Draft Final Evaluation of Options to Improve Fire Flow Infrastructure in Los Altos Hills County Fire District

Los Altos Hills

December 2017
EKI B70079.00

EKI ENVIRONMENT & WATER, INC.

www.ekiconsult.com

577 Airport Blvd, Suite 500 • Burlingame, CA 94010

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

EKI Environment & Water, Inc. ("EKI") is pleased to submit this evaluation of options to improve fire flow infrastructure to the Los Altos Hills County Fire District ("LAHCFD" or "District"). The District has received proposals for capital improvement projects to improve fire flow availability in the District from the two water agencies located within its boundaries, Purissima Hills Water District ("PHWD") on the west side and California Water Service Company – Los Altos District ("Cal Water") on the east side (see Figure 1, Appendix A, and Appendix B). Proposed project locations are shown on Figure 1. EKI has been retained by LAHCFD to assist in evaluating the proposals, engaging key stakeholders, identifying cost-sharing strategies, and providing recommendations for implementation.

The District requires that sufficient water flow and pressure is available for fire protection throughout the District. To achieve adequate fire protection, LAHCFD has identified a target fire flow of 1,250 gallons per minute ("gpm") for all fire hydrants within the District, while maintaining a system pressure of at least 20 pounds per square inch ("psi") at all service connections in the zone. Each water supplier that serves the District's residents has identified hydrants that currently do not meet this standard and has proposed capital projects to address these deficiencies. Proposed projects include upsizing several water mains and other system upgrades to achieve the flow and pressure requirements. The projects are potentially multi-year and multi-million-dollar capital projects, and each water agency would procure the design, engineering and construction services for their respective, agreed-upon projects. The District's goals are to responsibly fund effective fire flow improvement projects and increase public safety in the District.

1.1 Scope of Work

The scope of work for the evaluation included the following primary tasks:

- Request and gather information from the District and key stakeholders, including the PHWD, Cal Water, and the Santa Clara County Fire Department ("SCCFD") regarding the water systems, proposed projects, and priorities.
- Perform a high-level review of the agencies' analyses to check that the methods of analysis are reasonable.
- Confirm that the predicted fire flow improvements are expected to be achieved by the proposed capital improvement projects.
- Assess project benefits and costs.
- Prioritize projects.
- Develop cost-sharing strategies.
- Develop recommended implementation plan.
- Provide regular progress updates to the LAHCFD Board.
- Prepare a final report.

1.2 Report Organization

The WSMP is organized into the following sections:

- Section 1 - Introduction
- Section 2 – Criteria for Prioritizing Fire Flow Improvement Projects
- Section 3 – Evaluation of PHWD Fire Flow Improvement Options
- Section 4 – Evaluation of Cal Water Fire Flow Improvement Options
- Section 5 - Recommendations
- Section 6 - References

2. CRITERIA FOR PRIORITIZING FIRE FLOW IMPROVEMENT PROJECTS

In consultation with John Justice, the Deputy Fire Chief of the Santa Clara County Fire Department, and with George Tyson and Mark Warren, commissioners of the LAHCFD, EKI determined that LAHCFD has primary and secondary criteria for prioritizing fire flow improvement projects. The primary criterion is the quantity of fire flow available up to the goal of 1250 gpm while maintaining a minimum of 20 psi residual pressure at all service connections throughout the zone in which the fire flow is being provided, during any given day of the year. The most demanding conditions occur during the maximum day demand conditions, which typically occurs in the summer time. Fire flow availability should be evaluated under maximum day conditions.

The secondary criterion that LAHCFD weighs is the proximity of houses to the open space of the Rancho San Antonio Open Space Preserve running along the southern and southwestern border of LAHCFD (see Figure 1), a region with lots of vegetation which can be susceptible to wild fires. If competing projects serve the same number of hydrants, the projects which improve the fire flows along the border with the Rancho San Antonio Open Space Preserve should be prioritized.

LAHCFD seeks to fund projects that meet their criteria as cost-effectively as possible. Therefore, in the following sections projects are evaluated according to how much "bang for the buck" they provide.

Where information was not readily available or provided to weigh proposed projects against these criteria, EKI has proposed next steps for the District to obtain the necessary information to prudently prioritize spending.

3. EVALUATION OF PHWD FIRE FLOW IMPROVEMENT OPTIONS

EKI evaluated and prioritized the PHWD fire flow improvement options according to the criteria established in Section 2, and developed cost sharing-strategies.

3.1 PHWD Infrastructure Information Gathering and Review

After reviewing PHWD's *DRAFT PROPOSAL TO IMPROVE HYDRANT FIRE FLOWS IN ZONE 4*, EKI held an initial phone call with Patrick Walter, General Manager of the PHWD, to discuss the objectives of the evaluation, our basic understanding of the proposal, and the types of information we were seeking. PHWD provided a number of documents and files with detailed information on the water system and its fire flows (see Appendix A). EKI held an in person meeting with Patrick Walter and Erik Walter, GIS/Operation staff on 22 August 2017 in which the system maps, system schematics, and fire flow model analyses were reviewed in detail. PHWD provided further documents by email after the meeting (see Appendix A).

3.2 Assessment of PHWD's Fire Flows

EKI used the results of hydraulic modeling analyses conducted by PHWD's engineering consultant Pakpour Consulting Group to analyze PHWD's fire flows during maximum day demand conditions, with pumps off. As shown in Appendix A, the PHWD is composed of four pressure zones fed entirely from SFPUC in Zone 1. Table 1 shows a breakdown of available fire flows during maximum day demand (MDD), with pumps off, by pressure zone (see Appendix A for more detailed fire flow tables). PHWD Zone 4, the uppermost hydraulic grade line zone, and Zone 2 each have a total of 20 hydrants with fire flow under 1250 gpm, while Zone 3 has nine hydrants with fire flows under 1250 gpm. Although Zone 4 and Zone 2 have the same number of deficient hydrants, the deficient Zone 4 hydrants are clustered more closely together (see hydrant fire flow maps in Appendix A) and mostly occur relatively close to the main "backbone" of the water system, running from the Page Mill Tank Site to the west, up along Page Mill, and east along Altamont Rd (see Figure 2). Therefore, upsizing the Zone 4 backbone would provide a cost-effective means of boosting fire flows in many downstream deficient clusters on branches off the backbone by reducing head losses along the backbone.

3.3 Prioritization of PHWD Projects and Cost-Sharing Framework

The construction costs and fire flow benefits of implementing capital improvement projects ("CIPs") along the Page Mill Road and Altamont Rd backbone as well as the other proposed CIPs in PHWD's proposal are listed in two different cost-sharing approaches in Table 2A and Table 2B. The number of hydrants fully improved to fire flows exceeding 1250 gpm and total number of hydrants improved (these are the hydrants that will experience an increase in their flow because of the planned improvements but that increase may not exceed 1250 gpm; detailed modeling will be required to be more specific) are shown, as well as the number of parcels

served by the improved hydrants. The estimated costs shown in the tables are based on PHWD's recent construction costs (these costs only include construction costs and not other project costs, e.g., design, permitting, construction management). Shown in Table 2A are the costs to replace the smaller diameter pipe with a larger diameter pipe to accommodate the increase in flow required to meet the goal of 1,250 gpm with a 20 psi residual from each fire hydrant. Shown in Table 2B is the incremental cost of installing a larger diameter pipe, assuming that the water supplier is paying the portion of the cost share that would be spent if the pipe were just replaced with another pipe of the same diameter.

In Table 2A, clearly Zone 4 backbone improvements show the lowest cost per hydrant improved. In addition, Zone 4 borders the Foothill Preserve, so is considered a higher risk zone.

Because the original Altamont CIP was designed to meet a fire flow target of 1500 gpm, which is a more conservative criterion than 1250 gpm, less pipe can be upsized to meet the 1250 gpm criterion that LAHCFD is using than is shown on Figure 2. In addition, as the CIP extends from the source water to the west along the backbone to the east side of Zone 4, it provides diminishing returns, as CIPs further from the source impact fewer hydrants downstream. As stated in the notes, Figure 2A also makes clear that the existing water main is cast iron and susceptible to severe damage during seismic events. Thus, PHWD's desire to replace the cast iron pipe with ductile iron pipe serves two purposes: 1) provide enhanced reliability of water service and 2) improve the fire flow from nearby hydrants. Because these improvements have a two-fold benefit, EKI suggests two potential cost sharing strategies:

1. LAHCFD proposes to share costs of the improvements with PHWD by offering to pay for the upper backbone portions of the CIP, which has the greatest impacts on fire flows, as their budgets allow (refer to Table 2A); or

2. LAHCFD proposes to share costs of the improvements with PHWD by offering to pay for the incremental cost (refer to Table 2B) of CIPs.

Recommendations for CIP prioritization and cost sharing will be discussed in Section 5.

4. EVALUATION OF CAL WATER FIRE FLOW IMPROVEMENT OPTIONS

4.1 Cal Water Information Gathering and Review

After reviewing Cal Water's presentation LAHCFD 2017-2018 Budget proposal from Cal Water: for Los Altos Hills County Fire District, EKI held an initial phone call with Ronald Richardson, District Manager of Cal Water Los Altos, and Devi Prasanna, Senior Engineer of Cal Water, to discuss the objectives of the evaluation, our basic understanding of the proposal, and the types of information we were seeking. Mr. Richardson requested that EKI provide a formal signed request for information and to execute a liability and confidentiality agreement. EKI complied with this request. As a result, there is some information that has been used in these analyses the details of which cannot be published in this document.

Cal Water did not have a model of its distribution system. After review of the information that Cal Water provided, EKI determined that in order to evaluate the fire flows as a result of Cal Water's proposed improvements, a hydraulic model should be developed. EKI developed a simplified hydraulic model of the Mora Tank area of the system where Cal Water proposed CIPs and of an additional street also in the Mora Tank area where the District requested additional modeling, relying partly on fire hydrant testing records provided by Cal Water, and partly on publicly available GIS maps. EKI used the model and other information provided by Cal Water to evaluate and prioritize the proposed fire flow improvement options as well as our own proposed alternative options for the District's consideration.

