Water System Plan Update

Appendices

FINAL | MAY 2021

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Appendix P

CALIBRATION FIELD PLANS AND TESTING LOCATIONS

City of Renton
Water System Plan

Technical Memorandum 2
MODEL CALIBRATION PLAN

DRAFT | June 2018

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City of Renton
Water System Plan

Technical Memorandum 2
MODEL CALIBRATION PLAN

DRAFT | June 2018

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June 2018,
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Technical Memorandum 2

MODEL CALIBRATION PLAN

2.1 Overview

This calibration plan covers each of the calibration processes, specifically focusing on data gathering needs for an accurate and complete calibration of the City of Renton's (City's) water system hydraulic model.

2.1.1 Schedule

Field testing and data gathering for the model calibration will tentatively take place from June 18th through July 20th. Table 2.1 presents a preliminary schedule for the data gathering and field testing, detailing the activities within each day. This will allow our team to start the model calibration as soon as possible following the calibration data gathering.

The remainder of this plan details the data required for calibration and testing procedures for each portion of the calibration tests.

2.2 Model Update and Check

2.2.1 Model Update

Carollo Engineers, Inc. (Carollo) will perform an overall check of the hydraulic model to verify that it is running correctly. Carollo assumes the model received from the City is up-to-date, matches the City's geographic information system (GIS) data, and that no updates to pipes or other system geometric features are required. If nodes or pipes require a change in the hydraulic model, City staff will make the changes and provide Carollo with an updated model.

Projected demands will be applied in the model based on meter locations and demand factors for each customer class. Projected demands for the largest customers will be applied directly to each customer location. The demands will include the current year for model calibration, as well as the projected 10-year and 20-year average day demand (ADD) and maximum day demand (MDD) for planning. Carollo will verify that the model is set up to be able to perform water age analysis in the future.

2.2.2 Model Check

The model check process will involve several steps to ensure that the model is producing reasonable results.

Carollo will run the model with existing demand conditions and check system stability. Possible adjustments include modifications to pipeline connectivity, operational controls, ground elevations, facility characteristics, and pump curves.

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Table 2.1 Calibration Data Gathering and Testing Schedule

May	***Fri***	***Sat***	***Sun***	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***	***Sun***	***Mon***	***Tue***	***Wed***	***Thu***																
Tasks	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31																
Draft Calibration Plan	X																													
Calibration Plan Review Meeting														X																
June	***Fri***	***Sat***	***Sun***	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***	***Sun***	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***	***Sun***	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***	***Sun***	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***
Tasks	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30
Finalize Tests Locations								X																						
Hydrant Flow Tests																		X	X	X	X	X			X	X	X	X	X	
Pressure Loggers for EPS Calibration																													X	X

July	***Sun***	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***	***Sun***	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***	***Sun***	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***
Tasks	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Pressure Loggers for EPS Calibration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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2.2.3 Water System Controls Review

It is important to understand the overall operational objectives regarding prioritization of various water supply sources and key system facilities, prior to input of model controls. It is assumed that the operational strategy is replicated in the hydraulic model. It is assumed that the system controls provided in the latest hydraulic model correspond to the latest data. However, the operations of each pump station, reservoir, pressure reducing station and other valve structures will be checked as needed; for instance, if the model is unable to meet field results.

2.2.4 Transmission Main Connectivity Check

Carollo will use the connectivity features of InfoWater to verify the connectivity of the transmission mains within the distribution system. Any problems found using the connectivity locators will be reviewed on a case-by-case basis by the hydraulic modeler to determine whether adjustments need to be made to the connectivity of the model. Output reports of pipe flow characteristics, such as headloss (feet per kilofeet (ft/kft)) and velocity (feet per second (ft/s)) will also be used to locate problem areas to be further reviewed by the hydraulic modeler to determine whether additional adjustments need to be made to the connectivity of the model.

2.2.5 System Pressures Check

The model check will compare the model output to the typical pressures expected throughout the distribution system. This process will allow Carollo to locate major errors in model creation, elevations, or GIS connectivity, as well as changes that need to be made in how operational controls of the system should be implemented in the model.

2.3 Fire Flow Testing

2.3.1 Overview of Fire Flow Calibration Process

Model calibration using fire flow tests is intended to develop a steady state calibrated hydraulic model by closely matching modeled water pressures to field pressures under similar demand and system operating conditions. The primary varied parameter for this calibration will be pipeline roughness coefficients and facility minor loss coefficients, although other parameters may be adjusted as calibration results are generated.

The scope of work for the City's Water System Plan Update includes fire flow tests at up to twenty (20) locations over a two week period. The fire flow tests will consist of one or two flowing hydrants and two pressure hydrants. These field tests will be simulated in the model to calibrate the model under steady state conditions. Pressure loggers will be used to measure static and residual pressure at the pressure hydrants and also deployed throughout the system during hydrant tests to better measure the system's reaction to each fire flow.

The fire flow tests will each stress the City's distribution system by creating a differential between the hydraulic grade line (HGL) at the points of hydrant flow and the system HGL at neighboring hydrants. This HGL differential will increase the effect of the roughness coefficients on system losses. The model roughness coefficients will be adjusted to match model pressures to field pressures within an acceptable tolerance. As the model is adjusted to match system pressures, roughness and loss coefficients will be adjusted only within a tolerance of industry accepted roughness coefficient ranges. If the model is unable to match the calibration results without leaving the acceptable range of roughness coefficient values for a given pipeline

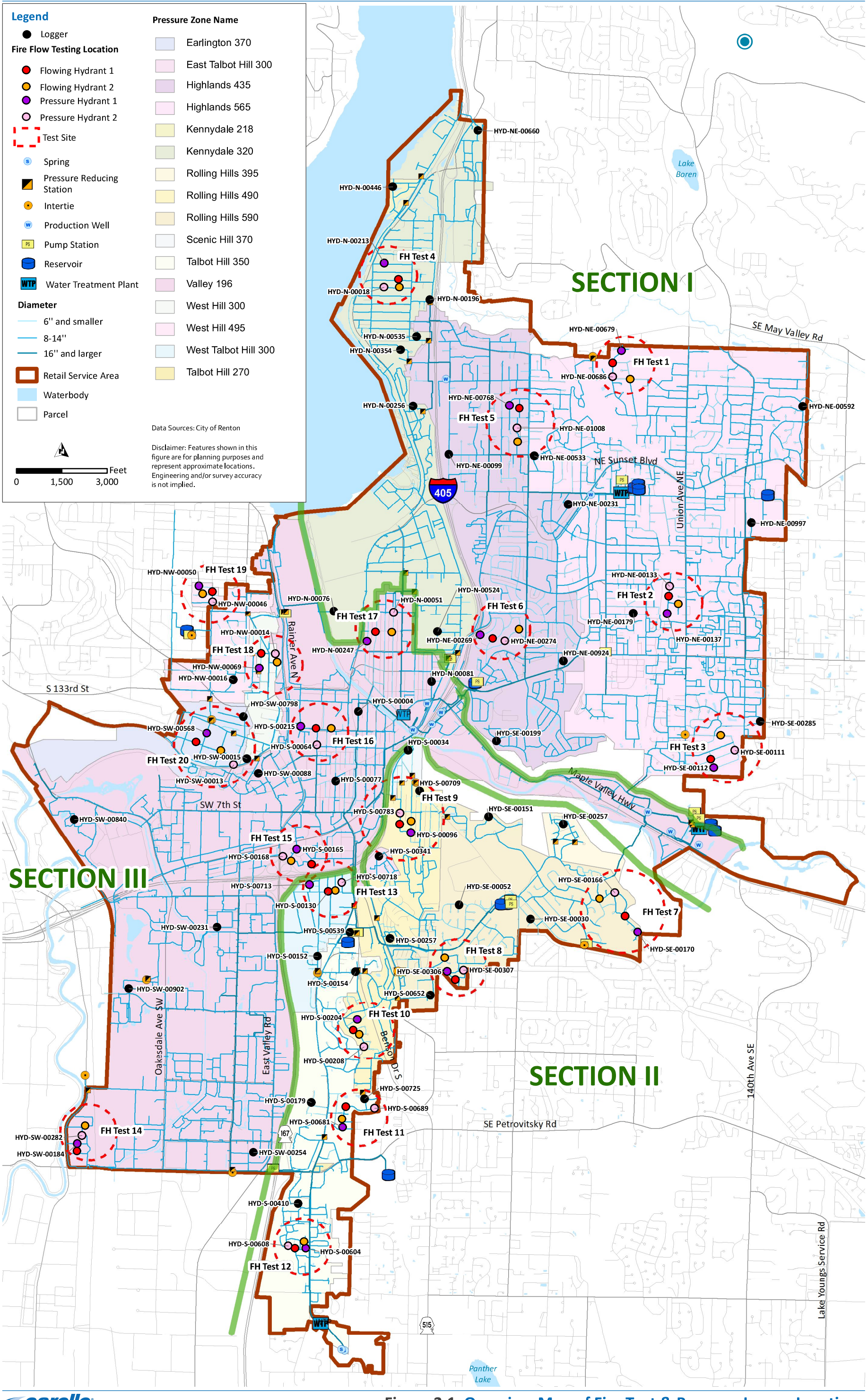
material and age, there may be cause for further investigation of a previously unknown field condition. Examples of such conditions, which typically arise during hydraulic model calibration, include closed pipelines, partially closed or malfunctioning valves, extreme corrosion within pipelines, connectivity and diameter errors in GIS/as-builts, and diurnal patterns of large water users.

2.3.2 Fire Flow Test Locations

Carollo has selected 20 preliminary testing sites, which are shown on Figure 2.1. Each of the testing sites is shown in detail on an individual detail map (Appendix 2A and Appendix 2B). Pressure loggers will also be installed in the system during the fire hydrant tests. The system was divided into three (3) sections, as shown on Figure 1. Each section is anticipated to have approximately 15 pressure loggers installed to help understand system's response to hydrant tests.

The test sites have been selected for accessibility and also such that they create a good geographical coverage of the City's entire distribution system. All tests involve 6-inch and 8-inch diameter pipelines and are located away from major transmission lines to increase the chance that a substantial pressure drop (> 10 pounds per square inch (psi)) is observed during the tests.

The fire test sites were selected using the City's updated hydraulic model water main database, however, the City should confirm the pipeline and fire hydrant information in the vicinity of each test site (e.g., alignment, diameter, age, and material of the pipelines and location of fire hydrants).



Last Revised: June 08, 2018 \\io-fs-1\Data\GIS\GISBackup\Renton\WaterSystemPlan2017\FireHydrantTestLocation.mxd

Figure 2.1 Overview Map of Fire Test & Pressure Logger Locations

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2.3.3 Preliminary Schedule for Testing Days

The equipment testing and fire flow tests are scheduled between Monday, June 18, 2018 and Friday, June 29, 2018. The following schedule details the events for the day.

June 18, 2018

8:00 am Meet at Renton Shop:

- Introductions.
- Record time difference between field time and supervisory control and data acquisition (SCADA) clock.
- Distribute packets and routing information.
- Check radios, if necessary (or fill in cell phone contact sheet).
- Calibrate pressure gauges on a nearby hydrant and record differences.
- Travel to sites determined for the day.

8:30 am - 3:00 pm

- Install all pressure loggers for Section I as shown on Figure 1.

June 19, 2018

8:00 am Meet at Renton Shop:

- Distribute packets and routing information.
- Check radios, if necessary (or fill in cell phone contact sheet).
- Travel to sites determined for the day.

8:30 am - 3:00 pm

- Perform fire hydrant tests 1, 2, 3, and 6.

June 20, 2018

8:00 am Meet at Renton Shop:

- Distribute packets and routing information.
- Check radios, if necessary (or fill in cell phone contact sheet).
- Travel to sites determined for the day.

8:30 am - 3:00 pm

- Perform fire hydrant tests 5 and 4.
- Remove all pressure loggers from Section I.
- Install all pressure loggers from Section II.

June 21, 2018

8:00 am Meet at Renton Shop:

- Distribute packets and routing information.
- Check radios, if necessary (or fill in cell phone contact sheet).
- Travel to sites determined for the day.

8:30 am - 3:00 pm

- Download Section I pressure loggers data.
- Perform fire hydrant tests 7, 8, 10, and 11.

June 26, 2018

8:00 am Meet at Renton Shop:

- Distribute packets and routing information.
- Check radios, if necessary (or fill in cell phone contact sheet).
- Travel to sites determined for the day.

8:30 am - 3:00 pm

- Perform fire hydrant tests 12, 13, and 9.
- Remove Section II pressure loggers.

June 27, 2018

8:00 am Meet at Renton Shop:

- Distribute packets and routing information.
- Check radios, if necessary (or fill in cell phone contact sheet).
- Travel to sites determined for the day.

8:30 am - 3:00 pm

- Install Section III pressure loggers.
- Download Section II pressure loggers' data.
- Perform fire hydrant tests 19, 18, and 20.

June 28, 2018

8:00 am Meet at Renton Shop:

- Distribute packets and routing information.
- Check radios, if necessary (or fill in cell phone contact sheet).
- Travel to sites determined for the day.

8:30 am - 3:00 pm

- Perform fire hydrant tests 15, 14, 16, and 17.

June 29, 2018

8:00 am Meet at Renton Shop:

- Distribute packets and routing information.
- Check radios, if necessary (or fill in cell phone contact sheet).
- Travel to sites determined for the day.

8:30 am - 3:00 pm

- Remove Section III loggers.
- Install 20 pressure loggers for EPS calibration.

2.3.4 Standard Fire Flow Test Protocol

2.3.4.1 Required Equipment / Staff

Required Staff

A minimum of 5 people should be available during the hydrant flow testing for the following tasks:

- Three (3) City staff members at the flowing hydrant(s).
- Two (2) Carollo staff members at pressure hydrants.

City staff shall be responsible for installation/removal of data loggers on hydrants, operation of valves, driving City vehicles or any other function involving City property.

Required Equipment (City)

- 3 pressure gauges (1 primary, 1 secondary, 1 spare).
- 3 flow gauges and diffusers (1 primary, 1 secondary, 1 spare).
- Dechlorinating equipment for the discharged water.
- Signage and cones for traffic safety.
- Sand bags as needed for control of discharged water.
- 6 hand-held radios or push-to-talk type cell phones (1 per person and 1 spare).
- Wrenches and equipment to open/flow each hydrant and necessary valves.
- 5 Dickson pressure loggers.

Required Equipment (Carollo)

- Maps and field testing forms (including routing and order of testing).
- Data collection sheets.
- Means to pull data from pressure loggers.
- 15 Dickson pressure loggers.

2.3.4.2 Fire Flow Testing Procedure

1. Calibrate Meters. On the day of fire flow testing, all the pressure and flow meters should be calibrated by comparing readings when attached to the same hydrant.
2. Take Positions. Position everyone at their respective locations with their clipboard and field-testing forms and confirm that everyone is at their place via radio/cell phone/hand signals.
3. Install Pressure Loggers. Attach the pressure loggers to the pressure hydrants (P-1 and P-2) and Flow hydrant (F-1).
4. Record Pre-flow Conditions:
   a. Carollo coordinator will log the time, date and location in the testing form.
   b. Carollo coordinator will record the static pressure reading from each hydrant, one-by-one (before opening the flowing hydrant), and record in the field testing form.
5. Install Flow Gauge. Attach the flow gauge to the flow hydrant (F-1).
6. Start Hydrant Flow. Carollo coordinator will have a City staff member open the flowing hydrant (F-1) until a steady stream is flowing (divert into gutters).
7. Confirm Pressure Drop Target is Met and Record Flow Conditions:
   a. Carollo coordinator will ask for the flow from the flowing hydrant (F-1) and record in the field testing form.

   b. Carollo coordinator will obtain pressure drop from person at pressure hydrants (P-1 and P-2).
   c. Carollo coordinator will confirm that pressure is stabilized and at least 10 psi less than static pressure:
      i. If ΔP≥10 psi: go to next step.
      ii. If ΔP<10 psi: Carollo coordinator will ask person at flowing hydrant (F-1) to close the hydrant, repeat steps above with both flowing hydrants (F-1 and F-2).
      iii. If ΔP≥5 psi: go to next step (10 psi is preferred, but 5 psi is still acceptable).
      iv. If ΔP<5 psi: move to next site (test failed).
8. Close Flowing Hydrant. Carefully and slowly close the flowing hydrant. If two hydrants are flowing, close one at a time.
9. Check Results. Carollo coordinator will check for any anomalies (such as a gauge stuck on a high pressure or consistently showing significantly higher pressure than the rest of the readings). If results are irregular, repeat the test one more time.
10. Move to Next Site. If all looks good, Carollo coordinator will notify all field personnel to move on to the next hydrant flow test site.

2.3.5 Extended Period Calibration

The extended period calibration (EPS) improves the model's ability to simulate long-period operation of the system. The calibration is done by closely matching the model pressures, flows, and tank levels to field conditions over a 24-hour period of similar demand and system boundary conditions. Pressure data, tank levels, and flows from the water supplies, booster stations, and the pressure reducing stations will be recorded for several days in order to obtain EPS calibration data. The primary varied parameters for this calibration will be operational controls and pipeline roughness coefficients; although other parameters may also be adjusted as calibration results are generated.

2.3.5.1 Data Required for Extended Period Calibration

The calibration data required for the extended period calibration consists of records of system pressures, tank levels, and flows from groundwater wells, interconnections, pump stations, and the pressure reducing stations throughout the distribution system. These system pressures will be gathered both by the City's existing sensor network and by temporary pressure loggers, which will be attached to hydrants throughout the distribution system. Additional data, including system controls and operational details, will be required to establish boundary conditions for the model. This data will be gathered over the course of twenty-one (21) days between June 29, 2018 and July 20, 2018 (See Table 2.1 for the complete calibration schedule).

A target system interval of 15 minutes will be used for data gathering. If any facilities listed lack the capabilities for 15 minute interval data gathering (e.g., they use circular charts or flow totalizers), assumptions will be necessary to interpolate data for the calibration.

The calibration data required for EPS calibration is listed by site in Table 2.2. The location of the temporary pressure loggers are shown on Figure 2.2, and the respective hydrant number is listed on Table 2.3. See Appendix 2C for detailed temporary pressure logger site information.

Table 2.2 EPS Calibration Data Gathering Parameters

Facility Name	Measurement	Unit	Interval	Source
Reservoirs				
North Talbot Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
Mt. Olivet Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
Highlands 435 - 1.5 MG Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
Highlands 435 - 2.0 MG Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
Highlands 565 - 0.75 MG Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
Hazen 565 Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
Rolling Hills 590 Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
Rolling Hills 490 Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
West Hill Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
South Talbot Reservoir	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
Maplewood Clearwell	level	ft	15 min	SCADA
	flow	gpm	15 min	SCADA
	pressure	psi	15 min	SCADA
Pump Stations				
Mt Olivet PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
House Way PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA

Table 2.2 EPS Calibration Data Gathering Parameters (Continued)

Facility Name	Measurement	Unit	Interval	Source
Highlands PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
West Hill PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
Rolling Hills PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
North Talbot PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
Maplewood PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
South Talbot PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
Tiffany Park PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
Fred Nelson PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
Dimmitt PS	flow	gpm	15 min	SCADA
	suction pressure	psi	15 min	SCADA
	discharge pressure	psi	15 min	SCADA
System Inflows/Outflows				
PRV 28 SPU Sta. #33	flow	gpm	15 min	SCADA
Fred Nelson SPU Sta. #34	flow	gpm	15 min	SCADA
SPU Sta. #36	flow	gpm	15 min	SCADA
PRV 6 SPU Sta. #37	flow	gpm	15 min	SCADA
PRV 35 SPU Sta. #38	flow	gpm	15 min	SCADA

Table 2.2 EPS Calibration Data Gathering Parameters (Continued)

Facility Name	Measurement	Unit	Interval	Source
Tiffany Park SPU Sta. #39	flow	gpm	15 min	SCADA
Renton / Seattle	flow	gpm	15 min	SCADA
Boeing Plant Meter – East	flow	gpm	15 min	SCADA
Boeing Plant Meter – West	flow	gpm	15 min	SCADA
Skyway Wholesale	flow	gpm	15 min	SCADA
Wells (provide best available information on flows if SCADA not available)				
Springbrook	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well RW-1	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well RW-2	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well RW-3	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well PW-8	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well PW-9	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well PW-5A	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well PW-11	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well PW-12	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well PW-17	flow level	gpm ft	15 min 15 min	SCADA SCADA
Well EW-3R	flow level	gpm ft	15 min 15 min	SCADA SCADA

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Legend

- Loggers
- Spring
- Pressure Reducing Station
- Emergency Intertie
- Intertie
- Production Well
- Pump Station
- Reservoir
- Water Treatment Plant

Diameter

- 6'' and smaller
- 8-14''
- 16'' and larger

- Retail Service Area
- Waterbody
- Parcel

N

0 1,500 3,000 Feet

Data Sources: City of Renton

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Pressure Zone Name

- Earlington 370
- East Talbot Hill 300
- Highlands 435
- Highlands 565
- Kennydale 218
- Kennydale 320
- Rolling Hills 395
- Rolling Hills 490
- Rolling Hills 590
- Scenic Hill 370
- Talbot Hill 350
- Valley 196
- West Hill 300
- West Hill 495
- West Talbot Hill 300
- Talbot Hill 270

Logger 1- HYD-NE-00529
Logger 2- HYD-NE-00678
Logger 3- HYD-NE-00099
Logger 4- HYD-SE-00285
Logger 5- HYD-SE-00197
Logger 6- HYD-N-00076
Logger 7- HYD-NW-00091
Logger 8 WCV-0346 / WCV-0347 Downstream Side of PRV
Logger 9 WCV-0378 / WCV-0379 Downstream Side of PRV
Logger 10- HYD-S-00281
Logger 11 WCV-0394 / WCV-0395 Upstream Side of PRV
Logger 12 WCV-0443 / WCV-0444 Downstream Side of PRV
Logger 13 WCV-0375 / WCV-0376 Upstream Side of PRV
Logger 14- HYD-S-00034
Logger 15- HYD-S-00254
Logger 16- HYD-S-00187
Logger 17 (City) WCV-0360 / WCV-0361 Downstream Side of PRV
Logger 18- HYD-SW-00253
Logger 19- HYD-S-00134
Logger 20- HYD-NW-00015

Lake Boren
Panther Lake
SE May Valley Rd
NE Sunset Blvd
Union Ave NE
Rainier Ave N
S 133rd St
SW 7th St
Maple Valley Hwy
Oakesdale Ave SW
East Valley Rd
Benson Dr S
140th Ave SE
SE Petrovitsky Rd
Lake Youngs Service Rd
405
167
515

Figure 2.2 Pressure Logger Locations

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Table 2.3 Temporary Pressure Logger Summary

Logger Site	Location (Hydrant/Valve ID)	Logger ID	Notes
Logger 1	NE-00529	30	
Logger 2	NE-00678	32	
Logger 3	NE-00099	33	
Logger 4	SE-00285	34	
Logger 5	SE-00197	35	
Logger 6	N-00076	36	
Logger 7	NW-00091	37	
Logger 8	WCV-346/WCV-347	38	Downstream Side of PRV
Logger 9	WCV-378/WCV-379	39	Downstream Side of PRV
Logger 10	S-00281	41	
Logger 11	WCV-394/WCV-395	42	Upstream Side of PRV
Logger 12	WCV-0443/WCV-0444	43	Downstream Side of PRV
Logger 13	WCV-375/WCV-376	44	Upstream Side of PRV
Logger 14	S-00034	45	
Logger 15	SE-00254	46	
Logger 16 (City)	S-00187	City1	
Logger 17 (City)	WCV-360/WCV-361	City2	Downstream Side of PRV
Logger 18 (City)	SW-00253	City3	
Logger 19 (City)	S-00134	City4	
Logger 20 (City)	N-00015	City5	

2.3.5.2 Format of Data

SCADA Data

All SCADA data needs to be provided in Microsoft (MS) Excel or a MS compatible database format. Table 2.4 presents a sample format for the SCADA data.

Depending on the interval of data available and record keeping capabilities of the SCADA system, modifications may need to be made to the SCADA system prior to the calibration week (and impacting the schedule). It would be preferable to our team to obtain SCADA data on 15-minute intervals. If the SCADA data is queried from each facility independently, the time of each data point should be included in the output report.

Table 2.4 Sample SCADA Data Format

TANK3_LEVEL		TANK2_LEVEL		PS9_PRESSUR_SUCT		PS9_PRESSUR_DISC	
time	ft	time	ft	time	psi	time	psi
2/1/09 1:00	27.61	2/1/09 1:00	25.73	2/1/09 1:00	44.53	2/1/09 1:00	120.59
2/1/09 1:15	27.52	2/1/09 1:15	25.54	2/1/09 1:15	44.65	2/1/09 1:15	117.05
2/1/09 1:30	27.35	2/1/09 1:30	25.39	2/1/09 1:30	44.20	2/1/09 1:30	119.63
2/1/09 1:45	25.12	2/1/09 1:45	25.29	2/1/09 1:45	45.34	2/1/09 1:45	119.42
2/1/09 2:00	25.59	2/1/09 2:00	25.13	2/1/09 2:00	45.13	2/1/09 2:00	115.52
2/1/09 2:15	25.60	2/1/09 2:15	27.56	2/1/09 2:15	45.26	2/1/09 2:15	117.21
2/1/09 2:30	25.55	2/1/09 2:30	27.60	2/1/09 2:30	44.59	2/1/09 2:30	117.29
2/1/09 2:45	27.96	2/1/09 2:45	27.90	2/1/09 2:45	45.01	2/1/09 2:45	117.05
2/1/09 3:00	25.76	2/1/09 3:00	27.67	2/1/09 3:00	45.75	2/1/09 3:00	116.55
2/1/09 3:15	25.41	2/1/09 3:15	26.51	2/1/09 3:15	44.22	2/1/09 3:15	116.91
2/1/09 3:30	25.56	2/1/09 3:30	27.31	2/1/09 3:30	44.42	2/1/09 3:30	115.15
2/1/09 3:45	25.06	2/1/09 3:45	26.96	2/1/09 3:45	45.04	2/1/09 3:45	119.02
2/1/09 4:00	25.11	2/1/09 4:00	27.00	2/1/09 4:00	44.17	2/1/09 4:00	120.00

Note:
(1) This sample was taken from a different SCADA system and thus may not represent the exact format of the City's SCADA output.

Manual Facilities

For any manually operated facilities listed in Table 2.2 operated during the EPS data gathering period, an operational log should be substituted for the requested facility parameters. It is assumed that flow totalizers are used to take daily readings of the amount of water pumped during each 24-hour period. For any manually operated pump used during the extended period calibration week, the hours that the pump is on or off, along with the flow rate during each operation period will be needed. Photocopies of the log sheets for these pumps would be sufficient. If the City finds it more convenient, a handwritten or electronic log of all sites would also be sufficient.

Temporary Pressure Loggers

Carollo will provide 15 temporary pressure loggers to be attached to hydrants within the City's distribution system. The City has 5 pressure loggers that can also be used for this field test. Our team has indicated hydrant locations for the 20 pressure loggers on Figure 2.2. City staff will install near these locations as local meters and appurtenances allow, tentatively between June 29, and July 20, 2018.

2.3.5.3 Required Equipment / Staff

Required Staff (City)

City employees will place all of the pressure loggers in the field one day prior the testing (tentatively June 29, 2018). City staff shall be responsible for installation/removal of data loggers on hydrants, driving City vehicles, or any other function involving City property. At the end of the testing (tentatively July 20, 2018), the City staff shall remove the loggers and Carollo will have a courier pick up the pressure loggers at Renton Shop.

Required Equipment (City)

- Appropriate wrenches and equipment to place loggers at each location.
- 5 pressure loggers.

Required Equipment (Carollo)

- 15 pressure loggers – (C-30 through C-46).

2.3.5.4 Models and Intermediate Readings

The sampling interval for all pressure loggers should be set to 5 minutes. Each pressure logger will require approximately 6,048 data points (12 data points per hour over 21 days).

The internal capacity of the Dickson PR125 pressure loggers is limited to 60,000 data points, and the internal capacity of Track-IT 150 pressure loggers is limited to 64,000 data points, all of which are sufficient to record twenty-one days of data in 5-minute intervals.

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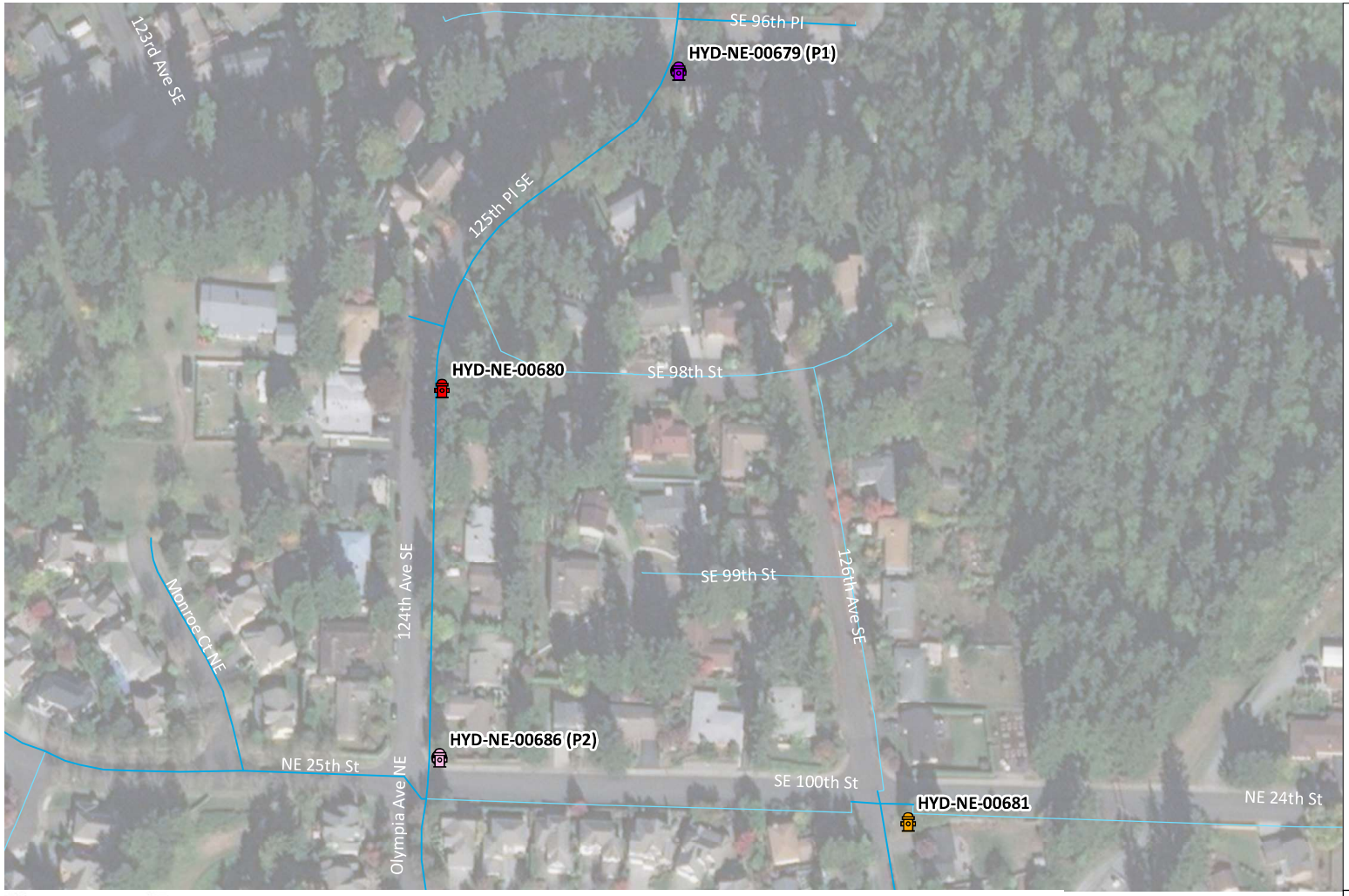
Appendix 2A

FIRE FLOW TEST DETAIL MAPS



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

N

0 100 200 Feet

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

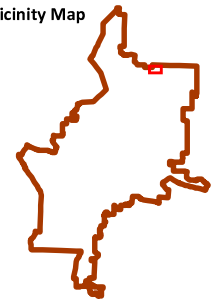
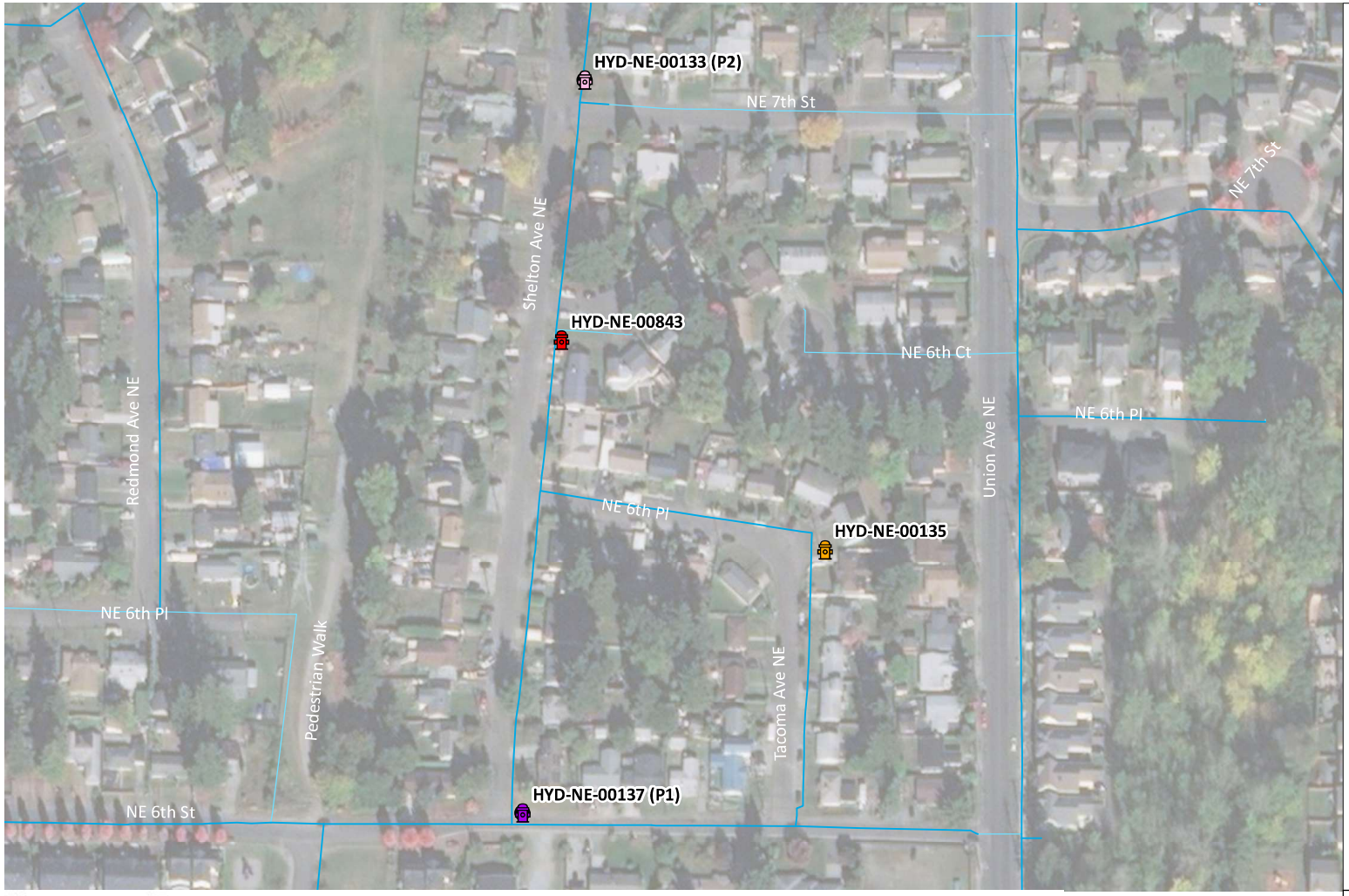


Figure 1 Hydrant Flow Test 1 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

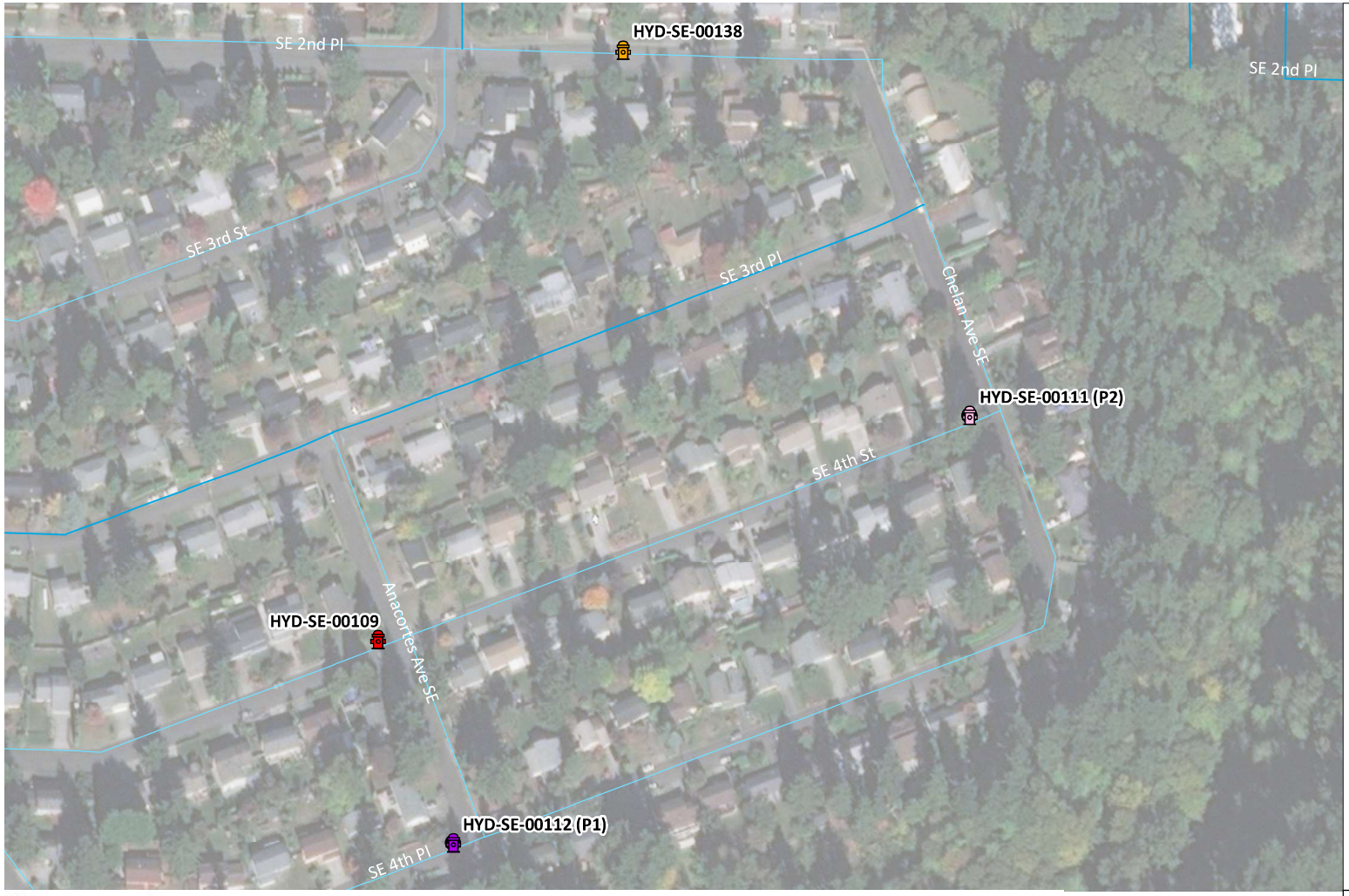
Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

Figure 2 Hydrant Flow Test 2 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

N

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

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Figure 3 Hydrant Flow Test 3 Form

Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

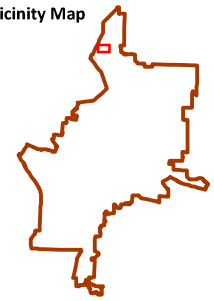

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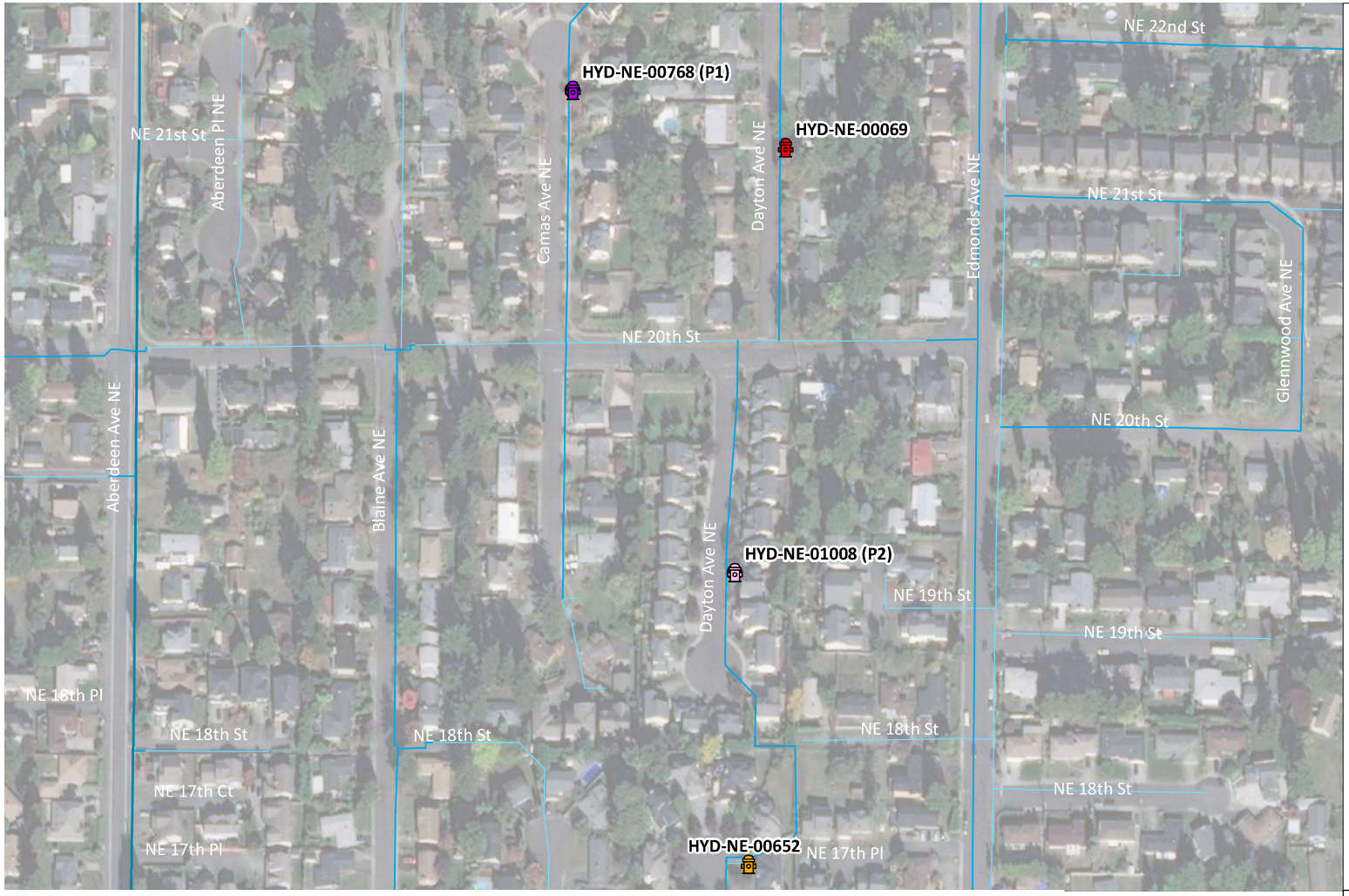
Figure 4 Hydrant Flow Test 4 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"
- 16" and larger

Feet
0 120 240

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

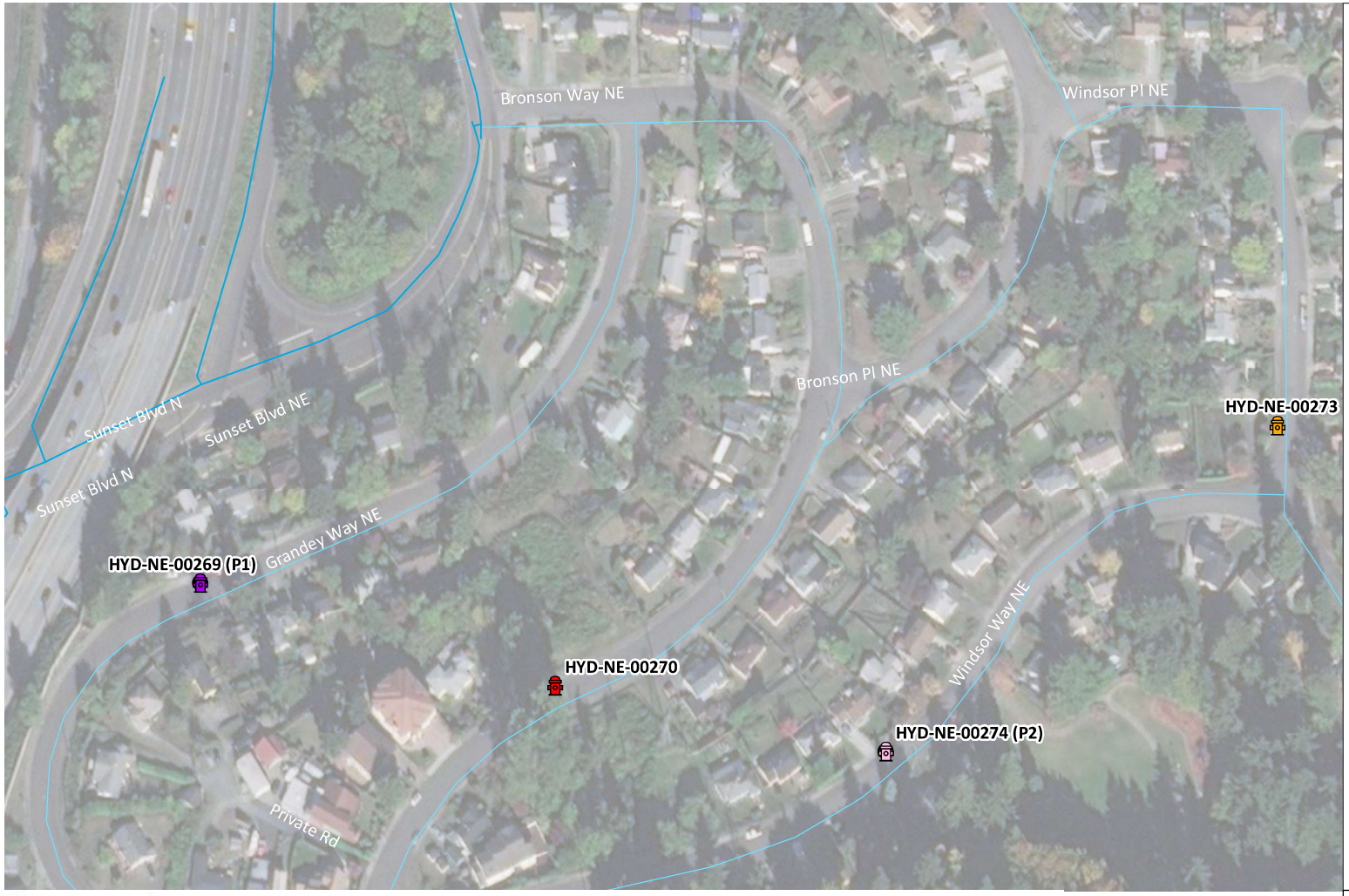
Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

Figure 5 Hydrant Flow Test 5 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

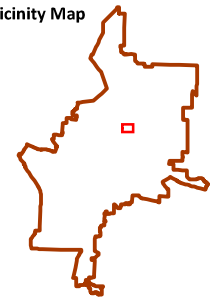


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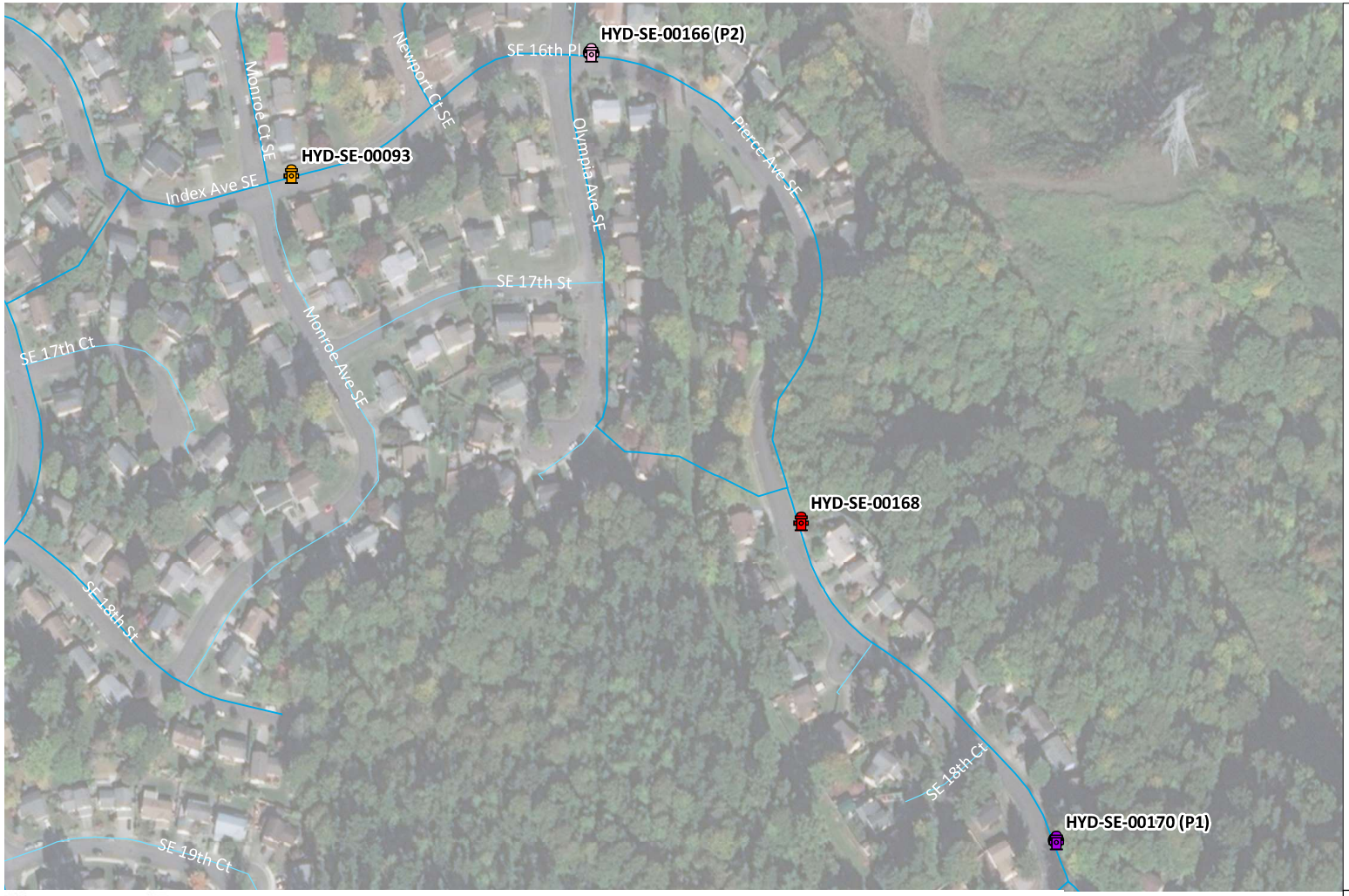
Figure 6 Hydrant Flow Test 6 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 137.5 275

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

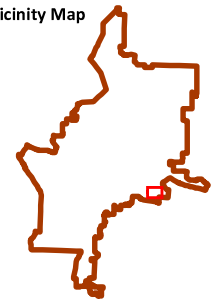
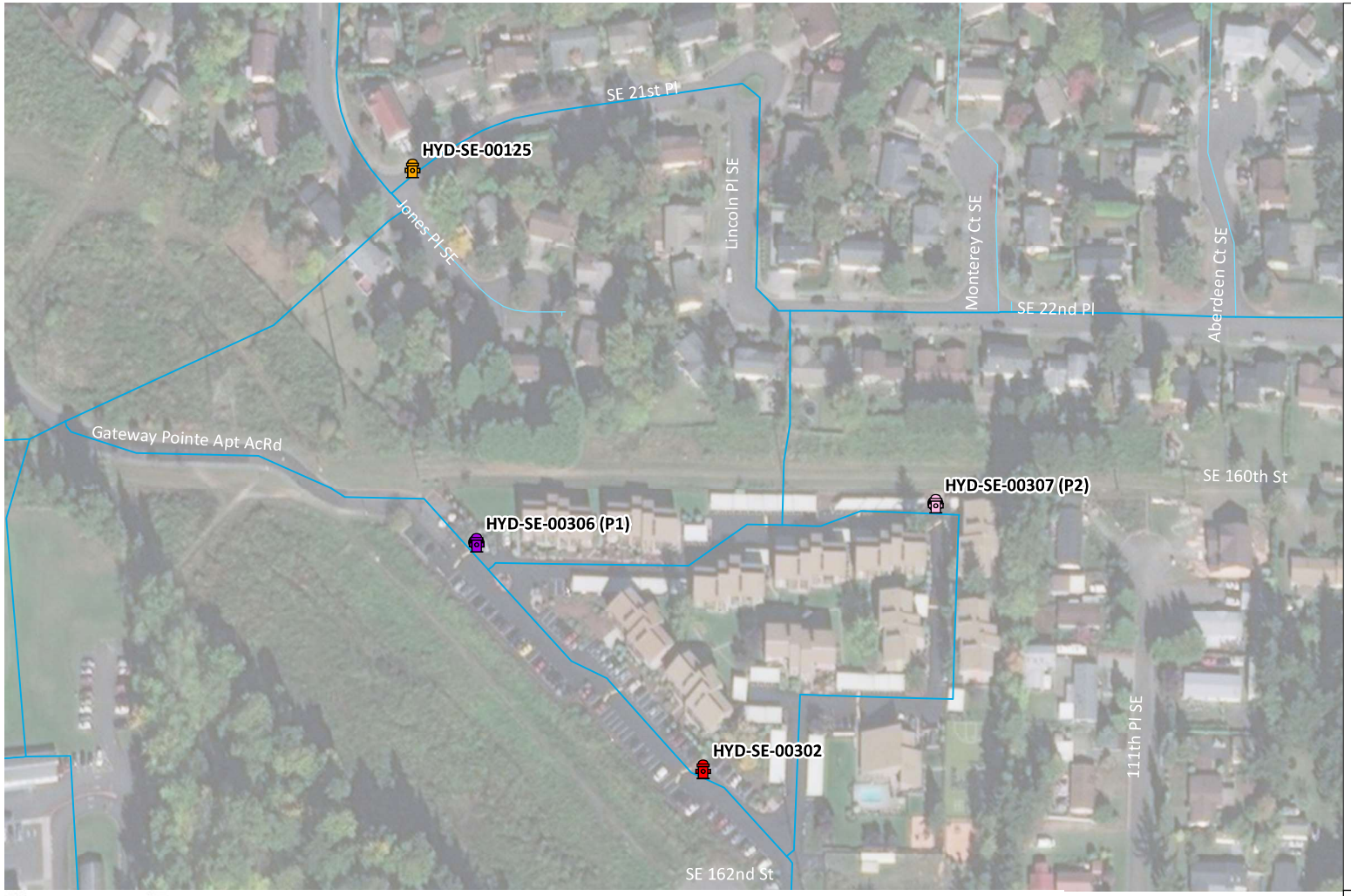


Figure 7 Hydrant Flow Test 7 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

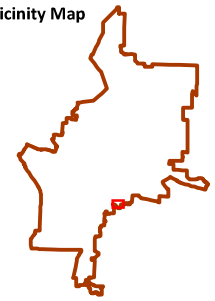


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Figure 8 Hydrant Flow Test 8 Form

Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

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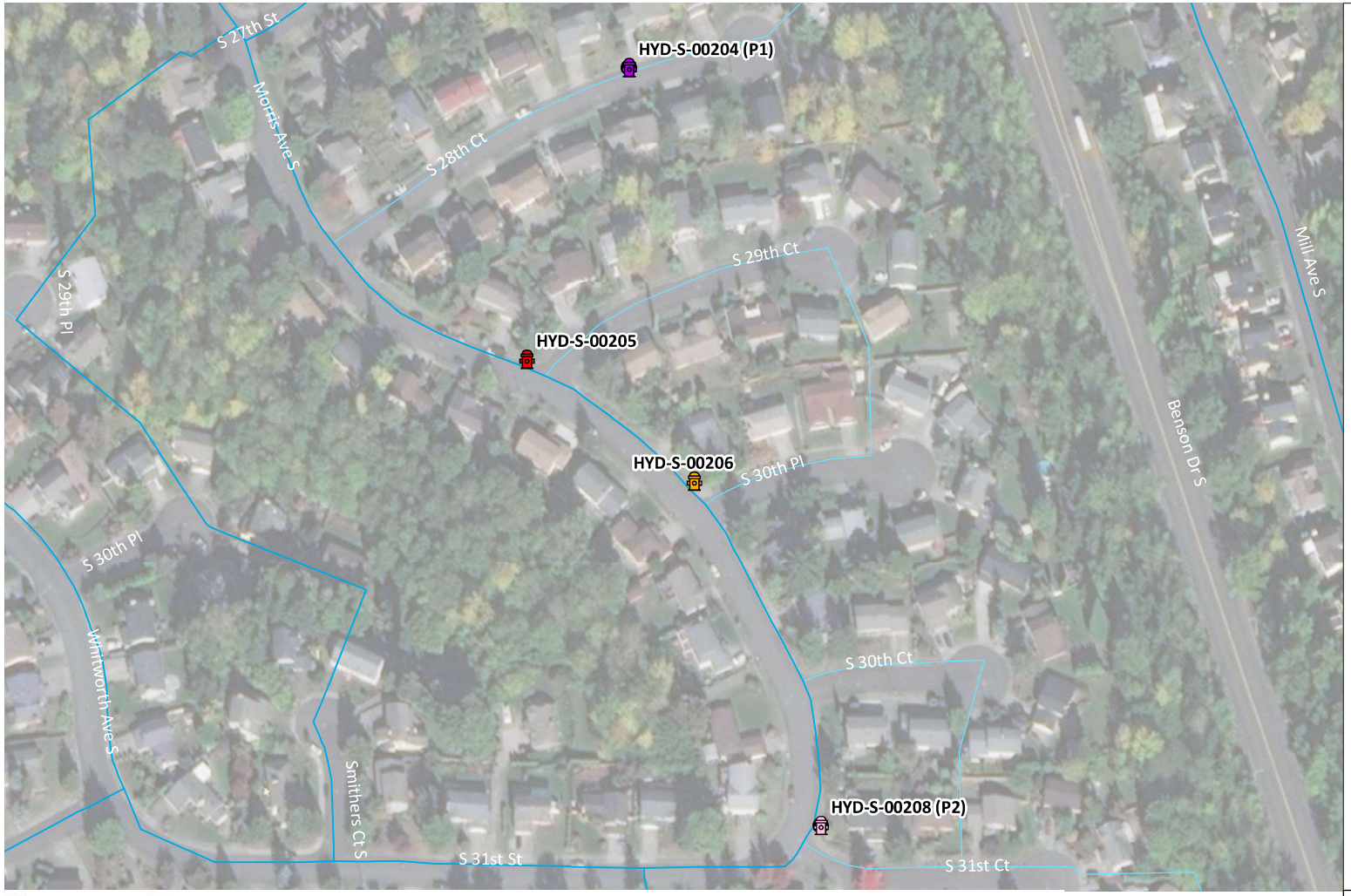
Figure 9 Hydrant Flow Test 9 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

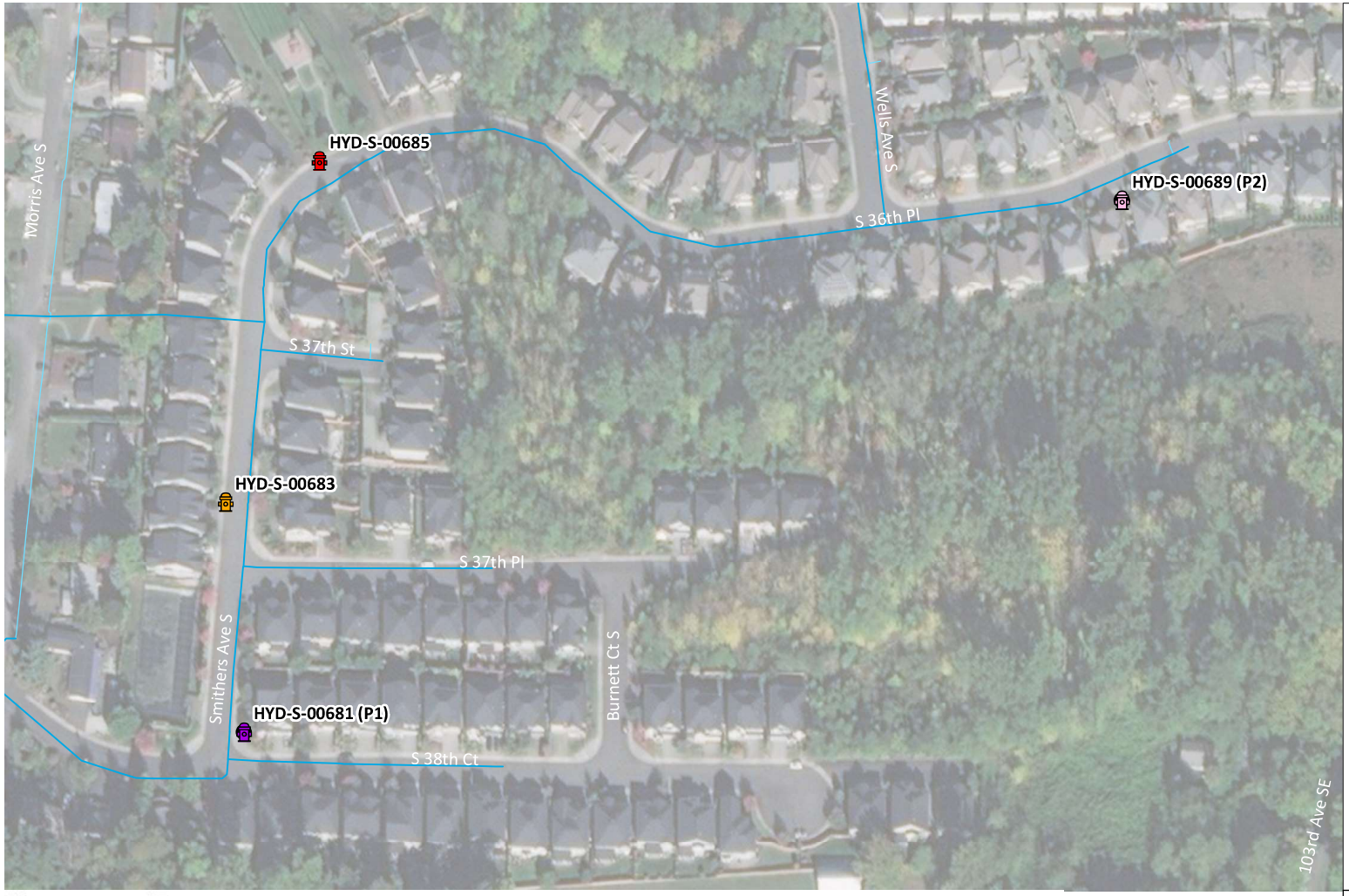
Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

Figure 10 Hydrant Flow Test 10 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

N

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

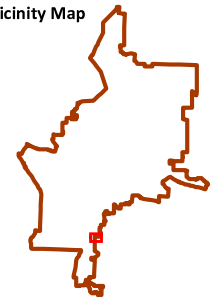
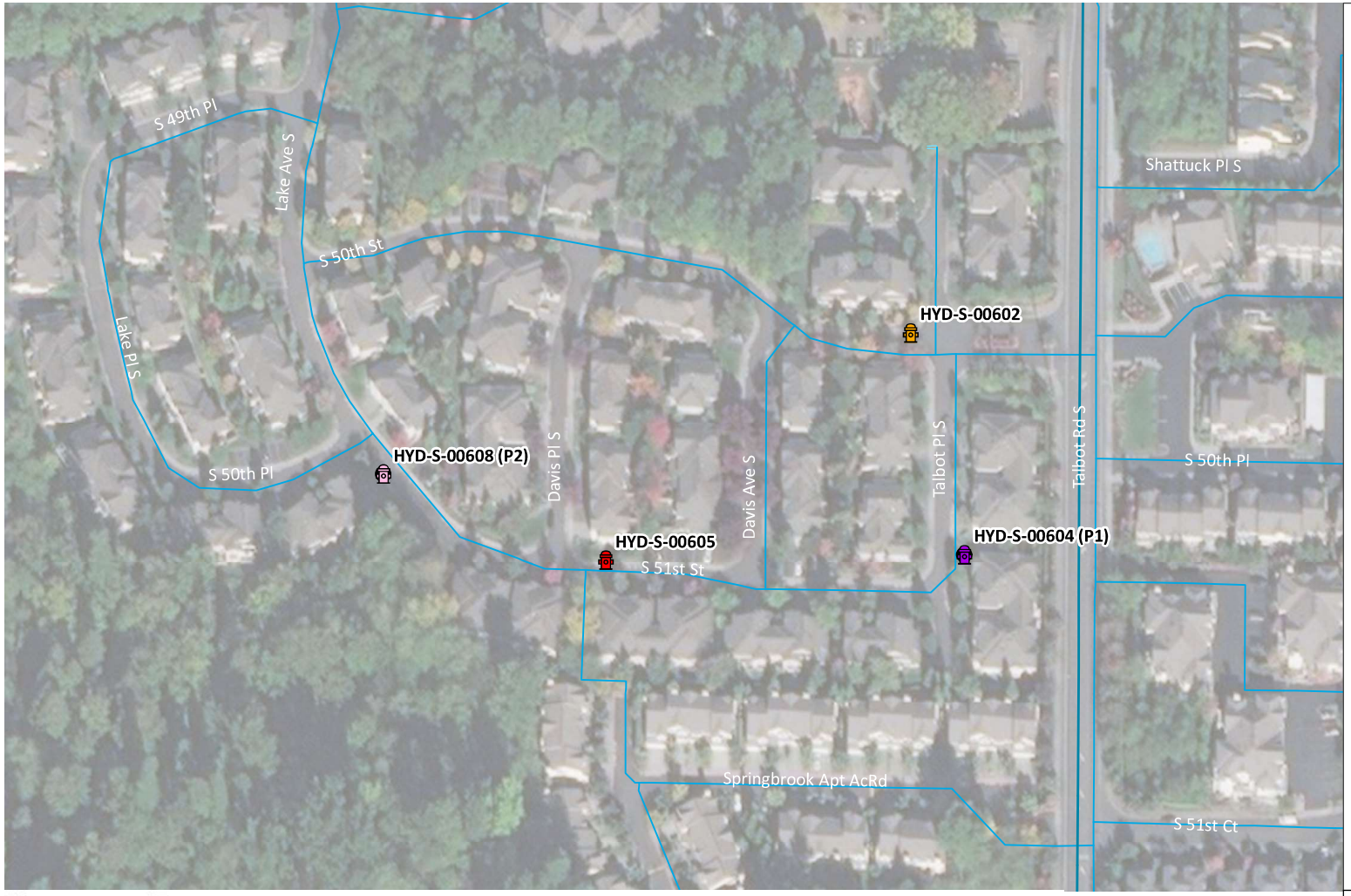


Figure 11 Hydrant Flow Test 11 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"
- 16" and larger

N

0 80 160 Feet

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

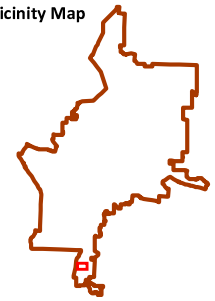
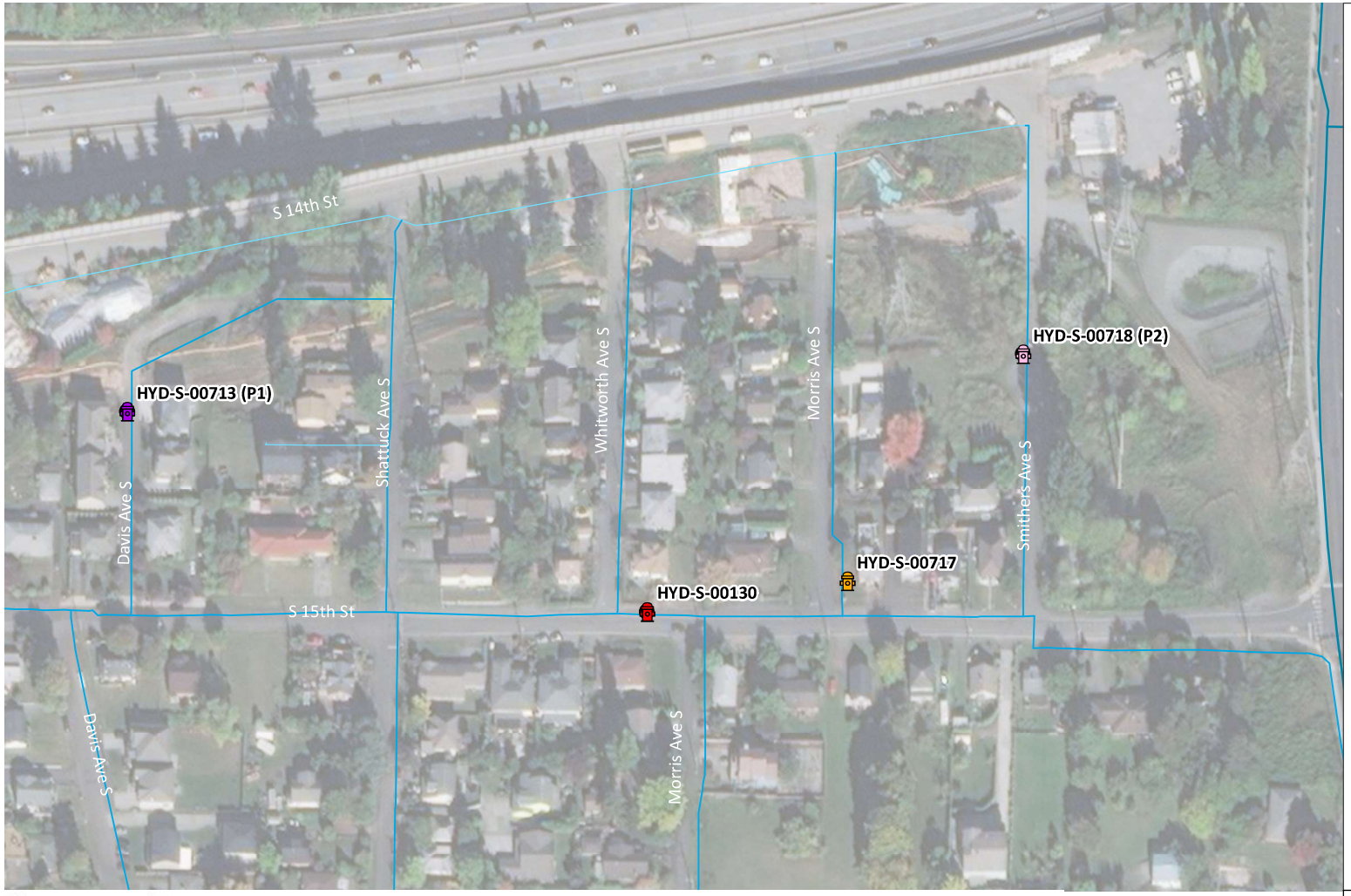


Figure 12 Hydrant Flow Test 12 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''
- 16'' and larger

N

0 100 200 Feet

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)

Static PSI: _____

Residual PSI: _____

Logger ID: _____

Pressure Hydrant 2 (P2)

Static PSI: _____

Residual PSI: _____

Logger ID: _____

Flow Hydrant 1 (F1)

Start Time: _____

End Time: _____

Static PSI: _____

Residual PSI: _____

Flow GPM: _____

Flow Hydrant 2 (F2)

Start Time: _____

End Time: _____

Static PSI: _____

Residual PSI: _____

Flow GPM: _____

Notes: _____

Vicinity Map

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Figure 13 Hydrant Flow Test 13 Form

Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)
Static PSI: _____
Residual PSI: _____
Logger ID: _____

Pressure Hydrant 2 (P2)
Static PSI: _____
Residual PSI: _____
Logger ID: _____

Flow Hydrant 1 (F1)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

Flow Hydrant 2 (F2)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

Notes: _____

Vicinity Map

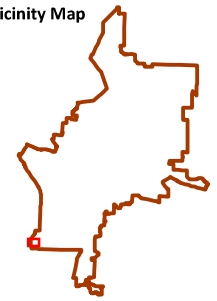


Figure 14 Hydrant Flow Test 14 Form

Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

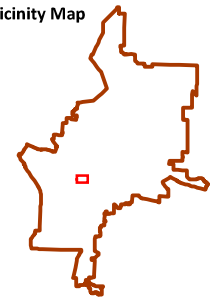
Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map



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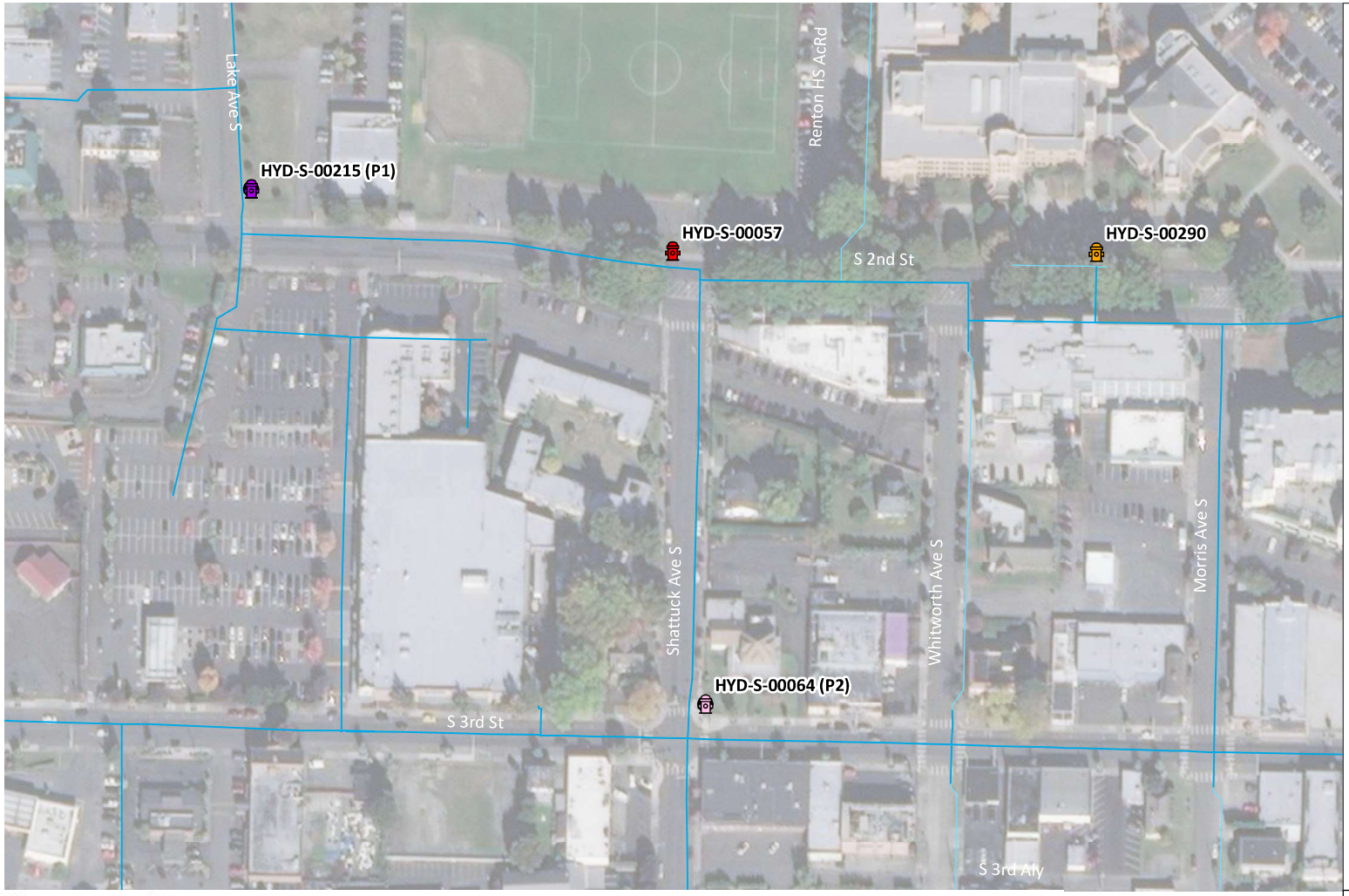
Last Revised: June 01, 2018 \\io-fs-1\Data\GIS\GISBackup\Renton\WaterSystemPlan2017\HydrantTestSites.mxd

Figure 15 Hydrant Flow Test 15 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

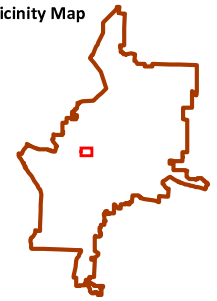
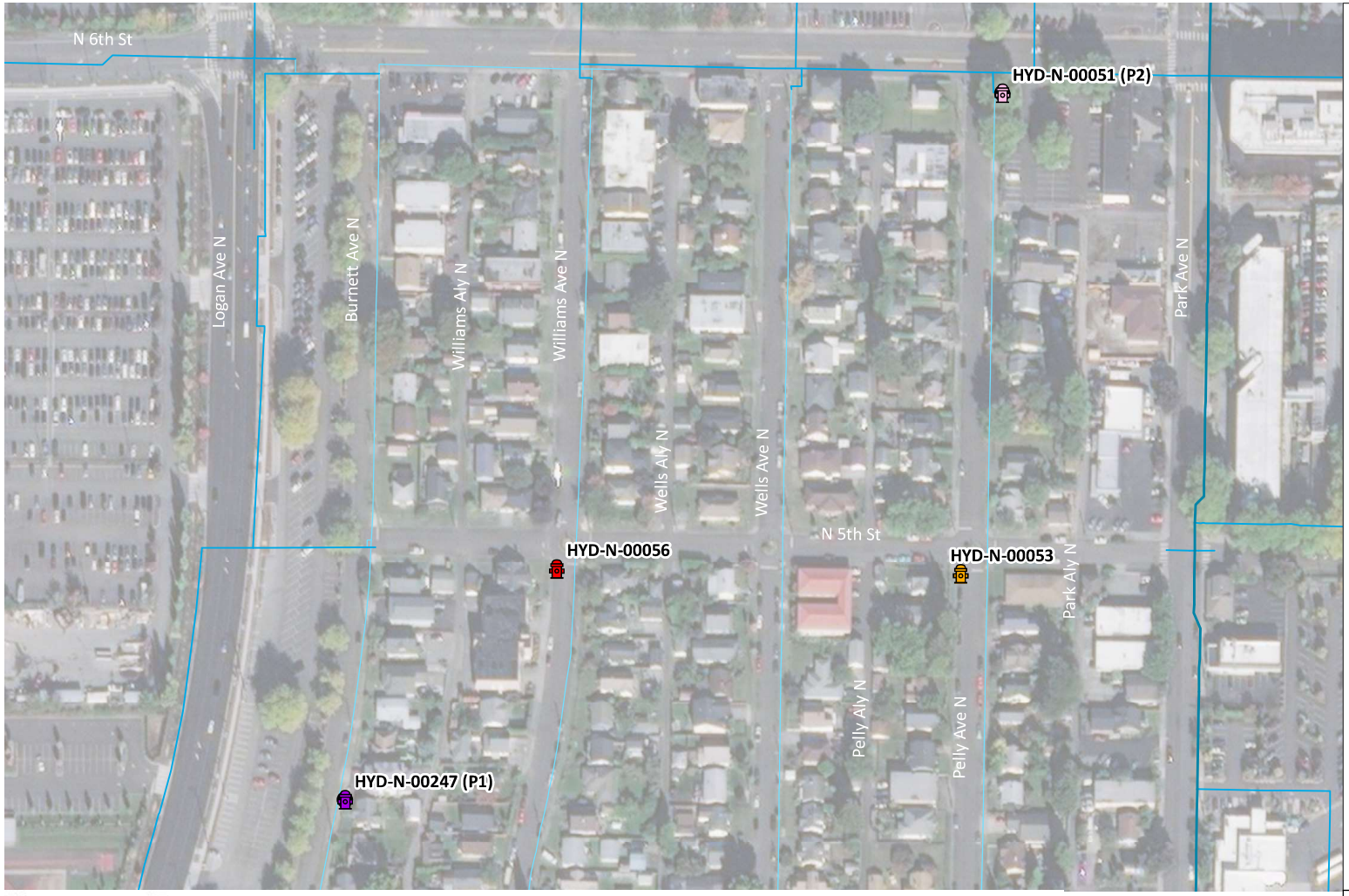


Figure 16 Hydrant Flow Test 16 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"
- 16" and larger

Feet
0 112.5 225

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

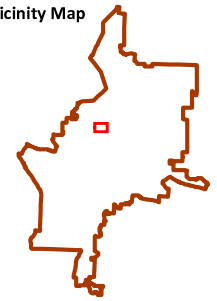
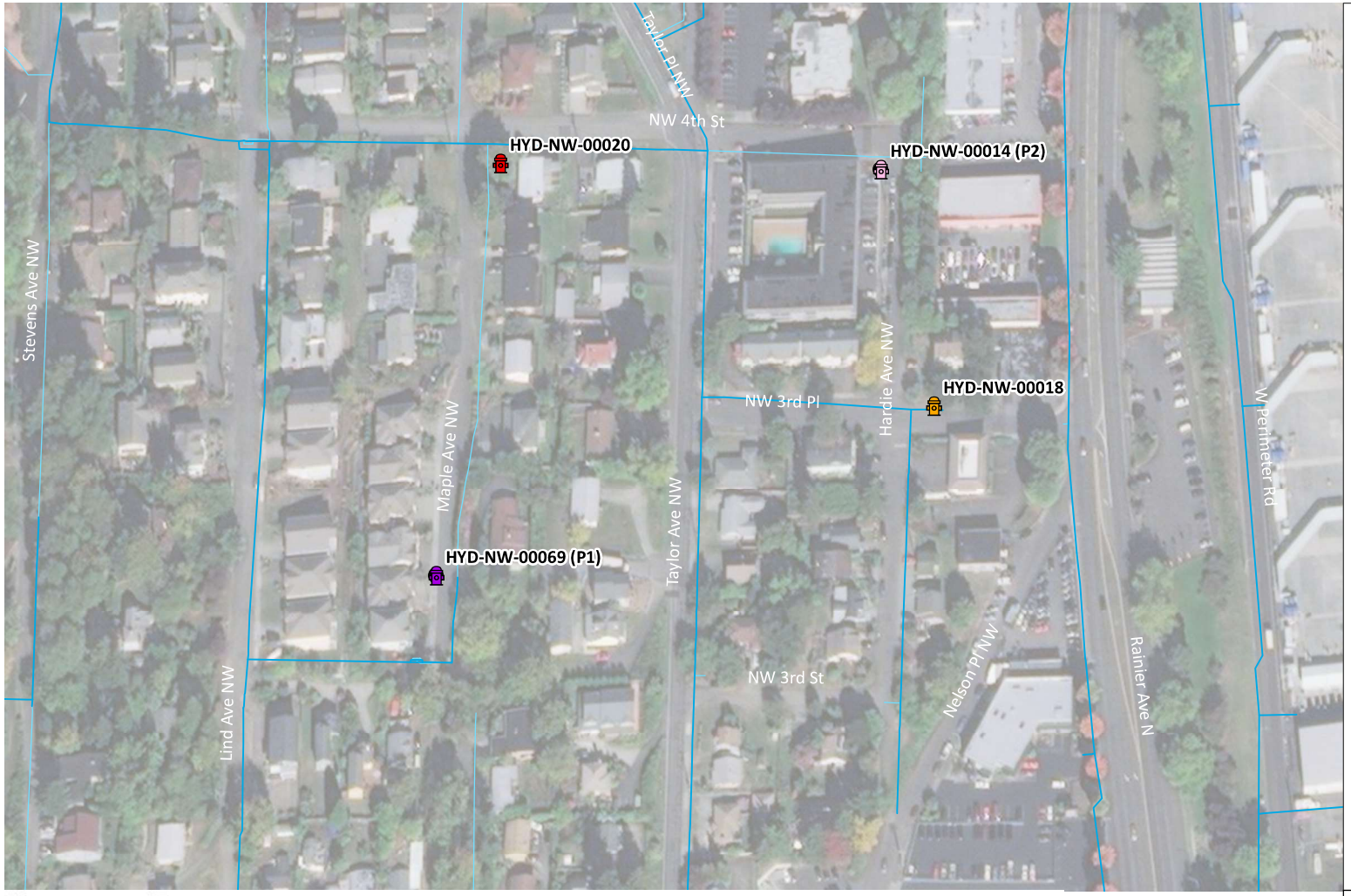


Figure 17 Hydrant Flow Test 17 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)
Static PSI: _____
Residual PSI: _____
Logger ID: _____

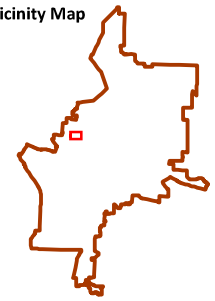
Pressure Hydrant 2 (P2)
Static PSI: _____
Residual PSI: _____
Logger ID: _____

Flow Hydrant 1 (F1)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

Flow Hydrant 2 (F2)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

Notes: _____

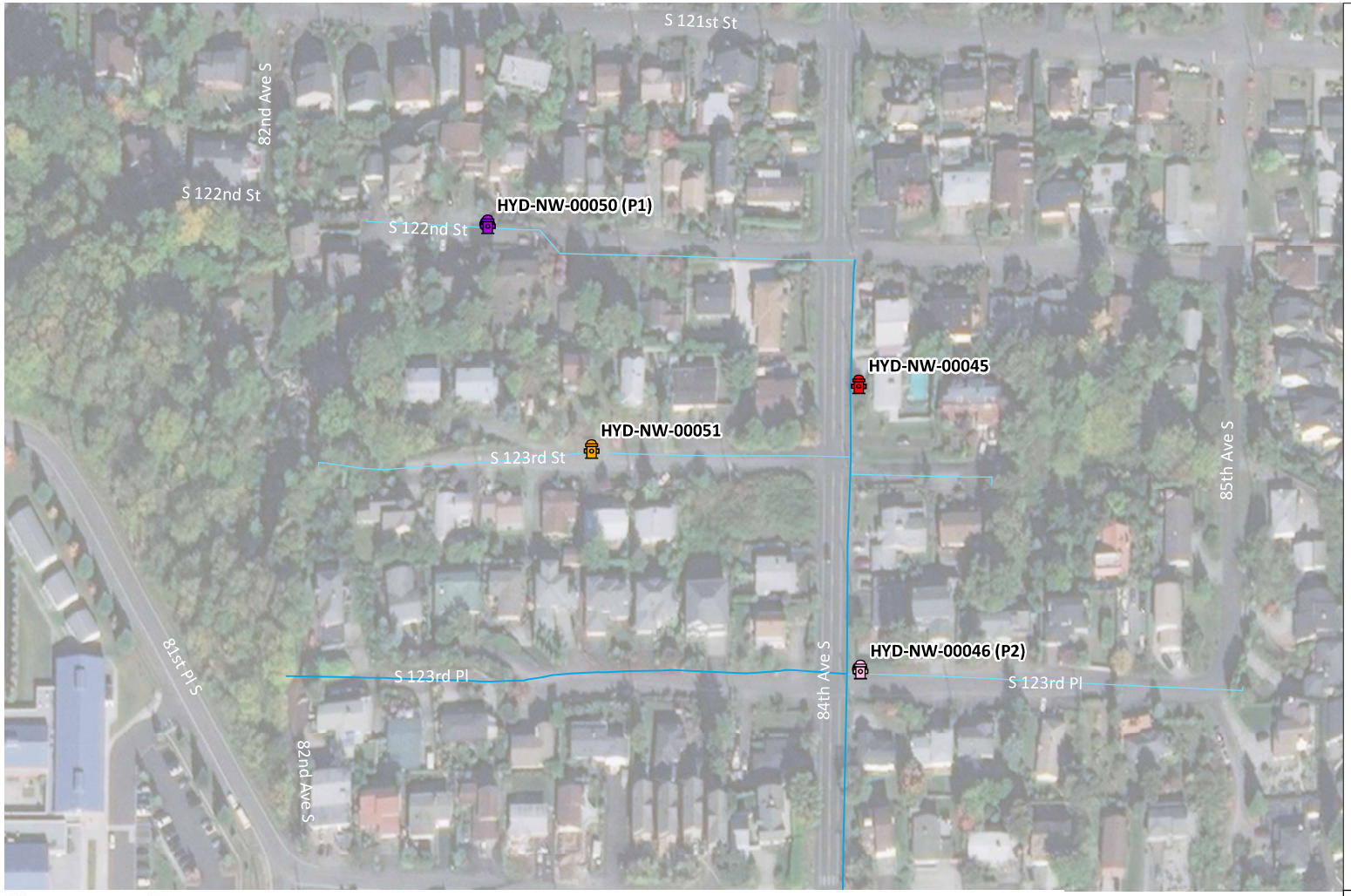
Vicinity Map



carollo

Last Revised: June 01, 2018 \\io-fs-1\Data\GIS\GISBackup\Renton\WaterSystemPlan2017\HydrantTestSites.mxd

Figure 18 Hydrant Flow Test 18 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

N

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)
Static PSI: _____
Residual PSI: _____
Logger ID: _____

