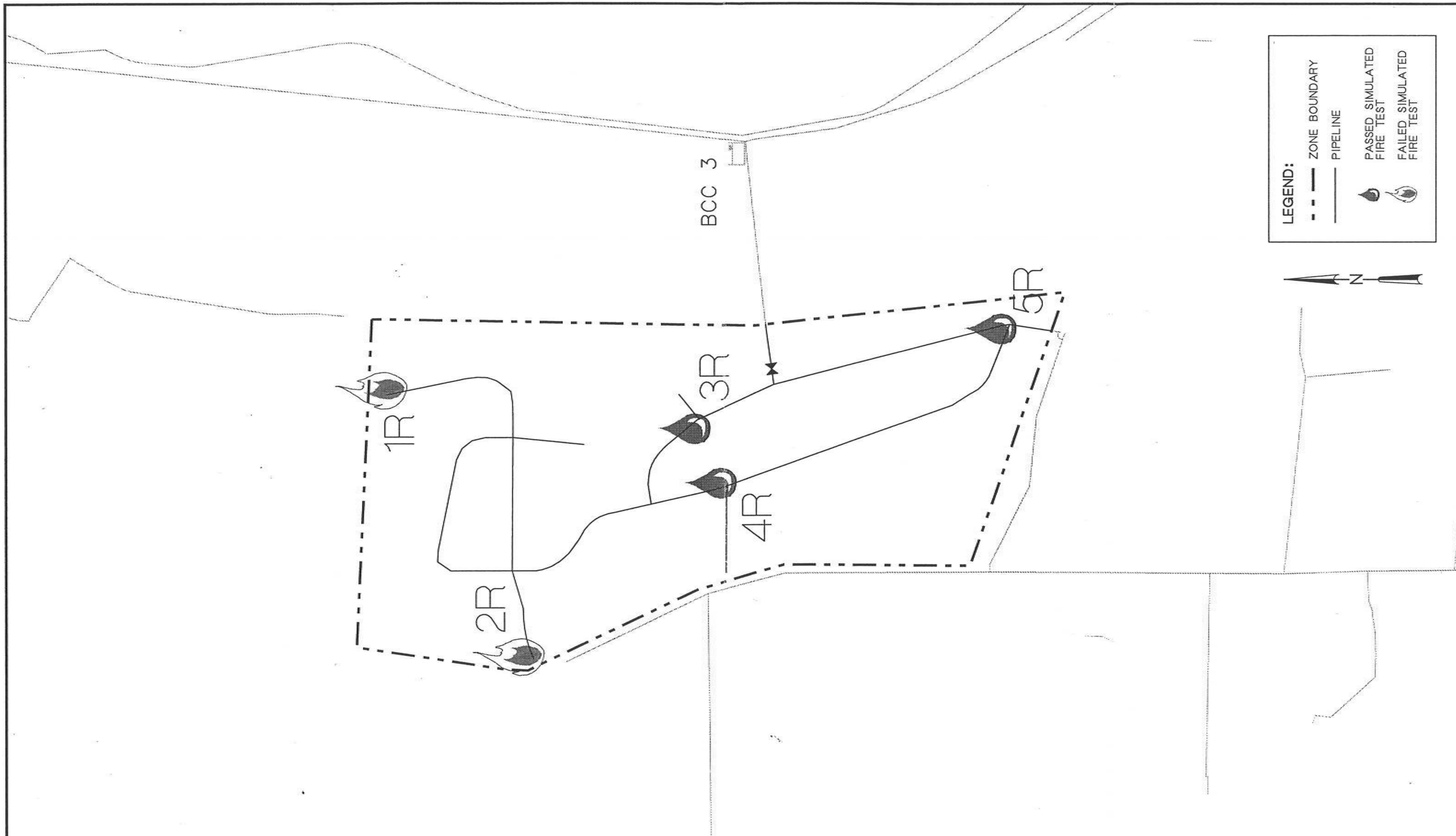


Figure 14-2
INDIAN ROCK
REGULATED ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

RMW37123\FIGURES\FIRES\INDIAN-2.DLV

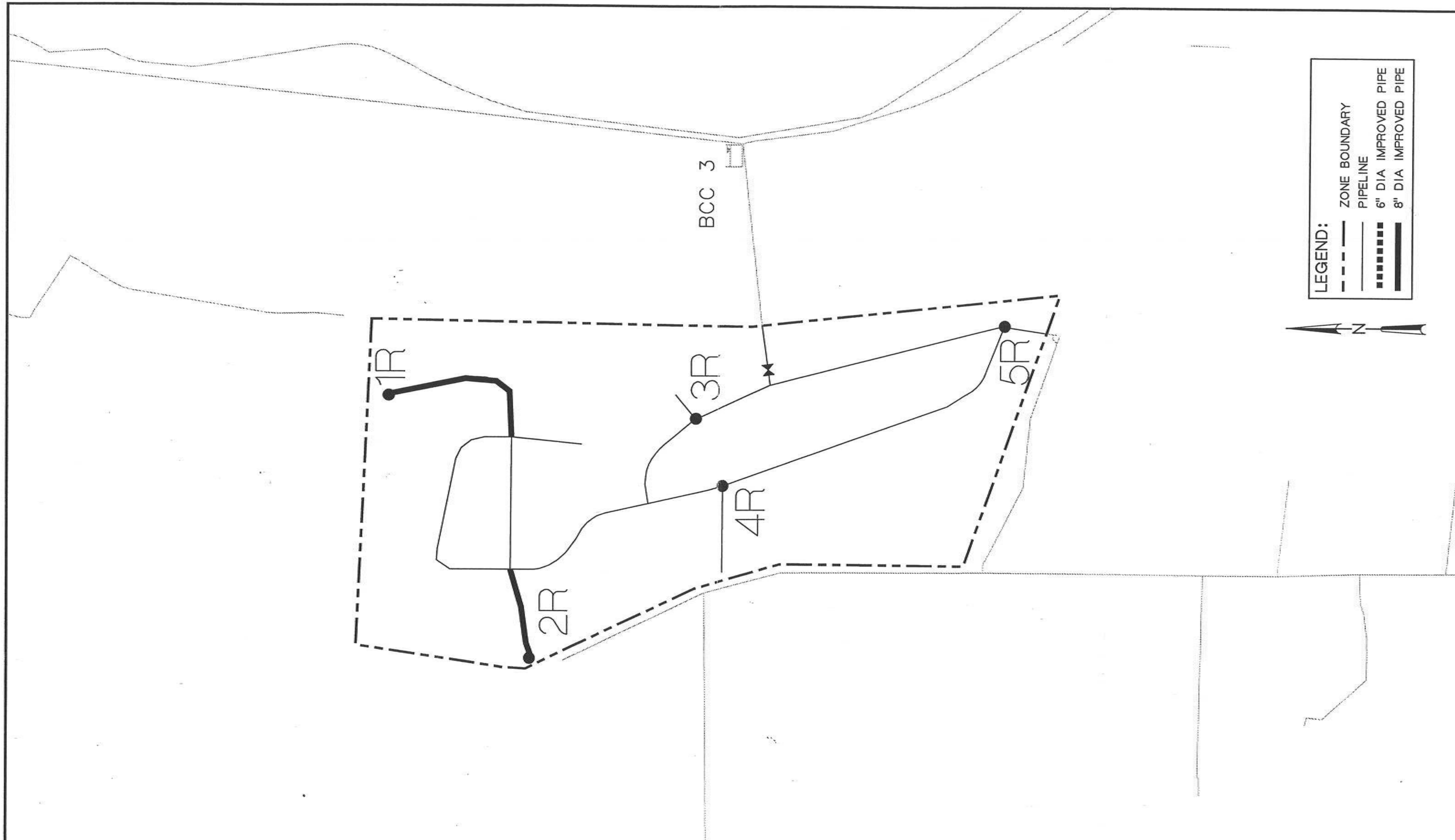


Figure 14-3
INDIAN ROCK
REGULATED ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

CH2M HILL

RMW37123\FIGURES\FIRES\INDIAN-3.DLV

Table 14-5

Salt Lake City Department of Public Utilities
Fire Flow Study
Cost Estimate - Indian Rock

idsys	Existing Length	New Length	Existing Diameter	New Diameter	Number Required				Cost					
					Valves	Hydrants	Service	Repair	Pipe	Valves	Hydrants	Service	Repair	TOTAL
	LF	LF	inch	inch	ea	ea	ea	cy	$	$	$	$	$	$
53544	643	643	6	8	2	2	15	2,142	41,777	1,560	5,000	9,750	10,305	68,392
10111	332	332	6	8	2	1	8	1,108	21,603	1,560	2,500	5,200	5,329	36,191
					4	3	23	3,250	63,379	3,120	7,500	14,950	15,634	104,583
									Eng, Legal & Admin				15%	15,687
									Subtotal				-	**120,270**
									Contigency				15%	18,041
									TOTAL				-	**138,311**

6200 South High Zone

Chapter 15
6200 South High Zone

System Geometry

The 6200 South High Zone of the Salt Lake County water distribution system is one of the larger service zones in Salt Lake City's county service area. It is located generally around 2000 East between 6500 South and Creek Road. The 6200 South High distribution system is shown in Figure 15-1.

Piping

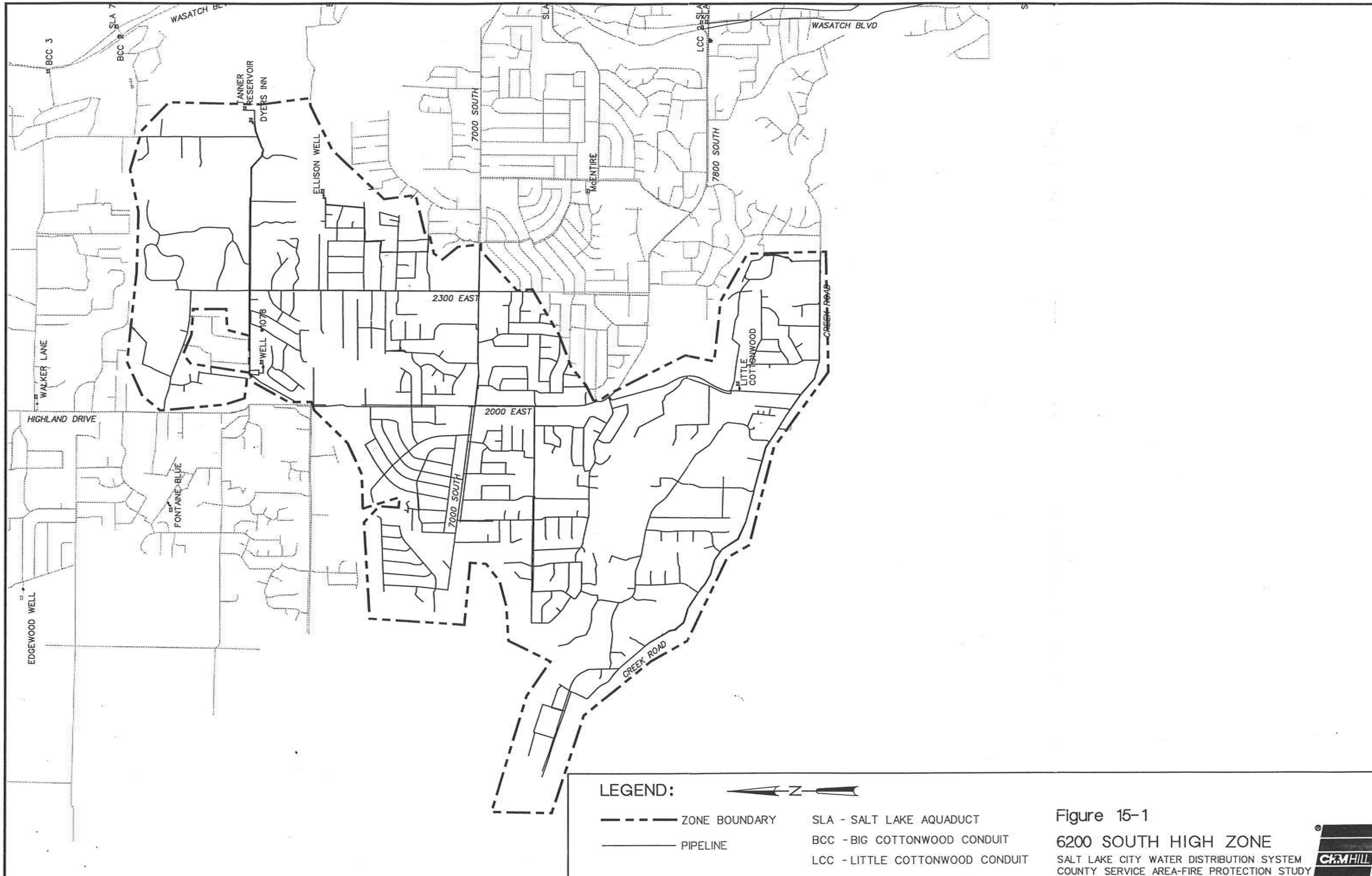
Table 15-1 indicates the size distribution and total length of the piping within the 6200 South High Zone.

Table 15-1
6200 South High
Reservoir Piping Distribution

Diameter	Length in Zone
4" or less	60,698
6"	176,515
8"	37,599
10"	2,094
12" or greater	42,388
Total Length	325,494

Valves

The 6200 South High Zone is separated from adjoining zones by SVs and PRVs. Table 15-2 shows the SVs within the 6200 South High Zone which were closed during the simulations.



LEGEND: N

ZONE BOUNDARY

PIPELINE

SLA - SALT LAKE AQUADUCT

BCC - BIG COTTONWOOD CONDUIT

LCC - LITTLE COTTONWOOD CONDUIT

Figure 15-1

6200 SOUTH HIGH ZONE

SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

CH2M HILL

RMW37123\FIGURES\FIRES\ZONE15-1.DLV

Table 15-2 6200 South High Reservoir System Valves	
idsys	**Location**
10573	Fardown, Highland
10655	Linden, Fardown
10664	2230 E., Fardown
10795	2300 E., 6200 S.
10917	2300 E., 6200 S.
11246	2000 E., 6400 S.
11258	2300 E., 6200 S.
11337	2000 E., 6400 S.
12567	2300 E., 7160 S.
13407	Highland, Parkridge
52621	Parkridge, Highland
52778	Michelle, Creek
52784	Chris, 7200 S.
52789	Forest Creek, Highland
53089	Cottonwood Cove, Highland
53098	8200 S., Willowstream
53293	2170 E., 7000 S.
53474	6200 S., 2120 E.
54929	6200 S., 2000 E.
56684	Highland, Parkridge

The 6200 South High zone portion of the model includes five PRVs. Table 15-3 shows the location, pressure setting and HGL of the PRVs.

Table 15-3 6200 South High PRVs				
Station No.	**idsys**	**Location**	**Pressure Setting**	**HGL**
CR-24A	56693	Creek Road	85	4885.93
CR-22	56692	Highland Drive	70	4758.00
CR-25	56694	2407 East	63	4850.00
CR-21	56682	Camino Drive	63	4786.28
CR-20	56677	7000 South	52	4782.00

Reservoirs

The Tanner Reservoir controls the hydraulic grade line within the 6200 South High zone. The static hydraulic grade line of Tanner Reservoir used in the model is 4631 feet.

Source Pumps

There are two source pumps in the 6200 South High Zone. Table 15-4 indicates the location of these source pumps, the elevation of the water surface in the well casing, and the status of the pump during the static simulation.

