WEST YOST
ASSOCIATES
Consulting Engineers

TECHNICAL MEMORANDUM

DATE: May 14, 2015 Project No.: 415-00-13-18

TO: Kelye McKinney, City of Roseville
Jim Mulligan, City of Roseville

FROM: Irene Suroso, P.E., R.C.E. #70771
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SUBJECT: City of Roseville – Critical Dry Year Water Supply and Infrastructure Needs Assessment

INTRODUCTION

The City of Roseville currently obtains 100 percent of its surface water supply from Folsom Lake. As a result of the dry conditions in 2013, which continued into 2014, the potential for a "dead pool" condition occurred in early 2014. Under "dead pool" conditions, all flows out of Folsom Lake, including water supplies for the City, would stop due to the historical low water level in the lake. The "dead pool" volume for Folsom Lake equates to a volume of approximately 100,000 acre-feet (af). This is approximately 10 percent of the total reservoir capacity of 977,000 af and 20 percent of historical average wintertime storage of about 500,000 af.

These unprecedented conditions prompted the City to conduct this Critical Dry Year Water Supply and Infrastructure Needs Assessment to identify alternative water supplies, required infrastructure improvements and revised operational protocols to meet both existing and future water demands. Fortunately, enough rainfall occurred in the early months of 2014 to avoid a "deadpool" condition. However, based on these unprecedented conditions, future operation of Folsom Lake may be modified and, if the dry conditions persist, the future water supply from Folsom Lake to the City could be significantly reduced or stopped completely.

Based on the City's concern regarding the reliability of its Folsom Lake water supply, the City requested West Yost Associates (West Yost) to conduct this assessment and prepare this Technical Memorandum (TM) summarizing the evaluation and its findings. This TM summarizes the infrastructure required to meet the City's existing and buildout demands under various alternative dry-year water supply scenarios. Additionally, this TM provides a summary of recommended operational changes to the City's existing water system facilities during the dry-year conditions.

An overview of the evaluation assumptions and findings is included in the following sections:

- Modeling Assumptions
- Existing System Evaluation
- Buildout System Evaluation

This TM also includes two appendices, Appendix A and Appendix B, which provide the detailed results of the existing system and buildout system evaluations, respectively.

MODELING ASSUMPTIONS

To analyze the required infrastructure under different water supply conditions, West Yost used the City's hydraulic water system model which was previously developed by West Yost for the Pressure Zone 4 Water System Evaluation[1]. This hydraulic model contains the extended period simulation which includes 72-hour diurnal patterns assigned to each demand node in the hydraulic model for each pressure zone. The diurnal patterns in the hydraulic model were thoroughly reviewed previously by City of Roseville Environmental Utilities staff and West Yost.

The operational settings for the future Zone 4 reservoirs for the West Roseville Specific Plan and Sierra Vista from the Pressure Zone 4 Water System Evaluation, as documented in the Pressure Zone 4 Evaluation Technical Memorandum, were used initially as the base condition. These operational settings were then modified as needed for each of the dry-year scenarios for existing and buildout system conditions.

EXISTING SYSTEM EVALUATION

Existing Water Demand

Based on information provided to West Yost by the City[2], the peak summer month water demand for 2014 was estimated to be 50 million gallons per day (mgd), or 77 cubic feet per second (cfs). Under drought stage conditions, assuming a 20 percent demand reduction, the peak summer month water demand for 2014 was assumed to be 40 mgd, or 62 cfs.

Existing Water Supplies

Under existing system conditions, the City is normally supplied from Folsom Lake. Groundwater wells, and connections with neighboring water agencies can be used if drought or emergency conditions warrant. These supplies would be delivered through the following facilities:

- Roseville Water Treatment Plant;
- Six existing City groundwater wells (Diamond Creek, Woodcreek North, Darling, Oakmont, Blue Oaks and Hayden Parkway);

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[1] Pressure Zone 4 Buildout Potable Water System Evaluation Technical Memorandum, prepared by West Yost Associates, December 7, 2011.

[2] Water Demand Calculations, prepared by City of Roseville, September 19, 2013.

- Four emergency connections with the Placer County Water Agency (PCWA) at Pleasant Grove, Highland, Five Star and Tinker Pump Station connections; and
- An emergency connection with the Sacramento Suburban Water District (SSWD) at Pacific Fruit Express (PFE) Road.

Additionally, a Zone 4 to Zone 1 pump station and a pump station between SSWD and the City's water system are under construction by the City and were also included in this evaluation. Figure 1 shows the locations of these existing water system facilities.

Existing System Evaluation Scenarios and Results

West Yost evaluated eight potential alternative dry-year supply scenarios under existing system conditions. These scenarios are summarized in Table 1.

Table 1. Water Supply Scenarios Evaluated for the Existing System

Scenario	Roseville Water Treatment Plant Supply, mgd	Roseville Groundwater Supply, mgd	Supply from Emergency Connections with PCWA, mgd	Supply from Emergency Connections with SSWD, mgd	Assumed System Demand, mgd	Demand Reduction, %
1	23	9.8	6.7	0	40	20
2	23	9.8	4.5	0	40	20
3	10.8	9.8	10.5	0	36	28
4	0	9.8	10.5	7	32.8	3
5[a]	0	9.8	10.5	7	27.2	27
6	0	9.8	7	3	21.6	22
7	0	12.7	7	3	24.8	25
8	0	15.3	7	3	26.8	27

[a] Assumed clearwells at the Water Treatment Plant were out of service.

As shown in Table 1, the 40 mgd existing system demands under drought conditions (assumes a 20 percent demand reduction) could be met when the City's WTP supplied 23 mgd, groundwater wells supplied 9.8 mgd, and emergency connections supplied 6.7 mgd into the existing distribution system. Other assumptions for the existing system analysis are summarized in Appendix A, Table A1.

When the City's WTP supply was decreased, or no supply was assumed to be available from the City's WTP (assumes no supply from Folsom Lake available), the City's existing system could provide adequate services to the City's existing customers when one of the following conditions were met:

- Water demands were further reduced (beyond the assumed 20 percent demand reduction);
- Additional supplies were available from new groundwater wells (Blue Oaks Well and Hayden Parkway Well); or
- Additional supplies were available from additional emergency connections with PCWA or SSWD.

The City's Pressure Zone 4 has four existing groundwater wells. Hydraulic results over the 72-hour simulation indicated that the City could deliver the excess groundwater supplies in Pressure Zone 4 to Pressure Zone 1 through a new pump station located at Pleasant Grove Boulevard, east of Rose Creek Road (Pleasant Grove Pump Station).

To convey water from SSWD through the emergency connection at PFE Road to the City's Pressure Zone 1, a new pump station would be required because the hydraulic head at the PFE Road emergency connection with SSWD is lower than the hydraulic head in the City's Pressure Zone 1. As of the writing of this technical memorandum, this pump station was under construction by the City.

Assumptions and results for the eight existing system evaluation scenarios are summarized in Appendix A, Table A1. In addition, Appendix A provides detailed figures for each existing system scenario that summarizes the following:

- Assumed water supply sources and quantities for the scenario;
- Minimum pressure for the existing maximum day demand condition;
- City's existing storage reservoir water level trends over the 72 hour simulation period; and
- WTP clearwell water level trends over the 72-hour simulation period (only for Scenarios 5, 6, 7, and 8).

BUILDOUT SYSTEM EVALUATION

Buildout Water Demand

Based on information provided to West Yost by the City[3], the peak summer month water demand for buildout was estimated to be 96.7 million gallons per day (mgd), or 150 cubic feet per second (cfs). Under drought stage conditions, assuming a 20 percent demand reduction, the peak summer month water demand for buildout was assumed to be 77.3 mgd, or 120 cfs.

Buildout Water Supplies

The water supplies for the City's buildout demand condition were assumed to include surface water from Folsom Lake, the City's existing and planned future groundwater wells, emergency connections with neighboring agencies, and the Sacramento River Water Supply Project. These supplies would be delivered to the City through the following facilities:

- Roseville Water Treatment Plant;
- 19 groundwater wells (include six existing groundwater wells and 13 future groundwater wells);
- Four emergency connections with PCWA (Pleasant Grove, HighlandFive Star and Tinker Pump Station);

[3] Water Demand Calculations, prepared by City of Roseville, September 19, 2013.

- An emergency connection with SSWD at PFE Road;
- A Pressure Zone 4 to Pressure Zone 1 pump station; and
- Treated Sacramento River Water at either Sierra Vista Specific Plan Reservoir Site or near the intersection of Baseline Road and Woodcreek Oaks Boulevard.

Figure 2 shows the locations of these facilities. For the buildout system evaluation, City staff had provided West Yost with four alternate groundwater well locations in Pressure Zone 1. There are a total of 19 groundwater wells shown on Figure 2; however, West Yost only assumed the use of 16 groundwater wells in the buildout system hydraulic evaluation.

Also shown in Figure 2, there are future storage tanks to be constructed for buildout in Pressure Zone 4. These storage tanks include a 12 MG storage tank at West Roseville Specific Plan, and a 6 MG storage tank at Sierra Vista Specific Plan.

Buildout System Evaluation Scenarios and Results

City staff developed eight alternative water supply scenarios for West Yost to evaluate under buildout conditions. Table 2 provides an overview of the supply scenarios evaluated.

Table 2. Water Supply Scenarios Evaluated for the Buildout System

Scenario	Roseville Water Treatment Plant Supply, mgd	Roseville Groundwater Supply, mgd	Supply from Emergency Connections with PCWA, mgd	Supply from Emergency Connections with SSWD, mgd	Sacramento River Water Supply Project, mgd	Assumed System Demand, mgd	Demand Reduction, %
1	10.8	40	10	7	0	68	30
2	10.8	40	10	7	10	78	20
3	0	40	10	7	10	67	31
4	0	40	10	7	0	57	41
5[a]	0	40	10	7	20	77	20
6[b]	0	40	10	7	20	77	20
7[c]	0	40	10	7	20	77	20
8[d]	0	40	10	7	20	77	20

(a) Sacramento River treated water was assumed to be delivered to the City's buildout system through a 36-inch diameter pipeline from the Sierra Vista facility site to the suction side of the Pleasant Grove Pump Station.

(b) Sacramento River treated water was assumed to be delivered to the City's Pressure Zone 4 at the Sierra Vista facility site at a hydraulic head of 305 feet.

(c) Sacramento River treated water was assumed to be delivered to the City's Pressure Zone 4 at the Sierra Vista facility site at a hydraulic head of 305 feet, and the service area of Pressure Zone 4 was expanded to the east side of the City's system.

(d) Sacramento River treated water was assumed to be delivered to the City's Pressure Zone 1 system at intersection of Baseline Road and Woodcreek Oaks Boulevard at a hydraulic head of 405 feet.

Buildout evaluation results indicated that the City's buildout system could provide services to the existing and future customers under the various supply scenarios summarized in Table 2. Depending on the supply and demand conditions assumed, an additional transmission main to convey Sacramento River Water Supply and relocation of proposed future groundwater wells from Pressure Zone 4 to Pressure Zone 1 should be considered.

Similar to the existing system evaluation, excess groundwater supply in the City's Pressure Zone 4 could be delivered to Pressure Zone 1 during the off-peak demand condition. Therefore, the relocation of some of the proposed future groundwater wells from Pressure Zone 4 to Pressure Zone 1 is recommended to reduce the future pumping requirement, and associated energy consumption, at the proposed Pleasant Grove booster pump station. City staff has identified three potential alternative locations for the proposed future groundwater wells which are listed below:

- Mahaney Park;
- Maidu Park; and
- City's Corporation Yard.

As an alternative to the Pleasant Grove booster pump station, under the buildout system evaluation, West Yost investigated the potential expansion of the Pressure Zone 4 service area to include the service area directly east of the current Pressure Zone 4 service area (currently in the Pressure Zone 1 service area) when the Sacramento River Water Supply is delivered to Pressure Zone 4. Four new pressure reducing stations and five new isolation valves would be required to expand the Pressure Zone 4 service area east. The results of this evaluation indicated that some of the rezoned area in the new, expanded Pressure Zone 4, experienced low pressure due to higher topology. Based on these results, West Yost did not consider this alternative as a viable option for the City in the future. As an alternative to the expansion of the Pressure Zone 4 service area, West Yost also evaluated moving the delivery point for the proposed Sacramento River Water Supply from the Sierra Vista tank to a direct connection into Pressure 1 at the intersection of Baseline Road and Woodcreek Oaks Boulevard. Under this configuration, the results indicated that the City could maintain system pressure within 30 to 40 psi throughout all of the City's service areas. If and when the Sacramento River Water Supply Project moves forward, West Yost recommends that the City further evaluate the feasibility of this alternative.

Assumptions and results for the eight buildout system evaluation scenarios are summarized in Appendix B, Table B1. In addition, Appendix B provides detailed figures for each existing system scenario that summarizes the following:

- Assumed water supply sources and quantities for the scenario;
- Minimum pressure for the buildout maximum day demand condition;
- Future storage reservoir water level trends over the 72-hour simulation period; and
- System pressure trends of selected nodes over the 72-hour simulation period.

CONCLUSIONS

Overall, the City's existing system could provide adequate system pressures to the existing customers during the dry year conditions by reducing system demands. A new pump station at Pleasant Grove Boulevard should be considered to deliver the excess groundwater supply from Pressure Zone 4 to Pressure Zone 1, and a new pump station at PFE Road would be required to deliver emergency water supply from SSWD because the hydraulic head at the SSWD emergency connection point is lower than the City's Pressure Zone 1 system. As of the writing of this technical memorandum, this pump station was under construction by the City.

The City's buildout system could provide adequate system pressures to the existing and future customers during the dry year conditions with future groundwater wells, storage tanks and pump stations. The should consider relocating some of the proposed future groundwater well sites to Pressure Zone 1 to reduce the pumping requirement from Pressure Zone 4 to Pressure Zone 1 during the off-peak demand condition. Additionally, the City should consider the potential of including a delivery location for the Sacramento River supply in Pressure Zone 1, near the intersection of Baseline Road and Woodcreek Oaks Boulevard, once the Sacramento River Water Supply Project is closer to development. This could be an alternative site to the Sierra Visa Reservoir Site.

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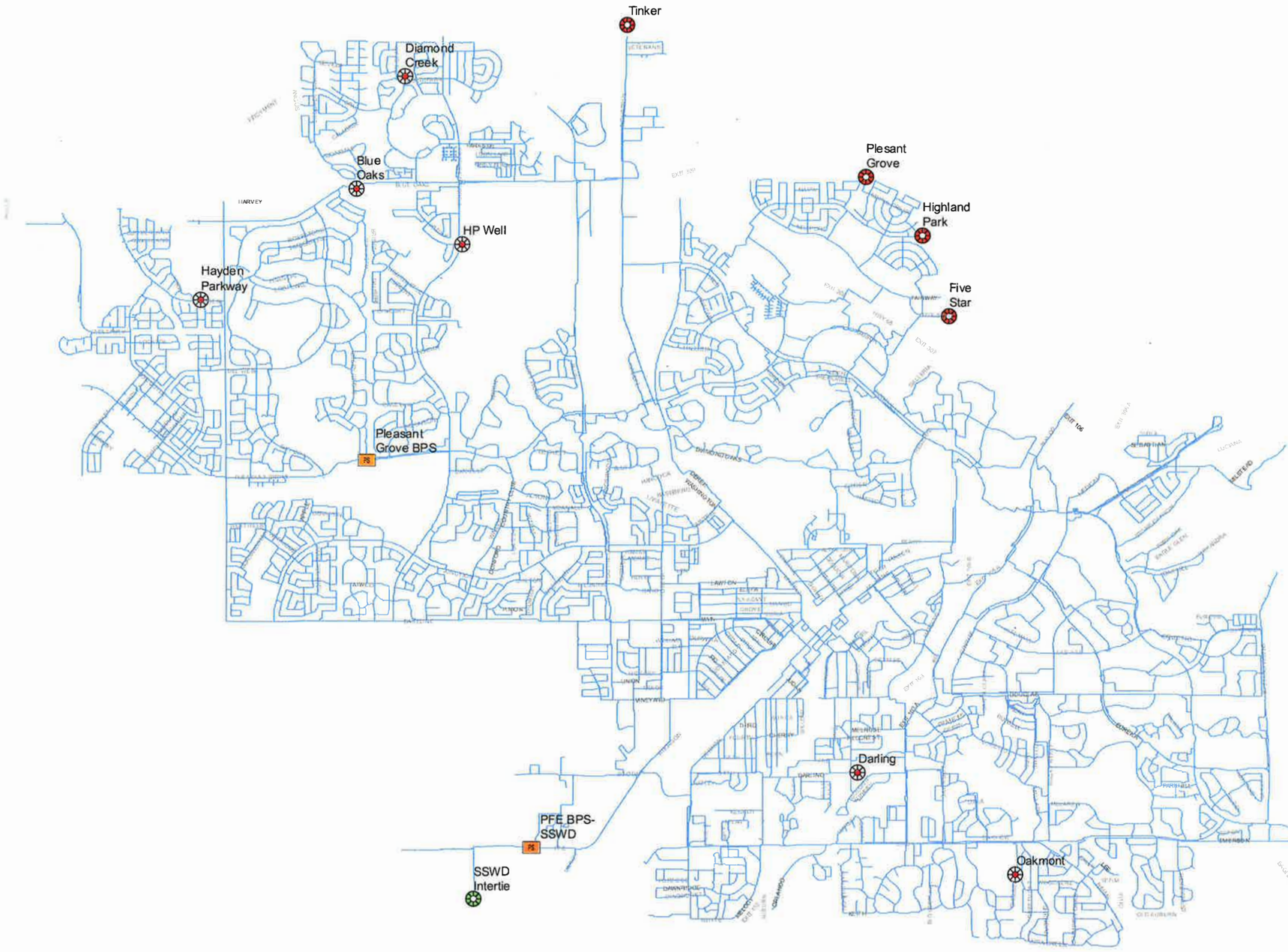

FIGURE 1

City of Roseville
Dry Year Evaluation

EXISTING SYSTEM EVALUATION FACILITY LOCATIONS

N

0 2,000 4,000

Scale in Feet

LEGEND

- PCWA Interties
- SSWD Intertie
- City Wells
- New Pump Stations
- Pipeline

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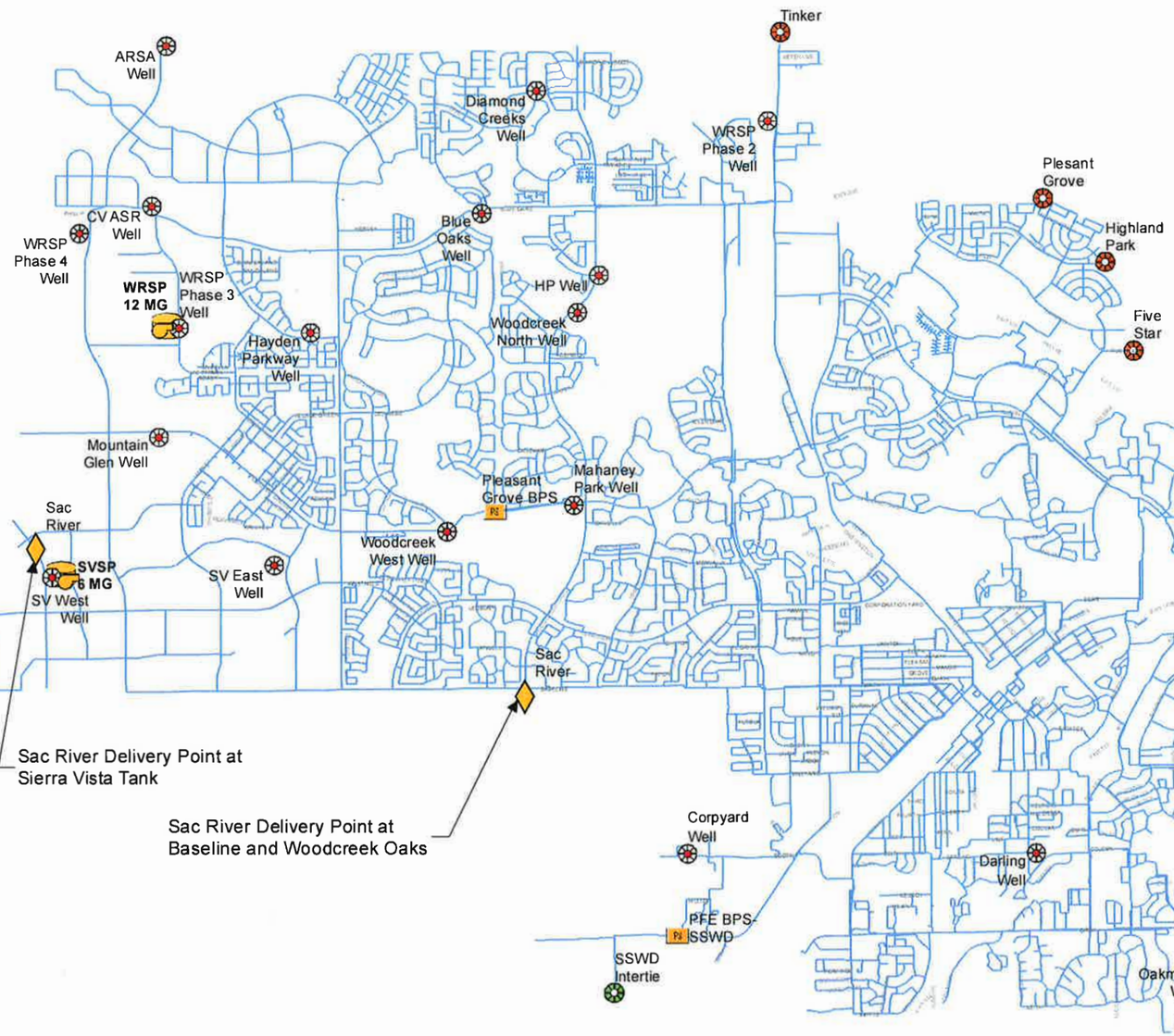
FIGURE 2

City of Roseville
Dry Year Evaluation

BUILDOUT SYSTEM EVALUATION FACILITY LOCATIONS



N

0 2,250 4,500

Scale in Feet

LEGEND

- PCWA Interties
- SSWD Intertie
- New Pump Stations
- City Wells
- Future Booster Pump Station
- Future Reservoirs
- Potential Sacramento River Water Supply Project Delivery Point

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APPENDIX A

Existing System Evaluation Results

Table A1. Summary of Hydraulic Conditions and Hydraulic Results for Existing Drought Year Evaluation

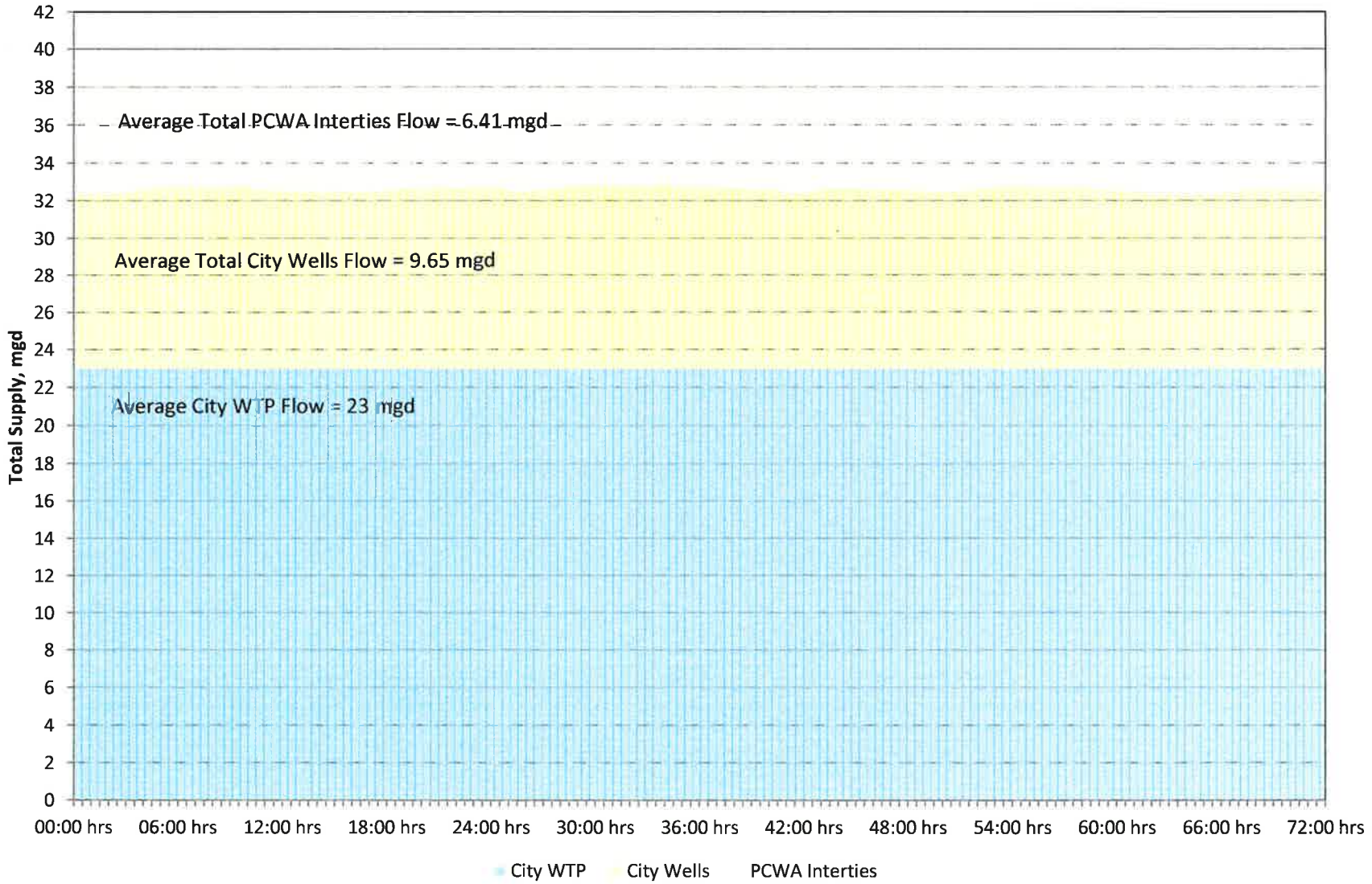
Roseville Wells Flow	PCWA/SSWD Available Flow	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Existing 1, WTP Flow = 23 mgd					
Total Groundwater Supply = 9.8 mgd Simulated flow for each well (average flow): • Diamond Creek Well=2.92 mgd • Woodcreek North = 2.6 mgd • Darling Well = 1.4 mgd • Oakmont Well = 2.88 mgd	**Total Interties = 6.7 mgd** Simulated flow for each interties: • Pleasant Grove = 0.35 mgd • Highland Conn = 0.35 mgd • Five Star Conn = 3 mgd • Tinker = 3 mgd	40 mgd (20% demand reduction)	Most pressures are above 50 psi, except for these following areas: • Area located along Eureka Road, between Douglas Boulevard and Sunrise Avenue. The minimum pressure at this area ranged from 40 to 49 psi. • Area located near Antelope Creek Drive. The minimum pressure was 46 psi. • Area located near Zone 3, on Secret Ravine Parkway. The minimum pressure ranged from 37 to 41 psi.	Scenario 1 Figures 1, 2, 3	• 72-hour period simulation • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 380'
Scenario: Existing 2, WTP Flow = 23 mgd					
Total Groundwater Supply = 9.8 mgd Simulated flow for each well (average flow): • Diamond Creek Well=2.92 mgd • Woodcreek North = 2.6 mgd • Darling Well = 1.4 mgd • Oakmont Well = 2.88 mgd	**Total Interties = 4.5 mgd** Simulated flow for each interties: • Pleasant Grove = 0.35 mgd • Highland Conn = 0.35 mgd • Five Star Conn = 3.8 mgd • Tinker = 0 mgd	40 mgd (20% demand reduction)	Most pressures are above 45 psi, except for these following areas: • Area located along Eureka Road, between Douglas Boulevard and Sunrise Avenue. The minimum pressure at this area ranged from 39 to 48 psi. • Area located between Eureka Road, Lead Hill Boulevard and Rocky Ridge Drive. The minimum pressure ranged from 43 to 45 psi. • Area located near Antelope Creek Drive and Creekside Ridge Court. The minimum pressure was 43 psi. • Area located near Automall Drive. The minimum pressure was 43 psi. • Area located near Zone 3, on Secret Ravine Parkway. The minimum pressure ranged from 25 to 34 psi.	Scenario 2 Figures 1, 2, 3	• Additional Operational Assumption: — Zone 1 BPS to fill Zone 1 Tanks from 9 pm to 8 am • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 380'
Scenario: Existing 3, WTP Flow = 10.8 mgd					
Total Groundwater Supply = 9.8 mgd Simulated flow for each well (average flow): • Diamond Creek Well=2.92 mgd • Woodcreek North = 2.6 mgd • Darling Well = 1.4 mgd • Oakmont Well = 2.88 mgd	**Total Interties = 10.5 mgd** Simulated flow for each interties: • Pleasant Grove = 0.35 mgd • Highland Conn = 0.35 mgd • Five Star Conn = 3.8 mgd • Tinker = 6 mgd	36 mgd (28% demand reduction)	Most pressures are above 45 psi, except for these following areas: • Area located along Eureka Road, between Douglas Boulevard and Sunrise Avenue. The minimum pressure at this area ranged from 43 to 50 psi. • Area located between Eureka Road, Lead Hill Boulevard and Rocky Ridge Drive. The minimum pressure was 49 psi. • Area located near Antelope Creek Drive and Creekside Ridge Court. The minimum pressure was 43 psi. • Area located near Automall Drive. The minimum pressure was 48 psi. • Area located near Zone 3, on Secret Ravine Parkway. The minimum pressure ranged from 35 to 39 psi.	Scenario 3 Figures 1, 2, 3	• Additional Operational Assumption: — Zone 1 BPS to fill Zone 1 Tanks from 9 pm to 5 am • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 380'
Scenario: Existing 4, WTP Flow = 0 mgd					
Total Groundwater Supply = 9.8 mgd Simulated flow for each well (average flow): • Diamond Creek Well=2.92 mgd • Woodcreek North = 2.6 mgd • Darling Well = 1.4 mgd • Oakmont Well = 2.88 mgd	**Total Interties = 10.5 mgd** Simulated flow for each interties: • Pleasant Grove = 0.35 mgd • Highland Conn = 0.35 mgd • Five Star Conn = 3.8 mgd • Tinker = 6 mgd • SSWD = 7 mgd	32.8 mgd (34% demand reduction)	Most pressures are above 45 psi, except for these following areas: • Area located along Eureka Road, between Douglas Boulevard and Sunrise Avenue. The minimum pressure at this area ranged from 38 to 50 psi. • Area located between Eureka Road, Lead Hill Boulevard and Rocky Ridge Drive. The minimum pressure ranged from 44 to 48 psi. • Area located near Antelope Creek Drive and Creekside Ridge Court. The minimum pressure was 43 psi. • Area located near Automall Drive. The minimum pressure was 44 psi. • Area located near Zone 3, on Secret Ravine Parkway. The minimum pressure ranged from 30 to 35 psi.	Scenario 4 Figures 1, 2, 3	• New Pump Station at PFE Road to deliver SSWD flow into Roseville System at 7 mgd • Additional Operational Assumption: — Zone 1 BPS to fill Zone 1 Tanks from 9 pm to 3 am • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 380'
Scenario: Existing 5, WTP Flow = 0 mgd					
Total Groundwater Supply = 9.8 mgd Simulated flow for each well (average flow): • Diamond Creek Well=2.92 mgd • Woodcreek North = 2.6 mgd • Darling Well = 1.4 mgd • Oakmont Well = 2.88 mgd	**Total Interties = 17.5 mgd** Simulated flow for each interties: • Pleasant Grove = 0.35 mgd • Highland Conn = 0.35 mgd • Five Star Conn = 3.8 mgd • Tinker = 6 mgd • SSWD = 7 mgd	27.2 mgd (46% demand reduction)	Most pressures are above 45 psi, except for these following areas: • Area located between Eureka Road and Douglas Boulevard. The minimum pressures at this area are around 42-43 psi. • Area located between Eureka Road, Lead Hill Boulevard and Rocky Ridge Drive. The minimum pressure is 45 psi.	Scenario 5 Figures 1, 2, 3, 4	• Assumed WTP Clearwells out of service • New Pump Station at PFE Road to deliver SSWD flow into Roseville System at 7 mgd • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 380'
Scenario: Existing 6, WTP Flow = 0 mgd					
Total Groundwater Supply = 9.8 mgd Simulated flow for each well (average flow): • Diamond Creek Well=2.92 mgd • Woodcreek North = 2.6 mgd • Darling Well = 1.4 mgd • Oakmont Well = 2.88 mgd	**Total Interties = 10 mgd** Simulated flow for each interties: • Pleasant Grove = 0 mgd • Highland Conn = 0 mgd • Five Star Conn = 3.8 mgd • Tinker = 3.2 mgd • SSWD = 3 mgd	21.6 mgd (57% demand reduction)	Most pressures are above 45 psi, except for these following areas: • Zone 5 areas near Sagemore Drive and Silver Mill Way. The minimum pressures at these areas are 42 to 44 psi.	Scenario 6 Figures 1, 2, 3, 4	• Assumed Zone 1 Tank Fill BPS offline, Zone 1 Tank Fill bypass was opened – NE Tanks float on Zone 1 pressure • WTP Clearwells were also operated off Zone 1 pressure • New Pump Station at PFE Road to deliver SSWD flow into Roseville System at 3 mgd • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 380'

Table A1. Summary of Hydraulic Conditions and Hydraulic Results for Existing Drought Year Evaluation

Roseville Wells Flow	PCWA/SSWD Available Flow	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Existing 7, WTP Flow = 0 mgd					
Total Groundwater Supply = 12.7 mgd Simulated flow for each well (average flow): • Diamond Creek Well=2.92 mgd • Woodcreek North = 2.6 mgd • Darling Well = 1.4 mgd • Oakmont Well = 2.88 mgd • Blue Oaks Well = 2.88 mgd	**Total Interties = 10 mgd** Simulated flow for each interties: • Pleasant Grove = 0 mgd • Highland Conn = 0 mgd • Five Star Conn = 3.8 mgd • Tinker = 3.2 mgd • SSWD = 3 mgd	24.8 mgd (50% demand reduction)	Most pressures are above 45 psi, except for these following areas: • Area located between Eureka Road and Douglas Boulevard. The minimum pressures at this area are around 44-45 psi. • Zone 5 areas near Sagemore Drive, Iron Crest Drive, and Silver Mill Way. The minimum pressures at these areas are 40 to 45 psi.	Scenario 7 Figures 1, 2, 3, 4	• New Pump Station at Pleasant Grove to pump from Zone 4 to Zone 1 – Operated only when PRV Station on Junction Boulevard is closed (zero flow) • New Blue Oaks Well operated at 2.9 mgd • Assumed Zone 1 Tank Fill BPS offline, Zone 1 Tank Fill bypass was opened – NE Tanks float on Zone 1 pressure • WTP Clearwells were also operated off Zone 1 pressure • New Pump Station at PFE Road to deliver SSWD flow into Roseville System at 3 mgd • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 380'
Scenario: Existing 8, WTP Flow = 0 mgd					
Total Groundwater Supply = 15.3 mgd Simulated flow for each well (average flow): • Diamond Creek Well=2.92 mgd • Woodcreek North = 2.6 mgd • Darling Well = 1.4 mgd • Oakmont Well = 2.88 mgd • Blue Oaks Well = 2.88 mgd • Hayden Parkway Well = 2.59 mgd	**Total Interties = 10 mgd** Simulated flow for each interties: • Pleasant Grove = 0 mgd • Highland Conn = 0 mgd • Five Star Conn = 3.8 mgd • Tinker = 3.2 mgd • SSWD = 3 mgd	26.8 mgd (46% demand reduction)	Most pressures are above 45 psi, except for these following areas: • Area located between Eureka Road and Douglas Boulevard. The minimum pressures at this area are around 43-44 psi. • Zone 5 areas near Sagemore Drive, Iron Crest Drive, and Silver Mill Way. The minimum pressures at these areas are 39 to 44 psi.	Scenario 8 Figures 1, 2, 3, 4	• New Hayden Parkway Well operated at 2.6 mgd • New Pump Station at Pleasant Grove to pump from Zone 4 to Zone 1 – Operated only when PRV Station on Junction Boulevard is closed (zero flow) • New Blue Oaks Well operated at 2.9 mgd • Assumed Zone 1 Tank Fill BPS offline, Zone 1 Tank Fill bypass was opened – NE Tanks float on Zone 1 pressure • WTP Clearwells were also operated off Zone 1 pressure • New Pump Station at PFE Road to deliver SSWD flow into Roseville System at 3 mgd • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 380'

SCENARIO 1

Scenario 1 - Figure 1. Summary of Total Supply During 2014 Drought Event
Existing Average Maximum Day Demand Condition at 40 mgd
WTP Supplies at 23 MGD



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Tinker
Average Supply
Flow=0.82 mgd;
delivered head from
PCWA = 380 feet

Diamond Creek
Average Supply
Flow=2.93 mgd

Plesant Grove
Average Supply Flow=3
mgd; delivered
head from PCWA
= 405 feet

Highland Park
Average Supply Flow=0.18 mgd; delivered head from PCWA = 405 feet

Woodcreek North
Average Supply
Flow=2.51 mgd

Five Star
Average Supply Flow=0.23 mgd; delivered head from PCWA = 405 feet

Darling
Average Supply
Flow=1.4 mgd

Oakmont
Average Supply
Flow=2.87 mgd

46.2 psi
38.6 psi
42.6 psi
45.3 psi
44.9 psi
45.4 psi
48.8 psi
44.6 psi
46.7 psi
44.6 psi
47.5 psi
44.5 psi
41.2 psi
42.1 psi
41.3 psi
42.4 psi
48.5 psi
48.4 psi
49.5 psi
49.5 psi
48.8 psi
49.6 psi
49.6 psi
44.3 psi
49.7 psi

FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 1
MINIMUM PRESSURE FOR EXISTING MAXIMUM DAY DEMAND CONDITION

N

0 2,000 4,000
Scale in Feet

Notes
1. Existing Maximum Day Demand is 40 mgd.
2. Average total supply from Water Treatment Plant is 23 mgd.
3. Average total supply from PCWA Interties is 4.22 mgd.
4. Average total supply from City Wells is 9.71 mgd.
5. Hydraulic model was simulated for 72-hour extended period condition. Minimum pressure at hour 33:00 was obtained from hydraulic results.

