000
302	18'-10½"			18.537			7'-11"	Pv
BL	1.6820	50.18	7.25	120		0.071601	7'-11"	Pf 0.567
302	18'-10½"	24.11	5.6	18.537		Sprinkler		Pe -0.000
303	18'-10½"			19.104			7'-11"	Pv
BL	1.6820	74.66	10.78	120		0.149312	7'-11"	Pf 1.182
303	18'-10½"	24.48	5.6	19.104		Sprinkler		Pe -0.000
304	18'-10½"			20.286			7'-11"	Pv
BL	1.6820	99.88	14.42	120		0.255822	61'-6"	Pf 20.799
304	18'-10½"	25.22	5.6	20.286		Sprinkler,	19'-9½"	Pe 2.040
2000	14'-2"			43.125		T(9'-11), PO(9'-11)	81'-3½"	Pv
CM	4.2600	99.88	2.25	120		0.002770	14'-11½"	Pf 0.041
2000	14'-2"			43.125				Pe 0.000
2001	14'-2"			43.167			14'-11½"	Pv
CM	4.2600	199.73	4.50	120		0.009983	4'-7"	Pf 0.256
2001	14'-2"	99.85		43.167		Flow (q) from Route 4	21'-1"	Pe 0.000
4008	14'-2"			43.423		ft(21'-1)	25'-8"	Pv
CM	4.2600	345.09	7.77	120		0.027454	18'-5"	Pf 6.254
4008	14'-2"	145.36		43.423		Flow (q) from Route 2	84'-9½"	Pe 5.566
4	1'-4"			55.243		fE(8'-11½"), CV(23'-2), 2PO(26'-4), BFP(-3.421), BOR	103'-2½"	Pv
UG	4.2200	345.09	7.92	140		0.021613	164'-9"	Pf 4.573
4	1'-4"			55.243			46'-10"	Pe 3.182
3	-6'-0"			62.998		2E(16'-8½"), 2EE(6'-8½")	211'-7"	Pv
UG	6.2800	345.09	3.57	140		0.003118	1148'-8"	Pf 4.339
3	-6'-0"			62.998			242'-8½"	Pe
2	-6'-0"			67.336		2GV(4'-8½"), 2E(22'-1), 3EE(11'-0½"), LtE(14'-2), 3T(47'-3½")	1391'-4"	Pv
UG	6.2800	345.09	3.57	140		0.003118	9'-0"	Pf 0.028
2	-6'-0"			67.336				Pe -3.902
1	3'-0"			63.463		S	9'-0"	Pv
		250.00				Hose Allowance At Source		
1		595.09						
Route 2								
BL	1.6820	21.93	3.17	120		0.015479	7'-11"	Pf 0.123
300	18'-10½"	24.00	5.6	18.367		Sprinkler		Pe 0.000
305	18'-10½"			18.490			7'-11"	Pv
BL	1.6820	46.01	6.64	120		0.060971	3'-9"	Pf 0.833
305	18'-10½"	24.08	5.6	18.490		Sprinkler,	9'-11"	Pe 0.000
2002	18'-10½"			19.323		PO(9'-11)	13'-8"	Pv
CM	2.1570	70.47	6.19	120		0.039956	15'-0"	Pf 0.600
2002	18'-10½"	24.46		19.323		Flow (q) from Route 3		Pe 0.542
2003	17'-7½"			20.464			15'-0"	Pv
CM	2.1570	145.36	12.76	120		0.152522	15'-0"	Pf 2.289
2003	17'-7½"	49.72 + 25.17		20.464		Flow (q) from Route 5 and 6		Pe 0.541
2004	16'-4½"			23.294			15'-0"	Pv
CM	2.1570	72.18	6.34	120		0.041775	15'-0"	Pf 0.627
2004	16'-4½"			23.294				Pe 0.542
2005	15'-1½"			24.463			15'-0"	Pv
BL	1.6820	72.18	10.42	120		0.140279	101'-1"	Pf 18.347
2005	15'-1½"			24.463		PO(9'-11)	29'-8½"	Pe 0.415
2006	14'-2"			43.226		T(9'-11), PO(9'-11)	130'-9½"	Pv
CM	4.2600	72.18	1.62	120		0.001519	14'-11½"	Pf 0.023
2006	14'-2"			43.226				Pe
2007	14'-2"			43.248			14'-11½"	Pv
CM	4.2600	145.36	3.27	120		0.005546	10'-4½"	Pf 0.174
2007	14'-2"	73.18		43.248		Flow (q) from Route 7	21'-1"	Pe
4008	14'-2"			43.423		ft(21'-1)	31'-5½"	Pv
Route 3								
BL	1.6820	24.46	3.53	120		0.018946	3'-0½"	Pf 0.245
306	18'-10½"	24.46	5.6	19.078		Sprinkler,	9'-11"	Pe -0.000
2002	18'-10½"			19.323		PO(9'-11)	12'-11"	Pv



Hydraulic Analysis

Job Number: 4352CK - COLLISION CENTER
Report Description: Ordinary Group II - AREA 1 -

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
Route 4							
BL	1.6820	24.27	3.50	120	0.018679	7'-11"	Pf 0.148
307	17'-7½"	24.63	5.6	19.347	Sprinkler		Pe -0.000
308	17'-7½"			19.494		7'-11"	Pv
BL	1.6820	49.00	7.07	120	0.068504	7'-11"	Pf 0.542
308	17'-7½"	24.73	5.6	19.494	Sprinkler		Pe -0.000
309	17'-7½"			20.037		7'-11"	Pv
BL	1.6820	74.07	10.69	120	0.147119	7'-11"	Pf 1.165
309	17'-7½"	25.07	5.6	20.037	Sprinkler		Pe -0.000
310	17'-7½"			21.201		7'-11"	Pv
BL	1.6820	99.85	14.42	120	0.255669	60'-3"	Pf 20.467
310	17'-7½"	25.79	5.6	21.201	Sprinkler,	19'-9½"	Pe 1.498
2001	14'-2"			43.167	T(9'-11), PO(9'-11)	80'-0½"	Pv
Route 5							
BL	1.6820	0.36	0.05	120	0.000008	7'-11"	Pf 0.000
307	17'-7½"	24.63	5.6	19.347	Sprinkler		Pe 0.000
311	17'-7½"			19.347		7'-11"	Pv
BL	1.6820	24.99	3.61	120	0.019713	7'-11"	Pf 0.156
311	17'-7½"	24.63	5.6	19.347	Sprinkler		Pe 0.000
312	17'-7½"			19.503		7'-11"	Pv
BL	1.6820	49.72	7.18	120	0.070384	3'-9"	Pf 0.961
312	17'-7½"	24.73	5.6	19.503	Sprinkler,	9'-11"	Pe 0.000
2003	17'-7½"			20.464	PO(9'-11)	13'-8"	Pv
Route 6							
BL	1.6820	25.17	3.63	120	0.019980	3'-0½"	Pf 0.258
313	17'-7½"	25.17	5.6	20.206	Sprinkler,	9'-11"	Pe 0.000
2003	17'-7½"			20.464	PO(9'-11)	12'-11"	Pv
Route 7							
BL	1.6820	73.18	10.57	120	0.143873	102'-4"	Pf 18.997
2004	16'-4½"			23.294	PO(9'-11)	29'-8½"	Pe 0.957
2007	14'-2"			43.248	T(9'-11), PO(9'-11)	132'-0½"	Pv

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

C Value Multiplier

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

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



Hydraulic Analysis

Job Number: 4352CK - COLLISION CENTER
Report Description: Ordinary Group II - AREA 1 -

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		Units Legend		Fittings Legend	
AO	Arm-Over	Diameter	Inch	ALV	Alarm Valve
BL	Branch Line	Elevation	Foot	AngV	Angle Valve
CM	Cross Main	Flow	gpm	b	Bushing
DN	Drain	Discharge	gpm	BaIV	Ball Valve
DR	Drop	Velocity	fps	BFP	Backflow Preventer
DY	Dynamic	Pressure	psi	BV	Butterfly Valve
FM	Feed Main	Length	Foot	C	Cross Flow Turn 90°
FR	Feed Riser	Friction Loss	psi/Foot	cplg	Coupling
MS	Miscellaneous	HWC	Hazen-Williams Constant	Cr	Cross Run
OR	Outrigger	Pt	Total pressure at a point in a pipe	CV	Check Valve
RN	Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV	Deluge Valve
SN	Swing Nipple	Pf	Pressure loss due to friction between points	DPV	Dry Pipe Valve
SP	Sprig	Pe	Pressure due to elevation difference between indicated points	E	90° Elbow
ST	Stand Pipe	Pv	Velocity pressure at a point in a pipe	EE	45° Elbow
UG	Underground			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

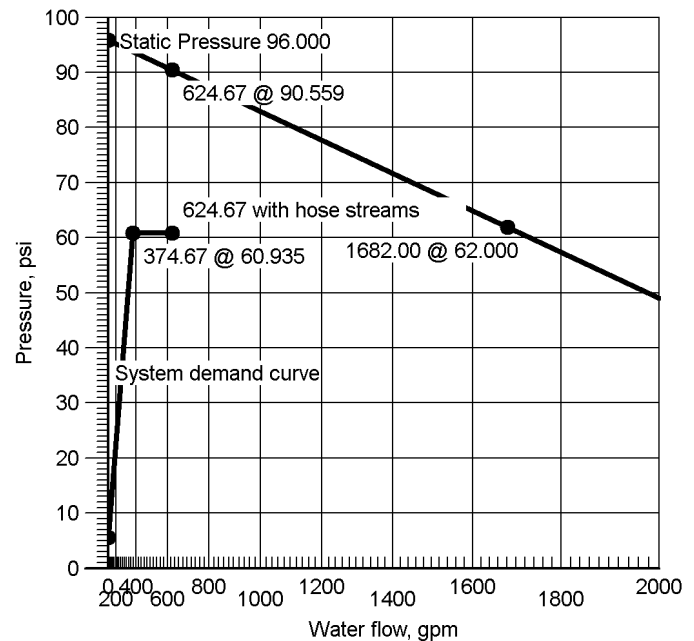
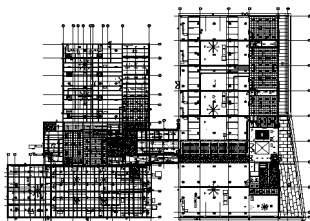
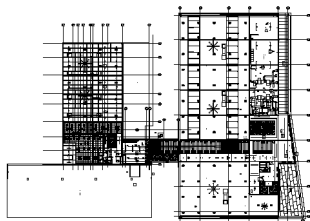
Job Number: 4352CK - MCC AUTO SHOP
Report Description: Ordinary Group II - AREA 2 - (TWO)