4.2 Assessment of Cal Water's Fire Flows

A confidential figure provided by Cal Water shows the estimated fire flow from hydrants with a residual pressure of 20 psi in the Cal Water service area. Where pressures are estimated to be less than 20 psi the hydrant has been highlighted. The method Cal Water used to estimate the fire flow availabilities was a simple extrapolation calculation from observed hydrant testing data from pairs of flow hydrants and residual pressure measurement hydrants. The extrapolation does not take into account other variables such as changing boundary conditions of tank elevations and domestic water demand conditions, and therefore EKI does not consider Cal Water's extrapolated values to be conservative estimates of fire flows at 20 psi during maximum day conditions ("MDD") conditions. EKI still considers Cal Water's fire flow estimates useful for identifying low fire flow regions worthy of CIPs, but they should be considered in a separate context from fire flows modeled during MDD conditions, such as the PHWD modeled fire flows.

Table 3 shows a breakdown of Cal Water's estimated available fire flows at 20 psi, by pressure zone, gleaned from the confidential figure discussed above. The Price Zone, which is the zone where Cal Water has proposed $1-million dollars in CIPs, has clusters of hydrants shown with under 1250 gpm fire flow, some of which are close to the bordering Rancho San Antonio Open Space Preserve. Downstream of the proposed pipelines in the D-1 pressure zone, separated

from the Price Zone by a PRV, are four hydrants where fire flows have not yet been calculated by Cal Water (but were modeled by EKI as explained in Section 4.3). The Price Zone also has 18 hydrants where fire flows have not yet been calculated, so many more hydrants may be deficient than are marked deficient on the table.

The Loyola Zone has 60 hydrants without calculated fire flows. So, in Section 5 Recommendations, EKI proposes that a study should be performed on fire flows in the Loyola Zone, to assess the fire flow availability and develop appropriate CIPs as necessary.

The new southwest zone, formed from a combination of the Sta 28, Sta 37, and Olive Tree zones has not yet undergone fire hydrant testing. Cal Water provided a description of some modeling they conducted of the new southeast zone and asserted that with the improvements they have put in place the prior fire flow deficiencies should be rectified. To confirm the available fire flows, fire hydrants should be tested, and the results should be analyzed.

In order to evaluate the Cal Water proposed pipeline CIPs in the Price zone in a conservative manner and perform an apples-to-apples comparison to the modeled PHWD projects, EKI built in InfoWater software a simplified hydraulic model of the Cal Water CIP pipelines and ran the model during conservative MDD conditions. This simplified model is not meant to fully represent the daily operations of the system, but rather, is meant to evaluate the costs and benefits of the proposed CIPs, consider conservative alternative solutions, and probe the potential benefits of developing models of Cal Water's fire flows.

4.3 Development of the Conservative EKI Simplified Hydraulic Model of Fire Flows During MDD

The Mora Tank study area water system piping was digitized with diameter and hydrant locations using (with Cal Water's permission) the confidential Cal Water Los Altos Hills District and Los Altos Hills Fire Protection District Fire Flow Exhibit Map. Although the Fire Flow Exhibit Map is confidential, Cal Water approved for EKI to publicly present the pipeline diameters in this specific Mora Tank study area. Pipe materials were assigned per Cal Water's CIP proposal where possible, or otherwise logically assumed based on the neighboring pipe types. Elevations were assigned to each model node by extracting elevations from publicly available light detection and ranging (LiDAR) data (Cupertino, 2017).

To calibrate the model, EKI followed methods outlined in the American Water Works Associations Computer Modeling of Water Distribution System Manual (Robinson, 2012). These methods describe how to calibrate a model using fire hydrant testing data. Cal Water provided EKI with five fire flow testing data sets which EKI used to calibrate the model's pressure reducing valve settings and pipe roughness coefficients. These fire flow data were taken at different times of year, and at different times of the day. To conservatively calibrate C-factors during unknown tank and demand conditions under which hydrant testing occurred, EKI made boundary condition

assumptions which would conservatively result in lower C-factors (rougher pipes) during calibration:

1. EKI set the initial tank setting at a full level; therefore, pressure losses would all need to be born through the piping and PRV.
2. EKI calibrated the PRV setting to match the hydrant testing static pressure downstream of the PRV.
3. EKI then assigned flow rates consistent with hydrant testing data and calibrated the C-factors to produce head losses resulting in the residual pressures observed during actual hydrant testing (see Appendix B for actual hydrant testing records).

EKI determined that C-factors of 75 for cast iron pipe and 140 for Transite pipe produced residual pressures at or below those shown in hydrant testing. It is understood from Cal Water that existing pipes could have been installed as early as the 1940s. These C-factors are within the expected range of pipes of these materials and age (Robinson 2012) (Lindberg 2015).

For fire flow modeling under MDD conditions, MDD demands were determined by applying a peaking factor of two to the average day demands (ADDs) based on Title 22 standards. ADDs for 2015 were determined based on the Cal Water 2015 Urban Water Management Plans per capita water usage during the 2015 drought. ADD demands were scaled up to 2013 non-drought demands to better represent future non-drought year demands. The MDD demands were applied on a parcel by parcel basis to the nearest node for the modeled infrastructure, and the demands for the remainder of the Price pressure zone were applied at a point node representing the western portion of the Price zone.

During fire flow modeling, the Mora Tank was set at an initial condition of half full, with a hydraulic grade line of 657 feet, to conservatively estimate its drawdown at the end of a maximum demand day before pumps could refill it. Based on the Cal Water Fire Flow exhibit, the D-2 PRV was set at a hydraulic grade line of 560 feet, equivalent to a 91-psi pressure given the PRV's elevation.

4.4 Fire Flow Modeling Results from EKI Simplied Model

The following sections describe the results of fire flow modeling of the Cal Water Mora Tank area using the EKI Simplified Model. The hydraulic grade line decreases moving away from the Mora tank source due to frictional losses in the pipes, and fire flows decrease or remain the same as distance from the tank increases[1].

[1]Per Title 22 of the California Code of Regulations, a minimum of 20 psi residual pressure at all service connections throughout the zone in which the fire flow is being provided is required to be maintained. Thus, a service connection located at a higher elevation than a hydrant or group of hydrants can be the low pressure point which is the limiting factor for the available fire flow to the hydrant(s). As a result, hydrants at varying distances from the source can share the same fire flow.

4.4.1 *Evaluation of Cal Water's Existing Infrastructure*

Based on EKI's modeling, as seen in Table 4 and on Figure 5, the fire flows of fourteen hydrants shown along Mora Drive, Private Driveway, Mora Glen Dr, Mora Heights Way, and Eastbrook Ave do not meet the 1250-gpm fire flow requirement at any hydrant, and three hydrants along Mora Dr and the Private Driveway do meet the requirement.

4.4.2 *Evaluation of Cal Water's Proposed Fire Flow Improvements Using EKI Simplified Model*

Using EKI's model, as seen in Table 5 and on Figure 6, the Cal Water proposed CIPs improve fire flows of thirteen deficient hydrants downstream of the CIPs. Because hydrants 1342, 1341, and 1328 are upstream of the proposed CIPs, their fire flows are unchanged by the Cal Water proposed CIPs.

4.4.3 *Alternative CIPs Proposal*

EKI conducted additional modeling to consider more cost-effective alternatives for meeting fire flow goals during the EKI Simplified Model's MDD scenario. Figure 8 shows where pipelines along Mora Drive, Private Driveway, Eastbrook Avenue, and Mora Glen Drive are proposed to be upsized with new ductile iron pipe (DIP). The effects of these alternative CIPs are summarized in Table 6 and described below.

Six Mora Drive CIPs are proposed:

1. From hydrant 1312 to hydrant 1266, a 1,000-ft section of 8" DIP termed "Mora Dr. upstream" is proposed.
2. From hydrant 1266 to Eastbrook Ave, a 1,240-ft section of 8" DIP termed "Mora Dr. downstream" is proposed.
3. Along Eastbrook from Mora Dr to Mora Glen Dr, a 140-ft section of 8" DIP is proposed.
4. For 340 feet of Mora Glen Dr, an 8" DIP pipe is proposed. (This is 430 less feet of pipe than was proposed by Cal Water.)
5. From Mora Drive to Private Driveway, a 105-ft section of 10" DIP termed "Mora Dr. Intertie #2" is proposed.
6. The northern intertie between the 10" and 6" parallel pipelines along Mora Drive is proposed to be upsized to 10". The existing intertie has large head losses due to velocities as high as 12 ft/sec when transferring water to the downstream network during fire flow conditions.

In Table 6, the seventeen modeled hydrants all show fire flows exceeding 1250 gpm during MDD with these six CIPs instantiated. The model also shows that increasing the D-2 PRV setting can increase fire flow. With the CIPs in place, the D-2 pressure zone PRV is seen to significantly reduce pressure from 102 psi down to 91 psi, limiting available fire flows downstream of the PRV. By modifying the D-2 pressure zone PRV to a setting of approximately 102 psi, significantly less

upsizing would be required on Mora Glen Drive to meet fire flow requirements at hydrant 1304, which is seen to be the most difficult hydrant to produce 1250 gpm due to its relatively high elevation. These preliminary results indicate that there could be potential cost-savings by increasing the setpoint of the D-2 pressure zone PRV and installing less CIP pipeline. However, increasing the PRV setpoint could increase pressure undesirably in the domestic connections if domestic connections lack pressure reducers, so this option should be further analyzed.

4.4.4 Comparison of Cal Water CIP Project Costs and Benefits

Presented in Tables 7A and 7B is a comparison of the Cal Water proposed improvements and EKI's proposed pipeline improvements in the Price zone. As discussed for the PHWD proposals Shown in Table 7A are the costs to replace the smaller diameter pipe with a larger diameter pipe to accommodate the increase in flow required to meet the goal of 1,250 gpm with a 20-psi residual from each fire hydrant. Shown in Table 7B is the incremental cost of installing a larger diameter pipe.

