

Lake Hills Main Blvd. & Mass Grading

Water Main Report



MADDEN

MOORHEAD & STOKES, LLC

CIVIL ENGINEERS

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This item has been electronically signed and sealed by David Ashley Stokes, P.E. using a digital signature and date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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David A Stokes
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David A. Stokes, P.E. #66527
Certificate of Authorization No. EB-0007723

Documents included herein which have been prepared by professionals other than Madden, Moorhead, and Stokes, Inc. are not covered under the above registered engineer's signature and seal

APPENDIX

- A Potable Water Demand and Needed Fire Flow Demand Summaries
- B Water Main Schematic
- C Needed Fire Flow plus Max Day Flow WaterCAD Hydraulic Analysis
- D Peak Hour Flow WaterCAD Hydraulic Analysis
- E HGL Calculations

WATER MAIN ANALYSIS

The proposed development consists of a spine road for future development. The future development consists of +/- 560 senior living homes. The project has an 8" system that will be looped with a future phase. The connection point is the proposed Water Treatment Plant for the Town of Howey-In-The-Hills. The water main will be owned and maintained by the town.

The water main has been modeled under two conditions: (1) needed fire flow (NFF) per NFPA of 1,000 gpm plus max day flow, and (2) peak hour flow. The model analyses presented in Appendices C and D demonstrate minimum system pressures greater than 20 psi for the needed fire flow plus max day condition.

Appendix A

Potable Water Demand and Needed Fire Flow Demand Summaries

Lake Hills

POTABLE WATER DEMANDS

TYPE	DEMAND PER UNIT (GPD)	# OF UNITS	DEMAND TOTAL (GPD)
Lake Hills	300.00	558	167400
			0
			0
		<hr/>	<hr/>
		558	167400

FLOW SUMMARY

AVG DAILY	167400 GPD	116.25 GPM
MAX DAY (x2)	334800 GPD	232.50 GPM
PEAK HOUR (x4)	669600 GPD	465.00 GPM

Lake Hills

NEEDED FIRE FLOW DEMANDS

Needed Fire Flow = 1,000 GPM

Needed fire flow for single family dwellings shall be as follows: homes 5,000SF or less shall provide 1,000 GPM for 1 hour, homes exceeding 5,000 SF shall provide fire flow in accordance with Table 18.4.5.1.2 of NFPQ 1 (FFPC 2012).