LEGEND

System Pressure

- Less than 45 psi
- 45 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi
- PCWA Interties
- City Wells
- Pipeline

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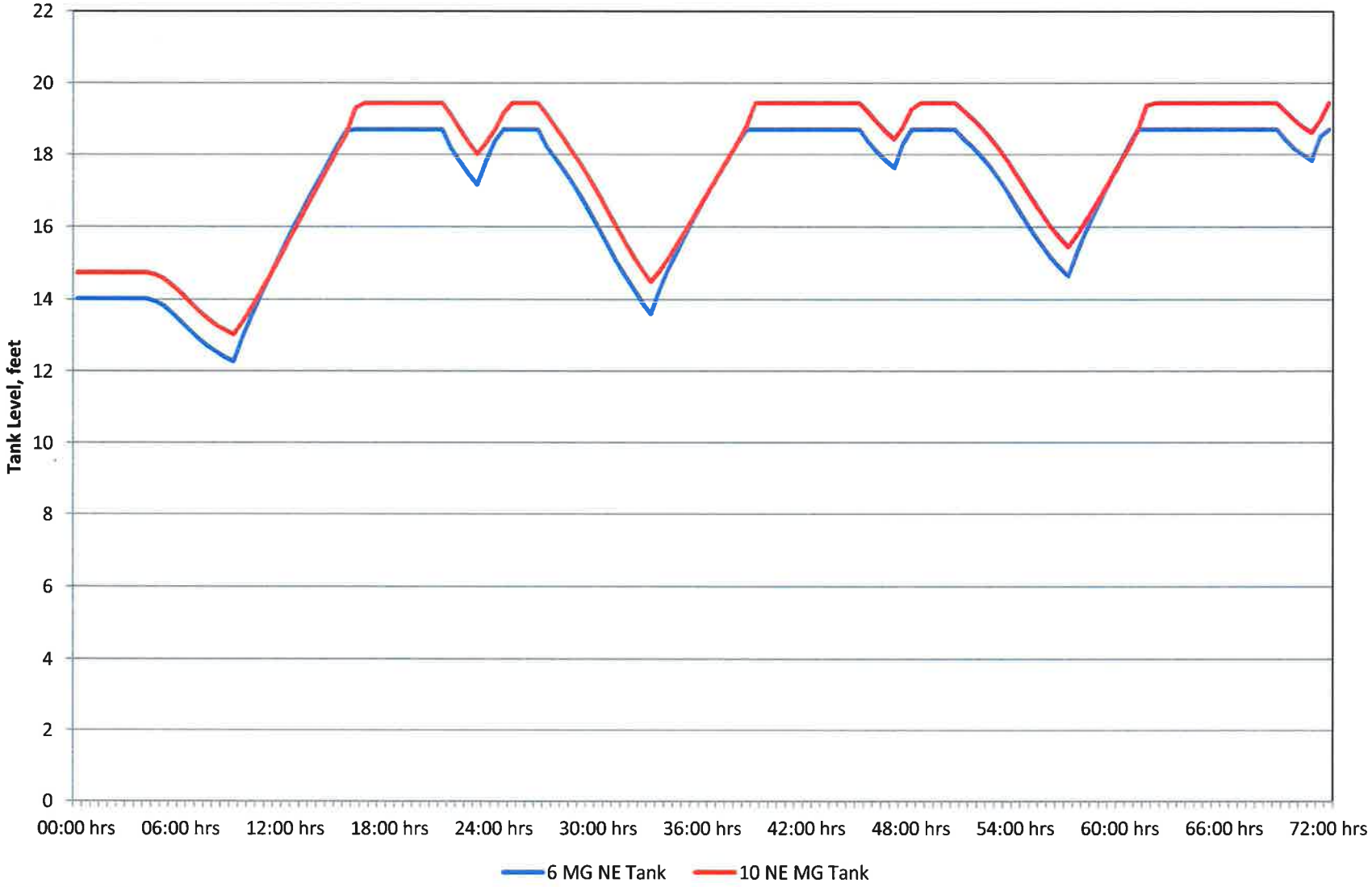
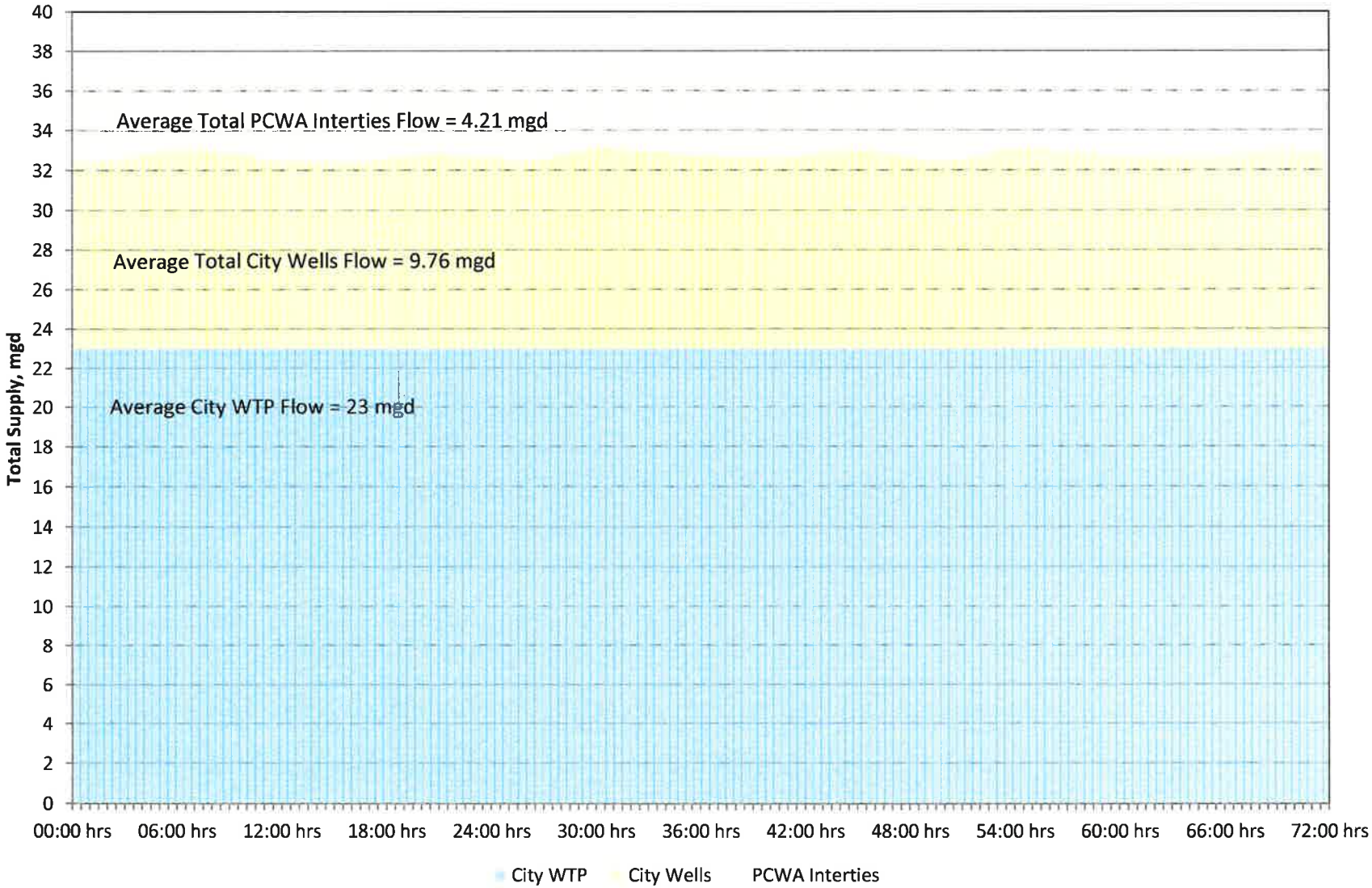
Scenario 1 - Figure 3. Summary of Northeast Storage Reservoir Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 40 mgd WTP Supplies at 23 MGD



SCENARIO 2

Scenario 2 - Figure 1. Summary of Total Supply During 2014 Drought Event
Existing Average Maximum Day Demand Condition at 40 mgd
WTP supplies at 23 mgd, No Tinker Flow



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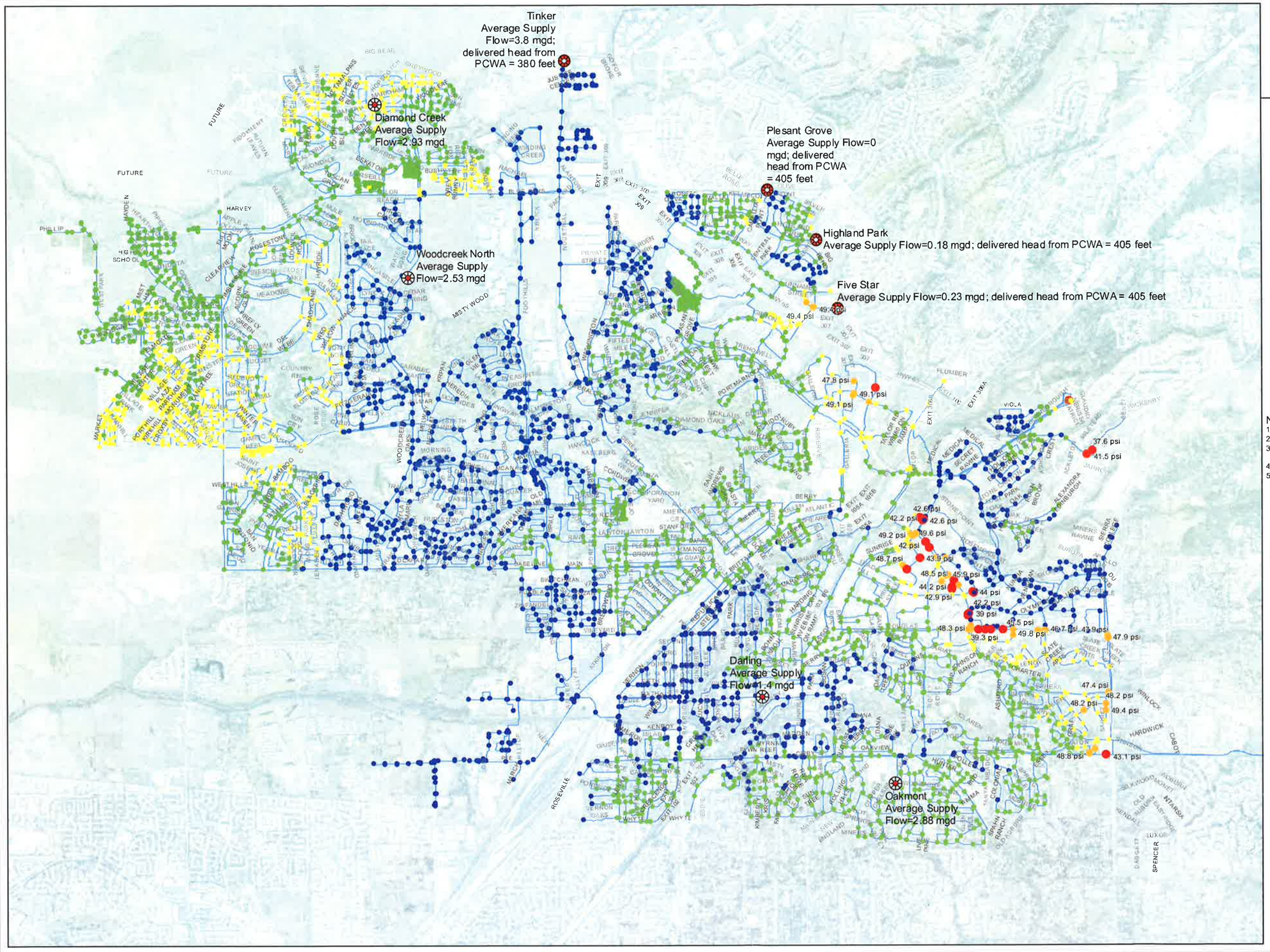

FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 2
MINIMUM PRESSURE FOR EXISTING MAXIMUM DAY DEMAND CONDITION (No Flow at Tinker)

N

0 2,000 4,000

Scale in Feet

Notes

1. Existing Maximum Day Demand is 40 mgd.
2. Average total supply from Water Treatment Plant is 23 mgd.
3. Average total supply from PCWA Interties is 4.21 mgd (Tinker Connection has 0 mgd)
4. Average total supply from City Wells is 9.76 mgd.
5. Hydraulic model was simulated for 72-hour extended period condition. Minimum pressure at hour 55:30 was obtained from hydraulic results.

LEGEND

System Pressure

- Less than 45 psi
- 45 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi
- PCWA Interties
- City Wells
- Pipeline

CITY OF ROSEVILLE
TRUST ON-TIME PROJECTS

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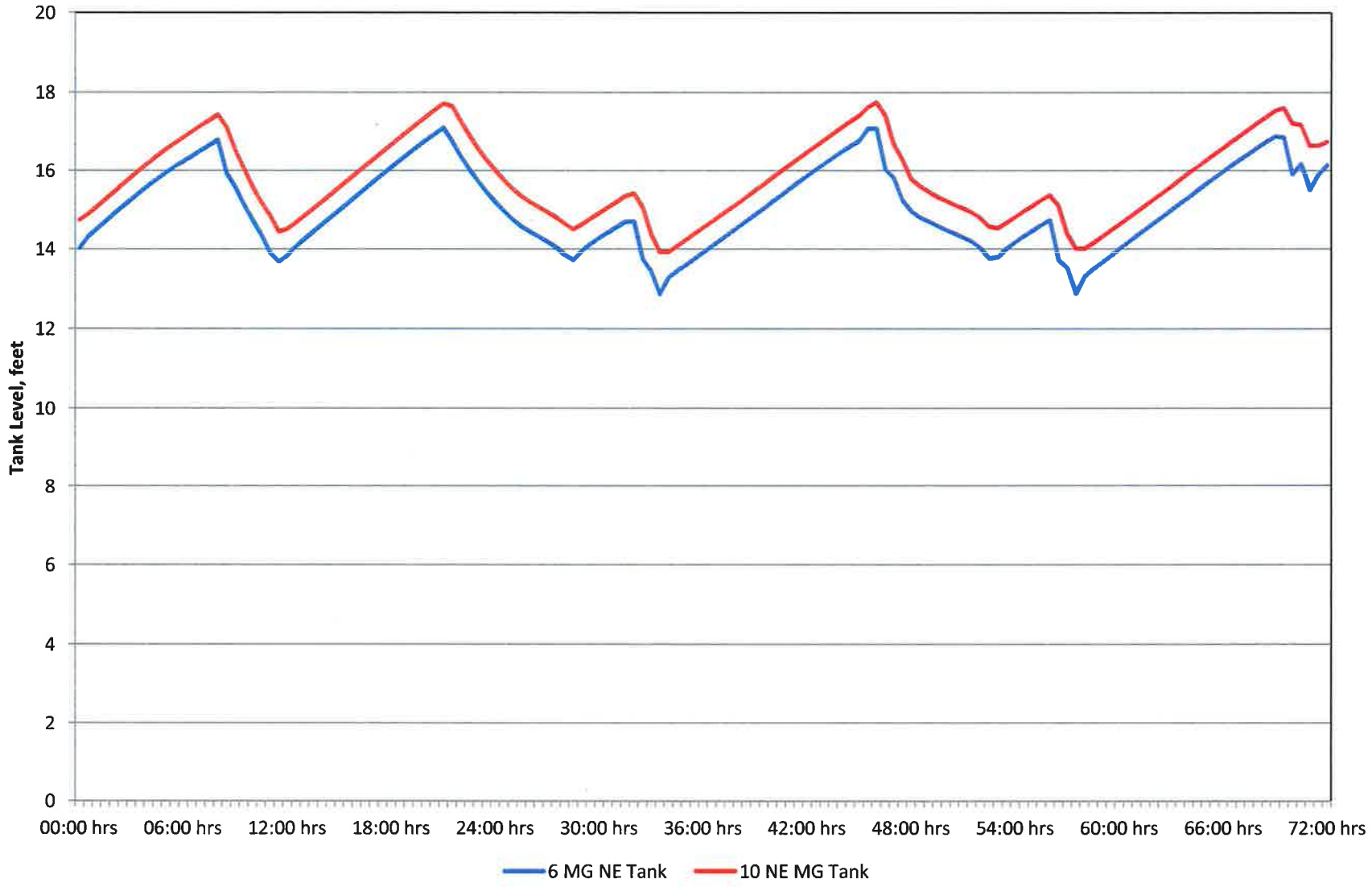
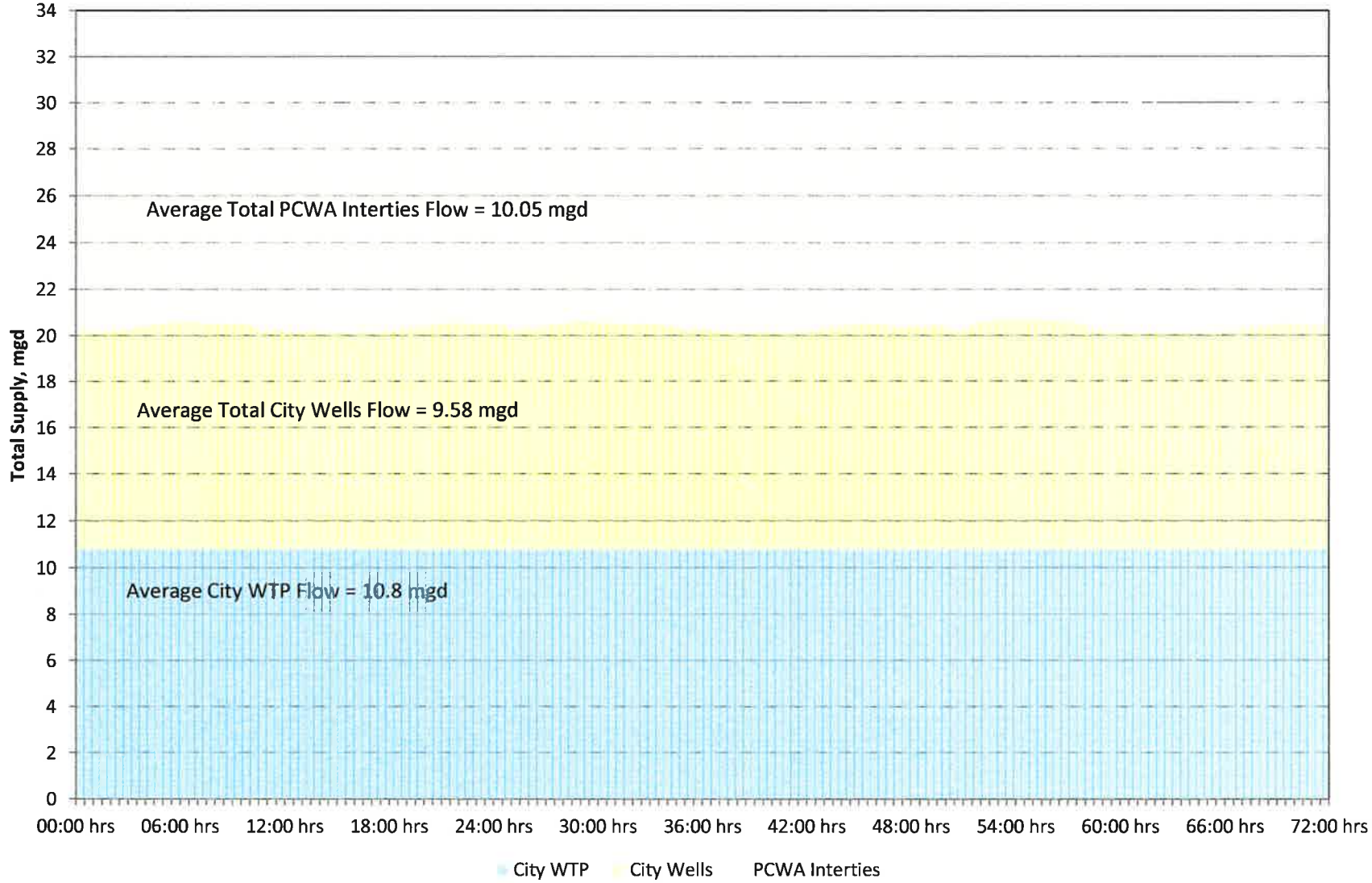
Scenario 2 - Figure 3. Summary of Northeast Storage Reservoir Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 40 mgd WTP supplies at 23 mgd, No Tinker Flow



SCENARIO 3

Scenario 3 - Figure 1. Summary of Total Supply During 2014 Drought Event
Existing Average Maximum Day Demand Condition at 36 mgd
WTP Supplies at 10.8 MGD



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Tinker
Average Supply
Flow=3.8 mgd;
delivered head from
PCWA = 380 feet

Diamond Creek
Average Supply
Flow=2.92 mgd

Woodcreek North
Average Supply
Flow=2.46 mgd

Pleasant Grove
Average Supply
Flow=5.89 mgd;
delivered head
from PCWA
= 405 feet

Highland Park
Average Supply Flow=0.16 mgd; delivered head from PCWA = 405 feet

Five Star
Average Supply Flow=0.20 mgd; delivered head from PCWA = 405 feet

Dahlia
Average Supply
Flow=1.37 mgd

Oakmont
Average Supply
Flow=2.83 mgd

48.54 psi
35.2 psi
39.1 psi
47.37 psi
47.37 psi
46.93 psi
46.54 psi
46.55 psi
46.67 psi
49.22 psi
49.54 psi
47.07 psi
47.91 psi
46.24 psi
47.97 psi
44.12 psi
43.69 psi
42.82 psi
49.88 psi
42.87 psi
45.2 psi

FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 3
MINIMUM PRESSURE FOR EXISTING MAXIMUM DAY DEMAND CONDITION (WTP at 10.8 mgd)

N

0 2,000 4,000
Scale in Feet

Notes
1. Existing Maximum Day Demand is 36 mgd.
2. Average total supply from Water Treatment Plant is 10.8 mgd.
3. Average total supply from PCWA Interties is 10.05 mgd.
4. Average total supply from City Wells is 9.58 mgd.
5. Hydraulic model was simulated for 72-hour extended period condition. Minimum pressure at hour 49:30 was obtained from hydraulic results.

LEGEND

System Pressure

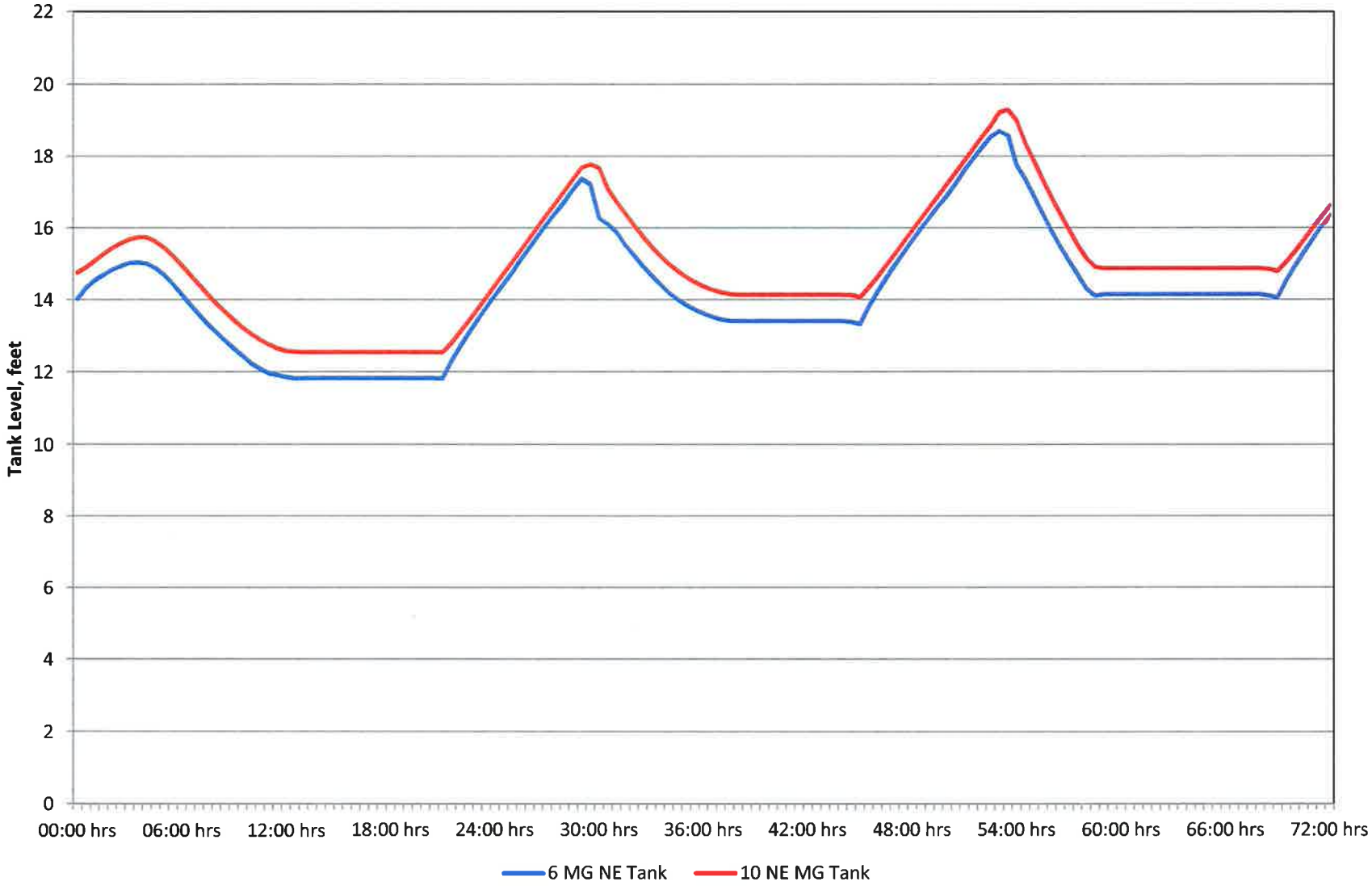
- Less than 45 psi
- 45 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi
- PCWA Interties
- City Wells
- Pipeline

CITY OF ROSEVILLE
TRUSTS OUR PAST PROSPERS

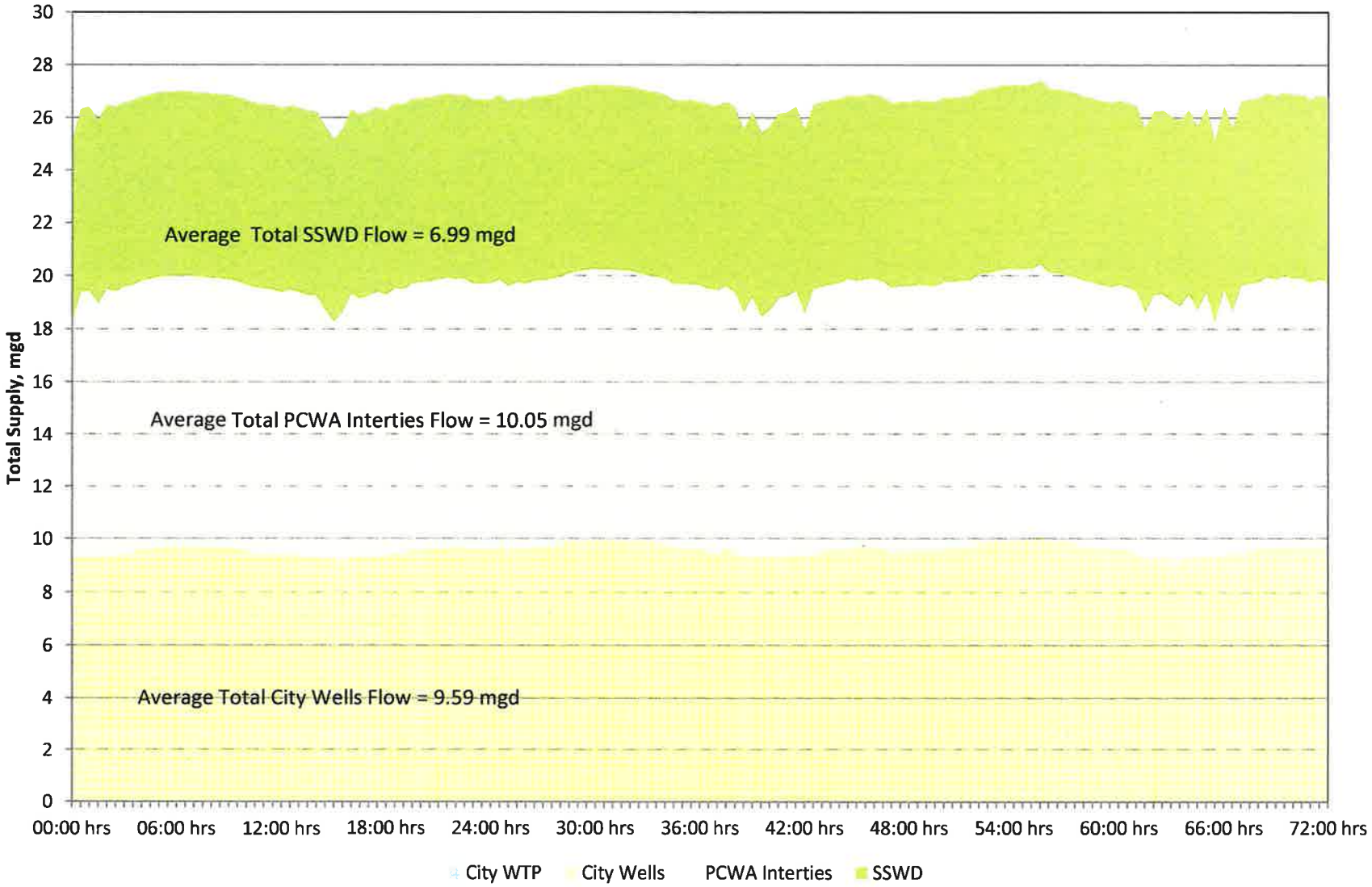
WEST YOST ASSOCIATES

SCENARIO 3

Scenario 3 - Figure 3. Summary of Northeast Storage Reservoir Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 36 mgd WTP Supplies at 10.8 MGD



Scenario 4 - Figure 1. Summary of Total Supply During 2014 Drought Event
Existing Average Maximum Day Demand Condition at 32.8 mgd
WTP Supplies at 0 MGD



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Tinker
Average Supply
Flow=3.8 mgd;
delivered head from
PCWA = 380 feet

Diamond Creek
Average Supply
Flow=2.93 mgd

Woodcreek North
Average Supply
Flow=2.53 mgd

Plesant Grove
Average Supply Flow=0
mgd; delivered
head from PCWA
= 405 feet

Highland Park
Average Supply Flow=0.18 mgd; delivered head from PCWA = 405 feet

Five Star
Average Supply Flow=0.23 mgd; delivered head from PCWA = 405 feet

Dating
Average Supply
Flow=1.4mgd

Oakmont
Average Supply
Flow=2.88 mgd

48.87 psi
44.12 psi
48.46 psi
30.87 psi
34.77 psi
42.85 psi
42.41 psi
48.91 psi
49.33 psi
49.77 psi
41.98 psi
41.98 psi
48.82 psi
49.78 psi
48.03 psi
43.69 psi
43.27 psi
49.77 psi
38.07 psi
45 psi
49.77 psi
48.47 psi
45.93 psi
49.33 psi
45.93 psi
49.79 psi
48.91 psi
49.77 psi
47.17 psi
49.34 psi
47.18 psi
45.87 psi
46.29 psi
40.22 psi

FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 4 MINIMUM PRESSURE FOR EXISTING MAXIMUM DAY DEMAND CONDITION (WTP at 0 mgd with SSWD Connection)

N

0 2,000 4,000
Scale in Feet

Notes
1. Existing Maximum Day Demand is 32.8 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 10.05 mgd.
4. Average total supply from SSWD through New Pump Station is 6.99 mgd.
5. Average total supply from City Wells is 9.59 mgd.
6. Hydraulic model was simulated for 72-hour extended period condition. Minimum pressure at hour 55:30 was obtained from hydraulic results.

LEGEND

System Pressure

- Less than 45 psi
- 45 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi
- PCWA Interties
- City Wells
- New Pump for SSWD
- Pipeline

CITY OF ROSEVILLE
TRADITION AND STEADY PROGRESS

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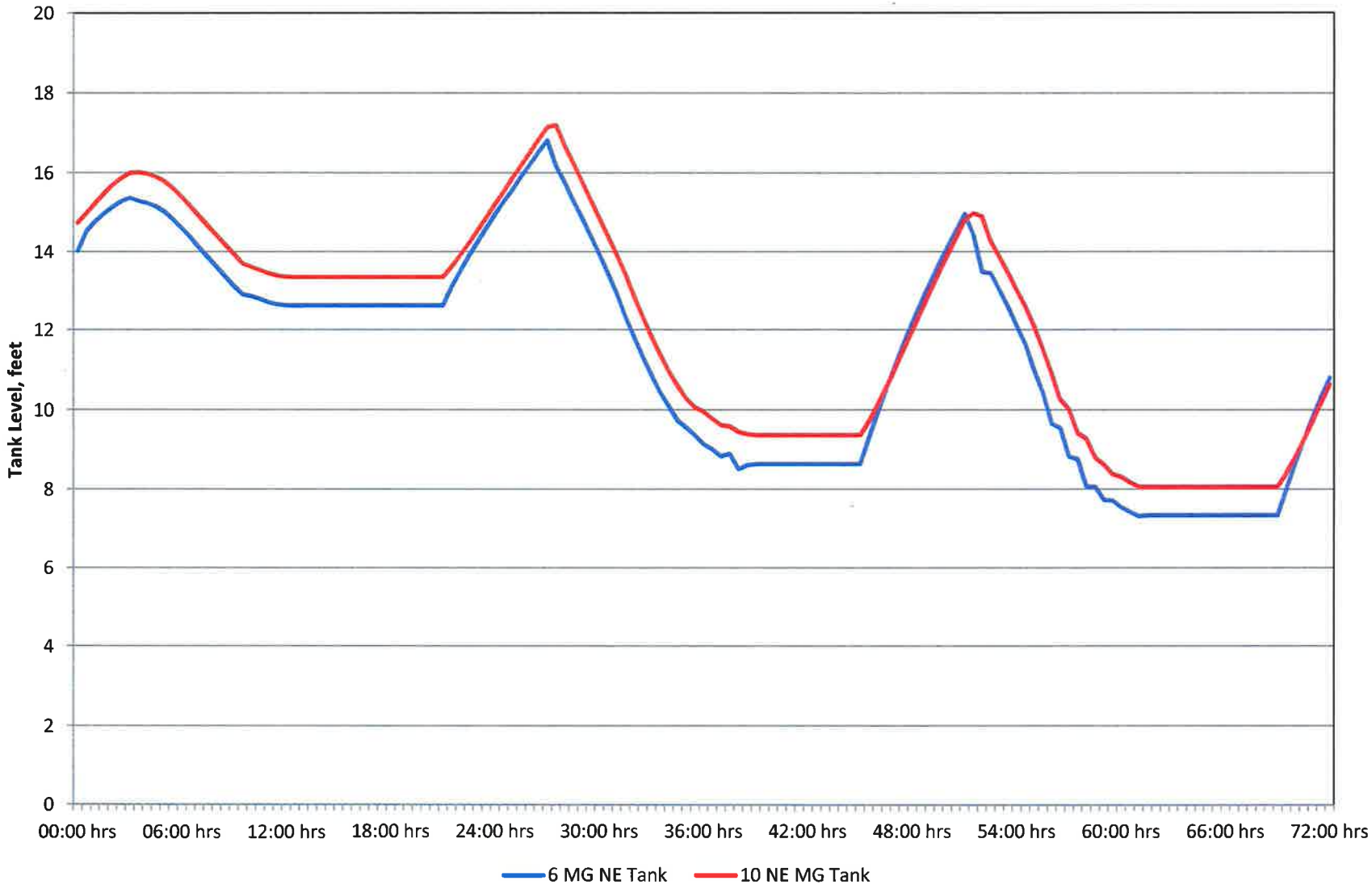
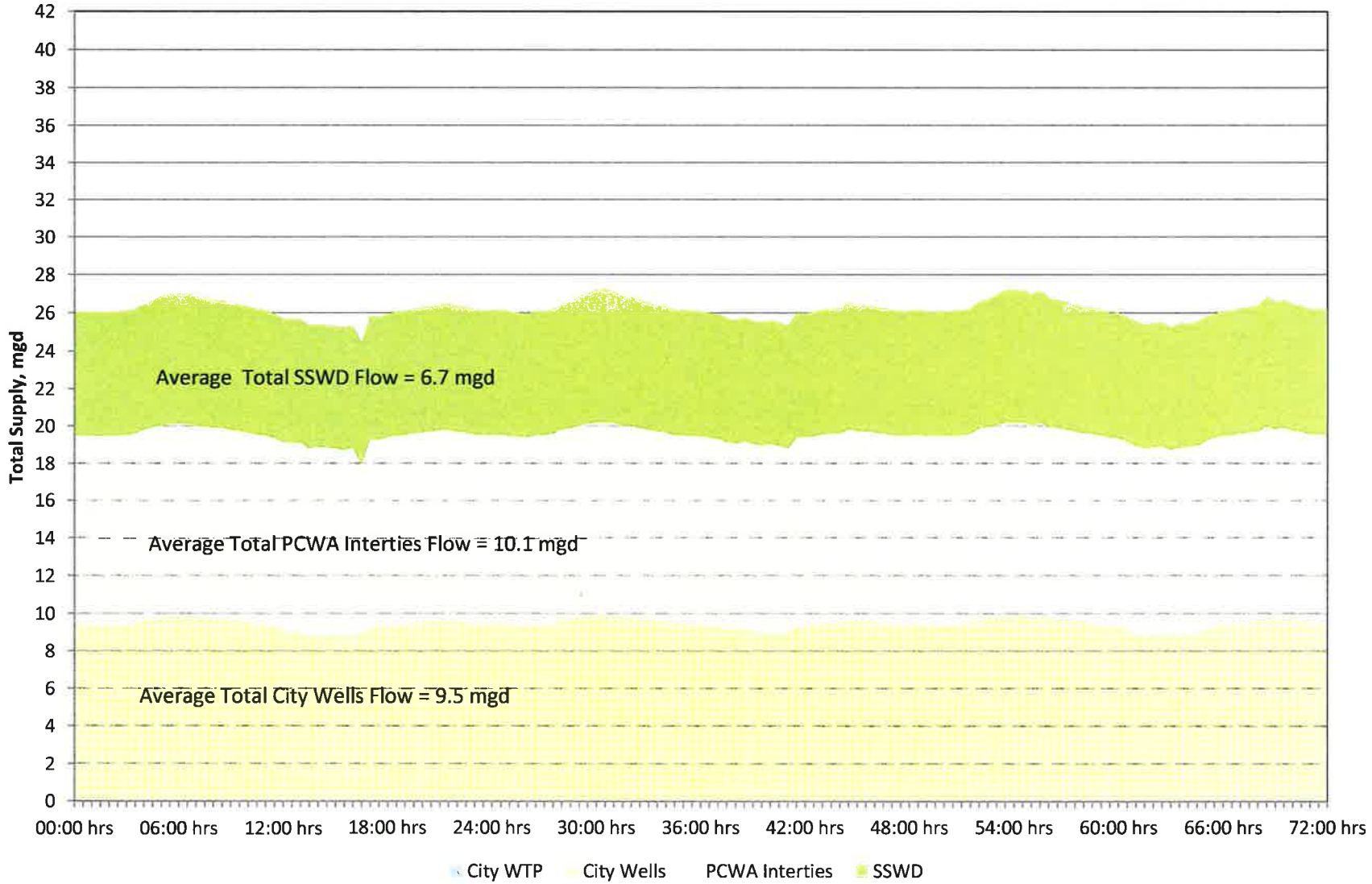
Scenario 4 - Figure 3. Summary of Northeast Storage Reservoir Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 32.8 mgd WTP Supplies at 0 MGD



Scenario 5 - Figure 1. Summary of Total Supply During 2014 Drought Event
Existing Average Maximum Day Demand Condition at 27.2 mgd
WTP Supplies at 0 MGD



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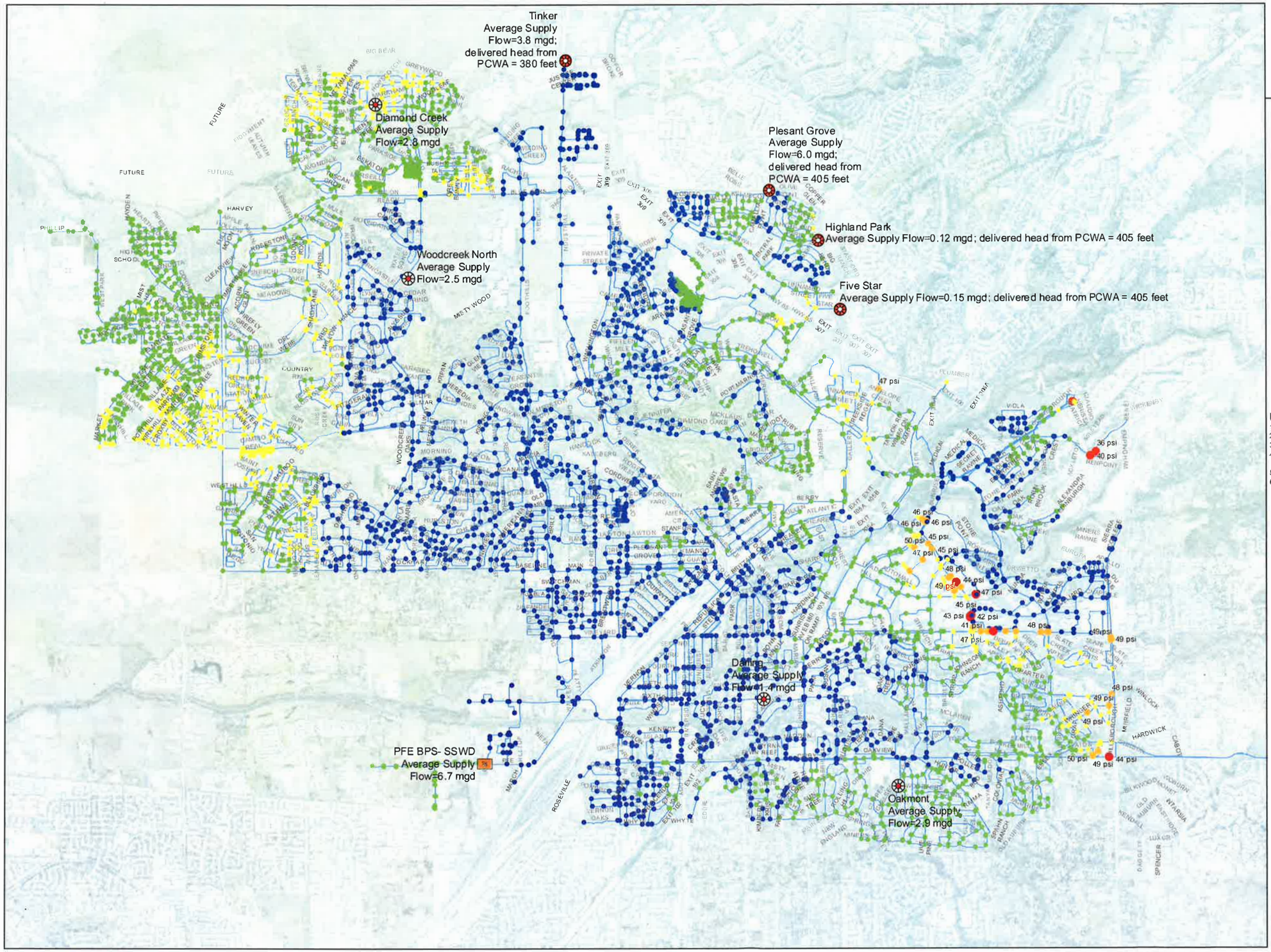


FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 5 MINIMUM PRESSURE FOR EXISTING MAXIMUM DAY DEMAND CONDITION (WTP at 0 mgd with SSWD Connection; without WTP Clearwells)

N

0 2,000 4,000

Scale in Feet

Notes
1. Existing Maximum Day Demand is 27.2 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 10.1 mgd.
4. Average total supply from SSWD through New Pump Station is 6.7 mgd.
5. Average total supply from City Wells is 9.5 mgd.
6. Hydraulic model was simulated for 72-hour extended period condition. Minimum pressure at hour 54:00 was obtained from hydraulic results.
7. Assumed Clearwells are offline (0 mgd from WTP Clearwells).

