Appendix 4.14-1
Hydraulic Modeling Analysis

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January 31, 2019

Letter Report

Stan Gryczko
City of Davis
1717 5th Street
Davis, California 95616

152992

Subject: Hydraulic Model Analysis of Existing System Impacts from Additional Downtown Davis Water Demands

Dear Mr. Gryczko:

At your request, Brown and Caldwell (BC) performed a hydraulic model analysis of the impacts on the City's buildout water system from the future additional Downtown Davis demands using the City's InfoWater hydraulic model. The peak hour pressures, maximum velocities, and unit headlosses in the system were evaluated with the City's current service area at buildout and with the addition of the buildout demands for the future Downtown Davis demands. The fire flow capacity was also evaluated.

Analysis Inputs and Assumptions

The following items include the inputs and assumptions used in this model analysis.

1. Table 1 summarizes the buildout maximum day demands (MDD) for the existing service area and the future Downtown Davis water demands. Future Downtown Davis demands were taken from the shapefile titled "181017_Demands.zip" emailed to BC on November 1, 2018.

Table 1. Summary of Buildout Maximum Day Demands

Location	Demand	
	mgd	gpm
Existing City service area	21.30	14,792
Downtown Davis additional demands	0.15	103
TOTAL	21.45	14,895

mgd = million gallons per day
gpm = gallons per minute

2. The active water supply sources available in the hydraulic model include the surface water supply and the five Davis deep wells (DDW) 30, 31, 32, 33, and 34.
3. Table 2 lists the criteria for analyzing piping used for this analysis. The criteria are from the 2011 Water Distribution System Optimization Plan, (BC, May 2011).

Table 2. Pipe Criteria		
Criteria	**Value/description**	**Reference**
Minimum Size	Newly installed water mains in a community water system shall have a nominal diameter of at least four inches.	22 CCR § 64573
	Sufficient size to carry maximum day plus fire flow or peak hour demands	BC
Minimum Pressure at Customer Connection, during MDD	Required with fire flow: 20 psi	22 CCR § 64602
	Desired without fire flow: 40 psi	M32, pg 68
	Allowable during peak hour: 35 psi	BC
Maximum Velocity	Evaluation: 10 fps (velocities this high have potential for water hammer) New Facilities: 5 fps	M32, pg 69
Unit Headloss	5 to 7 ft/1,000 ft (values higher than 10 ft/1,000 ft may have wasted energy)	BC
Hazen Williams C Factor	New Facilities: 130	BC

4. Based on City staff conversations (January 2019) with the City's Fire Marshall a minimum fire flow of 3,000 gpm is required in the Downtown Davis area. For the analysis of fire flow capacity it is assumed there are no maximum velocity constraints in the system during a fire flow event.

Analysis Results

The hydraulic model was analyzed for a 24-hour run using the inputs listed above. Figures 1 through 4 in Attachment A illustrate the results of this modeling analysis. The analysis results are summarized by figure below.

Figure 1. Buildout Peak Hour Pressure with Downtown Davis Demands

The peak hour pressure over a 24-hour period is illustrated in the existing service area with the buildout demands including future new Downtown Davis demands. Peak hour pressures are maintained above 35 psi throughout the system which meets the City's performance criteria. This figure is provided to show the context of the Downtown Davis area within the larger existing system.

Figure 2. Buildout Peak Hour Velocities with Downtown Davis Demands

The peak hour velocities comply with the City's performance criteria and typically range from 0.1 fps to 1.5 fps.

Figure 3. Buildout Peak Hour Unit Headloss with Downtown Davis Demands

The maximum unit headlosses comply with the City's performance criteria and typically are lower than 3 ft per 1,000 ft (ft/1,000 ft).

Figure 4. Buildout Fire Flow Capacities in Downtown Davis with Downtown Davis demands

The hydraulic model was used to evaluate the fire flow capacity at each of the nodes near existing fire hydrants in the Downtown Davis area. The fire flow capacity is the flow available in the system while maintaining 20 psi. Over 3,000 gpm is available throughout this area, meeting the minimum fire flow capacity.

Conclusions

Based on the hydraulic model analysis, no system improvements are needed to meet the City's pipe criteria for minimum pressure, maximum velocity, and unit headloss. The system also has the fire flow capacity required for this area with no additional system improvements.

