Sample Calculation

Pipe diameter for Node 20, 21 of Zone 1:

- Water demand at node 21: $7.1 + 24.3 = 31.4$ klpd
- Water demand of d/s nodes: 40.1 klpd
- Cumulative demand: $31.4 + 40.1 = 71.5$ klpd $= 0.0292\ ft^3$/s
- Length: 117.5 ft
- Pipe area: $\frac{Q}{v} = \frac{0.0292}{3} \times 144 = 1.4\ in^2$
- Pipe diameter: $1.4 = \frac{\pi D^2}{4} or, D = 1.34$ in
- Provided pipe diameter: 1.5 in

Pressure check for path P02 of Zone 1:

Pressure loss for node 5, 6,

- Length: 167.5 ft
- Diameter: 1.5 in
- Head loss: $4 \times 0.01 \times \frac{167.5}{1.5/12} \frac{3^2}{2 \times 32.19} = 7.49$ ft
- Pressure loss: $7.49 \times \frac{62.4}{144} = 3.25$ psi

After calculation of pressure loss for other nodes of the same path,

- Total pressure loss:
  $0.52 + 1.20 + 1.83 + 2.13 + 3.25 + 2.04 + 3.25 = 14.21$ psi
- Initial pressure at OHT: 40 psi
- Hence, available pressure: $40 - 14.21 = 25.79$ psi $[< 30$ psi$]$
- Therefore, pipe diameter has to be reconsidered
- After reconsideration, new pressure loss:
  $0.30 + 0.53 + 0.81 + 0.95 + 1.22 + 0.76 + 1.22 = 5.80$ psi
- Available pressure: $40 - 5.80 = 34.2$ psi $[\geq 30$ psi$]$

Zone 1: Residential, Commercial, Administrative

Initial Pipe Diameter

Node	Length (ft)	Peak Demand (klpd)	Peak Demand (ft^3/s)	Pipe Area (in^2)	Required Diameter (in)	Provided Diameter (in)
23, 24	130.0	0.7	0.000286	0.01	0.13	1.5
22, 23	162.5	7	0.002861	0.14	0.42	1.5
21, 22	195.0	40.1	0.016390	0.79	1.00	1.5
20, 21	117.5	71.5	0.029225	1.40	1.34	1.5
25, 26	130.0	2.7	0.001104	0.05	0.26	1.5
20, 25	85.0	3.3	0.001349	0.06	0.29	1.5
17, 20	168.0	74.8	0.030573	1.47	1.37	1.5
18, 19	130.0	4.6	0.001880	0.09	0.34	1.5
17, 18	85.0	53.9	0.022031	1.06	1.16	1.5
11, 17	168.0	128.7	0.052604	2.52	1.79	2
15, 16	134.0	4.6	0.001880	0.09	0.34	1.5
14, 15	138.5	108	0.044143	2.12	1.64	2
13, 14	125.0	109.1	0.044593	2.14	1.65	2
12, 13	85.0	110.9	0.045329	2.18	1.66	2
11, 12	82.6	111.9	0.045737	2.20	1.67	2
10, 11	230.0	243.3	0.099445	4.77	2.47	2.5
2, 10	210.0	243.3	0.099445	4.77	2.47	2.5
7, 8	167.5	13.9	0.005681	0.27	0.59	1.5
6, 7	105.0	24.9	0.010177	0.49	0.79	1.5
5, 6	167.5	47.1	0.019251	0.92	1.08	1.5
4, 5	146.7	92	0.037604	1.80	1.52	2
3, 4	125.8	94.7	0.038707	1.86	1.54	2
2, 3	82.5	126.6	0.051746	2.48	1.78	2
2, 9	82.5	0.1	0.000041	0.00	0.05	1.5
1, 2	62.5	370	0.151232	7.26	3.04	3.5