Job		
Job Number 4352CK	Designer	
Job Name: MCC AUTO SHOP	Phone	FAX
Address 1 500 SW LONGVIEW RD	State Certification/License Number	
Address 2 LEE'S SUMMIT, MO 64081	AHJ	
Address 3	Job Site/Building	

System		
Density 0.20gpm/ft ²	Area of Application 1500ft ² (Actual 1617ft ²)	
Most Demanding Sprinkler Data 5.6 K-Factor 25.60 at 20.898	Hose Streams 250.00	
Coverage Per Sprinkler 128ft ²	Number Of Sprinklers Calculated 14	Number Of Nozzles Calculated 0
System Pressure Demand 60.935	System Flow Demand 374.67	
Total Demand 624.67 @ 60.935	Pressure Result +29.625 (32.7%)	

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1682.00	250.00	96.000	62.000	BOR (4)	51.247	52.34	374.67

4352CK MCC AUTO SHOP.cad Supply at Node 1 (1682.00, 250.00, 96.000, 62.000)





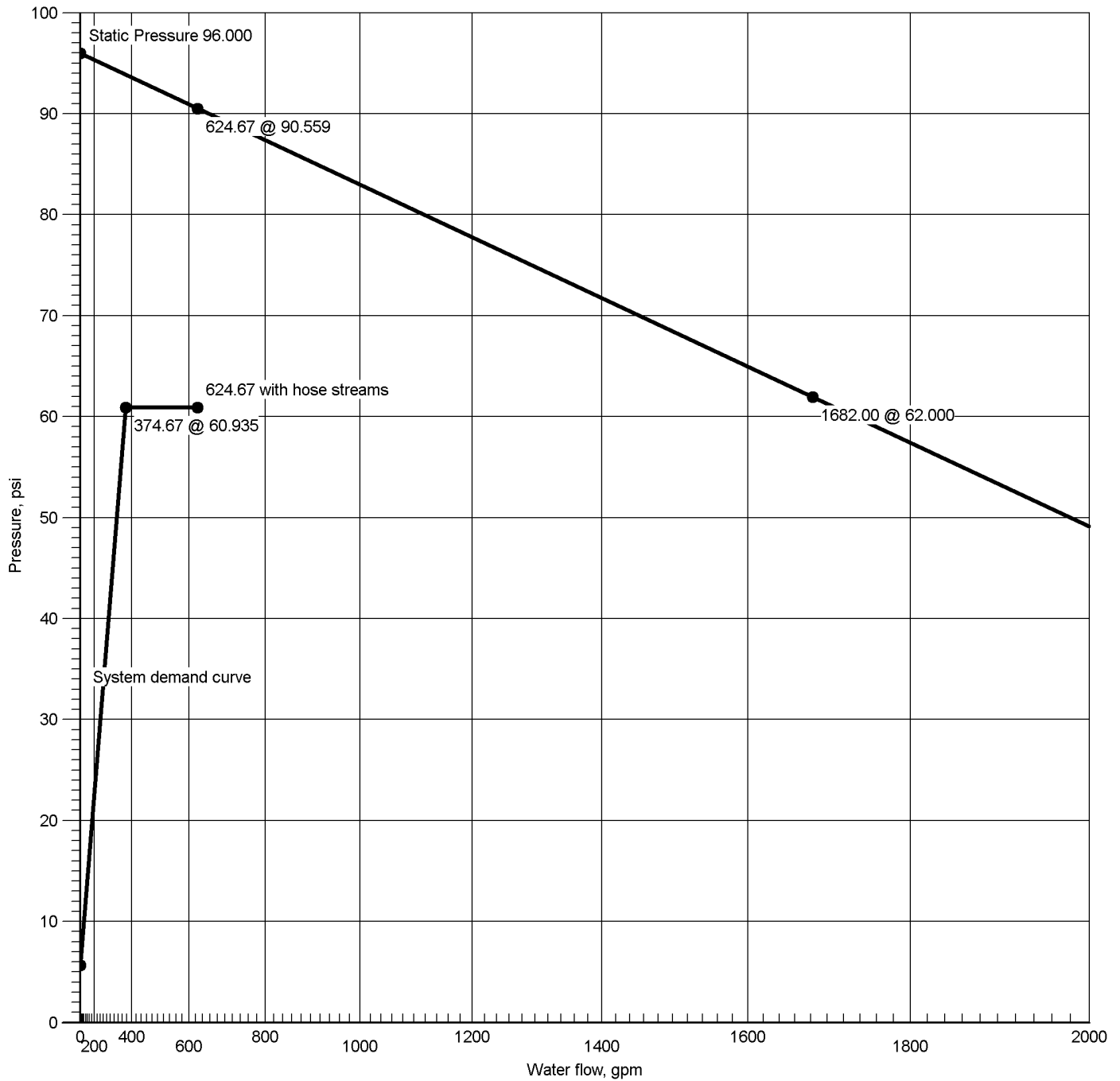
Hydraulic Summary

Job Number: 4352CK - MCC AUTO SHOP
Report Description: Ordinary Group II - AREA 2 - (TWO)

Job											
Job Number 4352CK					Designer						
Job Name: MCC AUTO SHOP					State Certification/License Number						
Address 1 500 SW LONGVIEW RD					AHJ						
Address 2 LEE'S SUMMIT, MO 64081					Job Site/Building						
Address 3					Drawing Name 4352CK MCC AUTO SHOP.cad						
System					Remote Area(s)						
Most Demanding Sprinkler Data 5.6 K-Factor 25.60 at 20.898					Occupancy Ordinary Group II - AREA 2 -			Job Suffix MCC AUTO SHOP			
Hose Allowance At Source 250.00					Density 0.20gpm/ft ²			Area of Application 1500ft ² (Actual 1617ft ²)			
Additional Hose Supplies <u>Node</u> <u>Flow(gpm)</u>					Number Of Sprinklers Calculated 14		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 128ft ²		
					AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area						
					Left: 60.935 Right: 60.935						
Total Hose Streams 250.00											
System Flow Demand 374.67			Total Water Required (Including Hose Allowance) 624.67								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 22.47 between nodes 3001 and 3000											
Maximum Velocity Under Ground 8.59 between nodes 3 and 4											
Volume capacity of Wet Pipes 3097.93gal			Volume capacity of Dry Pipes								
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	96.000	62.000		1682.00	90.559		624.67	60.935	29.625
Contractor											
		Contractor Number				Contact Name				Contact Title	
Name of Contractor:						Phone				Extension	
Address 1						FAX					
Address 2						E-mail					
Address 3						Web-Site					



Supply at Node 1



Hydraulic Graph

Supply at Node 1

Static Pressure
96.000

Residual Pressure Available Flow @ 20 PSI:
62.000 @ 1682.00 2596.97

Available Pressure at System Demand
90.559 @ 624.67

Required Pressure at System Demand
60.935 @ 374.67

Required Pressure at System Demand (Including Hose Allowance at Source)
60.935 @ 624.67



Summary Of Outflowing Devices

Job Number: 4352CK - MCC AUTO SHOP
Report Description: Ordinary Group II - AREA 2 - (TWO)

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
➡ Sprinkler	400	25.60	25.60	5.6	20.898			
Sprinkler	401	25.71	25.60	5.6	21.071			
Sprinkler	402	26.09	25.60	5.6	21.697			
Sprinkler	403	25.89	25.60	5.6	21.367			
Sprinkler	404	25.99	25.60	5.6	21.544			
Sprinkler	405	26.38	25.60	5.6	22.183			
Sprinkler	406	26.59	25.60	5.6	22.538			
Sprinkler	407	26.75	25.60	5.6	22.819			
Sprinkler	408	26.70	25.60	5.6	22.740			
Sprinkler	409	26.87	25.60	5.6	23.016			
Sprinkler	410	27.88	25.60	5.6	24.789			
Sprinkler	411	28.05	25.60	5.6	25.096			
Sprinkler	412	28.01	25.60	5.6	25.010			

➡ Most Demanding Sprinkler Data



Node Analysis

Job Number: 4352CK - MCC AUTO SHOP
Report Description: Ordinary Group II - AREA 2 - (TWO)

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	3'-0	S	60.935	374.67
400	14'-6	Spr(-20.898)	20.898	25.60
401	14'-6	Spr(-21.071)	21.071	25.71
402	14'-6	Spr(-21.697)	21.697	26.09
403	14'-6	Spr(-21.367)	21.367	25.89
404	14'-6	Spr(-21.544)	21.544	25.99
405	14'-6	Spr(-22.183)	22.183	26.38
406	15'-5	Spr(-22.538)	22.538	26.59
407	15'-5	Spr(-22.819)	22.819	26.75
408	15'-5	Spr(-22.740)	22.740	26.70
409	15'-5	Spr(-23.016)	23.016	26.87
410	16'-2	Spr(-24.789)	24.789	27.88
411	16'-2	Spr(-25.096)	25.096	28.05
412	16'-2	Spr(-25.010)	25.010	28.01
413	16'-2	Spr(-25.312)	25.312	28.17
2	-6'-0	E(22'-1)	64.804	
3	-6'-0		59.752	
4	1'-4	BOR	51.247	
2000	14'-2	PO(9'-11)	37.463	
2001	14'-2	PO(9'-11)	37.913	
2002	18'-10½	PO(9'-11)	36.101	
2003	17'-7½	PO(9'-11)	36.665	
2004	16'-4½	PO(9'-11)	37.259	
2005	15'-1½	PO(9'-11)	37.815	
2006	14'-2	PO(9'-11)	38.653	
2007	14'-2	PO(9'-11)	38.654	
3000	14'-6	T(9'-11)	24.156	
3001	13'-2½	PO(9'-11)	31.228	
3002	14'-1½	PO(9'-11), C(9'-11)	30.894	
3003	14'-10½	PO(9'-11)	30.726	
3004	15'-5	T(9'-11)	24.211	
3005	16'-2	T(9'-11)	26.616	
4008	14'-2	ft(21'-1)	38.658	



Hydraulic Analysis

Job Number: 4352CK - MCC AUTO SHOP
Report Description: Ordinary Group II - AREA 2 - (TWO)