Brown and Caldwell appreciates that the City has requested our services in assisting with this project. Should you have any questions, please do not hesitate to call me at 916-853-5353.

Very truly yours,

Brown and Caldwell

Melanie Holton
Project Manager, P.E.

cc: Carlos Quispe, Brown and Caldwell

Attachments:

1. Attachment A: Figures 1 through 4

Limitations:

This document was prepared solely for the City of Davis in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Davis and Brown and Caldwell dated December 18, 2014. This document is governed by the specific scope of work authorized by the City of Davis; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Davis and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Attachment A

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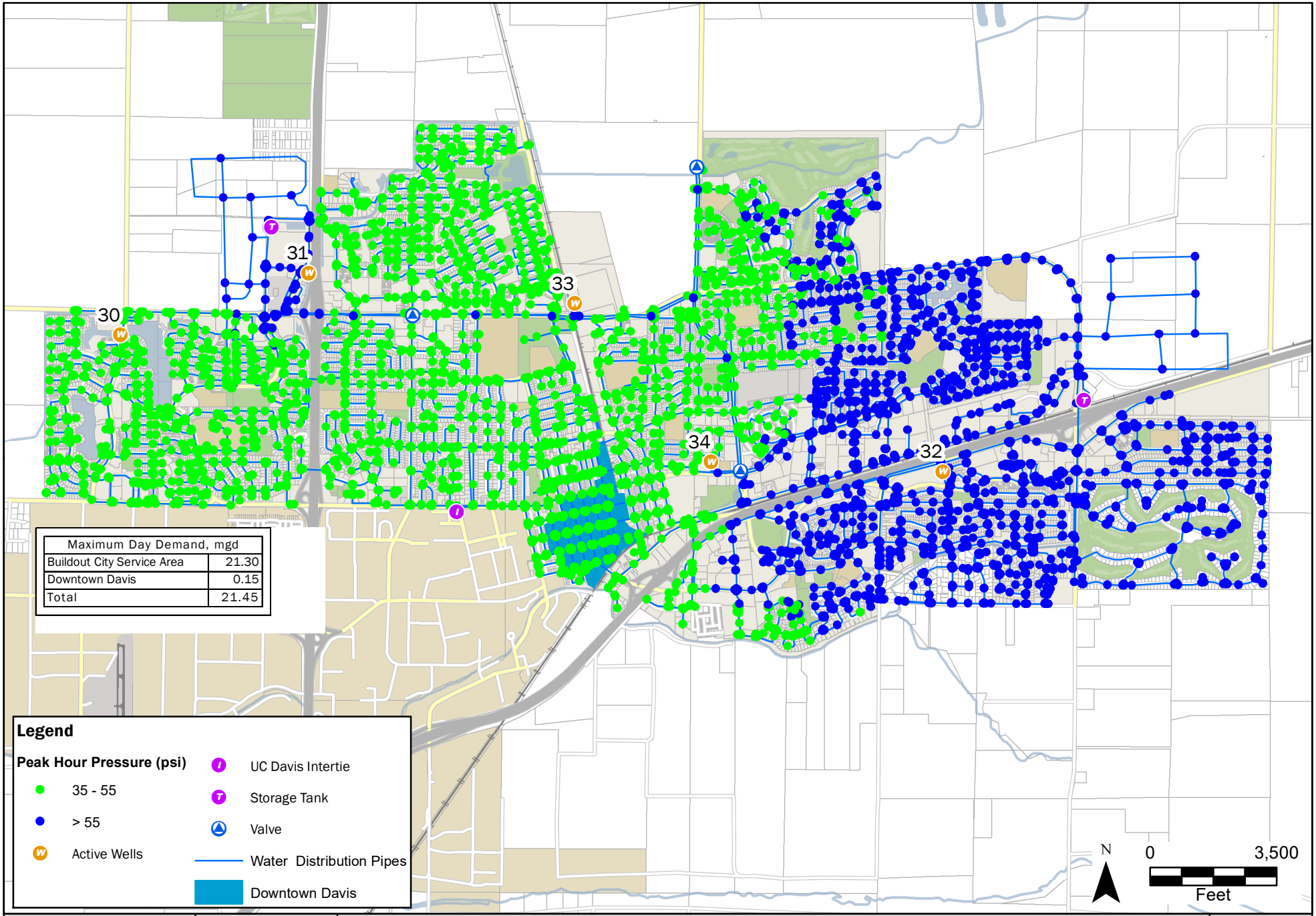