Table 15-4 6200 South High Reservoir Source Pumps		
Pump	**Location**	**Status**
Well #1078	6200 South	ON
Ellison Well	6485 South	OFF

Booster Pumps

There are two booster pumps in the 6200 South High Zone. Table 15-5 indicates the location of these booster pumps and the status of the pump during the static simulation.

Table 15-5 6200 South High Reservoir Booster Pumps		
Pump	**Location**	**Status**
Dryers Inn Booster Pump	6200 South	ON
Little Cottonwood	2000 E.	OFF

Calibration

Prior to the modelling effort, a series of fire hydrant flow tests were conducted within the Salt Lake County Distribution System to assist in the calibration of the model. Within the 6200 South High, four such tests were conducted. The results of the tests in the 6200 South High are summarized in Table 15-6.

Table 15-6 6200 South High Reservoir Calibration Test Results				
	Static Pressure		**Dynamic Pressure**	
Test No.	**Measured**	**Calculated**	**Measured**	**Calculated**
9	104	100	51	26
8	107	107	64	47
10	122	118	127	86
38	114	96	90	25

During the static calibration of the model, runs were made under an average demand condition and adjustments made until the measured pressure equalled the modelled pressure as near as possible. Typical adjustments included the opening and closing of system valves, the adjustment of PRV pressure settings, and the verification of node elevations.

After completion of the static calibration, the model was calibrated against the fire flow tests. This is called the dynamic calibration. The intent of the dynamic calibration is to test the system under some stress (high flows) and check the model's performance against that condition. The measured flows from the fire hydrants were modeled and the calculated pressures compared against those measured in the field. Adjustments in the model were made to bring the calculated results in line with the field measured results.

Dynamic calibration often requires an iterative process. Initial field measurements and system maps are used to set up the model, but the situation in the field is frequently not exactly as described in the maps and other system documentation. Inaccurate mapping (with inexact elevations), valves not in the position recorded (either open or closed), or pipes a different size than shown on maps, are all conditions that exist in most water distribution systems. To get an accurate dynamic model it is often necessary to go back into the field and check valve position, elevation, etc. This additional field work to verify model conditions was not done as a part of this study. It is recommended that as time and manpower permit, field verification be undertaken. For example, elevations of reservoirs, pump stations and PRVs are known. However, the elevations for the remainder of the system were obtained from USGS mapping and are likely not completely accurate for a given location. An elevation difference (between actual and the model) of 5 feet would result in a pressure difference of 2.2 psi. The elevation contours on the USGS mapping are 40 feet. Errors in elevations of up to 20 feet could be expected using this type of mapping. A 20-foot elevation difference would result in a pressure difference of almost 9 psi. Static and dynamic calibration results must be viewed with this potential for errors based on erroneous information in mind.

Fire Run Simulations

Fifty-five fire simulations were run in this zone. The location of the fire simulations are shown in Figure 15-2. Table 15-7 shows the low pressure in the zone for each of the fire runs.

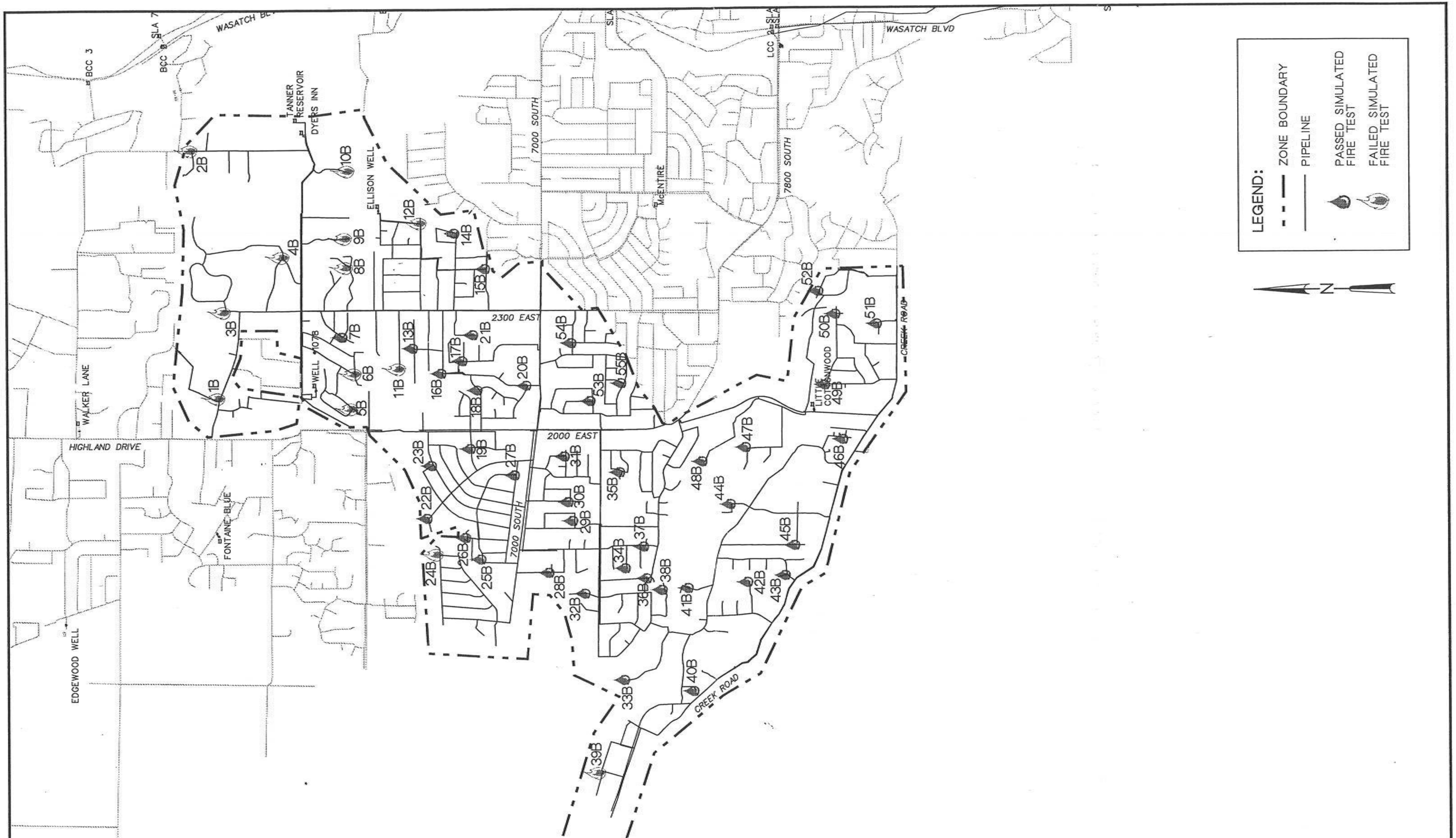


Figure 15-2

6200 SOUTH HIGH ZONE

SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

CH2M HILL

RMW37123\FIGURES\FIRES\ZONE15-2.DLV

Table 15-7
6200 South High Fire Flow Results

Simulation No.	Fire Flow (gpm)	Calculated Pressure	Simulation No.	Fire Flow (gpm)	Calculated Pressure
1B	1009.12	< 0	29B	1005.26	79.13
2B	1007.40	16.96	30B	1006.12	84.77
3B	1004.32	< 0	31B	1003.88	87.78
4B	1016.54	< 0	32B	1006.06	78.16
5B	1010.10	< 0	33B	1025.66	72.15
6B	1002.00	< 0	34B	1006.52	72.33
7B	1005.04	80.01	35B	1008.20	60.76
8B	1008.32	5.05	36B	1003.48	79.32
9B	1010.80	< 0	37B	1003.68	79.93
10B	1018.14	< 0	38B	1006.04	46.45
11B	1011.72	< 0	39B	1013.80	< 0
12B	1002.48	3.68	40B	1007.90	90.93
13B	1010.46	73.73	41B	1012.14	61.51
14B	1002.66	26.95	42B	1008.82	40.46
15B	1007.58	53.79	43B	1004.28	65.44
16B	1002.00	96.46	44B	1011.44	66.92
17B	1004.12	93.17	45B	1009.36	52.55
18B	1006.46	104.45	46B	1003.64	42.95
19B	1002.00	113.20	47B	1020.80	42.09
20B	1014.56	97.83	48B	1023.02	44.05
21B	1002.00	38.82	49B	1005.34	88.68
22B	1013.34	106.61	50B	1003.32	45.89
23B	1015.56	121.47	51B	1008.02	68.72
24B	1006.90	5.87	52B	1003.32	45.89
25B	1005.98	117.72	53B	1005.88	73.44
26B	1002.00	125.53	54B	1004.74	68.84
27B	1009.08	107.63	55B	1005.54	69.28
28B	1013.60	86.34			

Problem Areas

Portions of the 6200 South High Zone are characterized by small diameter pipe and dead end lines. This combination will always result in a situation where fire flow and pressure conditions cannot be met. In those areas where there is a high percentage of small diameter pipe and/or dead end lines, the fire conditions could not be met.

Areas in which fire flow and pressure were not achieved are shown in Figure 15-2.

Recommended Solutions

For each of the pipelines in which fire flow and pressure was not achieved, an improvement was developed. The model was changed to reflect the improvement and the same set of fire simulations run again. In each case the improvement corrected the fire flow problem. Figure 15-3 shows the required improvements for the 6200 South High Zone. A cost estimate was prepared for each of these improvements. Table 15-8 shows these cost estimates.

It should be noted that the improvements presented in Figure 15-3 may not be the optimum. It may be possible to reduce the pipe replaced (and thus the cost) by creating more loops. System maps do not contain enough information to determine if looping is possible.

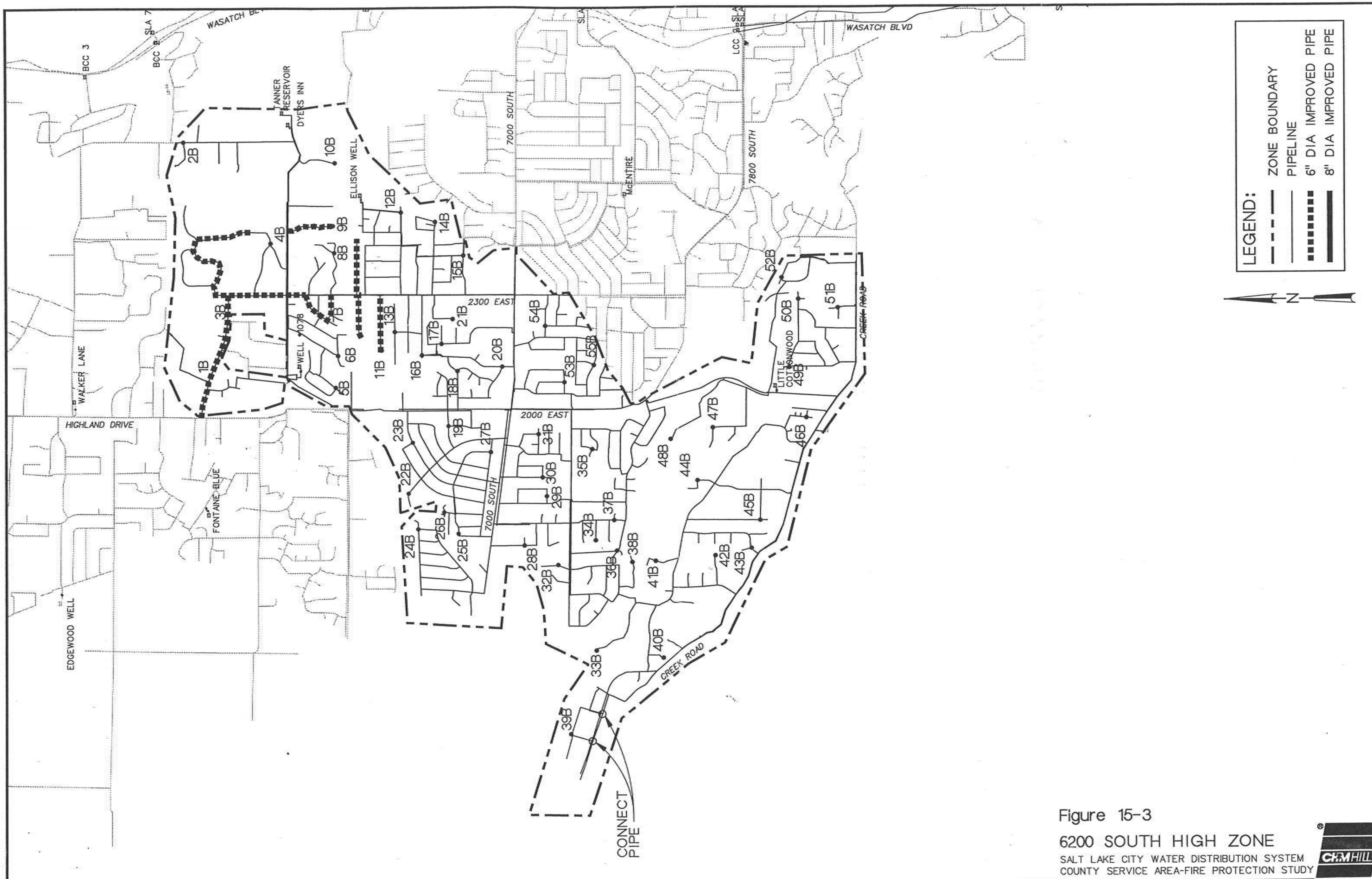


Figure 15-3

6200 SOUTH HIGH ZONE

SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

CH2M HILL

RMW37123\FIGURES\FIRES\ZONE15-3.DLV

Salt Lake City Department of Public Utilities
Fire Flow Study
Cost Estimate - 6200 South PS High Zone

Table 15-8

idsys	Existing Length	New Length	Existing Diameter	New Diameter	Number Required Valves	Hydrants	Service	Repair	Cost Pipe	Valves	Hydrants	Service	Repair	TOTAL
	LF	LF	inch	inch	ea	ea	ea	cy	$	$	$	$	$	$
12821	483	458	2	6	2	1	11	1,527	22,900	1,200	2,500	7,150	5,649	39,399
58089	0	25	0	6	1	1	1	83	1,250	600	2,500	650	308	5,308
58092	0	341	0	6	2	1	8	1,137	17,050	1,200	2,500	5,200	4,206	30,156
11276	1,008	1,008	4	6	4	3	23	3,358	50,376	2,400	7,500	14,950	12,426	87,652
11429	1,328	1,328	4	6	5	3	30	4,426	66,388	3,000	7,500	19,500	16,376	112,764
11259	1,307	1,307	4	6	4	3	30	4,356	65,334	2,400	7,500	19,500	16,116	110,850
11116	564	564	4	6	2	2	13	1,881	28,222	1,200	5,000	8,450	6,961	49,833
11097	182	182	4	6	1	1	5	606	9,086	600	2,500	3,250	2,241	17,677
52718	571	571	4	6	2	2	13	1,904	28,563	1,200	5,000	8,450	7,046	50,259
11121	1,071	1,071	4	6	4	3	24	3,571	53,563	2,400	7,500	15,600	13,212	92,276
10765	730	730	4	6	3	2	17	2,433	36,493	1,800	5,000	11,050	9,002	63,344
10679	585	585	4	6	2	2	13	1,949	29,240	1,200	5,000	8,450	7,212	51,102
10637	298	298	4	6	1	1	7	992	14,876	600	2,500	4,550	3,669	26,195
10590	230	230	4	6	1	1	6	766	11,485	600	2,500	3,900	2,833	21,318
10607	1,300	1,300	4	6	4	3	29	4,334	65,004	2,400	7,500	18,850	16,034	109,788
10534	259	259	4	6	1	1	6	863	12,951	600	2,500	3,900	3,195	23,146
10708	1,526	1,526	4	6	5	4	34	5,087	76,311	3,000	10,000	22,100	18,823	130,234
10636	603	603	4	6	2	2	14	2,010	30,143	1,200	5,000	9,100	7,435	52,879
53802	366	366	4	6	2	1	9	1,220	18,302	1,200	2,500	5,850	4,514	32,366
10632	313	313	4	6	1	1	7	1,042	15,629	600	2,500	4,550	3,855	27,134
10587	800	800	4	6	3	2	18	2,667	40,001	1,800	5,000	11,700	9,867	68,367
10576	171	171	4	6	1	1	4	568	8,527	600	2,500	2,600	2,103	16,330
10573	681	681	4	6	3	2	16	2,270	34,054	1,800	5,000	10,400	8,400	59,655
					56	43	338	49,050	735,747	33,600	107,500	219,700	181,484	1,278,031
									Eng, Legal & Admin				15%	191,705
									Subtotal				-	**1,469,736**
									Contigency				15%	220,460
									TOTAL				-	**1,690,197**

Crestview Estates Regulated zone (Gravity 0)

Chapter 16
Crestview Estates Regulated Zone (Gravity 0)

System Geometry

The Crestview Estates Regulated Zone of the Salt Lake County water distribution system (sometimes referred to as Gravity 0 Zone) is located generally between 2300 East and 2700 East and 2700 South and 4700 South. The Crestview Estates Regulated Zone distribution system is shown in Figure 16-1.

