

APPENDIX L

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This appendix supplements Chapter 7 and provides the detailed results from the hydrant (C-Factor) flow tests. A summary of the hydrant test calibration results is provided in Table 1.

As mentioned in Chapter 7, based on the comparison of the collected hydrant test data and model simulation results, five of the hydrant tests required further review and evaluation because they did not initially meet the ± 5 psi tolerance limit for calibration. Further discussion regarding these tests is provided in the subsections below.

Test 4: 6-inch AC Along Pantaleo Drive near Carmella Way

Initial model simulation results indicate that there may have been an error with the residual pressure reading at observed Hydrant 4B. The difference between field-observed and model-simulated pressures for Hydrant 4B was 9 psi. In addition, model simulation results from observed Hydrant 4A and 4C were well within the ± 5 psi tolerance limit. In addition, the C-factor for AC pipelines from the 1980s are validated by Tests 6 and 9. Therefore, it is recommended that the data from Hydrant 4B not be used.

Test 5: 6-inch AC (STL) Along Wycliffe Drive near Scenic Drive

During the initial field set-up, City Operations staff indicated that the tested pipeline was made of steel. This was later confirmed by a review of the material type contained in both the City's latest GIS shapefile and the City Water Operations mapbook. As a result, the material type for this tested pipeline and surrounding pipelines was updated in the hydraulic model and a C-factor of 85 was assigned.

Initial model simulation results indicate that there may have been an error with the residual pressure reading at observed Hydrant 5B. The difference between field-observed and model-simulated pressures for Hydrant 5B was 24 psi. Field recorded static and residual pressures at this location were 59 and 57 psi, respectively. The fact that there is not more of a pressure drop between the two readings suggests that field recorded results were inaccurately captured. In addition, Test 5 was conducted before Test 4 during that hydrant test day. It is likely that the field-observed pressure results were recorded incorrectly for both tests (Tests 4 and 5). In addition, the C-Factor for steel pipelines was validated by Test 17. Therefore, it is recommended that data from Hydrant 5B not be used.

Test 8: 6-inch STL Along Moran Avenue near Phoenix Avenue

Initial model simulation results indicate that the C-factor assigned for this pipeline may be incorrect. The difference between field-observed and model-simulated pressures for Hydrant 8A was 50 psi. During this test, there was a large amount of sand that was discharged. The flowing hydrant was allowed to flow until water discharged from the flowing hydrant began to clear up. As a result, the C-factor for this pipeline was decreased to 50. With this adjustment, model-simulated pressures were improved to be within 4 psi.

Based on the results of other tests, C-factors for steel pipes were estimated to be 85 or higher. However, the same discharge characteristics were not observed at other tests and thus, the low C-factor observed for this test is expected to be a localized issue. Therefore, C-factors of pipelines with the same material type, in the vicinity of the tested pipeline, were adjusted to 50.

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Test 12: 6-inch CI Along Hilton Street near Enslin Avenue

The difference between field-observed and model-simulated pressures for all observed hydrants in Test 12 initially ranged from 96 psi to 11 psi. These model simulation results indicate that there may have been system configuration issues (e.g., partially closed valve(s)) within the area of Test 12.

To conduct Test 12, the valve at the intersection of Enslin Avenue and Hilton Street and the valve at the intersection of Brady Avenue and Hilton Street had to be closed to isolate the 6-inch cast iron pipeline for testing. The large error at all observed hydrants, particularly at Hydrant 12A (i.e., the highest differential pressure reading from model-simulated results) suggests that the valve at the intersection of Enslin Avenue and Hilton Street may not have been fully closed during the test. When this valve is assumed to be partially open in the hydraulic model, the comparisons between field-observed and model-simulated differential pressures are well within ± 5 psi. Therefore, Test 12 was assumed to have a partially opened valve at the intersection of Enslin Avenue and Hilton Street.

Test 19: 6-inch ST Along Paradise Road near Pauline Avenue

The difference between field-observed and model-simulated pressures for all observed hydrants in Test 19 initially ranged from 36 psi to 16 psi. These model simulation results indicate that there may have been system configuration issues (e.g., partially closed valve(s)) within the area of Test 19.

To conduct Test 19, the valve at the intersection of Grimes Avenue and Paradise Avenue had to be closed to isolate the 6-inch steel pipeline for testing. The large errors (i.e., the differential pressure readings from model-simulated results) at all the observed hydrants suggests that this valve may not have been fully closed during the test. When this valve is assumed to be partially open in the hydraulic model, the comparisons between field-observed and model-simulated differential pressures are well within the ± 5 psi. Therefore, Test 19 was assumed to have a partially opened valve at the intersection of Grimes Avenue and Paradise Avenue.