LEGEND

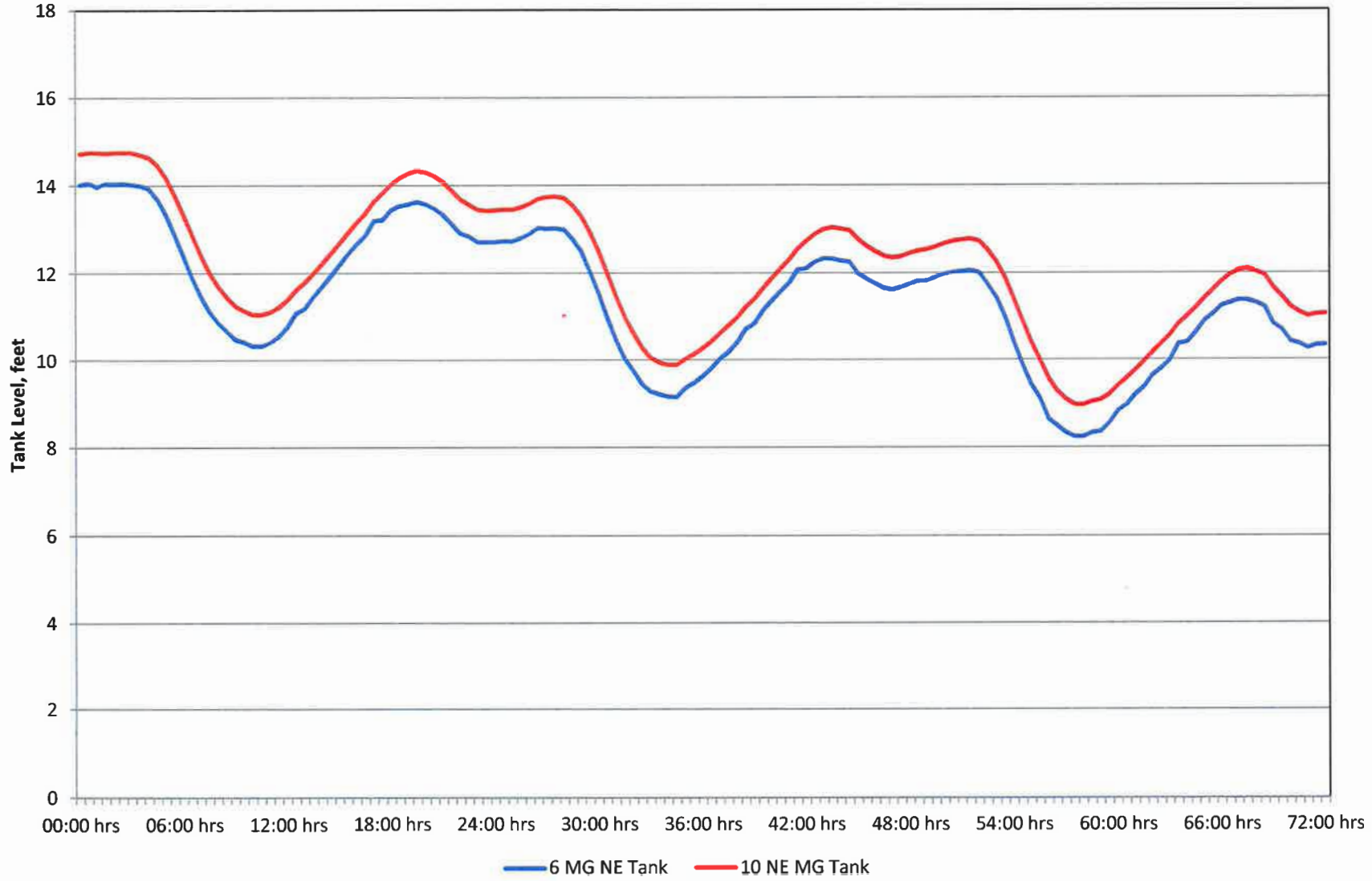
System Pressure

- Less than 45 psi
- 45 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi
- PCWA Interties
- City Wells
- New Pump for SSWD
- Pipeline

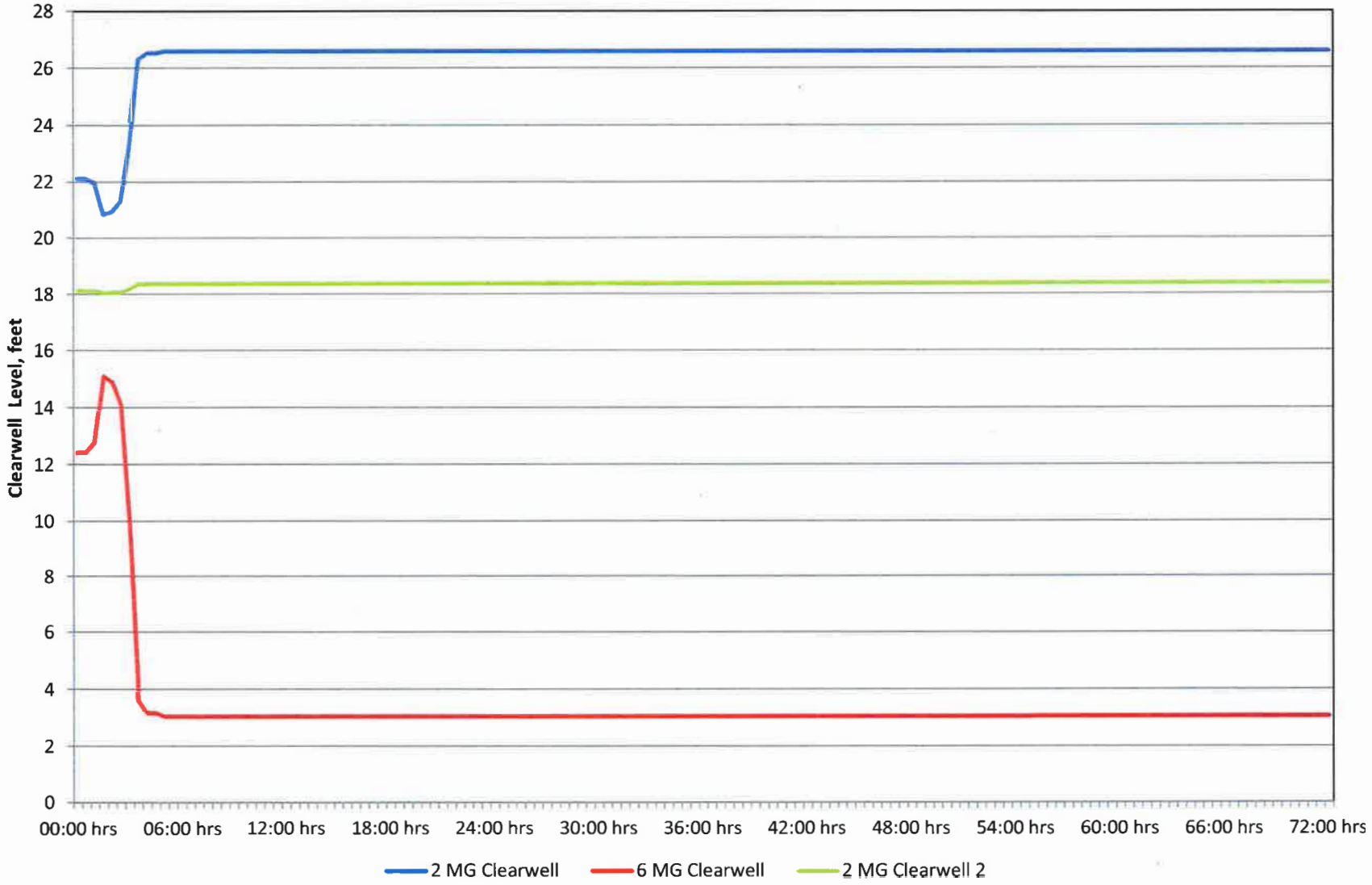
CITY OF ROSEVILLE
TRADITION AND PROGRESS

WEST YOST ASSOCIATES

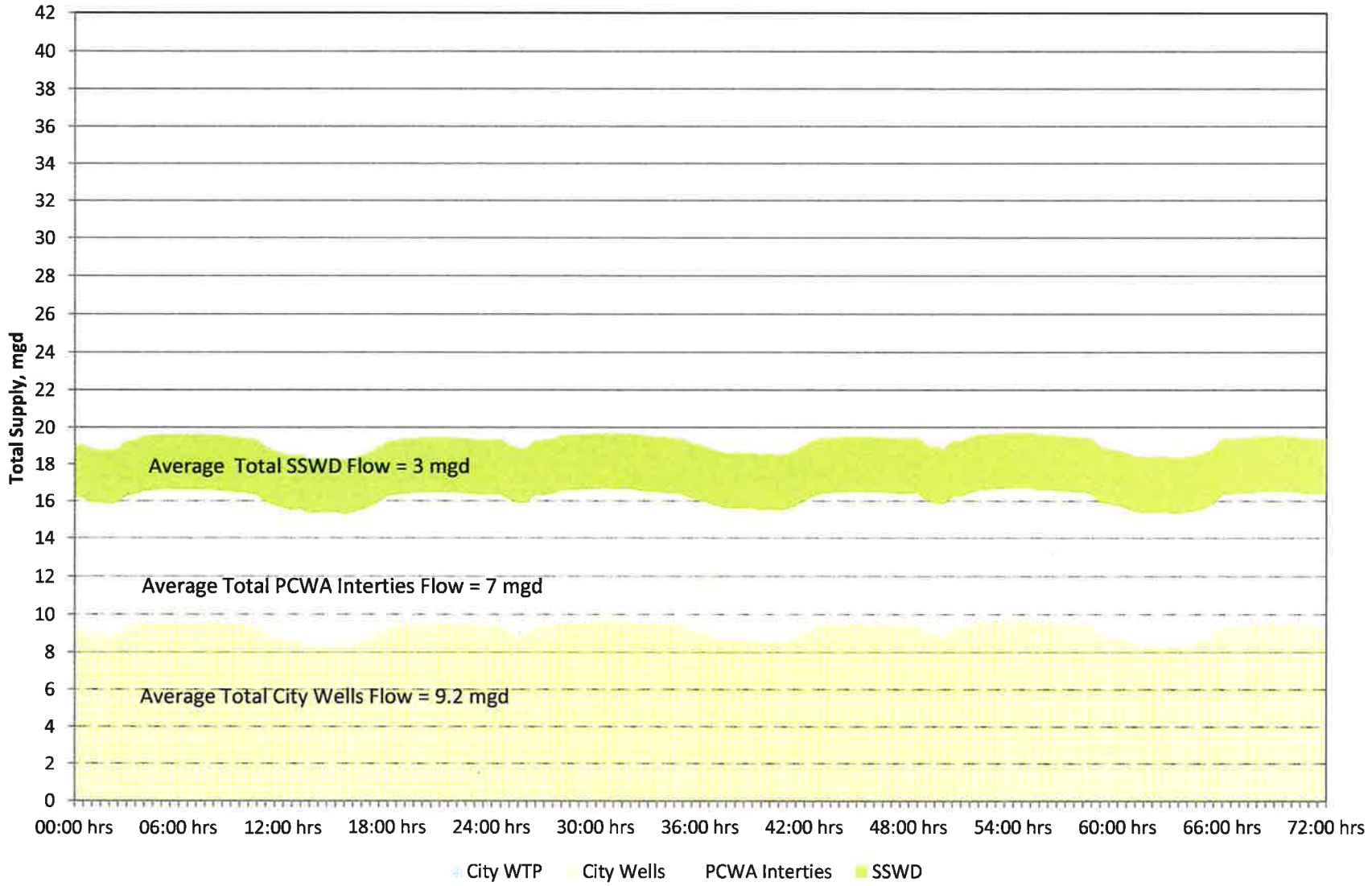
Scenario 5 - Figure 3. Summary of Northeast Storage Reservoir Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 27.2 mgd WTP Supplies at 0 MGD



Scenario 5 - Figure 4. Summary of Clearwells Trends over 72-hour Period Simulation
For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 27.2 mgd
WTP Supplies at 0 MGD



Scenario 6 - Figure 1. Summary of Total Supply During 2014 Drought Event
Existing Average Maximum Day Demand Condition at 21.6 mgd
WTP Supplies at 0 MGD



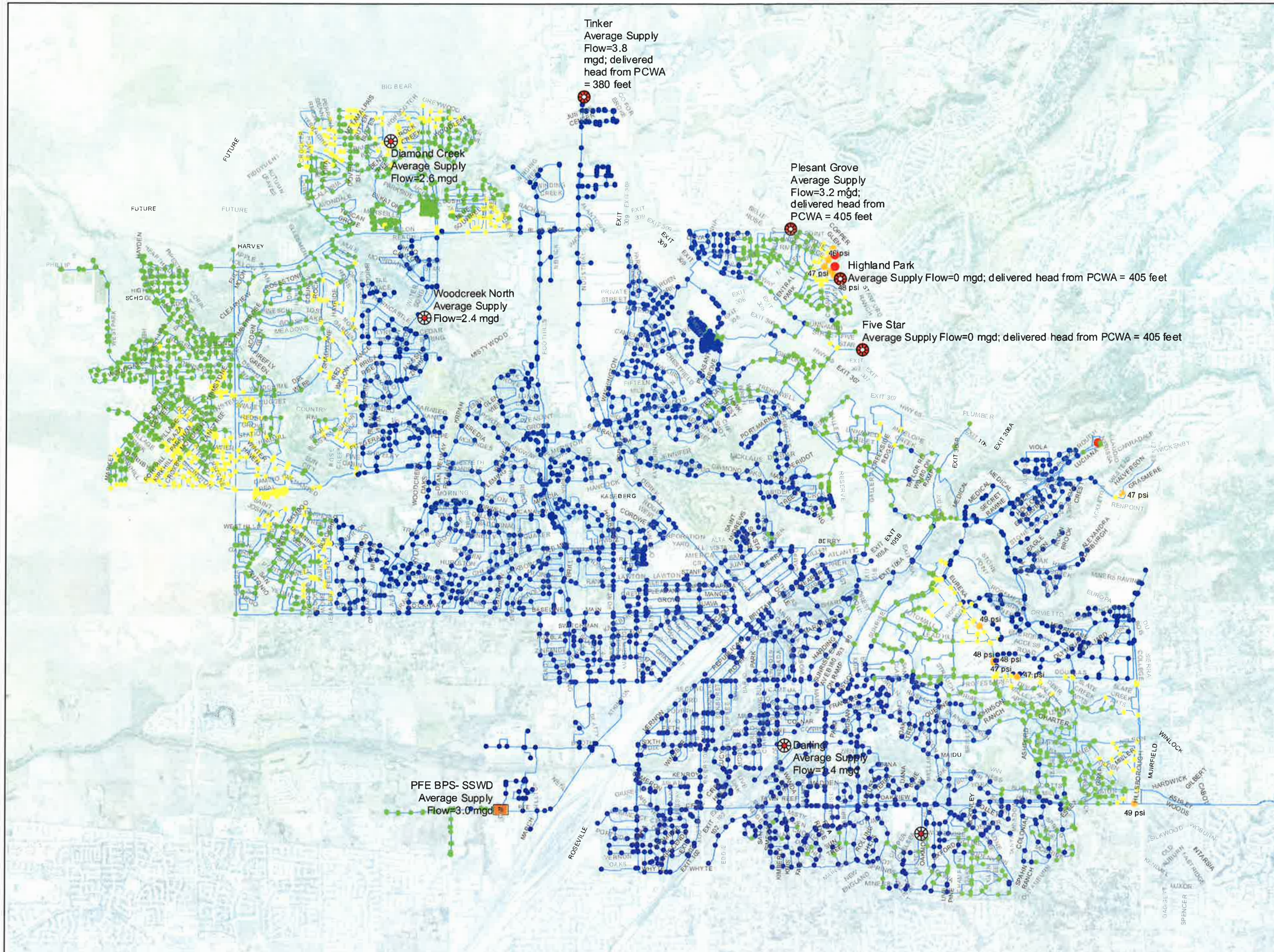


FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 6
MINIMUM PRESSURE FOR EXISTING MAXIMUM DAY DEMAND CONDITION

(WTP at 0 mgd, SSWD at 3 mgd, PCWA Tinker at 3.2 mgd, 5 Star at 3.8 mgd)

N

0 2,000 4,000
Scale in Feet

Notes
1. Existing Maximum Day Demand is 21.6 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 7 mgd.
4. Average total supply from SSWD through New Pump Station is 3 mgd.
5. Average total supply from City Wells is 9.2 mgd.
6. Hydraulic model was simulated for 72-hour extended period condition. Minimum pressure at hour 54:00 was obtained from hydraulic results.

LEGEND

System Pressure
- Less than 45 psi
- 45 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi
- PCWA Interties
- City Wells
- New Pump for SSWD
- Pipeline

CITY OF ROSEVILLE

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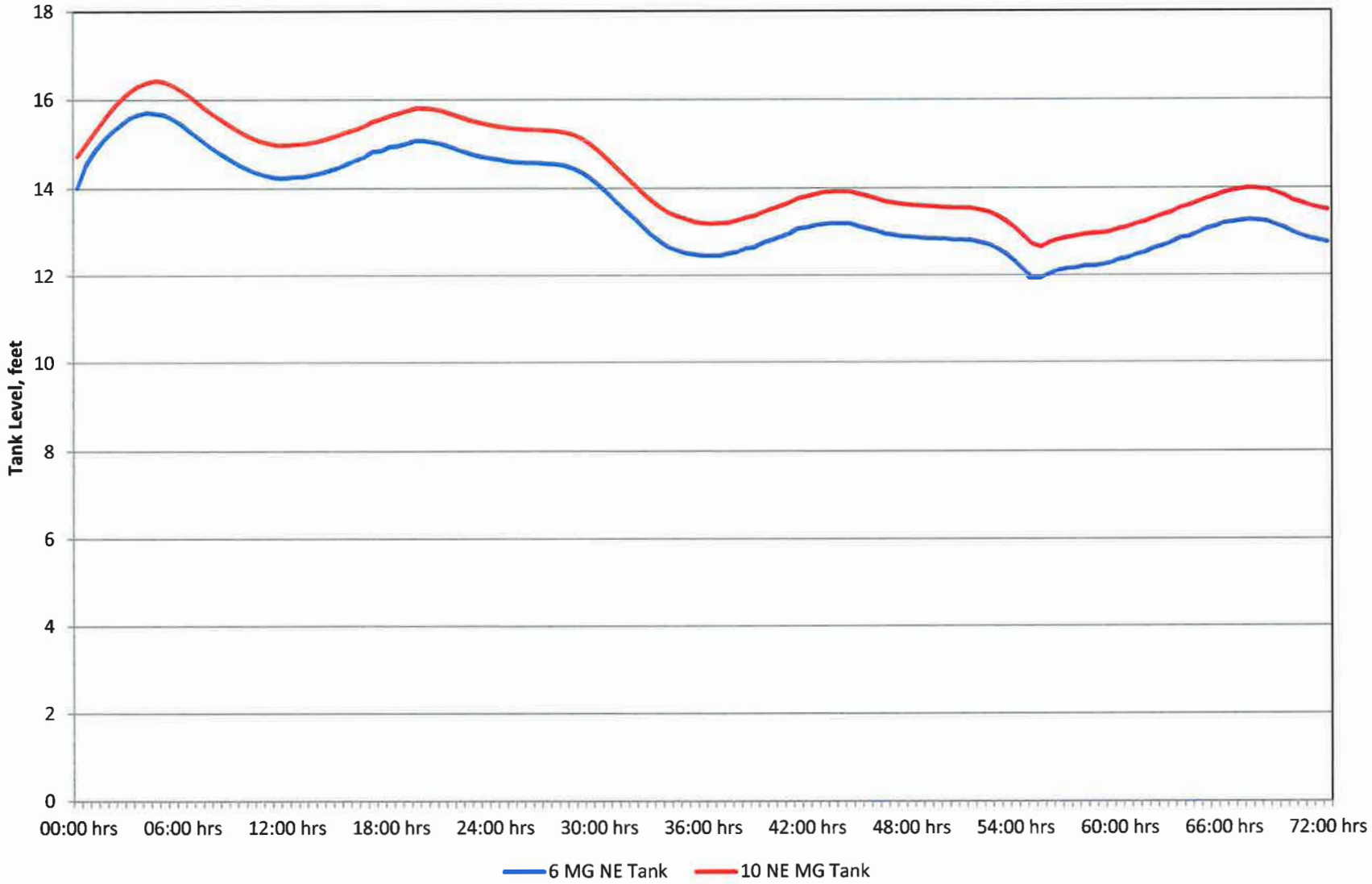
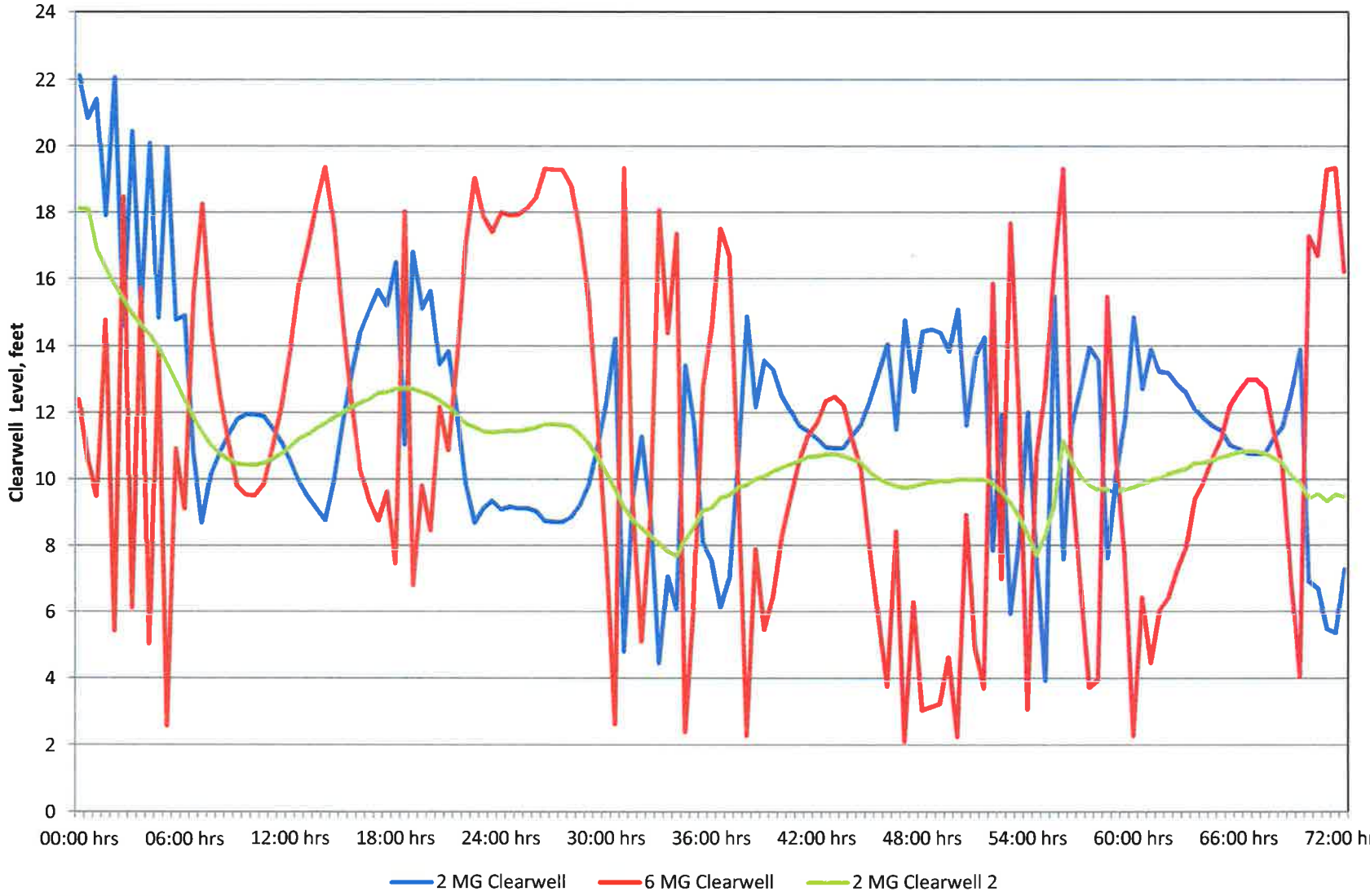
Scenario 6 - Figure 3. Summary of Northeast Storage Reservoir Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 21.6 mgd WTP Supplies at 0 MGD

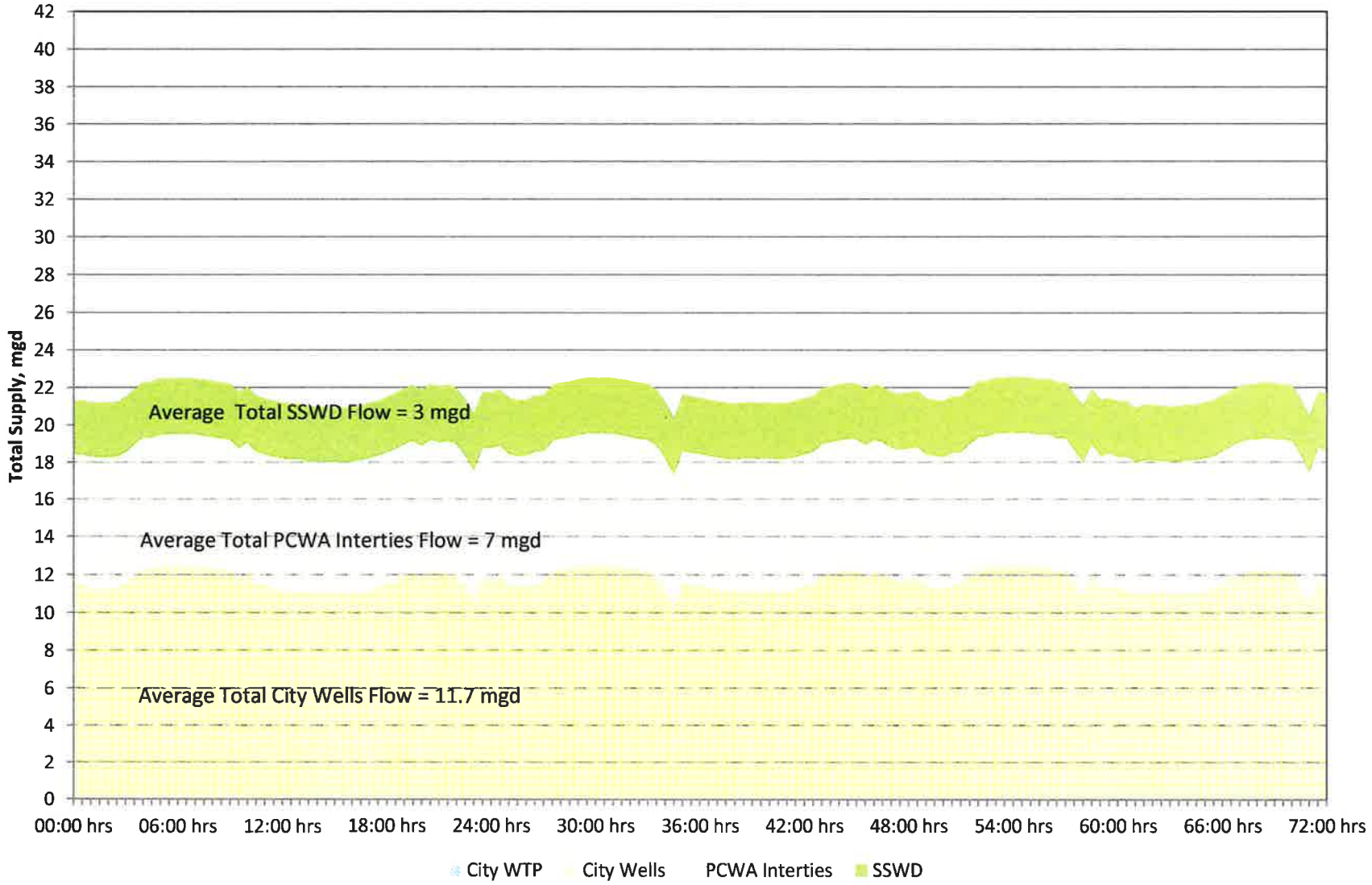


Scenario 6 - Figure 4. Summary of Clearwells Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 21.6 mgd WTP Supplies at 0 MGD



SCENARIO 7

Scenario 7 - Figure 1. Summary of Total Supply During 2014 Drought Event
Existing Average Maximum Day Demand Condition at 24.8 mgd
WTP Supplies at 0 MGD



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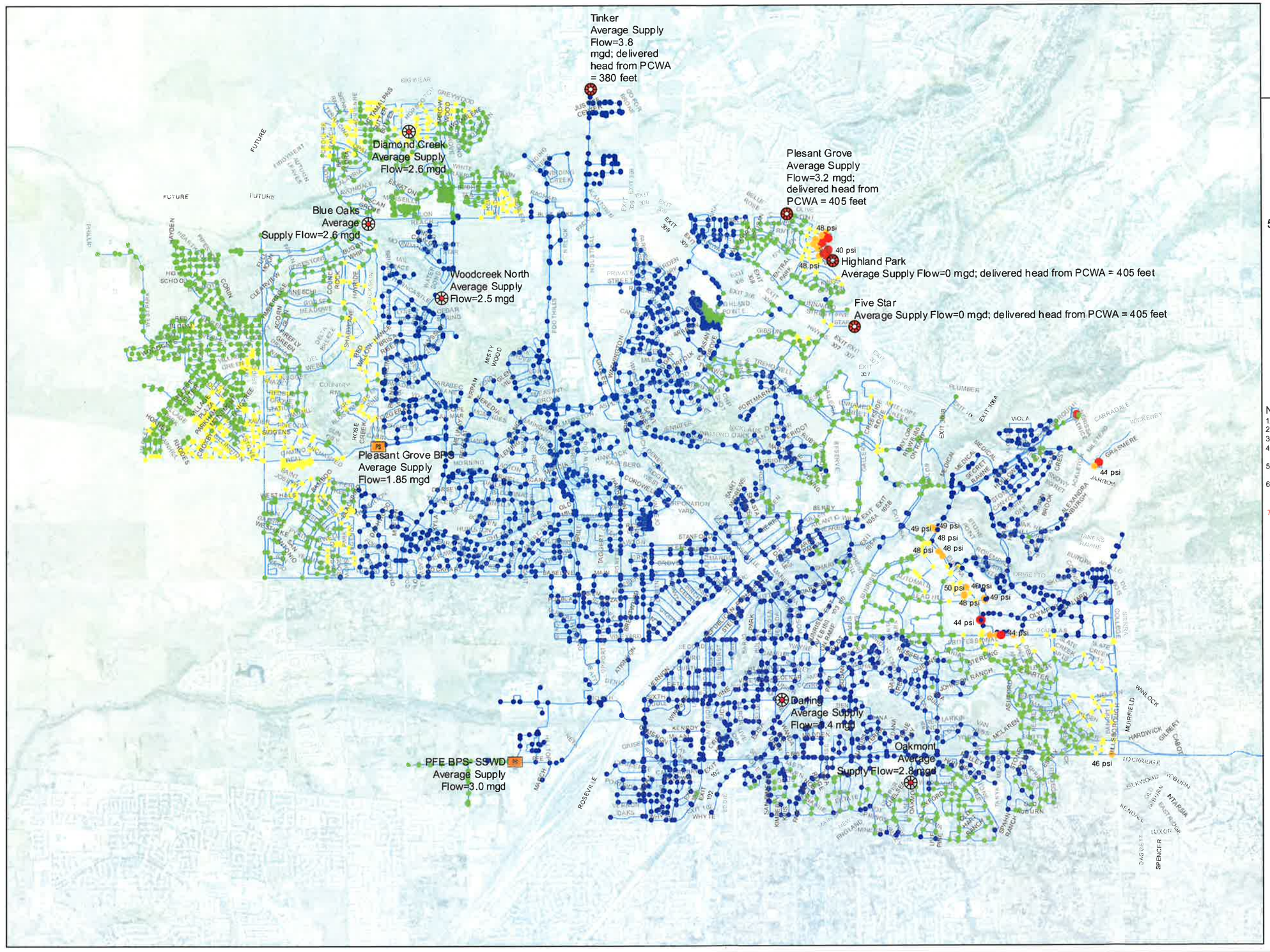


FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 7
MINIMUM PRESSURE FOR EXISTING MAXIMUM DAY DEMAND CONDITION

(WTP at 0 mgd, SSWD at 3 mgd,
PCWA Tinker at 3.2 mgd,
5 Star at 3.8 mgd, Future Blue Oaks Well)

N

0 2,000 4,000
Scale in Feet

Notes
1. Existing Maximum Day Demand is 24.8 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 7 mgd.
4. Average total supply from SSWD through New Pump Station is 3 mgd.
5. Average total supply from City Wells is 11.7 mgd, includes new Blue Oaks Well.
6. Hydraulic model was simulated for 72-hour extended period condition. Minimum pressure at hour 56:00 was obtained from hydraulic results.
7. Assumes new Zone 1 BPS located at Pleasant Grove Parkway operated at 1.9 mgd).