Node	Length (ft)	Peak Demand (klpd)	Peak Demand (ft^3/s)	Pipe Area (in^2)	Required Diameter (in)	Provided Diameter (in)
60, 61	100.0	16.9	0.006908	0.33	0.65	1.5
59, 60	352.0	33.8	0.013815	0.66	0.92	1.5
58, 59	84.0	42.2	0.017249	0.83	1.03	1.5
57, 58	84.0	50.6	0.020682	0.99	1.12	1.5
56, 57	84.0	59	0.024115	1.16	1.21	1.5
55, 56	84.0	67.4	0.027549	1.32	1.30	1.5
54, 55	62.0	75.8	0.030982	1.49	1.38	1.5
64, 65	70.0	13.8	0.005641	0.27	0.59	1.5
63, 64	70.0	27.6	0.011281	0.54	0.83	1.5
62, 63	70.0	41.4	0.016922	0.81	1.02	1.5
54, 62	70.0	55.2	0.022562	1.08	1.17	1.5
40, 54	165.0	131	0.053544	2.57	1.81	2
48, 49	100.0	16.9	0.006908	0.33	0.65	1.5
47, 48	170.0	40.9	0.016717	0.80	1.01	1.5
46, 47	120.0	284.7	0.116367	5.59	2.67	3
45, 46	177.0	284.7	0.116367	5.59	2.67	3
44, 45	84.0	293.1	0.119800	5.75	2.71	3
43, 44	84.0	301.5	0.123233	5.92	2.74	3
42, 43	84.0	309.9	0.126667	6.08	2.78	3
41, 42	84.0	318.3	0.130100	6.24	2.82	3
40, 41	62.0	341.7	0.139665	6.70	2.92	3
52, 53	70.0	27.6	0.011281	0.54	0.83	1.5
51, 52	70.0	55.2	0.022562	1.08	1.17	1.5
50, 51	70.0	82.8	0.033843	1.62	1.44	1.5
40, 50	55.0	110.4	0.045124	2.17	1.66	2
35, 40	220.0	583.1	0.238333	11.44	3.82	4
38, 39	70.0	23.6	0.009646	0.46	0.77	1.5
37, 38	70.0	47.2	0.019292	0.93	1.09	1.5

Node	Length (ft)	Peak Demand (klpd)	Peak Demand (ft^3/s)	Pipe Area (in^2)	Required Diameter (in)	Provided Diameter (in)
36, 37	70.0	70.8	0.028938	1.39	1.33	1.5
35, 36	55.0	94.4	0.038585	1.85	1.54	2
27, 35	155.0	677.5	0.276918	13.29	4.11	4.5
29, 30	502.5	16.1	0.006581	0.32	0.63	1.5
28, 29	207.2	248	0.101366	4.87	2.49	2.5
27, 28	80.3	248.1	0.101407	4.87	2.49	2.5
33, 34	70.0	11.8	0.004823	0.23	0.54	1.5
32, 33	70.0	23.6	0.009646	0.46	0.77	1.5
31, 32	70.0	35.4	0.014469	0.69	0.94	1.5
27, 31	55.0	47.2	0.019292	0.93	1.09	1.5
1, 27	155.0	972.8	0.397617	19.09	4.93	5

Pressure Check: Trial 1

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
P01	1, 2	62.5	3.5	1.20	0.52	145.0	2.12	37.88	OK
	2, 9	82.5	1.5	3.69	1.60				
P02	1, 2	62.5	3.5	1.20	0.52	857.5	14.21	25.79	NOT OK (Low Pressure)
	2, 3	82.5	2	2.77	1.20				
	3, 4	125.8	2	4.22	1.83				
	4, 5	146.7	2	4.92	2.13				
	5, 6	167.5	1.5	7.49	3.25				
	6, 7	105.0	1.5	4.70	2.04				
	7, 8	167.5	1.5	7.49	3.25				
P03	1, 2	62.5	3.5	1.20	0.52	1067.6	14.50	25.50	NOT OK (Low Pressure)
	2, 10	210.0	2.5	5.64	2.44				
	10, 11	230.0	2.5	6.17	2.68				
	11, 12	82.6	2	2.77	1.20				
	12, 13	85.0	2	2.85	1.24				
	13, 14	125.0	2	4.19	1.82				
	14, 15	138.5	2	4.65	2.01				
	15, 16	134.0	1.5	5.99	2.60				