Pressure Hydrant 2 (P2)
Static PSI: _____
Residual PSI: _____
Logger ID: _____

Flow Hydrant 1 (F1)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

Flow Hydrant 2 (F2)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

Notes: _____

Vicinity Map

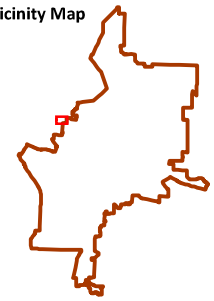
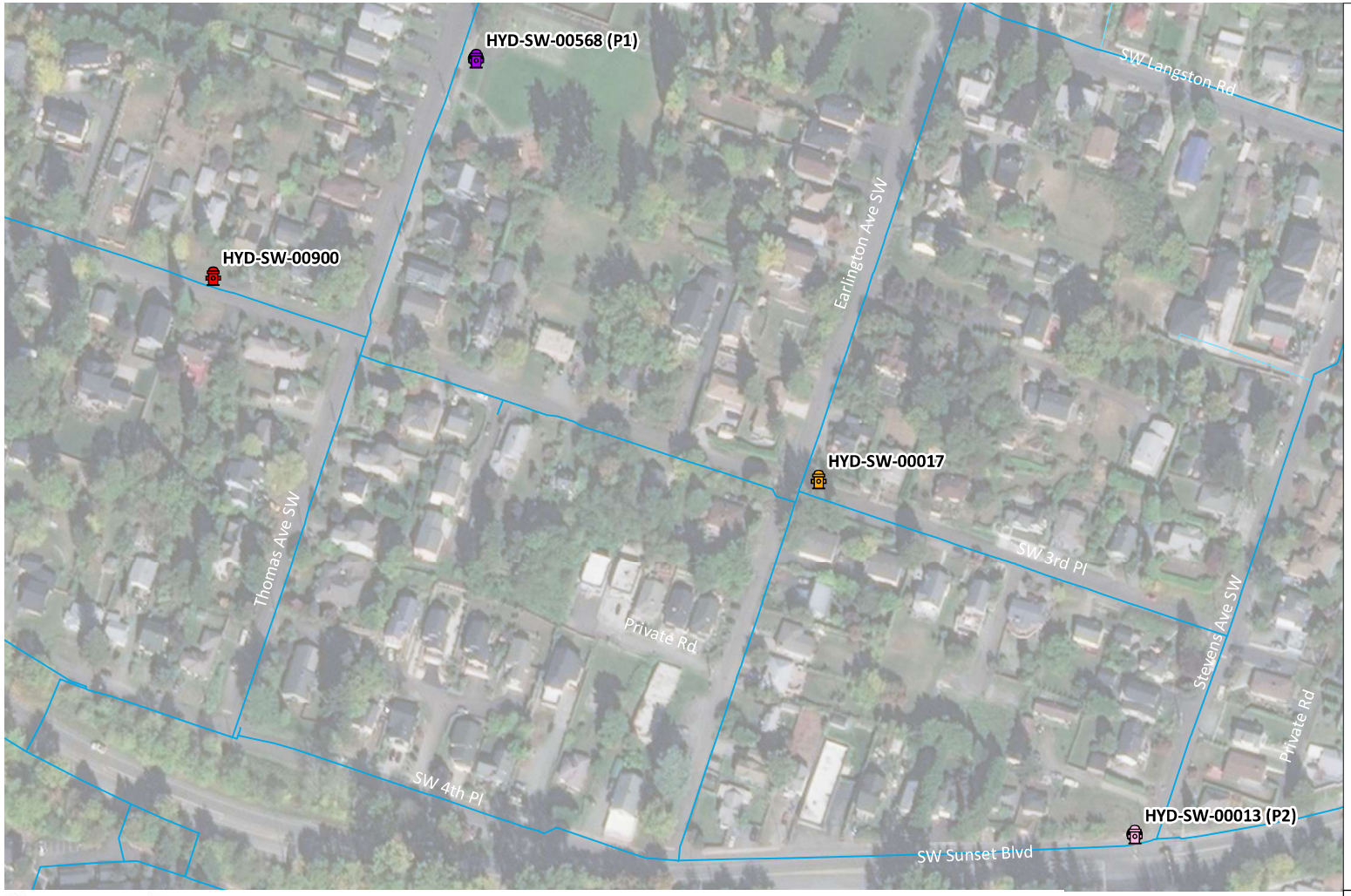


Figure 19 Hydrant Flow Test 19 Form



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

Feet
0 112.5 225

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: _____ Time: _____

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: _____	Static PSI: _____	Start Time: _____	Start Time: _____
Residual PSI: _____	Residual PSI: _____	End Time: _____	End Time: _____
Logger ID: _____	Logger ID: _____	Static PSI: _____	Static PSI: _____
		Residual PSI: _____	Residual PSI: _____
		Flow GPM: _____	Flow GPM: _____

Notes: _____

Vicinity Map

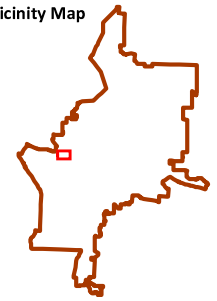


Figure 20 Hydrant Flow Test 20 Form

Appendix 2B

TEMPORARY PRESSURE LOGGERS DURING FIRE FLOW TESTS SUMMARY

Fire Hydrant Test #	Section Map ID	Flowing Hydrant F1	Flowing Hydrant F2	Pressure Hydrant P1	Pressure Hydrant P2
FH Test 1	I	NE-00680	NE-00681	NE-00679	NE-00686
FH Test 2	I	NE-00843	NE-00135	NE-00137	NE-00133
FH Test 3	I	SE-00109	SE-00138	SE-00112	SE-00111
FH Test 4	I	N-000309	N-00017	N-00213	N-00018
FH Test 5	I	NE-00069	NE-00652	NE-00768	NE-01008
FH Test 6	I	NE-00270	NE-00273	NE-00269	NE-00274
FH Test 7	II	SE-00168	SE-00093	SE-00170	SE-00166
FH Test 8	II	SE-00302	SE-00125	SE-00306	SE-00307
FH Test 9	II	S-00780	S-00097	S-00096	S-00783
FH Test 10	II	S-00205	S-00206	S-00204	S-00208
FH Test 11	II	S-00685	S-00683	S-00681	S-00689
FH Test 12	II	S-00605	S-00602	S-00604	S-00608
FH Test 13	II	S-00130	S-00717	S-00713	S-00718
FH Test 14	III	SW-00202	SW-00437	SW-00184	SW-00282
FH Test 15	III	S-00478	S-00169	S-00165	S-00168
FH Test 16	III	S-00057	S-00290	S-00215	S-00064
FH Test 17	III	N-00056	N-00053	N-00247	N-00051
FH Test 18	III	NW-00020	NW-00018	NW-00069	NW-00014
FH Test 19	III	NW-00045	NW-00051	NW-00050	NW-00046
FH Test 20	III	SW-00900	SW-00017	SW-00568	SW-00013

Section I Loggers			
Logger #	Hydrant iD	Serial Number	Carollo Assigned ID
1	NE-00592	3403734	30
2	NE-00997	3403735	32
3	SE-00285	3403705	33
4	NE-00179	3403848	34
5	NE-00533	3403849	35
6	NE-00231	3403850	36
7	NE-00099	3403851	37
8	NE-00660	3403852	38
9	N-00446	3403853	39
10	N-00196	3403855	41
11	N-00535	3404135	42
12	N-00354	3404136	43
13	N-00256	3404137	44
14	N-00524	3404138	45
15	SE-00199	3404139	46
16	NE-00924		City1
17	P1		City2
18	P2		City3
19	Back-up		
20	Back-up		

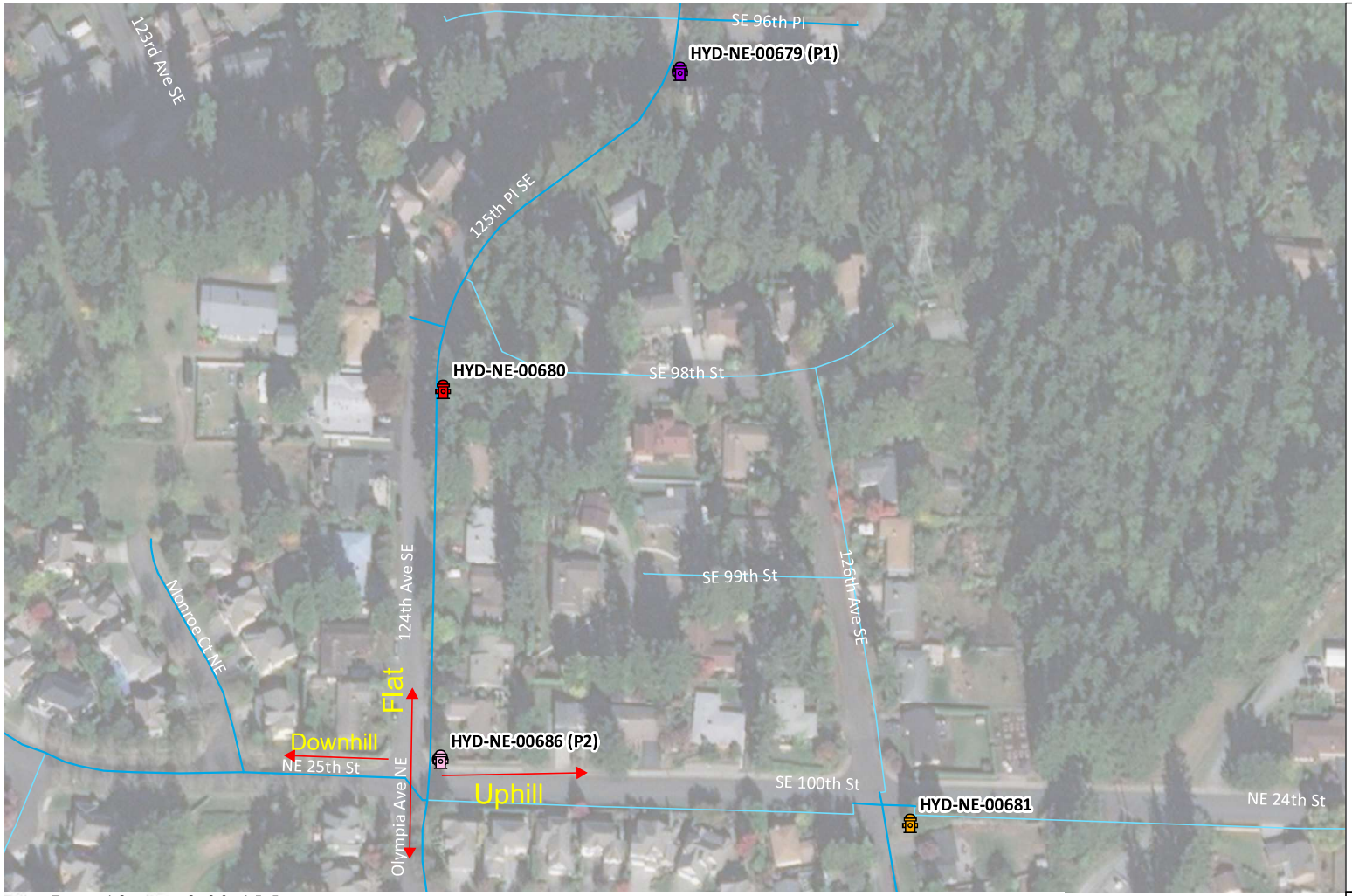
Section II Loggers			
Logger #	Hydrant iD	Serial Number	Carollo Assigned ID
1	N-00076	3403734	30
2	N-00081	3403735	32
3	NW-00016	3403705	33
4	SW-00798	3403848	34
5	SW-00088	3403849	35
6	SW-00015	3403850	36
7	S-00154	3403851	37
8	S-00152	3403852	38
9	S-00341	3403853	39
10	S-00257	3403855	41
11	S-00709	3404135	42
12	S-00034	3404136	43
13	S-00539	3404137	44
14	S-00179	3404138	45
15	SE-00151	3404139	46
16	P1		
17	P2		
18	Back-up		
19	Back-up		
20	Back-up		

Section III Loggers			
Logger #	Hydrant iD	Serial Number	Carollo Assigned ID
1	SE-00257	3403734	30
2	SE-00030	3403735	32
3	SE-00052	3403705	33
4	S-00652	3403848	34
5	S-00725	3403849	35
6	S-00410	3403850	36
7	S-00004	3403851	37
8	S-00077	3403852	38
9	SW-00840	3403853	39
10	SW-00231	3403855	41
11	SW-00902	3404135	42
12	SW-00254	3404136	43
13	P1	3404137	44
14	P2	3404138	45
15	Back-up	3404139	46
16	Back-up		
17	Back-up		
18	Back-up		
19	Back-up		
20	Back-up		

Appendix 2C

TEMPORARY PRESSURE LOGGER SUMMARY

Logger Site	Hydrant ID	Logger ID	Serial Number	Notes
Logger 1	NE-00529	30	3403734	
Logger 2	NE-00678	32	3403735	
Logger 3	NE-00099	33	3403705	
Logger 4	SE-00285	34	3403848	
Logger 5	SE-00197	35	3403849	
Logger 6	N-00076	36	3403850	
Logger 7	NW-00091	37	3403851	
Logger 8	WCV-346/WCV-347	38	3403852	Downstream Side of PRV
Logger 9	WCV-378/WCV-379	39	3403853	Downstream Side of PRV
Logger 10	S-00281	41	3403855	
Logger 11	WCV-394/WCV-395	42	3404135	Upstream Side of PRV
Logger 12	WCV-0443/WCV-0444	43	3404136	Downstream Side of PRV
Logger 13	WCV-375/WCV-376	44	3404137	Upstream Side of PRV
Logger 14	S-00034	45	3404138	
Logger 15	SE-00254	46	3404139	
Logger 16 (City)	S-00187	City1		
Logger 17 (City)	WCV-360/WCV-361	City2		Downstream Side of PRV
Logger 18 (City)	SW-00253	City3		
Logger 19 (City)	S-00134	City4		
Logger 20 (City)	N-00015	City5		



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

N

Feet

0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: June 19 Time: 9:00 AM

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 88	Static PSI: 60	Start Time: 9:02 AM	Start Time:
Residual PSI: 65/70	Residual PSI: 35	End Time: 9:07 AM	End Time:
Logger ID: City 3	Logger ID: City 4	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 840/860	Flow GPM:

Notes: P1: Hydrant on slope roughly at street level.
P2: Tree around hydrant, city had trouble shutting down

Vicinity Map

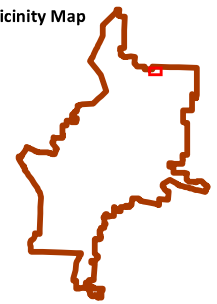


Figure 1 Hydrant Flow Test 1 Form

Notes/Photographs:

Location/setup of pressure hydrant 1

Logger setup for pressure hydrant 1

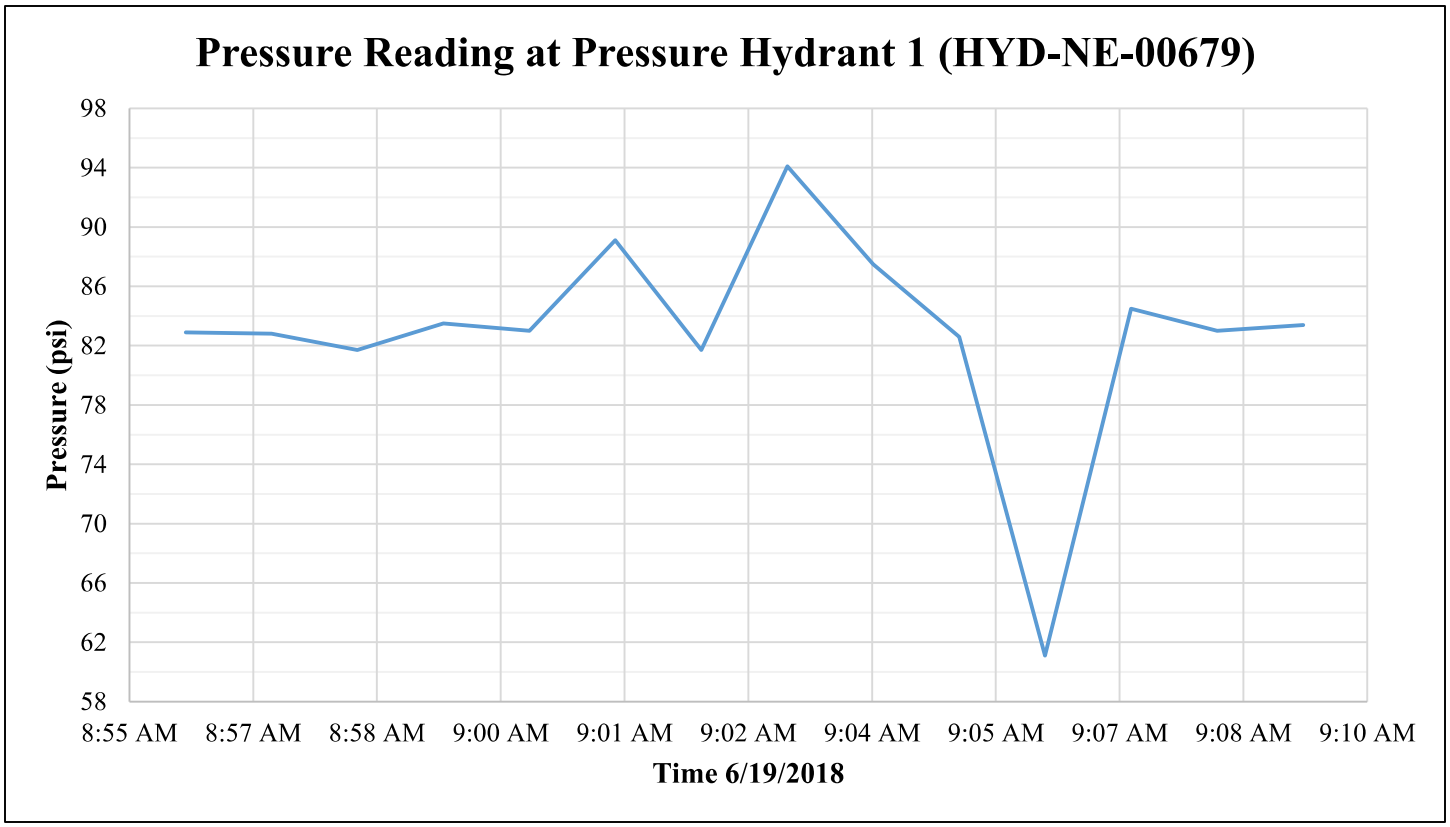
Location of pressure hydrant 2

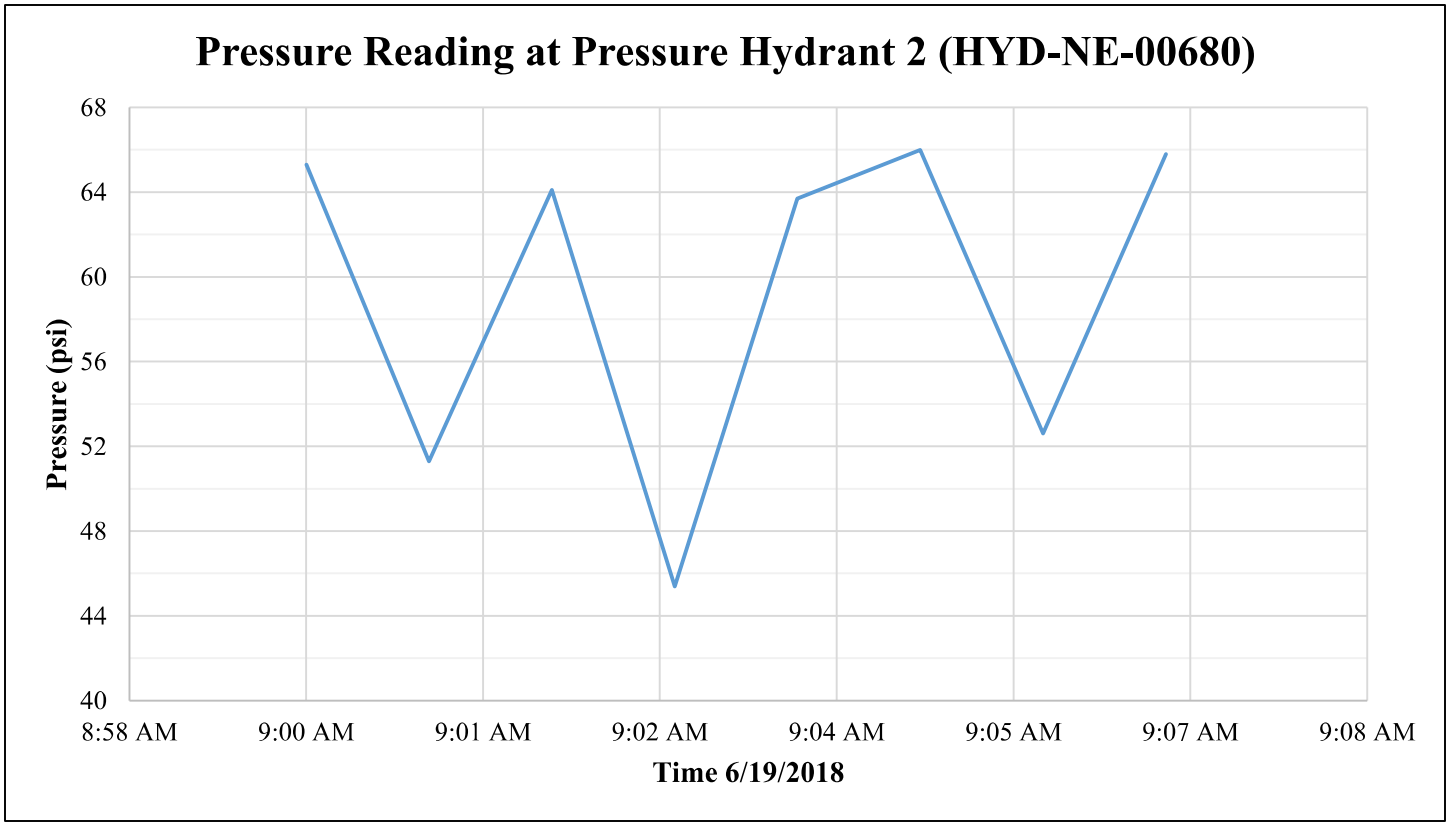
Logger setup for pressure hydrant 2

Diffuser setup and flowing the hydrant F1

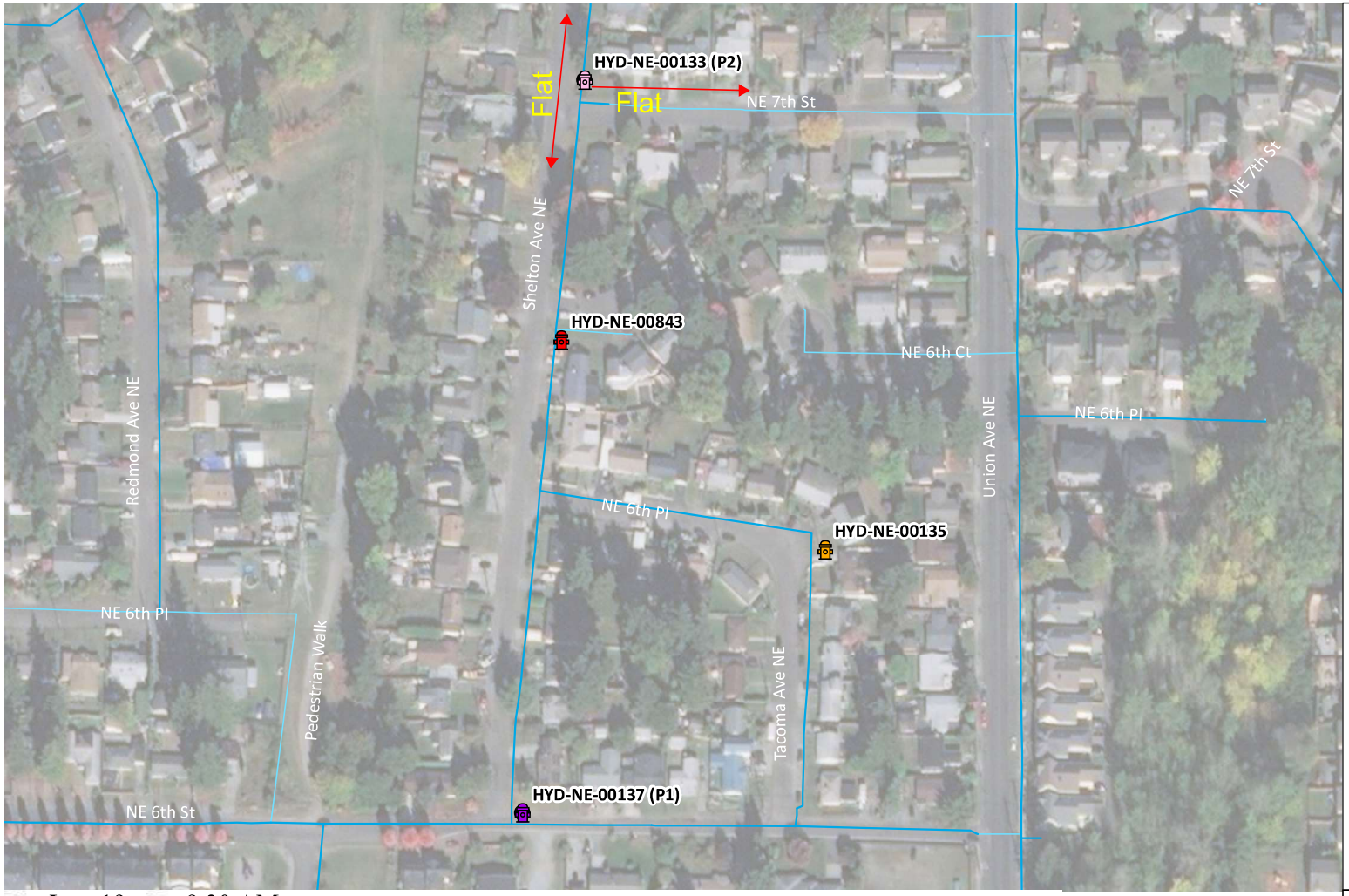
Flooding caused by flowing the hydrant F1

Pressure at Data Loggers:





Note: Section 1 loggers were set at a one minute recording interval. The test lasted less than a minute, therefore manual reading pressure gage might be more accurate for residual pressure values.



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

N

Feet

0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: June 19 Time: 9:30 AM

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 60	Static PSI: 65	Start Time:	Start Time:
Residual PSI: 55	Residual PSI: 55	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 960/1000	Flow GPM:

Notes: P1: P1 likely higher elevation than flowing hydrant. Pressure steady at 5 psi below static

Vicinity Map

Figure 2 Hydrant Flow Test 2 Form

Notes/Photographs:

Location of pressure hydrant 1

Logger setup for pressure hydrant 1

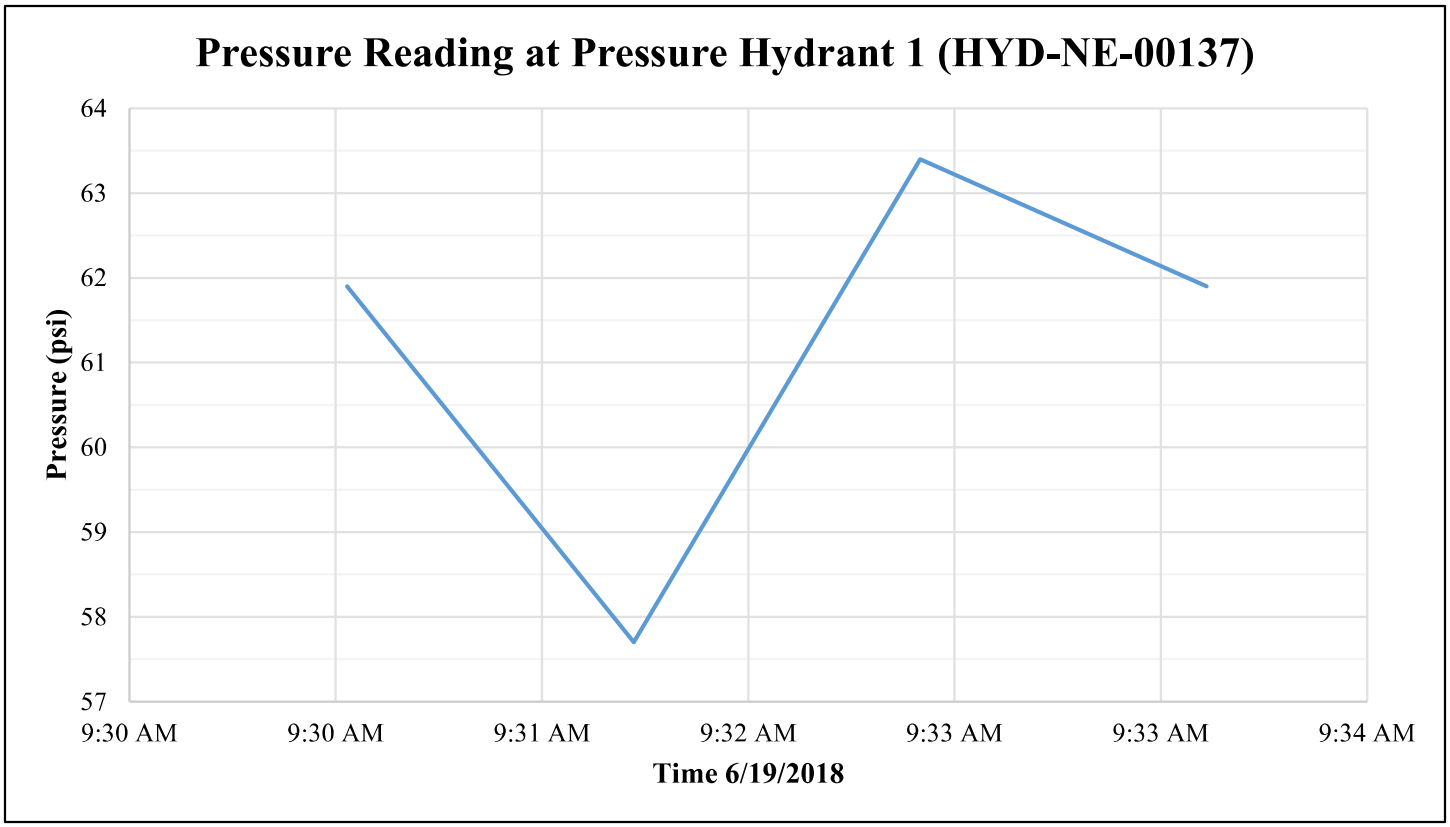
Location of pressure hydrant 2

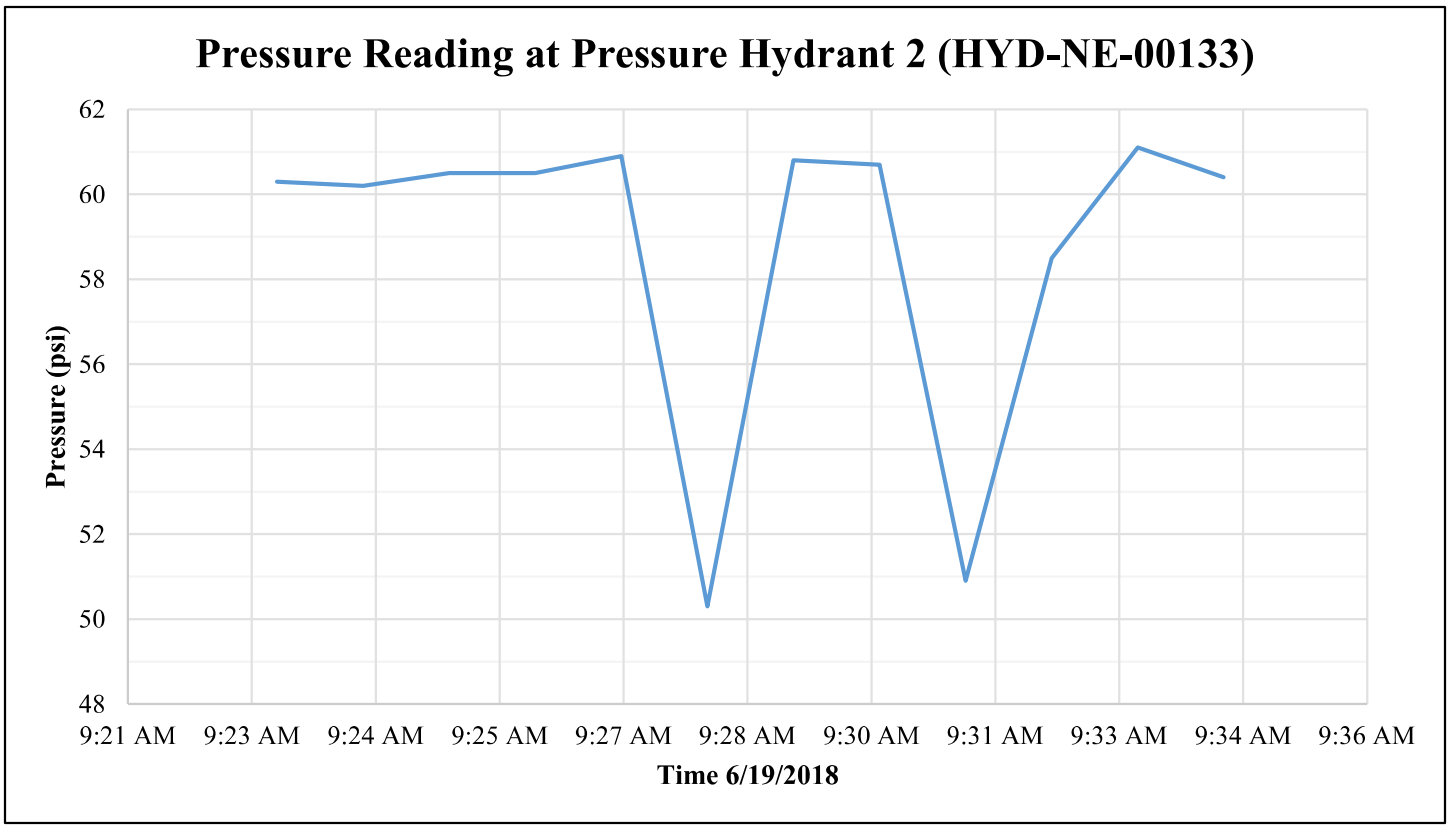
Logger setup for pressure hydrant 2

Location of flowing hydrant F1

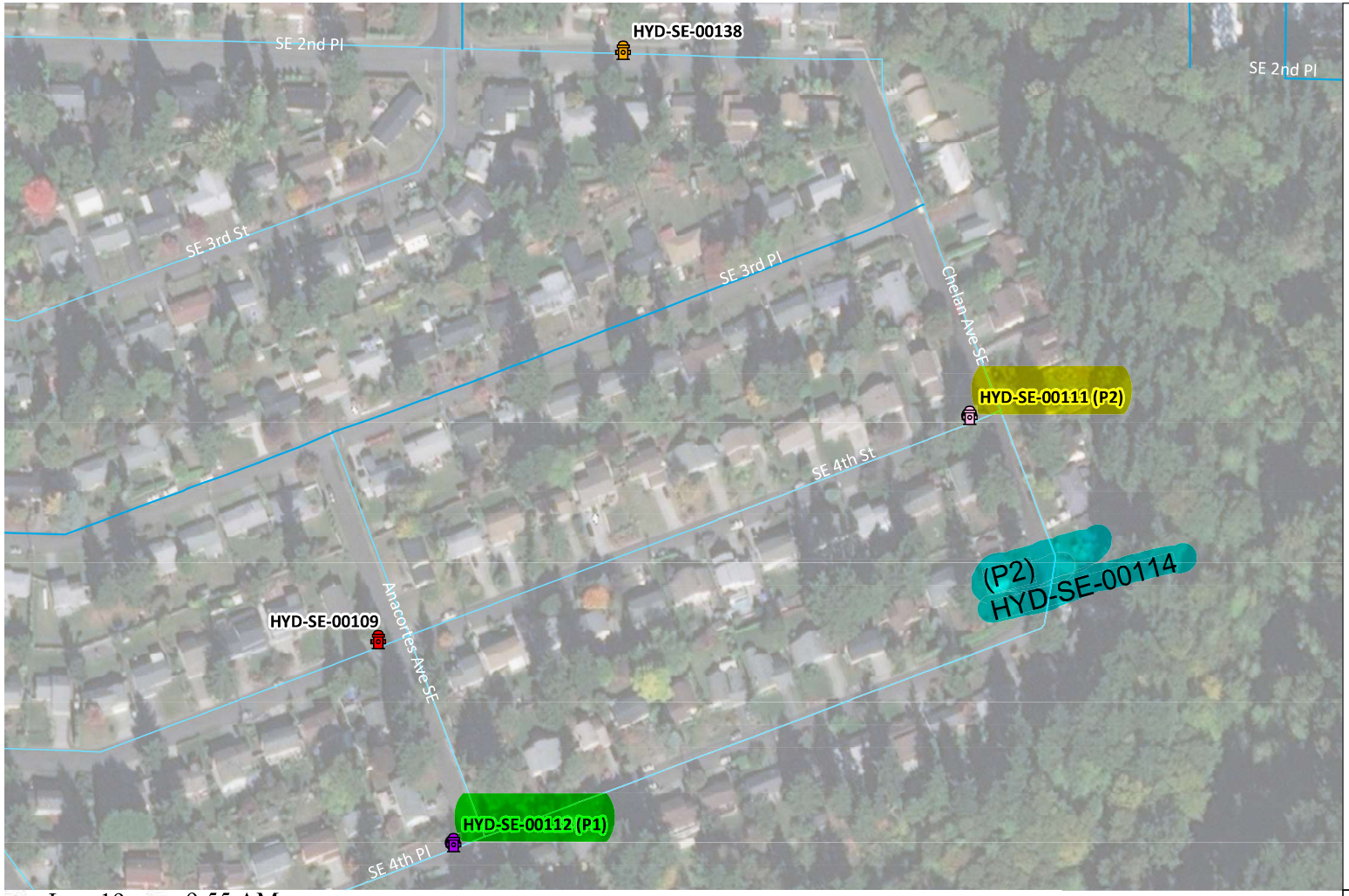
Diffuser setup of flowing hydrant F1

Pressure at Data Loggers:





Note: Section 1 loggers were set at a one minute recording interval. The test lasted less than a minute, therefore manual reading pressure gage might be more accurate for residual pressure values.



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: June 19 Time: 9:55 AM

Location: _____

Pressure Hydrant 1 (P1)
Static PSI: 74
Residual PSI: N/A
Logger ID: City 3

Pressure Hydrant 2 (P2)
Static PSI: 80
Residual PSI: 40/39/44
Logger ID: City 4

Flow Hydrant 1 (F1)
Start Time: 9:55 AM
End Time: 10:00 AM
Static PSI: _____
Residual PSI: _____
Flow GPM: 840 gpm

Flow Hydrant 2 (F2)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

Pressure drop at P1 missed due to miscommunication

Notes: P1: Top 2.5 ft above street level with respect to SE 4th Place.
1.5 ft with respect to Anacortes Ave SE. At corner SE 4th Place slopes downward.

Vicinity Map

Figure 3 Hydrant Flow Test 3 Form

Notes/Photographs:

Location of pressure hydrant 1

Logger setup for pressure hydrant 1

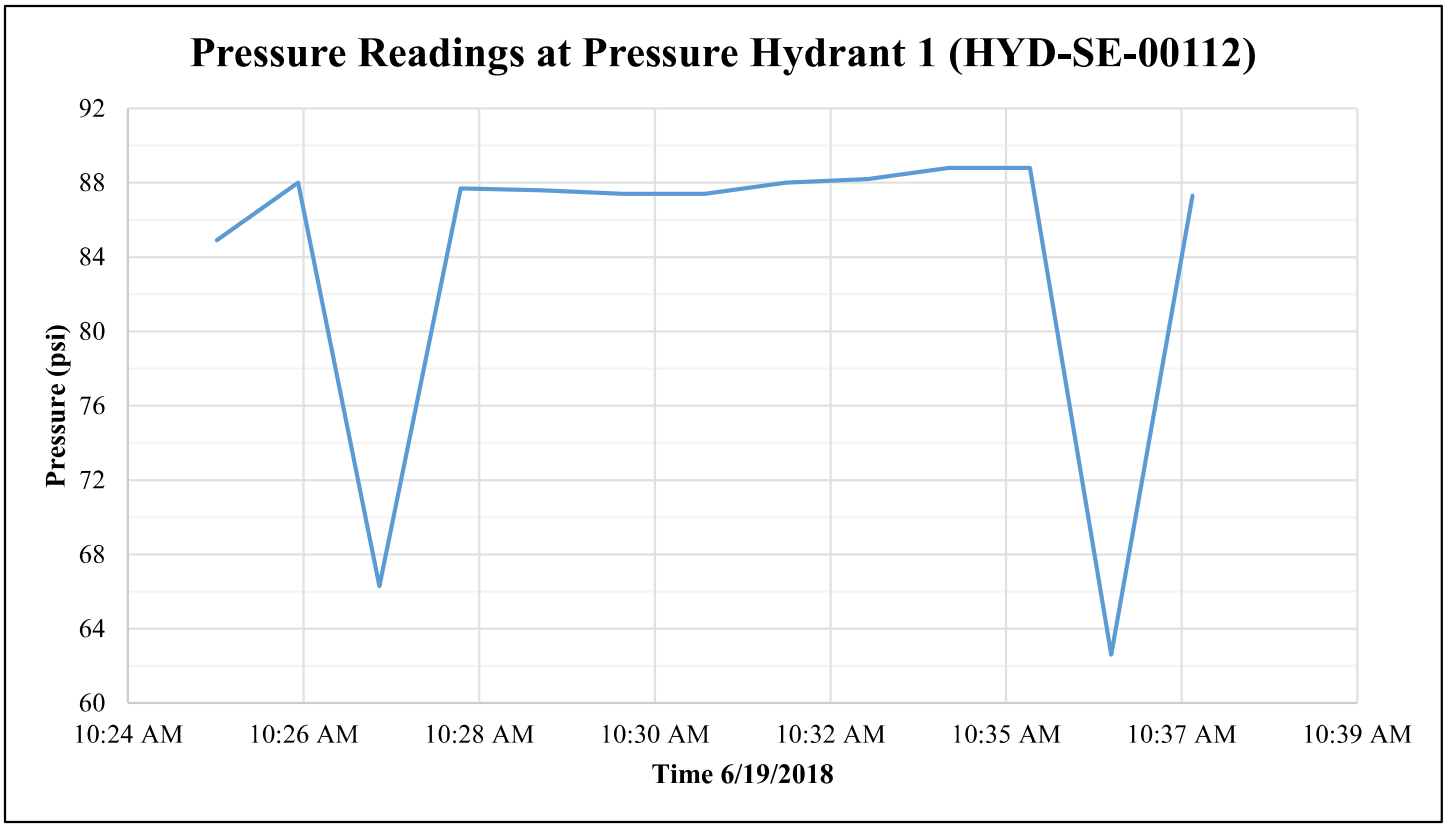
Location of pressure hydrant 2

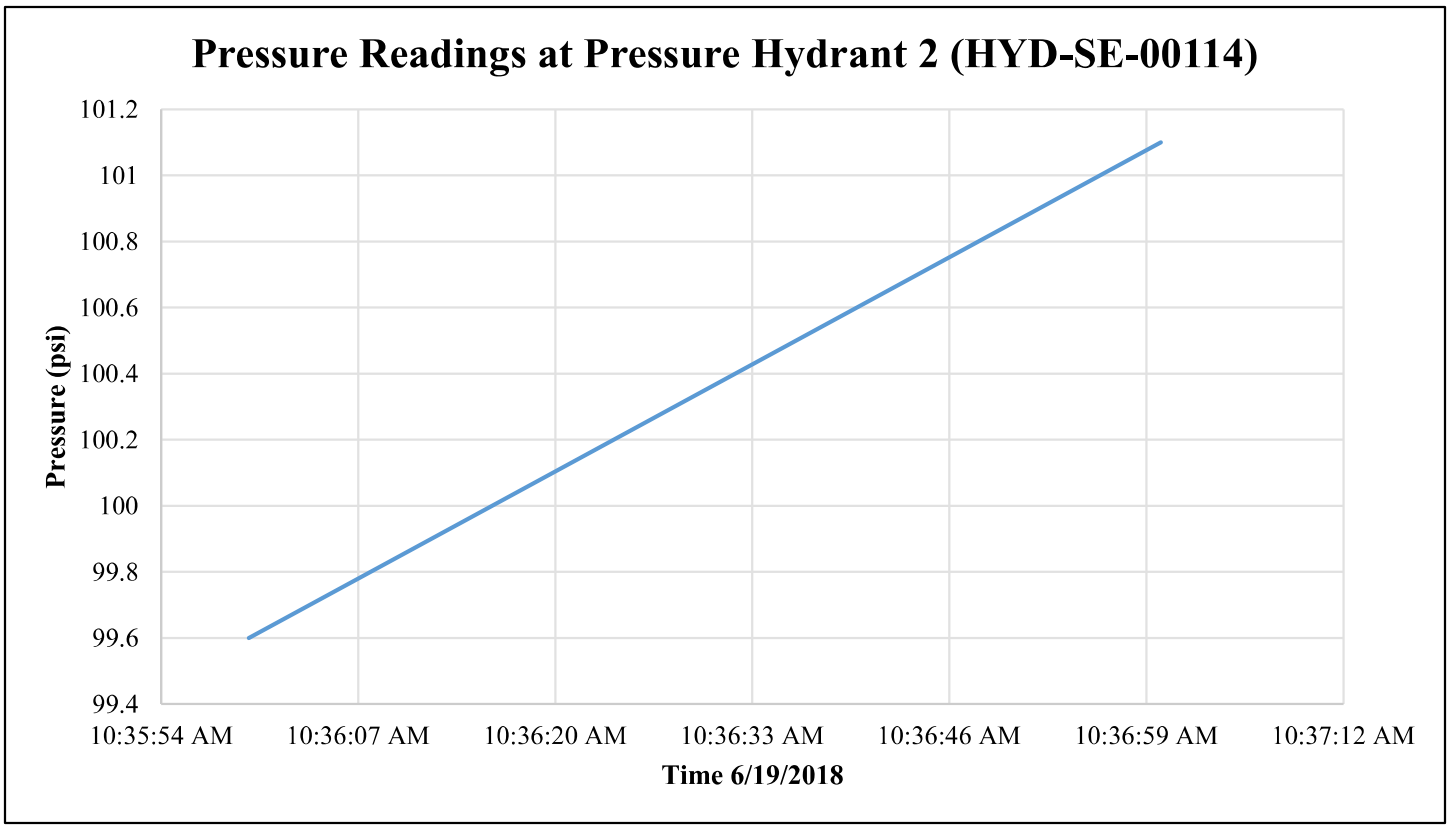
Logger setup for pressure hydrant 2

Diffuser set up and flowing on flow hydrant F1

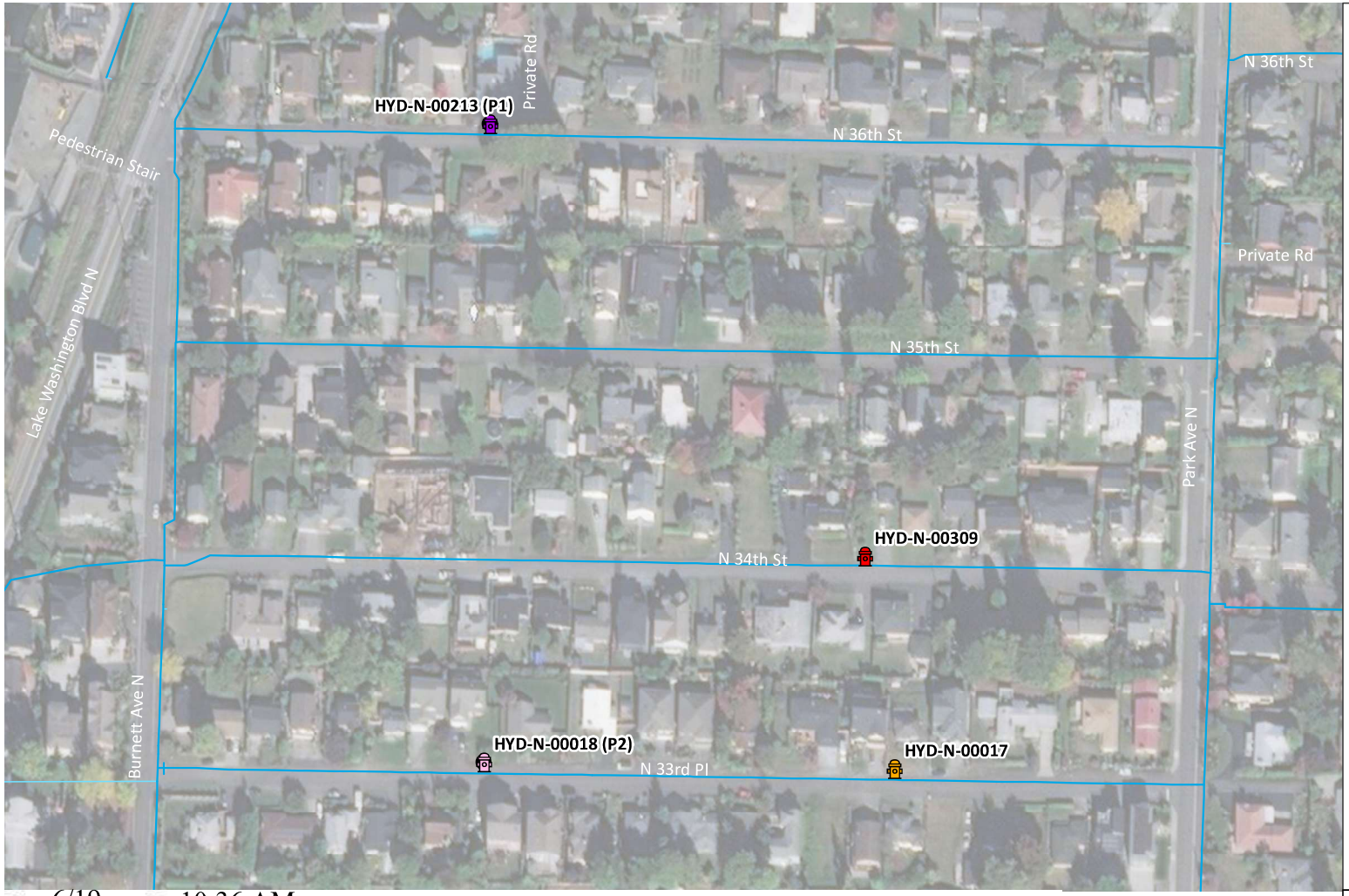
Water on roadway from flowing hydrant F1

Pressure at Data Loggers:





Note: Section 1 loggers were set at a one minute recording interval. The test lasted less than a minute, therefore manual reading pressure gage might be more accurate for residual pressure values.



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: 6/19 Time: 10:36 AM

Location:

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 99	Static PSI: 90	Start Time:	Start Time:
Residual PSI: 69	Residual PSI: 60-80	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 920/930	Flow GPM:

Notes: P1 bottomed out at 69 and was steady at 90 when flowing. N 36th St is steeply sloped. P2 minimum pressure was 60 psi when the hydrant opened and pressures stabilized at 80 psi afterwards

Vicinity Map

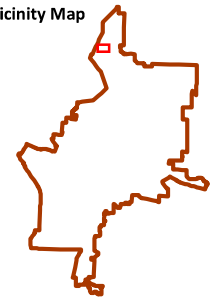


Figure 4 Hydrant Flow Test 4 Form

Notes/Photographs:

Location of pressure hydrant P1

.

Logger setup for pressure hydrant P1

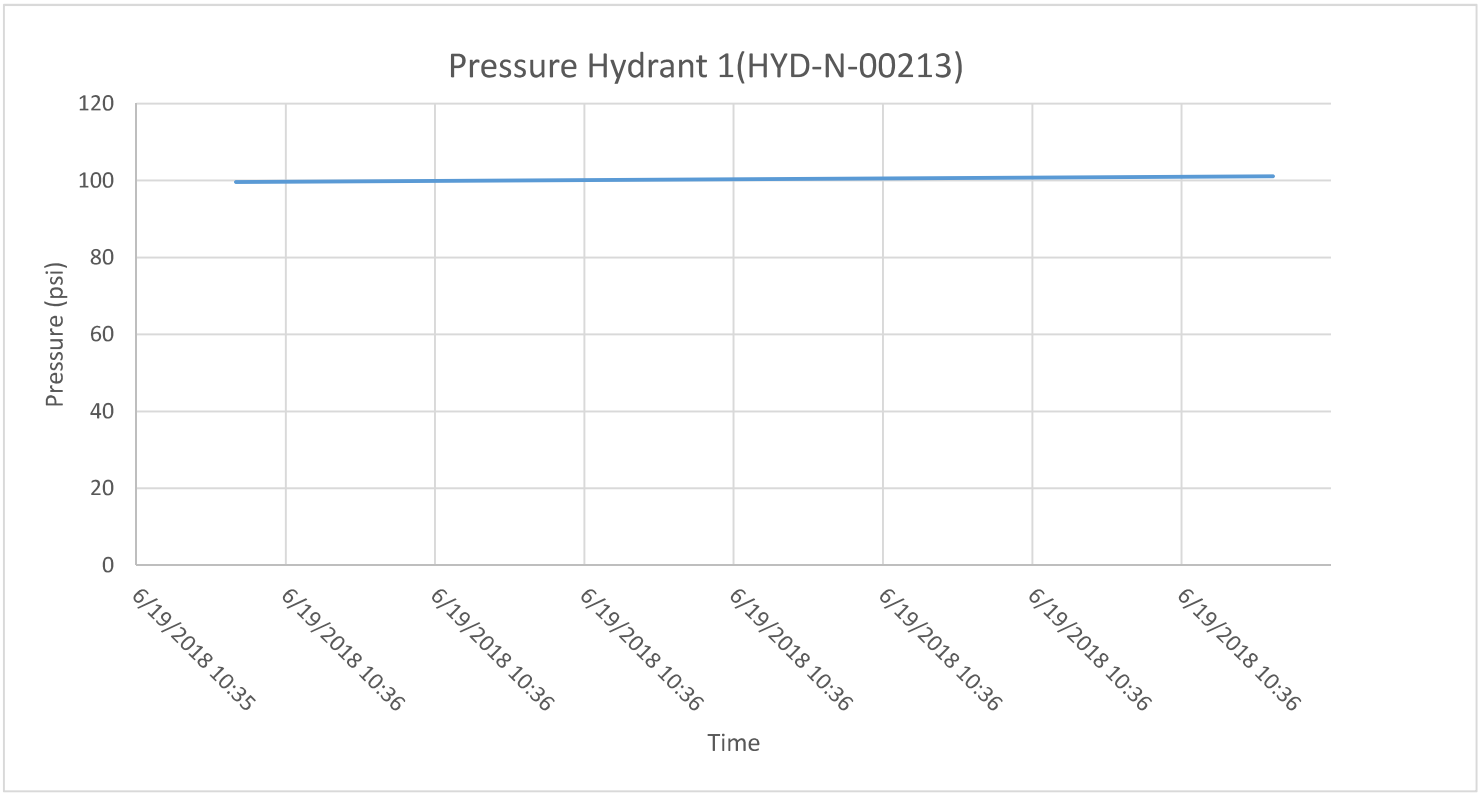
Location of pressure hydrant P2

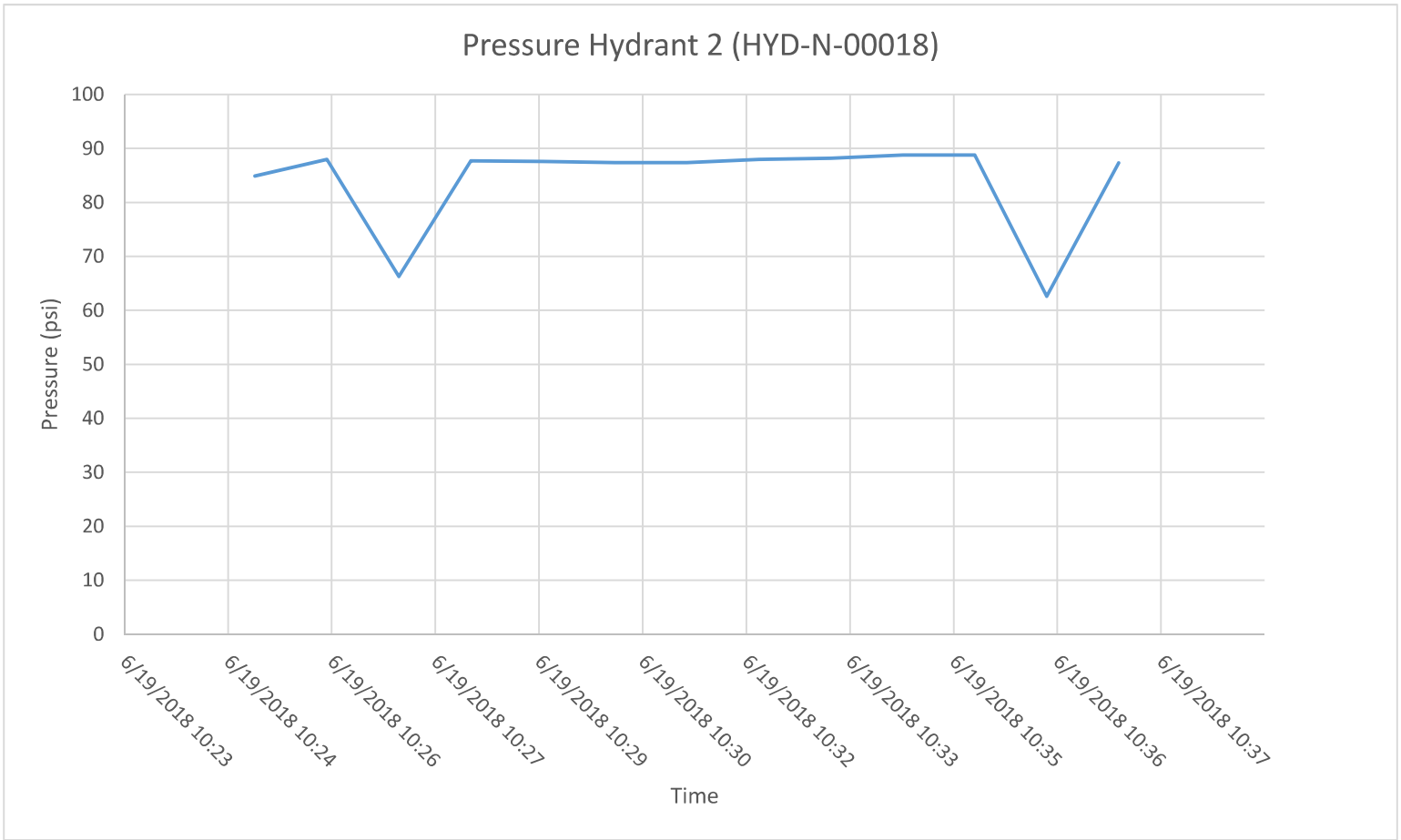
Logger setup for pressure hydrant P2

Location of flowing hydrant F1

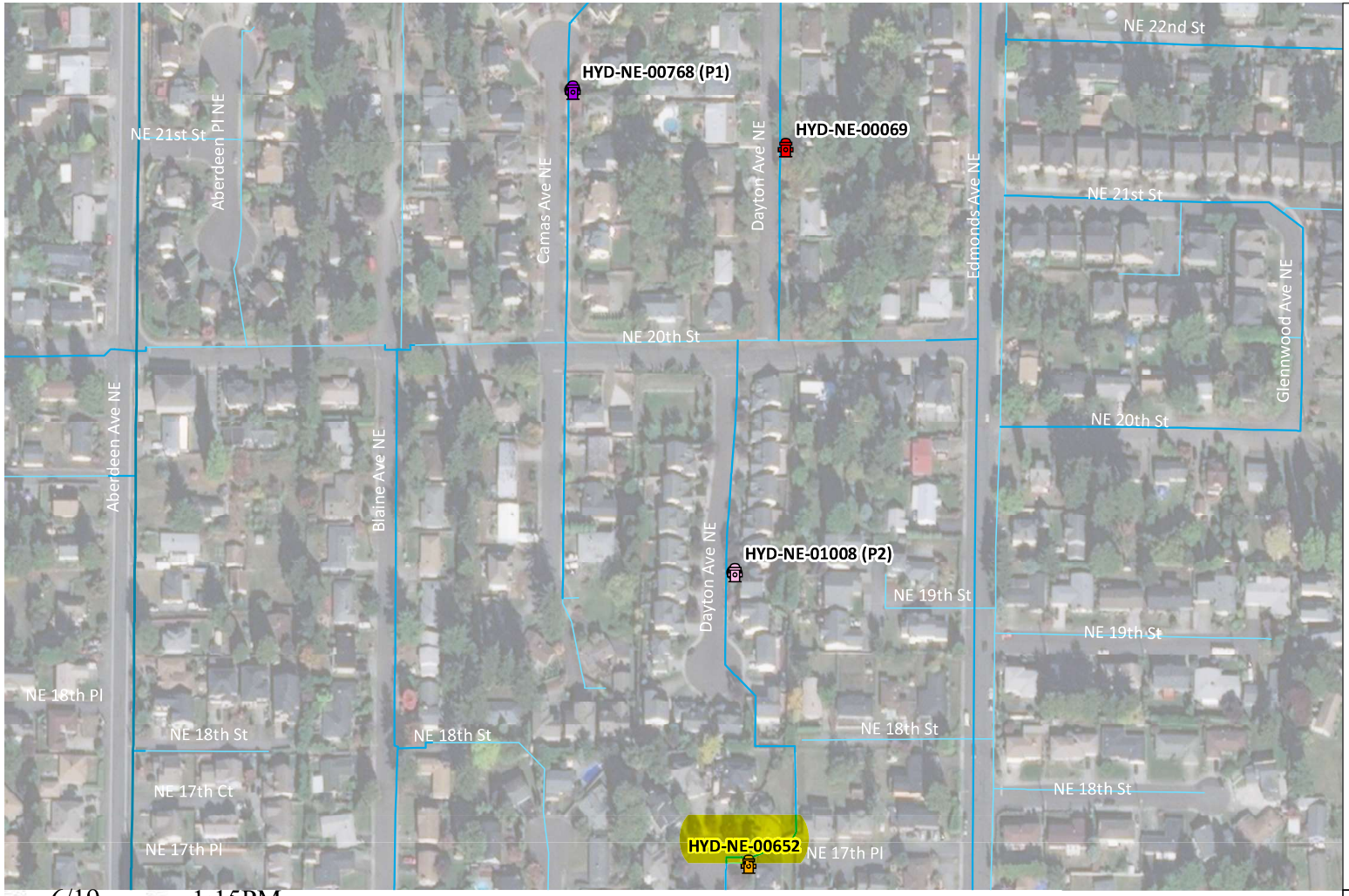
Flowing hydrant F1 discharge control

Pressure at Data Loggers:





Note: Section 1 loggers were set at a one minute recording interval the test lasted less than a minute, therefore manual reading pressure gages might be more accurate for residual pressure values.



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''
- 16'' and larger

Feet
0 120 240

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: 6/19 Time: 1:15PM

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 50	Static PSI: 60	Start Time:	Start Time:
Residual PSI: 41	Residual PSI: 50-55	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 750/800gpm	Flow GPM:

Notes: P1 was at the top of a hill. Top of Hydrant was at 2.5 ft from curb gutter, and 2ft from curb.

Vicinity Map

carollo

Last Revised: May 15, 2018 \\io-fs-1\Data\GIS\GISBackup\Renton\WaterSystemPlan2017\HydrantTestSites.mxd

Figure 5 Hydrant Flow Test 5 Form

Notes/Photographs:

Location of pressure hydrant P1

Logger setup for pressure hydrant P1

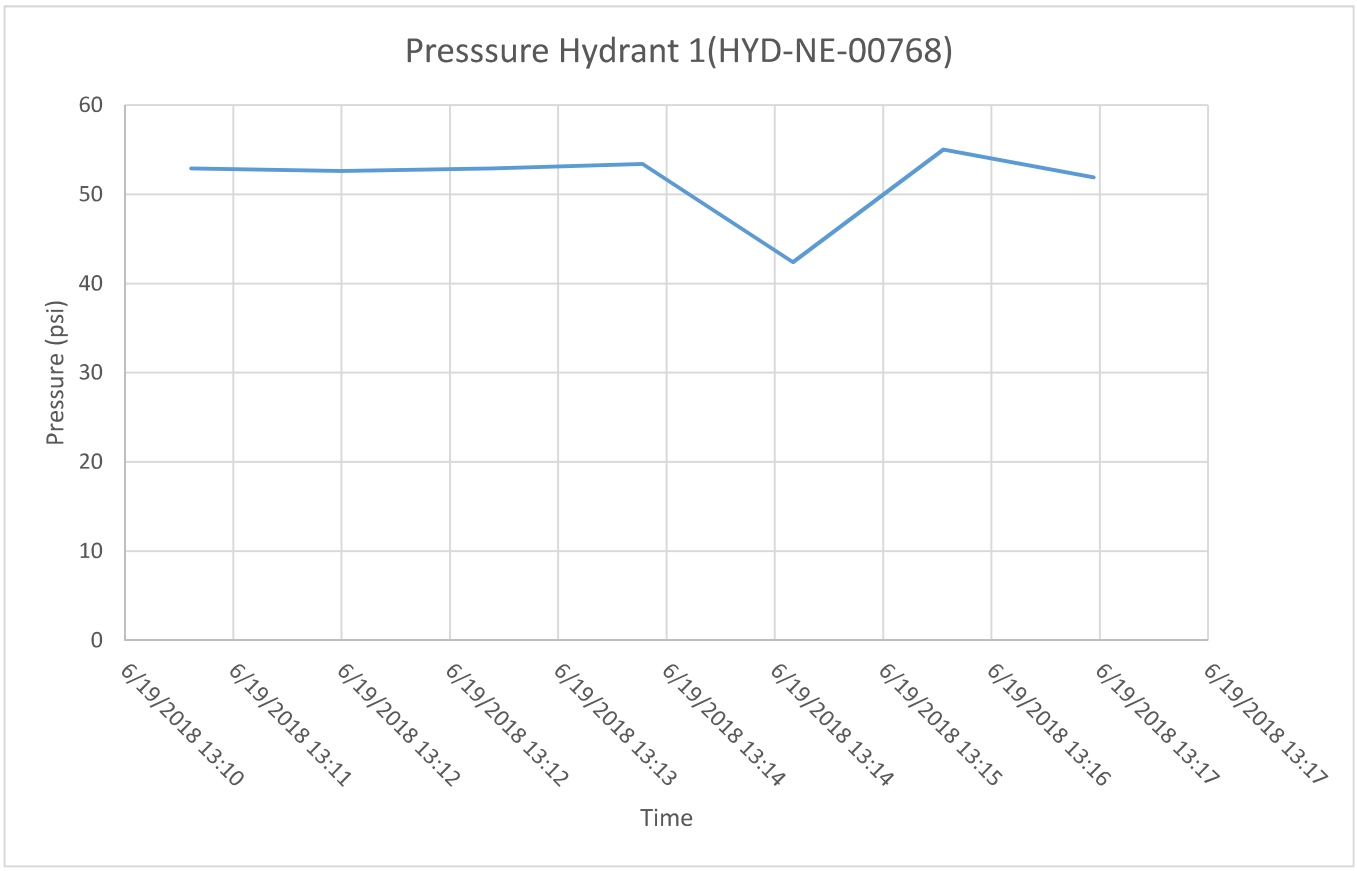
Location of pressure hydrant P2

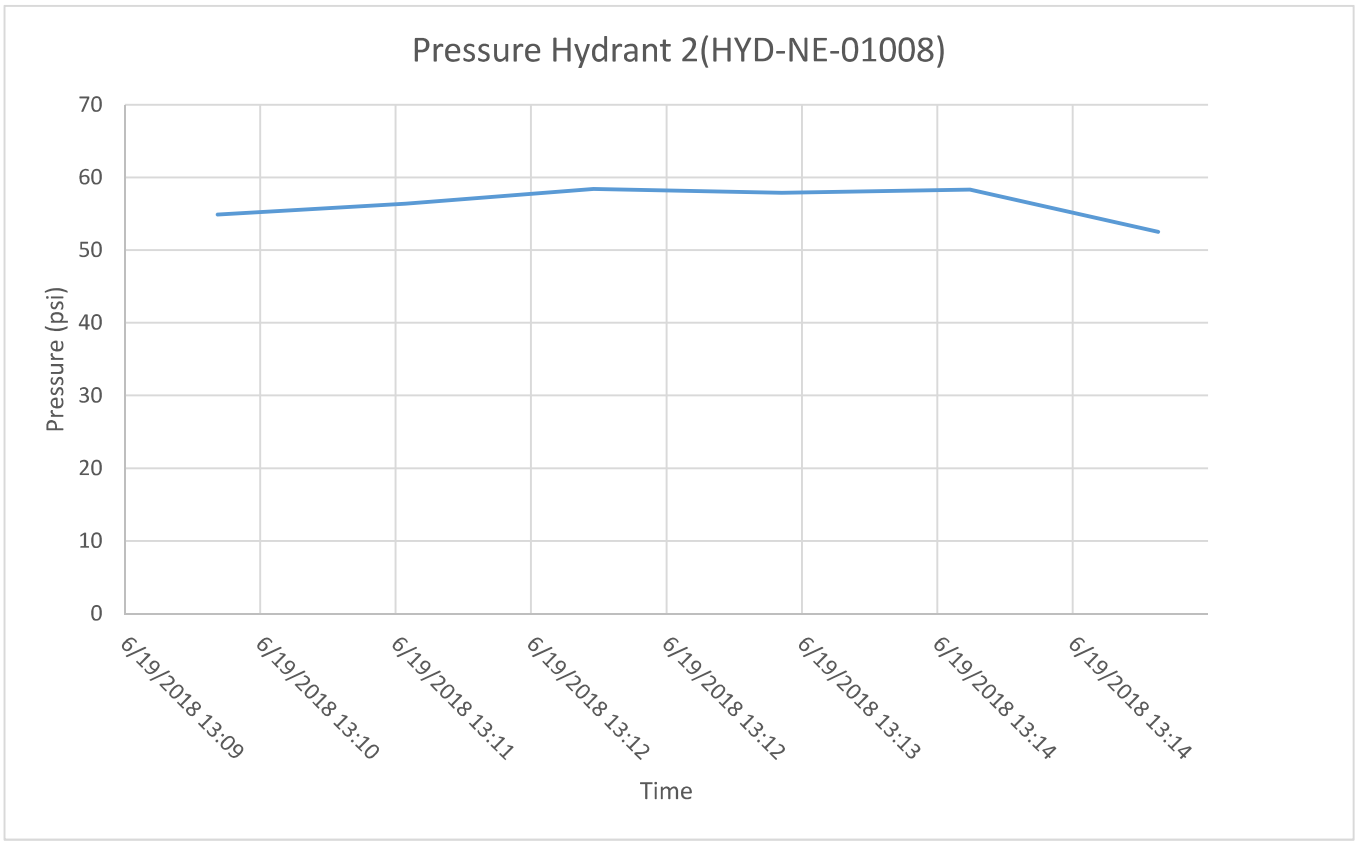
Logger setup for pressure hydrant P2

Diffuser setup of flowing hydrant F1

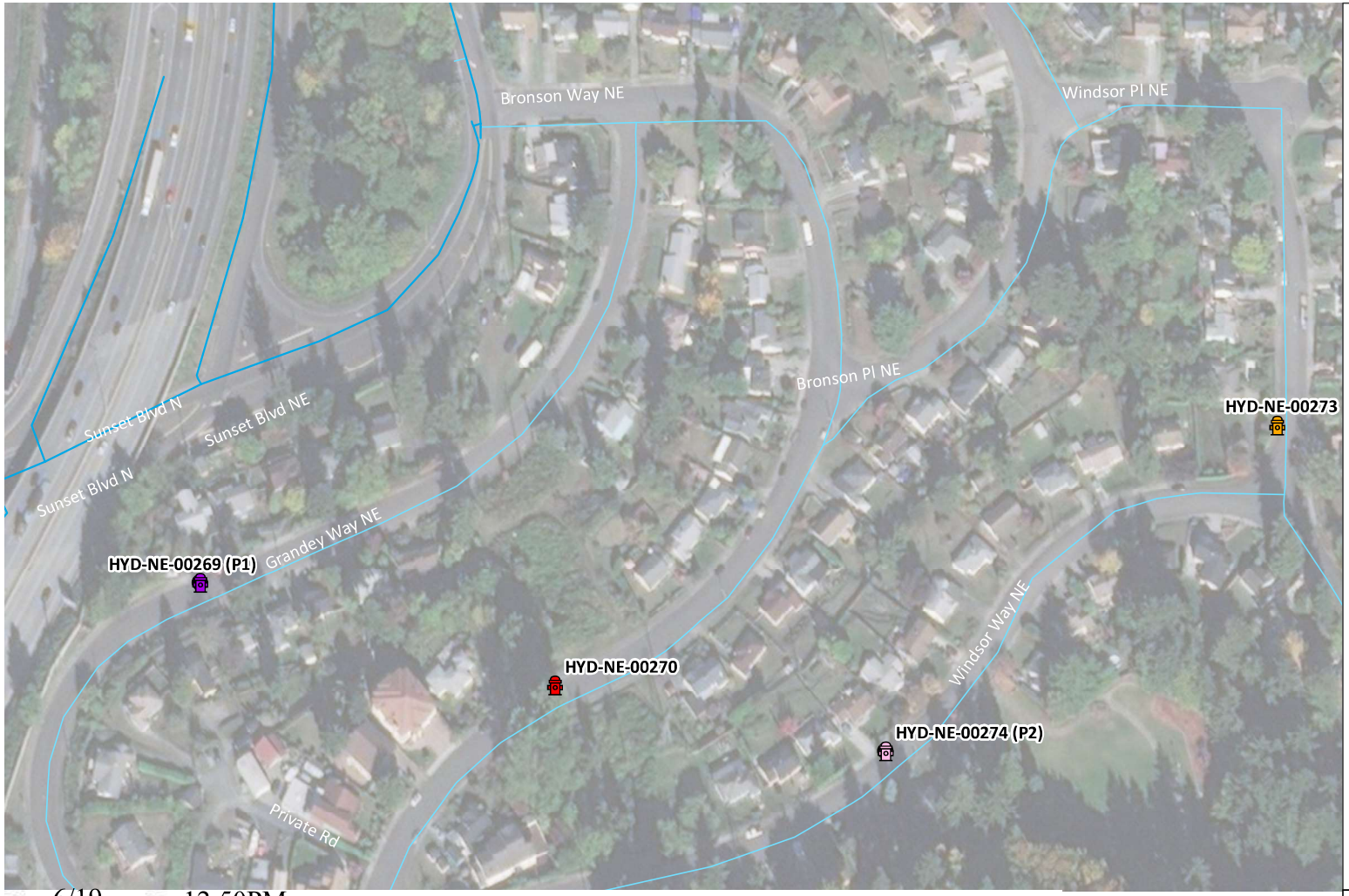
Surrounding area of flowing hydrant F1

Pressure at Data Loggers:





Note: Section 1 loggers were set at a one minute recording interval the test lasted less than a minute, therefore manual reading pressure gages might be more accurate for residual pressure values.



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

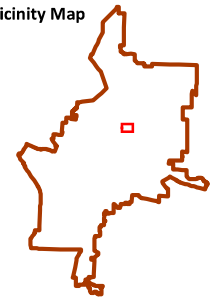
Date: 6/19 Time: 12:50PM

Location:

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 137	Static PSI: 115	Start Time:	Start Time:
Residual PSI: 125-130	Residual PSI: 105-110	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1060 gpm	Flow GPM:

Notes: P1 towards bottom of hill. Not super steep. Top of hydrant is 20 inches above street. Centerline of road was 4 inches higher than gutter near hydrant.

Vicinity Map



carollo

Last Revised: June 01, 2018 \\io-fs-1\Data\GIS\GISBackup\Renton\WaterSystemPlan2017\HydrantTestSites.mxd

Figure 6 Hydrant Flow Test 6 Form

Notes/Photographs:

Location of pressure hydrant P1

.

Logger setup for pressure hydrant P1

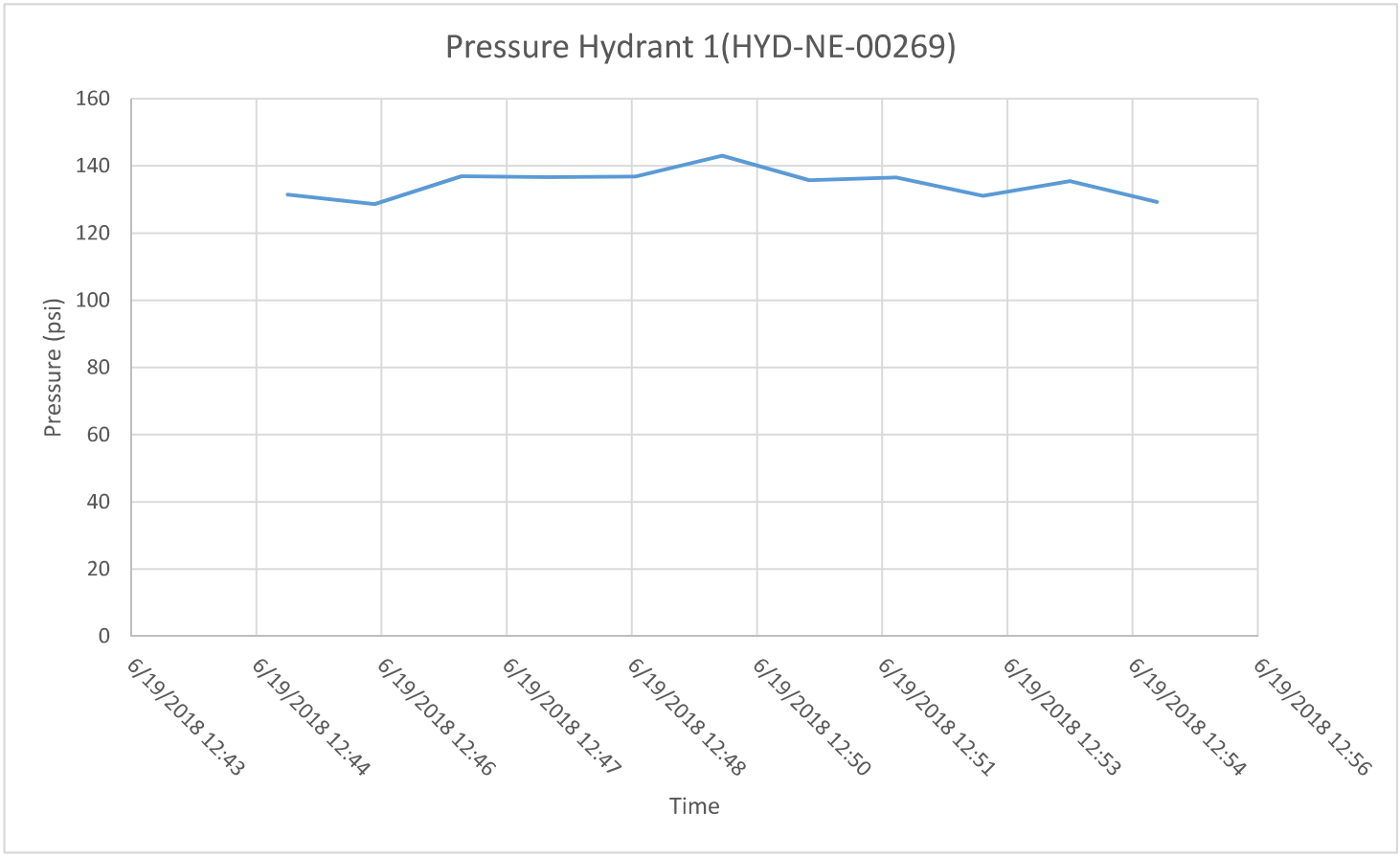
Location of pressure hydrant P2

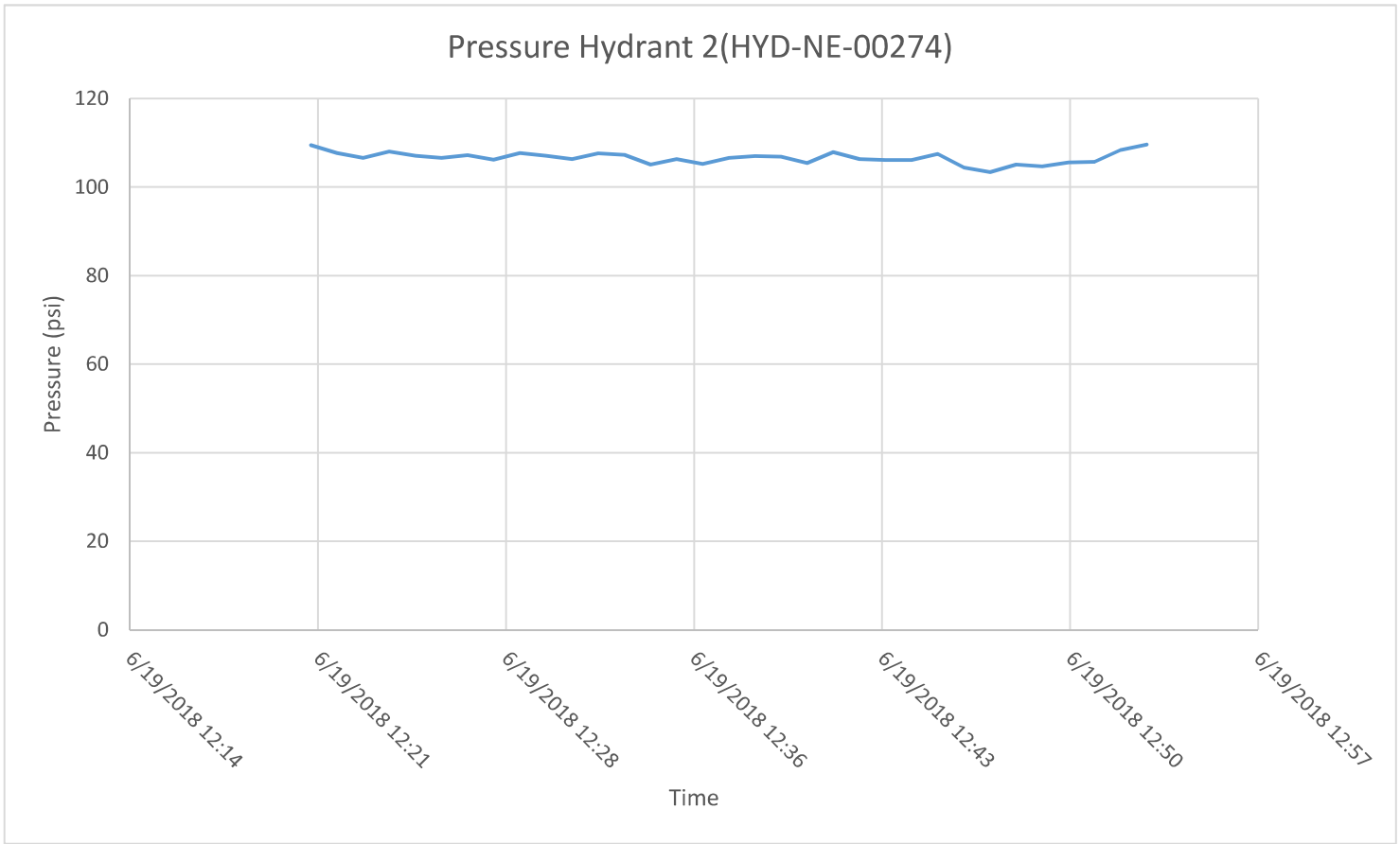
Logger setup for pressure hydrant P2

Diffuser of flowing hydrant F1

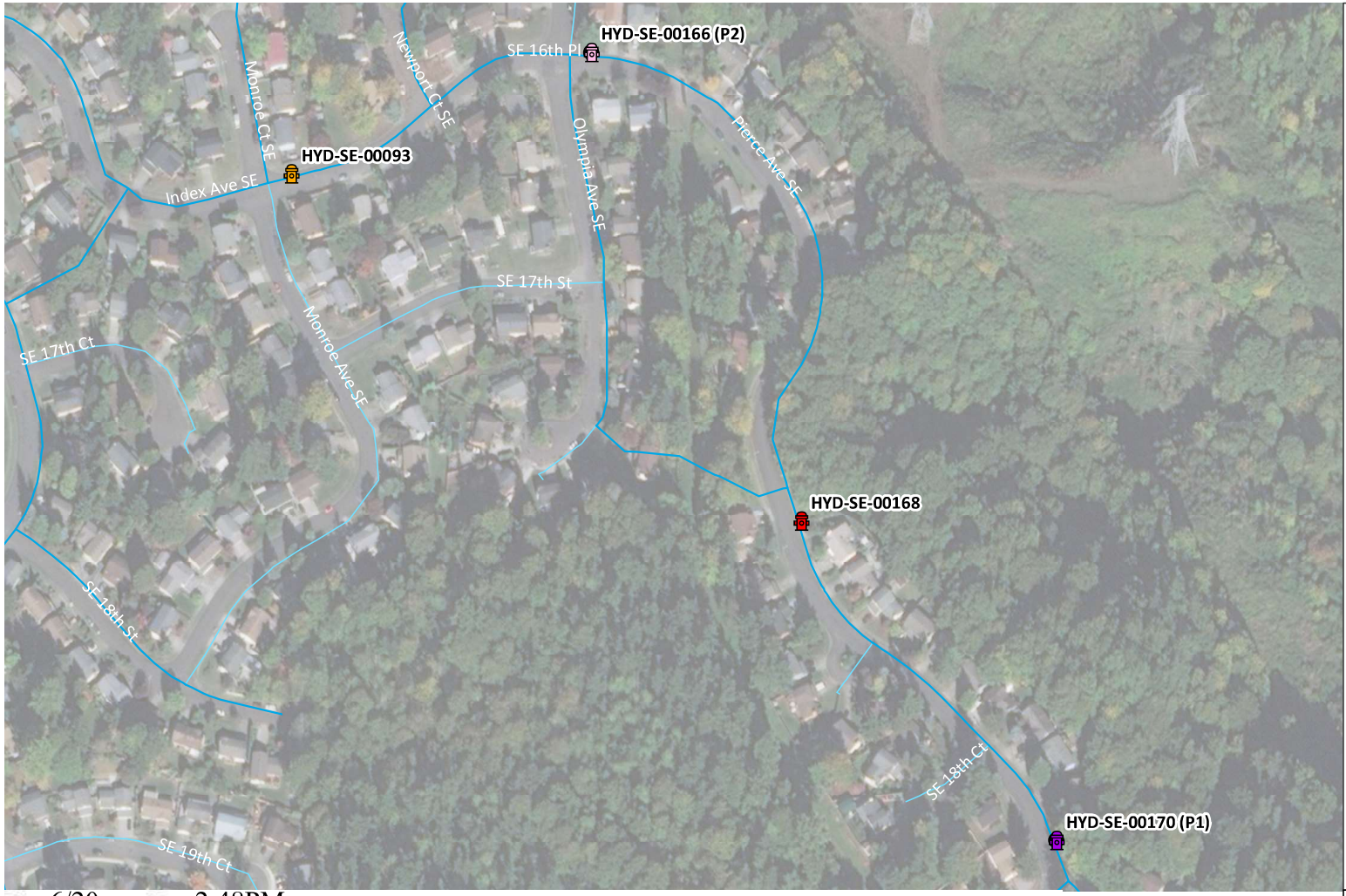
Surrounding area of flowing hydrant F1

Pressure at Data Loggers:





Note: Section 1 loggers were set at a one minute recording interval the test lasted less than a minute, therefore manual reading pressure gages might be more accurate for residual pressure values.



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 137.5 275

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: 6/20 Time: 2:48PM

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 60	Static PSI: 77	Start Time:	Start Time:
Residual PSI: 30-50	Residual PSI: 57/71 stable	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1130/1250	Flow GPM:

Notes: For P1 the lowest pressure was 30psi. P2 sloping downhill towards Olympia Ave. Top of hydrant was 2-2.5 ft above ground.

Vicinity Map

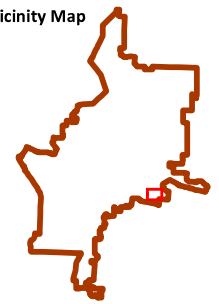


Figure 7 Hydrant Flow Test 7 Form

Notes/Photographs:

Logger setup of pressure hydrant P1 (Static)

.