The Cal Water proposed improvements are estimated to cost $1,040,000 dollars (Table 7A - $160,000 if the incremental cost sharing approach is used shown in Table 7B) and fully improve the fire flows of 13 of the 14 deficient hydrants analyzed. On the other hand, the EKI recommended improvements are estimated to cost $941,125 in total (or $147,000 using incremental cost-sharing) and fully improve the fire flows of all 14 deficient hydrants analyzed. This alternative option should be considered in cost-sharing discussions with Cal Water.

Recommendations for CIP prioritization and cost sharing are discussed in the next section.

5. RECOMMENDATIONS

Using the criteria established in Section 2, EKI prioritized implementation of proposed CIPs to improve fire flows, investigations of fire flows in areas lacking fire flow information, and development of future CIP proposals to improve fire flows in other low fire flow areas in LAHCFD. Priorities are assigned from one being highest priority to five being lowest priority, in Table 8A and Table 8B, which reflect different philosophies of cost sharing.

Table 8A reflects a "going-it-alone" independent philosophy, in which LAHCFD would pay the complete costs of specific sections of pipe replacement that LAHCFD deems high bang-for-the-buck based on how many hydrant fire flows are improved by the contemplated CIP. Under this philosophy, not all projects proposed by water providers are prioritized in the table; projects which impact less than three hydrants are not placed in the top four priority levels in Table 8A. The downstream section of the Altamont Rd CIP does not make the top four priority level list in Table 8A, since it has a high cost per hydrant improved.

Table 8B reflects a cost sharing perspective, in which it is understood that the District's objective is to have 1250 gpm fire flows available by increasing pipe diameters, whereas the water provider's objective is to provide reliable water service by replacing aged or brittle pipes, irrespective of pipe diameters. Therefore, the water supplier can pay the cost of replacing the pipe at the same diameter, and the District can pay the incremental cost between the cost of upsizing the pipe and the cost of replacing a pipe at the same diameter.

EKI recommends that the district starts implementing the Priority 1 projects using the incremental cost sharing philosophy.

6. REFERENCES

California Water Service, 2016. Los Altos Suburban District 2015 Urban Water Management Plan, June 2016.

Lindeburg, M. R. 2015. *Civil engineering reference manual for the PE exam*, Professional Publications, Inc. 2015.

Robinson, Laredo 2012. *Computer Modeling of Water Distribution Systems*, American Water Works Association, 2012.

Cupertino, 2017. R*aw LiDAR data in its native format and contour files in ESRI personal geodatabase format for the San Jose Phase 3 project of Santa Clara County, Ca*., City of Cupertino's Geographic Information Systems, accessed 16 November 2017. https://www.arcgis.com/home/item.html?id=ea711c7ab3b54fffb095a7d6811821f4.

Title 22 California Drinking Water-Related Regulations, 22 CCR § 64554 (b)(3)(D), September 2017.

TABLE 1

PHWD Available Fire Flows Under MDD Conditions

Los Altos Hills County Fire District, Los Altos Hills, California

Pressure Zone	*Hydrants shown with under 1250 gpm fire flow*		*Hydrants without calculated fire flows*	*Maximum potential number of hydrants with under 1250 gpm fire flow*	
	< 950 gpm	**950 <Q< 1250 gpm**		**< 950 gpm**	**950 <Q< 1250 gpm**
Zones Bordering Foothills Preserve					
PHWD Zone 4	2	18	0	2	18
PHWD Zone 3	3	6	0	3	6
Zones that Do Not Border Foothills Preserve					
PHWD Zone 2	8	12	0	8	12
PHWD Zone 1	Upper zones overlap geography with Zone 1 and provide fire flows in Zone 1 areas.				

Abbreviations

gpm: gallons per minute

MDD: maximum day demand

PHWD: Purissima Hills Water District

Q: fire flow rate in gpm

TABLE 2A

PHWD Comparison of Fire Flow Pipeline Improvements

Los Altos Hills County Fire District, Los Altos Hills, California

Improvement (a)	*Pipe Size*		*Cost for New Pipe per foot*	*Pipe Length*	*Cost*	*Hydrants Fully Improved*	*Total Hydrants Improved*	Cost per Hydrant Improved
	Original (inches)	*New* (inches)	($)	(feet)	($)	(b)	(c)	($)
PHWD Zone 2								
La Paloma Rd	6"	10"	$ 375	611	$ 229,125	2 to 5	5	$ 45,825
PHWD Zone 3								
Black Mountain Rd	6"	8"	$ 325	1357	$ 441,025	1 to 2	2	$ 220,513
PHWD Zone 4								
Page Mill Rd	8"	12"	$ 425	1335	$ 567,375	6 to 20	20	$ 28,369
Altamont Rd Upstream Portion	6"	8"	$ 325	750	$ 243,750	0 to 14	14	$ 17,411
Altamont Rd Downstream Portion	6"	8"	$ 325	5000	$ 1,625,000	0 to 6	6	$ 270,833
Briones Way	6"	8"	$ 325	300	$ 97,500	0 to 1	1	$ 97,500
Menalto Drive Cross Country	2"	8"	$ 325	300	$ 97,500	0 to 1	1	$ 97,500
Zone 4 PHWD Total	2", 6", & 8"	8" & 12"	--	600	$ 2,631,125	18 to 20	20	$ 131,556

Notes

(a) Improvements assume abandoning existing pipe in place and installing new ductile iron pipe with open trench construction.

(b) Hydrants fully improved are hydrants that will have fire flow exceeding 1,250 gpm after the improvement.

(c) Hydrants improved may or may not have fire flow exceeding 1,250 gpm after the improvement; they may require more than one improvement project. Modeling is required to demonstrate the effect of individual improvements.

Abbreviations

PHWD: Purissima Hills Water District

December 2017

EKI B70079.00

TABLE 2B

PHWD Comparison of Fire Flow Pipeline Improvements

Los Altos Hills County Fire District, Los Altos Hills, California

Improvement (a)	*Pipe Size*		*Cost for New Pipe per foot*	*Cost for Original Pipe Size Pipe per foot*	*Pipe Length*	*Incremental Cost* (d)	*Hydrants Fully Improved*	*Total Hydrants Improved*	Incremental Cost per Hydrant Improved
	Original (inches)	*New* (inches)	($)	($)	(feet)	($)	(b)	(c)	($)
PHWD Zone 2									
La Paloma Rd	6"	10"	$ 375	$ 275	611	$ 61,100	2 to 5	5	$ 12,220
PHWD Zone 3									
Black Mountain Rd	6"	8"	$ 325	$ 275	1357	$ 67,850	1 to 2	2	$ 33,925
PHWD Zone 4									
Page Mill Rd	8"	12"	$ 425	$ 325	1335	$ 133,500	6 to 20	20	$ 6,675
Altamont Rd Upstream Section	6"	8"	$ 325	$ 275	750	$ 37,500	0 to 14	14	$ 2,679
Altamont Rd Downstream Section	6"	8"	$ 325	$ 275	5000	$ 250,000	0 to 6	6	$ 41,667
Briones Way	6"	8"	$ 325	$ 275	300	$ 15,000	0 to 1	1	$ 15,000
Menalto Drive Cross Country (e)	2"	8"	$ 325	$ 275	300	$ 15,000	0 to 1	1	$ 15,000
Zone 4 PHWD Total	2", 6", & 8"	8" & 12"	--	--	600	$ 451,000	18 to 20	20	$ 22,550

Notes

(a) Improvements assume abandoning existing pipe in place and installing new ductile iron pipe with open trench construction.

(b) Hydrants fully improved are hydrants that will have fire flow exceeding 1,250 gpm after the improvement.

(c) Hydrants improved may or may not have fire flow exceeding 1,250 gpm after the improvement; they may require more than one improvement project. Modeling is required to demonstrate the effect of individual improvements.

(d) Difference between cost of replacing pipe with upsized pipe versus with same sized pipe.

(e) Pipe replacement cost presented are for 6" pipe, which is assumed to be the minimum diameter which would be installed.

Abbreviations

Cal Water: California Water Service Los Altos

PHWD: Purissima Hills Water District

TABLE 3

Cal Water Available Fire Flows

Los Altos Hills County Fire District, Los Altos Hills, California

Pressure Zone	*Hydrants shown with under 1250 gpm fire flow*		*Hydrants without calculated fire flows*	*Maximum potential number of hydrants with under 1250 gpm fire flow*	
	< 950 gpm	**950 <Q< 1250 gpm**		**< 950 gpm**	**950 <Q< 1250 gpm**
Zones Bordering Foothills Preserve					
Price	5	13	18	23	31
New southwest zone from combination of Sta 28, Sta 37, and Olive Tree zones	Untested since new zoning		10	10	10
D-2	2	2	1	3	3
Blandor	0	1	5	5	6
Zones that Do Not Border Foothills Preserve					
Loyola	6	6	60	66	66
STA 113	1	4	0	1	4
Robleda Heights (535)	2	6	6	8	12
Robleda Heights Subzone	1	1	2	3	3
Low	3	6	5	8	11
Sta 112	0	0	8	8	8
D-1	0	0	4	4	4
D-3	0	0	4	4	4
STA 118	0	0	1	1	1

Abbreviations

Cal Water: California Water Service

gpm: gallons per minute

Q: fire flow rate in gpm

Table 4

EKI Simplified Modeling of MDD Fire Flows in Cal Water Mora Area

Los Altos Hills County Fire District, Los Altos Hills, California

Hydrant	***Modeled Fire Flow***	***Hydrant Meeting Fire Flow Requirement***
	(gpm)	
1193	667	No
1202	667	No
1218	667	No
1230	667	No
1250	690	No
1252	657	No
1266	677	No
1269	677	No
1272	653	No
1284	614	No
1290	780	No
1304	584	No
1312	1,753	Yes
1319	607	No
1328	1,221	No
1341	1,485	Yes
1342	1,757	Yes

Notes:

(a) This scenario represents worst-case fire flows.

