Folsom Plan Area Water System Master Plan

Prepared for
City of Folsom
Folsom, CA
October 7, 2014

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October 7, 2014

Brown AND Caldwell

Mr. R. Todd Eising
City of Folsom
Department of Utilities
50 Natoma Street
Folsom, California 95630 145958-002

Subject: Folsom Plan Area Water Master Plan

Dear Mr. Eising:

I am pleased to submit to you the updated final of the Folsom Plan Area Water Master Plan. We have incorporated a brief discussion of recycled water storage tank phasing as well as updated the supply transmission mains to zones FPA 3, FPA 4, and FPA 5 to feed directly to the respective storage tanks. Pipeline diameters have been updated as necessary for the change in the supply transmission main approach. If you have any questions, please do not hesitate to contact me at (916) 853-5353.

Sincerely,

BROWN AND CALDWELL

Melanie Holton, P.E.
Project Manager

REGISTERED PROFESSIONAL ENGINEER
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No. 64983
CIVIL
STATE OF CALIFORNIA

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List of Abbreviations

ac-ft	acre-feet
ADD	average day demand
Agreement	Water Supply and Facilities Financing Plan and Agreement
BPS	booster pump station
City	City of Folsom
CVP	Central Valley Project
EID	El Dorado Irrigation District
FPA	Folsom Master Plan
fps	feet per second
GET	Groundwater Extraction and Treatment
GPM	gallons per minute
GSWC	Golden State Water Company
HGL	hydraulic grade line
Hp	horse power
in	inches
Master Plan	water system master plan
MDD	maximum day demand
MG	million gallons
mgd	million gallons per day
PRV	pressure reducing valve
psi	pounds per square inch
SBx7-7	Senate Bill x7-7
SCADA	supervisory control and data acquisition
SCWC	Southern California Water Company
WTP	water treatment plant

Section 1

Introduction

This document is a water system master plan (Master Plan) for the future Folsom Plan Area (FPA).

1.1 Purpose and Background

The purpose of this master plan is to present and summarize the FPA land use, water demand, and water supply as well as present the ultimate FPA backbone water system layout and provide guidelines for the development of the entire water system in the future. The required ultimate backbone water system infrastructure improvements in the FPA and the phasing of initial FPA facilities are described. This master plan also describes the City of Folsom's (City) water system design criteria and provides phasing criteria guidelines.

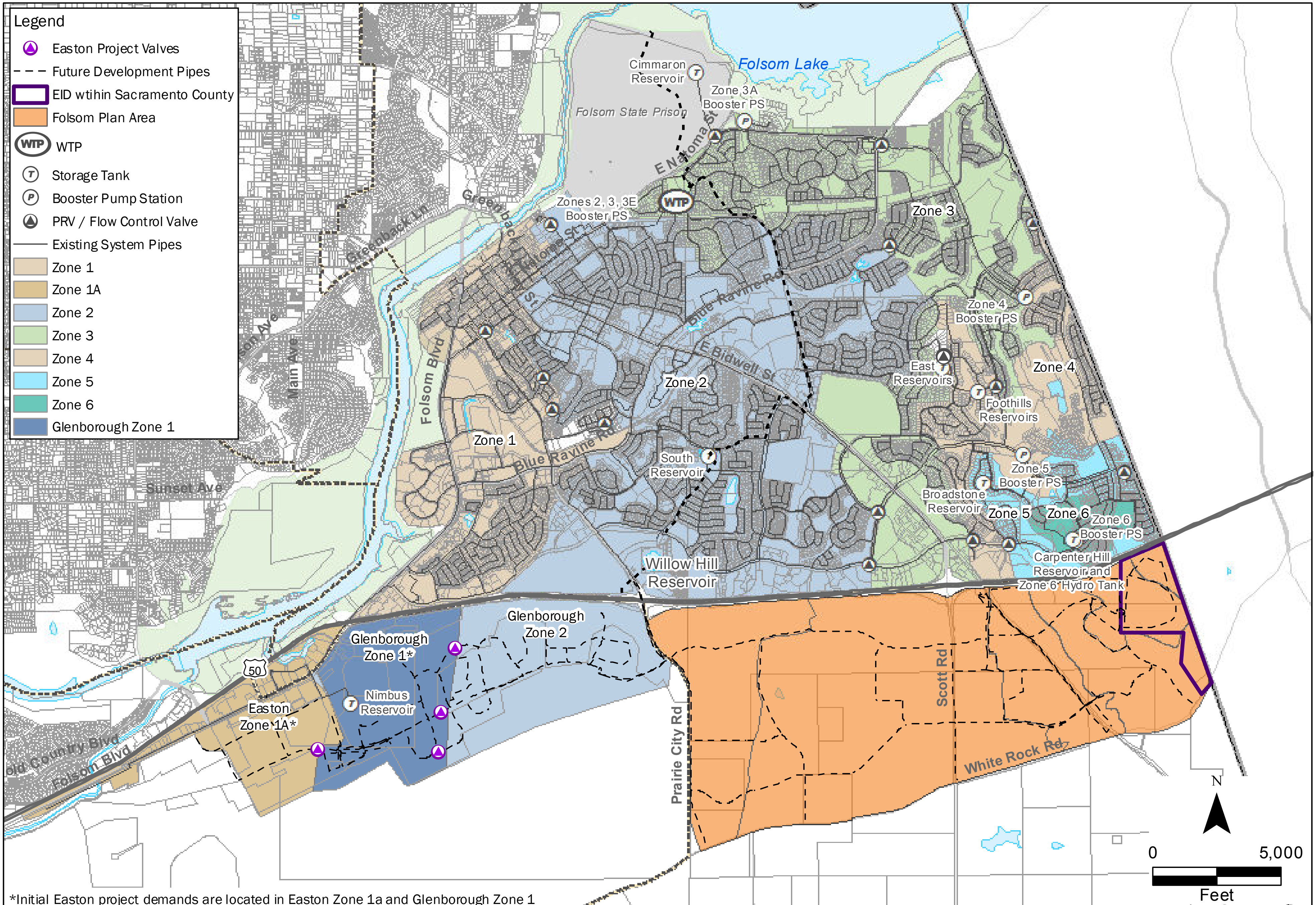
The conceptual main backbone water system consists of pipelines 12 inches (in) in diameter and larger as well as the associated appurtenances such as pressure reducing valves, storage tanks, and booster pump stations. The location of pipelines in the backbone water system are based on future backbone roads and utility easement locations as identified on a road alignment map provided by McKay and Somps (See Appendix A). The conceptual backbone water system is defined as the system required to transmit water supply to each development area within the FPA. The backbone water system must be looped to prevent pipeline dead ends that could result in water quality issues. Looping of the backbone piping will be a requirement for the design of the local distribution system piping when constructed. Locations for the future storage tanks and booster pump stations are based when possible on designated storage tank and booster pump station sites from a land use plan provided by MacKay and Somps (See Appendix A).

1.2 System Description

The FPA is located south of the City and Highway 50, bounded by the Sacramento/El Dorado County boundary to the east and Prairie City Road to the west. The FPA water system is designed for the normal water supply to enter the FPA from the City's existing Zone 3, at Scott Rd near HWY 50.

- The initial system maximum day demand (MDD) is up to 2 million gallons per day (mgd)
- The ultimate FPA MDD is up to 8.8 mgd.
- The ultimate FPA MDD of 8.8 mgd does not include the 0.4 mgd FPA demand within the El Dorado Irrigation District (EID) service area within Sacramento County. EID will provide water supply to this area.

A map of the existing City water system and the FPA boundary is shown on Figure 1-1. The EID service area within Sacramento County is also shown on Figure 1-1. For consistency with the City's other concurrent planning efforts, the Easton Project development is shown on the figures in this document and included in the water demand table in Section 2. The Easton Project development is located south of Highway 50 and west of Prairie City Road, adjacent to the FPA.



PROJECT	SITE	
145958	**City of Folsom, California**	**Figure 1-1**
DATE	TITLE	
7/2/14	**Existing System, Future Easton Project, and Future Folsom Plan Area**	

1.3 Limitations of this Document

The water system infrastructure improvements recommended in this document are based on the results of the City's Innovyze InfoWater hydraulic model. The model was updated and operationally calibrated in May 2010 based on 2009 maximum day supervisory control and data acquisition (SCADA) data and operational set points. A field calibration including flow tests or field site visits to City facilities to confirm model calibration was not conducted as part of the May 2010 model update and operational calibration. As part of this project the Zone 2 and Zone 3 booster pump stations (BPS) were field visited to confirm model pumps at these locations match field conditions. The model has not been compared to City GIS data or updated to reflect updates in GIS data since the May 2010 model update. The recommendations in this document are planning level recommendations and should be further analyzed and refined through the pre-design process to determine exact improvement locations and required modifications necessary as a result of field conditions and limitations prior to initiation of design or construction of the recommended improvements in this document.

Section 2

Water Demand and Supply

This section describes the City's projected water demand and water supply.

2.1 Water Demands

Water demands for the existing City service area and the FPA are shown in Table 2-1. The Easton Project demands are also shown in this table for continuity with other City planning efforts. Infrastructure required to serve the Easton Project is not included in this analysis. For this analysis a 20 percent reduction in the existing and future 2018 demands presented in the master plan are used to evaluate the water system. The 2018 demands were calculated in the City's master plan (West Yost and Associates, 2008); however, the demands did not account for the following water use reduction measures:

- Metered billing – the City has not previously billed residential water customers outside of the Ashland area using metered rates and has begun to do so in 2013. This has been shown to reduce water consumption.
- Mandated water conservation – the state requires a 20 percent reduction in water consumption by the year 2020 per Senate Bill x7-7 (SBx7-7). The City is implementing measures to comply with this requirement which will result in reduced water demands.

The FPA demands are based on demand by parcel provided by MacKay and Somps in Appendix A. The diurnal demand pattern used in the extended period hydraulic analysis is based on the diurnal demand patter observed in Zone 3 in the existing system. Appendix B contains the hourly data and graph of the existing system diurnal demand patterns on which the FPA demand pattern is based.

This master plan assumes 100 percent of the FPA demands are met with a potable source. For information purposes Table 2-1 presents the potential recycled water use within the FPA. The potential recycled water maximum day and peak hour demand is based on the 2014 FPA Recycled Water Analysis 2.0 (J. Crowley Group, 2014) included in Appendix C. The potential annual recycled water demand of 1,200 acre-feet (ac-ft) is assumed to reduce the overall and peak water use due to offsetting otherwise potable peak irrigation demands with recycled water supply. The total potable water demand is shown two ways: (1) assuming no use of recycled water to offset potable demands and (2) assuming FPA recycled water demands reduce the total potable demand in the ultimate system.

Table 2-1. Water Demands									
Year	City of Folsom (existing system)[a]				Easton Project	FPA		Total potable demand	
	2005	2009	2018 (Master Plan)	This analysis[b]	Ultimate	Ultimate (potable, no recycled water)	Potential recycled water[c]	Ultimate (This analysis-no use of recycled water)	Ultimate - with FPA recycled water offset[c]
Average annual, ac-ft/yr	22,401	25,063	25,762	20,610	3,360	5,421	1,200	29,391	28,191
Average day, mgd	20	22.4	23.0	18.4	3.0	4.8	1.1	26.2	25.2
ADD/MDD peaking factor	1.90	1.47	1.87	1.87	2.23	1.8	2.6	1.91	1.91
Maximum day, mgd (gpm)	38 (26,388)	33 (22,896)	43 (29,861)	34.4 (23,889)	6.7 (4,670)	8.8 (6,096)	2.8 (1,954)	49.9 (34,653)	48.0 (33,300)
Peak-hour, gpm	47,222	41,250	54,167	43,334	8,407	9,717	5,862	61,458	59,375

ADD = average day demand

MDD = maximum day demand

[a] *Demands based on area within current City water service area proper boundaries. This analysis does not include services in the Ashland water system located north of the American River, which is supplied water from San Juan Water District.*

[b] *The demands used in this analysis are based on 20 percent reduction of Master Plan 2018 demands.*

[c] *Potential annual recycled water demand of 1,200 ac-ft provided by City staff on 5/29/1014. Potential recycled water demand within the FPA assumed to reduce the overall and peak water use due to offsetting peak irrigation demands with recycled water supply.*

Table 2-2 provides the estimated maximum day demand by pressure zone in the existing system and the FPA. The FPA demands by pressure zone and as allocated in the hydraulic model are based on the parcel demands (See Appendix A). The potential recycled water maximum day demand and the potable maximum day demand if recycled water is used as a potable demand offset is also presented by pressure zone.

Table 2-2. FPA Maximum Day Demand by Pressure Zone						
FPA zone	Total potable maximum day demand		Potential recycled water maximum day demand		Potable maximum day demand with recycled water offset	
	mgd	gpm	mgd	gpm	mgd	gpm
2	3.1	2,130	1.1	735	2.0	1,395
3	3.5	2,420	1.3	919	2.2	1,501
4	1.0	720	0.4	301	0.6	419
5	0.8	550	--	--	0.8	550
6	0.4	280	--	--	0.4	280
Total	8.8	6,100	2.8	1,954	6.0	4,145

2.2 Water Supply

The City's primary water supply is surface water supply derived from many different water rights. During the annexation of the Folsom Plan Area two primary water rights were identified to make up the supply for the Folsom Plan Area which include;

- A pre-1914 appropriative water right for 5,000 ac-ft per that is also based on Natoma's pre-1914 appropriative right from the South Fork of the American River. In November 1994, the City executed a contract with Southern California Water Company-Folsom Division (SCWC) (now referred to as Golden State Water Company (GSWC) under which the City acquired the right to lease 5,000 ac-ft of water per year (of GSWC's remaining 10,000 ac-ft per year under the original Natoma purchase) for an indefinite period. This right is held with GSWC pursuant to a co-tenancy agreement. This water right was also formally recognized in the settlement agreement between Reclamation and the City of Folsom. Under this agreement, Reclamation delivers this entire water supply without reduction on a permanent basis.
- A portion of a pre-1914 appropriative water right for 22,000 ac-ft per year from the South Fork of the American River established by the Natoma Water Company (Natoma) in 1851. Natoma's original pre-1914 water right established a maximum diversion rate of 60 cfs and a maximum allocation of 32,000 ac-ft per year. This right is held with Golden State Water Company pursuant to a co-tenancy agreement. This water right was formally recognized in the settlement agreement between the U.S. Bureau of Reclamation ("Reclamation") and the City of Folsom.

Per the Water Supply and Facilities Financing Plan and Agreement (Agreement) between the City of Folsom and certain landowners in the FPA the City has determined the water supply for the FPA to be as follows (from Section K of that Agreement):

> The City has determined that its Water Systems Optimization Review Program and implementation of metered rates will provide additional water supplies in an estimated amount of 6,450 acre-feet per year, which is surplus to the present and forecasted demands of the City's existing water users. The City is willing to use a portion of this 6,450 acre-feet per year of available water to meet present and future water demands in the East Area in order to make the 5,000 acre-feet per year of GSWC Agreement water supply available for use in the FPA, on the terms and conditions of that GSWC Agreement. The City would meet the additional build-out water demands of the FPA with approximately 600 acre-feet per year of water production by the Water Systems Optimization Review Program that is in excess of the water demands in the East Area, on the terms set forth in the Agreement. The water made available under the GSWC Agreement and Water Systems Optimization Review Program are referred to collectively herein as the "FPA Water Supply".

The FPA Water Supply is treated at the City's water treatment plant (WTP) and initially delivered to the FPA through the City's existing Zone 3 East, and ultimately by a dedicated transmission main and BPS at the City's WTP. These facilities are described in Section 3.

Section 3

FPA System Evaluation

This section describes the analyses criteria and the system evaluation.

3.1 Analysis Criteria

The criteria used to design the conceptual main backbone water system are described in this section. These criteria include storage, booster pumps, system performance, and reliable supply.

3.1.1 Storage

Storage is needed in the water system to provide peaking or operational flows, emergency storage, and fire flow supply. In the FPA all supply for each pressure zone is delivered to the storage tank for each pressure zone. From the storage tank all supply is then conveyed to the distribution system. The purpose of this approach is to ensure proper turn-over of water in the storage tanks to reduce water age in the FPA. This is important to consider due to the long distance of the FPA from the WTP. During normal operations the supply system provides enough water to meet the average 24-hour demand occurring throughout the day, via the storage tank. During the peak demand hours, supply is delivered from the system storage tank volume to make up the difference between the average flow and the peak hour demand flows. During the low demand hours of the day, when the system demand is less than the 24-hour average, the extra supply is used to refill the storage in the system. This concept is illustrated on Figure 3-1. Using storage in the system allows the water supply facilities to be sized for the maximum day 24-hr average, which is about half of the peak hour demand.

System storage is also important to provide the higher flows needed during a fire for short durations (no more than four hours), and for emergency supply if the normal system supply source is taken offline for maintenance or during an emergency outage.

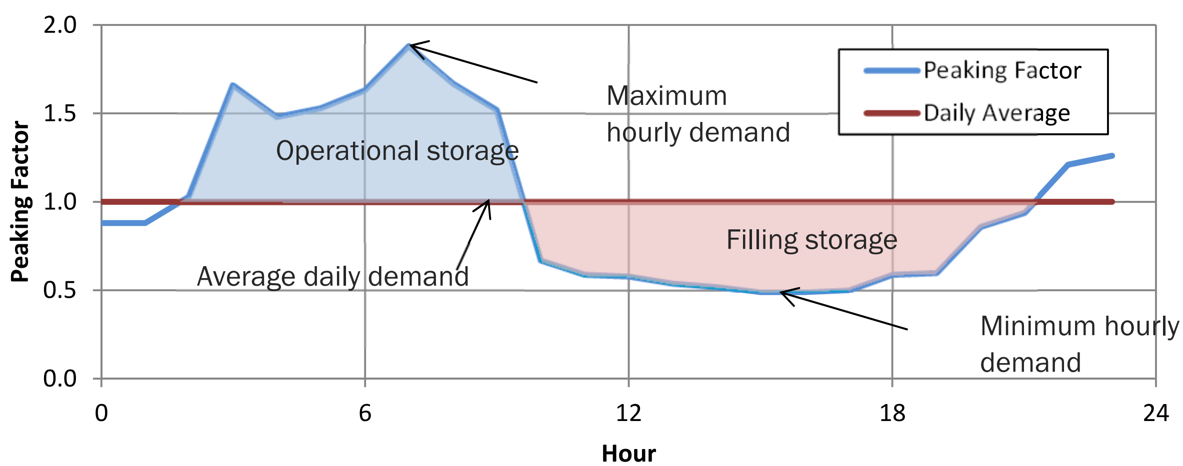


Figure 3-1. Example Diurnal Curve and Storage Cycling

The storage capacity volumes are based on criteria defined by the City's master plan (West Yost and Associates, 2008). The recommended volume of storage in each pressure zone is one maximum day plus fire demands. The storage capacity criteria are as follows:

Equation 3-1. Storage volume required = Operational + Emergency + Fire

Where:

Operational = 25% MDD (estimated, actual storage calculated from model results)

Emergency = 75% MDD

Fire = varies based on land use

The fire flow storage requirements vary based on land use. Table 3-1 provides the flow and duration and resulting volume requirements based on land use type. The fire storage volume required for each zone is based on the land use type present in each zone that requires the greatest amount of fire storage volume.

Table 3-1. Fire Flow Storage Criteria

Land use type	Flow/duration	Fire storage volume, MG
Single family residential	1,500 gpm for 2 hours	0.18
Multi-family residential	2,000 gpm for 2 hours	0.24
Commercial/Industrial	3,000 gpm for 3 hours	0.54
Schools	4,000 gpm for 4 hours	0.96

3.1.2 Distribution System Booster Pump Stations

Booster pumps are required to increase head from one pressure zone to a higher pressure zone or boost the pressure of water from ground level storage tanks. Booster pump stations are typically sized to meet maximum day demand when storage is available in the receiving pressure zone. When storage is not available in the receiving pressure zone, the booster pump station must be sized to meet maximum day plus fire flow and peak hour demands, whichever is greater. In all cases the booster pump stations must be sized to meet these demand requirements with the largest pump out of service and with backup generators.