Logger setup for pressure hydrant P1(Residual)

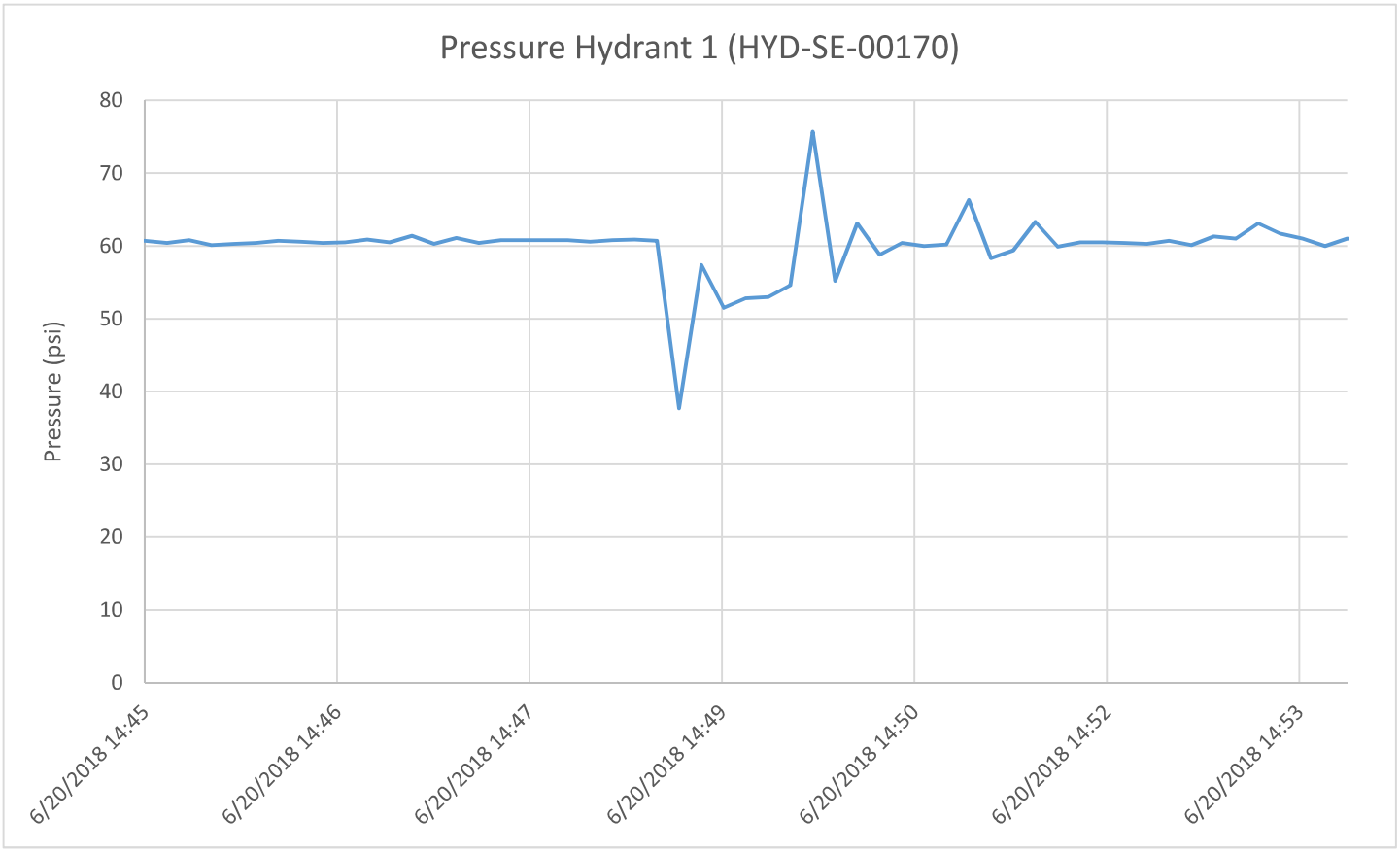
Location of pressure hydrant P2

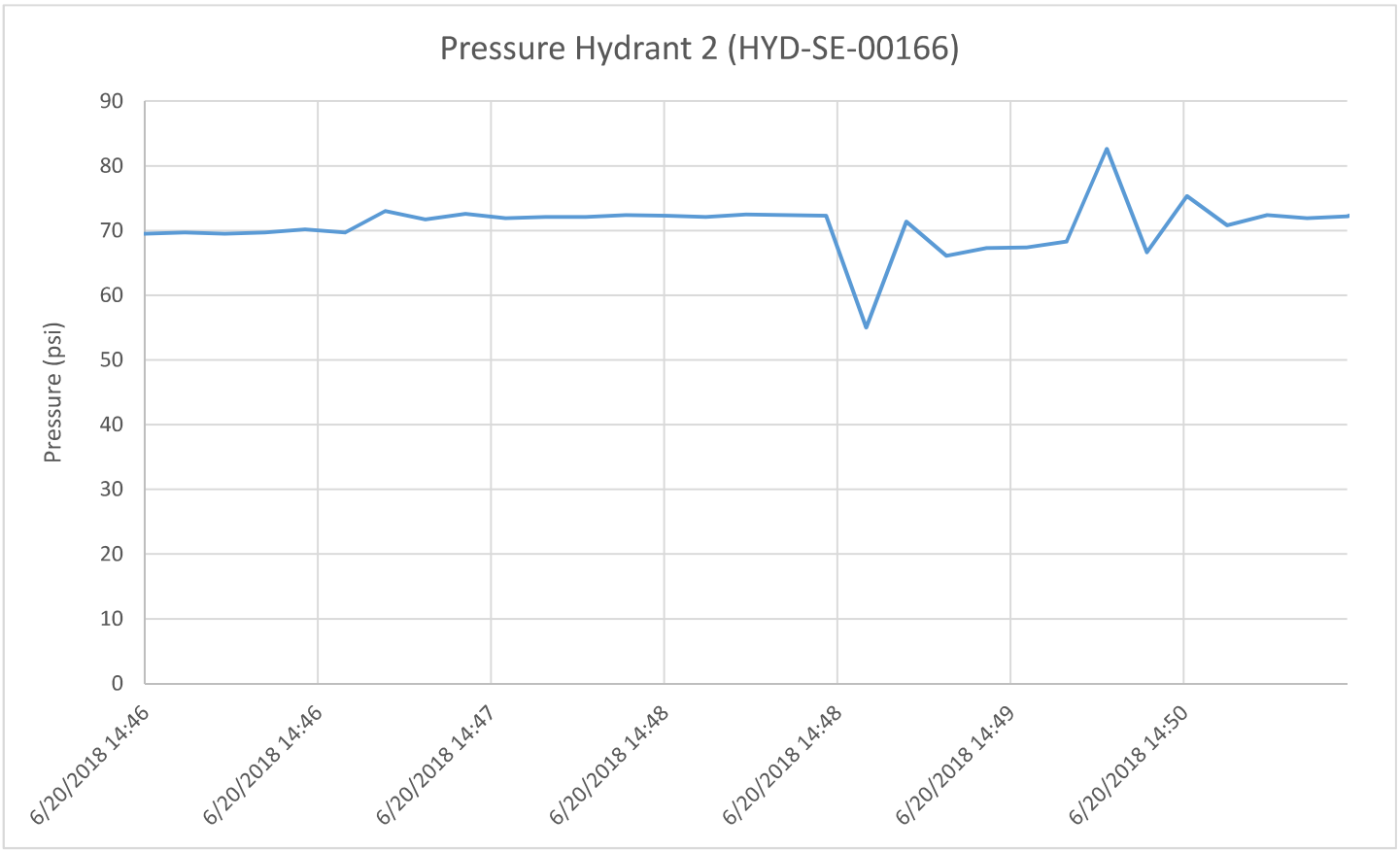
Logger setup for pressure hydrant P2

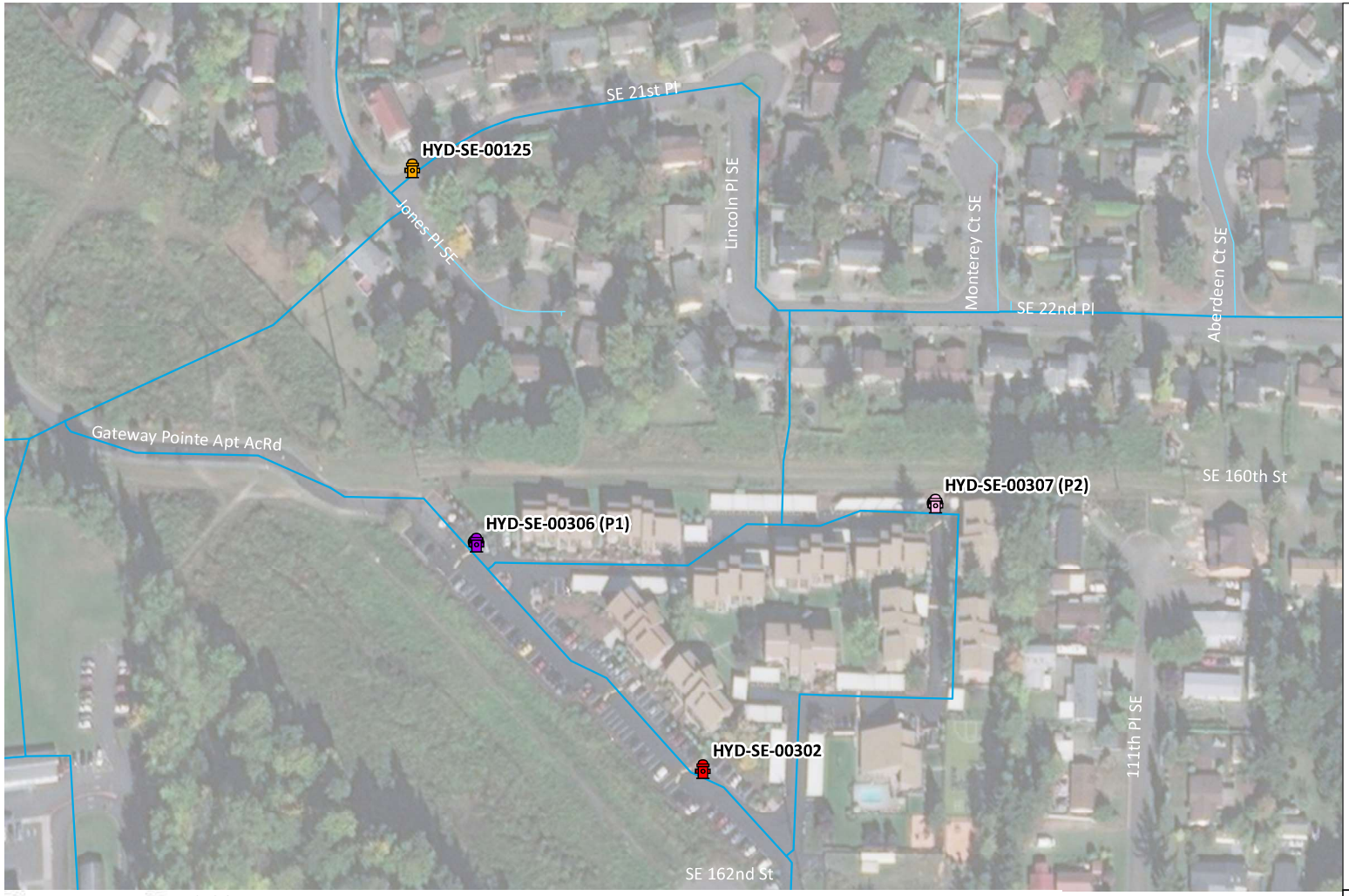
Diffuser setup of flowing hydrant F1

Surrounding area of flowing hydrant F1

Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

N

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

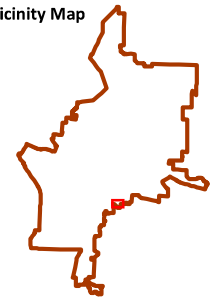
Date: June 20 Time: 2:28 PM

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 70	Static PSI: 54	Start Time: 2:28 PM	Start Time:
Residual PSI: 60	Residual PSI: 35 / 49	End Time: 2:30 PM	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1130 gpm	Flow GPM:

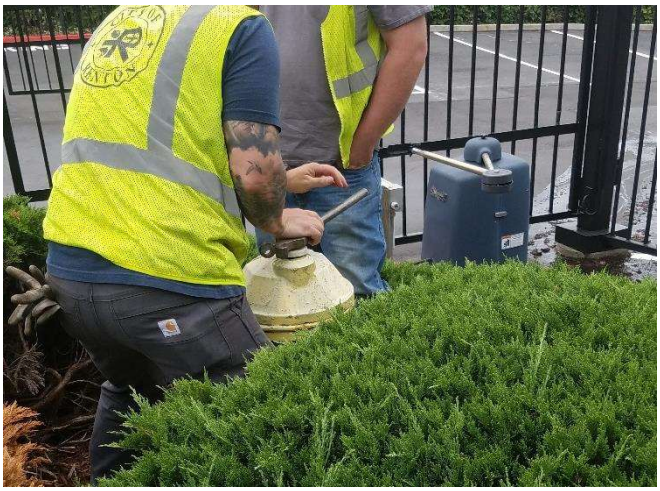
Notes: P2: In apartment complex. Elevated hydrant ~3 ft above ground level to top. Parking spaces slope down to centerline of road

Vicinity Map



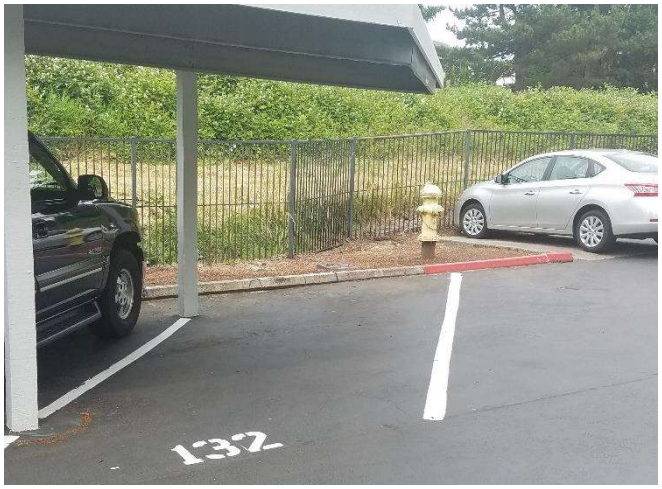
Notes/Photographs:

Location/setup of pressure hydrant 1



Logger setup for pressure hydrant 1

Location of pressure hydrant 2

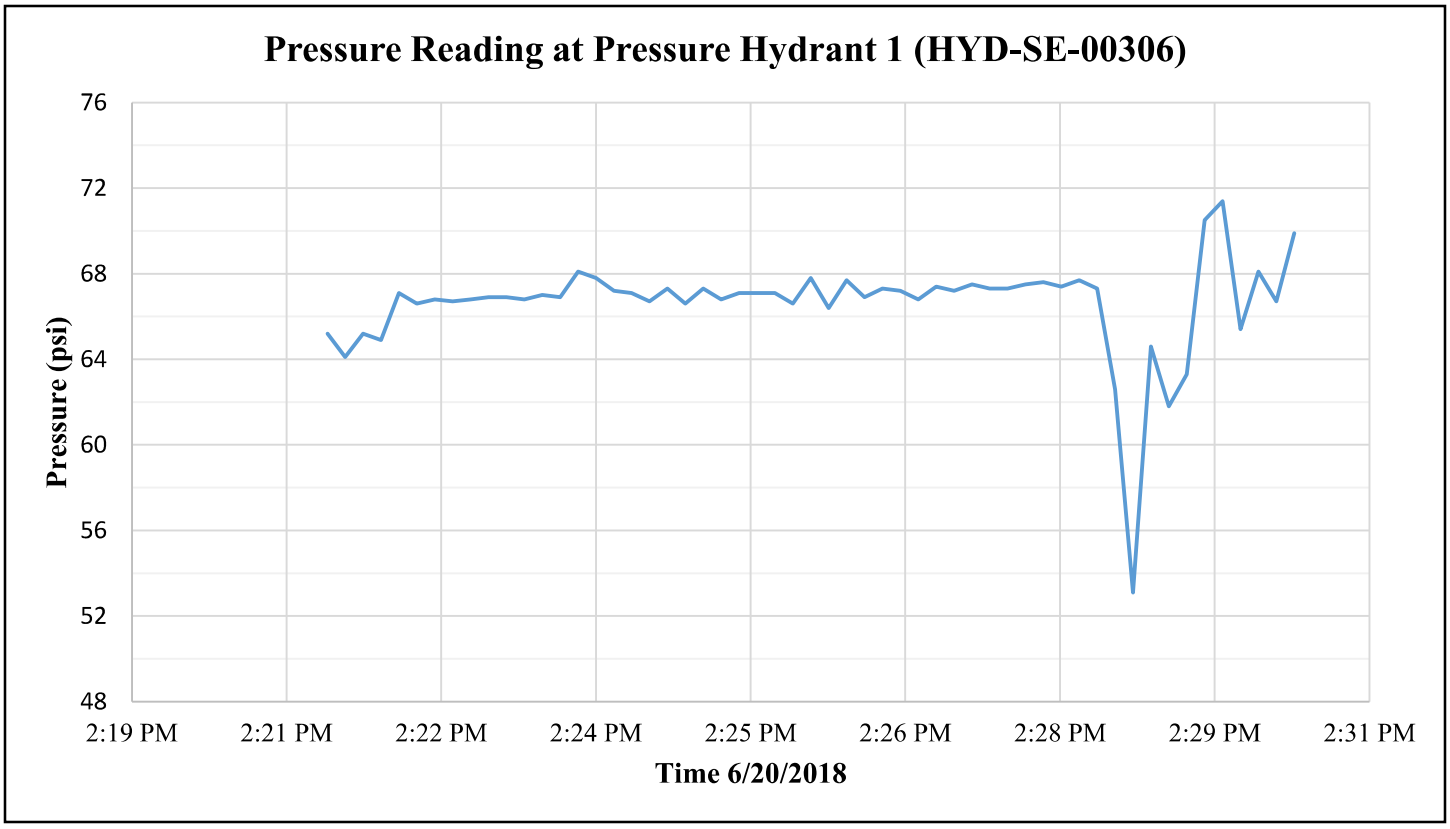


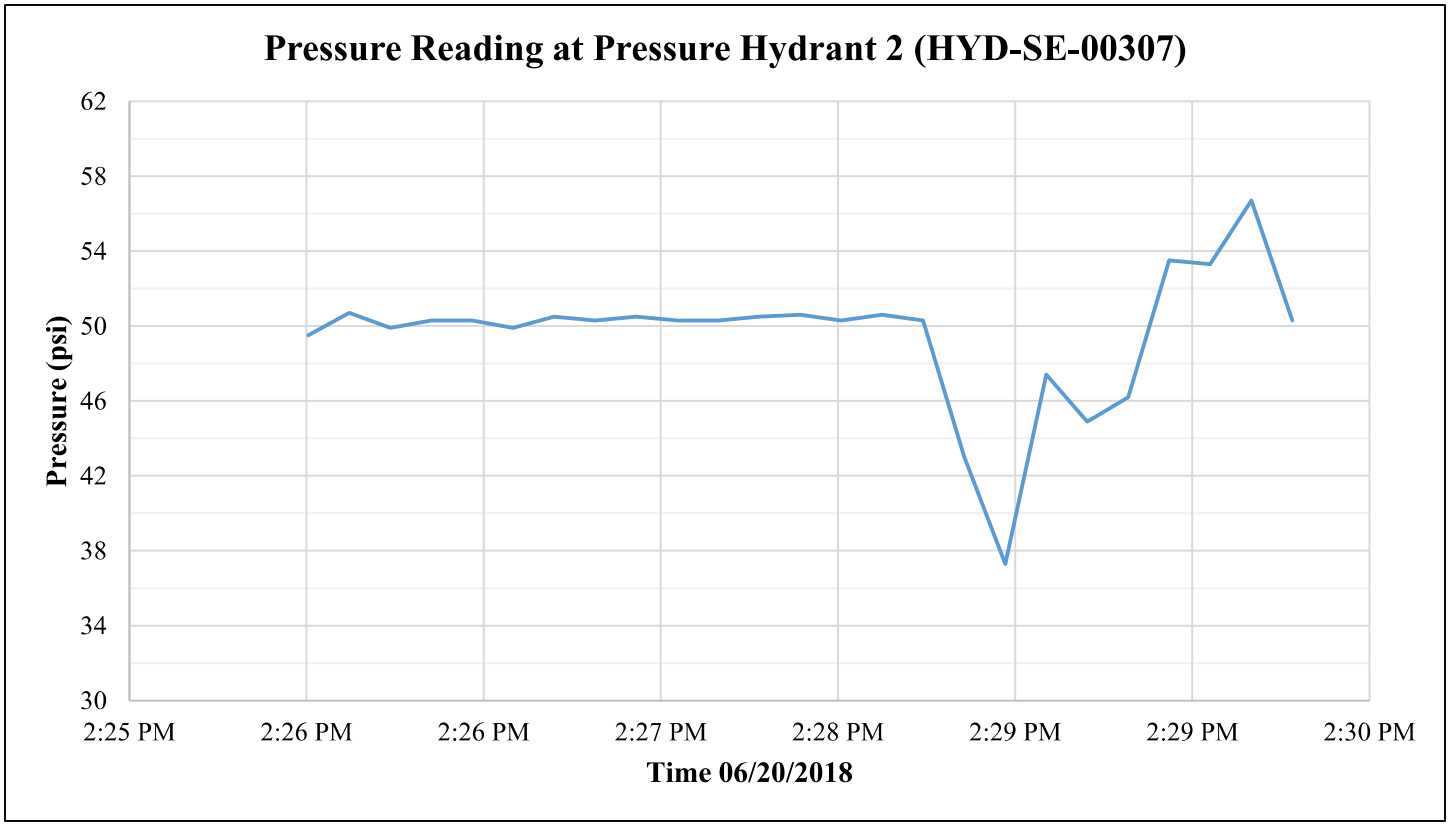
Logger setup for pressure hydrant 2

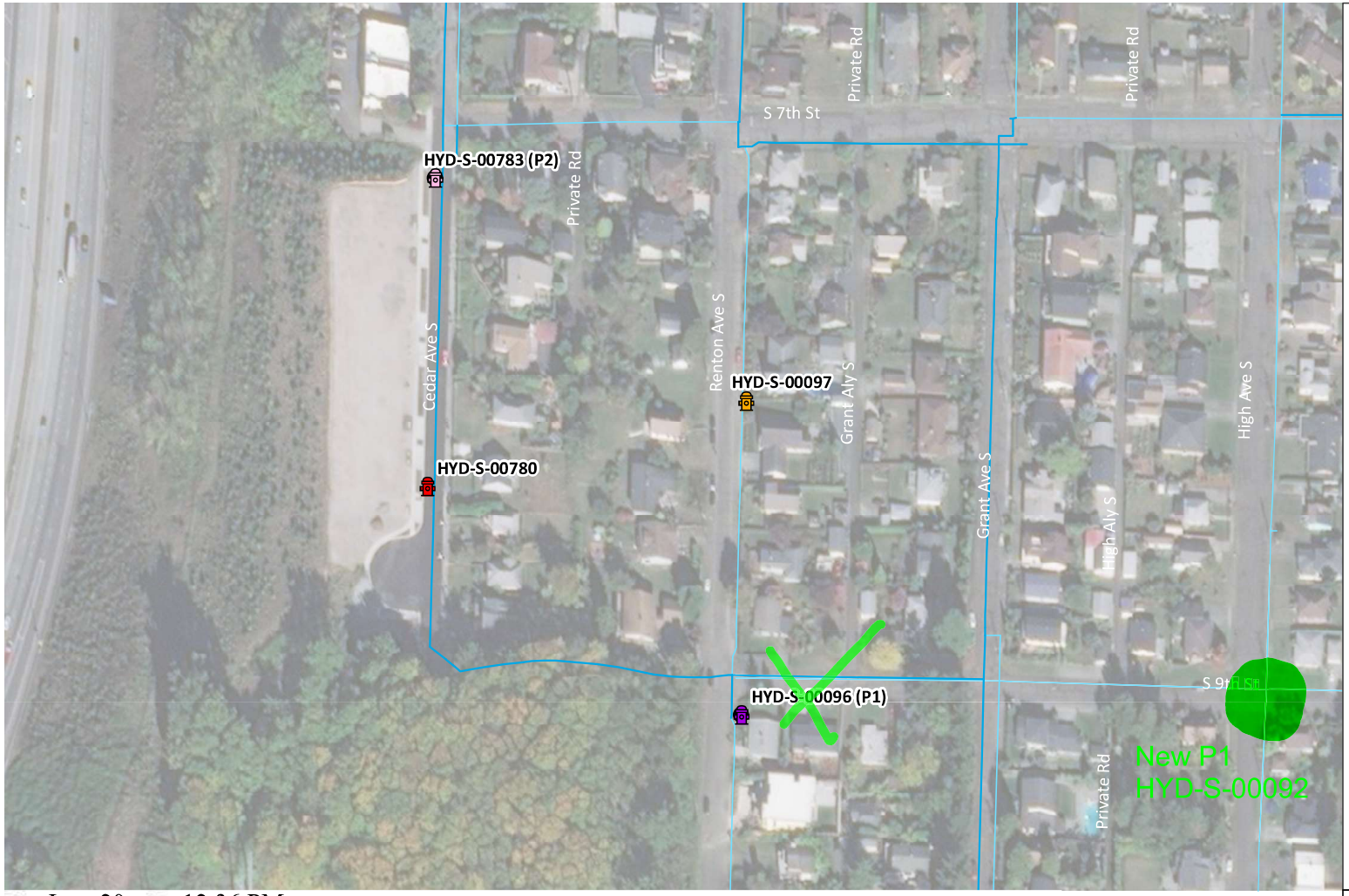
Location of flowing hydrant F1

Diffuser setup of flowing hydrant F1

Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: June 20 Time: 12:36 PM

Location: _____

Pressure Hydrant 1 (P1)
Static PSI: 54
Residual PSI: 15/39
Logger ID: City 3

Pressure Hydrant 2 (P2)
Static PSI: 111
Residual PSI: 60/90/105
Logger ID: City 4

Flow Hydrant 1 (F1)
Start Time: 12:36 PM
End Time: 12:37 PM
Static PSI: _____
Residual PSI: _____
Flow GPM: 840 gpm

Flow Hydrant 2 (F2)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

Notes: P1 in grass at street level, no curb

Vicinity Map

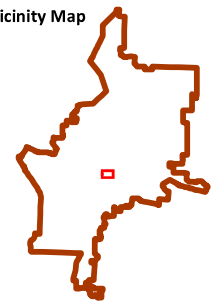


Figure 9 Hydrant Flow Test 9 Form

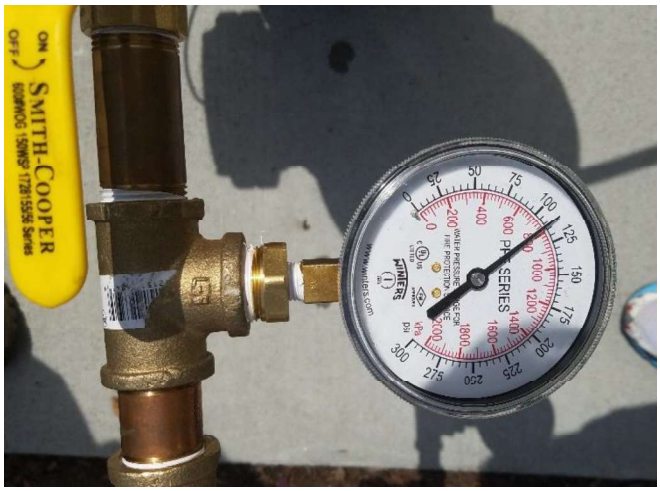
Notes/Photographs:

Location/setup of pressure hydrant 1

Logger setup for pressure hydrant 1

Setup of pressure hydrant 2

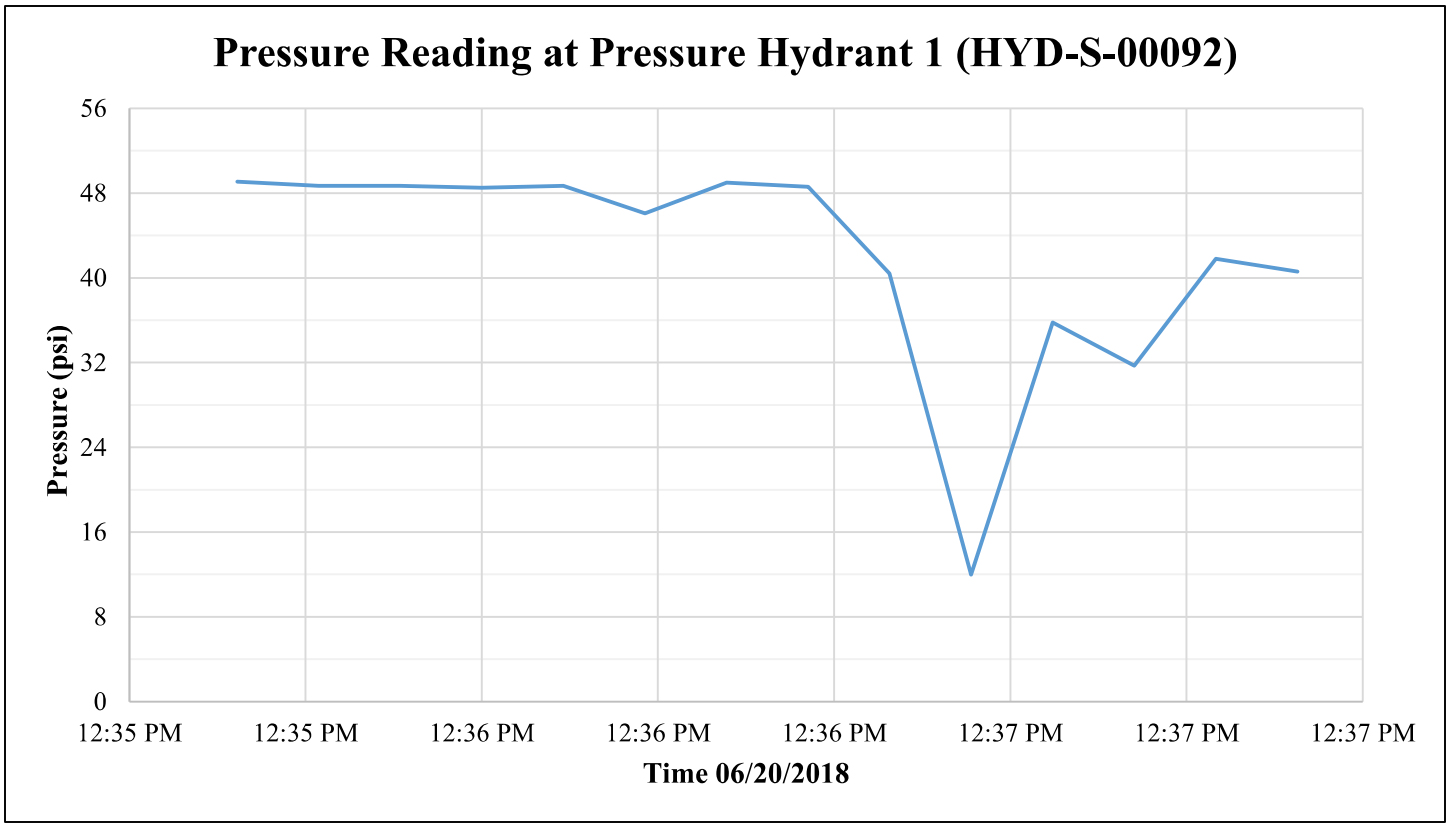
Static pressure for pressure hydrant 2

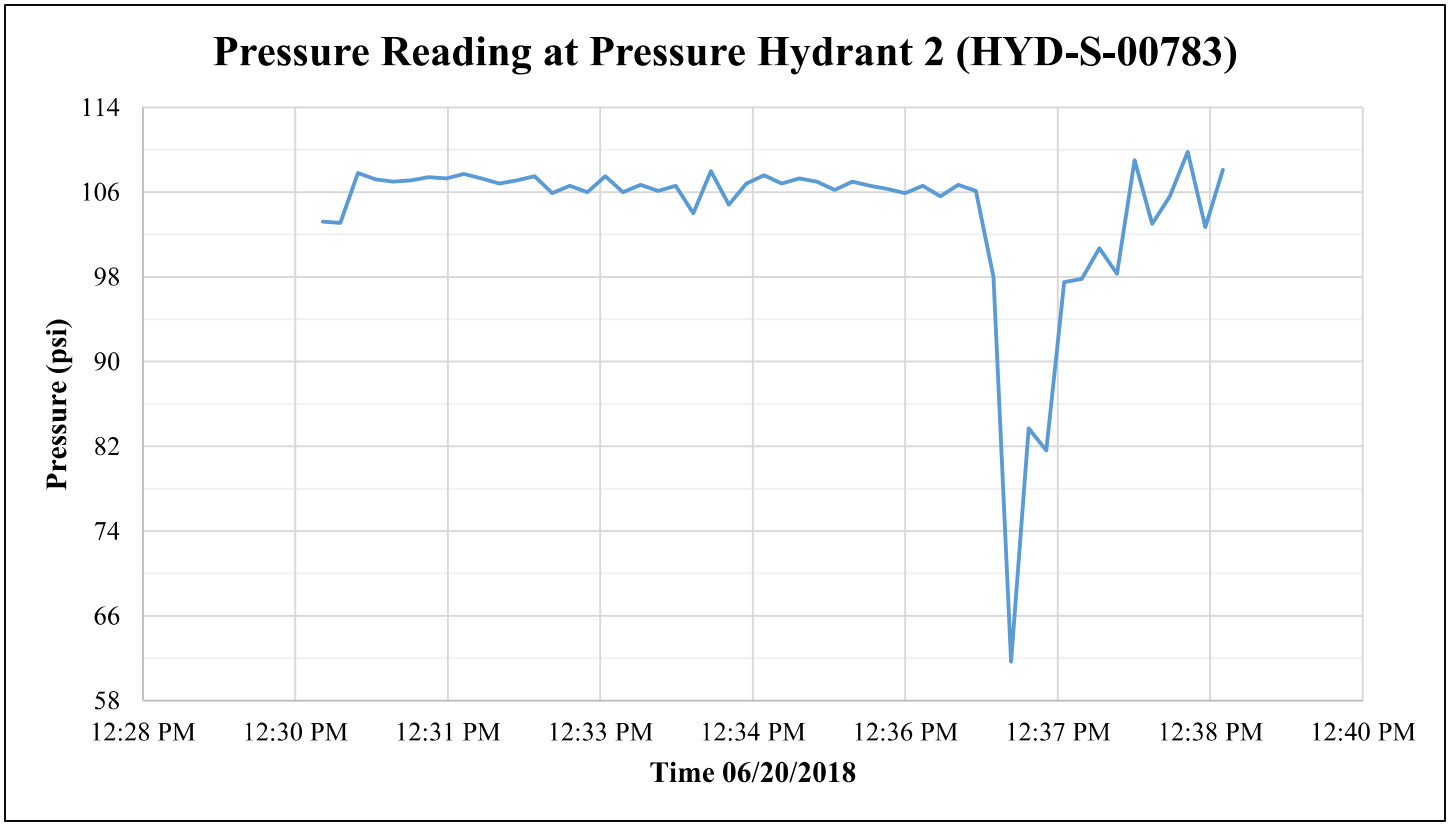


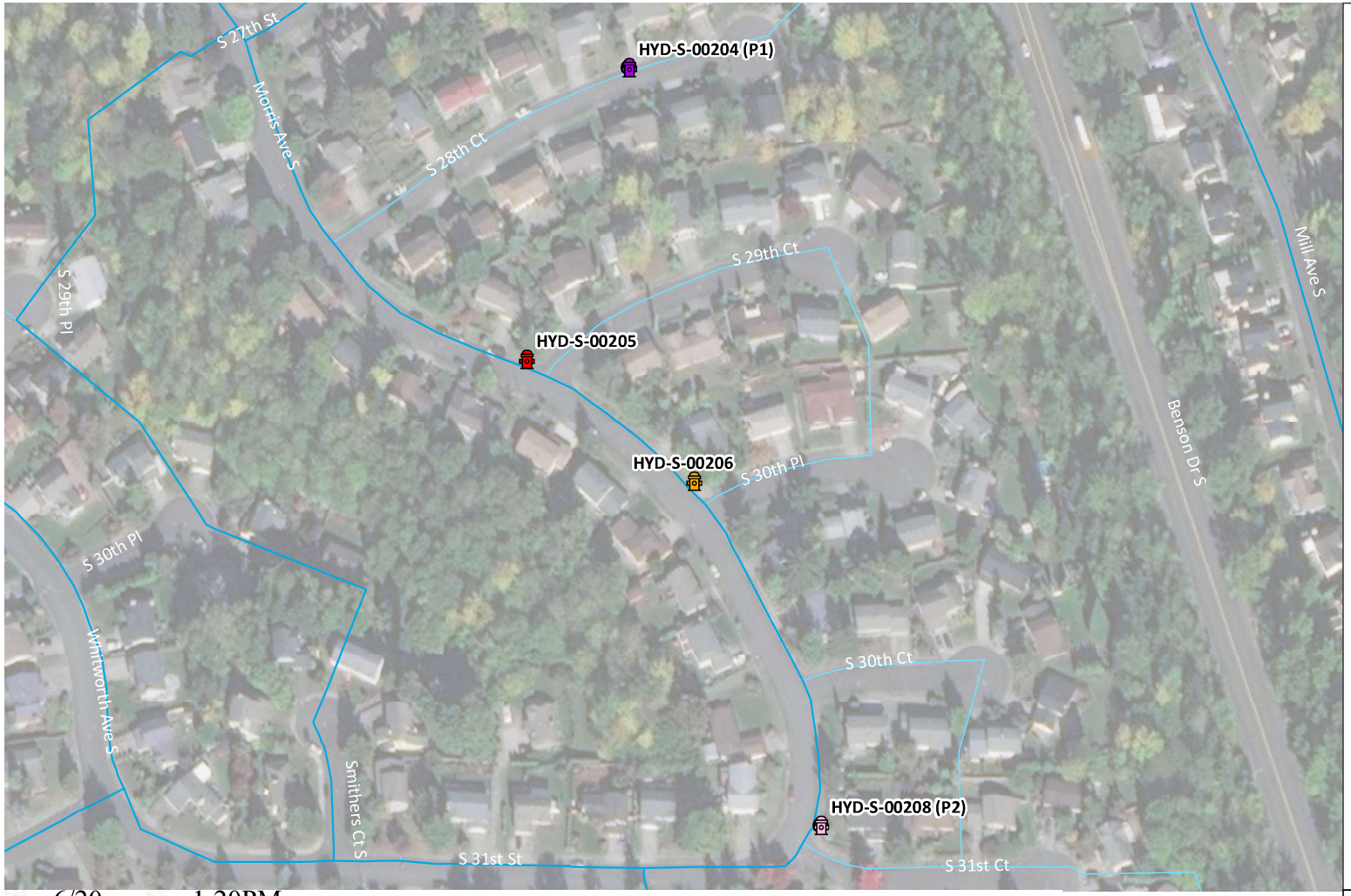
Location of flowing hydrant F1

Diffuser setup of flowing hydrant F1

Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: 6/20 Time: 1:20PM

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 110	Static PSI: 108	Start Time:	Start Time:
Residual PSI: 60-90(stable)	Residual PSI: 55/79(stable)	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1030gpm	Flow GPM:

Notes: P2 lowest pressure was 55 psi and then was stable when flowing at 79psi. Top of P2 hydrant was 2ft above street level. Street sloping downhill, water valve in street in front of the curb roughly at centerline.

Vicinity Map

Figure 10 Hydrant Flow Test 10 Form

Notes/Photographs:

Location of pressure hydrant P1

.

Logger setup for pressure hydrant P1

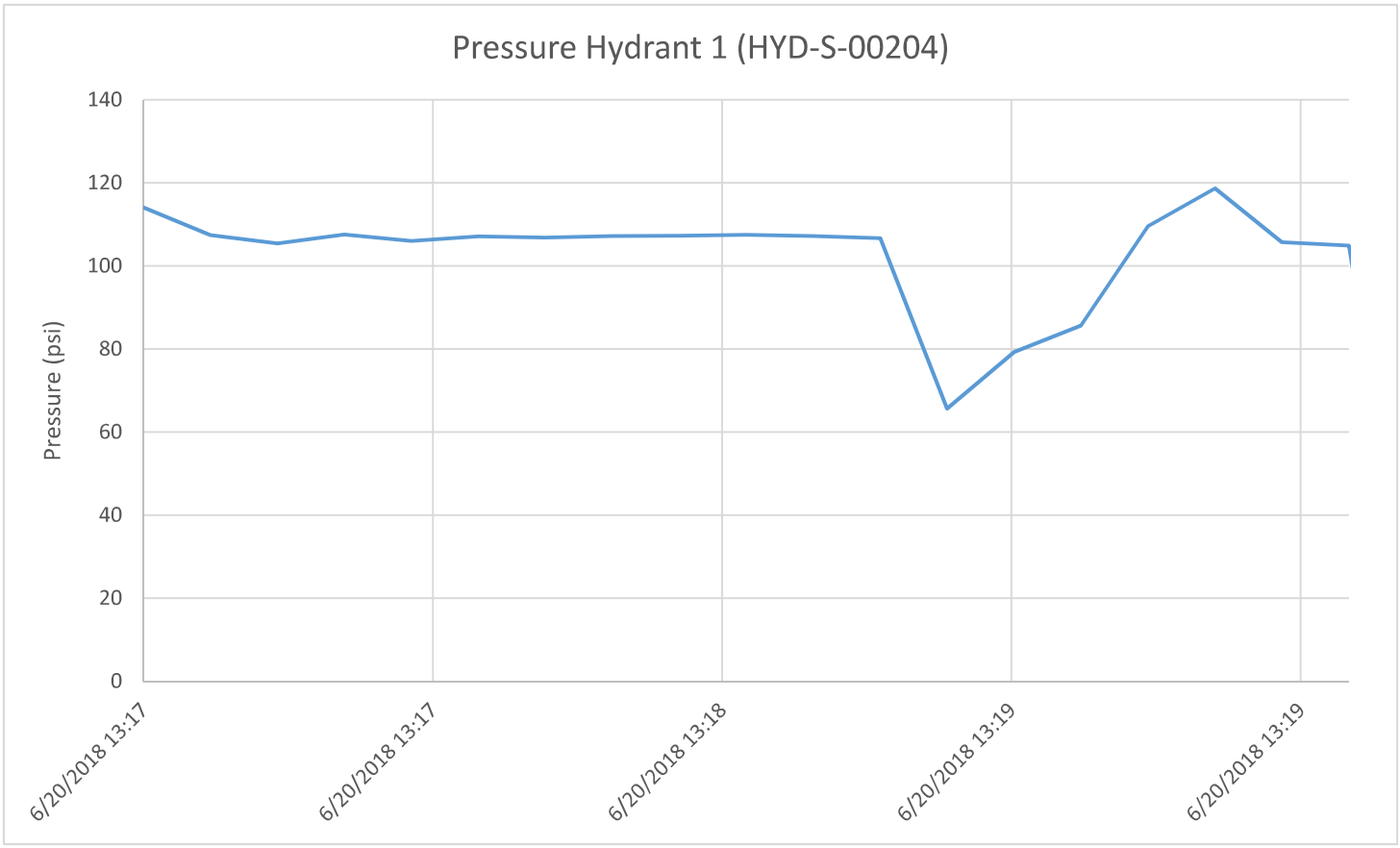
Location of pressure hydrant P2

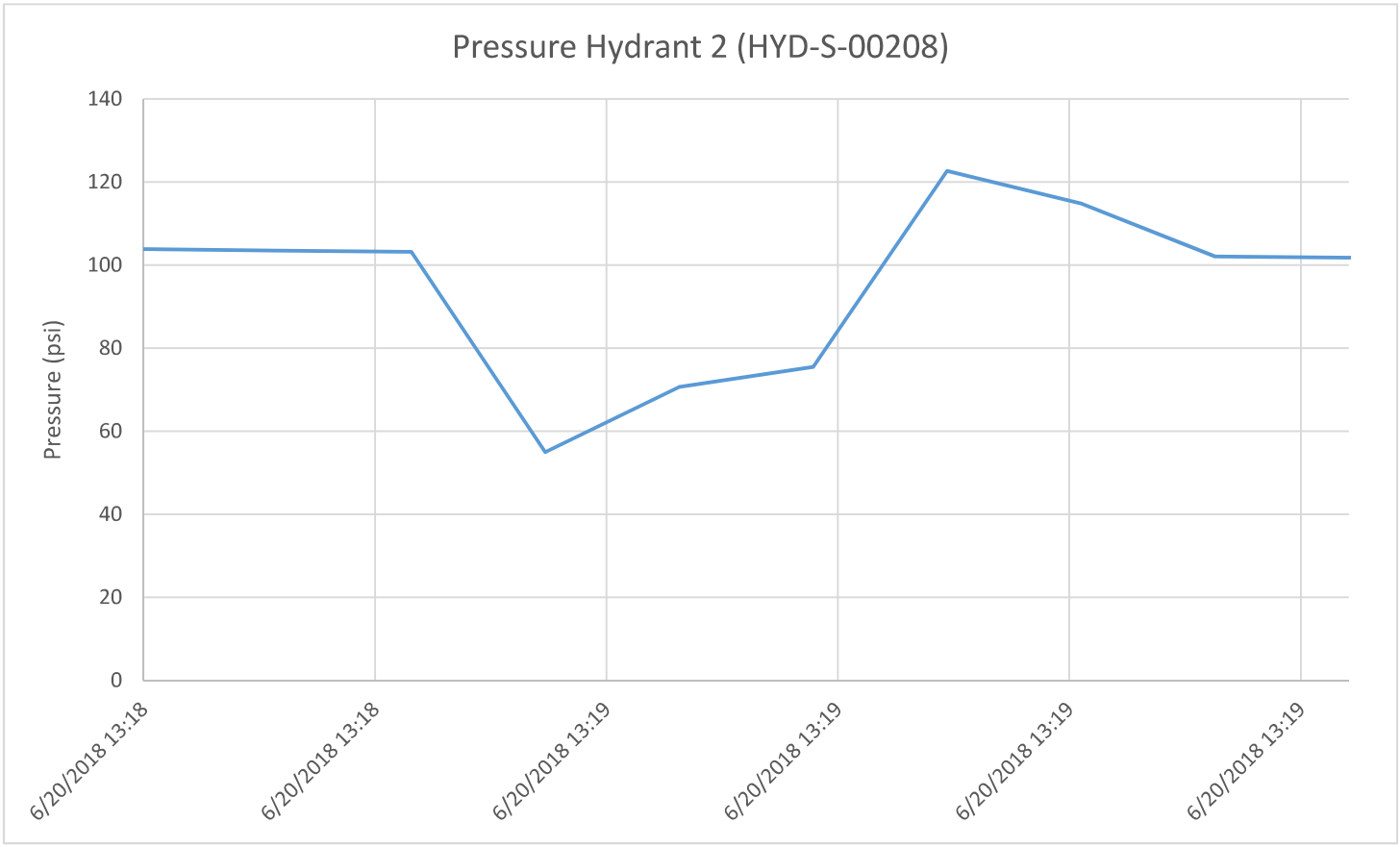
Logger setup for pressure hydrant P2

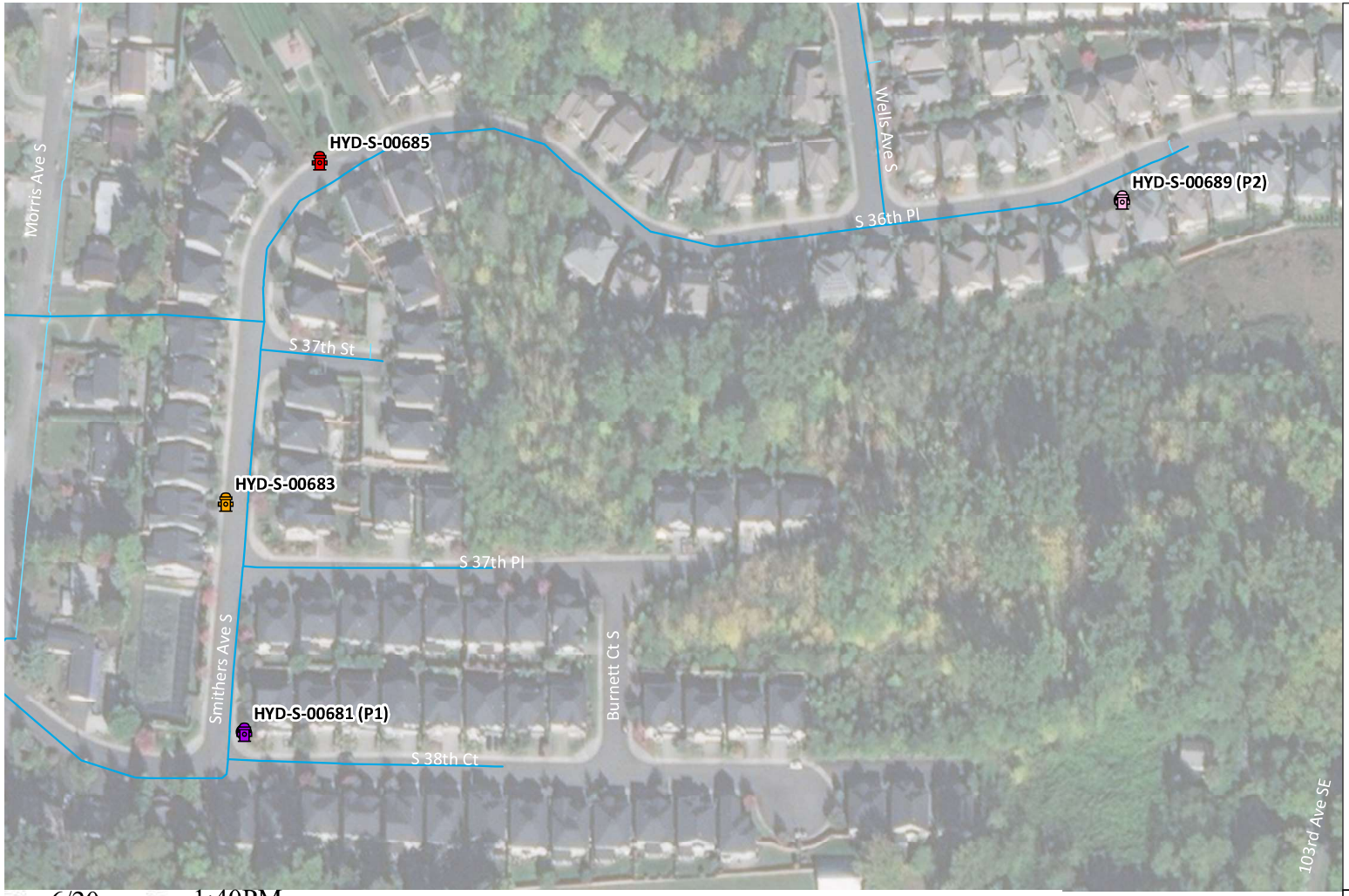
Surrounding area of flowing hydrant F1

Diffuser setup of flowing hydrant F1

Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: 6/20 Time: 1:40PM

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 100	Static PSI: 51	Start Time: 1:41 PM	Start Time:
Residual PSI: 95	Residual PSI: 40-42	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1190 gpm	Flow GPM:

Notes: P2: hydrant on street with steep slope 6 inch curb sidewalk not level (sloping) in front of hydrant. Valve in center of street in front of hydrant. Top of hydrant is 2 feet above road elevation.

Vicinity Map

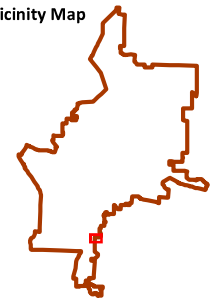


Figure 11 Hydrant Flow Test 11 Form

Notes/Photographs:

Location of pressure hydrant P1

.

Logger setup for pressure hydrant P1

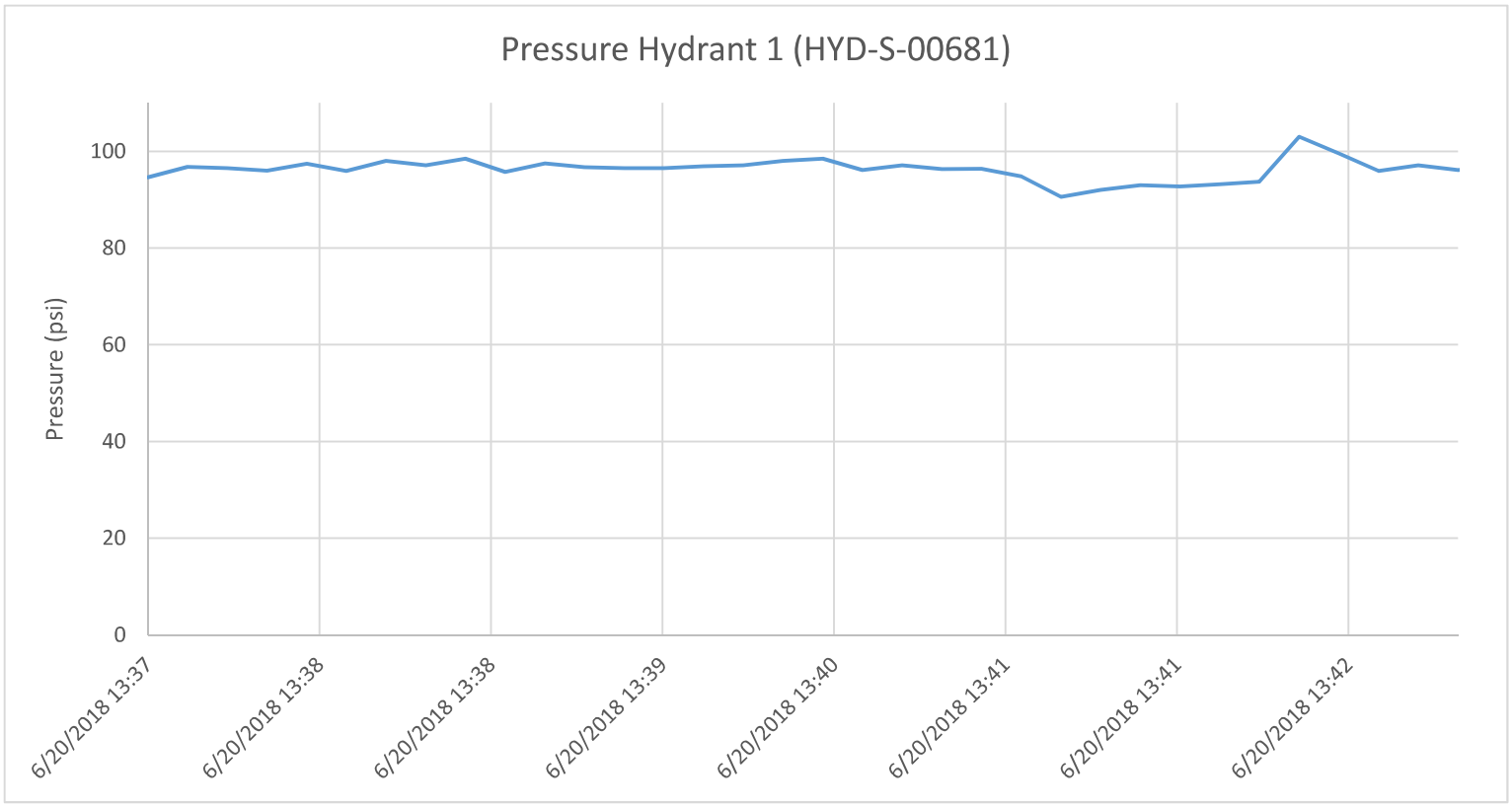
Location of pressure hydrant P2

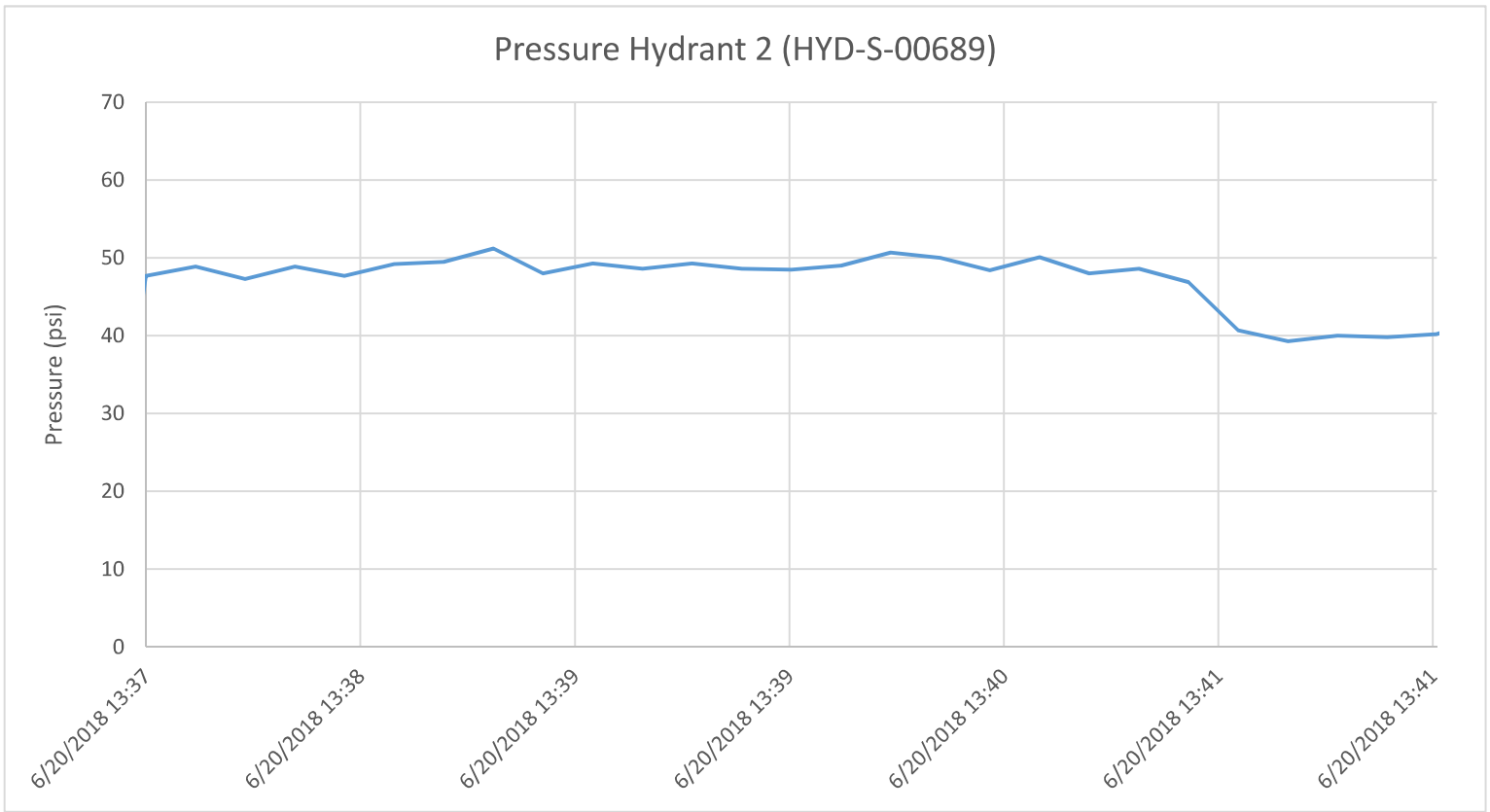
Logger setup for pressure hydrant P2

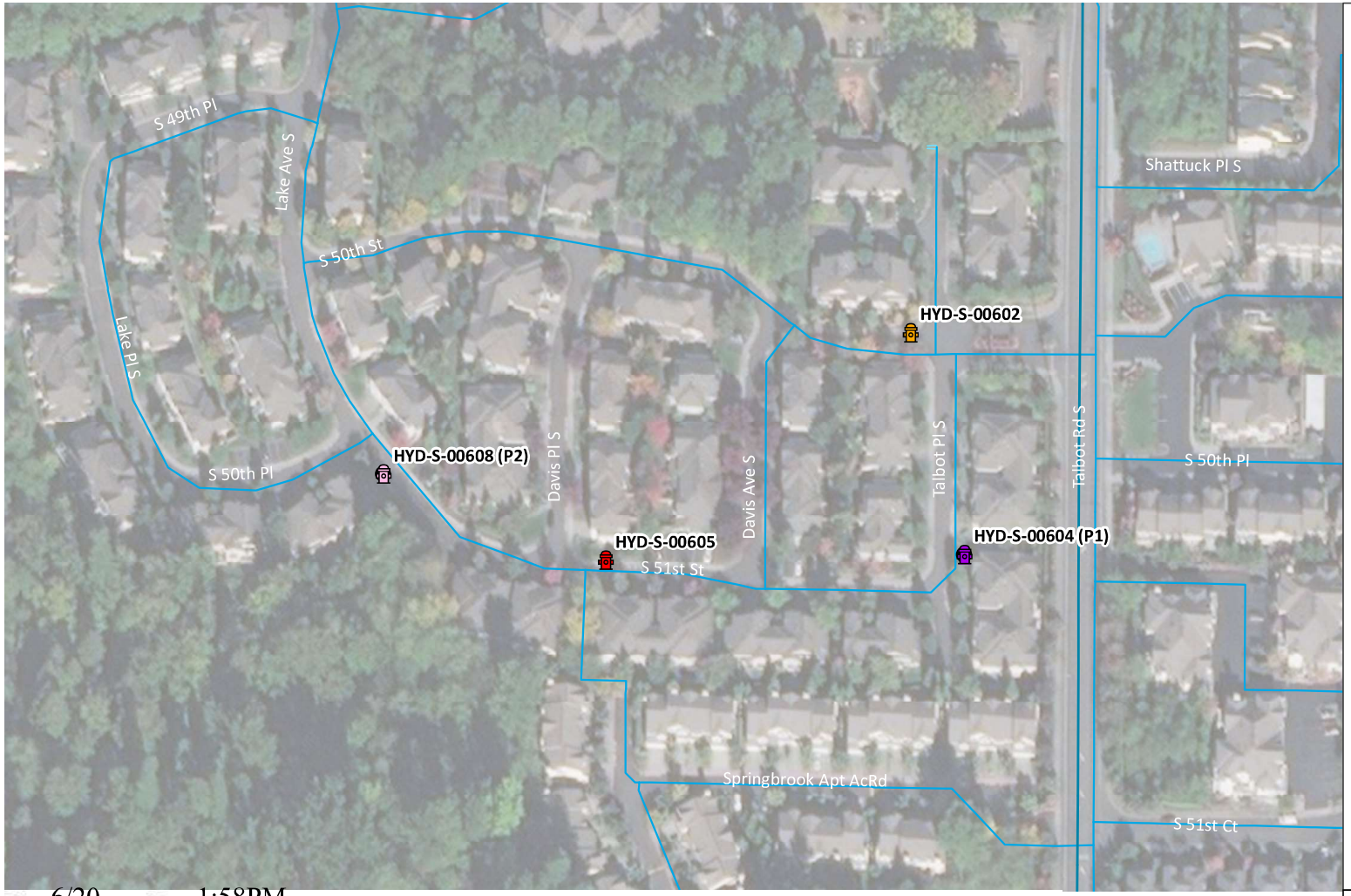
Location of flowing hydrant F1

Diffuser setup of flowing hydrant F1

Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

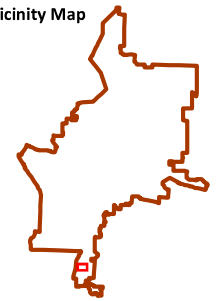
- 6'' and smaller
- 8-14''
- 16'' and larger

Feet
0 80 160

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Vicinity Map



Date: 6/20 Time: 1:58PM

Location: _____

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 91	Static PSI: 111	Start Time: 1:58PM	Start Time:
Residual PSI: 75/89(stable)	Residual PSI: 95	End Time:	End Time:
Logger ID: City 3	Logger ID: City 4	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1325 gpm	Flow GPM:

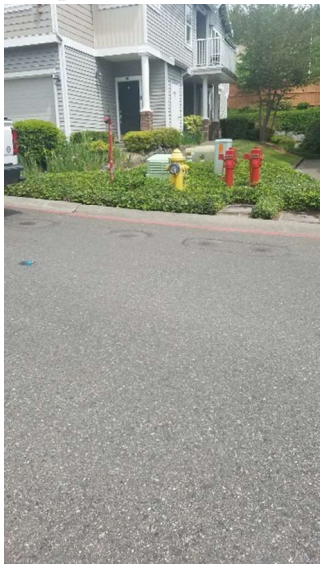
Notes: P1: 75 was the min psi then the needle fluttered at 80 psi before stabilizing at 89 psi. Uphill from flowing hydrant at the part of the street where the road begins to slope downhill to 51st street. Roadway is sloped and the top of the hydrant was 2.5 ft above street level.

Figure 12 Hydrant Flow Test 12 Form

Notes/Photographs:

Location of pressure hydrant P1

.



Logger setup for pressure hydrant P1

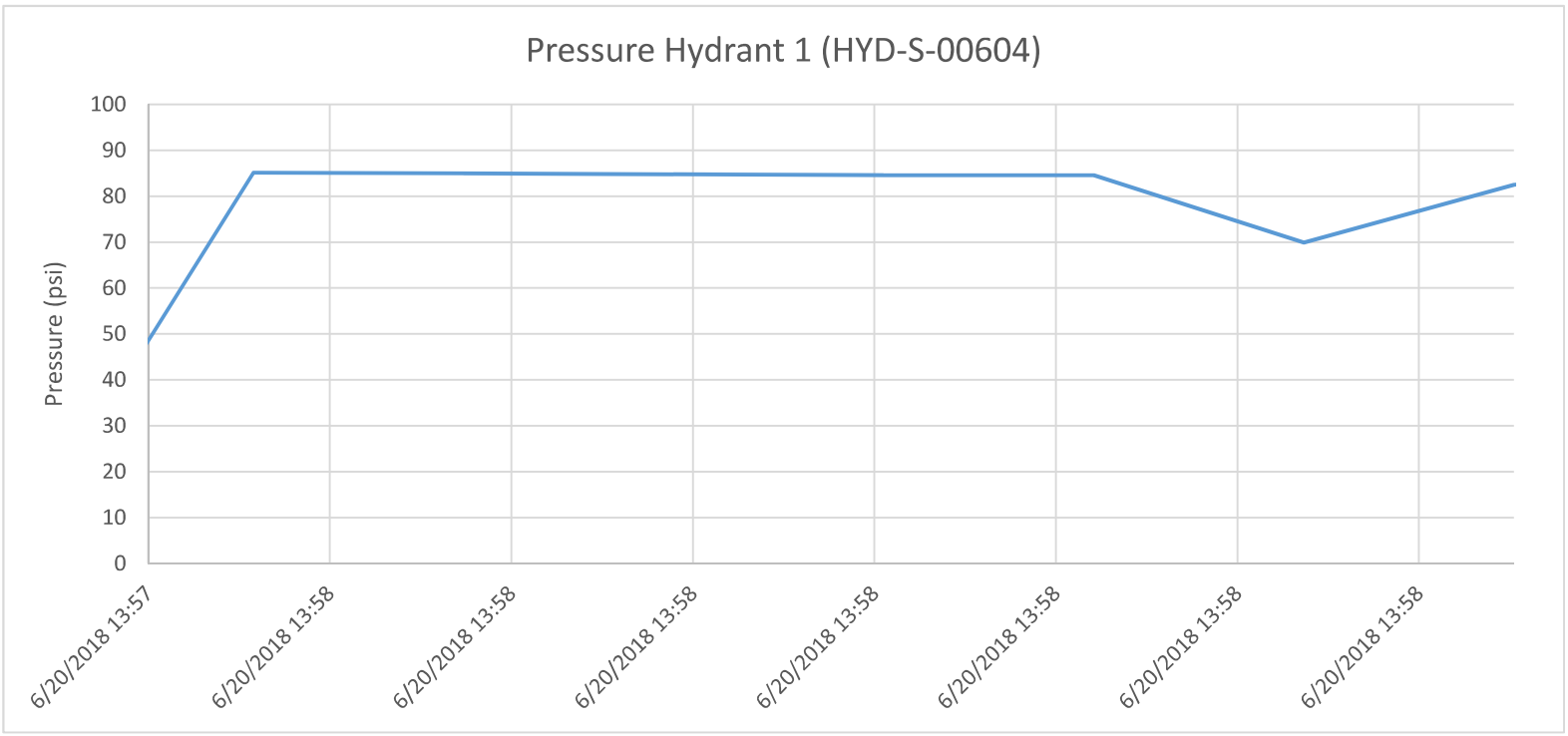
Location of pressure hydrant P2

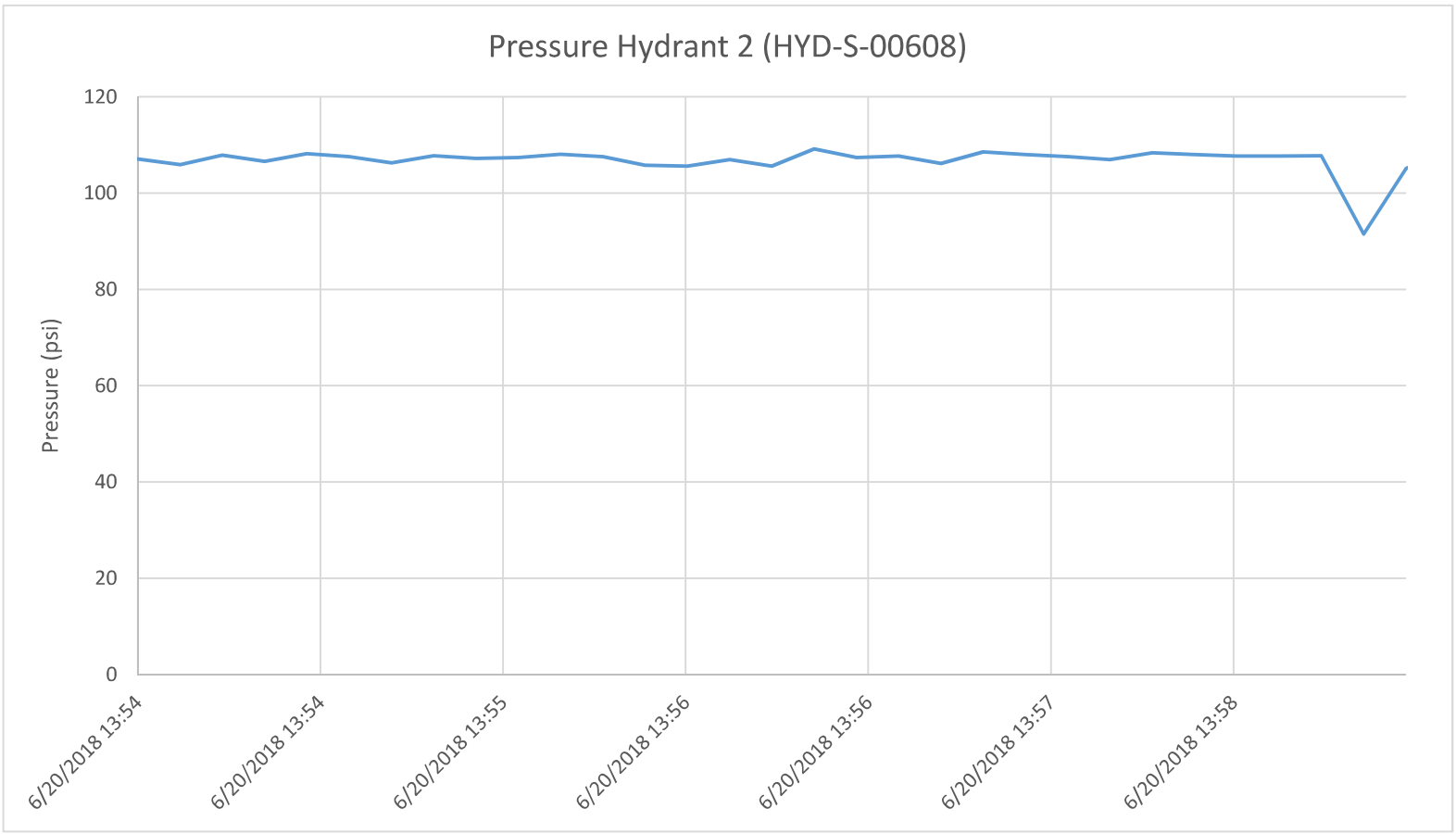
Logger setup for pressure hydrant P2

Location of flowing hydrant F1

Diffuser setup of flowing hydrant F1

Pressure at Data Loggers:





Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''
- 16'' and larger

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Vicinity Map

Date: June 20 Time: 1:04 PM

Location:

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 64	Static PSI: 75	Start Time: 1:04 PM	Start Time:
Residual PSI: 35/50	Residual PSI: 45/60	End Time: 1:05 PM	End Time:
Logger ID: City 3	Logger ID: City 4	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1000 gpm	Flow GPM:

Notes: P1: moved, hydrant at street level near houses. Centerline of main road ~1-1.5 ft higher than hydrant towards top of hill. Minimal slope at hydrant.

Figure 13 Hydrant Flow Test 13 Form

Notes/Photographs:

Location/setup of pressure hydrant 1

Logger setup for pressure hydrant 1

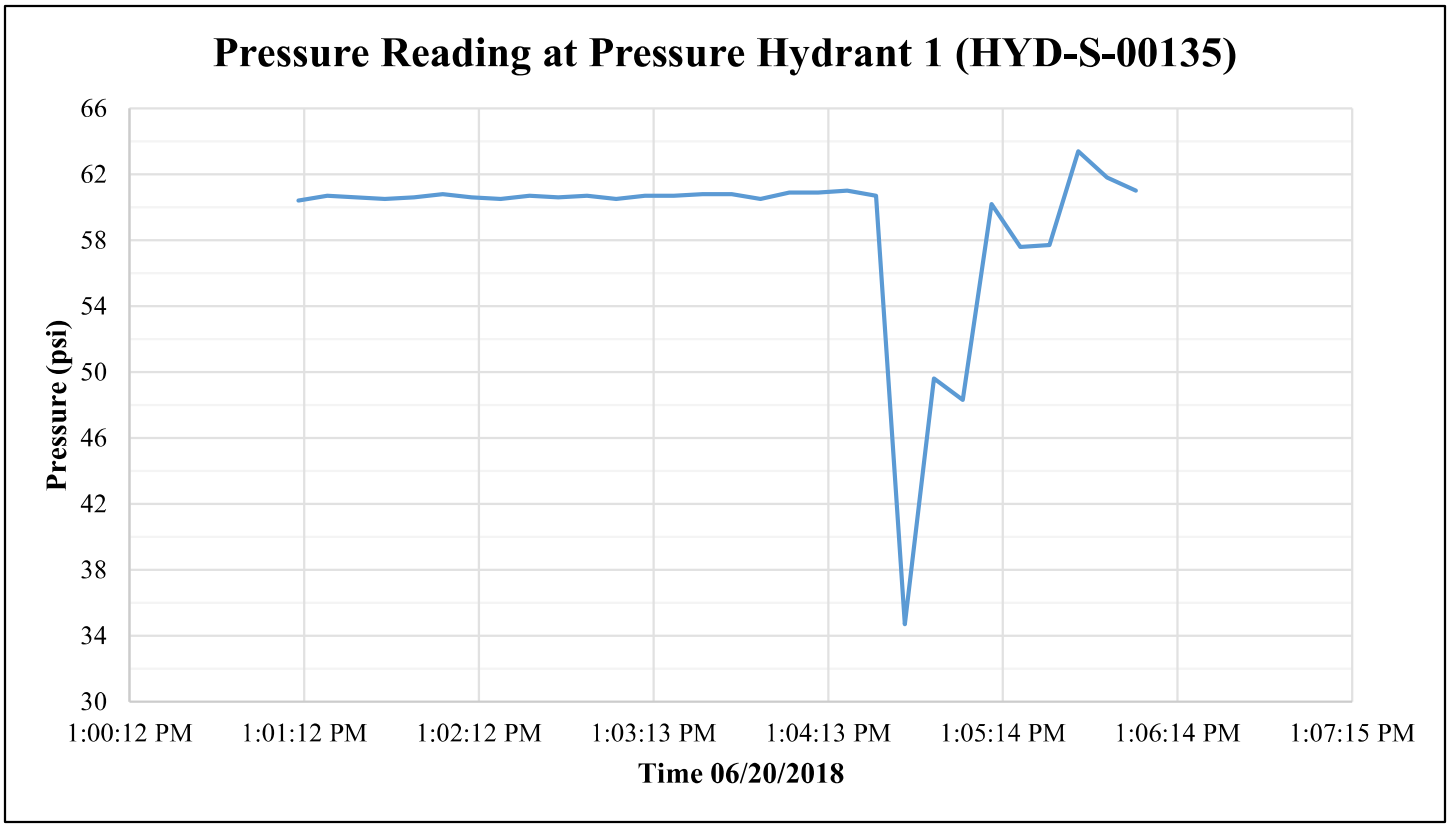
Location/setup of pressure hydrant 2

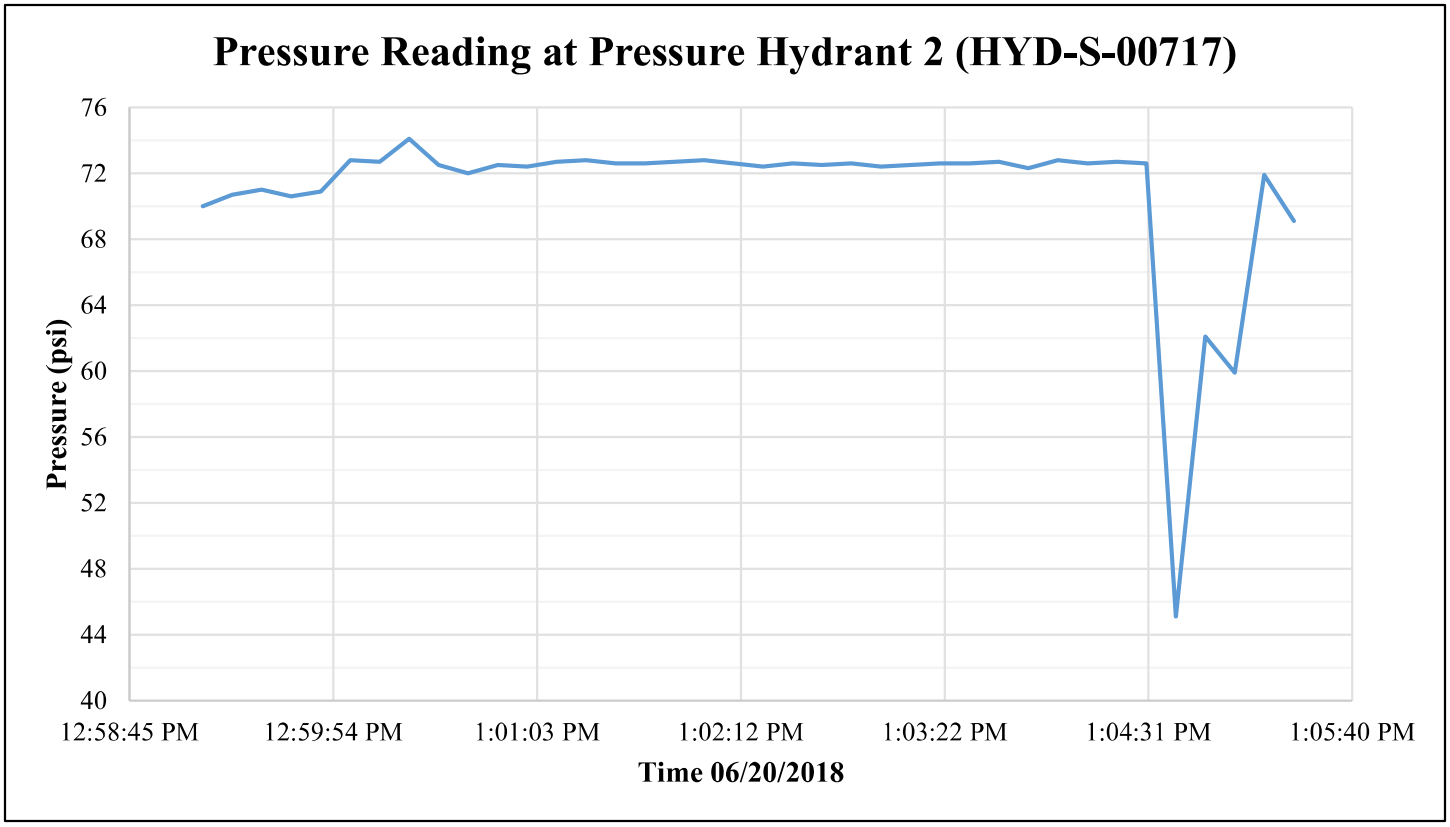
Logger setup for pressure hydrant 2

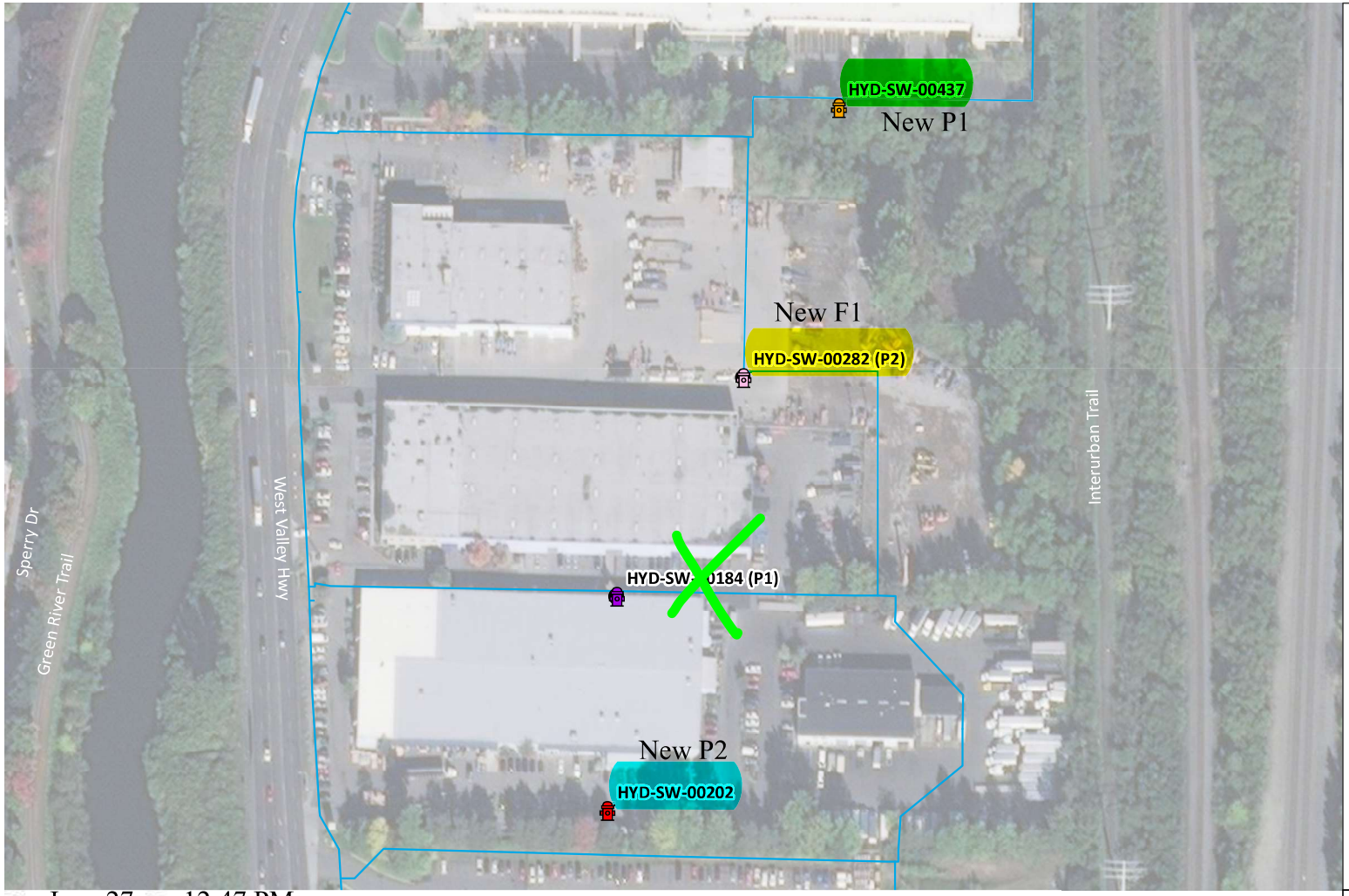
Area surrounding flowing hydrant F1

Location of flowing hydrant F1

Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: June 27 Time: 12:47 PM

Location: _____

Pressure Hydrant 1 (P1)
Static PSI: 75
Residual PSI: 40/70
Logger ID: City 4

Pressure Hydrant 2 (P2)
Static PSI: 72
Residual PSI: 40
Logger ID: City 3

Flow Hydrant 1 (F1)
Start Time: 12:48 PM
End Time: 12:49 PM
Static PSI: _____
Residual PSI: _____
Flow GPM: 980

Flow Hydrant 2 (F2)
Start Time: _____
End Time: _____
Static PSI: _____
Residual PSI: _____
Flow GPM: _____

Notes: _____

Vicinity Map

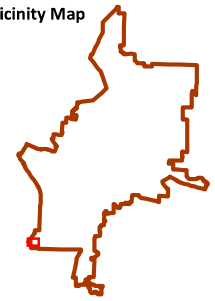
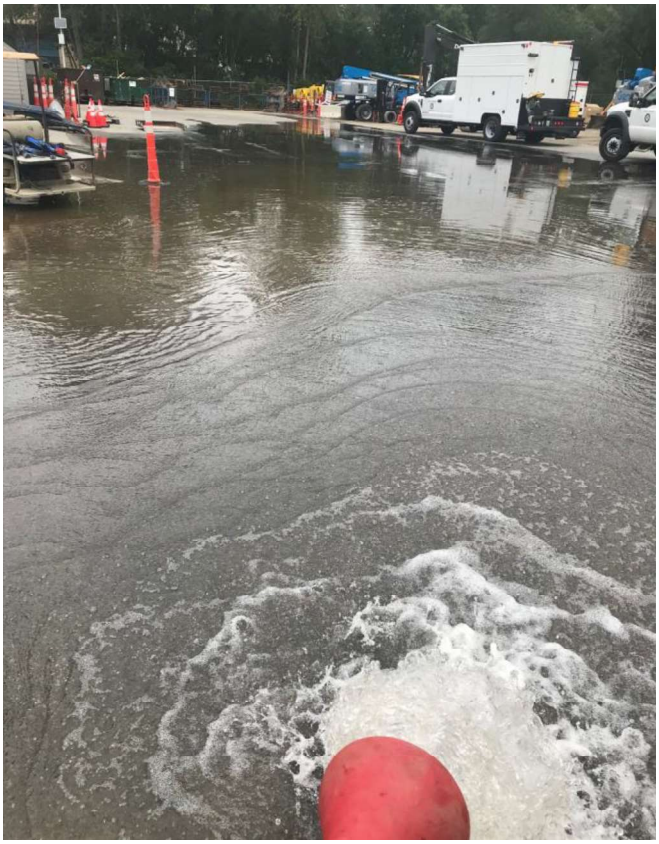


Figure 14 Hydrant Flow Test 14 Form

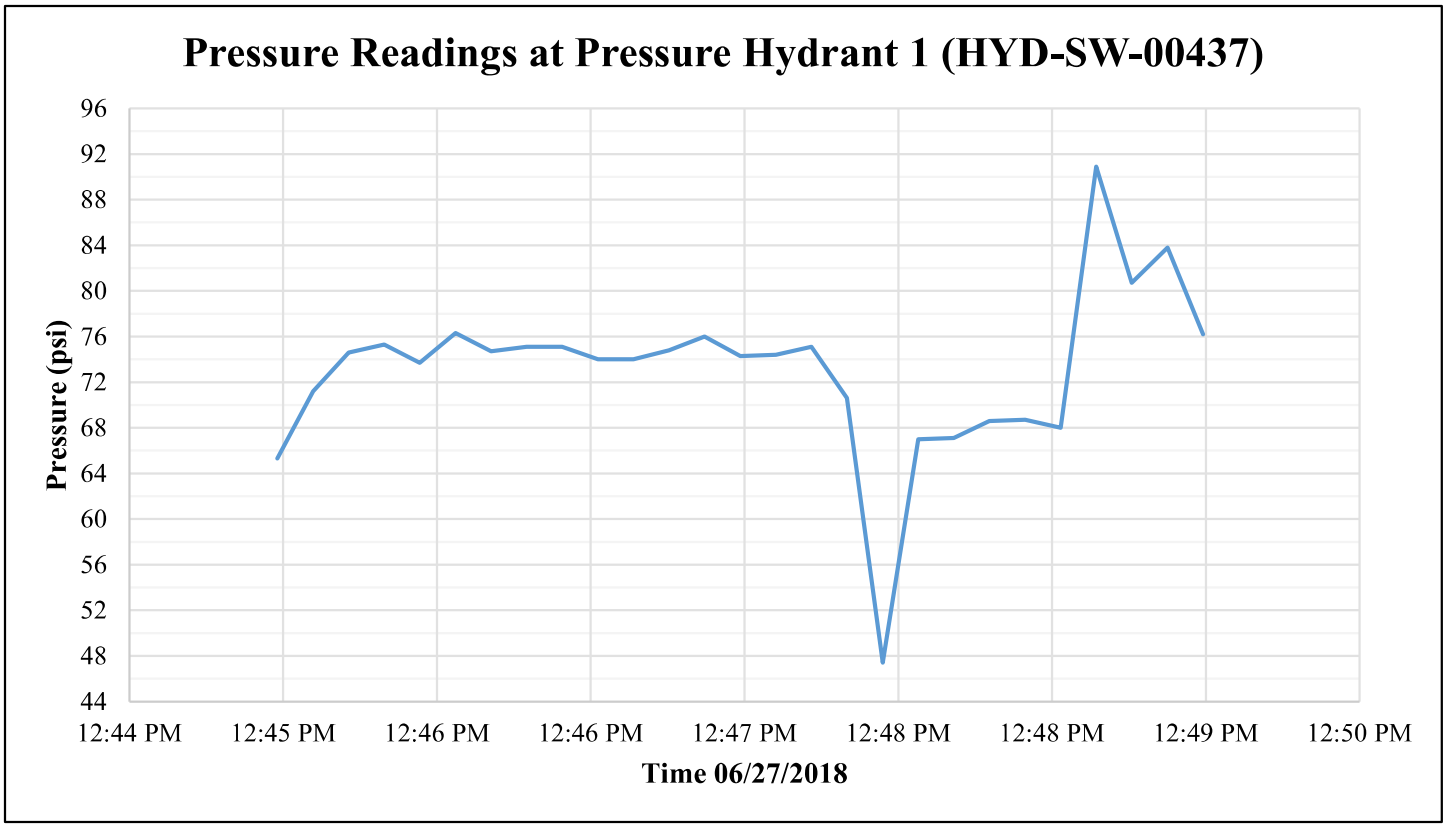
Notes/Photographs:

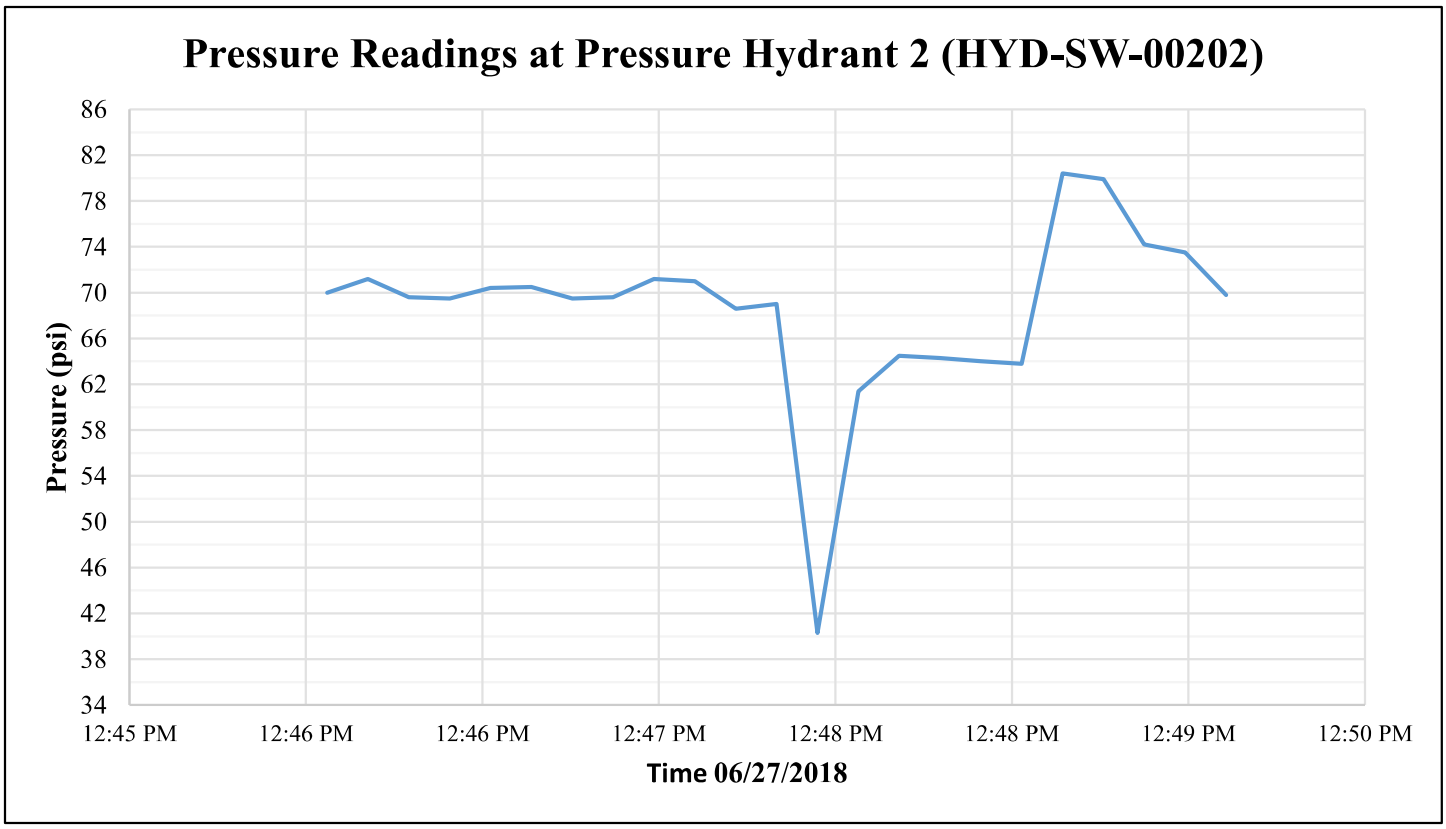
Location and logger setup of pressure hydrant 1

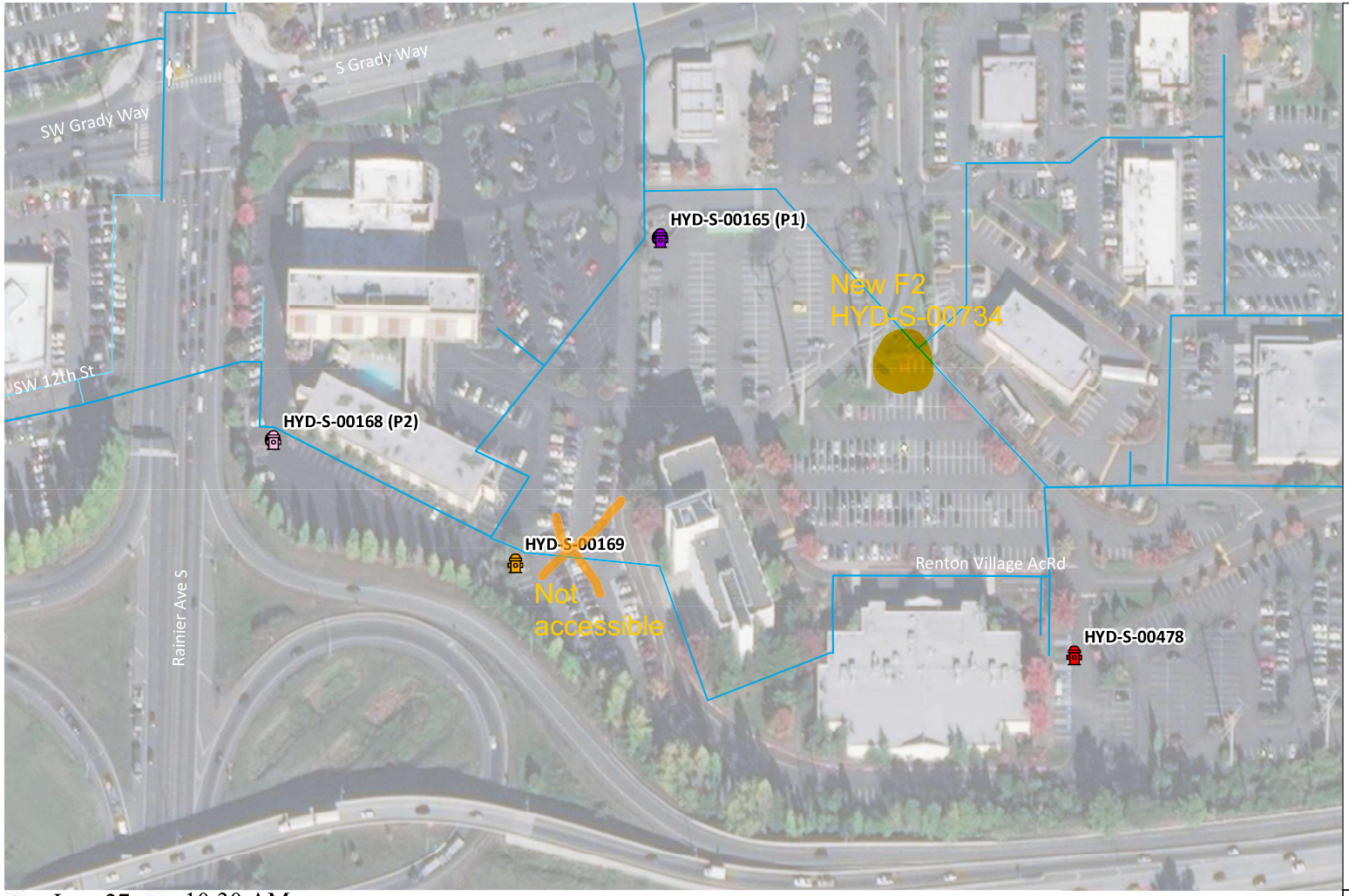
Location, diffuser setup, and flowing hydrant (F1)



Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: June 27 Time: 10:30 AM

Location:

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 78	Static PSI: 71/72	Start Time: 10:42 AM	Start Time:
Residual PSI: 67	Residual PSI: 69/65	End Time: 10:43 AM	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1180	Flow GPM: 930

Notes: 1st try not enough pressure drop at P1 and P2

Vicinity Map

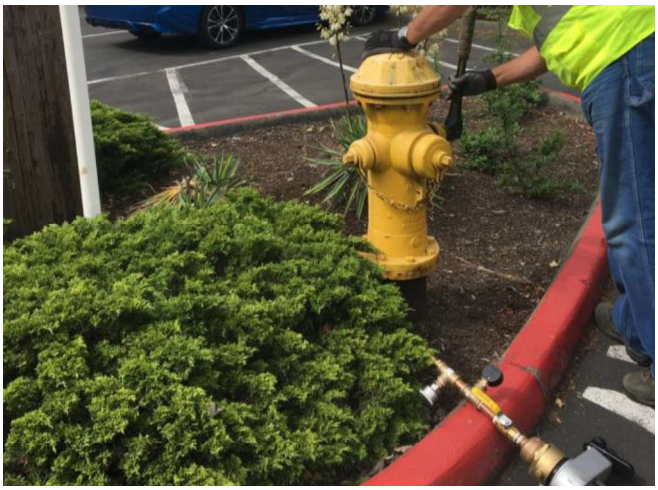
carollo

Last Revised: June 01, 2018 \\io-fs-1\Data\GIS\GISBackup\Renton\WaterSystemPlan2017\HydrantTestSites.mxd

Figure 15 Hydrant Flow Test 15 Form

Notes/Photographs:

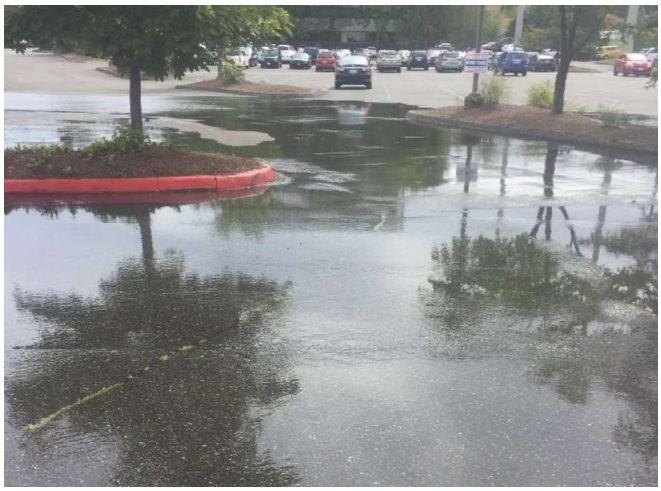
Location/setup of pressure hydrant 1



Logger setup for pressure hydrant 2

Location/setup of flowing hydrant F1

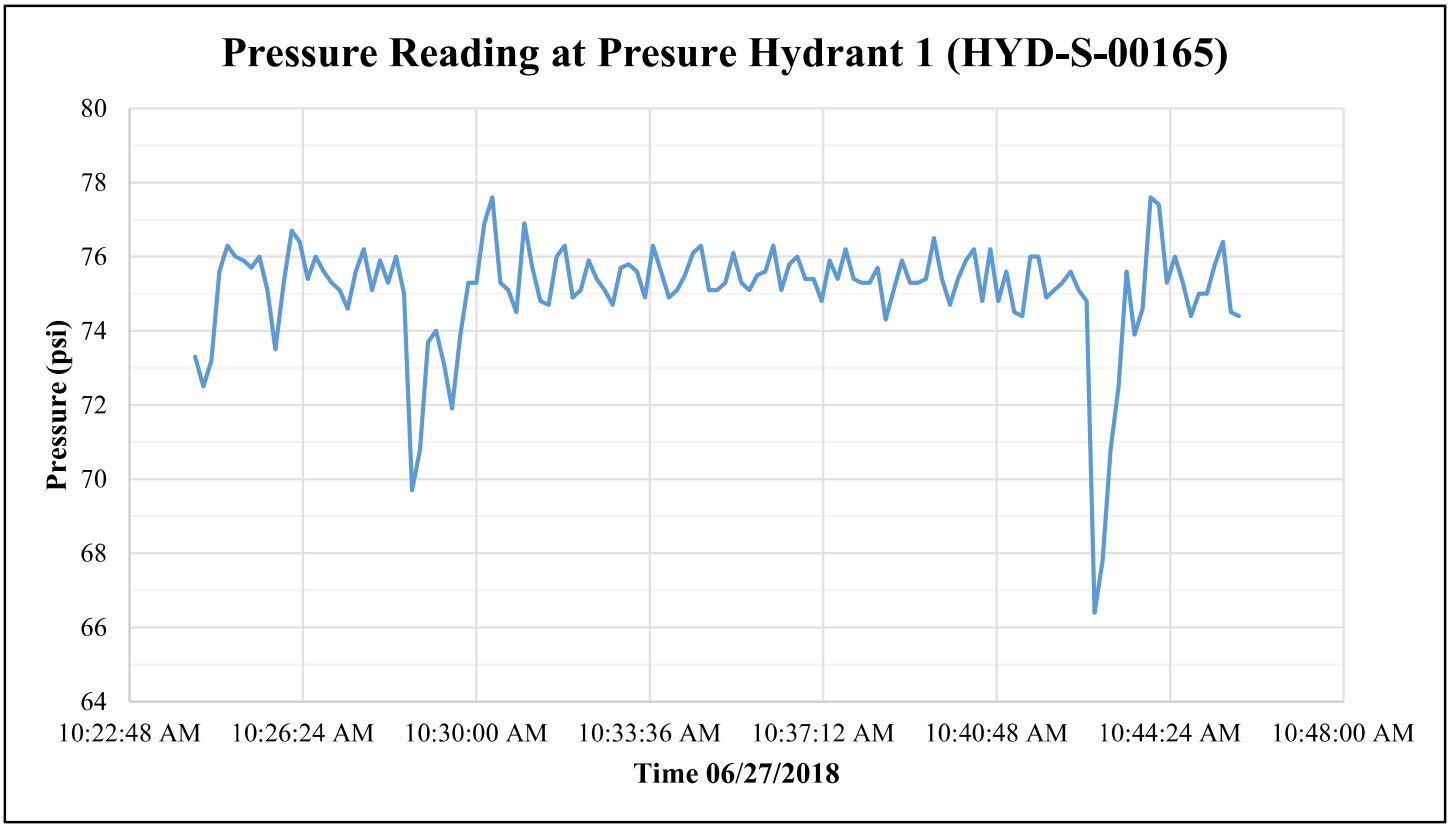
Water on road from flowing hydrant F1

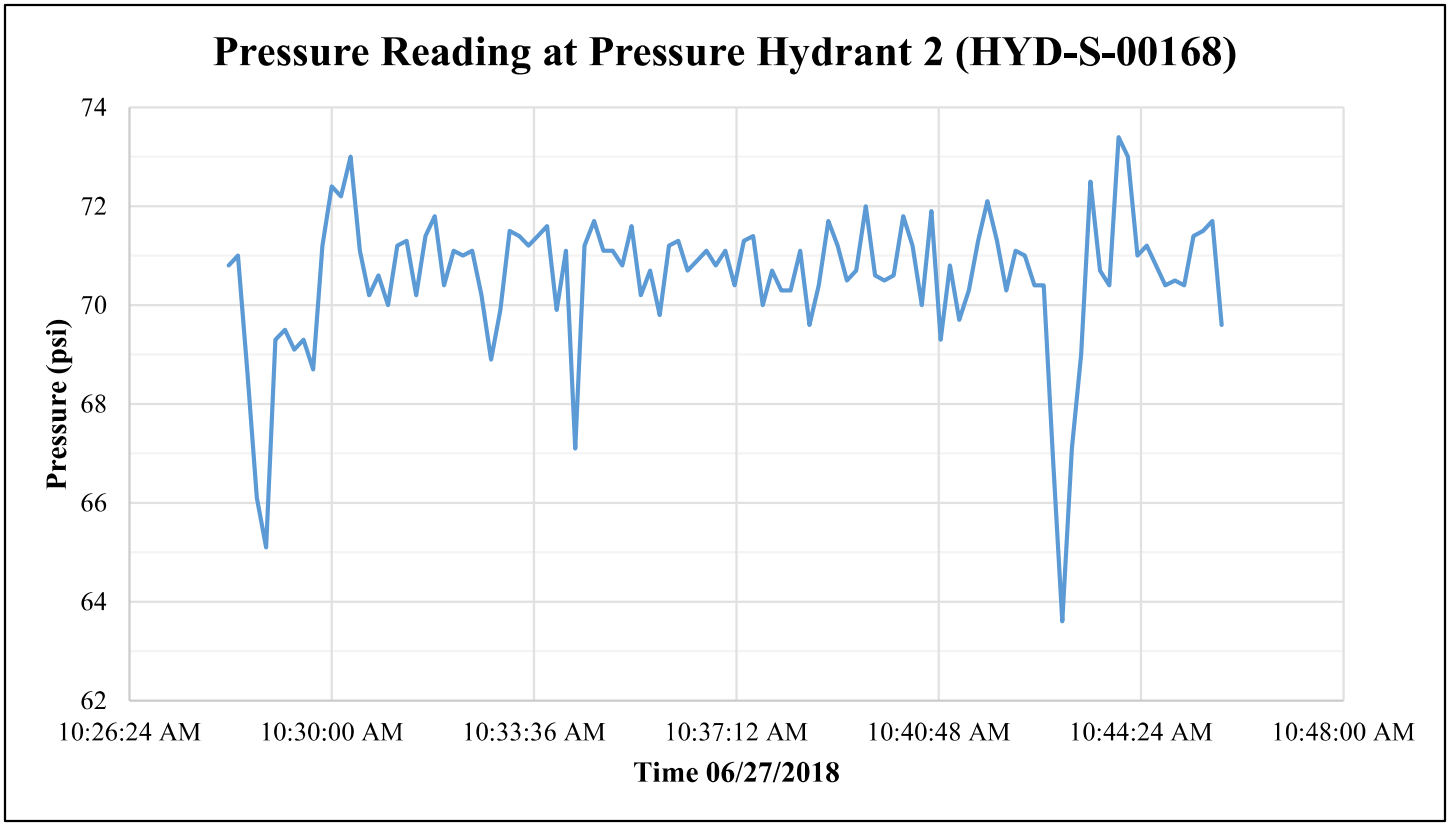


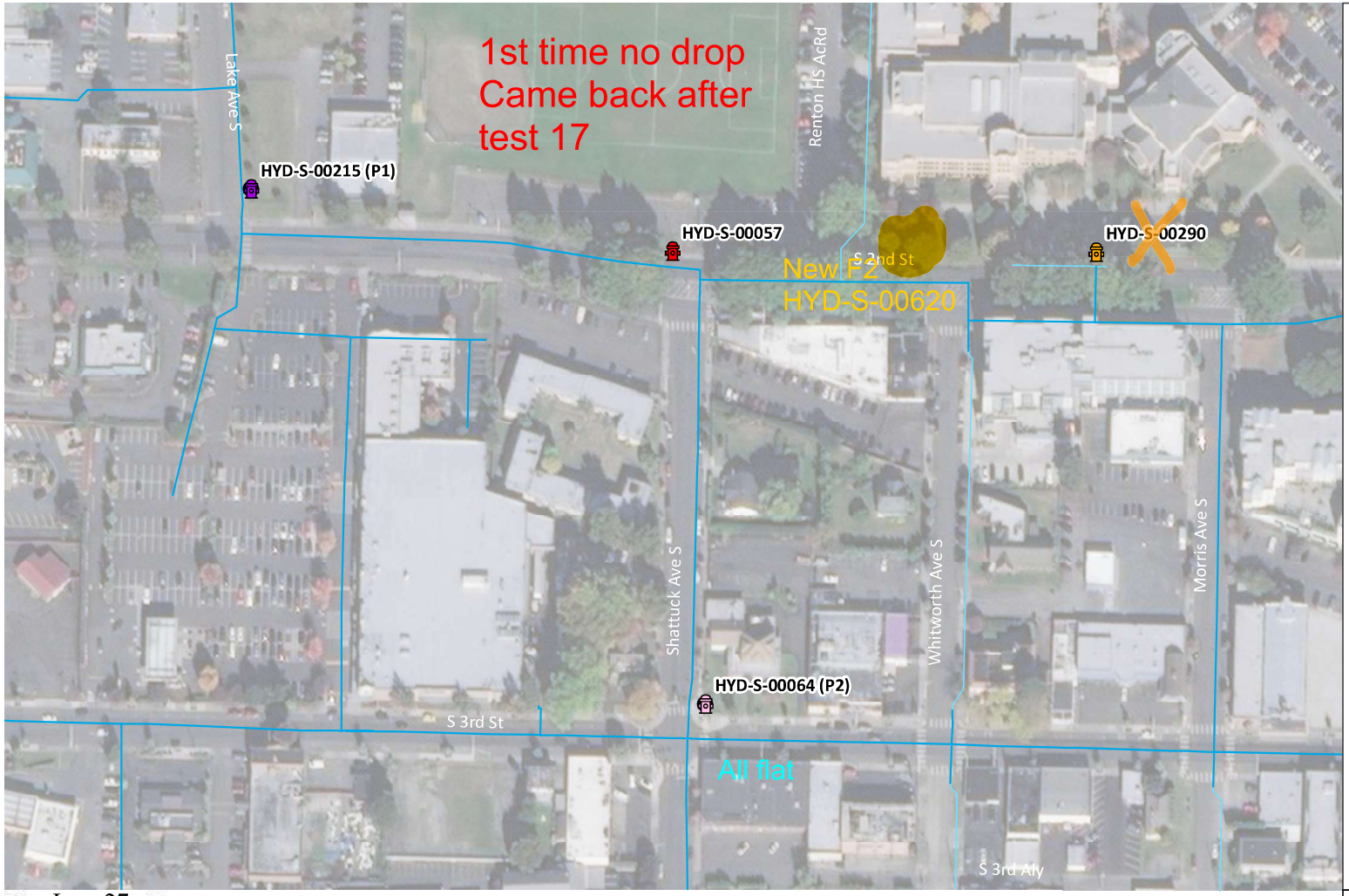
Location of flowing hydrant 2 (F2)

Diffuser setup of flowing hydrant 2 (F2)

Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

N

0 100 200 Feet

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: June 27 Time: 9:15 AM / 10:00 AM

Location:

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 75	Static PSI: 70 | 71	Start Time:	Start Time:
Residual PSI: 60	Residual PSI: 60	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1300 | 920	Flow GPM: 1000

Notes: Abandoned first time: did not get pressure drop when hydrant flowing
2nd try with 2 hydrants

Vicinity Map

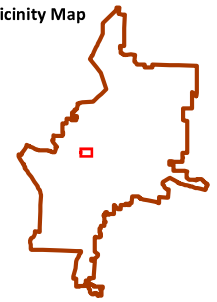


Figure 16 Hydrant Flow Test 16 Form

Notes/Photographs:

Locationof pressure hydrant 1

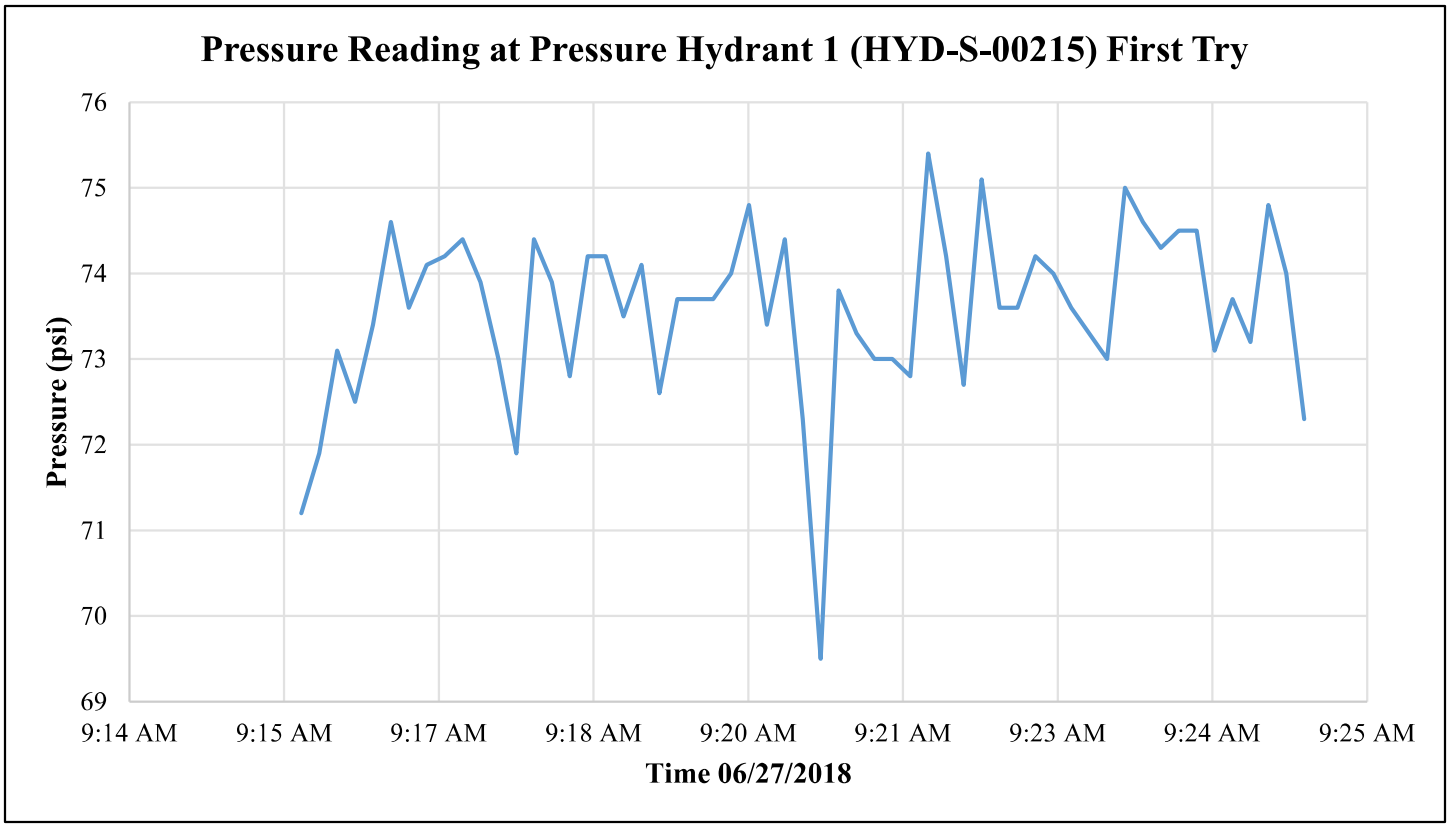
Logger setup for pressure hydrant 1

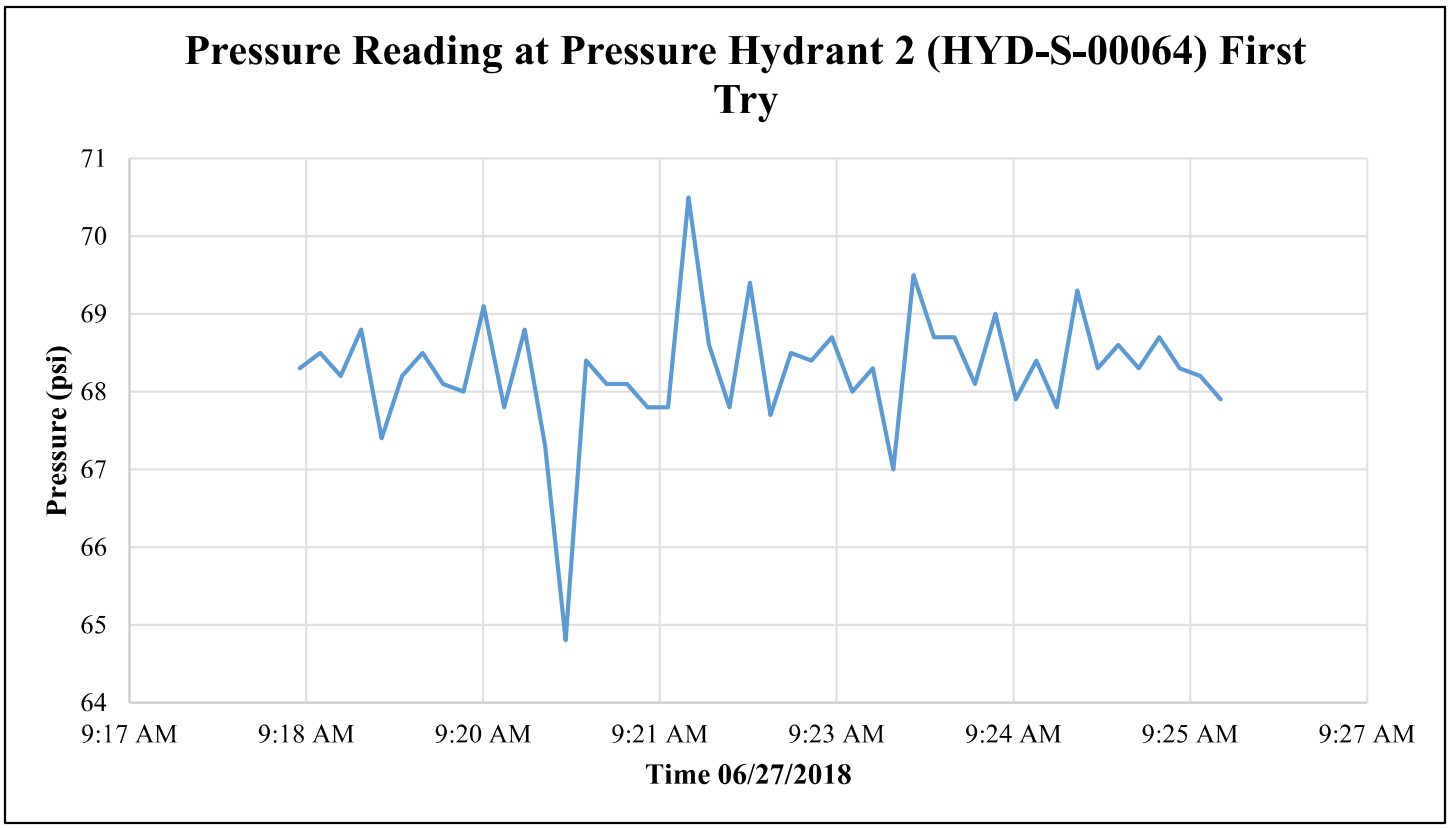
Location of pressure hydrant 2

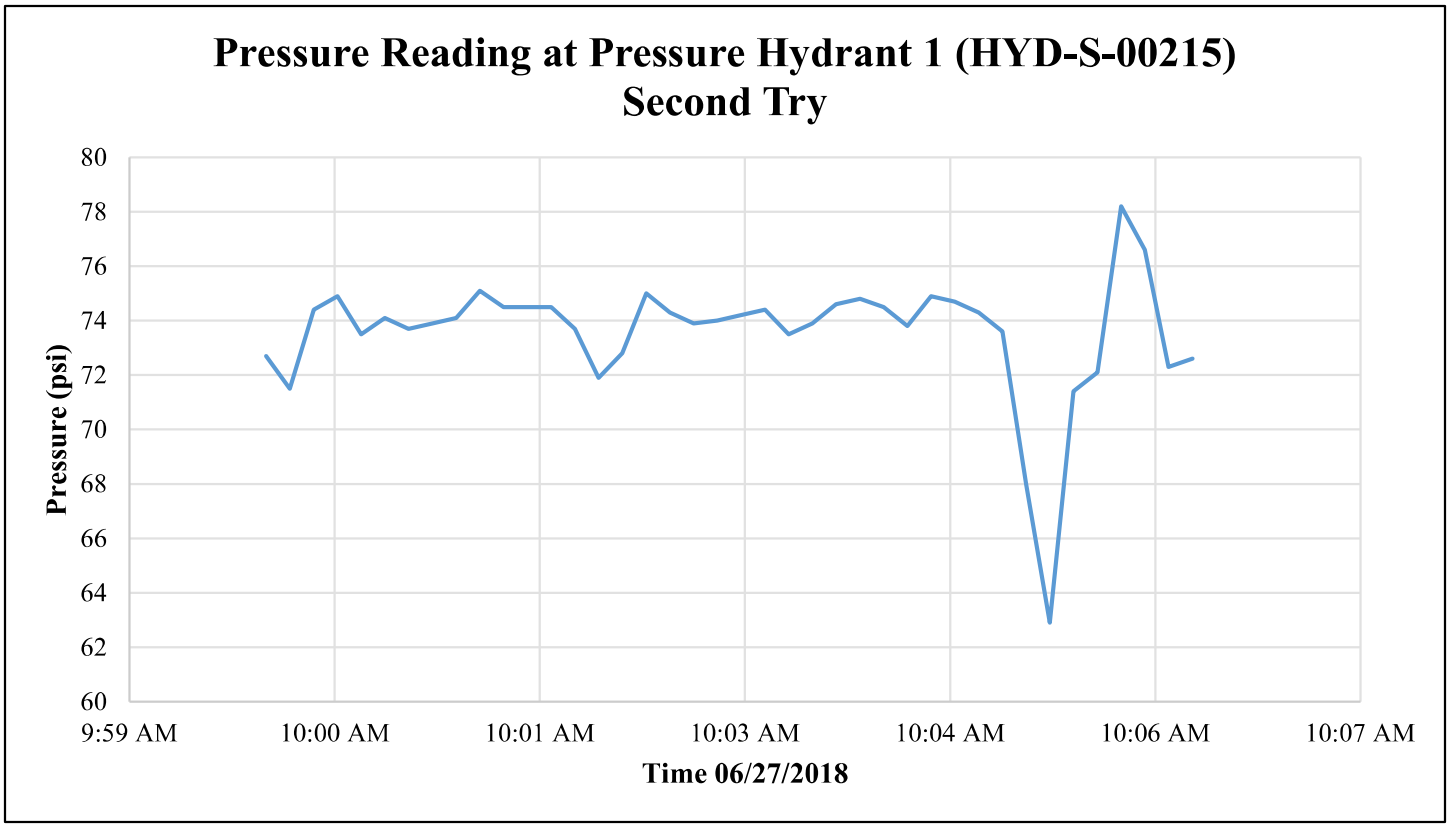
Location of flowing hydrant F1

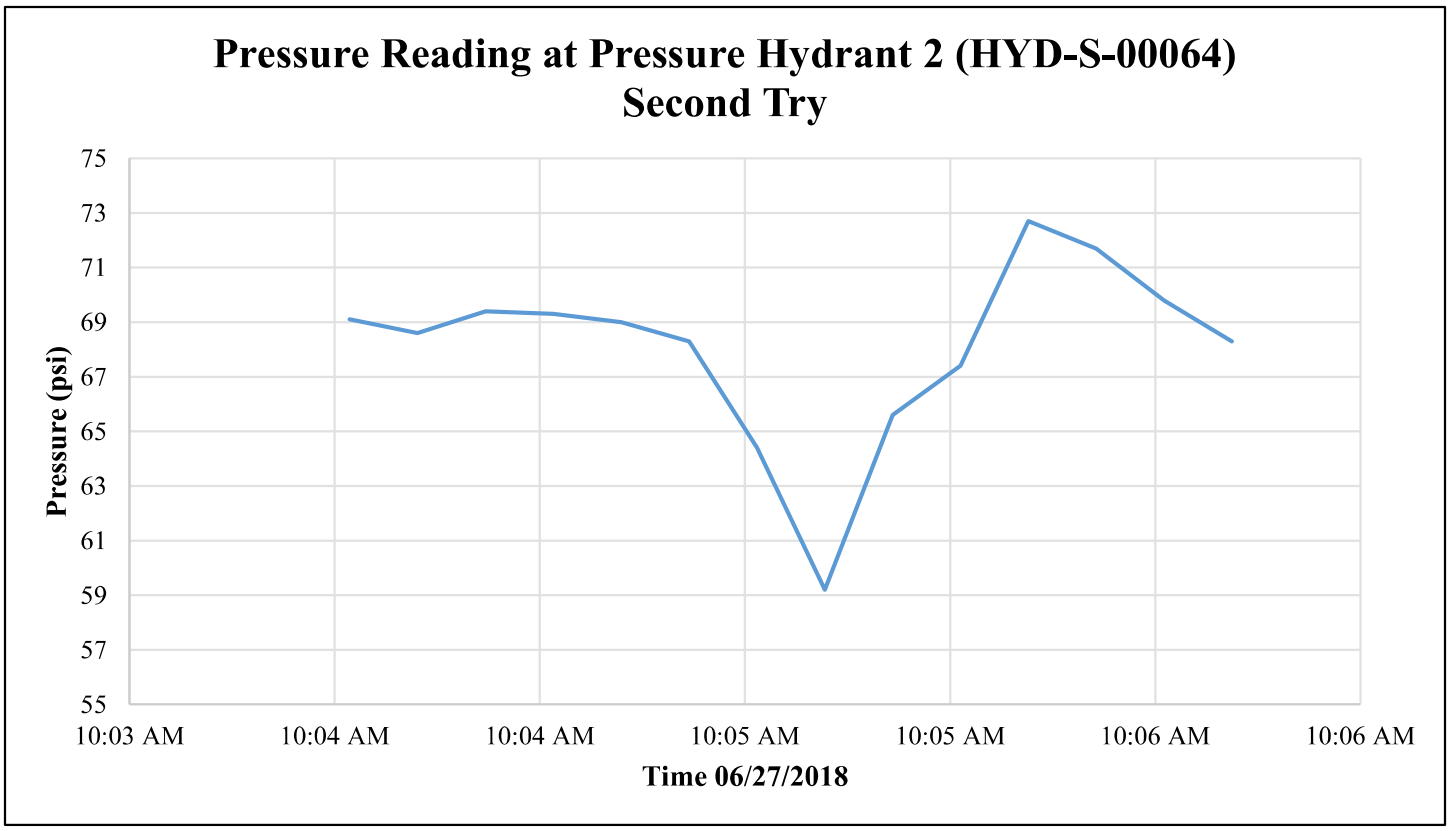
Diffuser setup and flowing the hydrant F1

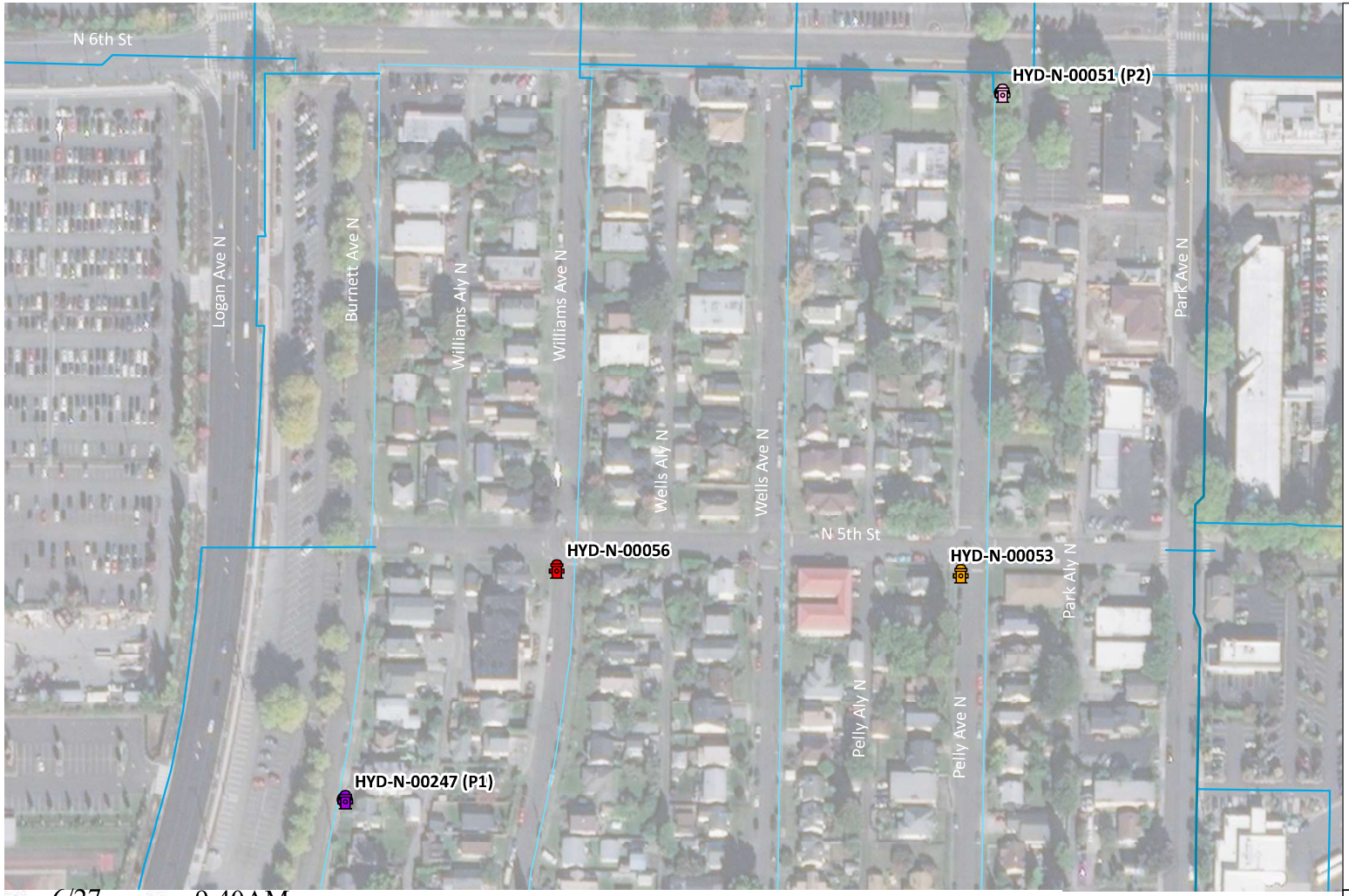
Pressure at Data Loggers:






Pressure Reading at Pressure Hydrant 1 (HYD-S-00215)
Second Try
Pressure (psi)
80
78
76
74
72
70
68
66
64
62
60
9:59 AM
10:00 AM
10:01 AM
10:03 AM
10:04 AM
10:06 AM
10:07 AM
Time 06/27/2018


Pressure Reading at Pressure Hydrant 2 (HYD-S-00064)
Second Try
Pressure (psi)
75
73
71
69
67
65
63
61
59
57
55
10:03 AM
10:04 AM
10:04 AM
10:05 AM
10:05 AM
10:06 AM
10:06 AM
Time 06/27/2018



Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6" and smaller
- 8-14"
- 16" and larger

N

Feet
0 112.5 225

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: 6/27 Time: 9:40AM

Location:

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 75	Static PSI: 70	Start Time: 9:40 AM	Start Time:
Residual PSI: 75	Residual PSI: 68	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 530gpm	Flow GPM:

Notes: P1: No drop in pressure. P2: Only could drop 2 psi.

Vicinity Map

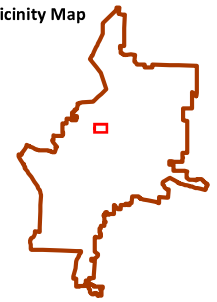


Figure 17 Hydrant Flow Test 17 Form

Notes/Photographs:

Location of pressure hydrant P1

.

Surrounding area for pressure hydrant P1

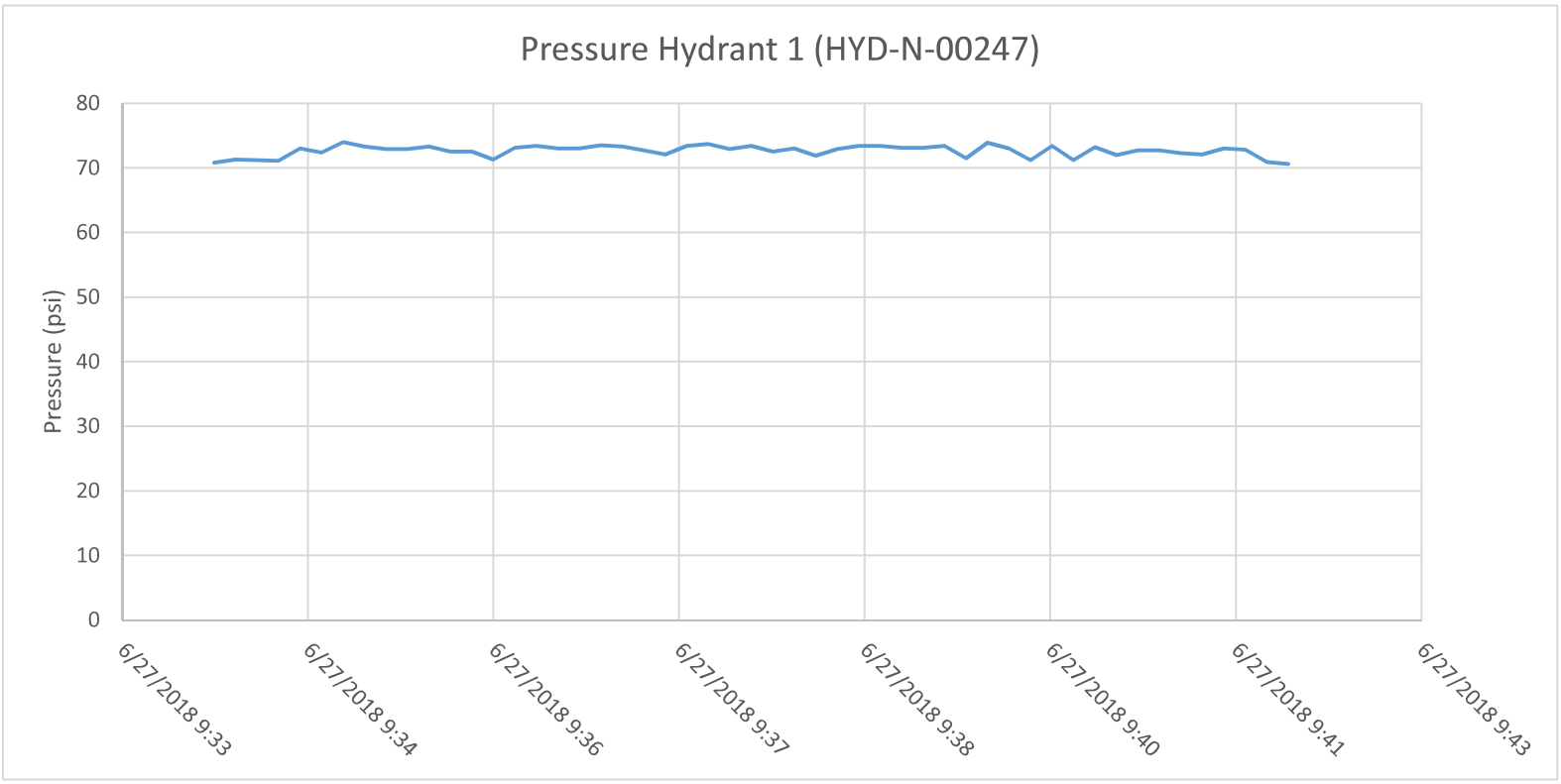
Location of pressure hydrant P2

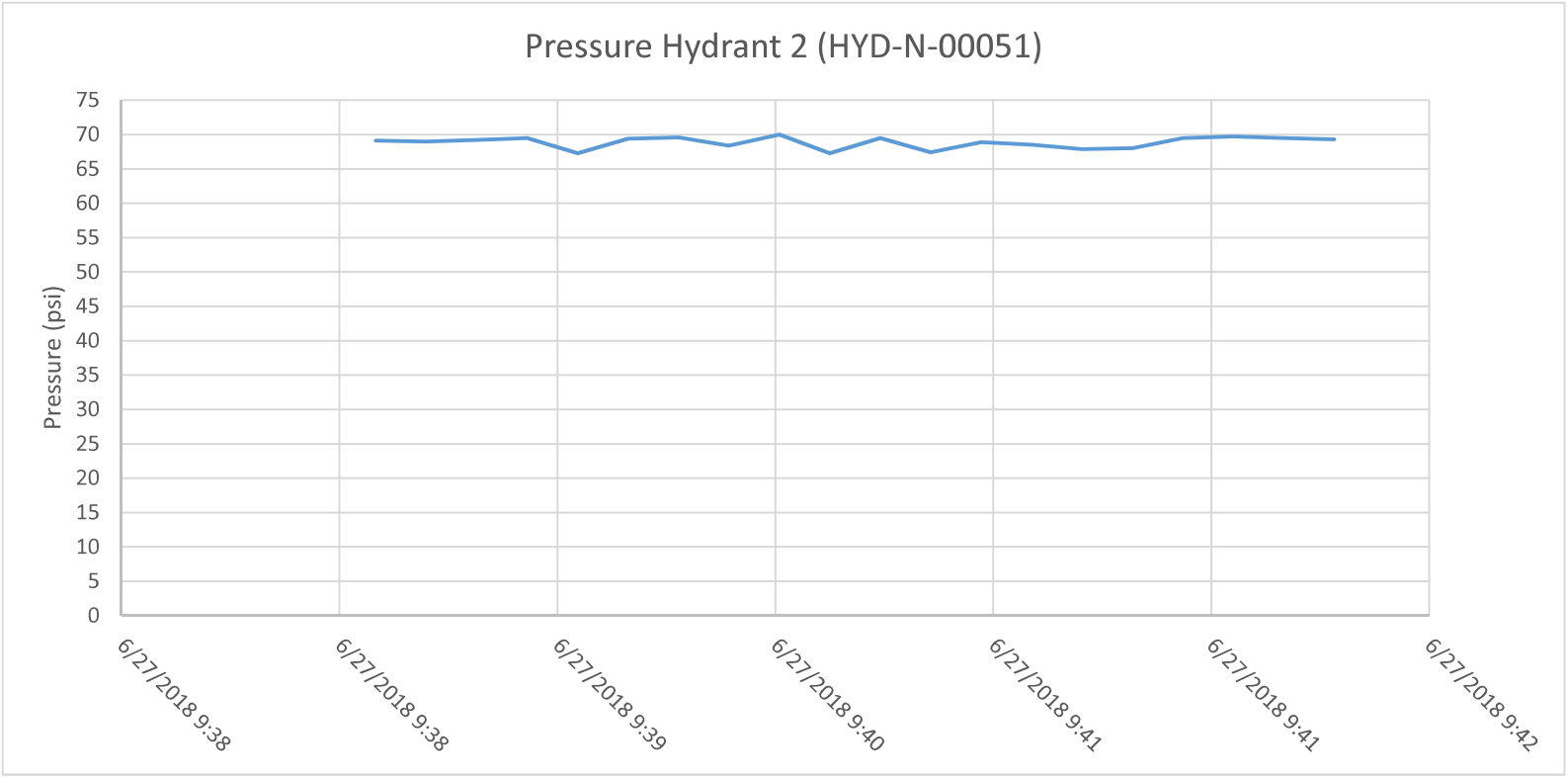
Surrounding area for pressure hydrant P2

Diffuser setup of flowing hydrant F1

Surrounding area of flowing hydrant F1

Pressure at Data Loggers:





Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: June 27 Time: 8:50 AM

Location:

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 70	Static PSI: 98	Start Time: 8:50 AM	Start Time:
Residual PSI: 55/60	Residual PSI: 80	End Time: 8:51 AM	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1190	Flow GPM:

Notes: P1: lowest was 55, site might have been near to PRV

Vicinity Map

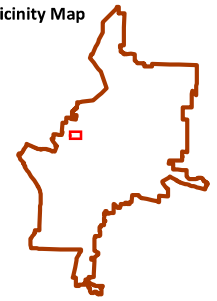


Figure 18 Hydrant Flow Test 18 Form

Notes/Photographs:

Location/setup of pressure hydrant 1

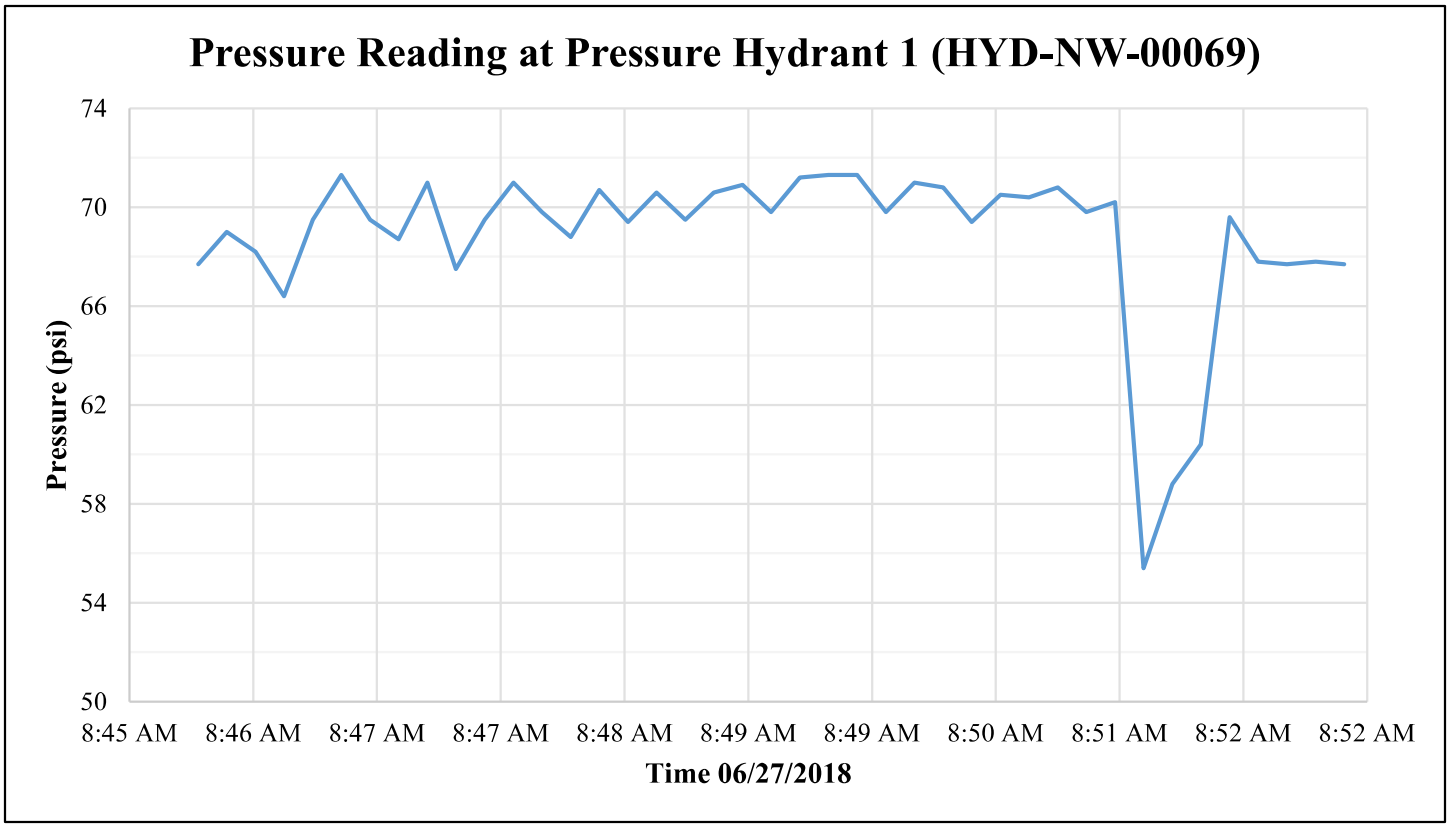
Location of pressure hydrant 2

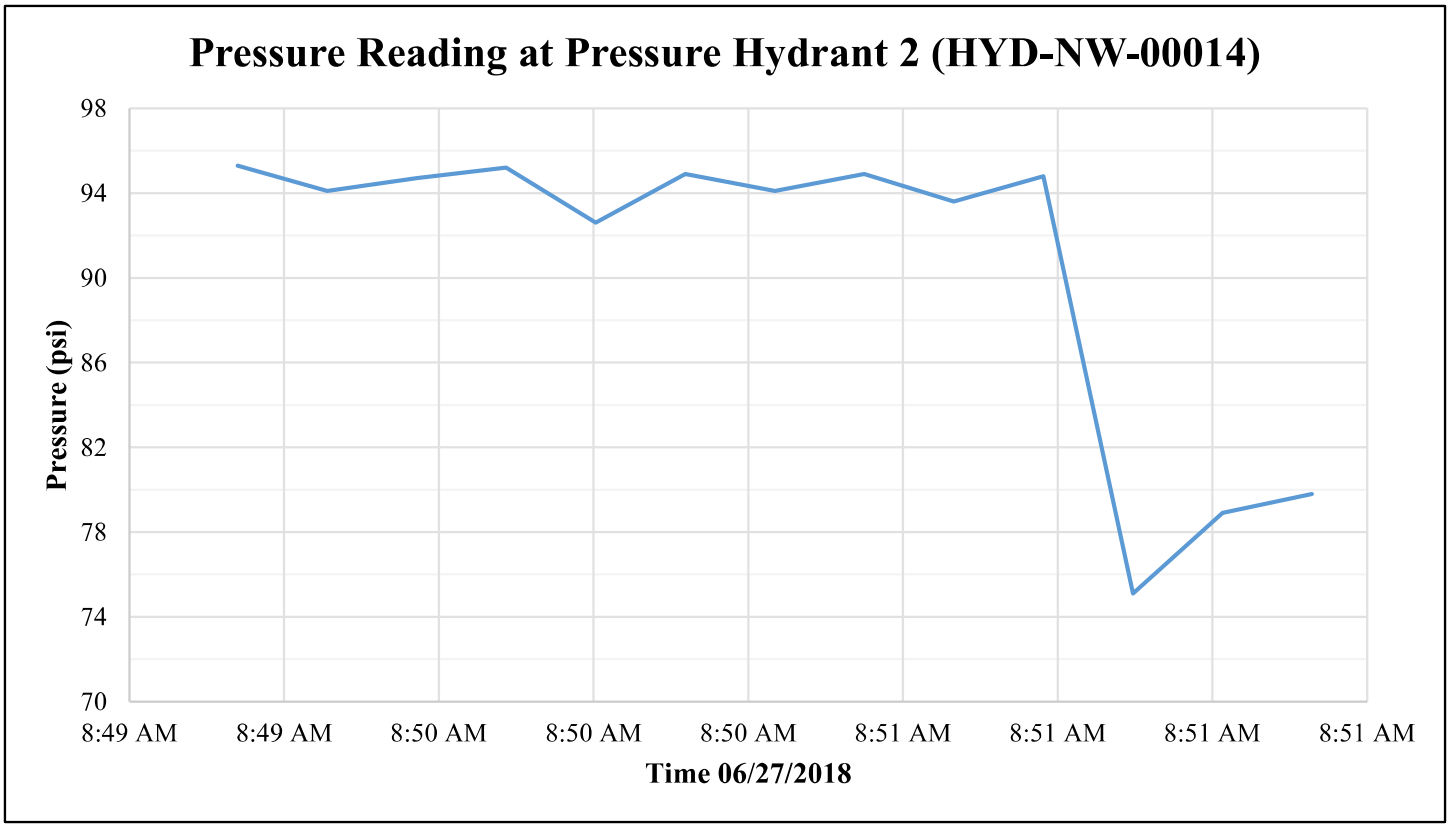
Logger setup for pressure hydrant 2

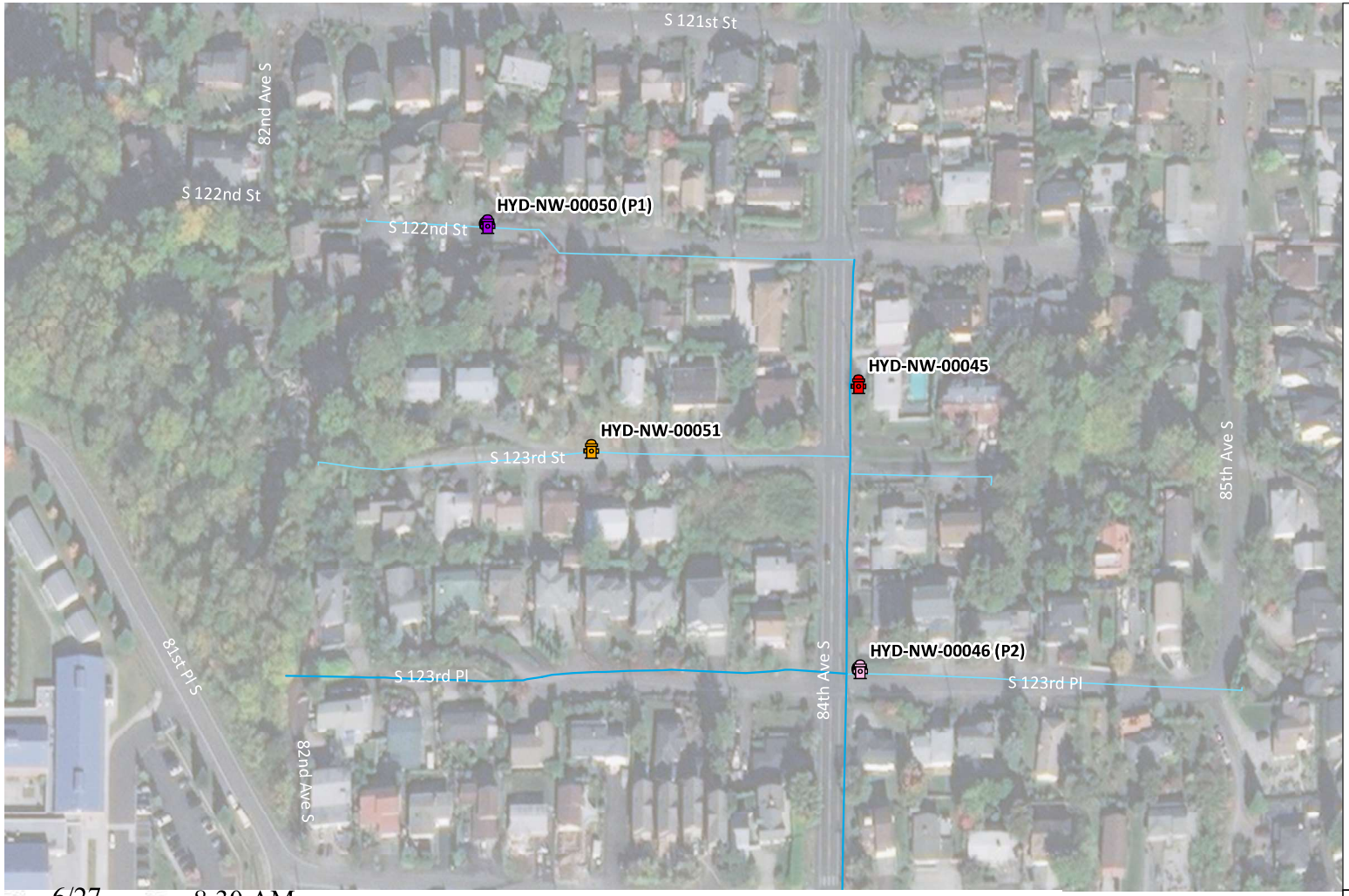
Location of flowing hydrant F1

Diffuser setup of flowing hydrant F1

Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

- 6'' and smaller
- 8-14''

Feet
0 100 200

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Date: 6/27 Time: 8:30 AM

Location:

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 100	Static PSI: 90	Start Time:	Start Time:
Residual PSI: 80/90	Residual PSI: 80 (70 psi)	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1400 gpm	Flow GPM:

Notes: P1: Lowest was 80 psi the needle bounced from 80 to 90 then stabilized at 90 psi.
P2: Loggers show a pressure of 70 psi, while hand gauge read 80 psi. This will be accounted for during model calibration.

Vicinity Map

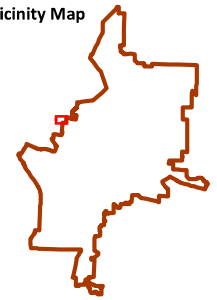
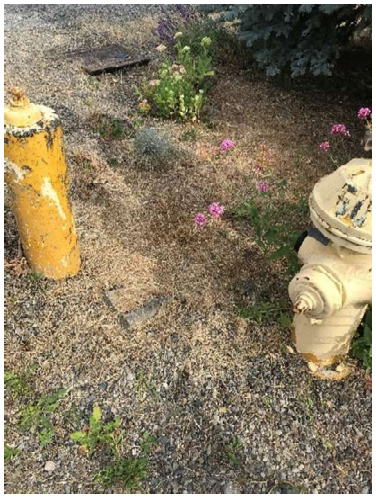


Figure 19 Hydrant Flow Test 19 Form

Notes/Photographs:

Location of pressure hydrant P1

.



Surrounding area for pressure hydrant P1

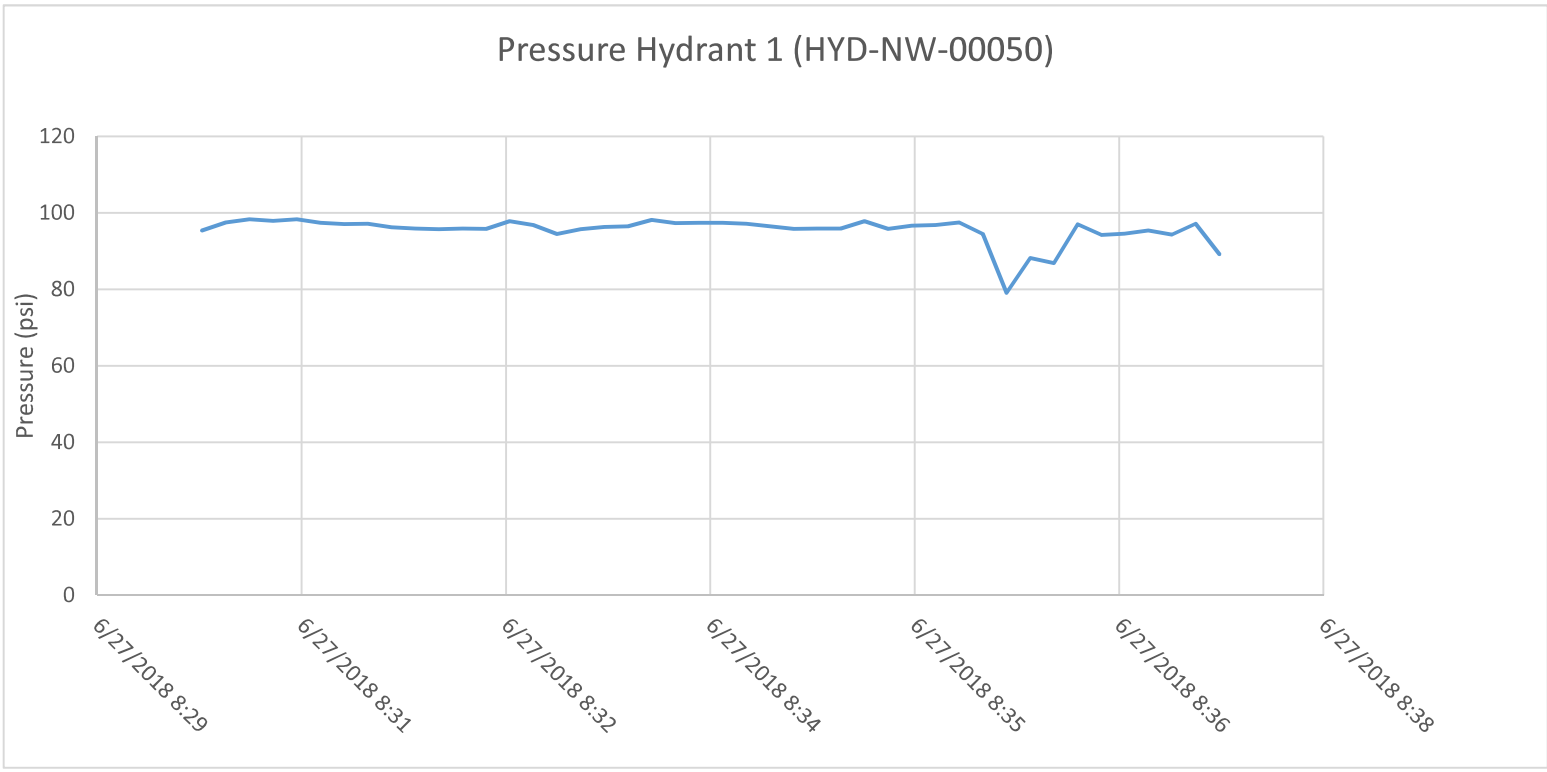
Location of pressure hydrant P2

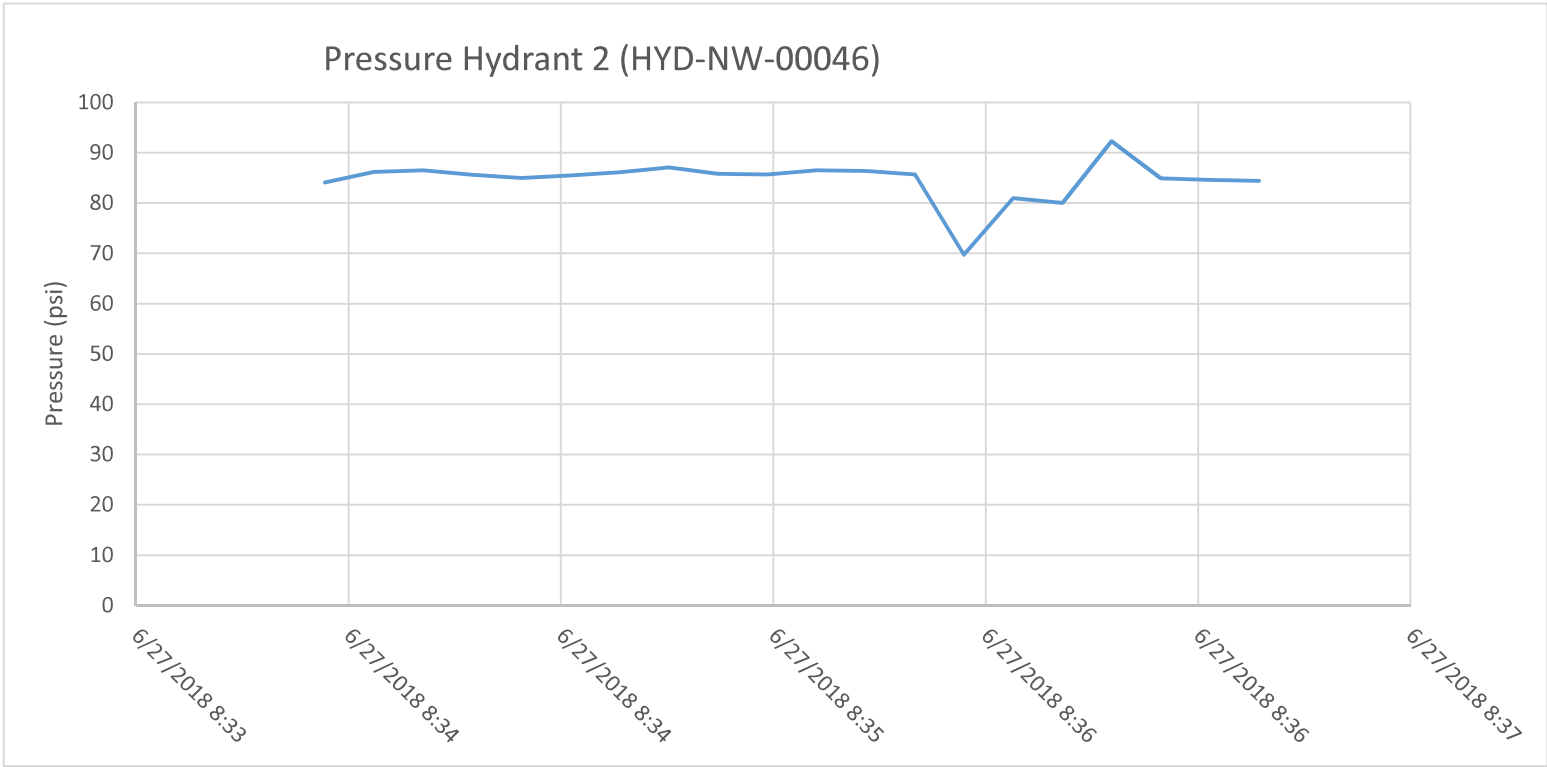
Surrounding area for pressure hydrant P2

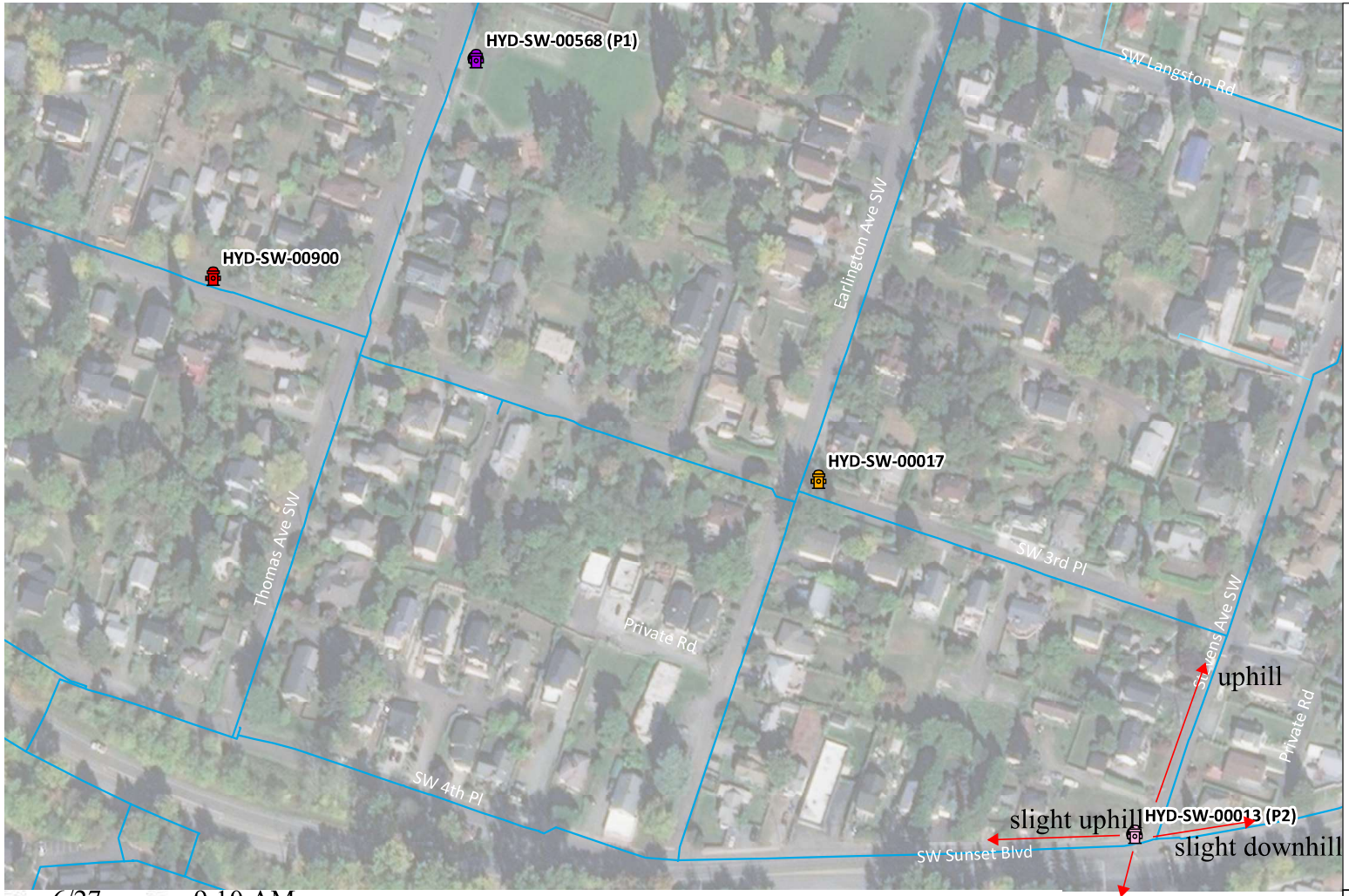
Location of flowing hydrant F1

Surrounding area of flowing hydrant F1

Pressure at Data Loggers:







Legend

Fire Flow Testing

- Flowing Hydrant 1
- Flowing Hydrant 2
- Pressure Hydrant 1
- Pressure Hydrant 2
- Loggers

Water Distribution System

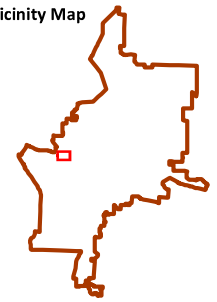
- 6'' and smaller
- 8-14''

Feet
0 112.5 225

Data Sources: City of Renton, ESRI

Disclaimer: Features shown in this figure are for planning purposes and represent approximate locations. Engineering and/or survey accuracy is not implied.

Vicinity Map



Date: 6/27 Time: 9:10 AM

Location:

Pressure Hydrant 1 (P1)	Pressure Hydrant 2 (P2)	Flow Hydrant 1 (F1)	Flow Hydrant 2 (F2)
Static PSI: 75	Static PSI: 124	Start Time: 9:06 AM	Start Time:
Residual PSI: 45-65	Residual PSI: 90	End Time:	End Time:
Logger ID: City 4	Logger ID: City 3	Static PSI:	Static PSI:
		Residual PSI:	Residual PSI:
		Flow GPM: 1190 gpm	Flow GPM:

Notes: P1: Lowest drop was down to 45 psi in residual pressure.

Figure 20 Hydrant Flow Test 20 Form

Notes/Photographs:

Surroudning area of pressure hydrant P1

.

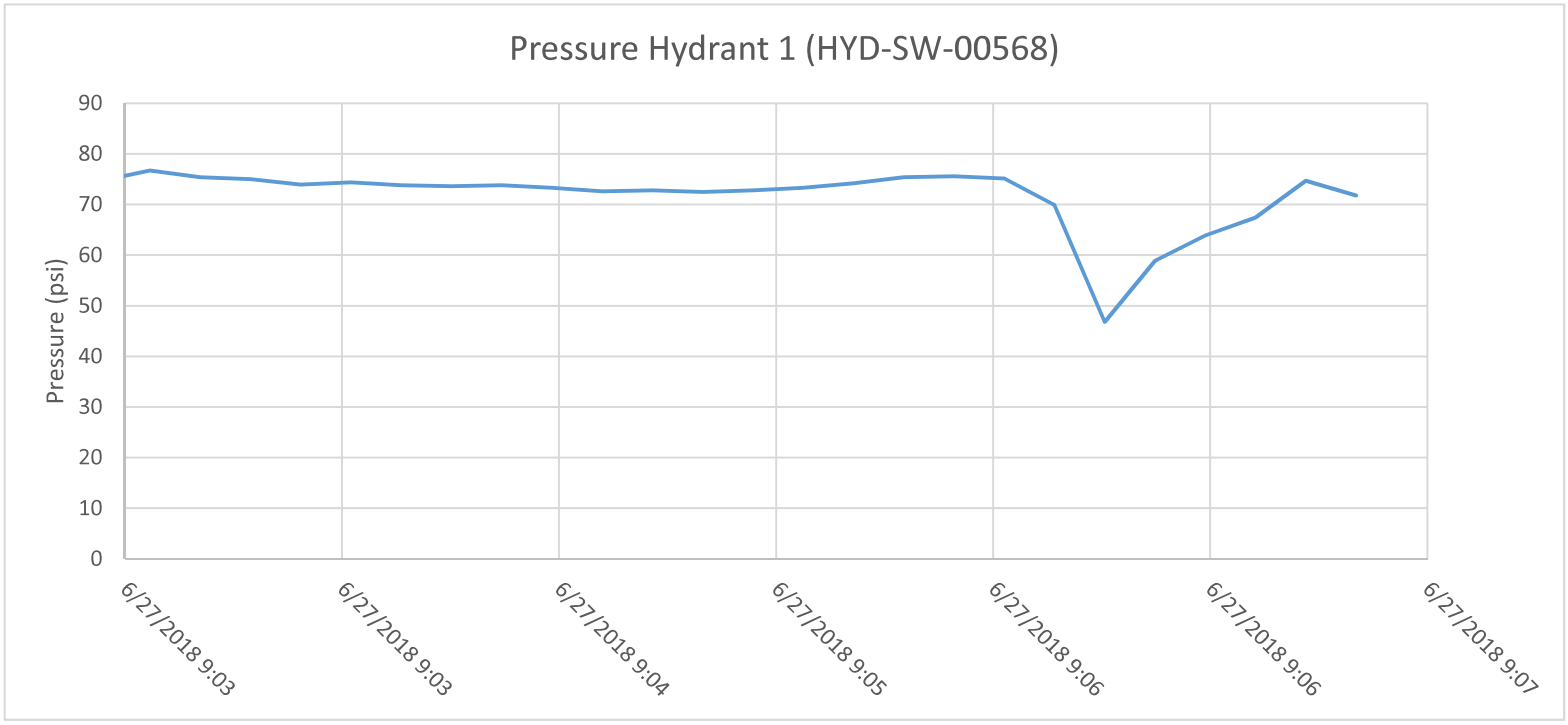
Location of pressure hydrant P2

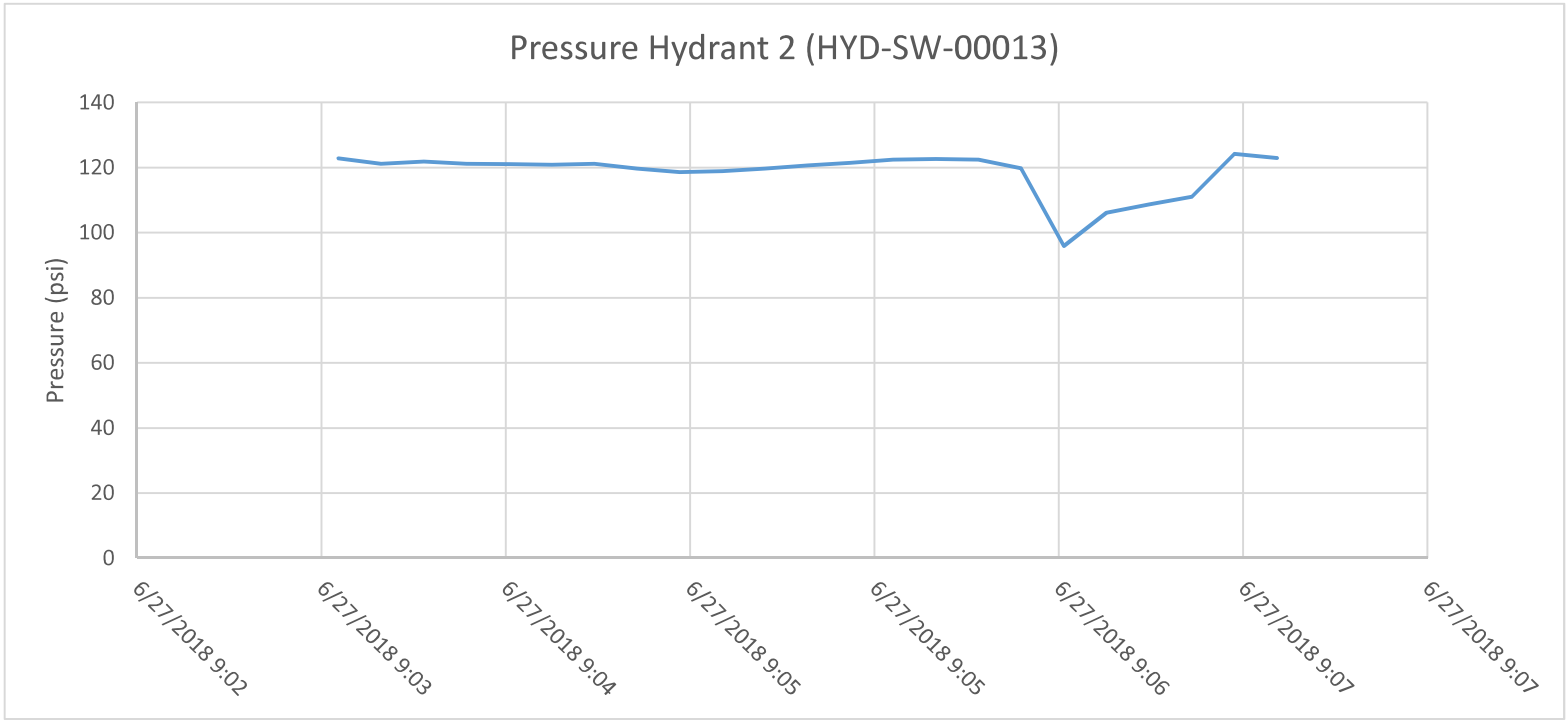
Surrounding area for pressure hydrant P2

Location of flowing hydrant F1

Surrounding area of flowing hydrant F1

Pressure at Data Loggers:





Appendix Q

HYDRAULIC MODEL DEVELOPMENT AND CALIBRATION

Section 1

INTRODUCTION

This appendix provides an overview of the procedures used in the development and calibration of the City of Renton's (City's) water system hydraulic model, as part the City's Water System Plan Update.

Section 2

HYDRAULIC MODEL DEVELOPMENT

The City provided its existing hydraulic computer model of the water distribution system to Carollo for use as part of the Water System Plan Update (Plan). The existing hydraulic model uses the InfoWater modeling software platform, developed by Innovyze.

This section summarizes the procedures used to update the existing hydraulic model per the Plan Scope of Services.

2.1 Model Demands

Water demands in the City's existing hydraulic model were geocoded by the City based on customer AMI records for the year 2018. As part of the model update process, these demands were reviewed by pressure zone to verify the demand estimates provided in Chapter 3 of the Plan.

2.2 Operational Area Diurnal Patterns

Custom diurnal patterns for both winter and summer demands were developed for each of the City's five operational areas. The custom diurnal patterns are based on AMI data provided by the City for winter and summer periods in 2018 for each customer category and normalized so that the average of the hourly multipliers is equal to one. The diurnal patterns are then multiplied by the 24-hour average demands input at the model nodes for the planning scenario to simulate the normal daily demand variations that occur during a typical winter or summer demand condition. This provides operating data on how the tanks and pumps move water through the system.

The diurnal patterns were developed using the hourly AMI data provided by the City in SQL format. The AMI usage data was analyzed using a combination of SQL Server, R, and Tableau. Figure 1 is a screenshot from R Studio illustrating examples of patterns developed by customer category. The rest of the patterns for each operational area and each customer category can be found in Attachment A of this Appendix document.

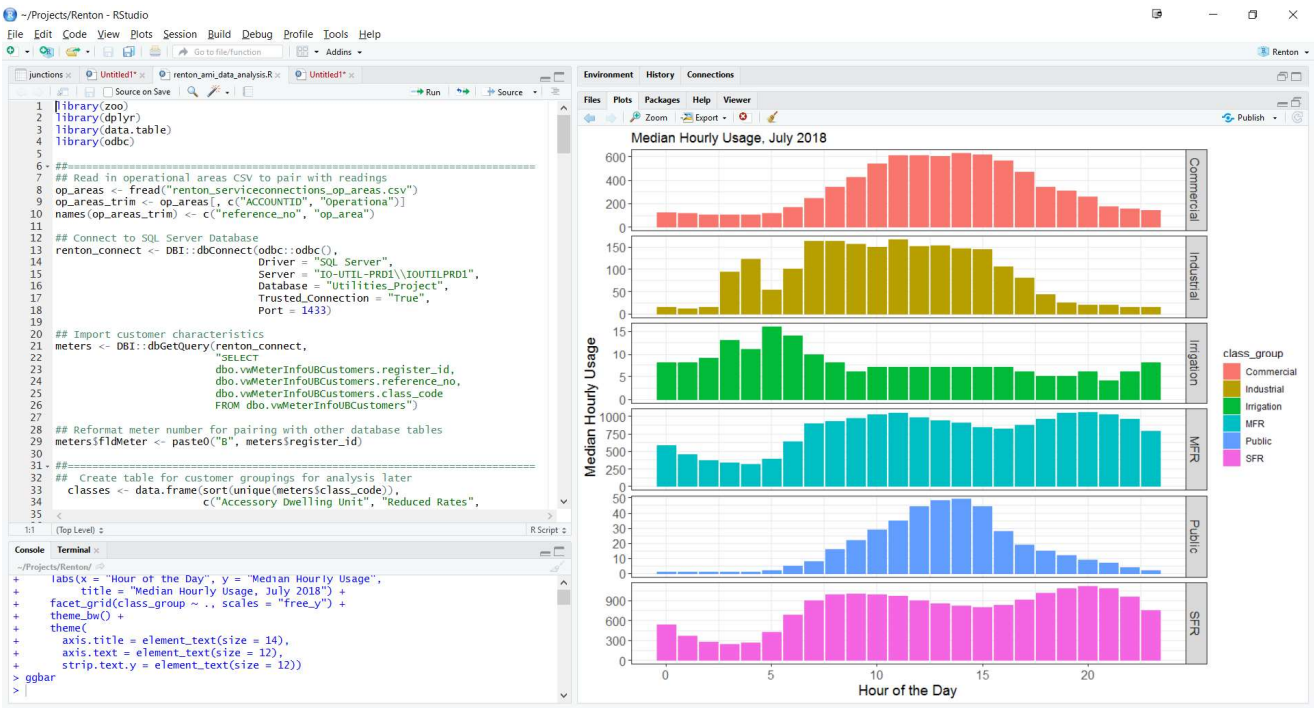


Figure 1 Patterns Example

Section 3
HYDRAULIC MODEL CALIBRATION

The purpose of the water system hydraulic model is to estimate, or predict, how the water system will respond under a given set of demand conditions. One way to test the accuracy of the hydraulic model is to create a set of known conditions in the water system and then compare the results observed in the field against the results of the hydraulic model simulation using the same conditions.

Two types of calibration were performed under this effort:

- Extended Period Simulation (EPS) calibration.
- Steady-state calibration.

The EPS calibration uses the SCADA and pressure loggers data and compares pressure, flow, and tank levels at all of the City's facilities during a representative 24-hour period.

Flow tests conducted in the field on the water system are a standard method to verify the models accuracy and confirm the accuracy of the data used in the hydraulic model construction. Analysis of the flow test data also provides a greater understanding of how the water system operates. Field testing can indicate errors in the data used to develop the hydraulic model, or show that a condition might exist in the field not otherwise known. For example, valves, which are reported as being open, might actually be closed (or vice versa), an obstruction could exist in a pipeline, or pressure settings for a PRV may be slightly different than noted.

Field testing can also correct erroneous model data such as incorrect pipe diameters or connections. Data obtained from the field tests can be used to determine appropriate roughness coefficients for mains, as roughness coefficients can vary with age and pipe material.

3.1 Model Calibration Overview and Methodology

The model calibration consisted of two parts, a EPS calibration and a fire flow (hydrant) test calibration. This section describes both of the calibration steps.

3.1.1 EPS Calibration

The initial calibration process consisted of a macro ou EPS calibration. Carollo ran the model under existing demand conditions in order to verify that the model forecasted pressures are reasonable and to make sure that the reservoirs were replenishing following peak hour demands.

The macro calibration process included executing the following steps to ensure that the model produces reasonable results.

- Transmission Main Connectivity. Carollo used the connectivity features of the hydraulic modeling software to verify the connectivity of the transmission and distribution mains within the distribution system. Proper connectivity verifies that there are no interruptions in the pipe connections. Possible issues found using the connectivity locators are reviewed on a case-by-case basis to determine whether adjustments needed to be made to the connectivity of the model. The model output reports on headloss (ft/kft) and velocity (ft/s) were also used to locate possible connectivity issues that required adjustment.
- System Pressures. The macro calibration compared the model output to typical pressures of each pressure zone. This process allowed Carollo to verify that model facility size (pipe diameters and pump capacity), ground elevations, connectivity, and operational controls were reasonable.
- Facility Characteristics. Hydraulic model results for the City's wells, booster pump stations, and tanks were reviewed and compared to the City's available SCADA data to verify that data input into the hydraulic model (e.g., pump curves, operational controls, PRV settings, etc.) produced results comparable to what the system experiences.