Needed Fire Flow per NFPA = 1,000 GPM

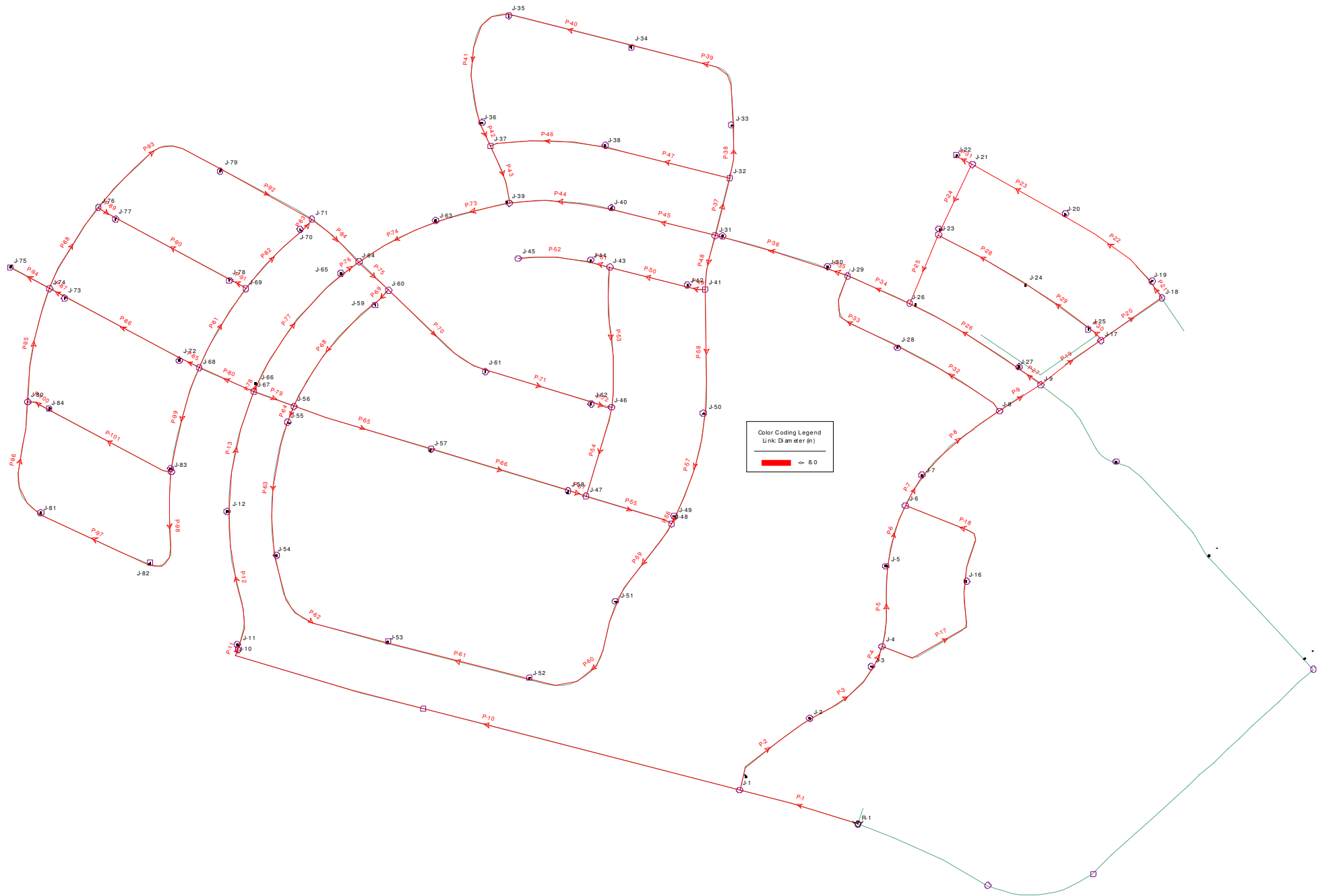
Max Day Demand = 232.50 GPM

TOTAL NFF + MAX DAY DEMAND = 1,232.50 GPM

Appendix B

Water Main Schematic

Scenario: NFF



Color Coding Legend
Link Diameter (in)
8.0

Appendix C

Needed Fire Flow plus Max Day Flow WaterCAD Hydraulic Analysis

Scenario: NFF
Steady State Analysis
Junction Report

Label	Base Flow (gpm)	Elevation (ft)	Type	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)	Description
J-1	4.48	100.31	Demand	4.48	215.84	49.99	
J-2	4.48	97.68	Demand	4.48	212.07	49.49	
J-3	4.48	95.14	Demand	4.48	209.00	49.26	
J-4	0.00	94.23	Demand	0.00	207.80	49.14	
J-5	4.48	91.92	Demand	4.48	206.77	49.69	
J-6	0.00	89.32	Demand	0.00	205.94	50.46	
J-7	4.48	88.68	Demand	4.48	204.42	50.08	
J-8	0.00	86.57	Demand	0.00	200.98	49.50	
J-9	0.00	87.33	Demand	0.00	200.37	48.91	
J-10	0.00	92.19	Demand	0.00	202.15	47.58	
J-11	4.48	90.36	Demand	4.48	201.44	48.06	
J-12	4.47	84.60	Demand	4.47	197.61	48.89	
J-16	4.47	91.00	Demand	4.47	206.80	50.10	
J-17	0.00	81.27	Demand	0.00	200.17	51.44	
J-18	0.00	74.79	Demand	0.00	200.13	54.23	
J-19	4.47	74.65	Demand	4.47	200.11	54.28	
J-20	4.47	74.77	Demand	4.47	200.06	54.21	
J-21	0.00	72.72	Demand	0.00	200.02	55.08	
J-22	4.47	72.18	Demand	4.47	200.02	55.31	
J-23	4.47	76.45	Demand	4.47	200.00	53.45	
J-24	4.47	78.41	Demand	4.47	200.07	52.64	
J-25	4.47	78.61	Demand	4.47	200.14	52.58	
J-26	4.47	82.67	Demand	4.47	199.85	50.70	
J-27	4.47	85.73	Demand	4.47	200.25	49.55	
J-28	4.47	82.90	Demand	4.47	200.04	50.68	
J-29	0.00	79.15	Demand	0.00	199.22	51.95	
J-30	4.47	78.86	Demand	4.47	198.22	51.64	
J-31	4.47	76.16	Demand	4.47	194.83	51.34	
J-32	0.00	74.10	Demand	0.00	194.75	52.20	
J-33	4.47	71.03	Demand	4.47	194.74	53.52	
J-34	4.47	68.89	Demand	4.47	194.71	54.43	
J-35	4.47	70.78	Demand	4.47	194.68	53.61	
J-36	4.47	69.86	Demand	4.47	194.67	54.00	
J-37	0.00	71.13	Demand	0.00	194.66	53.45	
J-38	4.47	71.13	Demand	4.47	194.70	53.46	
J-39	4.47	71.82	Demand	4.47	194.61	53.13	
J-40	0.00	73.71	Demand	0.00	194.72	52.36	
J-41	0.00	76.94	Demand	0.00	194.03	50.66	
J-42	4.47	75.83	Demand	4.47	193.98	51.12	
J-43	0.00	74.32	Demand	0.00	193.83	51.70	
J-44	4.47	74.40	Demand	4.47	193.83	51.67	
J-45	0.00	72.97	Demand	0.00	193.83	52.29	
J-46	0.00	77.74	Demand	0.00	193.59	50.12	
J-47	0.00	82.68	Demand	0.00	193.21	47.82	
J-48	0.00	79.68	Demand	0.00	192.67	48.88	
J-49	4.47	78.48	Demand	4.47	192.77	49.45	
J-50	4.47	75.91	Demand	4.47	193.35	50.81	
J-51	4.47	82.89	Demand	4.47	190.70	46.65	
J-52	4.47	85.38	Demand	4.47	187.99	44.39	
J-53	1,004.47	87.14	Demand	1,004.47	185.24	42.44	
J-54	4.47	84.37	Demand	4.47	189.11	45.32	
J-55	4.47	83.73	Demand	4.47	192.52	47.07	
J-56	0.00	82.12	Demand	0.00	193.30	48.10	
J-57	4.47	84.23	Demand	4.47	193.26	47.17	

