Appendix B – SCLA Model Calibration Technical Memo

Technical Memorandum

Date: 8/26/2016

To: Victor Fajardo, P.E., Frank Echeverria, P.E.
City of Victorville
Engineering Department

Prepared by: Kaylie Ashton, Christy Stevens, P.E.

Reviewed by: Laine Carlson, P.E., Jeroen Olthof, P.E.

Project: On-Call Water Engineering Services

SUBJECT: **MODEL RECONCILIATION AND CALIBRATION TECHNICAL MEMORANDUM**

Water Systems Consulting, Inc. (WSC) was engaged by the City of Victorville (City) to update the existing water system hydraulic model and develop a Calibration Plan that will layout the criteria and approach to effectively calibrate the model. The updates to the model and the calibration plan are the subject of this Technical Memorandum (TM). The TM is organized into the following main sections:

- Section 1 – Background
- Section 2 – Model Input Review
- Section 3 – Model Update
- Section 4 – Model Calibration Approach
- Section 5 – Model Calibration Results
- Section 6 – Conclusions and Recommendations

1. Background

The City's current hydraulic model was developed as a part of the 2010 Water Master Plan (WMP) using the H2ONET software package marketed by Innovyze. According to the WMP, separate hydraulic models were updated and calibrated for Improvement District (ID) 1 and ID 2 and then merged into a single model. The hydraulic model of the Southern California Logistics Airport (SCLA) was also merged into the model; however, the focus of that effort was on the activation of the backbone network of larger diameter pipelines in the main streets. The SCLA portion of the model was not calibrated as part of the WMP.

In general, the City is moving toward an integrated data management system with GIS as the core database. The City and WSC discussed the benefits of converting the model from H2ONET, an AutoCAD based software, to InfoWater, a GIS based software, also offered by Innovyze. The City decided to move forward with the software conversion to better coordinate with the City's long term data management goals. WSC converted the model provided by the City in H20NET to InfoWater 10.0.

Since the creation of the hydraulic model, the City has continued implementing a major pressure zone conversion, added to its supply sources with connections to the Regional Recharge and Recovery (R-Cubed) Project and experienced developer improvements related to the St. Mary's Hospital.

2. Model Input Review

WSC reviewed the existing hydraulic model including the existing infrastructure, current water demands and demand allocation, operational settings and supply sources. The existing model includes seven scenarios, summarized in Table 1 below. The Existing System, Existing Average Day Demands scenario was the subject of the model review.

Table 1 – Model Scenarios

System	Scenario
Existing System	Existing Average Day Demands
	Existing Maximum Day Demand
Future System	Existing Maximum Day Demand
Future System	2020 Average Day Demands
	2020 Maximum Day Demands
Future System	2030 Average Day Demands
	2030 Maximum Day Demands

Within the model, individual elements such as pipes and valves have been assigned a status of: Abandoned, Buildout, Existing, Future_Abandonment, Inactive, Private, Proposed and Skeletonized. The status of "Future_Abandonment" is used to identify existing facilities that are expected to be abandoned as part of future improvement projects. WSC will utilize these statuses in order to keep the existing facility sets accurate and operational. In the current model, the existing system supply comes solely from 36 wells modeled as pumps connected to fixed head groundwater reservoirs. The actual system also receives supply from the R-Cubed Project. The supply infrastructure of the R-Cubed system is included in the model, but the elements are assigned a status of "Proposed" so that the elements are not included in existing system runs.

Each element in the model has a unique identification number (ID). Currently these model IDs are five-digit numbers that were developed specifically for the hydraulic model. As part of a future enhancement, the City may wish to use the GIS ID or Munis ID for each asset as the model ID.

WSC performed a general review of the hydraulic model input data. The infrastructure data appeared to include a reasonable range of values for attributes such as pipe diameters and roughness values, tank sizes, valve settings, and pump curves. The model demands appeared to represent a reasonable allocation of demands around the distribution system. The model was considered to be a reasonable starting point for further system analysis. A detailed summary of the model review is located in Appendix A.

3. Model Update

The City provided a list of projects, listed in Table 2, that were completed after preparation of the current model. WSC incorporated these projects into the model using record drawings provided by the City and GIS shapefiles that were exported from the City's GIS database.

Table 2 – Projects Added to Model

Project	Model Updates	Source of Data
PRV 118 and PRV 119	Addition of two pressure reducing valve (PRV) assemblies with connecting piping	WP-1292 signed 2/21/13
Seneca Road Zone 3170 Pipeline	Addition of approximately 2,000 feet of new 12-inch pipe; addition of five inter-connections with existing pipes	WP-162 signed 3/25/13
Water Improvement Plans Parcel Map 19344 (Saint Mary's Hospital)	Addition of approximately 2,600 feet of new 12-inch pipe on Cobalt Road; addition of approximately 1,800 feet of new 12-inch pipe on El Portal Drive; addition of approximately 1,500 feet of new 12-inch pipe on Garden Park Place; addition of approximately 1,300 feet of new 12-inch pipe on Las Hermanas Way; addition of approximately 2,700 feet of new 12-inch pipe on Mesa Street; addition of approximately 1,900 feet of new 12-inch pipe on Amargosa Road; addition of approximately 300 feet of new 12-inch pipe on Smoketree Road	GIS Shapefiles provided by the City on 5/16/14; WP-1024 signed 3/12/13
Water Improvement Plans Mesa Street (Pressure Zone 3675)	Addition of approximately 4,700 feet of new 16-inch pipe on Mesa Street	WP-1023 signed 11/19/12
Large Distribution Main Relocation at Seneca Road and Cobalt Road Intersection	Addition of approximately 140 feet of new 16-inch pipe and removal of existing pipe to be removed for storm drain construction	WP-1293 signed 3/7/13
Predator Line at SCLA	Addition of approximately 3,300 feet of new 8-inch and 12-inch pipe at the northern portion of the SCLA runway.	WP-15 As-built signed 8/24/10
Site 21 School	Addition of approximately 1,300 feet of new 12-inch pipe on Hopland Street; addition of approximately 2,600 feet of new 8-inch and 12-inch pipe on Diamond Road; addition of approximately 1,800 feet of new 12-inch pipe on Tawney Ridge Lane	WP-1086 Revised signed 1/17/12
Stoddard Wells Rd Pipeline	Connected Zones 2906 to 3065 through addition of a PRV and approximately 1,600 feet of new 12-inch pipe on 11th Street; addition of approximately 1,600 feet of new 12-inch on Mojave River Bridge and Mineral Road; addition of approximately 3,000 feet in of new 12-inch pipe on Stoddard Wells Road.	Project CC13-038
3170 Zone Conversion	Updated pipe and zone information to match zone based on zone conversion. Updated the flowing valves to be normally closed: • GV164 • GV145	WP-162 signed 3/25/13 and System Zone 2015 CAD

To help document changes to the model, WSC added an additional field to the element information databases, WSC_Notes, which can be used to include brief comments about the modifications made. For projects with infrastructure that was originally included in the model, the status was changed from "Proposed" to "Existing" and the year of installation was added. For projects not previously included in the model, the pipelines and junctions were added or imported from City provided GIS shapefiles and elevations were assigned using topographic mapping of the ground surface. For zone conversion projects, pipes in the model were closed to simulate closed valves at zone breaks.

As part of a separate hydraulic analysis requested by the City, the portion of the R-Cubed system which connects to Zone 3485 was activated in the model by WSC to depict current (2014) system operations. This was accomplished by changing the status of the R-Cubed Reservoir (formerly the LePanto Reservoir 211), pipeline and valves to Existing and changing the existing initial settings of the HWY 395 and I-15 tanks to align with the current operating scenario described to WSC by the City.

The portion of the R-Cubed system which connects to Zone 3170 has not been activated. WSC proposes to discuss this with the City to determine whether additional updates are needed to reflect the current operation of the Zone 3170 R-Cubed connection.

After making the changes above, WSC merged the model of the SCLA area into the overall system model. The existing model included a skeletonized representation of the SCLA, while the SCLA model included additional infrastructure. WSC imported the SCLA infrastructure into the existing model and reviewed the current model contents in that area. WSC set some pipelines in the current system model to be inactive when the same facility was included in the SCLA data that was imported from the SCLA model.