Brown AND Caldwell / Davis California	PROJECT 152992	SITE **Additional Downtown Water Demands**	**Figure 1**
	DATE 01/06/2019	TITLE **Buildout Peak Hour Pressure with Downtown Davis Demands**	

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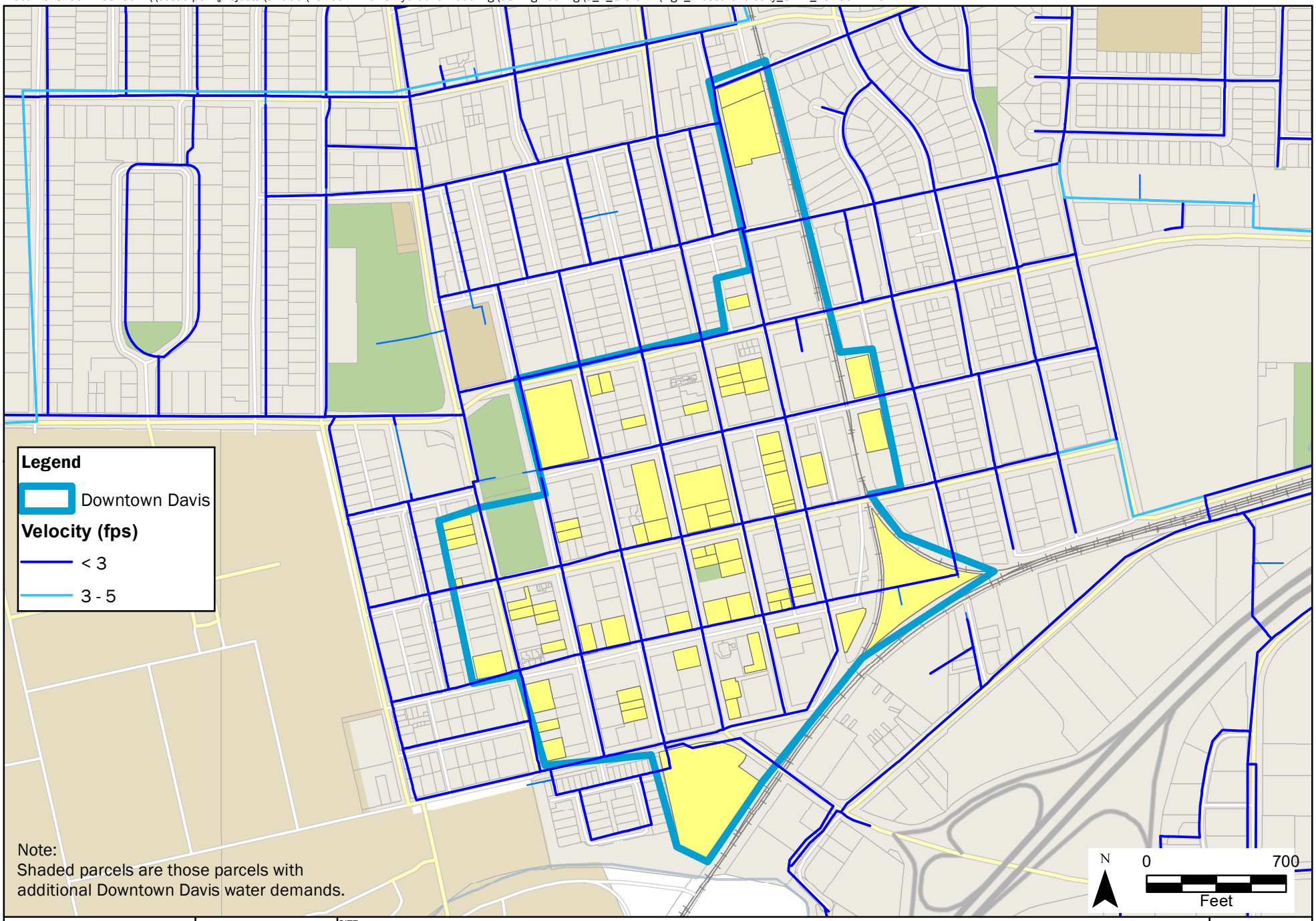