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
P04	1, 2	62.5	3.5	1.20	0.52	885.5	12.25	27.75	NOT OK (Low Pressure)
	2, 10	210.0	2.5	5.64	2.44				
	10, 11	230.0	2.5	6.17	2.68				
	11, 17	168.0	2	5.64	2.44				
	17, 18	85.0	1.5	3.80	1.65				
	18, 19	130.0	1.5	5.82	2.52				
P05	1, 2	62.5	3.5	1.20	0.52	1443.5	23.06	16.94	NOT OK (Low Pressure)
	2, 10	210.0	2.5	5.64	2.44				
	10, 11	230.0	2.5	6.17	2.68				
	11, 17	168.0	2	5.64	2.44				
	17, 20	168.0	1.5	7.52	3.26				
	20, 21	117.5	1.5	5.26	2.28				
	21, 22	195.0	1.5	8.72	3.78				
	22, 23	162.5	1.5	7.27	3.15				
	23, 24	130.0	1.5	5.82	2.52				
P06	1, 2	62.5	3.5	1.20	0.52	1053.5	15.50	24.50	NOT OK (Low Pressure)
	2, 10	210.0	2.5	5.64	2.44				
	10, 11	230.0	2.5	6.17	2.68				
	11, 17	168.0	2	5.64	2.44				

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
	17, 20	168.0	1.5	7.52	3.26				
	20, 25	85.0	1.5	3.80	1.65				
	25, 26	130.0	1.5	5.82	2.52				
P07	1, 27	155.0	5	2.08	0.90	945.0	13.99	26.01	NOT OK (Low Pressure)
	27, 28	80.3	2.5	2.16	0.93				
	28, 29	207.2	2.5	5.56	2.41				
	29, 30	502.5	1.5	22.48	9.74				
P08	1, 27	155.0	5	2.08	0.90	420.0	6.04	33.96	OK
	27, 31	55.0	1.5	2.46	1.07				
	31, 32	70.0	1.5	3.13	1.36				
	32, 33	70.0	1.5	3.13	1.36				
	33, 34	70.0	1.5	3.13	1.36				
P09	1, 27	155.0	5	2.08	0.90	575.0	6.77	33.23	OK
	27, 35	155.0	4.5	2.31	1.00				
	35, 36	55.0	2	1.85	0.80				
	36, 37	70.0	1.5	3.13	1.36				
	37, 38	70.0	1.5	3.13	1.36				
	38, 39	70.0	1.5	3.13	1.36				
P10	1, 27	155.0	5	2.08	0.90	1495.0	15.47	24.53	

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
	27, 35	155.0	4.5	2.31	1.00				
	35, 40	220.0	4	3.69	1.60				
	40, 41	62.0	3	1.39	0.60				
	41, 42	84.0	3	1.88	0.81				
	42, 43	84.0	3	1.88	0.81				
	43, 44	84.0	3	1.88	0.81				NOT OK (Low Pressure)
	44, 45	84.0	3	1.88	0.81				
	45, 46	177.0	3	3.96	1.72				
	46, 47	120.0	3	2.68	1.16				
	47, 48	170.0	1.5	7.60	3.30				
	48, 49	100.0	1.5	4.47	1.94				
	1, 27	155.0	5	2.08	0.90				
	27, 35	155.0	4.5	2.31	1.00				
	35, 40	220.0	4	3.69	1.60				
P11	40, 50	55.0	2	1.85	0.80	795.0	8.37	31.63	OK
	50, 51	70.0	1.5	3.13	1.36				
	51, 52	70.0	1.5	3.13	1.36				
	52, 53	70.0	1.5	3.13	1.36				
P12	1, 27	155.0	5	2.08	0.90	1545.0	22.38	17.62	

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
	27, 35	155.0	4.5	2.31	1.00				
	35, 40	220.0	4	3.69	1.60				
	40, 54	165.0	2	5.54	2.40				
	54, 55	62.0	1.5	2.77	1.20				
	55, 56	84.0	1.5	3.76	1.63				NOT OK (Low Pressure)
	56, 57	84.0	1.5	3.76	1.63				
	57, 58	84.0	1.5	3.76	1.63				
	58, 59	84.0	1.5	3.76	1.63				
	59, 60	352.0	1.5	15.75	6.82				
	60, 61	100.0	1.5	4.47	1.94				
P13	1, 27	155.0	5	2.08	0.90	975.0	11.33	28.67	NOT OK (Low Pressure)
	27, 35	155.0	4.5	2.31	1.00				
	35, 40	220.0	4	3.69	1.60				
	40, 54	165.0	2	5.54	2.40				
	54, 62	70.0	1.5	3.13	1.36				
	62, 63	70.0	1.5	3.13	1.36				
	63, 64	70.0	1.5	3.13	1.36				

