Lake Whatcom Water and Sewer District

Eagleridge Booster Conversion Project

PROJECT REPORT

System ID: 08118 1

Bellingham, Washington

8/11/21

By

Wilson Engineering, LLC

August 2021

Contents

PROJECT REPORT

This project report is submitted to the Washington State Department of Health (DOH) for approval for the Lake Whatcom Water and Sewer District (District) Eagleridge Booster Conversion Project. This project will modify the existing booster pump station to retrofit the existing fire pump control valves to better regulate pressure and remove the existing domestic pumps at the Eagleridge Booster Station because they are no longer needed to maintain sufficient pressure in the Eagleridge water system (DOH System ID 08118 1).

1. Project Description

1.1 Problem Description

EXISTING FACILITY

The Eagleridge Water System is served by water from the City of Bellingham water system (DOH System ID 056003) through a 6 inch diameter service line, feeding into the District-owned booster pump station through a strainer, a meter, and a backflow preventer (two parallel 6 inch double check valve assemblies [DCVAs]). The pump station is located at 2029 North Shore Drive, and consists of a CMU structure containing three pumps for domestic service, two pumps for fire suppression, pump controls, and an auxiliary diesel generator. The pump station feeds into a looped network consisting of approximately 5,000 lineal feet of mostly 8 inch diameter pipe, serving 70 single family residences and associated fire hydrants.

Figure 1: Exterior of Existing Eagleridge Booster Pump Station

Figure 2a: Interior of Existing Eagleridge Booster Pump Station

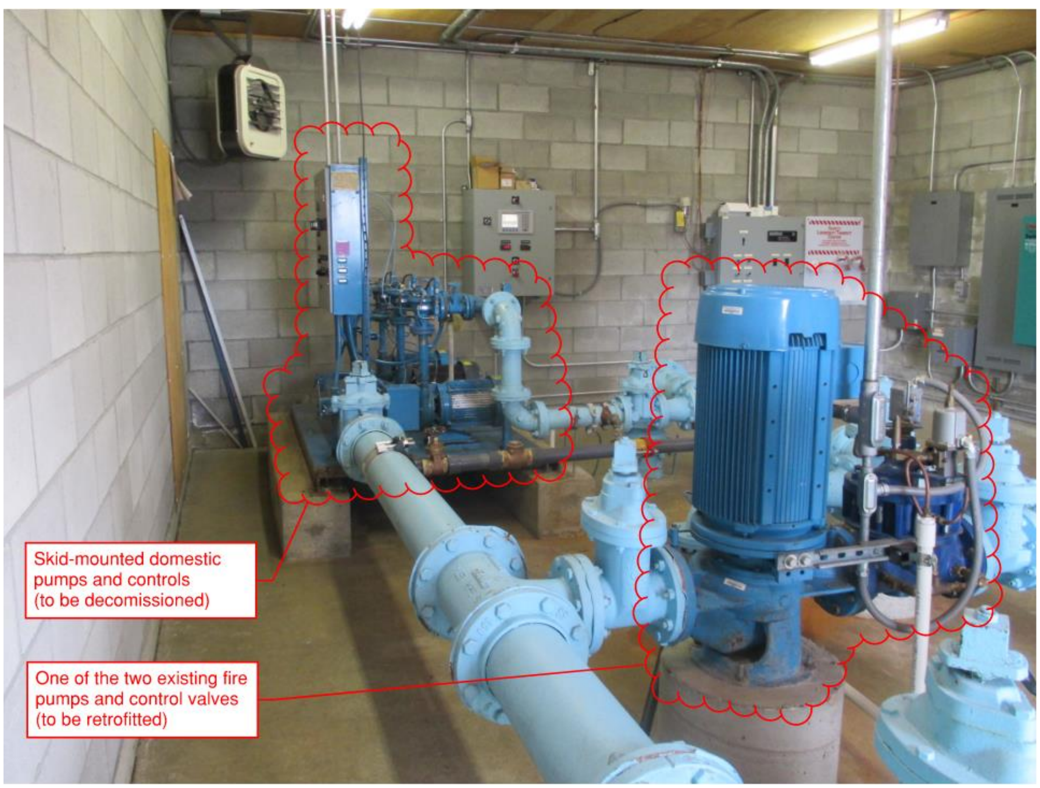

Figure 2b: Interior of Existing Eagleridge Booster Pump Station

PROJECT OBJECTIVE

The Eagleridge Booster Pump Station, along with the rest of the Eagleridge water system, was constructed in 1989. The station was originally built to deliver City of Bellingham water throughout the Eagleridge system because City water system pressures alone were not sufficient to meet minimum pressure and flow requirements. The Eagleridge community is situated on a hillside, with the highest service being approximately 80 feet higher than the intertie.