Abbreviations:

gpm : gallons per minute

Table 5
EKI Simplified Modeling of MDD Fire Flows with Cal Water's Proposed CIPs

Los Altos Hills County Fire District, Los Altos Hills, California

Hydrant	*Modeled Flow Before CIP*	*Modeled Flow After CIP*	*Hydrant Meeting Fire Flow Requirement Before CIP*	*Hydrant Meeting Fire Flow Requirement After CIP*
	(gpm)	*(gpm)*		
1193	667	1,628	No	Yes
1202	667	1,753	No	Yes
1218	667	1,753	No	Yes
1230	667	1,753	No	Yes
1250	690	1,302	No	Yes
1252	657	1,753	No	Yes
1266	677	1,753	No	Yes
1269	677	1,753	No	Yes
1272	653	1,753	No	Yes
1284	614	1,732	No	Yes
1290	780	1,753	No	Yes
1304	584	1,309	No	Yes
1312	1,753	1,753	Yes	Yes
1319	607	1,612	No	Yes
1328	1,221	1,221	No	No
1341	1,485	1,485	Yes	Yes
1342	1,757	1,757	Yes	Yes

Notes:

(a) This scenario represents conservative fires flows while upsizing approximately 3200 LF on Mora Drive, Eastbrook Avenue, and Mora Glen Drive from 6" to 8".

Abbreviations:

gpm : gallons per minute

CIPs: capital improvement projects

Table 6
EKI Simplified Modeling of MDD Fire Flows with EKI's Fire Flow CIPs
Los Altos Hills County Fire District, Los Altos Hills, California

Hydrant	*Modeled Flow Before CIP*	*Modeled Flow After CIP*	*Hydrant Meeting Fire Flow Requirement Before CIP*	*Hydrant Meeting Fire Flow Requirement After CIP*
	(gpm)	*(gpm)*		
1193	667	1,628	No	Yes
1202	667	1,753	No	Yes
1218	667	1,753	No	Yes
1230	667	1,753	No	Yes
1250	690	1,325	No	Yes
1252	657	1,753	No	Yes
1266	677	1,753	No	Yes
1269	677	1,753	No	Yes
1272	653	1,753	No	Yes
1284	614	1,593	No	Yes
1290	780	1,753	No	Yes
1304	584	1,259	No	Yes
1312	1753	1,753	Yes	Yes
1319	607	1,493	No	Yes
1328	1221	1,255	No	Yes
1341	1485	1,546	Yes	Yes
1342	1757	1,757	Yes	Yes

Notes:

(a) This scenario represents conservative fire flows while upsizing approximately 2740 LF on Mora Drive, Eastbrook Ave, and Mora Glen drive from 6" to 8", upsizing 65 LF on Mora Drive from 6" to 10", upsizing 70 LF on an unnamed road from 8" to 10", and setting the D-2 pressure zone PRV to 102 PSI.

Abbreviations:

gpm : gallons per minute

CIPs: capital improvement projects

Table 7A
Comparison of Fire Flow CIP Costs in Cal Water Mora Area
Los Altos Hills County Fire District, Los Altos Hills, California

Improvement (a)	*Pipe Size* Original	New	*Cost for New Pipe per foot*	*Pipe Length*	*Cost*	*Hydrants Fully Improved*	*Total Hydrants Improved*	Cost per Hydrant Improved
	(inches)	(inches)	($)	(feet)	($)	(b)	(c)	($)
EKI's Proposed Improvements								
Mora Dr. Intertie #1	6"	10"	*$ 375*	*30*	*$ 11,250*	*1 to 14*	*14*	*$ 804*
Mora Dr. Intertie #2	6" & 8"	10"	*$ 375*	*105*	*$ 39,375*	*1*	*1*	*$ 39,375*
Mora Dr. Upstream	6"	8"	*$ 325*	*1000*	*$ 325,000*	*3 to 13*	*13*	*$ 25,000*
Mora Dr. Downstream	6"	8"	*$ 325*	*1240*	*$ 403,000*	*0 to 10*	*10*	*$ 40,300*
Eastbrook Ave.	6"	8"	*$ 325*	*160*	*$ 52,000*	*0*	*5*	*$ 10,400*
Mora Glen Dr.	6"	8"	*$ 325*	*340*	*$ 110,500*	*0*	*3*	*$ 36,833*
Total	6" & 8"	8" & 10"	--	*2875*	***$ 941,125***	*15*	*15*	***$ 62,742***
Cal Water's Proposed Improvements								
Mora Dr., Eastbrook Ave. & Mora Glen Dr.	6"	8"	*$ 325*	*3200*	***$ 1,040,000***	*13*	*13*	***$ 80,000***

Notes:

(a) Improvements assume abandoning existing pipe in place and installing new ductile iron pipe with open trench construction.

(b) Hydrants fully improved are those which were deficient prior to the improvement and will have fire flow exceeding 1,250 gpm after the improvement.

(c) Hydrants improved may or may not have fire flow exceeding 1,250 gpm after the improvement; they may require more than one improvement project. Modeling is required to demonstrate the effect of individual improvements.

Abbreviations:

Cal Water: California Water Service Los Altos

Table 7B
Comparison of Fire Flow CIP Costs in Cal Water Mora Area
Los Altos Hills County Fire District, Los Altos Hills, California

Improvement (a)	*Pipe Size* Original (inches)	*Pipe Size* New (inches)	*Cost for New Pipe per foot* ($)	*Cost for Original Pipe Size Pipe per foot* ($)	*Pipe Length* (feet)	*Incremental Cost* (d) ($)	*Hydrants Fully Improved* (b)	*Hydrants Improved* (c)	Incremental Cost per Hydrant Improved ($)
EKI's Proposed Improvements									
Mora Dr. Intertie #1	6"	10"	*$ 375*	*$ 275*	*30*	*$ 3,000*	*1 to 14*	*14*	*$ 214*
Mora Dr. Intertie #2	6"	10"	*$ 375*	*$ 275*	*35*	*$ 3,500*	*1*	*1*	*$ 7,000*
	8"	10"	*$ 375*	*$ 325*	*70*	*$ 3,500*			
Mora Dr. Upstream	6"	8"	*$ 325*	*$ 275*	*1000*	*$ 50,000*	*3 to 13*	*13*	*$ 3,846*
Mora Dr. Downstream	6"	8"	*$ 325*	*$ 275*	*1240*	*$ 62,000*	*0 to 10*	*10*	*$ 6,200*
Eastbrook Ave.	6"	8"	*$ 325*	*$ 275*	*160*	*$ 8,000*	*0*	*5*	*$ 1,600*
Mora Glen Dr.	6"	8"	*$ 325*	*$ 275*	*340*	*$ 17,000*	*0*	*3*	*$ 5,667*
Total	6" & 8"	8" & 10"			*2875*	***$ 147,000***	*15*	*15*	***$ 9,800***
Cal Water's Proposed Improvements									
Mora Dr., Eastbrook Ave. & Mora Glen Dr.	6"	8"	*$ 325*	*$ 275*	*3200*	***$ 160,000***	*9 to 13*	*13*	***$ 12,308***

Notes:

(a) Improvements assume abandoning existing pipe in place and installing new ductile iron pipe with open trench construction.

(b) Hydrants fully improved are those which were deficient prior to the improvement and will have fire flow exceeding 1,250 gpm after the improvement.

(c) Hydrants improved may or may not have fire flow exceeding 1,250 gpm after the improvement; they may require more than one improvement project. Modeling is required to demonstrate the effect of individual improvements.

(d) Difference between cost of replacing pipe with upsized pipe versus with same sized pipe.

Abbreviations:

Cal Water: California Water Service Los Altos

December 2017
EKI B70079.00

TABLE 8A

Recommended Project Prioritization

Los Altos Hills County Fire District, Los Altos Hills, California

Priority	*Zone*	*Improvement* (a)	*New Pipe Size*	*Pipe Length* (feet)	*Total Hydrants Improved* (b)	*Zone borders Foothills Preserve*	Cost per Hydrant Improved	*Cost* ($)
1	Cal Water Price	Mora Dr Upstream Section	8"	*1000*	*13*	yes	*$ 25,000*	*$ 325,000*
1	PHWD Zone 4	Page Mill Rd	12"	*1335*	*20*	yes	*$ 28,369*	*$ 567,375*
1	PHWD Zone 4	Altamont Rd Upstream Section	8"	*750*	*11*	yes	*$ 22,159*	*$ 243,750*
2	Cal Water Price	Mora Dr Downstream Section	8"	*1240*	*10*	yes	*$ 40,300*	*$ 403,000*
2	Cal Water D-2	Eastbrook Ave	8"	*160*	*5*	yes	*$ 10,400*	*$ 52,000*
2	Cal Water D-2	Mora Glen Dr	8"	*340*	*3*	yes	*$ 36,833*	*$ 110,500*
2	Cal Water	Perform a fire flow reliability study across Cal Water, including evaluating proposal for 2 control valves			*NA*	yes	*TBD*	*TBD/RFP*
3	Cal Water D-1	Perform fire flow availability modeling in D-1			*NA*	no	*TBD*	*TBD/RFP*
3	Cal Water Loyola	Perform modeling study on available fire flows in Loyola Zone during maximum day demand conditions			*9*	no	*TBD*	*TBD/RFP*
3	Cal Water Price	Mora Dr Intertie #1	10"	*30*	*14*	yes	*$ 804*	*$ 11,250*
4	PHWD Zone 2	La Paloma Rd	10"	*611*	*5*	no	*$ 45,825*	*$ 229,125*
4	Cal Water New	Perform hydrant testing in newly rezoned Olive Tree Zone			*9*	no	*TBD*	*TBD*

Notes

(a) Improvements assume abandoning existing pipe in place and installing new ductile iron pipe with open trench construction.