Pressure Check: Trial 2

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
P01	1, 2	62.5	6	0.70	0.30	145.0	0.90	39.10	OK
	2, 9	82.5	4	1.38	0.60				
P02	1, 2	62.5	6	0.70	0.30	857.5	5.80	34.20	OK
	2, 3	82.5	4.5	1.23	0.53				
	3, 4	125.8	4.5	1.88	0.81				
	4, 5	146.7	4.5	2.19	0.95				
	5, 6	167.5	4	2.81	1.22				
	6, 7	105.0	4	1.76	0.76				
	7, 8	167.5	4	2.81	1.22				
P03	1, 2	62.5	6	0.70	0.30	1067.6	6.62	33.38	OK
	2, 10	210.0	5	2.82	1.22				
	10, 11	230.0	5	3.09	1.34				
	11, 12	82.6	4.5	1.23	0.53				
	12, 13	85.0	4.5	1.27	0.55				
	13, 14	125.0	4.5	1.86	0.81				
	14, 15	138.5	4.5	2.07	0.89				
	15, 16	134.0	4	2.25	0.97				

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
P04	1, 2	62.5	6	0.70	0.30	885.5	5.51	34.49	OK
	2, 10	210.0	5	2.82	1.22				
	10, 11	230.0	5	3.09	1.34				
	11, 17	168.0	4.5	2.51	1.09				
	17, 18	85.0	4	1.43	0.62				
	18, 19	130.0	4	2.18	0.95				
P05	1, 2	62.5	6	0.70	0.30	1443.5	9.57	30.43	OK
	2, 10	210.0	5	2.82	1.22				
	10, 11	230.0	5	3.09	1.34				
	11, 17	168.0	4.5	2.51	1.09				
	17, 20	168.0	4	2.82	1.22				
	20, 21	117.5	4	1.97	0.85				
	21, 22	195.0	4	3.27	1.42				
	22, 23	162.5	4	2.73	1.18				
	23, 24	130.0	4	2.18	0.95				
P06	1, 2	62.5	6	0.70	0.30	1053.5	6.73	33.27	OK
	2, 10	210.0	5	2.82	1.22				
	10, 11	230.0	5	3.09	1.34				
	11, 17	168.0	4.5	2.51	1.09				

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
	17, 20	168.0	4	2.82	1.22				
	20, 25	85.0	4	1.43	0.62				
	25, 26	130.0	4	2.18	0.95				
P07	1, 27	155.0	7.5	1.39	0.60	945.0	5.93	34.07	OK
	27, 28	80.3	5	1.08	0.47				
	28, 29	207.2	5	2.78	1.20				
	29, 30	502.5	4	8.43	3.65				
P08	1, 27	155.0	7.5	1.39	0.60	420.0	2.53	37.47	OK
	27, 31	55.0	4	0.92	0.40				
	31, 32	70.0	4	1.17	0.51				
	32, 33	70.0	4	1.17	0.51				
	33, 34	70.0	4	1.17	0.51				
P09	1, 27	155.0	7.5	1.39	0.60	575.0	3.13	36.87	OK
	27, 35	155.0	7	1.49	0.64				
	35, 36	55.0	4.5	0.82	0.36				
	36, 37	70.0	4	1.17	0.51				
	37, 38	70.0	4	1.17	0.51				
	38, 39	70.0	4	1.17	0.51				
P10	1, 27	155.0	7.5	1.39	0.60	1495.0	7.87	32.13	OK

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
	27, 35	155.0	7	1.49	0.64				
	35, 40	220.0	6.5	2.27	0.98				
	40, 41	62.0	5.5	0.76	0.33				
	41, 42	84.0	5.5	1.02	0.44				
	42, 43	84.0	5.5	1.02	0.44				
	43, 44	84.0	5.5	1.02	0.44				
	44, 45	84.0	5.5	1.02	0.44				
	45, 46	177.0	5.5	2.16	0.94				
	46, 47	120.0	5.5	1.46	0.63				
	47, 48	170.0	4	2.85	1.24				
	48, 49	100.0	4	1.68	0.73				
P11	1, 27	155.0	7.5	1.39	0.60	795.0	4.11	35.89	OK
	27, 35	155.0	7	1.49	0.64				
	35, 40	220.0	6.5	2.27	0.98				
	40, 50	55.0	4.5	0.82	0.36				
	50, 51	70.0	4	1.17	0.51				
	51, 52	70.0	4	1.17	0.51				
	52, 53	70.0	4	1.17	0.51				
P12	1, 27	155.0	7.5	1.39	0.60	1545.0	9.47	30.53	OK