The hydraulic model was run under existing conditions and results were compared to the SCADA data at all wells, booster pump stations, tanks, and pressure loggers.

3.1.2 Fire Flow Test Calibration

The second step in model calibration after macro calibration is to compare model results to field pressures measured during a series of fire flow tests. This process is used to develop a calibrated hydraulic model by closely matching model simulated pressures to field pressures under similar demand and system boundary conditions. The model parameters that are adjusted during this process are primarily the pipeline roughness coefficients, although other parameters can also be adjusted as calibration results are generated.

Hazen-Williams roughness coefficients, or C-factors, have industry accepted value ranges based on pipeline material, diameter, and age. Characteristics specific to the City's water distribution system such as water quality, temperature, construction methodologies, material suppliers, and other factors may result in roughness coefficients that differ from the average of the industry accepted ranges. Fire flow calibration refines the value of roughness coefficients that best indicate the conditions of the City's distribution system.

During average day flows, roughness coefficients have a relatively small effect on the operation of the distribution system. However, as the flows increase in the system on higher demand days or during fire flows, velocity within pipelines increase and roughness coefficients contribute more to overall system headloss. Fire flow tests artificially create high demand events to generate more headloss, allowing a better estimation of the pipeline roughness coefficients.

Fire flow tests stress the distribution system by creating a differential between the hydraulic grade line (HGL) at the point of hydrant flow and the system HGL at neighboring hydrants. This HGL differential increases the effect of the roughness coefficients on system losses and allows adjustments to the model to match model pressures to field pressures within an acceptable tolerance. As the model is adjusted to match system pressures, roughness coefficients should be adjusted only within a tolerance of industry accepted roughness coefficient ranges. If a model is unable to match the calibration results without leaving the acceptable range of roughness coefficient values for a given pipeline material and age, there may be cause for further investigation of a previously unknown field condition. Examples of such conditions, which typically arise during hydraulic model calibration, include closed valves, partially closed or malfunctioning valves, extreme corrosion within pipelines, connectivity and diameter errors, and diurnal patterns of large water users.

The City performed hydrant flow tests as part of this project so that the most current data available could be utilized to update the model. The sites were selected so that each of the City's pressure zones had at least one fire flow test and so that the locations were not near pump stations, valves, or storage facilities, if possible. Calibration Plans and testing locations are located in Appendix P

Each fire test was conducted by first measuring static pressures at two "pressure" hydrants. Next, two "flowing" hydrants were opened to release a large amount of flow and to cause a significant headloss and pressure drop. With the flowing hydrants open, measurements were recorded to quantify the flow rate from each hydrant, and to determine the residual pressure of the two pressure hydrants.

The City also provided SCADA data for the majority of major system facilities, including supply sources (i.e., wells, Springbrook Springs), tanks, and booster pump stations. SCADA data were not available for the City's PRVs.

Two model simulations, or scenarios, were created in the hydraulic model for each fire flow test. The first scenario was called the "static" run, which simulated the water system just prior to each test. The second scenario, referred to as the "residual" run, simulated the system during the test while the hydrants were flowing. A total of 20 tests were performed on the system and therefore a total of 40 computer simulations were created to calibrate the model.

In both static and residual model scenarios, model demands were scaled up or down to represent the model demand during the fire flow test as reasonably as possible. Tank levels were also adjusted in each fire test scenario to match the actual tank levels recorded during the tests. In addition, the initial status of the City's wells and booster pumps were modified so that they matched actual conditions (i.e., open or closed) recorded during the tests.

The residual model scenarios are identical to the appropriate static model scenarios, except that fire flow demands were added to the appropriate nodes.

3.2 Model Calibration Results

Numerous simulations were performed during the calibration phase.

The model was run for a 24-hour representative period from the field testing period and modeled results were compared to field recorded data from SCADA and pressure loggers. For each facility, pressure, flow, and levels were compared. A total of 12 tanks, seven booster pump stations (BPS), eight wells and sources, and 20 loggers were used during calibration. Figure 2 shows an example of calibration results for the Highlands BPS; the rest of the calibration graphs can be found in Attachment B.

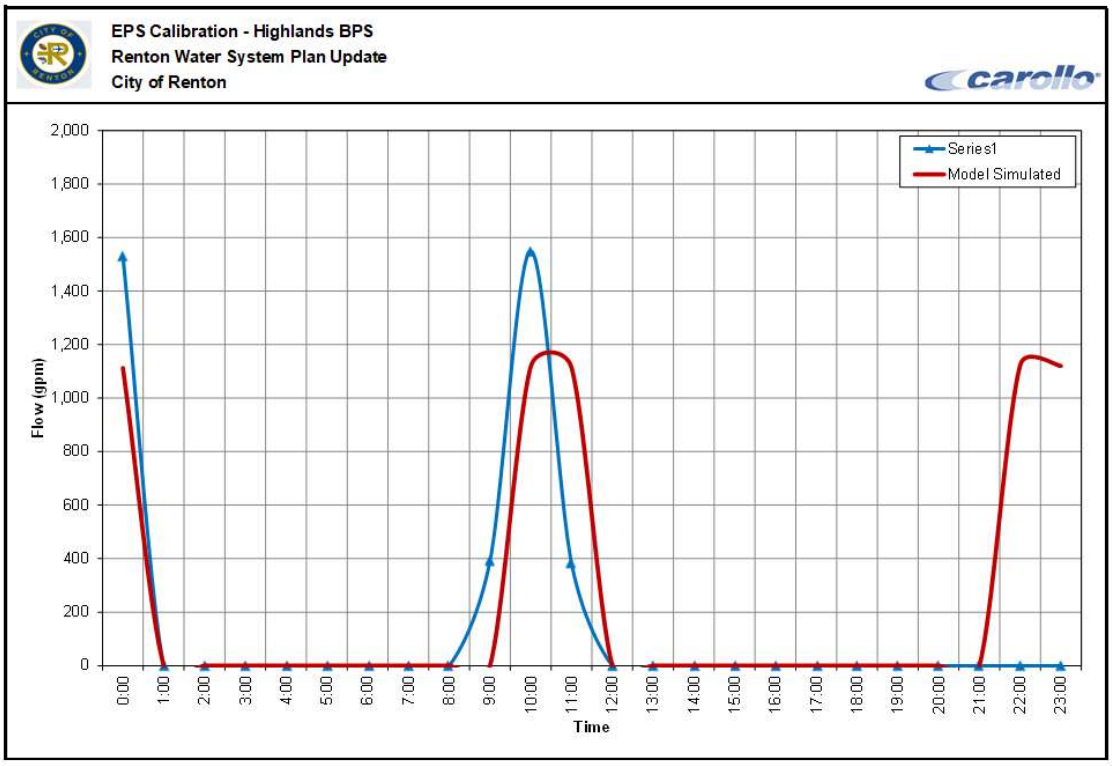


Figure 2 EPS Calibration Example

For several test locations, the hydrant tests were re-run to check system changes and verify test results. Adjustments were made to the model between runs to minimize the differences between the model and field results. A detailed summary of the calibration results is shown in Table 1. The table lists the results of each field test conducted and corresponding hydraulic model results.

For the pressure hydrant tests, the results are considered acceptable if the model simulated pressures are within 10 ft (4.3 psi) difference to the field data. As shown in Figures 3 and 4, 90 percent of all static pressure are within the +/-4.3 psi, while 80 percent of the residual pressure are within +/-4.3 psi.

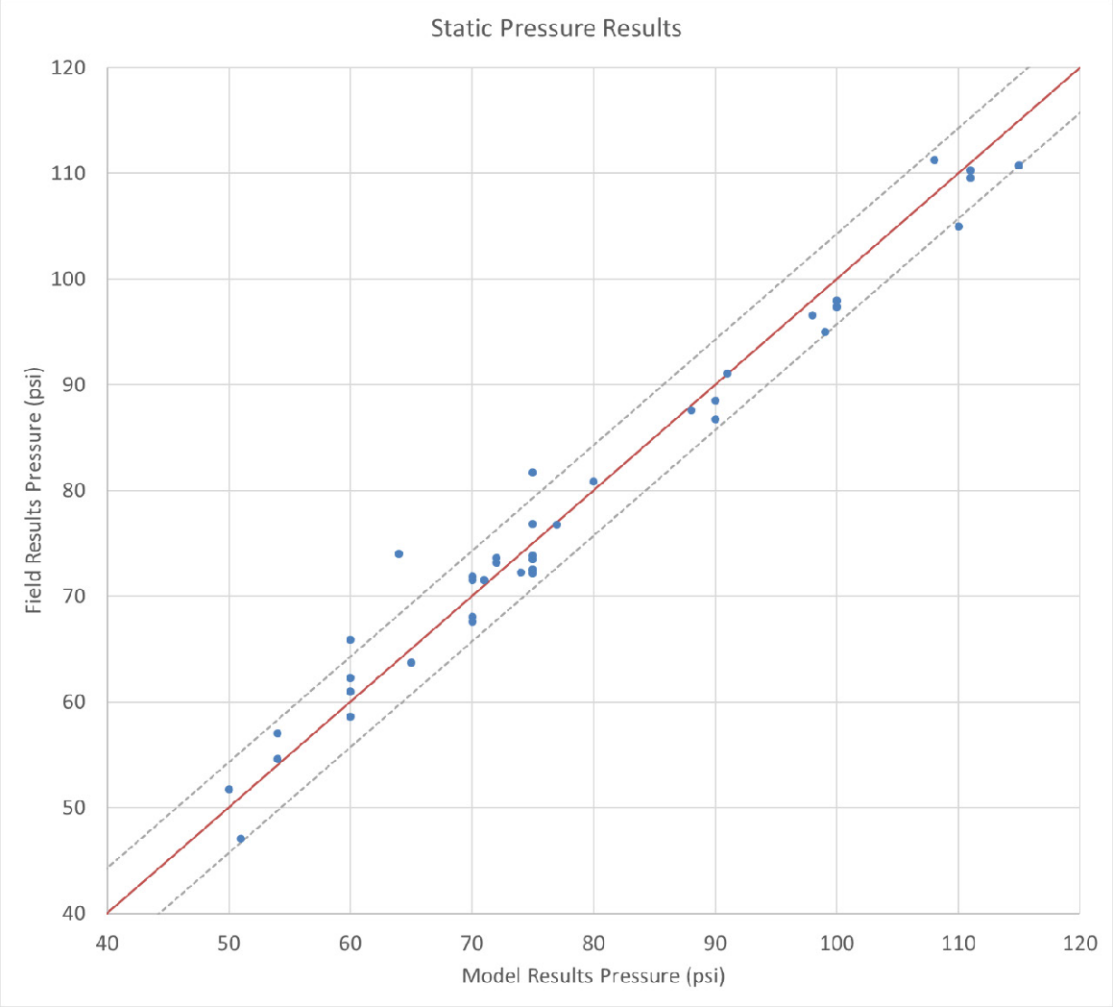


Figure 3 Steady-State Static Pressure Calibration Results Summary

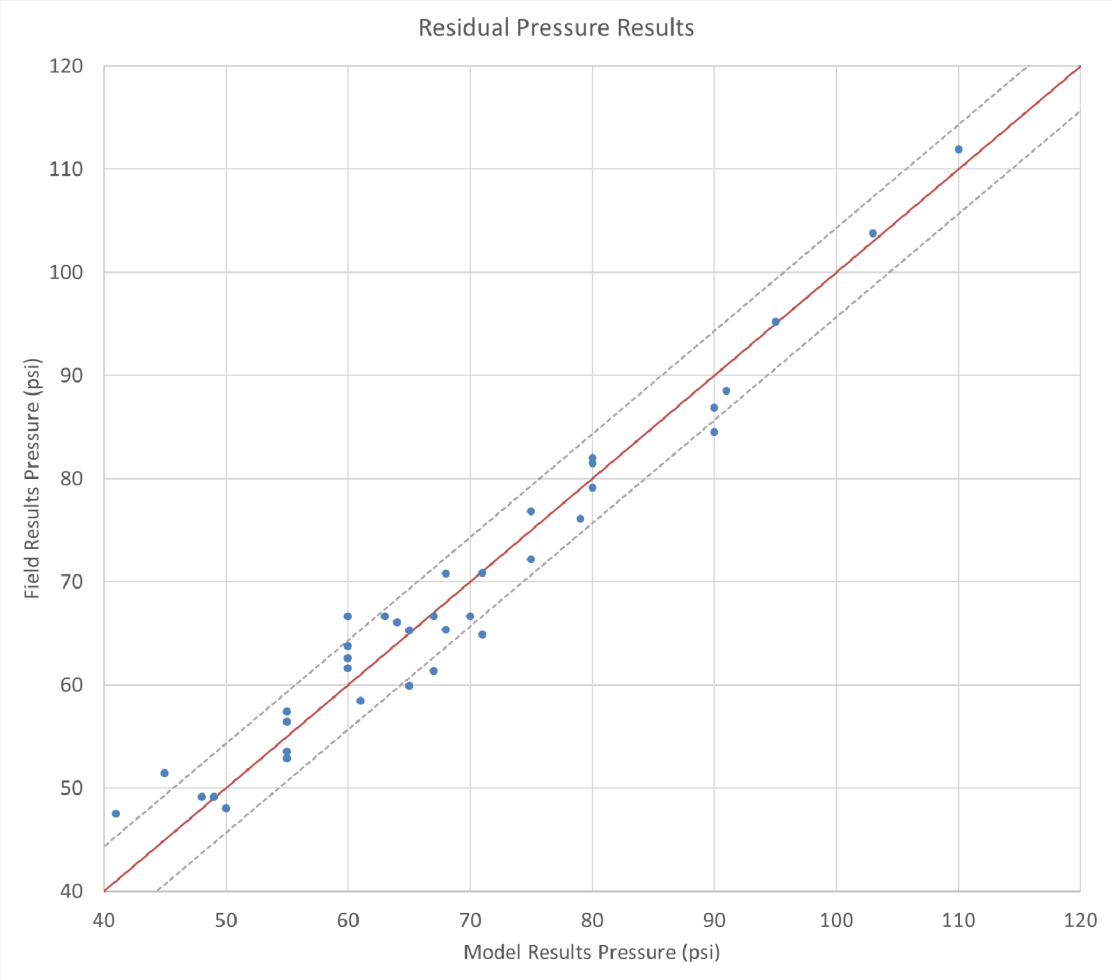


Figure 4 Steady-State Residual Pressure Calibration Results Summary

Section 4

SUMMARY

For all of the facilities SCADA data and all fire flow tests performed by City staff, the model-simulated pressures, flows, and levels as compared to the corresponding field-measured metrics are in the good or very good range. The model is calibrated for the system as it is configured and operated in 2018. Therefore, the model is an appropriate tool for projecting future conditions.

Table 1 Hydraulic Model Fire Test Calibration Results

Hydrant Test Data Sheet - Calibration Results

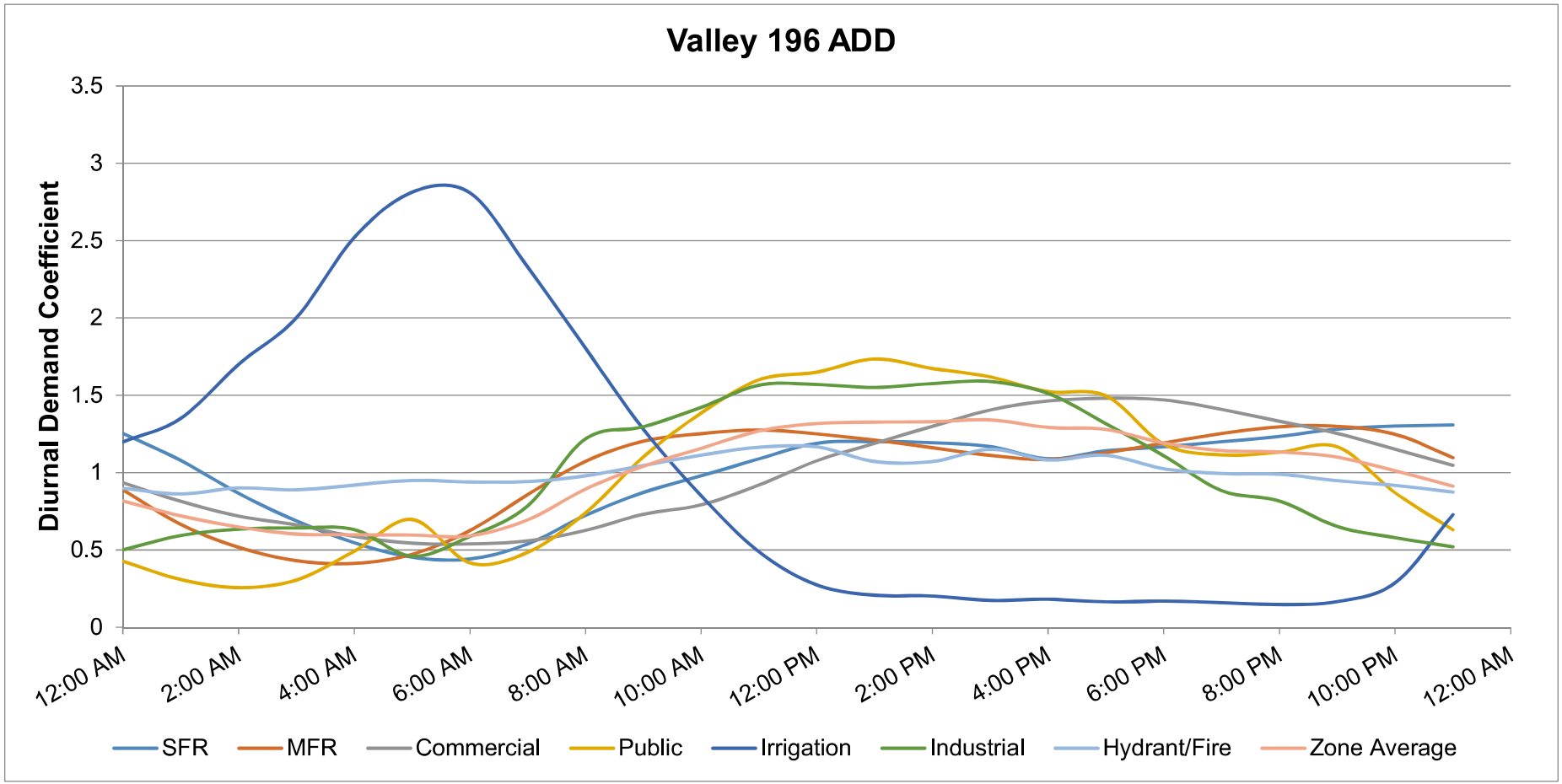
Test No.	Pressure Zone	Date	Time	Hydrant	Hydrant Number	Recorded Flow (gpm)	Adjusted Flow (gpm)	Field Results: Static Pressure (psi)	Field Results: Static HGL (FT)	Field Results: Res. Pressure (psi)	Field Results: Res. HGL (FT)	Model Results: Static Pressure (psi)	Model Results: Static HGL (FT)	Model Results: Residual Pressure (psi)	Model Results: Res. HGL (FT)	Comparison: Static Pressure Diff (psi)	Comparison: Res. Pressure Diff (psi)	Calibration Comments
1	Highlands 565 Zone	19-Jun	9:00	F1	HYD-NE-00680	850	2180											
				P1	HYD-NE-00679			88	564	61	502	88	561	58	494	1.4	3.5	
				P2	HYD-NE-00686			60	549	45	514	66	561	51	528	-5.4	-6.0	Elevation of J2684 appears off
2	Highlands 565 Zone	19-Jun	9:30	F1	HYD-NE-00843	980	2510											
				P1	HYD-NE-00137			60	557	55	545	62	561	57	550	-2.3	-2.4	
				P2	HYD-NE-00133			65	564	55	541	64	561	56	544	1.3	-1.4	
3	Highlands 565 Zone	19-Jun	9:55	F1	HYD-SE-00111	840	2150											
				P1	HYD-SE-00112			74	564	N/A		72	560	54	519	1.7		
				P2	HYD-SE-00114			80	557	48	483	81	560	49	487	-0.8	-1.1	
4	Kennydale 320 Zone	19-Jun	10:36	F1	HYD-N-00309	925	2370											
				P1	HYD-N-00213			99	317	90	296	95	326	87	307	4.0	3.1	
				P2	HYD-N-00018			90	318	80	295	87	326	79	308	3.2	0.9	
5	Highlands 435 Zone	19-Jun	13:15	F1	HYD-NE-00652	775	1980											
				P1	HYD-NE-00768			50	438	41	417	52	441	48	432	-1.7	-6.5	
				P2	HYD-NE-01008			60	440	55	429	61	441	54	424	-0.9	1.4	
6	Highlands 435 Zone	19-Jun	12:50	F1	HYD-NE-00270	1060	Gage on 2.5" port											
				P1	HYD-NE-00269			137	439	130	423	138	443	129	422	-1.0	0.9	
				P2	HYD-NE-00274			115	453	103	425	111	443	104	427	4.3	-0.8	
7	Rolling Hills 590 Zone	20-Jun	14:48	F1	HYD-SE-00168	1225	Gage on 2.5" port											
				P1	HYD-SE-00170			60	592	38	541	59	592	39	546	0.0	-2.3	
				P2	HYD-SE-00166			77	593	71	579	77	592	65	564	0.4	6.3	
8	Rolling Hills 590 Zone	20-Jun	14:28	F1	HYD-SE-00302	1130	Gage on 2.5" port											
				P1	HYD-SE-00306			70	596	60	573	68	591	63	579	2.5	-2.5	
				P2	HYD-SE-00307			54	588	49	577	55	591	49	578	-1.1	-0.6	
9	Rolling Hills 490 Zone	20-Jun	12:36	F1	HYD-S-00780	1316	3370											Construction in PZ during hydrant tests
				P1	HYD-S-00092			54	489	39	454	57	493	36	444	-1.7	4.7	
				P2	HYD-S-00783			111	495	60	377	110	493	64	386	0.8	-3.7	
10	Rolling Hills 490 Zone	20-Jun	13:20	F1	HYD-S-00205	1030	2640											Construction in PZ during hydrant tests
				P1	HYD-S-00204			110	496	90	450	105	492	85	445	1.6	2.1	
				P2	HYD-S-00208			108	486	79	419	111	492	76	411	-2.6	3.5	
11	Talbot Hill 350 Zone	20-Jun	13:40	F1	HYD-S-00685	1190	3050											
				P1	HYD-S-00681			100	357	91	336	98	351	89	330	2.4	2.9	
				P2	HYD-S-00689			51	348	40	322	47	351	31	314	-1.6	3.7	
12	Talbot Hill 350 Zone	20-Jun	13:58	F1	HYD-S-00605	1325	3390											
				P1	HYD-S-00604			91	352	75	315	91	351	77	318	0.2	-1.5	
				P2	HYD-S-00608			111	355	95	318	110	351	95	318	1.5	-0.1	
13	West Talbot Hill 300 Zone	20-Jun	13:04	F1	HYD-S-00131	1000	2560											Need to confirm the PRV settings 10 psi different thank what the field/logger read at the time. Prior testing similary showed zone HGL was ~278 feet Today's pressure readings: HYD-S-00717 (15th & Morris) = 85psi HYD-s-00135 (15th & Davis) = 78psi
				P1	HYD-S-00135			64	265	50	233	74	290	48	230	-10.5	1.5	
				P2	HYD-S-00717			75	275	60	241	82	290	62	243	-6.2	-1.1	
14	Valley 196 Zone	27-Jun	12:47	F1	HYD-SW-00282	980	2510											
				P1	HYD-SW-00437			75	200	68	184	74	196	65	177	1.9	3.1	logger indicates 68 psi during flow
				P2	HYD-SW-00202			72	194	64	176	74	196	66	178	-0.5	-1.0	logger indicateds 64 psi during flow
15	Valley 196 Zone	27-Jun	10:30	F1	HYD-S-00478	1180	3020											
				F2	HYD-S-00734	930	2380											
				P1	HYD-S-00165			75	200	67	181	74	196	61	167	1.4	5.9	
				P2	HYD-S-00168			72	194	65	178	73	196	65	178	-1.1	-0.2	

Hydrant Test Data Sheet - Calibration Results

								Field Results				Model Results				Comparison		
Test No.	Pressure Zone	Date	Time	Hydrant	Hydrant Number	Recorded Flow (gpm)	Adjusted Flow (gpm)	Static Pressure (psi)	Static HGL (FT)	Res. Pressure (psi)	Res. HGL (FT)	Static Pressure (psi)	Static HGL (FT)	Residual Pressure (psi)	Res. HGL (FT)	Static Pressure Diff (psi)	Res. Pressure Diff (psi)	Calibration Comments
16	Valley 196 Zone	27-Jun	9:15	F1	HYD-S-00057	1300	3330											
				P1	HYD-S-00215			75	203	70	191	72	197	67	183	2.6	3.4	
				P2	HYD-S-00064			70	193	67	186	72	197	67	186	-1.5	0.3	
16.2	Valley 196 Zone	27-Jun	9:15	F1	HYD-S-00057	920	2360											
				F2	HYD-S-00620	1000	2560											
				P1	HYD-S-00215			75	203	63	175	72	197	67	183	2.6	-3.6	
				P2	HYD-S-00064			71	196	60	170	72	197	67	186	-0.5	-6.7	
17	Valley 196 Zone	27-Jun	9:40	F1	HYD-N-00056	530	1360											
				P1	HYD-N-00247			75	204	71	195	72	197	71	194	3.0	0.4	
				P2	HYD-N-00051			70	193	68	188	72	197	71	194	-1.6	-2.6	
18	West Hill 300	27-Jun	8:50	F1	HYD-NW-00019	1190	3050											
				P1	HYD-NW-00069			70	308	55	274	68	303	53	267	2.5	2.8	
				P2	HYD-NW-00014			98	306	75	253	97	303	72	246	1.5	2.9	
19	West Hill 495	27-Jun	8:30	F1	HYD-NW-00045	1400	Gage on 2.5" port											
				P1	HYD-NW-00050			100	497	80	451	97	487	82	452	4.1	-0.5	
				P2	HYD-NW-00046			90	488	80	465	88	487	81	471	0.5	-2.5	
20	Earlington 370 Zone	27-Jun	9:10	F1	HYD-SW-00900	1190	3050											
				P1	HYD-SW-00568			75	382	65	359	77	386	60	347	-1.9	5.0	
				P2	HYD-SW-00013			124	375	110	343	129	387	112	347	-5.2	-1.4	

Attachment A

RENTON DIURNAL PATTERNS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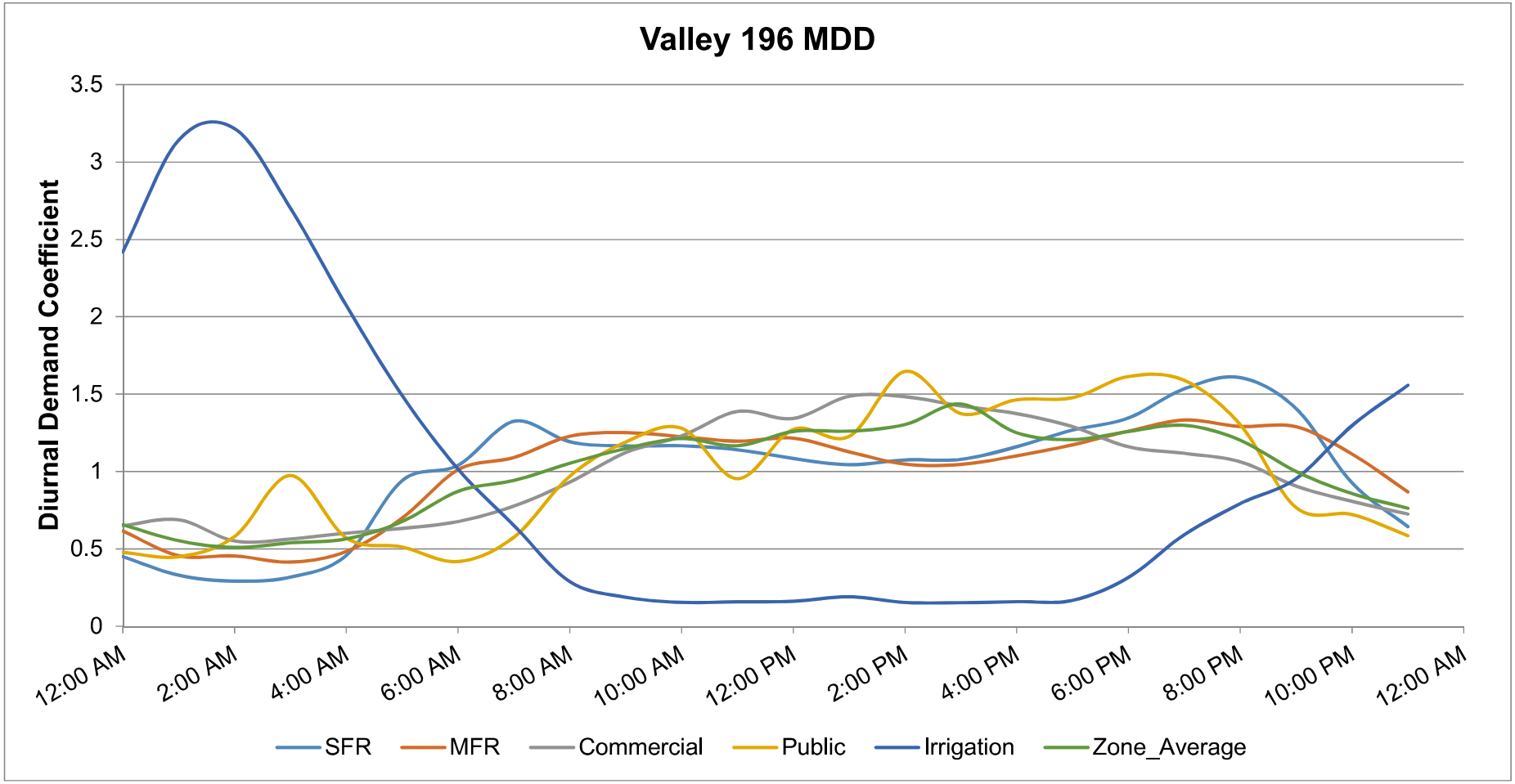
Industrial
Hydrant/Fire
Zone Average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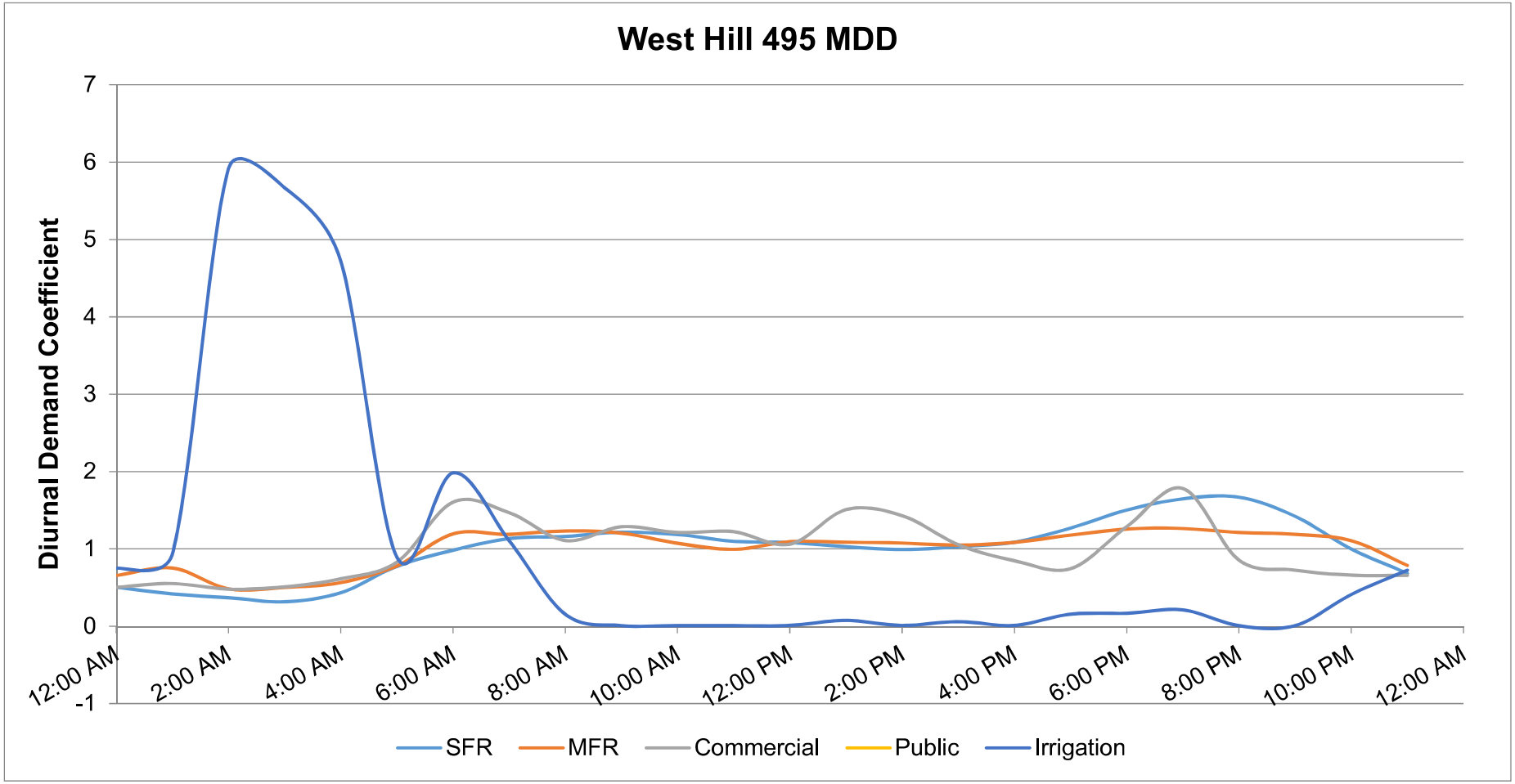
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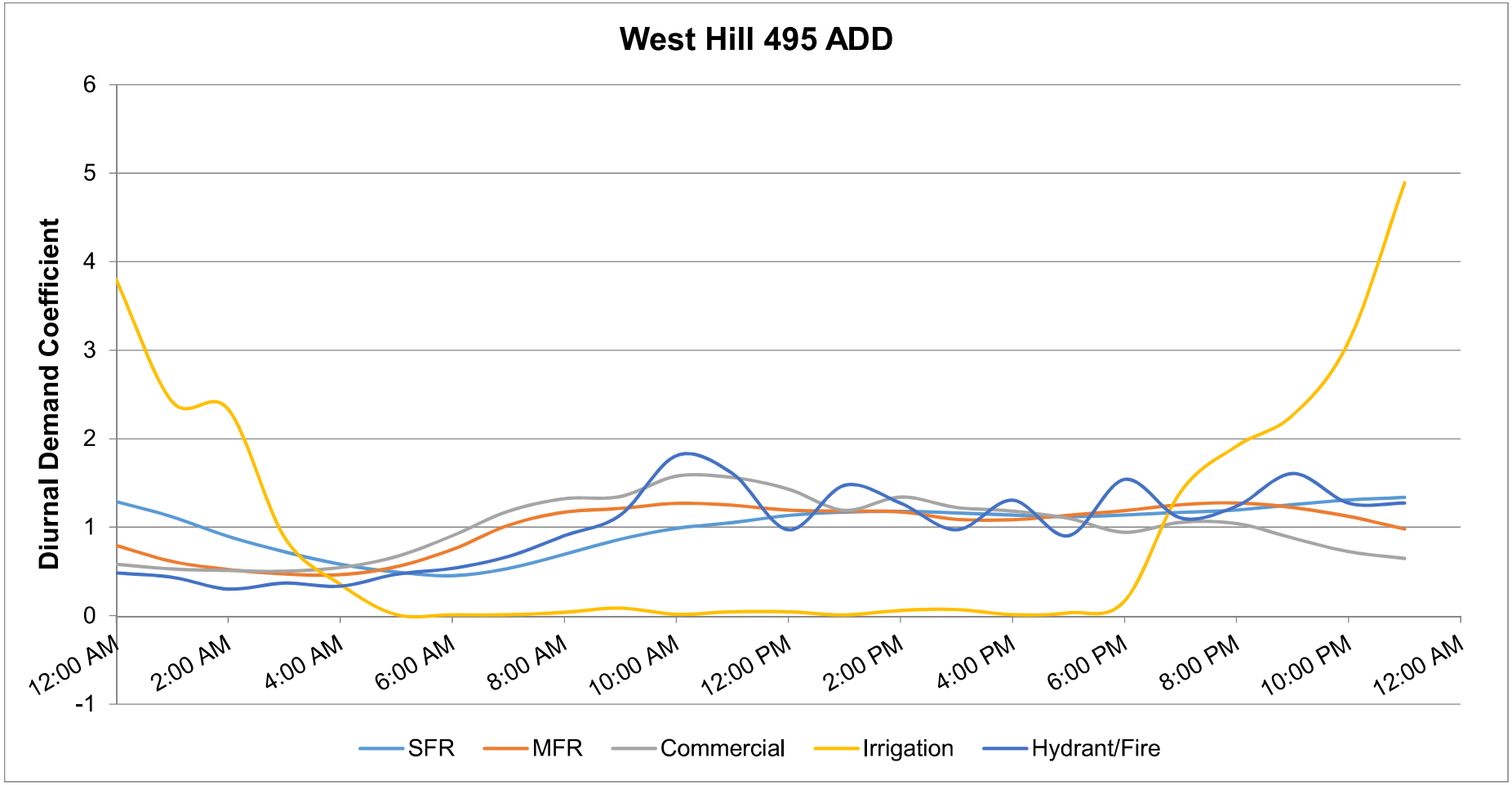
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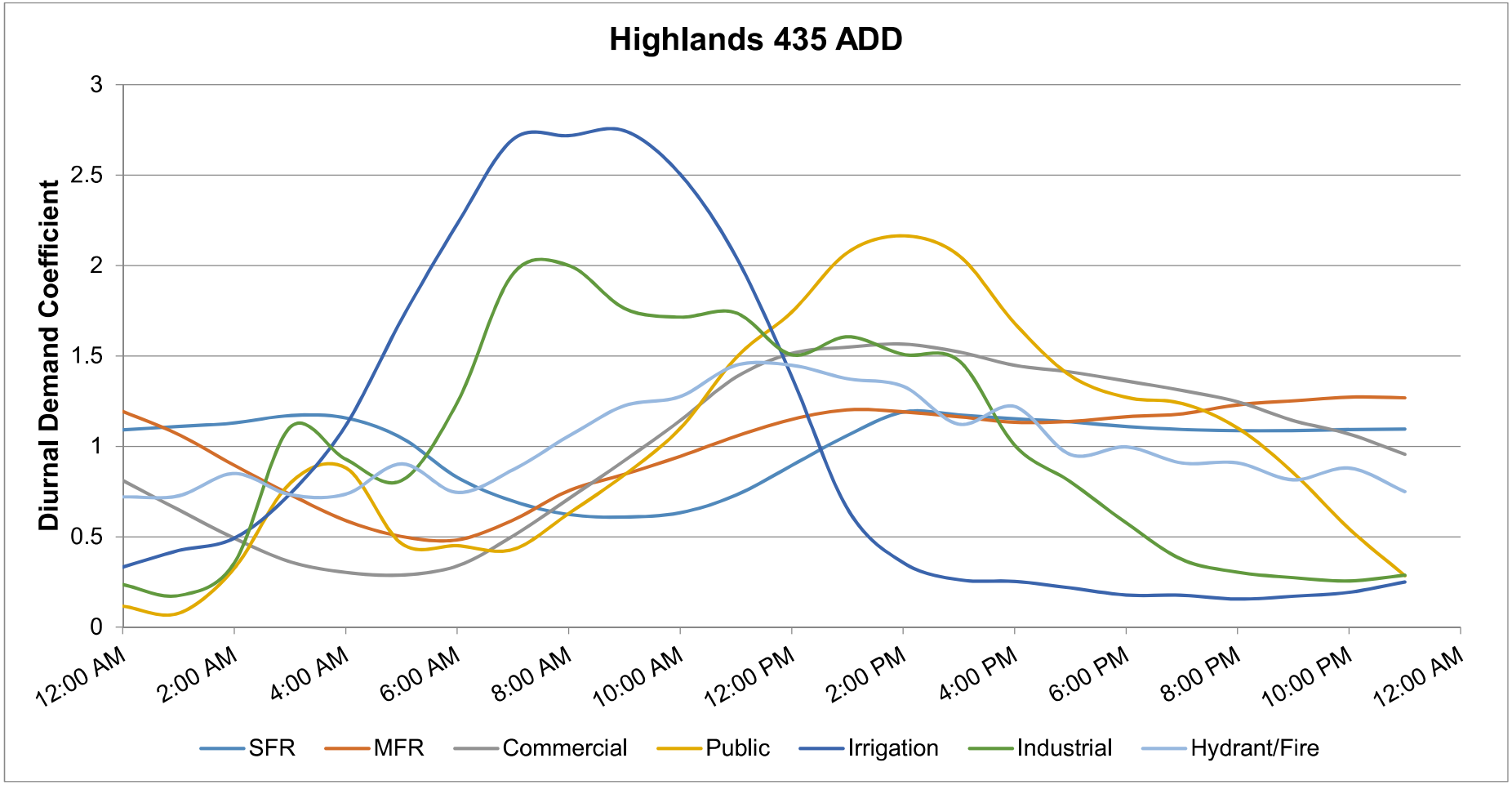
Irrigation
Hydrant/Fire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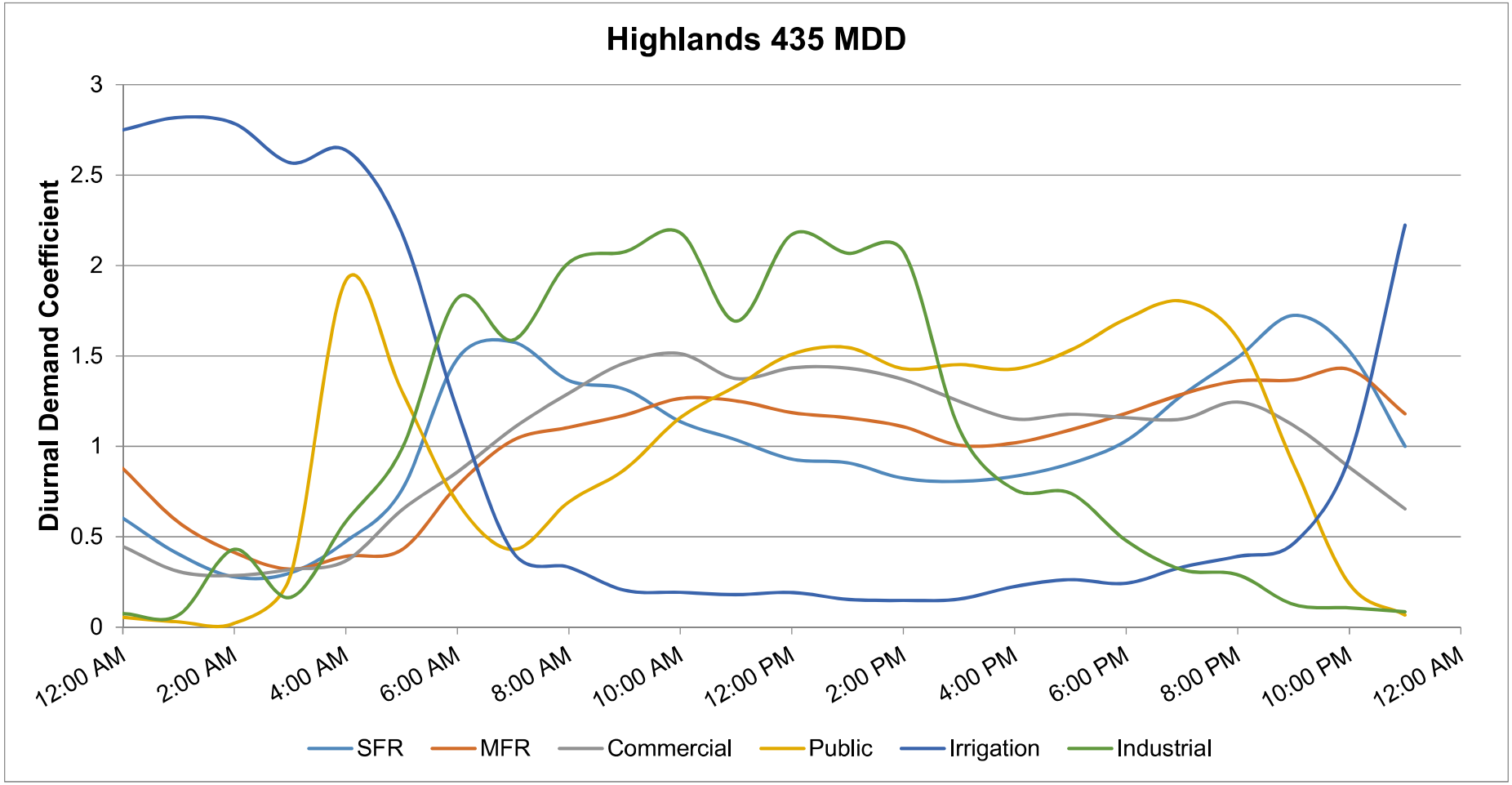
Irrigation
Industrial
Hydrant/Fire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MFR
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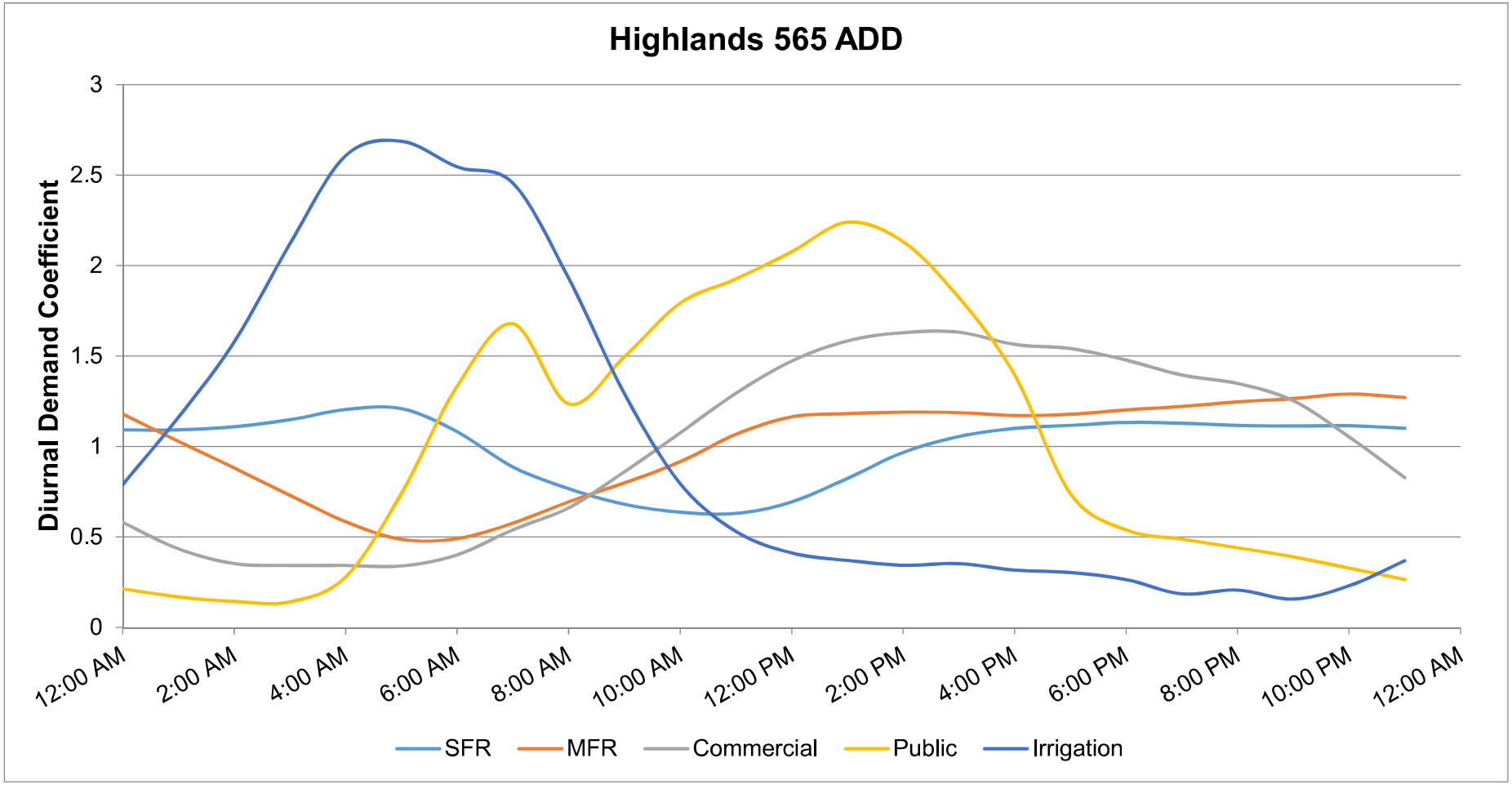
Irrigation
Industrial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Diurnal Demand Coefficient
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2.5
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1.5
1
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12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
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8:00 PM
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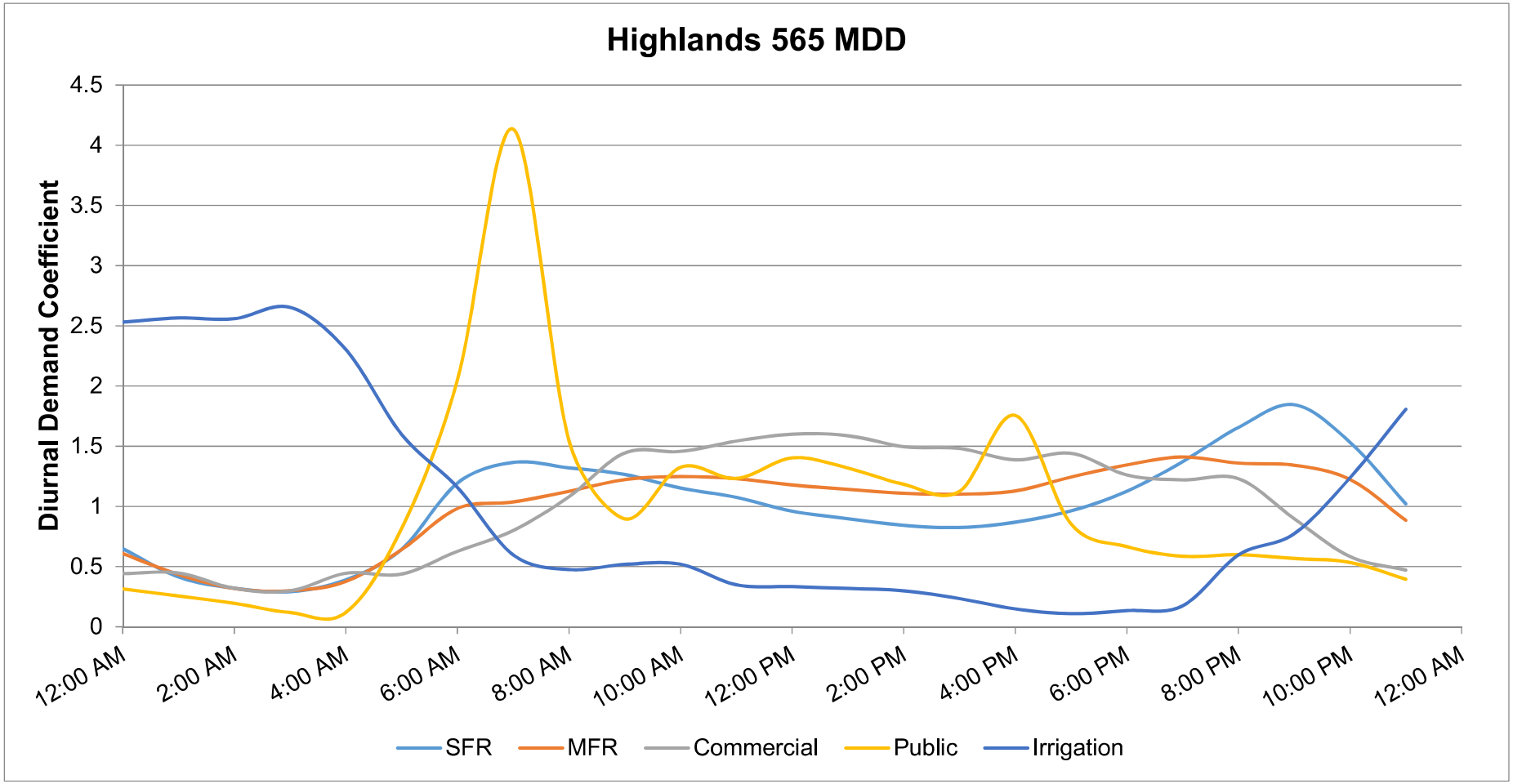
12:00 AM
SFR
MFR
Commercial
Public
Irrigation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3.5
3
2.5
2
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1
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2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
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10:00 PM
12:00 AM
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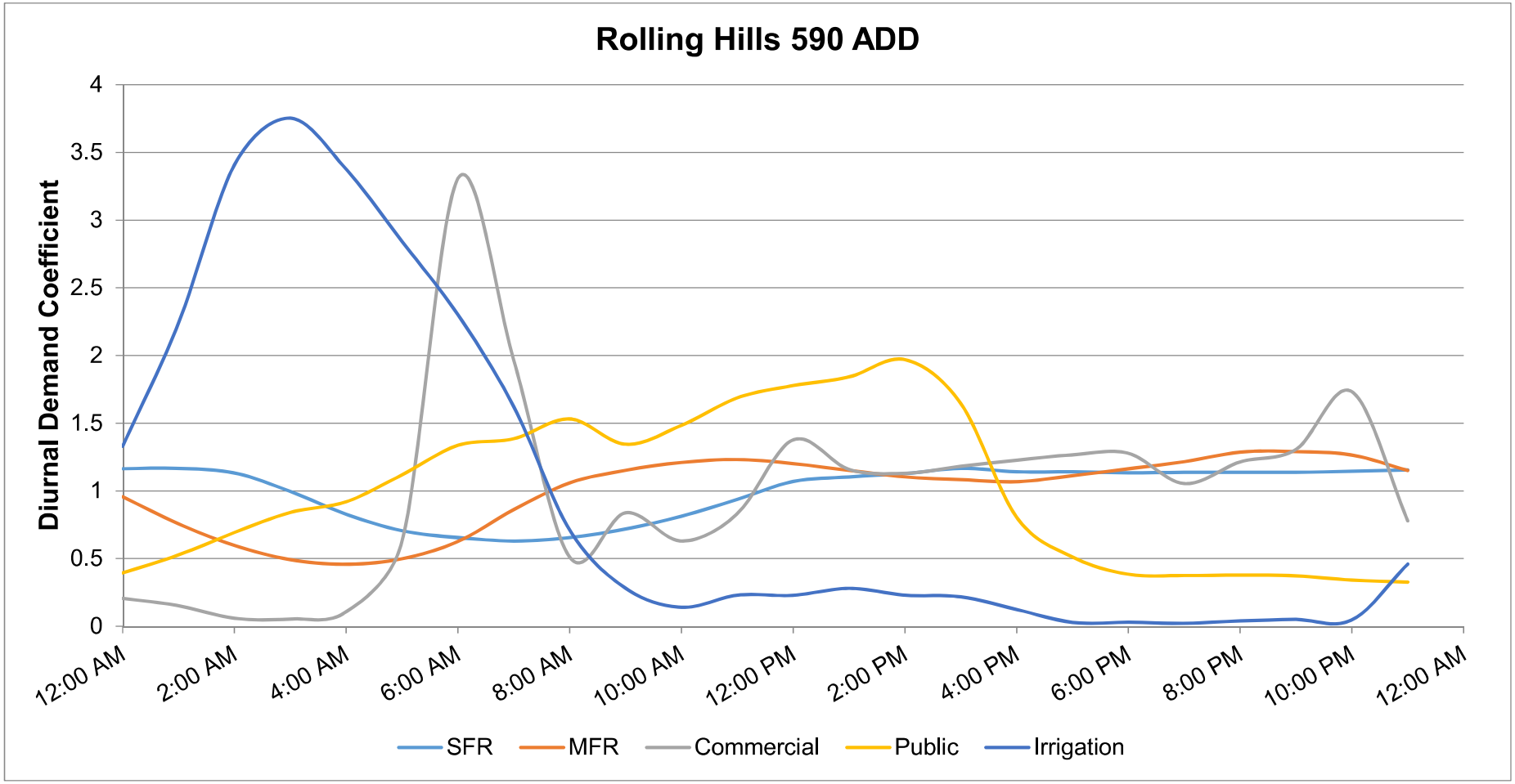
Commercial
Public
Irrigation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3.5
3
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2
1.5
1
0.5
0
12:00 AM
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6:00 AM
8:00 AM
10:00 AM
12:00 PM
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4:00 PM
6:00 PM
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12:00 AM
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MFR
Commercial
Public
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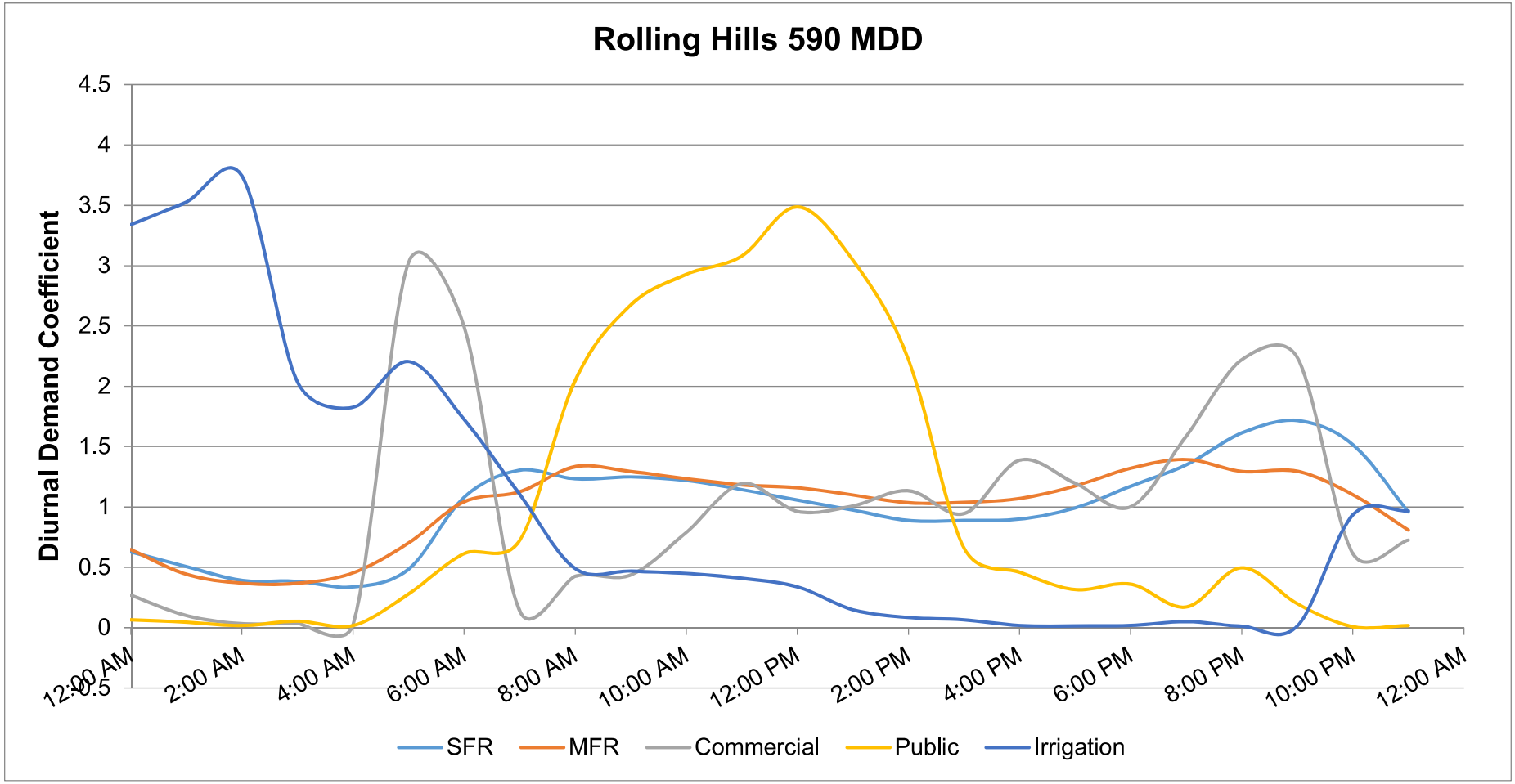
Rolling Hills 590 MDD
Diurnal Demand Coefficient
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
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SFR
MFR
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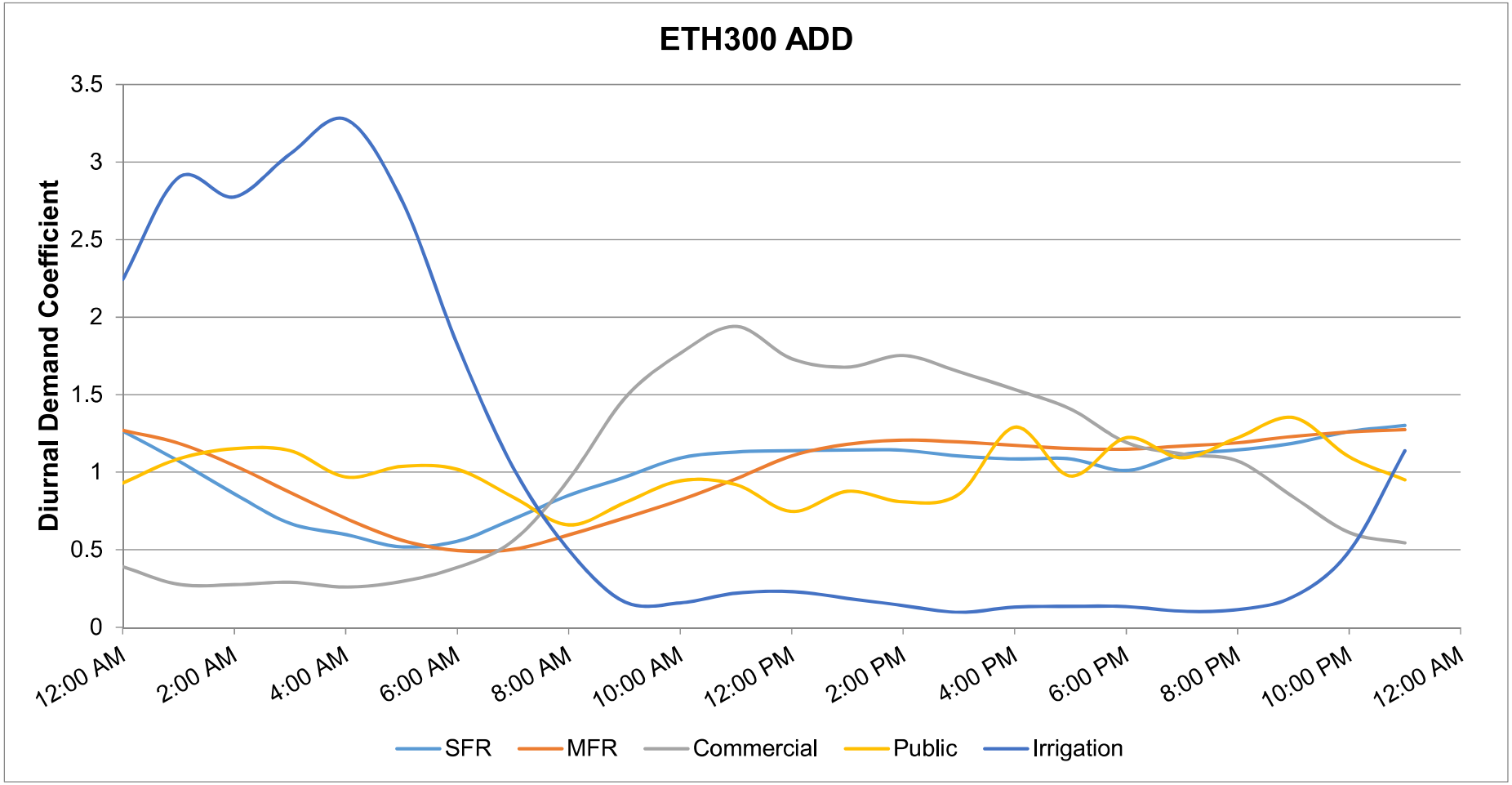
Public
Irrigation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Diurnal Demand Coefficient
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3
2.5
2
1.5
1
0.5
0
12:00 AM
2:00 AM
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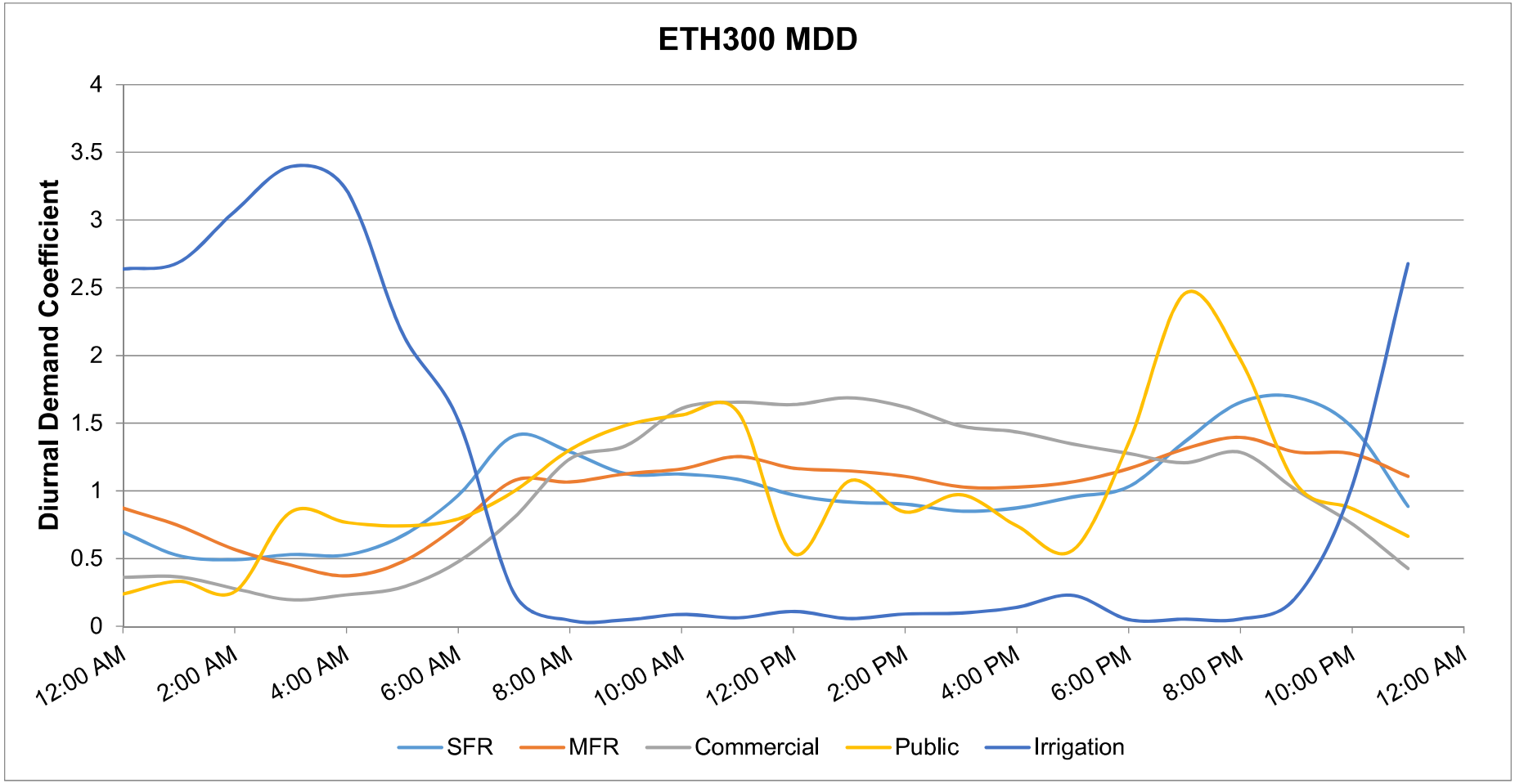
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM
SFR
MFR
Commercial
Public
Irrigation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Diurnal Demand Coefficient
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3.5
3
2.5
2
1.5
1
0.5
0
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2:00 AM
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6:00 AM
8:00 AM
10:00 AM
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2:00 PM
4:00 PM
6:00 PM
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12:00 AM
SFR
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Public
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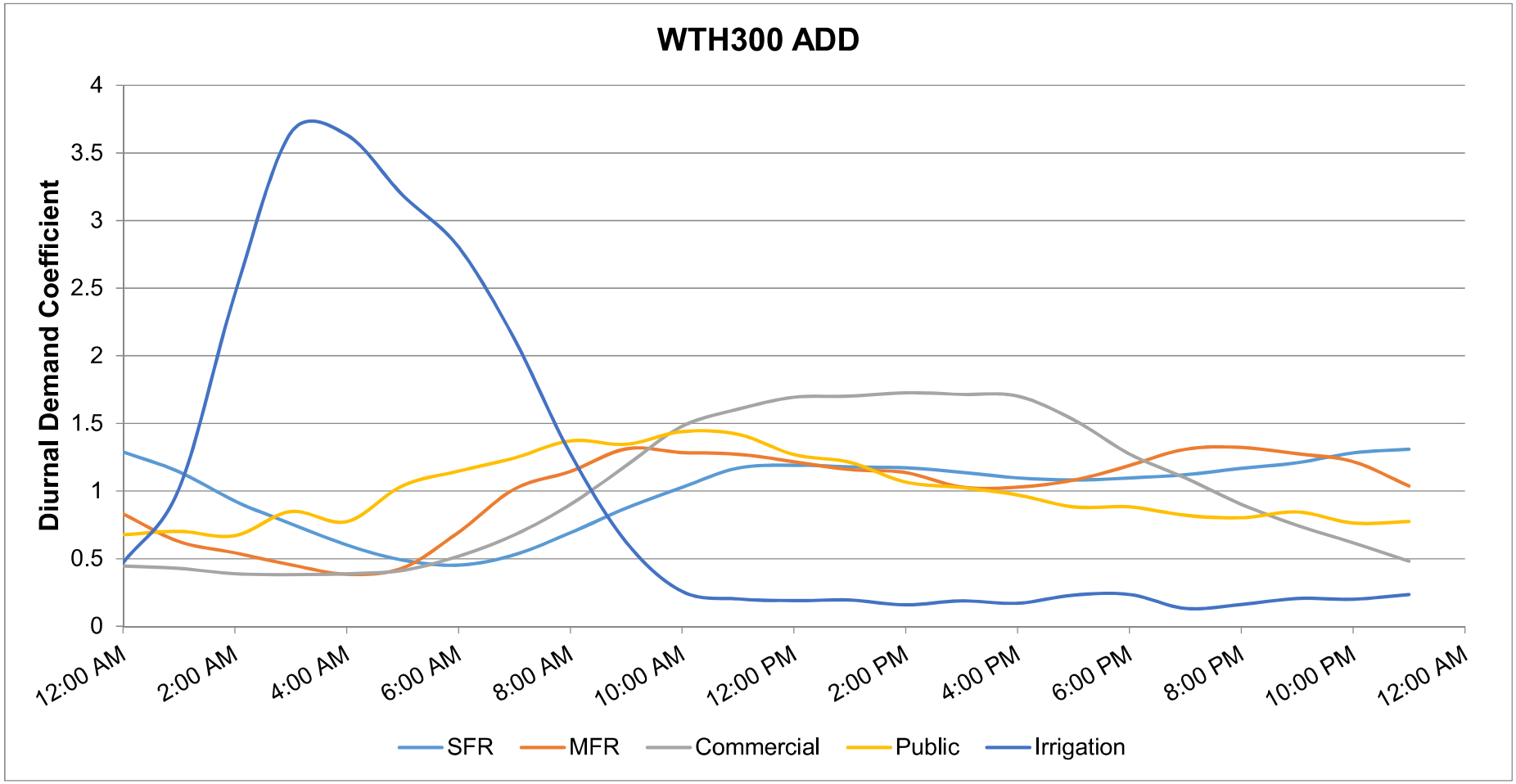
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3.5
3
2.5
2
1.5
1
0.5
0
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2:00 AM
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6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
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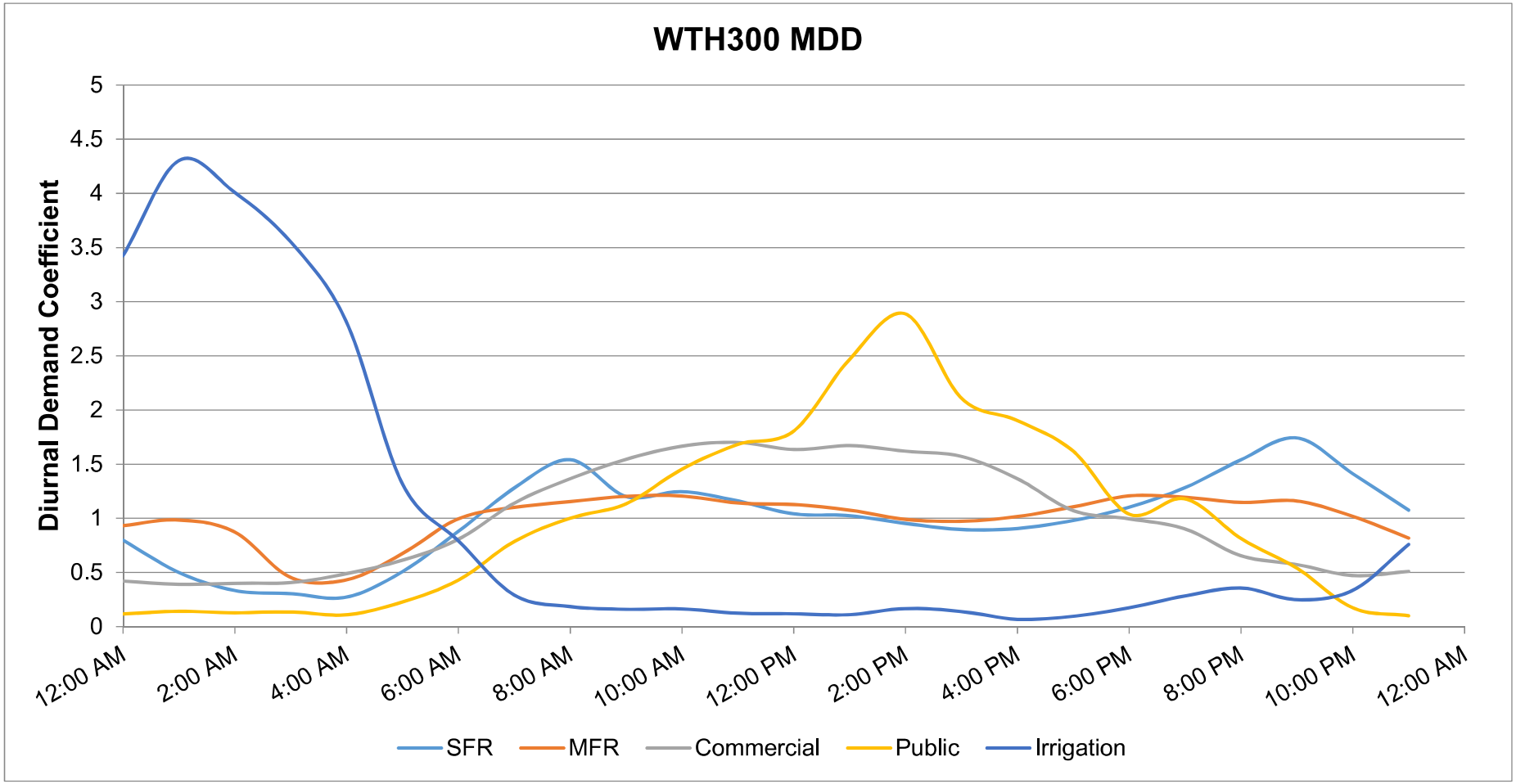
10:00 PM
12:00 AM
SFR
MFR
Commercial
Public
Irrigation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Diurnal Demand Coefficient
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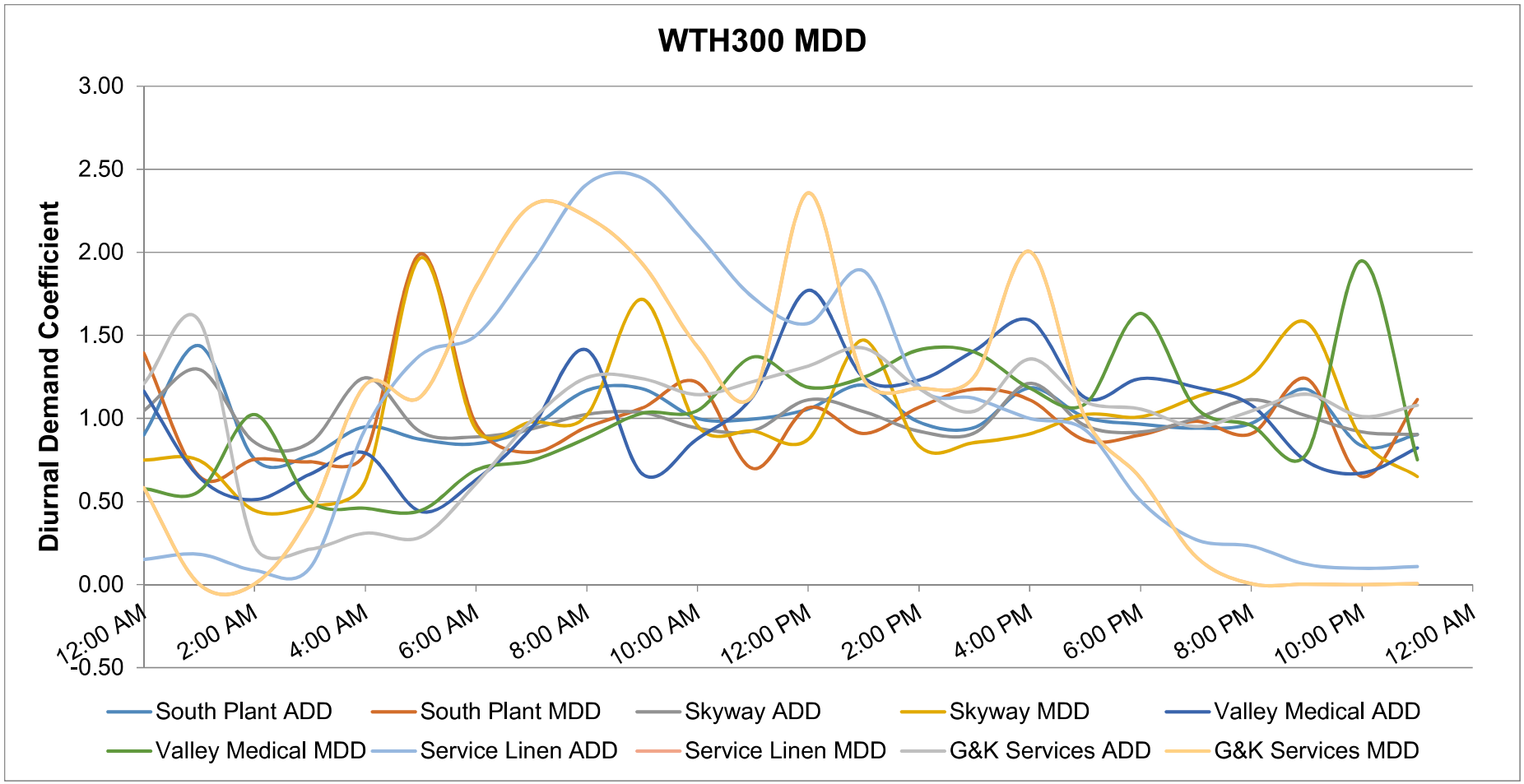
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM
SFR
MFR
Commercial
Public
Irrigation


WTH300 MDD
Diurnal Demand Coefficient
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM
South Plant ADD
South Plant MDD
Skyway ADD
Skyway MDD
Valley Medical ADD
Valley Medical MDD
Service Linen ADD
Service Linen MDD
G&K Services ADD
G&K Services MDD

Attachment B

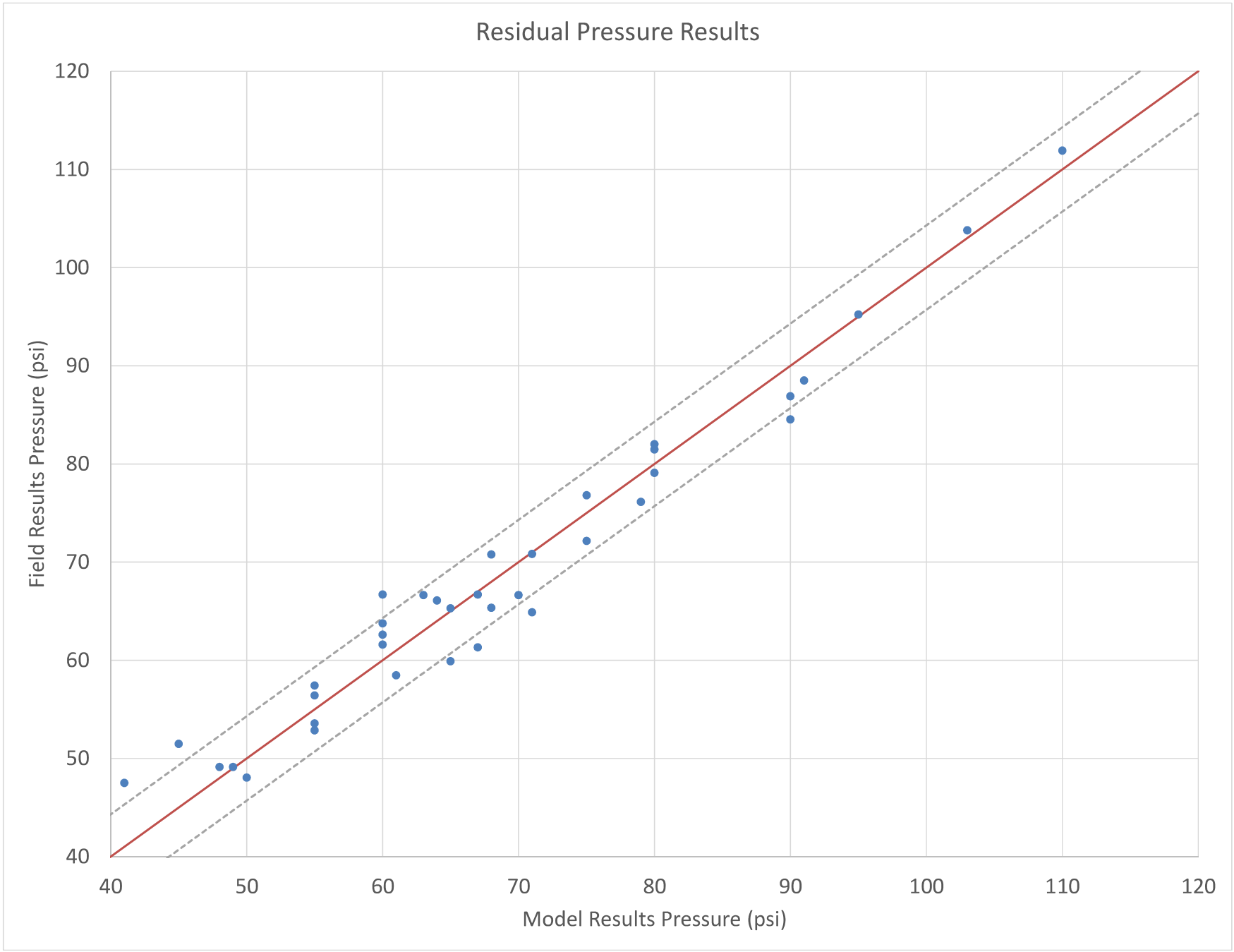
MODEL CALIBRATION DETAILED RESULTS

Hydrant Test Data Sheet - Calibration Results

								Field Results				Model Results				Comparison		
Test No.	Pressure Zone	Date	Time	Hydrant	Hydrant Number	Recorded Flow (gpm)	Adjusted Flow (gpm)	Static Pressure (psi)	Static HGL (FT)	Res. Pressure (psi)	Res. HGL (FT)	Static Pressure (psi)	Static HGL (FT)	Residual Pressure (psi)	Res. HGL (FT)	Static Pressure Diff (psi)	Res. Pressure Diff (psi)	Calibration Comments
1	Highlands 565 Zone	19-Jun	9:00	F1	HYD-NE-00680	850	2180											
				P1	HYD-NE-00679			88	564	61	502	88	561	58	494	1.4	3.5	
				P2	HYD-NE-00686			60	549	45	514	66	561	51	528	-5.4	-6.0	Elevation of J2684 appears off
2	Highlands 565 Zone	19-Jun	9:30	F1	HYD-NE-00843	980	2510											
				P1	HYD-NE-00137			60	557	55	545	62	561	57	550	-2.3	-2.4	
				P2	HYD-NE-00133			65	564	55	541	64	561	56	544	1.3	-1.4	
3	Highlands 565 Zone	19-Jun	9:55	F1	HYD-SE-00111	840	2150											
				P1	HYD-SE-00112			74	564	N/A		72	560	54	519	1.7		
				P2	HYD-SE-00114			80	557	48	483	81	560	49	487	-0.8	-1.1	
4	Kennydale 320 Zone	19-Jun	10:36	F1	HYD-N-00309	925	2370											
				P1	HYD-N-00213			99	317	90	296	95	326	87	307	4.0	3.1	
				P2	HYD-N-00018			90	318	80	295	87	326	79	308	3.2	0.9	
5	Highlands 435 Zone	19-Jun	13:15	F1	HYD-NE-00652	775	1980											
				P1	HYD-NE-00768			50	438	41	417	52	441	48	432	-1.7	-6.5	
				P2	HYD-NE-01008			60	440	55	429	61	441	54	424	-0.9	1.4	
6	Highlands 435 Zone	19-Jun	12:50	F1	HYD-NE-00270	1060	Gage on 2.5" port											
				P1	HYD-NE-00269			137	439	130	423	138	443	129	422	-1.0	0.9	
				P2	HYD-NE-00274			115	453	103	425	111	443	104	427	4.3	-0.8	
7	Rolling Hills 590 Zone	20-Jun	14:48	F1	HYD-SE-00168	1225	Gage on 2.5" port											
				P1	HYD-SE-00170			60	592	38	541	59	592	39	546	0.0	-2.3	
				P2	HYD-SE-00166			77	593	71	579	77	592	65	564	0.4	6.3	
8	Rolling Hills 590 Zone	20-Jun	14:28	F1	HYD-SE-00302	1130	Gage on 2.5" port											
				P1	HYD-SE-00306			70	596	60	573	68	591	63	579	2.5	-2.5	
				P2	HYD-SE-00307			54	588	49	577	55	591	49	578	-1.1	-0.6	
9	Rolling Hills 490 Zone	20-Jun	12:36	F1	HYD-S-00780	1316	3370											Construction in PZ during hydrant tests
				P1	HYD-S-00092			54	489	39	454	57	493	36	444	-1.7	4.7	
				P2	HYD-S-00783			111	495	60	377	110	493	64	386	0.8	-3.7	
10	Rolling Hills 490 Zone	20-Jun	13:20	F1	HYD-S-00205	1030	2640											Construction in PZ during hydrant tests
				P1	HYD-S-00204			110	496	90	450	105	492	85	445	1.6	2.1	
				P2	HYD-S-00208			108	486	79	419	111	492	76	411	-2.6	3.5	
11	Talbot Hill 350 Zone	20-Jun	13:40	F1	HYD-S-00685	1190	3050											
				P1	HYD-S-00681			100	357	91	336	98	351	89	330	2.4	2.9	
				P2	HYD-S-00689			51	348	40	322	47	351	31	314	-1.6	3.7	
12	Talbot Hill 350 Zone	20-Jun	13:58	F1	HYD-S-00605	1325	3390											
				P1	HYD-S-00604			91	352	75	315	91	351	77	318	0.2	-1.5	
				P2	HYD-S-00608			111	355	95	318	110	351	95	318	1.5	-0.1	
13	West Talbot Hill 300 Zone	20-Jun	13:04	F1	HYD-S-00131	1000	2560											Need to confirm the PRV settings 10 psi different thank what the field/logger read at the time. Prior testing similary showed zone HGL was ~278 feet Today's pressure readings: HYD-S-00717 (15th & Morris) = 85psi HYD-s-00135 (15th & Davis) = 78psi
				P1	HYD-S-00135			64	265	50	233	74	290	48	230	-10.5	1.5	
				P2	HYD-S-00717			75	275	60	241	82	290	62	243	-6.2	-1.1	
14	Valley 196 Zone	27-Jun	12:47	F1	HYD-SW-00282	980	2510											
				P1	HYD-SW-00437			75	200	68	184	74	196	65	177	1.9	3.1	logger indicates 68 psi during flow
				P2	HYD-SW-00202			72	194	64	176	74	196	66	178	-0.5	-1.0	logger indicateds 64 psi during flow
15	Valley 196 Zone	27-Jun	10:30	F1	HYD-S-00478	1180	3020											
				F2	HYD-S-00734	930	2380											
				P1	HYD-S-00165			75	200	67	181	74	196	61	167	1.4	5.9	
				P2	HYD-S-00168			72	194	65	178	73	196	65	178	-1.1	-0.2	