Scenario: NFF
Steady State Analysis
Junction Report

Label	Base Flow (gpm)	Elevation (ft)	Type	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)	Description
J-58	4.47	84.67	Demand	4.47	193.21	46.96	
J-59	4.47	74.50	Demand	4.47	193.69	51.57	
J-60	0.00	74.66	Demand	0.00	193.78	51.54	
J-61	4.47	75.10	Demand	4.47	193.68	51.31	
J-62	4.47	76.47	Demand	4.47	193.61	50.68	
J-63	0.00	69.30	Demand	0.00	194.37	54.11	
J-64	0.00	71.89	Demand	0.00	194.09	52.87	
J-65	4.47	73.00	Demand	4.47	194.10	52.39	
J-66	4.47	79.80	Demand	4.47	194.16	49.48	
J-67	0.00	80.27	Demand	0.00	194.16	49.28	
J-68	0.00	78.12	Demand	0.00	194.12	50.19	
J-69	0.00	74.40	Demand	0.00	194.11	51.79	
J-70	4.47	70.85	Demand	4.47	194.10	53.32	
J-71	0.00	92.08	Demand	0.00	194.10	44.14	
J-72	4.47	76.94	Demand	4.47	194.12	50.70	
J-73	4.47	74.84	Demand	4.47	194.11	51.60	
J-74	0.00	72.19	Demand	0.00	194.11	52.75	
J-75	4.47	72.38	Demand	4.47	194.11	52.67	
J-76	0.00	71.68	Demand	0.00	194.11	52.97	
J-77	4.47	70.97	Demand	4.47	194.11	53.27	
J-78	4.47	72.88	Demand	4.47	194.11	52.45	
J-79	4.47	68.21	Demand	4.47	194.10	54.47	
J-80	0.00	75.28	Demand	0.00	194.11	51.41	
J-81	4.47	77.11	Demand	4.47	194.11	50.62	
J-82	4.47	81.89	Demand	4.47	194.11	48.55	
J-83	4.47	81.50	Demand	4.47	194.11	48.72	
J-84	4.47	75.21	Demand	4.47	194.11	51.44	

Scenario: NFF
Steady State Analysis
Pipe Report

Label	Diameter (in)	Length (ft)	Material	Start Node	Stop Node	Hazen-Williams C	Upstream Calculated Pressure (psi)	Downstream Calculated Pressure (psi)	Minor Loss Coefficient	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-1	8.0	405.00	PVC	R-1	J-1	120.0	0.00	49.99	2.00	14.56	7.87
P-2	8.0	342.00	PVC	J-1	J-2	120.0	49.99	49.49	2.00	3.77	4.14
P-3	8.0	272.00	PVC	J-2	J-3	120.0	49.49	49.26	2.00	3.07	4.11
P-4	8.0	74.00	PVC	J-3	J-4	120.0	49.26	49.14	2.00	1.20	4.08
P-5	8.0	266.00	PVC	J-4	J-5	120.0	49.14	49.69	2.00	1.03	2.32
P-6	8.0	208.00	PVC	J-5	J-6	120.0	49.69	50.46	2.00	0.82	2.29
P-7	8.0	113.00	PVC	J-6	J-7	120.0	50.46	50.08	2.00	1.52	4.02
P-8	8.0	332.00	PVC	J-7	J-8	120.0	50.08	49.50	2.00	3.44	3.99
P-9	8.0	162.00	PVC	J-8	J-9	120.0	49.50	48.91	2.00	0.61	2.16
P-10	8.0	1,716.00	PVC	J-1	J-10	120.0	49.99	47.58	2.00	13.69	3.70
P-11	8.0	37.00	PVC	J-10	J-11	120.0	47.58	48.06	2.00	0.71	3.70
P-12	8.0	448.00	PVC	J-11	J-12	120.0	48.06	48.89	2.00	3.83	3.67
P-13	8.0	404.00	PVC	J-12	J-67	120.0	48.89	49.28	2.00	3.45	3.65
P-17	8.0	463.00	PVC	J-4	J-16	120.0	49.14	50.10	2.00	1.00	1.76
P-18	8.0	407.00	PVC	J-16	J-6	120.0	50.10	50.46	2.00	0.86	1.73
P-19	8.0	245.00	PVC	J-9	J-17	120.0	48.91	51.44	2.00	0.20	1.01
P-20	8.0	244.00	PVC	J-17	J-18	120.0	51.44	54.23	2.00	0.04	0.42
P-21	8.0	65.00	PVC	J-18	J-19	120.0	54.23	54.28	2.00	0.01	0.42
P-22	8.0	359.00	PVC	J-19	J-20	120.0	54.28	54.21	2.00	0.05	0.40
P-23	8.0	347.00	PVC	J-20	J-21	120.0	54.21	55.08	2.00	0.04	0.37
P-24	8.0	257.00	PVC	J-21	J-23	120.0	55.08	53.45	2.00	0.03	0.34
P-25	8.0	245.00	PVC	J-23	J-26	120.0	53.45	50.70	2.00	0.14	0.84
P-26	8.0	416.00	PVC	J-26	J-27	120.0	50.70	49.55	2.00	0.39	1.12
P-27	8.0	93.00	PVC	J-27	J-9	120.0	49.55	48.91	2.00	0.12	1.15
P-28	8.0	330.00	PVC	J-23	J-24	120.0	53.45	52.64	2.00	0.08	0.53
P-29	8.0	252.00	PVC	J-24	J-25	120.0	52.64	52.58	2.00	0.07	0.56
P-30	8.0	58.00	PVC	J-25	J-17	120.0	52.58	51.44	2.00	0.03	0.59
P-31	8.0	59.00	PVC	J-22	J-21	120.0	55.31	55.08	2.00	0.00	0.03
P-32	8.0	398.00	PVC	J-8	J-28	120.0	49.50	50.68	2.00	0.94	1.83
P-33	8.0	353.00	PVC	J-28	J-29	120.0	50.68	51.95	2.00	0.82	1.80
P-34	8.0	222.00	PVC	J-29	J-26	120.0	51.95	50.70	2.00	0.63	1.93
P-35	8.0	72.00	PVC	J-29	J-30	120.0	51.95	51.64	2.00	1.00	3.74
P-36	8.0	383.00	PVC	J-30	J-31	120.0	51.64	51.34	2.00	3.39	3.71
P-37	8.0	195.00	PVC	J-31	J-32	120.0	51.34	52.20	2.00	0.08	0.67
P-38	8.0	176.00	PVC	J-32	J-33	120.0	52.20	53.52	2.00	0.02	0.30
P-39	8.0	502.00	PVC	J-33	J-34	120.0	53.52	54.43	2.00	0.03	0.27
P-40	8.0	417.00	PVC	J-34	J-35	120.0	54.43	53.61	2.00	0.02	0.24
P-41	8.0	429.00	PVC	J-35	J-36	120.0	53.61	54.00	2.00	0.02	0.21
P-42	8.0	82.00	PVC	J-36	J-37	120.0	54.00	53.45	2.00	0.00	0.18
P-43	8.0	199.00	PVC	J-37	J-39	120.0	53.45	53.13	2.00	0.05	0.52
P-44	8.0	338.00	PVC	J-39	J-40	120.0	53.13	52.36	2.00	0.11	0.62
P-45	8.0	352.00	PVC	J-40	J-31	120.0	52.36	51.34	2.00	0.11	0.62
P-46	8.0	379.00	PVC	J-37	J-38	120.0	53.45	53.46	2.00	0.04	0.34
P-47	8.0	424.00	PVC	J-38	J-32	120.0	53.46	52.20	2.00	0.05	0.37
P-48	8.0	179.00	PVC	J-31	J-41	120.0	51.34	50.66	2.00	0.80	2.39
P-49	8.0	61.00	PVC	J-41	J-42	120.0	50.66	51.12	2.00	0.06	0.87
P-50	8.0	261.00	PVC	J-42	J-43	120.0	51.12	51.70	2.00	0.15	0.84
P-51	8.0	68.00	PVC	J-43	J-44	120.0	51.70	51.67	2.00	0.00	0.03
P-52	8.0	234.00	PVC	J-44	J-45	120.0	51.67	52.29	2.00	0.00	0.00
P-53	8.0	461.00	PVC	J-43	J-46	120.0	51.70	50.12	2.00	0.24	0.81
P-54	8.0	307.00	PVC	J-46	J-47	120.0	50.12	47.82	2.00	0.38	1.28
P-55	8.0	295.00	PVC	J-47	J-48	120.0	47.82	48.88	2.00	0.54	1.57
P-56	8.0	27.00	PVC	J-48	J-49	120.0	48.88	49.45	2.00	0.10	1.47