Table 1. Summary of Hydrant Test Calibration Results

Hydrant ^(a)	Field Data			Modeled Data			Comparison of Differential Pressures between Field and Modeled Data ^(b)
	Static Pressure, psi	Residual Pressure, psi	Differential Pressure, psi (Static - Residual)	Static Pressure, psi	Residual Pressure, psi	Differential Pressure, psi (Static - Residual)	
Hydrant Flow Test No. 1 [Ortega Drive, south of Galvez Ave]							
Flowing 1	56	20	N/A	66	N/A	N/A	N/A
1A	61	39	22	66	41	25	-3
1B	61	45	16	66	50	16	0
1C	62	58	4	66	61	4	0
Hydrant Flow Test No. 2 [Kientz Avenue, west of Stuben Way]							
Flowing 2	56	5	N/A	0	N/A	N/A	N/A
2A	61	34	27	63	33	30	-3
2B	60	50	10	63	51	12	-2
Hydrant Flow Test No. 3 [Norik Drive, north of Margo Drive]							
Flowing 3	55	22	N/A	65	N/A	N/A	N/A
3A	62	38	24	65	41	24	0
3B	62	49	13	65	53	12	1
3C	60	56	4	65	61	3	1
Hydrant Flow Test No. 4 [Pantaleo Drive, South of Carmella Way]							
Flowing 4	56	6	N/A	65	N/A	N/A	N/A
4A	64	22	42	65	23	41	0
4B	64	25	39	65	35	30	9
4C	65	46	19	65	47	18	1
Hydrant Flow Test No. 5 [East end of Wycliffe Drive, south of Scenic Drive]							
Flowing 5	50	0	N/A	61	N/A	N/A	N/A
5A	58	12	46	62	15	47	-1
5B	59	57	2	62	37	26	-24
Hydrant Flow Test No. 6 [Larned Lane, at intersection of Goodland Court]							
Flowing 6	56	3	N/A	63	N/A	N/A	N/A
6A	56	12	44	63	18	45	-1
6B	55	26	29	63	33	30	-1
6C	58	40	18	63	46	17	1
Hydrant Flow Test No. 7 [El Goya Drive, east of N. Riverside Drive]							
Flowing 7	64	12	N/A	65	N/A	N/A	N/A
7A	60	24	36	65	30	35	1
7B	61	39	22	65	42	23	-1
7C	63	51	12	65	53	12	-1
Hydrant Flow Test No. 8 [Moran Avenue, east of Pheonix Avenue]							
Flowing 8	68	0	N/A	65	N/A	N/A	N/A
8A	62	24	38	64	31	34	4
8B	61	48	13	64	48	16	-3
Hydrant Flow Test No. 9 [Albion Way, east of July Drive]							
Flowing 9	67	7	N/A	75	N/A	N/A	N/A
9A	66	25	41	75	37	38	3
9B	67	38	29	75	50	25	4
9C	70	56	14	75	63	12	2
Hydrant Flow Test No. 10 [Jim Way, south of Olivero Road]							
Flowing 10	62	25	N/A	63	N/A	N/A	N/A
10A	58	46	12	63	49	14	-2
10B	59	49	10	63	50	13	-3
10C	59	51	8	63	53	10	-2
10D	61	54	7	63	54	9	-2

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Hydrant ^(a)	Field Data			Modeled Data			Comparison of Differential Pressures between Field and Modeled Data ^(b)
	Static Pressure, psi	Residual Pressure, psi	Differential Pressure, psi (Static - Residual)	Static Pressure, psi	Residual Pressure, psi	Differential Pressure, psi (Static - Residual)	
Hydrant Flow Test No. 11 [Hahn Drive, north of English Oaks Drive]							
Flowing 11	66	30	N/A	72	N/A	N/A	N/A
11A	67	52	15	72	56	16	-1
11B	68	52	16	72	60	12	4
11C	68	60	8	72	64	8	0
Hydrant Flow Test No. 12 [Hilton Street, east of Enslin Avenue]							
Flowing 12	62	18	N/A	69	N/A	N/A	N/A
12A	67	39	28	69	41	28	0
12B	68	47	21	69	51	18	3
12C	70	60	10	69	63	5	5
Hydrant Flow Test No. 13 [Lauralee Court, east of southwest curve]							
Flowing 13	72	10	N/A	72	N/A	N/A	N/A
13A	72	36	36	72	36	36	0
13B	69	51	18	72	54	17	1
Hydrant Flow Test No. 14 [Wellington Drive, east of York Way]							
Flowing 14	62	3	N/A	68	N/A	N/A	N/A
14A	63	25	38	68	31	37	1
14B	63	44	19	68	49	19	0
Hydrant Flow Test No. 15 [Rugby Lane, west of Brentford Way]							
Flowing 15	63	12	N/A	65	N/A	N/A	N/A
15A	59	27	32	65	32	34	-2
15B	60	41	19	65	47	18	1
15C	63	58	5	65	62	3	2
Hydrant Flow Test No. 16 [West end of Elmo Loop, north of Snyder Avenue]							
Flowing 16	74	31	N/A	74	N/A	N/A	N/A
16A	72	46	26	74	52	22	3
16B	70	56	14	74	61	13	1
16C	72	64	9	74	67	7	1
Hydrant Flow Test No. 17 [River Road, southeast of Herndon Road]							
Flowing 17	67	0	N/A	62	N/A	N/A	N/A
17A	62	29	33	62	31	31	2
17B	60	38	22	60	37	24	-2
17C	61	42	19	61	42	19	0
Hydrant Flow Test No. 18 [Countryview Drive, east of Stonegate Drive (Del Rio)]							
Hydrant Flow Test No. 19 [Intersection of Paradise Road and Pauline Avenue]							
Flowing 19	74	0	N/A	76	N/A	N/A	N/A
19A	71	19	52	77	28	48	4
19B	72	41	31	77	42	35	-4
19C	74	57	17	76	57	18	-1
19D	76	64	12	76	65	11	1
Hydrant Flow Test No. 20 [Semallon Drive, south of Lindsay Drive]							
Flowing 20	60	31	N/A	65	N/A	N/A	N/A
20A	62	40	22	65	42	23	-1
20B	61	44	17	64	44	20	-3
20C	64	56	8	65	55	10	-2

^(a) Location of hydrants can be found in Appendix K or Chapter 7.

^(b) The goal of the calibration effort is to achieve a differential pressure comparison within 5 psi for observed hydrants.