3.1.3 System Performance

The system performance criteria for maximum velocity and minimum pressure are summarized in Table 3-2. These criteria define the desired level of service and are used to evaluate the performance of the current water distribution system with the alternative and recommended improvements.

Table 3-2. System Performance Criteria		
Performance standard	Criteria	
	Maximum day demand plus fire flow	Peak hour demand
Maximum velocity	10 fps	7 fps
Desirable pipe velocity[c]	4.0 to 7 fps	--
Minimum pressure	20 psi in the pipelines in the vicinity of a fire; (40 psi without a fire) [a]	30 psi (existing service area) 40 psi (new development) [a,b]

Source: West Yost Associates, 2008

fps=feet per second

psi=pounds per square inch

[a] *Minimum pressure (without fire) requirements must be met when storage levels are at 30 percent of capacity, per City of Folsom.*

[b] *Per Waterworks Standards Section 64602 (b) Each new distribution system that expands the existing system service connections by more than 20 percent or that may otherwise adversely affect the distribution system pressure shall be designed to provide a minimum operating pressure throughout the new distribution system of not less than 40 pounds per square inch at all times excluding fire flow.*

[c] *City staff desires maximum pipeline velocities around 3 fps during maximum day conditions.*

3.1.4 Reliable Supply

The City of Folsom Fire Department requires that there be a redundant water supply, more than one point of connection, to all areas of the water system. The City's standard design practice is for the water system to sustain the minimum pressures shown in Table 3-2 during maximum days plus fire with the largest source out of service.

3.2 Hydraulic Model Update

The City's Innovyze InfoWater hydraulic water model was used for this analysis. The conceptual FPA backbone water system was added to the model facilities. The FPA demands are allocated in the hydraulic model based on the location of the maximum day demand by parcel. Demands for larger parcels may be allocated to multiple nodes. A figure that illustrates the maximum day demands by parcel and model junction is in Appendix D.

3.3 System Evaluation

Using the analysis criteria and the hydraulic model described above the FPA backbone facilities are determined. This section describes the offsite facilities require to transmit supply to the FPA as well as the backbone facilities needed on-site within the FPA.

3.3.1 Off Site Water Supply Facilities

The off site water supply facilities are those facilities necessary to transmit supply to the FPA from the City's WTP. The offsite facilities are all located within the City's existing water system. There are interim and ultimate offsite supply facilities.

3.3.1.1 Interim Supply Facilities

The interim supply approach is based on providing supply from the City's existing WTP to the FPA via the City's existing water system, Zone 3 East, and entering the FPA at a location just south of HWY 50 near Placerville Road. The initial interim supply phase to the FPA is assumed to be 2 mgd.

System improvements to serve the interim FPA (2 mgd) through Zone 3 East are illustrated on Figure 3-2.

For the Interim FPA phase, the required improvements include Phase 1 Zone 3 BPS improvements and two parallel (one pipe is the redundant supply pipeline) new pipelines from Iron Point Road to under HWY 50 at the FPA. The Phase 1 BPS improvements have been evaluated at the planning level in this analysis and could be up to an additional 1,000 gpm. The BPS improvement capacity will be determined as part of the pre-design process under separate contract. The shared capacity in the City's existing system that will be used to serve the initial FPA development includes the existing WTP, Zone 3 East BPS, Natoma raw water pipeline, Foothills Reservoirs, and Zone 3 East distribution system. The new and shared capacity is quantified as follows:

Shared capacity:

- 2 mgd shared capacity in existing Natoma raw water pipeline
- 2 mgd shared in existing WTP capacity
- Zone 3 East BPS shared capacity at the Zone 3 East BPS (up to 1,400 gpm)
- 1,000,000 gallons Foothills Reservoirs capacity (it is assumed that no new fire flow capacity is required)
- Zone 3 East distribution system

New capacity:

- Phase 1 Zone 3 East BPS improvements (Up to 1,000 gpm)
- 3,000 LF of 24-in diameter transmission pipeline from Iron Point Road to Placerville Road, under HWY 50
- 3,000 LF of 18-in diameter transmission pipeline from Iron Point Road to Placerville Road, under HWY 50 (redundant pipeline)

3.3.1.2 Ultimate Supply Improvements

There are improvements required within the City's existing water system to deliver water through the existing system to the FPA to meet the ultimate FPA MDD of 8.8 mgd. As illustrated on Figure 3-2 the improvements required for the Ultimate FPA supply phase are a new booster pump station at the WTP and a new dedicated FPA transmission main pipeline. The shared capacity for this phase includes the existing WTP. The additional storage required to meet peak hour demands within the FPA ultimate system will be located within the FPA and not within the City's existing water system. The new FPA booster pump station at the WTP and transmission main from the FPA BPS to the FPA distribution system will supply maximum day demand to the FPA. The new and shared capacity is quantified as follows:

Shared capacity:

- Additional 6.8 mgd shared capacity in existing Natoma raw water pipeline for a total of 8.8 mgd shared capacity.
- Additional 6.8 mgd shared capacity in the WTP for a total of 8.8 mgd shared capacity.

New capacity:

- 6,100 gpm firm booster pump capacity at new FPA BPS located at the WTP.
- 18,000 LF of 30-in diameter transmission pipeline from the WTP Iron Point Road, near the FPA.
- Emergency 2-way pressure reducing valve (PRV) to connect the Zone FPA2 to the existing Zone 2 piping at Easton Glenborough.

3.3.2 FPA Conceptual Backbone Distribution System

The water main backbone system for the ultimate FPA system is illustrated on Figure 3-3 and 3-3a. There are five pressure zones in the FPA. A description of the infrastructure and normal operation of each pressure zone in the FPA is provided below. A water system hydraulic schematic of the existing City system with the proposed FPA addition is illustrated on Figure 3-4. The hydraulic model results for minimum pressures and maximum pipeline velocities over a maximum day 24-hour period as well as for maximum day plus fire flow demands at key locations within the FPA are provided in Appendix E.

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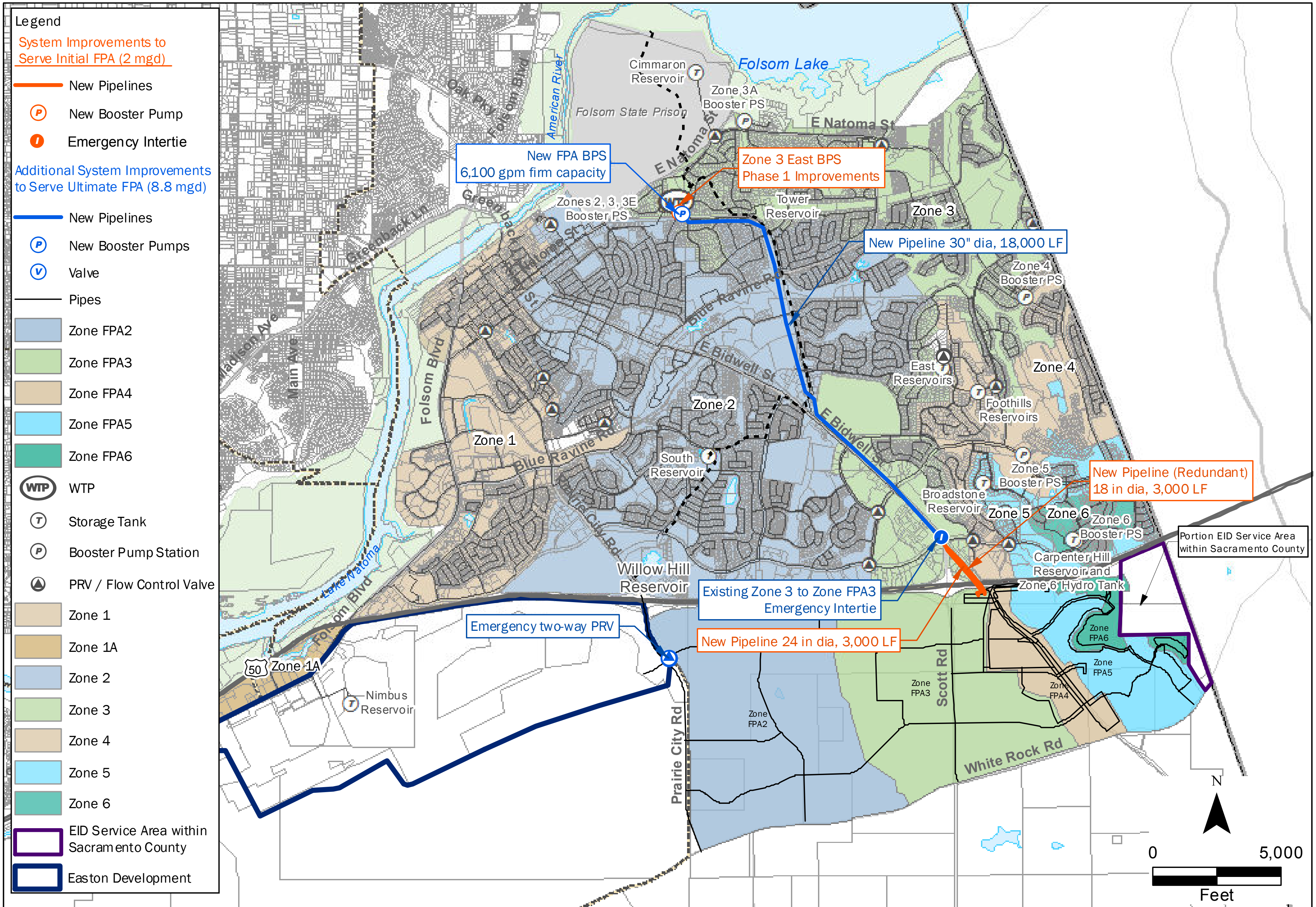

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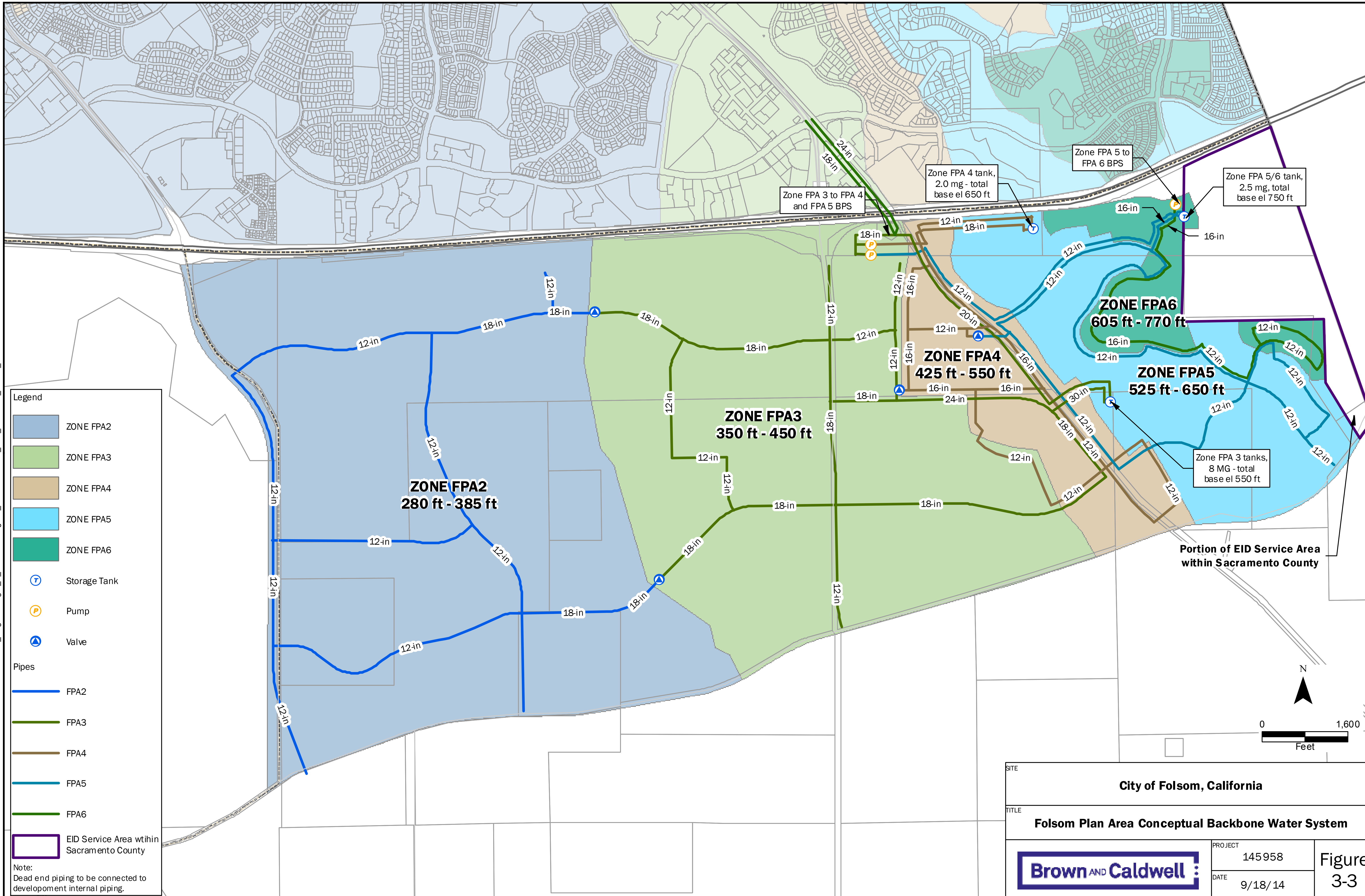
PROJECT	SITE	
145958	City of Folsom, California	Figure 3-2
DATE 9/18/14	TITLE Existing City Improvements to Serve the Folsom Plan	



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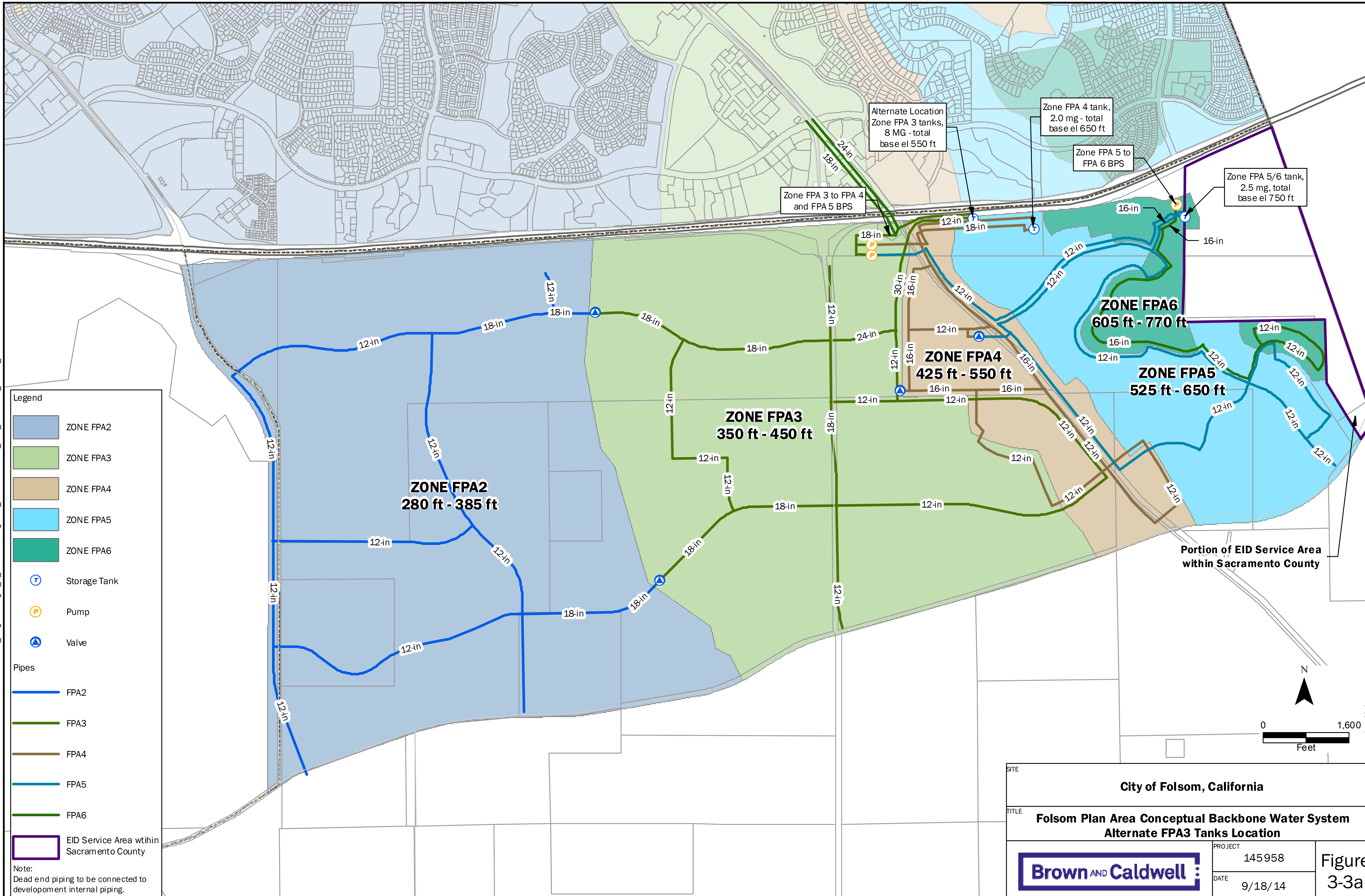

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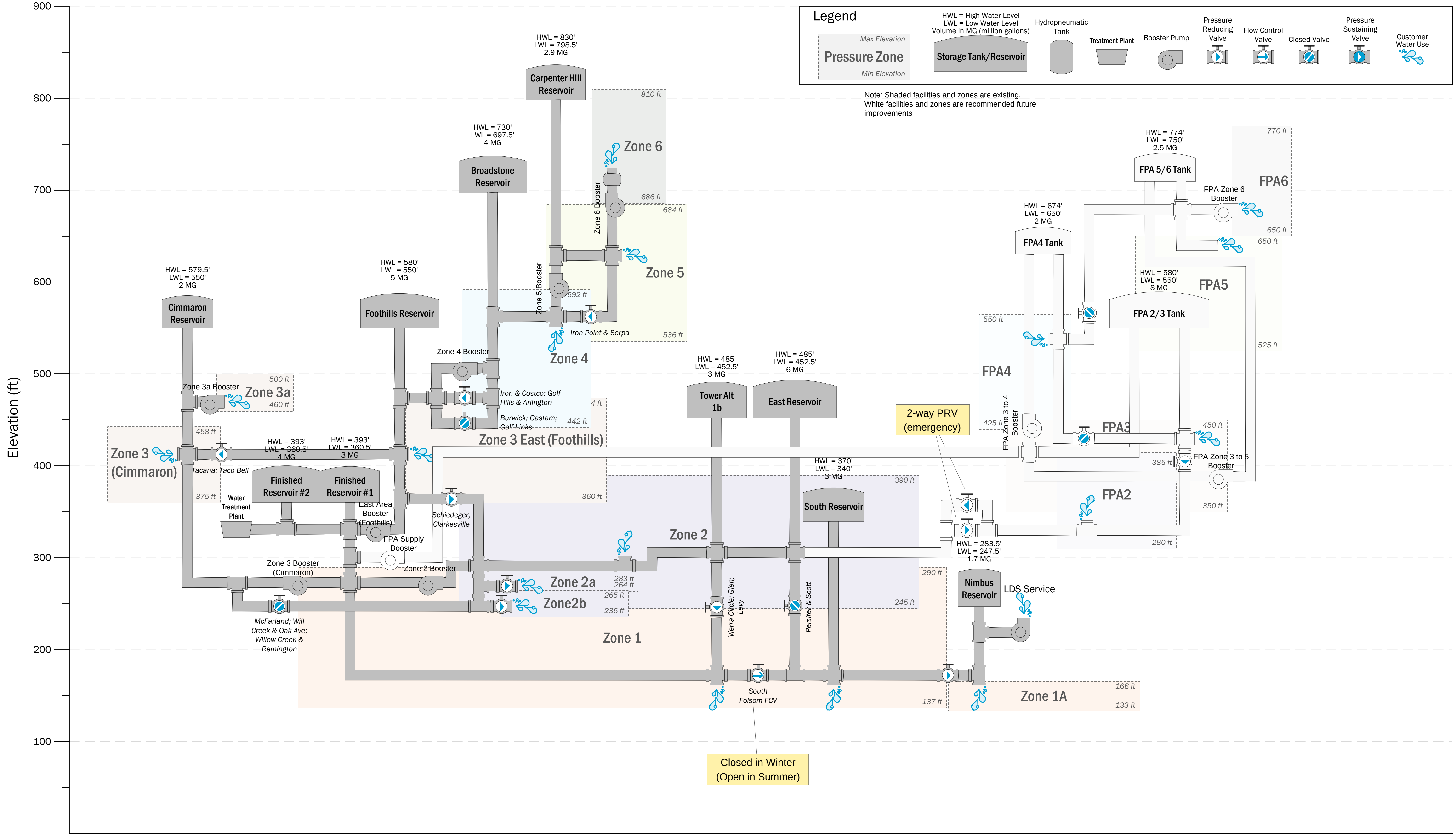

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Figure 3-4. Existing System Plus Future Folsom Plan Area
Water System Hydraulic Schematic

3.3.3 Backbone Pipelines

The length of the FPA backbone pipe by diameter in each pressure zone is summarized in Table 3-3.