Scenario: NFF
Steady State Analysis
Pipe Report

Label	Diameter (in)	Length (ft)	Material	Start Node	Stop Node	Hazen-Williams C	Upstream Calculated Pressure (psi)	Downstream Calculated Pressure (psi)	Minor Loss Coefficient	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-57	8.0	354.00	PVC	J-49	J-50	120.0	49.45	50.81	2.00	0.58	1.50
P-58	8.0	410.00	PVC	J-50	J-41	120.0	50.81	50.66	2.00	0.68	1.52
P-59	8.0	314.00	PVC	J-48	J-51	120.0	48.88	46.65	2.00	1.96	3.03
P-60	8.0	463.00	PVC	J-51	J-52	120.0	46.65	44.39	2.00	2.71	3.01
P-61	8.0	480.00	PVC	J-52	J-53	120.0	44.39	42.44	2.00	2.75	2.98
P-62	8.0	522.00	PVC	J-53	J-54	120.0	42.44	45.32	2.00	3.87	3.43
P-63	8.0	444.00	PVC	J-54	J-55	120.0	45.32	47.07	2.00	3.40	3.46
P-64	8.0	59.00	PVC	J-55	J-56	120.0	47.07	48.10	2.00	0.79	3.49
P-65	8.0	472.00	PVC	J-56	J-57	120.0	48.10	47.17	2.00	0.05	0.34
P-66	8.0	470.00	PVC	J-57	J-58	120.0	47.17	46.96	2.00	0.04	0.32
P-67	8.0	62.00	PVC	J-58	J-47	120.0	46.96	47.82	2.00	0.01	0.29
P-68	8.0	430.00	PVC	J-56	J-59	120.0	48.10	51.57	2.00	0.38	1.09
P-69	8.0	64.00	PVC	J-59	J-60	120.0	51.57	51.54	2.00	0.09	1.12
P-70	8.0	417.00	PVC	J-60	J-61	120.0	51.54	51.31	2.00	0.09	0.52
P-71	8.0	362.00	PVC	J-61	J-62	120.0	51.31	50.68	2.00	0.07	0.49
P-72	8.0	70.00	PVC	J-62	J-46	120.0	50.68	50.12	2.00	0.02	0.47
P-73	8.0	247.00	PVC	J-39	J-63	120.0	53.13	54.11	2.00	0.24	1.11
P-74	8.0	287.00	PVC	J-63	J-64	120.0	54.11	52.87	2.00	0.28	1.11
P-75	8.0	134.00	PVC	J-64	J-60	120.0	52.87	51.54	2.00	0.31	1.64
P-76	8.0	71.00	PVC	J-64	J-65	120.0	52.87	52.39	2.00	0.01	0.34
P-77	8.0	459.00	PVC	J-65	J-66	120.0	52.39	49.48	2.00	0.05	0.37
P-78	8.0	26.00	PVC	J-66	J-67	120.0	49.48	49.28	2.00	0.01	0.40
P-79	8.0	141.00	PVC	J-67	J-56	120.0	49.28	48.10	2.00	0.86	2.75
P-80	8.0	195.00	PVC	J-67	J-68	120.0	49.28	50.19	2.00	0.05	0.50
P-81	8.0	302.00	PVC	J-68	J-69	120.0	50.19	51.79	2.00	0.01	0.20
P-82	8.0	265.00	PVC	J-69	J-70	120.0	51.79	53.32	2.00	0.01	0.15
P-83	8.0	52.00	PVC	J-70	J-71	120.0	53.32	44.14	2.00	0.00	0.12
P-84	8.0	209.00	PVC	J-71	J-64	120.0	44.14	52.87	2.00	0.01	0.19
P-85	8.0	71.00	PVC	J-68	J-72	120.0	50.19	50.70	2.00	0.00	0.15
P-86	8.0	426.00	PVC	J-72	J-73	120.0	50.70	51.60	2.00	0.01	0.12
P-87	8.0	60.00	PVC	J-73	J-74	120.0	51.60	52.75	2.00	0.00	0.10
P-88	8.0	313.00	PVC	J-74	J-76	120.0	52.75	52.97	2.00	0.00	0.10
P-89	8.0	66.00	PVC	J-76	J-77	120.0	52.97	53.27	2.00	0.00	0.00
P-90	8.0	423.00	PVC	J-77	J-78	120.0	53.27	52.45	2.00	0.00	0.03
P-91	8.0	63.00	PVC	J-78	J-69	120.0	52.45	51.79	2.00	0.00	0.06
P-92	8.0	340.00	PVC	J-71	J-79	120.0	44.14	54.47	2.00	0.00	0.07
P-93	8.0	505.00	PVC	J-79	J-76	120.0	54.47	52.97	2.00	0.00	0.10
P-94	8.0	147.00	PVC	J-74	J-75	120.0	52.75	52.67	2.00	0.00	0.03
P-95	8.0	380.00	PVC	J-74	J-80	120.0	52.75	51.41	2.00	0.00	0.03
P-96	8.0	397.00	PVC	J-80	J-81	120.0	51.41	50.62	2.00	0.00	0.00
P-97	8.0	396.00	PVC	J-81	J-82	120.0	50.62	48.55	2.00	0.00	0.03
P-98	8.0	362.00	PVC	J-82	J-83	120.0	48.55	48.72	2.00	0.00	0.06
P-99	8.0	356.00	PVC	J-83	J-68	120.0	48.72	50.19	2.00	0.01	0.14
P-100	8.0	78.00	PVC	J-80	J-84	120.0	51.41	51.44	2.00	0.00	0.03
P-101	8.0	453.00	PVC	J-84	J-83	120.0	51.44	48.72	2.00	0.00	0.06