As described earlier, the hydraulic model of the SCLA area was merged into the model but the focus was on activating the large diameter pipe backbone; therefore the smaller pipes have not been updated since the model was created. The WSC team reviewed the SCLA area model features and connectivity to the rest of the model and made adjustments to enable the model to operate properly. The SCLA area is served by Zone 3170 and there is a lower pressure sub-zone that is protected by PRVs. To simulate this configuration in the model, several pipes were closed in the model to create these sub-zones. Table 3 summarizes the pipes that were closed as part of the model update process.

Table 3 – Pipes Closed in the SCLA Area

Pipe ID	Pipe Approximate Location
S1671	At the intersection of Cargo Ln and Readiness St
S0175	At the intersection of Phantom and Nevada Ave (north of PRV)
S1627	On Phantom between Sabre Blvd and Mustang St
S1631	At the intersection of Phantom and Mustang St
S1151	North of Pol Access Rd
S1195	North of Pol Access Rd
S0183	North of PRV on Nevada Ave
S0777	At the intersection of Nevada Ave and George Blvd
S1965	At the intersection of Sage St and Starfighter St

4. Model Calibration Approach

During the original model development for the WMP, fire flow tests were performed to calibrate the hydraulic models for ID 1 and ID 2. Within ID 1, twelve fire flow test were performed at ten different locations in 2004. In 2009, ten fire flow tests were performed in ID 2. The results of these test were used to adjust the Hazen-Williams C values for various pipe segments. The fire flow tests for ID 1 and ID 2 were well documented in the WMP and it was determined the model was calibrated.

Since the SCLA area was not calibrated with the WMP and this is an area subject to substantial large-user growth, WSC recommended that the City calibrate this portion of the model by performing additional fire flow tests. Through discussions with the City at the Model Review and Calibration Workshop, five locations were chosen to complete the tests. Three locations are within areas with older, smaller diameter pipelines in order to stress the system. The fourth location is on the larger diameter, backbone system that will serve as the connection point for most future developments. The fifth location is on the large diameter pipe near the Dr. Pepper Snapple manufacturing center on the west side of the SCLA Area. Approximate locations for these tests are shown in Figure 1.

Based on the selected test locations, WSC provided the City with Fire Flow Test Data sheets which included a map of the locations for the residual and flow hydrants and detail on which facilities either needed to be closed or turned off. The facilities included pressure reducing valves, wells and turnouts. These sheets also include areas to fill in static and residual pressure at the residual hydrant and pressure and observed flows at the flow hydrants observed during the tests. The data from the Fire Flow Test Data sheets is summarized in Table 7 and was used by the WSC team to perform hydraulic model runs to compare model results to field observations.

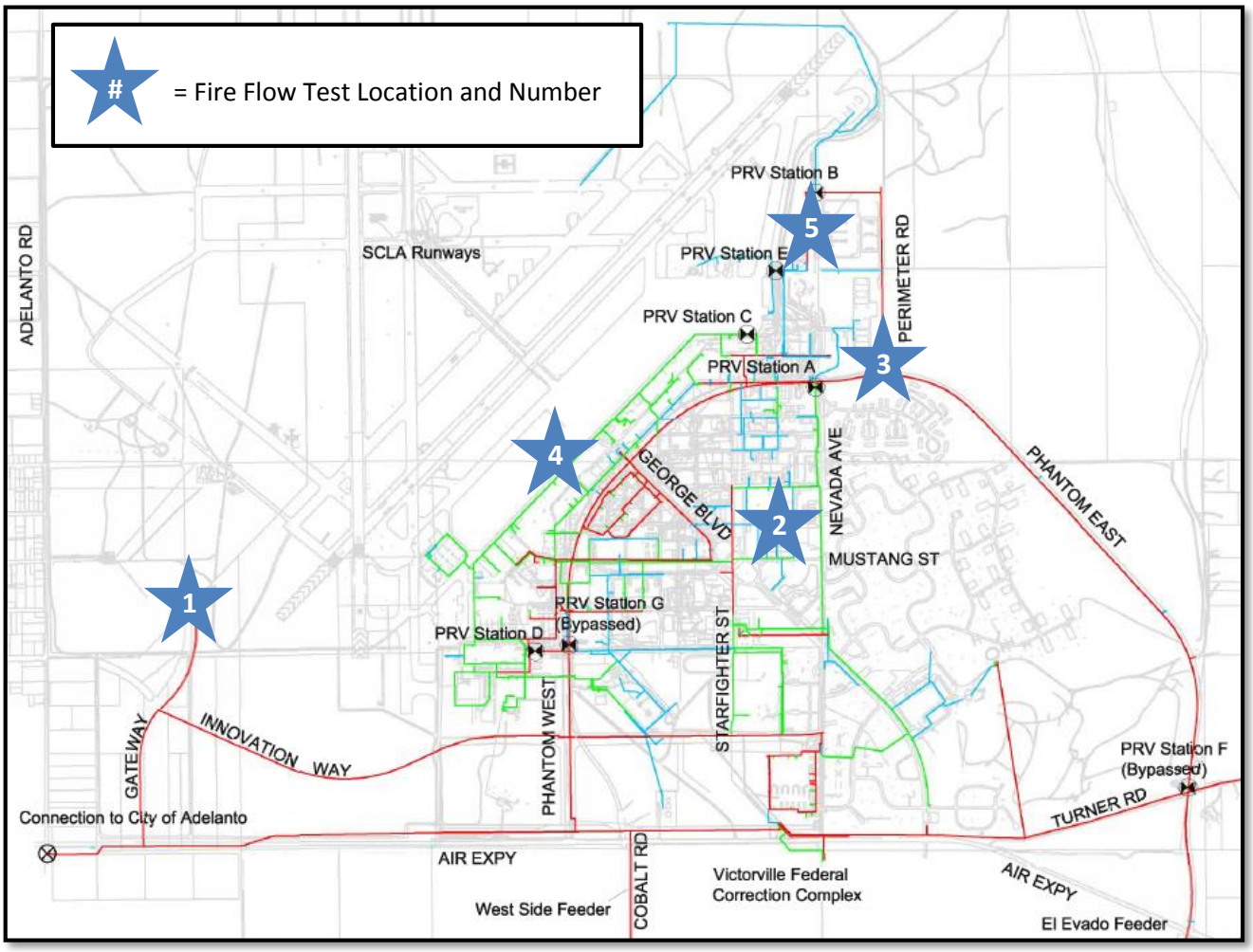


Figure 1 – Approximate Fire Flow Locations

WSC used the results of these additional fire flow tests to assess the model's ability to simulate conditions at SCLA. As necessary, WSC made adjustments the Hazen-Williams C values, or roughness factors, to increase the model's ability to simulate the distribution system performance within SCLA. The selected roughness values are presented in the following section. Model fire flow runs were determined in good standing when the model pressure difference from static to residual pressure was similar to the observed pressure difference.

5. Model Calibration Results

The City performed five fire flow tests in the SCLA area October 9th 2014 and October 16th 2014 in the morning hours. Along with the fire flows, the City filled out the Fire Flow Test Data sheets, which are presented in Appendix B. Per the Fire Flow Test Data sheets, designated facilities were closed in the model to match the conditions in the field. Since the tests were performed in October, when the temperature is still warm but not at its peak, the demands were factored down by 40 percent from Maximum Day Demands (MDD). The initial model runs were performed with demands at 50 percent of the MDD. All the pipes in the SCLA area had an initial Hazen Williams value of 120, based on the previous SCLA model. Through the calibration process, WSC reviewed the model output and adjusted the demands and roughness values to improve the agreement between model results and observed conditions. Table 4 summarizes the initial status for the first calibration run and the final status after the calibration was complete.

Table 4 - Existing Model Status and Initial Calibration Status

Model Component	Initial Calibration Status	Final Calibration Status
Scenario[1]	CAL_2014	CAL_2014
Demands	50% of MDD	60% of MDD
Roughness	120 for all pipes	Less than 12" = 80 Greater than or equal to 12" = 120
PRV 101	Closed	Closed
PRV 102	Closed	Closed
PRV 103	Closed	Closed
Balsam & Nisqualli ATP Site	Closed	Closed
Well 120	Closed	Closed
Well 122	Closed	Closed
Well 140	Closed	Closed
R-Cubed Turnout 3	Not Activated	Not Activated

Notes:

1. The CAL_2014 scenario is a child of the EX_MDD, which consists of existing system components at max day demand. This scenario was used to adjust the demands without changing the demands in the existing model scenarios.