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	1.6820	25.60	3.70	120		0.020612	8'-5"	Pf 0.173
400	14'-6"	25.60	5.6	20.898		Sprinkler		Pe 0.000
401	14'-6"			21.071			8'-5"	Pv
BL	1.6820	51.31	7.41	120		0.074591	8'-5"	Pf 0.626
401	14'-6"	25.71	5.6	21.071		Sprinkler		Pe 0.000
402	14'-6"			21.697			8'-5"	Pv
BL	1.6820	77.39	11.17	120		0.159572	5'-6"	Pf 2.459
402	14'-6"	26.09	5.6	21.697		Sprinkler,	9'-11"	Pe 0.000
3000	14'-6"			24.156		T(9'-11)	15'-5"	Pv
BL	1.6820	155.64	22.47	120		0.581202	1'-3 1/2"	Pf 6.510
3000	14'-6"	78.25		24.156		Flow (q) from Route 2	9'-11"	Pe 0.562
3001	13'-2 1/2"			31.228		PO(9'-11)	11'-2 1/2"	Pv
CM	4.2600	155.64	3.50	120		0.006293	11'-11 1/2"	Pf 0.075
3001	13'-2 1/2"			31.228				Pe -0.410
3002	14'-1 1/2"			30.894			11'-11 1/2"	Pv
CM	4.2600	262.55	5.91	120		0.016557	8'-7 1/2"	Pf 0.143
3002	14'-1 1/2"	106.91		30.894		Flow (q) from Route 3		Pe -0.310
3003	14'-10 1/2"			30.726			8'-7 1/2"	Pv
CM	4.2600	374.67	8.43	120		0.031965	167'-9"	Pf 6.438
3003	14'-10 1/2"	112.12		30.726		Flow (q) from Route 5	33'-8"	Pe 0.299
2000	14'-2"			37.463		3fE(8'-11 1/2), Tr(6'-9 1/2)	201'-5"	Pv
CM	4.2600	362.72	8.16	120		0.030104	14'-11 1/2"	Pf 0.450
2000	14'-2"			37.463				Pe 0.000
2001	14'-2"			37.913			14'-11 1/2"	Pv
CM	4.2600	355.71	8.01	120		0.029038	4'-7"	Pf 0.745
2001	14'-2"			37.913			21'-1"	Pe 0.000
4008	14'-2"			38.658		fT(21'-1)	25'-8"	Pv
CM	4.2600	374.67	8.43	120		0.031965	18'-5"	Pf 7.022
4008	14'-2"	18.95		38.658		Flow (q) from Route 7	84'-9 1/2"	Pe 5.566
4	1'-4"			51.247		fE(8'-11 1/2), CV(23'-2), 2PO(26'-4), BFP(-3.724), BOR	103'-2 1/2"	Pv
UG	4.2200	374.67	8.59	140		0.025164	164'-9"	Pf 5.324
4	1'-4"			51.247			46'-10"	Pe 3.182
3	-6'-0"			59.752		2E(16'-8 1/2), 2EE(6'-8 1/2)	211'-7"	Pv
UG	6.2800	374.67	3.88	140		0.003631	1148'-8"	Pf 5.051
3	-6'-0"			59.752			242'-8 1/2"	Pe
2	-6'-0"			64.804		2GV(4'-8 1/2), 2E(22'-1), 3EE(11'-0 1/2), LtE(14'-2), 3T(47'-3 1/2)	1391'-4"	Pv
UG	6.2800	374.67	3.88	140		0.003631	9'-0"	Pf 0.033
2	-6'-0"			64.804				Pe -3.902
1	3'-0"			60.935		S	9'-0"	Pv
		250.00				Hose Allowance At Source		
1		624.67						
Route 2								
BL	1.6820	25.89	3.74	120		0.021040	8'-4 1/2"	Pf 0.176
403	14'-6"	25.89	5.6	21.367		Sprinkler		Pe -0.000
404	14'-6"			21.544			8'-4 1/2"	Pv
BL	1.6820	51.88	7.49	120		0.076138	8'-5"	Pf 0.639
404	14'-6"	25.99	5.6	21.544		Sprinkler		Pe -0.000
405	14'-6"			22.183			8'-5"	Pv
BL	1.6820	78.25	11.30	120		0.162878	2'-2 1/2"	Pf 1.974
405	14'-6"	26.38	5.6	22.183		Sprinkler,	9'-11"	Pe -0.000
3000	14'-6"			24.156		T(9'-11)	12'-1 1/2"	Pv
Route 3								
BL	1.6820	26.59	3.84	120		0.022104	12'-9"	Pf 0.281
406	15'-5"	26.59	5.6	22.538		Sprinkler		Pe 0.000
407	15'-5"			22.819			12'-9"	Pv
BL	1.6820	53.34	7.70	120		0.080144	7'-5 1/2"	Pf 1.392
407	15'-5"	26.75	5.6	22.819		Sprinkler,	9'-11"	Pe 0.000
3004	15'-5"			24.211		T(9'-11)	17'-4 1/2"	Pv
BL	1.6820	106.91	15.44	120		0.290095	1'-3 1/2"	Pf 6.121
3004	15'-5"	53.57		24.211		Flow (q) from Route 4	19'-9 1/2"	Pe 0.562
3002	14'-1 1/2"			30.894		PO(9'-11), C(9'-11)	21'-1"	Pv
Route 4								



Hydraulic Analysis

Job Number: 4352CK - MCC AUTO SHOP
Report Description: Ordinary Group II - AREA 2 - (TWO)

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	1.6820	26.70	3.86	120		0.022288	12'-5	Pf 0.276
408	15'-5	26.70	5.6	22.740		Sprinkler		Pe -0.000
409	15'-5			23.016			12'-5	Pv
BL	1.6820	53.57	7.74	120		0.080797	4'-10½	Pf 1.194
409	15'-5	26.87	5.6	23.016		Sprinkler,	9'-11	Pe -0.000
3004	15'-5			24.211		T(9'-11)	14'-9½	Pv
Route 5								
BL	1.6820	27.88	4.03	120		0.024139	12'-9	Pf 0.307
410	16'-2	27.88	5.6	24.789		Sprinkler		Pe 0.000
411	16'-2			25.096			12'-9	Pv
BL	1.6820	55.94	8.08	120		0.087519	7'-5½	Pf 1.520
411	16'-2	28.05	5.6	25.096		Sprinkler,	9'-11	Pe 0.000
3005	16'-2			26.616		T(9'-11)	17'-4½	Pv
BL	1.6820	112.12	16.19	120		0.316781	1'-3½	Pf 3.548
3005	16'-2	56.18		26.616		Flow (q) from Route 6	9'-11	Pe 0.562
3003	14'-10½			30.726		PO(9'-11)	11'-2½	Pv
Route 6								
BL	1.6820	28.01	4.04	120		0.024338	12'-5	Pf 0.302
412	16'-2	28.01	5.6	25.010		Sprinkler		Pe -0.000
413	16'-2			25.312			12'-5	Pv
BL	1.6820	56.18	8.11	120		0.088227	4'-10½	Pf 1.304
413	16'-2	28.17	5.6	25.312		Sprinkler,	9'-11	Pe -0.000
3005	16'-2			26.616		T(9'-11)	14'-9½	Pv
Route 7								
CM	2.1570	18.95	1.66	120		0.003519	15'-0	Pf 0.053
2003	17'-7½	11.95 + 7.00		36.665		Flow (q) from Route 8 and 10		Pe 0.541
2004	16'-4½			37.259			15'-0	Pv
CM	2.1570	9.41	0.83	120		0.000964	15'-0	Pf 0.014
2004	16'-4½			37.259				Pe 0.542
2005	15'-1½			37.815			15'-0	Pv
BL	1.6820	9.41	1.36	120		0.003237	101'-1	Pf 0.423
2005	15'-1½			37.815		PO(9'-11)	29'-8½	Pe 0.415
2006	14'-2			38.653		T(9'-11), PO(9'-11)	130'-9½	Pv
CM	4.2600	9.41	0.21	120		0.000035	14'-11½	Pf 0.001
2006	14'-2			38.653				Pe
2007	14'-2			38.654			14'-11½	Pv
CM	4.2600	18.95	0.43	120		0.000128	10'-4½	Pf 0.004
2007	14'-2	9.54		38.654		Flow (q) from Route 11	21'-1	Pe
4008	14'-2			38.658		ft(21'-1)	31'-5½	Pv
Route 8								
CM	2.1570	11.95	1.05	120		0.001500	15'-0	Pf 0.023
2002	18'-10½	11.95		36.101		Flow (q) from Route 9		Pe 0.542
2003	17'-7½			36.665			15'-0	Pv
Route 9								
BL	1.6820	11.95	1.73	120		0.005035	104'-10	Pf 0.677
2000	14'-2			37.463		PO(9'-11)	29'-8½	Pe -2.039
2002	18'-10½			36.101		T(9'-11), PO(9'-11)	134'-6½	Pv
Route 10								
BL	1.6820	7.00	1.01	120		0.001873	103'-7	Pf 0.250
2001	14'-2			37.913		PO(9'-11)	29'-8½	Pe -1.498
2003	17'-7½			36.665		T(9'-11), PO(9'-11)	133'-3½	Pv
Route 11								
BL	1.6820	9.54	1.38	120		0.003320	102'-4	Pf 0.438
2004	16'-4½			37.259		PO(9'-11)	29'-8½	Pe 0.957
2007	14'-2			38.654		T(9'-11), PO(9'-11)	132'-0½	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)		C Value Multiplier				
$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}} \right)^{4.87} = \text{Factor}$		Value Of C	100	130	140	150
		Multiplying Factor	0.713	1.16	1.33	1.51



Hydraulic Analysis

Job Number: 4352CK - MCC AUTO SHOP
Report Description: Ordinary Group II - AREA 2 - (TWO)

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

Pipe Type Legend	Units Legend	Fittings Legend
AO Arm-Over	Diameter Inch	ALV Alarm Valve
BL Branch Line	Elevation Foot	AngV Angle Valve
CM Cross Main	Flow gpm	b Bushing
DN Drain	Discharge gpm	BaV Ball Valve
DR Drop	Velocity fps	BFP Backflow Preventer
DY Dynamic	Pressure psi	BV Butterfly Valve
FM Feed Main	Length Foot	C Cross Flow Turn 90°
FR Feed Riser	Friction Loss psi/Foot	cplg Coupling
MS Miscellaneous	HWC Hazen-Williams Constant	Cr Cross Run
OR Outrigger	Pt Total pressure at a point in a pipe	CV Check Valve
RN Riser Nipple	Pn Normal pressure at a point in a pipe	DeV Deluge Valve
SN Swing Nipple	Pf Pressure loss due to friction between points	DPV Dry Pipe Valve
SP Sprig	Pe Pressure due to elevation difference between indicated points	E 90° Elbow
ST Stand Pipe	Pv Velocity pressure at a point in a pipe	EE 45° Elbow
UG Underground		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



