Mark Taylor Apartments - Rawhide
Scottsdale, Arizona

Basis of Design
Water and Wastewater Needs Report

Prepared for:
Mark Taylor Residential
6623 North Scottsdale Road
Scottsdale, Arizona 85250

Prepared by:
Kimley-Horn and Associates, Inc.
7740 North 16th Street
Suite 300
Phoenix, Arizona 85020

Accepted for -

191769002
February 2015

Kimley»Horn

City of Scottsdale
Water Resources Administration
9379 E. San Salvador
Scottsdale, AZ 85258

Doug Mahaun
3.20.2015

53-DR-2014
3/16/2015

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1.0 INTRODUCTION

Kimley-Horn and Associates, Inc. has prepared this water and wastewater report for the proposed Mark-Taylor Apartments development at the southeast corner of Scottsdale Road and Silverstone Drive as required per the City of Scottsdale. This report will demonstrate that the proposed site conforms to City of Scottsdale design requirements as well as the *Silverstone 160-Acre Mixed Use Project Master Plan* prepared by Wood/Patel.

The proposed project encompasses approximately 16.7 acres and 14 multistory multifamily residential buildings totaling 262 dwelling units.

2.0 DOMESTIC WATER ANALYSIS

2.1 INTENT AND SCOPE

The intent of this section is to evaluate the potable water infrastructure for the proposed Mark-Taylor Apartments development in Scottsdale, Arizona. As a result of this analysis, it will be determined if the potable water infrastructure is capable of satisfying the projected water demands for the proposed development in accordance with the International Fire Code, 2012 ("IFC") for fire prevention.

2.2 GENERAL THEORY

The water system modeling program WaterCAD, developed by Haestad Methods, is used to model the water system servicing the proposed development. The program uses the fluid mechanic headloss theory known as the Hazen-Williams method. This is the typical method used to evaluate water distribution systems.

2.3 INTERNATIONAL FIRE CODE, 2012

According to the City of Scottsdale Fire Department, the 2012 IFC is currently the governing code with respect to fire water system requirements. The IFC evaluates building construction type, occupancy descriptions, and square footage in order to set minimum fire flow with regards to a particular development.

2.4 DOMESTIC WATER SUPPLY

A public water main exists in Silverstone Drive and 74th Street. A portion of this water main is 12" DIP, and the remainder is 8" DIP. This water main is connected to existing water mains in Scottsdale Road (12" DIP) and Williams Drive (8" DIP), creating a loop. A 12" and 8" DIP water main loop will be constructed on-site that will connect to existing 12" DIP stubs in Silverstone Drive and 74th Street and serve new on-site fire hydrants and 8" firelines to the multiple buildings. Domestic water supplies are proposed to serve the apartment buildings. See Appendix C for the Preliminary Utility Plan.

2.5 WATER DEMANDS

Domestic Water Demand

According to the guidelines provided in Figure 6.1-2 of the City of Scottsdale *Standards and Policies, Chapter 6, Water*, the proposed building will add the following demands to the City of Scottsdale's existing system:

Table 1: Domestic Water Demands

	Area (SF)	Unit Count (DU)	Total Demand* (GPD/DU) or (GPD/SF)	ADD (GPM)	Peak Hour (GPM)	Maximum Day (GPM)
Building A	8374	-	0.8	4.7	16.45	9.4
Building B	-	24	185.3	3.1	10.85	6.2
Building C	-	24	185.3	3.1	10.85	6.2
Building D	-	29	185.3	3.7	12.95	7.4
Building E	-	2	185.3	0.3	1.05	0.6
Building F	-	24	185.3	3.1	10.85	6.2
Building G	-	24	185.3	3.1	10.85	6.2
Building H	-	29	185.3	3.7	12.95	7.4
Building I	-	2	185.3	0.3	1.05	0.6
Building J	-	2	185.3	0.3	1.05	0.6
Building K	-	29	185.3	3.7	12.95	7.4
Building L	-	18	185.3	2.3	8.05	4.6
Building M	-	29	185.3	3.7	12.95	7.4
Building N	-	2	185.3	0.3	1.05	0.6
Building O	-	24	185.3	3.1	10.85	6.2
Cabana	470	-	0.8	0.3	1.05	0.6
Maintenance	1016	-	0.8	0.6	2.10	1.2
TOTAL	9860	262		39.4 ✓	137.90	78.8

*High Density Condominium and Commercial/Retail Land use demands per the City of Scottsdale *Standards and Policies, Chapter 6, Water.*

The Peak Hour demand is 3.5 times the Average Daily Demand (ADD). The Maximum Day Demand is two times the ADD.

The *Silverstone 160-Acre Mixed Use Project Master Plan* accounted for the following demands associated with the proposed site:

Table 2: Master Plan Domestic Water Demands

Parcel	Area of Contributing Parcel (AC)	Master Plan WaterCAD Node	Unit Count (DU)	ADD/DU (GPD)	ADD (GPM)	Peak Hour (GPM)	Maximum Day (GPM)
E	8.8	J-40	131	228	20.7	72.6	41.5
E	8.8	J-120	131	228	20.7	72.6	41.5
TOTAL	17.6		262		41.4	145.2	83.0

As demonstrated in the two demand tables above, the water demands for the proposed site are below the demands assigned in the *Silverstone 160-Acre Mixed Use Project Master Plan.* See Appendix F for excerpts from the *Silverstone 160-Acre Mixed Use Project Master Plan.*

Fire Flow Demand

According to the 2012 International Fire Code (IFC), fire flow to Group R (residential) buildings may be reduced by 25%, and then by another 50% if an approved fire sprinkler system is installed. A fire sprinkler system will be installed with all buildings. The largest proposed building is 50,600 S.F. with a V-B

construction type. Therefore, the required maximum building fire flow rate for the proposed buildings is 2,250 gallons per minute.

2.6 HYDRAULIC CALCULATIONS

Water Model

Through the use of WaterCAD, the proposed water distribution system was modeled. Residual and static pressures were obtained from two flow tests performed on four fire hydrants (two flow and two pressure) near both existing 12" stubs. Both tests were performed by EJ Flow Testing Services. The first test took place July 11, 2014 along Silverstone Drive and the second test took place on February 9, 2015 along 74th Street. See Appendix B for the Fire Flow Tests. The pressures from the flow tests were modeled using a reservoir and pump to match the flow test results. The reduced residual and static pressures from the flow tests are included in Table 3.

Table 3: Fire Hydrant Flow Rate Test Results

Fire Hydrant	Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm)
Test #1 Flow	67.5	N/A	N/A
Test #1 Pressure	N/A	40.5	1,808
Test #2 Flow	72.0	N/A	N/A
Test #2 Pressure	N/A	40.0	1,760

From the static and residual pressures obtained through the first test on July 11, 2014, the maximum operating flow was calculated to be 2,453 gpm at 20 psi. From the static and residual pressures obtained through the first test on February 9, 2015, the maximum operating flow was calculated to be 2,288 gpm at 20 psi. These calculations include a 10% safety factor. The computer model geometry was constructed based on the existing and proposed water infrastructure. See Appendix D for the WaterCAD Analysis.

Water Analysis

Four water analyses were performed to evaluate the existing adjacent off-site water infrastructure and the proposed on-site water system:

1. Average Day Demand
2. Maximum Day Demand
3. Peak Hour Demand
4. Maximum Day Demand + Fire Flow Demand

The system was analyzed to ensure that the existing and proposed public water infrastructure can maintain a minimum pressure of 40 psi for the Average Day, Maximum Day, and Peak Hour Demands and 20 psi for the Maximum Day plus Fire Flow Demand. See Appendix D for water model layout to identify nodes and pipes.

Results

As previously discussed, four water analyses were performed for the development to evaluate the existing adjacent off-site water infrastructure and the proposed on-site water system:

1. Average Day Demand
2. Maximum Day Demand
3. Peak hour Demand
4. Maximum Day Demand + Fire Flow Demand

Fire flow demands were modeled accordingly:

Building Fireline Connections are modeled with the fire flow demand for the largest building as determined using the 2012 IFC. Fire hydrants are modeled using the fire flow required by the 2012 IFC for the largest building.

See Appendix D for the WaterCAD Analysis. A summary of the water analysis results is tabulated below:

Table 4a: Domestic Water Model Result Summary

Criteria	Constraint	Average Day	Max Day	Peak Hour
Minimum Pressure	40 psi	69.5 psi	69.4 psi	69.2 psi
Meets Criteria?	-	Yes	Yes	Yes

Table 46: Fire Flow Water Model Result Summary

3.0 WASTEWATER COLLECTION SYSTEM

WASTEWATER COLLECTION SYSTEM

An 8" PVC sewer main exists at the southwest corner of the property. This sewer main includes an 8" PVC stub to the north. Additionally, a 12" PVC sewer main exists in 74th Street with an 8" PVC stub extending onto the proposed site. Three new 8" PVC private sewer mains along with sewer services are proposed on-site. Two of the sewer mains will connect to the 8" sewer main near the southwest corner of the property, and the third private sewer main will connect to the stub along 74th Street. Refer to Appendix C for the Preliminary Utility Plan. The following demand calculations are based on Figure 7.1-2 of the City of Scottsdale *Design Standards and Policies Manual.* The number of dwelling units assigned to each existing sewer stub is based on preliminary site layout.

Table 65: Proposed Wastewater Demands

	Master Plan Assumed Dwelling Units	Proposed Dwelling Units (DU)	Demand* (GPD/DU)	ADD (GPM)	Peaking Factor	Peak Demand (GPM)	Max Day (GPM)	Master Plan Calculated Peak Demand (GPM)
SW Corner Stub	183	162	170	19.1	4.5	85.95	38.2	127
74th Street Stub	79	100	170	11.8	4.5	53.10	23.6	55
TOTAL	262	262		30.9		149.05	61.8	182

*Demand is based on 1.7 persons/DU and 100 GPD/person

The Maximum Day Demand is two times the Average Day Demand (ADD). Refer to Appendix E for the Sewer Capacity Calculations.