At some point between 1989 and 2016, the City of Bellingham increased the pressure in the service area that feeds the Eagleridge system. Based on this, a project was identified in the District's most recent Water System Comprehensive Plan update (approved by DOH on October 3, 2018) to study whether part or all of the pump station could be decommissioned. In 2020, the District requested Wilson Engineering perform a detailed hydraulic analysis using current system pressures at the City of Bellingham's system upstream of the Booster Pump Station. The detailed hydraulic analysis was conducted to determine if the City's higher pressures, on their side of the intertie, would be sufficient to meet the District's Eagleridge water system needs. This analysis is summarized in the technical memorandum "*Hydraulic Analysis of the Eagleridge Water System*", attached to this report in Appendix A.

Wilson Engineering's hydraulic analysis concluded that the domestic pumps are no longer necessary and can be removed, with the City's pressure being sufficient to serve the domestic demands of the Eagleridge system. However, the fire pumps must remain, as the hydraulic analysis found that the City pressures were not sufficient to deliver the minimum required flow and pressure in a fire flow scenario. The hydraulic analysis found the existing fire pumps to be oversized, and since they are simple on/off pumps (i.e., not controlled by a Variable Frequency Drive) with pump control valves (no pressure reducing function), they tend to create undesirable pressure spikes in the system. The analysis therefore concluded that the fire pumps could be replaced with modern and appropriately-sized pumps, or as a lower cost alternative, the existing pump control valves could be modified to add a pressure reducing function to prevent pressure spikes.

The project objective is twofold: 1) for domestic service, the objective is to minimize ongoing operating and maintenance costs while still meeting the minimum pressure and flow requirements; and 2) for fire service, the objective is to provide sufficient fire flow and pressure while eliminating over-pressurization of the system.

Recommendations and design parameters for both project objectives are detailed below.

1.2 Summary of Recommended Alternative, Construction Schedule, Estimated Project Cost and Method of Financing

Section 3 details the alternatives considered to achieve the project objectives. The recommended alternative to achieve the domestic service objective is to remove the domestic pumps from service. The recommended alternative to achieve the objective for the fire pumps is to retrofit the existing fire pump control valves with functionality to reduce and regulate the discharge pressure. In the future, when the fire pumps reach the end of their useful service life, the proposed action is to complete a full upgrade of both pumps and controls. This future replacement is not expected in the near future since the fire pumps and control panel appear to be in good condition.

The equipment to retrofit the fire pump control valves with pressure reducing and regulating functionality is included as Appendix B. Construction plans detailing the equipment to be decommissioned, and the pipe and check valve that will replace the domestic pump station for the recommended projects is included as Appendix C.

The estimated total project cost for both project components (domestic pump decommissioning and fire pump control retrofits) is $13,000, including design, construction, contingencies, sales tax, and construction administration. This estimate assumes that District staff will perform the decommissioning and bypass pipe work and that the control modifications will be performed using an outside contractor. The project will be funded by the District's Water Utility Fund 401.

The estimated project costs (including sales tax and contingency) are:

- Design and Construction (includes materials, contingencies and sales tax): $13,000
- Construction Administration: $0 (performed by District staff)
- TOTAL PROJECT Design and Construction COSTS: $13,000

The domestic pumps will be scheduled for removal upon receipt of DOH project plan approval with a goal to complete the project by March 2022.

The anticipated schedule for the fire pump retrofit is below.

- DOH Approval: October 2021
- Construction – Fire pump control valves: October-December 2021

1.3 Project Relationship to Other System Components

The project will modify the existing Eagleridge booster pumping system because the pressure on the City's side of the intertie has been substantially increased since original construction of the Eagleridge booster pumping system. The project will not alter, nor is it anticipated to adversely impact, any other water system components. The project will improve the resiliency of the water distribution system because it will not be reliant on a pump system to provide sufficient pressure for domestic demand.

1.4 Statement of Change in Physical Capacity

This project will not change the physical capacity of the system.

1.5 State Environmental Policy Act (SEPA)

This project is categorically exempt from the Washington State Environmental Policy Act (SEPA) as supported by the following:

- Repair, remodeling, maintenance, or minor alteration of existing public structures, facilities or equipment, including utilities involving no material expansions or changes in use beyond that previously existing (WAC 197-11-800 (3)),
- Utility construction related to lines 12-inches or less in diameter – (WAC 197-11-800 (23) (b)).

1.6 Summary of Source Development

Not applicable to this project.