Hydrant Test Data Sheet - Calibration Results

								Field Results				Model Results				Comparison		
Test No.	Pressure Zone	Date	Time	Hydrant	Hydrant Number	Recorded Flow (gpm)	Adjusted Flow (gpm)	Static Pressure (psi)	Static HGL (FT)	Res. Pressure (psi)	Res. HGL (FT)	Static Pressure (psi)	Static HGL (FT)	Residual Pressure (psi)	Res. HGL (FT)	Static Pressure Diff (psi)	Res. Pressure Diff (psi)	Calibration Comments
16	Valley 196 Zone	27-Jun	9:15	F1	HYD-S-00057	1300	3330											
				P1	HYD-S-00215			75	203	70	191	72	197	67	183	2.6	3.4	
				P2	HYD-S-00064			70	193	67	186	72	197	67	186	-1.5	0.3	
16.2	Valley 196 Zone	27-Jun	9:15	F1	HYD-S-00057	920	2360											
				F2	HYD-S-00620	1000	2560											
				P1	HYD-S-00215			75	203	63	175	72	197	67	183	2.6	-3.6	
				P2	HYD-S-00064			71	196	60	170	72	197	67	186	-0.5	-6.7	
17	Valley 196 Zone	27-Jun	9:40	F1	HYD-N-00056	530	1360											
				P1	HYD-N-00247			75	204	71	195	72	197	71	194	3.0	0.4	
				P2	HYD-N-00051			70	193	68	188	72	197	71	194	-1.6	-2.6	
18	West Hill 300	27-Jun	8:50	F1	HYD-NW-00019	1190	3050											
				P1	HYD-NW-00069			70	308	55	274	68	303	53	267	2.5	2.8	
				P2	HYD-NW-00014			98	306	75	253	97	303	72	246	1.5	2.9	
19	West Hill 495	27-Jun	8:30	F1	HYD-NW-00045	1400	Gage on 2.5" port											
				P1	HYD-NW-00050			100	497	80	451	97	487	82	452	4.1	-0.5	
				P2	HYD-NW-00046			90	488	80	465	88	487	81	471	0.5	-2.5	
20	Earlington 370 Zone	27-Jun	9:10	F1	HYD-SW-00900	1190	3050											
				P1	HYD-SW-00568			75	382	65	359	77	386	60	347	-1.9	5.0	
				P2	HYD-SW-00013			124	375	110	343	129	387	112	347	-5.2	-1.4	


Residual Pressure Results
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Model Results Pressure (psi)
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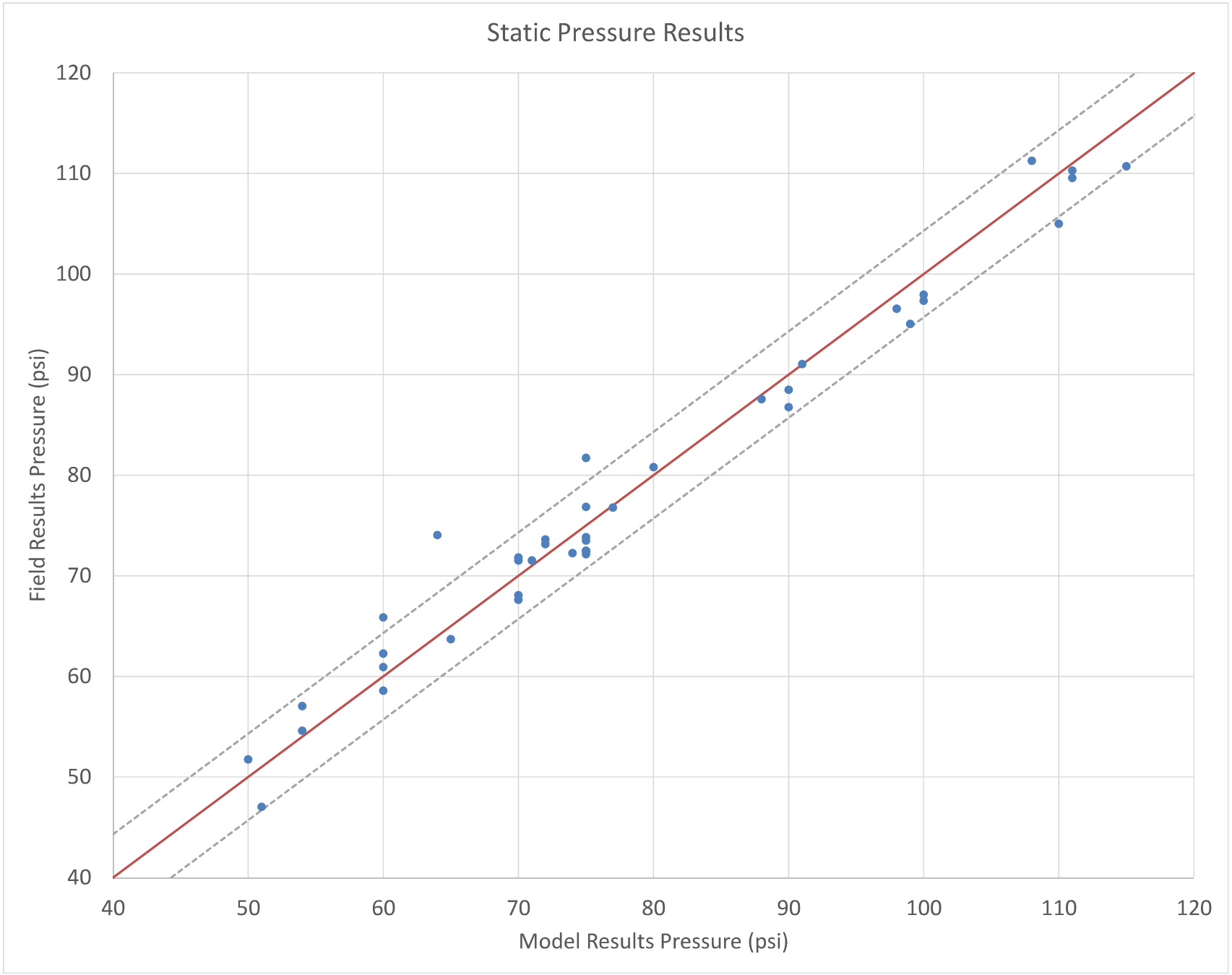
100
110
120


Static Pressure Results
Field Results Pressure (psi)
Model Results Pressure (psi)
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70
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90
100
110
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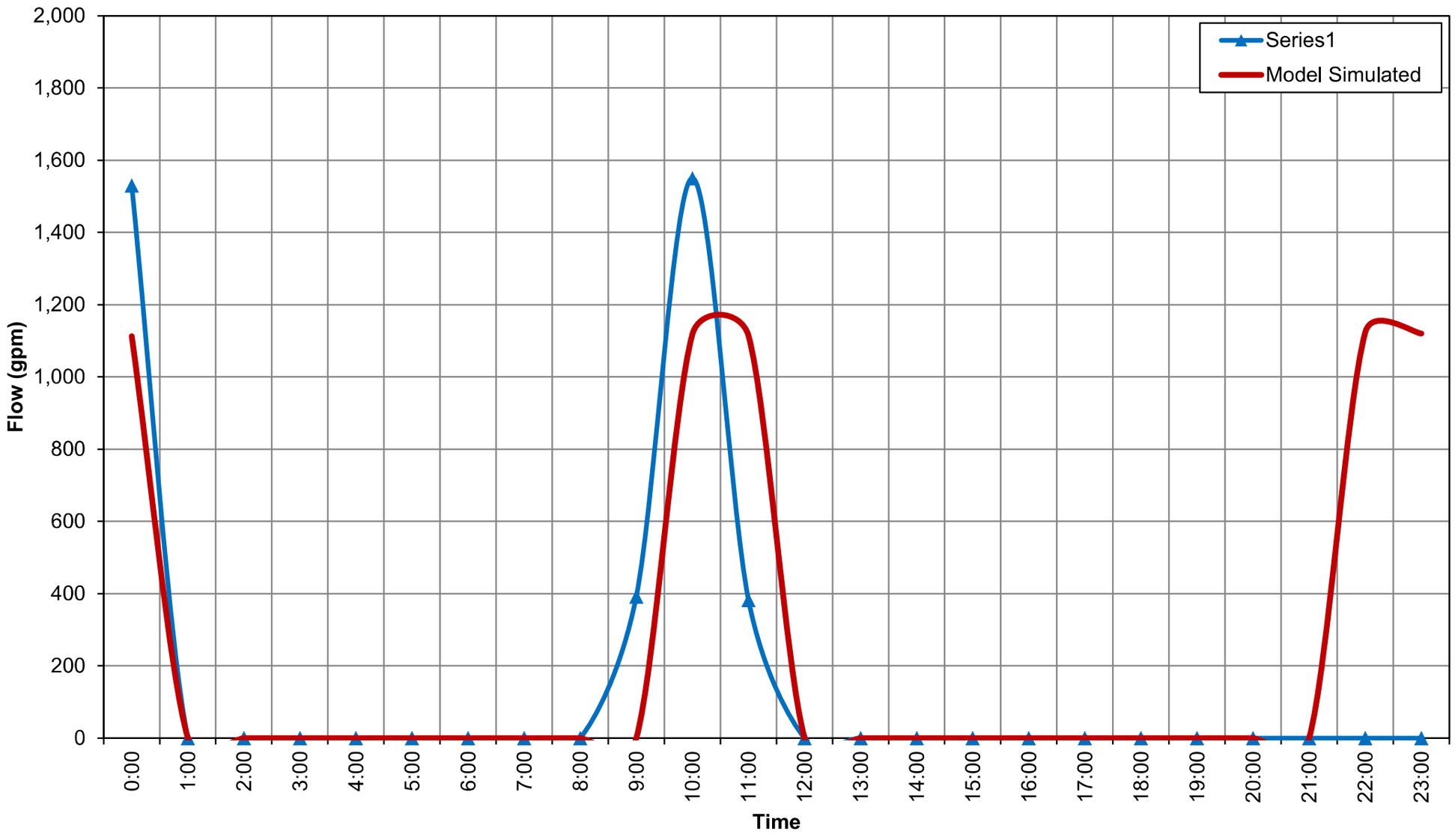
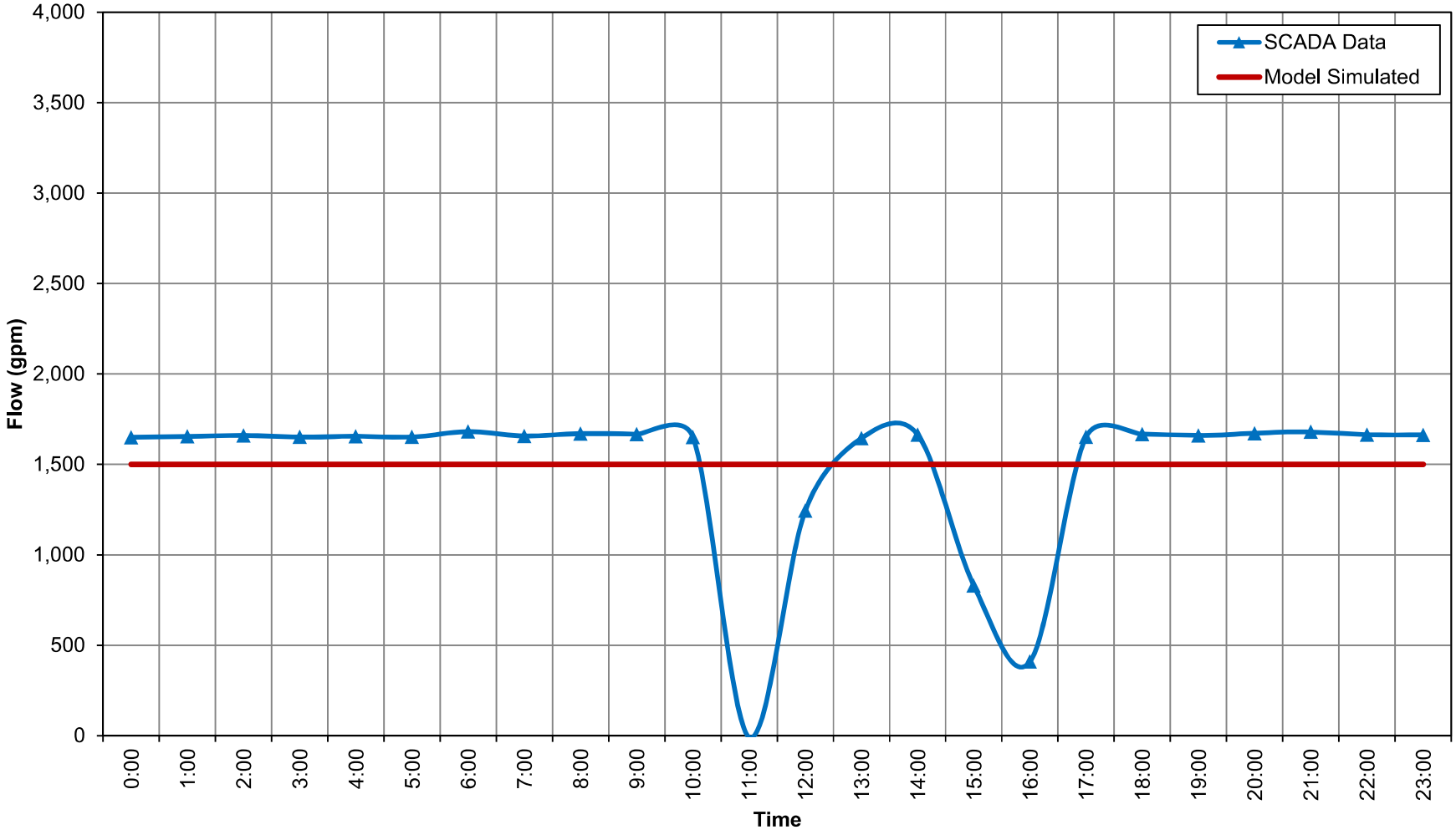
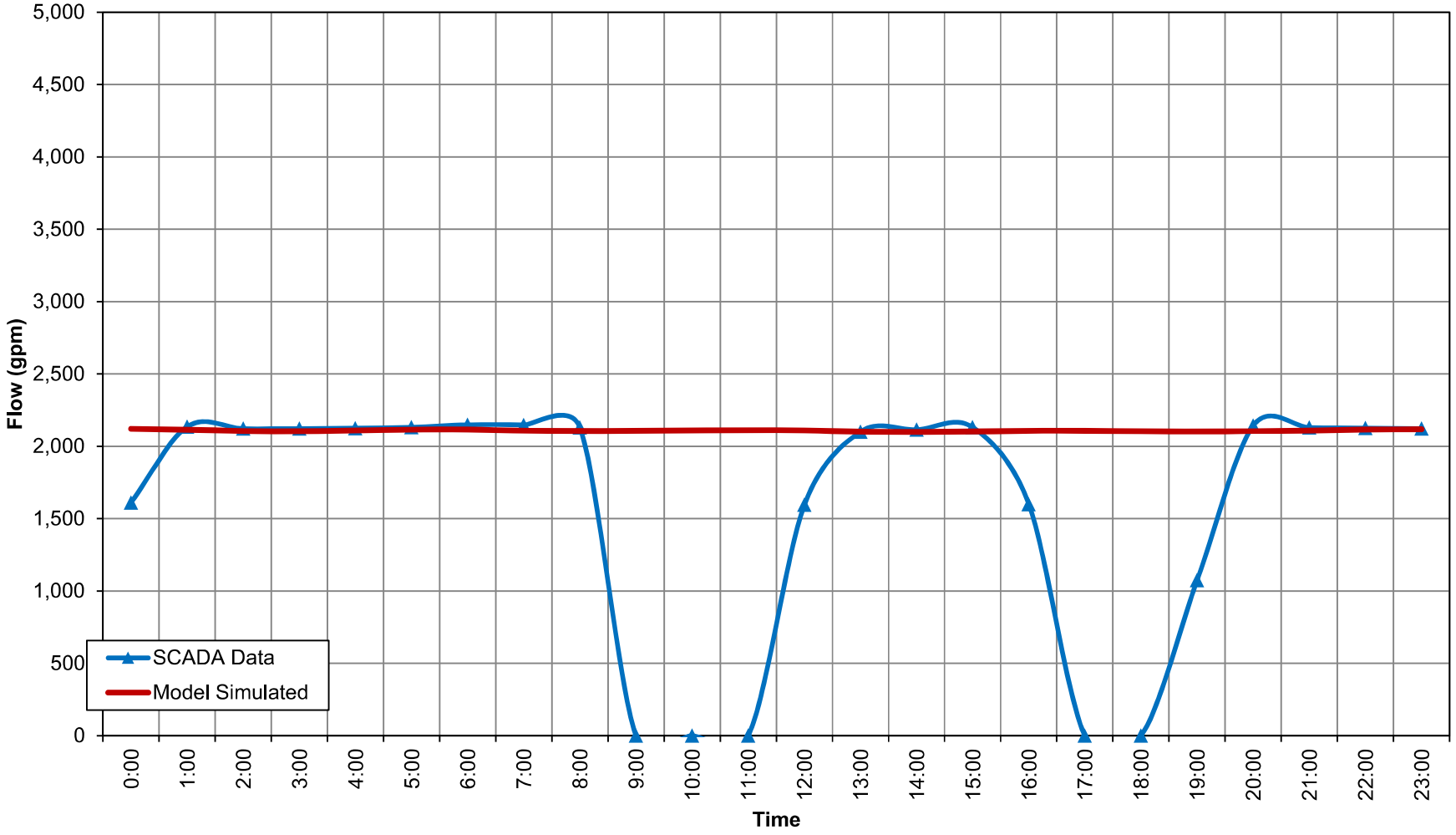
EPS Calibration - Highlands BPS
Renton Water System Plan Update
City of Renton



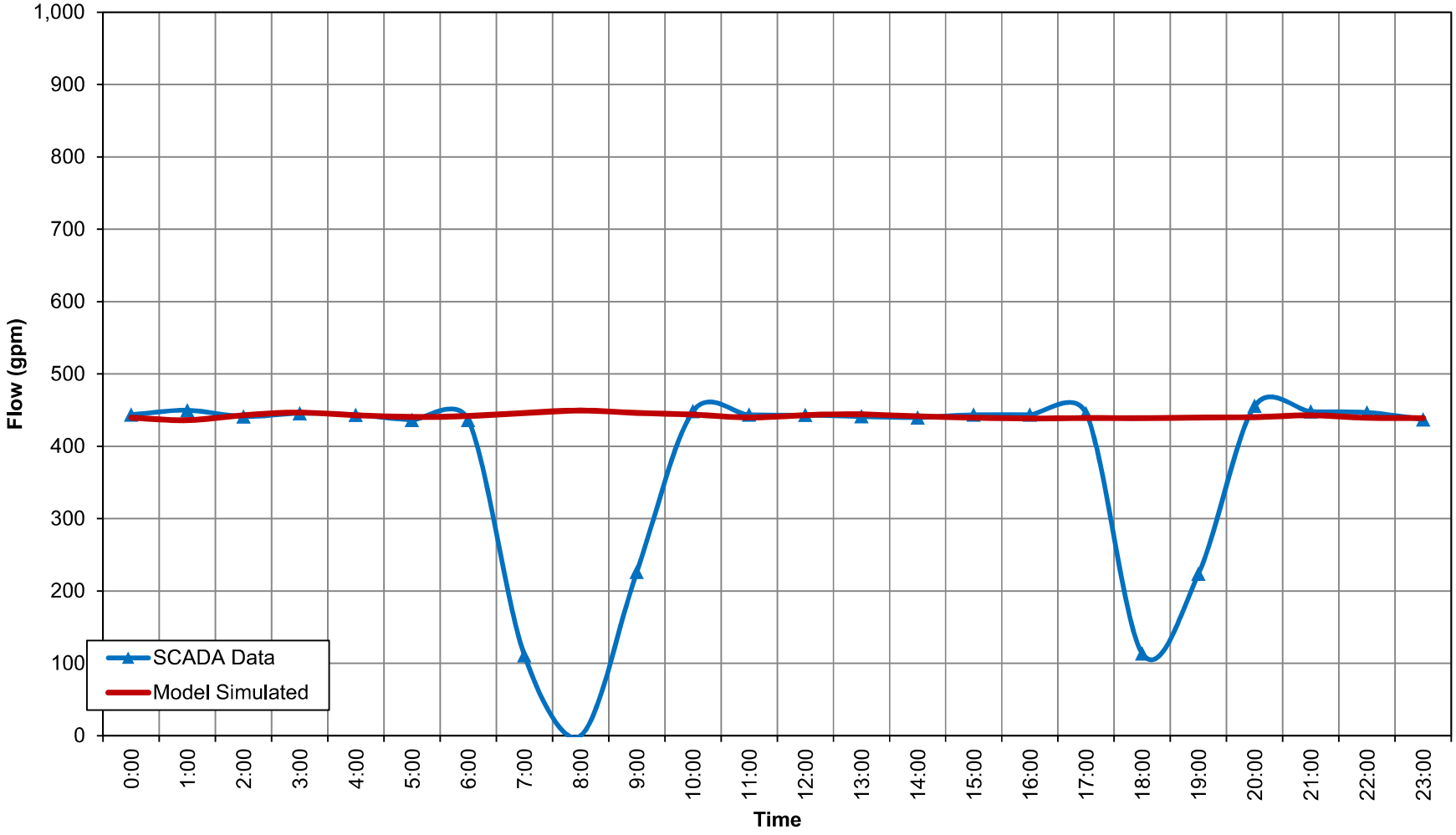
EPS Calibration - Maplewood 565 BPS
Renton Water System Plan Update
City of Renton



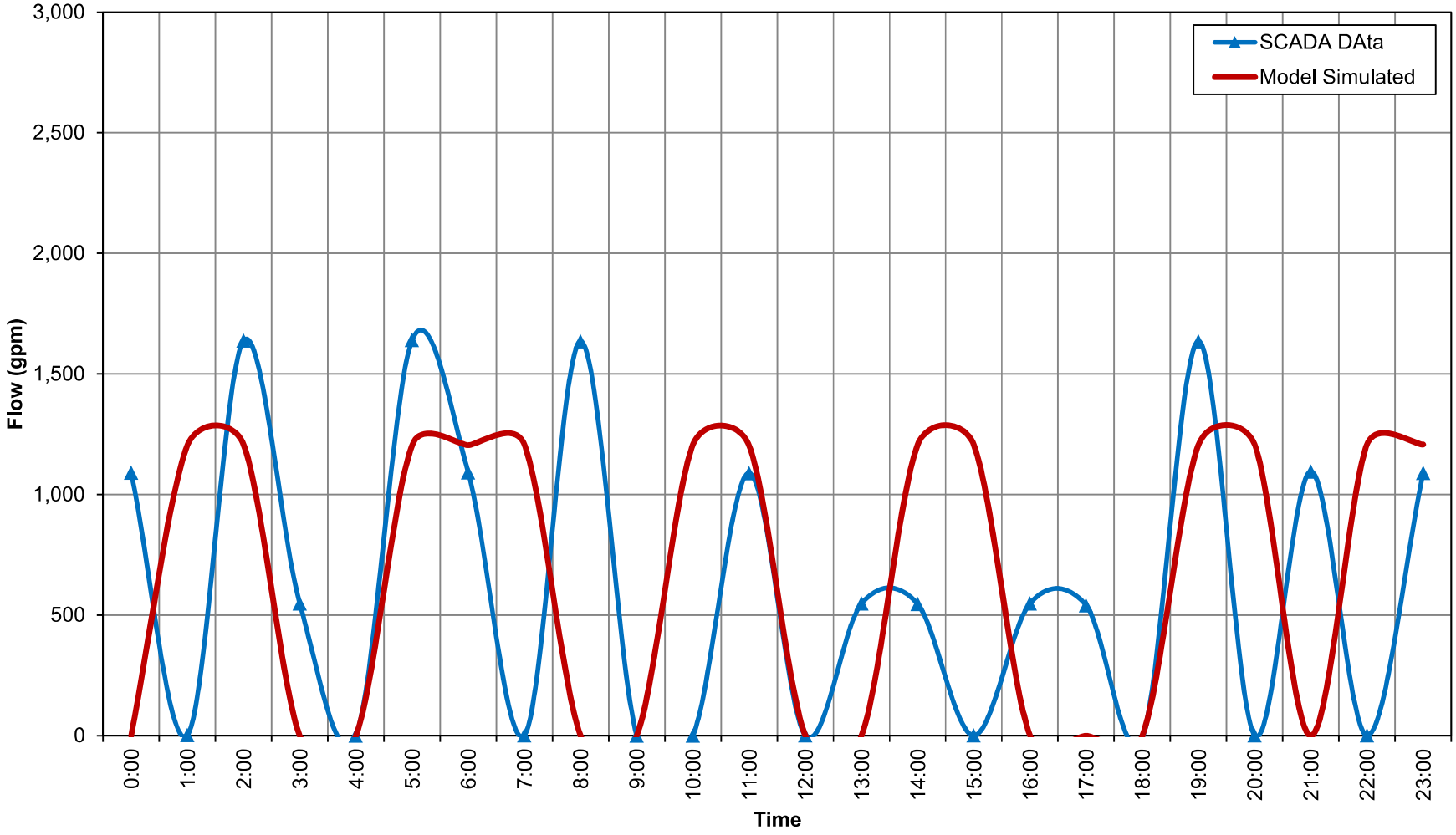
EPS Calibration - Mt. Olivet BPS
Renton Water System Plan Update
City of Renton



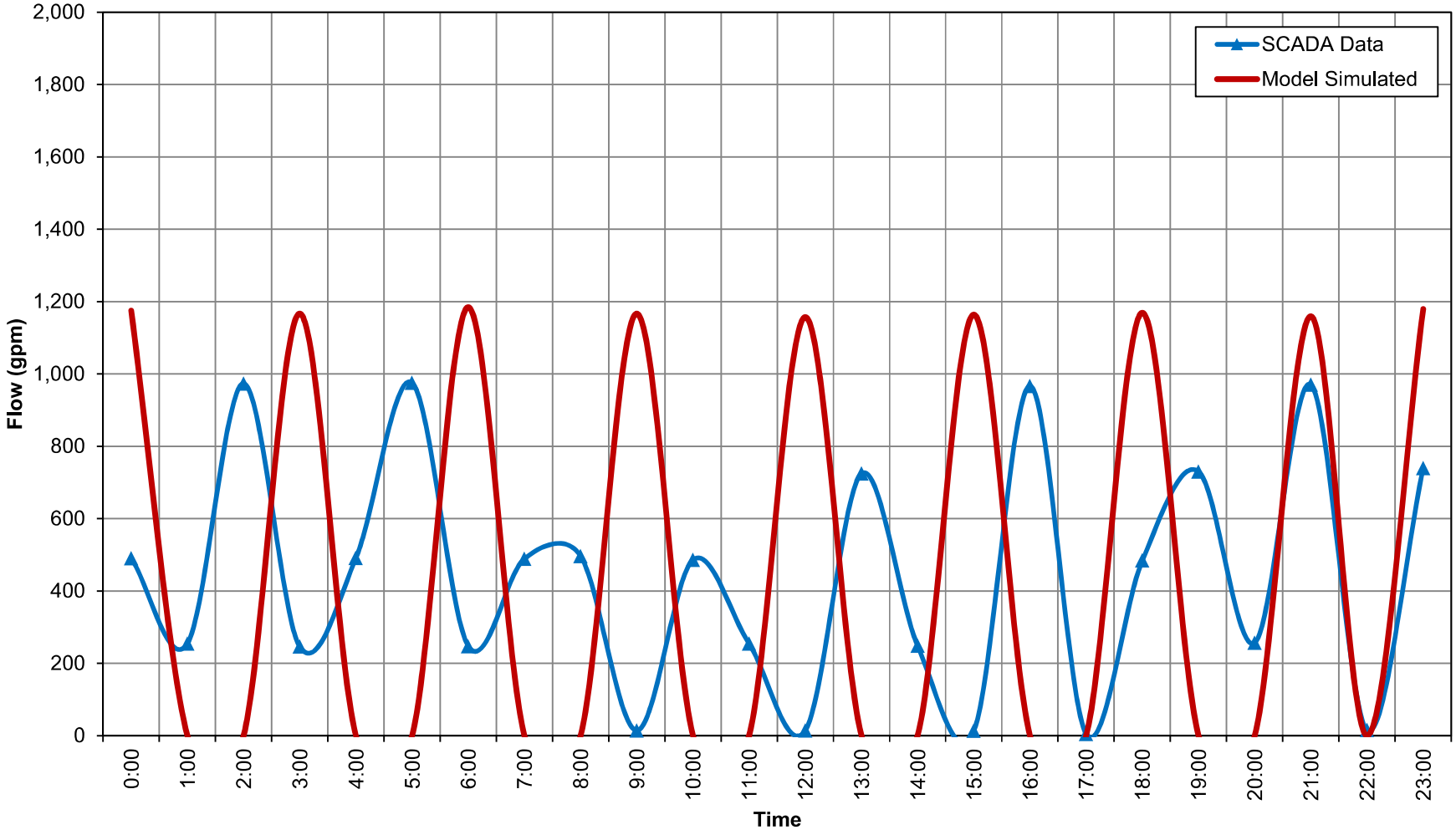
EPS Calibration - N Talbot Hill 350 BPS
Renton Water System Plan Update
City of Renton



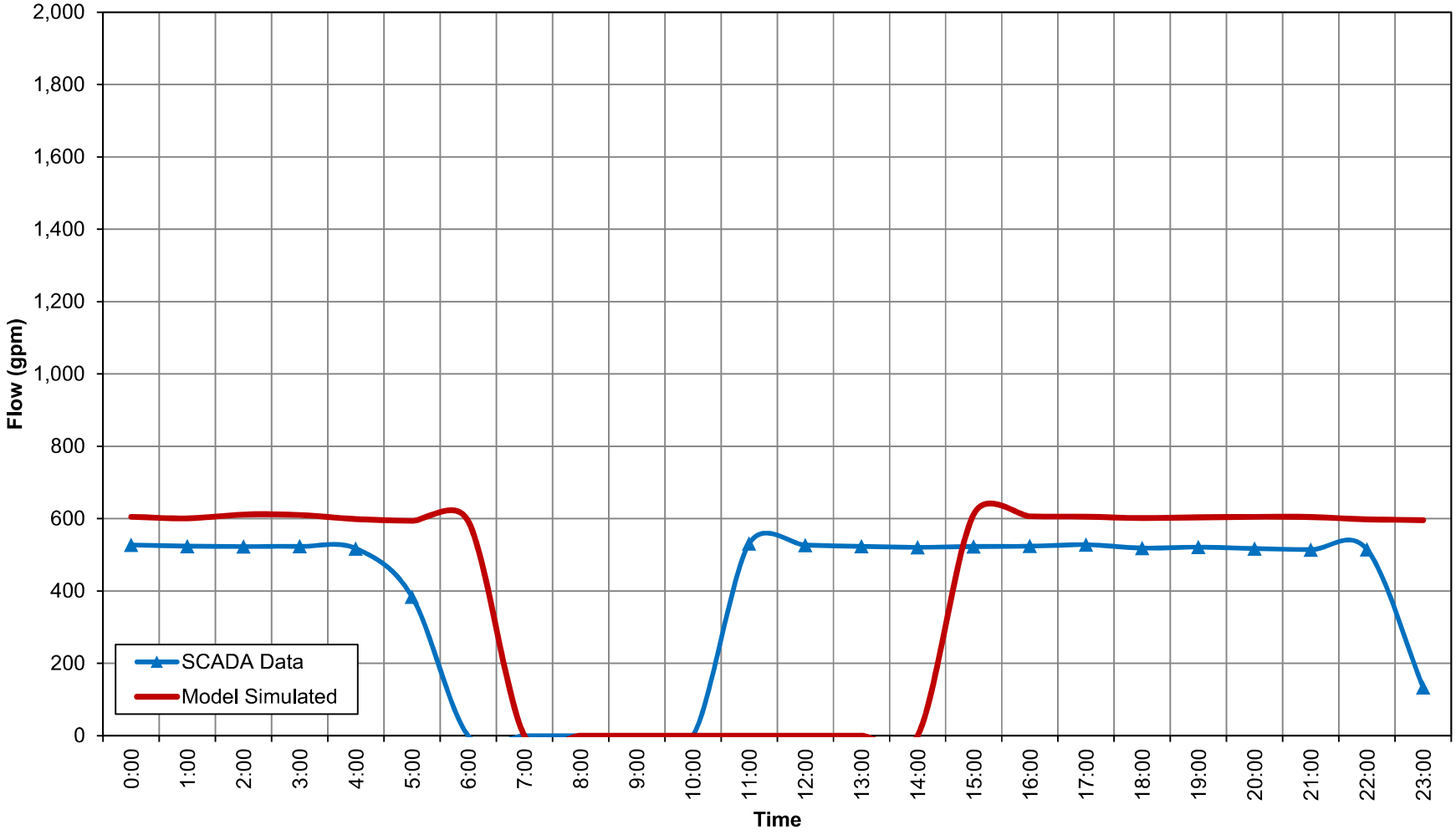
EPS Calibration - N Talbot Hill 490 BPS
Renton Water System Plan Update
City of Renton



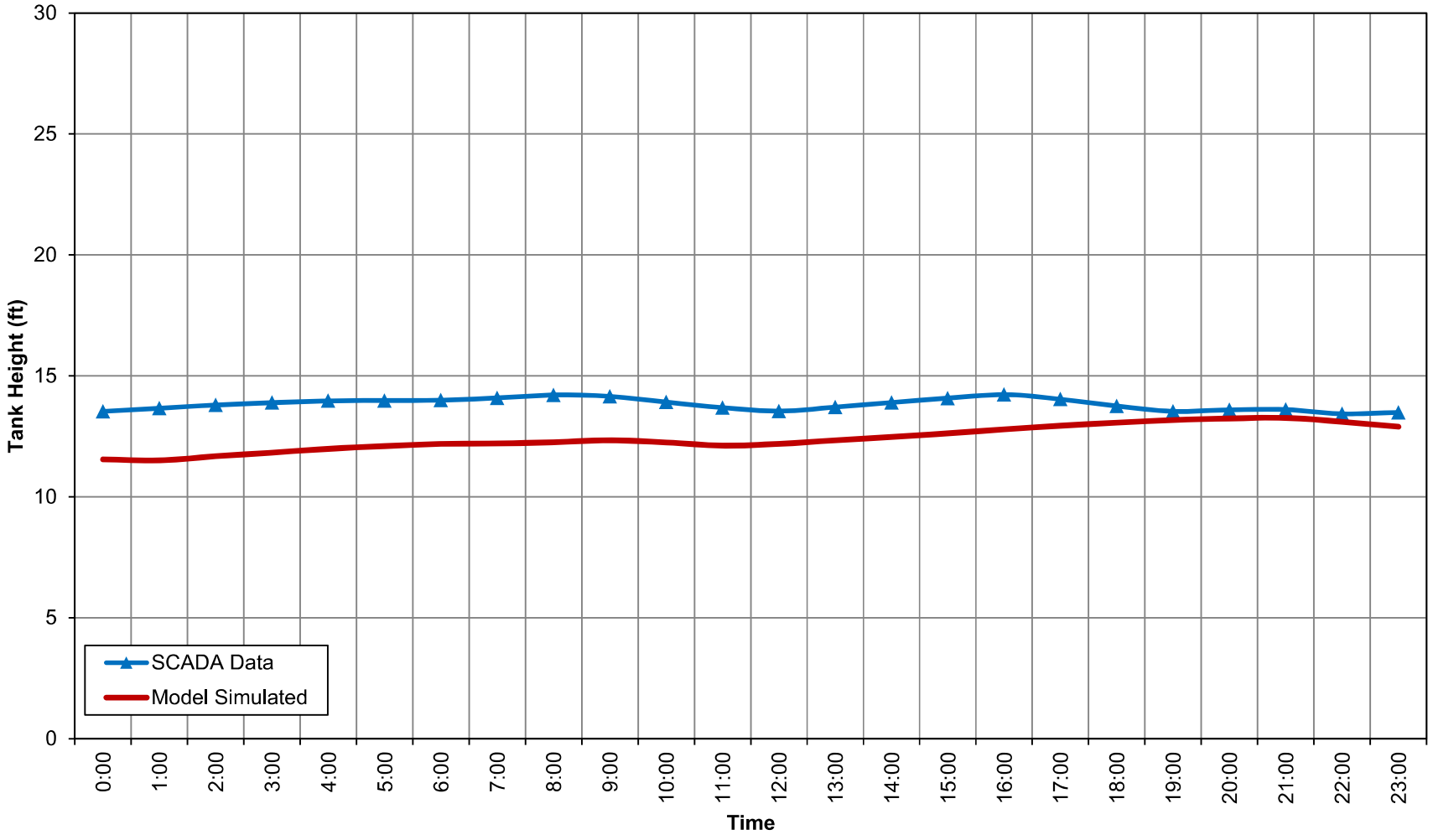
EPS Calibration - Rolling Hills BPS
Renton Water System Plan Update
City of Renton



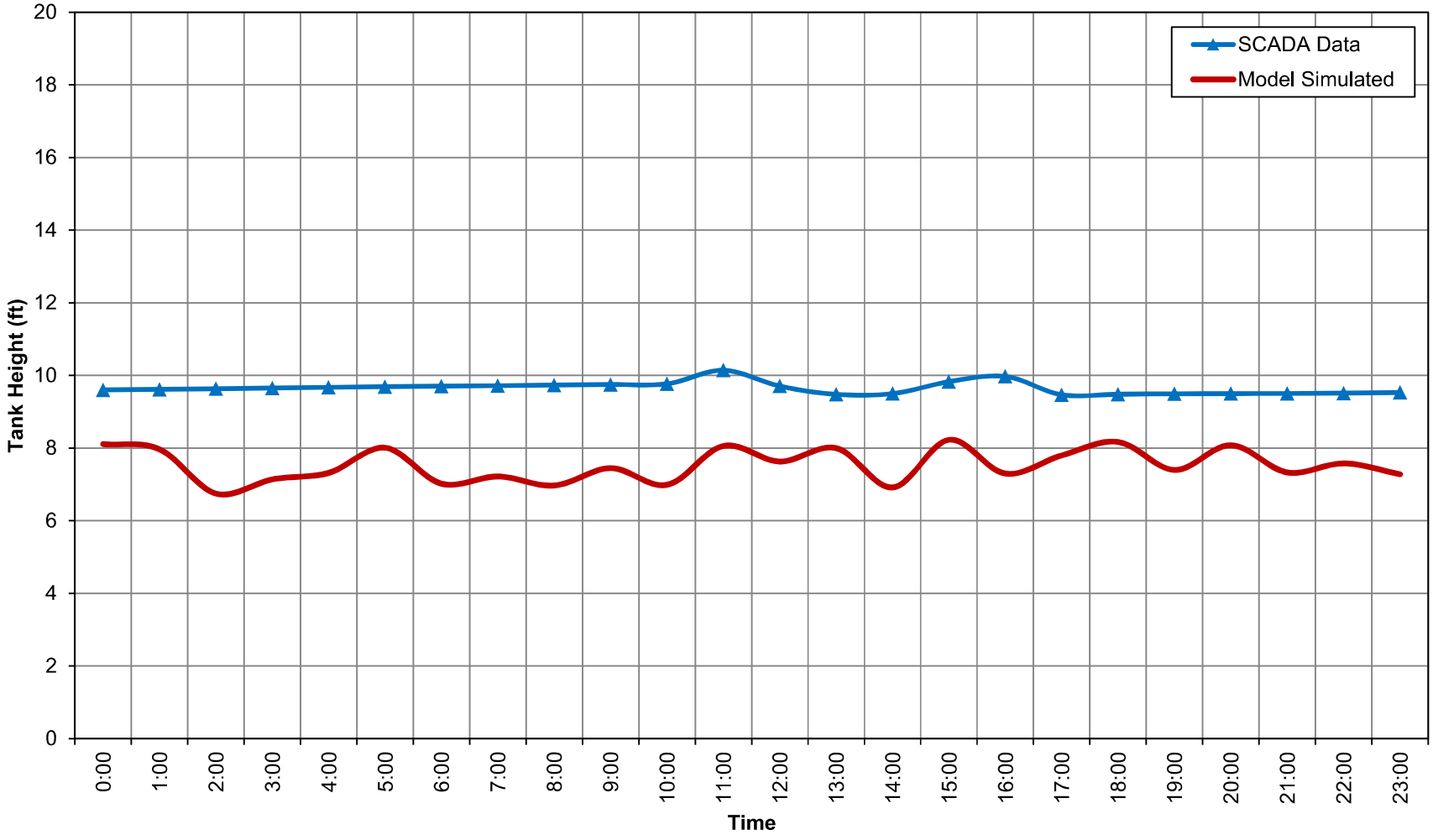
EPS Calibration - West Hill BPS
Renton Water System Plan Update
City of Renton



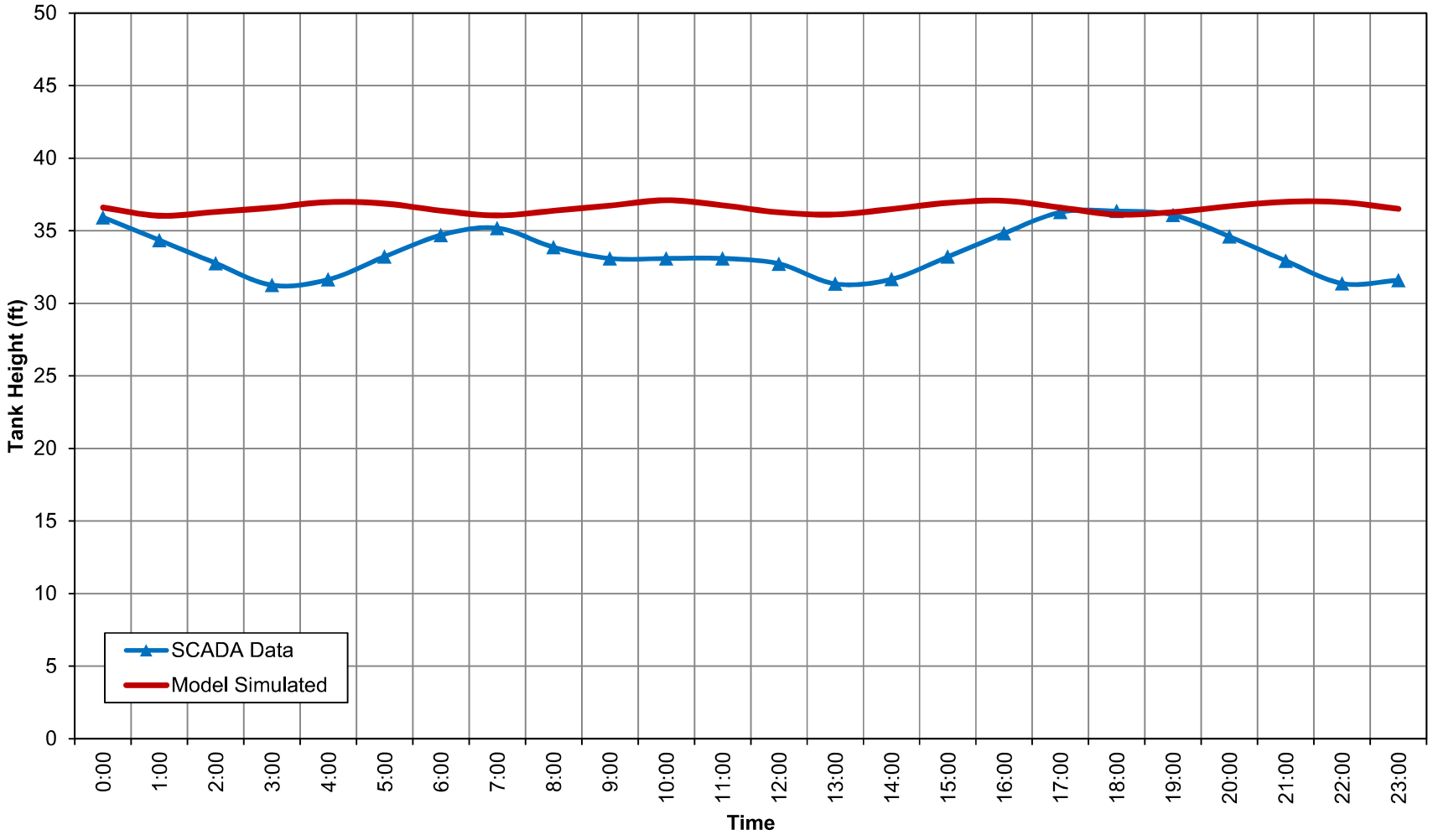
EPS Calibration - Highlands 435 Res
Renton Water System Plan Update
City of Renton



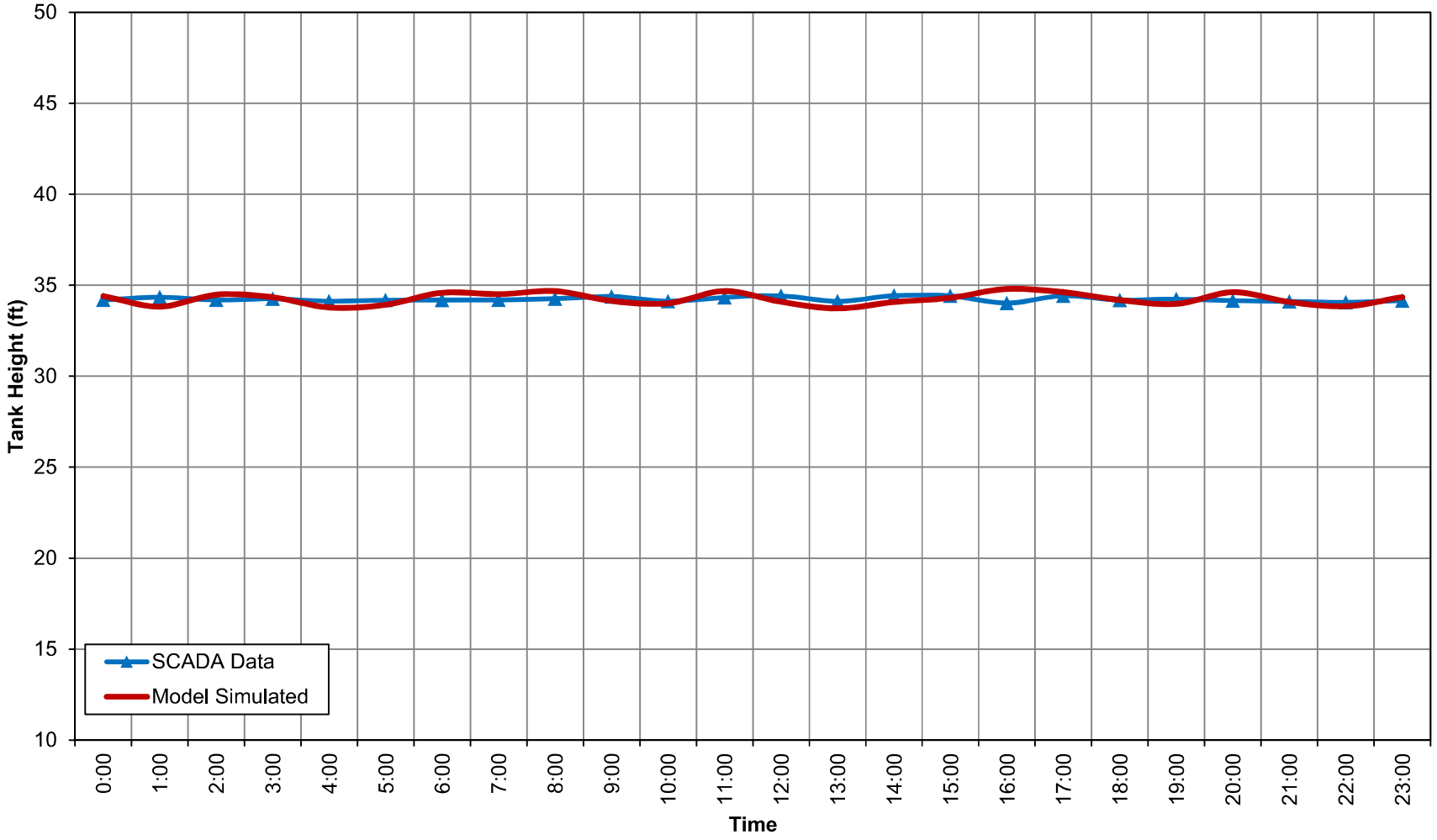
EPS Calibration - Maplewood Clearwell
Renton Water System Plan Update
City of Renton



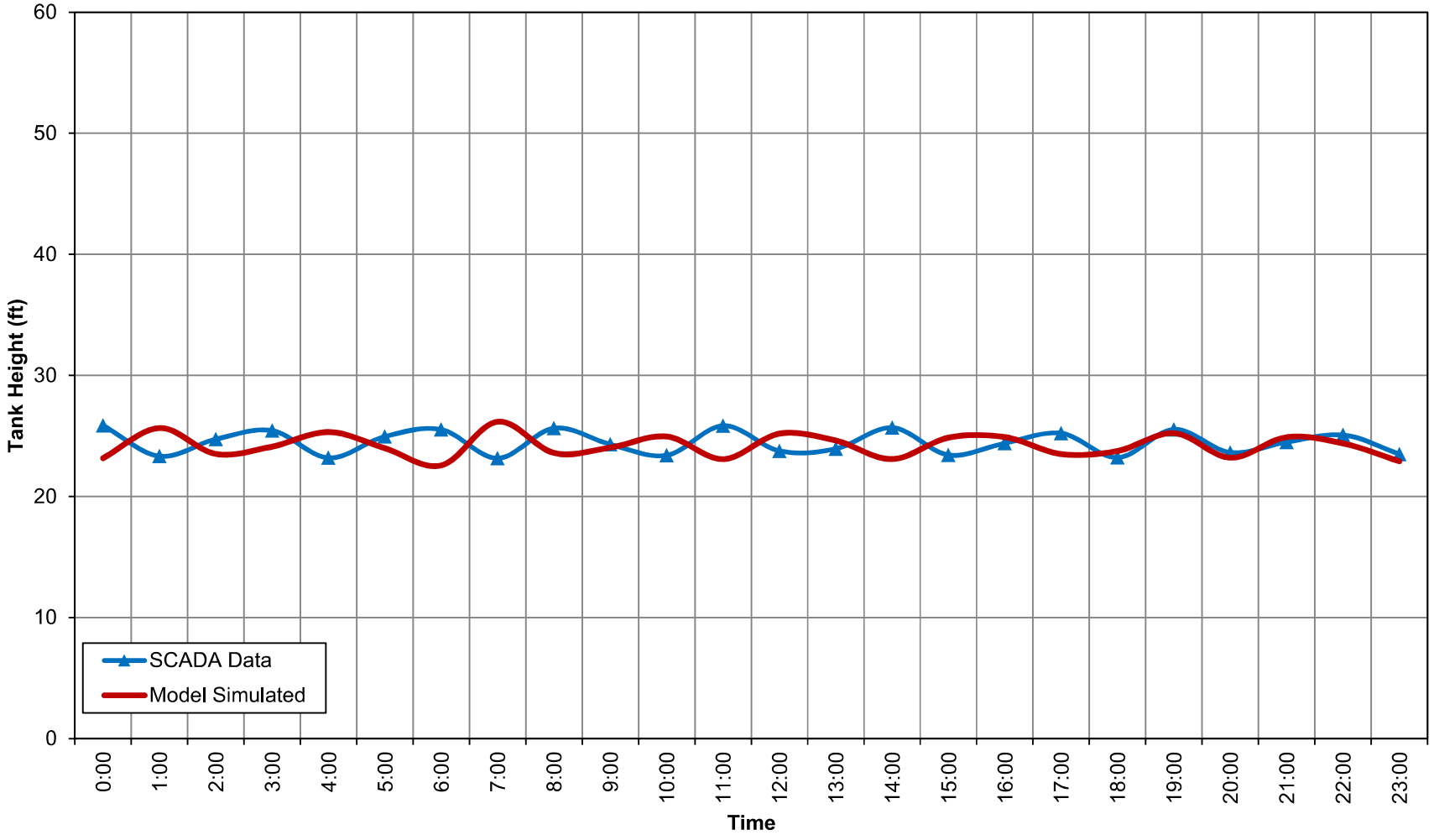
EPS Calibration - Mt. Olivet Res
Renton Water System Plan Update
City of Renton



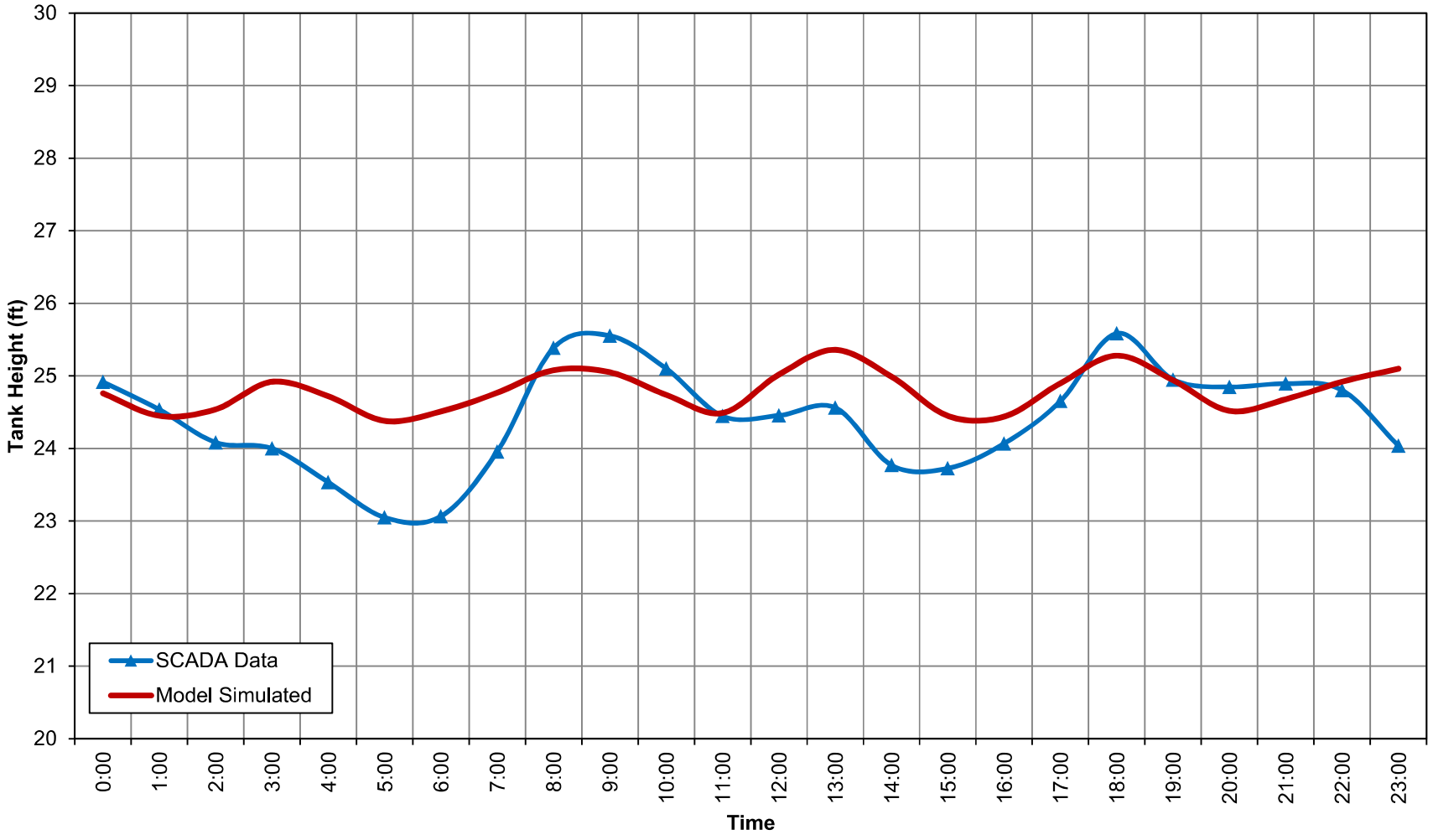
EPS Calibration - Rolling Hills 490 Res
Renton Water System Plan Update
City of Renton



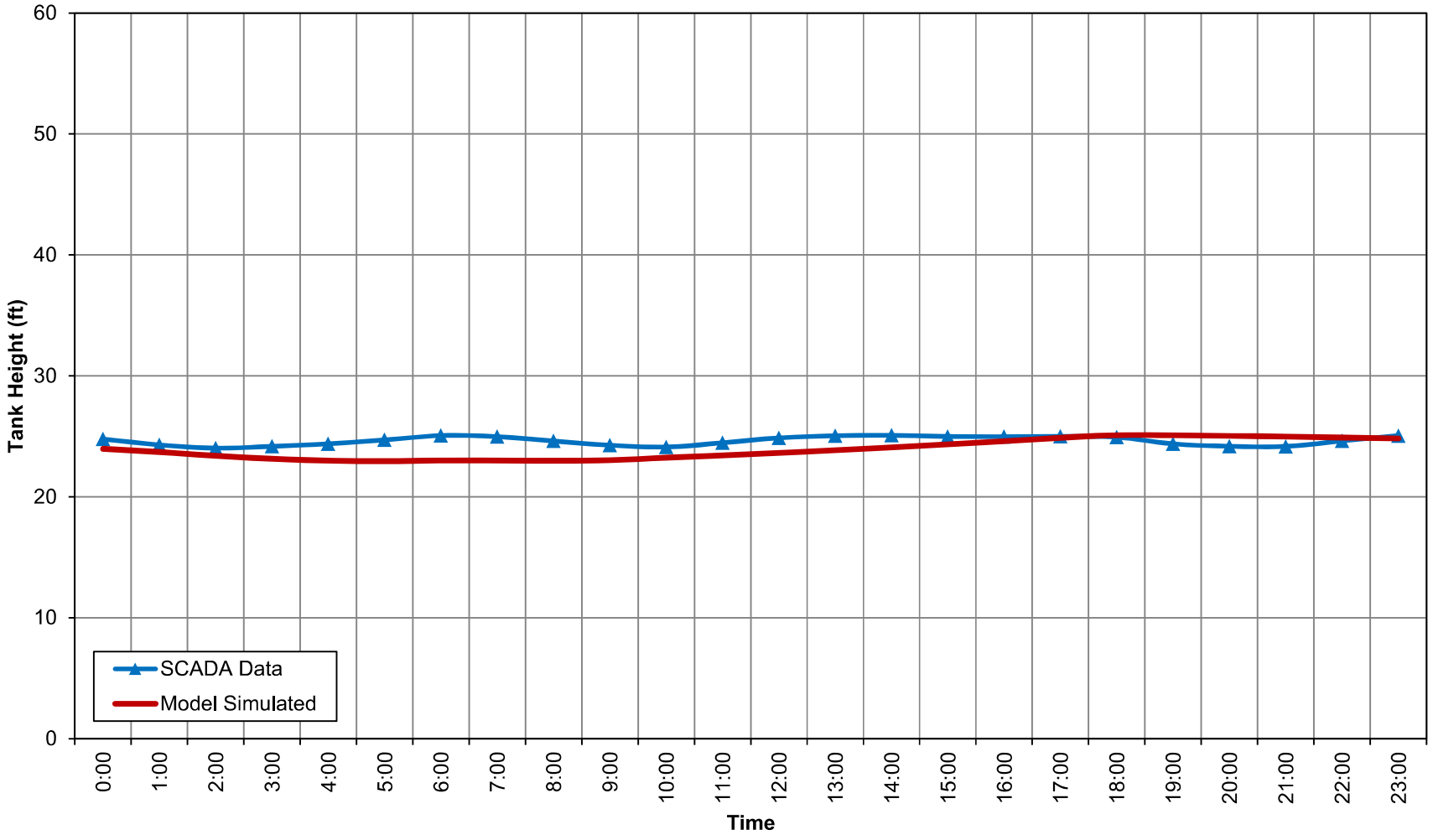
EPS Calibration - Rolling Hills 590 Res
Renton Water System Plan Update
City of Renton



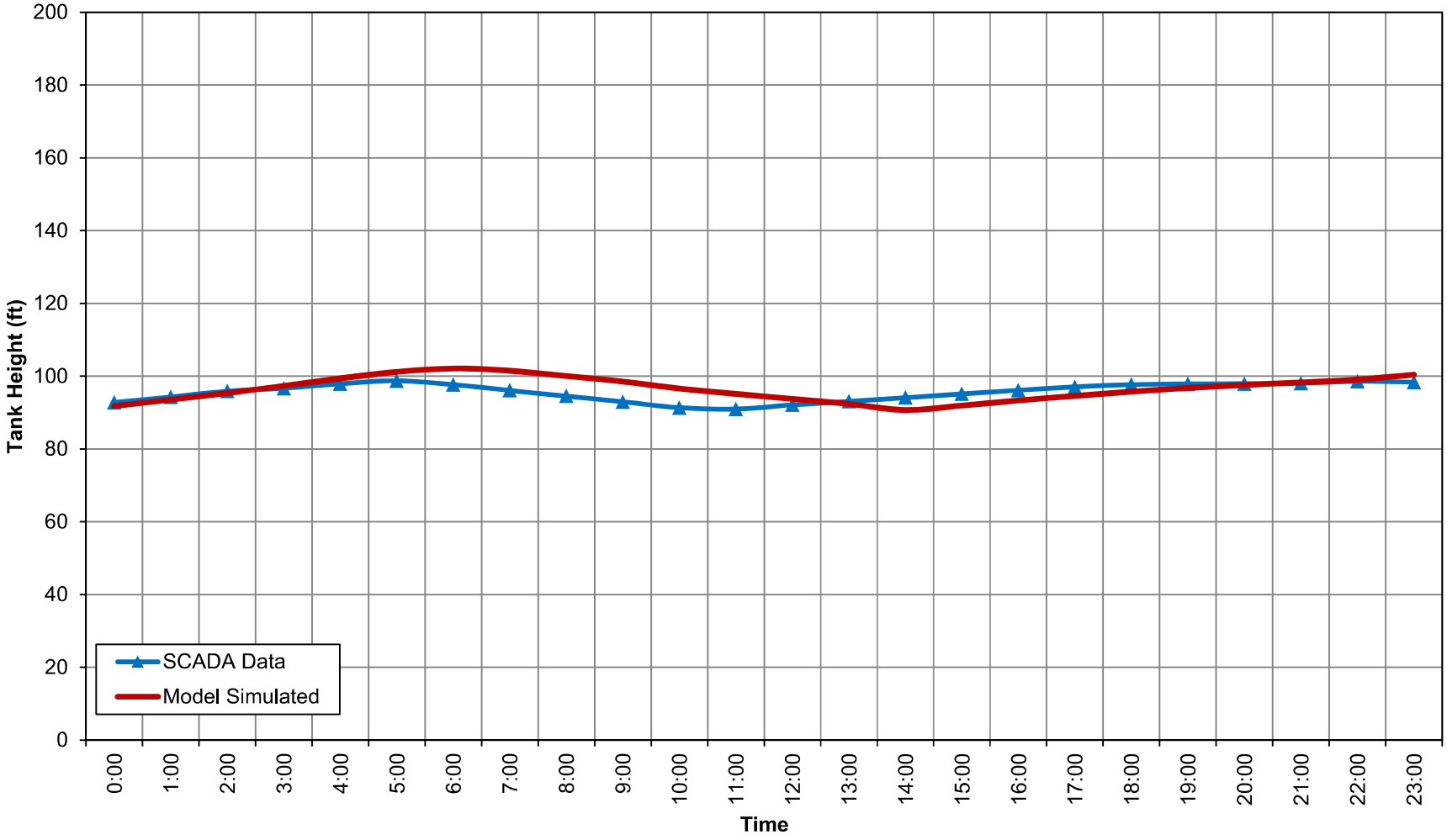
EPS Calibration - N Talbot Hill Res
Renton Water System Plan Update
City of Renton



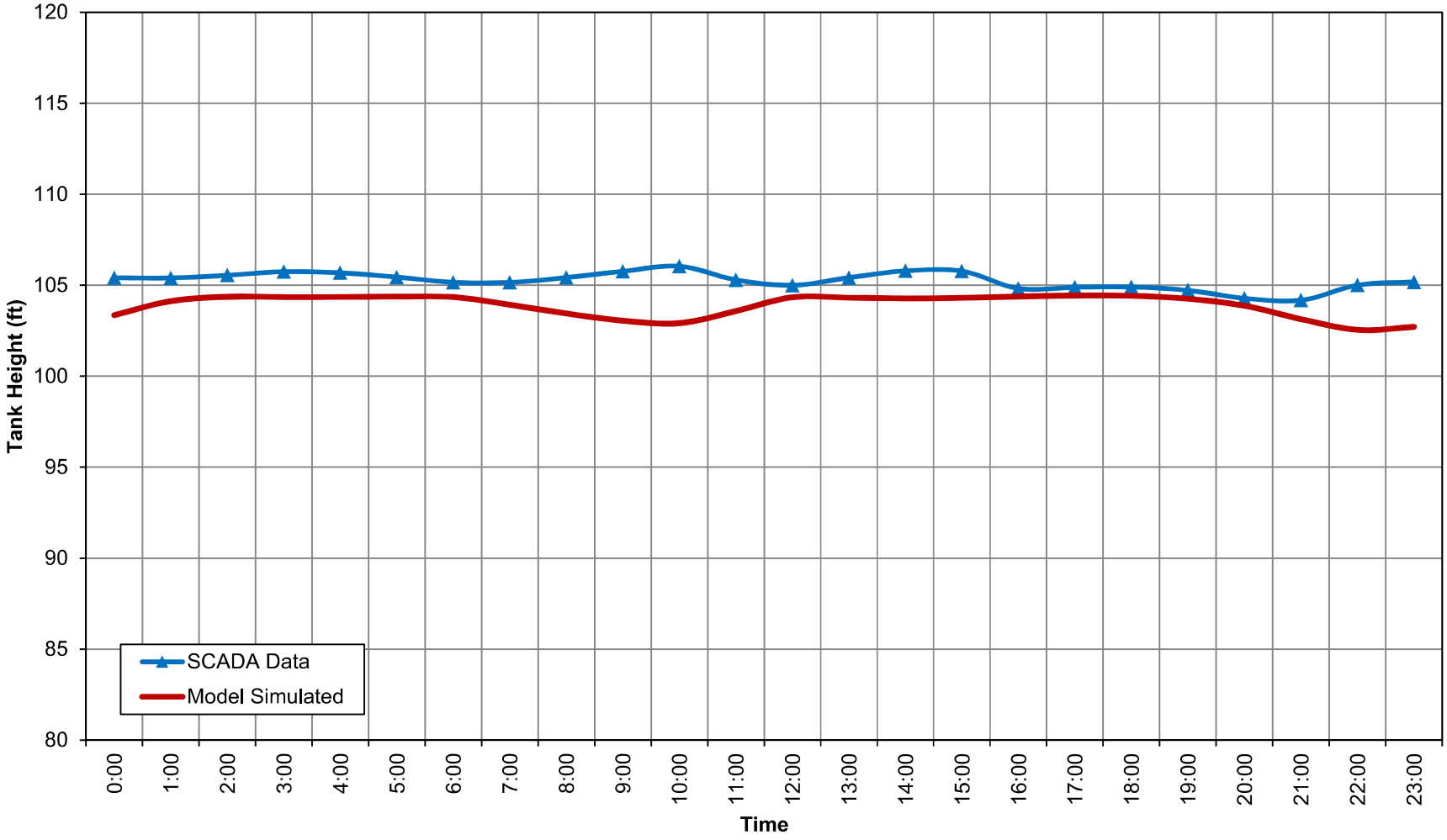
EPS Calibration - S Talbot Hill Res
Renton Water System Plan Update
City of Renton



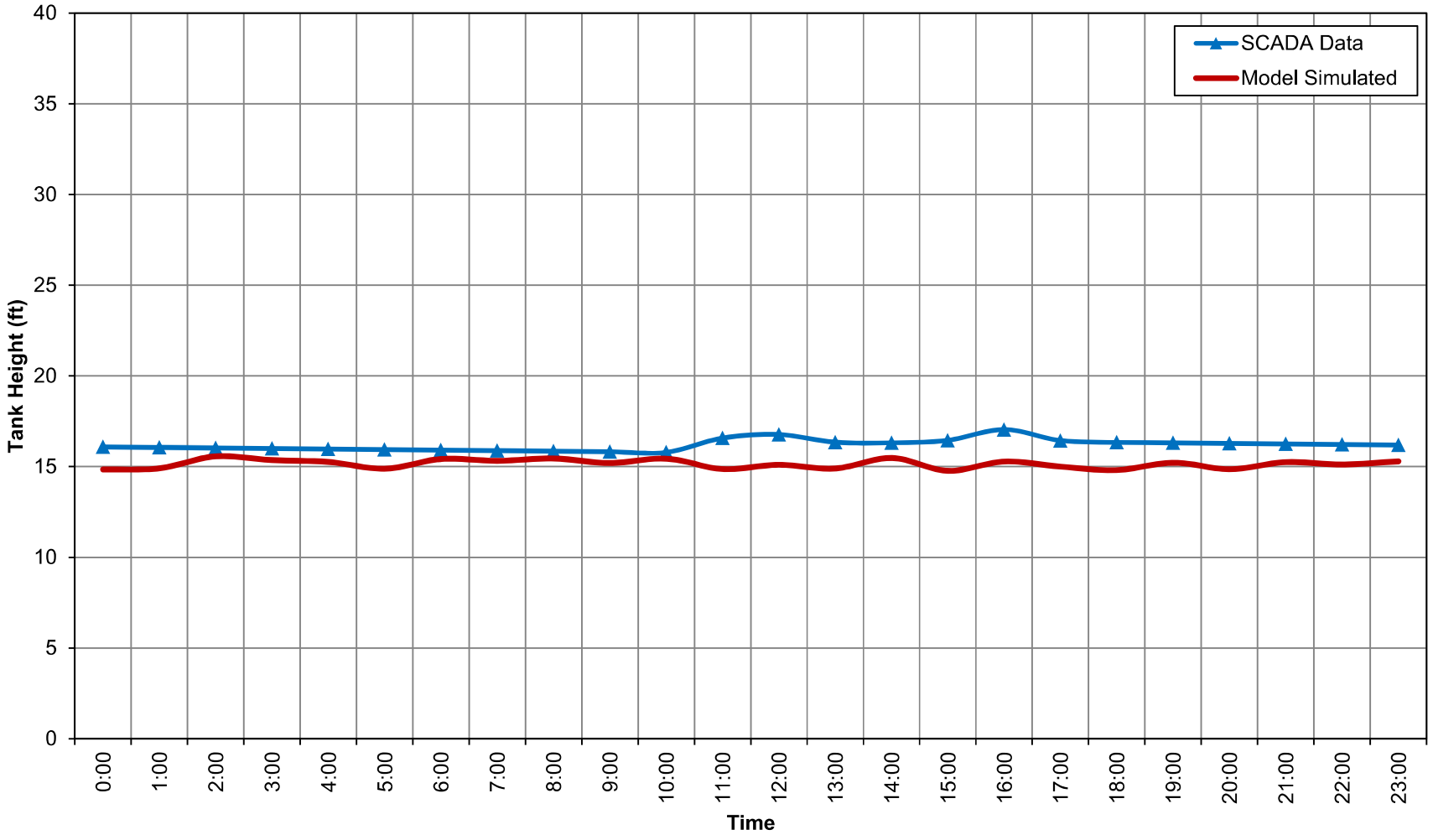
EPS Calibration - West Hill Res
Renton Water System Plan Update
City of Renton



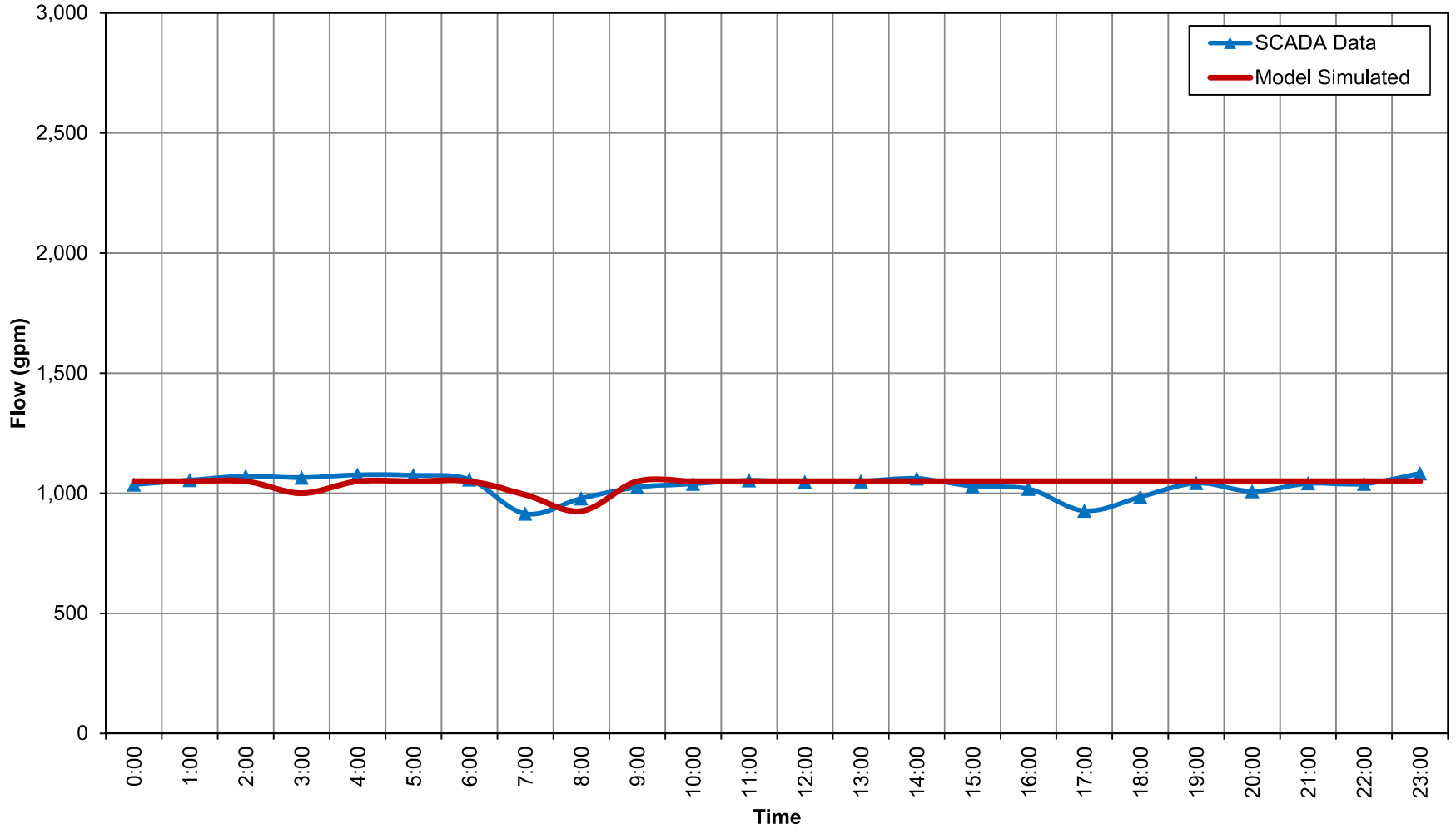
EPS Calibration - Hazen Res
Renton Water System Plan Update
City of Renton



EPS Calibration - Maplewood CI Contact Basin
Renton Water System Plan Update
City of Renton



EPS Calibration - Springbrook Spring
Renton Water System Plan Update
City of Renton



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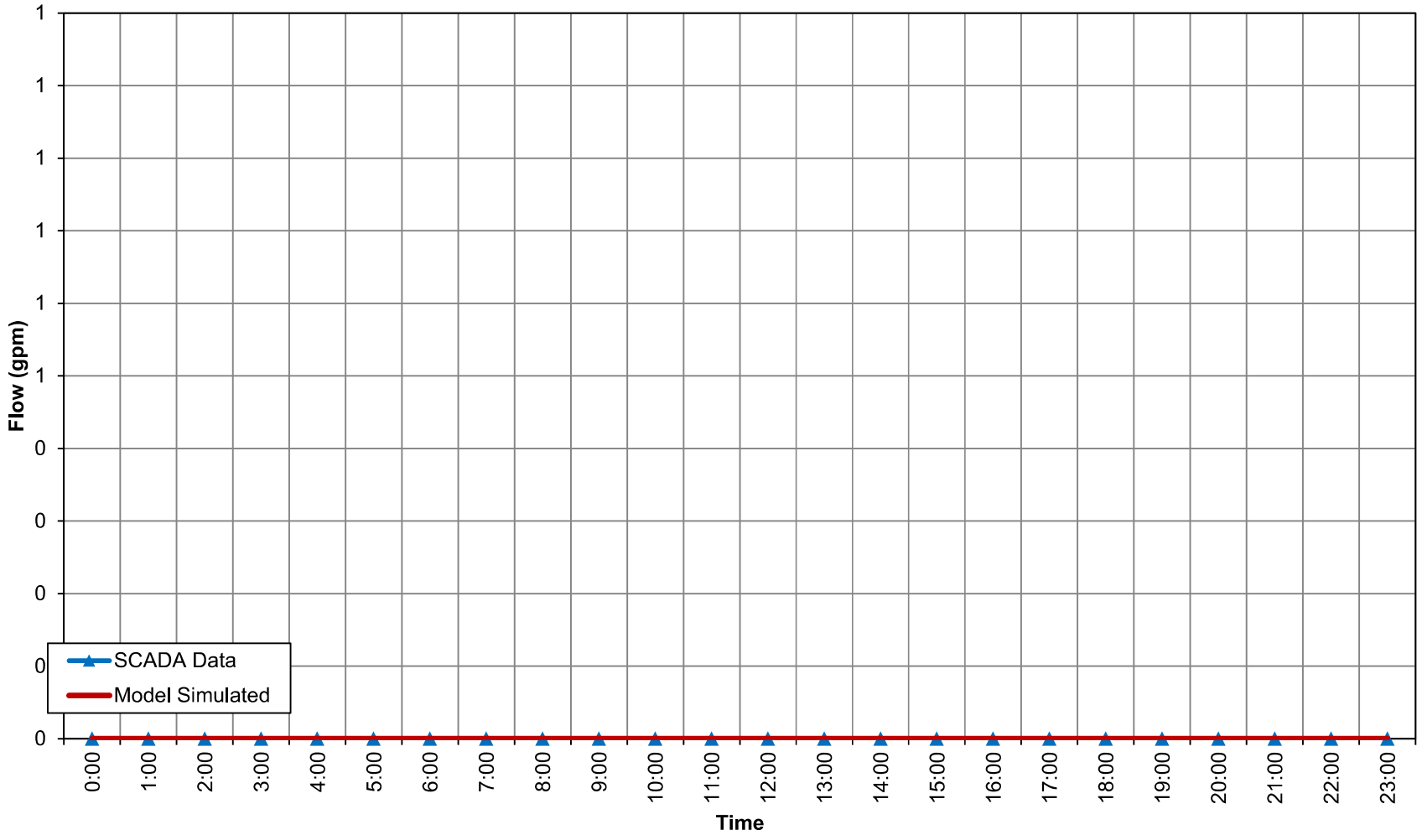
Renton Water System Plan Update
City of Renton



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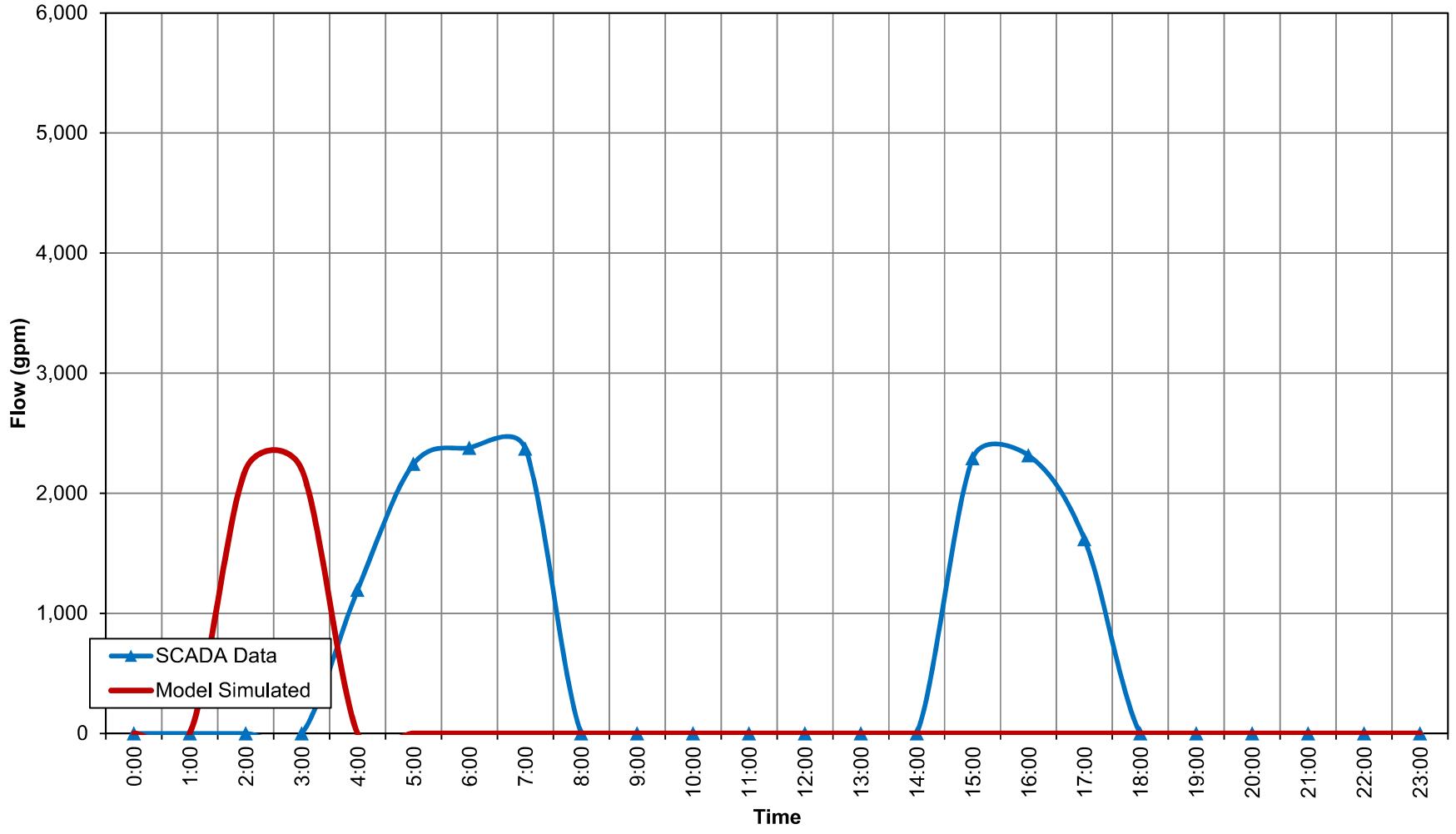
Renton Water System Plan Update
City of Renton



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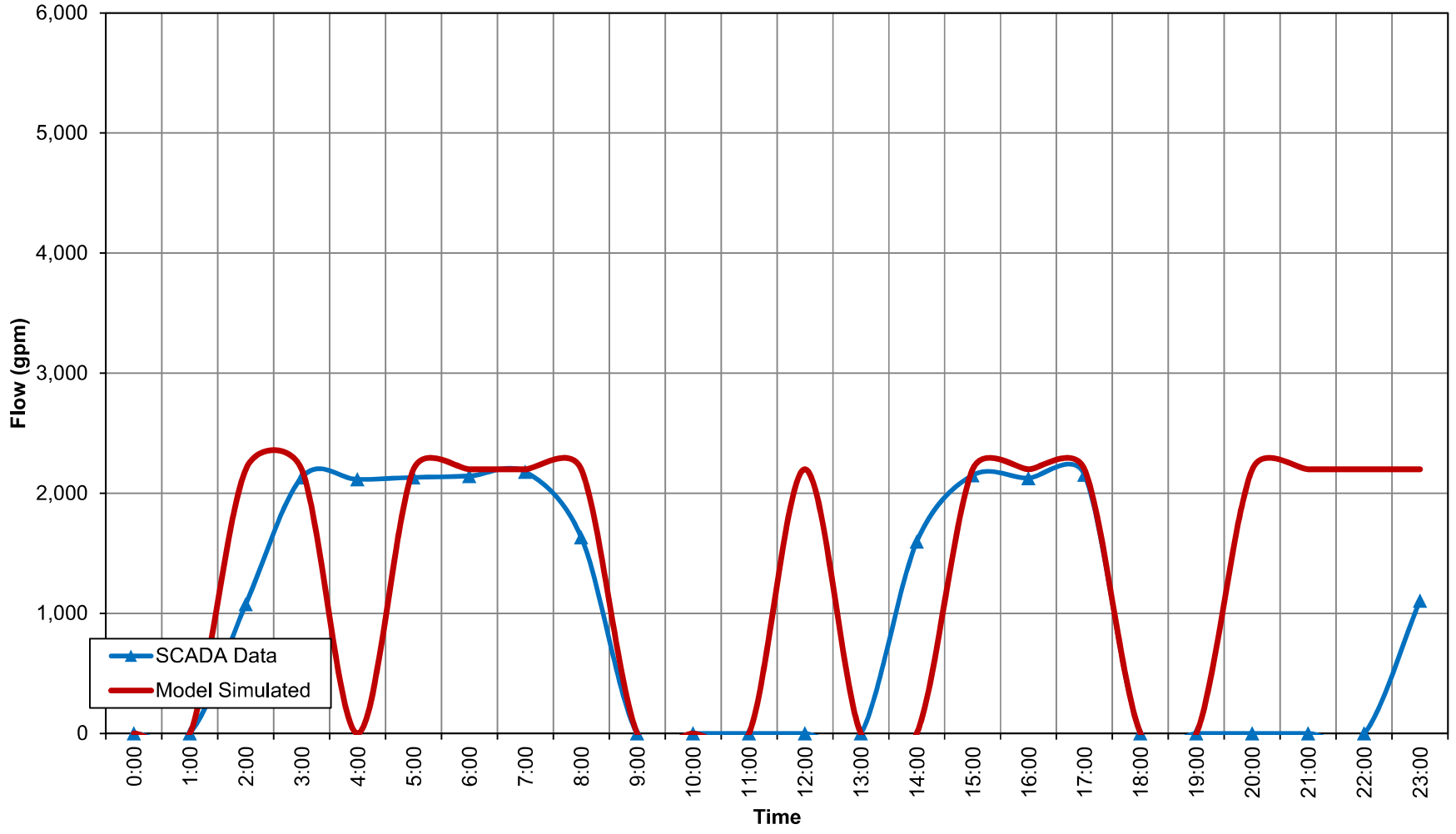
Renton Water System Plan Update
City of Renton



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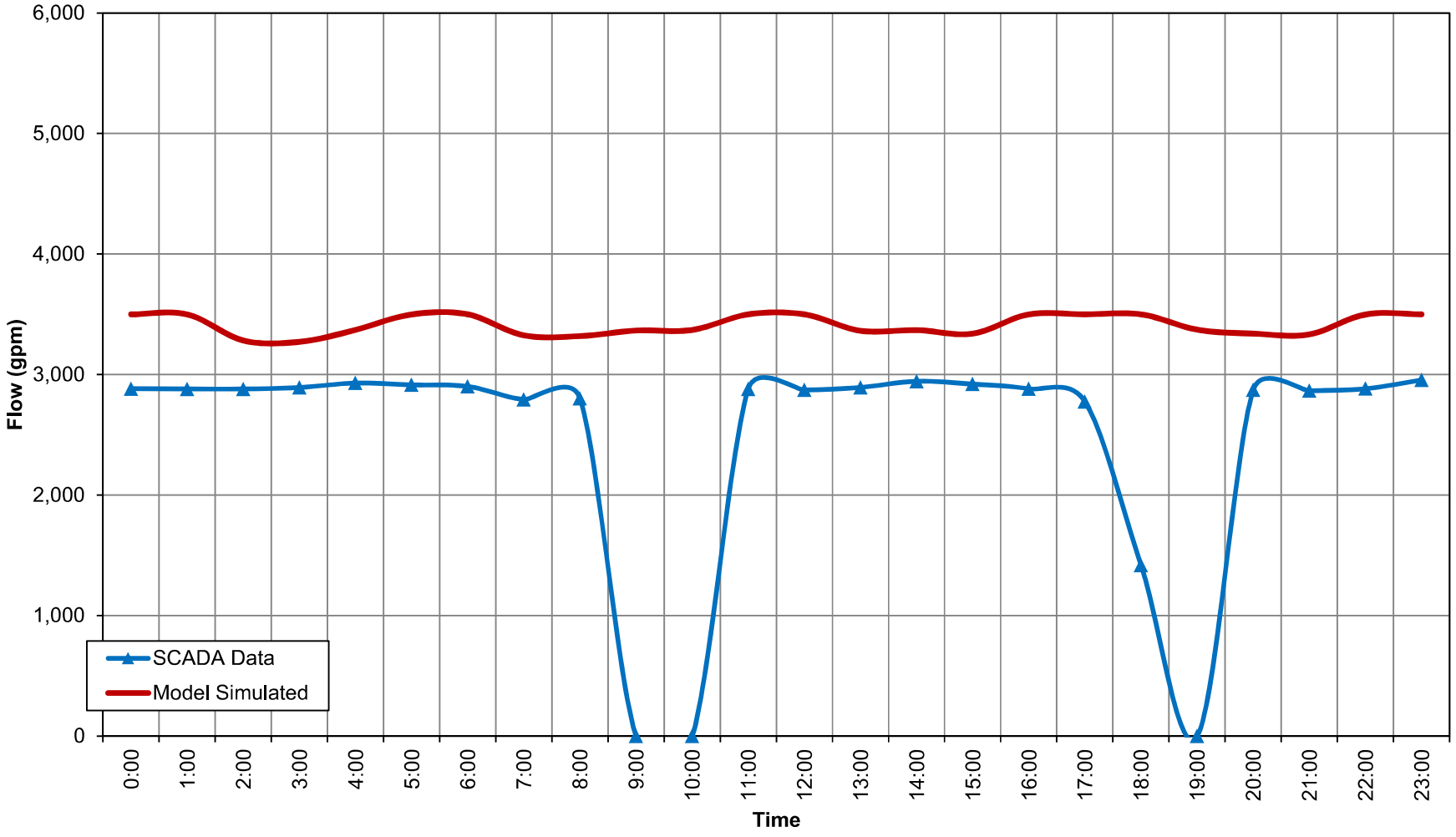
Renton Water System Plan Update
City of Renton