As demonstrated in Table 5 above, the proposed wastewater demands for the proposed development are below the demands assumed in the *Silverstone 160-Acre Mixed Use Project Master Plan.* See Appendix F for excerpts from the *Silverstone 160-Acre Mixed Use Project Master Plan.*

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings.
The minimum fire-flow and flow duration requirements for one- and two-family *dwellings* having a fire-flow calculation area that does not exceed 3,600 square feet (344.5 m^2) shall be 1,000 gallons per minute (3785.4 L/min) for 1 hour. Fire-flow and flow duration for *dwellings* having a fire-flow calculation area in excess of 3,600 square feet (344.5m^2) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire-flow of 50 percent, as *approved,* is allowed when the building is equipped with an *approved automatic sprinkler system.*

TABLE B105.1 MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-	92,401-	59,101-	42,701-	26,301-	4,500	

183,400	103,100	66,000	47,700	29,300		
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

B105.2 Buildings other than one- and two-family dwellings.
The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings* shall be as specified in Table B105.1.

Exception: A reduction in required fire-flow of up to 75 percent, as *approved,* is allowed when the building is provided with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. The resulting fire-flow shall not be less than 1,500 gallons per minute (5678 L/min) for the prescribed duration as specified in Table B105.1.

Appendix B
Fire Flow Tests

E•J Flow Tests

FLOW TESTING SERVICES

Flow Test Summary

EJ Flow Tests Project Name:	Mark Taylor Apartments - Rawhide
EJ Flow Tests Project No.:	14075
Project Address:	North Scottsdale Road & East Silverstone Drive, Scottsdale, Arizona 85255
Date of Flow Test:	July 11, 2014
Time of Flow Test:	7:50 AM
Data is Current and Reliable Until:	January 11, 2015

Raw Test Data:

Static Pressure: (measured in pounds per square inch)	75.0 psi
Residual Pressure: (measured in pounds per square inch)	48.0 psi
Pitot Pressure: (measured in pounds per square inch)	29.0 psi
Number of Outlets Flowed:	2
Fire Hydrant Orifice Diameter: (measured in inches)	2.5 inches
Coefficient of Discharge: (0.9 smooth/round outlet, 0.8 square/sharp outlet, 0.7 square/raised outlet)	0.9
Flowing GPM: (measured in gallons per minute)	1,808
GPM at 20 PSI:	2,655

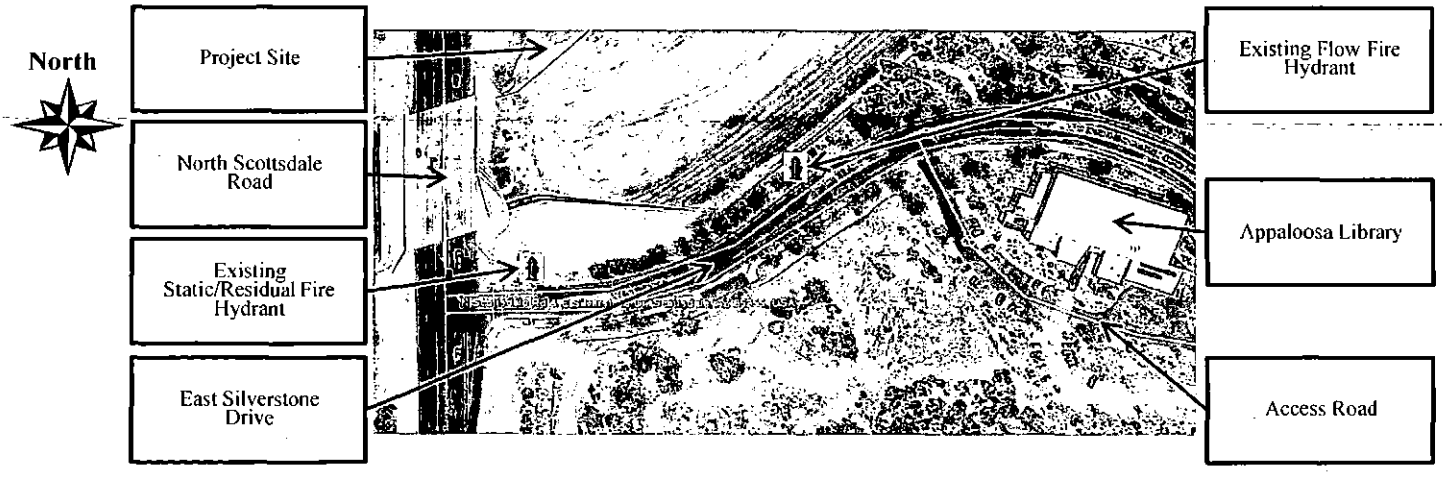
Data with minimum safety factor of: 10% :

Static Pressure: (measured in pounds per square inch)	67.5 psi
Residual Pressure: (measured in pounds per square inch)	40.5 psi
Main Size: (measured in inches)	8 & 12 inches
Approximate Distance Between Hydrants: (measured in feet)	400 ft
Approx. Static/Residual Hydrant Elevation: (measured above sea level)	1,817 ft
Approx. Flow Hydrant Elevation: (measured above sea level)	1,825 ft
Flowing GPM: (measured in gallons per minute)	1,808
GPM at 20 PSI:	2,453

Conducted by/Witnessed by/City Forces Contacted:

Conducted by:	Eric S. & Austin G. (EJ Flow Tests) 602.999.7637
Witnessed by:	Larry Frandle (City of Scottsdale) 480.312.5774
City Forces Contacted:	City of Scottsdale

Flow Test Vicinity Map (No Scale)



E•J Flow Tests

FLOW TESTING SERVICES

Flow Test Summary

EJ Flow Tests Project Name:	Mark Taylor Apt - Rawhide - Test 2
EJ Flow Tests Project No.:	15011
Project Address:	North Scottsdale Road & East Silverstone Drive, Scottsdale, Arizona 85255
Date of Flow Test:	February 9, 2015
Time of Flow Test:	8:10 AM
Data is Current and Reliable Until:	August 9, 2015

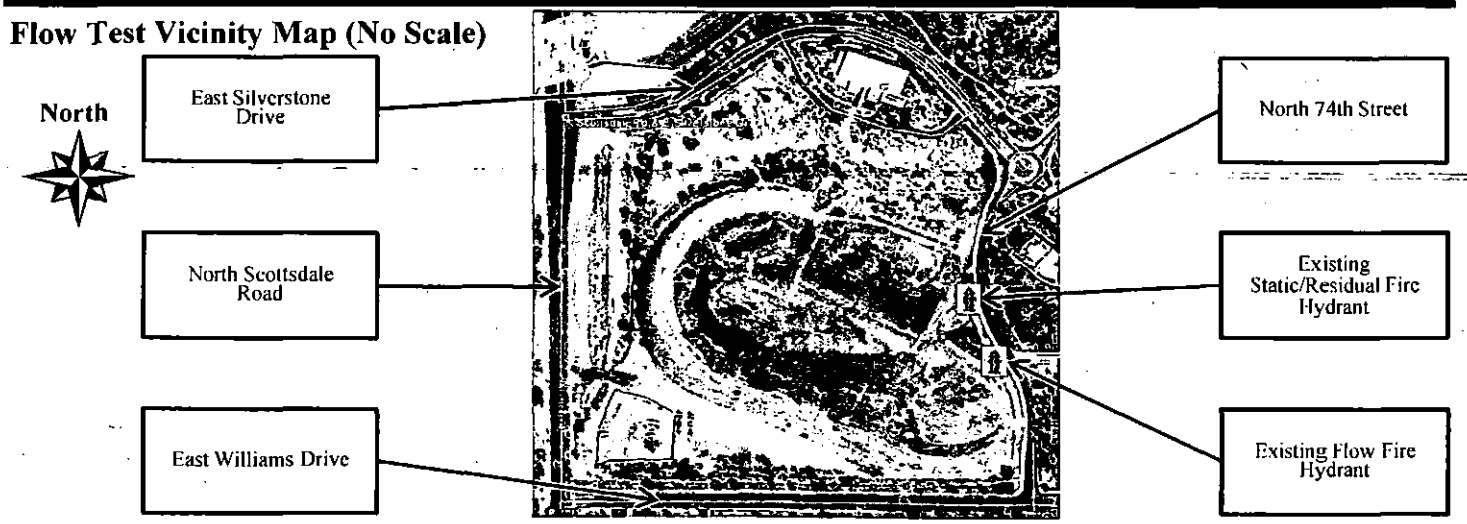
City of Scottsdale requires a Maximum Static Pressure of 72 PSI for use as a Safety Factor.

Raw Test Data:		**Data with minimum safety factor of: 10 PSI :**	
Static Pressure: (measured in pounds per square inch)	82.0 psi	Static Pressure: (measured in pounds per square inch)	72.0 psi
Residual Pressure: (measured in pounds per square inch)	50.0 psi	Residual Pressure: (measured in pounds per square inch)	40.0 psi
Pitot Pressure: (measured in pounds per square inch)	27.5 psi	Main Size: (measured in inches)	8
Number of Outlets Flowed:	2	Approximate Distance Between Hydrants: (measured in feet)	250 ft
Fire Hydrant Orifice Diameter: (measured in inches)	2.5 inches	Approx. Static/Residual Hydrant Elevation: (measured above sea level)	1,819 ft
Coefficient of Discharge: (0.9 smooth/round outlet, 0.8 square/sharp outlet, 0.7 square/raised outlet)	0.9	Approx. Flow Hydrant Elevation: (measured above sea level)	1,814 ft
Flowing GPM: (measured in gallons per minute)	1,760	Flowing GPM: (measured in gallons per minute)	1,760
GPM at 20 PSI:	2,516	GPM at 20 PSI:	2,288

Conducted by/Witnessed by/City Forces Contacted:

Conducted by:	Cesar Reyna & Austin Gourley (EJ Flow Tests) 602.999.7637
Witnessed by:	Larry Frandle (City of Scottsdale) 602.541.4942
City Forces Contacted:	City of Scottsdale (Permit #: C46990)

Flow Test Vicinity Map (No Scale)



E J Flow Tests, LLC
21505 North 78th Ave. • Suite 125 • Peoria, Arizona 85382 • 602.999.7637 • www.ejflowtests.com
John L. Echeverri • NICET Level IV 078493 SME • C-16 FP Contractor ROC 271705 AZ • NFPA CFPS 1915