1.7 Description of Water Treatment System

Not applicable to this project.

2. Planning

The Project provides improvements to the existing Eagleridge booster station and increases water system resiliency by removing the unnecessary domestic pumps and retrofitting the existing fire pumps with pressure reducing and regulating functionality. The project will not affect the service area or modify the number of approved connections.

3. Analysis of Alternatives

Several alternatives were considered to meet the project objectives. These alternatives, and their advantages and disadvantages, are described as follows.

Alternative 1 – Replace fire pumps and domestic pumps

Replace the existing fire pumps with VFD-controlled pumps that are more appropriately sized for the system and the higher suction-side pressure. Replace the domestic pumps that are nearing the end of their useful life *and* the associated control panel that has already reached the end of its useful life. This alternative would result in domestic service system pressures exceeding system requirements.

The rough order of magnitude (ROM) capital cost for this option is $275,000, and the ongoing electrical and maintenance ROM costs for the lifetime of the new domestic pumps (20 years) is estimated to be approximately $50,000.

Alternative 2 – Retrofit fire pumps, replace domestic pumps

The control valves for the existing fire pumps would be retrofitted to both reduce and regulate the discharge pressure, as discussed. The domestic pumps are nearing the end of their useful life and associated control panel has already reached the end of its useful life, so under this alternative they would be replaced with a new pump system and domestic service would continue with higher than required pressures.

The ROM capital cost for this alternative is $135,000, and the ongoing electrical and maintenance ROM costs for the lifetime of the new domestic pumps (20 years) would be approximately $50,000.

Alternative 3 (Preferred) – Retrofit fire pumps, decommission domestic pumps

The control valves for the existing fire pumps would be retrofitted to both reduce and regulate the discharge pressure, as discussed. The fire pumps would be replaced and upgraded only once they have reached the end of the useful service life, which is not anticipated to occur within the next 10 years. The domestic pumps would be replaced with a simple piped connection and necessary appurtenances within the existing building.

The ROM capital cost for this alterative is $13,000, assuming District labor. Because there would be no domestic pump system, there would be no ongoing operations and maintenance costs for that system. Operations and maintenance costs exist for the fire pumps and generator, but this is the case for any of the alternatives and therefore is not quantified.

Preferred Alternative:
Alternative 3 is the preferred alternative because it meets the regulatory requirements for domestic and fire flows and pressures at both the lowest capital and lowest O&M costs.

4. Water Quality

This project does not include any activities that will change the raw water or finished water quality.

5. Water Quantity and Water Rights

Water Quantity
This project does not involve changing the overall water quantity conditions in the District.

Water Rights
This project does not involve any activities that will change water rights or impact the use of available water rights for the District. The District's Water Right Self-Assessments are included in the current revision of the District's Water System Comprehensive Plan (WSCP), which was approved by the DOH on October 3, 2018.

6. Design Criteria

The design criteria for the Eagleridge area are detailed in Appendix A and are presented here for convenience:

> MDD = 39.44 gpm (which is 71 ERUs [build-out] at 800 gallons/day per ERU)
> PHD = 130.5 gpm at 30 psi minimum for full anticipated build-out of the Eagleridge system (71 ERUs)
> Fire Flow = 500 gpm at 20 psi minimum system pressure

7. Engineering Calculations

<u>Hydraulic Modeling</u>
A detailed hydraulic analysis was completed in November, 2020. The modeling software used to perform the hydraulic analysis was Innovyze InfoWater Version 12.3 (for ArcGIS). The technical memorandum included in Appendix A (*Hydraulic Analysis of the Eagleridge Water System)* describes the scenarios modeled and includes the model results for removal of the existing domestic pumps.

The analysis results indicate that there is sufficient pressure provided by the City's water system to provide the minimum required 30 psi throughout the system while supplying the peak hour demand of 130.5 gpm. The minimum system pressure in this scenario was 34.4 psi. However, the analysis results also show that the City pressure is not sufficient to provide the minimum required flow and pressure in a fire flow scenario, so fire pumps must remain.

Equipment Sizing

The three existing domestic pumps are skid mounted. The skid is fed directly off of the 6 inch diameter service line. When the three domestic pumps are decommissioned, the skid will be removed and flow will instead be routed through a 3 inch diameter pipe and check valve, which will provide adequate capacity for domestic demands. This is shown in Appendix C.

The manufacturer's representative for the existing fire pump control valves was contacted for recommendations on a proposed configuration for adding a pressure reducing feature to the current fire pump control valves. The recommendation was to retrofit the existing control valve to match the functionality and specifications of the following model of control valve (which also provides pressure reducing and regulation):

- Cla-Val Co. Model #60-12 - Combination Pump Control and Pressure Reducing Valve

The product cut-sheet is included in Appendix B.