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
	27, 35	155.0	7	1.49	0.64				
	35, 40	220.0	6.5	2.27	0.98				
	40, 54	165.0	4.5	2.46	1.07				
	54, 55	62.0	4	1.04	0.45				
	55, 56	84.0	4	1.41	0.61				
	56, 57	84.0	4	1.41	0.61				
	57, 58	84.0	4	1.41	0.61				
	58, 59	84.0	4	1.41	0.61				
	59, 60	352.0	4	5.90	2.56				
	60, 61	100.0	4	1.68	0.73				
P13	1, 27	155.0	7.5	1.39	0.60	975.0	5.33	34.67	OK
	27, 35	155.0	7	1.49	0.64				
	35, 40	220.0	6.5	2.27	0.98				
	40, 54	165.0	4.5	2.46	1.07				
	54, 62	70.0	4	1.17	0.51				
	62, 63	70.0	4	1.17	0.51				
	63, 64	70.0	4	1.17	0.51				
	64, 65	70.0	4	1.17	0.51				

Zone 2: Industrial

Initial Pipe Diameter

Node	Length (ft)	Peak Demand (klpd)	Peak Demand (ft^2/s)	Pipe Area (in^2)	Required Diameter (in)	Provided Diameter (in)
13, 14	230.0	0.1	0.000041	0.0020	0.05	1.5
13, 15	380.0	0.1	0.000041	0.0020	0.05	1.5
12, 13	265.0	0.2	0.000082	0.0039	0.07	1.5
11, 12	150.0	62.3	0.025464	1.2223	1.25	1.5
10, 11	265.0	103.3	0.042222	2.0267	1.61	2
2, 10	170.0	312.7	0.127811	6.1349	2.79	3
8, 9	425.0	11	0.004496	0.2158	0.52	1.5
7, 8	170.0	11.2	0.004578	0.2197	0.53	1.5
6, 7	165.0	11.7	0.004782	0.2295	0.54	1.5
5, 6	150.0	93.6	0.038258	1.8364	1.53	2
4, 5	260.0	258.5	0.105658	5.0716	2.54	3
3, 4	230.0	974.7	0.398394	19.1229	4.93	5
2, 3	230.0	1009.2	0.412495	19.7998	5.02	5.5
1, 2	90.0	1322	0.540347	25.9367	5.75	6
18, 19	190.0	716.2	0.292736	14.0513	4.23	4.5
17, 18	365.0	716.5	0.292858	14.0572	4.23	4.5
17, 20	230.0	0.4	0.000163	0.0078	0.10	1.5
16, 17	85.0	716.9	0.293022	14.0650	4.23	4.5
1, 16	165.0	739	0.302055	14.4986	4.30	4.5

Pressure Check: Trial 1

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
P01	1, 2	90.0	6	1.01	0.44	1720.0	22.42	17.58	NOT OK (Low Pressure)
	2, 3	230.0	5.5	2.81	1.22				
	3, 4	230.0	5	3.09	1.34				
	4, 5	260.0	3	5.82	2.52				
	5, 6	150.0	2	5.03	2.18				
	6, 7	165.0	1.5	7.38	3.20				
	7, 8	170.0	1.5	7.60	3.30				
	8, 9	425.0	1.5	19.01	8.24				
P02	1, 2	90.0	6	1.01	0.44	1170.0	18.44	21.56	NOT OK (Low Pressure)
	2, 10	170.0	3	3.80	1.65				
	10, 11	265.0	2	8.89	3.85				
	11, 12	150.0	1.5	6.71	2.91				
	12, 13	265.0	1.5	11.85	5.14				
	13, 14	230.0	1.5	10.29	4.46				
P03	1, 2	90.0	6	1.01	0.44	1320.0	21.35	18.65	NOT OK (Low Pressure)
	2, 10	170.0	3	3.80	1.65				
	10, 11	265.0	2	8.89	3.85				