Appendix C
Preliminary Utility Plan

Appendix D
WaterCAD Analysis

07-11-2014 Fire Flow Test
Pump Report

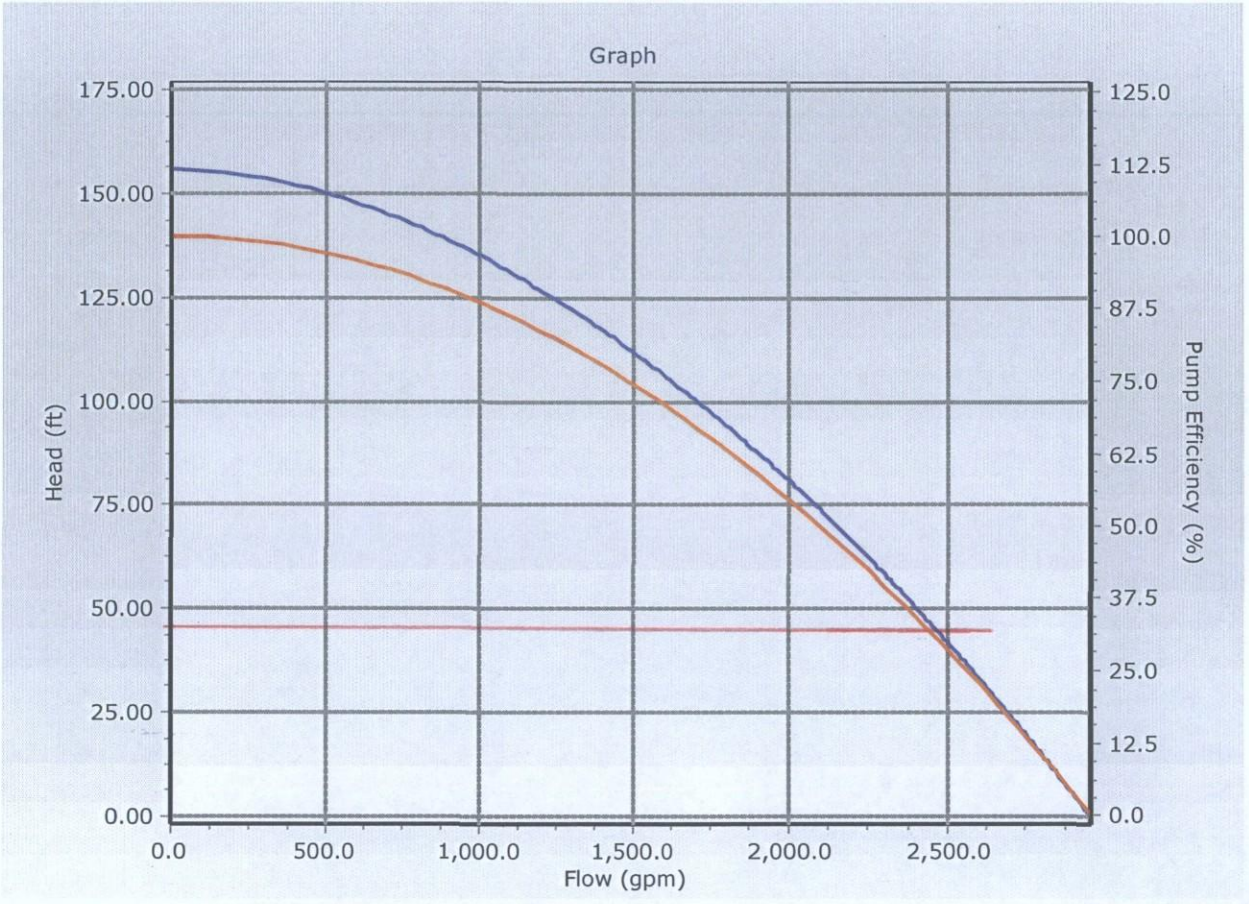
Element Details			
ID	42	Notes	
Label	07-11-2014 Flow Test		

Pump Definition Type			
Pump Definition Type	Standard (3 Point)	Design Head	93.60 ft
Shutoff Flow	0.0 gpm	Maximum Operating Flow	2,453.0 gpm
Shutoff Head	155.90 ft	Maximum Operating Head	46.20 ft
Design Flow	1,808.0 gpm		

Pump Efficiency			
Pump Efficiency	Best Efficiency Point	Motor Efficiency	100.0 %
BEP Efficiency	100.0 %	Is Variable Speed Drive?	False
BEP Flow	0.0 gpm		

Transient (Physical)			
Inertia (Pump and Motor)	0.000 lb·ft²	Specific Speed	SI=25, US=1280
Speed (Full)	0 rpm	Reverse Spin Allowed?	True

07-11-2014 Fire Flow Test
Pump Report



02-09-2015 Fire Flow Test
Pump Report

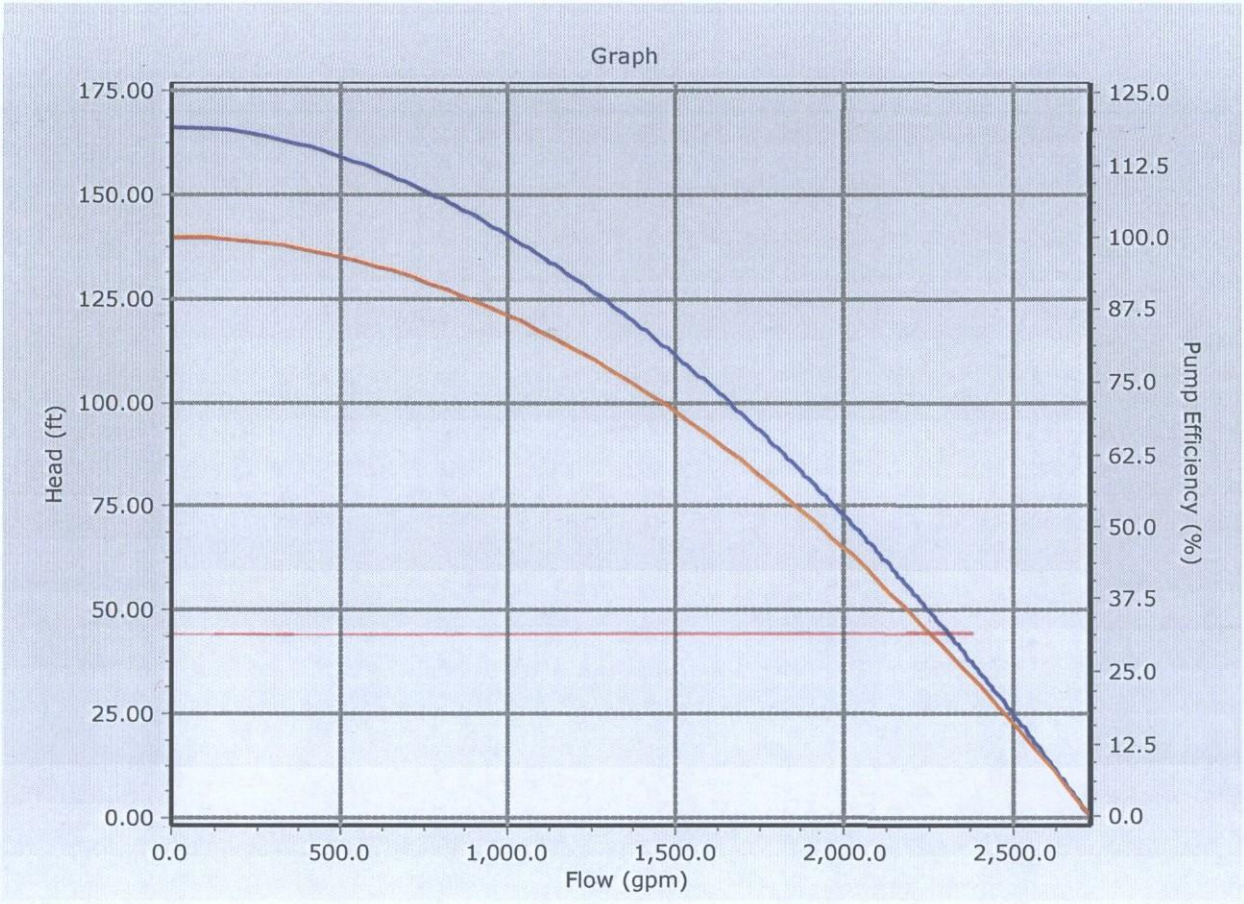
Element Details			
ID	166	Notes	
Label	02-09-2015 Flow Test		

Pump Definition Type			
Pump Definition Type	Standard (3 Point)	Design Head	92.40 ft
Shutoff Flow	0.0 gpm	Maximum Operating Flow	2,288.0 gpm
Shutoff Head	166.32 ft	Maximum Operating Head	46.20 ft
Design Flow	1,760.0 gpm		

Pump Efficiency			
Pump Efficiency	Best Efficiency Point	Motor Efficiency	100.0 %
BEP Efficiency	100.0 %	Is Variable Speed Drive?	False
BEP Flow	0.0 gpm		

Transient (Physical)			
Inertia (Pump and Motor)	0.000 lb·ft²	Specific Speed	SI=25, US=1280
Speed (Full)	0 rpm	Reverse Spin Allowed?	True

02-09-2015 Fire Flow Test
Pump Report



Average Day Demand
Node Report

Current Time: 0.000 hours

Label	Demand (gpm)	Pressure (psi)	Elevation (ft)	Flow (Total Available) (gpm)	Velocity (Upper Limit) (ft/s)
BLDG A	5	71.4	20.10	881	10.00
BLDG B	3	69.5	24.70	881	10.00
BLDG C	3	71.0	21.17	881	10.00
BLDG D	4	71.5	20.07	881	10.00
BLDG E	0	71.2	20.60	392	10.00
BLDG F	3	69.5	24.57	881	10.00
BLDG G	3	72.2	18.37	881	10.00
BLDG H	4	73.3	15.87	881	10.00
BLDG I	0	74.5	13.10	392	10.00
BLDG J	0	75.4	11.00	392	10.00
BLDG K	4	73.8	14.77	881	10.00
BLDG L	2	73.0	16.47	881	10.00
BLDG M	4	71.9	18.97	881	10.00
BLDG N	0	73.0	16.60	881	10.00
BLDG O	3	72.1	18.67	881	10.00
CABANA	0	72.1	18.60	881	10.00
J-1	5	75.8	10.00	3,195	10.00
J-2	0	73.9	14.50	3,132	10.00
J-3	0	72.8	17.00	2,101	10.00
J-4	0	73.4	15.60	3,093	10.00
J-5	0	74.0	14.30	3,090	10.00
J-6	0	75.0	11.80	3,084	10.00
J-6	0	74.5	13.00	3,088	10.00
J-7	0	75.2	11.40	3,084	10.00
J-8	0	75.5	10.70	2,304	10.00
J-9	0	75.7	10.30	2,396	10.00
J-10	0	75.9	9.90	2,488	10.00
J-11	0	76.5	8.40	2,699	10.00
J-12	0	76.6	8.20	2,864	10.00
J-13	0	77.2	6.80	2,746	10.00
J-14	0	76.2	9.00	2,382	10.00
J-15	0	76.1	9.30	2,266	10.00
J-16	0	75.1	11.70	2,132	10.00
J-17	0	75.0	11.90	2,011	10.00
J-18	0	75.0	11.80	3,049	10.00
J-19	0	75.1	11.60	3,055	10.00
J-20	0	75.0	12.00	3,056	10.00
J-21	0	74.1	14.00	3,064	10.00
J-22	0	73.4	15.50	3,069	10.00
J-23	0	72.8	17.00	3,072	10.00
J-24	0	72.4	18.00	3,073	10.00
J-25	0	72.3	18.20	3,076	10.00
J-26	0	73.2	16.10	3,089	10.00
J-45	0	70.8	21.66	2,511	10.00
J-46	0	71.3	20.50	3,036	10.00
J-47	0	73.9	14.40	3,018	10.00
J-48	0	74.3	13.50	3,269	10.00
J-49	0	76.7	7.90	1,567	10.00
MAINTENANCE	1	73.9	14.50	392	10.00