Table 3-3. FPA Length of Pipe by Diameter by Pressure Zone

Zone	Length of pipe, LF						
	12-in diameter	16-in diameter	18-in diameter[a]	20-in diameter	24-in diameter[b]	30-in diameter	Total
FPA2	28,000	0	6,300		0	0	34,300
FPA3	12,400	0	21,800	6,000	5,600	1,000	46,800
FPA4	15,100	9,100	3,400		0	0	27,600
FPA5	29,900	1,100	0		0	0	31,000
FPA6	5,300	5,800	0		0	0	11,100
Total	90,700	16,000	31,500		5,600	1,000	150,800

[a] *Includes 3,000 linear feet of 18-in diameter redundant supply pipeline from Iron Point Road at East Bidwell.*

[b] *Includes 3,000 linear feet of 24-inch diameter supply pipeline from Iron Point Road at East Bidwell.*

3.3.4 Booster Pump Stations

The water supply entering the FPA is from a dedicated booster pump station and transmission main from the WTP. Booster pumps are required within the FPA in order to pump supply at the Zone 3 hydraulic grade line (HGL) up to Zones FPA4, FPA5, and FPA6 which are at higher HGLs than Zone 3. If the locations of the booster pump stations are modified from the current locations or elevations on Figure 3-3 or if demands within these pressure zones are modified, the required pumping head and flow, as summarized in Table 3-4, should be updated.

Table 3-4. FPA Booster Pump Stations

Booster pump station	Flow, gpm	Required horse power, Hp
FPA 3 to FPA 4	800	50 to 75
FPA 3 to FPA 5	900	75 to 100
FPA 5 to FPA 6		
Normal duty	500	25 to 50
Fire demand	3,000	125 to 150

3.3.5 Storage – No Recycled Water Offset

The storage volume required for the ultimate FPA based on all demands being met by potable sources is summarized in Table 3-5. The location of the storage reservoirs is shown on Figure 3-3.

An alternative FPA 3 storage location was evaluated in the hydraulic model and determined to be a hydraulically acceptable alternative location to the currently proposed FPA 3 storage location. This alternative site is located at the same base elevation of 550 ft, on a parcel south of HWY 50, west of the FPA 4 storage location, as shown on Figure 3-3a. This alternative was evaluated assuming the entire FPA 3 storage volume would be located at this alternative site and not split between this alternative site and the current site location shown on Figure 3-3. In the event the alternative FPA 3 storage site is selected, some pipeline diameters in the FPA3 pressure zone will have to be increased from the currently proposed diameters.

Table 3-5. FPA Storage- No Recycled Water Supply Offset

Storage tank	Tank base elevation, ft	MDD gpm	MDD mgd	25%MDD operational storage (MG)	75%MDD emergency storage (MG)	Fire storage (MG)	Total storage required (MG)
FPA 3[a]	550	4,550	6.6	1.6	5.0	1.5[c]	8
FPA 4	650	720	1.0	0.3	0.8	1	2
FPA 5[b]	750	830	1.2	0.3	0.9	1	2.5
Total	--	6,100	8.8	2.2	6.7	3.5	12.5

[a] *FPA 3 tank also serves zone FPA 2. It is assumed this storage will be constructed as two storage tanks. Two 4- million gallon (MG) tanks or 3MG and 5MG tanks at the same site.*

[b] *FPA 5 tank also serves zone FPA 6.*

[c] *Fire storage for the FPA 2/3 tank includes storage volume for one school and one commercial/industrial fire demand.*

3.3.6 Storage - with Recycled Water Supply Offset

In the event recycled water develops as a supply source to offset potable demands in the FPA the required potable storage volume would decrease. The reduced potable storage requirements are shown in Table 3-6.

Table 3-6. Reduced FPA Storage – with Recycled Water Supply Offset

Storage tank	Tank base elevation, ft	Total MDD gpm	MDD mgd	25%MDD operational storage (MG)	75%MDD emergency storage (MG)	Fire storage (MG)	Total storage required (MG)
FPA 3[a]	550	2,896	4.2	1.0	3.1	1.5	6
FPA 4	650	419	0.6	0.2	0.5	1	2
FPA 5[b]	750	830	1.2	0.3	0.9	1	2.5
Total	--	4,145	6.0	1.5	4.5	3.0	10.5

[a] *FPA 3 tank also serves zone FPA 2. It is assumed this storage will be constructed as two storage tanks. Two 3- million gallon (MG) tanks at the same site.*

[b] *FPA 5 tank also serves zone FPA 6.*

3.3.7 Zone FPA 3 Phased Potable and Recycled Water Storage Construction

One approach to phasing construction of the Zone FPA 3 potable storage facilities is to construct the potable storage tanks in conjunction with the recycled water tank. In this approach Tank 1 would be a 3 MG potable tank. Tank 2 would be a recycled water tank that would initially be used as a potable facility until it is needed for the recycled water system or the Tank 2 3 MG tank could be used as an interim recycled water tank until the potable demand and development requires additional potable storage. At which point Tank 3, the second potable storage tank, would be constructed. This would allow the City to delay or possibly avoid construction of the 5 MG potable storage tank. It is recommended to follow this approach and avoid construction of a 5 MG tank. Table 3-7 lists the FPA 3 potable and recycled water storage construction phasing. Trigger points for the construction of the major FPA facilities are listed in Section 3.5.

Table 3-7. Zone FPA 3Potable and Recycled Water Storage Tank Construction Phasing

Storage tank	25%MDD operational storage, MG	75%MDD emergency storage, MG	Fire storage, MG	Total storage, MG
Tank 1 (potable)	0.38	1.13	1.5	3
Tank 2 (interim recycled/ultimate potable)	0.75	2.25	0	3
Tank 3 (recycled)	0.75	2.25	0	3

3.3.8 Pressure Zone Descriptions

A description of the infrastructure and normal operation of each pressure zone in the FPA is provided below. Due to the grade variation in all zones, service PRVs will be required on all service connections throughout the FPA.

- FPA Zone 2 - The FPA Zone 2 is located in the western most area of the FPA, and serves connections at elevations ranging from 280 ft to 385 ft. The water supply for FPA Zone 2 is provided through PRVs from FPA Zone 3. The operational, emergency, and fire storage for FPA Zone 2 is located in the Zone 3 storage reservoir that also serves Zone 3. The FPA Zone 2 is also connected with a two-way PRV to the existing Zone 2 at Prairie City Road to operate when pressures are critically low during an emergency only, allowing water to flow between the existing system and the FPA in the event of an emergency in either zone.
- FPA Zone 3 - The FPA Zone 3 serves connections at elevations ranging from 350 ft to 450 ft. The water supply for the FPA Zone 3 is provided from the existing system Zone 3 at Scott Road, just south of HWY 50. The operational, emergency, and fire storage for FPA Zone 3 is located in the Zone 3 storage reservoir that also serves Zone 2. The FPA Zone 3 storage reservoir is located at a higher elevation than FPA Zone 3 which allows the storage tank to fill and empty based on the hydraulic head in the FPA Zone 3. From the FPA Zone 3, water flows by gravity through PRVs to serve Zone 2. Water is also boosted from Zone 3 through booster pumps to served FPA Zone 4 and FPA Zone 5.

- FPA Zone 4 - The FPA Zone 4 serves connections at elevations ranging from 425 ft to 550 ft. The water supply for the FPA Zone 4 is provided through a booster pump station that pumps water from the FPA Zone 3. The operational, emergency, and fire storage for FPA Zone 4 is located in the FPA Zone 4 storage reservoir. The FPA Zone 4 storage reservoir is located at a higher elevation than FPA Zone 4 which allows the storage tank to fill and empty based on the hydraulic head in the FPA Zone 4.
- FPA Zone 5 - The FPA Zone 5 serves connections at elevations ranging from 525 ft to 650 ft. The water supply for the FPA Zone 5 is provided through a booster pump station that pumps water from the FPA Zone 3. The operational, emergency, and fire storage for FPA Zone 5 is located in the FPA Zone 5 storage reservoir that is also used to serve Zone 6. The FPA Zone 5 storage reservoir also serves Zone 6. The FPA Zone 5 storage reservoir is located at a higher elevation than FPA Zone 5 which allows the storage tank to fill and empty based on the hydraulic head in the FPA Zone 5.
- FPA Zone 6 - The FPA Zone 6 serves connections at elevations ranging from 605 ft to 770 ft. All water supply for the FPA Zone 6 is provided through a booster pump station that pumps water from the FPA Zone 5 tank. The operational, emergency, and fire storage for FPA Zone 6 is located in the FPA Zone 5 storage reservoir and must be pumped to the FPA Zone 6.

3.4 Initial Folsom Plan Area Phasing

The probable initial developments within the FPA are Phase 1 for Westlands (840 units), Easton-Hillsborough (820 units), and Russell Ranch (350 units). The backbone facilities necessary to serve these initial developments are identified. Appendix F contains a summary of the information used for each analysis and the required facilities to serve each area. Also included for each development is a map illustrating the backbone infrastructure layout and sizing for each of the three initial developments.

3.5 Trigger Points for the Construction of Major Facilities

Trigger points for the construction of major FPA facilities are listed in Table 3-8. The design start, construction start, and construction completion trigger points are defined predominantly based on the number of dwelling units in the FPA.

Table 3-8. Trigger Points for Construction of Major Facilities

Facility	Trigger
FPA Zone 3 – Tank 1 (3 MG) & Tank 2 (3 MG)	
Start design	a. 75 percent MDD of Zone 3 Foothill b. 1,300 dwelling units in FPA
Start construction	a. 90 percent MDD of Zone 3 Foothill b. 1,900 dwelling units in FPA
Complete construction	a. 100 percent MDD of Zone 3 Foothill b. 2,500 dwelling units in FPA
FPA Zone 3 - Tank 3 (3 MG)	
Start design	a. Start of non-potable supply design b. 5,200 dwelling units in FPA
Start construction	a. Start of non-potable supply construction b. 5,700 dwelling units in FPA
Complete construction	a. Completion of non-potable supply construction b. 6,200 dwelling units in FPA
FPA Zone 4 – Tank (2 MG) and Zone 4 Pump Station	
Start design	600 dwelling units in FPA Zone 4, 5, and 6
Start construction	1,100 dwelling units in FPA Zone 4, 5, and 6
Complete construction	1,600 dwelling units in FPA Zone 4, 5, and 6
WTP FPA Zone 3 Pump Station	
Start design	1,300 dwelling units in FPA Zone 4, 5, and 6
Start construction	1,900 dwelling units in FPA Zone 4, 5, and 6
Complete construction	2,500 dwelling units in FPA Zone 4, 5, and 6
WTP Zone 3 Pipeline	
Start design	1,000 dwelling units in FPA Zone 4, 5, and 6
Start construction	1,500 dwelling units in FPA Zone 4, 5, and 6
Complete construction	2,500 dwelling units in FPA Zone 4, 5, and 6

Note: The information in this table was provided by City Staff and is based on an assumed growth of 500 dwelling units per year and UWMP demand factors.

Section 4

Performance Based Standards

This section summarizes the key criteria required by the City for the water system for future development of the FPA.

4.1 Backbone Pipes and Valves

The conceptual main backbone piping described in Section 3 is developed using the City's Innovyze InfoWater hydraulic water model. The piping is located along roadways where possible. The majority of the pipelines are required to convey water to the proposed development. Some pipelines are not necessarily needed as part of the water backbone for this purpose, but are included in the backbone system because major roadways will be constructed in the area and the water infrastructure should be installed before the roadway construction is completed. In addition, there are some backbone pipelines that dead-end near White Rock Road. These pipelines will be looped within the development as part of the development design. Dead-end water pipelines are not considered an acceptable design in the system once built out.

The exact location of each pipeline will be determined once development plans are available so pipelines can be located in roadways and other accessible areas. The recommended conceptual backbone layout should be used as a guide for the general location of pipelines and valves, the locations and elevations of pressure zones, and the required diameter of backbone pipelines. Pipelines serving different pressure zones shall be allowed in the same roadway but must be located on opposite sides of the street.

Valves included in the backbone system include pressure reducing valves between system pressure zones. The valves should be connected to the City's SCADA system for monitoring and control remotely by the system operators. The design of the distribution system should also include isolation valves. Below is an explanation of each valve type and when and where they should be included.

Pressure reducing valves – Pressure reducing valves are used in the water system to create zone boundaries between areas under normal conditions, and provide flow from a higher pressure zone to a lower pressure during normal operations, or in some cases only for emergencies.

Isolation valves – Isolation valves should be located at piping intersections/connections and along transmission mains at no more than 1,000-foot spacing. The purpose of isolation valves is so that water distribution system operators can isolate specific segments of pipelines within the system for replacement/repair purposes without compromising the ability to provide water supply to other areas of the system. Isolation valves are also important for system maintenance such as flushing. A lock box is required for isolation valves located on pipelines in the same roadway as pipelines from different pressure zones.

4.2 Storage Tanks

Tanks included in the backbone system provide the required storage for each pressure zone. The critical design component for storage tanks is the tank base elevation shown on Figure 3-3. Since the water levels and filling/emptying of tanks within the system is dependent upon the design pressure in the system, placing tanks at the correct elevation and connecting to the system as shown is critical for proper system operation. It should be noted that the elevations selected in this analysis are based on preliminary development information. The tank elevations should be verified with the water model as the design of the project proceeds and more definitive system information becomes available. The storage in the system can be phased as development occurs by dividing the total required storage into multiple tanks. The guidelines for phasing storage include:

- Storage should not be divided such that any storage tank size is less than 1 MG.
- In general, it may be possible to divide the storage at most sites, but more than two tanks at any one site must be approved by the City.
- Multiple storage tanks at each site must include adequate piping systems to allow any tank to be taken offline for maintenance while the remaining storage continues to operate.

4.3 Booster Pump Stations

There are a number of booster pump stations included in the backbone system. The booster pump stations provide sufficient pressure to the higher elevations in the development. In some cases, such as Pressure Zone FPA6, the booster pump station provides all supply to meet the demands in the system. Therefore the booster pump stations in the system must be designed with redundancy. The redundancy and key design criteria include:

- For pump stations serving a pressure zone with adequate storage, pump station redundancy must include sufficient pumping capacity to meet maximum day demands with the largest pump out of service.
- For pump stations serving a closed system (i.e. a pressure zone without storage, such as Pressure Zone FPA6), pump station redundancy must include sufficient pumping capacity to meet peak hour and maximum day plus fire flow demands, whichever is larger, with the largest pump out of service.
- For pump stations serving a closed system (i.e. a pressure zone without storage, such as Pressure Zone FPA6), a hydropneumatic tank must be included.
- Lead pumps in the system should be controlled by variable frequency drives to provide stable pressure in the distribution system and minimize pump cycling.
- Pump station facilities shall be enclosed in masonry building structures with separate electrical/control rooms.
- All pump stations shall include backup power generators capable of supplying sufficient power to meet maximum day demand during an extended power outage (minimum of 24 hours).

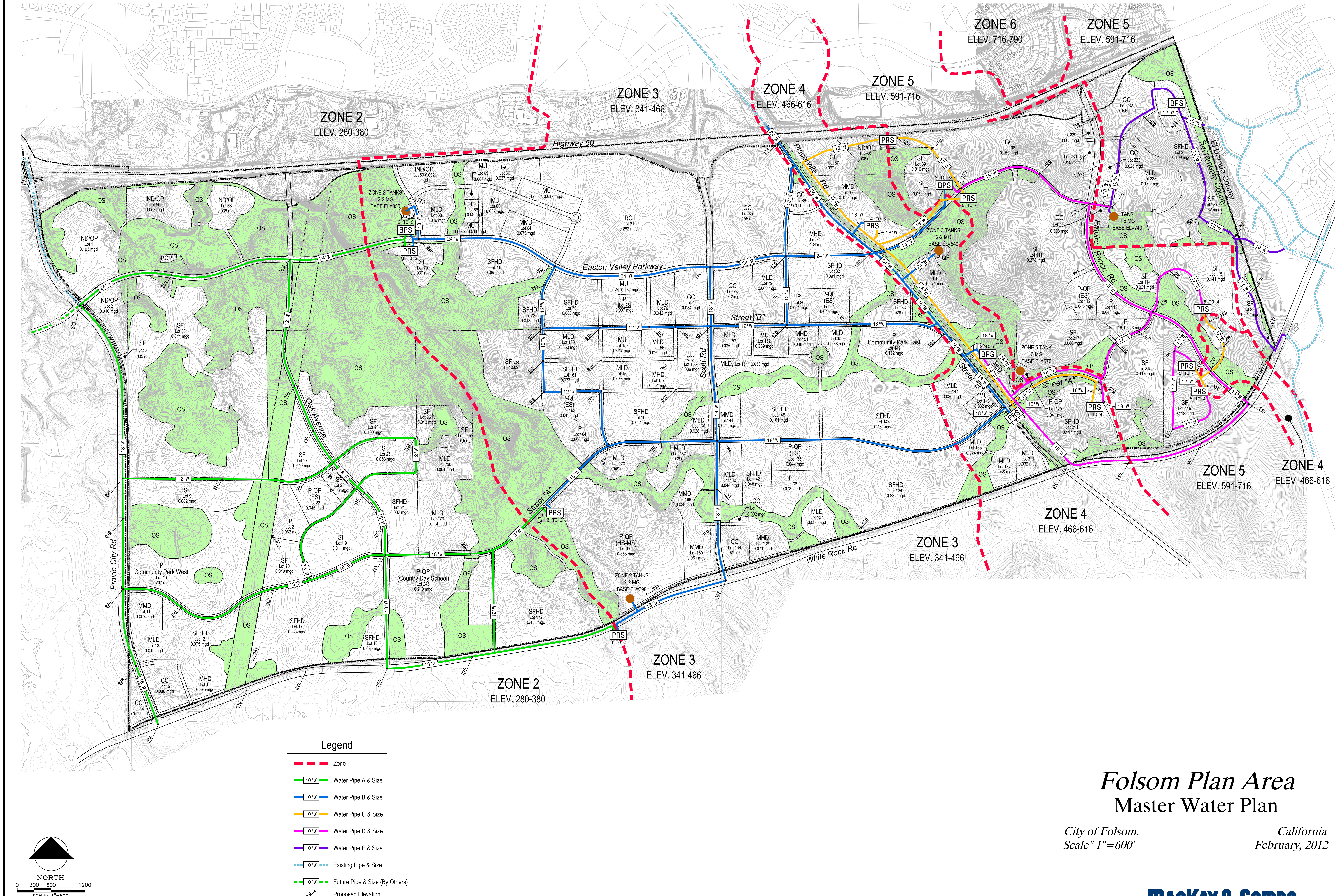
References

West Yost Associates. City of Folsom Water System Master Plan. 2008.