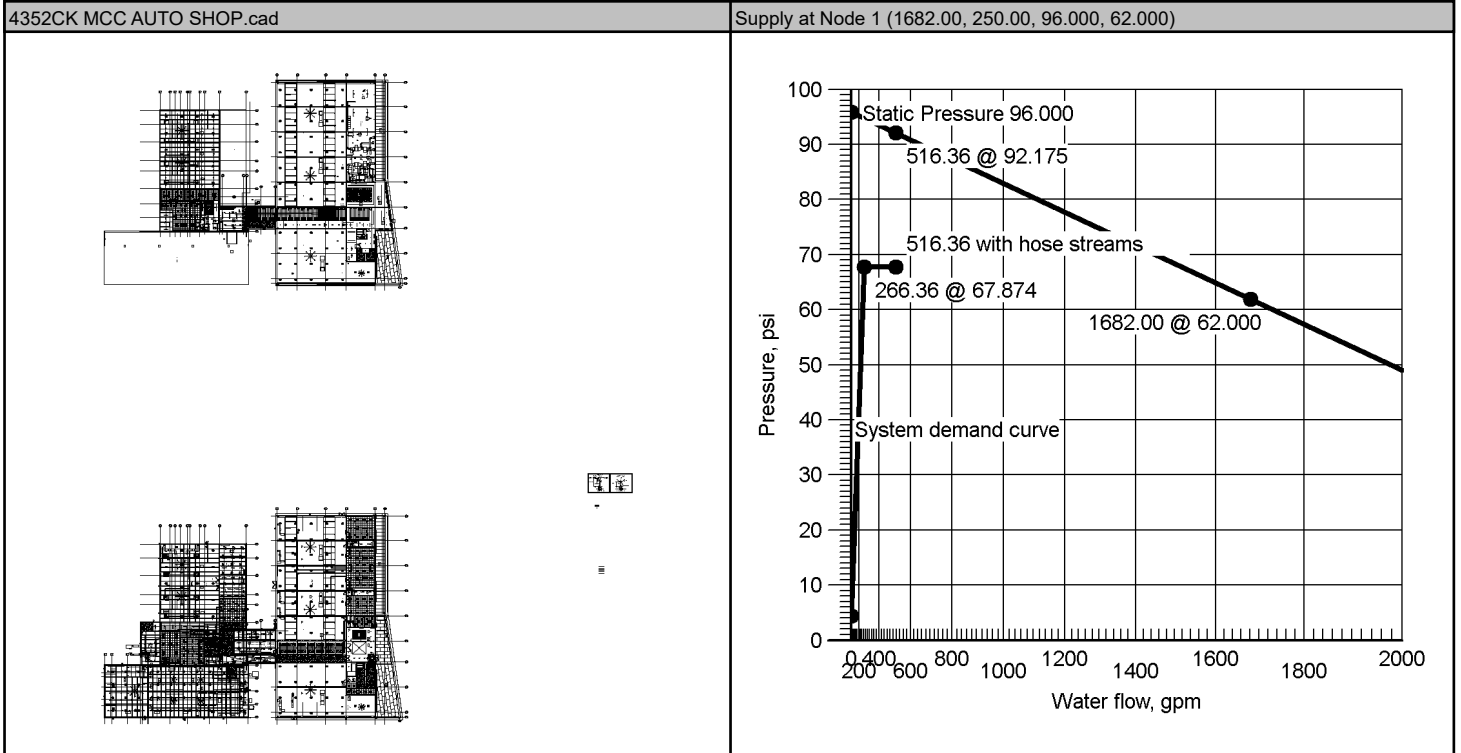
Hydraulic Overview

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 3 -

Job		
Job Number 4352CK	Designer	
Job Name: MCC AUTO SHOP	Phone	FAX
Address 1 500 SW LONGVIEW RD	State Certification/License Number	
Address 2 LEE'S SUMMIT, MO 64081	AHJ	
Address 3	Job Site/Building	

System		
Density 0.20gpm/ft ²	Area of Application 1500ft ² (Actual 1197ft ²)	
Most Demanding Sprinkler Data 5.6 K-Factor 19.67 at 12.333	Hose Streams 250.00	
Coverage Per Sprinkler 98ft ²	Number Of Sprinklers Calculated 13	Number Of Nozzles Calculated 0
System Pressure Demand 67.874	System Flow Demand 266.36	
Total Demand 516.36 @ 67.874	Pressure Result +24.301 (26.4%)	

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1682.00	250.00	96.000	62.000	BOR (4)	63.057	33.54	266.36





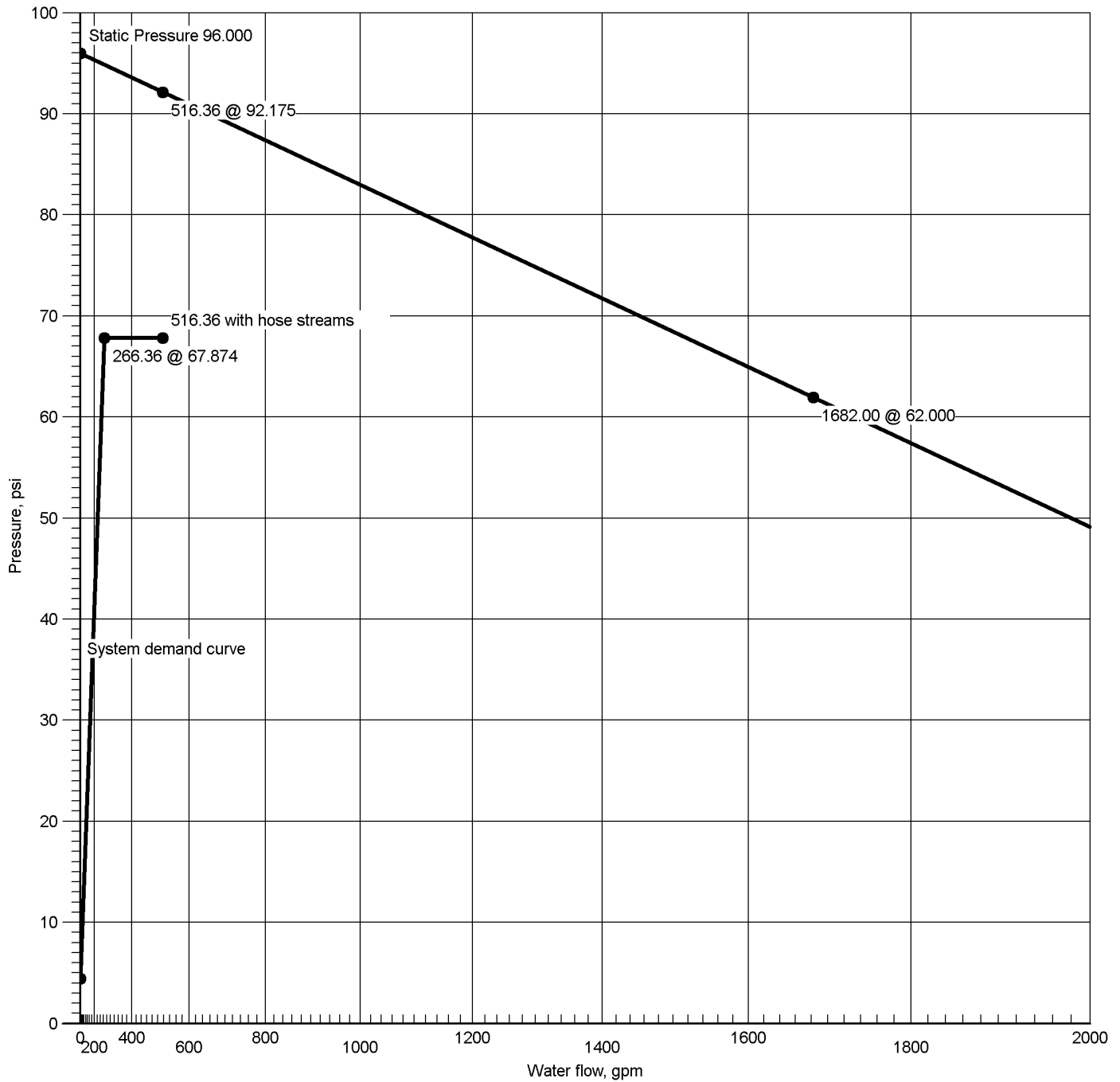
Hydraulic Summary

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 3 -

Job											
Job Number 4352CK					Designer						
Job Name: MCC AUTO SHOP					State Certification/License Number						
Address 1 500 SW LONGVIEW RD					AHJ						
Address 2 LEE'S SUMMIT, MO 64081					Job Site/Building						
Address 3					Drawing Name 4352CK MCC AUTO SHOP.cad						
System					Remote Area(s)						
Most Demanding Sprinkler Data 5.6 K-Factor 19.67 at 12.333					Occupancy Ordinary Group II - AREA 3 -			Job Suffix			
Hose Allowance At Source 250.00					Density 0.20gpm/ft²			Area of Application 1500ft² (Actual 1197ft²)			
Additional Hose Supplies <u>Node</u> <u>Flow(gpm)</u>					Number Of Sprinklers Calculated 13		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 98ft²		
					AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area Right: 66.879						
Total Hose Streams 250.00											
System Flow Demand 266.36			Total Water Required (Including Hose Allowance) 516.36								
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 16.40 between nodes 4014 and 4013											
Maximum Velocity Under Ground 6.11 between nodes 3 and 4											
Volume capacity of Wet Pipes 3097.93gal			Volume capacity of Dry Pipes								
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	96.000	62.000		1682.00	92.175		516.36	67.874	24.301
Contractor											
Contractor Number		Contact Name					Contact Title				
Name of Contractor:		Phone					Extension				
Address 1		FAX									
Address 2		E-mail									
Address 3		Web-Site									



Supply at Node 1



Hydraulic Graph

Supply at Node 1

Static: Pressure
96.000

Residual: Pressure
62.000 @ 1682.00

Available Flow @ 20 PSI:
2596.97

Available Pressure at System Demand
92.175 @ 516.36

Required Pressure at System Demand
67.874 @ 266.36

Required Pressure at System Demand (Including Hose Allowance at Source)
67.874 @ 516.36



Summary Of Outflowing Devices

Job Number: 4352CK

Report Description: Ordinary Group II - AREA 3 -

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
⇒ Sprinkler	1200	19.67	19.67	5.6	12.333			
Sprinkler	1201	19.78	19.67	5.6	12.478			
Sprinkler	1202	19.84	19.67	5.6	12.548			
Sprinkler	1203	19.89	19.67	5.6	12.616			
Sprinkler	1204	19.95	19.67	5.6	12.695			
Sprinkler	1205	20.01	19.67	5.6	12.763			
Sprinkler	1206	20.19	19.67	5.6	13.004			
Sprinkler	1207	20.37	19.67	5.6	13.229			
Sprinkler	1208	20.42	19.67	5.6	13.297			
Sprinkler	1209	21.05	19.67	5.6	14.134			
Sprinkler	1210	21.23	19.67	5.6	14.377			
Sprinkler	1211	21.28	19.67	5.6	14.445			