Table 5 presents the static and residual pressures observed in the field along with the final calibration run results. The difference between residual and static pressure observed in the field and model are also presented in Table 5.

Table 5 - Observed Fire Flow Test Results and Model Calibration Results

Test	Date	Start/End Time	Flow Hydrant	Pitot Pressure (psi)	Flow (gpm)[1]	Residual Hydrant	Observed Static Pressure (psi)	Model Static Pressure (psi)[2]	Observed Residual Pressure (psi)	Model Residual Pressure (psi)[2]	Observed Pressure Drop (psi)[3]	Model Pressure Drop(psi)[3]
1	10/9/14	9:37 am/ 9:44 am	689	80	1396	688	122	119.69	97	107.28	25	12.41
2	10/9/14	9:04 am/ 9:08 am	622-1	5	349	622	56	54.98	18	48.27	38	6.71
			622	5	349							
3	10/9/14	8:22 am/ 8:30 am	625-6	102	1575	624	118	124.23	93	93.14	25	31.09
			611	80	1396							
4	10/16/14	8:21 am/ 8:27 am	657-17	22	732	648-1	56	56.6	26	26.61	30	29.99
			647-3	20	698							
5	10/16/14	8:56 am/ 9:05 am	642-5	25	780	646	134	131.33	106	95.09	28	36.24
			645-3	90	1480							

Notes:

1. Flow from the Flow Hydrants was calculated by the use of the Bernoulli equation.
2. Model Static Pressure and Model Residual Pressure results were obtained from model runs using the final calibration statuses summarized in Error! Reference source not found..
3. Observed Pressure Difference and Model Pressure Difference were calculated by subtracting the residual pressure from the static pressure.

Through the calibration process, the pressure drop for three out the five fire flow tests was within 10 psi of the pressure drop observed in the field. These tests were Test 3, located on Perimeter Rd; Test 4, located on the flight line and within the sub-zone; and Test 5, located near Perimeter Rd and Aviation Dr. However during the calibration process, Test 1 and Test 2 did not show similar pressure drops as observed in the field. The model pressure drop for Test 1 was 12.6 psi lower than the observed pressure drop; meaning the field crew observed a larger pressure drop than what was predicted in the model. Test 1 was located on at the end of Gateway Dr which had no other demands coming from off the pipe. This could mean that the second flow hydrant indicated on the Fire Flow Test Data sheet for Test 1 was flowed in the field but not recorded. Test 2, located on Sabre Blvd, had an observed pressure difference that was 31.3 psi lower than the modeled pressure drop. Two hydrants were flowed for this test; therefore, there could be a partially closed valve in the area that is not allowing additional water to flow to the hydrant during the test.

6. Conclusions and Recommendation

WSC made global adjustments to the demands and the Hazen Williams roughness factors to improve the agreement between the observed pressure drop and the model-predicted pressure drop at five flow test locations. The selected roughness values at the end of the calibration are summarized in **Error! Reference s ource not found.**. Using these input values, the model was able to replicate the observed pressure drop to a reasonable degree at three of the five test locations. At test locations 1 and 2, the field crews recorded an observed pressure drop that was higher than could be generated in the hydraulic model. The City may wish to consider repeating tests at those two locations. If the observed pressure drop continues to be much higher than the model results, there may be partially closed valves in the system that are generating more head loss than predicted by the model.

Appendix A – Hydraulic Model Review

Appendix A

WSC reviewed the existing hydraulic model including existing infrastructure, current water demands and demand allocation, operational settings and supply sources. The model review was performed in the Existing System Existing Average Day Demand scenario. Table 1 through Table 3 provides a summary of the review.

Table 1 – Model Element Review Summary

Pipe	Settings	Notes
IDs	5-digit number	May not be aligned with GIS ID
Status	Existing or Future Abandonment	9,824 pipes
Lengths	Most pipe lengths are equal to GIS feature lengths, but some are user-defined lengths.	There is a total of 688 miles model length and 659 miles of GIS length
Diameters	Range from 2 to 36 inches. Also includes 99 inches	21 segments have a diameter of 99 inches for modeling purposes.
Materials	Mostly AC, DIP, PVC, and STL.	Almost half of the segments do not have a material assigned.
Years of Installation	Ranges from 1948 to 2010, includes 9999.	106 segments have a year of installation of 9999
C Values	Range from 90 to 150	2 segments have a roughness of 6 to simulate losses through a WTP
Check Valves		No pipes segments have a check valve
Pressure Zones	**Zone**	**Number of Pipe Segments**
	2890	218
	2906	47
	2942	43
	3065	1754
	3065A	41
	3065B	48
	3170	1343
	3290	1961
	3290A	46
	3485	2928
	3675	782
	3820	442
	ATP	7
	GW	52
	RW	111
	SCLA-3154	1

Junction	Settings	Notes
IDs	5-digit number	May not align with GIS ID
Status	Existing or Future Abandonment	8,270 junctions
Elevations	Ranges from 2621 to 3811	
Pressure Zones	**Zone**	**Number of Junctions**
	2890	165
	2906	41
	2942	40
	3065	1533
	3065A	34
	3065B	39
	3170	918
	3290	1594
	3290A	33
	3485	2681
	3675	726
	3820	411
	ATP	4
	GW	26
	RW	25
Valves	**Settings**	**Notes**
IDs	2 letters and 3 numbers	May not align with GIS ID
Status	Existing or Future Abandonment	119 valves
Diameters	Range from 2 to 30 inches	
Elevations	Range from 2782 to 3465	
Valves	**Type**	**Setting**
	PRV	25; range from 0 to 98 psi
	FCV	93; range from 0 to 140 gpm
	GPV	1; LA_Mesa_ATP curve
Headloss		Defined for some valves
Valve Controls		FM103 can be open or set to 4500 gpm
Pump	**Settings**	**Notes**
Booster Pumps	**Plant**	**Number of Pumps**
	395 Plant	3 pumps
	White Road Plant	3 pumps
	Plant 133	1 pump
Well Pumps		36 pumps; identified with “W” plus three digits
Pump Curves		About half the pumps have curves; the remainder have a design head and flow
Pump Controls		Well pumps are set to open or close based on tank level. Some booster pumps are turned on or off at certain clock times.

Tanks	Settings	Notes
IDs	"R" plus three digits	May not align with GIS ID
Status	Existing or Future Abandonment	25 tanks
Diameters	Range from 60 to 182 feet	
Elevations	Range from 2874 to 3809	
Heights	Range from 24 to 40 feet	
Inlet/Outlet Controls		Not apparent
Reservoirs	**Settings**	**Notes**
IDs	"GW" plus three digits	
Fixed Head Elevation	Range from 2545 to 2839	36 reservoirs, one representing groundwater at each well

Table 2 –Pressure Zone Boundaries

Boundary Controls	Notes
Normally Closed Pipes	13 pipes have initial status of closed
Normally Closed Valves	Some FCVs are labeled as "GV" and have a description showing that they are normally closed gate valves.

Table 3 –Demands

Demands	Notes
Average Day	Total 15,462 gpm
Maximum Day	Total 26,963 gpm
Peak Hour	Embedded in MDD with diurnal pattern
Global Adjustment Factor	None (1.0)
Diurnal Patterns	Defined for most demand junctions; most are ID_1 or ID_2

Appendix B – Fire Flow Test Data Sheets

Fire Flow Test Data Sheet

Date: 8-10-9-14

Calibration Test No. 2

Start Time (first flow hyd open): 9:04

Location: George Blvd. near Sabre

End Time (last flow hyd closed): 9:08

Before performing fire flow, please confirm the following facilities are OFF:

PRVs:		Confirmed
101	Nisqualli west of Balsam	
102	Balsam & Bear Valley	
103	3rd & Green Tree	
110	Dean & Shivers	
new	Balsam & Nisqualli ATP site	

Wells:		Confirmed
120	16955 Jasmine	
122	12326 1st Ave	
140	Piñon & Sycamore	

R-Cubed:	Confirmed
Piñon Tank Site, Turnout 3	

Fire Flow Data:

Static/Residual, Test Hydrant

Hydrant #: 622- see map

Static Pressure (PSI) 56

Residual Pressure (PSI) 18

Flow Hydrant 1

Hydrant #: 622-1 George south of Sabre

Pitot (PSI) 5 psi

Observed Flow (GPM)