City of Folsom. 2010 Urban Water Management Plan. June 2011.

J. Crowley Group. 2014 FPA Recycled Water Analysis 2.0. August 2014.

Appendix A: Land Use Plan, Parcel Demands from Mackay and Somps



Folsom Plan Area

Master Water Plan

City of Folsom, California

Scale" 1"=600' February, 2012

MacKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
1552 Eureka Road, Suite 100, Roseville, CA 95661 (916) 773-1189

7919-00

Appendix B: Basis of FPA Diurnal Demand Pattern

Table B-1. Diurnal Curves			
Hour	Existing system zone 3	Existing system zones 1&2	Existing system total (7/2009)
	Factor	Factor	Factor
1	1.19	1.33	1.23
2	1.28	1.35	1.32
3	1.26	1.3	1.22
4	1.45	1.28	1.4
5	1.59	1.35	1.44
6	1.7	1.43	1.56
7	1.61	1.45	1.63
8	1.53	1.35	1.51
9	1.2	1.16	1.34
10	0.79	1	0.93
11	0.63	0.89	0.68
12	0.5	0.8	0.59
13	0.62	0.77	0.62
14	0.56	0.65	0.53
15	0.58	0.48	0.57
16	0.61	0.39	0.41
17	0.58	0.53	0.46
18	0.51	0.44	0.51
19	0.64	0.52	0.51
20	0.73	0.65	0.65
21	0.87	0.85	1.05
22	1.15	1.05	1.11
23	1.01	1.38	1.18
24	1.41	1.59	1.54

Note – The existing system zone 3 diurnal curve is used for the FPA analysis.

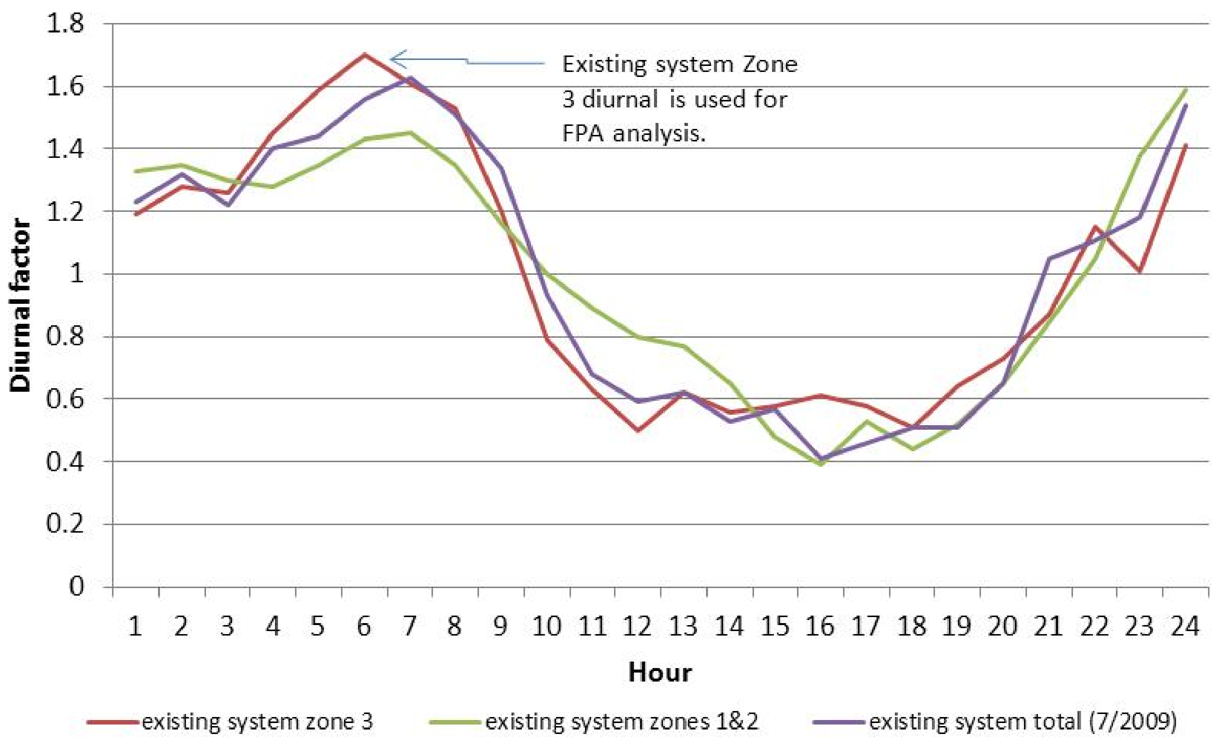


Figure B-1. Diurnal Curve

Appendix C: 2014 FPA Recycled Water Analysis 2.0

J. CROWLEY GROUP
WATER RESOURCES PLANNING AND POLICY

DRAFT

Technical Memorandum 010-011

TO: Todd Eising, City of Folsom

FROM: Jim Crowley, J. Crowley Group

DATE: August 11, 2014

SUBJECT: 2014 FPA Recycled Water Analysis 2.0

Section 1 Introduction

This recycled water infrastructure analysis provides a discussion and summary of the anticipated recycled water infrastructure needs to serve the Folsom Plan Area (FPA) south of Highway 50. As the area is developed, the City of Folsom intends to install the main transmission pipelines for a recycled water system. Although no supply source is identified at this time, the City would like to install the transmission system with the other utilities to avoid extra costs and congestion in the future once a recycled source is developed. This recycled water infrastructure analysis identifies potential demands and corresponding transmission system infrastructure requirements.

Section 2 Recycled Water Policy Assumptions

Many policy, operational, and design assumptions must be made to preliminarily size the infrastructure requirements. The following lists the assumptions made for this analysis. When the recycled water system is designed for implementation, the City will need to develop policy and design guidelines for the operations and design of the recycled water system.

- The analysis assumes the supply will be delivered from the west at Zone 2 pressures. This analysis does not investigate supply requirements or potential sources. It is assumed the west side supply provides the most infrastructure requirements as a "most intensive" scenario for the environmental documentation.
- Irrigation will be allowed from 9 PM to 6 AM to avoid potential contact with overspray or runoff.
- Flow will be pumped to a storage tank during the non-irrigation times of the day. Supply from the tank will generally meet daily irrigation demands.
- A portion of the FPA on the east side is in the El Dorado Irrigation District (EID) service area. EID requires all new development to include recycled water irrigation of parks, schools, streetscape, and residential. This analysis does not include the EID service area of the FPA.
- This analysis is based on the land use plan provided by MacKay & Somps (May 2014).
- Daily storage is provided, but seasonal storage is not investigated.

Section 3 Recycled System Parcels

This analysis assumes that recycled water will be used for irrigation at parks and schools in the central and west side of the FPA. The transmission main alignment was based on serving all schools and parks west of Placerville Road. Placerville road serves as a natural break as elevations increase considerably to the east, and there are few non-residential parcels east of Placerville Road that are within the Folsom service area. In addition, all streetscape, non-residential, and multi-family medium- and high-density residential near the transmission main alignment will also be served. Parcels initially selected for recycled water use are shown in Figure 1.

Section 4 Recycled Water Demand Projections

4.1 ETo-Based Demand Pattern

Landscape irrigation demand patterns are more accentuated than total potable water demand patterns. Landscape demand is highest during the summer months, and near zero in winter months during the traditional rainy season. Evapotranspiration (ETo) is a measure of irrigation water requirements. Average monthly ETo data from the nearby Fair Oaks CIMIS Station are shown in Table 1. A monthly peaking factor is calculated that is used to convert the annual demands to monthly irrigation demands. Data is presented for an average year (average precipitation) and a dry year with a return frequency of five percent.

The data indicate that ETo during the dry months does not change with hydrology; it remains the same regardless of precipitation during the wet months. As shown in Table 1, the dry year irrigation demand is 10 percent greater than the average year. Due to precipitation and weather patterns in the Sacramento Valley, irrigation demands during the summer months are relatively constant regardless of hydrologic year type. Only the normal year demands are carried forward throughout this analysis, as dry year demands do not influence infrastructure sizing.

Table 1. ETo-Based Irrigation Demands

Month	Precipitation[a], inches		ETo[b], inches	Irrigation Demand[c], inches		Average Year Monthly Peak Factor
	Average	Dry		Average	Dry	
Jan	4.4	2.2	1.59	0	0.3	0.03
Feb	3.8	2.3	2.20	0	0.9	0.04
Mar	3.9	2.2	3.66	1.5	2.7	0.06
Apr	1.9	1.0	5.08	4.7	5.4	0.09
May	0.6	0.3	6.83	7.8	8.0	0.12
Jun	0.1	0.2	7.80	9.3	9.2	0.14
Jul	0.1	0.1	8.67	10.3	10.3	0.15
Aug	0.5	0.1	7.81	9.0	9.3	0.14
Sep	0.5	0.3	5.67	6.5	6.6	0.10
Oct	1.5	0.8	4.03	3.7	4.2	0.07
Nov	3.4	1.9	2.13	0	1.1	0.04
Dec	3.5	1.9	1.59	0	0.5	0.03
Annual Totals	**24.2**	**13.3**	**57.06**	**52.6**	**58.5**	**--**

[a] Folsom Dam Station, Western Regional Climate Center, 1955-1993. Dry year represents five percent return frequency.

[b] CIMIS, Fair Oaks Station No. 131. (April 1977-2005)

[c] Irrigation demand per *A Guide to Estimating Irrigation Water Needs of Landscape Plantings in* California (UC Cooperative Extension and California DWR, August 2000)

4.2 Projected Irrigation Demands

Irrigation demands are based on the unit water factors and irrigated land factors provided in the Folsom SPA SB610 Water Supply Assessment (June 2010). Detailed demand calculations for each parcel are presented in Attachment A. Annual demands per landuse are summarized in Table 2. The total annual demand of the selected parcels is 1,469 acre-feet per year. The monthly irrigation demands are presented in Table 3 using the monthly peaking factors from Table 1. The maximum day demand is estimated as the average day during maximum month (July) times a factor of 1.2. Maximum day demand is approximately 2.8 mgd.

Table 2. Irrigation Demands Per Land Use

Land Use ID	Recycled Irrigated Area, acres	Annual Irrigation Demand, AFY
SF	0	0
SFHD	0	0
MFLD	0	0
MFMD	17.1	64
MFHD	15.3	57
RC	27.7	103
OP	31.5	117
CC	11.8	44
GC	35.7	133
Park	110.9	414
MU-Res	5.9	22
OS	0	0
OSL	0	0
SCH	84.6	316
EXCL RW	0	0
MAJ CIRC	17.4	65
UAW (10 percent)	--	134
Total	**352**	**1,469**

Table 3. Monthly Water Demand[a]

Month	Irrigation Water Demand, Ac-ft	Monthly Average Day Demand, mgd
Jan	41	0.43
Feb	57	0.66
Mar	94	0.99
Apr	131	1.42
May	176	1.85
Jun	201	2.18
Jul	223	2.35
Aug	201	2.11
Sep	146	1.59
Oct	104	1.09
Nov	55	0.60
Dec	41	0.43
Annual Total	1,469	--

[a]Based on Factors in Table 1.

Section 5 Recycled Water System

This section develops the recycled water transmission system within the FPA. The distribution systems within each development parcel are not considered at this time. The recycled water system is set to mirror the potable water system pressure zones to allow interconnectivity while a recycled water supply is being developed and/or during emergencies.

5.1 Demand Assignment

Demands developed in this technical memorandum are grouped together and assigned to node locations. Parcel node assignments and a figure of the node system are included in Attachment A and summarized in Table 4. All street irrigation (MAJ CIRC) is spread proportionally to each demand node based on proportion of parcel demands assigned to each node. A diurnal time pattern was established to simulate system demands over a 24-hour period. For this analysis it is assumed that the recycled water use will occur between 9 PM to 6 AM to reflect the probable schedules of programmed irrigation controllers. The time pattern used in this extended period analysis is illustrated on Figure 2.

Table 4. Demand Node Assignment

Pressure Zone	Node	Max Day Base Demand, gpm
Zone 2	3	164
	4	403
	5	140
	6	28
Subtotal:		735
Zone 3	7	242
	8	9
	9	100
	10	92
	11	14
	12	57
	19	49
	20	39
	22	318
Subtotal:		919
Zone 4	23	3
	24	142
	25	56
	26	75
	27	24
Subtotal:		301
Total:		1,954

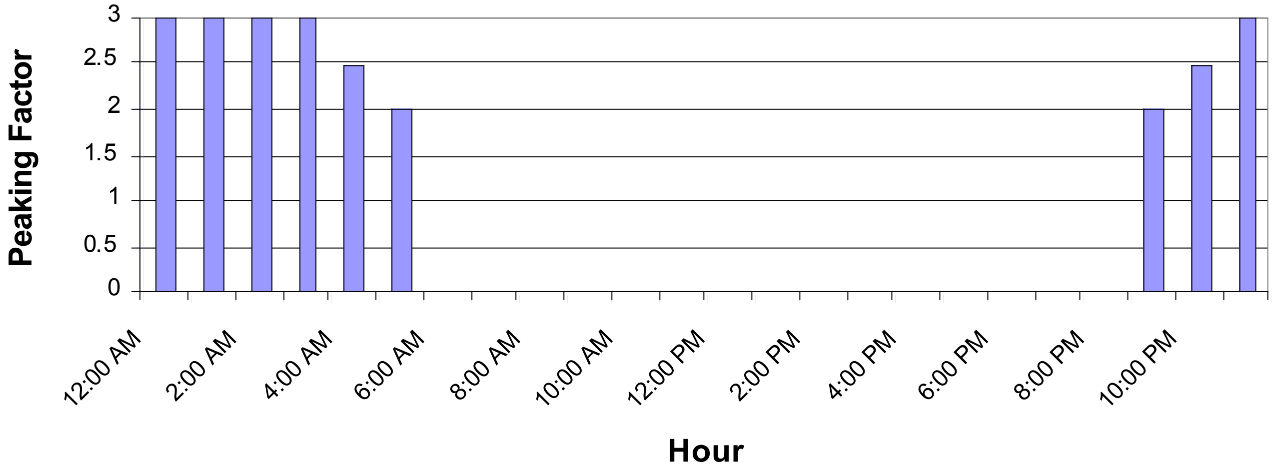


Figure 2. Demand Peaking Curve for 24-Hour Maximum Day Period

5.2 Supply Location

Actual supply source and location are unknown at this time. The supply could come from the west side, the east side, or even a future scalping plant within Folsom. This analysis aims to identify the supply location with the most distribution infrastructure requirements as a worst-case condition. The analysis assumes the worst-case supply condition is a supply coming from the west side of the FPA. It is assumed the supply will be delivered to the FPA at Zone 2 pressures. The supply will then need to be pumped up to Zone 3 pressures and the Zone 3 Tank.

5.3 System Development

An extended period simulation hydraulic model of the FPA transmission system was developed using EPANet, a hydraulic pressure-system modeling software. A distribution system consisting of storage, booster pumping, and transmission mains was developed and input into the model. Sizing and modeling assumptions used to create the system are summarized in Table 5. These design criteria should be reviewed and further developed by the City during the FPA recycled water system design process.

Table 5. Sizing and Modeling Assumptions

Element	Value
Daily Storage	Volume equal to one maximum day demand
Pressure range	30 psi – 100 psi
Pipeline velocity	3 to 5 feet per second maximum
Pipeline roughness coefficient	130
Minimum transmission main diameter	8-in

5.4 System Operational Strategy

The system is developed to mirror the potable water system pressure zones. The supply will feed into the west side of the FPA at Zone 2 pressures. Supply will then be boosted up into Zone 3, pumping into the Zone 3 Storage Tank. Zone 4 demands will be supplied through a booster pumping station located at the Zone 3 Storage Tank site. Because Zone 4 demands are relatively small, a Zone 4 storage tank is not necessary. The Zone 3 Storage Tank is sized to provide the required storage for all system demands. In general, the system operation assumes the Zone 3 booster pumping station fills the Zone 3 tank during non-irrigation times (daytime), and that the tank is drawn down during the irrigation demand schedule (nighttime).

It is likely that a supply source will not be available when the FPA installs the initial recycled water system infrastructure. Therefore, the system will be supplied by the potable system. Interconnections will be provided at each potable water pressure zone as shown on the system figure (Figure 3). Interconnections are governed by State regulations and include elements such as reduced pressure principle backflow devices to prevent cross-system contamination.

5.5 Infrastructure Requirements

The proposed recycled water distribution and storage system is presented in Figure 3. The system consists of 12-inch diameter transmission mains serving Pressure Zones 2 and 3, and 8-inch lines serving Pressure Zone 4. Only one Zone 3 booster pumping station is required. However, two alternative locations are shown on the figure. The final location will be determined in the future by the location of the actual parcels served, the pace of development, and final hydraulic analysis. A pressure reducing bypass system will be included at the booster pumping station site to allow flow from the Zone 3 Tank to back-feed Zone 2 demands during emergencies or other conditions when the supply is temporarily offline. The Zone 3 booster pumping station is sized to fill the Zone 3 tank during the 15 hours of non-irrigation demand in the daytime. For this planning level, the pumps station capacity is assumed to be 2,000 gpm and total dynamic head of approximately 200 feet.

Similarly, there are two alternative Tank 3 locations proposed. The final location will be determined during system design based on the actual hydraulic needs and site availability. The tank is set to mirror the Zone 3 potable water tank with a base elevation of 550 feet. However, final system demands, hydraulics, and site characteristics may allow a range of base elevation options of approximately 520-550 feet.

The Pressure Zone 4 system only serves eight parcels, and only three of them are parks/schools with larger demands. The planned system is a closed booster pump system that will draw from Tank 3 storage to meet the Zone 4 demands and maintain pressures. Depending on final system demands, the system could include a hydro-pneumatic surge tank at the Tank 3 site. Zone 4 booster pumping capacity is 300 gpm at total dynamic head of approximately 200 feet.

The recycled water system is summarized in Table 6. Site layouts for each booster pumping station and storage tank optional locations are presented in Attachment B.