Scenario: NFF
Steady State Analysis
Reservoir Report

Label	Elevation (ft)	Calculated Hydraulic Grade (ft)	Outflow (gpm)	Description
R-1	230.40	230.40	1,232.50	

Appendix D

Peak Hour Flow WaterCAD Hydraulic Analysis

Scenario: NFF
Steady State Analysis
Junction Report

Label	Base Flow (gpm)	Elevation (ft)	Type	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)	Description
J-1	9.30	100.31	Demand	9.30	230.33	56.25	
J-2	9.30	97.68	Demand	9.30	229.92	57.21	
J-3	9.30	95.14	Demand	9.30	229.62	58.18	
J-4	0.00	94.23	Demand	0.00	229.51	58.53	
J-5	9.30	91.92	Demand	9.30	229.42	59.49	
J-6	0.00	89.32	Demand	0.00	229.36	60.59	
J-7	9.30	88.68	Demand	9.30	229.25	60.82	
J-8	0.00	86.57	Demand	0.00	229.01	61.63	
J-9	0.00	87.33	Demand	0.00	229.00	61.29	
J-10	0.00	87.20	Demand	0.00	229.25	61.46	
J-11	0.00	88.40	Demand	0.00	229.54	61.07	
J-12	0.00	98.10	Demand	0.00	229.85	57.00	
J-13	0.00	105.80	Demand	0.00	229.91	53.70	
J-14	0.00	131.78	Demand	0.00	230.16	42.57	
J-15	0.00	130.96	Demand	0.00	230.27	42.97	
J-16	9.30	91.00	Demand	9.30	229.42	59.89	
J-17	0.00	81.27	Demand	0.00	228.90	63.87	
J-18	0.00	74.79	Demand	0.00	228.88	66.67	
J-19	9.30	74.65	Demand	9.30	228.88	66.73	
J-20	9.30	74.77	Demand	9.30	228.86	66.67	
J-21	0.00	72.72	Demand	0.00	228.85	67.55	
J-22	9.30	72.18	Demand	9.30	228.85	67.78	
J-23	9.30	76.45	Demand	9.30	228.84	65.93	
J-24	9.30	78.41	Demand	9.30	228.87	65.09	
J-25	9.30	78.61	Demand	9.30	228.89	65.02	
J-26	9.30	82.67	Demand	9.30	228.82	63.23	
J-27	9.30	85.73	Demand	9.30	228.95	61.97	
J-28	9.30	82.90	Demand	9.30	228.83	63.14	
J-29	0.00	79.15	Demand	0.00	228.70	64.70	
J-30	9.30	78.86	Demand	9.30	228.58	64.78	
J-31	9.30	76.16	Demand	9.30	228.20	65.78	
J-32	0.00	74.10	Demand	0.00	228.16	66.65	
J-33	9.30	71.03	Demand	9.30	228.15	67.98	
J-34	9.30	68.89	Demand	9.30	228.13	68.90	
J-35	9.30	70.78	Demand	9.30	228.13	68.08	
J-36	9.30	69.86	Demand	9.30	228.12	68.47	
J-37	0.00	71.13	Demand	0.00	228.12	67.92	
J-38	9.30	71.13	Demand	9.30	228.14	67.93	
J-39	9.30	71.82	Demand	9.30	228.12	67.62	
J-40	0.00	73.71	Demand	0.00	228.16	66.82	
J-41	0.00	76.94	Demand	0.00	228.10	65.40	
J-42	9.30	75.83	Demand	9.30	228.09	65.88	
J-43	0.00	74.32	Demand	0.00	228.06	66.52	
J-44	9.30	74.40	Demand	9.30	228.06	66.48	
J-45	0.00	72.97	Demand	0.00	228.06	67.10	
J-46	0.00	77.74	Demand	0.00	228.02	65.02	
J-47	0.00	82.68	Demand	0.00	228.02	62.88	
J-48	0.00	79.68	Demand	0.00	228.02	64.18	
J-49	9.30	78.48	Demand	9.30	228.02	64.70	
J-50	9.30	75.91	Demand	9.30	228.05	65.83	
J-51	9.30	82.89	Demand	9.30	228.01	62.79	
J-52	9.30	85.38	Demand	9.30	228.00	61.71	
J-53	9.30	87.14	Demand	9.30	228.00	60.94	
J-54	9.30	84.37	Demand	9.30	228.00	62.14	