LEGEND

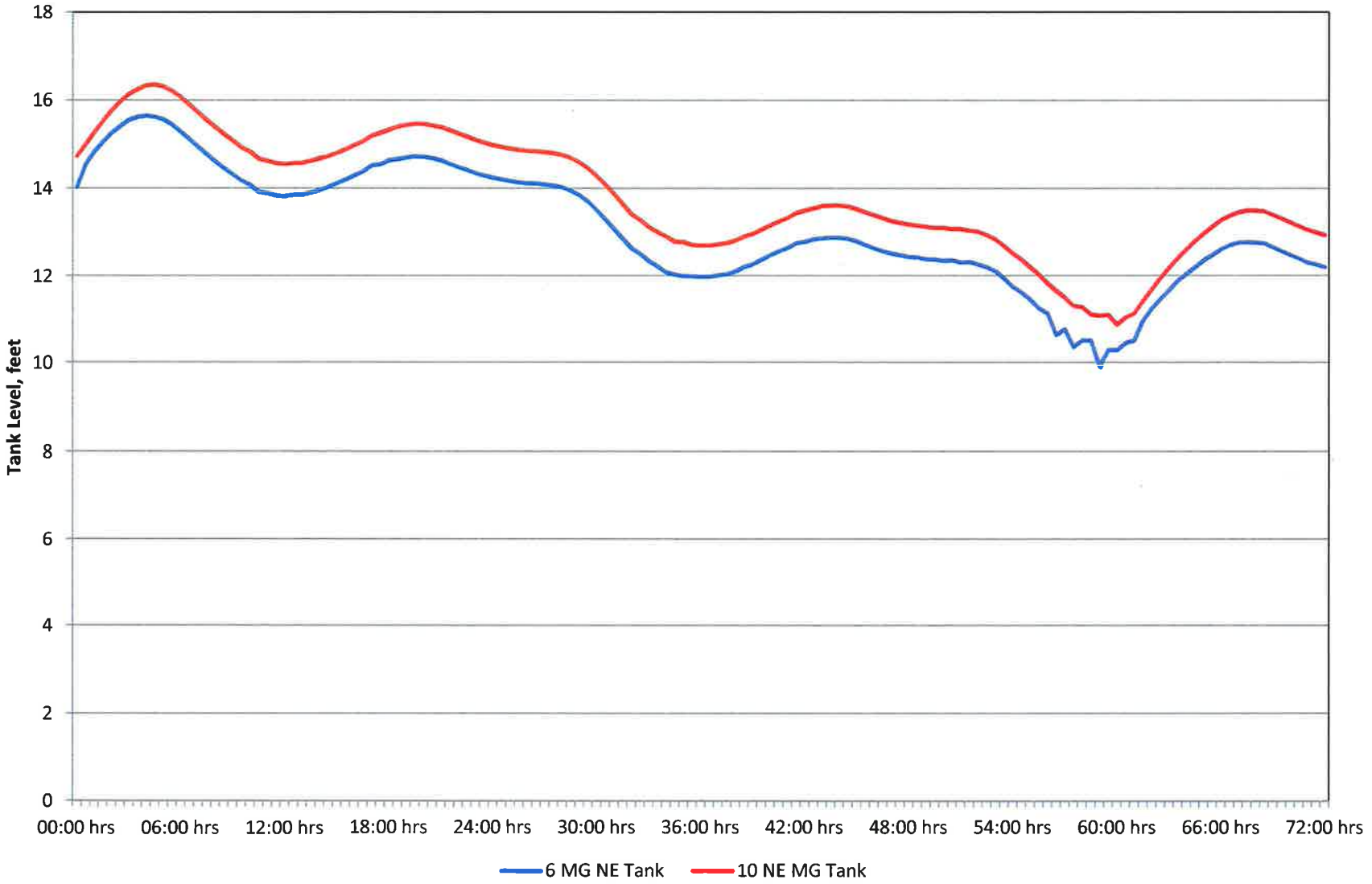
System Pressure

- Less than 45 psi
- 45 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi
- PCWA Interties
- City Wells
- New Pump for SSWD and Zone 1
- Pipeline

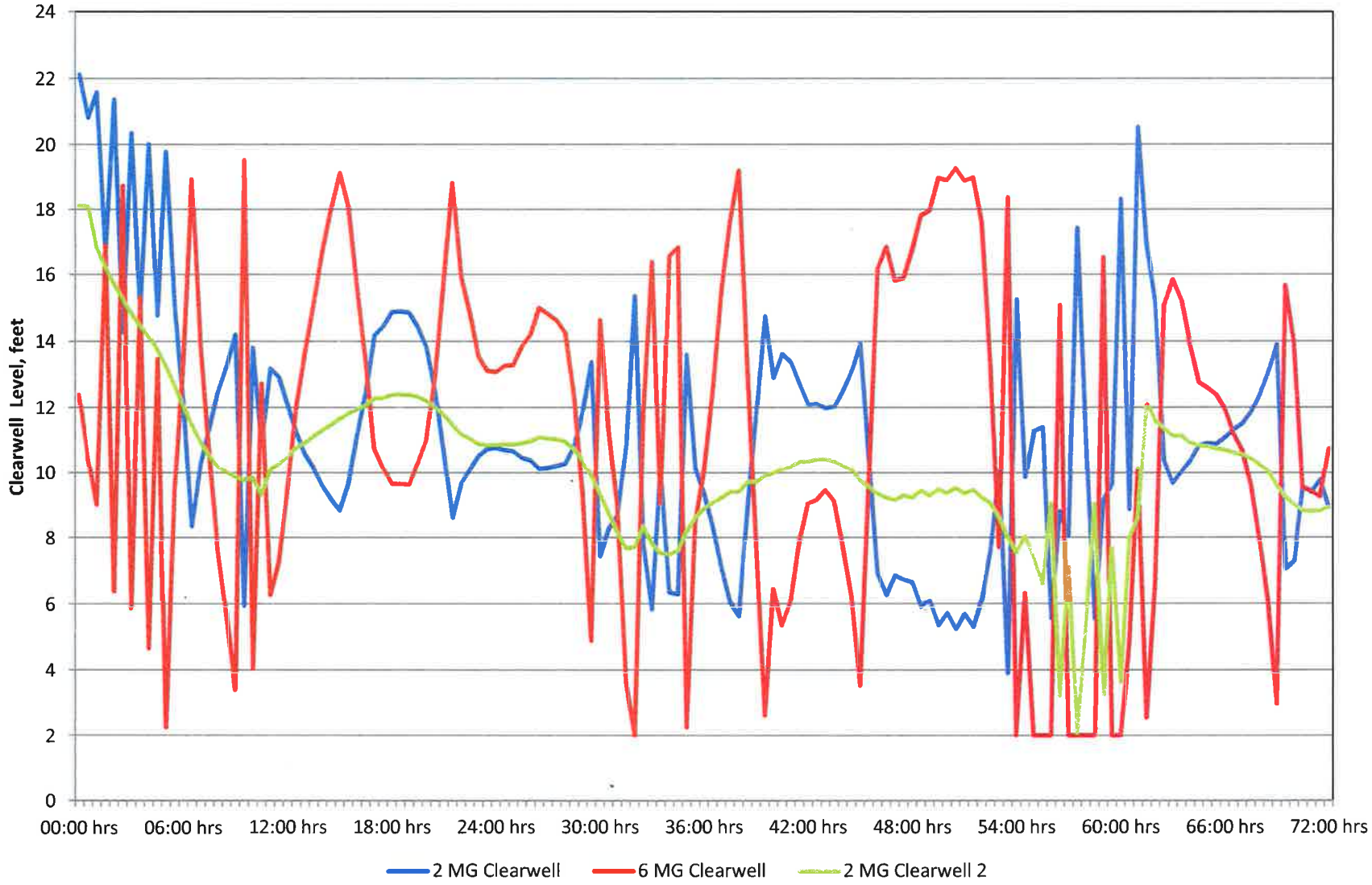
CITY OF ROSEVILLE
TRADITION AND FUTURE PROSPERITY

WEST YOST ASSOCIATES

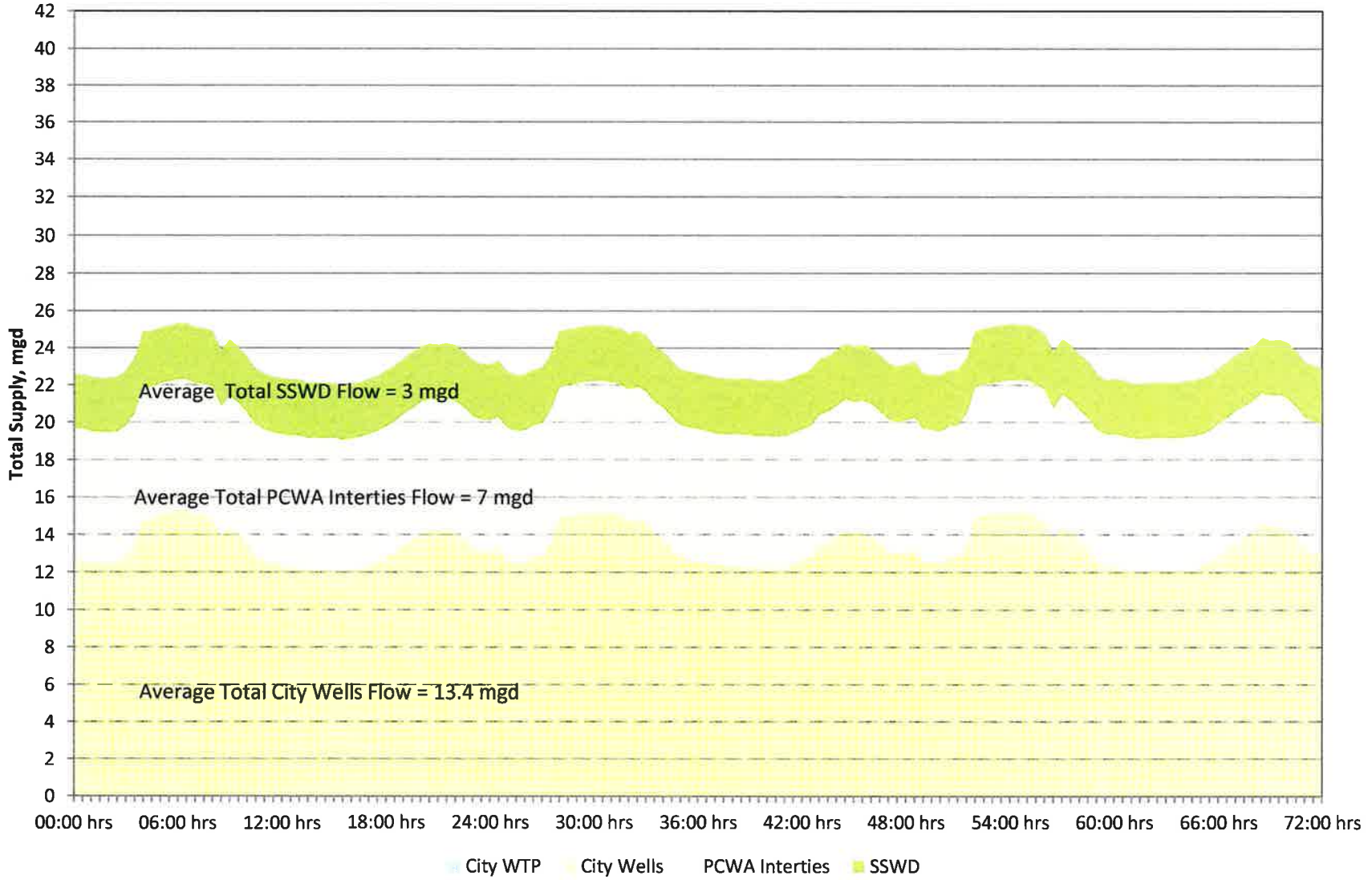
Scenario 7 - Figure 3. Summary of Northeast Storage Reservoir Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 24.8 mgd WTP Supplies at 0 MGD



Scenario 7 - Figure 4. Summary of Clearwells Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 24.8 mgd WTP Supplies at 0 MGD



Scenario 8 - Figure 1. Summary of Total Supply During 2014 Drought Event
Existing Average Maximum Day Demand Condition at 26.8 mgd
WTP Supplies at 0 MGD



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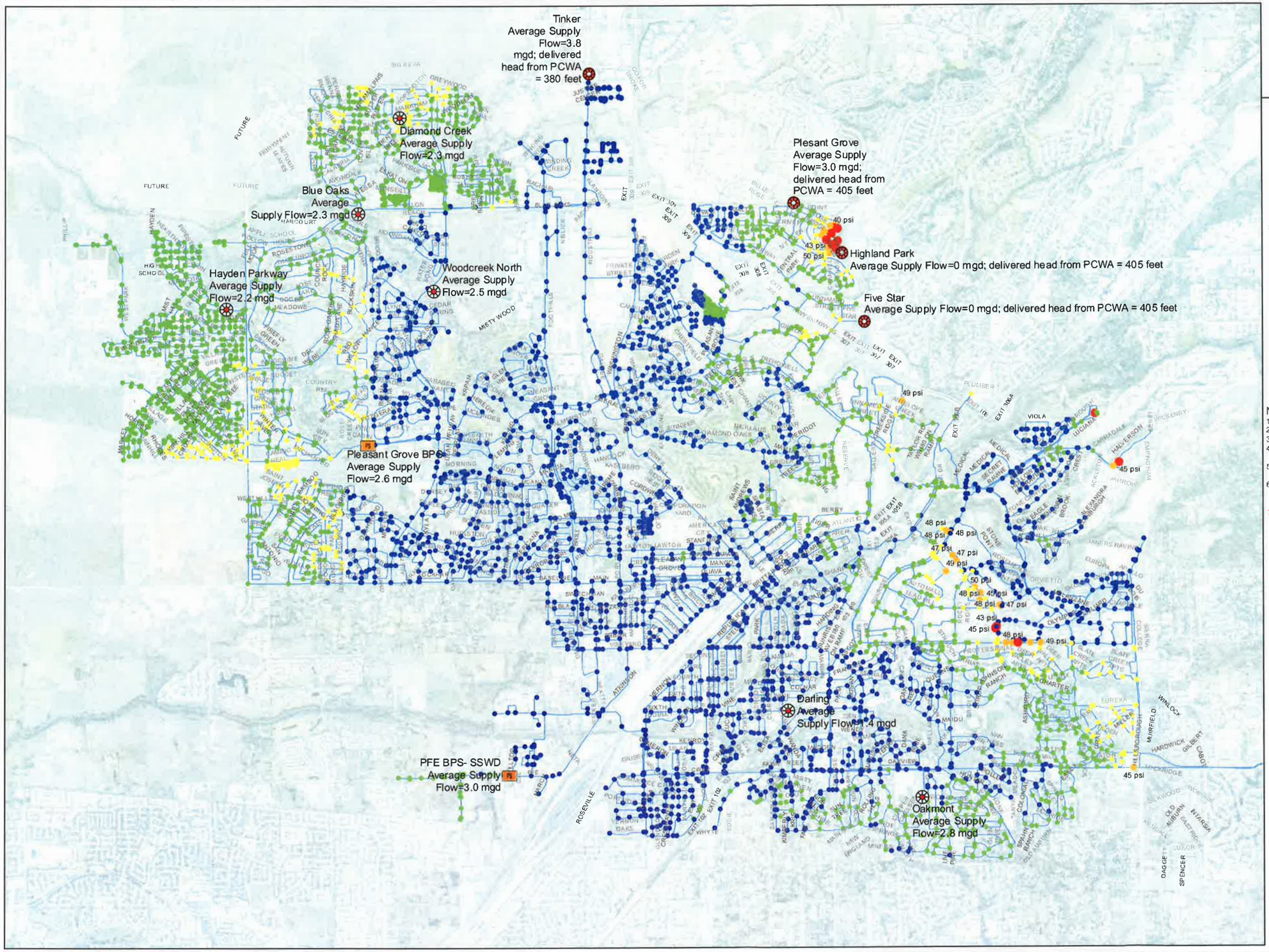


FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 8 MINIMUM PRESSURE FOR EXISTING MAXIMUM DAY DEMAND CONDITION

(WTP at 0 mgd, SSWD at 3 mgd,
PCWA Tinker at 3.2 mgd,
5 Star at 3.8 mgd, Future Blue Oaks Well,
Hayden Parkway Well)

N

0 2,000 4,000
Scale in Feet

Notes
1. Existing Maximum Day Demand is 26.8 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 7 mgd.
4. Average total supply from SSWD through New Pump Station is 3 mgd.
5. Average total supply from City Wells is 13.4 mgd, includes new Blue Oaks and Hayden Parkway Wells.
6. Hydraulic model was simulated for 72-hour extended period condition. Minimum pressure at hour 55:00 was obtained from hydraulic results.
7. Assumes new Zone 1 BPS located at Pleasant Grove Parkway operated at 2.6 mgd).

LEGEND

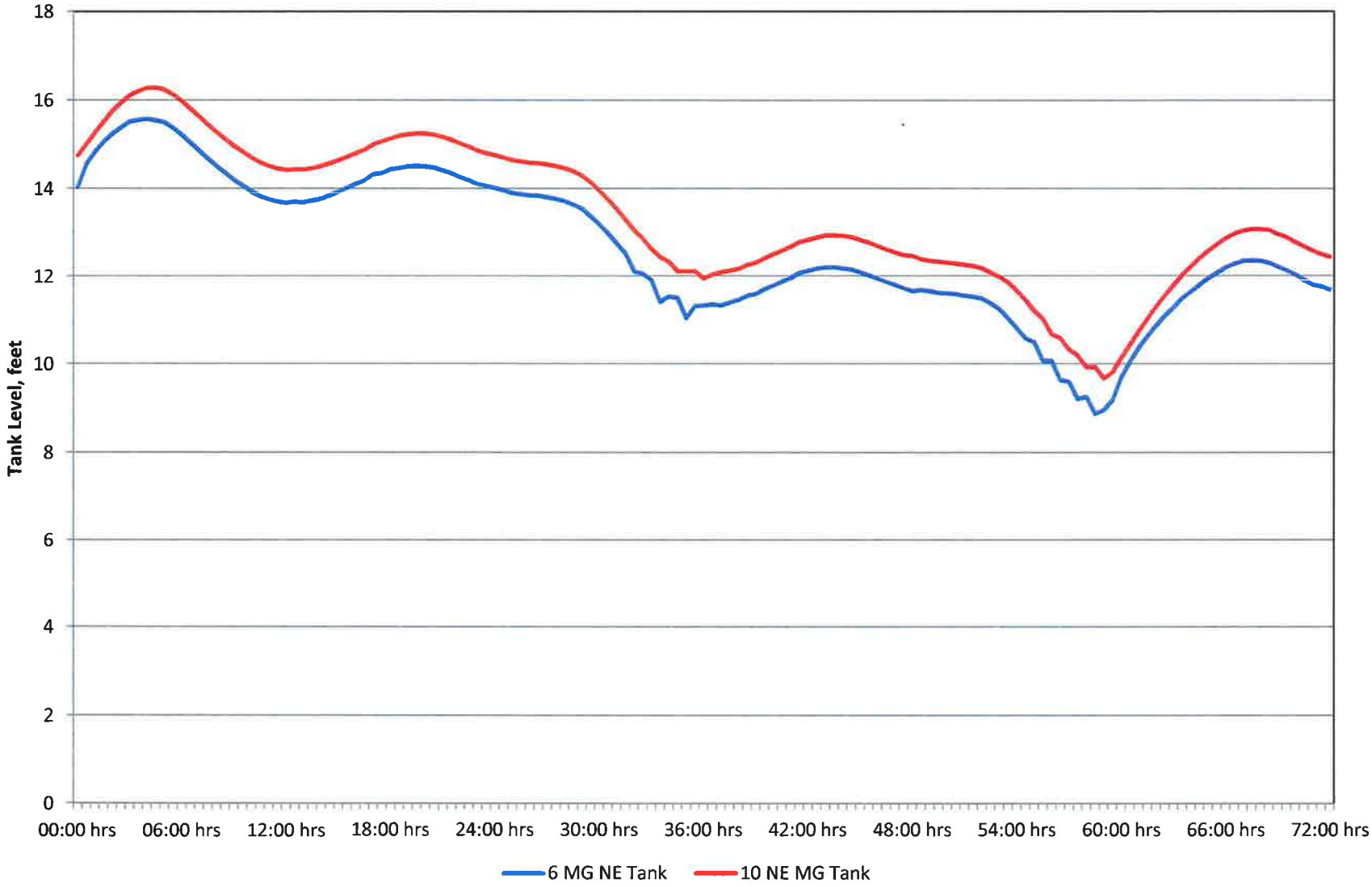
System Pressure

- Less than 45 psi
- 45 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi
- PCWA Interties
- City Wells
- New Pump for SSWD and Zone 1
- Pipeline

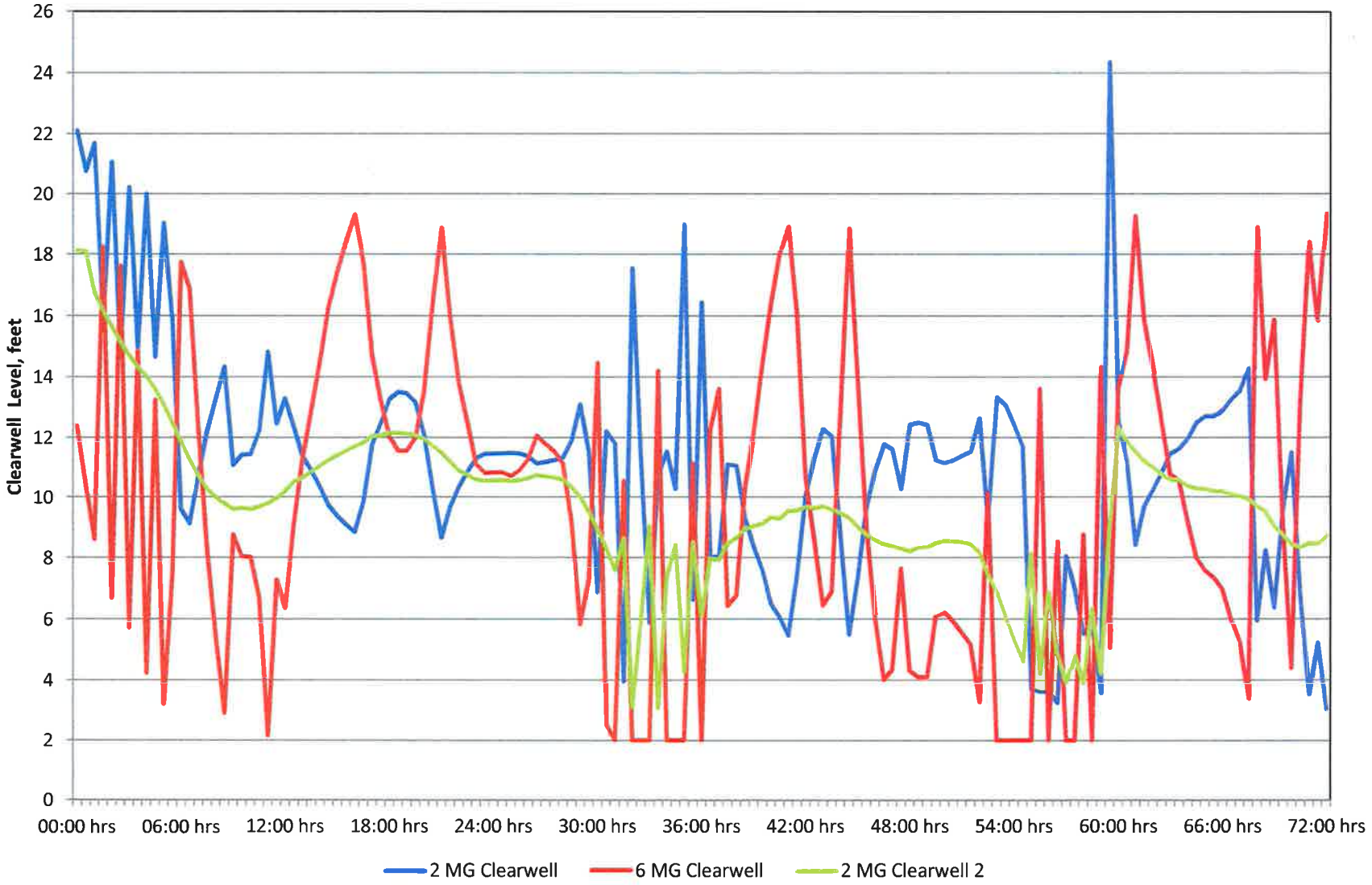
CITY OF ROSEVILLE
TRADITION AND PROGRESS

WEST YOST ASSOCIATES

Scenario 8 - Figure 3. Summary of Northeast Storage Reservoir Trends over 72-hour Period Simulation For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 26.8 mgd WTP Supplies at 0 MGD



Scenario 8 - Figure 4. Summary of Clearwells Trends over 72-hour Period Simulation
For 2014 Drought Event Under Existing Average Maximum Day Demand Condition at 26.8 mgd
WTP Supplies at 0 MGD



APPENDIX B

Buildout System Evaluation Results

Table B1. Summary of Hydraulic Conditions and Hydraulic Results for Buildout Drought Year Evaluation

Roseville Groundwater Supply	Intertie and Sac River Supplies	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Buildout 1, WTP Flow = 10.8 mgd					
Total GW Supply = 40 mgd Simulated flow for each well (average flow): • Diamond Creek Well=4.08 mgd • HP Well = 2.48 mgd • Darling Well = 1.44 mgd • Oakmont Well = 3.13 mgd • Blue Oaks Well = 2.65 mgd • Hayden Way Well = 2.58 mgd • Woodcreek North Well = 2.48 mgd • Woodcreek West Well = 2.73 mgd • WRSP Phase 2 (moved to Zone 1) = 2.46 mgd • WRSP Phase 3 = 2.4 mgd • WRSP Phase 4 = 2.58 mgd • SV West Well = 2.43 mgd • SV East Well = 2.1 mgd • CV Well = 2.41 mgd • Mountain Glen Well = 2.41 mgd • ARSA Well = 2.57 mgd	**Total Sac River = 0 mgd** **Total Interties = 17 mgd** Simulated flow for each intertie: • Pleasant Grove = 0.22 mgd • Highland Conn = 0.26 mgd • Five Star Conn = 3.8 mgd • Tinker = 5.5 mgd • SSWD = 6.83 mgd	68 mgd (Buildout demand in the hydraulic model was uniformly reduced to 68 mgd)	Most pressures are above 50 psi, except for these following areas in Pressure Zone 4: • Cluster of junctions around Diamond Creek Well – pressures range from 46 to 49 psi • Cluster of junction located northwest of Woodcreek West Well – pressures range from 43 to 49 psi • Cluster of junctions located southwest of Woodcreek West Well – pressures range from 42 to 49 psi • Cluster of junctions located west of HP Well and Woodcreek North Well – pressures range from 43 to 49 psi • Cluster of junctions located in Zone 5 – pressures range from 43 to 49 psi. (Figure 4 presents system pressure on selected nodes during 72-hour period simulation)	Scenario 1 Figures 1, 2, 3, 4	• Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 390' • PFE Pump Station to deliver SSWD flow into Roseville System — Design Flow at 7 mgd — Design Head at 165 feet • Pleasant Grove Pump Station to deliver excess groundwater supply from Zone 4 to Zone 1 — Design Flow at 6,000 gpm (8.64 mgd) — Design Head at 150 feet — Based on Zone 1 Tank level ▪ On when Zone 1 Tank < 16 feet ▪ Off when Zone 1 Tank > 19 feet • West Roseville Specific Plan Reservoirs (12MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3 am ▪ Setting at 53 psi at 10 am ▪ Close at 7 pm ▪ Setting at 53 psi at 10 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • Sierra Vista Specific Plan Reservoirs (6MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 4 am ▪ Setting at 57 psi at 10 am ▪ Close at 7 pm ▪ Setting at 57 psi at 11 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • All Zone 4 PRVs were set to be offline • Zone 1 Dual Purpose BPS was offline • Zone 1 Bypass was open to allow water to flow in or out of Zone 1 Reservoirs

Table B1. Summary of Hydraulic Conditions and Hydraulic Results for Buildout Drought Year Evaluation

Roseville Groundwater Supply	Intertie and Sac River Supplies	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Buildout 2, WTP Flow = 10.8 mgd					
Total GW Supply = 40 mgd Simulated flow for each well (average flow): • Diamond Creek Well= 3.59 mgd • HP Well = 2.51 mgd • Darling Well = 1.45 mgd • Oakmont Well = 3.13 mgd • Blue Oaks Well = 2.64 mgd • Hayden Way Well = 2.58 mgd • Woodcreek North Well = 2.51mgd • Woodcreek West Well = 2.54 mgd • WRSP Phase 2 (moved to Zone 1) = 2.49 mgd • WRSP Phase 3 = 2.50 mgd • WRSP Phase 4 = 2.58 mgd • SV West Well = 2.42 mgd • SV East Well = 2.53 mgd • CV Well = 2.64 mgd • Mountain Glen Well = 2.59 mgd • ARSA Well = 2.59 mgd	**Total Sac River = 10 mgd** Simulated flow for Sac River (average flow): • 10 mgd was delivered to Sierra Vista Plan Area and was continually conveyed through 24-inch diameter pipeline to Pleasant Grove Pump Station that delivered Sac River Water to Zone 1 **Total Interties = 17 mgd** Simulated flow for each intertie: • Pleasant Grove = 0.25mgd • Highland Conn = 0.29 mgd • Five Star Conn = 3.8 mgd • Tinker = 5.49 mgd • SSWD = 7 mgd	78 mgd (Buildout demand in the hydraulic model was uniformly reduced to 78 mgd)	Most pressures are above 50 psi in Pressure Zones 1, 2 and 5. However, in Zone 4, system pressures range from 29 to 40 psi in some areas. The following areas in Pressure Zone 4 that experienced pressure between 30 to 40 psi are: • Cluster of junctions near Diamond Oaks Well – pressures range from 31 to 39 psi • Cluster of junctions located north of Pleasant Grove BPS – pressures range from 31 to 39 psi • Cluster of junction located northwest of Woodcreek West Well – pressures range from 30 to 39 psi • Cluster of junctions located southwest of Woodcreek West Well – pressures range from 29 to 39 psi (Figure 4 presents system pressure on selected nodes during 72-hour period simulation)	Scenario 4 Figures 1, 2, 3, 4	• Added 24-inch diameter pipeline (17,662 feet) from Sierra Vista Station to Pleasant Grove Pump Station • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 390' • PFE Pump Station to deliver SSWD flow into Roseville System — Design Flow at 7 mgd and TDH at 170 feet • Pleasant Grove Pump Station was modeled as dual pump station — 1st set of pumps deliver 10 mgd of Sac River to Zone 1 through 24-inch diameter pipeline from Sierra Vista Station to Pleasant Grove ▪ Total flow at 6,900 gpm and TDH at 300 feet — 2nd set of pumps deliver excess groundwater supply from Zone 4 to Zone 1 ▪ Design Flow at 3,500 gpm for each pump (assuming 2 pumps) ▪ Design Head at 160 feet ▪ Based on Zone 1 Tank level • Pump 1 on 24-hour • Pump 2 on when Zone 1 Tank < 13 feet • Pump 2 off when Zone 1 Tank > 17.5 feet • West Roseville Specific Plan Reservoirs (12MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3 am ▪ Setting at 51 psi at 10 am ▪ Close at 7 pm ▪ Setting at 51 psi at 10 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • Sierra Vista Specific Plan Reservoirs (6MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 4 am ▪ Setting at 54 psi at 10 am ▪ Close at 7 pm ▪ Setting at 54 psi at 11 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • All Zone 4 PRVs were set to be offline • Zone 1 Dual Purpose BPS was offline — Zone 1 Bypass was open to allow water to flow in or out of Zone 1 Reservoirs

Table B1. Summary of Hydraulic Conditions and Hydraulic Results for Buildout Drought Year Evaluation

Roseville Groundwater Supply	Intertie and Sac River Supplies	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Buildout 3, WTP Flow = 0 mgd					
Total GW Supply = 40 mgd Simulated flow for each well (average flow): • Diamond Creek Well= 3.54 mgd • HP Well = 2.49 mgd • Darling Well = 1.44 mgd • Oakmont Well = 3.13 mgd • Blue Oaks Well = 2.62 mgd • Hayden Way Well = 2.56 mgd • Woodcreek North Well = 2.49mgd • Woodcreek West Well = 2.56 mgd • WRSP Phase 2 (moved to Zone 1) = 2.48 mgd • WRSP Phase 3 = 2.47 mgd • WRSP Phase 4 = 2.55 mgd • SV West Well = 2.39 mgd • SV East Well = 2.51 mgd • CV Well = 2.61 mgd • Mountain Glen Well = 2.56 mgd • ARSA Well = 2.55 mgd	**Total Sac River = 10 mgd** Simulated flow for Sac River (average flow): • 10 mgd was delivered to Sierra Vista Plan Area and was continually conveyed through 24-inch diameter pipeline to Pleasant Grove Pump Station that delivered Sac River Water to Zone 1 **Total Interties = 17 mgd** Simulated flow for each intertie: • Pleasant Grove = 0.22mgd • Highland Conn = 0.26 mgd • Five Star Conn = 3.8 mgd • Tinker = 5.46 mgd • SSWD = 7 mgd	67 mgd (Buildout demand in the hydraulic model was uniformly reduced to 67 mgd)	Most pressures are above 50 psi in Pressure Zones 1, 2 and 5. However, in Zone 4, system pressures range from 30 to 40 psi in some areas. The following areas in Pressure Zone 4 that experienced pressure between 30 to 40 psi are: • Cluster of junctions near Diamond Creek Well – pressures range from 35 to 39 psi • Cluster of junctions located north of Pleasant Grove BPS – pressures range from 34 to 39 psi • Cluster of junction located northwest of Woodcreek West Well – pressures range from 33 to 39 psi • Cluster of junctions located southwest of Woodcreek West Well – pressures range from 33 to 39 psi (Figure 4 presents system pressure on selected nodes during 72-hour period simulation)	Scenario 3B Figures 1, 2, 3, 4	• Added 24-inch diameter pipeline (17,662 feet) from Sierra Vista Station to Pleasant Grove Pump Station • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 390' • PFE Pump Station to deliver SSWD flow into Roseville System — Design Flow at 7 mgd and TDH at 170 feet • Pleasant Grove Pump Station was modeled as dual pump station — 1st set of pumps deliver 10 mgd of Sac River to Zone 1 through 24-inch diameter pipeline from Sierra Vista Station to Pleasant Grove ▪ Total flow at 6,900 gpm and TDH at 300 feet — 2nd set of pumps deliver excess groundwater supply from Zone 4 to Zone 1 ▪ Design Flow at 3,500 gpm for each pump (assuming 2 pumps) ▪ Design Head at 170 feet ▪ Based on Zone 1 Tank level • Pump 1 on 24-hour • Pump 2 on when Zone 1 Tank < 16 feet • Pump 2 off when Zone 1 Tank > 19.1 feet • West Roseville Specific Plan Reservoirs (12MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3 am ▪ Setting at 51 psi at 10 am ▪ Close at 7 pm ▪ Setting at 51psi at 10 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • Sierra Vista Specific Plan Reservoirs (6MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 4 am ▪ Setting at 54 psi at 10 am ▪ Close at 7 pm ▪ Setting at 54 psi at 11 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • All Zone 4 PRVs were set to be offline • Zone 1 Dual Purpose BPS was offline — Zone 1 Bypass was open to allow water to flow in or out of Zone 1 Reservoirs

Table B1. Summary of Hydraulic Conditions and Hydraulic Results for Buildout Drought Year Evaluation

Roseville Groundwater Supply	Intertie and Sac River Supplies	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Buildout 4, WTP Flow = 0 mgd					
Total GW Supply = 40 mgd Simulated flow for each well (average flow): • Diamond Creek Well= 3.98 mgd • HP Well = 2.5 mgd • Darling Well = 1.44 mgd • Oakmont Well = 3.13 mgd • Blue Oaks Well = 3.26 mgd • Hayden Way Well = 2.51 mgd • Woodcreek North Well = 2.5mgd • Woodcreek West Well = 3.15 mgd • WRSP Phase 2 (moved to Zone 1) = 2.48 mgd • WRSP Phase 3 = 2.06 mgd • WRSP Phase 4 = 2.31 mgd • SV West Well = 2.10 mgd • SV East Well = 2.11 mgd • CV Well = 2.31 mgd • Mountain Glen Well = 2.33 mgd • ARSA Well = 2.26 mgd	**Total Sac River = 0 mgd** **Total Interties = 17 mgd** Simulated flow for each intertie: • Pleasant Grove = 0.17 mgd • Highland Conn = 0.21 mgd • Five Star Conn = 3.8 mgd • Tinker = 5.5 mgd • SSWD = 6.92 mgd	57 mgd (Buildout demands in Zone 4 were reduced by 30%, and Zones 1, 2, 3, 5 were reduced by 46.6%)	Most pressures are above 50 psi, except for these following areas in Pressure Zone 4: • Cluster of junctions around Diamond Creek Well – pressures range from 43 to 49 psi • Cluster of junctions north of Blue Oaks, southeast of Diamond Creek Well – pressures range from 46 to 49 psi • Cluster of junction near Sierra Vista East Well – pressures range from 44 to 49 psi • Cluster of junction located northwest of Woodcreek West Well – pressures range from 40 to 49 psi • Cluster of junctions located southwest of Woodcreek West Well – pressures range from 39 to 49 psi • Cluster of junctions located west of HP Well and Woodcreek North Well – pressures range from 41 to 49 psi (Figure 4 presents system pressure on selected nodes during 72-hour period simulation)	Scenario 4 Figures 1, 2, 3, 4	• Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 390' • PFE Pump Station to deliver SSWD flow into Roseville System — Design Flow at 7 mgd and TDH at 170 feet • Pleasant Grove Pump Station to deliver excess groundwater supply from Zone 4 to Zone 1 — Design Flow at 6000 gpm (8.64 mgd) and TDH at 150 feet — Based on Zone 1 Tank level ▪ On when Zone 1 Tank < 15 feet ▪ Off when Zone 1 Tank > 19 feet • West Roseville Specific Plan Reservoirs (12MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3 am ▪ Setting at 52 psi at 10 am ▪ Close at 7 pm ▪ Setting at 52 psi at 10 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • Sierra Vista Specific Plan Reservoirs (6MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 4 am ▪ Setting at 56 psi at 10 am ▪ Close at 7 pm ▪ Setting at 56 psi at 11 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • All Zone 4 PRVs were set to be offline • Zone 1 Dual Purpose BPS was offline — Zone 1 Bypass was open to allow water to flow in or out of Zone 1 Reservoirs

Table B1. Summary of Hydraulic Conditions and Hydraulic Results for Buildout Drought Year Evaluation

Roseville Groundwater Supply	Intertie and Sac River Supplies	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Buildout 5, WTP Flow = 0 mgd					
Total GW Supply = 40 mgd Simulated flow for each well (average flow): • Diamond Creek Well= 3.61 mgd • HP Well = 2.48 mgd • Darling Well = 1.44 mgd • Oakmont Well = 3.13 mgd • Blue Oaks Well = 2.64 mgd • Hayden Way Well = 2.59 mgd • Woodcreek North Well = 2.48 mgd • Woodcreek West Well = 2.55 mgd • WRSP Phase 2 (moved to Zone 1) = 2.47 mgd • WRSP Phase 3 = 2.51 mgd • WRSP Phase 4 = 2.59 mgd • SV West Well = 2.42 mgd • SV East Well = 2.53 mgd • CV Well = 2.65 mgd • Mountain Glen Well = 2.59 mgd • ARSA Well = 2.59 mgd	**Total Sac River = 20 mgd** Simulated flow for Sac River (average flow): • 20 mgd was delivered to Sierra Vista Plan Area and was continually conveyed through 36-inch diameter pipeline to Pleasant Grove Pump Station that delivered Sac River Water to Zone 1 **Total Interties = 17 mgd** Simulated flow for each intertie: • Pleasant Grove = 0.25mgd • Highland Conn = 0.29 mgd • Five Star Conn = 3.8 mgd • Tinker = 5.36 mgd • SSWD = 7 mgd	77 mgd (Buildout demand in the hydraulic model was uniformly reduced to 77 mgd)	Most pressures are above 50 psi in Pressure Zones 1, 2 and 5. However, in Zone 4, system pressures range from 29 to 40 psi in some areas. The following areas in Pressure Zone 4 that experienced pressure between 30 to 40 psi are: • Cluster of junctions near Diamond Oaks Well – pressures range from 32 to 39 psi • Cluster of junctions located north of Pleasant Grove BPS – pressures range from 31 to 39 psi • Cluster of junction located northwest of Woodcreek West Well – pressures range from 31 to 39 psi • Cluster of junctions located southwest of Woodcreek West Well – pressures range from 29 to 39 psi (Figure 4 presents system pressure on selected nodes during 72-hour period simulation)	Scenario 5 Figures 1, 2, 3, 4	• Added 36-inch diameter pipeline (17,662 feet) from Sierra Vista Station to Pleasant Grove Pump Station • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 390' • PFE Pump Station to deliver SSWD flow into Roseville System — Design Flow at 7 mgd and TDH at 170 feet • Pleasant Grove Pump Station was modeled as dual pump station — 1st set of pumps deliver 20 mgd of Sac River to Zone 1 through 24-inch diameter pipeline from Sierra Vista Station to Pleasant Grove ▪ Total flow at 6,900 gpm and TDH at 300 feet — 2nd set of pumps deliver excess groundwater supply from Zone 4 to Zone 1 ▪ Design Flow at 3,500 gpm for each pump (assuming 2 pumps) ▪ Design Head at 160 feet ▪ Based on Zone 1 Tank level • Pump 1 on when Zone 1 Tank <16 feet • Pump 1 off when Zone 1 Tank >19.5 feet • Pump 2 on when Zone 1 Tank < 15 feet • Pump 2 off when Zone 1 Tank > 15.5 feet • West Roseville Specific Plan Reservoirs (12MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3 am ▪ Setting at 52 psi at 10 am ▪ Close at 7 pm ▪ Setting at 52 psi at 10 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • Sierra Vista Specific Plan Reservoirs (6MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 4 am ▪ Setting at 54.5 psi at 10 am ▪ Close at 7 pm ▪ Setting at 54.5 psi at 11 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • All Zone 4 PRVs were set to be offline • Zone 1 Dual Purpose BPS was offline — Zone 1 Bypass was open to allow water to flow in or out of Zone 1 Reservoirs