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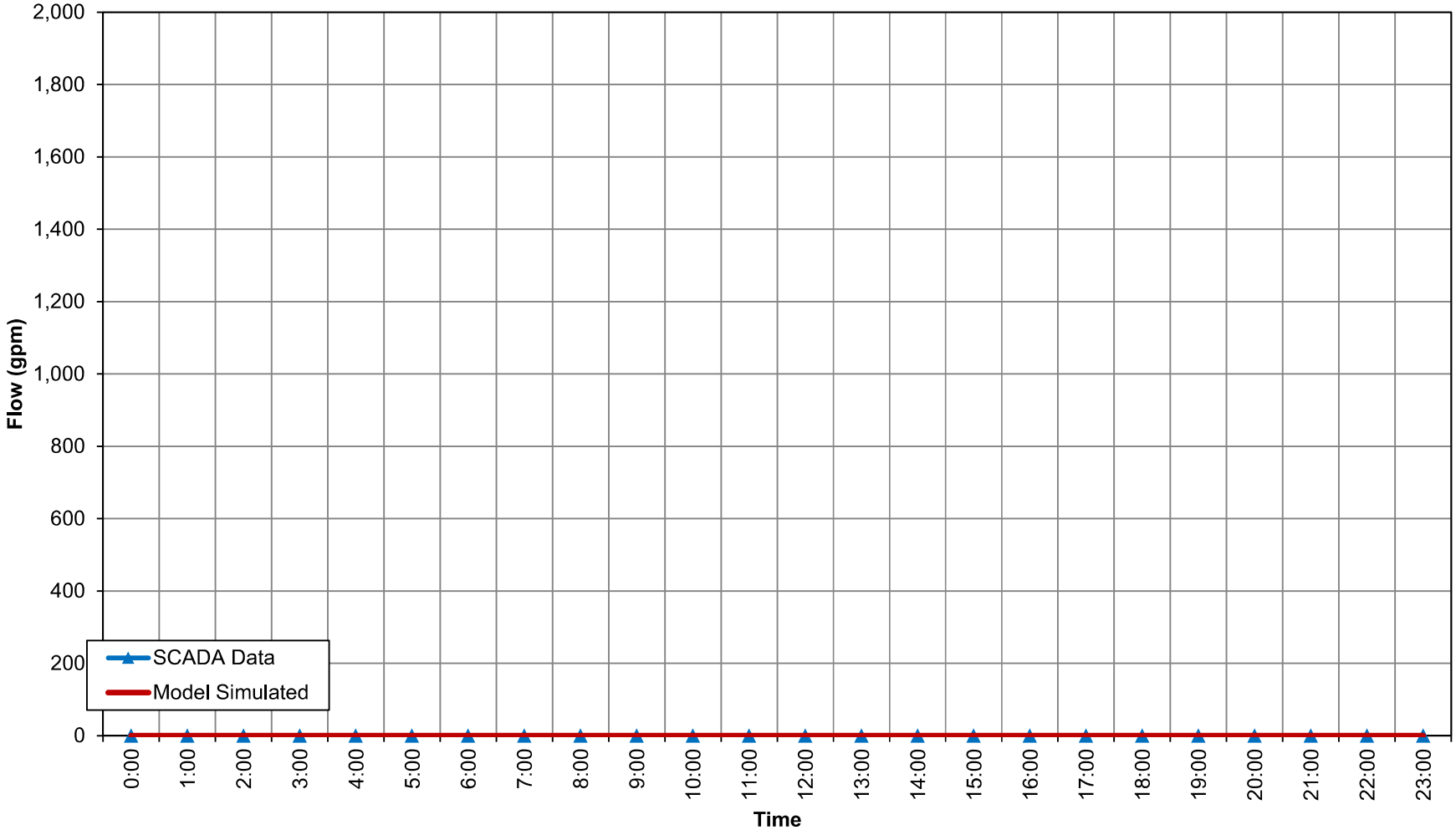
Renton Water System Plan Update
City of Renton



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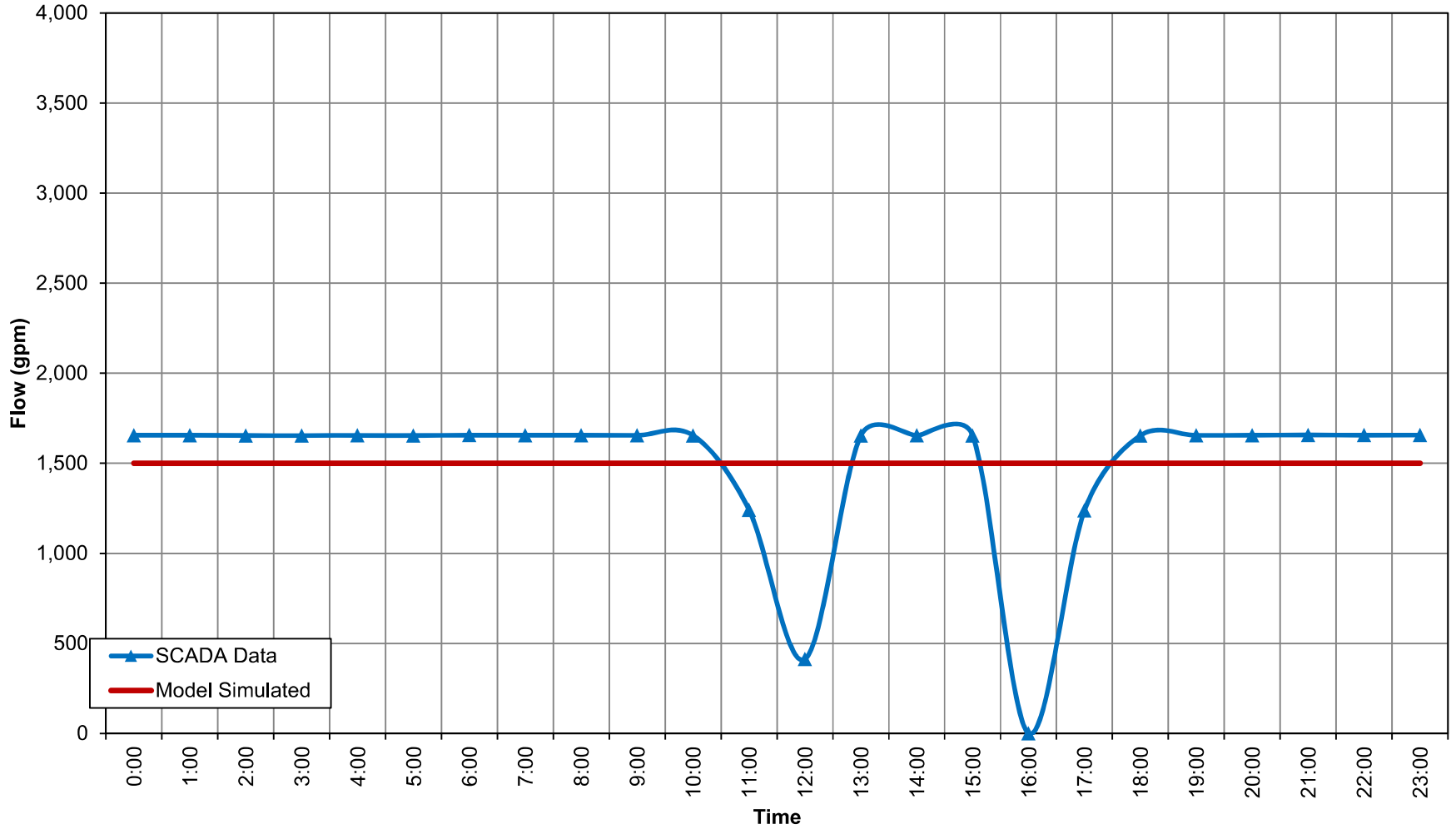
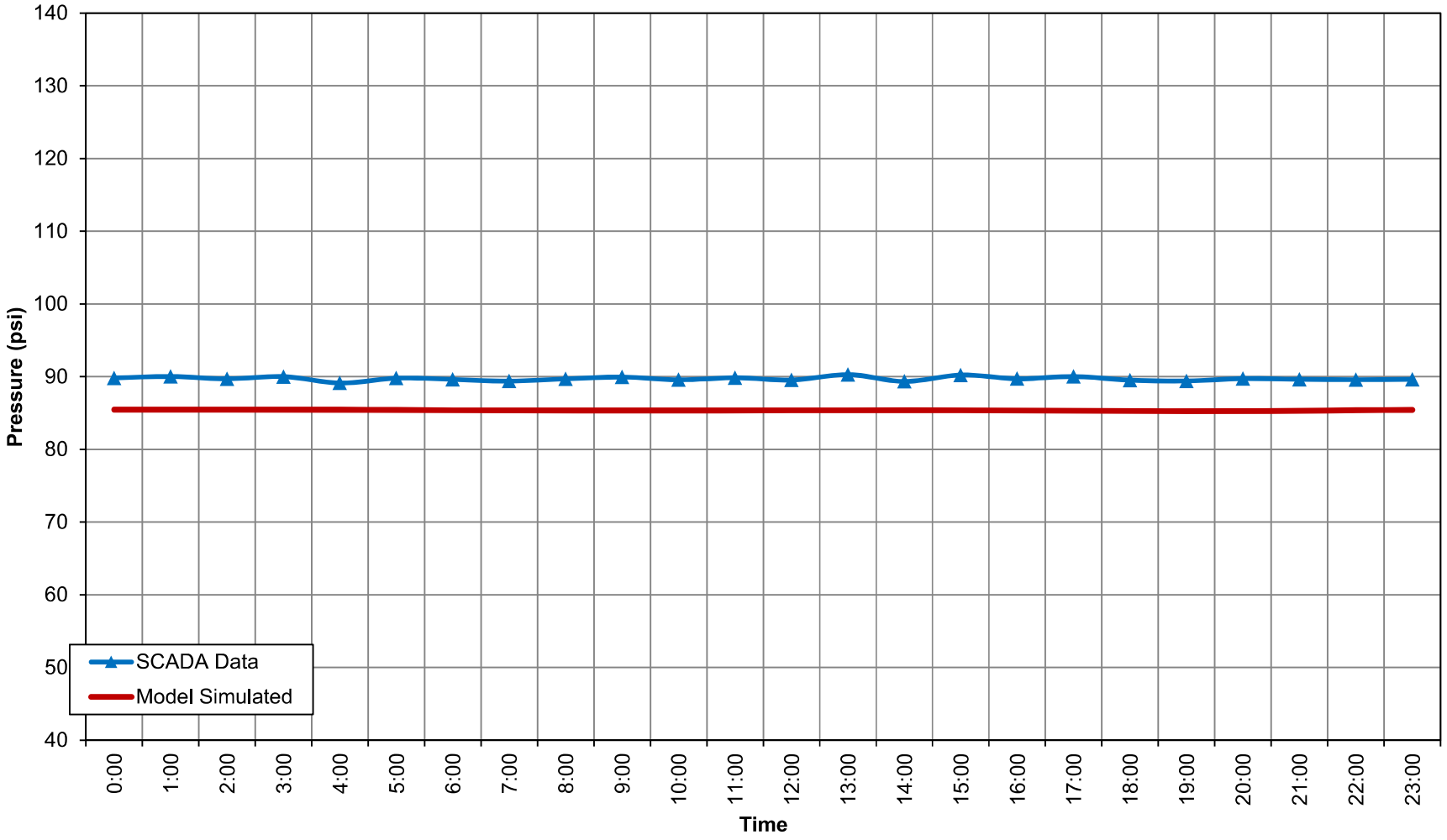
Renton Water System Plan Update
City of Renton



EPS Calibration - Logger 30
Renton Water System Plan Update
City of Renton



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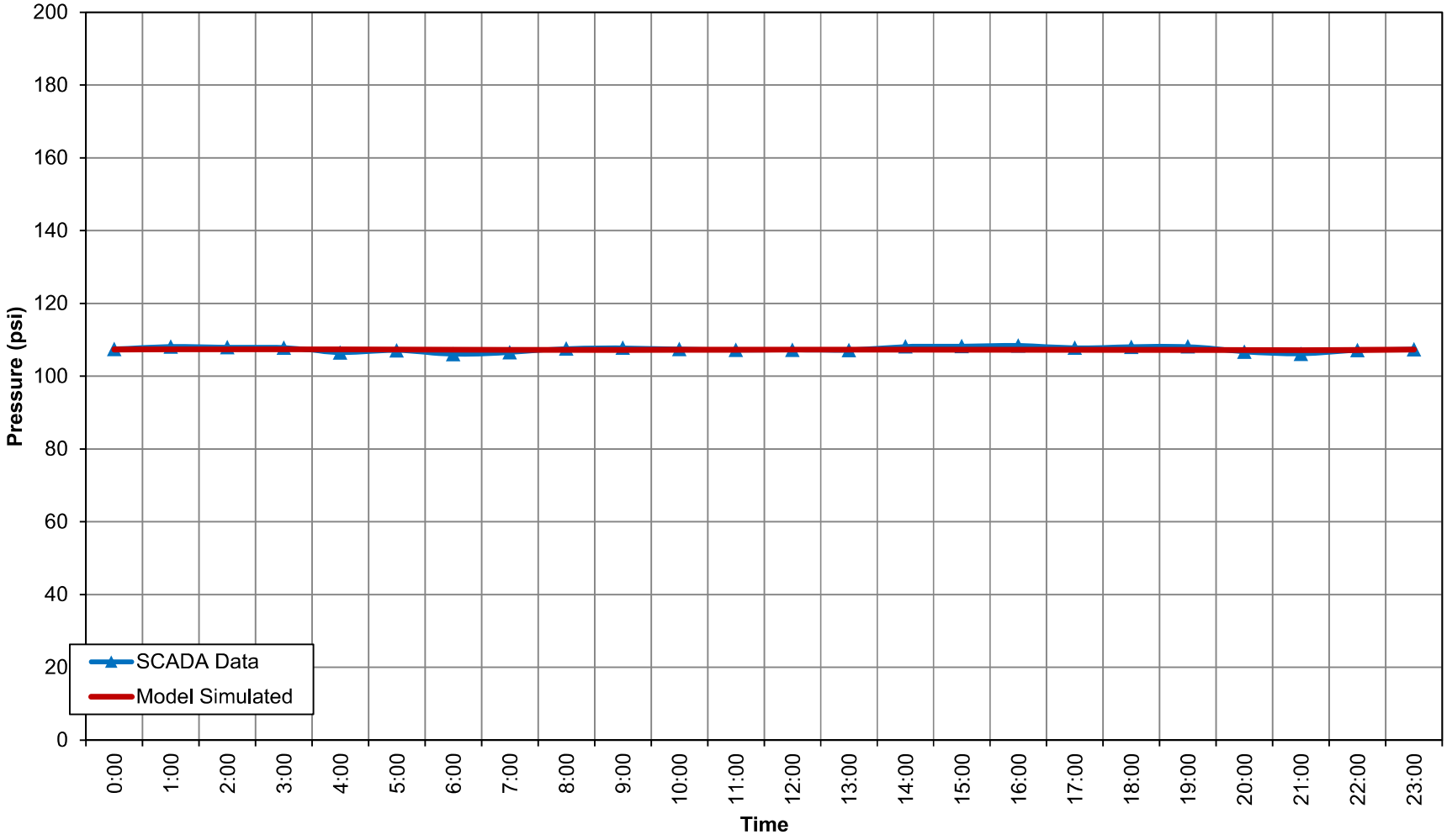
Renton Water System Plan Update
City of Renton



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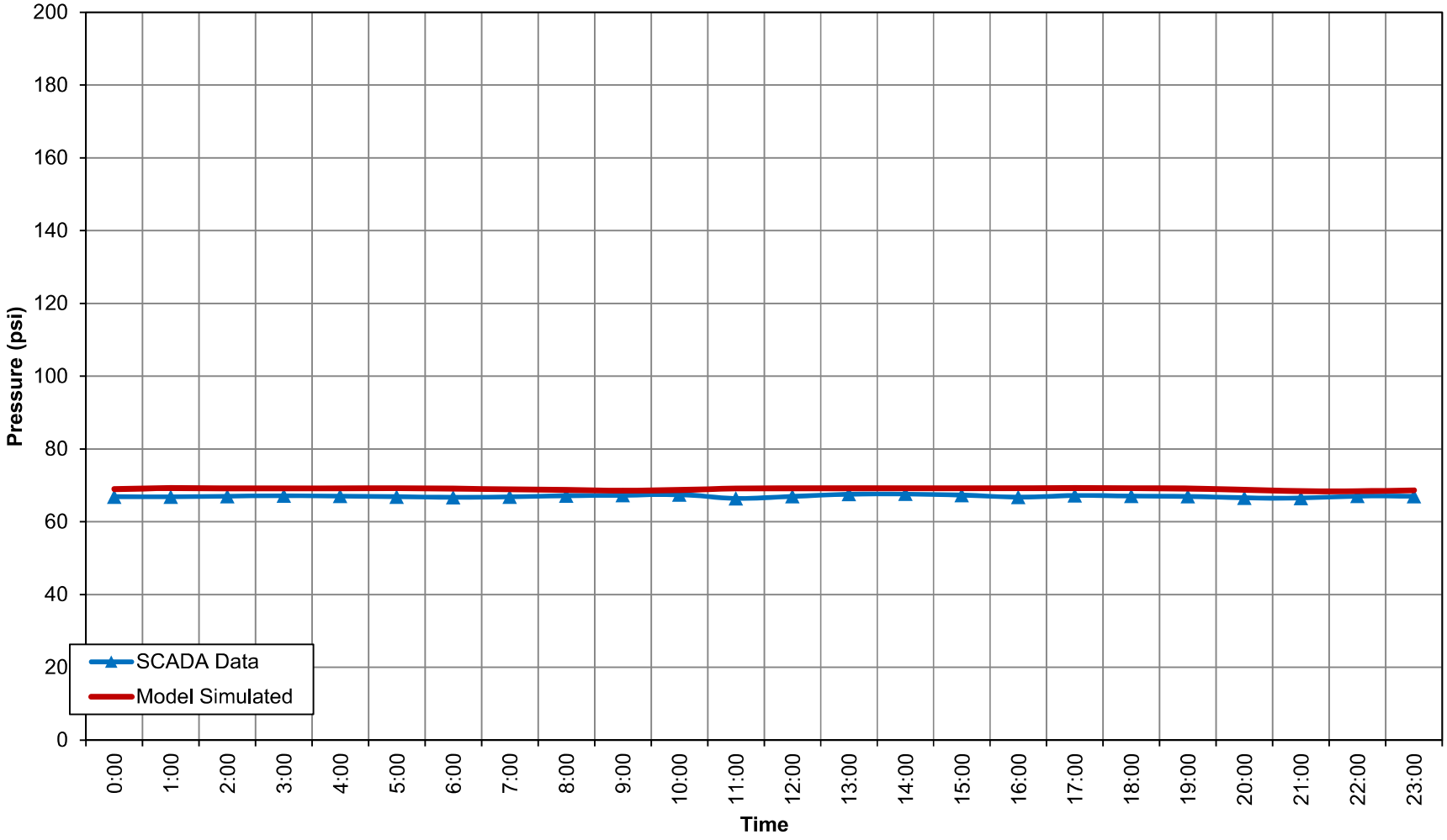
Renton Water System Plan Update
City of Renton



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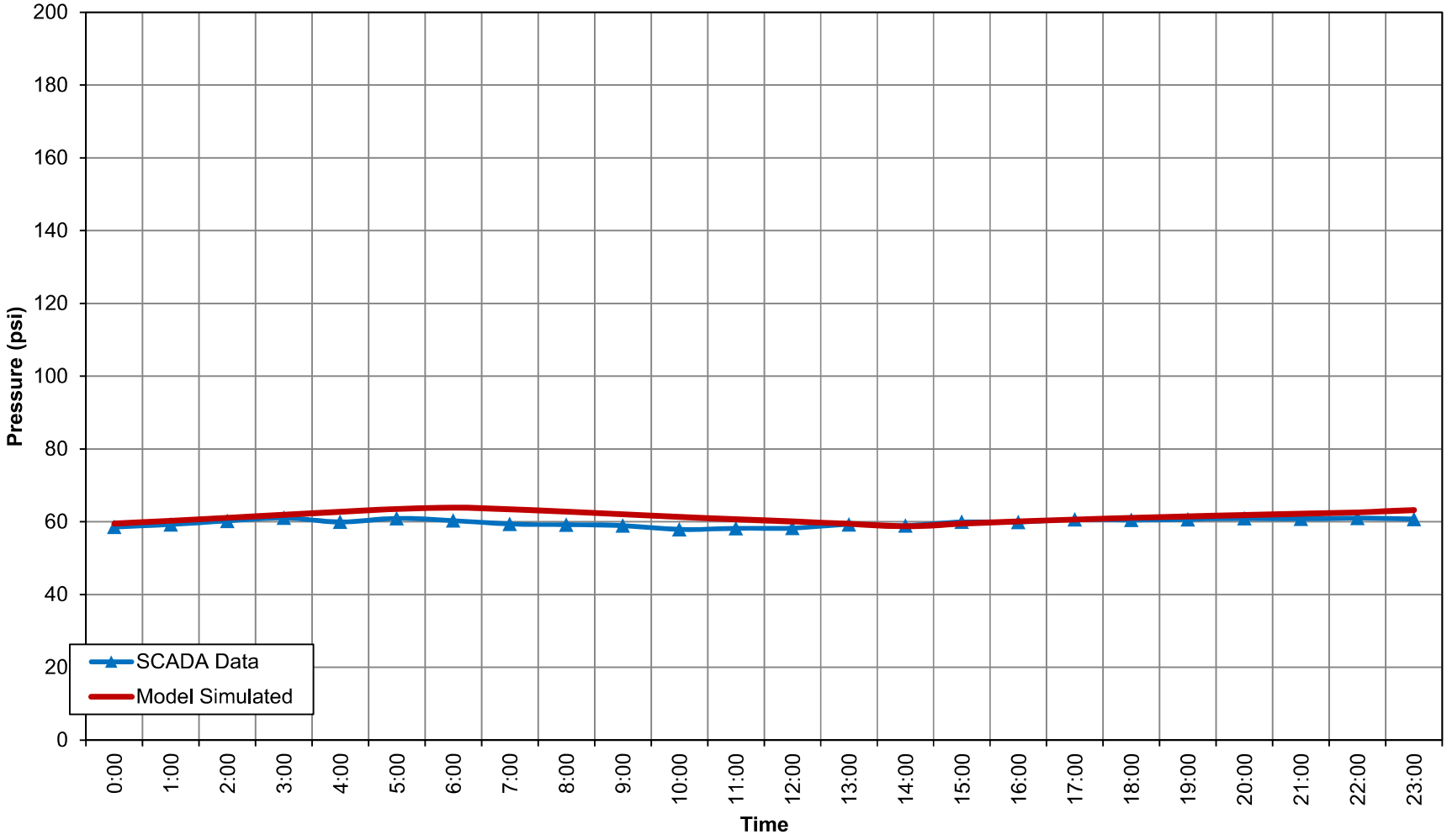
Renton Water System Plan Update
City of Renton



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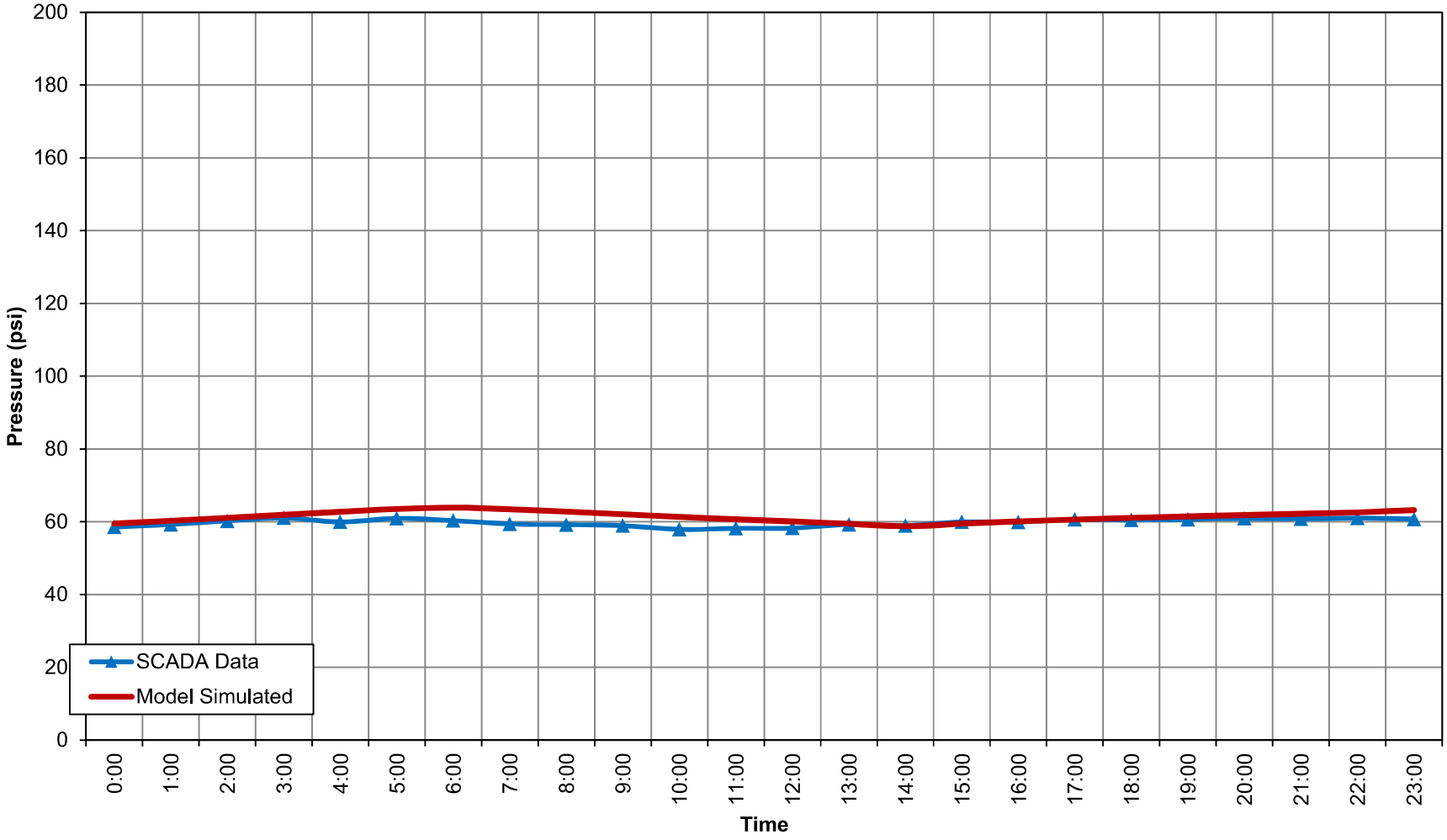
Renton Water System Plan Update
City of Renton



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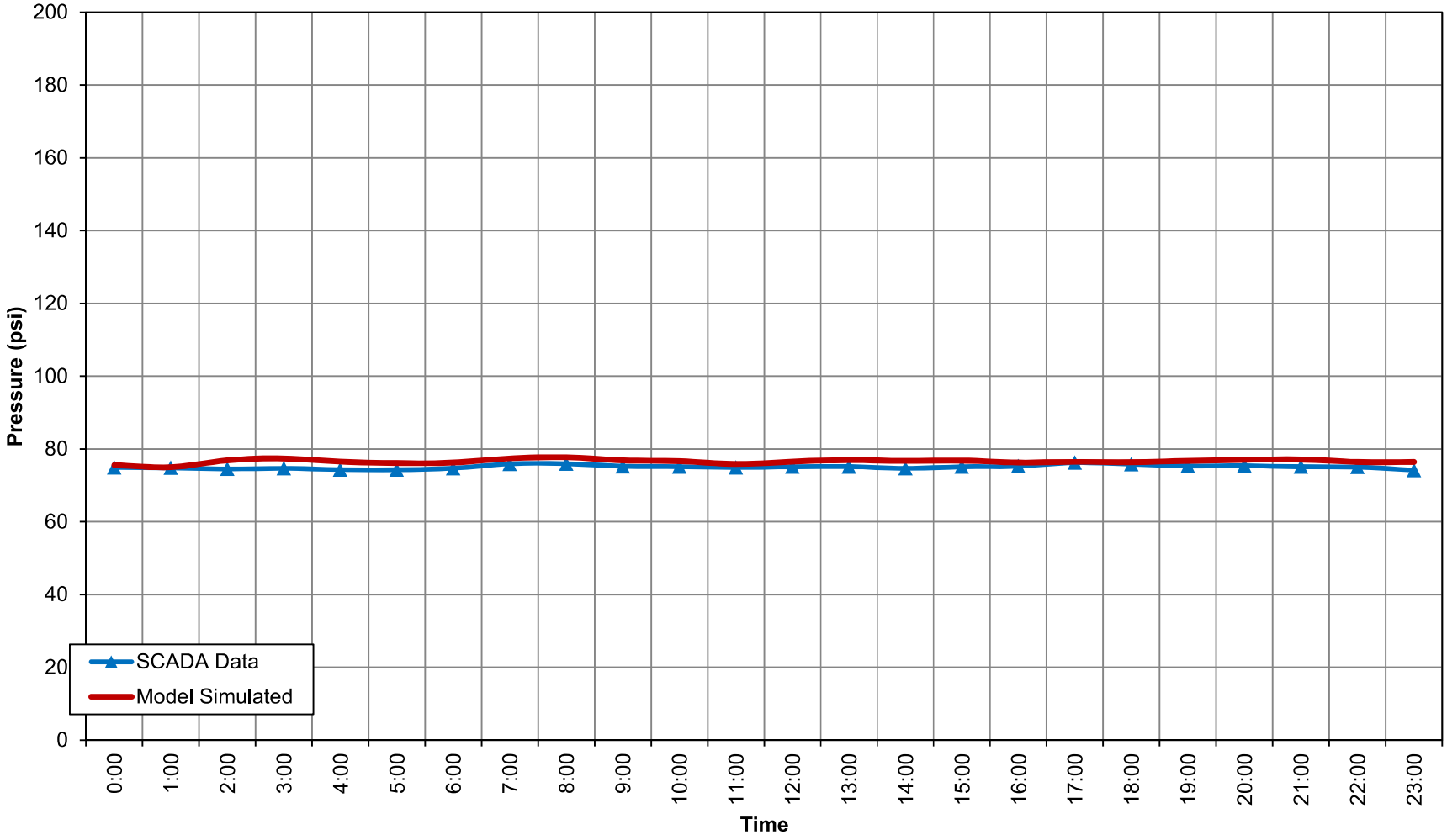
Renton Water System Plan Update
City of Renton



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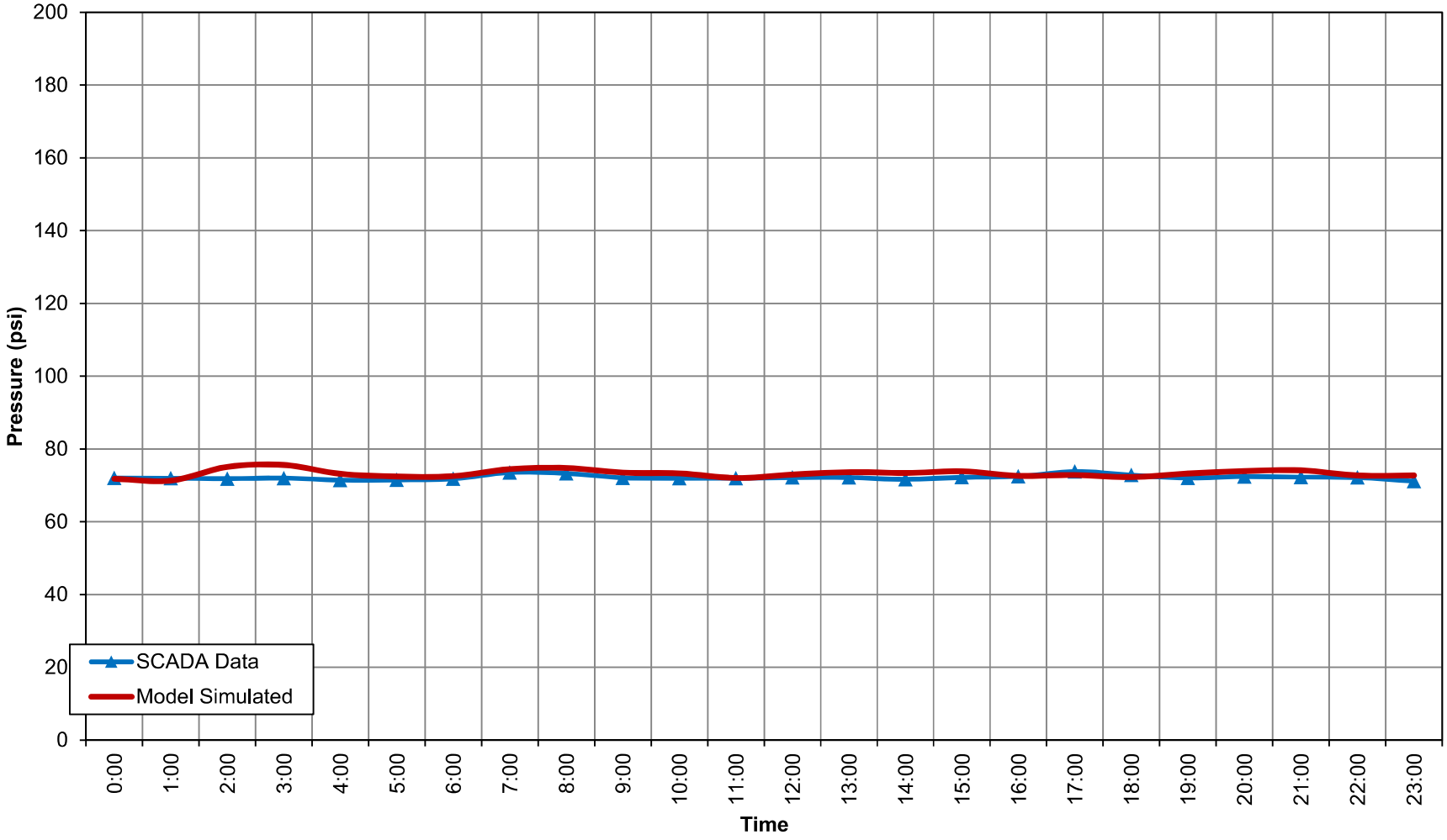
Renton Water System Plan Update
City of Renton



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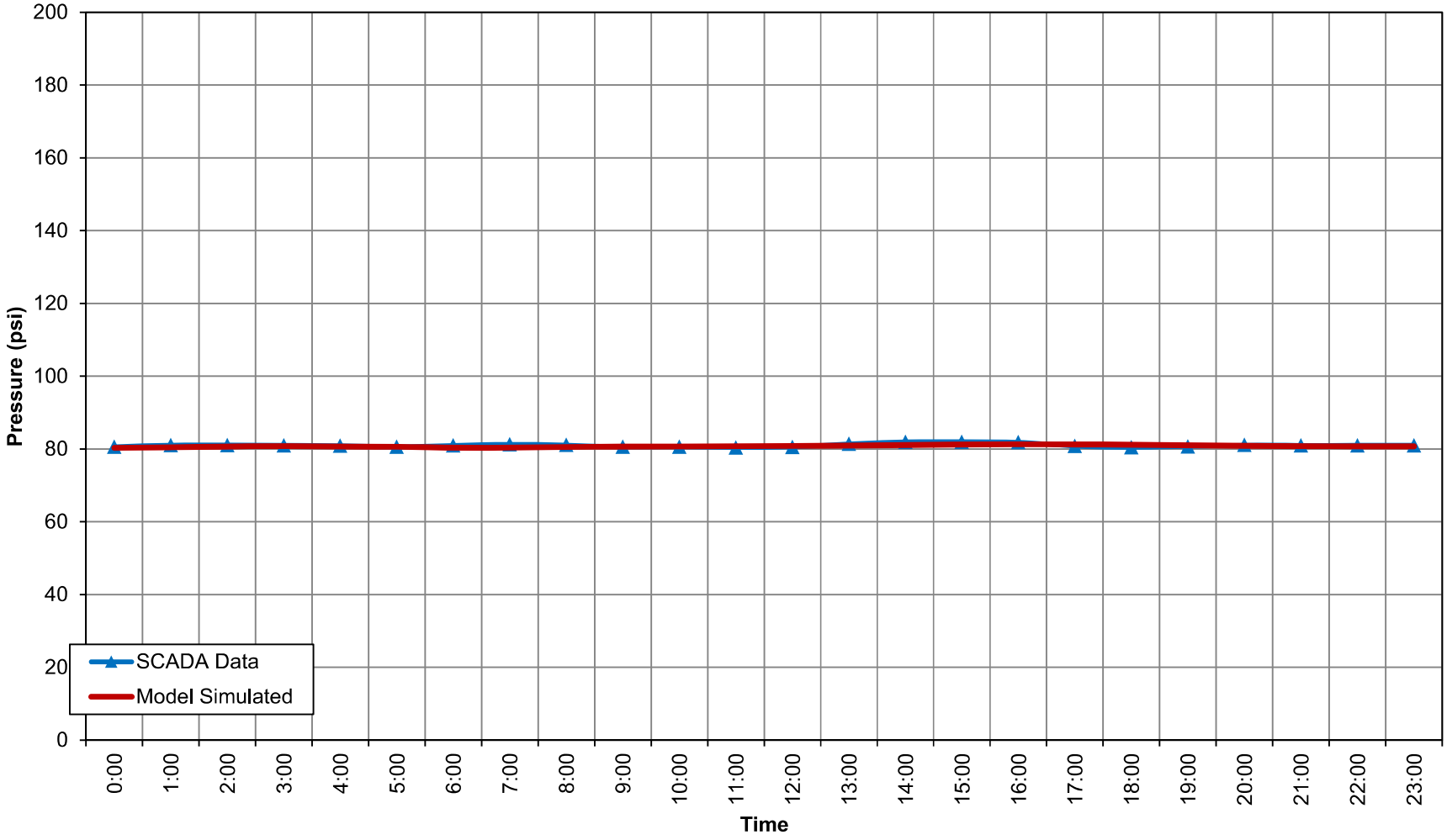
Renton Water System Plan Update
City of Renton



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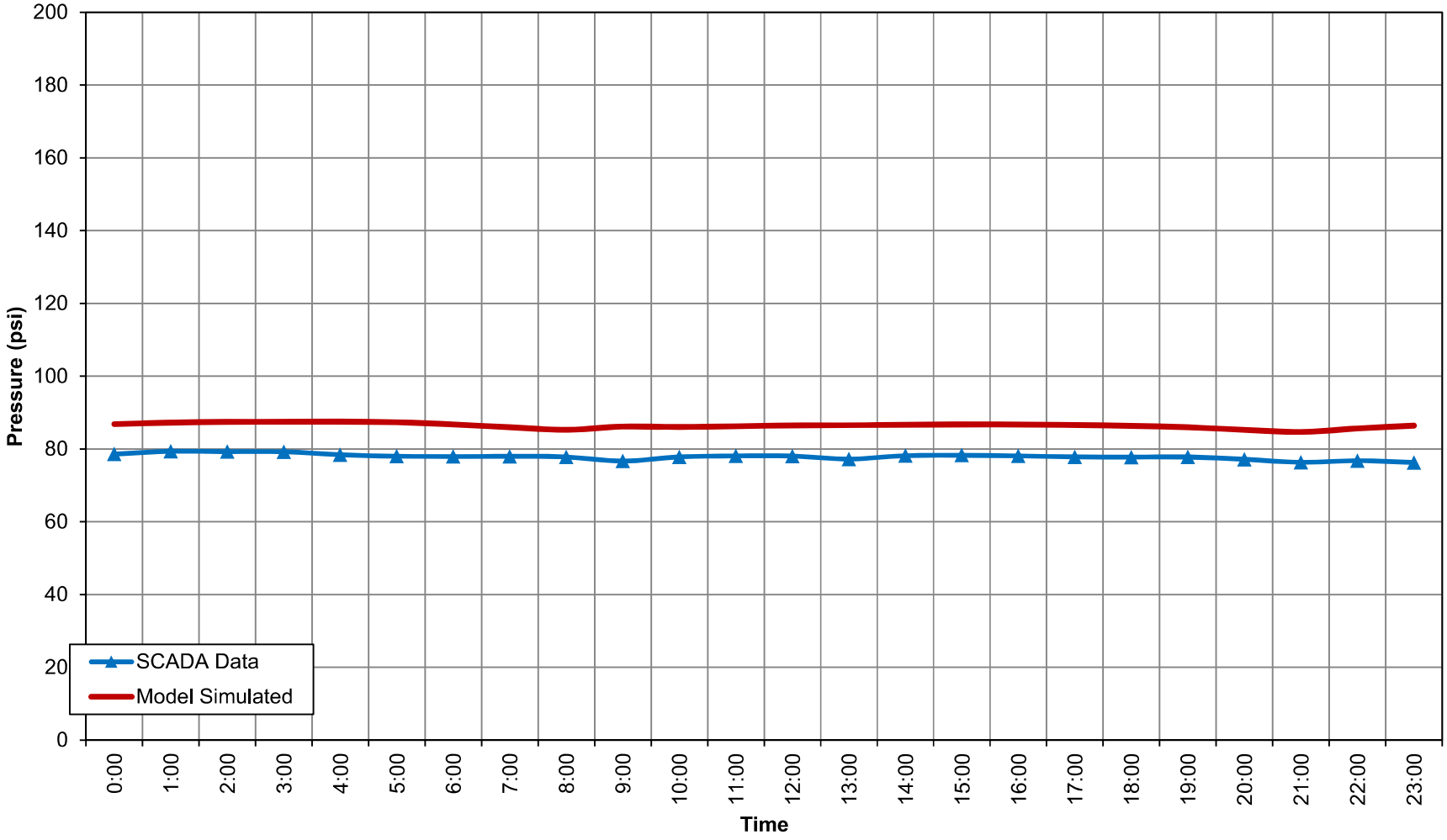
Renton Water System Plan Update
City of Renton



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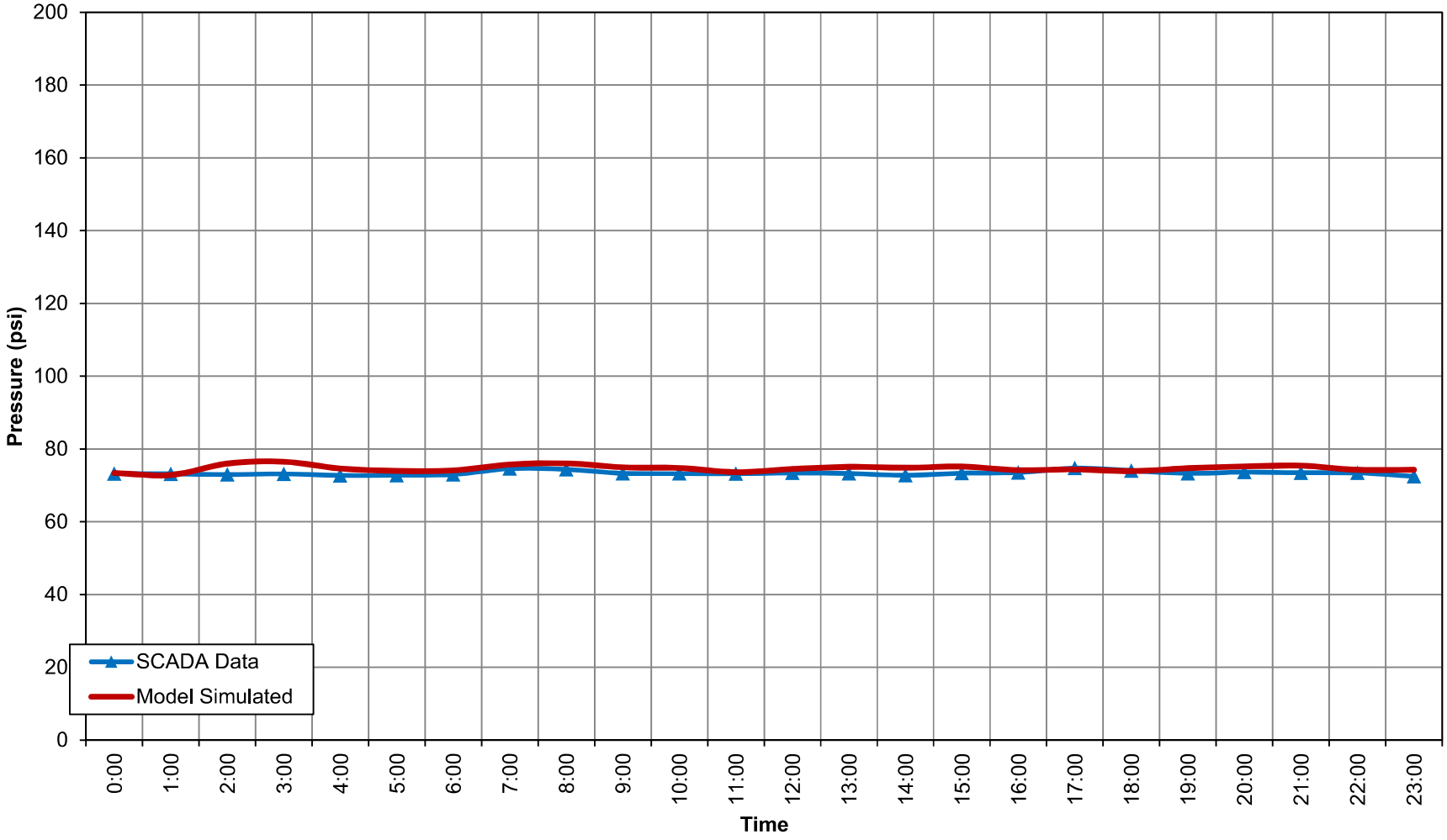
Renton Water System Plan Update
City of Renton



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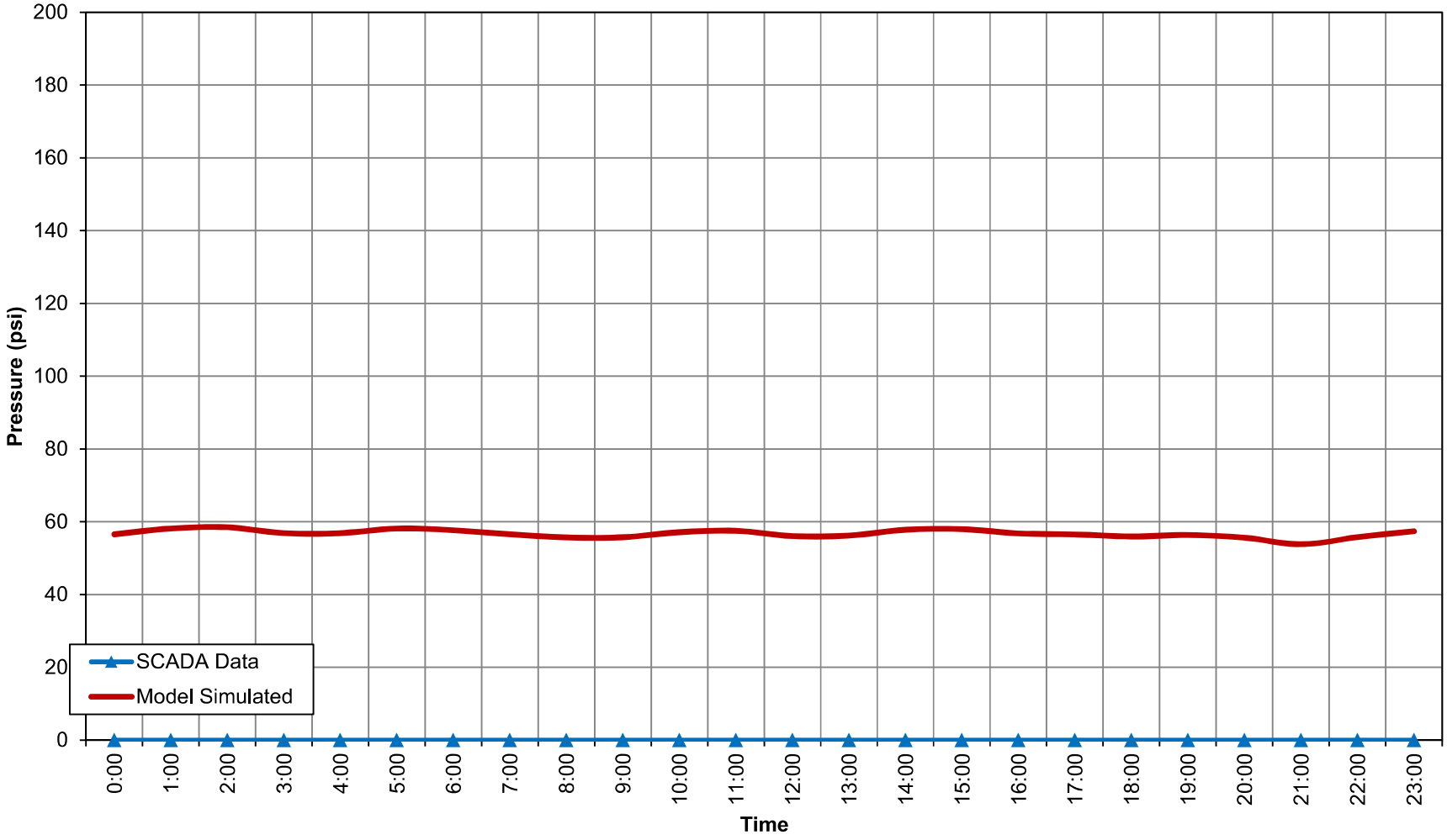
Renton Water System Plan Update
City of Renton



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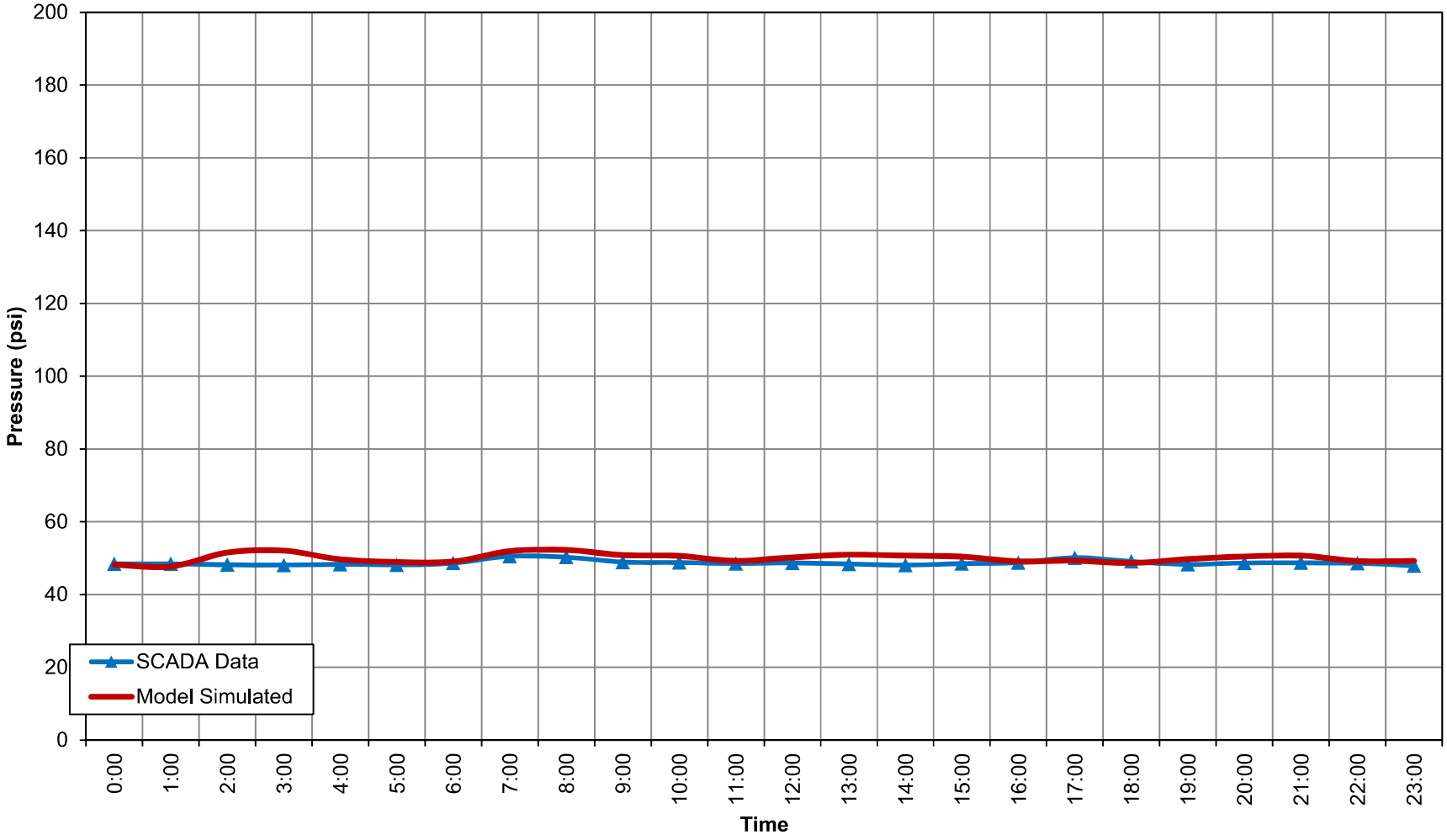
Renton Water System Plan Update
City of Renton



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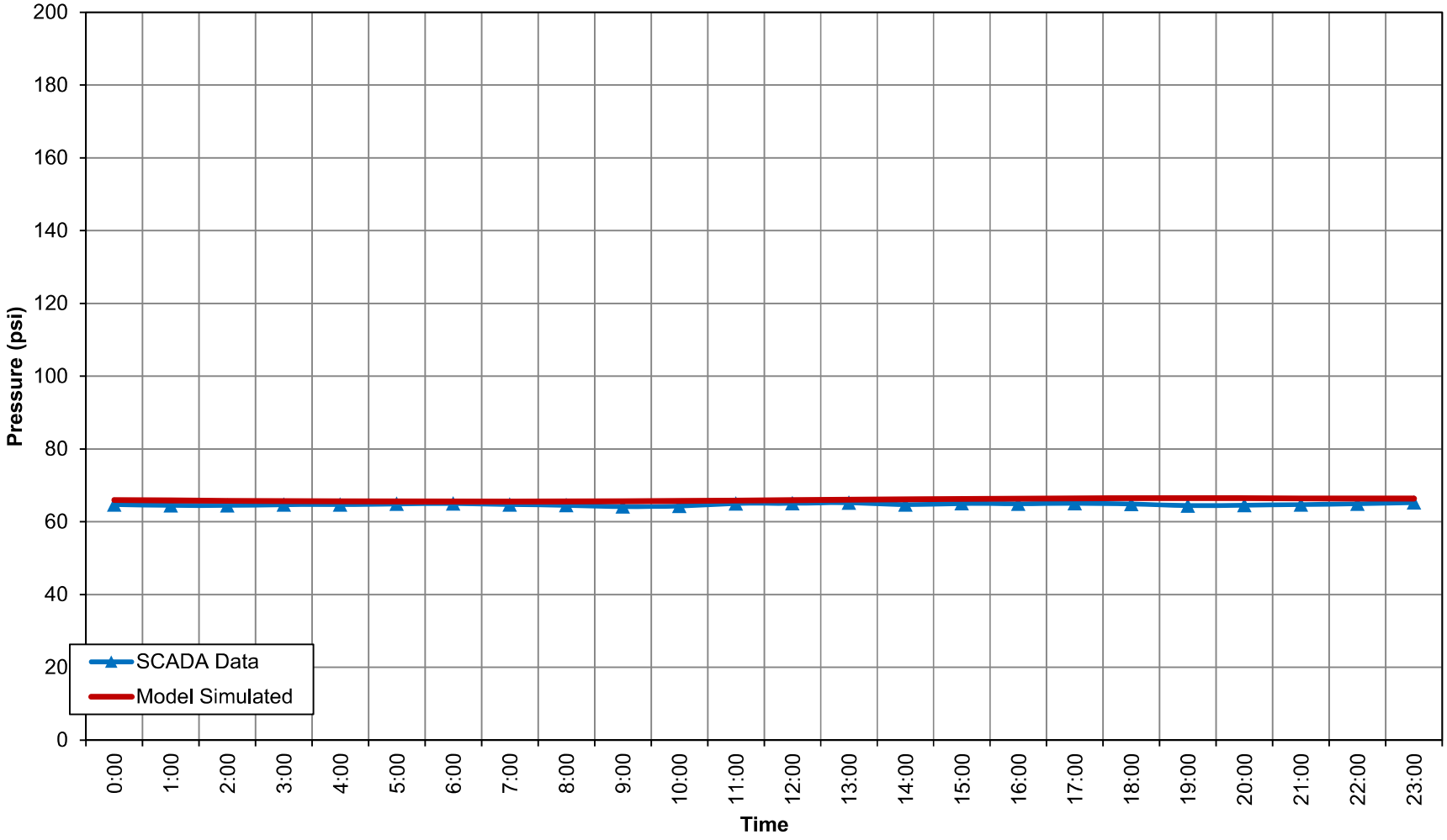
Renton Water System Plan Update
City of Renton



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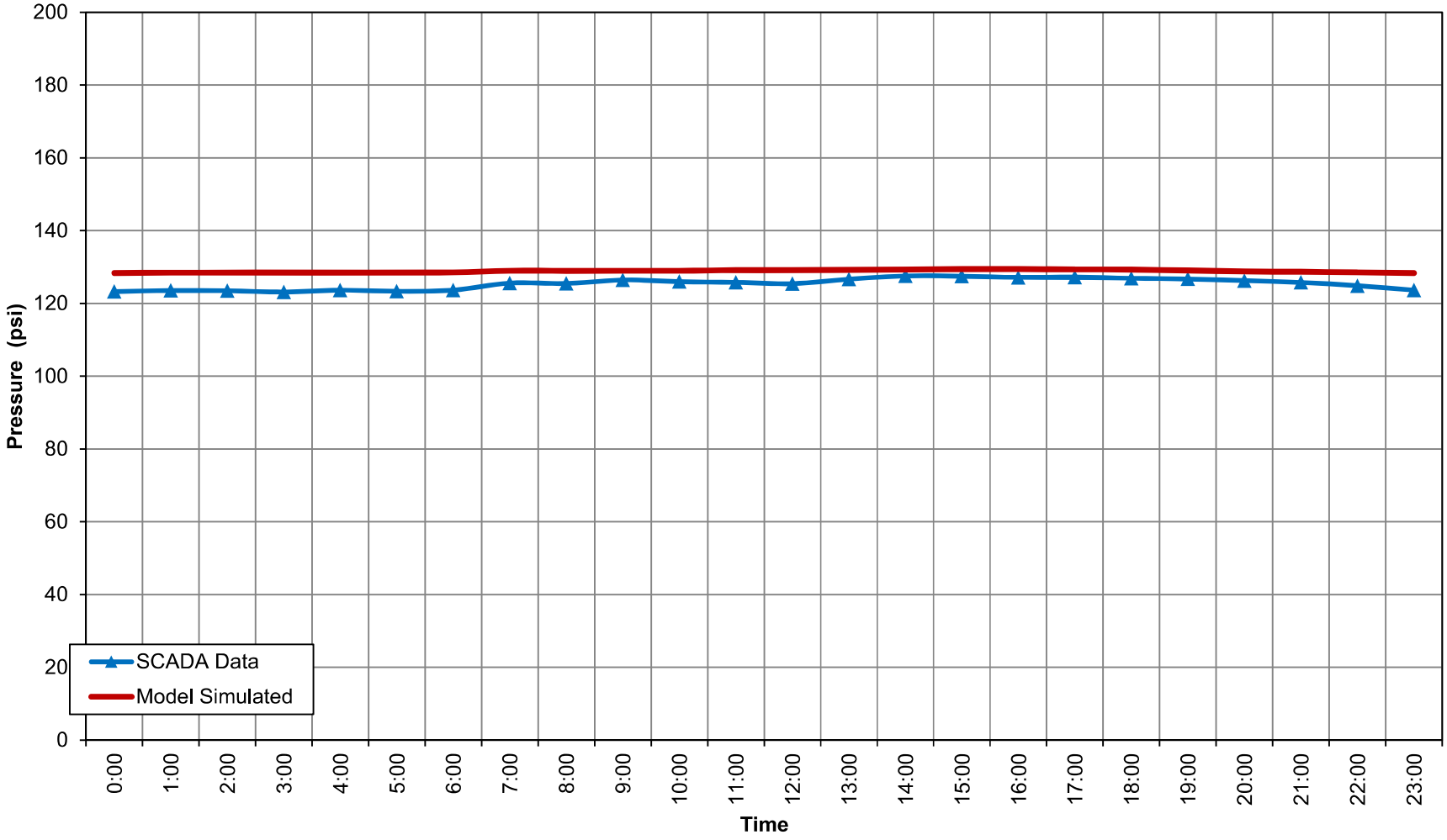
City of Renton



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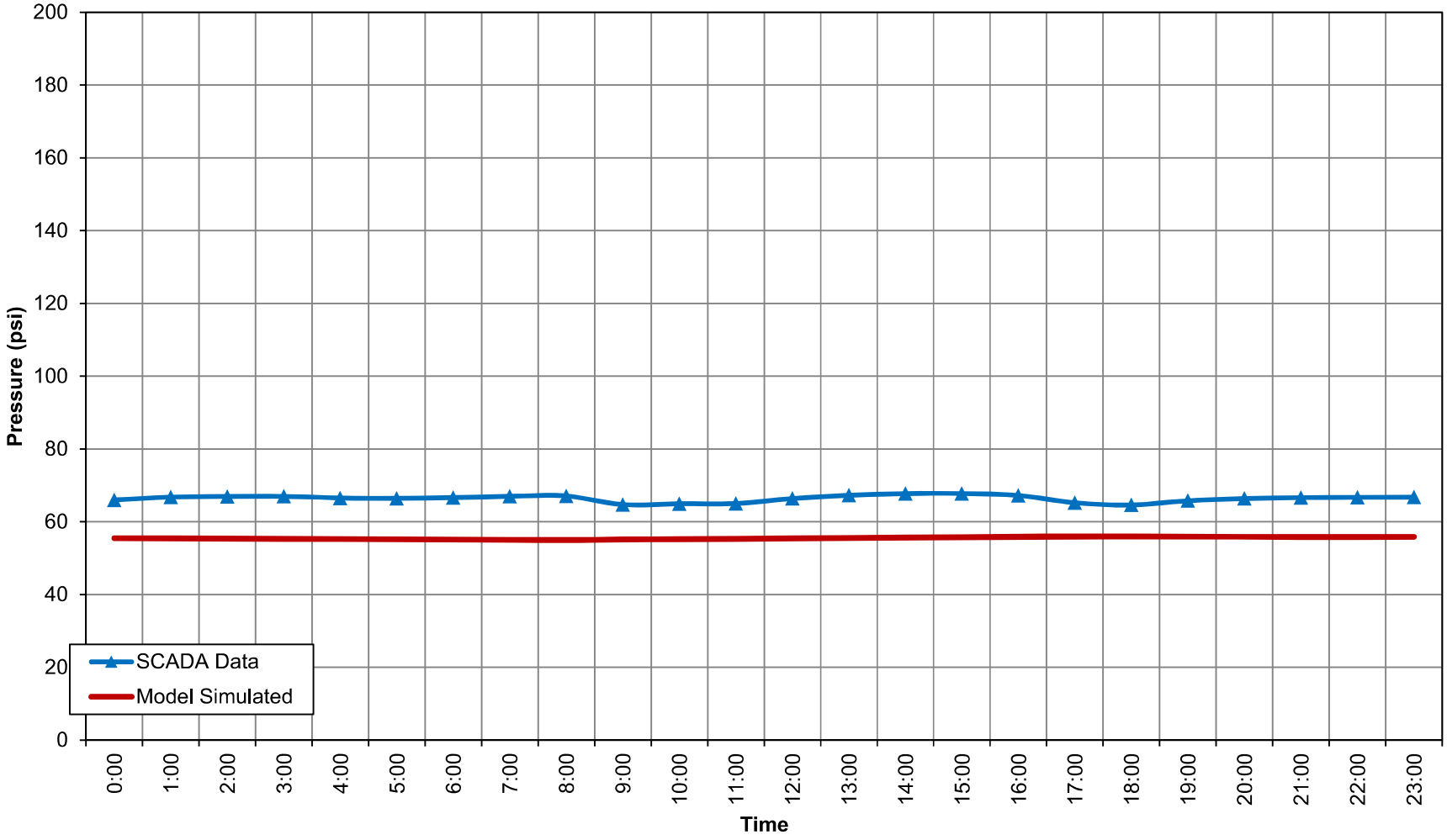
Renton Water System Plan Update
City of Renton



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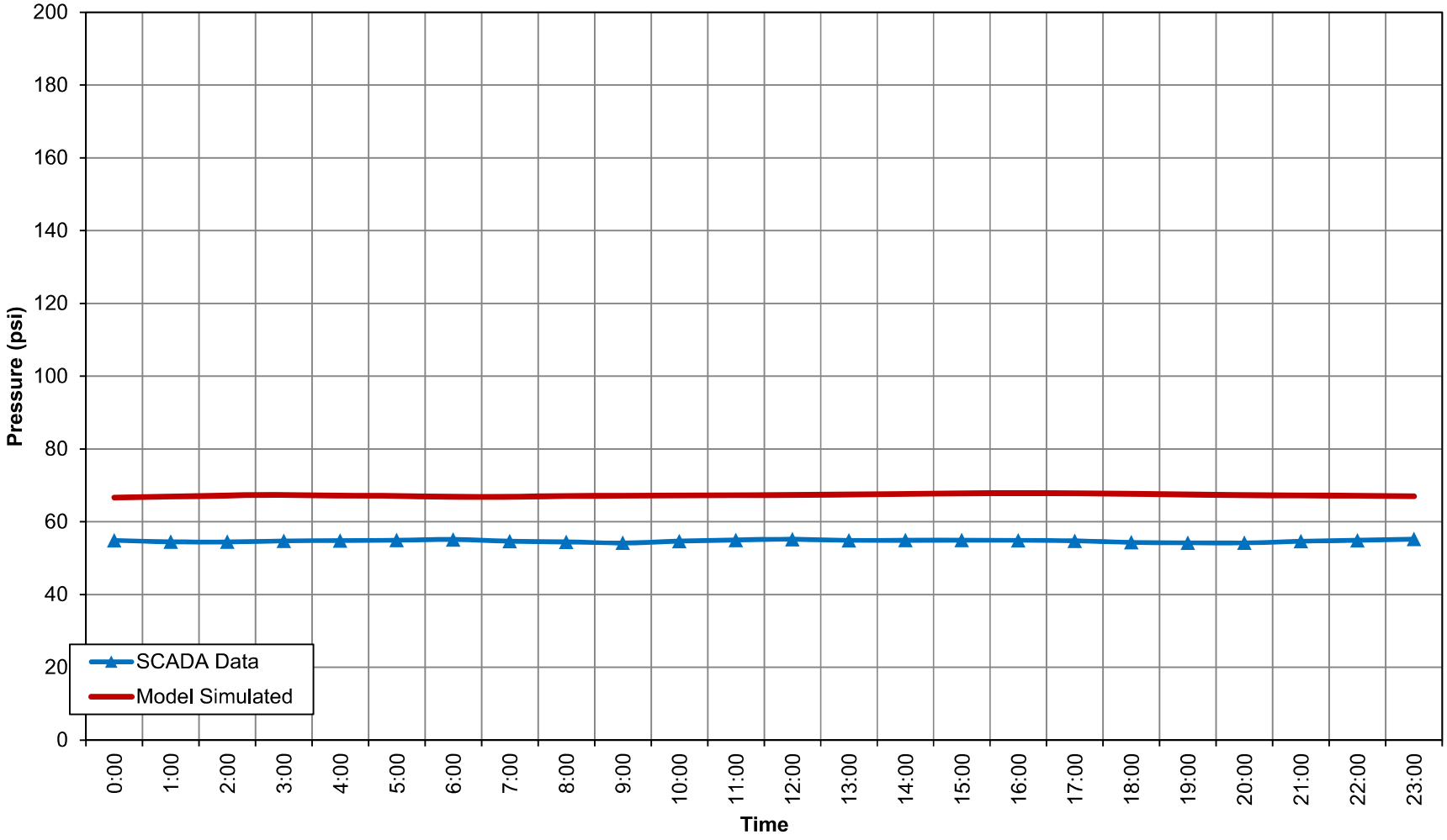
Renton Water System Plan Update
City of Renton



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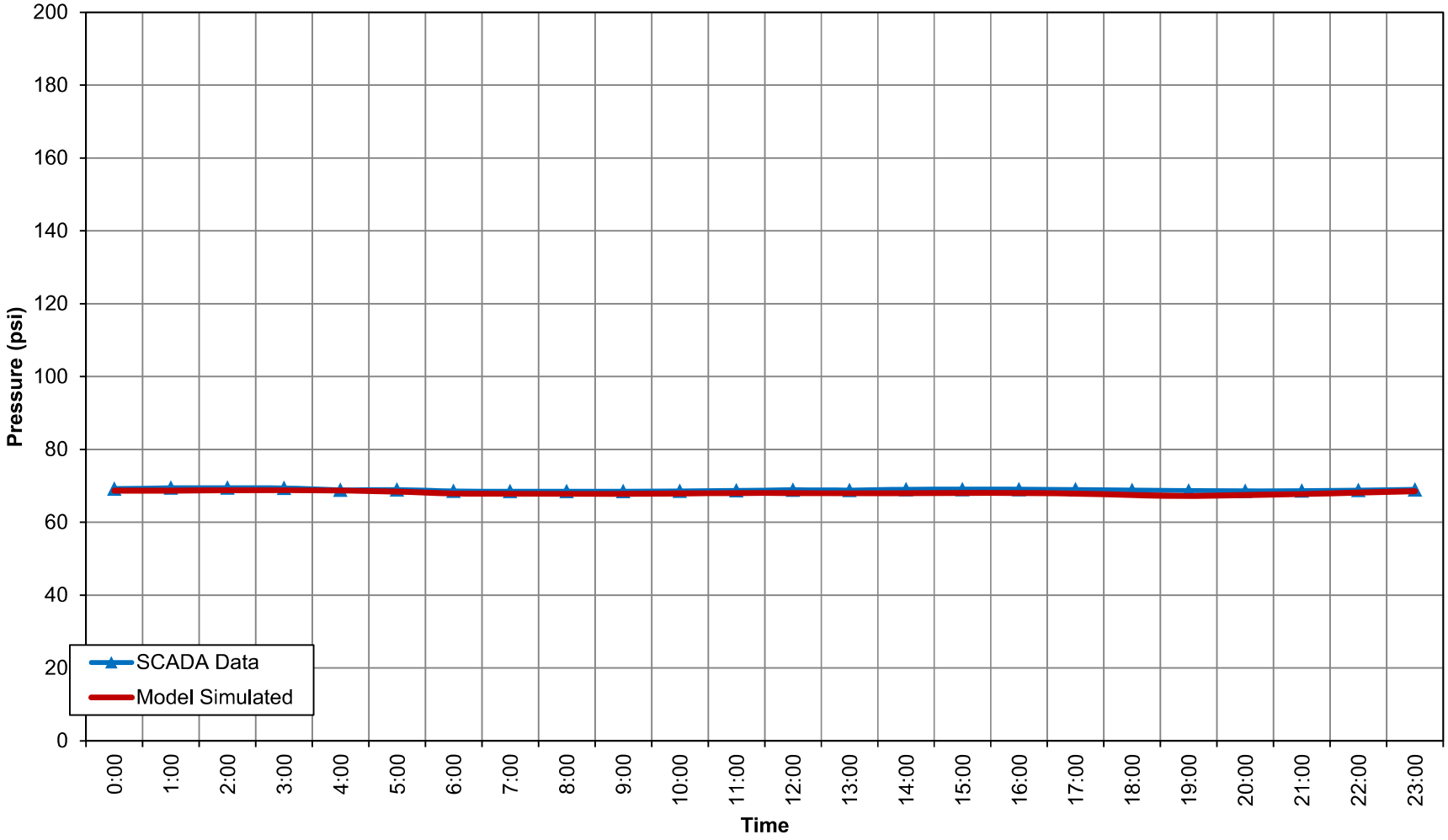
Renton Water System Plan Update
City of Renton



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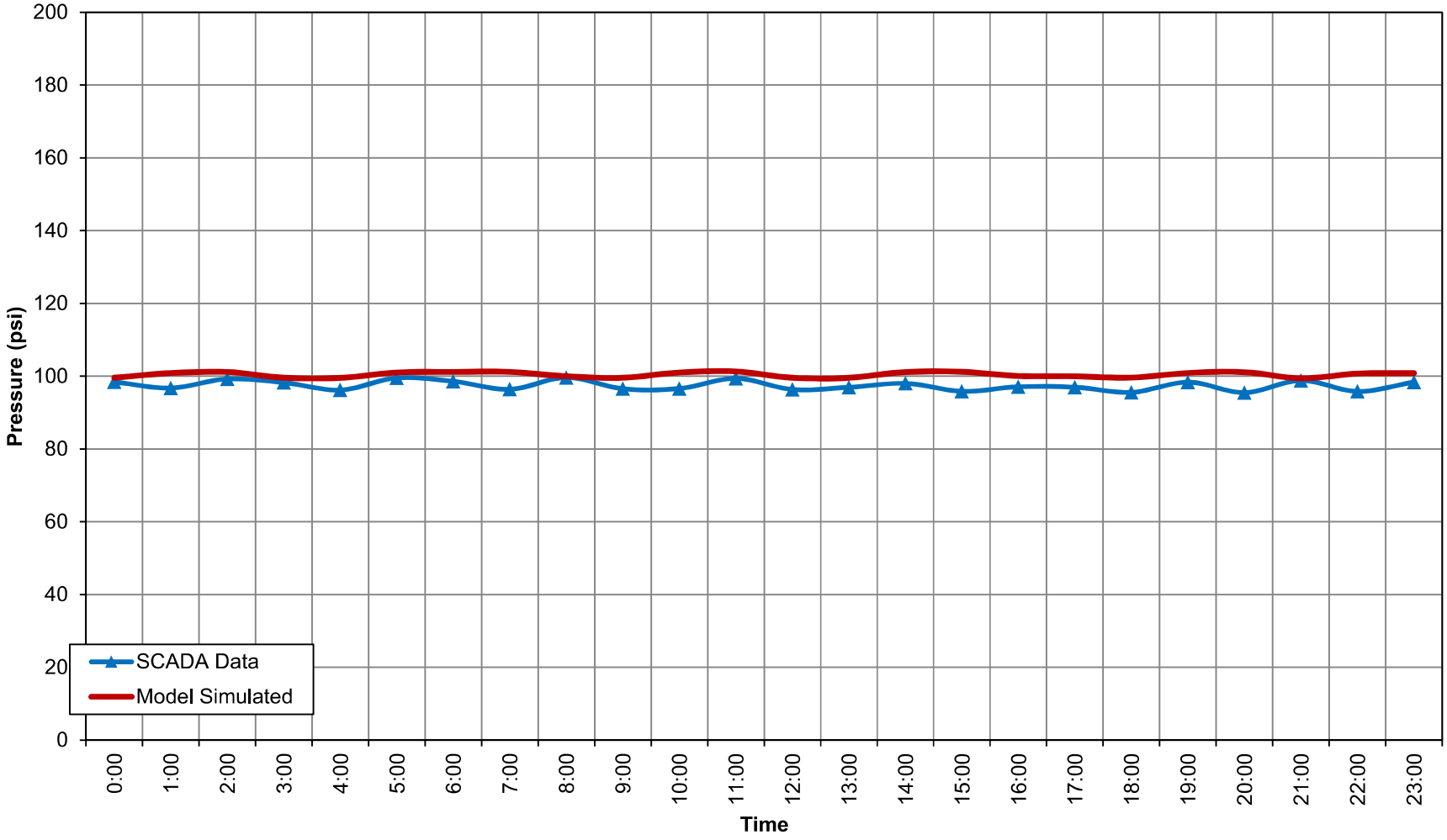
Renton Water System Plan Update
City of Renton



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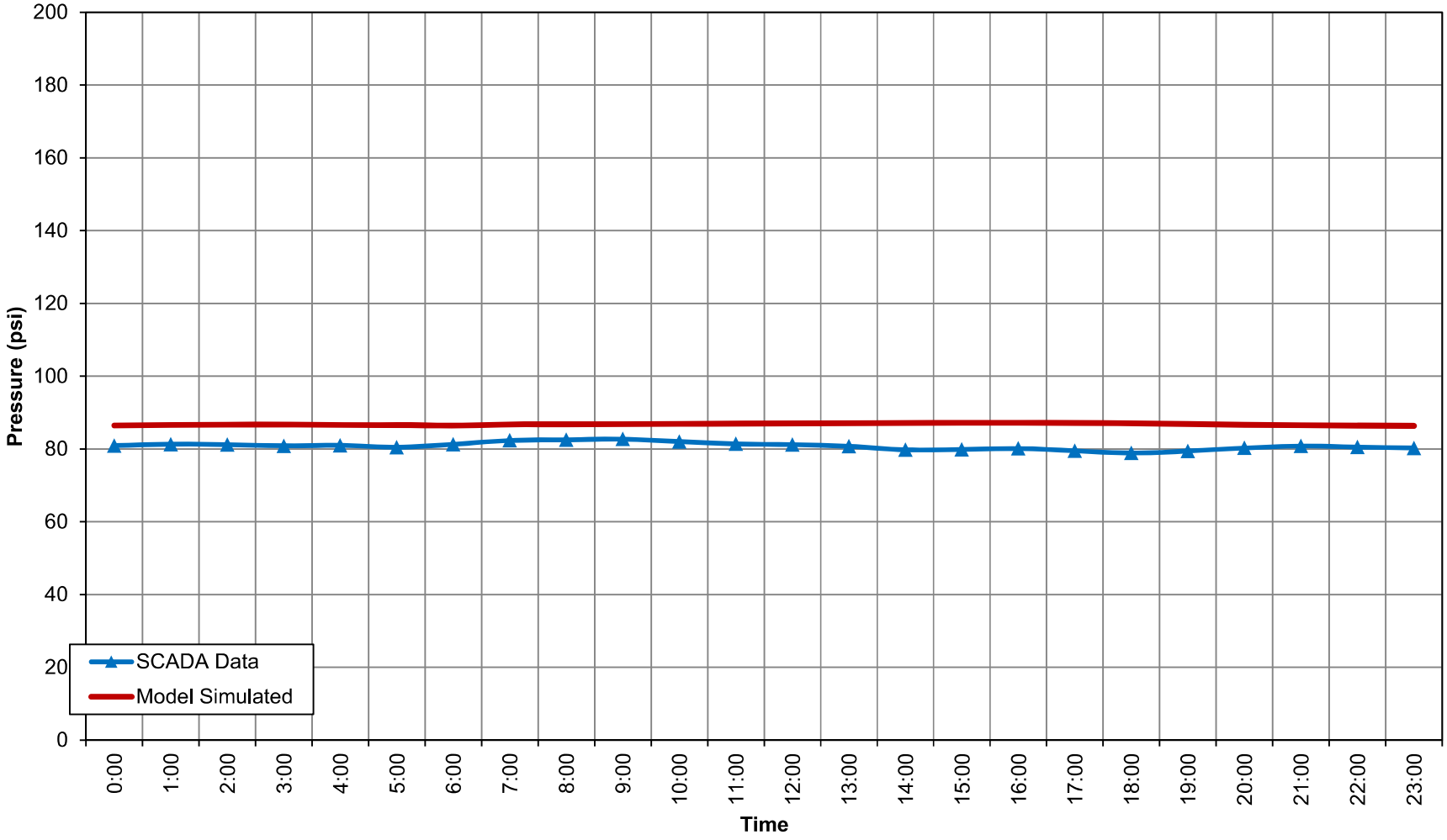
Renton Water System Plan Update
City of Renton



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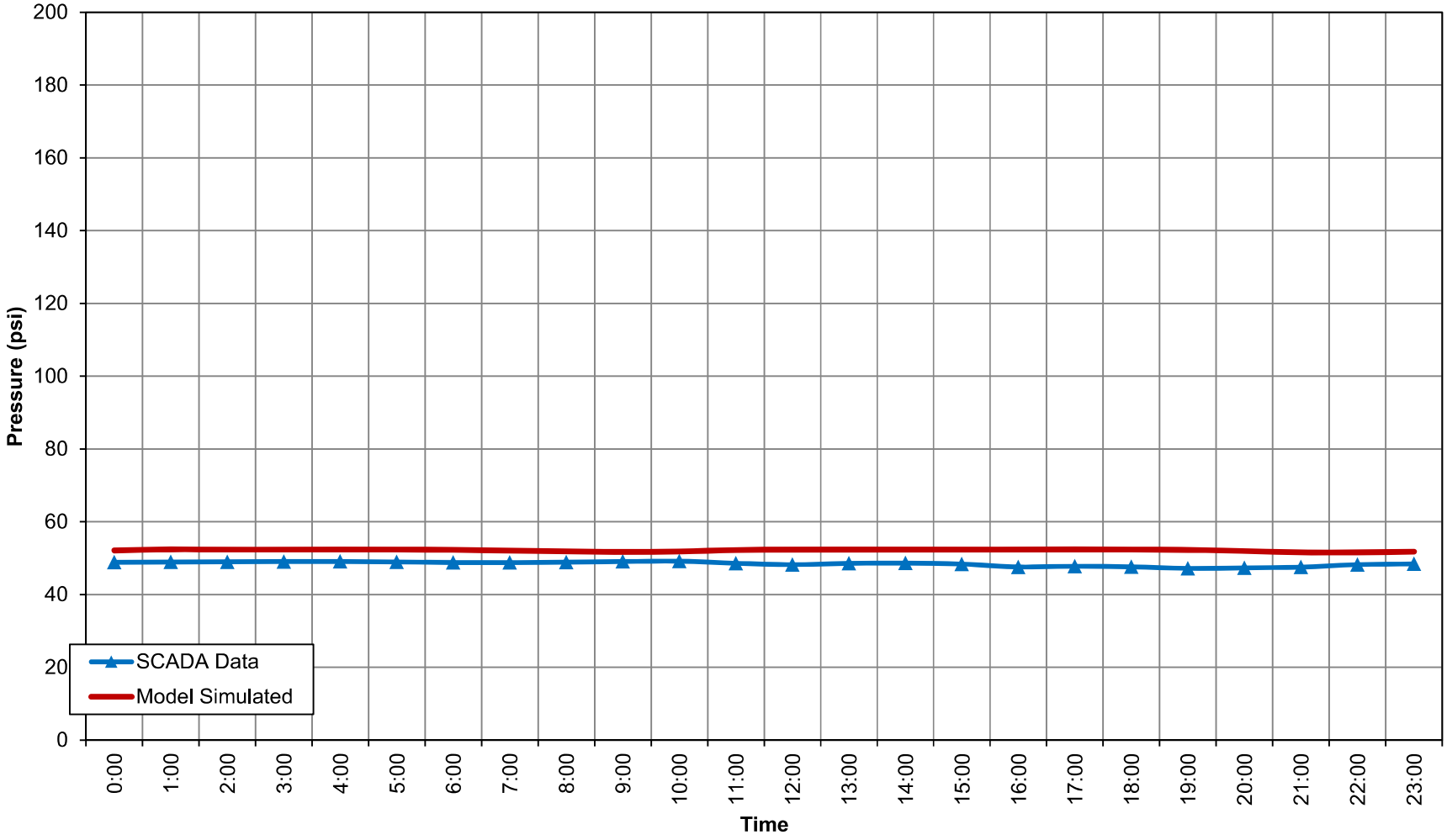
Renton Water System Plan Update
City of Renton



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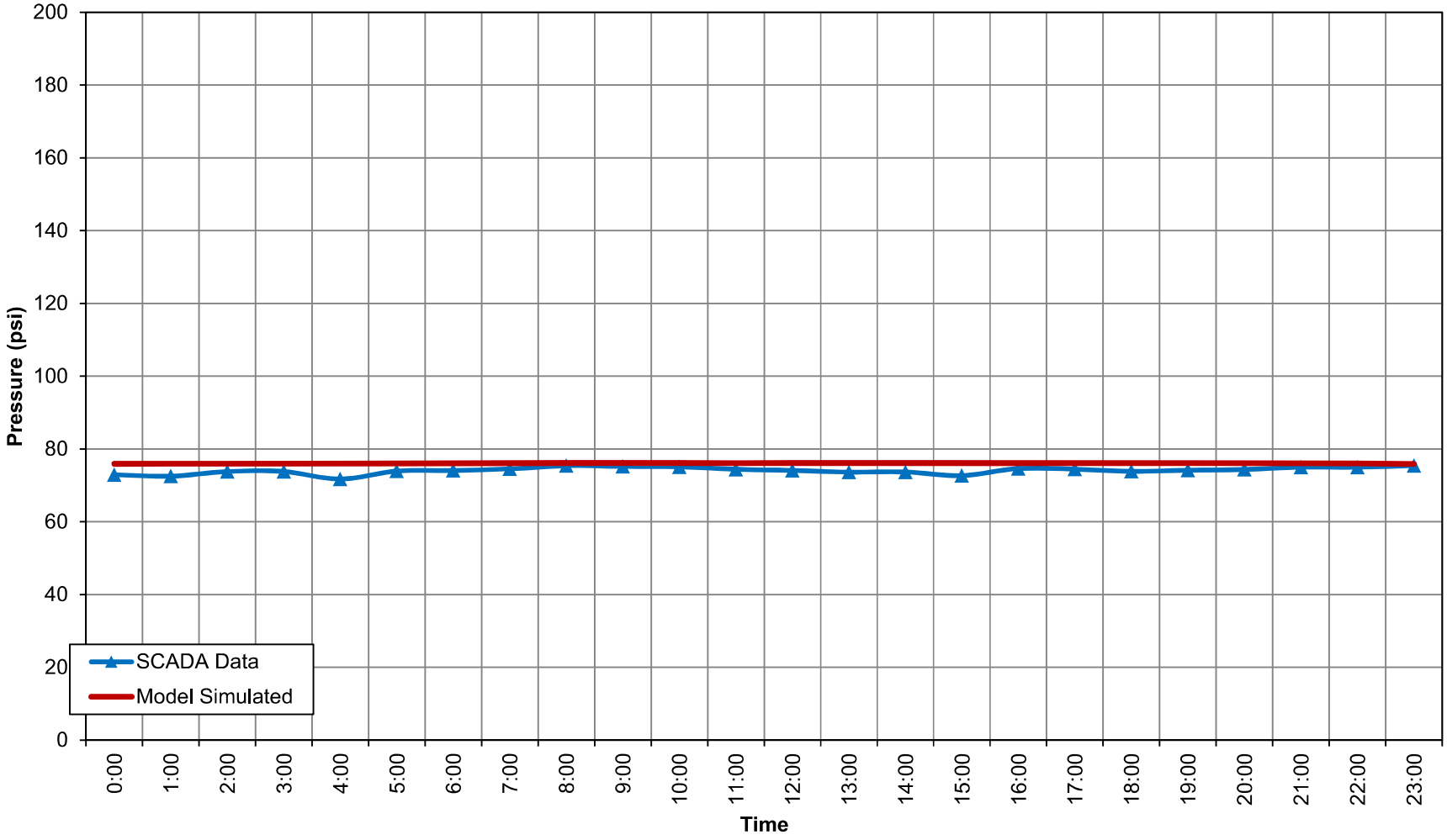
Renton Water System Plan Update
City of Renton



Appendix R

DETAILED CIP COSTS

City of Renton
Water System Plan
Capital Improvement Program

Summary
Distribution Piping
Pressure Zone Rezoning
Annual Programs
Pump Station
Storage
General
Regulatory
TOTAL

CIP Prioritization Table

						Project Description					
CIP ID	**2012 Plan ID**	**Project Name**	**Improvement Type**	**Project Status Implemented? Y/N**	**Pressure Zone**	**Pipe Length (LF)**	**Existing Diameter (inches)**	**Proposed Size**	**Units**	**Project Element**	**Location**
Distribution Piping											
D-01	R-33	NE 10th Place Pipe Upsize	Upsize	N	Highlands 445	1030	1, 6	8	Inches	8 " Pipe	NE 10th Place between Sunset Blvd NE and Edmonds Ave NE
D-01						70	1, 6	8	Inches	8 " Pipe	
D-01						350		8	Inches	8 " Pipe	
D-01						610		8	Inches	8 " Pipe	
D-02	n/a	Ferndale Place NE Pipe Upsize	Upsize	N	Highlands 445	500	4	8	Inches	8 " Pipe	Ferndale Pl NE between NE 7th St and Ferndale Ave NE
D-03	R-27	Windsor Hills Pipe Project	Upsize	N	Highlands 445	6850	4,6	8	Inches	8 " Pipe	Windsor Hills Area Fire flow deficiency location: Windsor Pl NE between Bronson Pl NE and Windsor Way NE
D-04	R-20	Sunset Blvd N Pipe Upsize	Upsize	N	Valley 196	1800	6	10	Inches	10 " Pipe	Sunset Blvd N between Bronson Way N and N 4th St.
D-05	R-7	Maplewood Place SE Pipe Upsize	Upsize	N	Valley 196	1200	6	8	Inches	8 " Pipe	Maplewood Pl SE from SE 6th St to SE 7th Ave, SE 7th Ave.
D-06	R-25	NW 4th St Pipe Upsize	Upsize	N	West Hill 300	210	6	8	Inches	8 " Pipe	NW 4th St between Taylor Ave NE and Hardie Ave NE.
D-07	R-24 R-26	SW Sunset Blvd at Crestview Apartments Pipe Upsize	Upsize / New PRV	N	Valley 196	30	6	12	Inches	12 " Pipe	SW Sunset Blvd at Crestview Apartments
D-08	R-11 R-14 R-16	Downtown Renton Pipe Project	Upsize/Replace	N	Valley 196	5900	4,6	8	Inches	8 " Pipe	Fire Flow Deficiency Locations: - S 4th St between Burnett Ave S and Whitworth Ave S. - Whitworth Ave S from Houser Way S to S 6th St, S 6th St from Whitworth Ave S to Morris Ave S. Maintenance Condition & RUL Locations: - 4" & 6" Cast Iron main replacement in north (downtown) Renton. Installed in the 1920's.
D-09	n/a	Glenwood Ave NE Pipe Upsize	Upsize	N	Highlands 445	850	4	8	Inches	8 " Pipe	Glendwood Ave NE and NE 9th Pl
D-10	R-4	S 178th St Pipe Upsize	Upsize pipe	N	Talbot Hill 350	460	6	8	Inches	8 " Pipe	S 178th St from 98th Ave S south to end of street; Talbot Rd S between SE Carr Rd and S 177th St.
D-11	R-35	N 4th St Pipe Upsize	Upsize	N	Valley 196	120	6	8	Inches	8 " Pipe	N 4th St from Houser Way N west to end of pipe.
D-12	R-1	Hydrant Lateral Connection at Benson Condominium	Change hydrant lateral connection	N	Rolling Hills 590	50	n/a	8	Inches	8 " Pipe	Hydrant S-00110 at Benson Condominium (Benson Rd S)
D-13	n/a	S 17th St Pipe Upsize	Upsize	N	Valley 196	634	4	8	Inches	8 " Pipe	S 17th St between Talbot Rd S and Morris Ave S.
D-14	n/a	Hydrant Lateral Connection on Sunset Blvd NE	Change hydrant lateral connection	N	Valley 196	20	n/a	8	Inches	8 " Pipe	Sunset Blvd NE at split to Houser Way Bypass.
D-15	n/a	Maple Valley Hwy Pipe Upsize at Henry Moses Aquatic Center	Upsize	N	West Talbot Hill 300	70	8	12	Inches	12 " Pipe	Maple Valley Hwy at the Henry Moses Aquatic Center.
D-16	n/a	Maintenance Condition Project: Kennydale (NE 24th)	Replace	N	Highlands 445	1670	8,12	8,12	Inches	8,12 " Pipe	In the Kennydale area, replace old asbestos cement water mains in NE 24th St from Jones Ave NE to Edmonds Ave.
D-17	n/a	Maintenance Condition Project: Highlands Reservoir to Queen Ave.	Replace	N	Highlands 565	1400	8	8	Inches	8 " Pipe	Replace 8" asbestos along NE 12th St with 12" DI. With the reservoir project, we are replacing the 8" main from the reservoir site to Queen Ave Ne.
D-18	n/a	Maintenance Condition Project: Monroe Ave NE	Replace	N	Highlands 565	2970	4, 6	8	Inches	8 " Pipe	South of the Highlands Reservoir & President Park, replace old steel water mains off of Monroe Ave NE.
D-19	n/a	Maintenance Condition Project: Shattuck Ave	Replace	N	Talbot Hill 350	490	6	8	Inches	8 " Pipe	Based on maintenance history, replace 6" CI on Shattuck Ave S. north of S. 36th Street.