Flow Hydrant 2 (If Needed)

Hydrant #: 622-see map

Pitot (PSI) [redacted] Less than 5

Observed Flow (GPM)

Flow Hydrant 3 (If Needed)

Hydrant #: 623-not shown, see redline

Pitot (PSI)

Observed Flow (GPM)

Provide reservoir level SCADA data during the test:

110 32.14 ft

111 31.69 ft

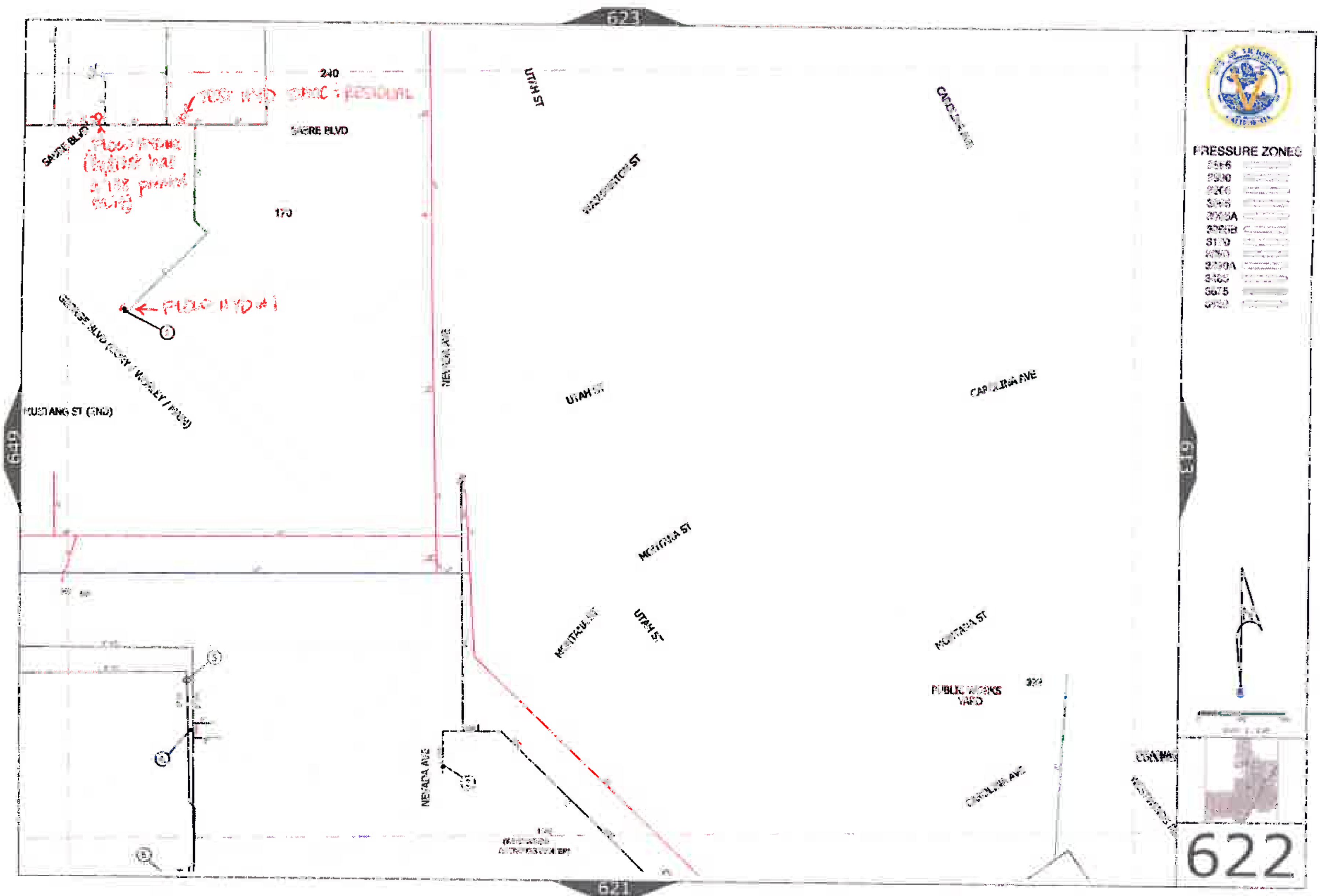
116 31.92 ft

117 30.69 ft

Provide PRV Setting:

George & Nevada:

We first tested all 3 hydrants, Risidual pressure Dropped to 0. Turned 3rd hydrant off and it was 18psi



George near Sabre 1 of 2

George near Sabre 2 of 2

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Fire Flow Test Data Sheet

Date: 10-9-14
Calibration Test No. 3
Start Time (first flow hyd open): 8:22
Location: Perimeter near HDPP
End Time (last flow hyd closed): 8:30

Before performing fire flow, please confirm the following facilities are OFF:

PRVs:		Confirmed
101	Nisqualli west of Balsam	
102	Balsam & Bear Valley	
103	3rd & Green Tree	
110	Dean & Shivers	
new	Balsam & Nisqualli ATP site	

Wells:		Confirmed
120	16955 Jasmine	
122	12326 1st Ave	
140	Piñon & Sycamore	

R-Cubed:	Confirmed
Piñon Tank Site, Turnout 3	

Fire Flow Data:

Static/Residual, Test Hydrant
Hydrant #: 624-see map
Location: 590' north of Phantom
Static Pressure (PSI) 118
Residual Pressure (PSI) 93

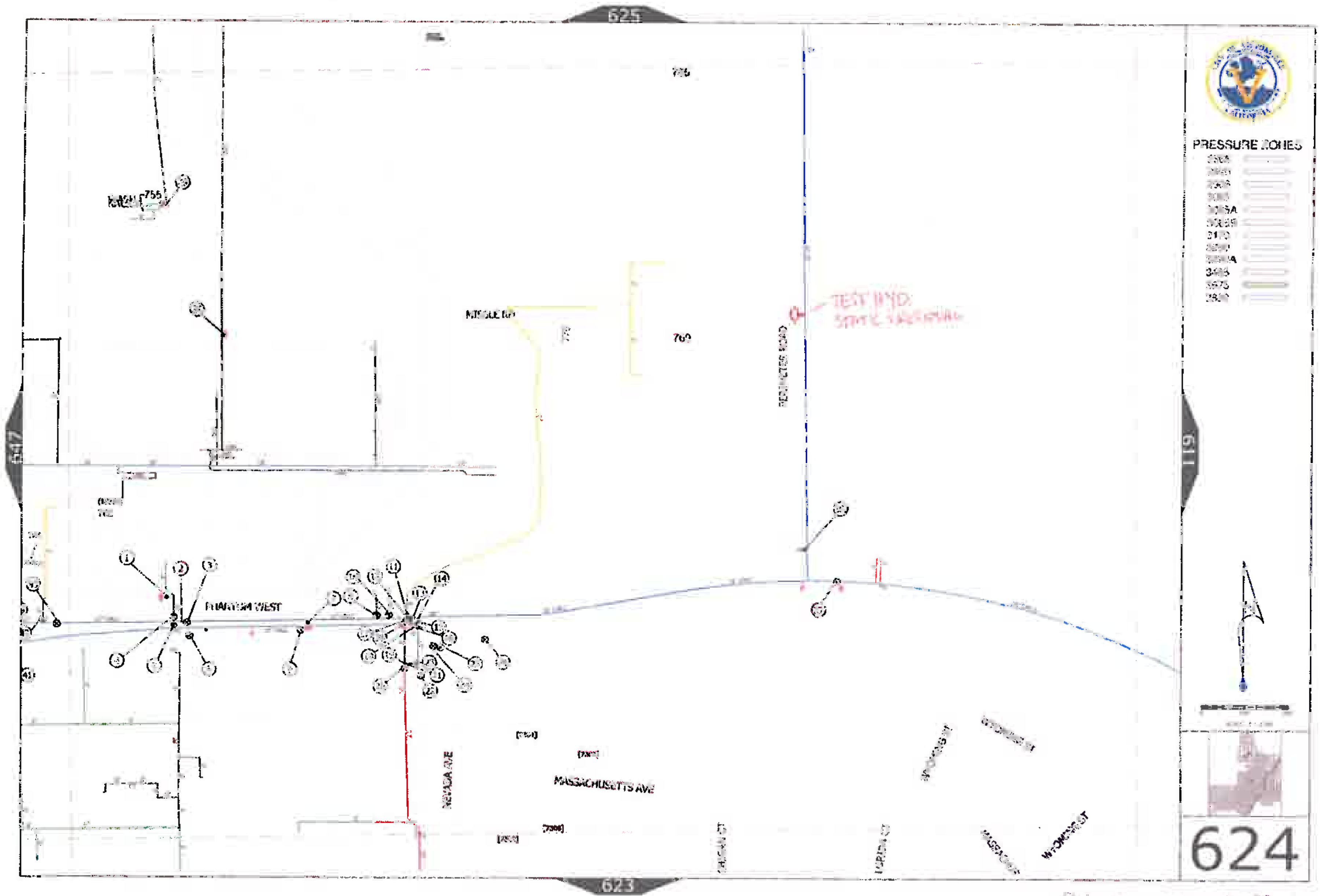
Flow Hydrant 1
Hydrant #: 625-6
Location: Perimeter near HDPP driveway
Pitot (PSI) 102
Observed Flow (GPM) 1575