⇒ Most Demanding Sprinkler Data



Node Analysis

Job Number: 4352CK

Report Description: Ordinary Group II - AREA 3 -

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	3'-0	S	67.874	266.36
1200	12'-5½	Spr(-12.333)	12.333	19.67
1201	12'-5½	Spr(-12.478)	12.478	19.78
1202	11'-7½	Spr(-12.548)	12.548	19.84
1203	13'-3½	Spr(-12.616)	12.616	19.89
1204	11'-7½	Spr(-12.695)	12.695	19.95
1205	13'-3½	Spr(-12.763)	12.763	20.01
1206	12'-5½	Spr(-13.004)	13.004	20.19
1207	11'-7½	Spr(-13.229)	13.229	20.37
1208	13'-3½	Spr(-13.297)	13.297	20.42
1209	12'-5½	Spr(-14.134)	14.134	21.05
1210	11'-7½	Spr(-14.377)	14.377	21.23
1211	13'-3½	Spr(-14.445)	14.445	21.28
1212	11'-7½	Spr(-16.385)	16.385	22.67
2	-6'-0	E(22'-1)	71.758	
3	-6'-0		69.071	
4	1'-4	BOR	63.057	
2000	14'-2	PO(9'-11)	52.475	
2001	14'-2	PO(9'-11)	52.714	
2002	18'-10½	PO(9'-11)	50.796	
2003	17'-7½	PO(9'-11)	51.350	
2004	16'-4½	PO(9'-11)	51.918	
2005	15'-1½	PO(9'-11)	52.468	
2006	14'-2	PO(9'-11)	53.108	
2007	14'-2	PO(9'-11)	53.109	
4000	10'-11	PO(5'-0)	13.828	
4001	10'-11	PO(5'-0)	13.982	
4002	10'-11	PO(5'-0)	14.540	
4003	10'-11	PO(5'-0)	15.739	
4004	10'-0½	PO(8'-0)	21.897	
4005	10'-0½	PO(8'-0)	22.727	
4006	8'-6	PO(16'-5½)	44.928	
4007	10'-4	FT(21'-11½)	51.608	
4008	14'-2	FT(21'-1)	53.111	
4009	10'-0½	PO(5'-0)	14.090	
4010	10'-0½	PO(5'-0)	14.246	
4011	10'-0½	PO(5'-0)	14.813	
4012	10'-0½	PO(5'-0)	16.032	
4013	10'-0½	PO(5'-0)	18.163	
4014	10'-0½	PO(8'-0)	21.587	
4015	11'-2	PO(5'-0)	14.445	
4016	11'-2	PO(5'-0)	14.603	
4017	11'-2	PO(5'-0)	15.173	
4018	11'-2	PO(5'-0)	16.397	



Hydraulic Analysis

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 3 -

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Eq. Length	Summary
Upstream					Fittings	Total Length	
Route 1							
AO	1.0490	19.67	7.30	120	0.126147	1'-6½" 5'-0" 6'-6½"	Pf 0.825
1200	12'-5½"	19.67	5.6	12.333	Sprinkler,		Pe 0.669
4000	10'-11"			13.828	PO(5'-0)		Pv
BL	1.6100	19.67	3.10	120	0.015661	9'-10" 9'-10"	Pf 0.154
4000	10'-11"			13.828			Pe
4001	10'-11"			13.982			Pv
BL	1.6100	39.45	6.22	120	0.056764	9'-10" 9'-10"	Pf 0.558
4001	10'-11"	19.78		13.982	Flow (q) from Route 2		Pe
4002	10'-11"			14.540			Pv
BL	1.6100	59.64	9.40	120	0.121954	9'-10" 9'-10"	Pf 1.199
4002	10'-11"	20.19		14.540	Flow (q) from Route 7		Pe
4003	10'-11"			15.739			Pv
BL	1.6100	80.70	12.72	120	0.213349	12'-9" 14'-4" 27'-1"	Pf 5.778
4003	10'-11"	21.05		15.739	Flow (q) from Route 10		Pe 0.379
4004	10'-0½"			21.897	T(6'-4), PO(8'-0)		Pv
CM	2.6350	184.76	10.87	120	0.089672	9'-3" 9'-3"	Pf 0.830
4004	10'-0½"	104.06		21.897	Flow (q) from Route 3		Pe
4005	10'-0½"			22.727			Pv
CM	2.6350	266.36	15.67	120	0.176425	81'-11½" 40'-1" 122'-0½"	Pf 21.533
4005	10'-0½"	81.60		22.727	Flow (q) from Route 4		Pe 0.668
4006	8'-6"			44.928	4fE(5'-11), PO(16'-5½)		Pv
CM	3.2600	266.36	10.24	120	0.062574	57'-7½" 61'-10" 119'-5½"	Pf 7.474
4006	8'-6"			44.928			Pe -0.795
4007	10'-4"			51.608	6fE(6'-8½), fT(21'-11½)		Pv
CM	4.2600	266.36	6.00	120	0.017003	70'-9½" 77'-11½" 148'-8½"	Pf 2.529
4007	10'-4"			51.608			Pe -1.662
2000	14'-2"			52.475	4fE(8'-11½), 2fT(21'-1)		Pv
CM	4.2600	257.86	5.80	120	0.016014	14'-11½" 14'-11½"	Pf 0.240
2000	14'-2"			52.475			Pe 0.000
2001	14'-2"			52.714			Pv
CM	4.2600	252.88	5.69	120	0.015447	4'-7" 21'-1" 25'-8"	Pf 0.396
2001	14'-2"			52.714			Pe 0.000
4008	14'-2"			53.111	fT(21'-1)		Pv
CM	4.2600	266.36	6.00	120	0.017003	18'-5" 84'-9½" 103'-2½"	Pf 4.380
4008	14'-2"	13.47		53.111	Flow (q) from Route 14		Pe 5.566
4	1'-4"			63.057	fE(8'-11½), CV(23'-2), 2PO(26'-4), BFP(-2.626), BOR		Pv
UG	4.2200	266.36	6.11	140	0.013386	164'-9" 46'-10" 211'-7"	Pf 2.832
4	1'-4"			63.057			Pe 3.182
3	-6'-0"			69.071	2E(16'-8½), 2EE(6'-8½)		Pv
UG	6.2800	266.36	2.76	140	0.001931	1148'-8" 242'-8½" 1391'-4"	Pf 2.687
3	-6'-0"			69.071			Pe
2	-6'-0"			71.758	2GV(4'-8½), 2E(22'-1), 3EE(11'-0½), LtE(14'-2), 3T(47'-3½)		Pv
UG	6.2800	266.36	2.76	140	0.001931	9'-0" 9'-0"	Pf 0.017
2	-6'-0"			71.758			Pe -3.902
1	3'-0"			67.874	S		Pv
		250.00			Hose Allowance At Source		
1		516.36					
Route 2							
AO	1.0490	19.78	7.34	120	0.127519	1'-6½" 5'-0" 6'-6½"	Pf 0.834
1201	12'-5½"	19.78	5.6	12.478	Sprinkler,		Pe 0.669
4001	10'-11"			13.982	PO(5'-0)		Pv
Route 3							
AO	1.0490	19.84	7.36	120	0.128176	1'-7" 5'-0" 6'-7"	Pf 0.846
1202	11'-7½"	19.84	5.6	12.548	Sprinkler,		Pe 0.695
4009	10'-0½"			14.090	PO(5'-0)		Pv
BL	1.6100	19.84	3.13	120	0.015913	9'-10" 9'-10"	Pf 0.156
4009	10'-0½"			14.090			Pe
4010	10'-0½"			14.246			Pv
BL	1.6100	39.79	6.27	120	0.057676	9'-10" 9'-10"	Pf 0.567
4010	10'-0½"	19.95		14.246	Flow (q) from Route 5		Pe
4011	10'-0½"			14.813			Pv
BL	1.6100	60.16	9.48	120	0.123911	9'-10" 9'-10"	Pf 1.218
4011	10'-0½"	20.37		14.813	Flow (q) from Route 8		Pe
4012	10'-0½"			16.032			Pv



Hydraulic Analysis

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 3 -

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	1.6100	81.39	12.83	120		0.216763	9'-10"	Pf 2.131
4012	10'-0½"	21.23		16.032		Flow (q) from Route 11		Pe
4013	10'-0½"			18.163			9'-10"	Pv
BL	1.6100	104.06	16.40	120		0.341493	2'-0½"	Pf 3.424
4013	10'-0½"	22.67		18.163		Flow (q) from Route 13	8'-0"	Pe
4014	10'-0½"			21.587		PO(8'-0)	10'-0½"	Pv
CM	2.6350	104.06	6.12	120		0.031004	10'-0"	Pf 0.310
4014	10'-0½"			21.587				Pe
4004	10'-0½"			21.897			10'-0"	Pv
Route 4								
AO	1.0490	19.89	7.38	120		0.128817	2'-1½"	Pf 0.916
1203	13'-3½"	19.89	5.6	12.616		Sprinkler,	5'-0"	Pe 0.914
4015	11'-2"			14.445		PO(5'-0)	7'-1½"	Pv
BL	1.6100	19.89	3.13	120		0.015992	9'-10"	Pf 0.157
4015	11'-2"			14.445				Pe
4016	11'-2"			14.603			9'-10"	Pv
BL	1.6100	39.90	6.29	120		0.057963	9'-10"	Pf 0.570
4016	11'-2"	20.01		14.603		Flow (q) from Route 6		Pe
4017	11'-2"			15.173			9'-10"	Pv
BL	1.6100	60.32	9.51	120		0.124518	9'-10"	Pf 1.224
4017	11'-2"	20.42		15.173		Flow (q) from Route 9		Pe
4018	11'-2"			16.397			9'-10"	Pv
BL	1.6100	81.60	12.86	120		0.217797	13'-8½"	Pf 5.843
4018	11'-2"	21.28		16.397		Flow (q) from Route 12	13'-1"	Pe 0.488
4005	10'-0½"			22.727		2E(2'-6½), PO(8'-0)	26'-10"	Pv
Route 5								
AO	1.0490	19.95	7.41	120		0.129567	1'-7"	Pf 0.856
1204	11'-7½"	19.95	5.6	12.695		Sprinkler,	5'-0"	Pe 0.695
4010	10'-0½"			14.246		PO(5'-0)	6'-7"	Pv
Route 6								
AO	1.0490	20.01	7.43	120		0.130208	2'-1½"	Pf 0.926
1205	13'-3½"	20.01	5.6	12.763		Sprinkler,	5'-0"	Pe 0.914
4016	11'-2"			14.603		PO(5'-0)	7'-1½"	Pv
Route 7								
AO	1.0490	20.19	7.50	120		0.132481	1'-6½"	Pf 0.867
1206	12'-5½"	20.19	5.6	13.004		Sprinkler,	5'-0"	Pe 0.669
4002	10'-11"			14.540		PO(5'-0)	6'-6½"	Pv
Route 8								
AO	1.0490	20.37	7.56	120		0.134600	1'-7"	Pf 0.889
1207	11'-7½"	20.37	5.6	13.229		Sprinkler,	5'-0"	Pe 0.695
4011	10'-0½"			14.813		PO(5'-0)	6'-7"	Pv
Route 9								
AO	1.0490	20.42	7.58	120		0.135241	2'-1½"	Pf 0.961
1208	13'-3½"	20.42	5.6	13.297		Sprinkler,	5'-0"	Pe 0.914
4017	11'-2"			15.173		PO(5'-0)	7'-1½"	Pv
Route 10								
AO	1.0490	21.05	7.82	120		0.143093	1'-6½"	Pf 0.936
1209	12'-5½"	21.05	5.6	14.134		Sprinkler,	5'-0"	Pe 0.669
4003	10'-11"			15.739		PO(5'-0)	6'-6½"	Pv
Route 11								
AO	1.0490	21.23	7.88	120		0.145364	1'-7"	Pf 0.960
1210	11'-7½"	21.23	5.6	14.377		Sprinkler,	5'-0"	Pe 0.695
4012	10'-0½"			16.032		PO(5'-0)	6'-7"	Pv
Route 12								
AO	1.0490	21.28	7.90	120		0.146006	2'-1½"	Pf 1.038
1211	13'-3½"	21.28	5.6	14.445		Sprinkler,	5'-0"	Pe 0.914
4018	11'-2"			16.397		PO(5'-0)	7'-1½"	Pv
Route 13								
AO	1.0490	22.67	8.41	120		0.164052	1'-7"	Pf 1.083
1212	11'-7½"	22.67	5.6	16.385		Sprinkler,	5'-0"	Pe 0.695
4013	10'-0½"			18.163		PO(5'-0)	6'-7"	Pv
Route 14								
CM	2.1570	13.47	1.18	120		0.001872	15'-0"	Pf 0.028
2003	17'-7½"	8.50 + 4.98		51.350		Flow (q) from Route 15 and 17		Pe 0.541
2004	16'-4½"			51.918			15'-0"	Pv
CM	2.1570	6.69	0.59	120		0.000513	15'-0"	Pf 0.008
2004	16'-4½"			51.918				Pe 0.542
2005	15'-1½"			52.468			15'-0"	Pv