Piping

Table 16-1 indicates the size distribution and total length of the piping within the Crestview Estates Regulated Zone.

Table 16-1
Crestview Estates Regulated Reservoir Piping Distribution

Diameter	Length in Zone
4" or less	62,666
6"	112,467
8"	4,517
10"	1,919
12" or greater	26,761
Total Length	208,169

Valves

The Crestview Estates Regulated Zone is separated from adjoining zones by SVs and PRVs. Table 16-2 shows the system valves within the Crestview Estates Regulated as well as the status of these valves during the simulations.

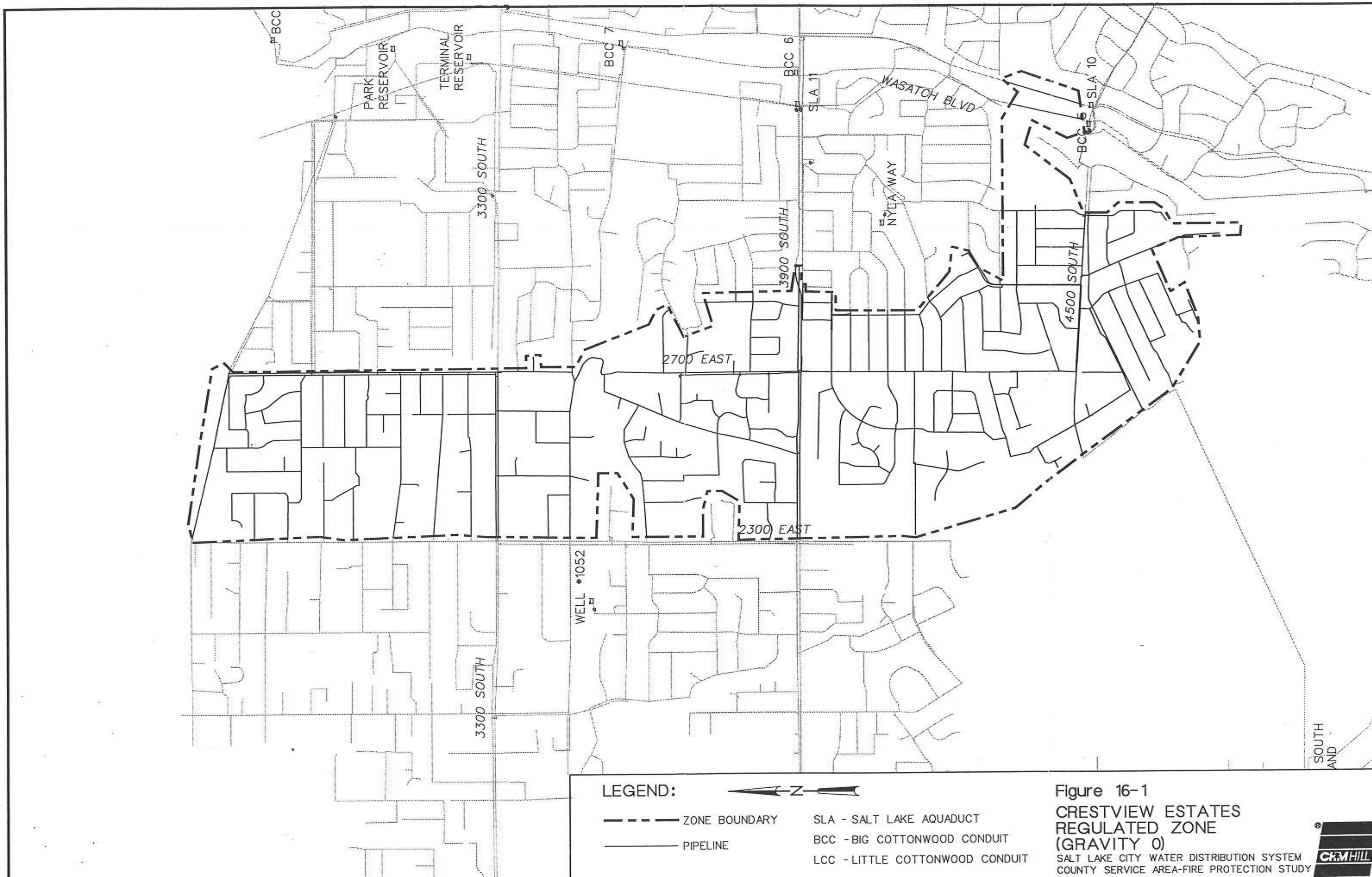


Figure 16-1
CRESTVIEW ESTATES
REGULATED ZONE
(GRAVITY 0)
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

RMW37123\FIGURES\FIRES\ZONE16-1.DLV

Table 16-2 Crestview Estates Regulated Reservoir System Valves			
idsys	**Status**	**idsys**	**Status**
4176	3335 S.	8215	4430 S.
4490	Evergreen	52693	Morningside
4538	3435 S.	52707	Nila Way, 4140 S.
4914	Neffs	54212	Bonnie Brae
5037	3600 S.	54213	Shanna
5150	Craig	54391	Morgan, 4100 S.
5341	2860 E.	54672	3395 S.
5350	Oakridge	56104	Lambourne
5459	Upland	56144	Gregson, 2300 E.
5604	Arnette	56154	3000 S.
5826	3900 S.	56162	3225 S.
6393	2900 E.	56203	3000 S.
6420	Nora	56260	Canyon View Drive
6571	Delsa	56597	Fisher Lane
6629	Wardway	56600	2880 S.
7497	Bluebell	56602	2815 S.
7625	3080 E.	56932	2700 E.

The Crestview Estates Regulated portion of the model includes two PRVs. Table 16-3 shows the location, pressure setting and HGL of the PRVs.

Table 16-3 Crestview Estates Regulated PRVs			
idsys	**Location**	**Pressure Setting**	**HGL**
57962	4430 S.	65	4943.92
57956	3300 S.	85	4887.15

Reservoirs

There are no reservoirs serving the Crestview Estates Zone.

Source Pumps

There are no source pumps in the Crestview Estates Regulated Zone.

Booster Pumps

There are no booster pumps in the Crestview Estates Regulated Zone.

Calibration

Prior to the modelling effort, a series of fire hydrant flow tests were conducted within the Salt Lake County Distribution System to assist in the calibration of the model. Within the Crestview Estates Regulated, two such tests were conducted. The results of the tests in the Crestview Estates Regulated are summarized in Table 16-4.

Table 16-4 Crestview Estates Regulated Zone Calibration Test Results				
	Static Pressure		Dynamic Pressure	
Test No.	Measured	Calculated	Measured	Calculated
23	141	141	60	119.32
28	115	129	76	96.99

During the static calibration of the model, runs were made at an average demand scenario and adjustments made until the measured pressure equalled the modelled pressure as near as possible. Typical adjustments included the opening and closing of system valves, the adjustment of PRV pressure settings, and the verification of node elevations.

After completion of the static calibration, the model was calibrated against the fire flow tests. This is called the dynamic calibration. The intent of the dynamic calibration is to test the system under some stress (high flows) and check the model's performance against that condition. The measured flows from the fire hydrants were modeled and the calculated pressures compared against those measured in the field. Adjustments in the model were made to bring the calculated results in line with the field measured results.

Dynamic calibration often requires an iterative process. Initial field measurements and system maps are used to set up the model, but the situation in the field is frequently not exactly as described in the maps and other system documentation. Inaccurate mapping (with inexact elevations), valves not in the position recorded (either open or closed), or pipes a different size than shown on maps, are all conditions that exist in most water distribution systems. To get an accurate dynamic model it is often necessary to go back into the field and check valve position, elevation, etc. This additional field work to verify model conditions was not done as a part of this study. It is recommended that as time and manpower permit, field verification be undertaken. For example, elevations of reservoirs, pump stations and PRVs are known. However, the elevations for the remainder of the system were obtained from USGS mapping and are likely not completely accurate for a given location. An elevation difference (between actual and the model) of 5 feet would result in a pressure difference of 2.2 psi. The elevation contours on the USGS mapping are 40 feet. Errors in elevations of up to 20 feet could be expected using this type of mapping. A 20-foot elevation difference would result in a pressure difference of almost 9 psi. Static and dynamic calibration results must be viewed with this potential for errors based on erroneous information in mind.

The calculated static calibration pressures matched the measured fairly closely. The calculated dynamic pressures did not match the measured pressures as well as desired. The calculated pressures were both significantly higher than the measured. The differences cannot be explained with friction factors, elevations or PRV settings. It is most likely valves that are supposed to be open that are closed or pipes smaller than shown on system maps. Additional field work to refine this portion of the model is recommended.

Fire Run Simulations

Thirty-seven fire simulations were run in this zone. The location of those simulations are shown in Figure 16-2. Table 16-5 shows the low pressure in the zone for each of the fire runs.

Table 16-5
Crestview Estates Regulated Fire Flow Results

Simulation No.	Fire Flow (gpm)	Calculated Pressure	Simulation No.	Fire Flow (gpm)	Calculated Pressure
1G0	1008.25	< 0	20G0	4.49	113.11
2G0	1006.18	80.73	21G0	1013.19	82.97
3G0	1009.77	114.52	22G0	1010.08	76.53
4G0	1002.00	139.52	23G0	1007.24	75.85
6G0	1006.53	111.44	24G0	1008.04	94.82
7G0	1012.81	76.10	25G0	1008.77	56.35
8G0	1004.22	91.42	26G0	1006.97	94.12
9G0	1009.93	< 0	27G0	1009.46	71.85
10G0	1007.11	37.69	28G0	1007.84	91.52
11G0	1009.75	< 0	29G0	1007.11	106.07
12G0	1015.20	74.38	30G0	5.45	128.20
13G0	1006.86	100.58	31G0	1010.16	83.84
14G0	1008.93	< 0	32G0	9008.44	< 0
15G0	1012.68	< 0	33G0	1007.10	116.75
16G0	1005.60	< 0	34G0	1013.49	90.39
17G0	1006.96	40.54	35G0	1011.34	71.75
18G0	1009.67	55.06	36G0	1015.42	111.36
19G0	1008.90	17.55	37G0	1004.66	59.26

Problem Areas

The Crestview Estates Regulated Zone is generally well looped. However, much of the effectiveness of this looping is lost because of the way the zone boundary is defined. SVs are closed on the west end of several long pipelines, essentially making them dead end lines. This condition results in high pressure losses, and in some areas the minimum criteria for flow and pressure could not be met.

Areas in which fire flow and pressure were not achieved are shown in Figure 16-2.

Recommended Solutions

For each of the areas in which fire flow and pressure were not achieved, an improvement was developed. The model was changed to reflect the improvement and the same set of fire simulations run again. In each case the resulting pressures were in excess of the required minimum. Figure 16-3 shows the required improvements for the Crestview Estates Regulated. A cost estimate was prepared for each of these improvements. Table 16-6 shows these cost estimates.

It should be noted that the improvements presented in Figure 16-3 may not be the optimum. It may be possible to reduce the amount of pipe replaced (and thus the cost) by configuring the improvements differently.

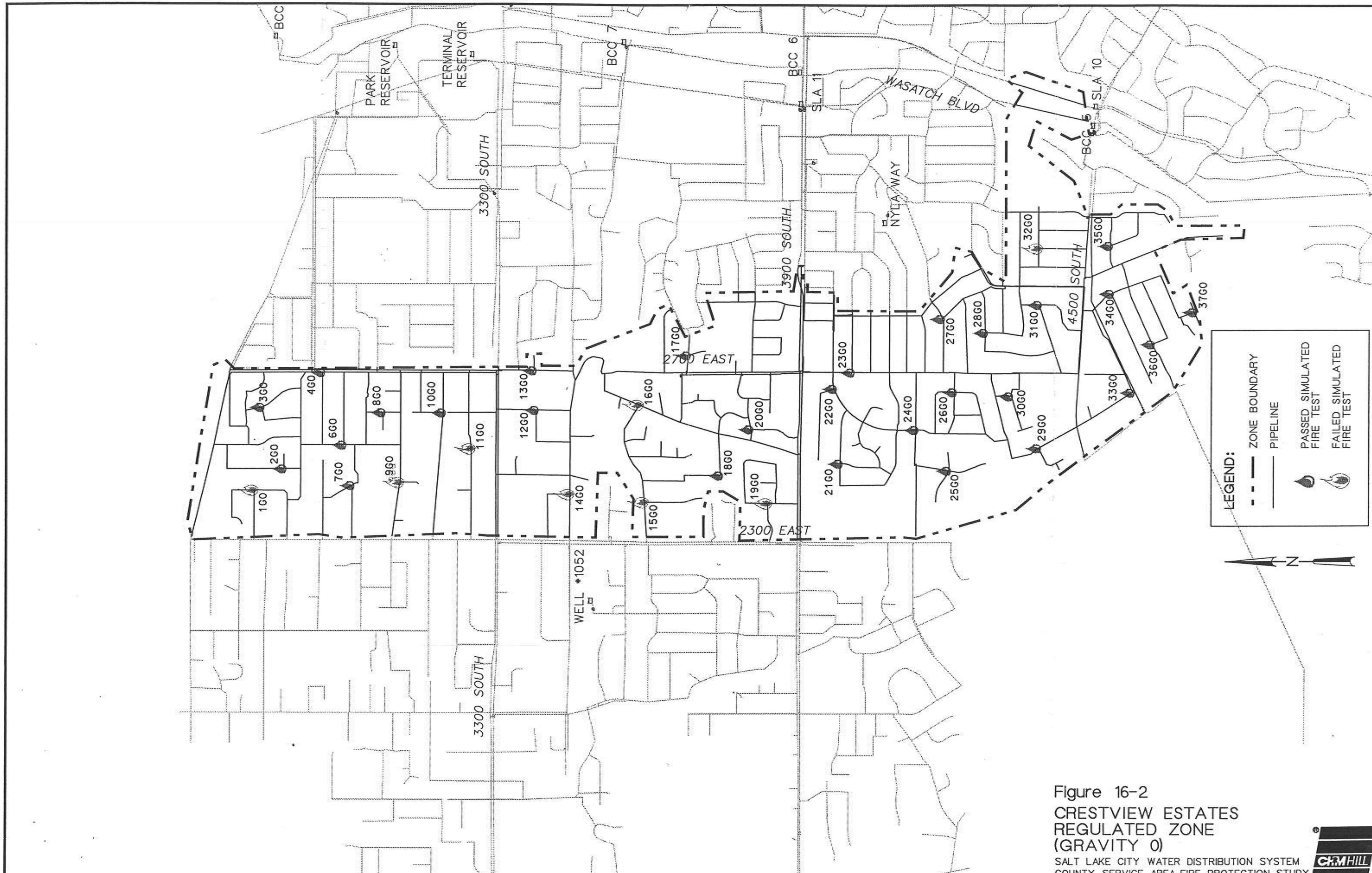


Figure 16-2
CRESTVIEW ESTATES
REGULATED ZONE
(GRAVITY 0)
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