(b) Hydrants improved may or may not have fire flow exceeding 1,250 gpm after the improvement; they may require more than one improvement project. Modeling is required to demonstrate the effect of individual improvements.

Abbreviations

Cal Water: California Water Service Los Altos

PHWD: Purissima Hills Water District

TABLE 8B

Recommended Project Prioritization

Los Altos Hills County Fire District, Los Altos Hills, California

Priority	*Zone*	*Improvement* (a)	*Pipe Size*		*New Pipe Cost per foot*	*Original Size Cost per foot*	*Pipe Length*	*Total Hydrants Improved*	*Zone borders Foothills*	Incremental Cost per Hydrant	Incremental Cost Share (b)
			Original (inches)	*New* (inches)	($)	($)	(feet)	(c)			($)
1	PHWD Zone 4	Page Mill Rd	8"	12"	$ 425	$ 325	1335	20	yes	$ 6,675	$ 133,500
1	PHWD Zone 4	Altamont Rd Upstream Section	6"	8"	$ 325	$ 275	750	11	yes	$ 3,409	$ 37,500
1	Cal Water Price	Mora Dr Upstream Section	6"	8"	$ 325	$ 275	1000	13	yes	$ 3,846	$ 50,000
2	Cal Water Price	Mora Dr Downstream Section	6"	8"	$ 325	$ 275	1240	10	yes	$ 6,200	$ 62,000
2	Cal Water D-2	Eastbrook Ave	6"	8"	$ 325	$ 275	160	5	yes	$ 1,600	$ 8,000
2	Cal Water D-2	Mora Glen Dr	6"	8"	$ 325	$ 275	340	3	yes	$ 5,667	$ 17,000
2	Cal Water	Perform a fire flow reliability study across Cal Water, including evaluating proposal for 2 control valves						NA	yes	TBD	$ -
3	Cal Water D-1	Perform fire flow availability modeling in D-1						NA	no	TBD	$ -
3	Cal Water Loyola	Perform modeling study on available fire flows in Loyola Zone during maximum day demand conditions						9	no	TBD	$ -
3	Cal Water Price	Mora Dr Intertie #1	6"	10"	$ 375	$ 275	30	14	yes	$ 214	$ 3,000
3	Cal Water Price	Mora Dr. Intertie #2	6"	10"	$ 375	$ 275	35	1	yes	$ 3,500	$ 3,500
			8"	10"	$ 375	$ 325	70	1	yes	$ 3,500	$ 3,500
4	PHWD Zone 2	La Paloma Rd	6"	10"	$ 375	$ 275	611	5	no	$ 12,220	$ 61,100
4	Cal Water New	Perform hydrant testing in newly rezoned Olive Tree Zone						9	no	TBD	$ -
4	PHWD Zone 4	Briones Way	6"	8"	$ 325	$ 275	300	1	no	$ 15,000	$ 15,000
4	PHWD Zone 4	Menalto Drive Cross Country	2"	8"	$ 325	$ 275	300	1	no	$ 15,000	$ 15,000
5	PHWD Zone 4	Altamont Rd Downstream Section	6"	8"	$ 325	$ 275	5000	6	yes	$ 41,667	$ 250,000

Notes

(a) Improvements assume abandoning existing pipe in place and installing new ductile iron pipe with open trench construction.

(b) Difference between cost of replacing pipe with upsized pipe versus with same sized pipe.

(c) Hydrants improved may or may not have fire flow exceeding 1,250 gpm after the improvement; they may require more than one improvement project. Modeling is required to demonstrate the effect of individual improvements.

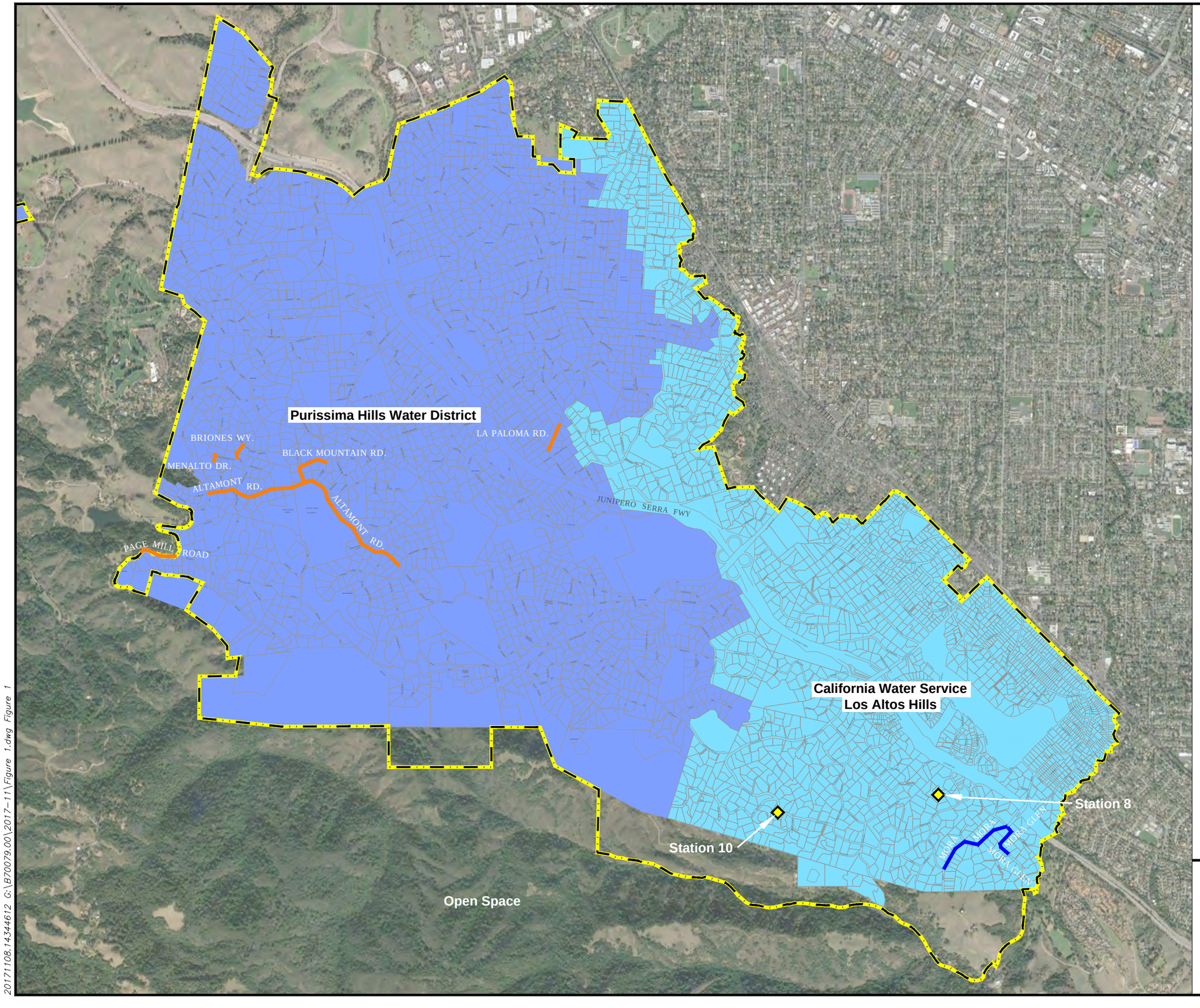
Abbreviations

Cal Water: California Water Service Los Altos

PHWD: Purissima Hills Water District

December 2017

EKI B70079.00



Legend:

- LAHCFD Boundary Line
- Purissima Hills Water District Proposed Pipeline Improvements
- California Water Service Los Altos Hills Proposed Pipeline Improvements
- Cal Water Proposed Control Valve Improvements
- PHWD - Los Altos Hills
- Cal Water

Abbreviations:

Cal Water = California Water Service Los Altos Hills
LAHCFD = Los Altos Hills County Fire District
PHWD = Purissima Hills Water District

Notes:

1. All locations are approximate.
2. Basemap sources: Mailing Zone Drawing acquired from Los Altos County Fire District; Google Earth Pro, date of imagery 2 November 2016.

N

0 2,500 5,000

(Scale in Feet)