Brown AND Caldwell / Davis California	PROJECT 152992	SITE **Additional Downtown Water Demands**	**Figure 2**
	DATE 01/06/2019	TITLE **Buildout Peak Hour Velocities with Downtown Davis Demands**	

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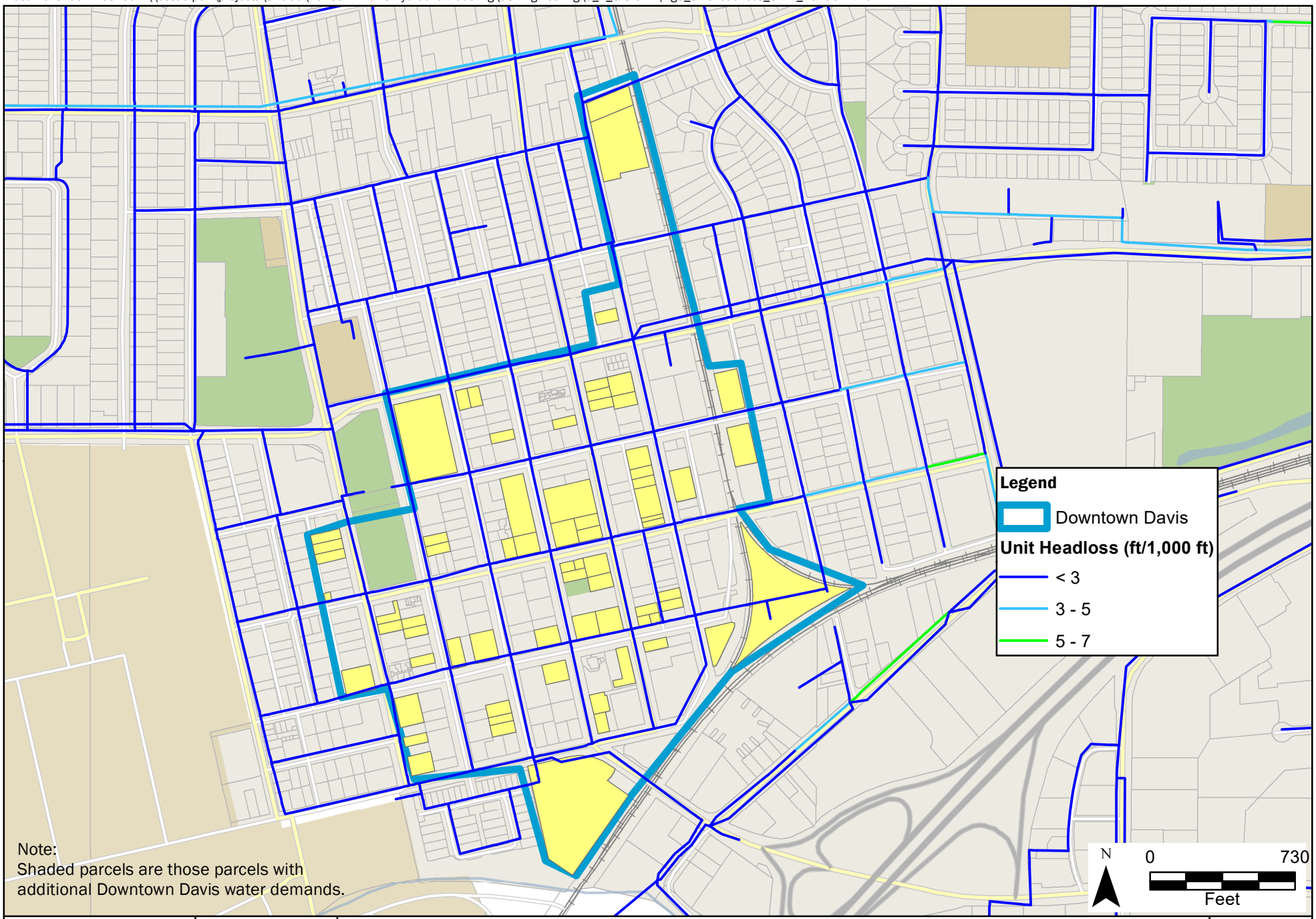