CH2M HILL

RMW37123\FIGURES\FIRES\ZONE16-2

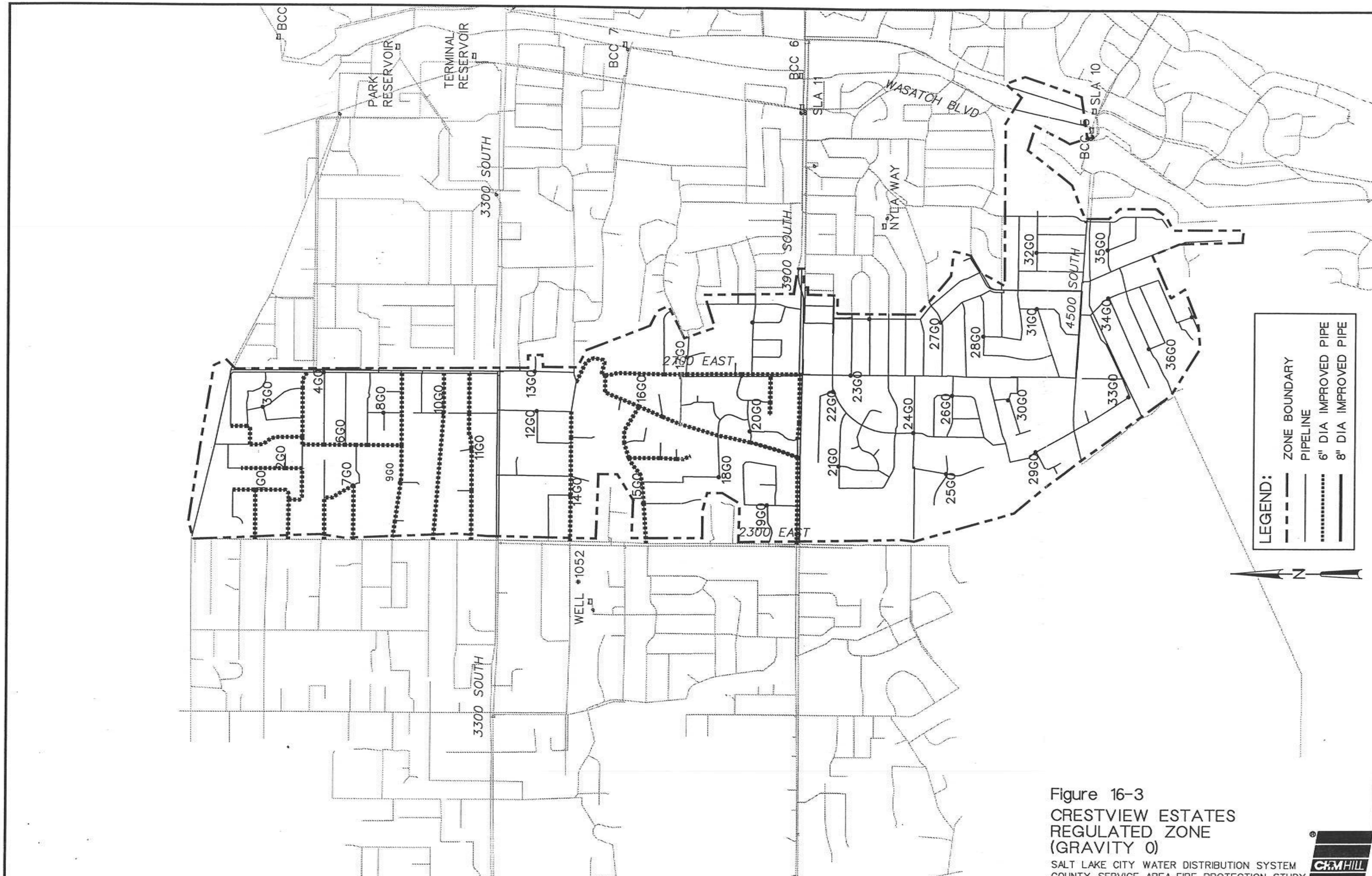


Figure 16-3
CRESTVIEW ESTATES
REGULATED ZONE
(GRAVITY 0)

SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

RMW37123\FIGURES\FIRES\ZON16-3A.DLV

Table 16-6

Salt Lake City Department of Public Utilities
Fire Flow Study
Cost Estimate - Gravity 0 Zone

idsys	Existing Length	New Length	Existing Diameter	New Diameter	Number Required				Cost					
					Valves	Hydrants	Service	Repair	Pipe	Valves	Hydrants	Service	Repair	TOTAL
	LF	LF	inch	inch	ea	ea	ea	cy	$	$	$	$	$	$
56627	349	349	4	6	2	1	8	1,165	17,472	1,200	2,500	5,200	4,310	30,682
56602	772	772	4	6	3	2	18	2,573	38,595	1,800	5,000	11,700	9,520	66,615
56628	637	637	4	6	2	2	15	2,124	31,856	1,200	5,000	9,750	7,858	55,664
56600	616	616	4	6	2	2	14	2,053	30,789	1,200	5,000	9,100	7,595	53,683
56653	665	665	4	6	3	2	15	2,218	33,271	1,800	5,000	9,750	8,207	58,028
56610	260	260	4	6	1	1	6	867	13,005	600	2,500	3,900	3,208	23,213
56621	684	684	4	6	3	2	16	2,279	34,185	1,800	5,000	10,400	8,432	59,817
56966	256	256	4	6	1	1	6	854	12,804	600	2,500	3,900	3,158	22,963
56640	311	311	4	6	1	1	7	1,037	15,550	600	2,500	4,550	3,836	27,035
56634	839	839	4	6	3	2	19	2,795	41,931	1,800	5,000	12,350	10,343	71,424
56912	271	271	4	6	1	1	7	903	13,539	600	2,500	4,550	3,340	24,528
56914	460	460	4	6	2	1	11	1,534	23,005	1,200	2,500	7,150	5,675	39,530
56643	291	291	4	6	1	1	7	970	14,555	600	2,500	4,550	3,590	25,795
56645	120	120	4	6	1	1	3	399	5,982	600	2,500	1,950	1,476	12,507
56648	334	334	4	6	2	1	8	1,113	16,692	1,200	2,500	5,200	4,117	29,709
56647	332	332	4	6	2	1	8	1,106	16,593	1,200	2,500	5,200	4,093	29,586
56646	167	167	4	6	1	1	4	556	8,342	600	2,500	2,600	2,058	16,100
56128	170	170	4	6	1	1	4	567	8,501	600	2,500	2,600	2,097	16,298
56122	525	525	4	6	2	2	12	1,750	26,250	1,200	5,000	7,800	6,475	46,725
56597	651	651	4	6	2	2	15	2,170	32,544	1,200	5,000	9,750	8,028	56,522
56151	502	502	4	6	2	2	12	1,672	25,079	1,200	5,000	7,800	6,186	45,265
56154	843	843	4	6	3	2	19	2,810	42,154	1,800	5,000	12,350	10,398	71,702
56144	303	303	4	6	1	1	7	1,011	15,165	600	2,500	4,550	3,741	26,555
56142	598	598	4	6	2	2	14	1,995	29,922	1,200	5,000	9,100	7,381	52,603
56135	578	578	4	6	2	2	13	1,926	28,883	1,200	5,000	8,450	7,124	50,657
56123	502	502	4	6	2	2	12	1,672	25,084	1,200	5,000	7,800	6,187	45,271
56131	328	328	4	6	1	1	8	1,094	16,411	600	2,500	5,200	4,048	28,759
56185	287	287	4	6	1	1	7	955	14,325	600	2,500	4,550	3,534	25,509
56104	1,973	1,973	4	6	6	4	44	6,576	98,647	3,600	10,000	28,600	24,333	165,179
56177	620	620	4	6	2	2	14	2,065	30,981	1,200	5,000	9,100	7,642	53,923
56162	767	767	4	6	3	2	18	2,557	38,348	1,800	5,000	11,700	9,459	66,308
56163	644	644	4	6	2	2	15	2,146	32,192	1,200	5,000	9,750	7,941	56,082
56168	565	565	4	6	2	2	13	1,883	28,246	1,200	5,000	8,450	6,967	49,863
56172	615	615	4	6	2	2	14	2,049	30,734	1,200	5,000	9,100	7,581	53,615
4490	716	716	4	6	3	2	16	2,388	35,823	1,800	5,000	10,400	8,836	61,860
4495	292	292	4	6	1	1	7	975	14,621	600	2,500	4,550	3,607	25,878
4498	513	513	4	6	2	2	12	1,708	25,626	1,200	5,000	7,800	6,321	45,948
4496	92	92	4	6	1	1	3	308	4,617	600	2,500	1,950	1,139	10,805
4502	397	397	4	6	2	1	9	1,323	19,838	1,200	2,500	5,850	4,893	34,282
4914	621	621	4	6	2	2	14	2,070	31,056	1,200	5,000	9,100	7,660	54,016
4894	334	334	4	6	2	1	8	1,114	16,715	1,200	2,500	5,200	4,123	29,739
54656	433	433	4	6	2	1	10	1,445	21,673	1,200	2,500	6,500	5,346	37,219
4834	238	238	4	6	1	1	6	795	11,923	600	2,500	3,900	2,941	21,864
52588	636	636	4	6	2	2	15	2,119	31,782	1,200	5,000	9,750	7,839	55,571
4977	491	491	4	6	2	1	11	1,636	24,544	1,200	2,500	7,150	6,054	41,448
5076	252	252	4	6	1	1	6	841	12,608	600	2,500	3,900	3,110	22,718
5165	231	231	4	6	1	1	6	771	11,568	600	2,500	3,900	2,853	21,422
4676	908	908	4	6	3	2	21	3,028	45,418	1,800	5,000	13,650	11,203	77,071
4750	540	540	4	6	2	2	13	1,801	27,022	1,200	5,000	8,450	6,665	48,337
4768	918	918	4	6	3	2	21	3,060	45,899	1,800	5,000	13,650	11,322	77,670
4873	302	302	4	6	1	1	7	1,006	15,084	600	2,500	4,550	3,721	26,455
4988	398	398	4	6	2	1	9	1,327	19,901	1,200	2,500	5,850	4,909	34,360
5088	287	287	4	6	1	1	7	955	14,332	600	2,500	4,550	3,535	25,517
5245	626	626	4	6	2	2	14	2,087	31,301	1,200	5,000	9,100	7,721	54,322
5428	506	506	4	6	2	2	12	1,688	25,320	1,200	5,000	7,800	6,246	45,566
5792	766	766	4	6	3	2	18	2,555	38,324	1,800	5,000	11,700	9,453	66,277
5104	271	271	4	6	1	1	7	904	13,555	600	2,500	4,550	3,344	24,548
5122	79	79	4	6	1	1	2	264	3,967	600	2,500	1,300	979	9,345
5368	850	850	4	6	3	2	19	2,834	42,506	1,800	5,000	12,350	10,485	72,140
5440	155	155	4	6	1	1	4	516	7,734	600	2,500	2,600	1,908	15,342
5595	286	286	4	6	1	1	7	952	14,284	600	2,500	4,550	3,523	25,457
52673	456	456	4	6	2	1	11	1,520	22,798	1,200	2,500	7,150	5,623	39,271
52680	24	24	4	6	1	1	1	78	1,176	600	2,500	650	290	5,215
5897	755	755	4	6	3	2	17	2,516	37,740	1,800	5,000	11,050	9,309	64,900
5596	42	42	4	6	1	1	1	141	2,118	600	2,500	650	522	6,390
5590	385	385	4	6	2	1	9	1,283	19,242	1,200	2,500	5,850	4,746	33,538
5832	754	754	4	6	3	2	17	2,513	37,697	1,800	5,000	11,050	9,299	64,846
5826	596	596	4	6	2	2	14	1,988	29,825	1,200	5,000	9,100	7,357	52,482
					100	80	607	87,157	1,307,348	60,000	200,000	394,550	322,479	2,284,377
									Eng, Legal & Admin				15%	342,657
									Subtotal				-	**2,627,034**
									Contigency				15%	394,055
									TOTAL				-	**3,021,089**

7800 South Low Zone

Chapter 17

7800 South Low Zone

System Geometry

The 7800 South Low Zone of the Salt Lake County water distribution system is located generally between 7000 South and 7800 South, west of Wasatch Boulevard. The 7800 South Low Zone distribution system is shown in Figure 17-1.

Piping

Table 17-1 indicates the size distribution and total length of the piping within the 7800 South Low.

Table 17-1 7800 South Low Reservoir Piping Distribution	
Diameter	**Length in Zone**
4" or less	573
6"	13,708
8"	8,204
10"	0
12" or greater	14,250
Total Length	44,535

Valves

The 7800 South Low Zone is isolated from adjoining zones by SVs. There are no PRVs that serve the area. Table 17-2 shows the system valves within the 7800 South Low during the simulations.