Average Day Demand
Pipe Report

Current Time: 0.000 hours

Label	Start Node	Stop Node	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/ft)	Flow (gpm)	Is Open?
P-1	H-1	J-1	185.24	185.24	6.0	18	Ductile Iron	130.0	0.00	0.000	0.0	True
P-2	J-1	J-2	185.24	185.24	12.0	295	Ductile Iron	130.0	0.01	0.000	-4.7	True
P-3	J-2	J-3	185.24	185.24	8.0	132	Ductile Iron	130.0	0.04	0.000	-7.0	True
P-4	J-3	H-2	185.24	185.24	6.0	19	Ductile Iron	130.0	0.00	0.000	0.0	True
P-5	PMP-1	J-1	185.24	185.24	100.0	1	Ductile Iron	130.0	0.00	0.000	0.0	True
P-6	R-1	PMP-1	17.00	17.00	100.0	1	Ductile Iron	130.0	0.00	0.000	0.0	True
P-7	J-2	J-4	185.24	185.24	12.0	277	Ductile Iron	130.0	0.01	0.000	2.3	True
P-8	J-4	J-5	185.24	185.24	12.0	81	Ductile Iron	130.0	0.03	0.000	9.2	True
P-10	J-6	J-7	185.24	185.24	12.0	29	Ductile Iron	130.0	0.02	0.000	5.8	True
P-11	J-7	J-8	185.24	185.24	8.0	145	Ductile Iron	130.0	0.01	0.000	2.1	True
P-12	J-8	J-9	185.24	185.24	8.0	39	Ductile Iron	130.0	0.00	0.000	-0.2	True
P-13	J-9	J-10	185.24	185.24	8.0	39	Ductile Iron	130.0	0.01	0.000	-0.8	True
P-14	J-10	J-11	185.24	185.24	8.0	85	Ductile Iron	130.0	0.01	0.000	-0.8	True
P-15	J-11	J-12	185.24	185.24	8.0	61	Ductile Iron	130.0	0.01	0.000	-1.1	True
P-16	J-12	J-13	185.24	185.24	8.0	209	Ductile Iron	130.0	0.03	0.000	-4.8	True
P-17	J-13	J-14	185.24	185.24	8.0	146	Ductile Iron	130.0	0.03	0.000	-5.1	True
P-18	J-14	J-15	185.24	185.24	8.0	48	Ductile Iron	130.0	0.06	0.000	-8.8	True
P-19	J-15	J-16	185.24	185.24	8.0	55	Ductile Iron	130.0	0.06	0.000	-9.1	True
P-20	J-16	J-17	185.24	185.24	8.0	46	Ductile Iron	130.0	0.06	0.000	-9.1	True
P-21	J-17	J-18	185.24	185.24	8.0	84	Ductile Iron	130.0	0.08	0.000	-12.2	True
P-22	J-18	J-19	185.24	185.24	12.0	64	Ductile Iron	130.0	0.07	0.000	24.9	True
P-23	J-19	J-20	185.24	185.24	12.0	14	Ductile Iron	130.0	0.07	0.000	24.9	True
P-24	J-20	J-21	185.24	185.24	12.0	105	Ductile Iron	130.0	0.06	0.000	21.8	True
P-25	J-21	J-22	185.24	185.24	12.0	97	Ductile Iron	130.0	0.05	0.000	18.1	True
P-26	J-22	J-23	185.24	185.24	12.0	113	Ductile Iron	130.0	0.05	0.000	17.8	True
P-27	J-23	J-24	185.24	185.24	12.0	87	Ductile Iron	130.0	0.05	0.000	17.8	True
P-28	J-24	J-25	185.24	185.24	12.0	97	Ductile Iron	130.0	0.04	0.000	14.7	True
P-29	J-25	J-26	185.24	185.24	12.0	178	Ductile Iron	130.0	0.03	0.000	11.6	True

Average Day Demand
Pipe Report

Current Time: 0.000 hours

Label	Start Node	Stop Node	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/ft)	Flow (gpm)	Is Open?
P-30	J-26	J-4	185.24	185.24	12.0	42	Ductile Iron	130.0	0.02	0.000	6.9	True
P-31	J-5	J-6	185.24	185.24	12.0	84	Ductile Iron	130.0	0.03	0.000	9.2	True
P-32	J-6	J-6	185.24	185.24	12.0	171	Ductile Iron	130.0	0.02	0.000	6.1	True
P-33	J-6	BLDG O	185.24	185.24	6.0	30	Ductile Iron	130.0	0.04	0.000	3.1	True
P-34	J-6	BLDG N	185.24	185.24	6.0	153	Ductile Iron	130.0	0.00	0.000	0.3	True
P-35	J-7	BLDG M	185.24	185.24	6.0	32	Ductile Iron	130.0	0.04	0.000	3.7	True
P-36	J-8	BLDG L	185.24	185.24	6.0	75	Ductile Iron	130.0	0.03	0.000	2.3	True
P-37	J-9	MAINTENANCE	185.24	185.24	4.0	48	Ductile Iron	130.0	0.02	0.000	0.6	True
P-38	J-11	CABANA	185.24	185.24	6.0	312	Ductile Iron	130.0	0.00	0.000	0.3	True
P-39	J-12	BLDG K	185.24	185.24	6.0	31	Ductile Iron	130.0	0.04	0.000	3.7	True
P-40	J-13	BLDG J	185.24	185.24	4.0	34	Ductile Iron	130.0	0.01	0.000	0.3	True
P-41	J-14	BLDG H	185.24	185.24	6.0	27	Ductile Iron	130.0	0.04	0.000	3.7	True
P-42	J-15	BLDG I	185.24	185.24	4.0	32	Ductile Iron	130.0	0.01	0.000	0.3	True
P-43	J-16	H-5	185.24	185.24	6.0	23	Ductile Iron	130.0	0.00	0.000	0.0	True
P-44	J-10	H-4	185.24	185.24	6.0	6	Ductile Iron	130.0	0.00	0.000	0.0	True
P-45	H-3	J-5	185.24	185.24	6.0	12	Ductile Iron	130.0	0.00	0.000	0.0	True
P-46	J-17	BLDG G	185.24	185.24	6.0	29	Ductile Iron	130.0	0.04	0.000	3.1	True
P-47	J-19	H-6	185.24	185.24	6.0	58	Ductile Iron	130.0	0.00	0.000	0.0	True
P-48	J-20	BLDG F	185.24	185.24	6.0	132	Ductile Iron	130.0	0.04	0.000	3.1	True
P-49	BLDG D	J-21	185.24	185.24	6.0	27	Ductile Iron	130.0	0.04	0.000	-3.7	True
P-50	BLDG E	J-22	185.24	185.24	4.0	40	Ductile Iron	130.0	0.01	0.000	-0.3	True
P-51	H-7	J-23	185.24	185.24	6.0	8	Ductile Iron	130.0	0.00	0.000	0.0	True
P-52	BLDG C	J-24	185.24	185.24	6.0	31	Ductile Iron	130.0	0.04	0.000	-3.1	True
P-53	BLDG B	J-25	185.24	185.24	6.0	190	Ductile Iron	130.0	0.04	0.000	-3.1	True
P-54	BLDG A	J-26	185.24	185.24	6.0	83	Ductile Iron	130.0	0.05	0.000	-4.7	True
P-55	J-3	J-45	185.24	185.24	8.0	217	Ductile Iron	130.0	0.04	0.000	-7.0	True
P-56	J-45	J-46	185.24	185.24	8.0	854	Ductile Iron	130.0	0.04	0.000	-7.0	True
P-57	J-46	J-47	185.24	185.24	12.0	426	Ductile Iron	130.0	0.02	0.000	-7.0	True

Average Day Demand
Pipe Report

Current Time: 0.000 hours

Label	Start Node	Stop Node	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/ft)	Flow (gpm)	Is Open?
P-58	J-47	J-18	185.24	185.24	12.0	229	Ductile Iron	130.0	0.11	0.000	37.1	True
P-59	H-8	J-48	185.24	185.24	6.0	54	Ductile Iron	130.0	0.00	0.000	0.0	True
P-60	J-48	J-49	185.24	185.24	8.0	259	Ductile Iron	130.0	0.00	0.000	0.0	True
P-61	J-49	H-9	185.24	185.24	6.0	31	Ductile Iron	130.0	0.00	0.000	0.0	True
P-62	PMP-2	J-48	185.24	185.24	100.0	1	Ductile Iron	130.0	0.00	0.000	44.1	True
P-63	R-2	PMP-2	19.00	19.00	100.0	1	Ductile Iron	130.0	0.00	0.000	44.1	True
P-64	J-47	J-48	185.24	185.24	8.0	32	Ductile Iron	130.0	0.28	0.000	-44.1	True