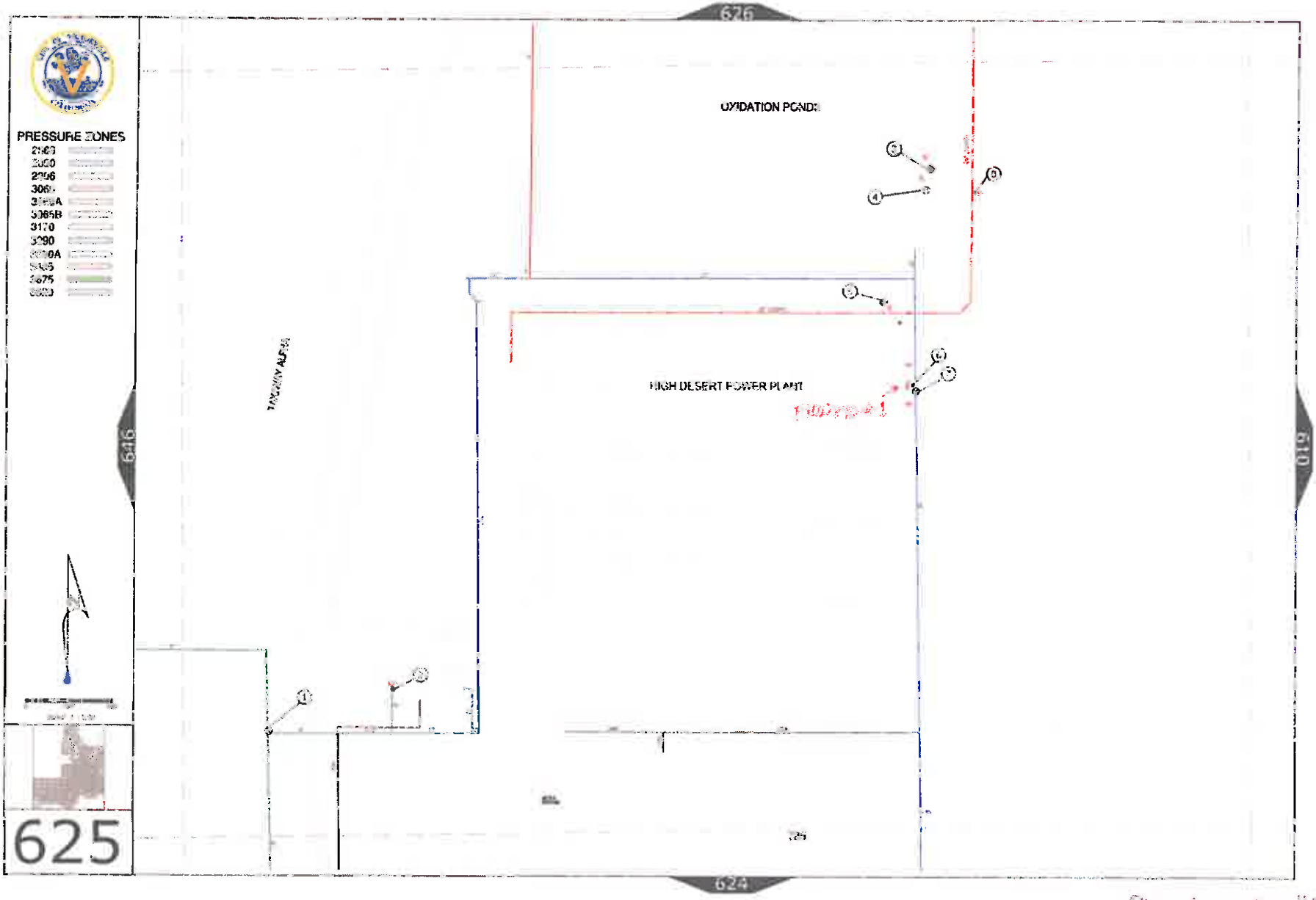
Flow Hydrant 2 (If Needed)
Hydrant #: 611-not numbered
Location: Phantom East 1200' east of Perimeter
Pitot (PSI) 80
Observed Flow (GPM)

Flow Hydrant 3 (If Needed)
Hydrant #: 647-36
Location: Phantom West
Pitot (PSI)
Observed Flow (GPM)

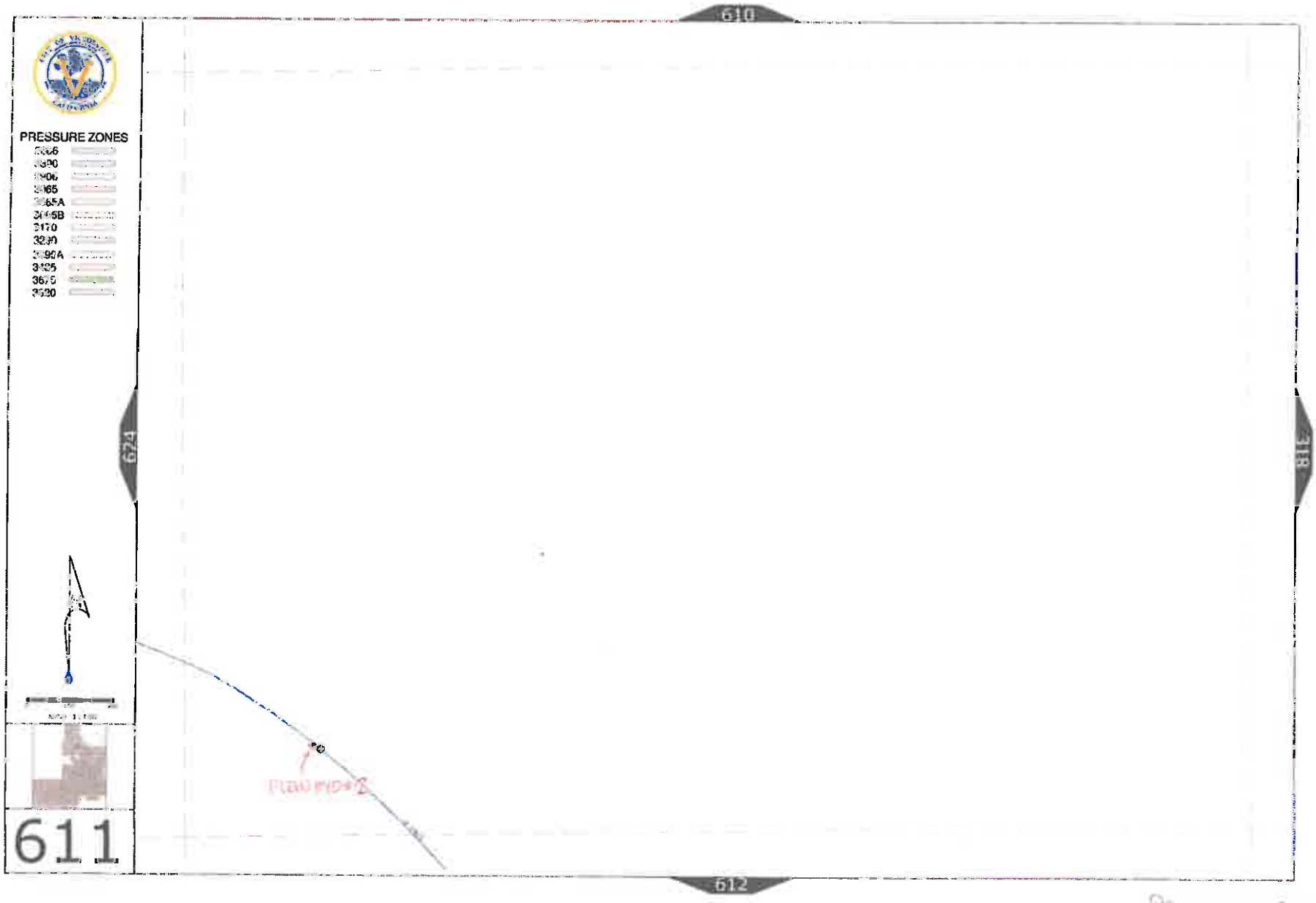
Provide reservoir level SCADA data during the test:

110 32.14 ft
111 31.69 ft
116 31.92 ft
117 30.69 ft


625
647
611
623
PRESSURE ZONES
PHANTOM WEST
NEVADA AVE
MASSACHUSETTS AVE
PERIMETER ROAD
TEST HYD.
760
755
624



Remember near HDPP 2



Pioneer near HCP

Fire Flow Test Data Sheet

Date: 10-9-14

Start Time (first flow hyd open): 9:37

End Time (last flow hyd closed): 944

Calibration Test No. 1

Location: Gateway Dr near Momentum

Before performing fire flow, please confirm the following facilities are OFF:

PRVs:		Confirmed
101	Nisqualli west of Balsam	✓
102	Balsam & Bear Valley	✓
103	3rd & Green Tree	✓
110	Dean & Shivers	✓
new	Balsam & Nisqualli ATP site	✓

Wells:		Confirmed
120	16955 Jasmine	✓
122	12326 1st Ave	✓
140	Piñon & Sycamore	✓

R-Cubed:	Confirmed
Piñon Tank Site, Turnout 3	✓

Fire Flow Data:

Static/Residual, Test Hydrant

Hydrant #: 688-see map

Static Pressure (PSI) 122

Residual Pressure (PSI) 97

Flow Hydrant 1

Hydrant #: 689-see map, hydrant on Momentum

Pitot (PSI) 80

Observed Flow (GPM) _____

Flow Hydrant 2 (If Needed)

Hydrant #: 689- see map, last hydrant on Gateway

Pitot (PSI) _____

Observed Flow (GPM) _____

Flow Hydrant 3 (If Needed)

Hydrant #: 689-see map

Pitot (PSI) not needed

Observed Flow (GPM) _____

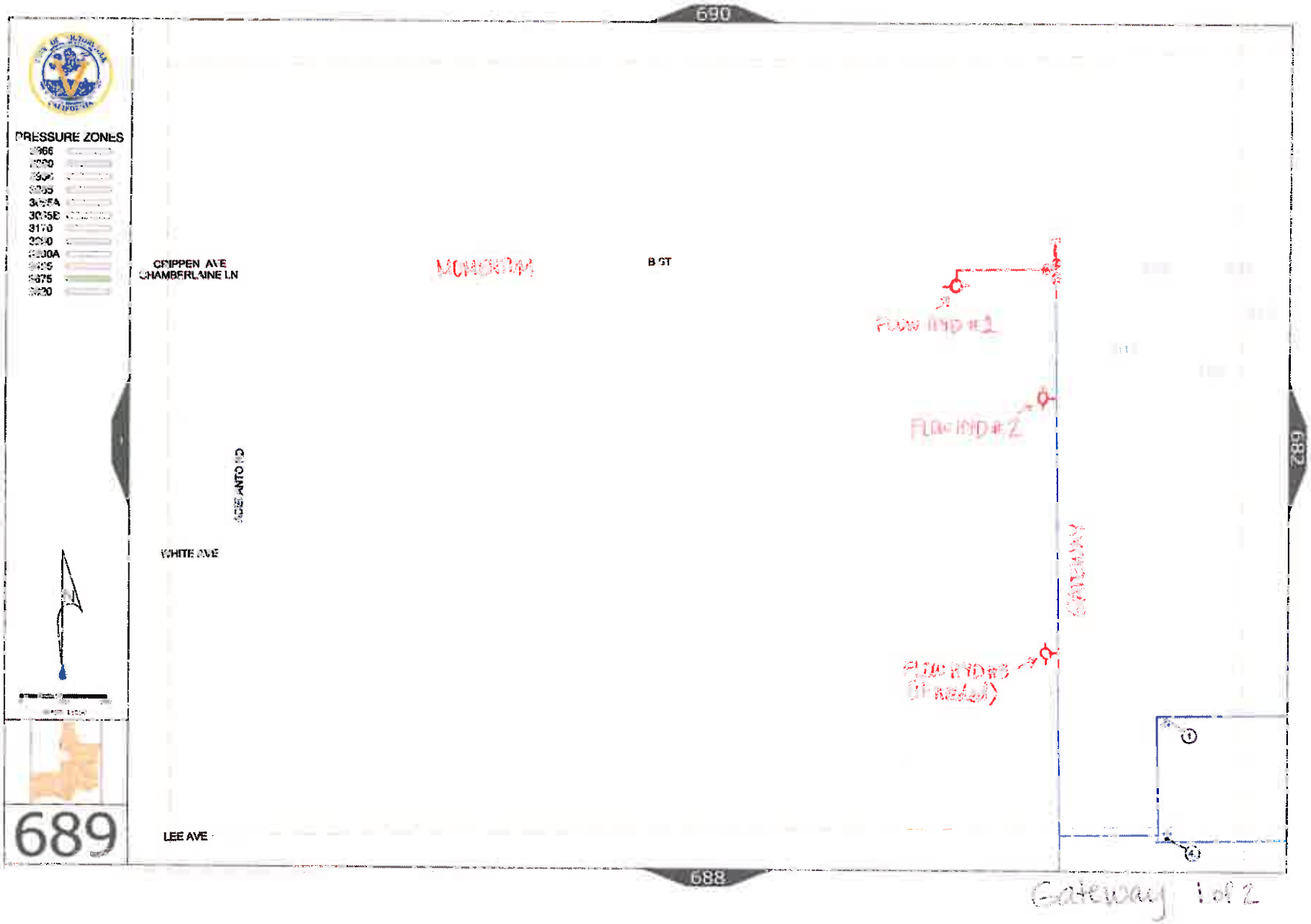
Provide reservoir level SCADA data during the test:

110 32.14 ft

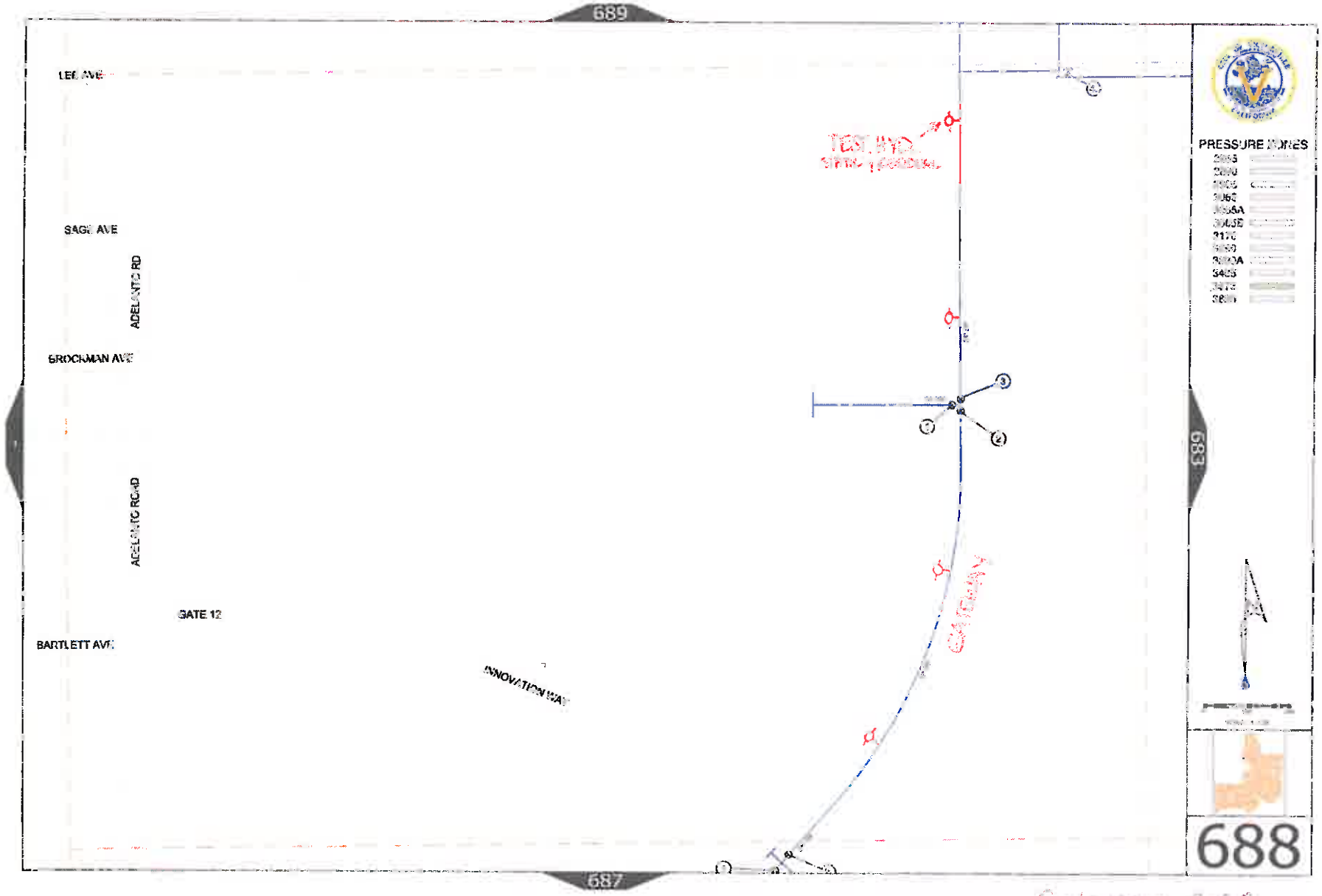
111 31.69 ft

116 31.92 ft

117 30.69 ft



Gateway 1 of 2



Gateway 2 of 2

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Fire Flow Test Data Sheet

Date: 10-16-14 Calibration Test No. 4

Start Time (first flow hyd open): 8:21 Location: Flightline

End Time (last flow hyd closed): 8:27

Before performing fire flow, please confirm the following facilities are OFF:

PRVs:		Confirmed
101	Nisqualli west of Balsam	
102	Balsam & Bear Valley	
103	3rd & Green Tree	
110	Dean & Shivers	
new	Balsam & Nisqualli ATP site	

Wells:		Confirmed
120	16955 Jasmine	
122	12326 1st Ave	
140	Piñon & Sycamore	

R-Cubed:	Confirmed
Piñon Tank Site, Turnout 3	

Fire Flow Data:

Static/Residual, Test Hydrant

Hydrant #: closest to 648-1

Location:

Static Pressure (PSI) 56

Residual Pressure (PSI) 26

Flow Hydrant 1

Hydrant #: 657-17

Location:

Pitot (PSI) 22

Observed Flow (GPM)

Flow Hydrant 2 (If Needed)

Hydrant #: 647-3

Location:

Pitot (PSI) 20

Observed Flow (GPM)

Flow Hydrant 3 (If Needed)

Hydrant #:

Location: Not needed

Pitot (PSI)

Observed Flow (GPM)

Provide reservoir level SCADA data during the test:

110 31.86 ft

111 31.84 ft

116 31.78 ft

117 31.61 ft

Provide PRV Setting:

North Flightline:

South Flightline:

WSC
WATER SYSTEMS CONSULTING, INC.

Fire Flow Test Data Sheet

Date: 10-16-14

Start Time (first flow hyd open): 8:56

End Time (last flow hyd closed): 9:05

Calibration Test No. 5

Location: Near Predator Hanger

Before performing fire flow, please confirm the following facilities are OFF:

PRVs:		Confirmed
101	Nisqualli west of Balsam	✓
102	Balsam & Bear Valley	✓
103	3rd & Green Tree	✓
110	Dean & Shivers	✓
new	Balsam & Nisqualli ATP site	✓

Wells:		Confirmed
120	16955 Jasmine	✓
122	12326 1st Ave	✓
140	Piñon & Sycamore	✓

R-Cubed:	Confirmed
Piñon Tank Site, Turnout 3	✓

Fire Flow Data:

Static/Residual, Test Hydrant

Hydrant #: 646-see map, blow off

Location:

Static Pressure (PSI) 134

Residual Pressure (PSI) 106

Flow Hydrant 1

Hydrant #: 642-5, blow-off at treatment plant

Location:

Pitot (PSI) 25 (Protected By PRV)

Observed Flow (GPM)

Flow Hydrant 2 (If Needed)

Hydrant #: 645-3

Location:

Pitot (PSI) 90

Observed Flow (GPM)

Flow Hydrant 3 (If Needed)

Hydrant #: 625-2

Location: Didnot need to flow

Pitot (PSI)

Observed Flow (GPM)

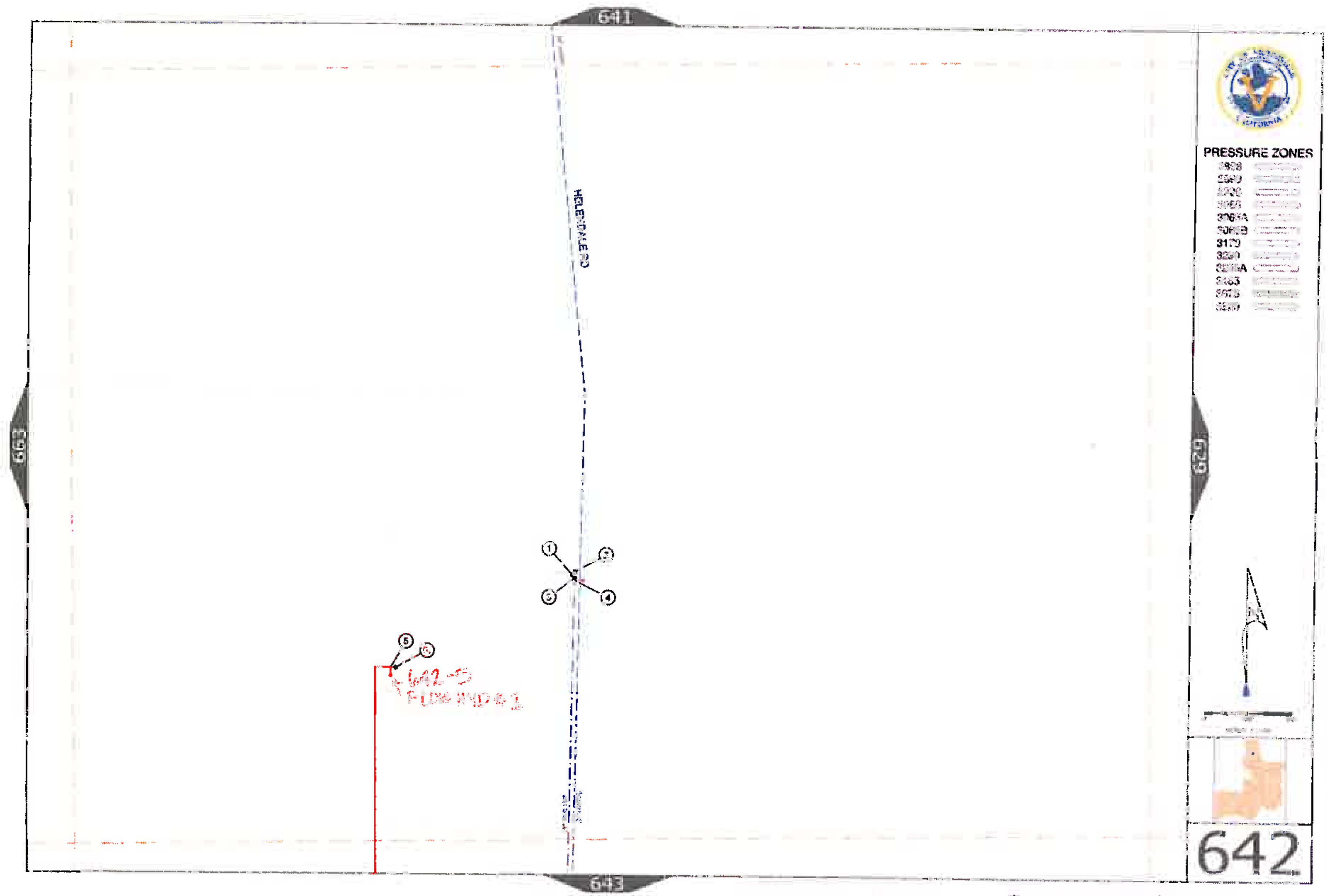
Provide reservoir level SCADA data during the test:

110 31.86 ft

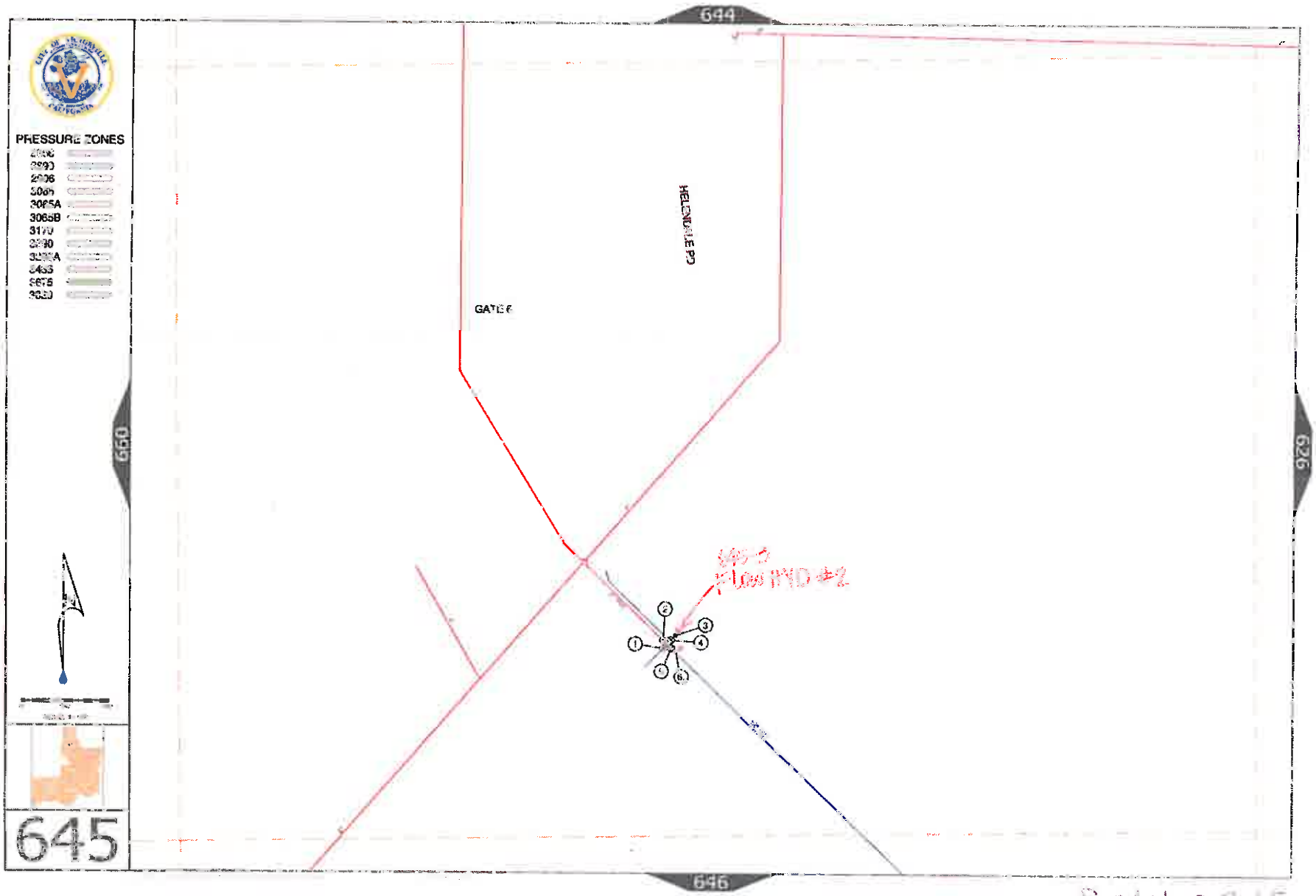
111 31.84 ft

116 31.78 ft

117 31.61 ft

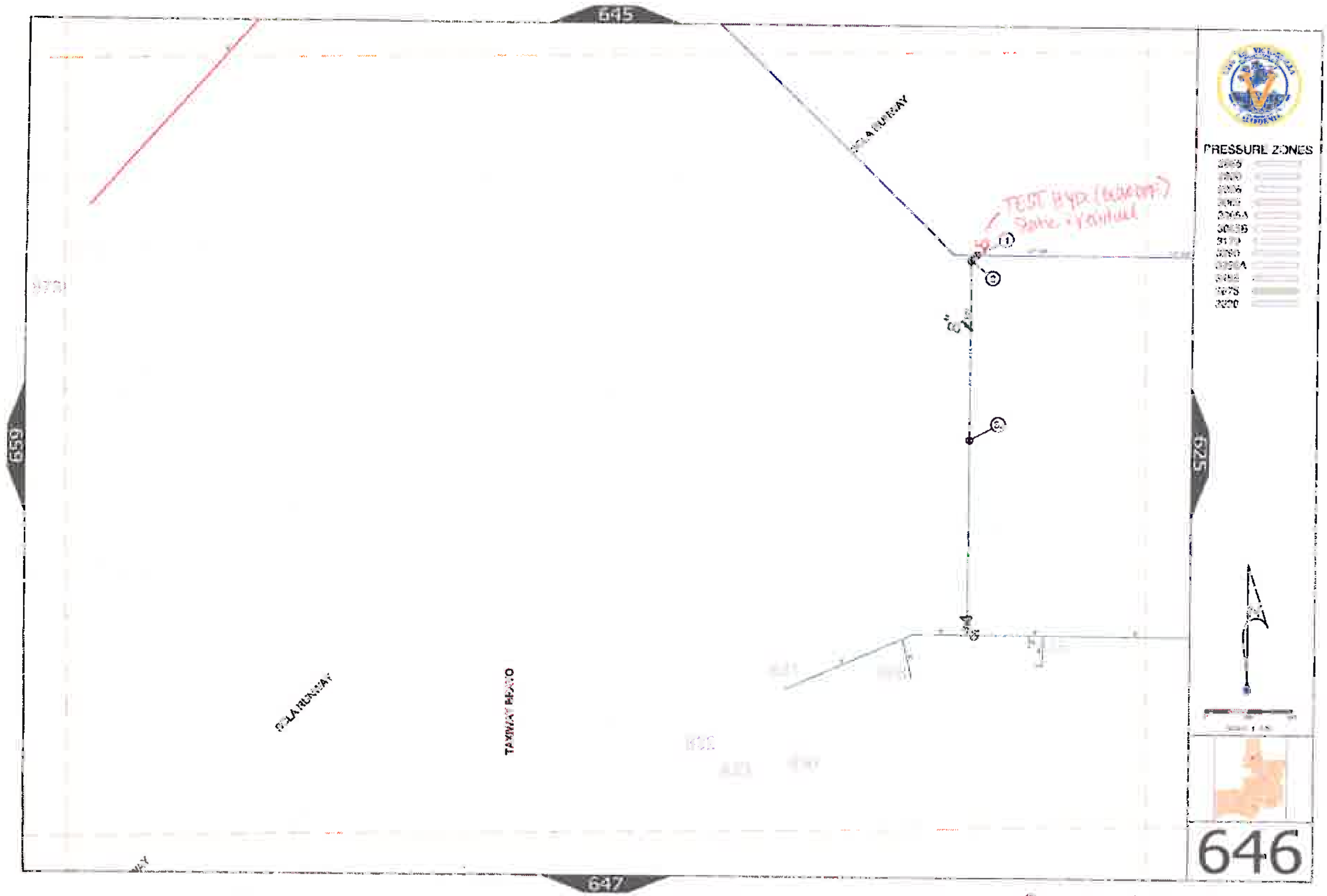


Predator 1 of 5



Predator 3 of 5

Predator 5 of 5



Predator 4 of 5