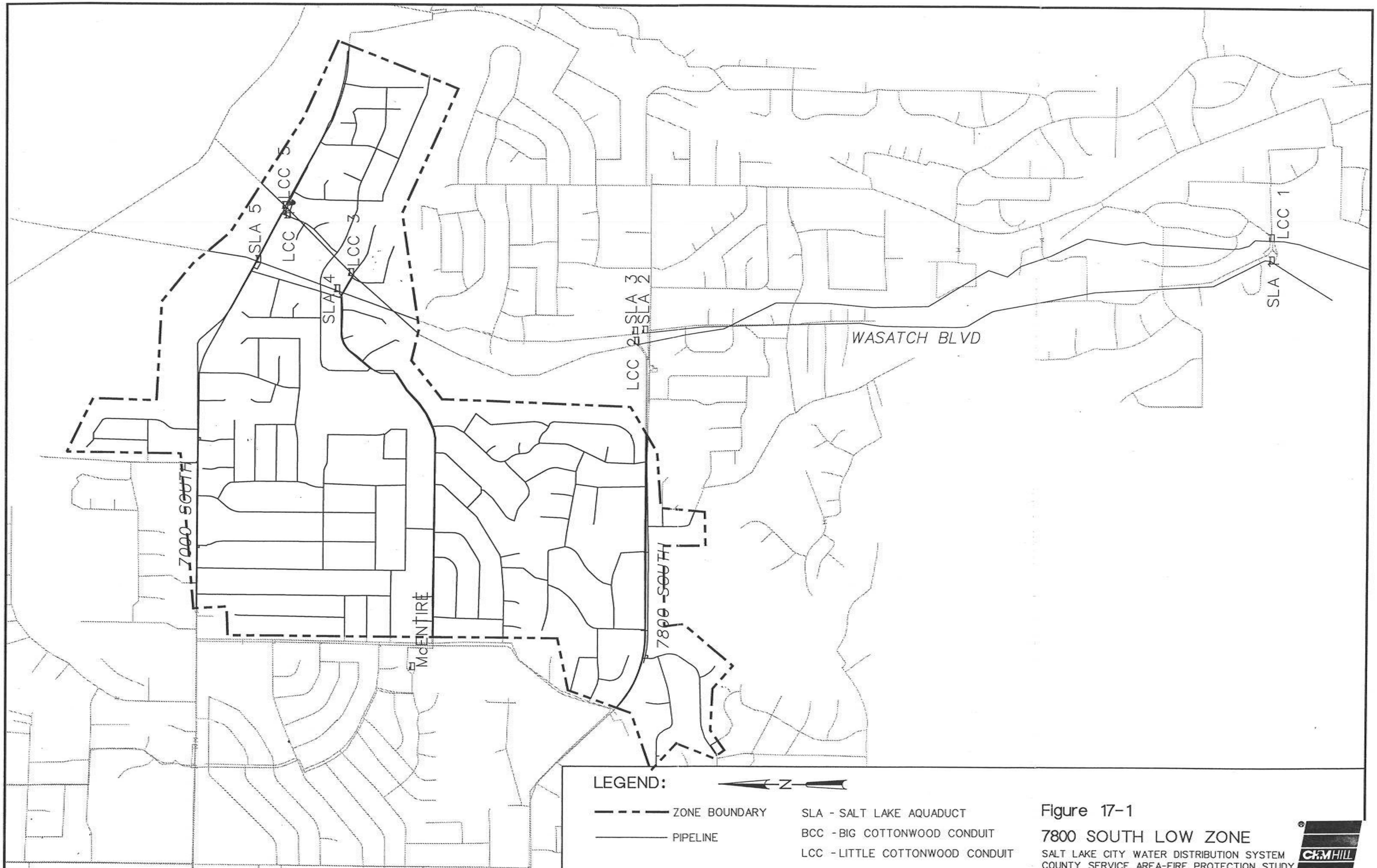


Figure 17-1
7800 SOUTH LOW ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

RMW37123\FIGURES\FIRES\ZONE-17.DLV

Table 17-2 7800 South Low Reservoir System Valves	
idsys	**Location**
11909	Pine View, 3000 E.
12358	2825 E., 7000 S.
12831	7260 S., 2700 E.
12954	7305 S., 2700 E.
13084	7350 S., 2700 E.
13087	7350 S., 2780 E.
13153	7375 S., 2825 E.
13305	7420 S., 2700 E.
13546	7550 S., 2700 E.
13840	Canterbury, 2700 E.
13859	Townes, 2610 E.
13995	7800 S., 2730 E.
14026	Nantucket, 7800 S.
14135	Dolphin, 2435 E.
52914	7000 S., 2870 E.
52931	3000 E., 7000 S.
52955	7000 S., Nutree
52965	Antler Way, Nutree
52978	Antler Way, Marinda
53113	Portsmouth, Nantucket
53119	Pamela, 7800 S.

Reservoirs

There are no reservoirs serving the zone directly. 7800 South Low water is supplied directly from Little Cottonwood Conduit and the Salt Lake Aqueduct.

Source Pumps

There are no source pumps in the 7800 South Low Zone.

Booster Pumps

There are three booster pumps which pump into the 7800 South Low. Table 17-3 indicates the location of these booster pumps and the status of the pump during the simulations.

Table 17-3
7800 South Low
Reservoir Booster Pumps

Pump	Location	Status
7000 S. #3	Butlerville Wasatch Blvd.	ON
7000 S. #4	Butlerville Wasatch Blvd.	OFF
7000 S. #5	Butlerville Wasatch Blvd.	OFF

Calibration

Prior to the modelling effort, a series of fire hydrant flow tests were conducted within the Salt Lake County Distribution System to assist in the calibration of the model. Within the 7800 South Low, three such tests were conducted. The results of the tests in the 7800 South Low are summarized in Table 17-4.

Table 17-4
7800 South Low Calibration Test Results

	Static Pressure		Dynamic Pressure	
Test No.	Measured	Calculated	Measured	Calculated
6	100	123	33	87.84
14	92	88	67	< 0
15	120	105	50	48.33

During the static calibration of the model, runs were made at an average demand scenario and adjustments made until the measured pressure equalled the modelled pressure as near as possible. Typical adjustments included the opening and closing of system valves, the adjustment of PRV pressure settings, and the verification of node elevations.

After completion of the static calibration, the model was calibrated against the fire flow tests. This is called the dynamic calibration. The intent of the dynamic calibration is to test the system under some stress (high flows) and check the model's performance against that condition. The measured flows from the fire hydrants were modeled and the calculated pressures compared against those measured in the field. Adjustments in the model were made to bring the calculated results in line with the field measured results.

Dynamic calibration often requires an iterative process. Initial field measurements and system maps are used to set up the model, but the situation in the field is frequently not exactly as described in the maps and other system documentation. Inaccurate mapping (with inexact elevations), valves not in the position recorded (either open or closed), or pipes a different size than shown on maps, are all conditions that exist in most water distribution systems. To get an accurate dynamic model it is often necessary to go back into the field and check valve position, elevation, etc. This additional field work to verify model conditions was not done as a part of this study. It is recommended that as time and manpower permit, field verification be undertaken. For example, elevations of reservoirs, pump stations and PRVs are known. However, the elevations for the remainder of the system were obtained from USGS mapping and are likely not completely accurate for a given location. An elevation difference (between actual and the model) of 5 feet would result in a pressure difference of 2.2 psi. The elevation contours on the USGS mapping are 40 feet. Errors in elevations of up to 20 feet could be expected using this type of mapping. A 20-foot elevation difference would result in a pressure difference of almost 9 psi. Static and dynamic calibration results must be viewed with this potential for errors based on erroneous information in mind.

The calculated static pressures were not as close in this zone as in many of the others, but still not too bad under the circumstances. Two of the three calculated dynamic pressures varied significantly from the measured dynamic pressures. One was high and one was low. This could be caused by a number of things. The pump curve could be incorrect (a curve for a different pump), an SV that is supposed to be closed is open (this would cause the measured pressure to be higher than calculated), or one that is supposed to be open is closed (this would cause the measured pressure to be lower than calculated). Incorrect pipe sizes could also cause this type of difference. Further field investigation to refine the calibration is recommended.

Fire Run Simulations

Twenty-nine fire simulation runs were made. The locations of the simulated fires are shown in Figure 17-2. Table 17-5 shows the low pressure in the zone for each of the fire runs.

Table 17-5 7800 South Low Fire Flow Results					
Simulation No.	Fire Flow (gpm)	Calculated Pressure	Simulation No.	Fire Flow (gpm)	Calculated Pressure
1L	1109.12	81.40	16L	1003.08	117.38
2L	1008.10	100.90	17L	1002.00	110.99
3L	1006.88	85.62	18L	1003.02	121.58
4L	1002.00	84.92	19L	1007.72	100.41
5L	1004.44	80.56	20L	1007.92	88.88
6L	1005.08	108.50	21L	1006.44	129.77
7L	1004.56	103.20	22L	1010.68	82.92
8L	1004.80	80.05	23L	1003.42	101.33
9L	1010.32	65.14	24L	1005.56	118.71
10L	1004.50	87.39	25L	1006.10	105.71
11L	1009.46	54.29	26L	1008.24	107.23
12L	1008.30	< 0	27L	1006.64	105.77
13L	1006.64	76.72	28L	1004.30	126.02
14L	1006.60	91.21	29L	1003.86	109.60
15L	1005.20	< 0			

Problem Areas

The areas where the simulated fires showed minimum pressure and flow requirements could not be met were areas with a number of closed SVs. Normally SVs are closed at a pressure zone boundary. Information obtained from system maps showed additional closed SVs. When these valves were opened and the same fire simulations run, the pressure problems did not occur. Field verification of the status of all SVs in this area is recommended.

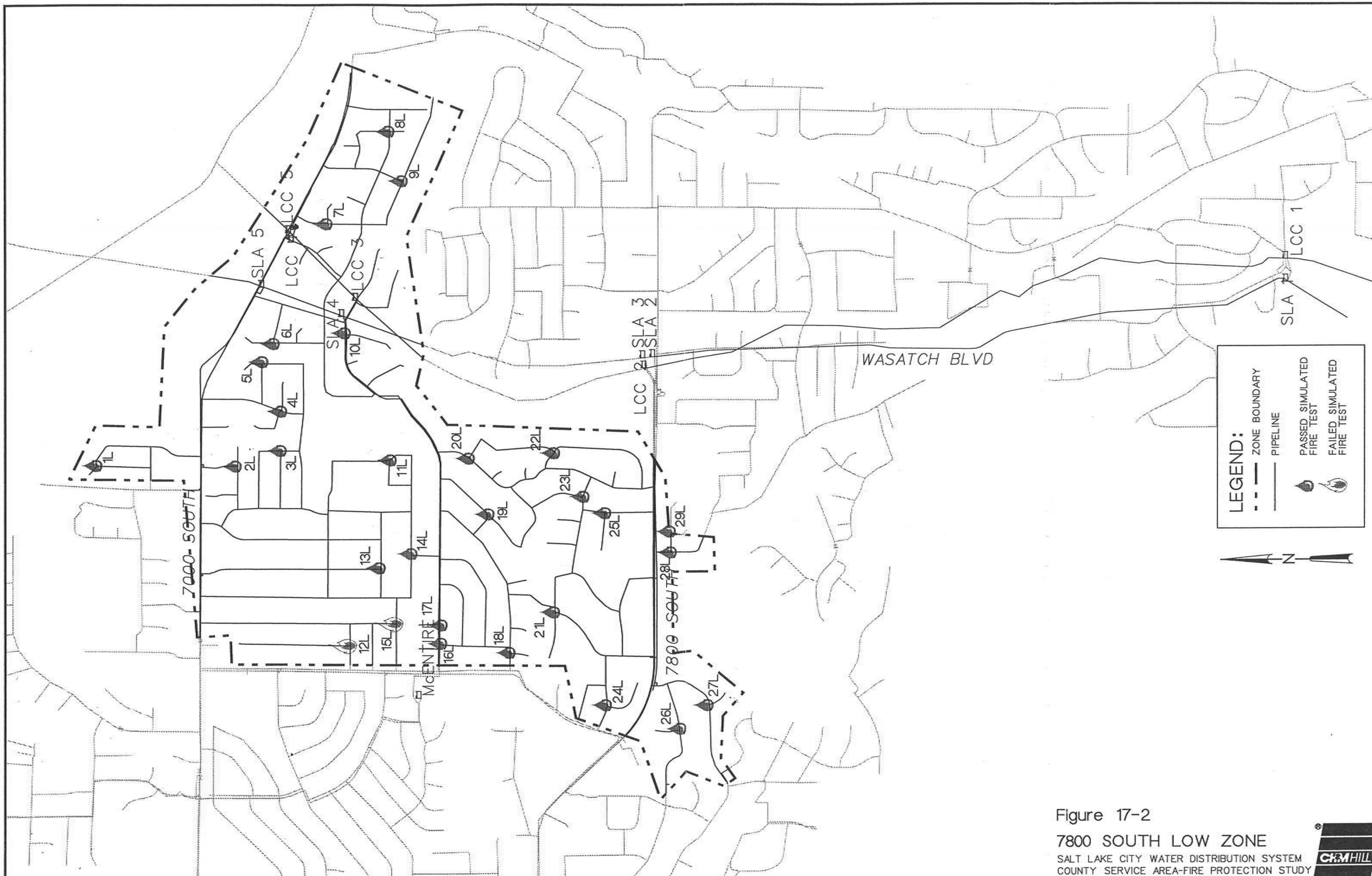


Figure 17-2
7800 SOUTH LOW ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

RMW37123\FIGURES\FIRES\ZONE17-2.DLV

Telford/Ferguson Zone

Chapter 18
Telford/Ferguson Zone

System Geometry

The Telford/Ferguson Zone of the Salt Lake County water distribution system is located in the extreme southeastern part of the county service area. The Telford/Ferguson Zone distribution system is shown in Figure 18-1.

Piping

Table 18-1 indicates the size distribution and total length of the piping within the Telford/Ferguson Zone.

Table 18-1
Telford/Ferguson Zone
Reservoir Piping Distribution

Diameter	Length in Zone
4" or less	4,275
6"	58,715
8"	20,155
10"	122
12" or greater	29,551
Total Length	112,637

Valves

The Telford/Ferguson Zone is isolated from the adjoining zones by SVs and PRVs. Table 18-2 gives the system valves within the Telford/Ferguson Zone which were closed during the simulations.

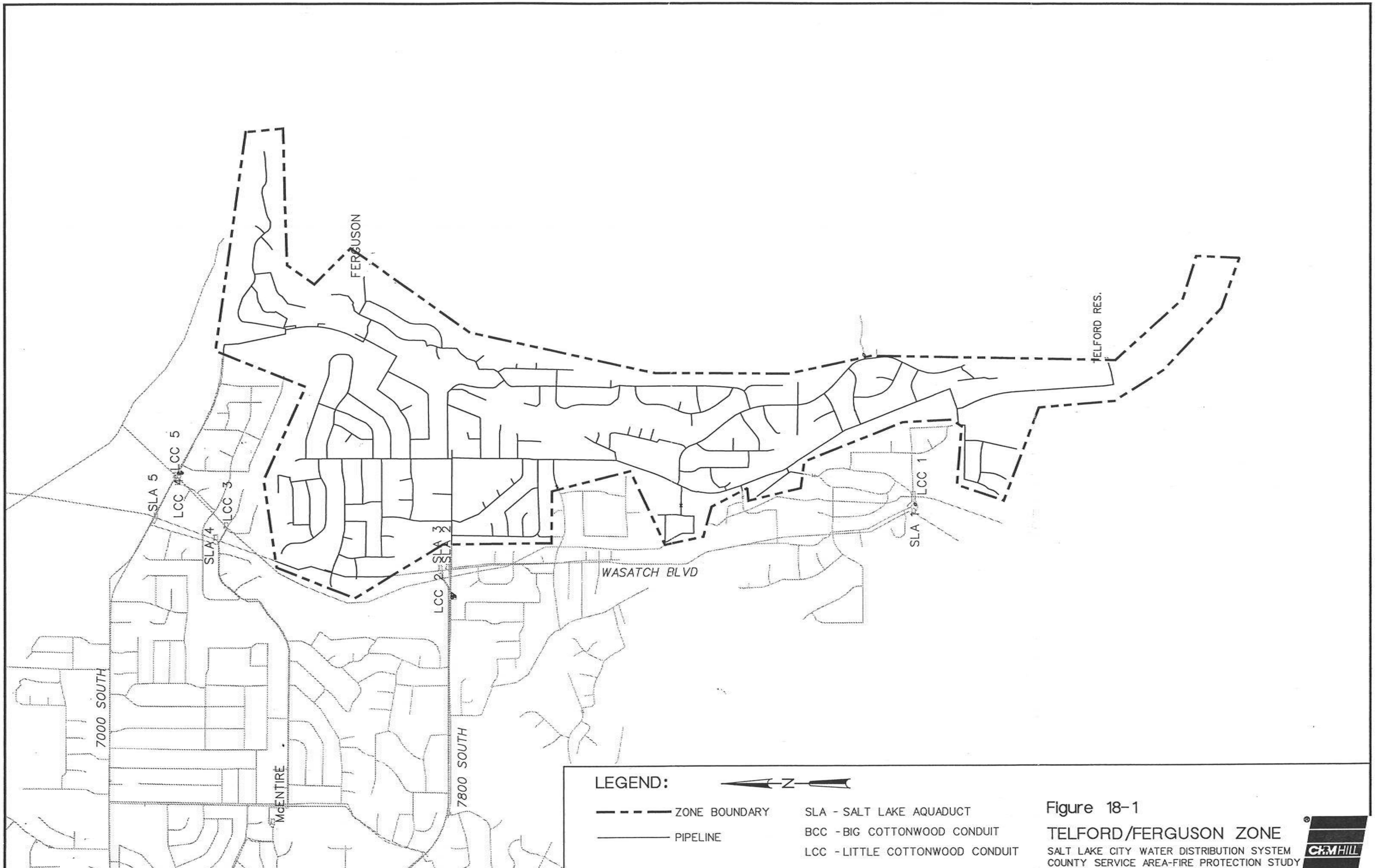


Figure 18-1
TELFORD/FERGUSON ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

RMW37123\FIGURES\FIRES\ZONE18-1.DLV

Table 18-2 Telford/Ferguson Zone Reservoir System Valves	
idsys	**Location**
14486	Demerest, Creek Road

The Telford/Ferguson Zone portion of the model includes one PRV. Table 18-3 shows the location, pressure setting and HGL of the PRVs.