Max Day Demand
Pipe Report

Current Time: 0.000 hours

Label	Start Node	Stop Node	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/ft)	Flow (gpm)	Is Open?
P-58	J-47	J-18	185.02	185.02	12.0	229	Ductile Iron	130.0	0.21	0.000	74.1	True
P-59	H-8	J-48	185.03	185.03	6.0	54	Ductile Iron	130.0	0.00	0.000	0.0	True
P-60	J-48	J-49	185.03	185.03	8.0	259	Ductile Iron	130.0	0.00	0.000	0.0	True
P-61	J-49	H-9	185.03	185.03	6.0	31	Ductile Iron	130.0	0.00	0.000	0.0	True
P-62	PMP-2	J-48	185.03	185.03	100.0	1	Ductile Iron	130.0	0.00	0.000	88.2	True
P-63	R-2	PMP-2	19.00	19.00	100.0	1	Ductile Iron	130.0	0.00	0.000	88.2	True
P-64	J-47	J-48	185.02	185.03	8.0	32	Ductile Iron	130.0	0.56	0.000	-88.2	True

Peak Hour Demand
Node Report

Current Time: 0.000 hours

Label	Demand (gpm)	Pressure (psi)	Elevation (ft)	Flow (Total Available) (gpm)	Velocity (Upper Limit) (ft/s)
BLDG A	16.5	71.2	20.10	881.3	10.00
BLDG B	10.8	69.2	24.70	881.3	10.00
BLDG C	10.8	70.7	21.17	881.3	10.00
BLDG D	12.9	71.2	20.07	881.3	10.00
BLDG E	1.0	71.0	20.60	391.7	10.00
BLDG F	10.8	69.2	24.57	881.3	10.00
BLDG G	10.8	71.9	18.37	881.3	10.00
BLDG H	12.9	73.0	15.87	881.3	10.00
BLDG I	1.0	74.2	13.10	391.7	10.00
BLDG J	1.0	75.1	11.00	391.7	10.00
BLDG K	12.9	73.5	14.77	881.3	10.00
BLDG L	8.1	72.8	16.47	881.3	10.00
BLDG M	12.9	71.7	18.97	881.3	10.00
BLDG N	1.0	72.7	16.60	881.3	10.00
BLDG O	10.8	71.8	18.67	881.3	10.00
CABANA	1.0	71.8	18.60	881.3	10.00
J-1	0.0	75.6	10.00	3,089.9	10.00
J-2	0.0	73.6	14.50	3,034.5	10.00
J-3	0.0	72.5	17.00	2,100.3	10.00
J-4	0.0	73.1	15.60	2,997.6	10.00
J-5	0.0	73.7	14.30	2,994.9	10.00
J-6	0.0	74.8	11.80	2,989.4	10.00
J-6	0.0	74.3	13.00	2,992.7	10.00
J-7	0.0	74.9	11.40	2,989.0	10.00
J-8	0.0	75.2	10.70	2,286.7	10.00
J-9	0.0	75.4	10.30	2,377.4	10.00
J-10	0.0	75.6	9.90	2,468.4	10.00
J-11	0.0	76.2	8.40	2,677.1	10.00
J-12	0.0	76.3	8.20	2,839.2	10.00
J-13	0.0	76.9	6.80	2,709.9	10.00
J-14	0.0	76.0	9.00	2,352.0	10.00
J-15	0.0	75.9	9.30	2,238.7	10.00
J-16	0.0	74.8	11.70	2,106.1	10.00
J-17	0.0	74.7	11.90	1,986.8	10.00
J-18	0.0	74.8	11.80	2,956.2	10.00
J-19	0.0	74.9	11.60	2,962.0	10.00
J-20	0.0	74.7	12.00	2,963.1	10.00
J-21	0.0	73.8	14.00	2,970.4	10.00
J-22	0.0	73.2	15.50	2,975.3	10.00
J-23	0.0	72.5	17.00	2,977.9	10.00
J-24	0.0	72.1	18.00	2,979.1	10.00
J-25	0.0	72.0	18.20	2,982.2	10.00
J-26	0.0	72.9	16.10	2,993.9	10.00
J-45	0.0	70.5	21.66	2,510.9	10.00
J-46	0.0	71.0	20.50	2,943.7	10.00
J-47	0.0	73.7	14.40	2,926.7	10.00
J-48	0.0	74.1	13.50	3,346.4	10.00
J-49	0.0	76.5	7.90	1,566.7	10.00
MAINTENANCE	2.1	73.6	14.50	391.7	10.00

Peak Hour Demand
Pipe Report

Current Time: 0.000 hours

Label	Start Node	Stop Node	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/ft)	Flow (gpm)	Is Open?
P-1	H-1	J-1	184.62	184.62	6.0	18	Ductile Iron	130.0	0.00	0.000	0.0	True
P-2	J-1	J-2	184.62	184.62	12.0	295	Ductile Iron	130.0	0.00	0.000	0.0	True
P-3	J-2	J-3	184.62	184.62	8.0	132	Ductile Iron	130.0	0.14	0.000	-21.2	True
P-4	J-3	H-2	184.62	184.62	6.0	19	Ductile Iron	130.0	0.00	0.000	0.0	True
P-5	PMP-1	J-1	184.62	184.62	100.0	1	Ductile Iron	130.0	0.00	0.000	0.0	True
P-6	R-1	PMP-1	17.00	17.00	100.0	1	Ductile Iron	130.0	0.00	0.000	0.0	True
P-7	J-2	J-4	184.62	184.62	12.0	277	Ductile Iron	130.0	0.06	0.000	21.2	True
P-8	J-4	J-5	184.62	184.62	12.0	81	Ductile Iron	130.0	0.10	0.000	35.3	True
P-10	J-6	J-7	184.62	184.62	12.0	29	Ductile Iron	130.0	0.07	0.000	23.4	True
P-11	J-7	J-8	184.62	184.62	8.0	145	Ductile Iron	130.0	0.07	0.000	10.4	True
P-12	J-8	J-9	184.62	184.62	8.0	39	Ductile Iron	130.0	0.02	0.000	2.4	True
P-13	J-9	J-10	184.62	184.62	8.0	39	Ductile Iron	130.0	0.00	0.000	0.3	True
P-14	J-10	J-11	184.62	184.62	8.0	85	Ductile Iron	130.0	0.00	0.000	0.3	True
P-15	J-11	J-12	184.62	184.62	8.0	61	Ductile Iron	130.0	0.00	0.000	-0.8	True
P-16	J-12	J-13	184.62	184.62	8.0	209	Ductile Iron	130.0	0.09	0.000	-13.7	True
P-17	J-13	J-14	184.62	184.62	8.0	146	Ductile Iron	130.0	0.09	0.000	-14.8	True
P-18	J-14	J-15	184.62	184.62	8.0	48	Ductile Iron	130.0	0.18	0.000	-27.7	True
P-19	J-15	J-16	184.62	184.63	8.0	55	Ductile Iron	130.0	0.18	0.000	-28.8	True
P-20	J-16	J-17	184.63	184.63	8.0	46	Ductile Iron	130.0	0.18	0.000	-28.8	True
P-21	J-17	J-18	184.63	184.63	8.0	84	Ductile Iron	130.0	0.25	0.000	-39.6	True
P-22	J-18	J-19	184.63	184.63	12.0	64	Ductile Iron	130.0	0.22	0.000	77.1	True
P-23	J-19	J-20	184.63	184.63	12.0	14	Ductile Iron	130.0	0.22	0.000	77.1	True
P-24	J-20	J-21	184.63	184.63	12.0	105	Ductile Iron	130.0	0.19	0.000	66.2	True
P-25	J-21	J-22	184.63	184.63	12.0	97	Ductile Iron	130.0	0.15	0.000	53.3	True
P-26	J-22	J-23	184.63	184.62	12.0	113	Ductile Iron	130.0	0.15	0.000	52.2	True
P-27	J-23	J-24	184.62	184.62	12.0	87	Ductile Iron	130.0	0.15	0.000	52.2	True
P-28	J-24	J-25	184.62	184.62	12.0	97	Ductile Iron	130.0	0.12	0.000	41.4	True
P-29	J-25	J-26	184.62	184.62	12.0	178	Ductile Iron	130.0	0.09	0.000	30.5	True

Peak Hour Demand
Pipe Report

Current Time: 0.000 hours

Label	Start Node	Stop Node	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/ft)	Flow (gpm)	Is Open?
P-30	J-26	J-4	184.62	184.62	12.0	42	Ductile Iron	130.0	0.04	0.000	14.1	True
P-31	J-5	J-6	184.62	184.62	12.0	84	Ductile Iron	130.0	0.10	0.000	35.3	True
P-32	J-6	J-6	184.62	184.62	12.0	171	Ductile Iron	130.0	0.07	0.000	24.4	True
P-33	J-6	BLDG O	184.62	184.62	6.0	30	Ductile Iron	130.0	0.12	0.000	10.8	True
P-34	J-6	BLDG N	184.62	184.62	6.0	153	Ductile Iron	130.0	0.01	0.000	1.0	True
P-35	J-7	BLDG M	184.62	184.62	6.0	32	Ductile Iron	130.0	0.15	0.000	12.9	True
P-36	J-8	BLDG L	184.62	184.62	6.0	75	Ductile Iron	130.0	0.09	0.000	8.1	True
P-37	J-9	MAINTENANCE	184.62	184.62	4.0	48	Ductile Iron	130.0	0.05	0.000	2.1	True
P-38	J-11	CABANA	184.62	184.62	6.0	312	Ductile Iron	130.0	0.01	0.000	1.0	True
P-39	J-12	BLDG K	184.62	184.62	6.0	31	Ductile Iron	130.0	0.15	0.000	12.9	True
P-40	J-13	BLDG J	184.62	184.62	4.0	34	Ductile Iron	130.0	0.03	0.000	1.0	True
P-41	J-14	BLDG H	184.62	184.62	6.0	27	Ductile Iron	130.0	0.15	0.000	12.9	True
P-42	J-15	BLDG I	184.62	184.62	4.0	32	Ductile Iron	130.0	0.03	0.000	1.0	True
P-43	J-16	H-5	184.63	184.63	6.0	23	Ductile Iron	130.0	0.00	0.000	0.0	True
P-44	J-10	H-4	184.62	184.62	6.0	6	Ductile Iron	130.0	0.00	0.000	0.0	True
P-45	H-3	J-5	184.62	184.62	6.0	12	Ductile Iron	130.0	0.00	0.000	0.0	True
P-46	J-17	BLDG G	184.63	184.63	6.0	29	Ductile Iron	130.0	0.12	0.000	10.8	True
P-47	J-19	H-6	184.63	184.63	6.0	58	Ductile Iron	130.0	0.00	0.000	0.0	True
P-48	J-20	BLDG F	184.63	184.63	6.0	132	Ductile Iron	130.0	0.12	0.000	10.8	True
P-49	BLDG D	J-21	184.63	184.63	6.0	27	Ductile Iron	130.0	0.15	0.000	-12.9	True
P-50	BLDG E	J-22	184.63	184.63	4.0	40	Ductile Iron	130.0	0.03	0.000	-1.0	True
P-51	H-7	J-23	184.62	184.62	6.0	8	Ductile Iron	130.0	0.00	0.000	0.0	True
P-52	BLDG C	J-24	184.62	184.62	6.0	31	Ductile Iron	130.0	0.12	0.000	-10.8	True
P-53	BLDG B	J-25	184.62	184.62	6.0	190	Ductile Iron	130.0	0.12	0.000	-10.8	True
P-54	BLDG A	J-26	184.62	184.62	6.0	83	Ductile Iron	130.0	0.19	0.000	-16.5	True
P-55	J-3	J-45	184.62	184.63	8.0	217	Ductile Iron	130.0	0.14	0.000	-21.2	True
P-56	J-45	J-46	184.63	184.64	8.0	854	Ductile Iron	130.0	0.14	0.000	-21.2	True
P-57	J-46	J-47	184.64	184.64	12.0	426	Ductile Iron	130.0	0.06	0.000	-21.2	True