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
	11, 12	150.0	1.5	6.71	2.91				
	12, 13	265.0	1.5	11.85	5.14				
	13, 15	380.0	1.5	17.00	7.37				
P04	1, 16	165.0	4.5	2.46	1.07	805.0	5.20	34.80	OK
	16, 17	85.0	4.5	1.27	0.55				
	17, 18	365.0	4.5	5.44	2.36				
	18, 19	190.0	4.5	2.83	1.23				
P05	1, 16	165.0	4.5	2.46	1.07	480.0	6.07	33.93	OK
	16, 17	85.0	4.5	1.27	0.55				
	17, 20	230.0	1.5	10.29	4.46				

Pressure Check: Trial 2

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
P01	1, 2	90.0	8.5	0.71	0.31	1720.0	9.90	30.10	OK
	2, 3	230.0	8	1.93	0.84				
	3, 4	230.0	7.5	2.06	0.89				
	4, 5	260.0	5.5	3.17	1.37				
	5, 6	150.0	4.5	2.24	0.97				
	6, 7	165.0	4	2.77	1.20				
	7, 8	170.0	4	2.85	1.24				
	8, 9	425.0	4	7.13	3.09				
P02	1, 2	90.0	8.5	0.71	0.31	1170.0	7.61	32.39	OK
	2, 10	170.0	5.5	2.07	0.90				
	10, 11	265.0	4.5	3.95	1.71				
	11, 12	150.0	4	2.52	1.09				
	12, 13	265.0	4	4.45	1.93				
	13, 14	230.0	4	3.86	1.67				
P03	1, 2	90.0	8.5	0.71	0.31	1320.0	8.70	31.30	OK
	2, 10	170.0	5.5	2.07	0.90				
	10, 11	265.0	4.5	3.95	1.71				

Path	Node	Length (ft)	Diameter (in)	Head Loss (ft)	Pressure Loss (psi)	Total Length (ft)	Total Pressure Loss (psi)	Available Pressure (psi)	Remarks
	11, 12	150.0	4	2.52	1.09				
	12, 13	265.0	4	4.45	1.93				
	13, 15	380.0	4	6.37	2.76				
P04	1, 16	165.0	4.5	2.46	1.07	805.0	5.20	34.80	OK
	16, 17	85.0	4.5	1.27	0.55				
	17, 18	365.0	4.5	5.44	2.36				
	18, 19	190.0	4.5	2.83	1.23				
P05	1, 16	165.0	4.5	2.46	1.07	480.0	6.07	33.93	OK
	16, 17	85.0	4.5	1.27	0.55				
	17, 20	230.0	1.5	10.29	4.46				

Looped Water Distribution Network

Introduction

Two looped water distribution networks for the two zones of the industrial park are computed in this report using Hardy Cross method.

Assumptions and conditions:

1. Water demand of each facility is taken from previously determined peak water demand for the design period of 30 years.
2. Flow entering a junction is equal to the flow leaving.
3. Algebraic sum of head loss in a closed loop is zero.
4. Value of Hazen-Williams constant k is assumed to be 1.
5. Value of x in Hazen-Williams equation is 1.85.

Methodology:

1. A layout of looped water distribution network is prepared for each zone.
2. Reasonable discharge rate is provided to each junction/intersection points throughout the network. The discharge rate is influenced by surrounding facilities' peak water demand.
   Note: For the industrial zone, production water demand is approximately distributed into relevant facilities
3. Through repeated trials, pipe flow is computed for each path using the Hazen-Williams equation for Hardy Cross method.
   a. For each loop, head loss (H) and H/Q was computed for each pipe.
   $$H = kQ^x$$
   Here,
   - H is head loss (ft).
   - k is a constant assumed to be 1.
   - Q is the assumed/corrected flow for the path.
   - x is 1.85.
   b. While taking into account the direction of flow with respect to adjacent loop, flow correction was computed and applied into initial pipe flow.
   $$Correction = -\frac{\sum H}{x\sum(H/Q)}$$
   c. This procedure is repeated until accuracy of 0.001 is obtained.
4. Pipe diameter (d) is computed assuming velocity (v) is 3 fps.
   $$Q = Av; A = \frac{\pi d^2}{4}$$