Table 18-3 Telford/Ferguson Zone PRVs				
Station No.	**idsys**	**Location**	**Pressure Setting**	**HGL**
CR-30A	56698	8350 S.	60	5177.00

Reservoirs

Telford and Ferguson Reservoirs control the hydraulic grade line within the Telford/Ferguson Zone. The static hydraulic grade line of the Ferguson is 5361; Telford reservoirs is 5362.

Source Pumps

There are no source pumps in the Telford/Ferguson Zone.

Booster Pumps

There is one booster pump in the Telford/Ferguson Zone. Table 18-5 indicates the location of this booster pump and the status of the pump during the static simulation.

Table 18-4 Telford/Ferguson Zone Reservoir Booster Pumps		
Pump	**Location**	**Status**
Golden Hills Pump Station	Canyon Road	ON

Calibration

Prior to the modelling effort, a series of fire hydrant flow tests were conducted within the Salt Lake County Distribution System to assist in the calibration of the model. Within the Telford/Ferguson Zone, two such tests were conducted. The results of the tests in the Telford/Ferguson Zone are summarized in Table 18-5.

Table 18-5
Telford/Ferguson Zone Calibration Test Results

Test No.	Static Pressure		Dynamic Pressure	
	Measured	Calculated	Measured	Calculated
17	130	137	100	119.47
18	120	120	80	97.76

During the static calibration of the model, runs were made at an average demand scenario and adjustments made until the measured pressure equalled the modelled pressure as near as possible. Typical adjustments included the opening and closing of system valves, the adjustment of PRV pressure settings, and the verification of node elevations.

After completion of the static calibration, the model was calibrated against the fire flow tests. This is called the dynamic calibration. The intent of the dynamic calibration is to test the system under some stress (high flows) and check the model's performance against that condition. The measured flows from the fire hydrants were modeled and the calculated pressures compared against those measured in the field. Adjustments in the model were made to bring the calculated results in line with the field measured results.

Dynamic calibration often requires an iterative process. Initial field measurements and system maps are used to set up the model, but the situation in the field is frequently not exactly as described in the maps and other system documentation. Inaccurate mapping (with inexact elevations), valves not in the position recorded (either open or closed), or pipes a different size than shown on maps, are all conditions that exist in most water distribution systems. To get an accurate dynamic model it is often necessary to go back into the field and check valve position, elevation, etc. This additional field work to verify model conditions was not done as a part of this study. It is recommended that as time and manpower permit, field verification be undertaken. For example, elevations of reservoirs, pump stations and PRVs are known. However, the elevations for the remainder of the system were obtained from USGS mapping and are likely not completely accurate for a given location. An elevation difference (between actual and the model) of 5 feet would result in a pressure difference of 2.2 psi. The elevation contours on the USGS mapping are 40 feet. Errors in elevations of up to 20 feet could be expected using this type of mapping. A 20-foot elevation difference would result in a pressure difference of almost 9 psi. Static and dynamic calibration results must be viewed with this potential for errors based on erroneous information in mind.

Fire Run Simulations

The simulated fires were run in the Telford/Ferguson Zone. The location of the simulated fires are shown in Figure 18-2. Table 18-6 shows the low pressure in the zone for each of the fire runs.

Table 18-6
Telford/Ferguson Zone Fire Flow Results

Simulation No.	Fire Flow (gpm)	Calculated Pressure
1F	2019.72	111.64
2F	1005.96	114.02
3F	1013.50	123.83
4F	1006.94	73.14
5F	1008.78	56.68
6F	1006.66	107.48
7F	1009.50	85.80
8F	1004.88	78.55
9F	1037.34	32.72
10F	1016.98	70.84

Problem Areas

Minimum required flow are pressure requirements were met at all simulated fire locations.

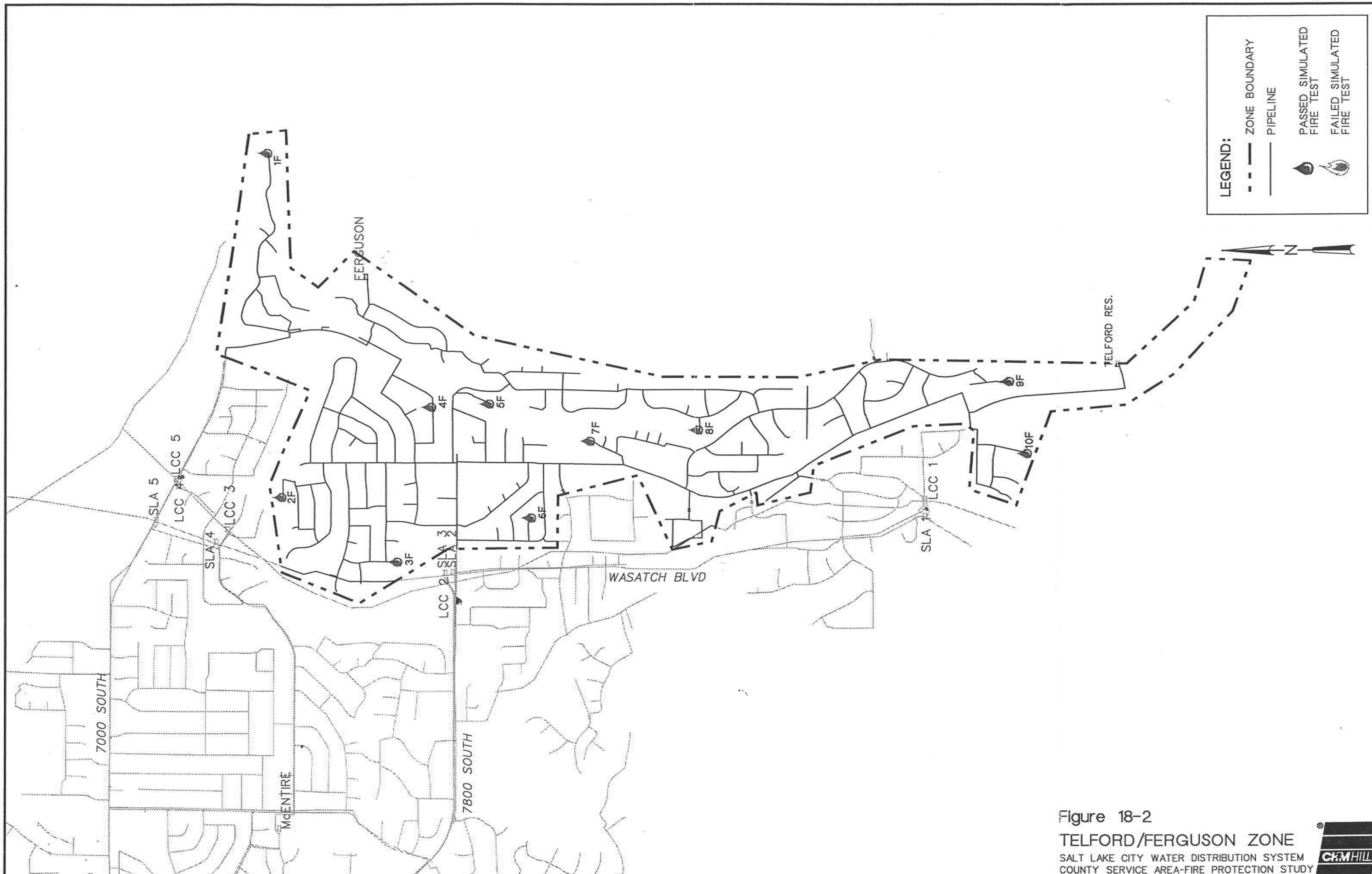


Figure 18-2
TELFORD/FERGUSON ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

RMW37123\FIGURES\FIRES\ZONE18-2.DLV

7800 South Intermediate Zone

Chapter 19
7800 South Intermediate Zone

System Geometry

The 7800 South Intermediate Zone of the Salt Lake County water distribution system is a small zone located just off 7800 South and Wasatch Boulevard. The 7800 South Intermediate Zone distribution system is shown in Figure 19-1.

Piping

Table 19-1 indicates the size distribution and total length of the piping within the 7800 South Intermediate.

Table 19-1
7800 South Intermediate
Reservoir Piping Distribution

Diameter	Length in Zone
4" or less	1,056
6"	77,089
8"	17,391
10"	7
12" or greater	19,537
Total Length	122,880

Valves

The 7800 South Intermediate zone is isolated from adjoining zones by SVs and PRVs. Table 19-2 indicates the system valves within the 7800 South Intermediate which were closed during the static simulation.

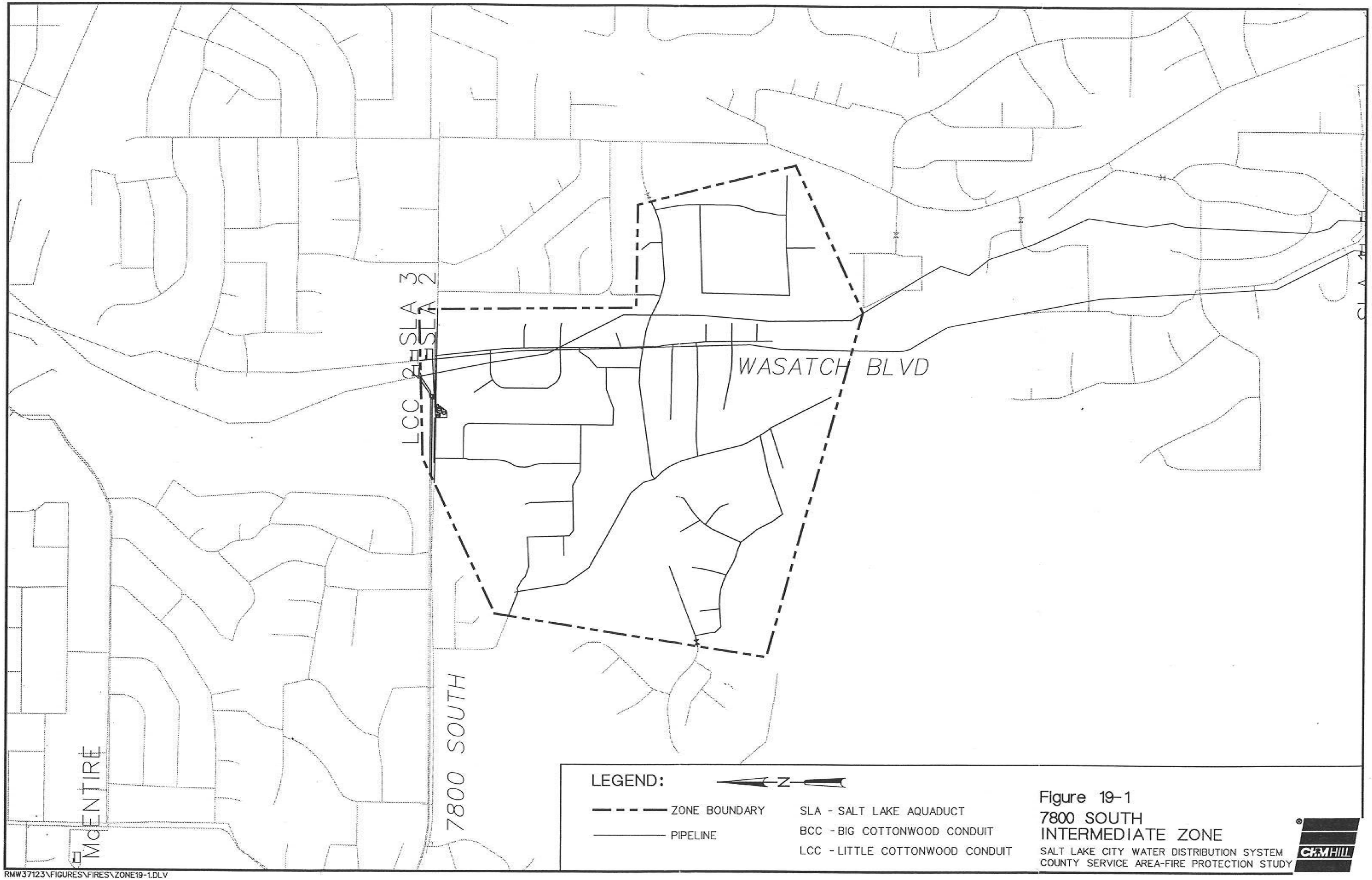


Figure 19-1
7800 SOUTH
INTERMEDIATE ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

Table 19-2 7800 South Intermediate Reservoir System Valves	
idsys	**Location**
14068	7800 S., Titan Street
53061	7800 S., Little Cottonwood Conduit
53136	7800 S., Little Cottonwood Conduit
53641	Danish Road, Danish Ridge

PRVs

The 7800 South Intermediate portion of the model includes two PRVs. Table 19-3 shows the location, pressure setting and HGL of the PRVs.

Table 19-3 7800 South Intermediate PRVs				
Station No.	**idsys**	**Location**	**Pressure Setting**	**HGL**
CR-26	56695	Creek Road	60	5176.00
PSR-14	56770	7800 S.	95	5200.00

Reservoirs

In the 7800 South Intermediate Zone the hydraulic grade line is controlled by the Little Cottonwood Conduit and the Salt Lake Aqueduct.

Source Pumps

There are no source pumps in the 7800 South Intermediate Zone.

Booster Pumps

There are six booster pumps pumping to the 7800 South Intermediate Zone. Table 19-4 indicates the location of these booster pumps and the status of the pumps during the static simulation.