Table B1. Summary of Hydraulic Conditions and Hydraulic Results for Buildout Drought Year Evaluation

Roseville Groundwater Supply	Intertie and Sac River Supplies	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Buildout 6, WTP Flow = 0 mgd					
Total GW Supply = 40 mgd Simulated flow for each well (average flow): • Diamond Creek Well= 3.60 mgd • HP Well = 2.47 mgd • Darling Well = 1.45 mgd • Oakmont Well = 3.15 mgd • Blue Oaks Well = 2.63 mgd • Hayden Way Well = 2.47 mgd • Woodcreek North Well = 2.48 mgd • Woodcreek West Well = 2.53 mgd • WRSP Phase 2 (moved to Zone 1) = 2.47 mgd • WRSP Phase 3 = 2.29 mgd • WRSP Phase 4 moved to Mahaney = 2.61 mgd • SV West Well moved to Corpyard= 2.46 mgd • SV East Well = 2.27 mgd • CV Well = 2.51 mgd • Mountain Glen Well = 2.34 mgd • ARSA Well moved to Maidu Park= 2.61 mgd	**Total Sac River = 20 mgd** Simulated flow for Sac River (average flow): • 20 mgd was delivered to Sierra Vista Plan Area and connected to Zone 4 Service Area (assumed Sac River was delivered hydraulic head of 305 feet) **Total Interties = 17 mgd** Simulated flow for each intertie: • Pleasant Grove = 0.25mgd • Highland Conn = 0.29 mgd • Five Star Conn = 3.8 mgd • Tinker = 5.36 mgd • SSWD = 7 mgd	77 mgd (Buildout demand in the hydraulic model was uniformly reduced to 77 mgd)	Most pressures are above 50 psi in Pressure Zones 1, 2 and 5. However, in Zone 4, system pressures range from 27 to 40 psi in some areas. (Figure 4 presents system pressure on selected nodes during 72-hour period simulation)	Scenario 6 Figures 1, 2, 3, 4	• Assumed 20 mgd Sac River was delivered to Zone 4 service area (near Sierra Vista Station) directly with hydraulic head of 305 feet. • New Pump Station at Blue Oaks to deliver access water to Zone 1 — Design Flow at 4500 gpm and TDH at 165 feet • Moved 3 wells from the Zone 4 to Zone 1 — Zone 1 Well at Mahaney — Zone 1 Well at Maidu Park — Zone 1 Well at Corpyard • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 390' • PFE Pump Station to deliver SSWD flow into Roseville System — Design Flow at 7 mgd and TDH at 170 feet • Pleasant Grove Pump Station deliver excess groundwater supply from Zone 4 to Zone 1 — Three pumps at 75 hp (~1700 gpm each which is currently being designed) — Based on Zone 1 Tank level ▪ On when Zone 1 Tank < 16 feet ▪ Off when Zone 1 Tank > 19 feet • West Roseville Specific Plan Reservoirs (12MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3:55 am ▪ Setting at 50 psi at 10 am ▪ Close at 7:25 pm ▪ Setting at 50 psi at 10 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • Sierra Vista Specific Plan Reservoirs (6MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3:55 am ▪ Setting at 60 psi at 10 am ▪ Close at 7 pm ▪ Setting at 60 psi at 11 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • All Zone 4 PRVs were set to be offline • Zone 1 Dual Purpose BPS was offline — Zone 1 Bypass was open to allow water to flow in or out of Zone 1 Reservoirs

Table B1. Summary of Hydraulic Conditions and Hydraulic Results for Buildout Drought Year Evaluation

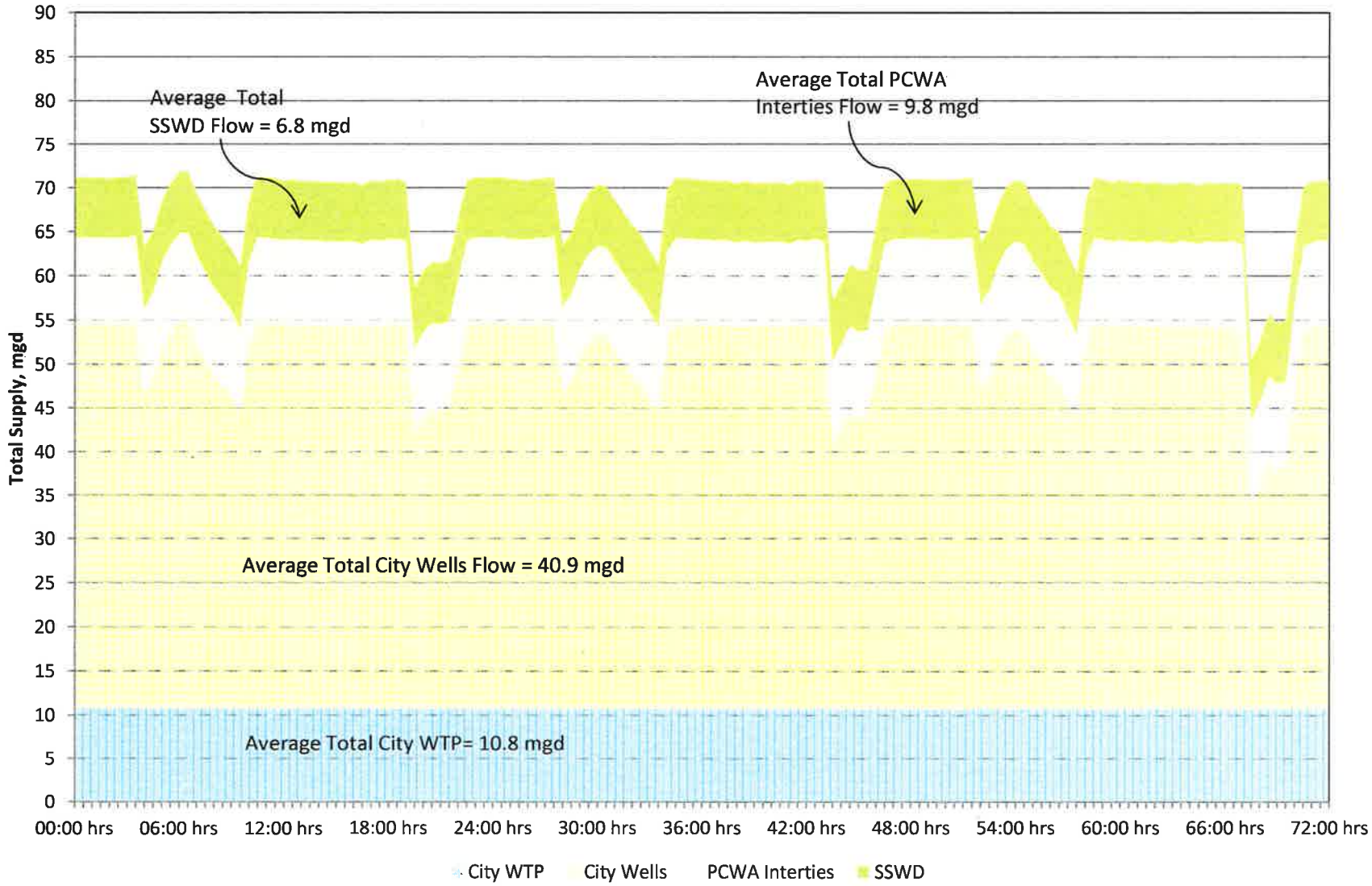
Roseville Groundwater Supply	Intertie and Sac River Supplies	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Buildout 7, WTP Flow = 0 mgd					
Total GW Supply = 40 mgd Simulated flow for each well (average flow): • Diamond Creek Well= 3.43 mgd • HP Well = 4.04 mgd • Darling Well = 1.44 mgd • Oakmont Well = 3.13 mgd • Blue Oaks Well = 2.58 mgd • Hayden Way Well = 2.45 mgd • Woodcreek North Well = 4.04 mgd • Woodcreek West Well = 2.53 mgd • WRSP Phase 2 (moved to Zone 1) = 2.44 mgd • WRSP Phase 3 = 2.28 mgd • WRSP Phase 4 moved to Mahaney = 2.44 mgd • SV West Well = 1.69 mgd • SV East Well = 2.34 mgd • CV Well = 2.47 mgd • Mountain Glen Well = 2.34 mgd • ARSA Well moved to Maidu Park= 2.58 mgd	**Total Sac River = 20 mgd** Simulated flow for Sac River (average flow): • 20 mgd was delivered to Sierra Vista Plan Area and connected to Zone 4 Service Area (assumed Sac River was delivered hydraulic head of 305 feet) **Total Interties = 17 mgd** Simulated flow for each intertie: • Pleasant Grove = 0.25mgd • Highland Conn = 0.29 mgd • Five Star Conn = 3.8 mgd • Tinker = 5.36 mgd • SSWD = 7 mgd	77 mgd (Buildout demand in the hydraulic model was uniformly reduced to 77 mgd)	Most pressures are above 50 psi in Pressure Zones 1, 2 and 5. The system pressures in Zone 4 are less than 20 psi in areas that being rezoned from Zone 1 to Zone 4. The elevations of the area that being rezoned from Zone 1 to Zone 4 range from 114 to 168 feet. The service elevations in existing Zone 4 range from 78 to 140 feet. (Figure 4 presents system pressure on selected nodes during 72-hour period simulation)	Scenario 7 Figures 1, 2, 3, 4	• Assumed 20 mgd Sac River was delivered to Zone 4 service area (near Sierra Vista Station) directly with hydraulic head of 305 feet. • Moved 2 wells from the Zone 4 to Zone 1 — Zone 1 Well at Mahaney — Zone 1 Well at Maidu Park • Expand Zone 4 service area to the east side — Install PRV station at Blue Oaks and Industrial — Install PRV station at Pleasant Grove and Industrial — Install PRV station at Junction and Washington — Install PRV station at Baseline/Main and Foothills — Close Valves at ▪ Sawtell Road and Washington ▪ Lawton Avenue (east of Vallejo) ▪ Porter Drive (north of Main) ▪ Union Street (east of Foothills) ▪ Vineyard and Foothills • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 390' • PFE Pump Station to deliver SSWD flow into Roseville System — Design Flow at 7 mgd and TDH at 170 feet • Pleasant Grove Pump Station deliver excess groundwater supply from Zone 4 to Zone 1 — Design Flow at 8,250 gpm (three 2750 gpm) and TDH at 190 feet — Based on Zone 1 Tank level ▪ On when Zone 1 Tank < 16 feet ▪ Off when Zone 1 Tank > 19.5 feet — Series of Isolation valves and a new 7,892 feet of 24-inch pipeline were assumed to deliver water from Pleasant Grove location to Zone 1 ▪ ISV at existing Pleasant Grove PRV station (suction side) ▪ ISV at intersection of Pleasant Grove and Woodcreek Oaks • West Roseville Specific Plan Reservoirs (12MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3:55 am ▪ Setting at 54 psi at 10 am ▪ Close at 7:25 pm ▪ Setting at 54 psi at 10 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • Sierra Vista Specific Plan Reservoirs (6MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3:55 am ▪ Setting at 63 psi at 10 am ▪ Close at 7 pm ▪ Setting at 63 psi at 11 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • All Zone 4 PRVs were set to be offline • Zone 1 Dual Purpose BPS was offline — Zone 1 Bypass was open to allow water to flow in or out of Zone 1 Reservoirs

Table B1. Summary of Hydraulic Conditions and Hydraulic Results for Buildout Drought Year Evaluation

Roseville Groundwater Supply	Intertie and Sac River Supplies	Assumed Demand	Summary of Results	Refer to Figure Number	Comments (Hydraulic Model Assumptions)
Scenario: Buildout 8, WTP Flow = 0 mgd					
Total GW Supply = 40 mgd Simulated flow for each well (average flow): • Diamond Creek Well= 3.47 mgd • HP Well = 2.49 mgd • Darling Well = 1.45 mgd • Oakmont Well = 3.14 mgd • Blue Oaks Well = 2.61 mgd • Hayden Way Well = 2.52 mgd • Woodcreek North Well = 2.49 mgd • Woodcreek West Well = 2.52 mgd • WRSP Phase 2 = 2.49 mgd (moved to Zone 1) • WRSP Phase 3 = 2.44 mgd • WRSP Phase 4 = 2.52 mgd • SV West Well = 2.35 mgd • SV East Well = 2.46 mgd • CV Well = 2.57 mgd • Mountain Glen Well = 2.53 mgd • ARSA Well = 2.52 mgd	**Total Sac River = 20 mgd** Simulated flow for Sac River (average flow): • 20 mgd was delivered to Baseline and Woodcreek Oaks Intersection with Hydraulic Head of 405 feet. **Total Interties = 17 mgd** Simulated flow for each intertie: • Pleasant Grove = 0.25 mgd • Highland Conn = 0.29 mgd • Five Star Conn = 3.8 mgd • Tinker = 5.33 mgd • SSWD = 7 mgd	77 mgd (Buildout demand in the hydraulic model was uniformly reduced to 77 mgd)	Most pressures are above 50 psi in Pressure Zones 1, 2 and 5. In some areas within Zone 4 service area, system pressures range from 33 to 40 psi in some areas which are located near the Zone 4 and Zone 1 boundary. (Figure 4 presents system pressure on selected nodes during 72-hour period simulation)	Scenario 8 Figures 1, 2, 3, 4	• Assumed 20 mgd Sac River was delivered at the intersection of Baseline and Woodcreek Oaks at hydraulic head of 405 feet. • Assumed hydraulic head at PCWA connections — Five Star @ HGL 405' — Pleasant Grove @ HGL 405' — Highland @ HGL 405' — Tinker @ HGL 390' • PFE Pump Station to deliver SSWD flow into Roseville System — Design Flow at 7 mgd and TDH at 170 feet • Pleasant Grove Pump Station (three pumps at 75 HP) — Pump station was modeled to deliver excess water in Zone 4 to Zone 1 based on time of use and Zone 1 tank level. ▪ BPS operation (2 pumps) • Off at 4 am • On at 10 am • Off at 7 pm • On at 10 pm ▪ Based on Zone 1 Tank level • Pump 2 on when Zone 1 Tank <15 feet • Pump 2 off when Zone 1 Tank >19.2 feet • Pump 3 on when Zone 1 Tank < 14.5 feet • Pump 3 off when Zone 1 Tank > 18.5 feet • West Roseville Specific Plan Reservoirs (12MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 3 am ▪ Setting at 49 psi at 10 am ▪ Close at 7 pm ▪ Setting at 49 psi at 10 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • Sierra Vista Specific Plan Reservoirs (6MG) and BPS were online — PSV to fill reservoir operation ▪ Close at 4 am ▪ Setting at 51 psi at 10 am ▪ Close at 7 pm ▪ Setting at 51 psi at 11 pm — BPS operation (2 pumps) ▪ On at 4 am ▪ Off at 10 am ▪ On at 7:30 pm ▪ Off at 10 pm • All Zone 4 PRVs were set to be offline • Zone 1 Dual Purpose BPS was offline — Zone 1 Bypass was open to allow water to flow in or out of Zone 1 Reservoirs

SCENARIO 1

Scenario 1 - Figure 1. Summary of Total Supply During 2014 Drought Event
Buildout Maximum Day Demand Condition at 68 mgd
WTP Supplies at 10.8 MGD



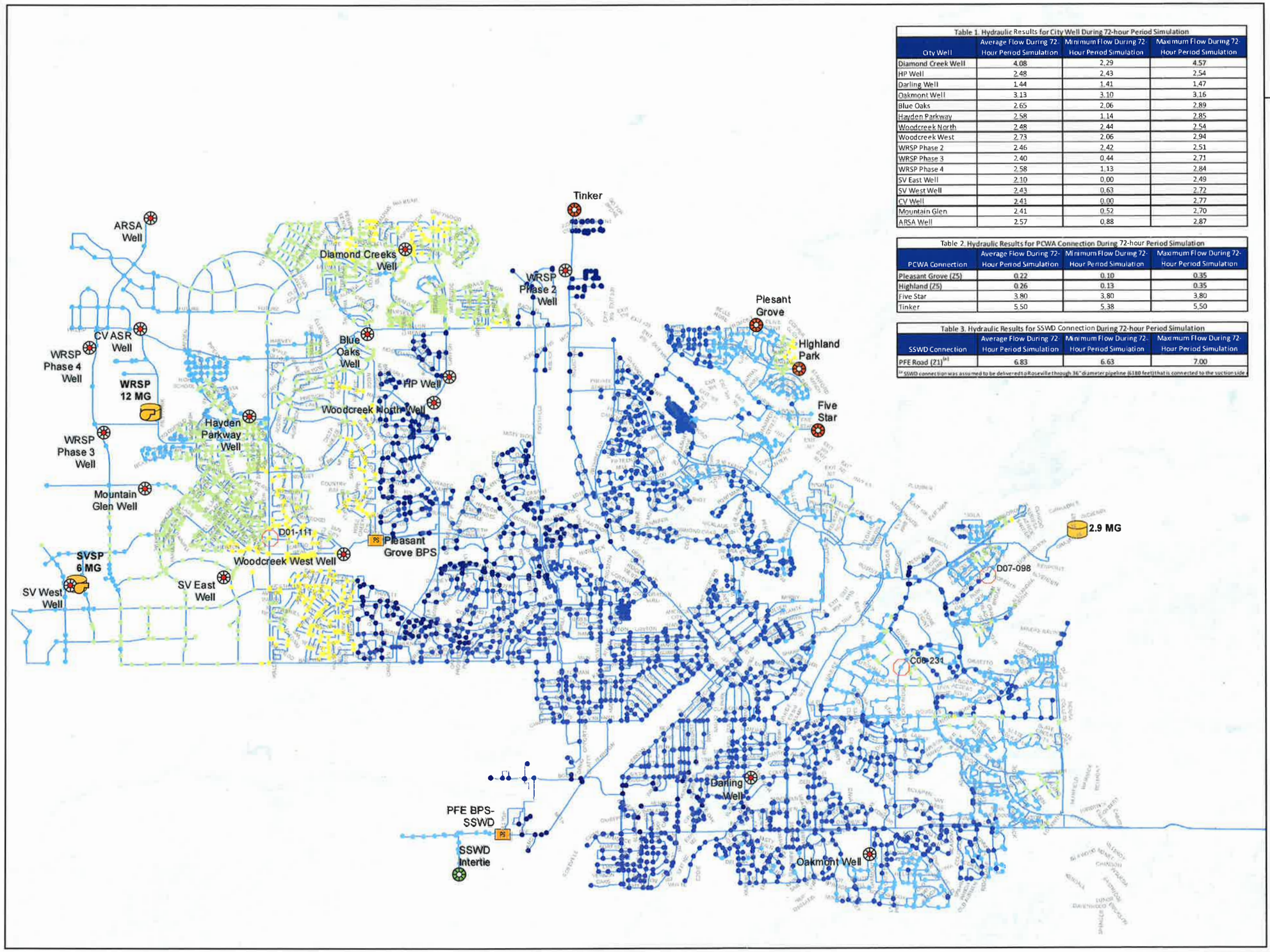


Table 1. Hydraulic Results for City Well During 72-hour Period Simulation

City Well	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Diamond Creek Well	4.08	2.29	4.57
HP Well	2.48	2.43	2.54
Darling Well	1.44	1.41	1.47
Oakmont Well	3.13	3.10	3.16
Blue Oaks	2.65	2.06	2.89
Hayden Parkway	2.58	1.14	2.85
Woodcreek North	2.48	2.44	2.54
Woodcreek West	2.73	2.06	2.94
WRSP Phase 2	2.46	2.42	2.51
WRSP Phase 3	2.40	0.44	2.71
WRSP Phase 4	2.58	1.13	2.84
SV East Well	2.10	0.00	2.49
SV West Well	2.43	0.63	2.72
CV Well	2.41	0.00	2.77
Mountain Glen	2.41	0.52	2.70
ARSA Well	2.57	0.88	2.87

Table 2. Hydraulic Results for PCWA Connection During 72-hour Period Simulation

PCWA Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Pleasant Grove (Z5)	0.22	0.10	0.35
Highland (Z5)	0.26	0.13	0.35
Five Star	3.80	3.80	3.80
Tinker	5.50	5.38	5.50

Table 3. Hydraulic Results for SSWD Connection During 72-hour Period Simulation

SSWD Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
PFE Road (Z1)[#1]	6.83	6.63	7.00

[#1] SSWD connection was assumed to be delivered to Roseville through 36" diameter pipeline (6180 feet) that is connected to the suction side

FIGURE 2

City of Roseville Dry Year Evaluation

SCENARIO 1 BUILDOUT MAXIMUM DAY DEMAND CONDITION (68 mgd)

N

0 2,250 4,500

Scale in Feet

Notes
1. Buildout Maximum Day Demand is 68 mgd. Buildout demands in hydraulic model were globally reduced to 68 mgd.
2. Average total supply from Water Treatment Plant is 10.8 mgd.
3. Average total supply from PCWA Interties is 9.8 mgd
4. Average total supply from City Wells is 40.9 mgd.
5. Average total supply from SSWD Intertie is 6.8 mgd.

LEGEND

- PCWA Interties
- SSWD Intertie
- New Pump Stations
- City Wells
- Future Booster Pump Station
- Future Reservoirs
- Selected Node

System Pressure:

- Less than 30 psi
- 30 to 40 psi
- 40 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi

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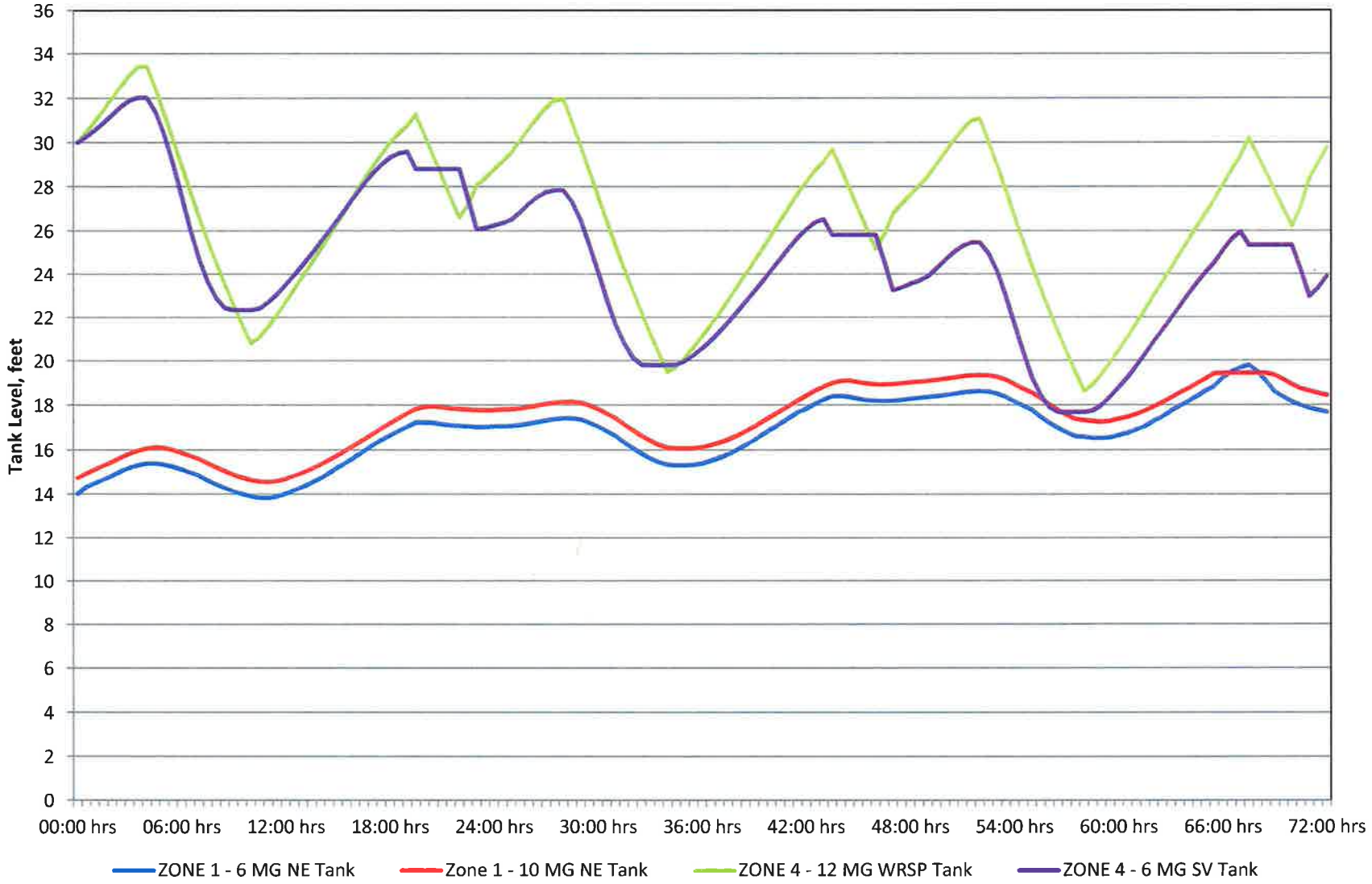
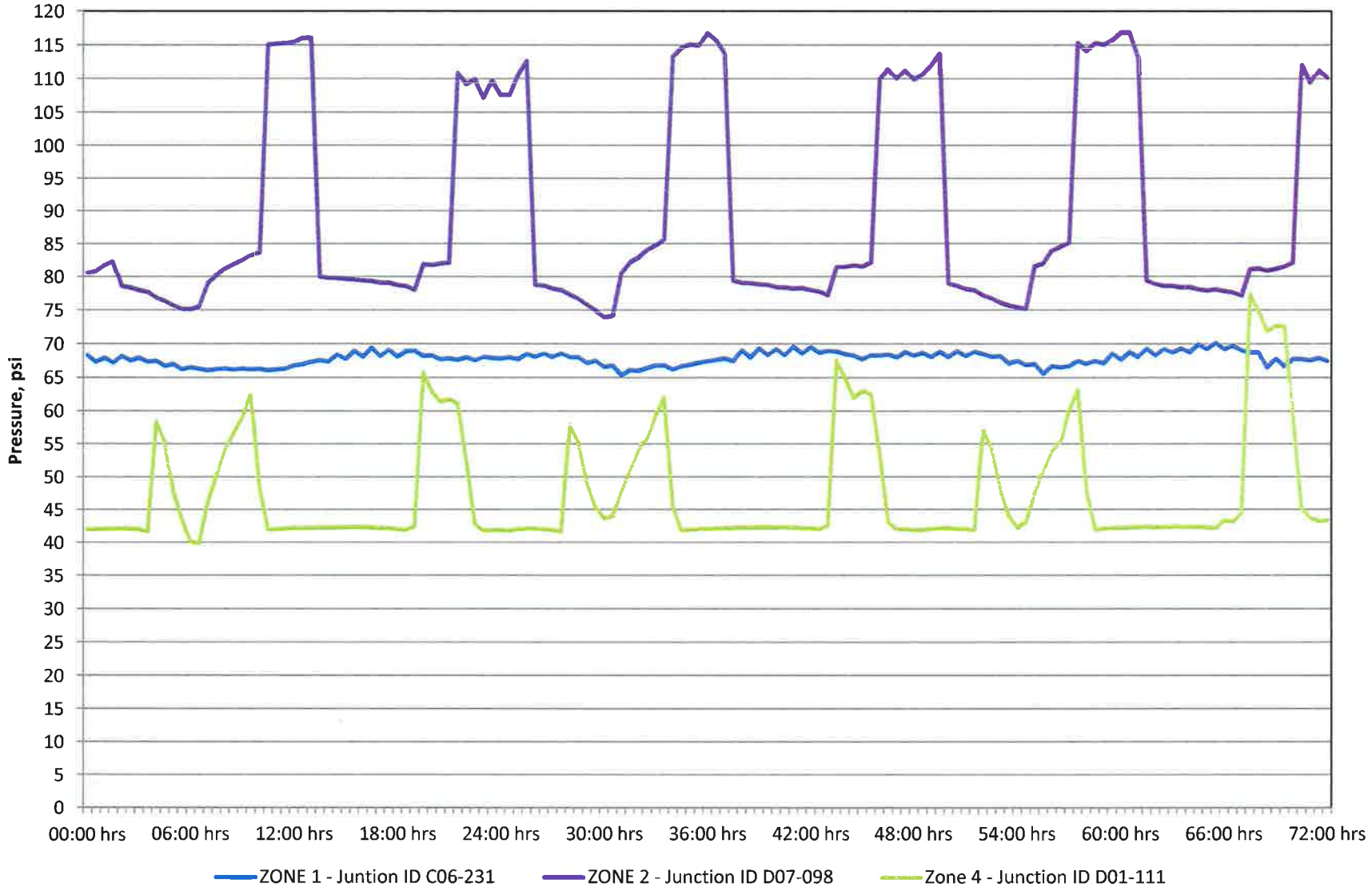
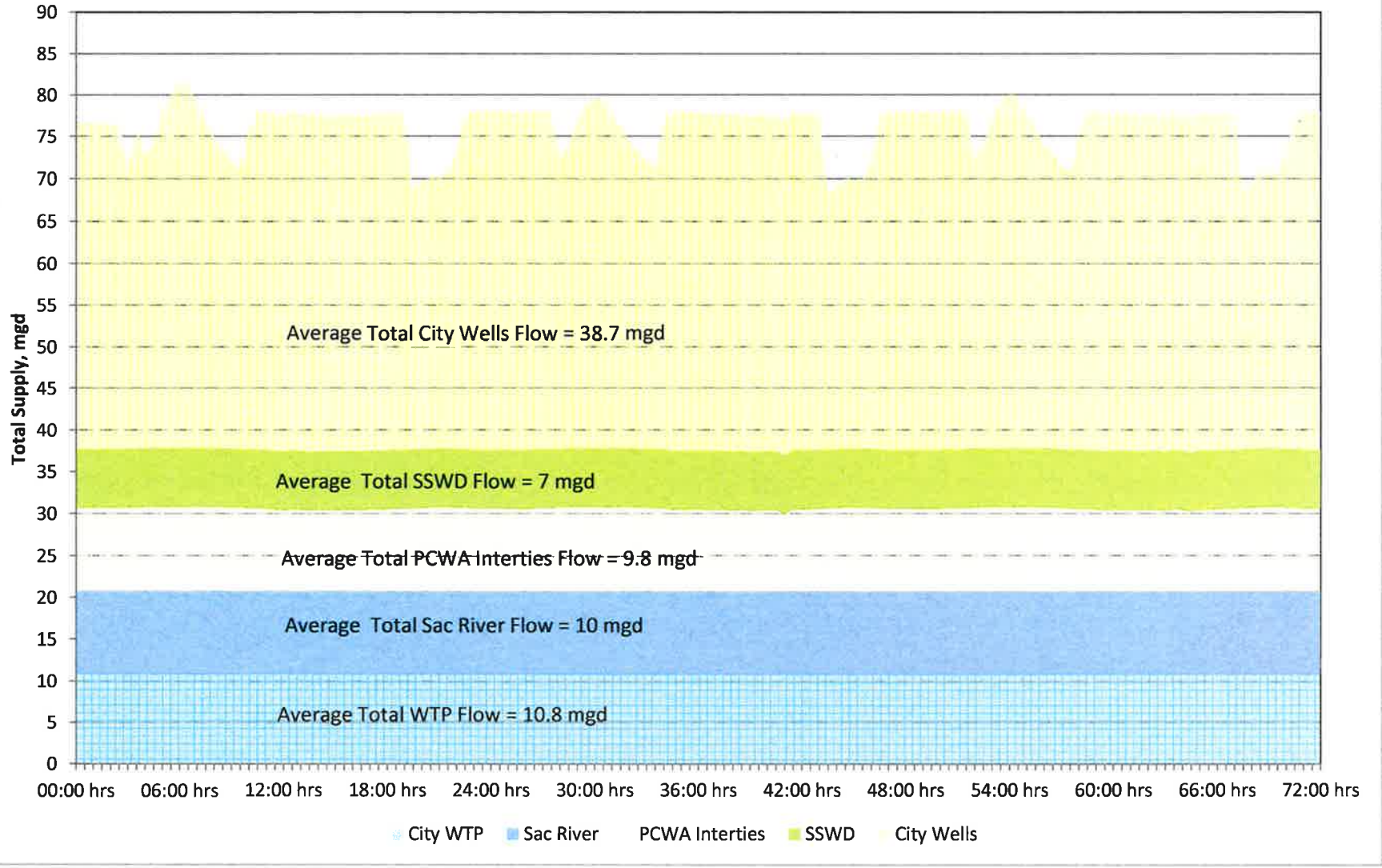
Scenario 1 - Figure 3. Summary of Zone 1 and Zone 4 Reservoirs over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 68 mgd WTP Supplies at 10.8 MGD



Scenario 1 - Figure 4. System Pressures for Selected Nodes over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 68 mgd WTP Supplies at 10.8 mgd



Scenario 2 - Figure 1. Summary of Total Supply During 2014 Drought Event
Buildout Maximum Day Demand Condition at 78 mgd
With 10.8 mgd from WTP and 10 mgd Sac River Delivered to Pleasant Grove BPS Through 24-inch Diameter Pipe (17,662 feet)



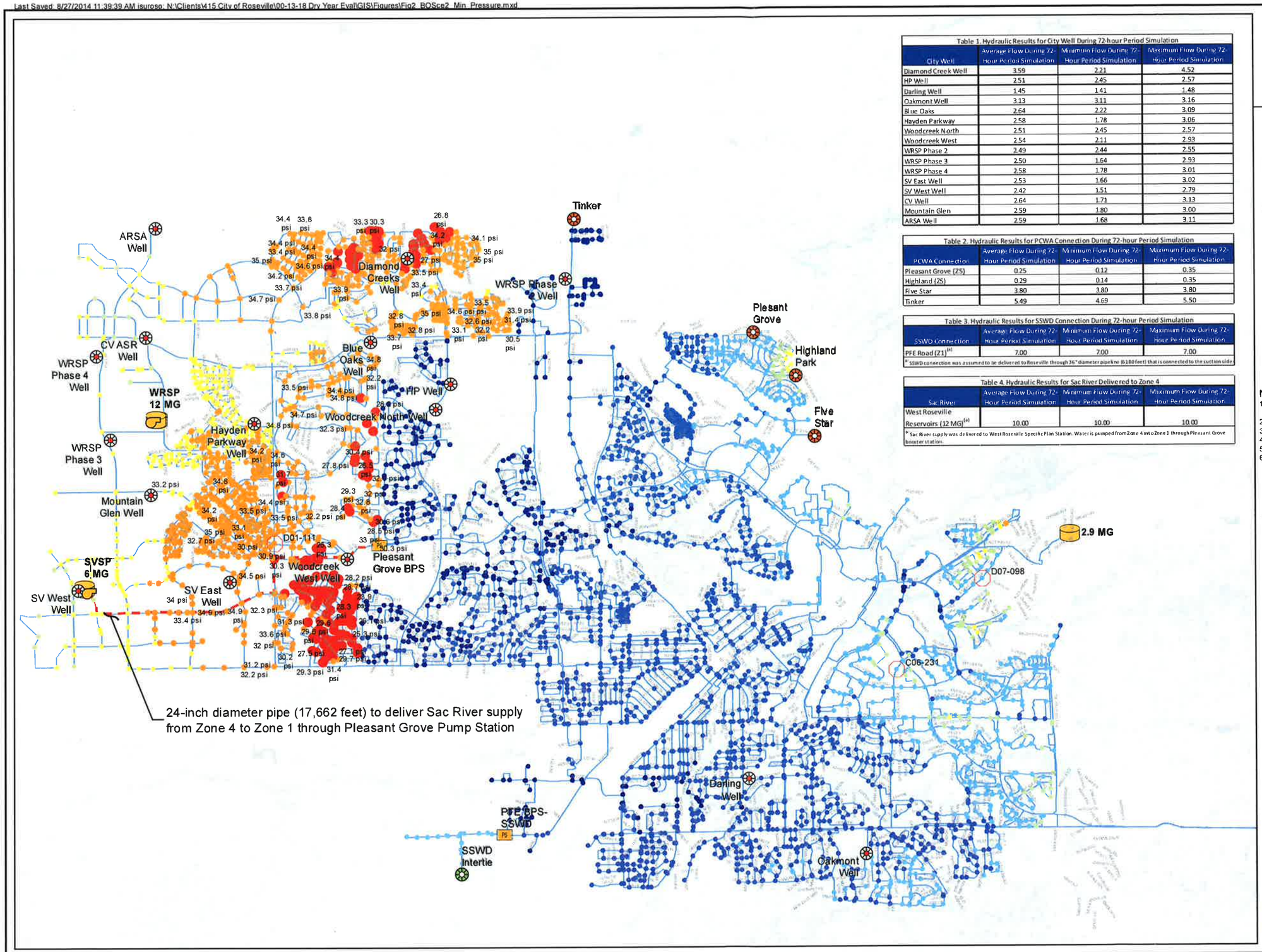


Table 1. Hydraulic Results for City Well During 72-hour Period Simulation

City Well	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Diamond Creek Well	3.59	2.21	4.52
HP Well	2.51	2.45	2.57
Darling Well	1.45	1.41	1.48
Oakmont Well	3.13	3.11	3.16
Blue Oaks	2.64	2.22	3.09
Hayden Parkway	2.58	1.78	3.06
Woodcreek North	2.51	2.45	2.57
Woodcreek West	2.54	2.11	2.93
WRSP Phase 2	2.49	2.44	2.55
WRSP Phase 3	2.50	1.64	2.93
WRSP Phase 4	2.58	1.78	3.01
SV East Well	2.53	1.66	3.02
SV West Well	2.42	1.51	2.79
CV Well	2.64	1.71	3.13
Mountain Glen	2.59	1.80	3.00
ARSA Well	2.59	1.68	3.11

Table 2. Hydraulic Results for PCWA Connection During 72-hour Period Simulation

PCWA Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Pleasant Grove (Z5)	0.25	0.12	0.35
Highland (Z5)	0.29	0.14	0.35
Five Star	3.80	3.80	3.80
Tinker	5.49	4.69	5.50

Table 3. Hydraulic Results for SSWD Connection During 72-hour Period Simulation

SSWD Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
PFE Road (Z1)[a]	7.00	7.00	7.00

[a] SSWD connection was assumed to be delivered to Roseville through 36" diameter pipeline (6180 feet) that is connected to the suction side

Table 4. Hydraulic Results for Sac River Delivered to Zone 4

Sac River	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
West Roseville Reservoirs (12 MG)[a]	10.00	10.00	10.00

[a] Sac River supply was delivered to West Roseville Specific Plan Station. Water is pumped from Zone 4 into Zone 1 through Pleasant Grove booster station.