Scenario: NFF
Steady State Analysis
Junction Report

Label	Base Flow (gpm)	Elevation (ft)	Type	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)	Description
J-55	9.30	83.73	Demand	9.30	228.00	62.42	
J-56	0.00	82.12	Demand	0.00	228.00	63.12	
J-57	9.30	84.23	Demand	9.30	228.00	62.20	
J-58	9.30	84.67	Demand	9.30	228.01	62.02	
J-59	9.30	74.50	Demand	9.30	228.01	66.42	
J-60	0.00	74.66	Demand	0.00	228.01	66.35	
J-61	9.30	75.10	Demand	9.30	228.01	66.16	
J-62	9.30	76.47	Demand	9.30	228.02	65.57	
J-63	0.00	69.30	Demand	0.00	228.07	68.69	
J-64	0.00	71.89	Demand	0.00	228.02	67.55	
J-65	9.30	73.00	Demand	9.30	228.01	67.07	
J-66	9.30	79.80	Demand	9.30	228.00	64.12	
J-67	0.00	80.27	Demand	0.00	228.00	63.92	
J-68	0.00	78.12	Demand	0.00	227.98	64.84	
J-69	0.00	74.40	Demand	0.00	227.98	66.45	
J-70	9.30	70.85	Demand	9.30	227.99	67.99	
J-71	0.00	92.08	Demand	0.00	227.99	58.80	
J-72	9.30	76.94	Demand	9.30	227.98	65.35	
J-73	9.30	74.84	Demand	9.30	227.98	66.25	
J-74	0.00	72.19	Demand	0.00	227.98	67.40	
J-75	9.30	72.38	Demand	9.30	227.98	67.32	
J-76	0.00	71.68	Demand	0.00	227.98	67.62	
J-77	9.30	70.97	Demand	9.30	227.98	67.93	
J-78	9.30	72.88	Demand	9.30	227.98	67.11	
J-79	9.30	68.21	Demand	9.30	227.98	69.13	
J-80	0.00	75.28	Demand	0.00	227.97	66.06	
J-81	9.30	77.11	Demand	9.30	227.97	65.27	
J-82	9.30	81.89	Demand	9.30	227.97	63.20	
J-83	9.30	81.50	Demand	9.30	227.97	63.37	
J-84	9.30	75.21	Demand	9.30	227.97	66.09	