8. Legal Considerations

The project is within existing District property and is a modification to an existing facility.

9. Operation and Maintenance Considerations

The proposed improvements will reduce operation and maintenance efforts and associated costs since there will be three fewer pumps and associated appurtenances. The proposed retrofit to the existing fire pump control valves is not expected to create any additional operation or maintenance needs, and will minimize the risk of creating leaks due to over pressurization or water hammer.

APPENDIX A

HYDRAULIC ANALYSES

WILSON ENGINEERING
805 Dupont Street, Ste. #7, Bellingham, Washington 98225
Telephone: (360) 733-6100 • Facsimile: (360) 647-9061

MEMORANDUM

TO:	LWWSD
FROM:	Ben Gibson, PE, and Brian Smith, PE
SUBJECT:	Hydraulic Analysis of the Eagleridge Water System
DATE:	November 10, 2020

Introduction

The District's Eagleridge water system was installed in 1989, and currently serves 68 residences from an intertie with the City of Bellingham water system. Historically the City water system alone has not provided adequate pressure at the intertie, requiring the use of the existing Eagleridge booster pumps. However, upgrades to the City system over the past few decades have resulted in higher pressures, and as such, the necessity of these existing pumps has come into question. The purpose of this technical memorandum is to summarize the results of the hydraulic analysis performed to investigate the feasibility of removing the existing Eagleridge booster pumps.

Executive Summary

A hydraulic model was developed for the Eagleridge water system in order to simulate two scenarios: peak hourly demand, and fire flow with maximum day demand, both without the existing booster pumps. The model showed that for the peak hourly demand scenario, the minimum system pressure would be 34.42 psi, which is greater than the minimum requirement of 30 psi. For the fire flow demand scenario, the maximum available hydrant flow while maintaining the required minimum 20 psi throughout the system ranged from 341 gpm to 359 gpm, which is less than the minimum required 500 gpm.

Therefore, we conclude that the domestic pumps could be decommissioned and remain within regulatory requirements for pressure. Note that the normal system pressures will be about 30 psi lower than they are now and may be perceived as a reduction in "level of services" by a few customers. Since it appears that the fire pumps will remain necessary, when they eventually need to be replaced we recommend that the new pumps have VFD controls and are sized appropriately based on current suction-side pressures and fire flow needs.

Current Water System Operation

Overview

The Eagleridge Water System connects to the City of Bellingham system through a 6 inch service line, feeding into the pump station through a strainer, a meter, and a backflow preventer (two parallel six inch DCVAs). The pump station is located at 1708 North Shore Drive, and consists of a CMU structure containing three pumps for domestic service, two pumps for fire suppression, pump controls, and a diesel generator. The pump station feeds into a looped network consisting of approximately 5,000 lineal feet of mostly 8 inch pipe, serving approximately 68 residences and 6 fire hydrants. The existing system is shown in Figure 1.

Current System Performance

The system was modeled in its current configuration (with pumps) to determine the existing system pressures. The model verifies that the current system provides adequate pressure and flow in both the peak hour demand (PHD) and fire flow scenarios. Demands for both scenarios are discussed in the following section. According to the model, the lowest system pressures during the PHD and fire flow scenarios were 68.35 and 64.40 psi, respectively, which are well above the 30 psi and 20 psi minimum requirements. For the PHD scenario, only two of the three domestic pumps were set to run, with both fire pumps off (fire pumps are only set to turn on when system pressure at the pump house drops below 60 psi). Similarly, for the fire flow scenario, only a single fire pump was turned on, with all of the domestic pumps off. In reality the domestic pumps would also be on during a fire event, in addition to the fire pumps, but to be conservative and to more accurately represent a scenario where the domestic pumps are removed with just the fire pumps remaining in service (as discussed later in this memo), the fire flow scenario was run without the domestic pumps.

Critical Node

The minimum pressures for both of the scenarios discussed above occurred at node J-NE-19, as shown on Figure 1, which represents the highest elevation node in the Eagleridge water main distribution system at an approximate elevation of 409' and is the critical node for this model (both with and without pumps). This node is located at the approximate location of the meter for the residence at 1777 Donald Avenue, where the residence itself is at an elevation of approximately 421'. This is the highest meter in the system. While 1777 Donald Avenue has the highest elevation *meter*, and is therefore the critical node from a distribution main standpoint, it is not the highest elevation *residence*. The highest elevation residence is 1784 Donald Avenue at an elevation of approximately 440', which is included in the model as node J-

90, and shown in Figure 1 for reference. This is the highest point in the system and represents the worst case scenario in terms of level of service. It is not the critical node in terms of regulatory requirement since the meter for 1784 Donald is actually located much lower, on Eagleridge Way (see node J-88, Figure 1) with an elevation of approximately 375’.