Table 6. Recycled Water Infrastructure Summary

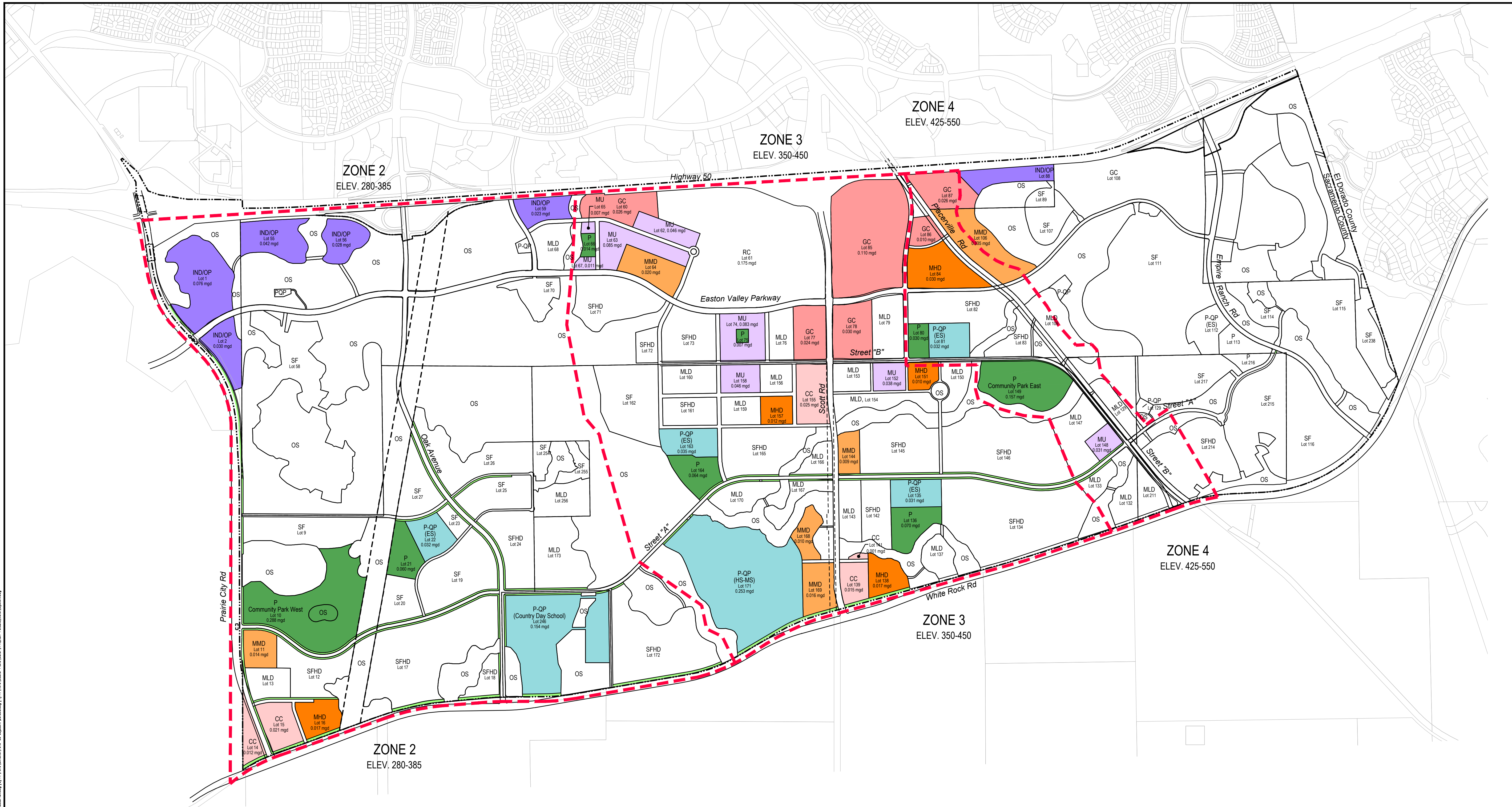
Element	Length/Capacity
Transmission Pipeline	
8-inch	10,300 feet
12-inch	67,200 feet
Zone 3 Booster Pumping Station	2,000 gpm 200 feet TDH
Zone 3 Storage Tank	2.8 million gallons
Zone 4 Booster Pumping Station	300 gpm 200 feet TDH

The proposed infrastructure represents a planning-level analysis using the assumptions listed at the beginning of this technical memorandum. Supply, storage, and pumping requirements will be further refined in the future during preliminary design efforts and in coordination with actual development progress. Preliminary design will also include cost to benefit analysis to provide service to the proposed lots, with possible recommendations to reduce the number of parcels served.

Section 6 Summary and Next Steps

This technical memorandum presents the planning-level requirements for the recycled water system. The following lists items to address next as the environmental documentation and design process moves forward.

1. Continue to evaluate potential recycled water sources and work to obtain the necessary volume of supply.
2. Work with FPA developer group to identify planned development phases and refine actual demands within a cost to benefit analysis to finalize system requirements.
3. Initiate system design task based on selected infrastructure phases developed in previous steps.
4. In future pre-design phase, City of Folsom should develop recycled water system operational policies and design criteria.
5. Finalize phase 1 design and begin construction in coordination with other infrastructure construction within the FPA.



Legend

Pressure Zone Boundary

NORTH

SCALE: 1"=800'

Figure 1 - Selected Parcels for Non-Potable Water
FPA - Non-Potable Water Analysis

City of Folsom, *California*

Scale 1"=800' *August 2014*

J. Crowley Group

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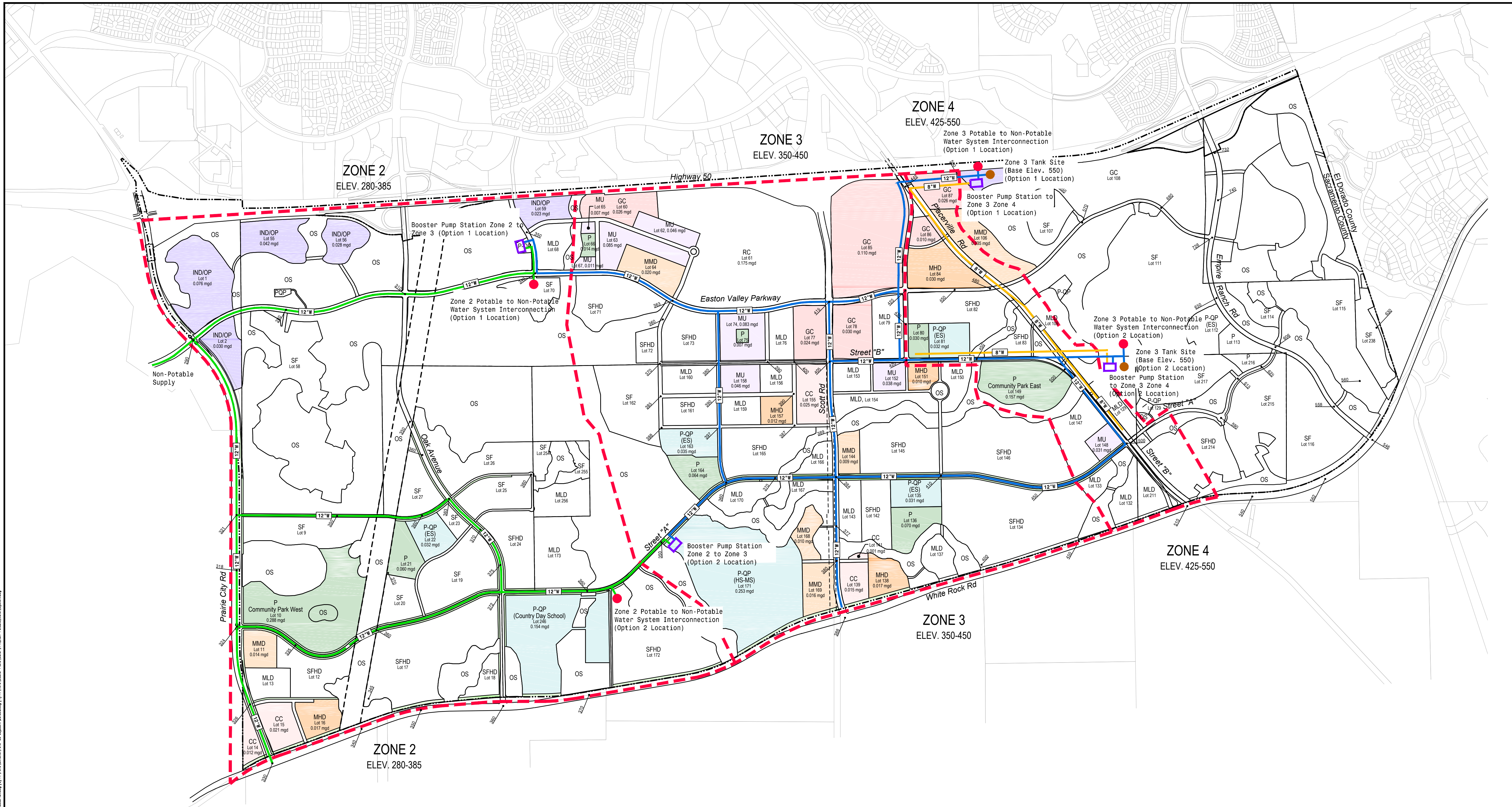

Legend

- Pressure Zone Boundary
- Zone 2 Non-Potable Water Pipe & Size
- Zone 3 Non-Potable Water Pipe & Size
- Zone 4 Non-Potable Water Pipe & Size
- Potable to Non-Potable Water System Interconnection
- Non-Potable Booster Pump Station
- Non-Potable Water Tank

Figure 3 - Proposed Non-Potable Water Infrastructure
FPA - Non-Potable Water Analysis

City of Folsom, *California*
Scale 1"=800' *August 2014*

J. Crowley Group

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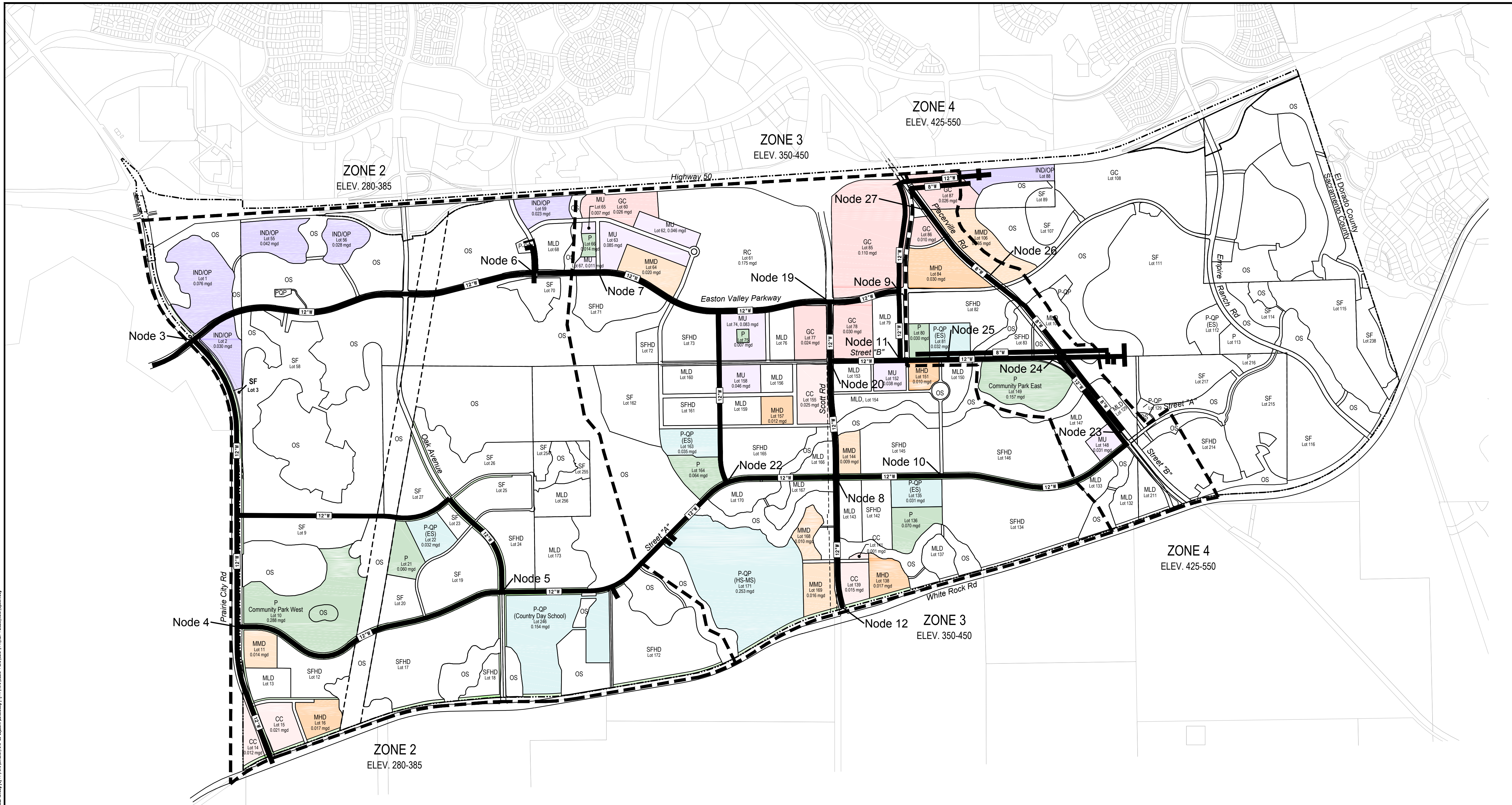
Attachment A
Parcel Demand Calculations and Assignment



Legend

- Pressure Zone Boundary
- Zone 2 Non-Potable Water Pipe & Size
- Zone 3 Non-Potable Water Pipe & Size
- Zone 4 Non-Potable Water Pipe & Size

Figure A-1 - Non-Potable Water Hydraulic Analysis
FPA - Non-Potable Water Analysis

City of Folsom, *California*
Scale 1"=800' *August 2014*

J. Crowley Group

MacKay & Somps
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Non-Potable Water Demands Parcel Summary

Parcel No.	Land Use	Acreage	Irrigated Acreage	Irrigated Acreage Reduction Factor	Unit Irrigation Demand Factor	Irrigtion Demand, AFY
1	IND/OP	30.09	12.036	0.40	3.73	44.9
2	IND/OP	11.76	4.704	0.40	3.73	17.5
10	P	47.86	45.467	0.95	3.73	169.6
11	MMD	8.56	2.140	0.25	3.73	8.0
14	CC	6.26	1.878	0.30	3.73	7.0
15	CC	11.06	3.318	0.30	3.73	12.4
16	MHD	9.77	2.931	0.30	3.73	10.9
21	P	10.03	9.529	0.95	3.73	35.5
22	PQP-SCHOOL	10.02	5.010	0.50	3.73	18.7
55	IND/OP	16.60	6.640	0.40	3.73	24.8
56	IND/OP	11.02	4.408	0.40	3.73	16.4
57	PQP	0.82	0.779	0.50	3.73	2.9
59	IND/OP	9.20	3.680	0.40	3.73	13.7
60	GC	13.65	4.095	0.30	3.73	15.3
61	RC	110.82	27.705	0.25	3.73	103.3
62	MU-RES	7.88	0.788	0.10	3.73	2.9
63	MU-RES	14.53	1.453	0.10	3.73	5.4
64	MMD	12.83	3.208	0.25	3.73	12.0
65	MU-RES	1.12	0.112	0.10	3.73	0.4
66	P	2.26	2.147	0.95	3.73	8.0
67	MU-RES	1.82	0.182	0.10	3.73	0.7
69	PQP	1.23	1.169	0.50	3.73	4.4
74	MU-RES	14.14	1.414	0.10	3.73	5.3
75	P	1.15	1.093	0.95	3.73	4.1
77	GC	12.57	3.771	0.30	3.73	14.1
78	GC	15.83	4.749	0.30	3.73	17.7
80	P	5.01	4.760	0.95	3.73	17.8
81	PQP-SCHOOL	10.01	5.005	0.50	3.73	18.7
84	MHD	20.03	6.009	0.30	3.73	22.4
85	GC	57.90	17.370	0.30	3.73	64.8
86	GC	5.31	1.593	0.30	3.73	5.9
87	GC	13.71	4.113	0.30	3.73	15.3
106	MMD	22.17	5.543	0.25	3.73	20.7
135	PQP-SCHOOL	9.89	4.945	0.50	3.73	18.4
136	P	11.70	11.115	0.95	3.73	41.5
138	MHD	9.11	2.733	0.30	3.73	10.2
139	CC	7.80	2.340	0.30	3.73	8.7
140	MMD	0.10	0.025	0.25	3.73	0.1
141	CC	0.72	0.216	0.30	3.73	0.8
144	MMD	6.41	1.603	0.25	3.73	6.0
148	MU-RES	5.26	0.526	0.10	3.73	2.0
149	P	26.12	24.814	0.95	3.73	92.6
151	MHD	5.70	1.710	0.30	3.73	6.4
152	MU-RES	6.52	0.652	0.10	3.73	2.4
155	CC	13.41	4.023	0.30	3.73	15.0
157	MHD	6.34	1.902	0.30	3.73	7.1
158	MU-RES	7.86	0.786	0.10	3.73	2.9
163	PQP-SCHOOL	11.02	5.510	0.50	3.73	20.6
164	P	10.61	10.080	0.95	3.73	37.6
168	MMD	7.21	1.803	0.25	3.73	6.7
169	MMD	11.23	2.808	0.25	3.73	10.5
171	PQP-SCHOOL	79.63	39.815	0.50	3.73	148.5
246	PQP-SCHOOL	48.69	24.345	0.50	3.73	90.8
	Subtotal	3,339.76	340.5			1,270.2
	Major Circulation	173.64	17.364	0.10	3.73	64.8
	Total	**3,513.40**				**1,335**

1) Land Uses are based on the approved Folsom Plan Area Specific Plan, adopted June 28, 2011.
2) Water demands and outdoor demand fractions are taken from Appendix M1- Water Supply Assessmen
Tables 2-4, 2-6 and 2-7

City of Folsom
Recycled Water EPAnet Model Demand Assignment

Total Max Day Demand = 2,814,560 gpd

Node	Elevation	Percent to Node	Node Demand, gpd	Node Demand, gpm	Zone	Zone Total, gpm
1	290	0.000	0	0	2	
2	290	0.000	0	0	2	
3	290	0.084	236,103	164	2	
4	324	0.206	580,793	403	2	
5	385	0.071	201,208	140	2	
6	340	0.014	40,072	28	2	735 Zone 2 total
7	363	0.124	348,744	242	3	
8	384	0.005	13,244	9	3	
9	425	0.051	143,561	100	3	
10	410	0.047	132,734	92	3	
11	420	0.007	19,522	14	3	
12	388	0.029	82,021	57	3	
13	450	0.000	-	-	3	
14	480	0.000	-	-	3	
15	445	0.000	-	-	3	
16	500	0.000	-	-	3	
17	500	0.000	-	-	3	
19	415	0.025	70,417	49	3	
20	405	0.020	55,466	39	3	
22	350	0.163	457,911	318	3	919 Zone 3 total
23	500	0.002	4,347	3	4	
24	500	0.073	205,085	142	4	
25	440	0.029	80,702	56	4	
26	480	0.039	108,638	75	4	
27	445	0.012	33,993	24	4	301 Zone 4 total
		Totals:	2,814,560	1,955		1,955