FIGURE 2

City of Roseville Dry Year Evaluation

SCENARIO 2 BUILDOUT MAXIMUM DAY DEMAND CONDITION (78 mgd)

(Sac River supply was delivered to Pleasant Grove BPS through 24-inch diameter pipe)

N

0 2,250 4,500

Scale in Feet

Notes
1. Buildout Maximum Day Demand is 78 mgd. Buildout demands in hydraulic model were globally reduced to 78 mgd.
2. Average total supply from Water Treatment Plant is 10.8 mgd.
3. Average total supply from PCWA Interties is 9.8 mgd
4. Average total supply from City Wells is 38.7 mgd.
5. Average total supply from SSWD Intertie is 7 mgd.
6. Total supply from Sac River is 10 mgd, and it was delivered from Sierra Vista to Pleasant Grove Pump Station through a 17,662 feet of 24-inch diameter pipe.

LEGEND

- PCWA Interties
- SSWD Intertie
- New Pump Stations
- City Wells
- Future Booster Pump Station
- Future Reservoirs
- 24-inch Diameter Pipe to Supply Sac River Supply
- Selected Node

System Pressure:

- Less than 30 psi
- 30 to 40 psi
- 40 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi

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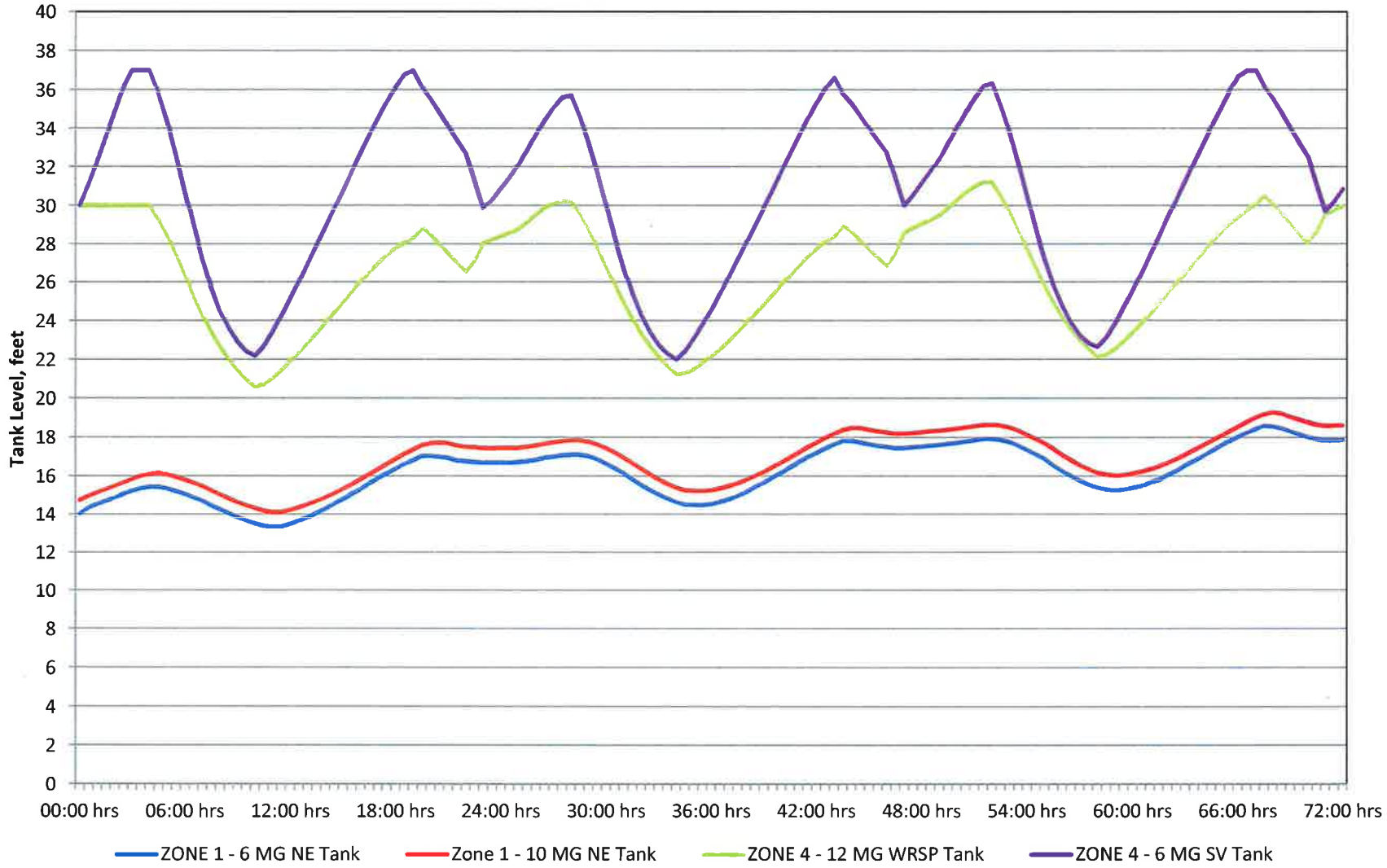
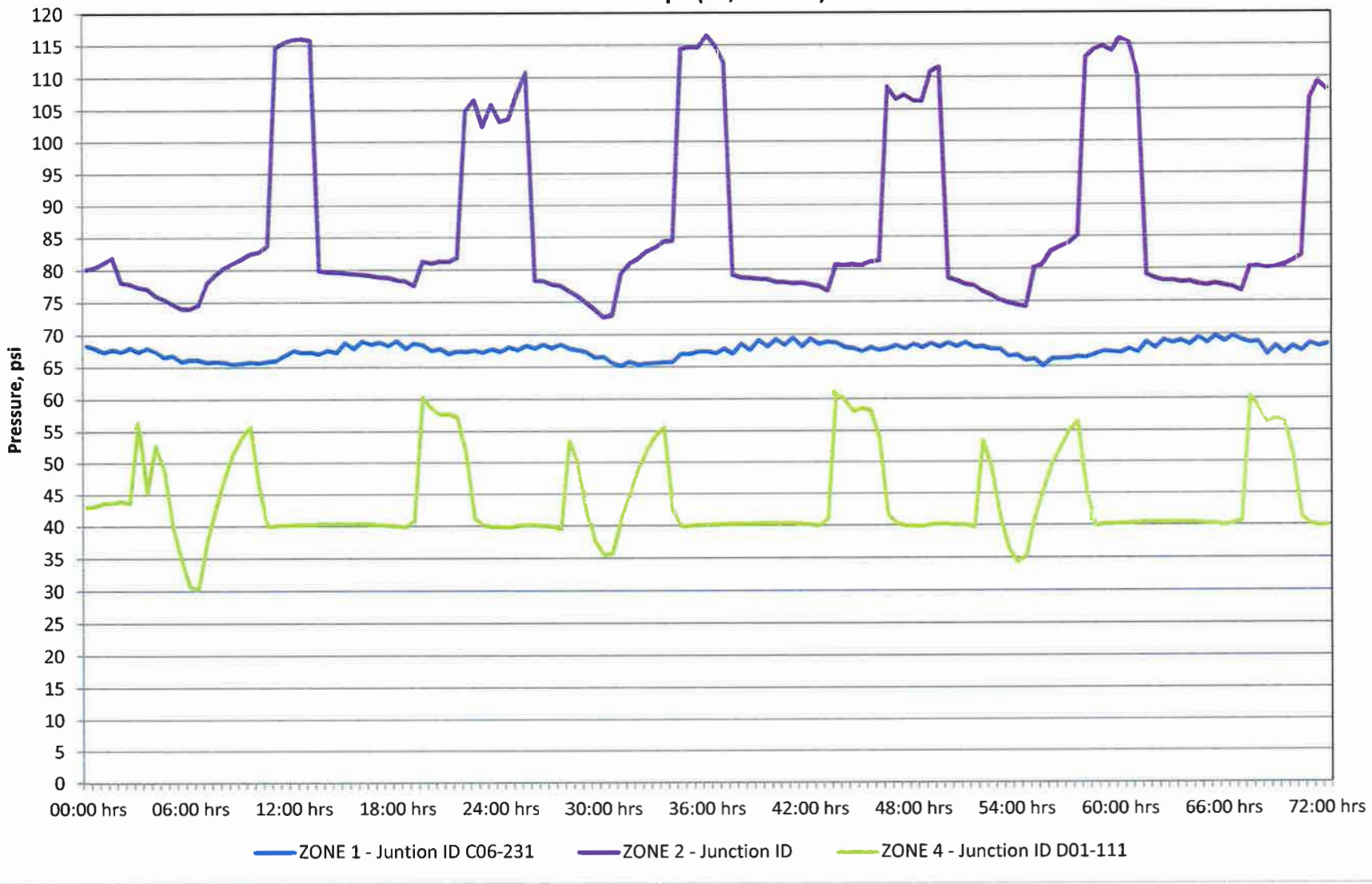
SCENARIO 2

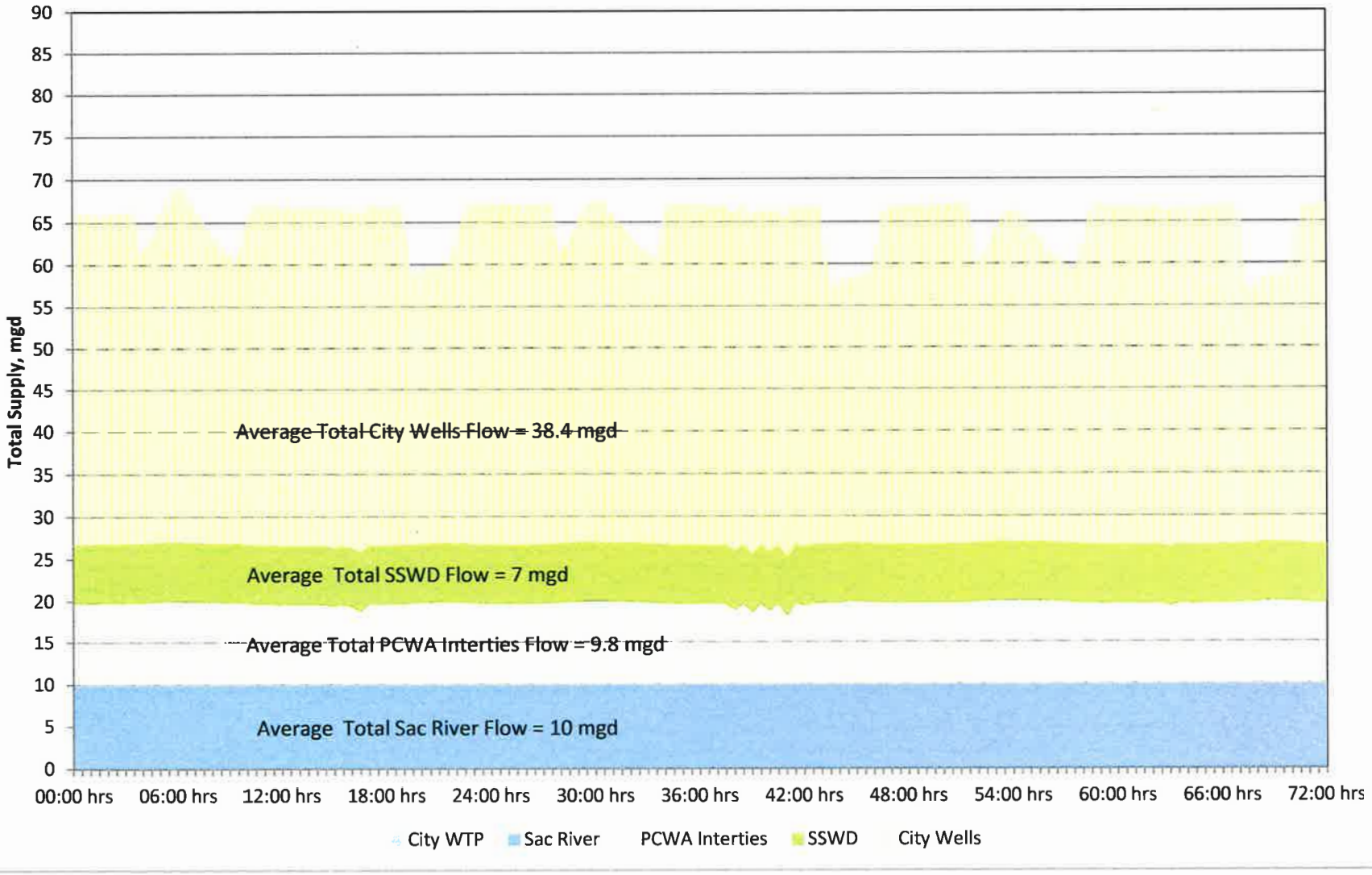
Scenario 2 - Figure 3. Summary of Zone 1 and Zone 4 Reservoirs over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 78 mgd with 10.8 mgd Supply from WTP and 10 mgd Sac River Delivered to Pleasant Grove BPS Through 24-inch Diameter Pipe (17,662 feet)



Scenario 2 - Figure 4. System Pressures for Selected Nodes over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 78 mgd with 10.8 mgd Supply from WTP and 10 mgd Sac River Delivered to Pleasant Grove BPS Through 24-inch Diameter Pipe (17,662 feet)



Scenario 3 - Figure 1. Summary of Total Supply During 2014 Drought Event
Buildout Maximum Day Demand Condition at 67 mgd
with No Supply from WTP and 10 mgd Sac River Delivered to Pleasant Grove BPS Through 24-inch Diameter Pipe (17,662 feet)



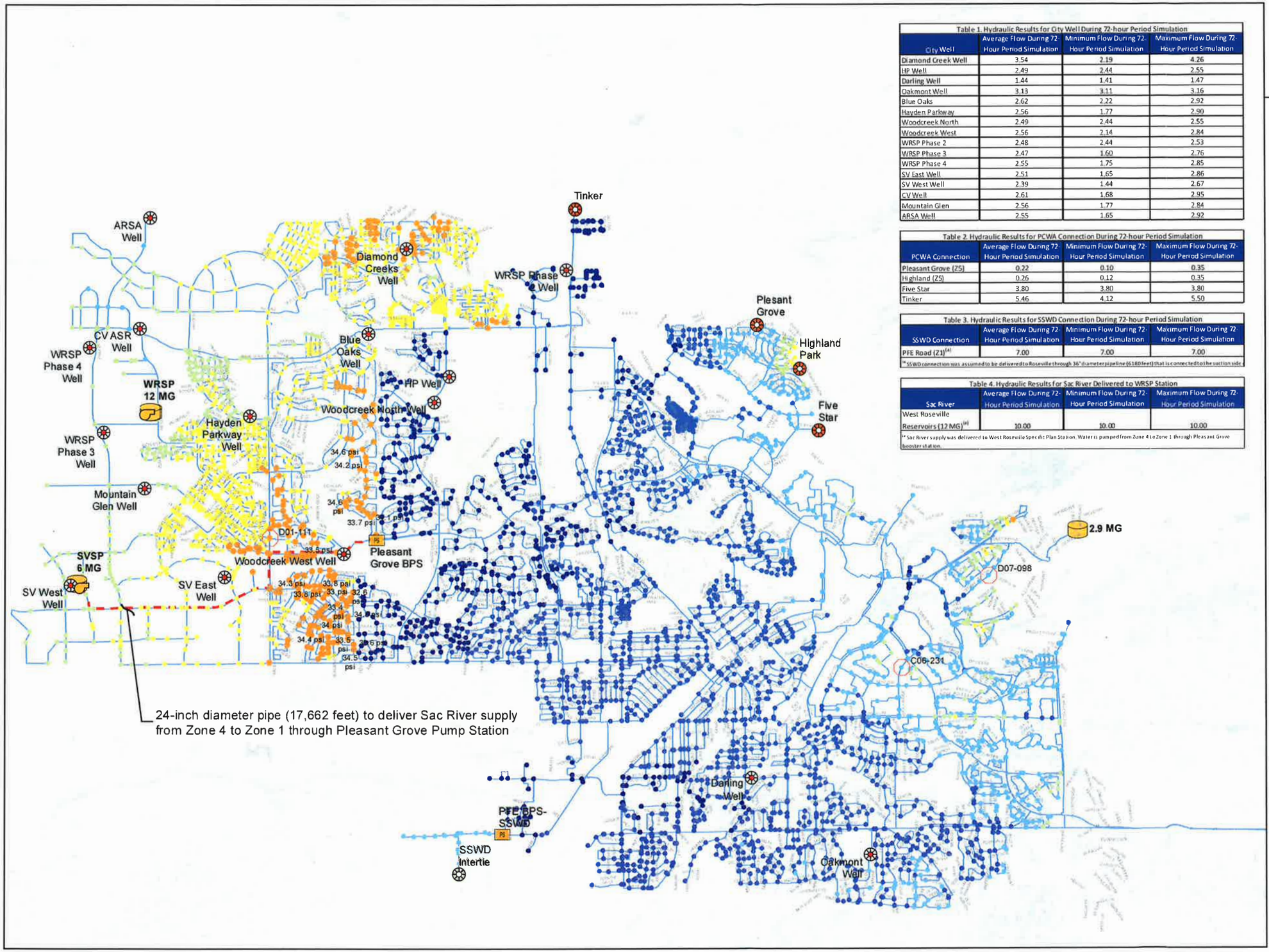


Table 1. Hydraulic Results for City Well During 72-hour Period Simulation

City Well	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Diamond Creek Well	3.54	2.19	4.26
HP Well	2.49	2.44	2.55
Darling Well	1.44	1.41	1.47
Oakmont Well	3.13	3.11	3.16
Blue Oaks	2.62	2.22	2.92
Hayden Parkway	2.56	1.77	2.90
Woodcreek North	2.49	2.44	2.55
Woodcreek West	2.56	2.14	2.84
WRSP Phase 2	2.48	2.44	2.53
WRSP Phase 3	2.47	1.60	2.76
WRSP Phase 4	2.55	1.75	2.85
SV East Well	2.51	1.65	2.86
SV West Well	2.39	1.44	2.67
CV Well	2.61	1.68	2.95
Mountain Glen	2.56	1.77	2.84
ARSA Well	2.55	1.65	2.92

Table 2. Hydraulic Results for PCWA Connection During 72-hour Period Simulation

PCWA Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Pleasant Grove (Z5)	0.22	0.10	0.35
Highland (Z5)	0.26	0.12	0.35
Five Star	3.80	3.80	3.80
Tinker	5.46	4.12	5.50

Table 3. Hydraulic Results for SSWD Connection During 72-hour Period Simulation

SSWD Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
PFE Road (Z1)[a]	7.00	7.00	7.00

[a] SSWD connection was assumed to be delivered to Roseville through 36" diameter pipeline (6180 feet) that is connected to the suction side

Table 4. Hydraulic Results for Sac River Delivered to WRSP Station

Sac River	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
West Roseville Reservoirs (12 MG)[a]	10.00	10.00	10.00

[a] Sac River supply was delivered to West Roseville Specific Plan Station. Water is pumped from Zone 4 to Zone 1 through Pleasant Grove booster station.

FIGURE 2

City of Roseville Dry Year Evaluation

SCENARIO 3 BUILDOUT MAXIMUM DAY DEMAND CONDITION (67 mgd)

(Sac River supply was delivered to Pleasant Grove BPS through 24-inch diameter pipe)

N

0 2,250 4,500

Scale in Feet

Notes
1. Buildout Maximum Day Demand is 67 mgd. Buildout demands in hydraulic model were globally reduced to 67 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 9.8 mgd
4. Average total supply from City Wells is 38.4 mgd.
5. Average total supply from SSWD Intertie is 7 mgd.
6. Total supply from Sac River is 10 mgd, and it was delivered from Sierra Vista Area to Pleasant Grove Pump Station through a 17,662 feet of 24-inch diameter pipe.

LEGEND

- PCWA Interties
- SSWD Intertie
- New Pump Stations
- City Wells
- Future Booster Pump Station
- Future Reservoirs
- 24-inch Diameter Pipe to Supply Sac River Supply
- Selected Node

System Pressure:

- Less than 30 psi
- 30 to 40 psi
- 40 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi

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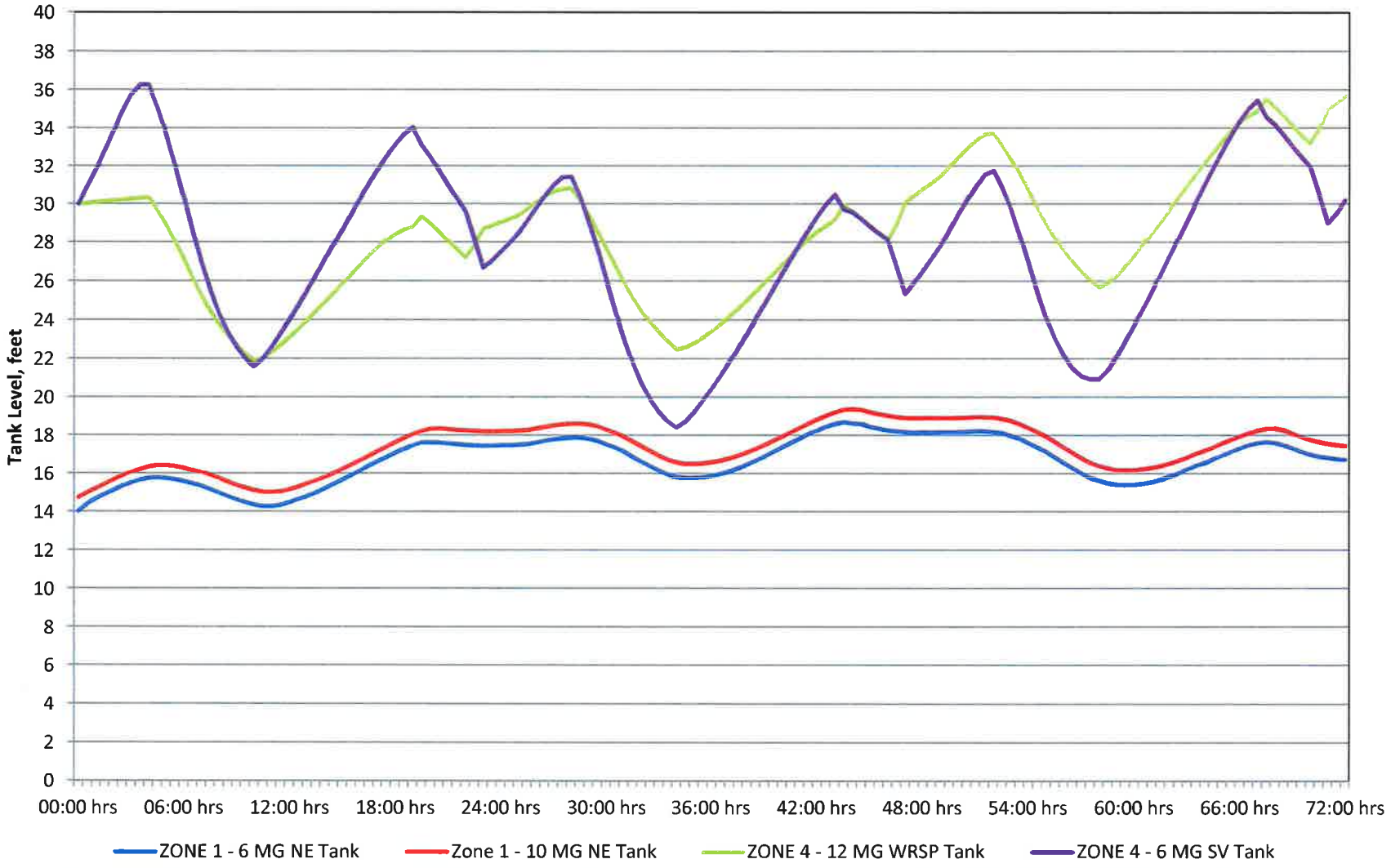
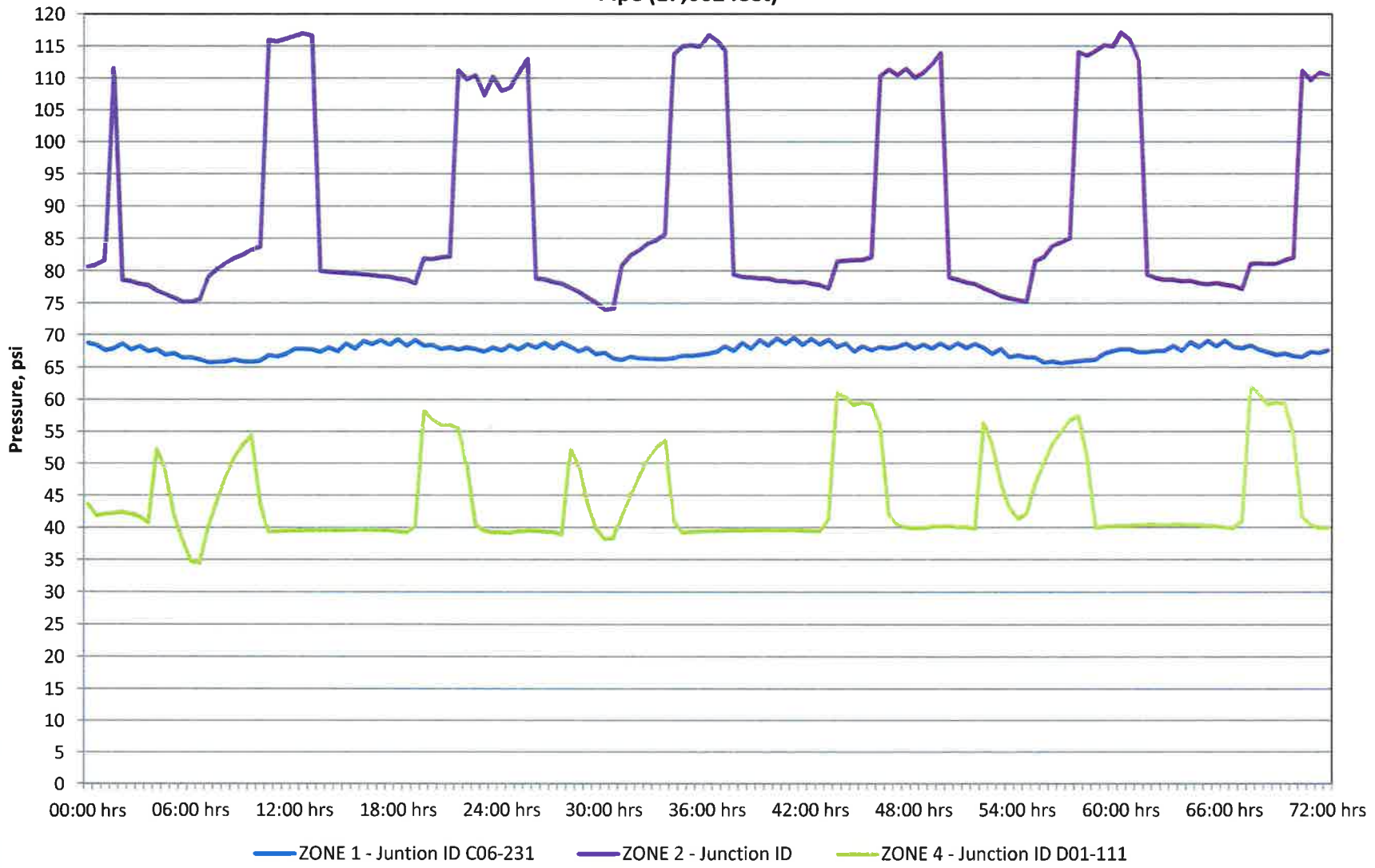
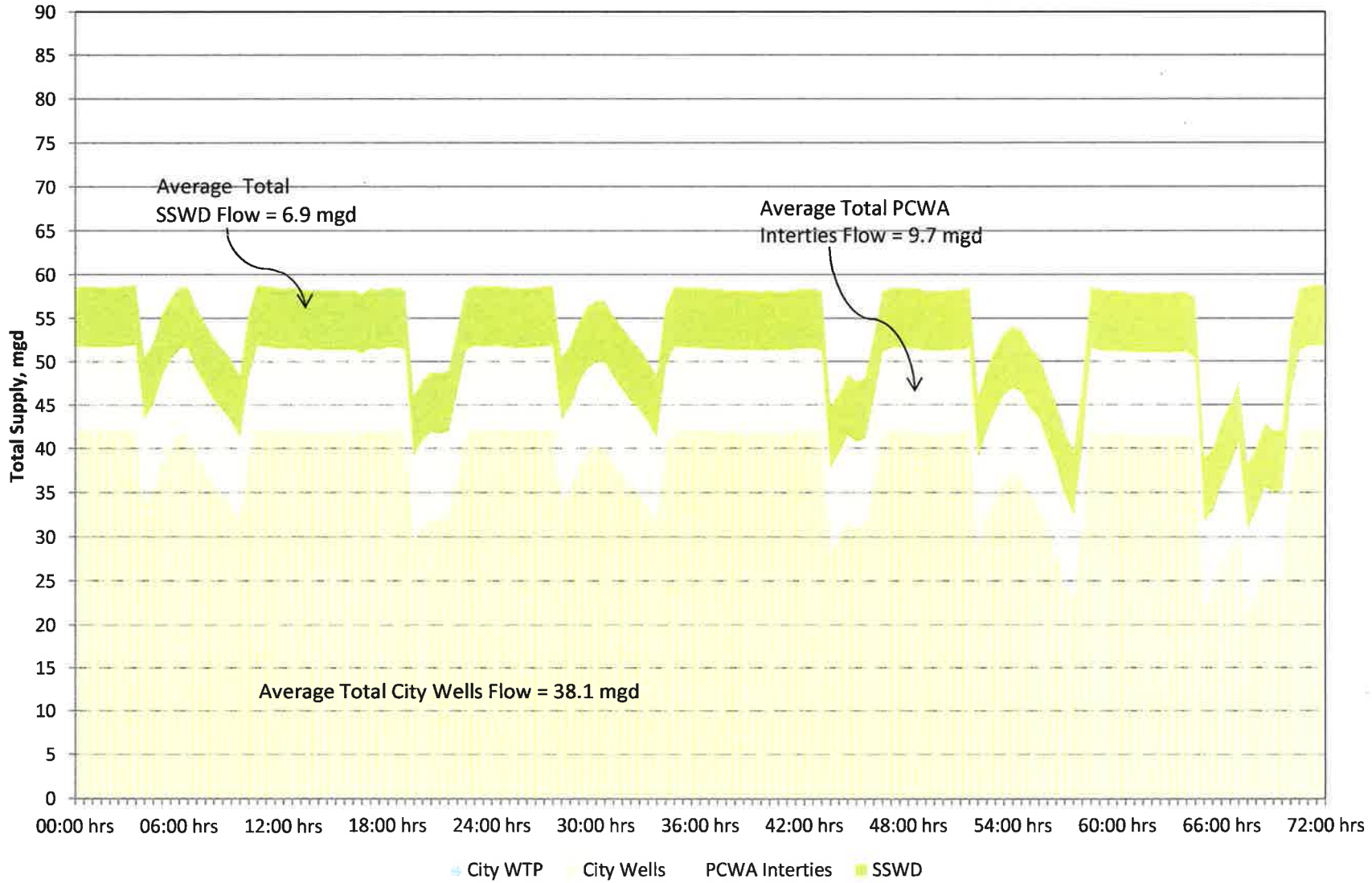
Scenario 3 - Figure 3. Summary of Zone 1 and Zone 4 Reservoirs over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 67 mgd with No Supply from WTP and 10 mgd Sac River Delivered to Pleasant Grove BPS Through 24-inch Diameter Pipe (17,662 feet)



Scenario 3 - Figure 4. System Pressures for Selected Nodes over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 67 mgd with No Supply from WTP and 10 mgd Sac River Delivered to Pleasant Grove BPS Through 24-inch Diameter Pipe (17,662 feet)



Scenario 4 - Figure 1. Summary of Total Supply During 2014 Drought Event
Buildout Maximum Day Demand Condition at 57 mgd
With No Supply from WTP



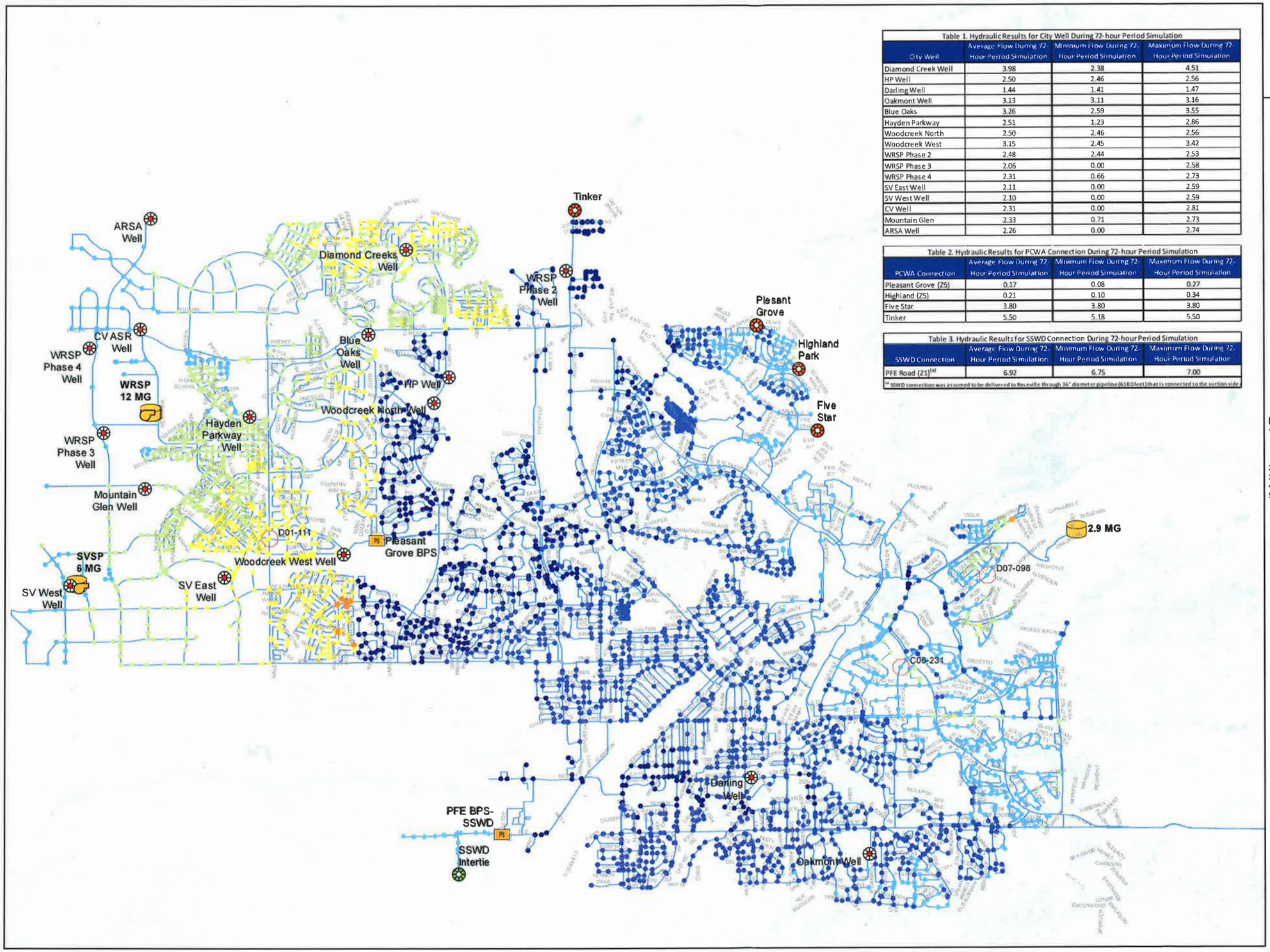


Table 1. Hydraulic Results for City Well During 72-hour Period Simulation

City Well	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Diamond Creek Well	3.98	2.38	4.51
HP Well	2.50	2.46	2.56
Darling Well	1.44	1.41	1.47
Oakmont Well	3.13	3.11	3.16
Blue Oaks	3.26	2.59	3.55
Hayden Parkway	2.51	1.23	2.86
Woodcreek North	2.50	2.46	2.56
Woodcreek West	3.15	2.45	3.42
WRSP Phase 2	2.48	2.44	2.53
WRSP Phase 3	2.06	0.00	2.58
WRSP Phase 4	2.31	0.66	2.73
SV East Well	2.11	0.00	2.59
SV West Well	2.10	0.00	2.59
CV Well	2.31	0.00	2.81
Mountain Glen	2.33	0.71	2.73
ARSA Well	2.26	0.00	2.74

Table 2. Hydraulic Results for PCWA Connection During 72-hour Period Simulation

PCWA Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Pleasant Grove (Z5)	0.17	0.08	0.27
Highland (Z5)	0.21	0.10	0.34
Five Star	3.80	3.80	3.80
Tinker	5.50	5.18	5.50

Table 3. Hydraulic Results for SSWD Connection During 72-hour Period Simulation

SSWD Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
PFE Road (Z1)[a]	6.92	6.75	7.00

[a] SSWD connection was assumed to be delivered to Roseville through 36" diameter pipeline (6180 feet) that is connected to the suction side

FIGURE 2

City of Roseville Dry Year Evaluation

SCENARIO 4 BUILDOUT MAXIMUM DAY DEMAND CONDITION (57 mgd)

N

0 2,250 4,500

Scale in Feet

Notes
1. Buildout Maximum Day Demand is 57 mgd. Buildout demands in Pressure Zone 4 were reduced by 30%, and Zones 1, 2, 3, 5 demands were reduced by 46.6% hydraulic model were globally reduced to 68 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 9.7 mgd
4. Average total supply from City Wells is 38.1 mgd.
5. Average total supply from SSWD Intertie is 6.9 mgd.