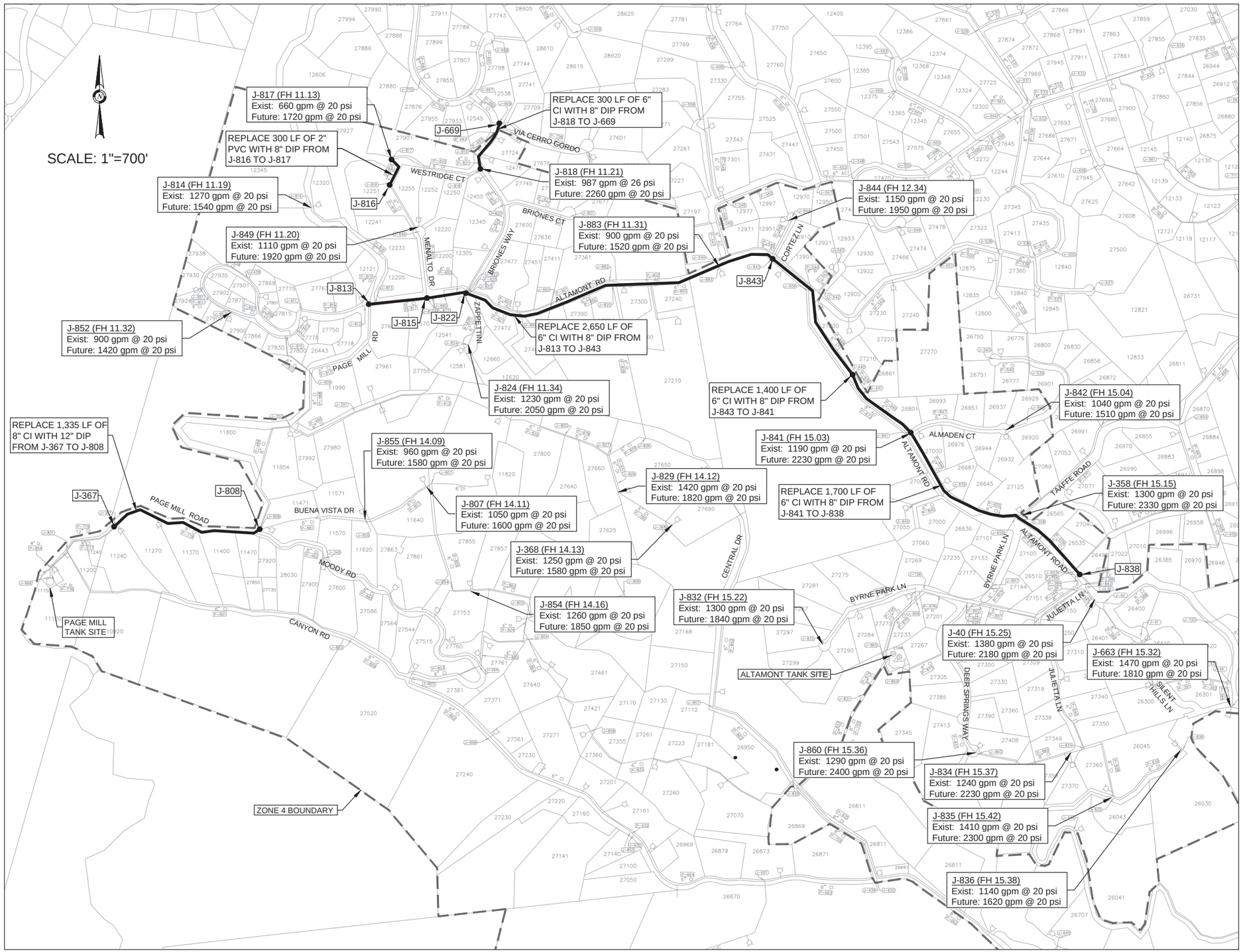
LAHCFD Proposed Improvements Under Evaluation

Los Altos Hills County Fire District
Los Altos Hills, CA
December 2017
EKI B70079.00

Figure 1

eki environment & water

20171108.14344612 G:\B70079.00\2017-11\Figure 1.dwg Figure 1



ZONE 4 WATER MAIN CIP PROJECTS

PROJECT BACKGROUND

The primary objective of the Zone 4 Los Alto Hills County Fire Department (LAHCFD) Capital Improvement Program was to increase the undersized water mains in Zone 4 to provide minimum fire flows of 1,500 gpm. Replacing all of the 6" CI water mains within Zone 4 solved this objective however other methods were investigated to optimize the number of water mains requiring replacement. One such method was to include running two of the Altamont pumps simultaneously during fire flows. Standard practice for determining fire flows is to turn pumps off during a maximum day demand as this is the worst case scenario during a power outage. The results of the modeling are based on the assumption that fire flows will be provided with two Altamont Pumps running during a fire flow.

This project replaces approximately 1,335 LF of 8" CI water main with 12" DIP to reduce restriction in the event of high velocity flows in the transmission main from Page Mill Tank. Distribution System Analysis No. 254.

The water main along Altamont Road (J-81 to J-838) consists of 6" cast iron water main. This CI water main is undersized and subject to severe damage during seismic events. This project will increase fire flows by essentially doubling the pipe size in a transmission main from the Altamont Tank Site to the northwest end of the district. The remaining 8" DIP improvements are required to meet fire flows in local areas in the vicinity of the Briones Way PRV and at the ends of Menalto Drive and Westridge Court. Distribution System Analysis No. 339.

PROPOSED IMPROVEMENTS

Replace1,335 LF of 8" CI with 12" DIP (Page Mill Road)
Replace 5,550 LF of 6" CI with 8" DIP (Altamont Road)
Replace 300 LF of 6" CI with 8" DIP (Briones Way)
Replace 300 LF of 2" PVC with 8" DIP (Menalto Drive Cross Country)
Abandon 1,500 LF of 6" CI at Canyon Road Cross Country

PROJECT BENEFITS

The Zone 4 (LAHCFD) Capital Improvement Projects will provide fire flows to meet 1,500 gpm when two pumps are operating simultaneously at the Altamont Pump Station throughout Zone 4.

PROJECT BUDGET

1,335 LF - 12" DIP @ $275 per LF	$ 365,000
6,150 LF - 8" DIP @ $250 per LF	$1,540,000
Subtotal Construction	$1,905,000
Planning, Design & Construction Support	$ 285,000
Contingency (±10%)	$ 220,000
Project Budget	$2,410,000

Note:
The fire flows and pressures mentioned herein are located at the water main and flows at adjacent fire hydrants may be lower due to physical constraints and the hydraulic losses in the fire hydrant lateral and fittings.

Pakpour Consulting Group, Inc.
5776 Stoneridge Mall Road, Suite 320
Pleasanton, CA 94588
925.224.7717 Fax 925.224.7726
www.pcgengr.com

JOB No.	10002.03						
DATE	2/14/17						
SCALE	1" = 700'						
DESIGN:	BY GU						
	CKD JP						
DRAWN:	BY GU						
	CKD JP	SYMBOL	DATE	REVISIONS	BY	CKD	

December 2017
Figure 2

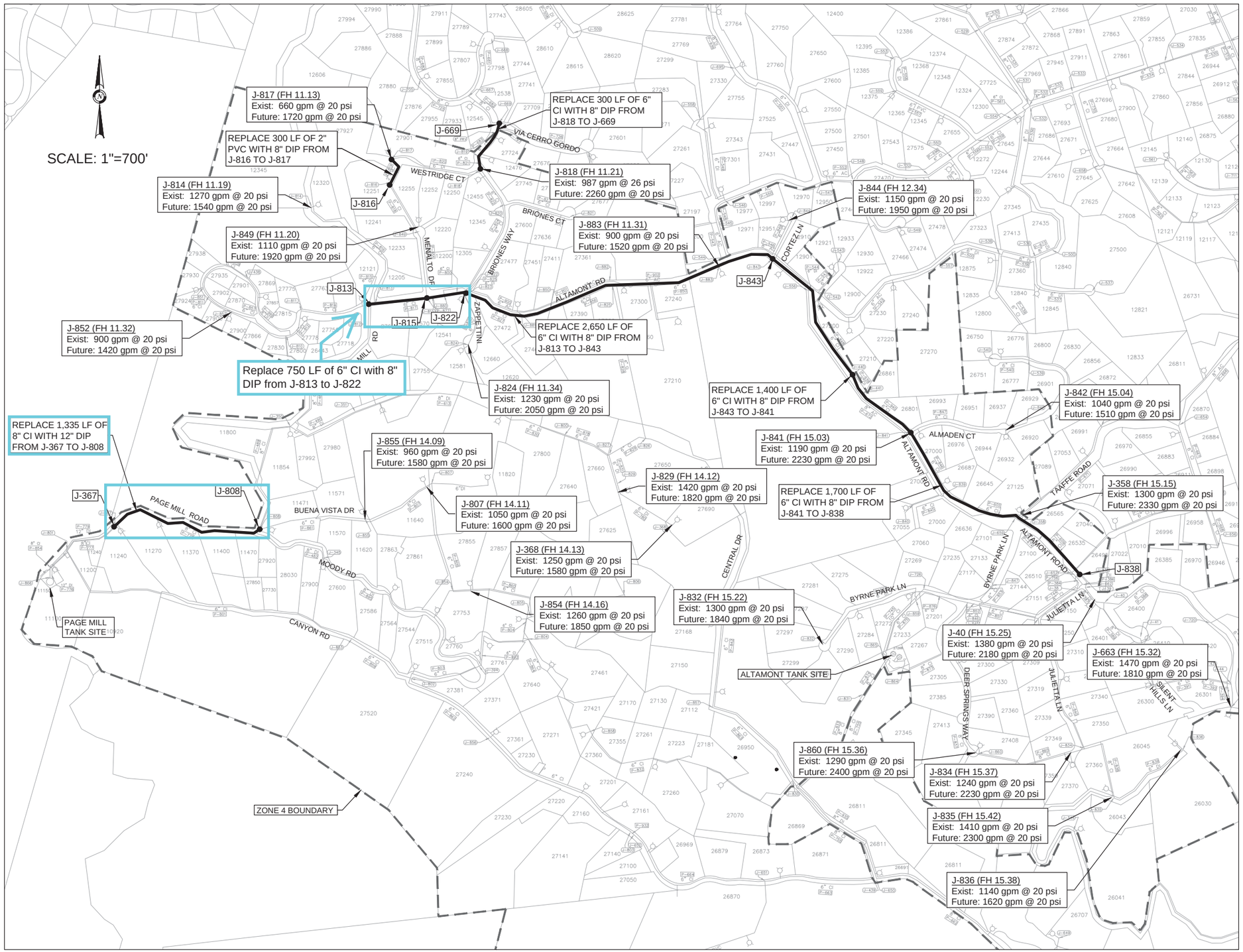
PURISSIMA HILLS WATER DISTRICT
SANTA CLARA COUNTY, CALIFORNIA
26375 FREMONT ROAD
LOS ALTOS HILLS, CA 94022-0264

DRAFT
2/14/17

ZONE 4 WATER MAIN CIP PROJECTS

SHEET 1
OF 1

DRAWING NAME: J:\CADD\10002.04\dwg\2016 CIP\Exhibits\PHWD-CIP-2016-Zone 4-2017-02-14.dwg
PLOT DATE: 01-31-17 PLOTTED BY:



ZONE 4 WATER MAIN CIP PROJECTS

PROJECT BACKGROUND

The primary objective of the Zone 4 Los Alto Hills County Fire Department (LAHCFD) Capital Improvement Program was to increase the undersized water mains in Zone 4 to provide minimum fire flows of 1,500 gpm. Replacing all of the 6" CI water mains within Zone 4 solved this objective however other methods were investigated to optimize the number of water mains requiring replacement. One such method was to include running two of the Altamont pumps simultaneously during fire flows. Standard practice for determining fire flows is to turn pumps off during a maximum day demand as this is the worst case scenario during a power outage. The results of the modeling are based on the assumption that fire flows will be provided with two Altamont Pumps running during a fire flow.