Attachment B
Option Pumping and Storage Tank Site Layouts

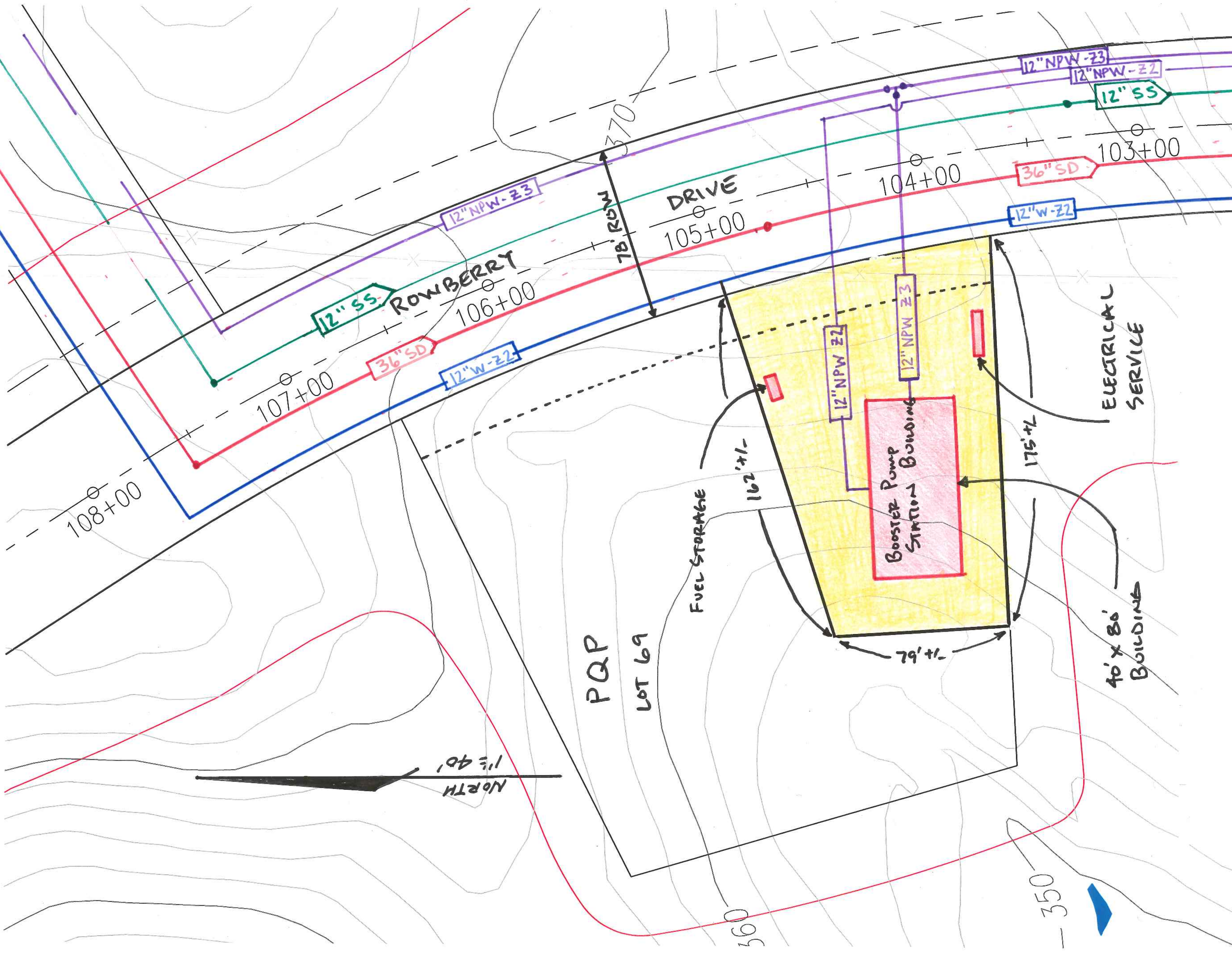


Figure B-1 - Zone 3 BPS Option 1 Site Layout
FPA - Non-Potable Water Analysis

City of Folsom, California
Scale 1"=800' August 2014

J. Crowley Group

MacKay & Somps

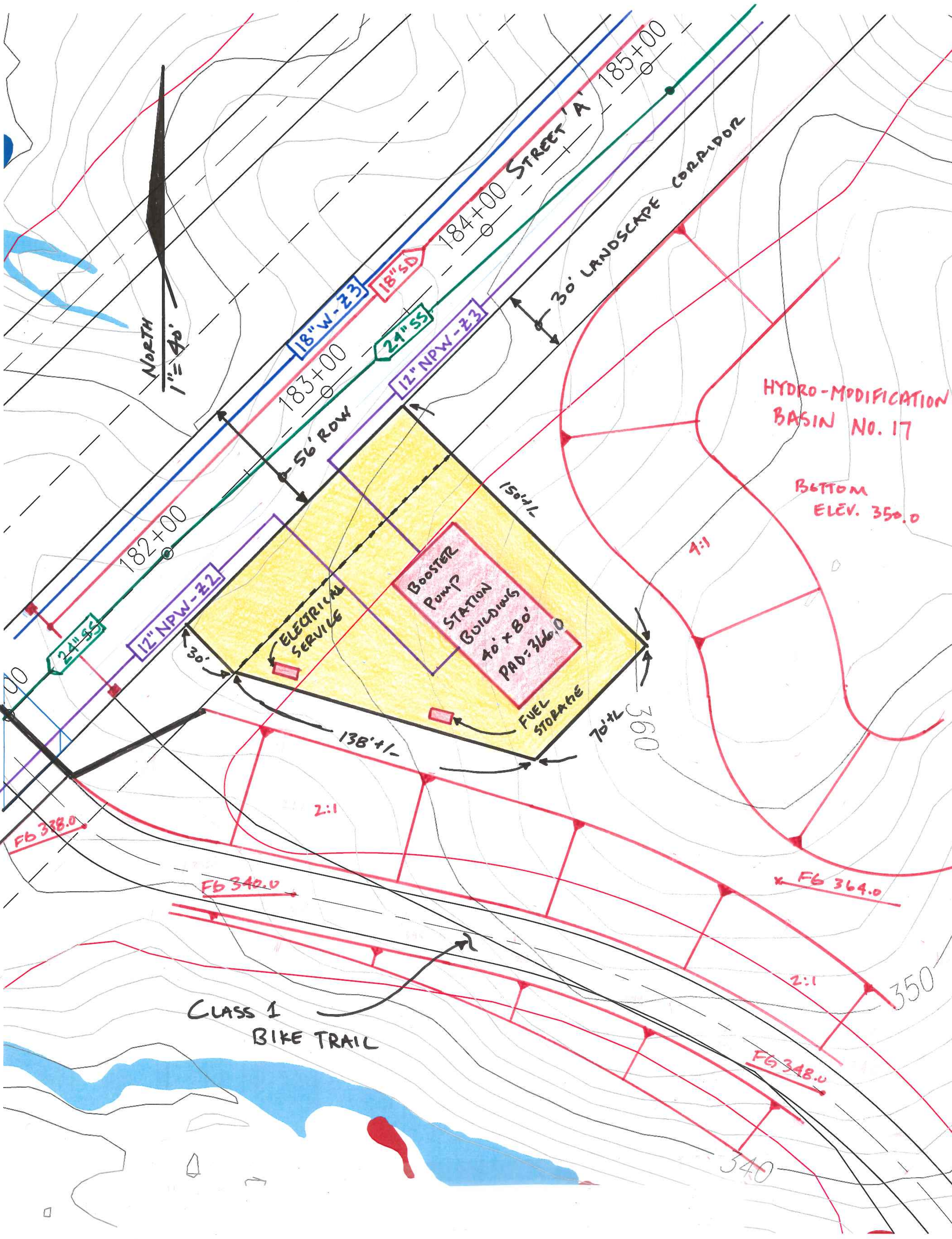


Figure B-2 - Zone 3 BPS Option 2 Site Layout
FPA - Non-Potable Water Analysis

City of Folsom, Scale 1"=800'

California August 2014

J. Crowley Group

MacKay & Somps

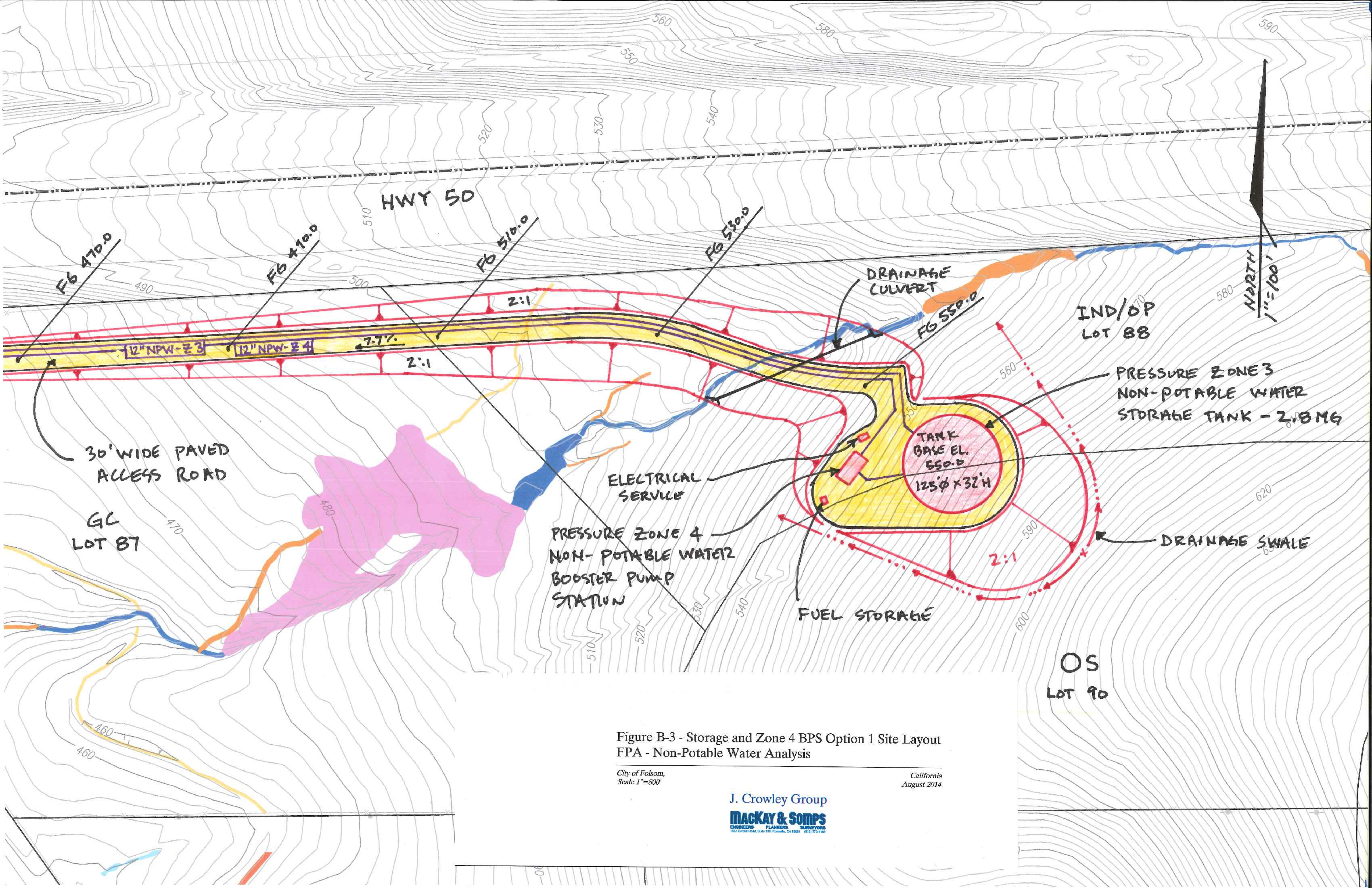


Figure B-3 - Storage and Zone 4 BPS Option 1 Site Layout
FPA - Non-Potable Water Analysis

City of Folsom,
Scale 1"=800'

California
August 2014

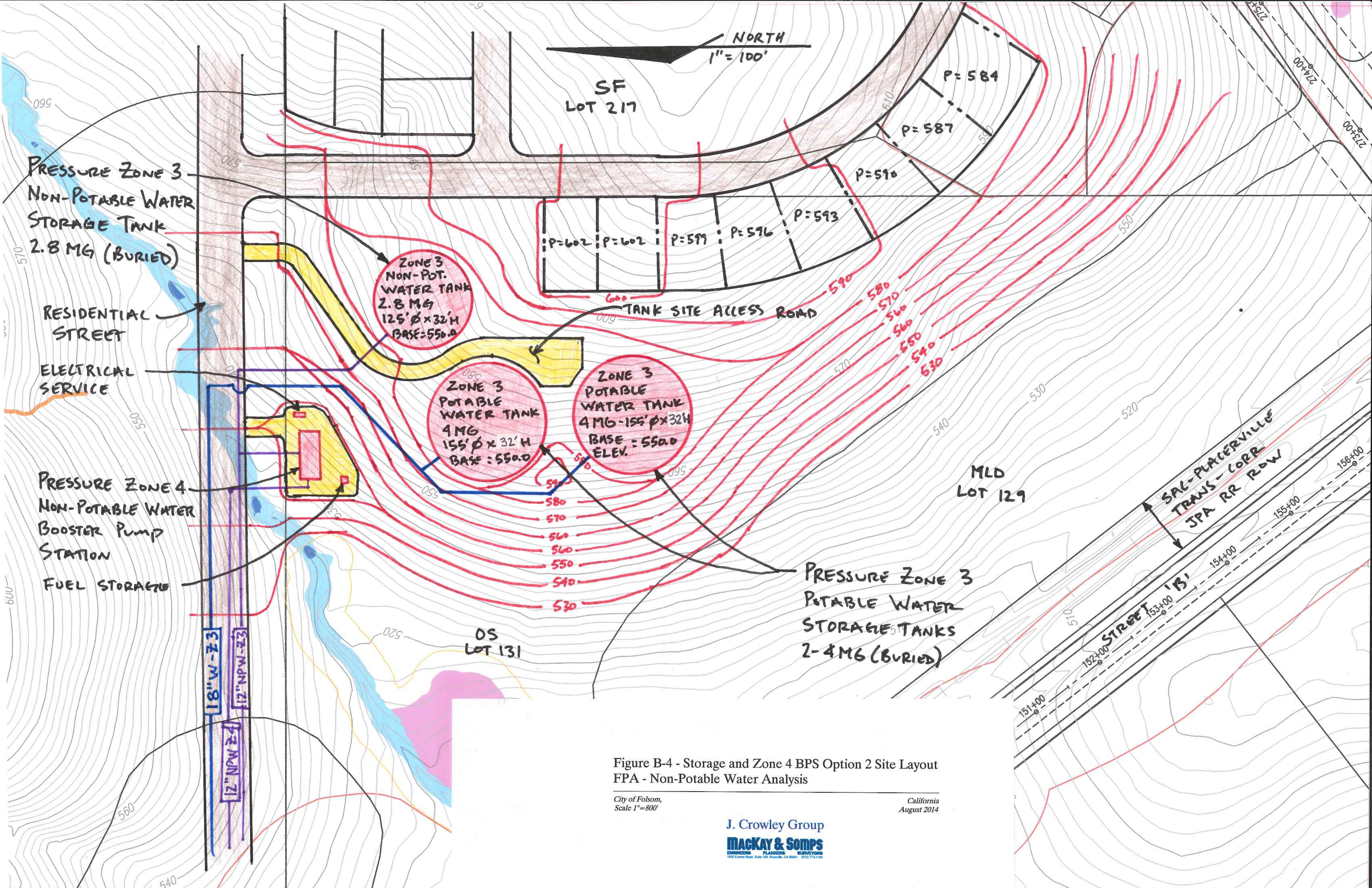


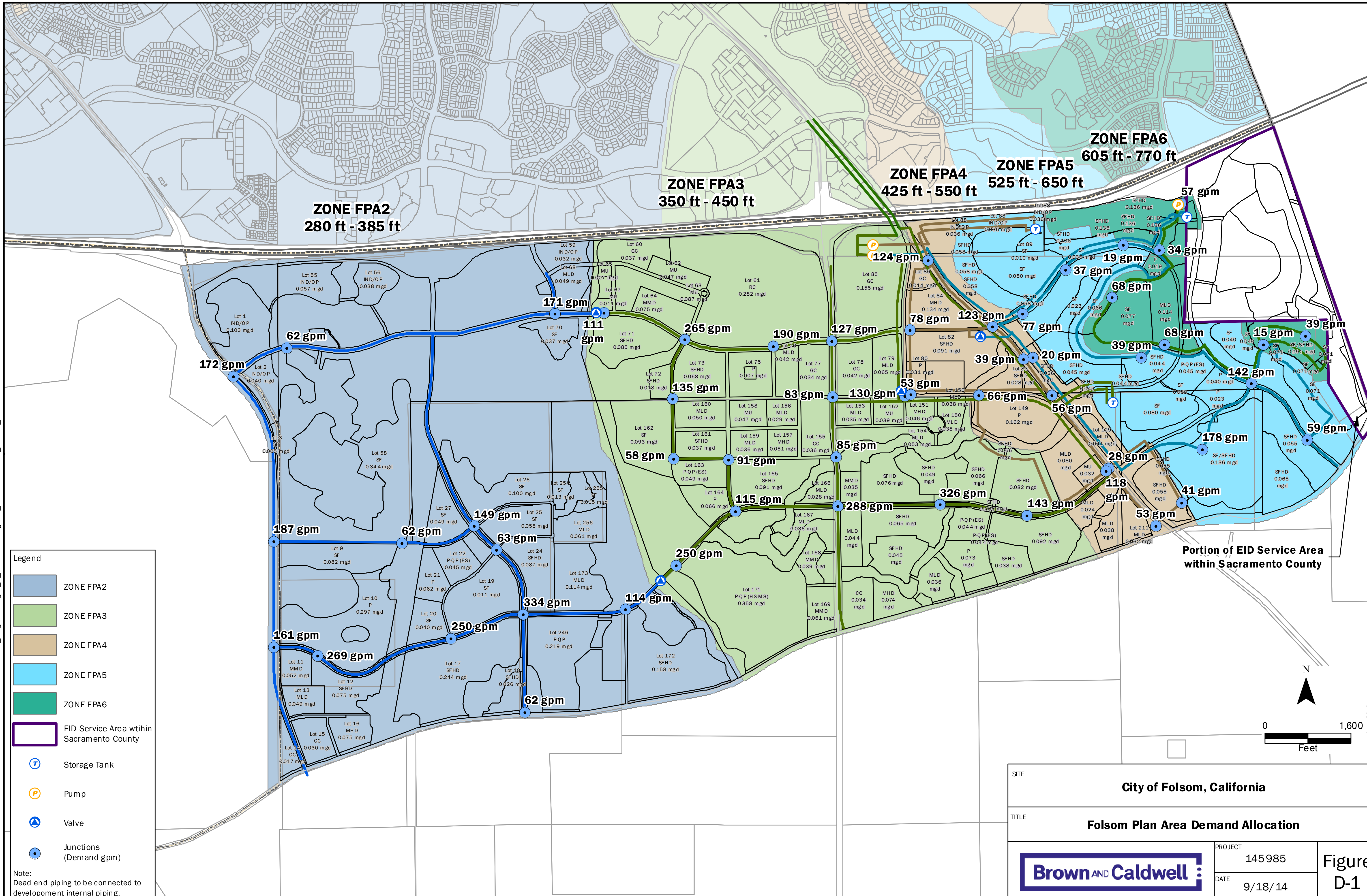
Figure B-4 - Storage and Zone 4 BPS Option 2 Site Layout
FPA - Non-Potable Water Analysis