Table 19-4 7800 South Intermediate Reservoir Booster Pumps		
Pump	**Location**	**Status No.**
7800 S. #1	7800 S.	OFF
7800 S. #2	7800 S.	ON
7800 S. #4	7800 S.	OFF
7800 S. #6	7800 S.	ON
7800 S. #8	7800 S.	OFF
7800 S. #9	7800 S.	OFF

Calibration

Prior to the modelling effort, a series of fire hydrant flow tests were conducted within the Salt Lake County Distribution System to assist in the calibration of the model. Within the 7800 South Intermediate, one test was conducted. The results of the tests in the 7800 South Intermediate are summarized in Table 19-5.

Table 19-5 7800 South Intermediate Calibration Test Results				
	Static Pressure		**Dynamic Pressure**	
Test No.	**Measured**	**Calculated**	**Measured**	**Calculated**
16	85	91	60	15.99

During the static calibration of the model, runs were made at an average demand scenario and adjustments made until the measured pressure equalled the modelled pressure as near as possible. Typical adjustments included the opening and closing of system valves, the adjustment of PRV pressure settings, and the verification of node elevations.

After completion of the static calibration, the model was calibrated against the fire flow tests. This is called the dynamic calibration. The intent of the dynamic calibration is to test the system under some stress (high flows) and check the model's performance against that condition. The measured flows from the fire hydrants were modeled and the calculated pressures compared against those measured in the field. Adjustments in the model were made to bring the calculated results in line with the field measured results.

Dynamic calibration often requires an iterative process. Initial field measurements and system maps are used to set up the model, but the situation in the field is frequently not exactly as described in the maps and other system documentation. Inaccurate mapping (with inexact elevations), valves not in the position recorded (either open or closed), or pipes a different size than shown on maps, are all conditions that exist in most water distribution systems. To get an accurate dynamic model it is often necessary to go back into the field and check valve position, elevation, etc. This additional field work to verify model conditions was not done as a part of this study. It is recommended that as time and manpower permit, field verification be undertaken. For example, elevations of reservoirs, pump stations and PRVs are known. However, the elevations for the remainder of the system were obtained from USGS mapping and are likely not completely accurate for a given location. An elevation difference (between actual and the model) of 5 feet would result in a pressure difference of 2.2 psi. The elevation contours on the USGS mapping are 40 feet. Errors in elevations of up to 20 feet could be expected using this type of mapping. A 20-foot elevation difference would result in a pressure difference of almost 9 psi. Static and dynamic calibration results must be viewed with this potential for errors based on erroneous information in mind.

The calculated static pressure is fairly close to the measured static pressure. However, the calculated dynamic pressure is about one-fourth of the measured pressure. This can be caused by an open SV that is not shown on system maps, a different pump operating plan than assumed or a PRV setting higher than believed. Field verification of the model operating parameters is recommended.

Fire Run Simulations

Fourteen simulated fires were run in the 7800 South Intermediate Zone. The location of the fire simulations are shown in Figure 19-2. Table 19-6 shows the low pressure in the zone for each of the fire runs.

Table 19-6
7800 South Intermediate Fire Flow Results

Simulation No.	Fire Flow (gpm)	Calculated Pressure	Simulation No.	Fire Flow (gpm)	Calculated Pressure
1T	1006.66	100.82	8T	1004.62	77.73
2T	1004.70	74.46	9T	1003.26	78.03
3T	1004.54	75.16	10T	1003.72	75.47
4T	1005.44	128.80	11T	1002.98	111.03
5T	1005.00	116.62	12T	1006.64	120.16
6T	1005.84	103.33	13T	1006.20	109.49
7T	1005.94	72.77	14T	1006.52	50.59

Problem Areas

All fire simulations showed pressure and flow above the minimum required.

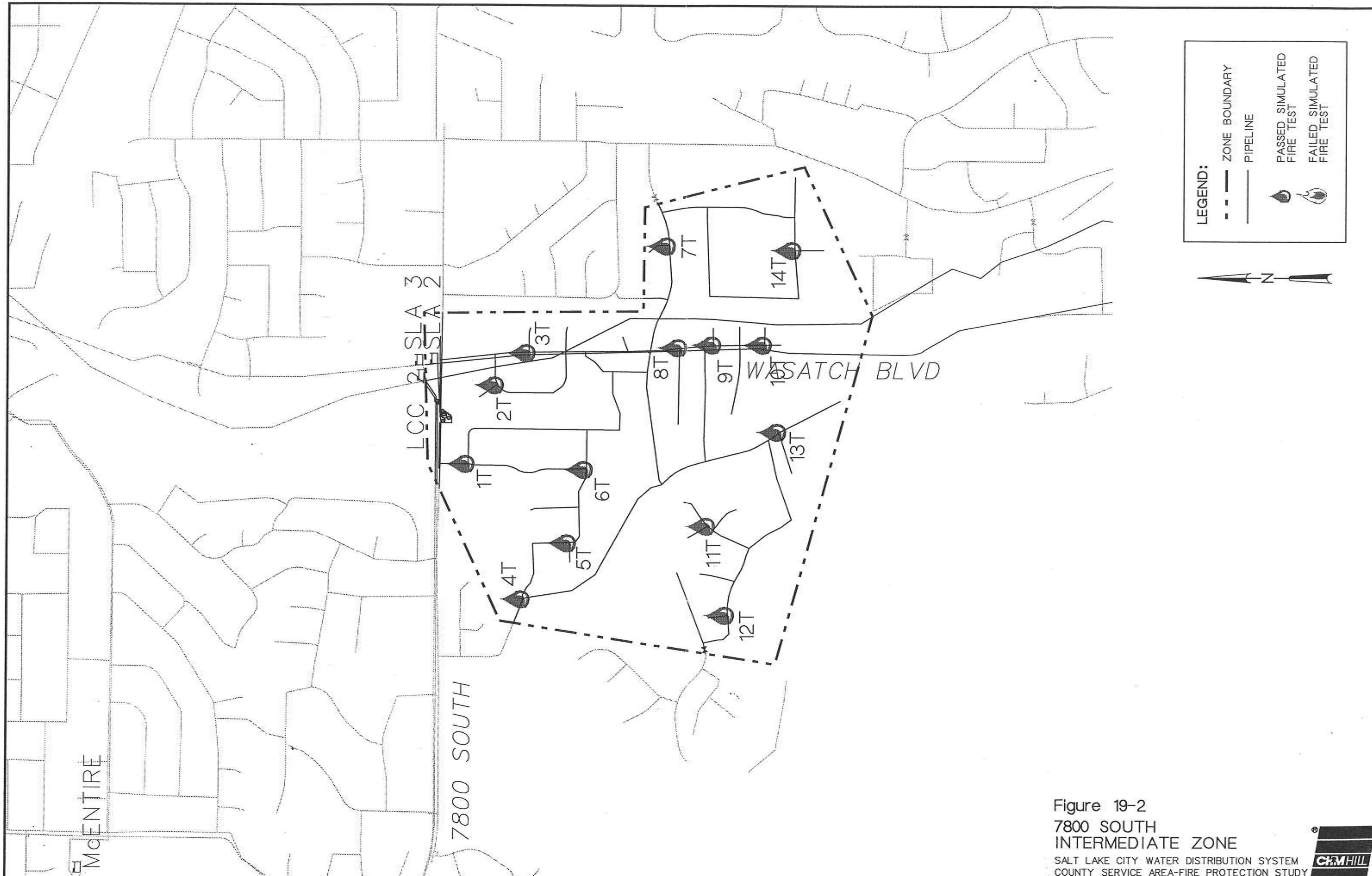


Figure 19-2
7800 SOUTH
INTERMEDIATE ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

CH2M HILL

RMW37123\FIGURES\FIRES\ZONE19-2.DLV

Russell Park Regulated Zone

Chapter 20
Russell Park Regulated Zone

System Geometry

The Russell Park Regulated Zone of the Salt Lake County water distribution system is a very small area located at the south of Wasatch Boulevard. The Russell Park Regulated Zone distribution system is shown in Figure 20-1.

Piping

Table 20-1 indicates the size distribution and total length of the piping within the Russell Park Regulated.

Table 20-1
Russell Park Regulated
Reservoir Piping Distribution

Diameter	Length in Zone
4" or less	0
6"	13,829
8"	2,765
10"	0
12" or greater	5,921
Total Length	22,314

Valves

The Russell Park Regulated Zone is separated from the adjoining zones through a series of SVs and PRVs. Table 20-2 shows the system valves within the Russell Park Regulated which were closed during the simulations.

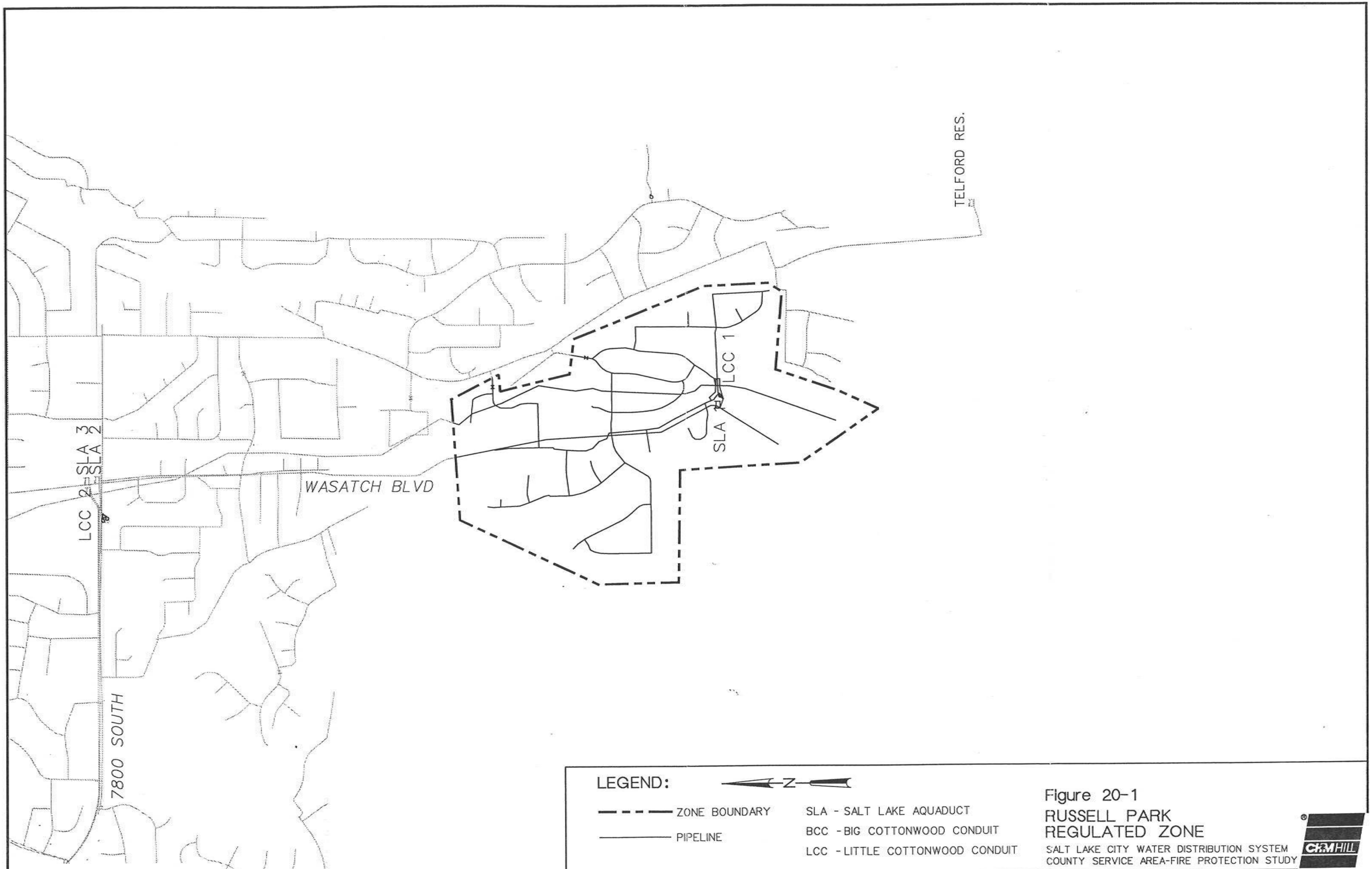


Figure 20-1
RUSSELL PARK
REGULATED ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

RMW37123\FIGURES\FIRES\ZONE21-1.DLV

Table 20-2 Russell Park Regulated Reservoir System Valves	
idsys	**Location**
14995	Little Willow, Little Cottonwood Conduit
57709	Little Willow, Little Cottonwood Conduit

The Russell Park Regulated portion of the model includes two PRVs. Table 20-3 shows the location, pressure setting and HGL of the PRVs.

Table 20-3 Russell Park Regulated PRVs				
Station No.	**idsys**	**Location**	**Pressure Setting**	**HGL**
CR-29A	56697	Daneborg Road	65	5159.00
CR-27A	56696	Russell Park	58	5172.00

Reservoirs

There are no reservoirs directly serving this zone.

Source Pumps

There are no source pumps in the Russell Park Regulated Zone.

Booster Pumps

There is one booster pump in the Russell Park Regulated Zone. Table 20-4 indicates the location of the booster pump and the status of the pump during the simulations.

Table 20-4 Russell Park Regulated Reservoir Booster Pumps		
Pump	**Location**	**Status**
Little Willow Pump	Danish	OFF

Calibration

There were no fire hydrant tests conducted in this zone.

Fire Run Simulations

Eight fire simulations were run in this zone. The location of the fire simulations are shown in Figure 20-2. Table 20-5 shows the low pressure in the zone for each of the fire runs.

Table 20-5
Russell Park Regulated Fire Flow Results

Simulation No.	Fire Flow (gpm)	Calculated Pressure
1R	1007.36	102.49
2R	1009.06	103.82
3R	1009.22	108.53
4R	1007.62	83.19
5R	1008.00	66.56
6R	1006.56	3.45
7R	1004.98	< 0
8R	1011.40	54.56

Problem Areas

The areas in which fire flow and pressure were not achieved are shown in Figure 20-2.

Recommended Solutions

For each of the areas in which fire flow and pressure were not achieved, an improvement was developed. For this pressure zone the improvements consisted of an additional PRV to supply the area and some additional pipe. Figure 20-3 shows the required improvements for the Russell Park Regulated Zone. A cost estimate was prepared for each of these improvements. Table 20-6 shows these cost estimates.