CIP Prioritization Table

					Project Description						
CIP ID	**2012 Plan ID**	**Project Name**	**Improvement Type**	**Project Status Implemented? Y/N**	**Pressure Zone**	**Pipe Length (LF)**	**Existing Diameter (inches)**	**Proposed Size**	**Units**	**Project Element**	**Location**
D-20	n/a	Maintenance Condition Project: Garden Ave N	Replace	N	Kennydale 308	2500	12	12	Inches	12 " Pipe	Replace old 12" asbestos water mains in Garden Ave N from N 3rd St to The Landing (N 8th St).
D-21	n/a	Maintenance Condition Project: West Hill	Replace	N	West Hill 495	1440	4, 6, 8	8	Inches	8 " Pipe	West Hill: Replace old 4", 6", and 8" steel water mains along Stevens Ave S from the south end of Stevens Ave to NW 4th St.
D-22	n/a	Maintenance Condition Project: Tiffany Park Area	Replace	N	Rolling Hills 590	11190	4, 6, 8, 12	8,12	Inches	8,12 " Pipe	Based on maintenance history, replace steel wrapped water mains in the Tiffany Park area (wastewater did a project here a few years ago, so we should have survey data for some of the area).
Pressure Zone Rezoning											
PZ-01	R-29	HLD 445/565 Pipe Reconfiguration		N	Highlands 445	1200		12	Inches	Rezone	Development area between Sunset Ln SE and NE Sunset Blvd
PZ-02	n/a	VLY196 Re-zone		N	Valley 196	300		12	Inches	Rezone	Intersection of SE Carr Rd and Talbot Rd S.
Annual Repair and Replacement Programs											
P-01	R-34 R-6 R-19 R-3 R-2	Dead end 3,000 gpm fire flow program	n/a	N	System-wide	n/a	n/a	n/a		Program	- Hydrant NW-00091 at 801 Rainier Ave N - SW CRN of Complex. - Hydrant S-00364 at 17910 Talbot Rd S. - Hydrant S-00174 at 1400 Talbot Rd S Renton Plaza NE CRN. - Hydrant S-00107 at 1301 Thomas Ln S. - Hydrant S-00123 at 1817 Grant Ave S - NW CRN of APT. - Hydrant S-00167 at 1 S Grady Wy Renton Village- W SD of Red Lion Hotel. - Hydrant S-00053 at 400 S 2nd St Renton High School - E End. - Hydrant S-00218 at 400 S 2nd St Rention High School - N SD. (5,000 gpm fire flow requirement) - Hydrant N-00129 at 480 Houser Way N. - Hydrant SE-00020 at 2205 Maple Valley Hwy Riviera Apt. - Hydrant NE-00038 at 1442 Hillcrest Ln NE.
P-02	n/a	Dead End 1,000 gpm fire flow program	n/a	N	System-wide	2370	4, 6	8	Inches	Program	- Hydrant S-00189 at 616 S 25th St & Smithers Ave S. - Hydrant NE-00801 at 1180 Monterey Ave NE. - Hydrant NE-01092 at 2025 NE 15th St. - Hydrant N-00172 at 2600 Garden Ct N. - Hydrant S-00182 at 2500 Talbot Dr S.
P-03		Pipeline Repair and Replacement Program (High Priority)	Replace	N	System-wide	116,120				Program	System Wide
Pump Station											
PS-01		Monroe Ave BPS Generator	Pump Station	N	Highlands 565	n/a	n/a	125	HP	Pump Station	Monroe Ave BPS
PS-02		West Hill BPS	Pump Station	N	West Hill 495					Pump Station	West Hill BPS
PS-03		South Talbot BPS	Pump Station	N	Talbot Hill 350					Pump Station	South Talbot BPS

CIP Prioritization Table

							Project Description			
CIP ID	**2012 Plan ID**	**Project Name**	**Improvement Type**	**Project Status Implemented? Y/N**	**Pressure Zone**	**Pipe Length (LF)**	**Existing Diameter (inches)**	**Proposed Size**	**Units**	**Project Element**	**Location**
Storage											
ST-01		Rolling Hills 590 Storage	Storage	N	Rolling Hills 590	n/a	n/a				Rolling Hills 590
ST-01				N				1.5	MG	Storage	Rolling Hills 590
ST-01				N				100	HP	Rolling Hills Generator	Rolling Hills BPS
ST-01				N				750	HP	Maplewood Generator	Maplewood BPS
ST-02		West Hill 495 Storage	Storage	N	West Hill 495	n/a	n/a	n/a		Storage	West Hill 495 PZ
General											
G-01		Reservoirs Repair, Painting, Cathodic Protection	General	N	System-wide			20	Years	General	
G-02		Emergency Response Water Projects	General	N	System-wide			20	Years	General	
G-03		Pump Station Condition Evaluation (mechanical, struture, electrical)	General	N	System-wide				Study	General	
G-04		Storage Condition Evaluation (structural, seimsic,…)	General	N	System-wide				Study	General	
G-05		Security Improvements	General	N	System-wide			20	Years	General	
G-06		Telemetry System and SCADA Upgrades	General	N	System-wide			20	Years	General	
G-07		PRV Rehabilitation	General	N	System-wide			20	Years	General	
G-08		Improvements to pipelines on bridge	General	N	System-wide			20	Years	General	
Regulatory											
R-01		Regulatory Compliance Projects	General	N	System-wide			20	Years	Regulatory	
R-02		Water Conservation Program Implementation	General	N	System-wide			20	Years	Regulatory	
R-03		Water System Plan	General	N	System-wide			2	Plans	Regulatory	

Summary

Distribution Piping	$ 21,511,000
Pressure Zone Rezoning	$ 425,000
Annual Programs	$ 58,752,000
Pump Station	$ 4,505,000
Storage	$ 17,395,000
General	$ 12,900,000
Regulatory	$ 8,800,000
TOTAL	**$ 124,288,000**

CIP Prioritization Table

CIP ID	2012 Plan ID	Project Name	Purpose	Project Type / Project Priority	Project Cost: Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Distribution Piping									
D-01	R-33	NE 10th Place Pipe Upsize	1. Upsize 1" and 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement). Pipe size and contribute to fire flow deficiencies. 2. Recommend looping existing dead-end to the west to increase fire flow availability.	0-10 years	$ 300	$ 309,000	$ 92,700	$ 100,425	$ 502,000
D-01					$ 300	$ 21,000	$ 6,300	$ 6,825	$ 34,000
D-01					$ 300	$ 105,000	$ 31,500	$ 34,125	$ 171,000
D-01					$ 300	$ 183,000	$ 54,900	$ 59,475	$ 297,000
D-02	n/a	Ferndale Place NE Pipe Upsize	Upsize 4" pipe to 8" pipe to meet fire flow deficiency (1,000 gpm fire flow requirement) due to pipe size and age.	0-10 years	$ 300	$ 150,000	$ 45,000	$ 48,750	$ 244,000
D-03	R-27	Windsor Hills Pipe Project	1. Upsize 4" pipe to 8" pipe to meet fire flow deficiency (1,000 gpm fire flow requirement) due to pipe size and age. 2. Based on maintenance history, replace old (1942) 4" and 6" cast iron water main in the Windsor Hills area.	0-10 years	$ 300	$ 2,055,000	$ 616,500	$ 667,875	$ 3,339,000
D-04	R-20	Sunset Blvd N Pipe Upsize	Upsize 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement)	10-20 years	$ 350	$ 630,000	$ 189,000	$ 204,750	$ 1,024,000
D-05	R-7	Maplewood Place SE Pipe Upsize	Upsize 4" and 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement)	10-20 years	$ 300	$ 360,000	$ 108,000	$ 117,000	$ 585,000
D-06	R-25	NW 4th St Pipe Upsize	Upsize 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement on dead end)	10-20 years	$ 300	$ 63,000	$ 18,900	$ 20,475	$ 102,000
D-07	R-24 R-26	SW Sunset Blvd at Crestview Apartments Pipe Upsize	1. Install new PRV from EARL370 to WH300 on 8" pipe at intersection of SW Sunset Blvd and Stevens Ave SW. 2. Upsize 30 ft of 6" to 12" pipe on Langston Rd at intersection with SW Sunset Blvd. Project is required to meet 3,000 gpm fire flow requirement on long 8" dead end pipe.	10-20 years	$ 400	$ 212,000	$ 63,600	$ 68,900	$ 345,000
D-08	R-11 R-14 R-16	Downtown Renton Pipe Project	1. System Analysis: Upsize 6" and 4" pipe to meet fire flow deficiency (3,000 gpm fire flow). Pipe size and age contribute to fire flow deficiencies. 2. Maintenance project based on installation year and size. 3. Pipes are past RUL.	0-10 years	$ 300	$ 1,770,000	$ 531,000	$ 575,250	$ 2,876,000
D-09	n/a	Glenwood Ave NE Pipe Upsize	Upsize 4" pipe to 8" pipe to meet fire flow deficiency (1,000 gpm fire flow requirement) due to pipe size and age.	10-20 years	$ 300	$ 255,000	$ 76,500	$ 82,875	$ 414,000
D-10	R-4	S 178th St Pipe Upsize	Upsize 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement). Pipe is dead end with pipes 12" then 6" then 8". Upsize middle section to 8"	10-20 years	$ 300	$ 138,000	$ 41,400	$ 44,850	$ 224,000
D-11	R-35	N 4th St Pipe Upsize	Upsize 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement on dead end)	0-10 years	$ 300	$ 36,000	$ 10,800	$ 11,700	$ 59,000
D-12	R-1	Hydrant Lateral Connection at Benson Condominium	Fire flow deficiency (3,000 gpm fire flow requirement). Move hydrant from 6" pipe to 8" pipe	10-20 years	$ 300	$ 15,000	$ 4,500	$ 4,875	$ 24,000
D-13	n/a	S 17th St Pipe Upsize	Upsize 4" pipe to 8" pipe to meet fire flow deficiency (1,000 gpm fire flow requirement) due to pipe size and age.	10-20 years	$ 300	$ 190,200	$ 57,060	$ 61,815	$ 309,000
D-14	n/a	Hydrant Lateral Connection on Sunset Blvd NE	Hydrant is on 8" dead end in VLY196. Move hydrant to 14" main line pipe in HLD435 zone (no deficiencies on pipe)	10-20 years	$ 300	$ 6,000	$ 1,800	$ 1,950	$ 10,000
D-15	n/a	Maple Valley Hwy Pipe Upsize at Henry Moses Aquatic Center	8" pipe segment is between 12" pipe segments and therefore has high velocity during Peak Hour Demand (PHD). Upsize 8" segment of pipe.	10-20 years	$ 400	$ 28,000	$ 8,400	$ 9,100	$ 46,000
D-16	n/a	Maintenance Condition Project: Kennydale (NE 24th)	Maintenance List of Main Replacement Projects	0-10 years		$ 630,000	$ 189,000	$ 204,750	$ 1,024,000
D-17	n/a	Maintenance Condition Project: Highlands Reservoir to Queen Ave.	Maintenance List of Main Replacement Projects	0-10 years	$ 300	$ 420,000	$ 126,000	$ 136,500	$ 683,000
D-18	n/a	Maintenance Condition Project: Monroe Ave NE	Maintenance List of Main Replacement Projects	0-10 years		$ 891,000	$ 267,300	$ 289,575	$ 1,448,000
D-19	n/a	Maintenance Condition Project: Shattuck Ave	Maintenance List of Main Replacement Projects	0-10 years	$ 300	$ 147,000	$ 44,100	$ 47,775	$ 239,000

CIP Prioritization Table

CIP ID	2012 Plan ID	Project Name	Purpose	Project Type / Project Priority	Unit Cost ($/Unit)	Subtotal	Design/Admin	Construction Contingency	Total Cost
							30%	25%	
D-20	n/a	Maintenance Condition Project: Garden Ave N	Maintenance List of Main Replacement Projects	0-10 years	$ 400	$ 1,000,000	$ 300,000	$ 325,000	$ 1,625,000
D-21	n/a	Maintenance Condition Project: West Hill	Maintenance List of Main Replacement Projects	0-10 years		$ 432,000	$ 129,600	$ 140,400	$ 703,000
D-22	n/a	Maintenance Condition Project: Tiffany Park Area	Maintenance List of Main Replacement Projects	0-10 years		$ 3,499,000	$ 1,049,700	$ 1,137,175	$ 5,686,000
Pressure Zone Rezoning									
PZ-01	R-29	HLD 445/565 Pipe Reconfiguration	As area gets re-developed, new developments will need to connect to HLD 565 pipe due to fire flow deficiencies on HLD 445 pipe.	10-20 years		$ 200,000	$ 60,000	$ 65,000	$ 325,000
PZ-02	n/a	VLY196 Re-zone	Re-zone area to address low pressure and fire flow deficiencies and in VLY196 on transmission main north of Springbrook Springs. Hydrant S-00235 at 401 S 43rd St & Talbot Rd will need to be re-zoned, decommissioned, or removed. From Ch 7: " Storage analysis showed that the Valley area is deficient for all planning years till 2039 to supply operational and equalizing volumes at 30 psi to the highest customers. The area has sufficient storage at 20 psi. To address this issue, the City is in the process of connecting high elevation residents within the Valley 196 zone to higher pressure zone infrastructure. These improvements will provide adequate operating pressures and fire flow pressures to these high elevation residents as well."	0-10 years		$ 100,000			$ 100,000
Annual Repair and Replacement Programs									
P-01	R-34 R-6 R-19 R-3 R-2	Dead end 3,000 gpm fire flow program	Hydrants are on dead ends but main line pipes are able to supply 3,000 gpm fire flow demand. These areas should be reviewed when new development takes place and potentially looped or upsized.	10-20 years	$ -	$ -	$ -	$ -	$ -
P-02	n/a	Dead End 1,000 gpm fire flow program	Hydrants are unable to supply 1,000 gpm fire flow requirement in dead end pipes. This program is to move hydrants from dead end pipes to main line pipes.	0-10 years	$ 300	$ 711,000	$ 213,300	$ 231,075	$ 1,155,000
P-03		Pipeline Repair and Replacement Program (High Priority)	Project to replace pipes that have reached or will reach their remaining useful life in the planning period based on installation date and pipe material type. (see RUL Summary tab for breakdown of LF by pipe diameter size)	Annual		$ 35,444,000	$ 10,633,200	$ 11,519,300	$ 57,597,000
Pump Station									
PS-01		Monroe Ave BPS Generator	With the existing reliable sources and reservoirs, the Highlands 565 Operational Area does not have sufficient storage for all planning years till 2039. The Highlands 565 area is deficient by 1.26 MG by 2029 and 1.65 MG by 2039. Excess storage located in the Highlands 445 Operational Area is sufficient to offset deficiency in Highlands 565. It is recommended that the City install back-up power generators at the Monroe Avenue BPS to allow storage to be provided from the Highlands 445 pressure zone to the Highlands 465 pressure zone (which will also improve pumping capacity for long-term). The City is already planning on adding a generator at Monroe BPS as part of the construction of the new 6.3 MG reservoir in Highlands 445 pressure zone.	0-10 years	$ 300,000	$ 300,000	$ 90,000	$ 97,500	$ 488,000
PS-02		West Hill BPS	Install generator, increase pumping capacity, electrical, structural, and mechanical improvements. Estimated cost from RH2 Preliminary Design Report.	0-10 years					$ 1,842,000
PS-03		South Talbot BPS	Replace fire and duty pumps, electrical, structural, and mechanical improvements. Estimated cost from RH2 Preliminary Design Report.	0-10 years					$ 2,175,000

CIP Prioritization Table

CIP ID	2012 Plan ID	Project Name	Purpose	Project Type / Project Priority	Project Cost: Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Storage									
ST-01		Rolling Hills 590 Storage	As shown in the storage analysis, with the existing reliable sources and reservoirs, the Rolling Hills 590 Operational Area does not have sufficient storage for all planning years till 2039. Analysis shows that the operational area is deficient by 0.95 MG by 2039. A few options are available to the City to mitigate the deficiency. • Construct a new 1.5 MG tank for the Rolling Hills 590 Operational Area. The new tank will replace the existing 0.3 MG tank. • Add back-up power to the Maplewood BPS to increase pumping capacity from the Rolling Hills 490 Zone to the Rolling Hills 590 Zone, and add auto-start, auto-transfer, and back-up power to the Rolling Hills BPS such that three pumps can be operated at the same time.		$ 7,700,000	$ 10,700,000	$ 3,210,000.00	$ 3,477,500	$ 17,395,000
ST-01			Construct a new 1.5 MG tank for the Rolling Hills 590 Operational Area. The new tank will replace the existing 0.3 MG tank.	10-20 years	$ 6,000,000	$ 9,000,000	$ 2,700,000	$ 2,925,000	$ 14,625,000
ST-01			Add back-up power to the Maplewood BPS to increase pumping capacity from the Rolling Hills 490 Zone to the Rolling Hills 590 Zone, confirm that three pumps at West Hill 490 PS can be operated at the same time.	0-10 years	$ 200,000	$ 200,000.00	$ 60,000	$ 65,000	$ 330,000
ST-01				0-10 years	$ 1,500,000	$ 1,500,000	$ 450,000	$ 487,500	$ 2,440,000
ST-02		West Hill 495 Storage	With the existing reliable sources and reservoirs, the West Hill 495 Operational Area does not have sufficient storage through 2039. The West Hill 495 storage deficiency is minimal (0.02 MG). The City currently operates the tank with a 16 feet operational band, which equates to a 0.22 MG operational storage volume (as shown on Table 7.10). It is recommended that the City slightly update operational strategy and tighten the operational band from 16 feet to 14 feet. This will allow to decrease operational volume and mitigate deficiency.	0-10 years	$ -	$ -	$ -	$ -	$ -
General									
G-01		Reservoirs Repair, Painting, Cathodic Protection	$150,000 per year	Annual	$ 150,000	$ 3,000,000			$ 3,000,000
G-02		Emergency Response Water Projects	$100,000 per year	Annual	$ 100,000	$ 2,000,000			$ 2,000,000
G-03		Pump Station Condition Evaluation (mechanical, struture, electrical)		0-10 years	$ 300,000				$ 300,000
G-04		Storage Condition Evaluation (structural, seimsic,…)		0-10 years	$ 400,000				$ 400,000
G-05		Security Improvements		Annual	$ 10,000	$ 200,000			$ 200,000
G-06		Telemetry System and SCADA Upgrades	$50,000 per year	Annual	$ 50,000	$ 1,000,000			$ 1,000,000
G-07		PRV Rehabilitation	$100,000 per year	Annual	$ 100,000	$ 2,000,000			$ 2,000,000
G-08		Improvements to pipelines on bridge		Annual	$ 200,000	$ 4,000,000			$ 4,000,000
Regulatory									
R-01		Regulatory Compliance Projects	$200,000 per year	Annual	$ 200,000	$ 4,000,000			$ 4,000,000
R-02		Water Conservation Program Implementation	$200,000 a year	Annual	$ 200,000	$ 4,000,000			$ 4,000,000
R-03		Water System Plan	$400,000 in 10 year and in 20 year	Annual	$ 400,000	$ 800,000			$ 800,000

Appendix S

CIP PRIORITIZATION

Appendix S – Detailed Ranking Methodology

As part of this Water System Plan (Plan), a high-level prioritization matrix was developed to help with prioritization and ranking of the projects identified in the Capital Improvement plan (CIP).

The capital improvement implementation was separated into two phases:

- Short term: 0 to 10 years.
- Long term: 10 to 20 years.

The City developed prioritization criteria to prioritize all projects and recommendations from this Plan between Short-term and Long-term. Short-term projects have already started or are committed to starting within a reasonable timeframe and include high-priority projects, such as the following:

- High priority multi-feature projects.
- Projects improving system reliability.
- Maintenance-identified projects.

All other CIP projects, such as dead-end programs or single feature projects are long term.

Table 1 summarizes the high-level prioritization matrix for different project types and purposes.

Table 1 Overall Prioritization Criteria

Project Types[1]	0-10 years	10-20 years
Dead-end pipes in existing non-single family areas (3,000 gpm):		X
Dead-end pipes in existing single family areas (1,000 gpm):	X	
Maintenance projects	X	
Pipe upsize due to excessive velocity (over 8 ft/sec)		X
R&R pipes only – past RUL	Annual replacement $	
R&R pipes only – reaching RUL 0-10 years		
R&R pipes only – reaching RUL 10-20 years		
Pipe upsize for fire flow only		X
Pipe upsize for fire flow, maintenance, and past RUL	X	
Pipe upsize for fire flow, and RUL reached in 0-10 years	X	
Pipe upsize for fire flow, and RUL reached in 10-20 years		X
Pressure Zone projects (PZ-02)	X	
Pump Station projects (PS-01, PS-02, PS-03)	X	

Note:
(1) gpm – gallons per minute; RUL – remaining useful life.

A detailed and customized scoring method using weighting factors was developed to help refine ranking and prioritizing specific pipeline projects from the general method above. Note, general repair and replacement program from the Remaining useful Life (RUL) analysis are done evaluated against the method below.

The City identified five categories with different weighting factors each:

1. Pipe age
2. Pipe material
3. Pipe size
4. Pipe type
5. Project location

The total score obtained by each pipeline once evaluated with the scores below is an indication of the priority to implement the project identified. Only specific projects developed during the system analysis using the hydraulic model and the specific projects identified by the City's maintenance Shops were run through this prioritization and ranking methodology. Results are presented in Table 2.

Table 1 Detailed Prioritization Criteria

Criteria	Score
Pipe Age	
Prior to 1949 (over 70 years)	10
1950 to 1960 (60 to 69 years)	6
1961 to 1970 (50 to 60 years)	4
Pipe Material	
A.C	10
Steel	7
C.I.	5
D.I.	3
Pipe Size (capacity)	
Dead-end 4" and 6" with hydrants	10
4" looped water mains with hydrants	8
6" looped	5
Dead-end 8"	3
Pipe Type	
Major transmission main	8
Secondary transmission main	6
Distribution main	5
Pipe Location	
Arterial street	5
Residential street	3

CIP Prioritization Table

Project Description											Project Type	Project Cost	Detailed Project Scoring					
CIP ID	2012 Plan ID	Project Name	Improvement Type	Project Status Implemented? Y/N	Pressure Zone	Pipe Length (LF)	Existing Diameter (inches)	Proposed Size	Units	Project Element	Project Priority	Total Cost	Pipe age	Pipe material	Pipe Size (capacity)	Transm/Dist	Residential street	Total
Distribution Piping																		
D-01	R-33	NE 10th Place Pipe Upsize	Upsize	N	Highlands 445	1030	1, 6	8	Inches	8 " Pipe	0-10 years	$ 502,000	4	5	10	5	3	27
D-01						70	1, 6	8	Inches	8 " Pipe		$ 34,000						
D-01						350		8	Inches	8 " Pipe		$ 171,000						
D-01						610		8	Inches	8 " Pipe		$ 297,000						
D-02	n/a	Ferndale Place NE Pipe Upsize	Upsize	N	Highlands 445	500	4	8	Inches	8 " Pipe	0-10 years	$ 244,000	10	5	10	5	3	33
D-03	R-27	Windsor Hills Pipe Project	Upsize	N	Highlands 445	6850	4,6	8	Inches	8 " Pipe	0-10 years	$ 3,339,000	10	5	10	5	3	33
D-04	R-20	Sunset Blvd N Pipe Upsize	Upsize	N	Valley 196	1800	6	10	Inches	10 " Pipe	10-20 years	$ 1,024,000	6	5	5	5	3	24
D-05	R-7	Maplewood Place SE Pipe Upsize	Upsize	N	Valley 196	1200	6	8	Inches	8 " Pipe	10-20 years	$ 585,000	10	5	10	5	3	33
D-06	R-25	NW 4th St Pipe Upsize	Upsize	N	West Hill 300	210	6	8	Inches	8 " Pipe	10-20 years	$ 102,000	4	5	10	5	3	27
D-07	R-24 R-26	SW Sunset Blvd at Crestview Apartments Pipe Upsize	Upsize / New PRV	N	Valley 196	30	6	12	Inches	12 " Pipe	10-20 years	$ 345,000	0	3	10	5	5	23
D-08	R-11 R-14 R-16	Downtown Renton Pipe Project	Upsize/Replace	N	Valley 196	5900	4,6	8	Inches	8 " Pipe	0-10 years	$ 2,876,000	10	5	10	5	5	35
D-09	n/a	Glenwood Ave NE Pipe Upsize	Upsize	N	Highlands 445	850	4	8	Inches	8 " Pipe	10-20 years	$ 414,000	6	5	10	5	5	31
D-10	R-4	S 178th St Pipe Upsize	Upsize pipe	N	Talbot Hill 350	460	6	8	Inches	8 " Pipe	10-20 years	$ 224,000						0
D-11	R-35	N 4th St Pipe Upsize	Upsize	N	Valley 196	120	6	8	Inches	8 " Pipe	0-10 years	$ 59,000	10	5	10	5	5	35
D-12	R-1	Hydrant Lateral Connection at Benson Condominium	Change hydrant lateral connection	N	Rolling Hills 590	50	n/a	8	Inches	8 " Pipe	10-20 years	$ 24,000						0
D-13	n/a	S 17th St Pipe Upsize	Upsize	N	Valley 196	634	4	8	Inches	8 " Pipe	10-20 years	$ 309,000	4	5	10	5	3	27
D-14	n/a	Hydrant Lateral Connection on Sunset Blvd NE	Change hydrant lateral connection	N	Valley 196	20	n/a	8	Inches	8 " Pipe	10-20 years	$ 10,000						0
D-15	n/a	Maple Valley Hwy Pipe Upsize at Henry Moses Aquatic Center	Upsize	N	West Talbot Hill 300	70	8	12	Inches	12 " Pipe	10-20 years	$ 46,000						0
D-16	n/a	Maintenance Condition Project: Kennydale (NE 24th)	Replace	N	Highlands 445	1670	8,12	8,12	Inches	8,12 " Pipe	0-10 years	$ 1,024,000	6	10	0	6	5	27
D-17	n/a	Maintenance Condition Project: Highlands Reservoir to Queen Ave.	Replace	N	Highlands 565	1400	8	8	Inches	8 " Pipe	0-10 years	$ 683,000	10	10	3	6	5	34
D-18	n/a	Maintenance Condition Project: Monroe Ave NE	Replace	N	Highlands 565	2970	4, 6	8	Inches	8 " Pipe	0-10 years	$ 1,448,000	10	7	8	5	3	33
D-19	n/a	Maintenance Condition Project: Shattuck Ave	Replace	N	Talbot Hill 350	490	6	8	Inches	8 " Pipe	0-10 years	$ 239,000	4	5	10	5	3	27

CIP Prioritization Table

Project Description											Project Type	Project Cost	Detailed Project Scoring					
CIP ID	2012 Plan ID	Project Name	Improvement Type	Project Status Implemented? Y/N	Pressure Zone	Pipe Length (LF)	Existing Diameter (inches)	Proposed Size	Units	Project Element	Project Priority	Total Cost	Pipe age	Pipe material	Pipe Size (capacity)	Transm/Dist	Residential street	Total
D-20	n/a	Maintenance Condition Project: Garden Ave N	Replace	N	Kennydale 308	2500	12	12	Inches	12 " Pipe	0-10 years	$ 1,625,000	6	10	0	6	5	27
D-21	n/a	Maintenance Condition Project: West Hill	Replace	N	West Hill 495	1440	4, 6, 8	8	Inches	8 " Pipe	0-10 years	$ 703,000	4	7	5	5	5	26
D-22	n/a	Maintenance Condition Project: Tiffany Park Area	Replace	N	Rolling Hills 590	11190	4, 6, 8, 12	8,12	Inches	8,12 " Pipe	0-10 years	$ 5,686,000	4	10	5	5	5	29

Appendix T

CIP SHEETS

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-01
Project Title: NE 10th Place Pipe Upsize
Facility Type: Distribution Piping
Pressure Zone: Highlands 445

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): N

Project Description:

Location: NE 10th Place between Sunset Blvd NE and Edmonds Ave NE

Purpose: 1. Upsize 1" and 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement). Pipe size and contribute to fire flow deficiencies.
2. Recommend looping existing dead-end to the west to increase fire flow availability.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	1,030	LF	$ 300	$ 309,000	$ 92,700	$ 100,425	$ 502,000
Total Anticipated Project Cost							$ 502,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 251,000
Capacity:	50%	$ 251,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 502,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 502,000
Total Anticipated Project Cost		$ 502,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-02
Project Title: Ferndale Place NE Pipe Upsize
Facility Type: Distribution Piping
Pressure Zone: Highlands 445

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): N

Project Description:

Location: Ferndale Pl NE between NE 7th St and Ferndale Ave NE

Purpose: Upsize 4" pipe to 8" pipe to meet fire flow deficiency (1,000 gpm fire flow requirement) due to pipe size and age.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	500	LF	$ 300	$ 150,000	$ 45,000	$ 48,750	$ 244,000
Total Anticipated Project Cost							$ 244,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 122,000
Capacity:	50%	$ 122,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 244,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 244,000
Total Anticipated Project Cost		$ 244,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-03
Project Title: Windsor Hills Pipe Project
Facility Type: Distribution Piping
Pressure Zone: Highlands 445

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): N

Project Description:

Location: Windsor Hills Area
Fire flow deficiency location: Windsor Pl NE between Bronson Pl NE and Windsor Way NE

Purpose: 1. Upsize 4" pipe to 8" pipe to meet fire flow deficiency (1,000 gpm fire flow requirement) due to pipe size and age.
2. Based on maintenance history, replace old (1942) 4" and 6" cast iron water main in the Windsor Hills area.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	6,850	LF	$ 300	$ 2,055,000	$ 616,500	$ 667,875	$ 3,339,000
Total Anticipated Project Cost							$ 3,339,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

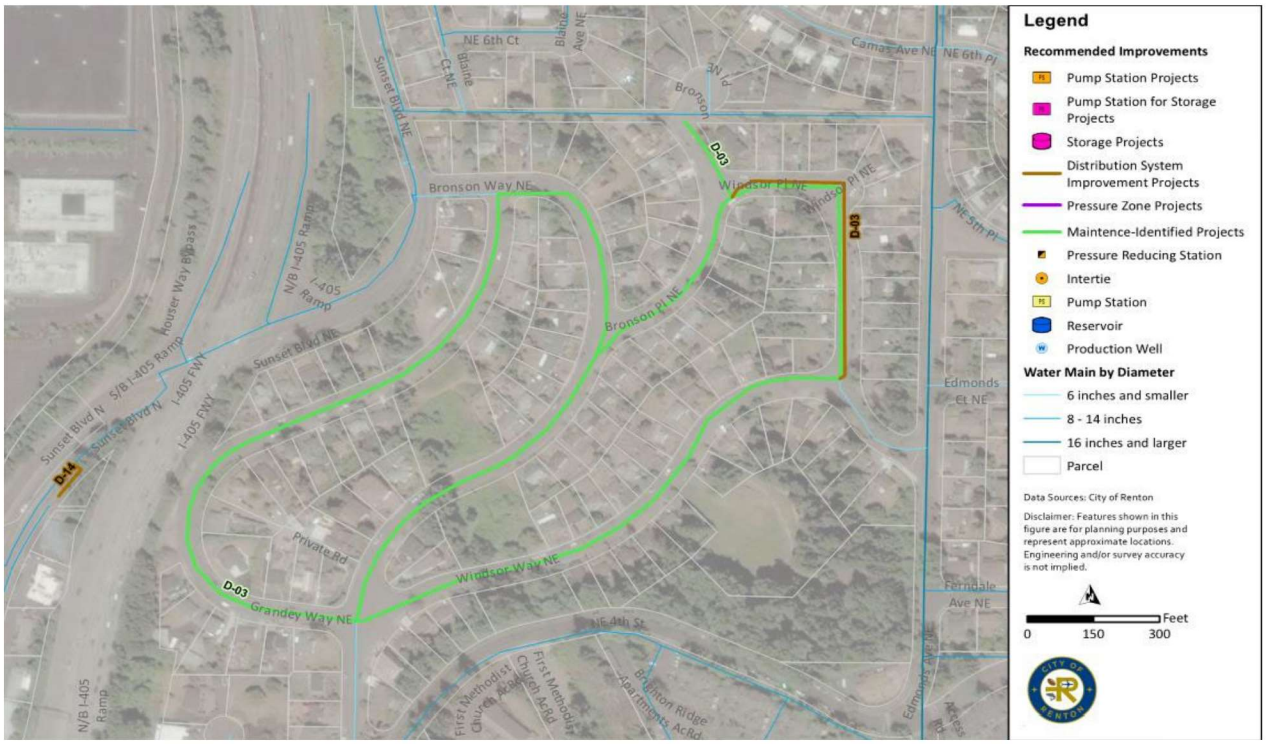
Project Type	Percent	Cost
Improvement:	10%	$ 333,900
Capacity:	10%	$ 333,900
Condition:	80%	$ 2,671,200
Total Anticipated Project Cost	100%	$ 3,339,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 3,339,000
Total Anticipated Project Cost		$ 3,339,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-04
Project Title: Sunset Blvd N Pipe Upsize
Facility Type: Distribution Piping
Pressure Zone: Valley 196

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): N

Project Description:

Location: Sunset Blvd N between Bronson Way N and N 4th St.

Purpose: Upsize 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement)

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
10 " Pipe	1,800	LF	$ 350	$ 630,000	$ 189,000	$ 204,750	$ 1,024,000
Total Anticipated Project Cost							$ 1,024,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

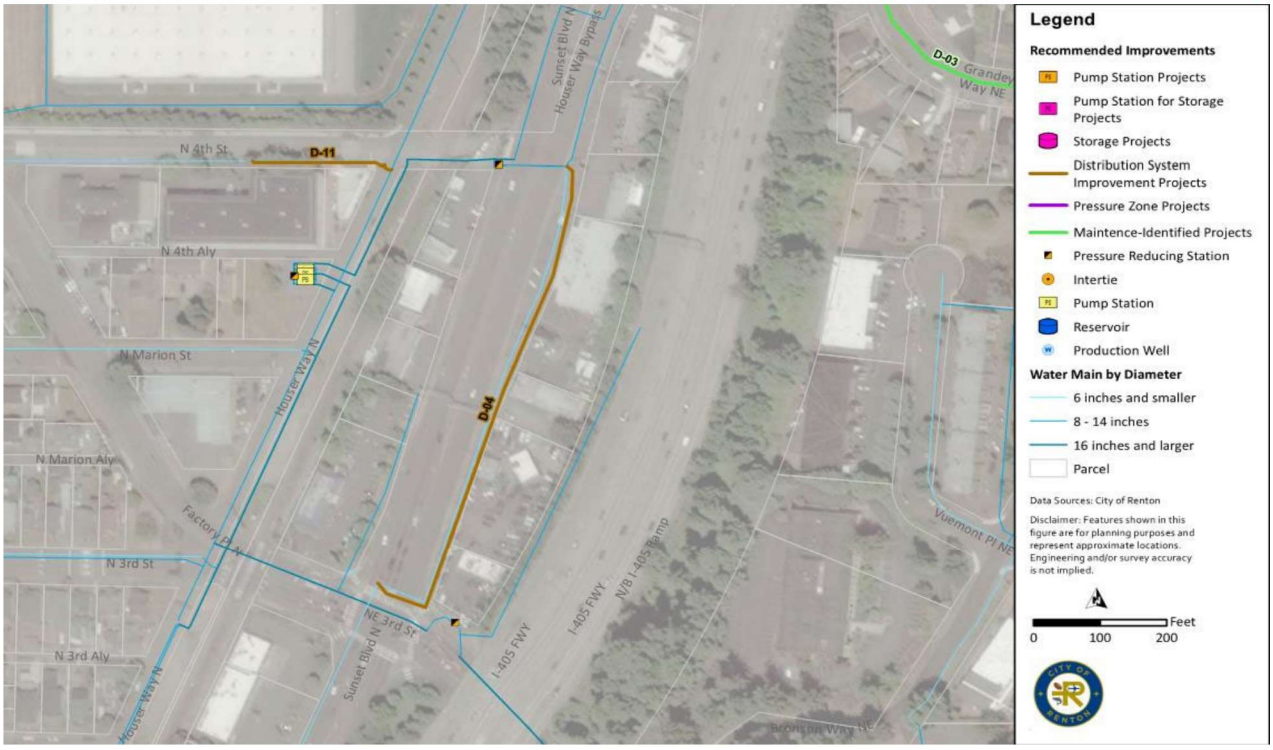
Project Type	Percent	Cost
Improvement:	50%	$ 512,000
Capacity:	50%	$ 512,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,024,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 1,024,000
Total Anticipated Project Cost		$ 1,024,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-05
Project Title: Maplewood Place SE Pipe Upsize
Facility Type: Distribution Piping
Pressure Zone: Valley 196

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): N

Project Description:

Location: Maplewood Pl SE from SE 6th St to SE 7th Ave, SE 7th Ave.

Purpose: Upsize 4" and 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement)

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	1,200	LF	$ 300	$ 360,000	$ 108,000	$ 117,000	$ 585,000
Total Anticipated Project Cost							$ 585,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 292,500
Capacity:	50%	$ 292,500
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 585,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 585,000
Total Anticipated Project Cost		$ 585,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-06
Project Title: NW 4th St Pipe Upsize
Facility Type: Distribution Piping
Pressure Zone: West Hill 300

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): N

Project Description:

Location: NW 4th St between Taylor Ave NE and Hardie Ave NE.

Purpose: Upsize 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement on dead end)

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	210	LF	$ 300	$ 63,000	$ 18,900	$ 20,475	$ 102,000
Total Anticipated Project Cost							$ 102,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 51,000
Capacity:	50%	$ 51,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 102,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 102,000
Total Anticipated Project Cost		$ 102,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-07
Project Title: SW Sunset Blvd at Crestview Apartments Pipe Upsize
Priority: 10-20 years
Facility Type: Distribution Piping
Pressure Zone: Valley 196
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: SW Sunset Blvd at Crestview Apartments

Purpose: 1. Install new PRV from EARL370 to WH300 on 8" pipe at intersection of SW Sunset Blvd and Stevens Ave SW.
2. Upsize 30 ft of 6" to 12" pipe on Langston Rd at intersection with SW Sunset Blvd.
Project is required to meet 3,000 gpm fire flow requirement on long 8" dead end pipe.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
12 " Pipe	30	LF	$ 400	$ 212,000	$ 63,600	$ 68,900	$ 345,000
Total Anticipated Project Cost							$ 345,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 172,500
Capacity:	50%	$ 172,500
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 345,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 345,000
Total Anticipated Project Cost		$ 345,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-08
Project Title: Downtown Renton Pipe Project
Facility Type: Distribution Piping
Pressure Zone: Valley 196

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): N

Project Description:

Location: Fire Flow Deficiency Locations:
- S 4th St between Burnett Ave S and Whitworth Ave S.

Purpose: 1. System Analysis: Upsize 6" and 4" pipe to meet fire flow deficiency (3,000 gpm fire flow). Pipe size and age contribute to fire flow deficiencies.
2. Maintenance project based on installation year and size.
3. Pipes are past RUL.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	5,900	LF	$ 300	$ 1,770,000	$ 531,000	$ 575,250	$ 2,876,000
Total Anticipated Project Cost							$ 2,876,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	25%	$ 719,000
Capacity:	25%	$ 719,000
Condition:	50%	$ 1,438,000
Total Anticipated Project Cost	100%	$ 2,876,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 2,876,000
Total Anticipated Project Cost		$ 2,876,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-09
Project Title: Glenwood Ave NE Pipe Upsize
Facility Type: Distribution Piping
Pressure Zone: Highlands 445

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): N

Project Description:
Location: Glendwood Ave NE and NE 9th Pl

Purpose: Upsize 4" pipe to 8" pipe to meet fire flow deficiency (1,000 gpm fire flow requirement) due to pipe size and age.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	850	LF	$ 300	$ 255,000	$ 76,500	$ 82,875	$ 414,000
Total Anticipated Project Cost							$ 414,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 207,000
Capacity:	50%	$ 207,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 414,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 414,000
Total Anticipated Project Cost		$ 414,000

Project Location Map:

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City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-10
Project Title: S 178th St Pipe Upsize
Facility Type: Distribution Piping
Pressure Zone: Talbot Hill 350

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): N

Project Description:

Location: S 178th St from 98th Ave S south to end of street; Talbot Rd S between SE Carr Rd and S 177th St.

Purpose: Upsize 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement). Pipe is dead end with pipes 12" then 6" then 8". Upsize middle section to 8"

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	460	LF	$ 300	$ 138,000	$ 41,400	$ 44,850	$ 224,000
Total Anticipated Project Cost							$ 224,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 112,000
Capacity:	50%	$ 112,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 224,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 224,000
Total Anticipated Project Cost		$ 224,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-11
Project Title: N 4th St Pipe Upsize
Facility Type: Distribution Piping
Pressure Zone: Valley 196

Go to CIP Summary Table

Priority: 0-10 years
Project Status (Completed?): N

Project Description:
Location: N 4th St from Houser Way N west to end of pipe.

Purpose: Upsize 6" pipe to 8" pipe to meet fire flow deficiency (3,000 gpm fire flow requirement on dead end)

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	120	LF	$ 300	$ 36,000	$ 10,800	$ 11,700	$ 59,000
Total Anticipated Project Cost							$ 59,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

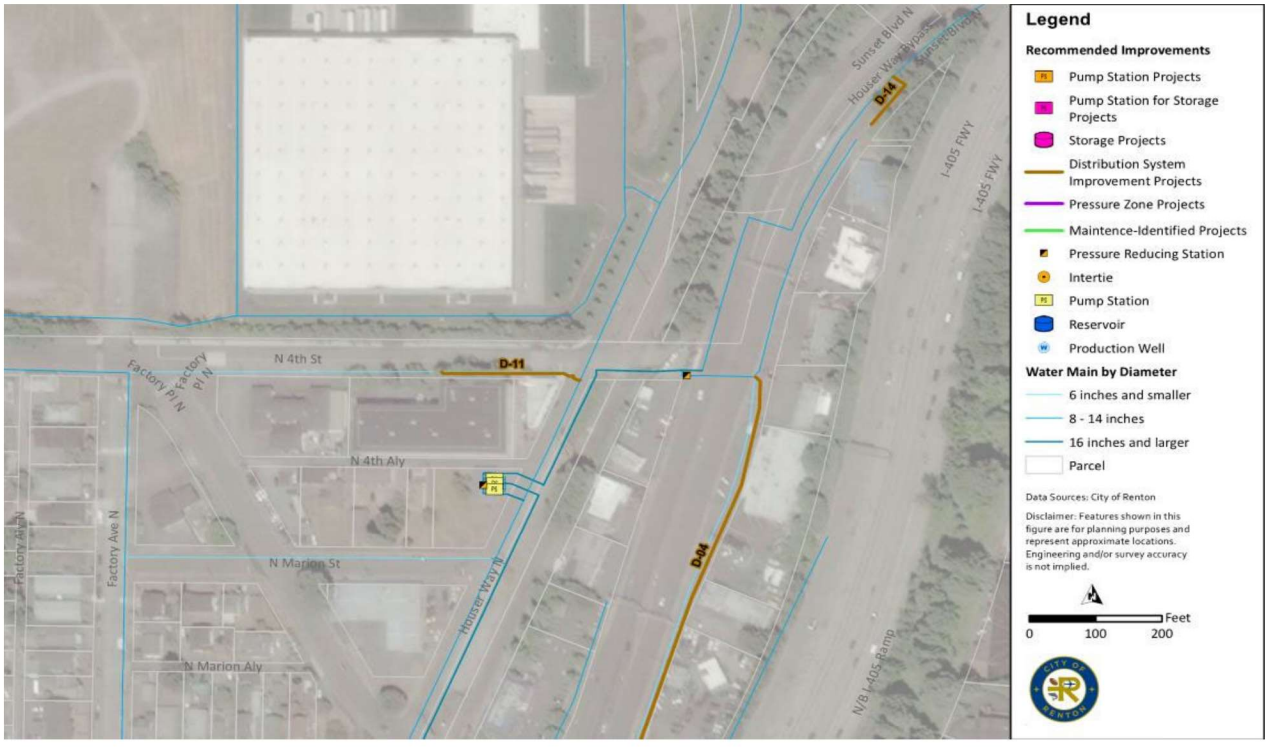
Project Type	Percent	Cost
Improvement:	50%	$ 29,500
Capacity:	50%	$ 29,500
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 59,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 59,000
Total Anticipated Project Cost		$ 59,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-12
Project Title: Hydrant Lateral Connection at Benson Condominium
Priority: 10-20 years
Facility Type: Distribution Piping
Pressure Zone: Rolling Hills 590
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Hydrant S-00110 at Benson Condominium (Benson Rd S)

Purpose: Fire flow deficiency (3,000 gpm fire flow requirement). Move hydrant from 6" pipe to 8" pipe

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	50	LF	$ 300	$ 15,000	$ 4,500	$ 4,875	$ 24,000
Total Anticipated Project Cost							$ 24,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 12,000
Capacity:	50%	$ 12,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 24,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 24,000
Total Anticipated Project Cost		$ 24,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-13
Project Title: S 17th St Pipe Upsize
Facility Type: Distribution Piping
Pressure Zone: Valley 196

Go to CIP Summary Table

Priority: 10-20 years
Project Status (Completed?): N

Project Description:

Location: S 17th St between Talbot Rd S and Morris Ave S.

Purpose: Upsize 4" pipe to 8" pipe to meet fire flow deficiency (1,000 gpm fire flow requirement) due to pipe size and age.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	634	LF	$ 300	$ 190,200	$ 57,060	$ 61,815	$ 309,000
Total Anticipated Project Cost							$ 309,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 154,500
Capacity:	50%	$ 154,500
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 309,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 309,000
Total Anticipated Project Cost		$ 309,000

Project Location Map:

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City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-14
Project Title: Hydrant Lateral Connection on Sunset Blvd NE
Priority: 10-20 years
Facility Type: Distribution Piping
Pressure Zone: Valley 196
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Sunset Blvd NE at split to Houser Way Bypass.

Hydrant is on 8" dead end in VLY196. Move hydrant to 14" main line pipe in HLD435 zone (no deficiencies on pipe)

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	20	LF	$ 300	$ 6,000	$ 1,800	$ 1,950	$ 10,000
Total Anticipated Project Cost							$ 10,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

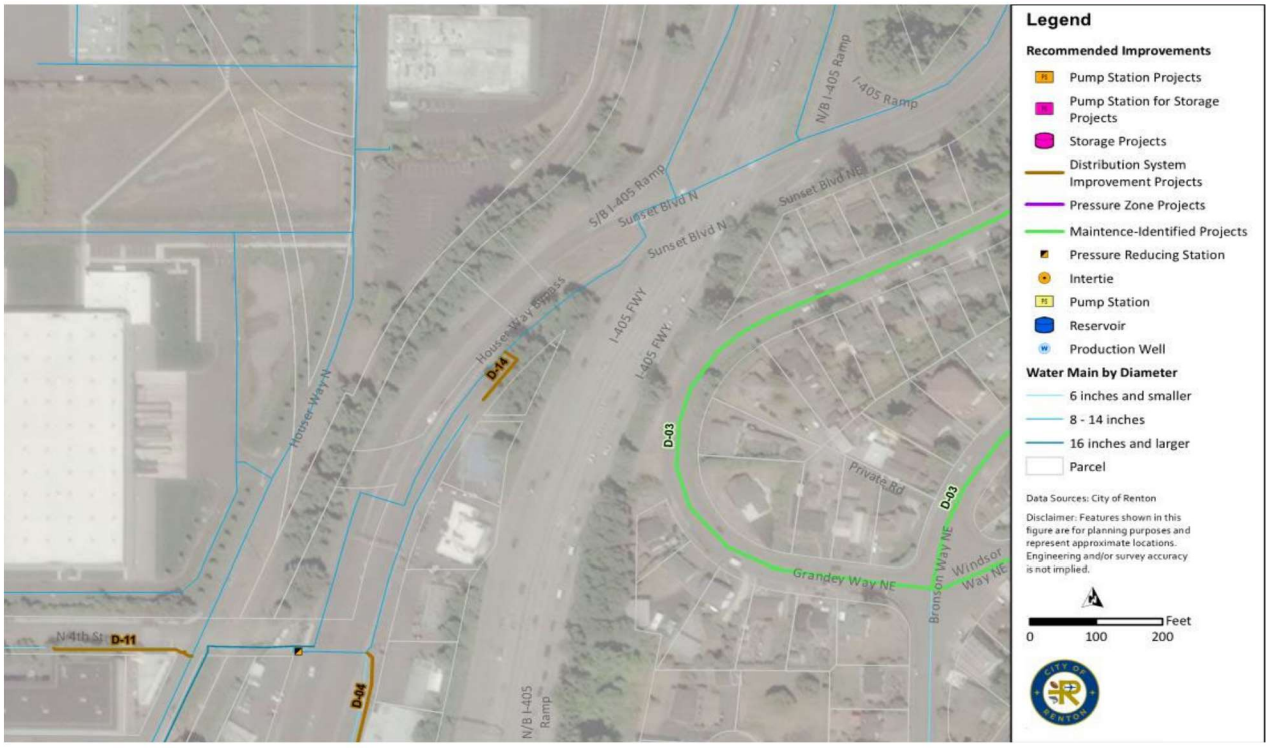
Project Type	Percent	Cost
Improvement:	50%	$ 5,000
Capacity:	50%	$ 5,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 10,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 10,000
Total Anticipated Project Cost		$ 10,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-15
Project Title: Maple Valley Hwy Pipe Upsize at Henry Moses Aquatic Center
Priority: 10-20 years
Facility Type: Distribution Piping
Pressure Zone: West Talbot Hill 300
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Maple Valley Hwy at the Henry Moses Aquatic Center.

Purpose: 8" pipe segment is between 12" pipe segments and therefore has high velocity during Peak Hour Demand (PHD). Upsize 8" segment of pipe.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
12 " Pipe	70	LF	$ 400	$ 28,000	$ 8,400	$ 9,100	$ 46,000
Total Anticipated Project Cost							$ 46,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 23,000
Capacity:	50%	$ 23,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 46,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 46,000
Total Anticipated Project Cost		$ 46,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-16
Project Title: Maintenance Condition Project: Kennydale (NE 24th)
Priority: 0-10 years
Facility Type: Distribution Piping
Pressure Zone: Highlands 445
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: In the Kennydale area, replace old asbestos cement water mains in NE 24th St from Jones Ave NE to Edmonds Ave.

Purpose: Maintenance List of Main Replacement Projects

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	380	LF	$ 300	$ 114,000	$ 34,200	$ 37,050	$ 185,000
12 " Pipe	1,290	LF	$ 400	$ 516,000	$ 154,800	$ 167,700	$ 839,000
Total Anticipated Project Cost							$ 1,024,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 1,024,000
Total Anticipated Project Cost	100%	$ 1,024,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 1,024,000
Total Anticipated Project Cost		$ 1,024,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-17
Project Title: Maintenance Condition Project: Highlands Reservoir to Queen Ave.
Priority: 0-10 years
Facility Type: Distribution Piping
Pressure Zone: Highlands 565
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Replace 8" asbestos along NE 12th St with 12" DI. With the reservoir project, we are replacing the 8" main from the reservoir site to Queen Ave Ne.

Purpose: Maintenance List of Main Replacement Projects

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	1,400	LF	$ 300	$ 420,000	$ 126,000	$ 136,500	$ 683,000
Total Anticipated Project Cost							$ 683,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 683,000
Total Anticipated Project Cost	100%	$ 683,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 683,000
Total Anticipated Project Cost		$ 683,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
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Project ID: D-18
Project Title: Maintenance Condition Project: Monroe Ave NE
Priority: 0-10 years
Facility Type: Distribution Piping
Pressure Zone: Highlands 565
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: South of the Highlands Reservoir & President Park, replace old steel water mains off of Monroe Ave NE.

Purpose: Maintenance List of Main Replacement Projects

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	2,970	LF	$ 300	$ 891,000	$ 267,300	$ 289,575	$ 1,448,000
Total Anticipated Project Cost							$ 1,448,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 1,448,000
Total Anticipated Project Cost	100%	$ 1,448,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 1,448,000
Total Anticipated Project Cost		$ 1,448,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-19
Project Title: Maintenance Condition Project: Shattuck Ave
Priority: 0-10 years
Facility Type: Distribution Piping
Pressure Zone: Talbot Hill 350
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Based on maintenance history, replace 6" CI on Shattuck Ave S. north of S. 36th Street.

Purpose: Maintenance List of Main Replacement Projects

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	490	LF	$ 300	$ 147,000	$ 44,100	$ 47,775	$ 239,000
Total Anticipated Project Cost							$ 239,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 239,000
Total Anticipated Project Cost	100%	$ 239,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 239,000
Total Anticipated Project Cost		$ 239,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-20
Project Title: Maintenance Condition Project: Garden Ave N
Priority: 0-10 years
Facility Type: Distribution Piping
Pressure Zone: Kennydale 308
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Replace old 12" asbestos water mains in Garden Ave N from N 3rd St to The Landing (N 8th St).

Purpose: Maintenance List of Main Replacement Projects

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
12 " Pipe	2,500	LF	$ 400	$ 1,000,000	$ 300,000	$ 325,000	$ 1,625,000
Total Anticipated Project Cost							$ 1,625,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

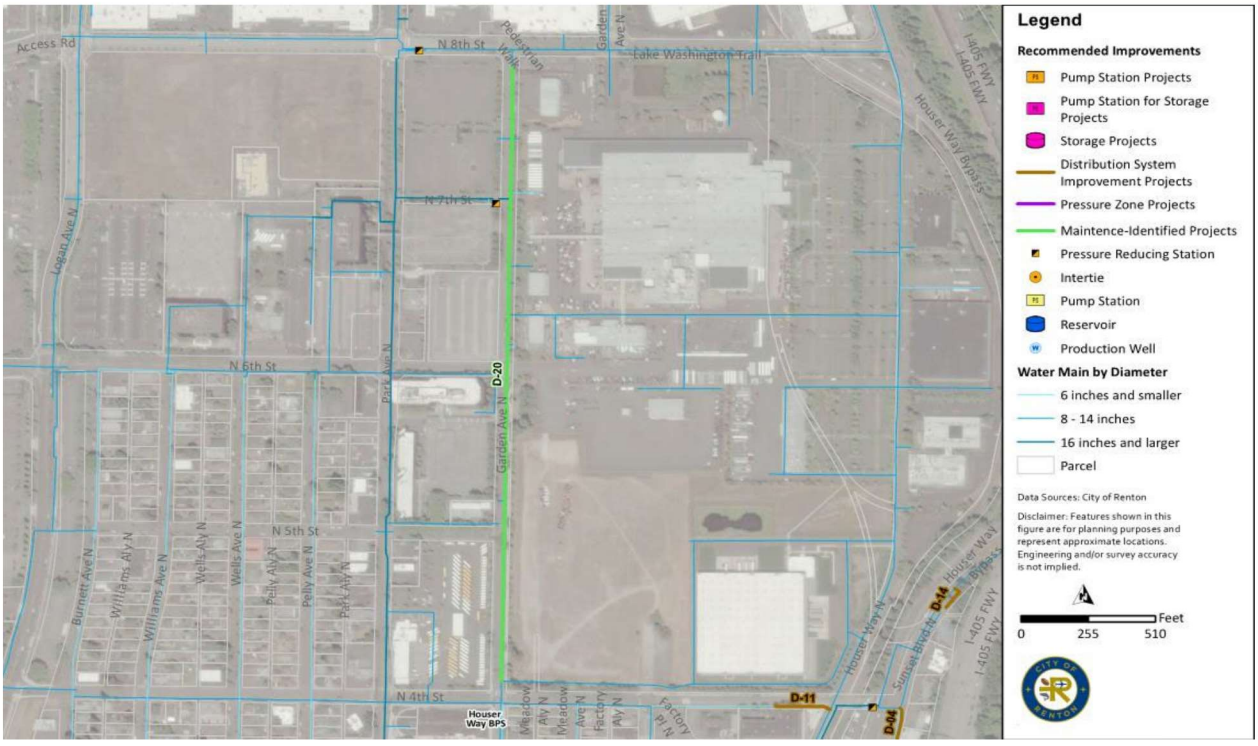
Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 1,625,000
Total Anticipated Project Cost	100%	$ 1,625,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 1,625,000
Total Anticipated Project Cost		$ 1,625,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-21
Project Title: Maintenance Condition Project: West Hill
Priority: 0-10 years
Facility Type: Distribution Piping
Pressure Zone: West Hill 495
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: West Hill: Replace old 4", 6", and 8" steel water mains along Stevens Ave S from the south end of Stevens Ave to NW 4th St.

Purpose: Maintenance List of Main Replacement Projects

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	1,440	LF	$ 300	$ 432,000	$ 129,600	$ 140,400	$ 703,000
Total Anticipated Project Cost							$ 703,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

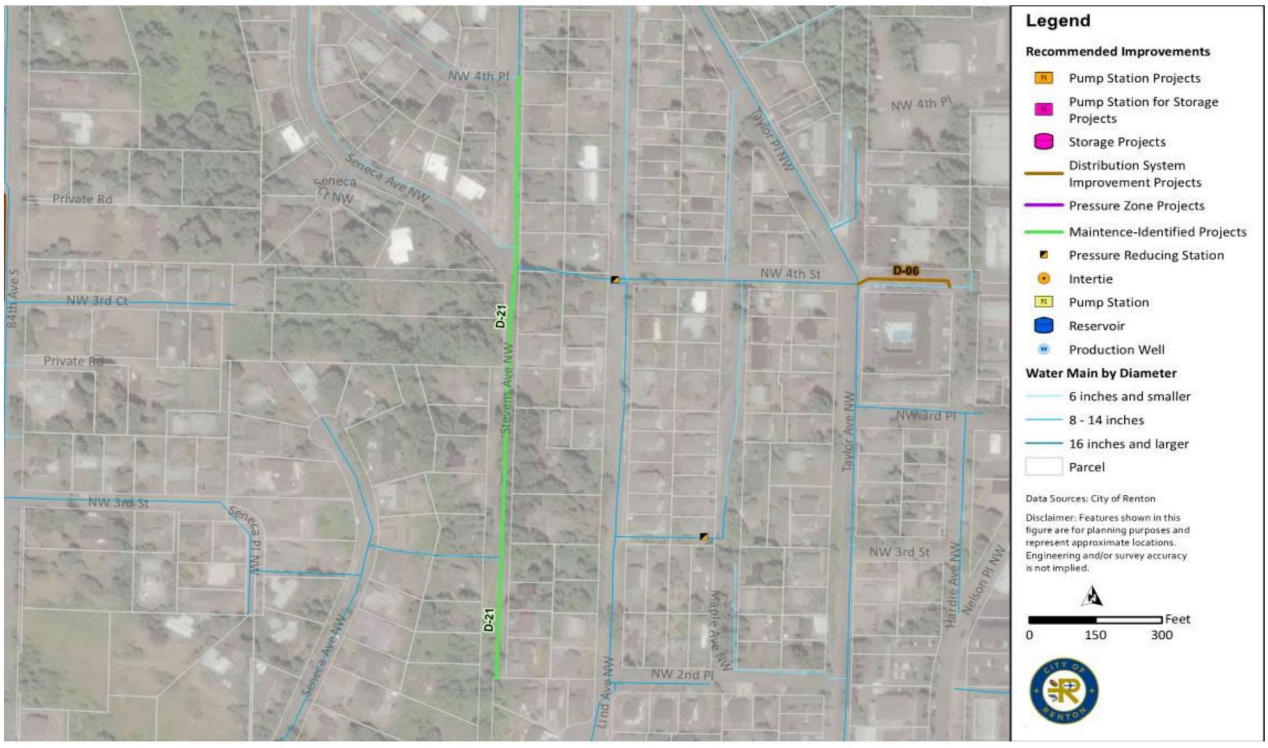
Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 703,000
Total Anticipated Project Cost	100%	$ 703,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 703,000
Total Anticipated Project Cost		$ 703,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: D-22
Project Title: Maintenance Condition Project: Tiffany Park Area
Priority: 0-10 years
Facility Type: Distribution Piping
Pressure Zone: Rolling Hills 590
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Based on maintenance history, replace steel wrapped water mains in the Tiffany Park area (wastewater did a project here a few years ago, so we should have survey data for some of the area).

Purpose: Maintenance List of Main Replacement Projects

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
8 " Pipe	9,770	LF	$ 300	$ 2,931,000	$ 879,300	$ 952,575	$ 4,763,000
12 " Pipe	1,420	LF	$ 400	$ 568,000	$ 170,400	$ 184,600	$ 923,000
Total Anticipated Project Cost							$ 5,686,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

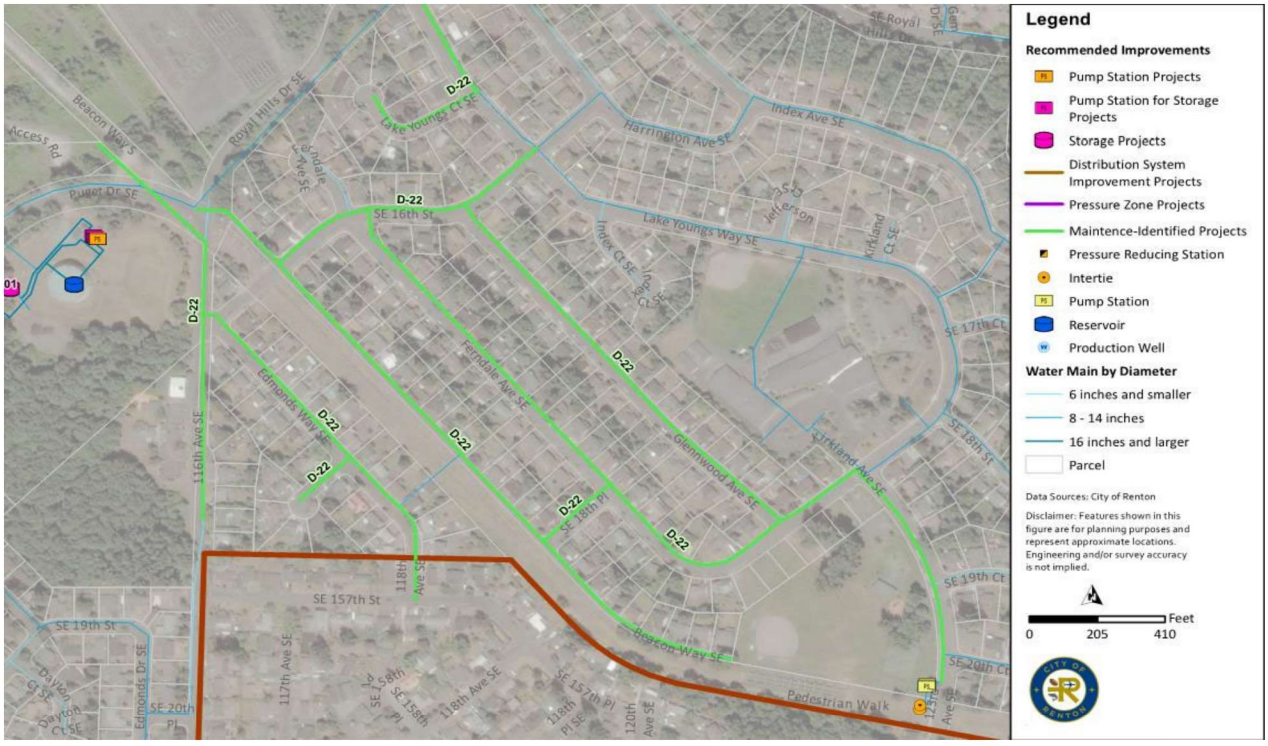
Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 5,686,000
Total Anticipated Project Cost	100%	$ 5,686,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 5,686,000
Total Anticipated Project Cost		$ 5,686,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: PZ-01
Project Title: HLD 445/565 Pipe Reconfiguration
Facility Type: Pressure Zone Rezoning
Pressure Zone: Highlands 445
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Development area between Sunset Ln SE and NE Sunset Blvd

Purpose: As area gets re-developed, new developments will need to connect to HLD 565 pipe due to fire flow deficiencies on HLD 445 pipe.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Rezone	1,200	LF	$ 300	$ 200,000	$ 60,000	$ 65,000	$ 325,000
Total Anticipated Project Cost							$ 325,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

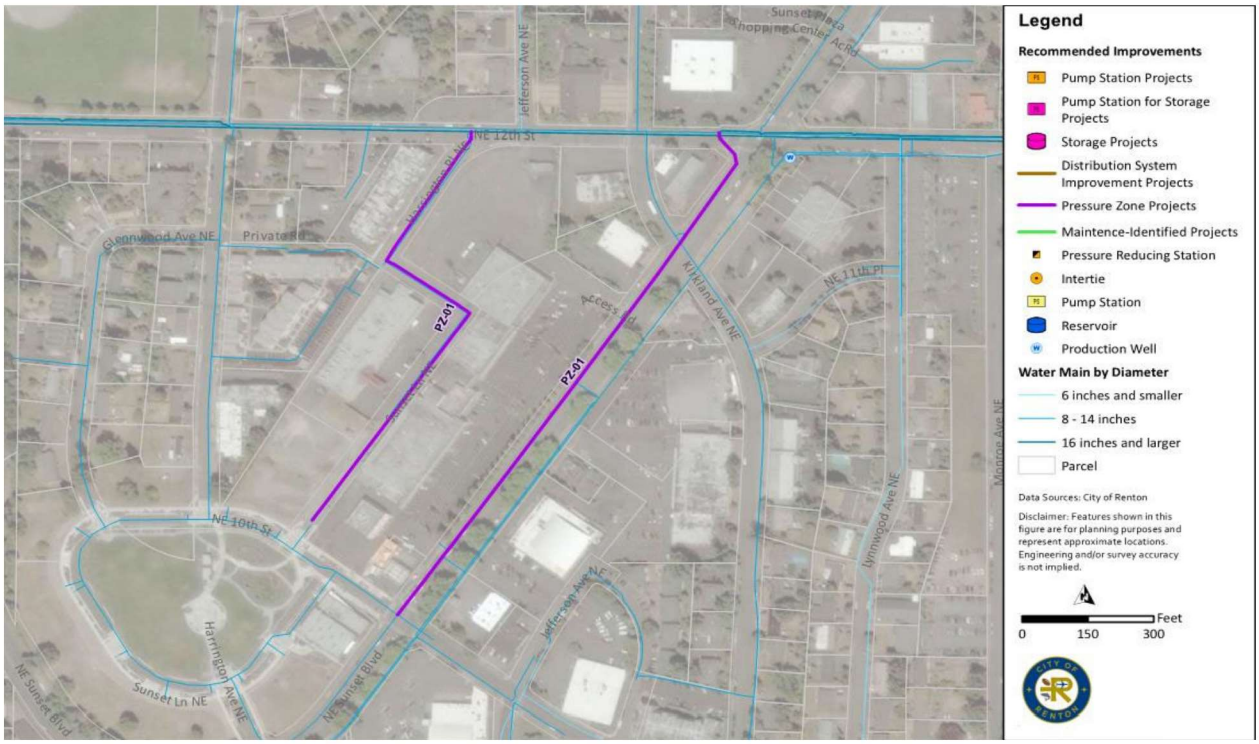
Project Type	Percent	Cost
Improvement:	50%	$ 162,500
Capacity:	50%	$ 162,500
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 325,000

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ 325,000
Total Anticipated Project Cost		$ 325,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: PZ-02
Project Title: VLY196 Re-zone
Priority: 0-10 years

Facility Type: Pressure Zone Rezoning
Pressure Zone: Valley 196
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Intersection of SE Carr Rd and Talbot Rd S.

Purpose: Re-zone area to address low pressure and fire flow deficiencies and in VLY196 on transmission main north of Springbrook Springs. Hydrant S-00235 at 401 S 43rd St & Talbot Rd will need to be re-zoned, decommissioned, or removed.
From Ch 7: " Storage analysis showed that the Valley area is deficient for all planning years till 2039 to supply operational and equalizing volumes at 30 psi to the highest customers. The area has sufficient storage at 20 psi. To address this issue, the City is in the process of connecting high elevation residents within the Valley 196 zone to higher pressure zone infrastructure. These improvements will provide adequate operating pressures and fire flow pressures to these high elevation residents as well."

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Rezone	300	LF	$ 300	$ 100,000	$ -	$ -	$ 100,000
Total Anticipated Project Cost							$ 100,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

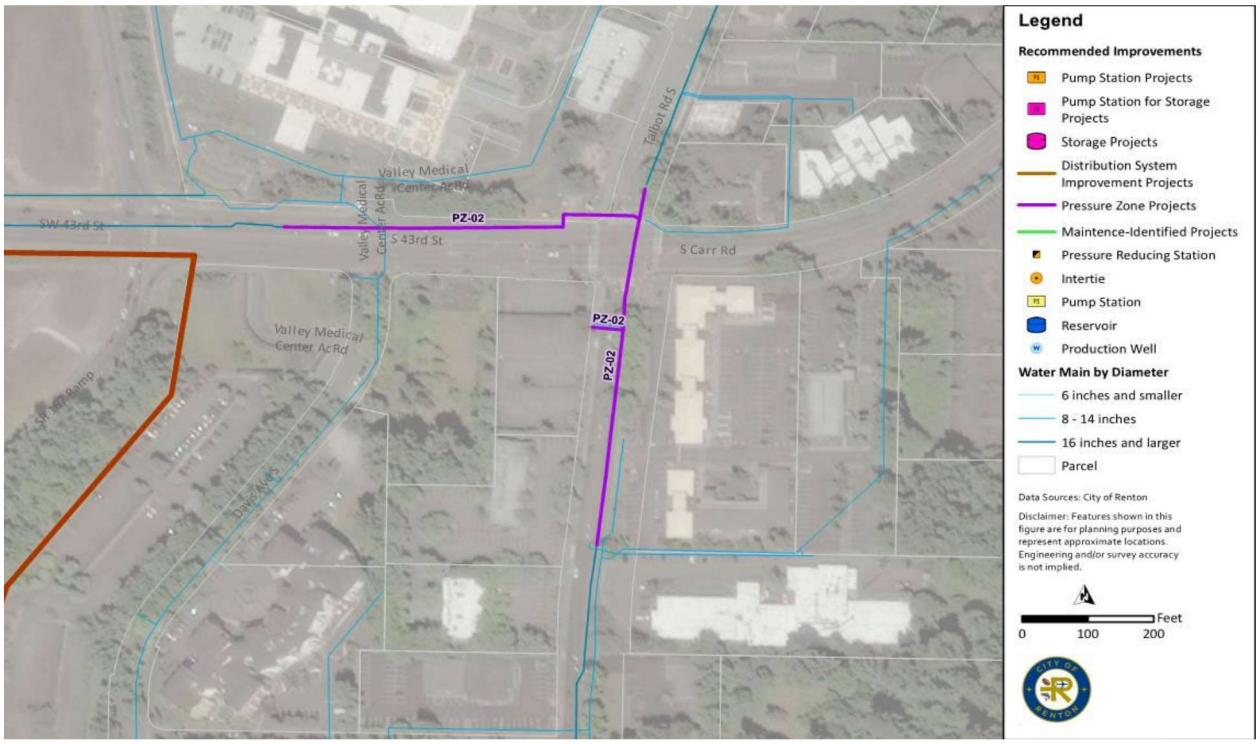
Project Type	Percent	Cost
Improvement:	50%	$ 50,000
Capacity:	50%	$ 50,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 100,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 100,000
Total Anticipated Project Cost		$ 100,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: P-01
Project Title: Dead end 3,000 gpm fire flow program
Priority: 10-20 years
Facility Type: Annual Repair and Replacement Programs
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location:
- Hydrant NW-00091 at 801 Rainier Ave N - SW CRN of Complex.
- Hydrant S-00364 at 17910 Talbot Rd S.
- Hydrant S-00174 at 1400 Talbot Rd S Renton Plaza NE CRN.
- Hydrant S-00107 at 1301 Thomas Ln S.
- Hydrant S-00123 at 1817 Grant Ave S - NW CRN of APT.
- Hydrant S-00167 at 1 S Grady Wy Renton Village- W SD of Red Lion Hotel.
- Hydrant S-00053 at 400 S 2nd St Renton High School - E End.
- Hydrant S-00218 at 400 S 2nd St Rention High School - N SD. (5,000 gpm fire flow requirement)
- Hydrant N-00129 at 480 Houser Way N.
- Hydrant SE-00020 at 2205 Maple Valley Hwy Riviera Apt.
- Hydrant NE-00038 at 1442 Hillcrest Ln NE.

Purpose: Hydrants are on dead ends but main line pipes are able to supply 3,000 gpm fire flow demand. These areas should be reviewed when new development takes place and potentially looped or upsized.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Program	n/a	LF	$ -	$ -	$ -	$ -	$ -
Total Anticipated Project Cost							$ -

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	100%	$ -
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Cost
Entire Project	10-20 years	$ -
Total Anticipated Project Cost		$ -

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: P-02
Project Title: Dead End 1,000 gpm fire flow program
Facility Type: Annual Repair and Replacement Programs
Pressure Zone: System-wide
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location:
- Hydrant S-00189 at 616 S 25th St & Smithers Ave S.
- Hydrant NE-00801 at 1180 Monterey Ave NE.
- Hydrant NE-01092 at 2025 NE 15th St.
- Hydrant N-00172 at 2600 Garden Ct N.
- Hydrant S-00182 at 2500 Talbot Dr S.

Purpose: Hydrants are unable to supply 1,000 gpm fire flow requirement in dead end pipes. This program is to move hydrants from dead end pipes to main line pipes.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Program	2,370	LF	$ 300	$ 711,000	$ 213,300	$ 231,075	$ 1,155,000
Total Anticipated Project Cost							$ 1,155,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	100%	$ 1,155,000
Capacity:	0%	$ -
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,155,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 1,155,000
Total Anticipated Project Cost		$ 1,155,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: P-03
Project Title: Pipeline Repair and Replacement Program (High Priority)
Priority: Annual
Facility Type: Annual Repair and Replacement Programs
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: System Wide

Purpose: Project to replace pipes that have reached or will reach their remaining useful life in the planning period based on installation date and pipe material type. (see RUL Summary tab for breakdown of LF by pipe diameter size)

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
6 " Pipe	65,630	LF	$ 250	$ 16,407,500	$ 4,922,250	$ 5,332,438	$ 26,662,000
8 " Pipe	17,950	LF	$ 300	$ 5,385,000	$ 1,615,500	$ 1,750,125	$ 8,751,000
10 " Pipe	4,620	LF	$ 350	$ 1,617,000	$ 485,100	$ 525,525	$ 2,628,000
12 " Pipe	20,270	LF	$ 400	$ 8,108,000	$ 2,432,400	$ 2,635,100	$ 13,176,000
14 " Pipe	770	LF	$ 450	$ 346,500	$ 103,950	$ 112,613	$ 563,000
16 " Pipe	4,410	LF	$ 500	$ 2,205,000	$ 661,500	$ 716,625	$ 3,583,000
18 " Pipe	2,360	LF	$ 550	$ 1,298,000	$ 389,400	$ 421,850	$ 2,109,000
24 " Pipe	110	LF	$ 700	$ 77,000	$ 23,100	$ 25,025	$ 125,000
Total Anticipated Project Cost							$ 57,597,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 57,597,000
Total Anticipated Project Cost	100%	$ 57,597,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 57,597,000
Total Anticipated Project Cost		$ 57,597,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: PS-01
Project Title: Monroe Ave BPS Generator
Priority: 0-10 years
Facility Type: Pump Station
Pressure Zone: Highlands 565
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Monroe Ave BPS

Purpose: With the existing reliable sources and reservoirs, the Highlands 565 Operational Area does not have sufficient storage for all planning years till 2039. The Highlands 565 area is deficient by 1.26 MG by 2029 and 1.65 MG by 2039.
Excess storage located in the Highlands 445 Operational Area is sufficient to offset deficiency in Highlands 565. It is recommended that the City install back-up power generators at the Monroe Avenue BPS to allow storage to be provided from the Highlands 445 pressure zone to the Highlands 465 pressure zone (which will also improve pumping capacity for long-term). The City is already planning on adding a generator at Monroe BPS as part of the construction of the new 6.3 MG reservoir in Highlands 445 pressure zone.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Pump Station	n/a	n/a	n/a	$ 300,000	$ 90,000	$ 97,500	$ 488,000
Total Anticipated Project Cost							$ 488,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 244,000
Capacity:	50%	$ 244,000
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 488,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 488,000
Total Anticipated Project Cost		$ 488,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: PS-02
Project Title: West Hill BPS
Priority: 0-10 years

Facility Type: Pump Station
Pressure Zone: West Hill 495
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: West Hill BPS

Purpose: Install generator, increase pumping capacity, electrical, structural, and mechanical improvements. Estimated cost from RH2 Preliminary Design Report.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Pump Station	n/a	n/a	n/a	$ -	$ -	$ -	$ 1,842,000
Total Anticipated Project Cost							$ 1,842,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	35%	$ 644,700
Capacity:	35%	$ 644,700
Condition:	30%	$ 552,600
Total Anticipated Project Cost	100%	$ 1,842,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 1,842,000
Total Anticipated Project Cost		$ 1,842,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: PS-03
Project Title: South Talbot BPS
Priority: 0-10 years
Facility Type: Pump Station
Pressure Zone: Talbot Hill 350
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: South Talbot BPS

Purpose: Replace fire and duty pumps, electrical, structural, and mechanical improvements. Estimated cost from RH2 Preliminary Design Report.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Pump Station	n/a	n/a	n/a	$ -	$ -	$ -	$ 2,175,000
Total Anticipated Project Cost							$ 2,175,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

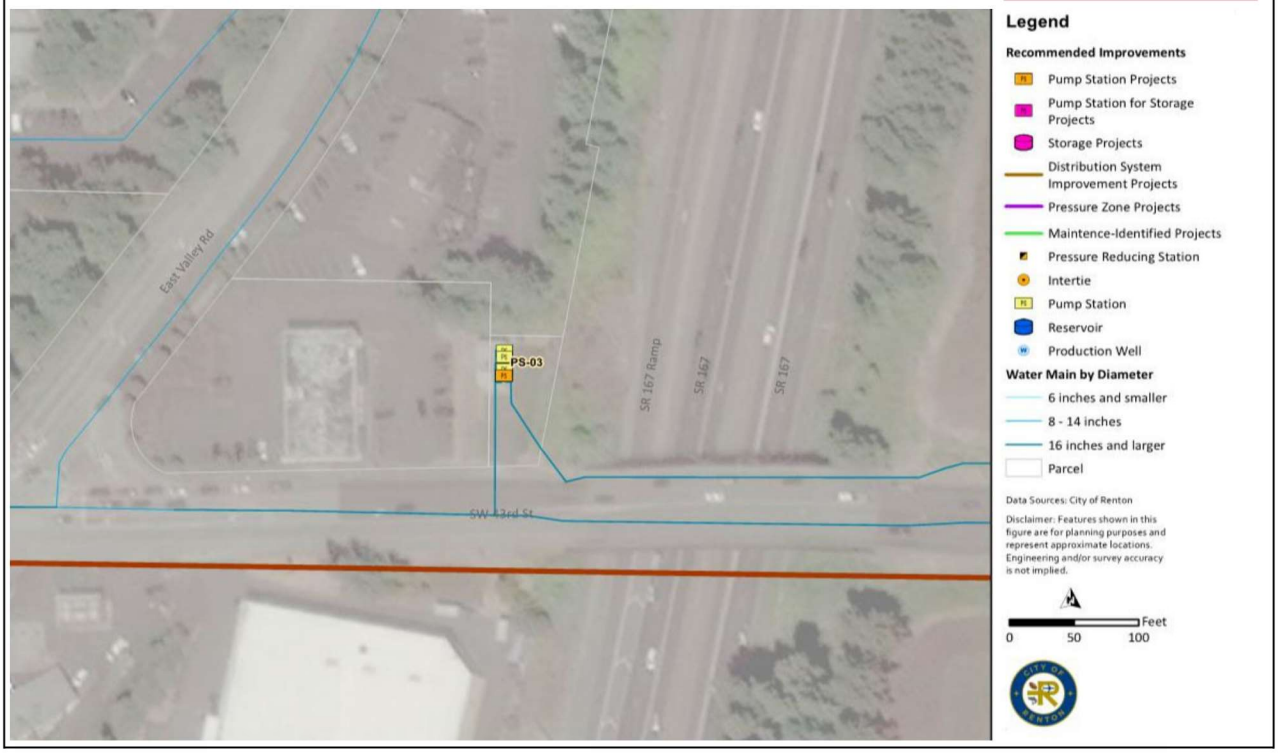
Project Type	Percent	Cost
Improvement:	35%	$ 761,250
Capacity:	35%	$ 761,250
Condition:	30%	$ 652,500
Total Anticipated Project Cost	100%	$ 2,175,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 2,175,000
Total Anticipated Project Cost		$ 2,175,000

Project Location Map:

Go to Maps Tab



City of Renton
Water System Plan
Capital Improvement Plan

Project ID: ST-01
Project Title: Rolling Hills 590 Storage
Facility Type: Storage
Pressure Zone: Rolling Hills 590
Priority: 0
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: Rolling Hills 590

Purpose: As shown in the storage analysis, with the existing reliable sources and reservoirs, the Rolling Hills 590 Operational Area does not have sufficient storage for all planning years till 2039. Analysis shows that the operational area is deficient by 0.95 MG by 2039. A few options are available to the City to mitigate the deficiency.

- Construct a new 1.5 MG tank for the Rolling Hills 590 Operational Area. The new tank will replace the existing 0.3 MG tank.
- Add back-up power to the Maplewood BPS to increase pumping capacity from the Rolling Hills 490 Zone to the Rolling Hills 590 Zone, and add auto-start, auto-transfer, and back-up power to the Rolling Hills BPS such that three pumps can be operated at the same time.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Storage	1.5	MG		$ 9,000,000	$ 2,700,000	$ 2,925,000	$ 14,625,000
Rolling Hills Generator	100	HP		$ 200,000	$ 60,000	$ 65,000	$ 330,000
Maplewood Generator	750	HP		$ 1,500,000	$ 450,000	$ 487,500	$ 2,440,000
Total Anticipated Project Cost							$ 17,395,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 8,697,500
Capacity:	50%	$ 8,697,500
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 17,395,000

Project Timing:

Project Element	Timing	Cost
Generators	0-10 years	$ 2,770,000
Storage	10-20 years	$ 14,625,000
Total Anticipated Project Cost		$ 17,395,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: ST-02
Project Title: West Hill 495 Storage
Facility Type: Storage
Pressure Zone: West Hill 495
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Location: West Hill 495 PZ

Purpose: With the existing reliable sources and reservoirs, the West Hill 495 Operational Area does not have sufficient storage through 2039. Excess storage located in the Valley Operational Area is sufficient to offset deficiencies in the West Hill 495. The Valley Operational Area has 1.04 MG of excess storage available by 2039, which can be reliably pumped to the West Hill 495 Operational Area via the new West Hill BPS. The City is currently planning on expanding capacity of the West Hill PS and adding a generator at the West Hill BPS as part of the West Hill BPS Improvement Project. It is recommended that the City update operational strategy and reduce the operational band thus decreasing the operational volume and mitigating deficiencies.

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Storage	n/a	LF	$ 300	$ -	$ -	$ -	$ -
Total Anticipated Project Cost							$ -

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	35%	$ -
Capacity:	35%	$ -
Condition:	30%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ -
Total Anticipated Project Cost		$ -

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: G-01
Project Title: Reservoirs Repair, Painting, Cathodic Protection
Priority: Annual
Facility Type: General
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: $150,000 per year

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
General	0	LF	$ 150,000	$ 3,000,000	$ -	$ -	$ 3,000,000
Total Anticipated Project Cost							$ 3,000,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	50%	$ 1,500,000
Capacity:	0%	$ -
Condition:	50%	$ 1,500,000
Total Anticipated Project Cost	100%	$ 3,000,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 3,000,000
Total Anticipated Project Cost		$ 3,000,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: G-02
Project Title: Emergency Response Water Projects
Priority: Annual

Facility Type: General
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: $100,000 per year

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
General	0	LF	$ 100,000	$ 2,000,000	$ -	$ -	$ 2,000,000
Total Anticipated Project Cost							$ 2,000,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 2,000,000
Total Anticipated Project Cost	100%	$ 2,000,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 2,000,000
Total Anticipated Project Cost		$ 2,000,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: G-03
Project Title: Pump Station Condition Evaluation (mechanical, struture, electrical)
Priority: 0-10 years
Facility Type: General
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: 0

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
General	0	LF	$ 300,000	$ -	$ -	$ -	$ 300,000
Total Anticipated Project Cost							$ 300,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 300,000
Total Anticipated Project Cost	100%	$ 300,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 300,000
Total Anticipated Project Cost		$ 300,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: G-04 **Facility Type:** General
Project Title: Storage Condition Evaluation (structural, seimsic,...) **Pressure Zone:** System-wide
Priority: 0-10 years **Project Status (Completed?):** N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: 0

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
General	0	LF	$ 400,000	$ -	$ -	$ -	$ 400,000
Total Anticipated Project Cost							$ 400,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 400,000
Total Anticipated Project Cost	100%	$ 400,000

Project Timing:

Project Element	Timing	Cost
Entire Project	0-10 years	$ 400,000
Total Anticipated Project Cost		$ 400,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: G-05
Project Title: Security Improvements
Priority: Annual

Facility Type: General
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: 0

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
General	0	LF	$ 10,000	$ 200,000	$ -	$ -	$ 200,000
Total Anticipated Project Cost							$ 200,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	100%	$ 200,000
Capacity:	0%	$ -
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 200,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 200,000
Total Anticipated Project Cost		$ 200,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: G-06
Project Title: Telemetry System and SCADA Upgrades
Priority: Annual
Facility Type: General
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: $50,000 per year

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
General	0	LF	$ 50,000	$ 1,000,000	$ -	$ -	$ 1,000,000
Total Anticipated Project Cost							$ 1,000,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	100%	$ 1,000,000
Capacity:	0%	$ -
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,000,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 1,000,000
Total Anticipated Project Cost		$ 1,000,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: G-07
Project Title: PRV Rehabilitation
Priority: Annual

Facility Type: General
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: $100,000 per year

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
General	0	LF	$ 100,000	$ 2,000,000	$ -	$ -	$ 2,000,000
Total Anticipated Project Cost							$ 2,000,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	0%	$ -
Capacity:	0%	$ -
Condition:	100%	$ 2,000,000
Total Anticipated Project Cost	100%	$ 2,000,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 2,000,000
Total Anticipated Project Cost		$ 2,000,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: G-08
Project Title: Improvements to pipelines on bridge
Priority: Annual
Facility Type: General
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: 0

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
General	0	LF	$ 200,000	$ 4,000,000	$ -	$ -	$ 4,000,000
Total Anticipated Project Cost							$ 4,000,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	100%	$ 4,000,000
Capacity:	0%	$ -
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 4,000,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 4,000,000
Total Anticipated Project Cost		$ 4,000,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: R-01
Project Title: Regulatory Compliance Projects
Priority: Annual

Facility Type: Regulatory
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: $200,000 per year

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Regulatory	0	LF	$ 200,000	$ 4,000,000	$ -	$ -	$ 4,000,000
Total Anticipated Project Cost							$ 4,000,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	100%	$ 4,000,000
Capacity:	0%	$ -
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 4,000,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 4,000,000
Total Anticipated Project Cost		$ 4,000,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: R-02
Project Title: Water Conservation Program Implementation
Priority: Annual

Facility Type: Regulatory
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: $200,000 a year

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Regulatory	0	LF	$ 200,000	$ 4,000,000	$ -	$ -	$ 4,000,000
Total Anticipated Project Cost							$ 4,000,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	100%	$ 4,000,000
Capacity:	0%	$ -
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 4,000,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 4,000,000
Total Anticipated Project Cost		$ 4,000,000

Project Location Map:

Go to Maps Tab

City of Renton
Water System Plan
Capital Improvement Plan

Project ID: R-03
Project Title: Water System Plan
Priority: Annual

Facility Type: Regulatory
Pressure Zone: System-wide
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:
Location: 0

Purpose: $400,000 in 10 year and in 20 year

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Design/Admin 30%	Construction Contingency 25%	Total Cost
Regulatory	0	LF	$ 400,000	$ 800,000	$ -	$ -	$ 800,000
Total Anticipated Project Cost							$ 800,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Improvement:	100%	$ 800,000
Capacity:	0%	$ -
Condition:	0%	$ -
Total Anticipated Project Cost	100%	$ 800,000

Project Timing:

Project Element	Timing	Cost
Entire Project	Annual	$ 800,000
Total Anticipated Project Cost		$ 800,000

Project Location Map:

Go to Maps Tab