City of Folsom, Scale 1"=800' — California, August 2014

J. Crowley Group

MacKay & Somps

Appendix D: Water Demand Allocation



SITE

City of Folsom, California

TITLE

Folsom Plan Area Demand Allocation

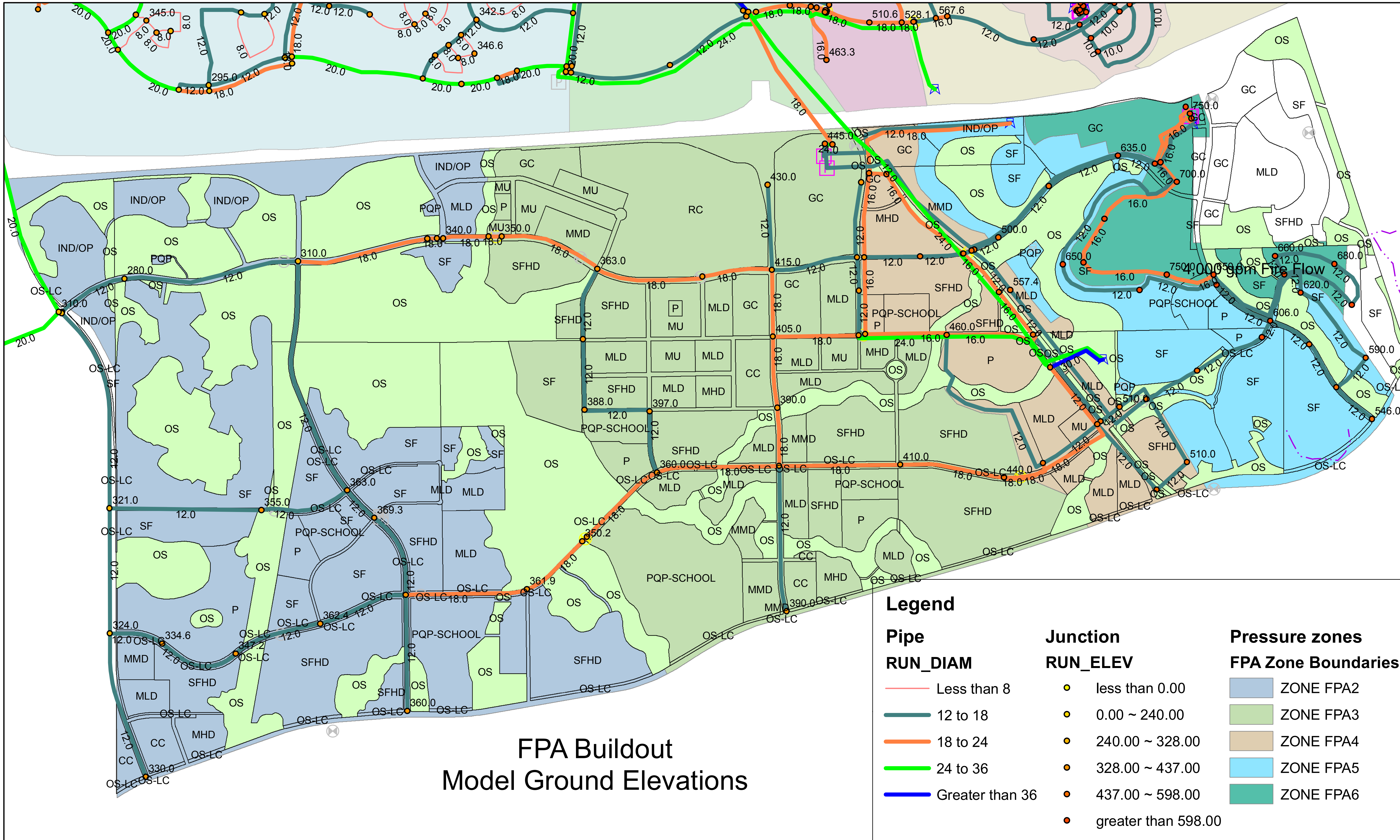
Brown AND Caldwell

PROJECT 145985

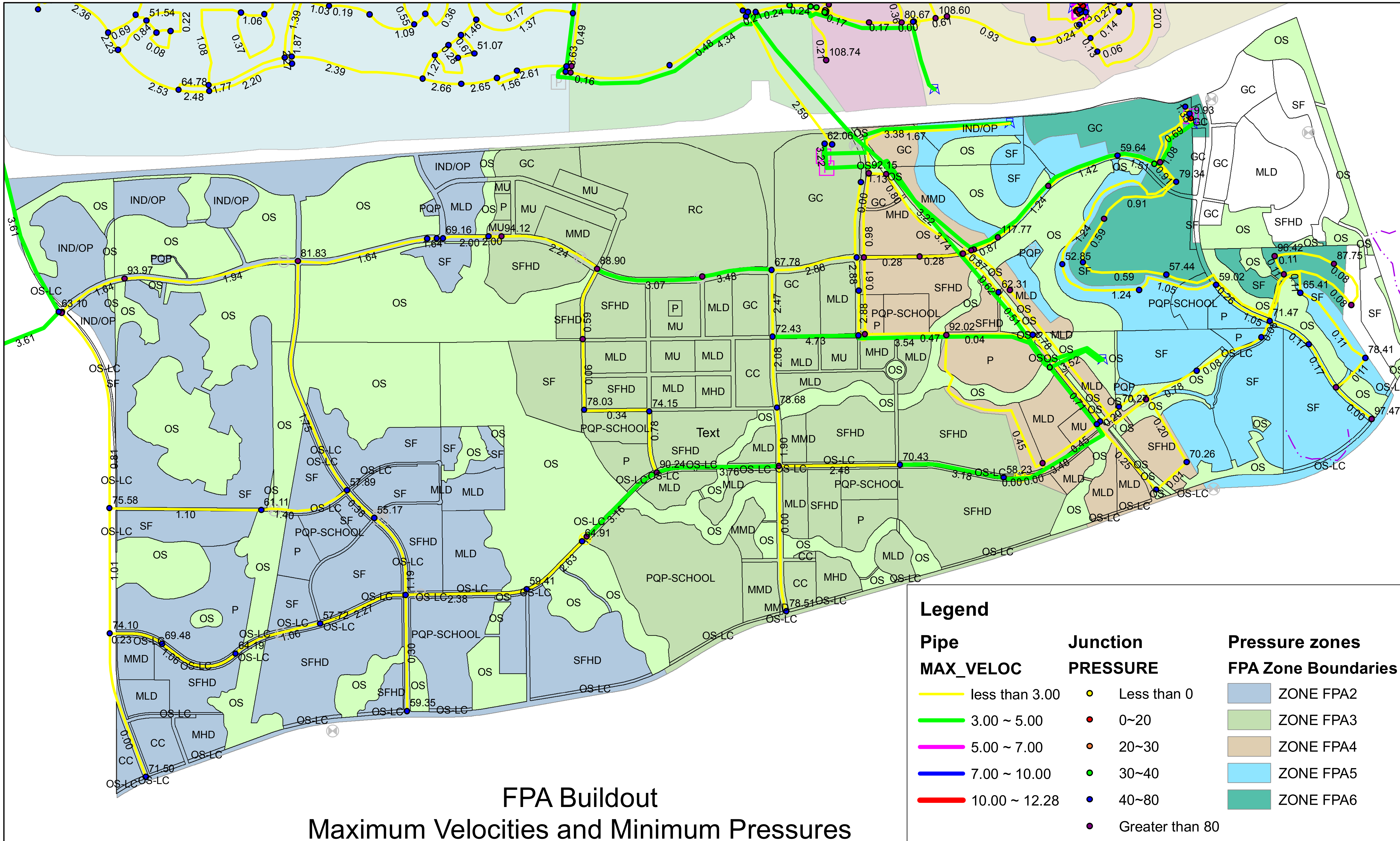
DATE 9/18/14

Figure D-1

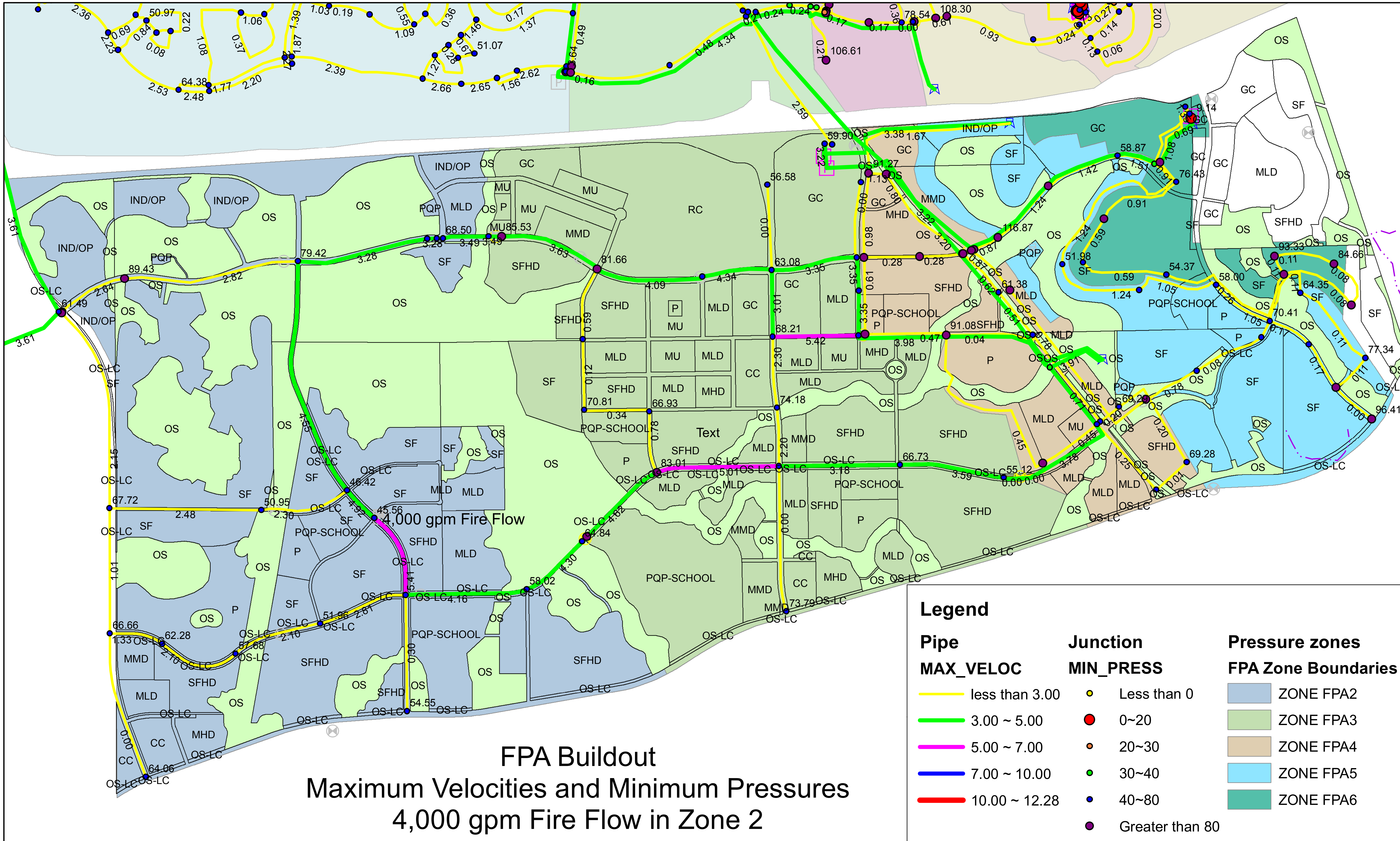
Appendix E: Hydraulic Model Results



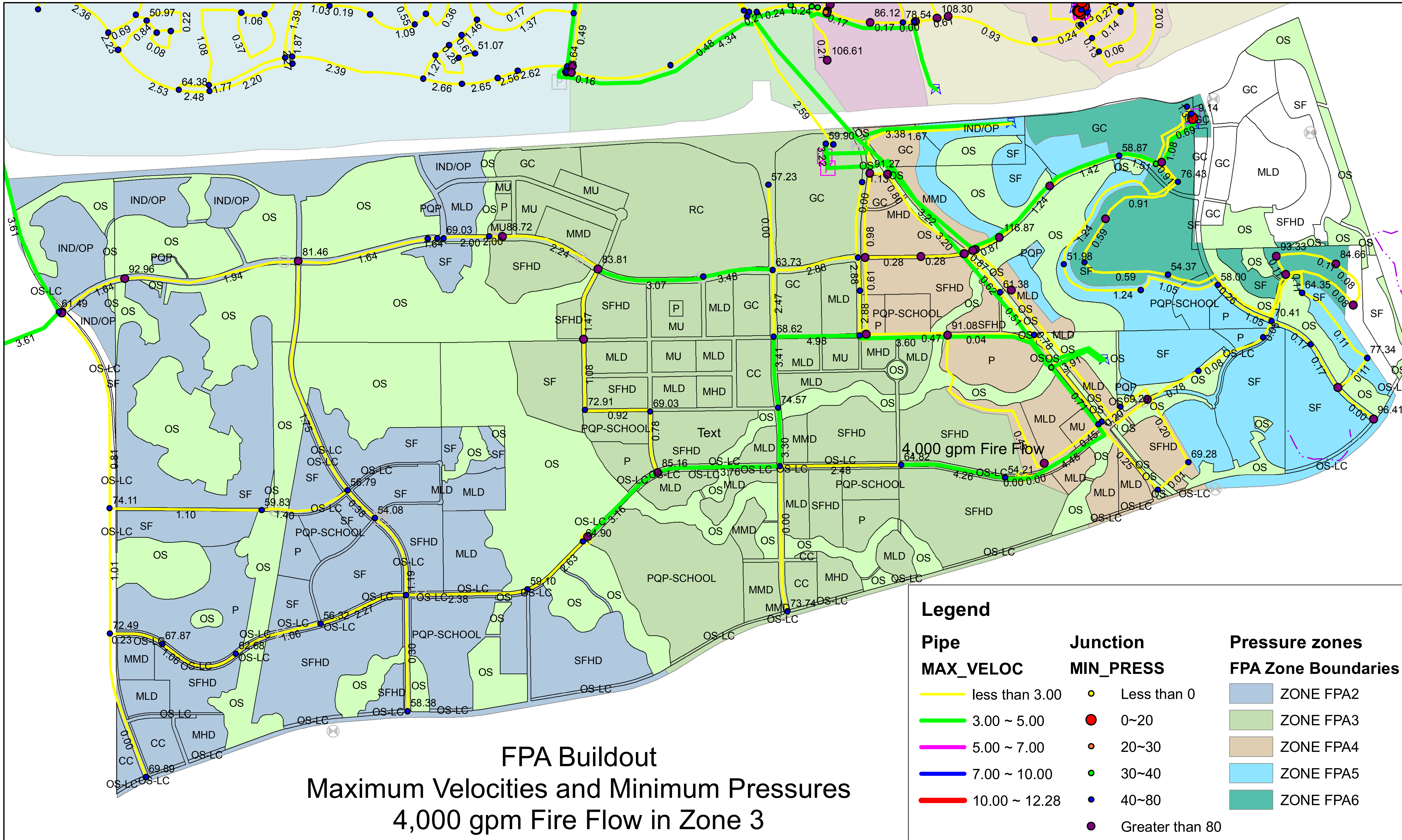
FPA Buildout
Model Ground Elevations



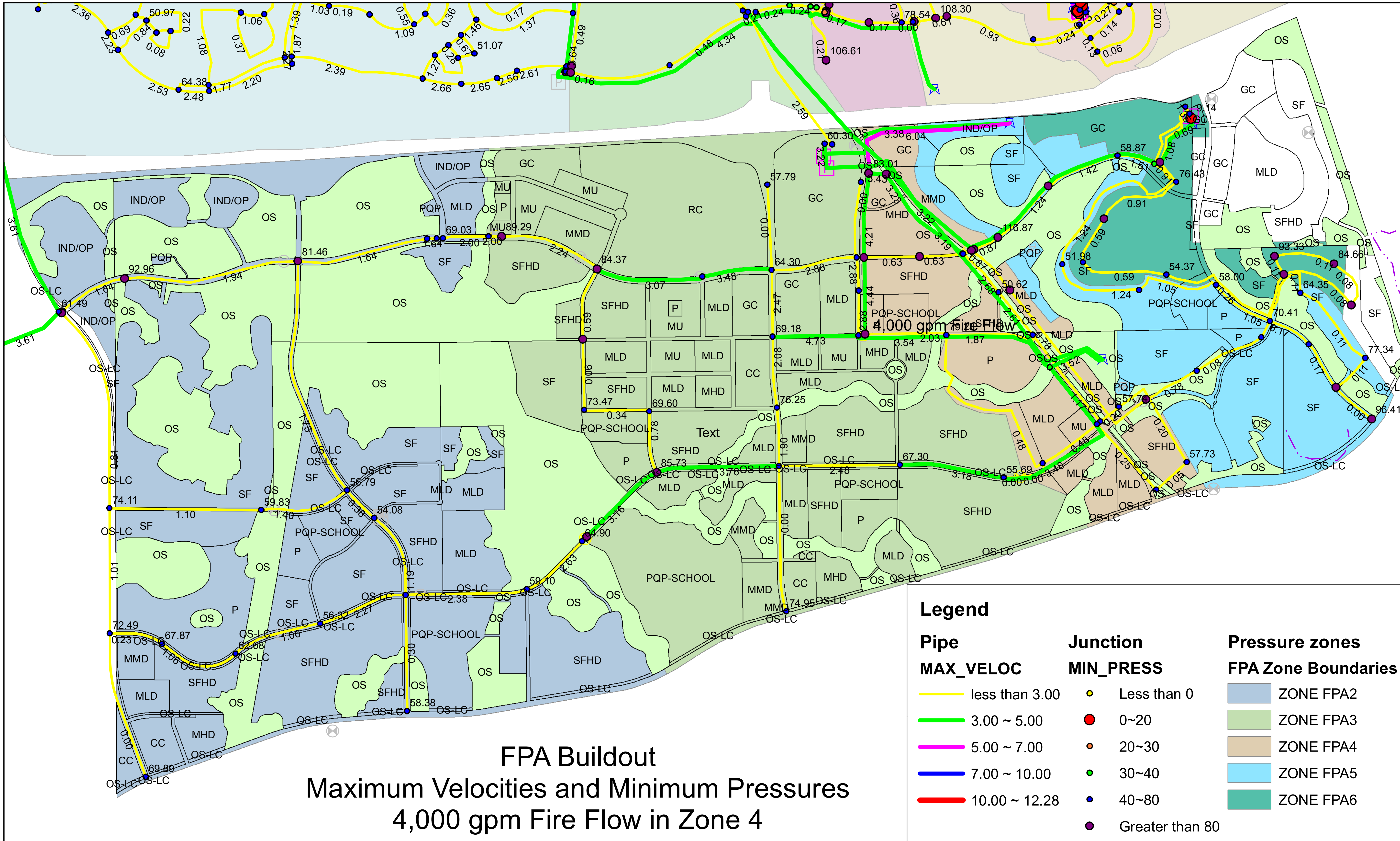
FPA Buildout
Maximum Velocities and Minimum Pressures



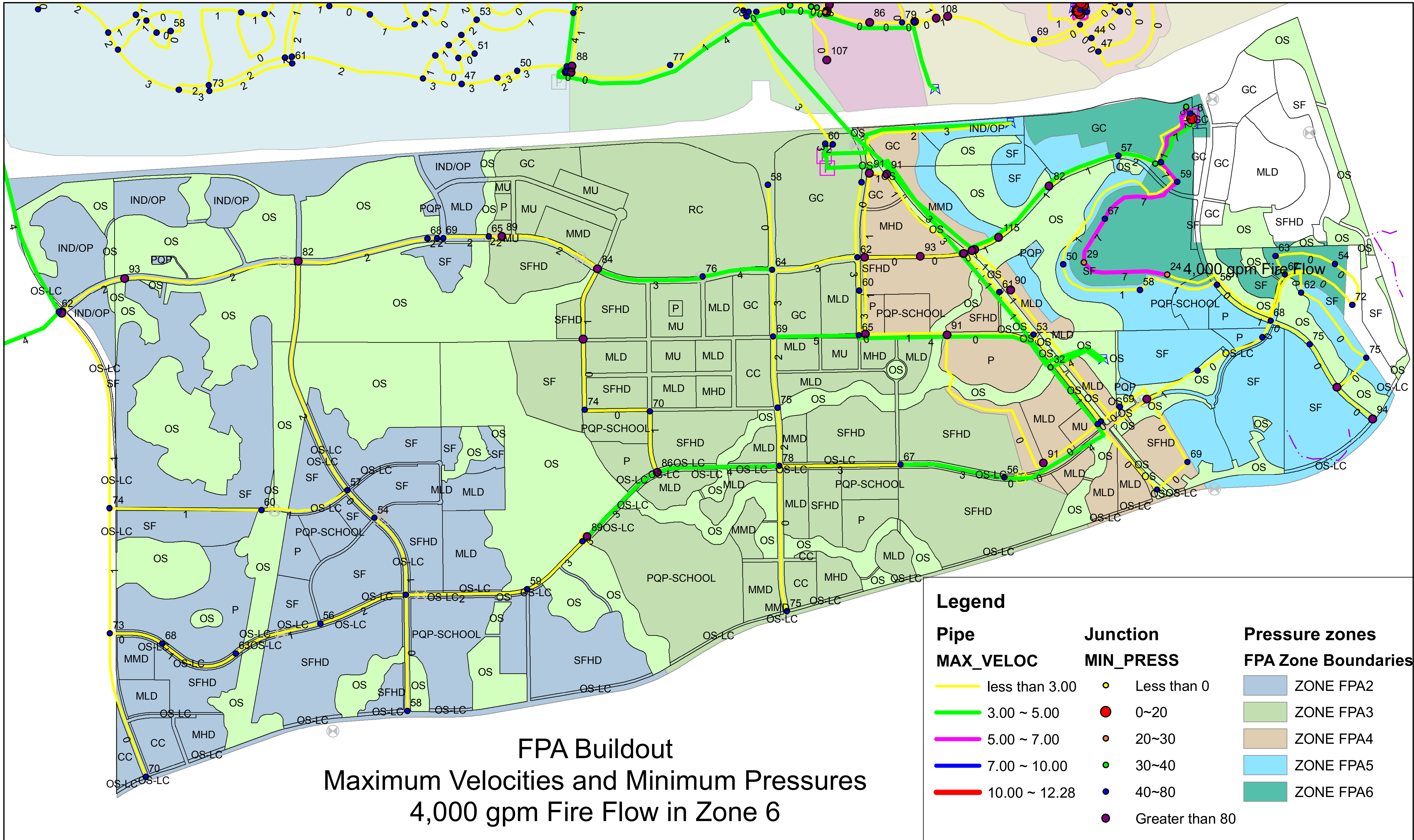
FPA Buildout
Maximum Velocities and Minimum Pressures
4,000 gpm Fire Flow in Zone 2



FPA Buildout
Maximum Velocities and Minimum Pressures
4,000 gpm Fire Flow in Zone 3



FPA Buildout
Maximum Velocities and Minimum Pressures
4,000 gpm Fire Flow in Zone 4



FPA Buildout
Maximum Velocities and Minimum Pressures
4,000 gpm Fire Flow in Zone 6

Appendix F: Water Infrastructure for Initial Folsom Area Plan

Phase 1. Westland 840 Units

Memorandum

10540 White Rock Road, Suite 180
Rancho Cordova, California 95670

T: 916.444.0123
F: 916.635.8805

Subject: Water Infrastructure for Phase 1. Westlands 840 Units

Date: February 10, 2014

To: Todd Eising, City of Folsom

From: Melanie Holton, PE

Copy to: Jeff Lawrence, PE

The backbone water system infrastructure required to serve Phase 1 Westlands 840 Units in the Folsom Plan Area (FPA) is illustrated on Figure 1. Below is a summary of the information used for this analysis and required facilities to serve the subject area.