Hydraulic Analysis

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 3 -

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	1.6820	6.69	0.97	120		0.001722	101'-1	Pf 0.225
2005	15'-1½			52.468		PO(9'-11)	29'-8½	Pe 0.415
2006	14'-2			53.108		T(9'-11), PO(9'-11)	130'-9½	Pv
CM	4.2600	6.69	0.15	120		0.000019	14'-11½	Pf 0.000
2006	14'-2			53.108				Pe
2007	14'-2			53.109			14'-11½	Pv
CM	4.2600	13.47	0.30	120		0.000068	10'-4½	Pf 0.002
2007	14'-2	6.78		53.109		Flow (q) from Route 18	21'-1	Pe
4008	14'-2			53.111		ft(21'-1)	31'-5½	Pv
Route 15								
CM	2.1570	8.50	0.75	120		0.000798	15'-0	Pf 0.012
2002	18'-10½	8.50		50.796		Flow (q) from Route 16		Pe 0.542
2003	17'-7½			51.350			15'-0	Pv
Route 16								
BL	1.6820	8.50	1.23	120		0.002679	104'-10	Pf 0.360
2000	14'-2			52.475		PO(9'-11)	29'-8½	Pe -2.039
2002	18'-10½			50.796		T(9'-11), PO(9'-11)	134'-6½	Pv
Route 17								
BL	1.6820	4.98	0.72	120		0.000996	103'-7	Pf 0.133
2001	14'-2			52.714		PO(9'-11)	29'-8½	Pe -1.498
2003	17'-7½			51.350		T(9'-11), PO(9'-11)	133'-3½	Pv
Route 18								
BL	1.6820	6.78	0.98	120		0.001766	102'-4	Pf 0.233
2004	16'-4½			51.918		PO(9'-11)	29'-8½	Pe 0.957
2007	14'-2			53.109		T(9'-11), PO(9'-11)	132'-0½	Pv

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

C Value Multiplier

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

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



Hydraulic Analysis

Job Number: 4352CK

Report Description: Ordinary Group II - AREA 3 -

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	Units Legend		Fittings Legend	
AO Arm-Over	Diameter	Inch	ALV Alarm Valve	
BL Branch Line	Elevation	Foot	AngV Angle Valve	
CM Cross Main	Flow	gpm	b Bushing	
DN Drain	Discharge	gpm	BaV Ball Valve	
DR Drop	Velocity	fps	BFP Backflow Preventer	
DY Dynamic	Pressure	psi	BV Butterfly Valve	
FM Feed Main	Length	Foot	C Cross Flow Turn 90°	
FR Feed Riser	Friction Loss	psi/Foot	cplg Coupling	
MS Miscellaneous	HWC	Hazen-Williams Constant	Cr Cross Run	
OR Outrigger	Pt	Total pressure at a point in a pipe	CV Check Valve	
RN Riser Nipple	Pn	Normal pressure at a point in a pipe	DeV Deluge Valve	
SN Swing Nipple	Pf	Pressure loss due to friction between points	DPV Dry Pipe Valve	
SP Sprig	Pe	Pressure due to elevation difference between indicated points	E 90° Elbow	
ST Stand Pipe	Pv	Velocity pressure at a point in a pipe	EE 45° Elbow	
UG Underground			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	



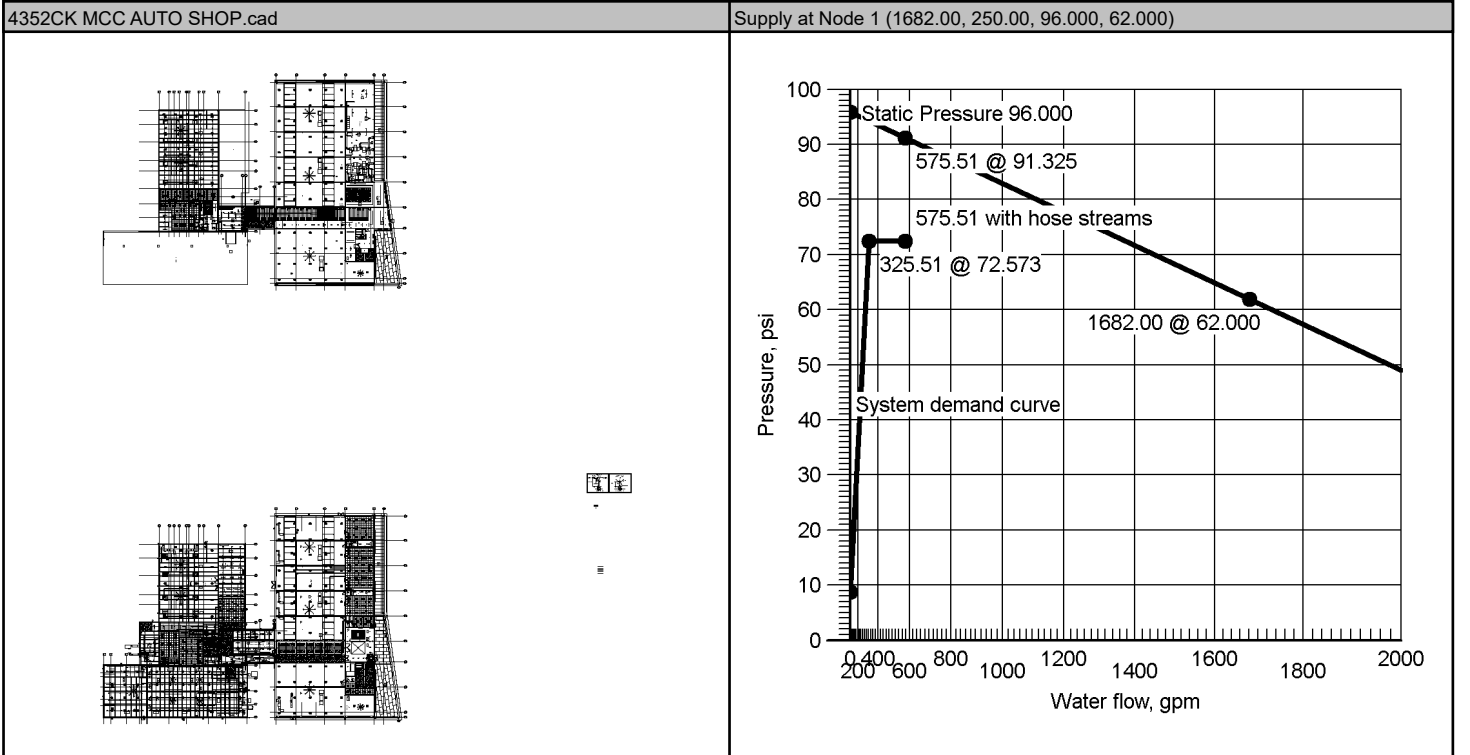
Hydraulic Overview

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 4 -

Job		
Job Number 4352CK	Designer	
Job Name: MCC AUTO SHOP	Phone	FAX
Address 1 500 SW LONGVIEW RD	State Certification/License Number	
Address 2 LEE'S SUMMIT, MO 64081	AHJ	
Address 3	Job Site/Building	

System		
Density 0.20gpm/ft ²	Area of Application 1500ft ² (Actual 1517ft ²)	
Most Demanding Sprinkler Data 5.6 K-Factor 22.59 at 16.279	Hose Streams 250.00	
Coverage Per Sprinkler 113ft ²	Number Of Sprinklers Calculated 14	Number Of Nozzles Calculated 0
System Pressure Demand 72.573	System Flow Demand 325.51	
Total Demand 575.51 @ 72.573	Pressure Result +18.752 (20.5%)	

Supplies						Check Point Gauges			
Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)	Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
1	Water Supply	1682.00	250.00	96.000	62.000	BOR (4)	65.269	40.29	325.51