Peak Hour Demand
Pipe Report

Current Time: 0.000 hours

Label	Start Node	Stop Node	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)	Diameter (in)	Length (ft)	Material	Hazen-Williams C	Velocity (ft/s)	Headloss Gradient (ft/ft)	Flow (gpm)	Is Open?
P-58	J-47	J-18	184.64	184.63	12.0	229	Ductile Iron	130.0	0.33	0.000	116.7	True
P-59	H-8	J-48	184.66	184.66	6.0	54	Ductile Iron	130.0	0.00	0.000	0.0	True
P-60	J-48	J-49	184.66	184.66	8.0	259	Ductile Iron	130.0	0.00	0.000	0.0	True
P-61	J-49	H-9	184.66	184.66	6.0	31	Ductile Iron	130.0	0.00	0.000	0.0	True
P-62	PMP-2	J-48	184.66	184.66	100.0	1	Ductile Iron	130.0	0.01	0.000	137.9	True
P-63	R-2	PMP-2	19.00	19.00	100.0	1	Ductile Iron	130.0	0.01	0.000	137.9	True
P-64	J-47	J-48	184.64	184.66	8.0	32	Ductile Iron	130.0	0.88	0.000	-137.9	True

Max Day + Fire Flow Demand

Fire Flow Report

Current Time: 0.000 hours

AT 20 PSI

Label	Demand (gpm)	Pressure (psi)	Elevation (ft)	Junction w/ Minimum Pressure (System)	Pressure (Minimum) (psi)	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Satisfies Fire Flow Constraints?
BLDG A	9.4	71.4	20.10	BLDG B	71.4	2,250.0	3,136.2	True
BLDG B	6.2	69.4	24.70	BLDG F	69.4	2,250.0	2,375.4	True
BLDG C	6.2	70.9	21.17	BLDG B	70.9	2,250.0	3,736.6	True
BLDG D	7.4	71.4	20.07	BLDG F	71.4	2,250.0	3,827.2	True
BLDG E	0.6	71.1	20.60	BLDG B	71.1	1,500.0	2,073.8	True
BLDG F	6.2	69.4	24.57	BLDG B	69.4	2,250.0	2,690.3	True
BLDG G	6.2	72.1	18.37	H-5	72.1	2,250.0	3,671.0	True
BLDG H	7.4	73.2	15.87	J-14	73.2	2,250.0	3,563.3	True
BLDG I	0.6	74.4	13.10	BLDG F	74.4	1,500.0	2,278.2	True
BLDG J	0.6	75.3	11.00	CABANA	75.3	1,500.0	2,218.8	True
BLDG K	7.4	73.7	14.77	CABANA	73.7	2,250.0	3,438.7	True
BLDG L	4.6	72.9	16.47	CABANA	72.9	2,250.0	3,068.1	True
BLDG M	7.4	71.8	18.97	BLDG B	71.8	2,250.0	3,678.9	True
BLDG N	0.6	72.9	16.60	BLDG B	72.9	1,500.0	2,634.0	True
BLDG O	6.2	72.0	18.67	BLDG B	72.0	2,250.0	3,772.1	True
CABANA	0.6	72.0	18.60	BLDG B	72.0	1,500.0	1,950.4	True
H-3	0.0	71.8	19.00	BLDG B	71.8	2,250.0	4,000.0	True
H-4	0.0	74.0	14.00	CABANA	74.0	2,250.0	3,868.1	True
H-5	0.0	73.0	16.30	BLDG H	73.0	2,250.0	3,720.1	True
H-6	0.0	72.5	17.50	BLDG F	72.5	2,250.0	3,453.3	True
H-7	0.0	70.8	21.30	BLDG B	70.8	2,250.0	4,000.0	True
MAINTENANCE	1.2	73.8	14.50	BLDG B	73.8	1,500.0	1,920.7	True

Appendix E

8" PVC Sewer Capacity Calculations

Worksheet for Mark Taylor Apt Sewer Main

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Normal Depth	8.00	in
Diameter	8.00	in
Discharge	383	gal/min

Results

Discharge	383	gal/min
Normal Depth	8.00	in
Flow Area	0.35	ft²
Wetted Perimeter	2.09	ft
Hydraulic Radius	2.00	in
Top Width	0.00	ft
Critical Depth	0.44	ft
Percent Full	100.0	%
Critical Slope	0.00848	ft/ft
Velocity	2.45	ft/s
Velocity Head	0.09	ft
Specific Energy	0.76	ft
Froude Number	0.00	
Maximum Discharge	0.92	ft³/s
Discharge Full	0.85	ft³/s
Slope Full	0.00500	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

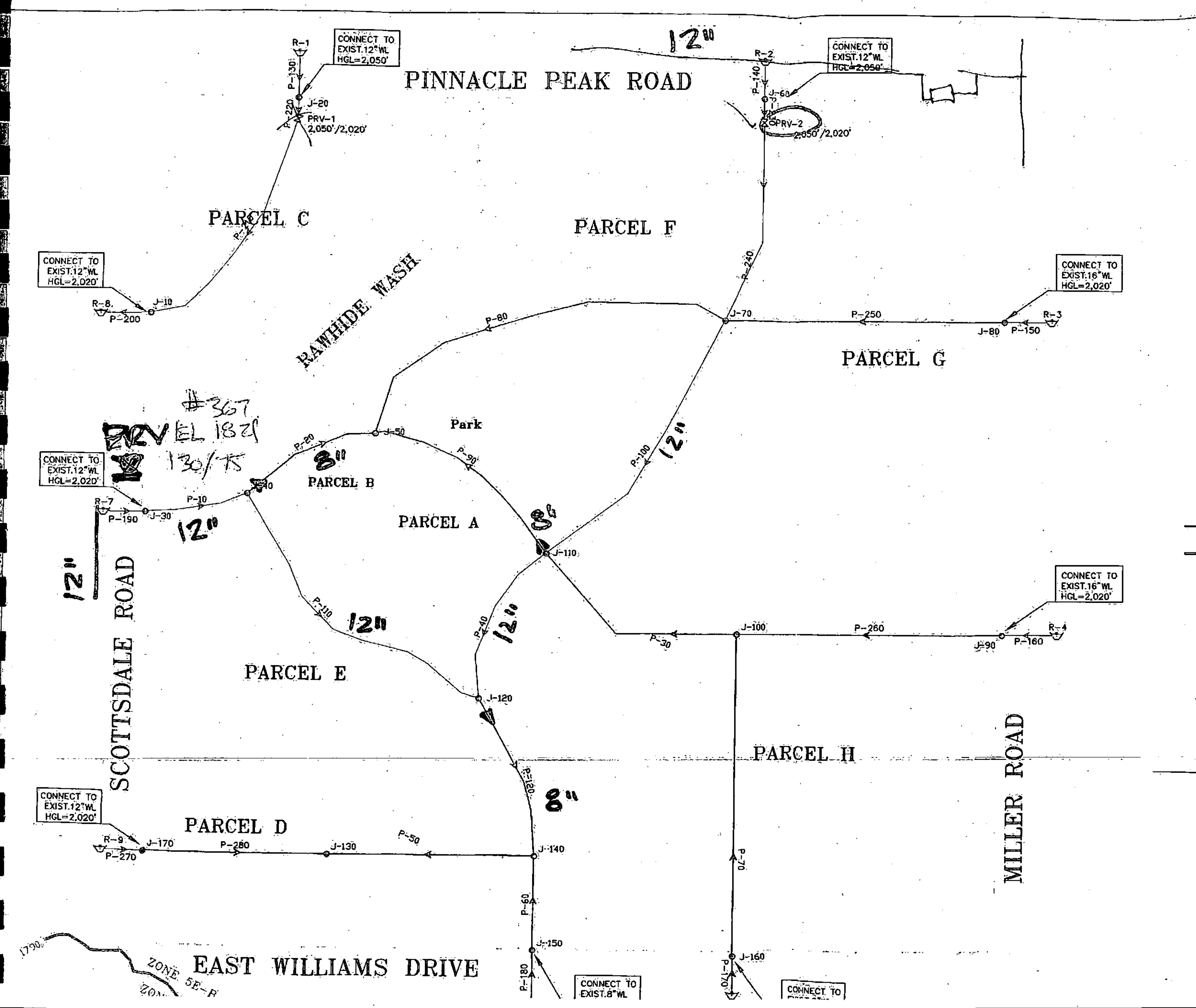
Worksheet for Mark Taylor Apt Sewer Main

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	8.00	in
Critical Depth	0.44	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00848	ft/ft

Appendix F

Excerpts from the *Silverstone 160-Acre Mixed Use Project Master Plan*
prepared by Wood/Patel



PINNACLE PEAK ROAD
CONNECT TO EXIST.12"WL HGL=2,050'
R-1
P-130
J-20
P-220
PRV-1 2,050'/2,020'
R-2
P-140
J-60
PRV-2 2,050'/2,020'
12"
PARCEL C
PARCEL F
CONNECT TO EXIST.12"WL HGL=2,020'
R-8
P-200
J-10
RAWHIDE WASH
P-240
CONNECT TO EXIST.16"WL HGL=2,020'
P-80
J-70
P-250
R-3
J-80
P-150
PARCEL G
#367
PRV EL 1825
130/75
Park
J-50
P-20
8"
P-90
P-100
12"
CONNECT TO EXIST.12"WL HGL=2,020'
R-7
P-190
J-30
P-10
J-40
PARCEL B
PARCEL A
8"
J-110
12"
12"
SCOTTSDALE ROAD
P-110
12"
P-40
12"
CONNECT TO EXIST.16"WL HGL=2,020'
J-100
P-260
R-4
P-30
J-90
P-160
PARCEL E
J-120
PARCEL H
MILLER ROAD
P-120
8"
CONNECT TO EXIST.12"WL HGL=2,020'
PARCEL D
R-9
P-270
J-170
P-280
J-130
P-50
J-140
P-70
P-60
J-150
J-160
P-180
P-170
EAST WILLIAMS DRIVE
1790
ZONE 5E-R
CONNECT TO EXIST.8"WL
CONNECT TO

300 0 150 300

1 inch = 300 ft.