Area served: Phase 1. Westlands 840 Units

Water supply: City's existing Zone 3

Storage: Operational, emergency, and fire flow demands will be provided by the City's existing Foothills Reservoir in existing Zone 3. For units served in Zone FPA4, if Zone FPA5 tank is installed, operational, emergency, and fire flow demands would be met by the Zone FPA5 tank (see below for Zone FPA4 facilities options)

Maximum day demand: 390 gpm (0.56 mgd). This is based on the water demand by parcel information in the FPA Master Plan dated February 2012.

Required facilities: FPA backbone facilities required to be constructed to serve this area are listed below.

Supply facilities from existing system to FPA:

- 24-in diameter pipeline – 3,000 linear feet
- 18-in diameter pipeline – 3,000 linear feet (redundant pipeline)

On site facilities:

Zone FPA3 (Service elevations < 450 ft)

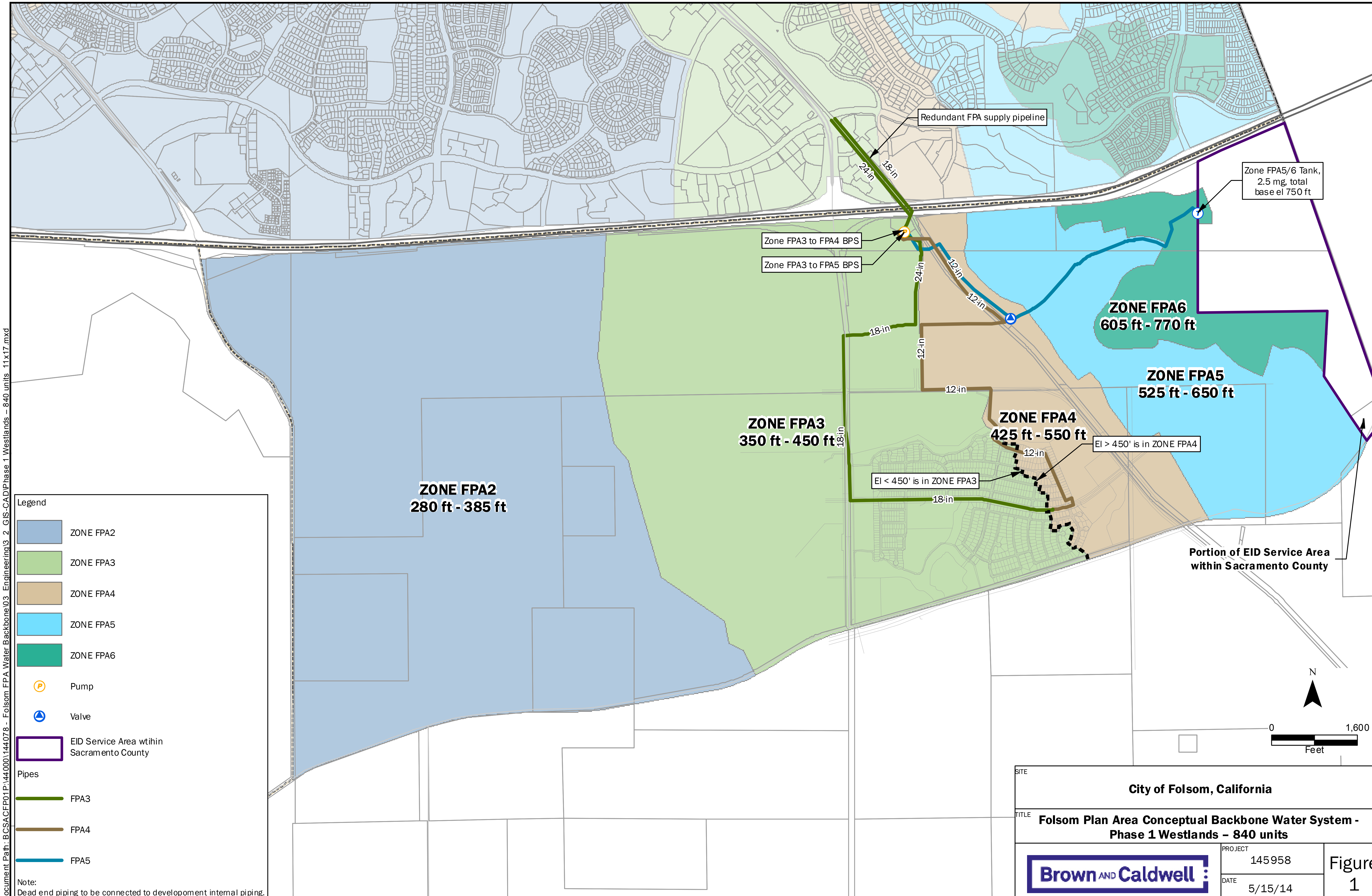
- 24-in diameter pipeline - 2,100 linear feet
- 18-in diameter pipeline – 8,000 linear feet
- The 24-in and 18-in diameter pipelines shall have valve boxes with locking lids

Zone FPA4 (Service elevations >450 ft)

- 12-in diameter FPA4 pipeline – 8,000 linear feet
- Option A. Either Zone FPA4 BPS (sized based on demand in Zone FPA4) to meet peak hour demands and with additional fire flow pump (1,500 gpm) with 3,000 linear feet of 12-in diameter pipeline.

  Option B. Or Zone FPA5 BPS and ZoneFPA5 tank with 8,500 linear feet of 12-in diameter pipeline.

Option B would allow operational, emergency, and fire storage to be held in Zone FPA5 tank. Zone 3 to 5 BPS would only need to be sized to meet maximum day demands in Zone FPA 4 of the Westlands 840 units areas. This option would accommodate a broader range of demands and provide more flexibility in phasing and less "throw away" facilities in comparison to the Option A FPA4 BPS for this phase.



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Phase 1. Russell Ranch 350 Units

Brown AND Caldwell

10540 White Rock Road, Suite 180
Rancho Cordova, California 95670

T: 916.444.0123
F: 916.635.8805

Memorandum

Subject: Water Infrastructure for Phase 1. Russell Ranch 350 Units

Date: May 15, 2014

To: Todd Eising, City of Folsom

From: Melanie Holton, PE

Copy to: Jeff Lawrence, PE

The backbone water system infrastructure required to serve Phase 1 Russell Ranch 350 units in the Folsom Plan Area (FPA) is illustrated on Figure 1. Below is a summary of the information used for this analysis and required facilities to serve the subject area.

Area served: Phase 1. Russell Ranch

Water supply: City's existing Zone 3

Storage: Operational, emergency, and fire flow demands will be provided by the future Zone FPA 5 tank.

Maximum day demand: 242 gpm (0.35 mgd). This is based on the water demand by parcel information in the FPA Master Plan dated February 2012.

Required facilities: FPA backbone facilities required to be constructed to serve this area are listed below.

Supply facilities from existing system to FPA:

- 24-in diameter pipeline – 3,000 linear feet
- 18-in diameter pipeline – 3,000 linear feet (redundant pipeline)

On site facilities:

Zone FPA4 (Service elevations 425ft – 550 ft)

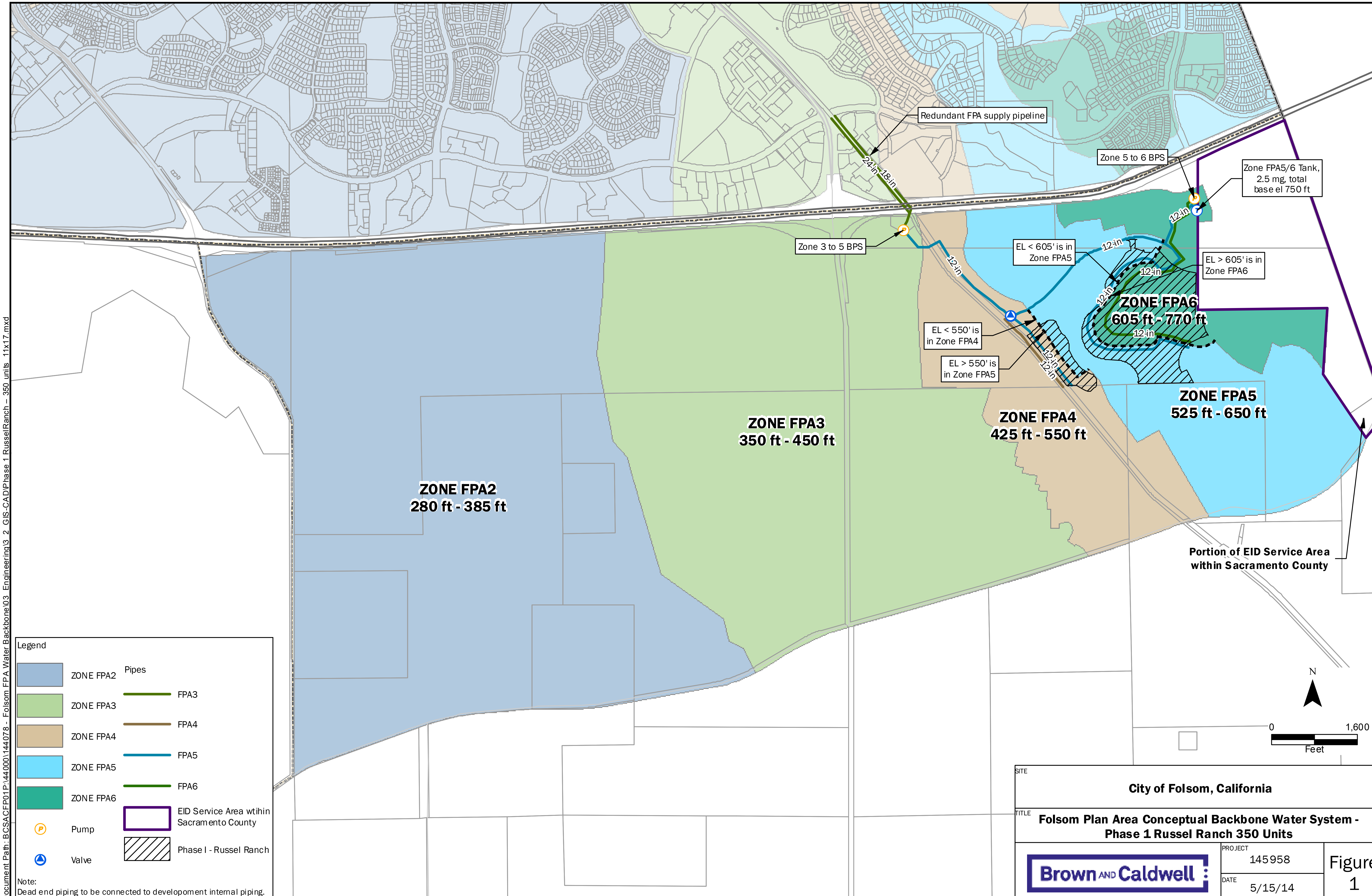
- 12-in diameter pipeline – 1,800 linear feet
- The 12-in diameter pipelines shall have valve boxes with locking lids

Zone FPA5 (Service elevations 550 ft – 650 ft)

- Zone FPA3 to FPA5 BPS (sized based on entire Phase 1 Russell Ranch demand in Zone FPA4, FPA5, and FPA6) to meet maximum day hour demands and with additional fire flow pump (2,000-3,000 gpm, dependant upon the fire flow requirement for the recreational center facilities the park)
- 12-in diameter pipeline – 14,600 linear feet
- The 12-in diameter pipelines shall have valve boxes with locking lids

Zone FPA6 (Service elevations 605 ft – 770 ft)

- Zone FPA5 to FPA6 BPS and ZoneFPA5/6 tank
- 12-in diameter pipeline – 5,300 linear feet
- The 12-in diameter pipelines shall have valve boxes with locking lids



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Phase 1. Easton-Hillsborough 800 Units

10540 White Rock Road, Suite 180
Rancho Cordova, California 95670

T: 916.444.0123
F: 916.635.8805

Memorandum

Subject: Water Infrastructure for Phase 1. Easton Hillsborough 800 Units

Date: May 15, 2014

To: Todd Eising, City of Folsom

From: Melanie Holton, PE

Copy to: Jeff Lawrence, PE

The backbone water system infrastructure required to serve Phase 1 Easton Hillsborough 800 units in the Folsom Plan Area (FPA) is illustrated on Figure 1. Below is a summary of the information used for this analysis and required facilities to serve the subject area.

Area served: Phase 1. Easton Hillsborough

Water supply: City's existing Zone 3

Storage: Operational, emergency, and fire flow demands will be provided by the City's existing Foothills Reservoir in existing Zone 3.

Maximum day demand: 421 gpm (0.61 mgd). This is based on the water demand by parcel information in the FPA Master Plan dated February 2012.

Required facilities: FPA backbone facilities required to be constructed to serve this area are listed below.

Supply facilities from existing system Zone 3 to FPA:

- 24-in diameter pipeline – 3,000 linear feet
- 18-in diameter pipeline – 3,000 linear feet (redundant pipeline)

Supply facilities from existing system Zone 2 to FPA:

- Emergency 2-way PRV
- 20-in diameter pipeline – 3,400 linear feet from existing Zone 2 to FPA Zone 2

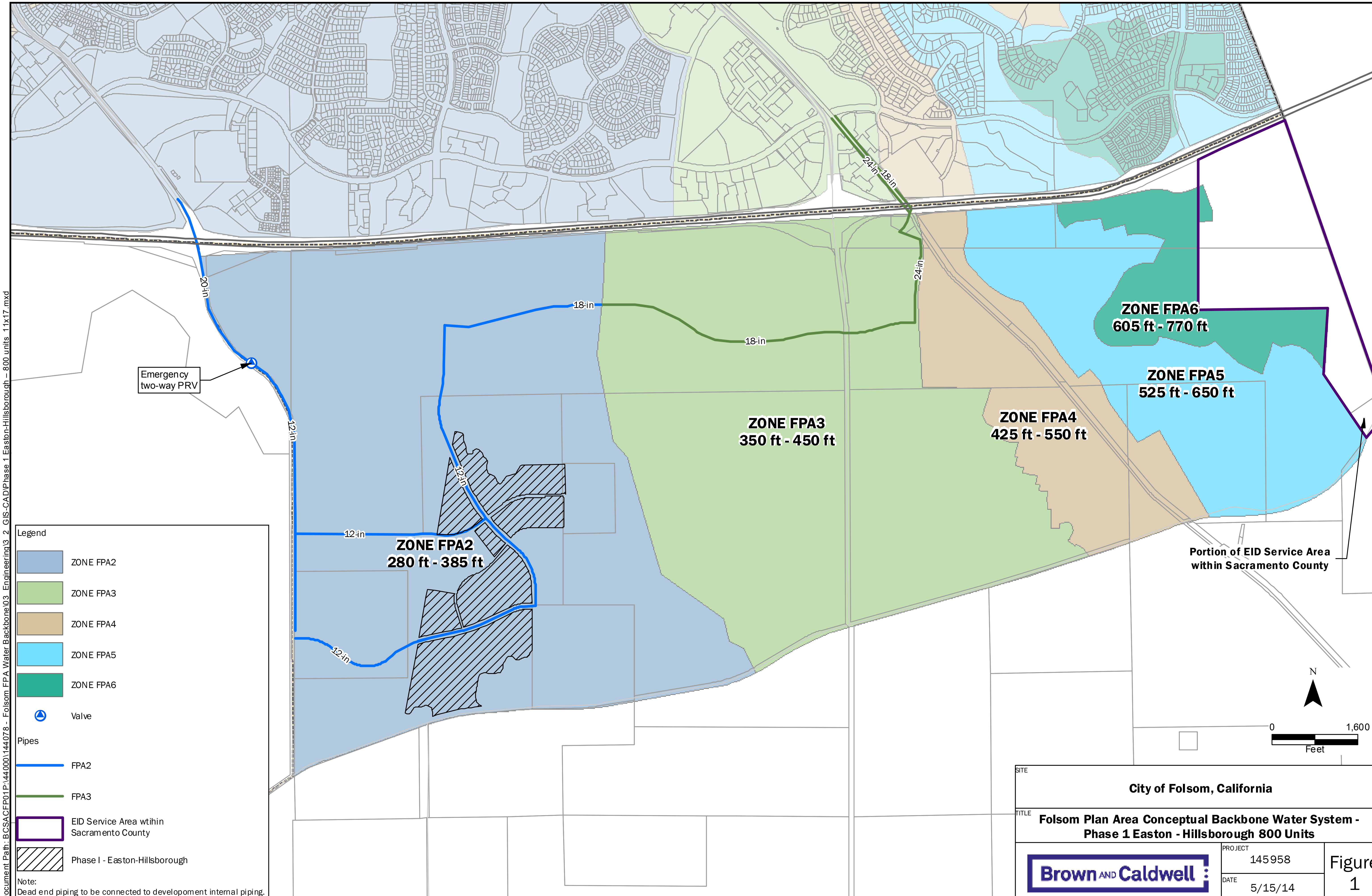
On site facilities:

Zone FPA3 (Service elevations 350ft – 450 ft)

- 24-in diameter pipeline – 1,700 linear feet
- 18-in diameter pipeline – 5,400 linear feet
- The 24-in and 18-in diameter pipelines shall have valve boxes with locking lids

Zone FPA2 (Service elevations 280ft – 385 ft)

- 18-in diameter pipeline - 650 linear feet
- 12-in diameter pipeline – 21,800 linear feet
- The 18-in and 12-in diameter pipelines shall have valve boxes with locking lids



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