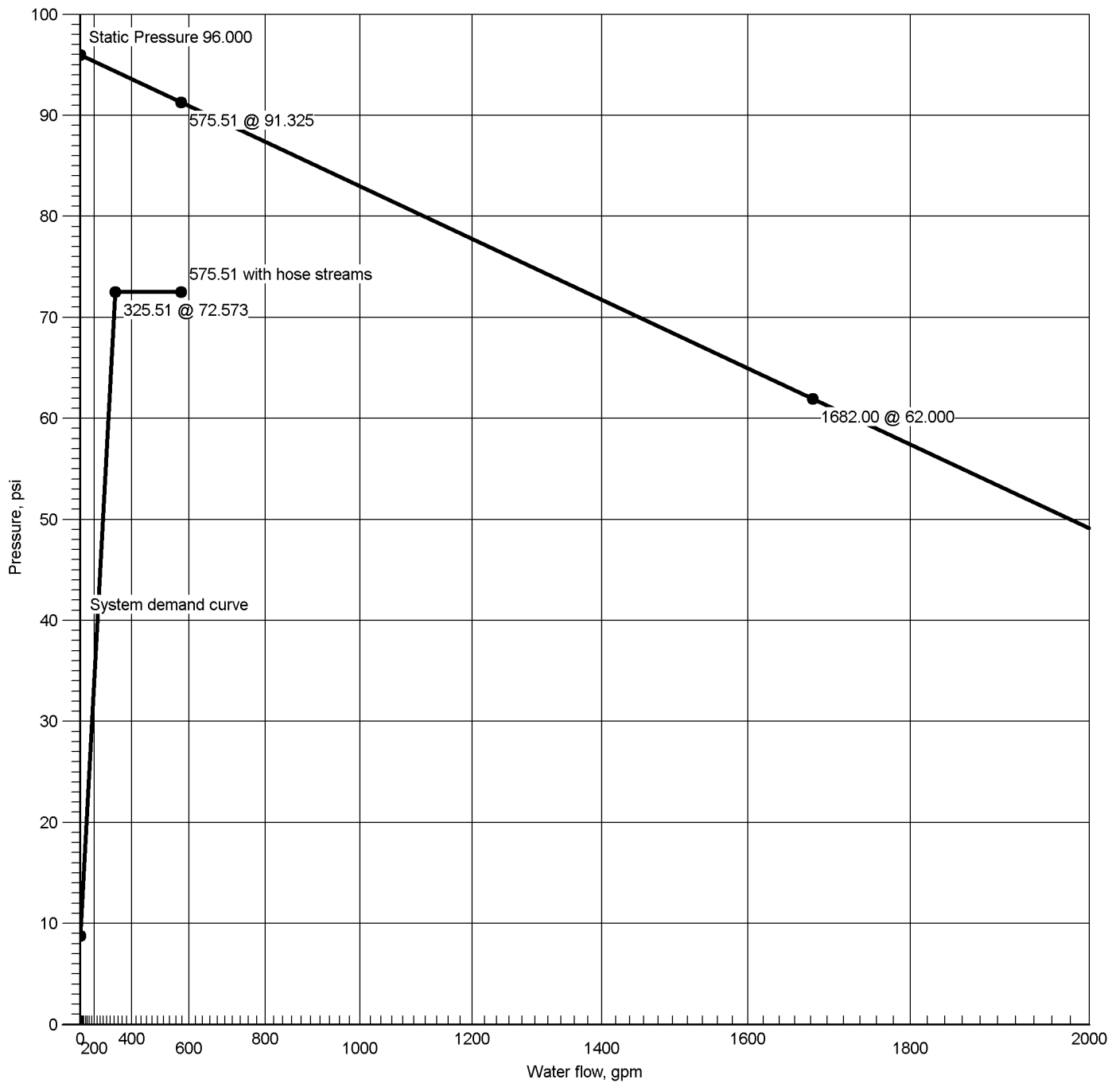
Hydraulic Summary

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 4 -

Job											
Job Number 4352CK					Designer						
Job Name: MCC AUTO SHOP					State Certification/License Number						
Address 1 500 SW LONGVIEW RD					AHJ						
Address 2 LEE'S SUMMIT, MO 64081					Job Site/Building						
Address 3					Drawing Name 4352CK MCC AUTO SHOP.cad						
System					Remote Area(s)						
Most Demanding Sprinkler Data 5.6 K-Factor 22.59 at 16.279					Occupancy Ordinary Group II - AREA 4 -			Job Suffix			
Hose Allowance At Source 250.00					Density 0.20gpm/ft²			Area of Application 1500ft² (Actual 1517ft²)			
Additional Hose Supplies <u>Node</u> <u>Flow(gpm)</u>					Number Of Sprinklers Calculated 14		Number Of Nozzles Calculated 0		Coverage Per Sprinkler 113ft²		
					AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area						
					Left: 72.334 Right: 72.923						
Total Hose Streams 250.00											
System Flow Demand 325.51		Total Water Required (Including Hose Allowance) 575.51									
Maximum Pressure Unbalance In Loops 0.000											
Maximum Velocity Above Ground 19.15 between nodes 5004 and 5003											
Maximum Velocity Under Ground 7.47 between nodes 3 and 4											
Volume capacity of Wet Pipes 3097.93gal		Volume capacity of Dry Pipes									
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	96.000	62.000		1682.00	91.325		575.51	72.573	18.752
Contractor											
Contractor Number		Contact Name				Contact Title					
Name of Contractor:		Phone				Extension					
Address 1		FAX									
Address 2		E-mail									
Address 3		Web-Site									



Supply at Node 1



Hydraulic Graph

Supply at Node 1

Static: Pressure
96.000

Residual: Pressure
62.000 @ 1682.00

Available Flow @ 20 PSI:
2596.97

Available Pressure at System Demand
91.325 @ 575.51

Required Pressure at System Demand
72.573 @ 325.51

Required Pressure at System Demand (Including Hose Allowance at Source)
72.573 @ 575.51



Summary Of Outflowing Devices

Device		Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
➡ Sprinkler	1500	22.59	22.59	5.6	16.279			
Sprinkler	1501	22.61	22.59	5.6	16.295			
Sprinkler	1502	22.76	22.59	5.6	16.518			
Sprinkler	1503	23.14	22.59	5.6	17.078			
Sprinkler	1504	22.64	22.59	5.6	16.345			
Sprinkler	1505	22.88	22.59	5.6	16.696			
Sprinkler	1506	22.78	22.59	5.6	16.546			
Sprinkler	1507	22.83	22.59	5.6	16.626			
Sprinkler	1508	23.10	22.59	5.6	17.010			
Sprinkler	1509	22.79	22.59	5.6	16.556			
Sprinkler	1510	22.93	22.59	5.6	16.761			
Sprinkler	1511	23.29	22.59	5.6	17.298			
Sprinkler	1512	25.48	22.59	5.6	20.707			

➡ Most Demanding Sprinkler Data



Node Analysis

Job Number: 4352CK

Report Description: Ordinary Group II - AREA 4 -

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)
1	3'-0	S	72.573	325.51
1500	23'-4½	Spr(-16.279)	16.279	22.59
1501	23'-4½	Spr(-16.295)	16.295	22.61
1502	23'-4½	Spr(-16.518)	16.518	22.76
1503	23'-4½	Spr(-17.078)	17.078	23.14
1504	23'-4½	Spr(-16.345)	16.345	22.64
1505	23'-4½	Spr(-16.696)	16.696	22.88
1506	23'-4½	Spr(-16.546)	16.546	22.78
1507	23'-4½	Spr(-16.626)	16.626	22.83
1508	23'-4½	Spr(-17.010)	17.010	23.10
1509	23'-4½	Spr(-16.556)	16.556	22.79
1510	23'-4½	Spr(-16.761)	16.761	22.93
1511	23'-4½	Spr(-17.298)	17.298	23.29
1512	23'-4½	Spr(-20.707)	20.707	25.48
1513	23'-4½	Spr(-21.045)	21.045	25.69
2	-6'-0	E(22'-1)	76.450	
3	-6'-0		72.556	
4	1'-4	BOR	65.269	
2000	14'-2	PO(9'-11)	53.007	
2001	14'-2	PO(9'-11)	53.354	
2002	18'-10½	PO(9'-11)	51.490	
2003	17'-7½	PO(9'-11)	52.049	
2004	16'-4½	PO(9'-11)	52.630	
2005	15'-1½	PO(9'-11)	53.183	
2006	14'-2	PO(9'-11)	53.925	
2007	14'-2	PO(9'-11)	53.925	
4008	14'-2	fT(21'-1)	53.928	
5000	23'-4½	PO(9'-11)	30.512	
5001	23'-4½	PO(9'-11)	30.706	
5002	23'-4½	PO(9'-11)	31.995	
5003	23'-4½	fT(14'-10)	33.902	
5004	20'-9	PO(16'-5½)	46.838	
5005	23'-4½	PO(9'-11)	18.360	
5006	23'-4½	PO(9'-11)	18.782	
5007	23'-4½	PO(9'-11)	20.353	
5008	23'-4½	PO(9'-11)	21.601	
5009	23'-4½	PO(12'-3½)	22.256	
5010	23'-4½	PO(9'-11)	33.008	
5011	23'-4½	PO(9'-11)	33.139	