Coordinate System: State Plane Washington, North FIPS 4601 North American Datum 1983

LWWSD EAGLERIDGE

FIGURE 1

EXISTING WATER DISTRIBUTION SYSTEM

WHATCOM COUNTY | WASHINGTON

DATE	SCALE	JOB NUMBER	SHEET
11-3-2020	AS SHOWN	2020-080	1 OF 1

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Hydraulic Model Inputs

Infrastructure

The system model was constructed using original record drawings from Weden Engineering, and is shown in Figure 1 – Existing Water System. The distribution network in the model is "skeletonized" to only include the mains, excluding the individual service lines (except for the worst-case service connection, J-90, as discussed previously). The distribution network consists mainly of 8 inch pipe, with a few short sections of 6 inch, and one section of 4 inch pipe. All piping is cement-lined ductile iron, and is modeled as having a Hazen-Williams roughness coefficient of 120. Pump curves were developed based on cut sheets for the existing pumps, but since the main intent of this analysis is to determine system performance without the pumps, they were only used to model the scenarios with the current configuration discussed previously.

Field Data

The system information that is needed to develop an accurate hydraulic model is fairly standard for most basic components such as pipe, bends, valves, etc. For other components such as pumps and meters, whose properties are make and model specific, the manufacturer will usually provide cut sheets with the necessary information. This was true for the Eagleridge pumps and DCVA, but information for the existing meter and strainer was not available.

A site visit was performed on August 4, 2020 with LWWSD staff, wherein a flow/pressure test was carried out to measure system pressures. A data logger was installed at two locations within the system to record pressures during known flow events, with the intent being to determine the actual headlosses within the system – specifically, for the portion between the City network and the pump station. Doing so results in a more accurate hydraulic model.

The first location where pressure was recorded was just upstream of the pumphouse, in the DCVA vault (immediately downstream of the DCVAs). A fire hydrant was opened at the intersection of Eagleridge Way and Aquila Court, and set to a flow of 220 gpm. Prior to opening the hydrant, the average recorded pressure at the DCVA was observed to be 75.6 psi. After opening the hydrant, the average recorded pressure at the DCVA was found to be 68.3 psi, which shows a pressure loss through the City system (City main, meter, DCVA) of 7.3 psi at a flow of 220 gpm.

The hydrant was then opened to a flow of approximately 393 gpm, which resulted in an average pressure at the DCVA of 58 psi, indicating a pressure loss across the City system (City main, meter, DCVA) of 17.6 psi at a flow of 393 gpm. Using these two pressure loss data points (7.3 psi at 220 gpm, and 17.6 psi at 393 gpm), along with the other known headlosses, the minor headloss coefficient, K, for the water meter and strainer was calibrated in the model to reflect the observed headloss.

Demands

The demands used in the hydraulic model are based on the 2017 LWWSD Water System Plan Update (2017 WSP), which states that the Eagleridge community's expected build-out is 71 ERUs, with an average daily demand (ADD) of 250 gpd/ERU, a maximum daily demand (MDD) of 800 gpd/ERU, and a fire flow requirement of 500 gpm. Therefore, a system MDD of 39.44 gpm was used for the fire flow scenario (in addition to the 500 gpm fire demand), and a demand of 130.5 gpm was used for the PHD scenario.

City of Bellingham System Pressure

Based on input from the City of Bellingham Utility Operations Engineer, Jim Bergner, pressure at the City intertie during a fire flow scenario of 539 gpm (accounting for the 500 gpm fire flow in addition to the 39 gpm MDD flow) will be 59 psi, with a static pressure of 78 psi. Similarly, pressure at the intertie during the 130.5 gpm peak hourly demand will be 73 psi, again with a static pressure of 78 psi. These pressures are with reservoir levels that are the lowest observed reservoir levels. Exact levels with equalizing storage and fire suppression storage depleted were not quantified by the City, but it is expected that the lowest observed reservoir levels that are represented are at least approximately close to those conditions.

It should be noted that according to the City, portions of their hydraulic model have not been updated since 2004. As the attached correspondence shows, a workaround was used to generate the requested pressures. This method seems to have yielded fairly accurate results, considering that the calculated static pressure is within 3% of the static pressure observed in the field: 78 psi according to model, and 75.6 psi average observed downstream of the strainer, meter, and backflow assemblies.