LEGEND

- PCWA Interties
- SSWD Intertie
- New Pump Stations
- City Wells
- Future Booster Pump Station
- Future Reservoirs
- Selected Node

System Pressure:

- Less than 30 psi
- 30 to 40 psi
- 40 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi

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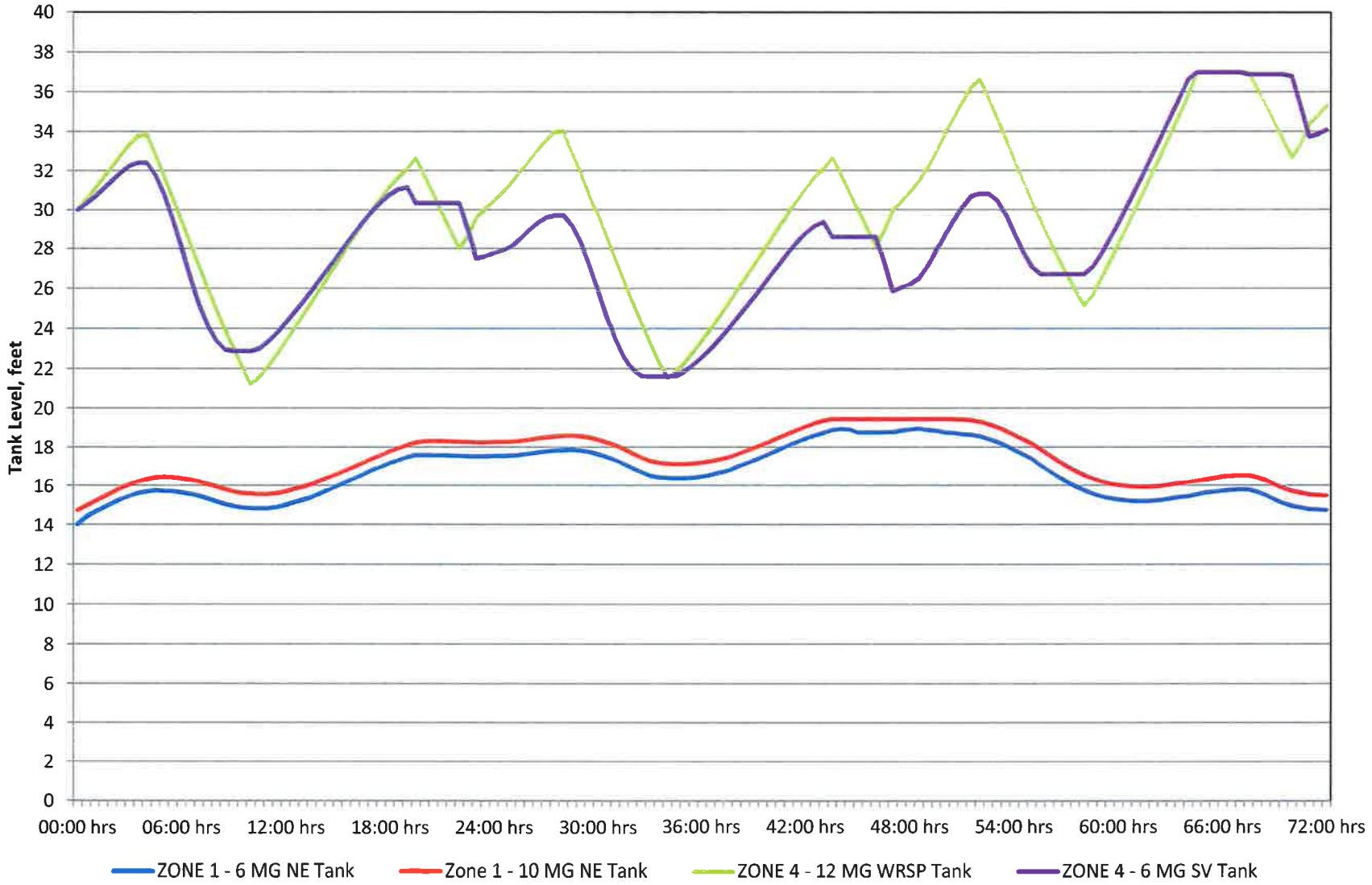
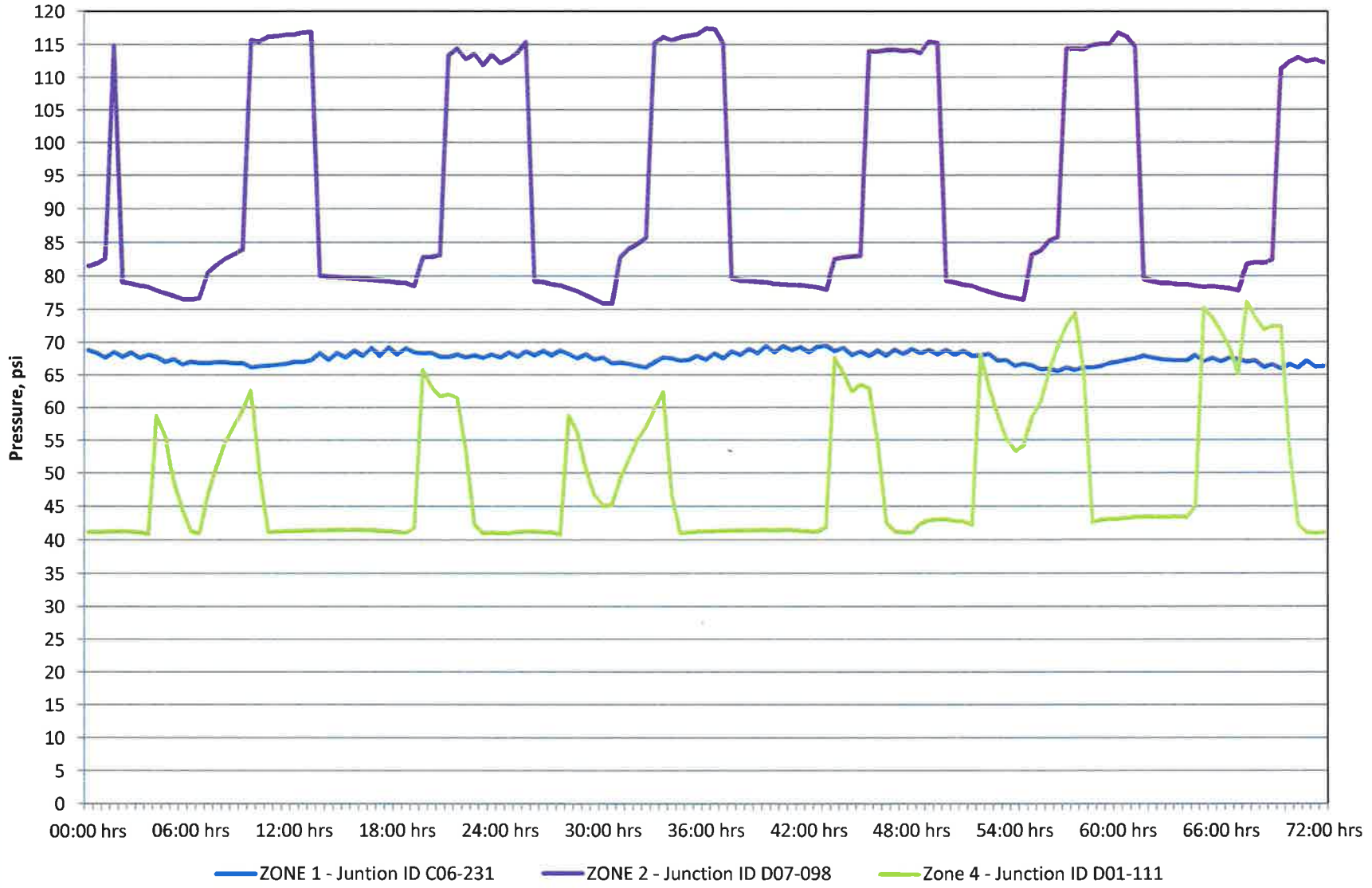
Scenario 4 - Figure 3. Summary of Zone 1 and Zone 4 Reservoirs over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 57 mgd with no Supply from WTP

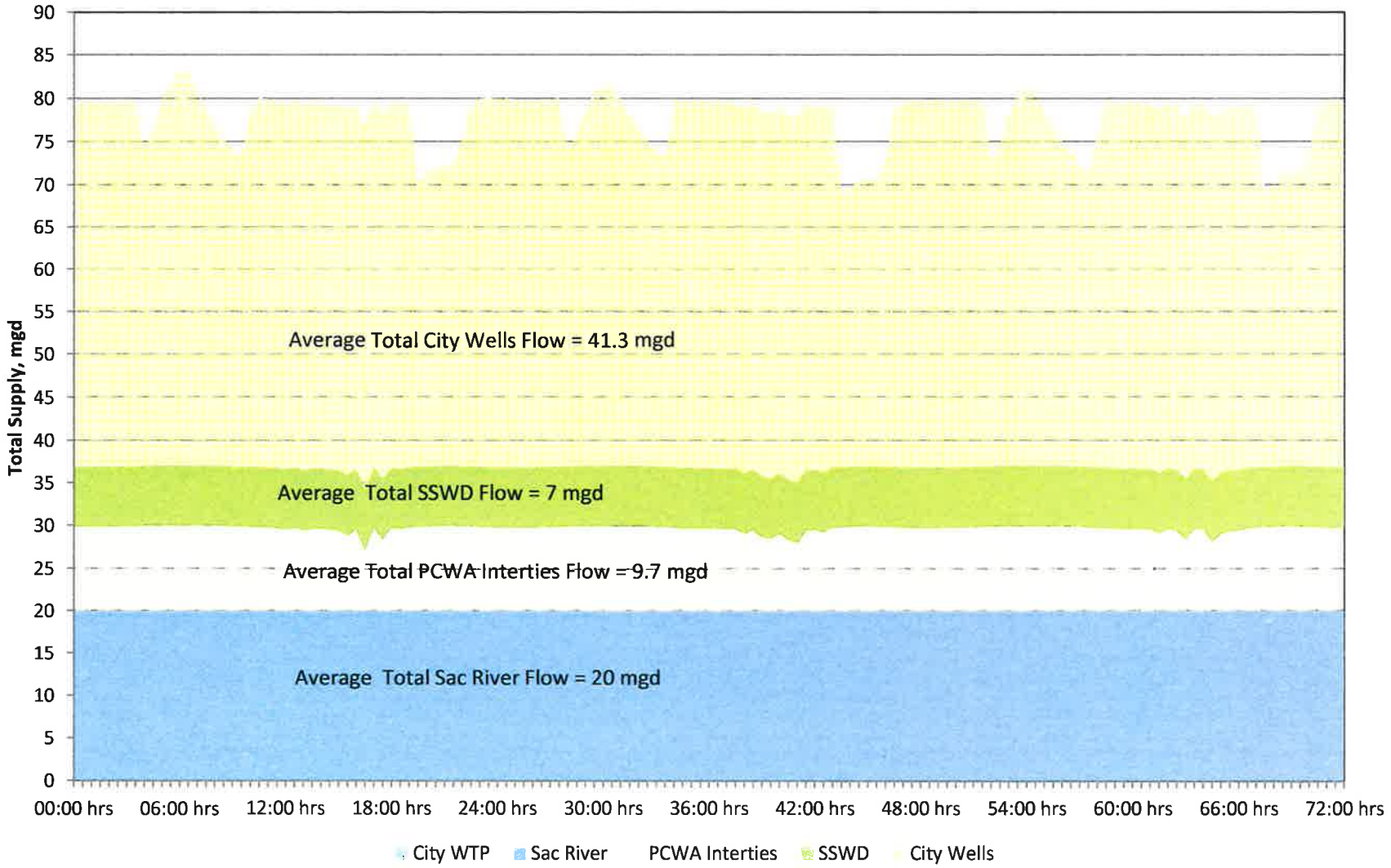


Scenario 4 - Figure 4. System Pressures for Selected Nodes over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 57 mgd with No Supply from WTP



SCENARIO 5

Scenario 5 - Figure 1. Summary of Total Supply During 2014 Drought Event
Buildout Maximum Day Demand Condition at 77 mgd
With No Supply from WTP and 20 mgd Sac River Delivered to Pleasant Grove BPS Through 36-inch Diameter Pipe (17,662 feet)



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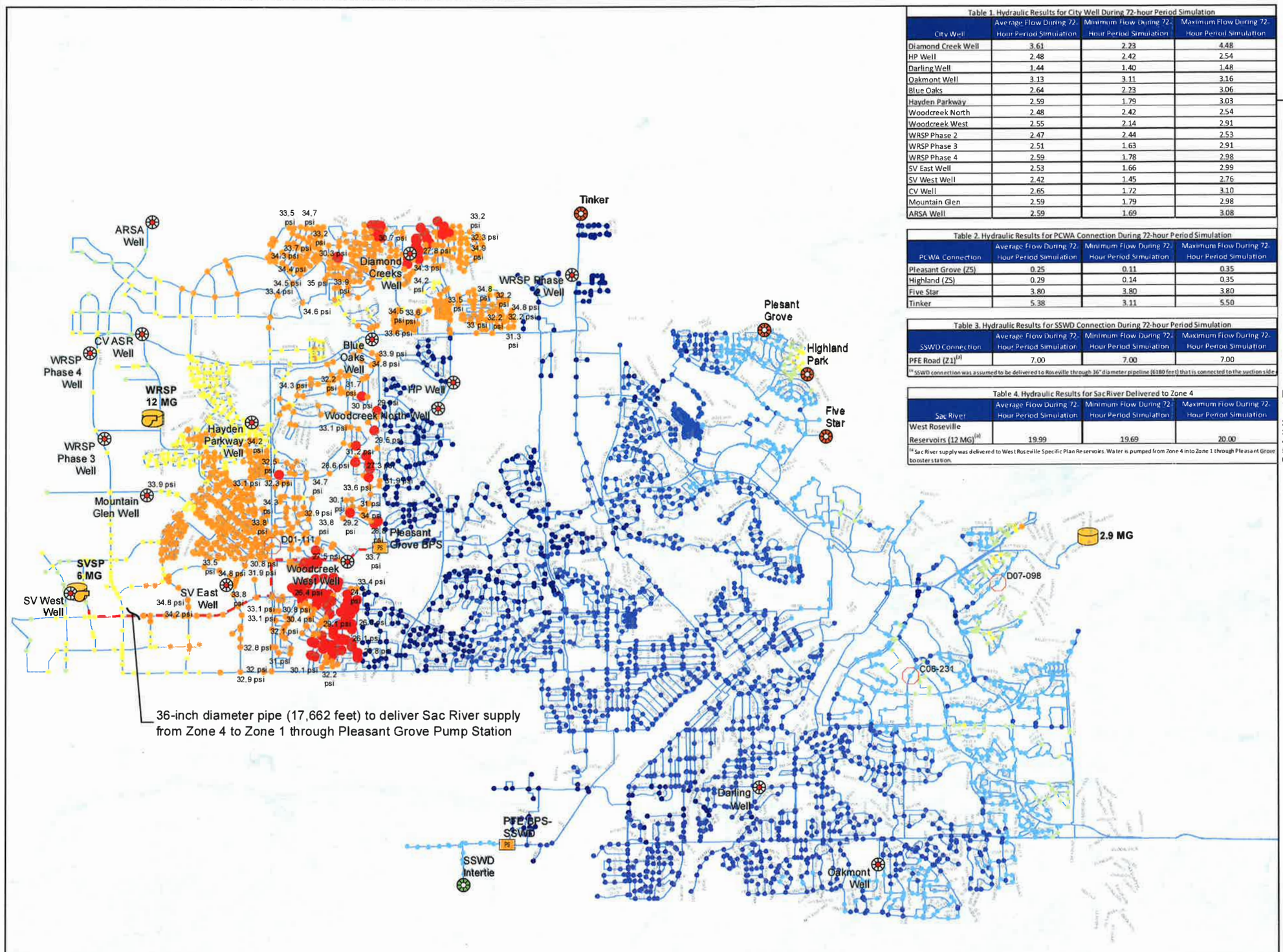

Table 1. Hydraulic Results for City Well During 72-hour Period Simulation

City Well	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Diamond Creek Well	3.61	2.23	4.48
HP Well	2.48	2.42	2.54
Darling Well	1.44	1.40	1.48
Oakmont Well	3.13	3.11	3.16
Blue Oaks	2.64	2.23	3.06
Hayden Parkway	2.59	1.79	3.03
Woodcreek North	2.48	2.42	2.54
Woodcreek West	2.55	2.14	2.91
WRSP Phase 2	2.47	2.44	2.53
WRSP Phase 3	2.51	1.63	2.91
WRSP Phase 4	2.59	1.78	2.98
SV East Well	2.53	1.66	2.99
SV West Well	2.42	1.45	2.76
CV Well	2.65	1.72	3.10
Mountain Glen	2.59	1.79	2.98
ARSA Well	2.59	1.69	3.08

Table 2. Hydraulic Results for PCWA Connection During 72-hour Period Simulation

PCWA Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Pleasant Grove (Z5)	0.25	0.11	0.35
Highland (Z5)	0.29	0.14	0.35
Five Star	3.80	3.80	3.80
Tinker	5.38	3.11	5.50

Table 3. Hydraulic Results for SSWD Connection During 72-hour Period Simulation

SSWD Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
PFE Road (Z1)[a]	7.00	7.00	7.00

[a] SSWD connection was assumed to be delivered to Roseville through 36" diameter pipeline (6180 feet) that is connected to the suction side

Table 4. Hydraulic Results for Sac River Delivered to Zone 4

Sac River	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
West Roseville Reservoirs (12 MG)[a]	19.99	19.69	20.00

[a] Sac River supply was delivered to West Roseville Specific Plan Reservoirs. Water is pumped from Zone 4 into Zone 1 through Pleasant Grove booster station.

FIGURE 2

City of Roseville Dry Year Evaluation

SCENARIO 5 BUILDOUT MAXIMUM DAY DEMAND CONDITION (77 mgd)

(Sac River supply was delivered to Pleasant Grove BPS through 36-inch diameter pipe)

N

0 2,250 4,500

Scale in Feet

Notes

1. Buildout Maximum Day Demand is 77 mgd. Buildout demands in hydraulic model were globally reduced to 77 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 9.7 mgd
4. Average total supply from City Wells is 41.3 mgd.
5. Average total supply from SSWD Intertie is 7 mgd.
6. Total supply from Sac River is 20 mgd, and it was delivered from Sierra Vista Area to Pleasant Grove Pump Station through a 17,662 feet of 36-inch diameter pipe.

LEGEND

- PCWA Interties
- SSWD Intertie
- New Pump Stations
- City Wells
- Future Booster Pump Station
- Future Reservoirs
- 36-inch Diameter Pipe to Supply Sac River Supply
- Selected Node

System Pressure:

- Less than 30 psi
- 30 to 40 psi
- 40 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi

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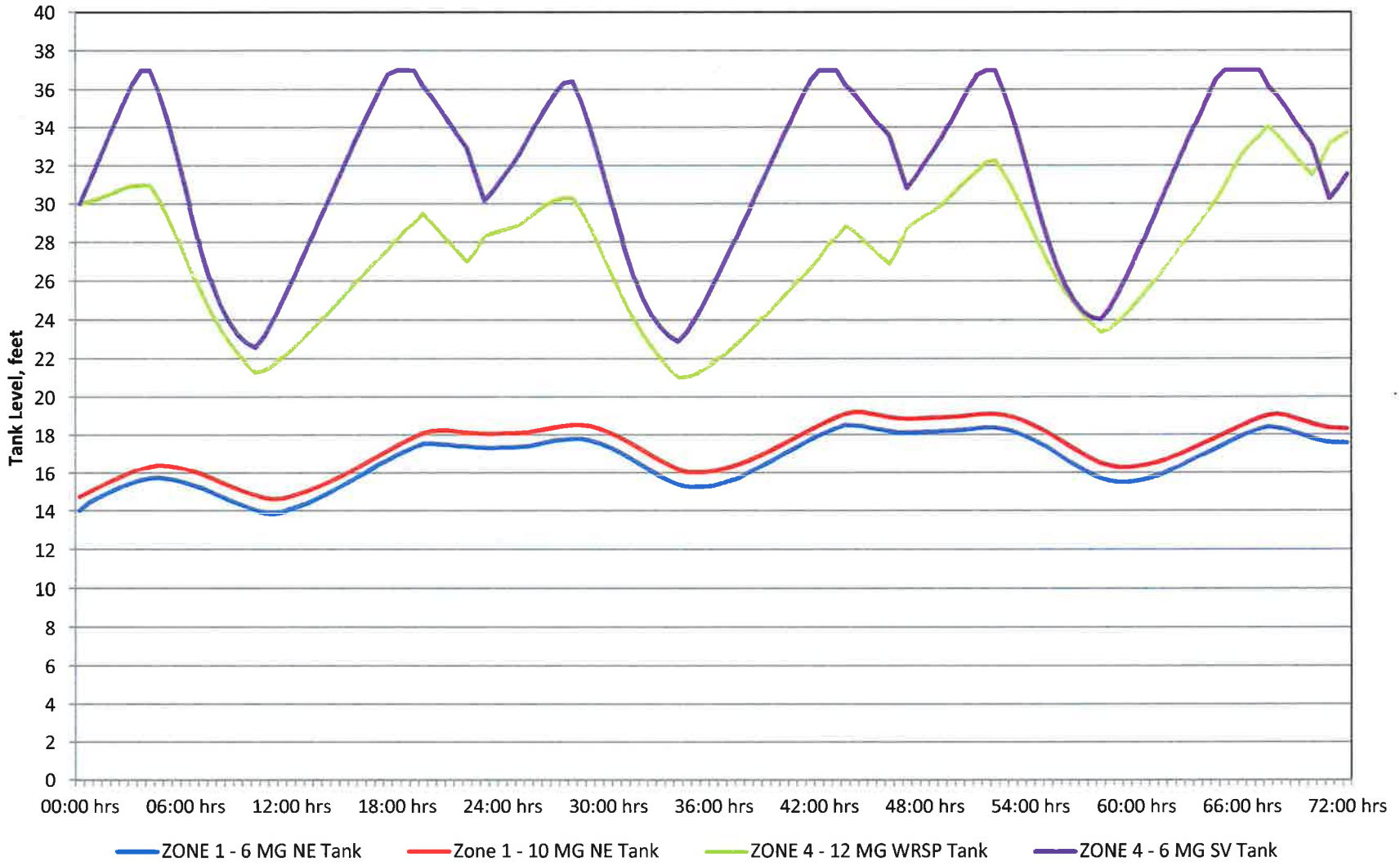
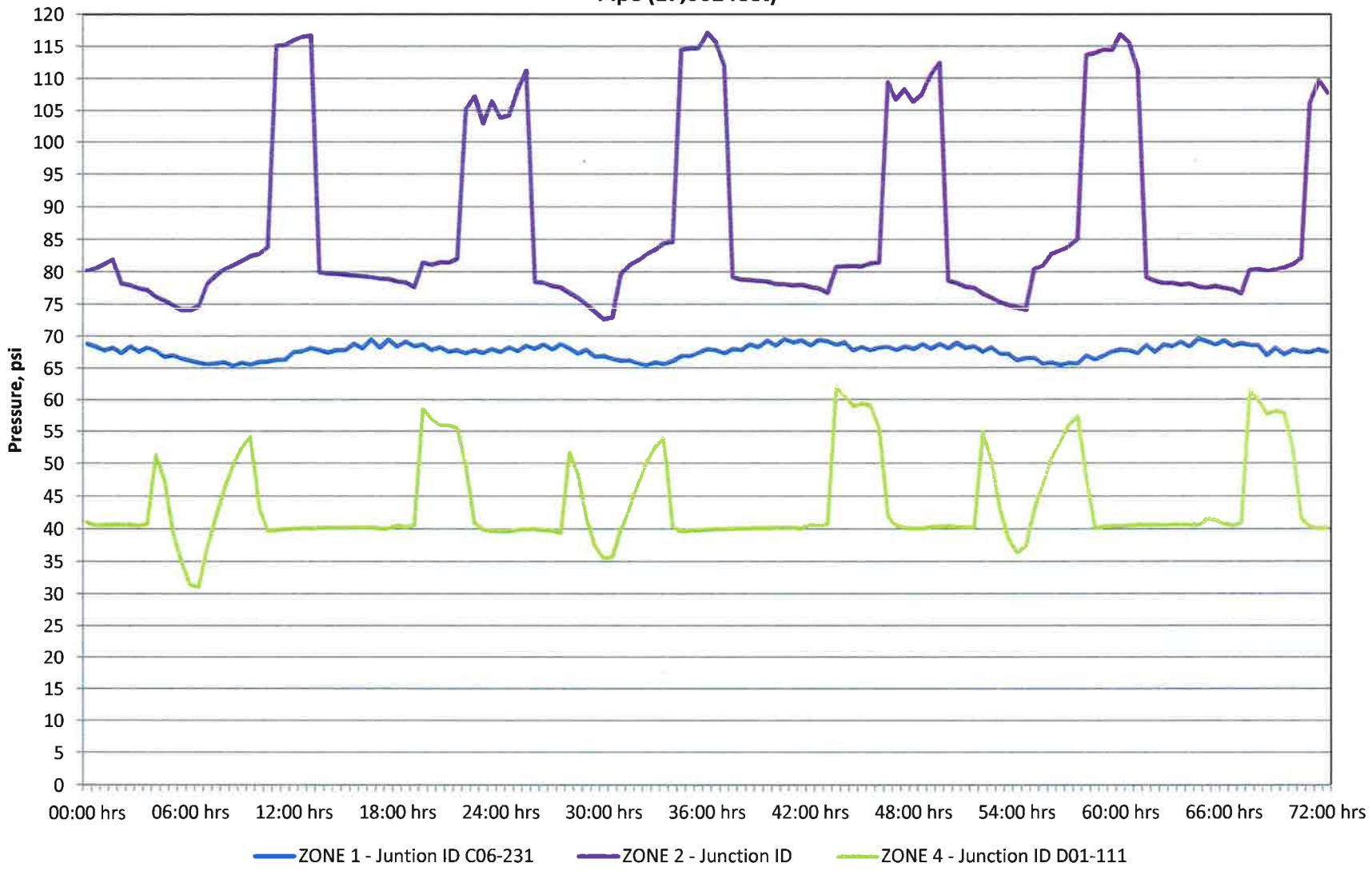
SCENARIO 5

Scenario 5 - Figure 3. Summary of Zone 1 and Zone 4 Reservoirs over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 77 mgd with No Supply from WTP and 20 mgd Sac River Delivered to Pleasant Grove BPS Through 36-inch Diameter Pipe (17,662 feet)

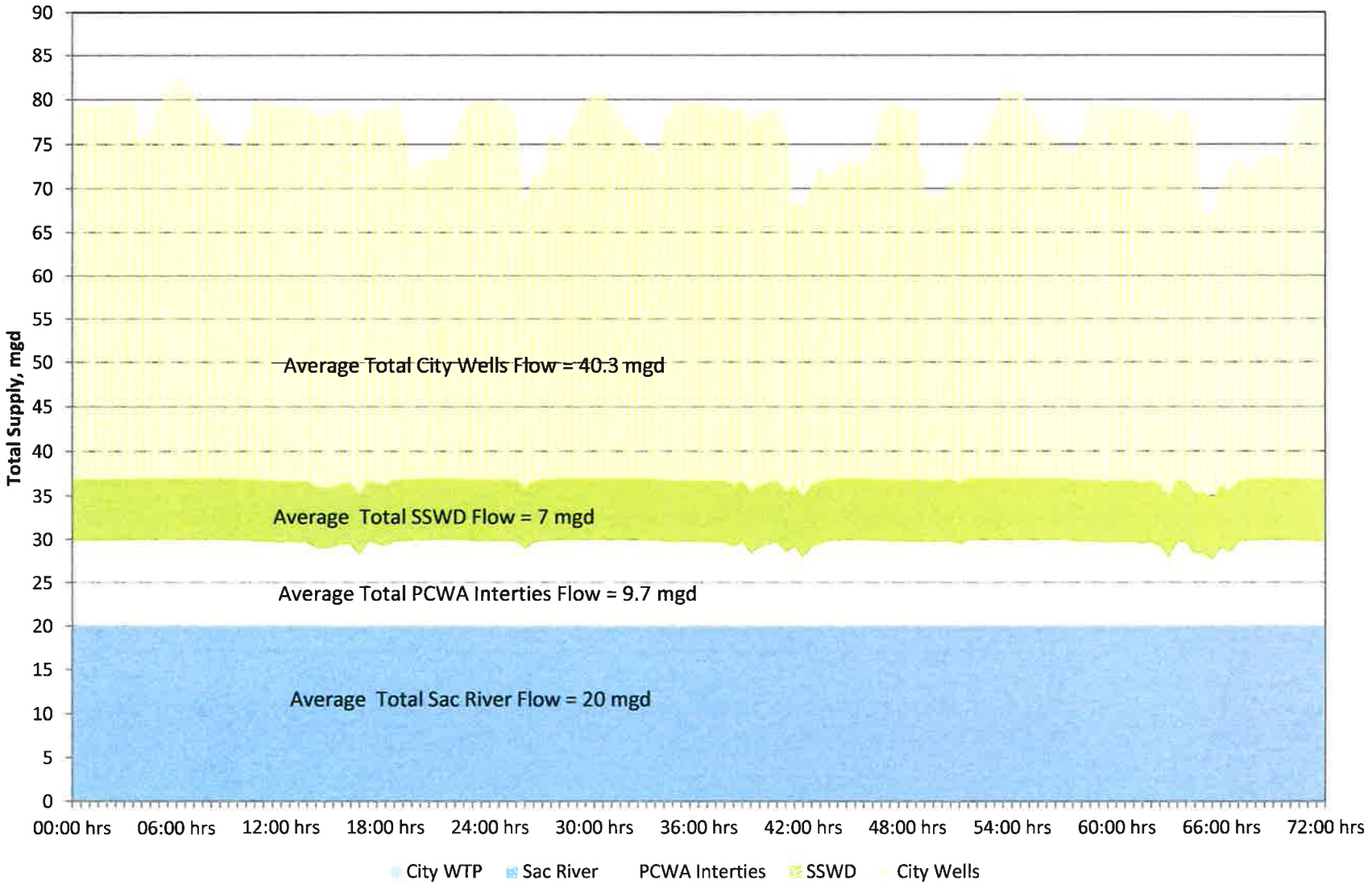


Scenario 5 - Figure 4. System Pressures for Selected Nodes over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 77 mgd with No Supply from WTP and 20 mgd Sac River Delivered to Pleasant Grove BPS Through 36-inch Diameter Pipe (17,662 feet)



SCENARIO 6

Scenario 6 - Figure 1. Summary of Total Supply During 2014 Drought Event
Buildout Maximum Day Demand Condition at 77 mgd
With No Supply from WTP and 20 mgd Sac River Delivered to Pleasant Grove BPS



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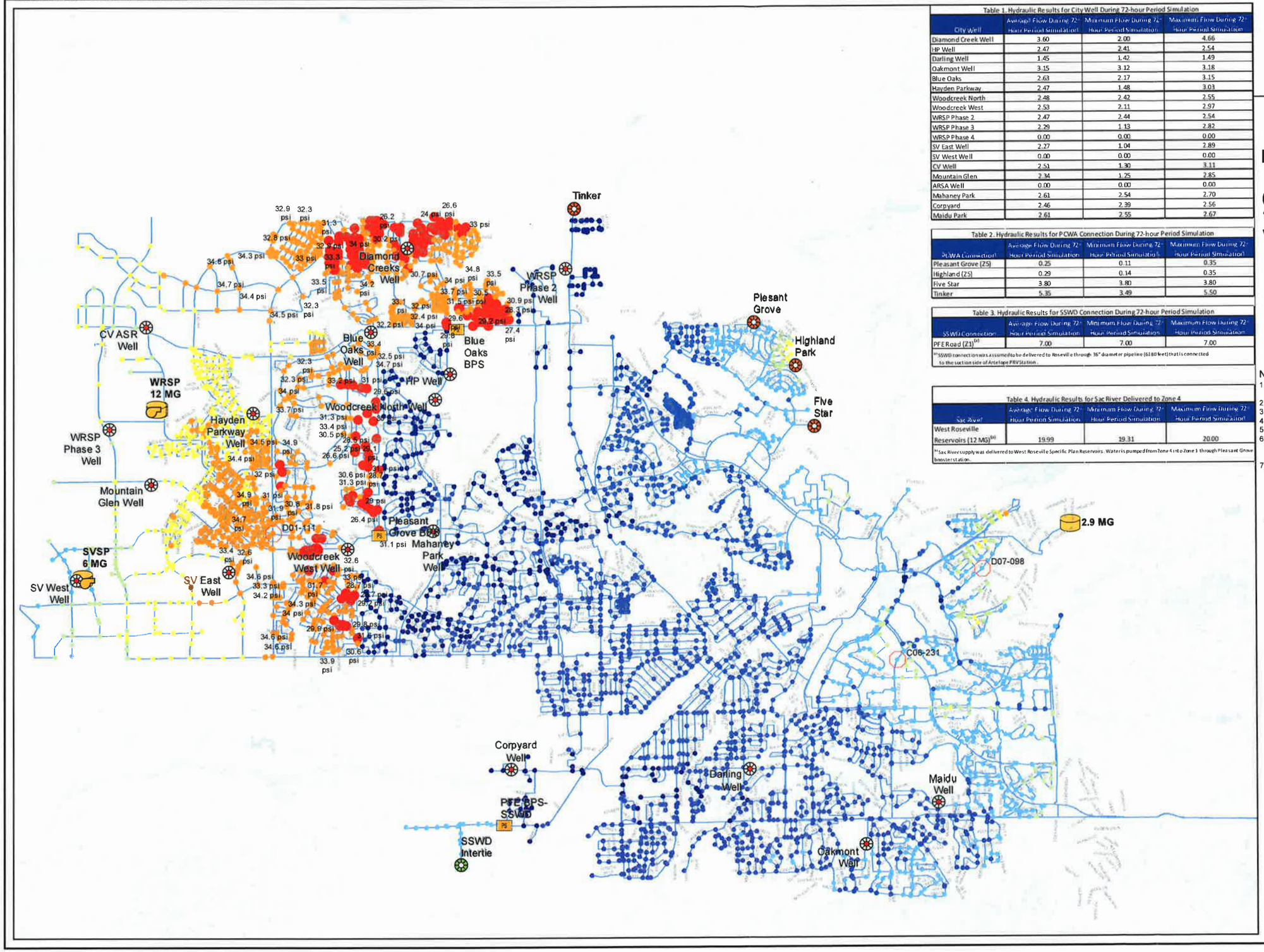

Table 1. Hydraulic Results for City Well During 72-hour Period Simulation

City Well	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Diamond Creek Well	3.60	2.00	4.66
HP Well	2.47	2.41	2.54
Darling Well	1.45	1.42	1.49
Oakmont Well	3.15	3.12	3.18
Blue Oaks	2.63	2.17	3.15
Hayden Parkway	2.47	1.48	3.03
Woodcreek North	2.48	2.42	2.55
Woodcreek West	2.53	2.11	2.97
WRSP Phase 2	2.47	2.44	2.54
WRSP Phase 3	2.29	1.13	2.82
WRSP Phase 4	0.00	0.00	0.00
SV East Well	2.27	1.04	2.89
SV West Well	0.00	0.00	0.00
CV Well	2.51	1.30	3.11
Mountain Glen	2.34	1.25	2.85
ARSA Well	0.00	0.00	0.00
Mahaney Park	2.61	2.54	2.70
Corpyard	2.46	2.39	2.56
Maidu Park	2.61	2.55	2.67

Table 2. Hydraulic Results for PCWA Connection During 72-hour Period Simulation

PCWA Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Pleasant Grove (Z5)	0.25	0.11	0.35
Highland (Z5)	0.29	0.14	0.35
Five Star	3.80	3.80	3.80
Tinker	5.35	3.49	5.50

Table 3. Hydraulic Results for SSWD Connection During 72-hour Period Simulation

SSWD Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
PFE Road (Z1)[a]	7.00	7.00	7.00

[a] SSWD connection was assumed to be delivered to Roseville through 36" diameter pipeline (6180 feet) that is connected to the suction side of Antelope PRV Station.

Table 4. Hydraulic Results for Sac River Delivered to Zone 4

Sac River	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
West Roseville Reservoirs (12 MG)[a]	19.99	19.31	20.00

[a] Sac River supply was delivered to West Roseville Specific Plan Reservoirs. Water is pumped from Zone 4 into Zone 1 through Pleasant Grove booster station.

FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 6 BUILDOUT MAXIMUM DAY DEMAND CONDITION (77 mgd)

(Sac River supply was delivered to Zone 4 at Sierra Vista Station with Hydraulic Head of 305 feet)

N

0 2,250 4,500

Scale in Feet

Notes

1. Buildout Maximum Day Demand is 77 mgd. Buildout demands in hydraulic model were globally reduced to 77 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 9.7 mgd
4. Average total supply from City Wells is 40.3 mgd.
5. Average total supply from SSWD Intertie is 7 mgd.
6. Total supply from Sac River is 20 mgd, and it was delivered to Sierra Vista Station and connected to Zone 4 system at hydraulic head of 305 feet.
7. New pump station at Blue Oaks with design flow of 4500 gpm and design head of 165 feet.