Hydraulic Analysis

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 4 -

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	
Route 1								
BL	1.6820	7.18	1.04	120		0.001961	8'-2	Pf 0.016
1500	23'-4½	22.59	5.6	16.279		Sprinkler		Pe
1501	23'-4½			16.295			8'-2	Pv
BL	1.6820	29.78	4.30	120		0.027274	8'-2	Pf 0.223
1501	23'-4½	22.61	5.6	16.295		Sprinkler		Pe
1502	23'-4½			16.518			8'-2	Pv
BL	1.6820	52.54	7.59	120		0.077955	7'-2	Pf 0.560
1502	23'-4½	22.76	5.6	16.518		Sprinkler		Pe
1503	23'-4½			17.078			7'-2	Pv
BL	1.6820	75.69	10.93	120		0.153130	71'-6	Pf 13.434
1503	23'-4½	23.14	5.6	17.078		Sprinkler,	16'-2½	Pe
5000	23'-4½			30.512		2E(3'-2), PO(9'-11)	87'-8½	Pv
CM	2.6350	75.69	4.45	120		0.017204	11'-3½	Pf 0.195
5000	23'-4½			30.512				Pe
5001	23'-4½			30.706			11'-3½	Pv
CM	2.6350	150.35	8.85	120		0.061250	21'-0½	Pf 1.289
5001	23'-4½	74.67		30.706		Flow (q) from Route 4		Pe
5002	23'-4½			31.995			21'-0½	Pv
CM	2.6350	216.05	12.71	120		0.119781	1'-1	Pf 1.906
5002	23'-4½	65.70		31.995		Flow (q) from Route 5	14'-10	Pe
5003	23'-4½			33.902		ft(14'-10)	15'-11	Pv
CM	2.6350	325.51	19.15	120		0.255681	17'-10½	Pf 11.798
5003	23'-4½	109.46		33.902		Flow (q) from Route 2	28'-3½	Pe
5004	20'-9			46.838		2fE(5'-11), PO(16'-5½)	46'-1½	Pv
FR	4.2600	325.51	7.33	120		0.024642	65'-6½	Pf 3.315
5004	20'-9			46.838			69'-0	Pe
2000	14'-2			53.007		2fT(21'-1), 3fE(8'-11½)	134'-6	Pv
CM	4.2600	315.13	7.09	120		0.023208	14'-11½	Pf 0.347
2000	14'-2			53.007				Pe 0.000
2001	14'-2			53.354			14'-11½	Pv
CM	4.2600	309.05	6.96	120		0.022386	4'-7	Pf 0.574
2001	14'-2			53.354			21'-1	Pe 0.000
4008	14'-2			53.928		ft(21'-1)	25'-8	Pv
CM	4.2600	325.51	7.33	120		0.024642	18'-5	Pf 5.775
4008	14'-2	16.47		53.928		Flow (q) from Route 8	84'-9½	Pe 5.566
4	1'-4			65.269		fE(8'-11½), CV(23'-2), 2PO(26'-4), BFP(-3.232), BOR	103'-2½	Pv
UG	4.2200	325.51	7.47	140		0.019399	164'-9	Pf 4.104
4	1'-4			65.269			46'-10	Pe 3.182
3	-6'-0			72.556		2E(16'-8½), 2EE(6'-8½)	211'-7	Pv
UG	6.2800	325.51	3.37	140		0.002799	1148'-8	Pf 3.894
3	-6'-0			72.556			242'-8½	Pe
2	-6'-0			76.450		2GV(4'-8½), 2E(22'-1), 3EE(11'-0½), LtE(14'-2), 3T(47'-3½)	1391'-4	Pv
UG	6.2800	325.51	3.37	140		0.002799	9'-0	Pf 0.025
2	-6'-0			76.450				Pe -3.902
1	3'-0			72.573		S	9'-0	Pv
		250.00				Hose Allowance At Source		
1		575.51						
Route 2								
BL	1.6820	15.42	2.23	120		0.008066	8'-2	Pf 0.066
1500	23'-4½	22.59	5.6	16.279		Sprinkler		Pe
1504	23'-4½			16.345			8'-2	Pv
BL	1.6820	38.06	5.49	120		0.042921	8'-2	Pf 0.351
1504	23'-4½	22.64	5.6	16.345		Sprinkler		Pe
1505	23'-4½			16.696			8'-2	Pv
BL	1.6820	60.94	8.80	120		0.102549	6'-4	Pf 1.664
1505	23'-4½	22.88	5.6	16.696		Sprinkler,	9'-11	Pe
5005	23'-4½			18.360		PO(9'-11)	16'-2½	Pv
BL	2.1570	60.94	5.35	120		0.030539	13'-10	Pf 0.422
5005	23'-4½			18.360				Pe
5006	23'-4½			18.782			13'-10	Pv
BL	2.1570	123.99	10.89	120		0.113641	13'-10	Pf 1.571
5006	23'-4½	63.05		18.782		Flow (q) from Route 3		Pe
5007	23'-4½			20.353			13'-10	Pv



Hydraulic Analysis

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 4 -

Pipe Type	Diameter	Flow	Velocity	HWC	Pn	Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt		Fittings	Eq. Length	Summary
Upstream							Total Length	
BL	2.1570	109.46	9.61	120		0.090242	13'-10"	Pf 1.248
5007	23'-4½"			20.353				Pe
5008	23'-4½"			21.601			13'-10"	Pv
BL	2.1570	54.79	4.81	120		0.025084	13'-10"	Pf 0.656
5008	23'-4½"			21.601			12'-3½"	Pe
5009	23'-4½"			22.256		PO(12'-3½")	26'-1½"	Pv
BL	1.6820	54.79	7.91	120		0.084231	117'-9"	Pf 10.752
5009	23'-4½"			22.256			9'-11"	Pe
5010	23'-4½"			33.008		PO(9'-11")	127'-8"	Pv
CM	2.6350	54.79	3.22	120		0.009463	13'-10"	Pf 0.131
5010	23'-4½"			33.008				Pe
5011	23'-4½"			33.139			13'-10"	Pv
CM	2.6350	109.46	6.44	120		0.034045	7'-7"	Pf 0.762
5011	23'-4½"	54.67		33.139		Flow (q) from Route 7	14'-10"	Pe
5003	23'-4½"			33.902		FT(14'-10")	22'-5"	Pv
Route 3								
BL	1.6820	17.12	2.47	120		0.009788	8'-2"	Pf 0.080
1506	23'-4½"	22.78	5.6	16.546		Sprinkler		Pe
1507	23'-4½"			16.626			8'-2"	Pv
BL	1.6820	39.95	5.77	120		0.046956	8'-2"	Pf 0.384
1507	23'-4½"	22.83	5.6	16.626		Sprinkler		Pe
1508	23'-4½"			17.010			8'-2"	Pv
BL	1.6820	63.05	9.10	120		0.109208	6'-4"	Pf 1.772
1508	23'-4½"	23.10	5.6	17.010		Sprinkler,	9'-11"	Pe
5006	23'-4½"			18.782		PO(9'-11")	16'-2½"	Pv
Route 4								
BL	1.6820	5.66	0.82	120		0.001265	8'-2"	Pf 0.010
1506	23'-4½"	22.78	5.6	16.546		Sprinkler		Pe
1509	23'-4½"			16.556			8'-2"	Pv
BL	1.6820	28.45	4.11	120		0.025056	8'-2"	Pf 0.205
1509	23'-4½"	22.79	5.6	16.556		Sprinkler		Pe
1510	23'-4½"			16.761			8'-2"	Pv
BL	1.6820	51.38	7.42	120		0.074780	7'-2"	Pf 0.537
1510	23'-4½"	22.93	5.6	16.761		Sprinkler		Pe
1511	23'-4½"			17.298			7'-2"	Pv
BL	1.6820	74.67	10.78	120		0.149338	73'-7"	Pf 13.408
1511	23'-4½"	23.29	5.6	17.298		Sprinkler,	16'-2½"	Pe
5001	23'-4½"			30.706		2E(3'-2), PO(9'-11")	89'-9½"	Pv
Route 5								
BL	1.6820	40.01	5.78	120		0.047086	7'-2"	Pf 0.338
1512	23'-4½"	25.48	5.6	20.707		Sprinkler		Pe
1513	23'-4½"			21.045			7'-2"	Pv
BL	1.6820	65.70	9.49	120		0.117863	76'-8½"	Pf 10.950
1513	23'-4½"	25.69	5.6	21.045		Sprinkler,	16'-2½"	Pe
5002	23'-4½"			31.995		2E(3'-2), PO(9'-11")	92'-11"	Pv
Route 6								
BL	1.6820	14.53	2.10	120		0.007226	39'-0½"	Pf 0.354
5007	23'-4½"			20.353		PO(9'-11")	9'-11"	Pe
1512	23'-4½"			20.707			48'-11½"	Pv
Route 7								
BL	1.6820	54.67	7.89	120		0.083886	117'-9"	Pf 11.538
5008	23'-4½"			21.601		PO(9'-11")	19'-9½"	Pe
5011	23'-4½"			33.139		PO(9'-11")	137'-6½"	Pv
Route 8								
CM	2.1570	16.47	1.45	120		0.002713	15'-0"	Pf 0.041
2003	17'-7½"	10.38 + 6.08		52.049		Flow (q) from Route 9 and 11		Pe 0.541
2004	16'-4½"			52.630			15'-0"	Pv
CM	2.1570	8.18	0.72	120		0.000743	15'-0"	Pf 0.011
2004	16'-4½"			52.630				Pe 0.542
2005	15'-1½"			53.183			15'-0"	Pv
BL	1.6820	8.18	1.18	120		0.002495	101'-1"	Pf 0.326
2005	15'-1½"			53.183		PO(9'-11")	29'-8½"	Pe 0.415
2006	14'-2"			53.925		T(9'-11), PO(9'-11")	130'-9½"	Pv
CM	4.2600	8.18	0.18	120		0.000027	14'-11½"	Pf 0.000
2006	14'-2"			53.925				Pe
2007	14'-2"			53.925			14'-11½"	Pv



Hydraulic Analysis

Job Number: 4352CK
Report Description: Ordinary Group II - AREA 4 -

Pipe Type	Diameter	Flow	Velocity	HWC	Friction Loss		Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	
CM	4.2600	16.47	0.37	120		0.000099	10'-4½"	Pf 0.003
2007	14'-2	8.29		53.925		Flow (q) from Route 12	21'-1"	Pe
4008	14'-2			53.928		ft(21'-1)	31'-5½"	Pv
Route 9								
CM	2.1570	10.38	0.91	120		0.001156	15'-0"	Pf 0.017
2002	18'-10½"	10.38		51.490		Flow (q) from Route 10		Pe 0.542
2003	17'-7½"			52.049			15'-0"	Pv
Route 10								
BL	1.6820	10.38	1.50	120		0.003882	104'-10"	Pf 0.522
2000	14'-2			53.007		PO(9'-11)	29'-8½"	Pe -2.039
2002	18'-10½"			51.490		T(9'-11), PO(9'-11)	134'-6½"	Pv
Route 11								
BL	1.6820	6.08	0.88	120		0.001444	103'-7"	Pf 0.192
2001	14'-2			53.354		PO(9'-11)	29'-8½"	Pe -1.498
2003	17'-7½"			52.049		T(9'-11), PO(9'-11)	133'-3½"	Pv
Route 12								
BL	1.6820	8.29	1.20	120		0.002559	102'-4"	Pf 0.338
2004	16'-4½"			52.630		PO(9'-11)	29'-8½"	Pe 0.957
2007	14'-2			53.925		T(9'-11), PO(9'-11)	132'-0½"	Pv

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

C Value Multiplier

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

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



Hydraulic Analysis

Job Number: 4352CK

Report Description: Ordinary Group II - AREA 4 -

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		Units Legend		Fittings Legend	
AO	Arm-Over	Diameter	Inch	ALV	Alarm Valve
BL	Branch Line	Elevation	Foot	AngV	Angle Valve
CM	Cross Main	Flow	gpm	b	Bushing
DN	Drain	Discharge	gpm	BaIV	Ball Valve
DR	Drop	Velocity	fps	BFP	Backflow Preventer
DY	Dynamic	Pressure	psi	BV	Butterfly Valve
FM	Feed Main	Length	Foot	C	Cross Flow Turn 90°
FR	Feed Riser	Friction Loss	psi/Foot	cplg	Coupling
MS	Miscellaneous	HWC	Hazen-Williams Constant	Cr	Cross Run
OR	Outrigger	Pt	Total pressure at a point in a pipe	CV	Check Valve
RN	Riser Nipple	Pn	Normal pressure at a point in a pipe	DeIV	Deluge Valve
SN	Swing Nipple	Pf	Pressure loss due to friction between points	DPV	Dry Pipe Valve
SP	Sprig	Pe	Pressure due to elevation difference between indicated points	E	90° Elbow
ST	Stand Pipe	Pv	Velocity pressure at a point in a pipe	EE	45° Elbow
UG	Underground			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