Hydraulic Model Results

The hydraulic model was run for two scenarios: peak hourly demand and fire flow with maximum daily demand. For both models, in order to simulate the removal of the existing pumps, the model pumps were deactivated and flow was routed through an 8 inch bypass line as shown in Figure 2.

Peak Hourly Demand

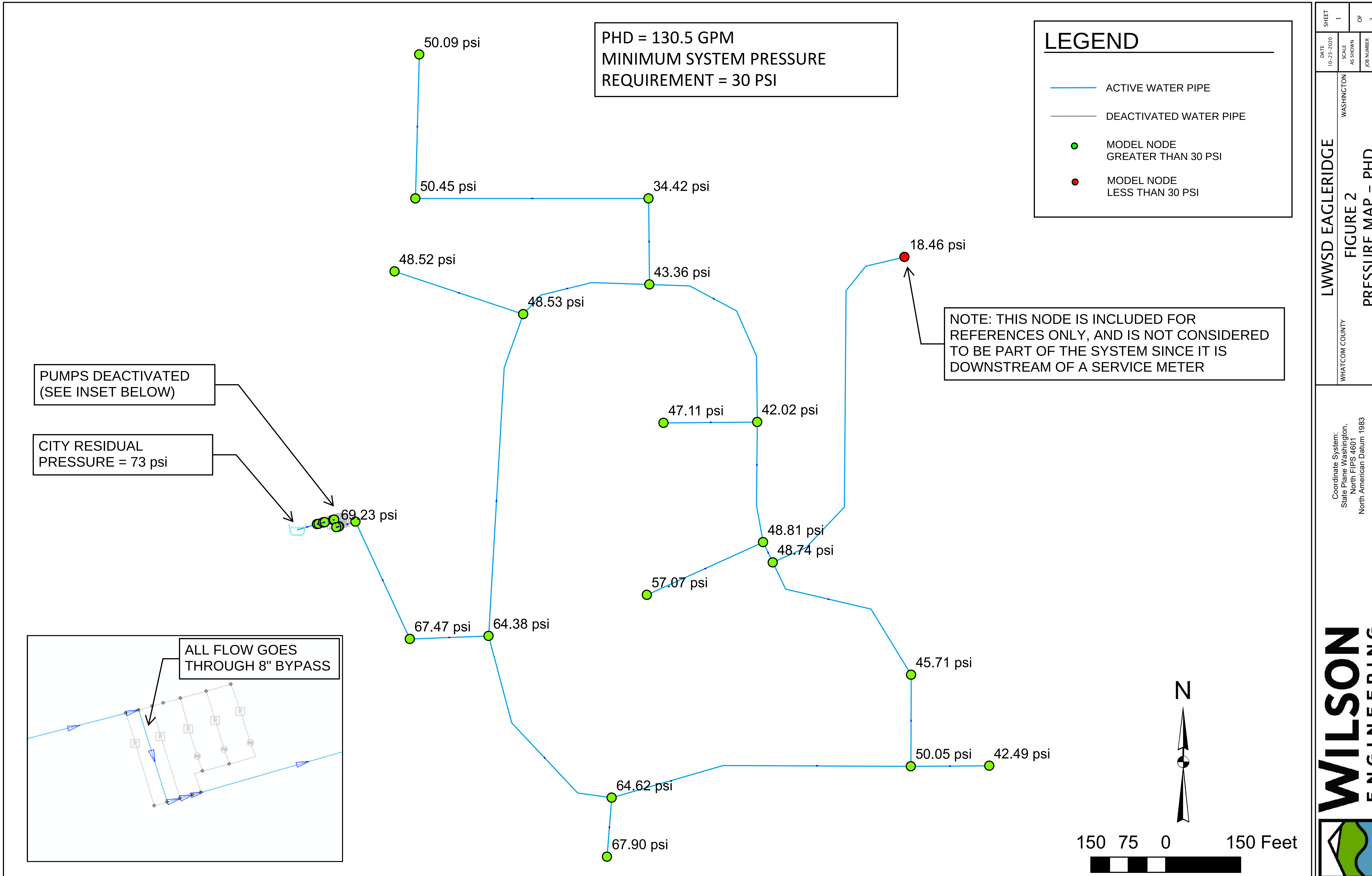
The District has adopted the Design Standards set forth in WAC 246-290-230. Paragraph 5 states that "New public water systems or additions to existing systems shall be designed with the capacity to deliver the design PHD quantity of water at 30 psi (210 kPa) under PHD flow conditions measured at all existing and proposed service water meters or along property lines adjacent to mains if no meter exists, and under the condition where all equalizing storage has been depleted."