LEGEND

PROPOSED 8" WATER

PROPOSED 12" WATER

PROJECT BOUNDARY

NOTE: THE LOCATION AND SIZES OF THESE WATER LINES ARE A CONCEPTUAL DESIGN AND SHOULD NOT BE USED FOR CONSTRUCTION.

PLATE 2
MASTER POTABLE WATER SYSTEM

SILVERSTONE
160-ACRE MIXED USE PROJECT

WOOD/PATEL

LAND DEVELOPMENT • WATER RESOURCES
TRANSPORTATION / TRAFFIC
WATER / WASTEWATER • SURVEYING
CONSTRUCTION MANAGEMENT

(602) 335-8500

Project: *SEC Pinnacle Peak and Scottsdale Road Mixed Land Use*
Location: *City of Scottsdale, Arizona*
Date: *8-Nov-07*
References: *City of Scottsdale Design Standards and Policy Manual*

Project Number: *042309.07*
Project Engineer: *Darrel Wood, P.E., R.L.S.*

						RESIDENTIAL		NON-RESIDENTIAL		PARKS/LANDSCAPE		AVERAGE DAY DEMAND		MAXIMUM DAY DEMAND		PEAK HOUR DEMAND	
WATERCAD NODE	PARCEL	ZONING	LAND USE	AREA OF CONTRIBUTING PARCEL (AC)	ELEV.	UNITS[1]	ADD'L UNIT (GPD)	AREA (SQ.FT.)[2]	ADD'L SQ.FT. (GPD)	AREA (ACRES)	ADD'L/AC (GPD)	(GPD)	(GPM)	(GPD)	(GPM)	(GPD)	(GPM)
J-10	C	IC-2	Retail	6.3	1,828			47,500	0.8			38,000	26.4	76,000	52.8	133,000	92.4
J-20	C	C-2	Retail	6.3	1,847			47,500	0.8			38,000	26.4	76,000	52.8	133,000	92.4
J-30	No Demand				1,818												
J-40	E	R-5	Residential	8.8	1,822	131.0	228					29,868	20.7	59,736	41.5	104,538	72.6
J-40				*9*	*1,822*	*131*						*29,868*	*20.7*	*59,736*	*41.5*	*104,538*	*72.6*
J-50	B	C-O	Municipal	2.2				22,500	0.8			18,000	12.5	36,000	25.0	63,000	43.8
J-50	Park		Park	12.9						12.9	1,766.0	23,075	16.0	46,150	32.0	80,763	56.1
J-60				*16*	*1,840*			*22,500*		*12.9*		*41,075*	*28.5*	*82,150*	*57.0*	*143,763*	*99.8*
J-80	No Demand				1,870												
J-70	F	R-5	Residential	21.9		185	228					42,408	29.5	84,816	58.9	148,428	103.1
J-70	G	R-5	Residential	23.8		258	228					58,824	40.9	117,648	81.7	205,884	143.0
J-70				*46*	*1,855*	*444*						*101,232*	*70.3*	*202,464*	*140.6*	*354,312*	*246.1*
J-80	No Demand				1,863												
J-90	No Demand				1,846												
J-100	H	R-5	Residential	8.6		68	228					15,504	10.8	31,008	21.5	54,264	37.7
J-100				*9*	*1,838*	*68*						*15,504*	*10.8*	*31,008*	*21.5*	*54,264*	*37.7*
J-110	A	C-O	Municipal	2.2				22,500	0.8			18,000	12.5	36,000	25.0	63,000	43.8
J-110				*2*	*1,837*			*22,500*				*18,000*	*12.5*	*36,000*	*25.0*	*63,000*	*43.8*
J-120	E	R-5	Residential	8.8		131.0	228					29,868	20.7	59,736	41.5	104,538	72.6
J-120	H	R-5	Residential	8.8		68	228					15,504	10.8	31,008	21.5	54,264	37.7
J-120				*17*	*1,817*	*199.0*						*45,372*	*31.6*	*90,744*	*63.0*	*158,802*	*110.3*
J-130	D	C-O	Office	6.2				82,500	0.8			49,500	34.4	99,000	68.8	173,250	120.3
J-130																	
J-130				*6*	*1,805*			*82,500*				*49,500*	*34.4*	*99,000*	*68.8*	*173,250*	*120.3*
J-140	D	C-O	Office	6.2				82,500	0.8			49,500	34.4	99,000	68.8	173,250	120.3
J-140	H	R-5	Residential	8.6		67	228					15,276	10.8	30,552	21.2	53,466	37.1
J-140																	
J-140				*15*	*1,810*	*67.0*		*82,500*				*64,776*	*45*	*129,552*	*90*	*226,716*	*157*
J-150	No Demand				1,806												
J-160	H	R-5	Residential	8.6	1,814	67	228					15,276	10.8	30,552	21.2	53,466	37.1
J-170					1,800												
Total				*140*		*976*		*305,000*				*456,603*	*317*	*913,206*	*634*	*1,598,111*	*1,110*

Notes:
(1) Multi-family dwelling units is the proposed dwelling units
(2) Area of non-residential land use is the proposed building area in square feet

Scenario: Average Day Demand
Steady State Analysis
Junction Report

Label	Elevation (ft)	Zone	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-10	1,828	Zone 6W	26.4	2,020	83.1
J-20	1,847	Zone 6W	26.4	2,050	87.8
J-30	1,818	Zone 6W	0.0	2,020	87.4
J-40	1,822	Zone 6W	20.7	2,020	85.7
J-50	1,840	Zone 6W	28.5	2,020	77.9
J-60	1,870	Zone 6W	0.0	2,050	77.9
J-70	1,855	Zone 6W	70.3	2,020	71.4
J-100	1,838	Zone 6W	10.8	2,020	78.7
J-110	1,837	Zone 6W	12.5	2,020	79.2
J-120	1,817	Zone 6W	31.5	2,020	87.8
J-130	1,805	Zone 6W	34.4	2,020	93.0
J-140	1,810	Zone 6W	45.0	2,020	90.9
J-150	1,806	Zone 6W	0.0	2,020	92.6
J-160	1,814	Zone 6W	10.6	2,020	89.1
J-170	1,800	Zone 6W	0.0	2,020	95.2

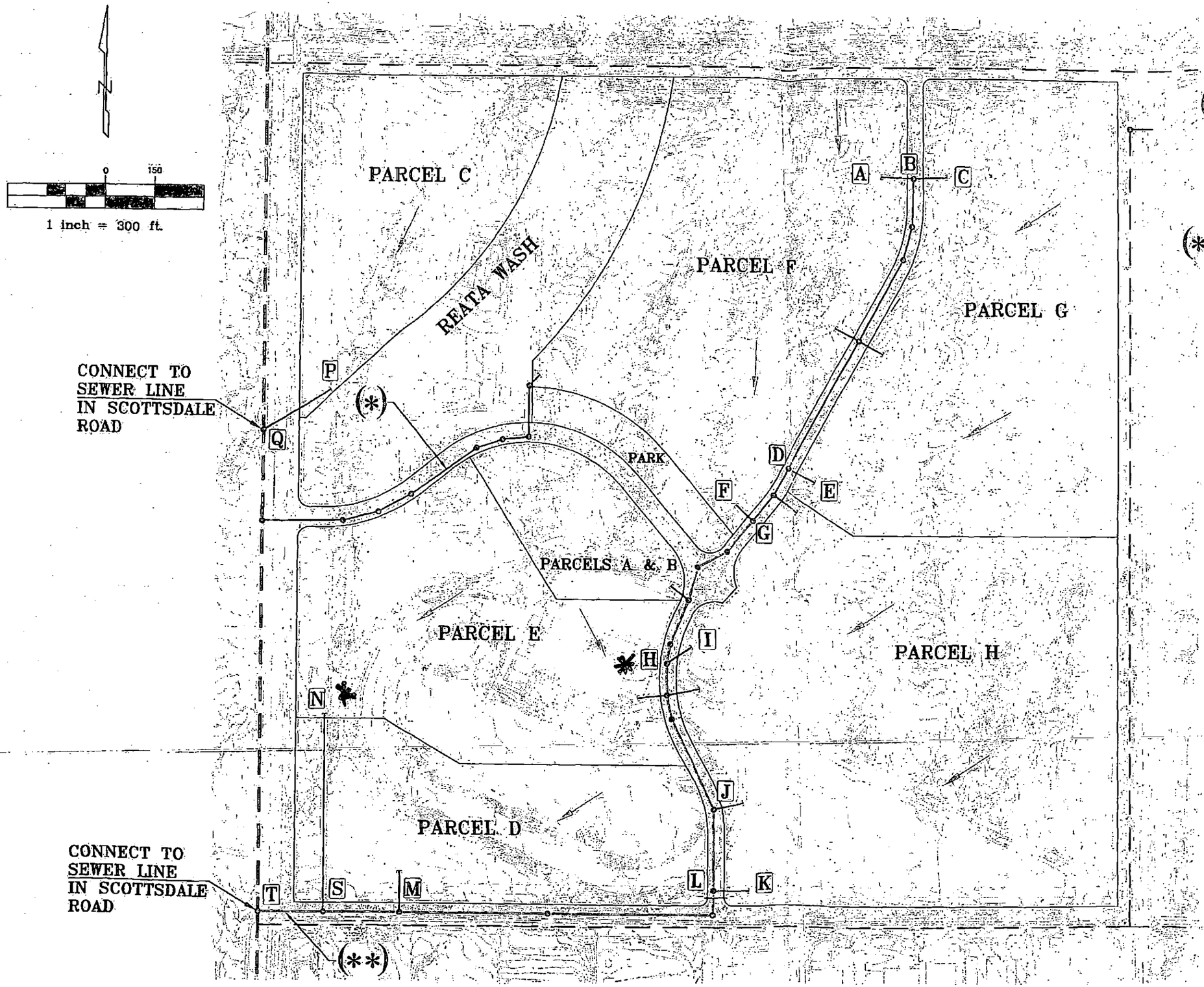
Scenario: Peak Hour Demand
Steady State Analysis
Junction Report