Scenario: NFF
Steady State Analysis
Pipe Report

Label	Diameter (in)	Length (ft)	Material	Start Node	Stop Node	Hazen-Williams C	Upstream Calculated Pressure (psi)	Downstream Calculated Pressure (psi)	Minor Loss Coefficient	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-1	12.0	405.00	PVC	R-1	J-1	120.0	0.00	56.25	2.00	0.07	0.58
P-2	8.0	342.00	PVC	J-1	J-2	120.0	56.25	57.21	2.00	0.40	1.25
P-3	8.0	272.00	PVC	J-2	J-3	120.0	57.21	58.18	2.00	0.30	1.19
P-4	8.0	74.00	PVC	J-3	J-4	120.0	58.18	58.53	2.00	0.10	1.14
P-5	8.0	266.00	PVC	J-4	J-5	120.0	58.53	59.49	2.00	0.09	0.64
P-6	8.0	208.00	PVC	J-5	J-6	120.0	59.49	60.59	2.00	0.06	0.58
P-7	8.0	113.00	PVC	J-6	J-7	120.0	60.59	60.82	2.00	0.11	1.02
P-8	8.0	332.00	PVC	J-7	J-8	120.0	60.82	61.63	2.00	0.24	0.96
P-9	8.0	162.00	PVC	J-8	J-9	120.0	61.63	61.29	2.00	0.01	0.21
P-10	10.0	364.00	PVC	J-9	J-10	120.0	61.29	61.46	2.00	0.25	1.06
P-11	10.0	440.00	PVC	J-10	J-11	120.0	61.46	61.07	2.00	0.29	1.06
P-12	10.0	463.00	PVC	J-11	J-12	120.0	61.07	57.00	2.00	0.31	1.06
P-13	10.0	46.00	PVC	J-12	J-13	120.0	57.00	53.70	2.00	0.06	1.06
P-14	12.0	990.00	PVC	J-13	J-14	120.0	53.70	42.57	2.00	0.26	0.74
P-15	12.0	365.00	PVC	J-14	J-15	120.0	42.57	42.97	2.00	0.10	0.74
P-16	12.0	470.00	PVC	J-15	R-1	120.0	42.97	0.00	2.00	0.13	0.74
P-17	8.0	463.00	PVC	J-4	J-16	120.0	58.53	59.89	2.00	0.09	0.49
P-18	8.0	407.00	PVC	J-16	J-6	120.0	59.89	60.59	2.00	0.06	0.43
P-19	8.0	245.00	PVC	J-9	J-17	120.0	61.29	63.87	2.00	0.10	0.68
P-20	8.0	244.00	PVC	J-17	J-18	120.0	63.87	66.67	2.00	0.02	0.29
P-21	8.0	65.00	PVC	J-18	J-19	120.0	66.67	66.73	2.00	0.01	0.29
P-22	8.0	359.00	PVC	J-19	J-20	120.0	66.73	66.67	2.00	0.02	0.23
P-23	8.0	347.00	PVC	J-20	J-21	120.0	66.67	67.55	2.00	0.01	0.18
P-24	8.0	257.00	PVC	J-21	J-23	120.0	67.55	65.93	2.00	0.00	0.12
P-25	8.0	245.00	PVC	J-23	J-26	120.0	65.93	63.23	2.00	0.02	0.33
P-26	10.0	416.00	PVC	J-26	J-27	120.0	63.23	61.97	2.00	0.14	0.72
P-27	10.0	93.00	PVC	J-27	J-9	120.0	61.97	61.29	2.00	0.05	0.76
P-28	8.0	330.00	PVC	J-23	J-24	120.0	65.93	65.09	2.00	0.02	0.27
P-29	8.0	252.00	PVC	J-24	J-25	120.0	65.09	65.02	2.00	0.03	0.33
P-30	8.0	58.00	PVC	J-25	J-17	120.0	65.02	63.87	2.00	0.01	0.39
P-31	8.0	59.00	PVC	J-22	J-21	120.0	67.78	67.55	2.00	0.00	0.06
P-32	8.0	398.00	PVC	J-8	J-28	120.0	61.63	63.14	2.00	0.17	0.74
P-33	8.0	353.00	PVC	J-28	J-29	120.0	63.14	64.70	2.00	0.13	0.68
P-34	10.0	222.00	PVC	J-29	J-26	120.0	64.70	63.23	2.00	0.12	0.89
P-35	10.0	72.00	PVC	J-29	J-30	120.0	64.70	64.78	2.00	0.12	1.33
P-36	10.0	383.00	PVC	J-30	J-31	120.0	64.78	65.78	2.00	0.38	1.29
P-37	8.0	195.00	PVC	J-31	J-32	120.0	65.78	66.65	2.00	0.04	0.49
P-38	8.0	176.00	PVC	J-32	J-33	120.0	66.65	67.98	2.00	0.01	0.25
P-39	8.0	502.00	PVC	J-33	J-34	120.0	67.98	68.90	2.00	0.02	0.19
P-40	8.0	417.00	PVC	J-34	J-35	120.0	68.90	68.08	2.00	0.01	0.13
P-41	8.0	429.00	PVC	J-35	J-36	120.0	68.08	68.47	2.00	0.00	0.07
P-42	8.0	82.00	PVC	J-36	J-37	120.0	68.47	67.92	2.00	0.00	0.01
P-43	8.0	199.00	PVC	J-37	J-39	120.0	67.92	67.62	2.00	0.01	0.20
P-44	10.0	338.00	PVC	J-39	J-40	120.0	67.62	66.82	2.00	0.04	0.43
P-45	10.0	352.00	PVC	J-40	J-31	120.0	66.82	65.78	2.00	0.04	0.43
P-46	8.0	379.00	PVC	J-37	J-38	120.0	67.92	67.93	2.00	0.01	0.19
P-47	8.0	424.00	PVC	J-38	J-32	120.0	67.93	66.65	2.00	0.02	0.25
P-48	8.0	179.00	PVC	J-31	J-41	120.0	65.78	65.40	2.00	0.10	0.79
P-49	8.0	61.00	PVC	J-41	J-42	120.0	65.40	65.88	2.00	0.01	0.42
P-50	8.0	261.00	PVC	J-42	J-43	120.0	65.88	66.52	2.00	0.03	0.36
P-51	8.0	68.00	PVC	J-43	J-44	120.0	66.52	66.48	2.00	0.00	0.06
P-52	8.0	234.00	PVC	J-44	J-45	120.0	66.48	67.10	2.00	0.00	0.00
P-53	8.0	461.00	PVC	J-43	J-46	120.0	66.52	65.02	2.00	0.04	0.30