This project replaces approximately 1,335 LF of 8" CI water main with 12" DIP to reduce restriction in the event of high velocity flows in the transmission main from Page Mill Tank. Distribution System Analysis No. 254.

The water main along Altamont Road (J-81 to J-838) consists of 6" cast iron water main. This CI water main is undersized and subject to severe damage during seismic events. This project will increase fire flows by essentially doubling the pipe size in a transmission main from the Altamont Tank Site to the northwest end of the district. The remaining 8" DIP improvements are required to meet fire flows in local areas in the vicinity of the Briones Way PRV and at the ends of Menalto Drive and Westridge Court. Distribution System Analysis No. 339.

PROPOSED IMPROVEMENTS

Replace1,335 LF of 8" CI with 12" DIP (Page Mill Road)
Replace 5,550 LF of 6" CI with 8" DIP (Altamont Road)
Replace 300 LF of 6" CI with 8" DIP (Briones Way)
Replace 300 LF of 2" PVC with 8" DIP (Menalto Drive Cross Country)
Abandon 1,500 LF of 6" CI at Canyon Road Cross Country

PROJECT BENEFITS

The Zone 4 (LAHCFD) Capital Improvement Projects will provide fire flows to meet 1,500 gpm when two pumps are operating simultaneously at the Altamont Pump Station throughout Zone 4.

PROJECT BUDGET

1,335 LF - 12" DIP @ $275 per LF	$ 365,000
6,150 LF - 8" DIP @ $250 per LF	$1,540,000
Subtotal Construction	$1,905,000
Planning, Design & Construction Support	$ 285,000
Contingency (±10%)	$ 220,000
Project Budget	$2,410,000

Note:
The fire flows and pressures mentioned herein are located at the water main and flows at adjacent fire hydrants may be lower due to physical constraints and the hydraulic losses in the fire hydrant lateral and fittings.

Pakpour Consulting Group, Inc.
5776 Stoneridge Mall Road, Suite 320
Pleasanton, CA 94588
925.224.7717 Fax 925.224.7726
www.pcgengr.com

JOB No.	10002.03
DATE	2/14/17
SCALE	1" = 700'
DESIGN: BY	GU
CKD	JP
DRAWN: BY	GU
CKD	JP

SYMBOL	DATE	REVISIONS	BY	CKD

PHWD Zone 4 Markup with EKI's CIPs
EKI Markup - December 2017
Figure 3

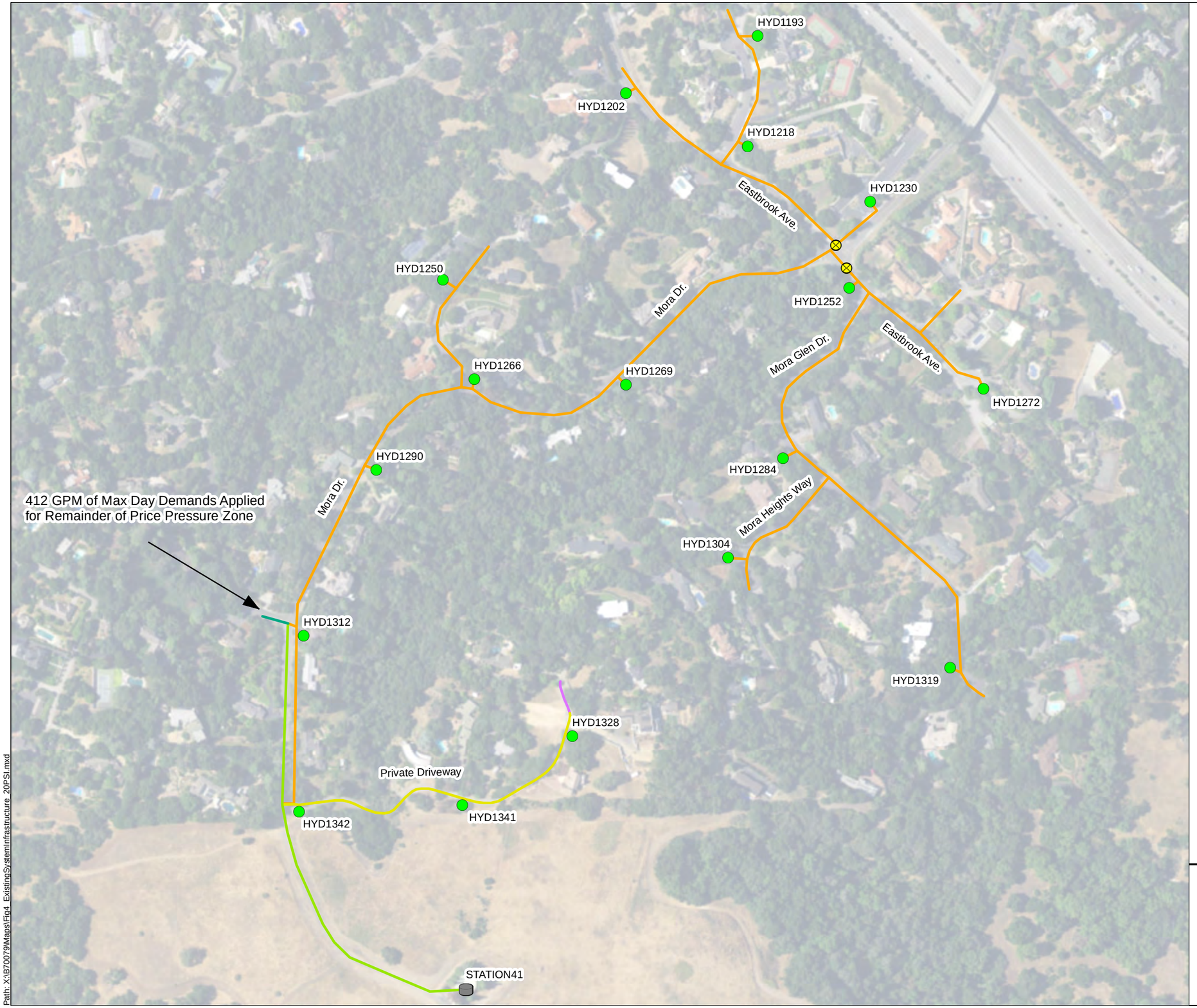
PURISSIMA HILLS WATER DISTRICT
SANTA CLARA COUNTY, CALIFORNIA
26375 FREMONT ROAD
LOS ALTOS HILLS, CA 94022-0264

DRAFT
2/14/17

ZONE 4 WATER MAIN CIP PROJECTS

SHEET 1
OF 1

DRAWING NAME: J:\CADD\10002.04\dwg\2016 CIP\Exhibits\PHWD-CIP-2016-Zone 4-2017-02-14.dwg
PLOT DATE: 01-31-17 PLOTTED BY: jp



Path: X:\B70079\Maps\Fig4_ExistingSystemInfrastructure_20PSI.mxd

Legend

Existing City Infrastructure

- Enclosed Storage Facility
- Hydrant
- Pressure Reducing Valve

Existing Pipe Diameter, Inches

- 4
- 6
- 8
- 10
- 12

Notes

1. All locations are approximate.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 20 December 2017.

N

0 250 500

(Scale in Feet)

EKI Simplified Model - Existing Infrastructure
Cal Water Mora Area

Los Altos Hills County Fire District
Los Altos Hills, CA
December 2017
B70079.00

Figure 4

eki environment & water

HYD1193 = 667 gpm
HYD1202 = 667 gpm
HYD1218 = 667 gpm
HYD1230 = 667 gpm
Eastbrook Ave.
HYD1250 = 690 gpm
HYD1252 = 657 gpm
Mora Dr.
Mora Glen Dr.
Eastbrook Ave.
HYD1266 = 677 gpm
HYD1269 = 677 gpm
HYD1272 = 653 gpm
HYD1284 = 614 gpm
HYD1290 = 780 gpm
Mora Dr.
Mora Heights Way
HYD1304 = 584 gpm
412 GPM of Max Day Demands Applied
for Remainder of Price Pressure Zone
HYD1312 = 1753 gpm
HYD1319 = 607 gpm
HYD1328 = 1221 gpm
Private Driveway
HYD1341 = 1485 gpm
HYD1342 = 1757 gpm
STATION41