As Figure 2 shows, the lowest *system* pressure occurs at node J-NE-19 (the critical node for this model), with 34.42 psi, which is greater than the minimum required pressure. Based on these results, it appears that removing the domestic pumps is acceptable from a PHD minimum pressure standpoint. A summary of the PHD system pressures is shown in Table 1 below for both the scenario with domestic pumps (current configuration) and without the domestic pumps.

Table 1: PHD System Pressures With and Without Domestic Pumps

Node	PHD Pressure with Pumps (psi)	PHD Pressure without Pumps (psi)		Node	PHD Pressure with Pumps (psi)	PHD Pressure without Pumps (psi)
J-NE-3	100.00	69.23		J-NE-14	75.94	42.02
J-NE-4	101.39	67.47		J-NE-15	81.04	47.11
J-NE-6	98.31	64.38		J-NE-16	82.45	48.53
J-NE-7	98.55	64.62		J-NE-17	82.45	48.52
J-NE-8	101.82	67.90		J-NE-18	77.29	43.36
J-NE-9	89.97	50.05		J-NE-19	68.35	34.42
J-NE-10	76.42	42.49		J-NE-20	84.38	50.45
J-NE-11	79.64	45.71		J-NE-21	84.02	50.09
J-NE-12	82.74	48.81		J-88	82.67	48.74
J-NE-13	91.00	57.07		J-90	52.39	18.46*

*Note: Node J-90 is downstream of a service meter, and not subject to the 30 psi minimum.


PHD = 130.5 GPM
MINIMUM SYSTEM PRESSURE
REQUIREMENT = 30 PSI
LEGEND
ACTIVE WATER PIPE
DEACTIVATED WATER PIPE
MODEL NODE
GREATER THAN 30 PSI
MODEL NODE
LESS THAN 30 PSI
50.09 psi
50.45 psi
34.42 psi
48.52 psi
43.36 psi
48.53 psi
18.46 psi
NOTE: THIS NODE IS INCLUDED FOR
REFERENCES ONLY, AND IS NOT CONSIDERED
TO BE PART OF THE SYSTEM SINCE IT IS
DOWNSTREAM OF A SERVICE METER
PUMPS DEACTIVATED
(SEE INSET BELOW)
CITY RESIDUAL
PRESSURE = 73 psi
47.11 psi
42.02 psi
69.23 psi
48.81 psi
48.74 psi
57.07 psi
67.47 psi
64.38 psi
45.71 psi
ALL FLOW GOES
THROUGH 8" BYPASS
50.05 psi
42.49 psi
64.62 psi
67.90 psi
N
150 75 0 150 Feet
SHEET 1 OF 1
DATE 10-23-2020
SCALE AS SHOWN
JOB NUMBER 2020-080
LWWSD EAGLERIDGE
FIGURE 2
PRESSURE MAP – PHD
WHATCOM COUNTY
WASHINGTON
Coordinate System:
State Plane Washington,
North FIPS 4601
North American Datum 1983
WILSON
ENGINEERING