Scenario: NFF
Steady State Analysis
Pipe Report

Label	Diameter (in)	Length (ft)	Material	Start Node	Stop Node	Hazen-Williams C	Upstream Calculated Pressure (psi)	Downstream Calculated Pressure (psi)	Minor Loss Coefficient	Pressure Pipe Headloss (ft)	Velocity (ft/s)
P-54	8.0	307.00	PVC	J-46	J-47	120.0	65.02	62.88	2.00	0.00	0.13
P-55	8.0	295.00	PVC	J-47	J-48	120.0	62.88	64.18	2.00	0.00	0.07
P-56	8.0	27.00	PVC	J-48	J-49	120.0	64.18	64.70	2.00	0.00	0.26
P-57	8.0	354.00	PVC	J-49	J-50	120.0	64.70	65.83	2.00	0.03	0.31
P-58	8.0	410.00	PVC	J-50	J-41	120.0	65.83	65.40	2.00	0.05	0.37
P-59	8.0	314.00	PVC	J-48	J-51	120.0	64.18	62.79	2.00	0.01	0.18
P-60	8.0	463.00	PVC	J-51	J-52	120.0	62.79	61.71	2.00	0.01	0.12
P-61	8.0	480.00	PVC	J-52	J-53	120.0	61.71	60.94	2.00	0.00	0.06
P-62	8.0	522.00	PVC	J-53	J-54	120.0	60.94	62.14	2.00	0.00	0.01
P-63	8.0	444.00	PVC	J-54	J-55	120.0	62.14	62.42	2.00	0.00	0.05
P-64	8.0	59.00	PVC	J-55	J-56	120.0	62.42	63.12	2.00	0.00	0.11
P-65	8.0	472.00	PVC	J-56	J-57	120.0	63.12	62.20	2.00	0.00	0.08
P-66	8.0	470.00	PVC	J-57	J-58	120.0	62.20	62.02	2.00	0.01	0.14
P-67	8.0	62.00	PVC	J-58	J-47	120.0	62.02	62.88	2.00	0.00	0.20
P-68	8.0	430.00	PVC	J-56	J-59	120.0	63.12	66.42	2.00	0.01	0.13
P-69	8.0	64.00	PVC	J-59	J-60	120.0	66.42	66.35	2.00	0.00	0.19
P-70	8.0	417.00	PVC	J-60	J-61	120.0	66.35	66.16	2.00	0.00	0.06
P-71	8.0	362.00	PVC	J-61	J-62	120.0	66.16	65.57	2.00	0.01	0.12
P-72	8.0	70.00	PVC	J-62	J-46	120.0	65.57	65.02	2.00	0.00	0.18
P-73	10.0	247.00	PVC	J-39	J-63	120.0	67.62	68.69	2.00	0.05	0.52
P-74	10.0	287.00	PVC	J-63	J-64	120.0	68.69	67.55	2.00	0.05	0.52
P-75	8.0	134.00	PVC	J-64	J-60	120.0	67.55	66.35	2.00	0.00	0.14
P-76	10.0	71.00	PVC	J-64	J-65	120.0	67.55	67.07	2.00	0.00	0.21
P-77	10.0	459.00	PVC	J-65	J-66	120.0	67.07	64.12	2.00	0.01	0.17
P-78	8.0	26.00	PVC	J-66	J-67	120.0	64.12	63.92	2.00	0.00	0.20
P-79	8.0	141.00	PVC	J-67	J-56	120.0	63.92	63.12	2.00	0.00	0.10
P-80	8.0	195.00	PVC	J-67	J-68	120.0	63.92	64.84	2.00	0.02	0.30
P-81	8.0	302.00	PVC	J-68	J-69	120.0	64.84	66.45	2.00	0.00	0.01
P-82	8.0	265.00	PVC	J-69	J-70	120.0	66.45	67.99	2.00	0.01	0.14
P-83	8.0	52.00	PVC	J-70	J-71	120.0	67.99	58.80	2.00	0.00	0.20
P-84	8.0	209.00	PVC	J-71	J-64	120.0	58.80	67.55	2.00	0.02	0.35
P-85	8.0	71.00	PVC	J-68	J-72	120.0	64.84	65.35	2.00	0.00	0.16
P-86	8.0	426.00	PVC	J-72	J-73	120.0	65.35	66.25	2.00	0.00	0.10
P-87	8.0	60.00	PVC	J-73	J-74	120.0	66.25	67.40	2.00	0.00	0.04
P-88	8.0	313.00	PVC	J-74	J-76	120.0	67.40	67.62	2.00	0.00	0.10
P-89	8.0	66.00	PVC	J-76	J-77	120.0	67.62	67.93	2.00	0.00	0.01
P-90	8.0	423.00	PVC	J-77	J-78	120.0	67.93	67.11	2.00	0.00	0.07
P-91	8.0	63.00	PVC	J-78	J-69	120.0	67.11	66.45	2.00	0.00	0.13
P-92	8.0	340.00	PVC	J-71	J-79	120.0	58.80	69.13	2.00	0.01	0.15
P-93	8.0	505.00	PVC	J-79	J-76	120.0	69.13	67.62	2.00	0.00	0.09
P-94	8.0	147.00	PVC	J-74	J-75	120.0	67.40	67.32	2.00	0.00	0.06
P-95	8.0	380.00	PVC	J-74	J-80	120.0	67.40	66.06	2.00	0.00	0.08
P-96	8.0	397.00	PVC	J-80	J-81	120.0	66.06	65.27	2.00	0.00	0.05
P-97	8.0	396.00	PVC	J-81	J-82	120.0	65.27	63.20	2.00	0.00	0.01
P-98	8.0	362.00	PVC	J-82	J-83	120.0	63.20	63.37	2.00	0.00	0.07
P-99	8.0	356.00	PVC	J-83	J-68	120.0	63.37	64.84	2.00	0.01	0.16
P-100	8.0	78.00	PVC	J-80	J-84	120.0	66.06	66.09	2.00	0.00	0.03
P-101	8.0	453.00	PVC	J-84	J-83	120.0	66.09	63.37	2.00	0.00	0.03

Scenario: NFF
Steady State Analysis
Reservoir Report

Label	Elevation (ft)	Calculated Hydraulic Grade (ft)	Outflow (gpm)	Description
R-1	230.40	230.40	465.00	

Appendix E
HGL Calculations

HGL CALCULATIONS

Lake Hills

PEAK HOUR FLOW HGL

PEAK HOUR FLOW = 465.00 GPM

TIE-IN PRESSURE AT 465.00 GPM = 50 PSI = 115.4 FT

EXISTING PIPE ELEVATION AT TIE-IN = 115 FT

HGL = 115.4 + 115 = 230.4 FT

NEEDED FIRE FLOW HGL

NEEDED FIRE FLOW + MAX DAY FLOW(LARGEST NEEDED FIRE FLOW USED) = 1,232.50 GPM

TIE-IN PRESSURE AT 1,232.50 GPM = 50 PSI = 115.4 FT

EXISTING PIPE ELEVATION AT TIE-IN = 115 FT

HGL = 115.4 + 115 = 230.4 FT