LEGEND

- PCWA Interties
- SSWD Intertie
- New Pump Stations
- City Wells
- Future Booster Pump Station
- Future Reservoirs
- Selected Node

System Pressure:

- Less than 30 psi
- 30 to 40 psi
- 40 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi

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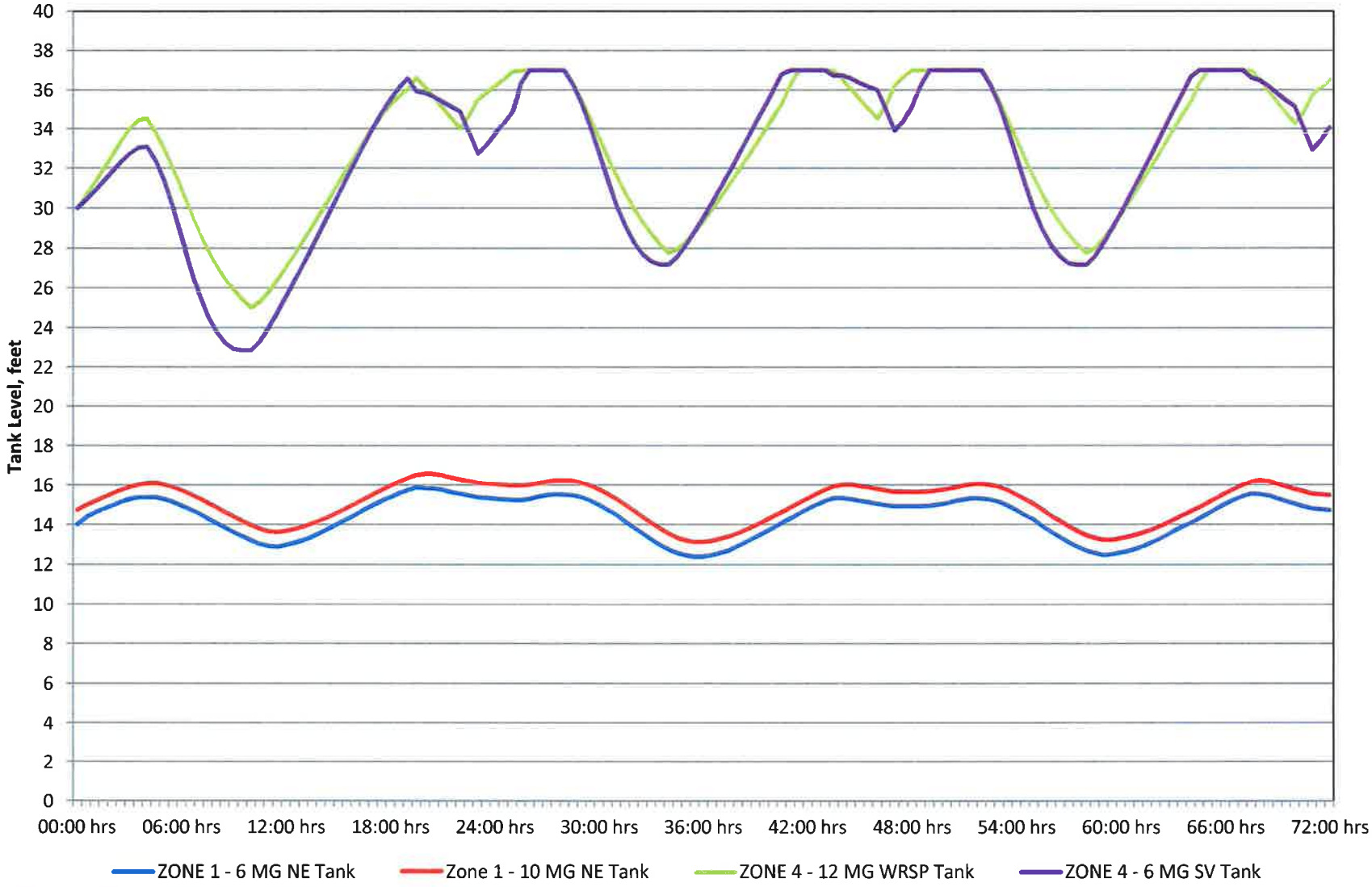
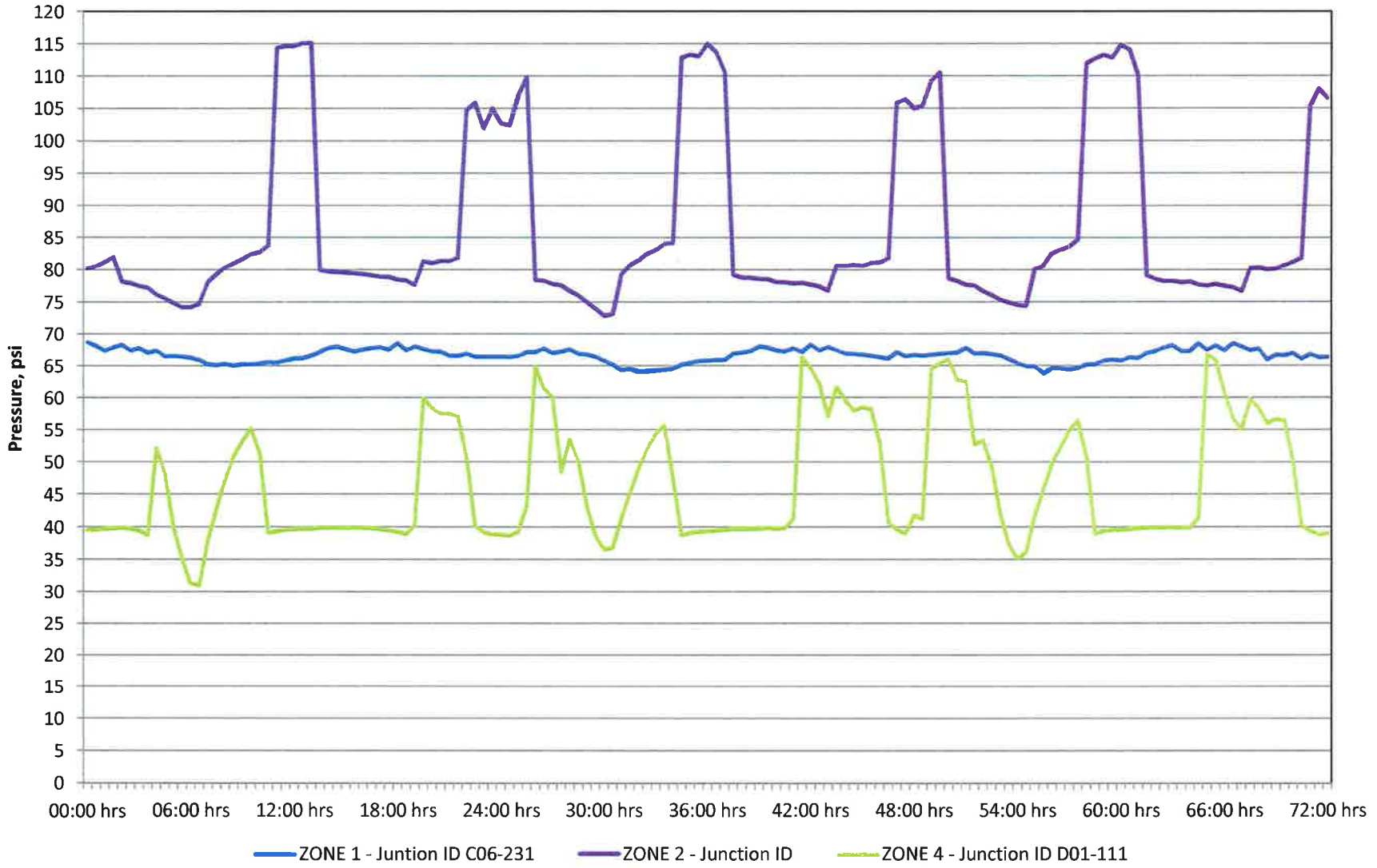
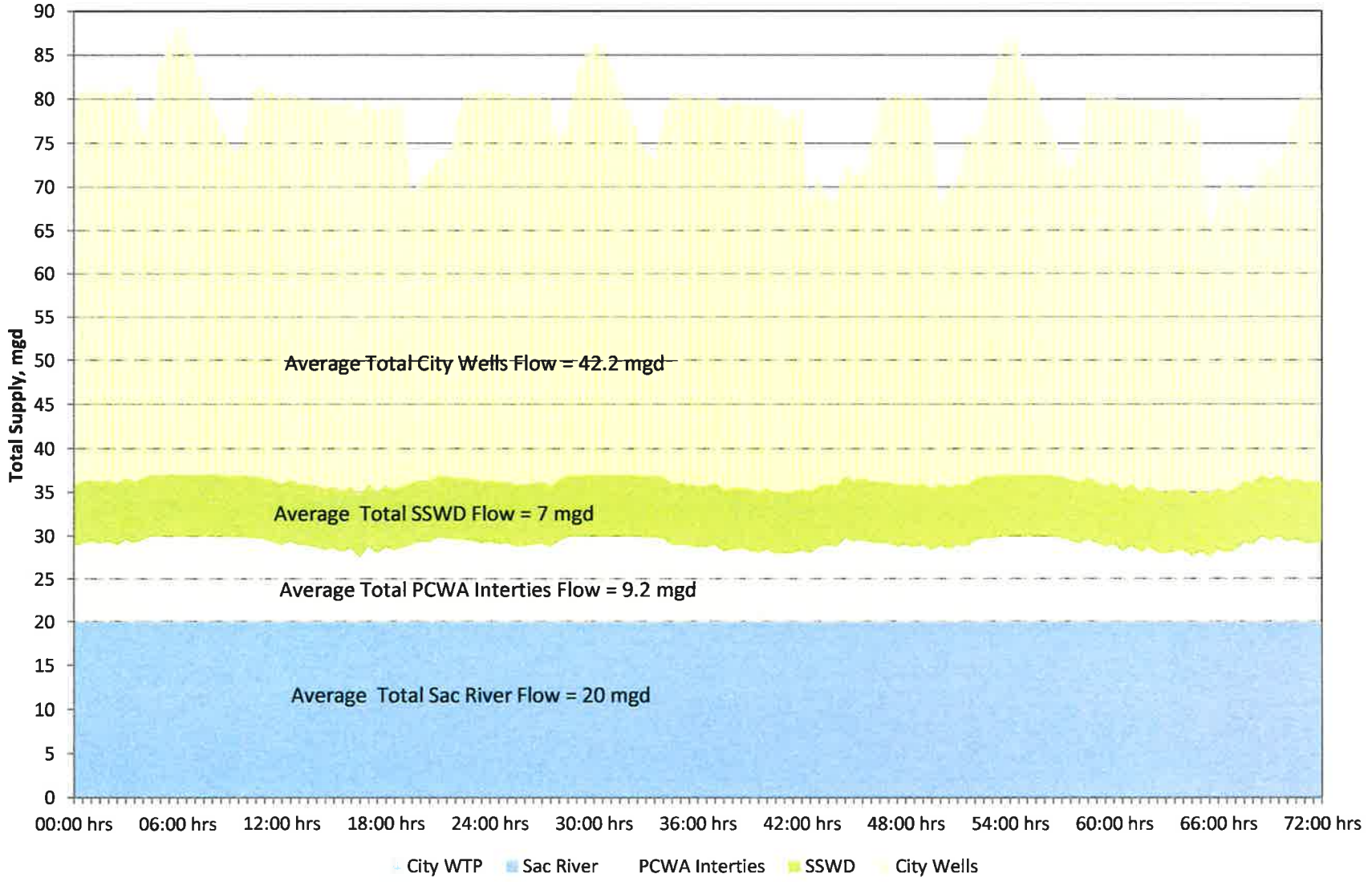
Scenario 6 - Figure 3. Summary of Zone 1 and Zone 4 Reservoirs over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 77 mgd with No Supply from WTP and 20 mgd Sac River Delivered to Pleasant Grove BPS



Scenario 6 - Figure 4. System Pressures for Selected Nodes over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 77 mgd with No Supply from WTP and 20 mgd Sac River Delivered to Pleasant Grove BPS



Scenario 7 - Figure 1. Summary of Total Supply During 2014 Drought Event
Buildout Maximum Day Demand Condition at 77 mgd
With No Supply from WTP and 20 mgd Sac River Delivered to Sierra Vista and Expand Zone 4 Service Area



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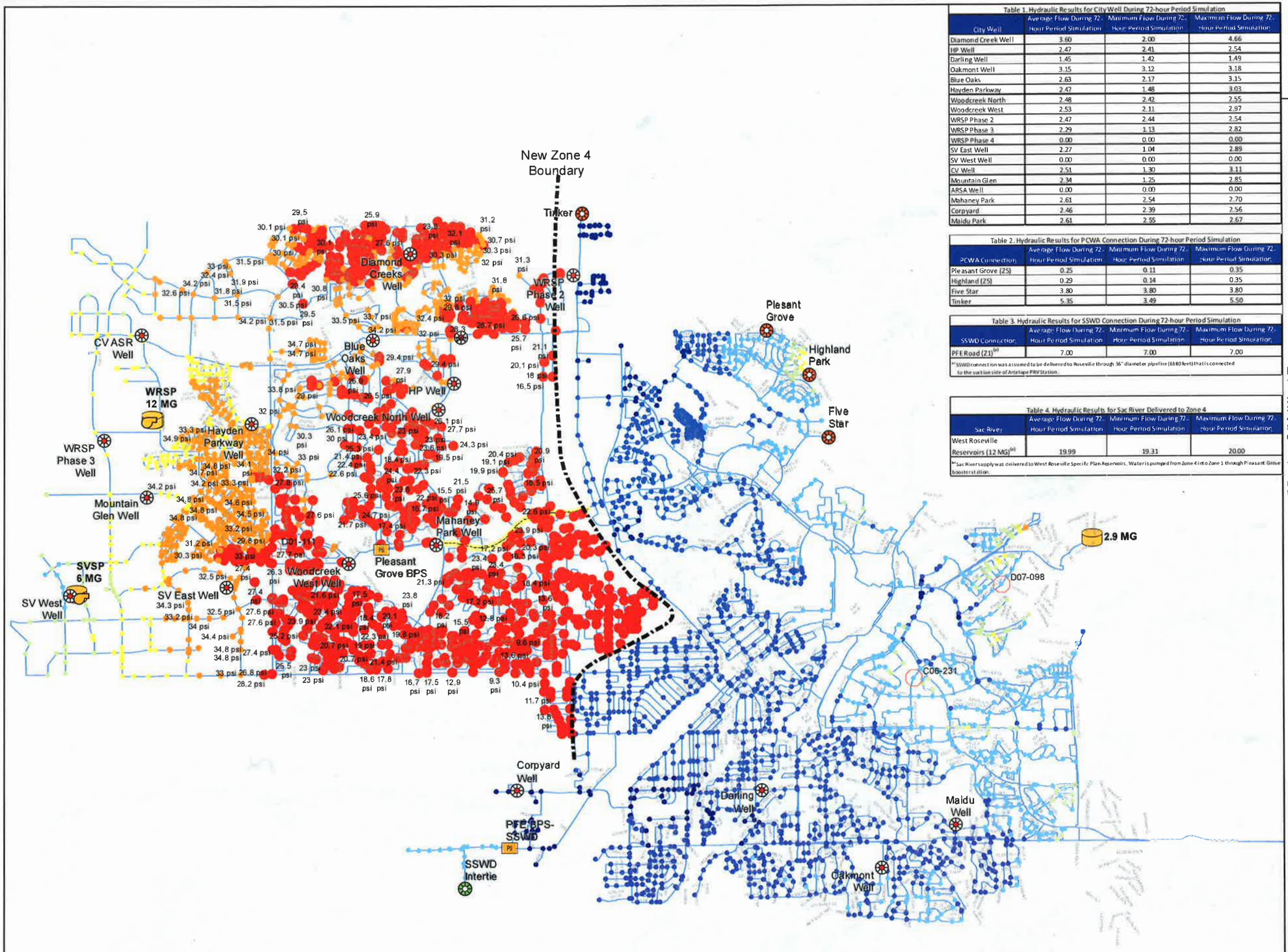


Table 1. Hydraulic Results for City Well During 72-hour Period Simulation

City Well	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Diamond Creek Well	3.60	2.00	4.66
HP Well	2.47	2.41	2.54
Darling Well	1.45	1.42	1.49
Oakmont Well	3.15	3.12	3.18
Blue Oaks	2.63	2.17	3.15
Hayden Parkway	2.47	1.48	3.03
Woodcreek North	2.48	2.42	2.55
Woodcreek West	2.53	2.11	2.97
WRSP Phase 2	2.47	2.44	2.54
WRSP Phase 3	2.29	1.13	2.82
WRSP Phase 4	0.00	0.00	0.00
SV East Well	2.27	1.04	2.89
SV West Well	0.00	0.00	0.00
CV Well	2.51	1.30	3.11
Mountain Glen	2.34	1.25	2.85
ARSA Well	0.00	0.00	0.00
Mahaney Park	2.61	2.54	2.70
Corpyard	2.46	2.39	2.56
Maidu Park	2.61	2.55	2.67

Table 2. Hydraulic Results for PCWA Connection During 72-hour Period Simulation

PCWA Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Pleasant Grove (25)	0.25	0.11	0.35
Highland (25)	0.29	0.14	0.35
Five Star	3.80	3.80	3.80
Tinker	5.35	3.49	5.50

Table 3. Hydraulic Results for SSWD Connection During 72-hour Period Simulation

SSWD Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
PFE Road (21)[a]	7.00	7.00	7.00

[a] SSWD connection was assumed to be delivered to Roseville through 36" diameter pipeline (6380 feet) that is connected to the suction side of Antelope PRV Station.

Table 4. Hydraulic Results for Sac River Delivered to Zone 4

Sac River	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
West Roseville Reservoirs (12 MG)[a]	19.99	19.31	20.00

[a] Sac River supply was delivered to West Roseville Specific Plan Reservoirs. Water is pumped from Zone 4 into Zone 1 through Pleasant Grove booster station.

FIGURE 2

City of Roseville Dry Year Evaluation

SCENARIO 7 BUILDOUT MAXIMUM DAY DEMAND CONDITION (77 mgd)

(Sac River supply was delivered to Zone 4 at Sierra Vista Station with Hydraulic Head of 305 feet)

N

0 2,250 4,500

Scale in Feet

Notes

1. Buildout Maximum Day Demand is 77 mgd. Buildout demands in hydraulic model were globally reduced to 77 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 9.2 mgd
4. Average total supply from City Wells is 42.2 mgd.
5. Average total supply from SSWD Intertie is 7 mgd.
6. Total supply from Sac River is 20 mgd, and it was delivered to Sierra Vista Station and connected to Zone 4 system at hydraulic head of 305 feet.
7. Expand Zone 4 service area to the east along Industrial Boulevard and Washington.
8. New Zone 1 pipeline (approx. 7892 feet).
9. New secondary PRV stations and mutiple isolation valves between new Zone 4 and Zone 1.

LEGEND

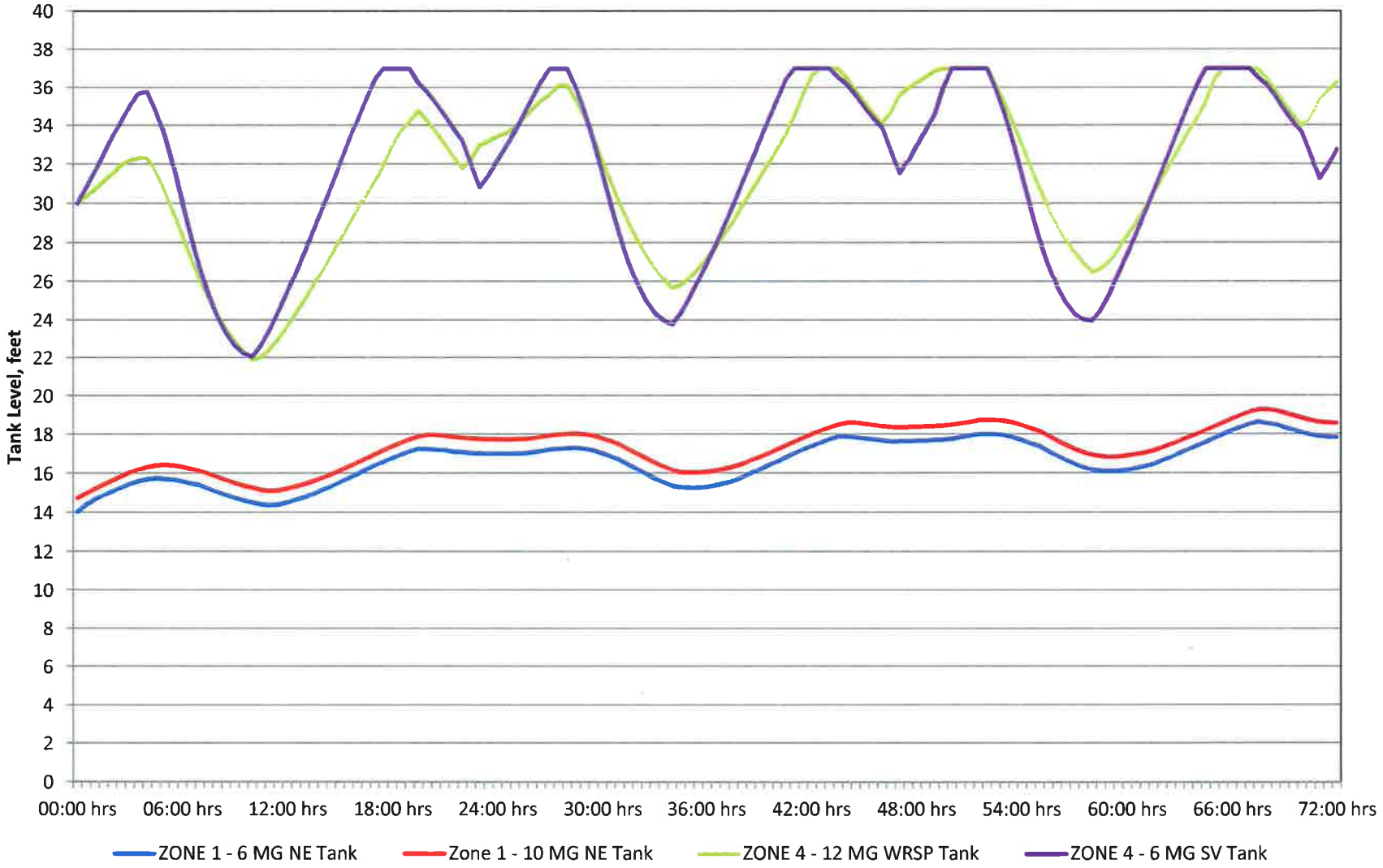
- PCWA Interties
- SSWD Intertie
- New Pump Stations
- City Wells
- Future Booster Pump Station
- Future Reservoirs
- Selected Node

System Pressure:

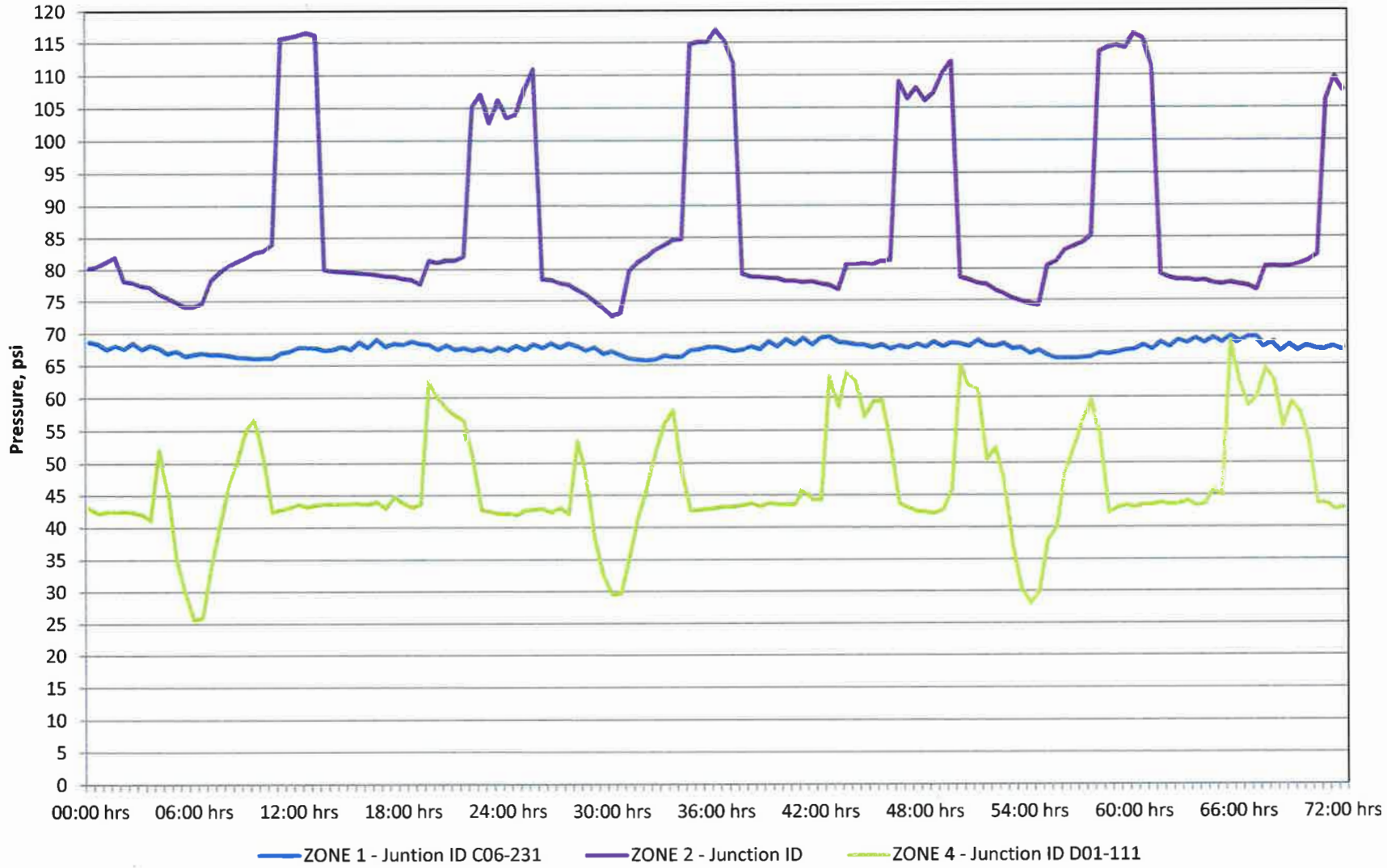
- Less than 30 psi
- 30 to 40 psi
- 40 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi

CITY OF ROSEVILLE

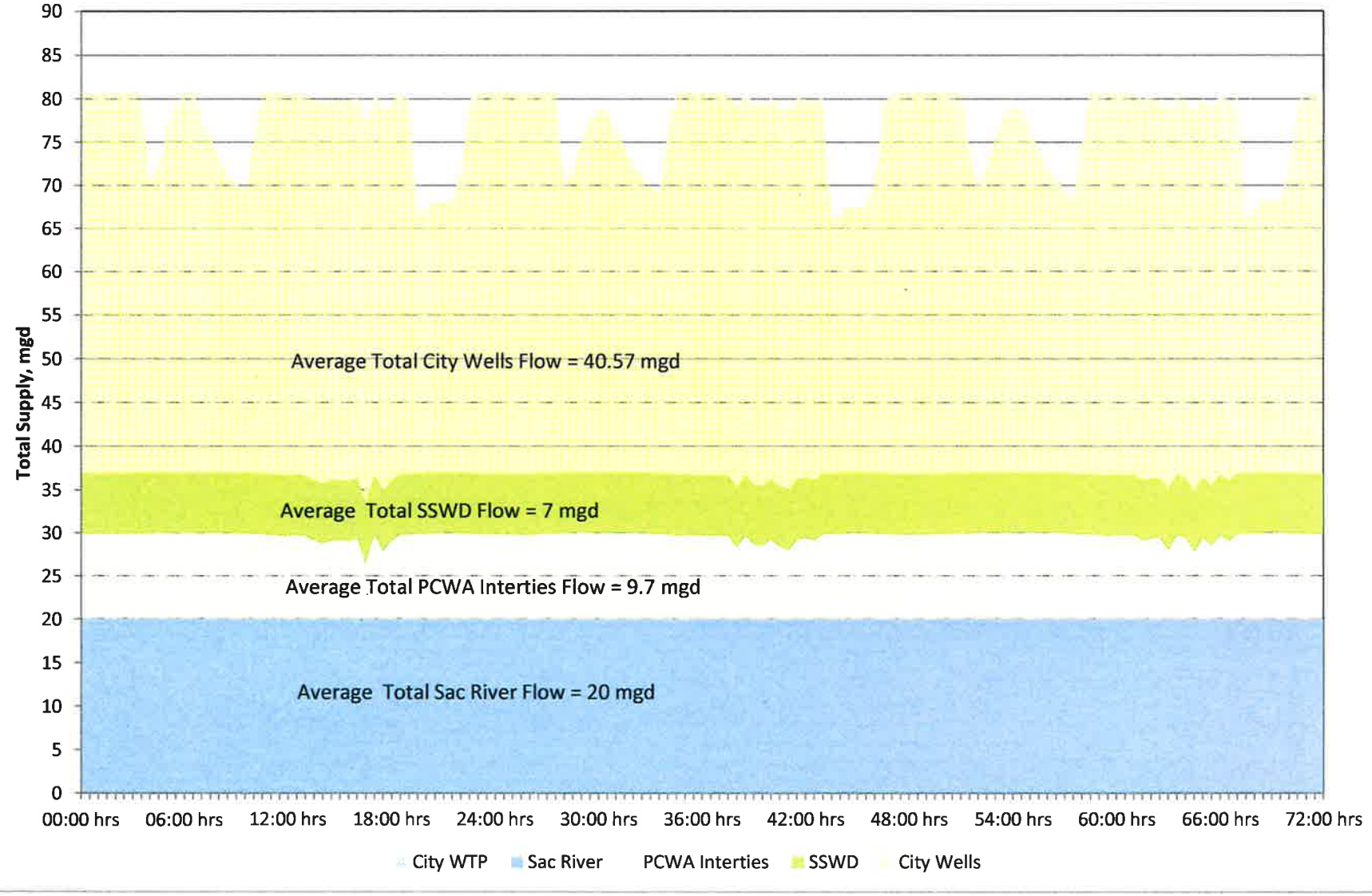
Scenario 7 - Figure 3. Summary of Zone 1 and Zone 4 Reservoirs over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 77 mgd with No Supply from WTP and 20 mgd Sac River Delivered to Sierra Vista and Expand Zone 4 Service Area



Scenario 7 - Figure 4. System Pressures for Selected Nodes over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 77 mgd with No Supply from WTP and 20 mgd Sac River Delivered to Sierra Vista and Expand Zone 4 Service Area



Scenario 8 - Figure 1. Summary of Total Supply During 2014 Drought Event
Buildout Maximum Day Demand Condition at 77 mgd
With No Supply from WTP and 20 mgd Sac River Delivered to Baseline and Woodcreek Oaks (Zone 1)



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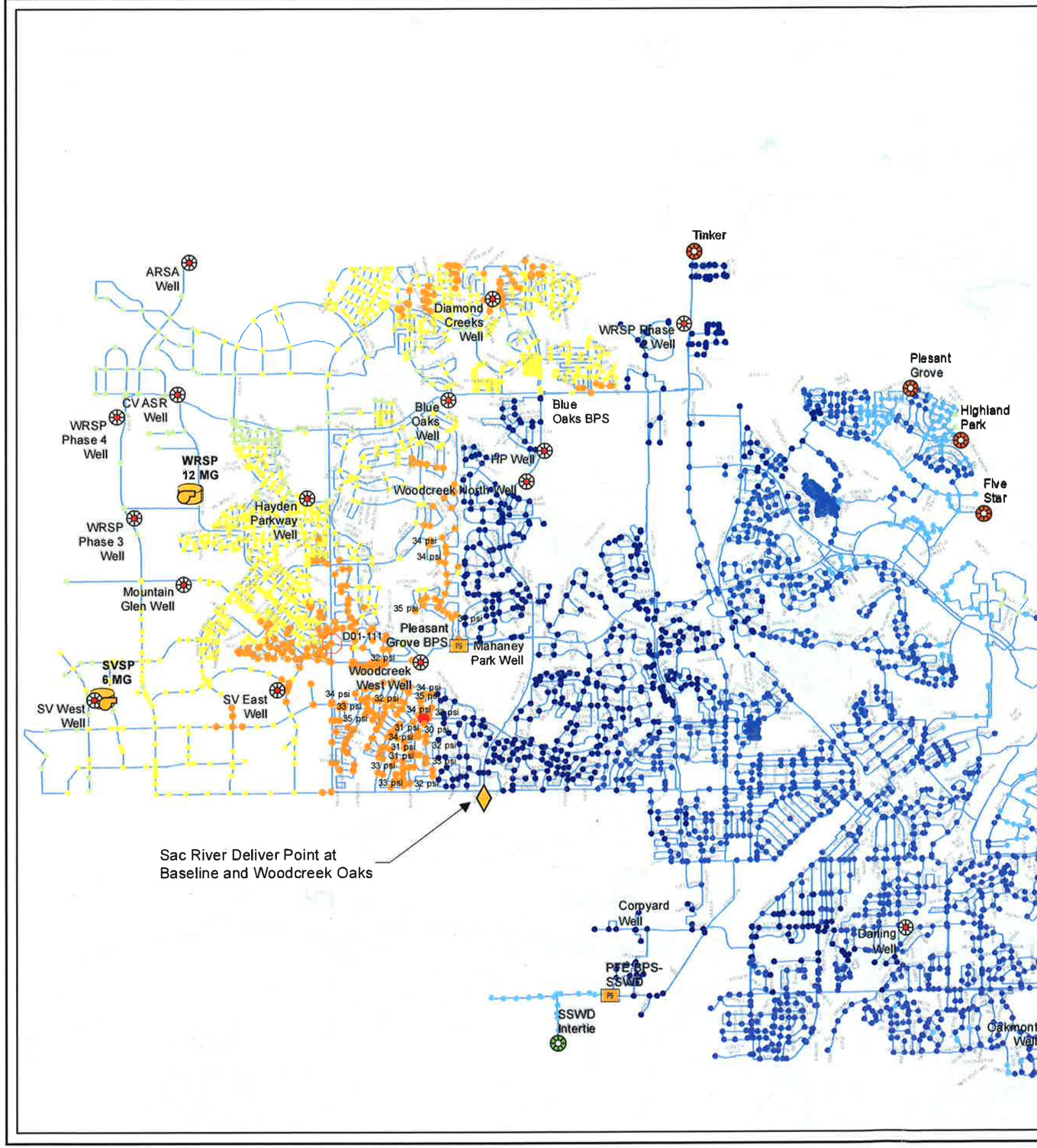

Table 1. Hydraulic Results for City Well During 72-hour Period Simulation

City Well	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Diamond Creek Well	3.47	1.72	4.17
HP Well	2.49	2.42	2.58
Darling Well	1.45	1.40	1.49
Oakmont Well	3.14	3.11	3.18
Blue Oaks	2.61	2.14	2.86
Hayden Parkway	2.52	1.54	2.85
Woodcreek North	2.49	2.41	2.58
Woodcreek West	2.52	2.04	2.74
WRSP Phase 2	2.49	2.43	2.56
WRSP Phase 3	2.44	1.35	2.80
WRSP Phase 4	2.52	1.54	2.85
SV East Well	2.46	1.36	2.83
SV West Well	2.35	1.10	2.78
CV Well	2.57	1.42	2.95
Mountain Glen	2.53	1.54	2.87
ARSA Well	2.52	1.39	2.89

Table 2. Hydraulic Results for PCWA Connection During 72-hour Period Simulation

PCWA Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
Pleasant Grove (Z5)	0.25	0.11	0.35
Highland (Z5)	0.29	0.14	0.35
Five Star	3.80	3.80	3.80
Tinker	5.33	2.43	5.50

Table 3. Hydraulic Results for SSWD Connection During 72-hour Period Simulation

SSWD Connection	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
PFE Road (Z1)[a]	7.00	7.00	7.00

[a] SSWD connection was assumed to be delivered to Roseville through 36" diameter pipeline (6180 feet) that is connected to the suction side

Table 4. Hydraulic Results for Sac River Delivered to Zone 4

Sac River	Average Flow During 72-Hour Period Simulation	Minimum Flow During 72-Hour Period Simulation	Maximum Flow During 72-Hour Period Simulation
West Roseville Reservoirs (12 MG)[a]	20.00	20.00	20.00

[a] Sac River supply was delivered to West Roseville Specific Plan Reservoirs. Water is pumped from Zone 4 into Zone 1 through Pleasant Grove booster station.

FIGURE 2

City of Roseville
Dry Year Evaluation

SCENARIO 8 BUILDOUT MAXIMUM DAY DEMAND CONDITION (77 mgd)

(Sac River supply was delivered to Zone 1 at Baseline and Woodcreek Oaks)

N

0 2,250 4,500

Scale in Feet

Notes

1. Buildout Maximum Day Demand is 77 mgd. Buildout demands in hydraulic model were globally reduced to 77 mgd.
2. Average total supply from Water Treatment Plant is 0 mgd.
3. Average total supply from PCWA Interties is 9.7 mgd
4. Average total supply from City Wells is 40.6 mgd.
5. Average total supply from SSWD Intertie is 7 mgd.
6. Total supply from Sac River is 20 mgd, and it was delivered to the intersection of Baseline and Woodcreek Oaks at hydraulic head of 405 feet.

LEGEND

- PCWA Interties
- SSWD Intertie
- New Pump Stations
- City Wells
- Future Booster Pump Station
- Future Reservoirs
- Selected Node

System Pressure:

- Less than 30 psi
- 30 to 40 psi
- 40 to 50 psi
- 50 to 60 psi
- 60 to 80 psi
- 80 to 100 psi
- Greater than 100 psi

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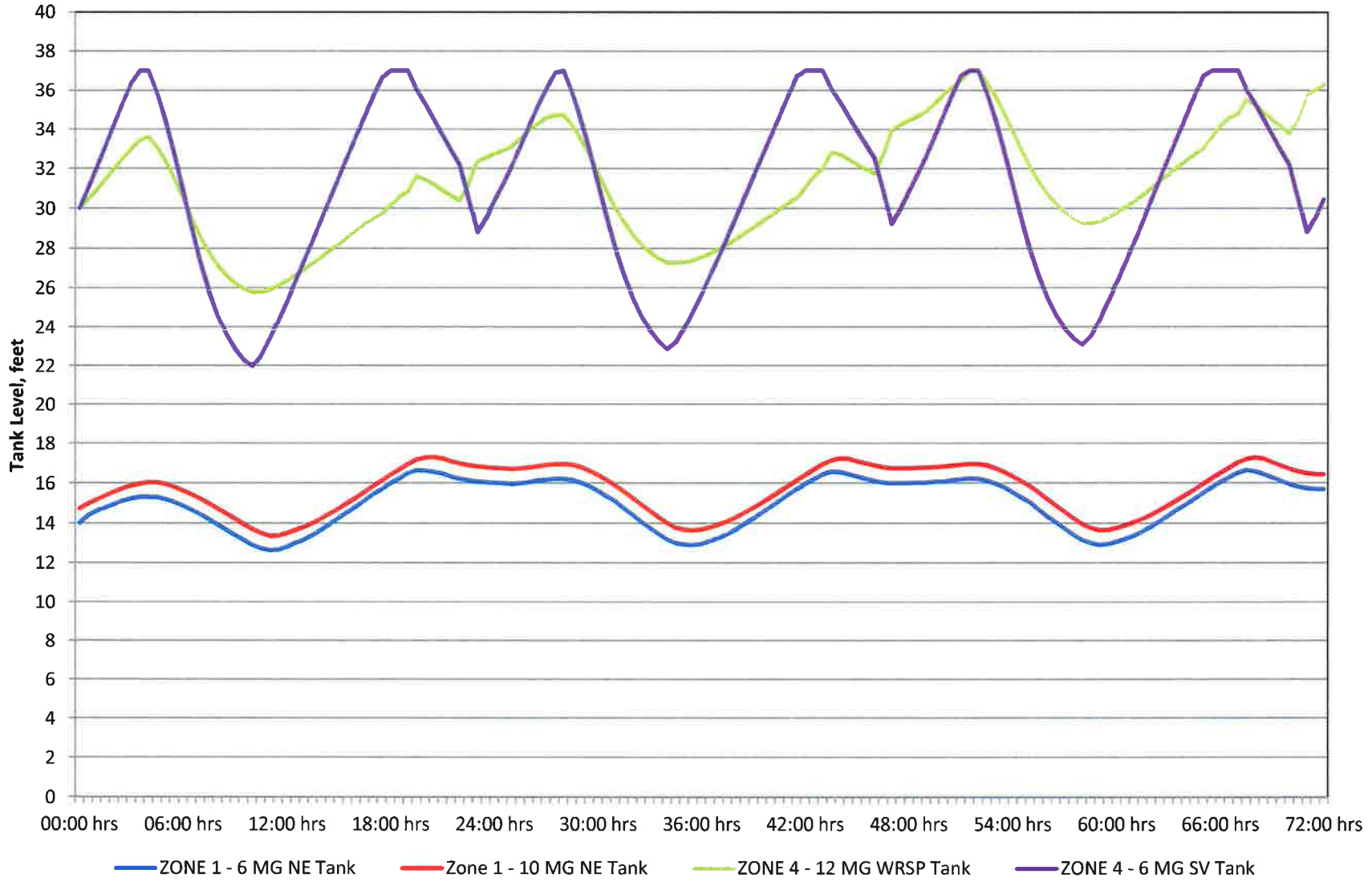
Scenario 8 - Figure 3. Summary of Zone 1 and Zone 4 Reservoirs over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 77 mgd with No Supply from WTP and 20 mgd Sac River Delivered to Baseline and Woodcreek Oaks (Zone 1)



Scenario 8 - Figure 4. System Pressures for Selected Nodes over 72-hour Period Simulation For 2014 Drought Event Under Buildout Maximum Day Demand Condition at 77 mgd with No Supply from WTP and 20 mgd Sac River Delivered to Baseline and Woodcreek Oaks (Zone 1)