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PROJECT	SITE	
152992	**Additional Downtown Water Demands**	**Figure 3**
DATE	TITLE	
01/06/2019	**Buildout Peak Hour Unit Headloss with Downtown Davis Demands**	

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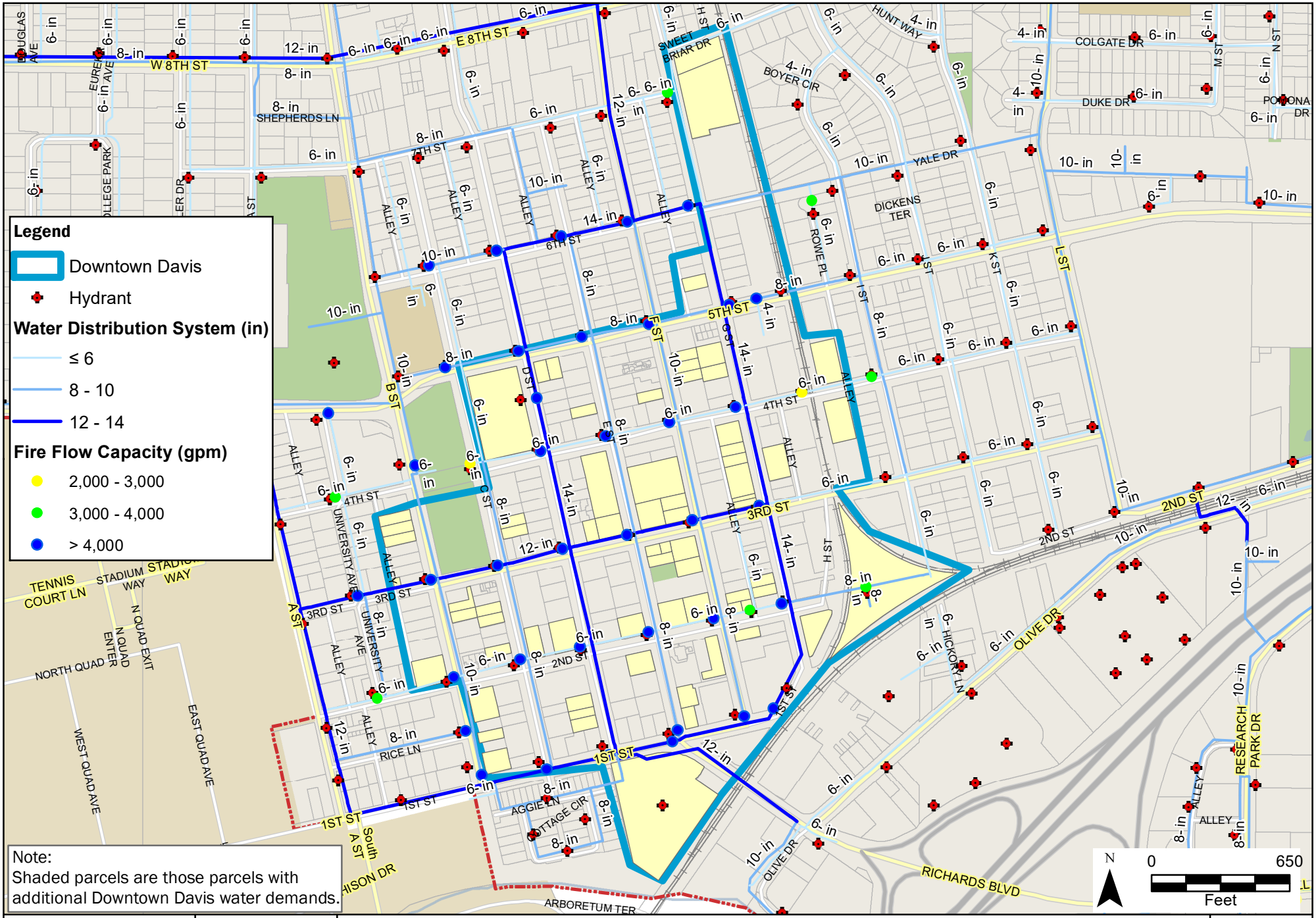

Brown AND Caldwell / Davis California	PROJECT 152992	SITE **Additional Downtown Water Demands**	**Figure 4**
	DATE 01/06/2019	TITLE **Buildout Fire Flow Capacities with Downtown Davis Demands**	