Label	Elevation (ft)	Zone	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-10	1,828	Zone 6W	92.4	2,020	83.1
J-20	1,847	Zone 6W	92.4	2,050	87.8
J-30	1,818	Zone 6W	0.0	2,020	87.4
J-40	1,822	Zone 6W	72.6	2,020	85.6
J-50	1,840	Zone 6W	99.8	2,020	77.8
J-60	1,870	Zone 6W	0.0	2,050	77.9
J-70	1,855	Zone 6W	246.1	2,020	71.4
J-100	1,838	Zone 6W	37.7	2,020	78.7
J-110	1,837	Zone 6W	43.8	2,020	79.1
J-120	1,817	Zone 6W	110.3	2,020	87.8
J-130	1,805	Zone 6W	120.3	2,020	93.0
J-140	1,810	Zone 6W	157.0	2,020	90.8
J-150	1,806	Zone 6W	0.0	2,020	92.6
J-160	1,814	Zone 6W	37.1	2,020	89.1
J-170	1,800	Zone 6W	0.0	2,020	95.2

Fire Flow Analysis

Fire Flow Report

Label	Elevation (ft)	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Pressure (psi)	Calculated Hydraulic Grade (ft)	Calculated Residual Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction
J-10	1,828	Zone 6W	true	1,500.0	1,552.8	1,652.8	83.1	2,020	83.0	71.4	J-70
J-20	1,847	Zone 6W	true	1,500.0	1,552.8	1,652.8	87.8	2,050	87.8	71.4	J-70
J-30	1,818	Zone 6W	true	1,500.0	1,500.0	1,600.0	87.4	2,020	87.3	71.4	J-70
J-40	1,822	Zone 6W	true	1,500.0	1,541.5	1,641.5	85.7	2,020	85.2	71.3	J-70
J-50	1,840	Zone 6W	true	1,500.0	1,557.0	1,657.0	77.9	2,020	75.8	71.1	J-70
J-60	1,870	Zone 6W	true	1,500.0	1,500.0	1,600.0	77.9	2,050	77.8	71.4	J-70
J-70	1,855	Zone 6W	true	1,500.0	1,640.6	1,740.6	71.4	2,020	70.9	77.6	J-50
J-80	1,863	No-Service	true	1,500.0	1,500.0	1,600.0	67.9	2,020	67.9	75.3	J-90
J-90	1,846	No-Service	true	1,500.0	1,500.0	1,600.0	75.3	2,020	75.3	67.9	J-80
J-100	1,838	Zone 6W	true	1,500.0	1,521.5	1,621.5	78.7	2,020	76.6	71.3	J-70
J-110	1,837	Zone 6W	true	1,500.0	1,525.0	1,625.0	79.2	2,020	78.5	71.1	J-70
J-120	1,817	Zone 6W	true	1,500.0	1,563.0	1,663.0	87.8	2,020	87.1	71.2	J-70
J-130	1,805	Zone 6W	true	1,500.0	1,568.8	1,668.8	93.0	2,020	89.2	71.4	J-70
J-140	1,810	Zone 6W	true	1,500.0	1,590.0	1,690.0	90.8	2,020	89.3	71.3	J-70
J-150	1,806	Zone 6W	true	1,500.0	1,500.0	1,600.0	92.6	2,020	92.3	71.4	J-70
J-160	1,814	Zone 6W	true	1,500.0	1,521.2	1,621.2	89.1	2,020	88.8	71.4	J-70
J-170	1,800	Zone 6W	true	1,500.0	1,500.0	1,600.0	95.2	2,020	94.9	71.4	J-70



(*) THIS LINE MAY OR MAY NOT BE INSTALLED. THE DEVELOPER OF PARCEL F IS TO PROVIDE DOCUMENTATION SUFFICIENT TO SATISFY THE TECHNICAL CONCERNS OF THE CITY OF SCOTTSDALE THAT THE PARCEL WILL GENERATE ENOUGH EFFLUENT, IN SUFFICIENT TIME TO SUBMITT, PROCESS AND OBTAIN CITY APPROVAL TO ALLOW THE MASTER DEVELOPER REASONABLE COORDINATION OF THE IMPROVEMENTS, MEANING BEFORE THE START OF CONSTRUCTIONOF SILVERSTONE DRIVE.

(**) SEE TABLE 2.2 MINIMUM SLOPES FOR SANITARY SEWER.

LEGEND

- 8" PROPOSED SANITARY SEWER
- 12" PROPOSED SANITARY SEWER
- 8" EXISTING SANITARY SEWER
- 15" EXISTING SANITARY SEWER
- PARCEL BOUNDARY
- FLOW ARROW

NOTE: THE LOCATION AND SIZES OF THESE SEWER LINES ARE A CONCEPTUAL DESIGN AND SHOULD NOT BE USED FOR CONSTRUCTION.

PLATE 2
MASTER WASTEWATER SYSTEM
SILVERSTONE
160-ACRE MIXED USE PROJECT

WOOD/PATEL

LAND DEVELOPMENT ◦ WATER RESOURCES
TRANSPORTATION / TRAFFIC
WATER / WASTEWATER ◦ SURVEYING
CONSTRUCTION MANAGEMENT

(602) 335-8500

Table 1-Estimated Wastewater Design Flow Calculations

Project: *SILVERSTONE - 160 ACRE MIXED USE PROJECT*
Location: *City of Scottsdale, Arizona*
Date: *20-Jun-07*
References: *City of Scottsdale Design Standards and Policy Manual*

CIVIL ENGINEERS * HYDROLOGISTS * LAND SURVEYORS * CONSTRUCTION MANAGERS

Project Number: *062731*
Project Engineer: *Darrel Wood, P.E.,R.L.S.*
Jason M. Casuga, E.I.T.

					RESIDENTIAL			COMMERCIAL-OFFICE			COMMERCIAL-RETAIL						
SEGMENT	PARCEL	ZONING	LAND USE	AREA OF CONTRIBUTING PARCEL	NUMBER OF DWELLING UNITS	ADF / UNIT (GPD)	RESIDENTAIL PEAKING FACTOR	OFFICE SPACE (SQ FT)	OFFICE ADF / SQ FT (GPD)	OFFICE PEAKING FACTOR	RETAIL SPACE (SQ FT)	RETAIL ADF / SQ FT (GPD)	RETAIL PEAKING FACTOR	PARCEL ADF (GPD)	PARCEL PEAK FLOW (GPD)	CUMULATIVE ADF (GPD)	CUMULATIVE PEAK FLOW (GPD)
A-B	F	R-5	Residential	14.55	124	250	4.0			4.0			4.0	31,000	124,000		
Total for Segment A-B				***15***	***124***									***31,000***	***124,000***	***31,000***	***124,000***
C-B	G	R-5	Residential	15.85	172	250	4.0			4.0			4.0	43,000	172,000		
Total for Segment C-B				***16***	***172***									***43,000***	***172,000***	***43,000***	***172,000***
							4.0			4.0			4.0				
Total for Segment B-D																***74,000***	***296,000***
E-D	G	R-5	Residential	7.93	86	250	4.0			4.0			4.0	21,500	86,000		
Total for Segment E-D				***8***	***86***									***21,500***	***86,000***	***21,500***	***86,000***
D-G	H	R-5	Residential	5.71	45	250	4.0			4.0			4.0	11,250	45,000		
Total for Segment D-G				***6***	***45***									***11,250***	***45,000***	***106,750***	***427,000***
F-G	F	R-5	Residential	7.28	62.0	250	4.0			4.0			4.0	15,500	62,000		
Total for Segment F-G				***7***	***62***									***15,500***	***62,000***	***15,500***	***62,000***
G-H	A & B	C-O	Municipal	4.48			4.0	45,000	0.100	4.0			4.0	4,500	18,000		
Total for Segment G-H				***4***				***45,000***						***4,500***	***18,000***	***126,750***	***507,000***
I-H	H	R-5	Residential	17.13	135	250	4.0			4.0			4.0	33,750	135,000		
Total for Segment I-H				***17***	***135***									***33,750***	***135,000***	***33,750***	***135,000***
H-J	E	R-5	Residential	5.24	79	250	4.0			4.0			4.0	19,750	79,000		
Total for Segment H-J				***5***	***79***									***19,750***	***79,000***	***180,250***	***721,000***
J-L	H	R-5	Residential	5.71	45	250	4.0			4.0			4.0	11,250	45,000		
Total for Segment J-L				***6***	***45***									***11,250***	***45,000***	***191,500***	***766,000***
K-L	H	R-5	Residential	5.71	45	250	4.0			4.0			4.0	11,250	45,000		
Total for Segment K-L				***6***	***45***									***11,250***	***45,000***	***11,250***	***45,000***
L-M	D	C-O	Office	6.21			4.0	82,500	0.100	4.0			4.0	8,250	33,000		
Total for Segment L-M				***6***				***82,500***						***8,250***	***33,000***	***211,000***	***844,000***
M-S	D	C-O	Office	6.21			4.0	82,500	0.100	4.0			4.0	8,250	33,000		
Total for Segment M-S				***6***				***82,500***						***8,250***	***33,000***	***219,250***	***877,000***
N-S	E	R-5	Residential	12.23	183	250	4.0			4.0			4.0	45,750	183,000		
Total for Segment N-S				***12***	***183***									***45,750***	***183,000***	***45,750***	***183,000***
S-T							4.0			4.0			4.0				
Total for Segment S-T																***265,000***	***1,060,000***
P-Q	C	C-2	Retail	12.47			4.0			4.0	95,000	0.71	4.0	67,450	269,800		
Total for Segment P-Q				***12***							***95,000***			***67,450***	***269,800***	***67,450***	***269,800***
Development Total				***127***	***976***			***210,000***			***95,000***			***332,450***	***1,329,800***	***332,450***	***1,329,800***