Path: X:\B70079\Maps\Fig5_ExistingFireFlow_20PSI.mxd

Legend

Existing City Infrastructure

- Enclosed Storage Facility
- Pressure Reducing Valve
- Pipe

Hydrant Flow

- Unable to Meet Requirement
- Meeting Requirement

Notes

1. All locations are approximate.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 20 December 2017.

N

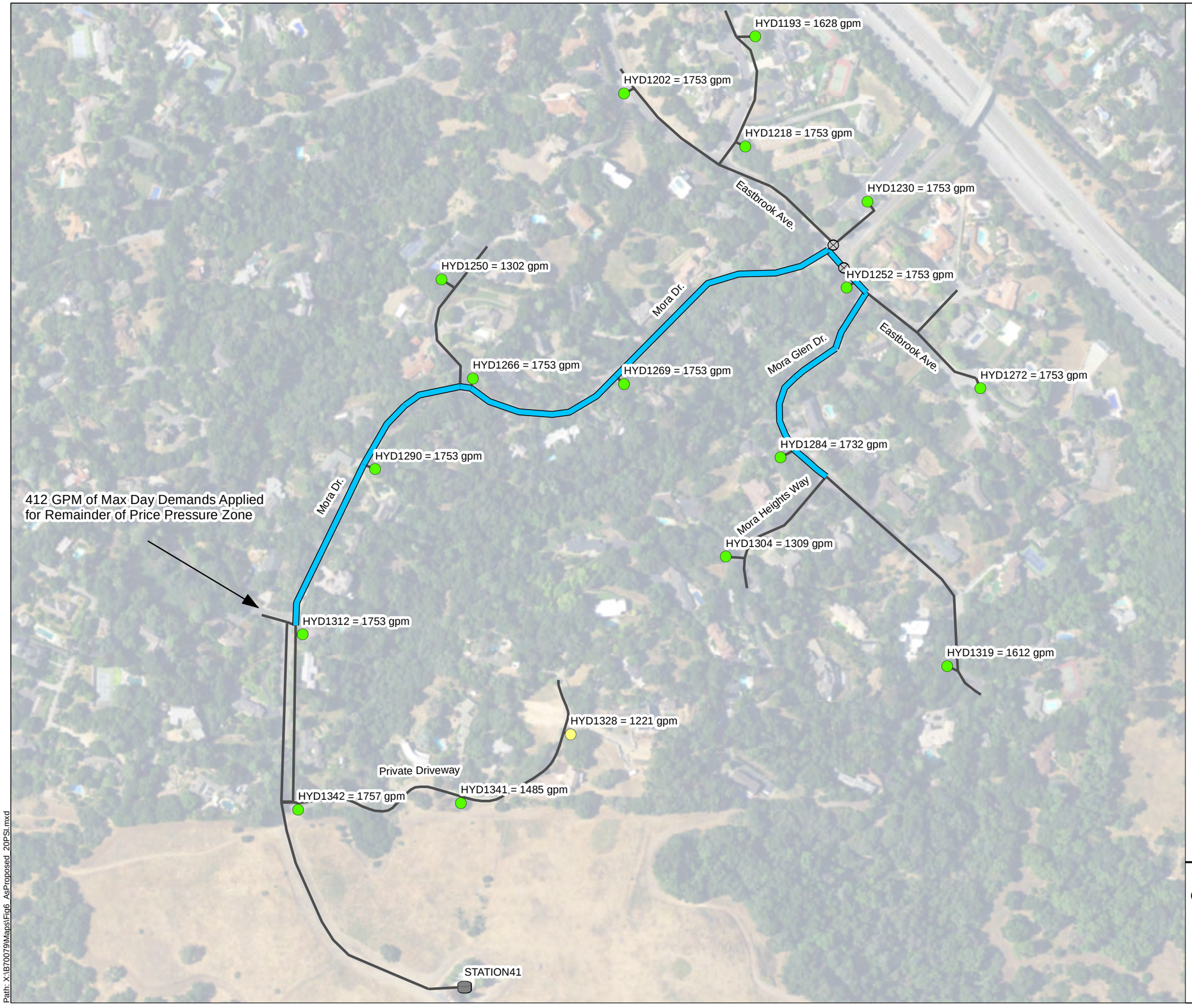
0 250 500

(Scale in Feet)

EKI Simplified Model - MDD Fire Flow Availability
Cal Water Mora Area with Existing Infrastructure

Los Altos Hills County Fire District
Los Altos Hills, CA
December 2017
B70079.00
Figure 5

eki environment & water



Legend

- Enclosed Storage Facility
- Pressure Reducing Valve
- Pipe
- Replacement Pipe 6" to 8"

Hydrant Flow

- Unable to Meet Requirement
- Meeting Requirement

Notes

1. All locations are approximate.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 20 December 2017.

N

0 250 500

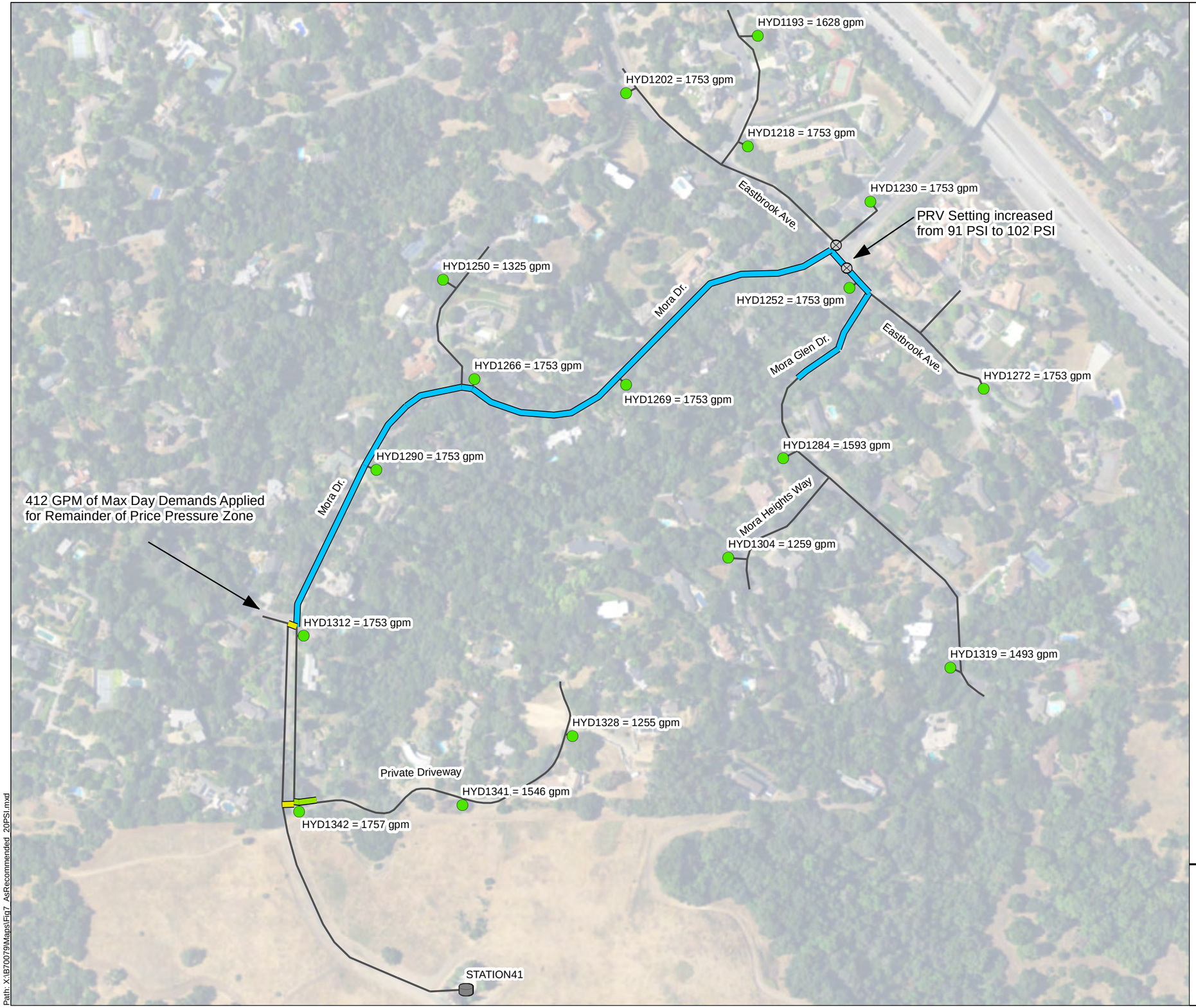
(Scale in Feet)

EKI Simplified Model - MDD Fire Flow Availability
Cal Water Mora Area with Cal Water's Proposed CIPs

Los Altos Hills County Fire District
Los Altos Hills, CA
December 2017
B70079.00
Figure 6

eki environment & water

Path: X:\B70079\Maps\Fig6_AsProposed_20PSI.mxd



Path: X:\B70079\Maps\Fig7_AsRecommended_20PSI.mxd

Legend

- Enclosed Storage Facility
- Pressure Reducing Valve
- Pipe
- Replacement Pipe 6" to 8"
- Replacement Pipe 6" to 10"
- Replacement Pipe 8" to 10"

Hydrant Flow

- Unable to Meet Requirement
- Meeting Requirement

Notes

1. All locations are approximate.

Sources

1. Aerial photograph provided by ESRI's ArcGIS Online, 21 December 2017.

N

0 250 500

(Scale in Feet)

EKI Simplified Model - MDD Fire Flow Availability
Cal Water Mora Area with EKI's Proposed CIPs

Los Altos Hills County Fire District
Los Altos Hills, CA
December 2017
B70079.00

Figure 7

eki environment & water

Eastbrook Ave. Improvement
160-ft, Priority = 2

Mora Dr. Downstream Section
1240-ft, Priority = 2

Mora Drive Upstream Section
1000-ft, Priority = 1

Mora Drive Intertie #1
30-ft, Priority = 3

Mora Glen Drive Improvement
340-ft, Priority = 2

Mora Drive Intertie #2
105-ft, Priority = 3

Eastbrook Ave.

Mora Dr.

Mora Glen Dr.

Eastbrook Ave.

Mora Heights Way

Private Driveway

STATION41

Legend

Existing City Infrastructure

- Enclosed Storage Facility
- Pressure Reducing Valve
- Pipe
- Hydrant

Projects

- Mora Drive Intertie #1, Replace with 10"
- Mora Drive Upstream, Replace with 8"
- Mora Drive Downstream, Replace with 8"
- Eastbrook Ave. Improvement, Replace with 8"
- Mora Glen Drive Improvement, Replace with 8"
- Private Road Improvement, Replace 8" with 10"
- Mora Drive Intertie #2, Replace 6" with 10"

Notes
1. All locations are approximate.

Sources
1. Aerial photograph provided by ESRI's ArcGIS Online, 21 December 2017.

N

0 250 500
(Scale in Feet)

Recommended Project Prioritization
Cal Water Mora Area

Los Altos Hills County Fire District
Los Altos Hills, CA
December 2017
B70079.00
Figure 8

eki environment & water

Path: X:\B70079\Maps\Fig8_Project Prioritzation_20PSI.mxd