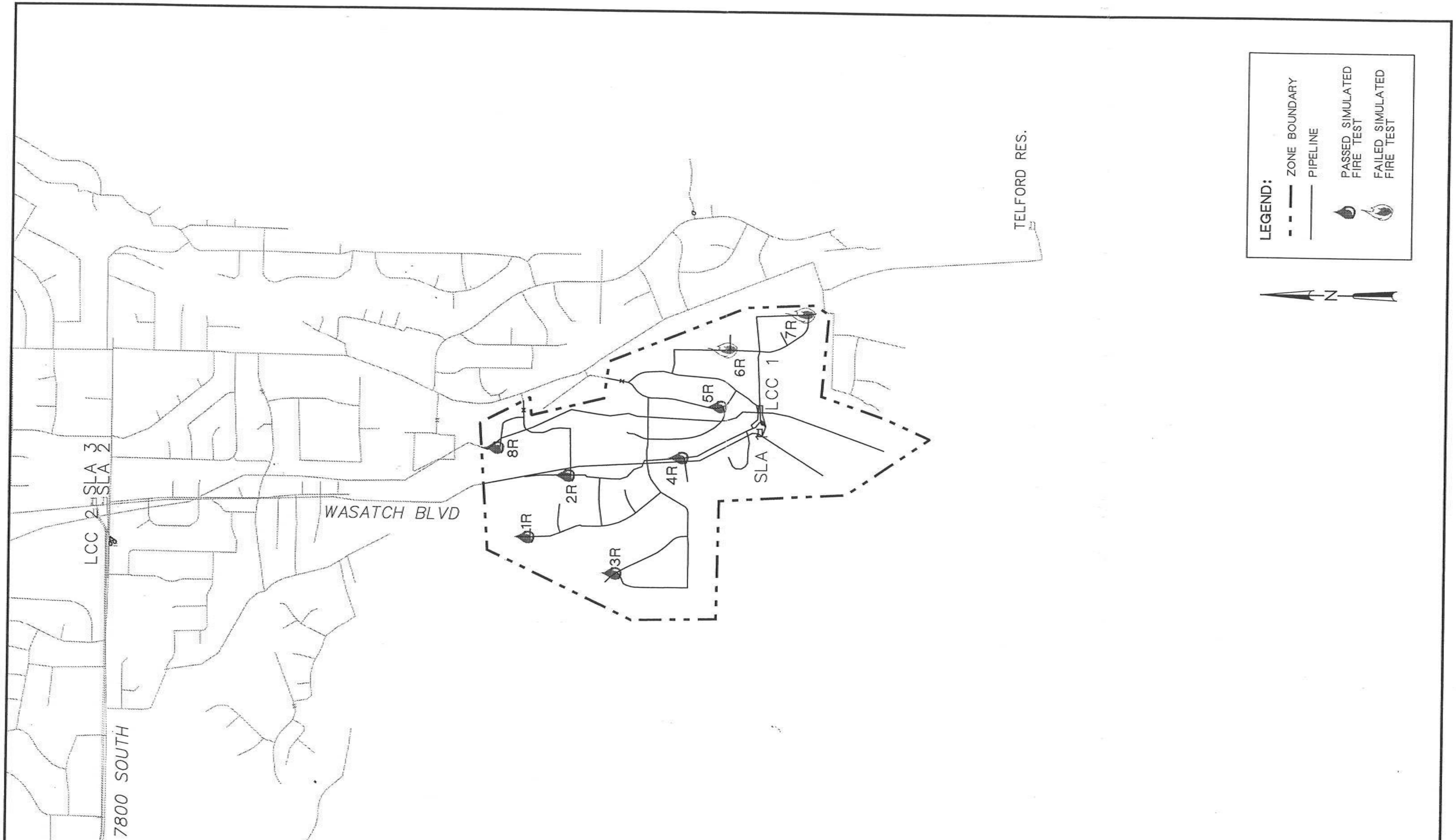
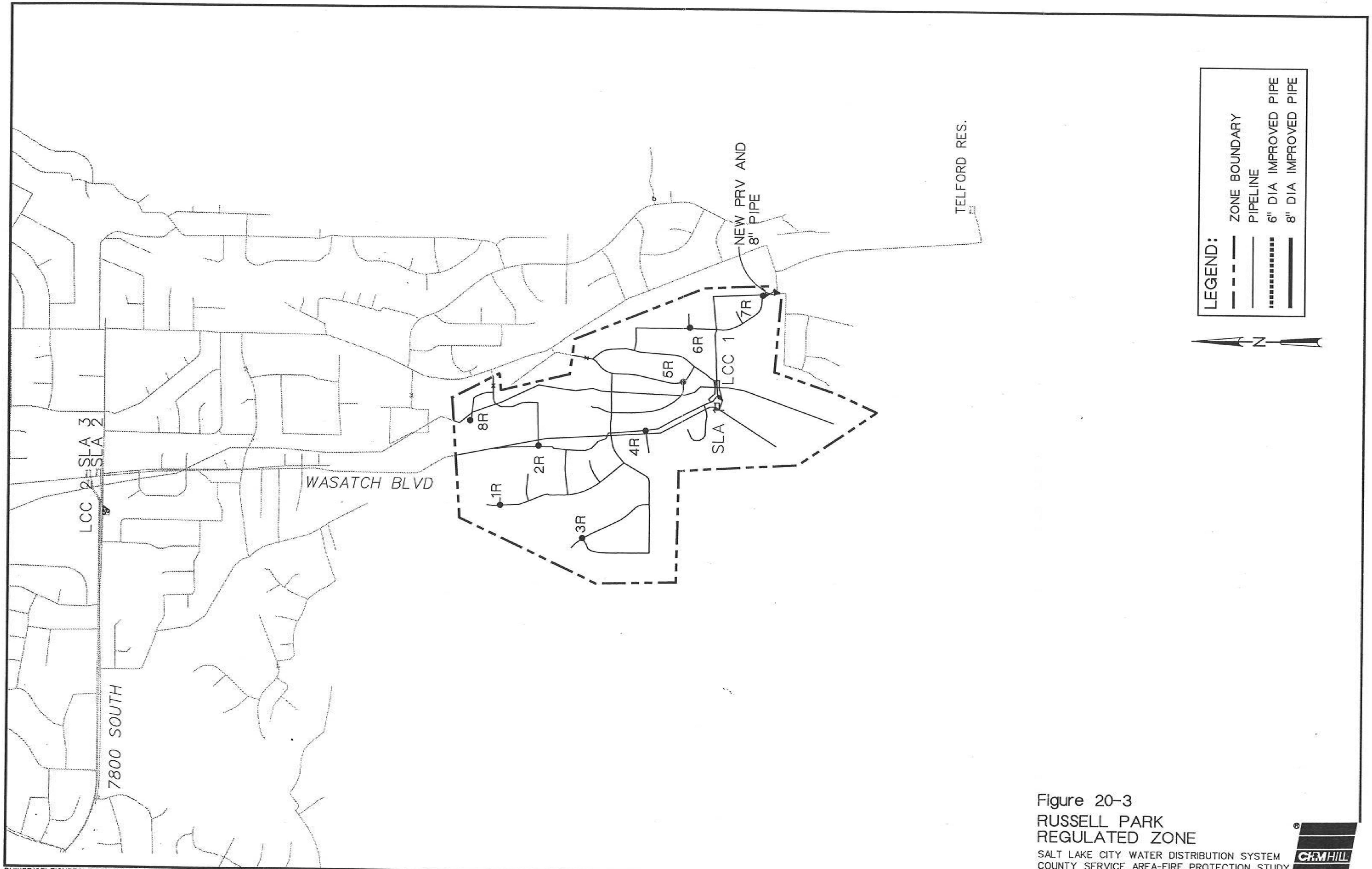


Figure 20-2
RUSSELL PARK
REGULATED ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

RMW37123\FIGURES\FIRES\ZONE21-2.DLV



RMW37123\FIGURES\FIRES\ZONE21-3.DLV

Figure 20-3
RUSSELL PARK
REGULATED ZONE
SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

CH2M HILL

Table 20-6

Salt Lake City Department of Public Utilities
Fire Flow Study
Cost Estimate - Russell Park

idsys	Existing Length	New Length	Existing Diameter	New Diameter	Number Required				Cost					
					Valves	Hydrants	Service	Repair	Pipe	Valves	Hydrants	Service	Repair	TOTAL
	LF	LF	inch	inch	ea	ea	ea	cy	$	$	$	$	$	$
58131	0	98	0	8	1	1	3	328	6,391	780	2,500	1,950	1,577	13,198
					1	1	3	328	6,391	780	2,500	1,950	1,577	13,198
									Eng, Legal & Admin				15%	1,980
									Subtotal				-	**15,178**
									Contigency				15%	2,277
									TOTAL				-	**17,454**

Gravity 3 Zone

Chapter 21
Gravity 3 Zone

System Geometry

The Gravity 3 Zone of the Salt Lake County water distribution system is the smallest of the county service area zones modeled. The Gravity 3 Zone distribution system is shown in Figure 21-1.

Piping

Table 21-1 indicates the size distribution and total length of the piping within the Gravity 3.

Table 21-1
Gravity 3
Reservoir Piping Distribution

Diameter	Length in Zone
4" or less	416.14
6"	4113.97
8"	546.95
10"	0
12" or greater	2754.909
Total Length	7831.96

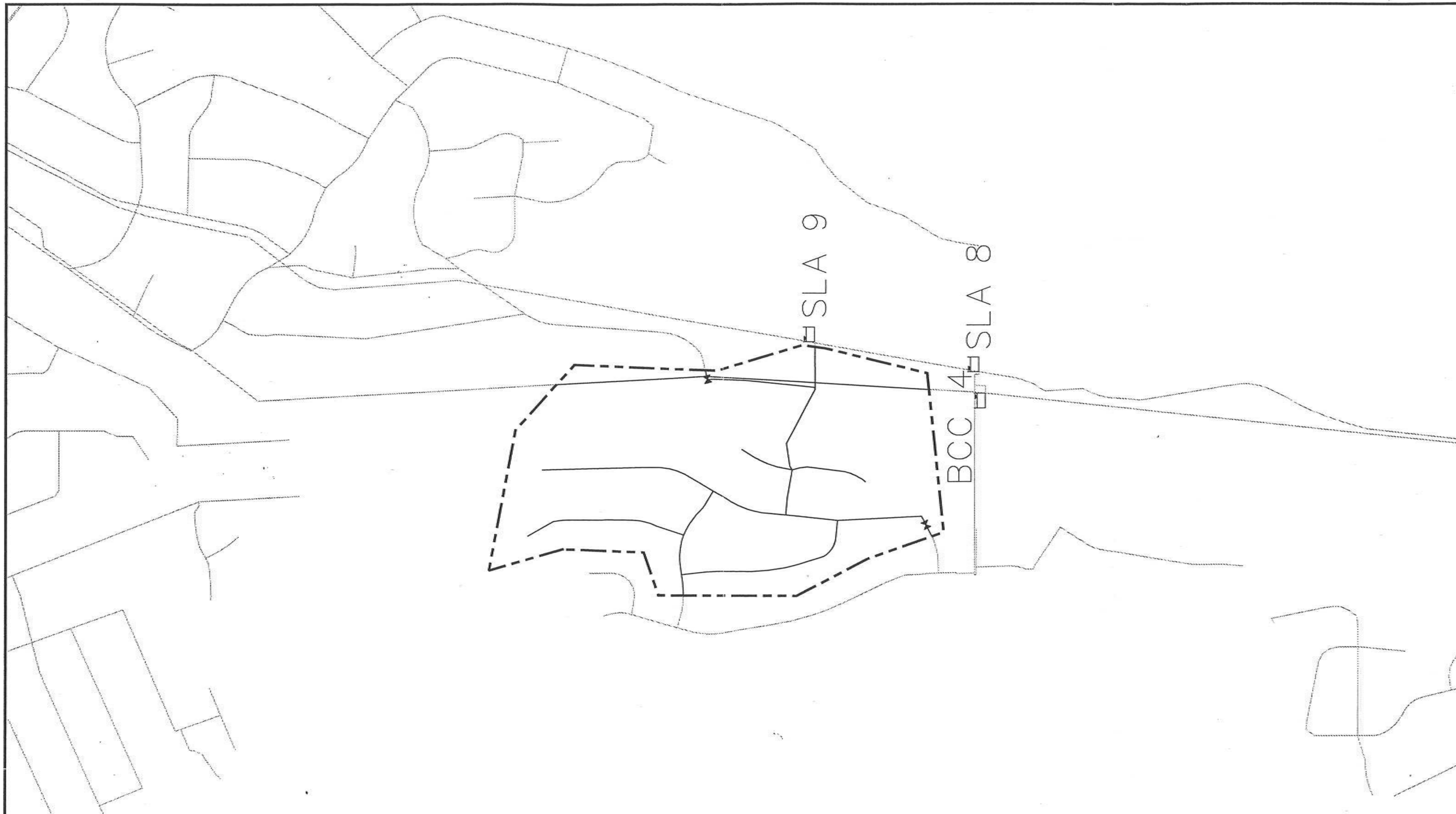
Valves

There are no system valves in the Gravity 3 Zone.

The Gravity 3 portion of the model includes one PRV. Table 21-2 shows the location, pressure setting and HGL of the PRVs.

Table 21-2
Gravity 3 PRVs

Station No.	idsys	Location	Pressure Setting	HGL
CR-13A	56670	Wallace Lane	65	4833.00



LEGEND: ←Z←

- - - ZONE BOUNDARY
—— PIPELINE

SLA - SALT LAKE AQUADUCT
BCC - BIG COTTONWOOD CONDUIT
LCC - LITTLE COTTONWOOD CONDUIT

Figure 21-1

GRAVITY 3

SALT LAKE CITY WATER DISTRIBUTION SYSTEM
COUNTY SERVICE AREA-FIRE PROTECTION STUDY

CH2M HILL

RMW37123\FIGURES\FIRES\ZONE23-1.DLV

Reservoirs

The Salt Lake Aqueduct supplies water to this zone and controls the hydraulic grade line.

Source Pumps

There are no source pumps in the Gravity 3 Zone.

Booster Pumps

There are no booster pumps in the Gravity 3 Zone.

Calibration

Prior to the modelling effort, a series of fire hydrant flow tests were conducted within the Salt Lake County distribution system to assist in the calibration of the model. Within the Gravity 3, one test was conducted. The results of the tests in the Gravity 3 are summarized in Table 21-3.

Table 21-3
Gravity 3 Zone Calibration Test Results

	Static Pressure		Dynamic Pressure	
Test No.	Measured	Calculated	Measured	Calculated
20	130	126	10	119.29

During the static calibration of the model, runs were made at an average demand scenario and adjustments made until the measured pressure equalled the modelled pressure as near as possible. Typical adjustments included the opening and closing of system valves, the adjustment of PRV pressure settings, and the verification of node elevations.

After completion of the static calibration, the model was calibrated against the fire flow tests. This is called the dynamic calibration. The intent of the dynamic calibration is to test the system under some stress (high flows) and check the model's performance against that condition. The measured flows from the fire hydrants were modeled and the calculated pressures compared against those measured in the field. Adjustments in the model were made to bring the calculated results in line with the field measured results.

Dynamic calibration often requires an iterative process. Initial field measurements and system maps are used to set up the model, but the situation in the field is frequently not exactly as described in the maps and other system documentation. Inaccurate mapping (with inexact elevations), valves not in the position recorded (either open or closed), or pipes a different size than shown on maps, are all conditions that exist in most water distribution systems. To get an accurate dynamic model it is often necessary to go back into the field and check valve position, elevation, etc. This additional field work to verify model conditions was not done as a part of this study. It is recommended that as time and manpower permit, field verification be undertaken. For example, elevations of reservoirs, pump stations and PRVs are known. However, the elevations for the remainder of the system were obtained from USGS mapping and are likely not completely accurate for a given location. An elevation difference (between actual and the model) of 5 feet would result in a pressure difference of 2.2 psi. The elevation contours on the USGS mapping are 40 feet. Errors in elevations of up to 20 feet could be expected using this type of mapping. A 20-foot elevation difference would result in a pressure difference of almost 9 psi. Static and dynamic calibration results must be viewed with this potential for errors based on erroneous information in mind.

Fire Run Simulations

Four fire simulations were run. The locations of the fire simulations are shown in Figure 21-2. Table 21-4 shows the low pressure in the zone for each of the fire runs.

Table 21-4
Gravity 3 Fire Flow Results

Simulation No.	Fire Flow (gpm)	Calculated Pressure
1G3	1007.10	110.83
2G3	1007.96	100.18
3G3	1002.00	67.96
4G3	1009.04	118.83