Fire Flow and Maximum Daily Demand

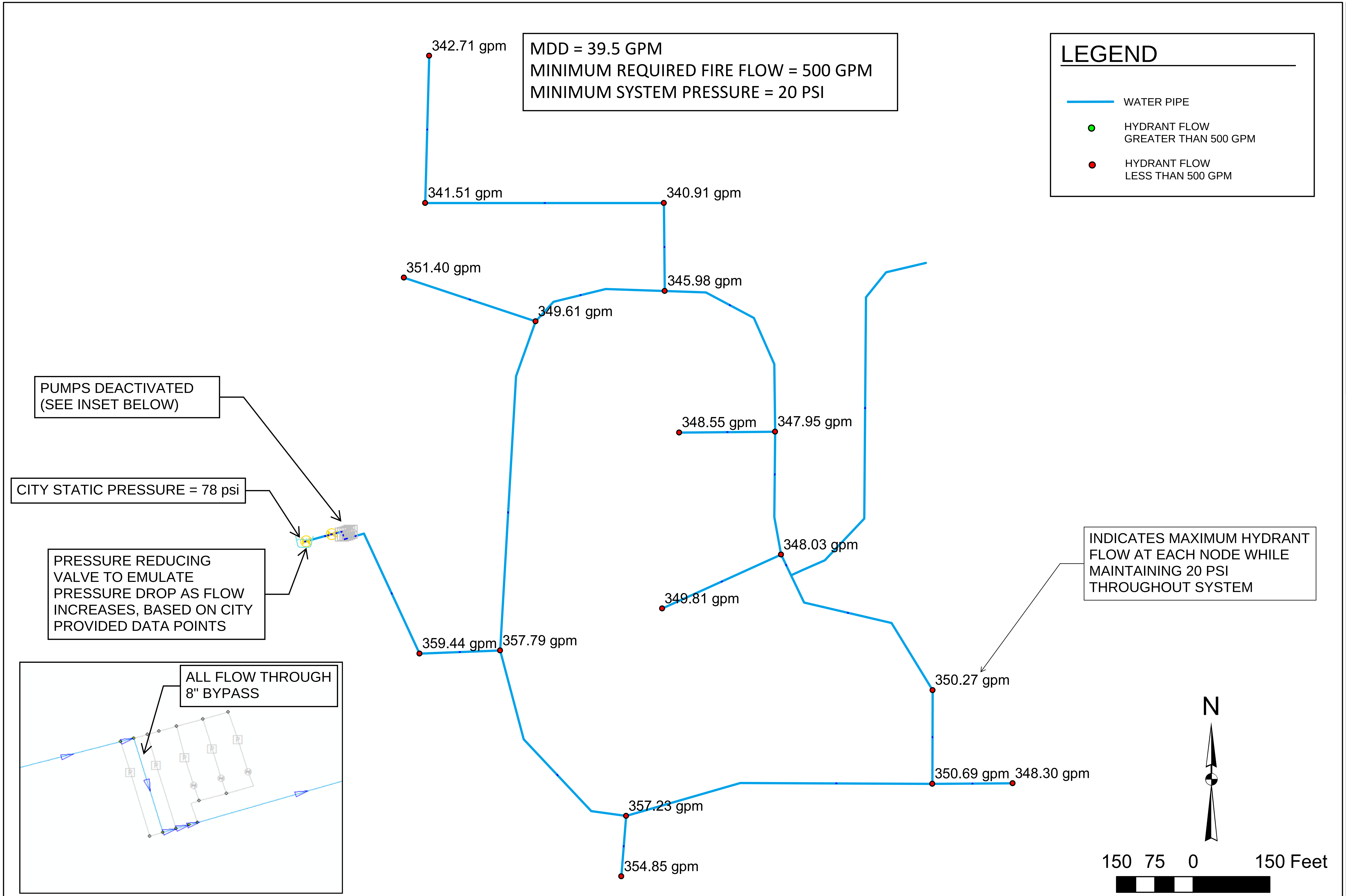
Paragraph 6 of WAC 246-290-230 states that “If fire flow is to be provided, the distribution system shall also provide maximum day demand (MDD) plus the required fire flow at a pressure of at least 20 psi (140 kPa) at all points throughout the distribution system, and under the condition where the designed volume of fire suppression and equalizing storage has been depleted.”

The hydraulic model allows for the analysis of fire flow scenarios in a number of ways. Figure 4 shows the maximum available hydrant flow at each node while maintaining a minimum pressure of 20 psi throughout the system. As Figure 4 shows, this maximum flow varies from 340.91 to 359.44 gpm, below the minimum required 500 gpm. Therefore, it appears that removing the fire suppression pumps is not acceptable.

Existing Fire Pumps

The existing two fire pumps are not very well suited to the current needs of the system and should be replaced when they reach the end of their useful life, at the latest. Since the existing fire pumps were installed when the fire flow requirement was 750 gpm (versus 500 gpm, now), and because the City water pressure has increased since this pumping system was designed and installed, it would appear that the existing fire pumps are significantly oversized. This is verified by the hydraulic model, which shows, with a single fire pump running, the available hydrant flow ranges from 1,112 gpm to 1,199 gpm while maintaining 20 psi throughout the system – over double the required flow.

Furthermore, the existing fire pumps are simple on-off controlled pumps. These are inefficient compared to modern variable frequency drive (VFD) controls, and since they do not have bladder tanks or precise controls to achieve a target discharge pressure, they tend to cause pressure spikes and dips. Figure 3 below shows a plot of the pressure recorded by a data logger at the hydrant. The pressure spike shown at approximately 9:40am on the plot represents one of the fire pumps turning on, where peak pressure exceeds 120 psi, which exceeds the DOH’s recommendation for maximum working pressure of 80 psi. Not only is the pressure excessive, but it could (and does, as shown) increase and decrease quickly, causing



SHEET 1 OF 1

DATE 11-5-2020

SCALE AS SHOWN

JOB NUMBER 2020-080

LWWSD EAGLERIDGE

WHATCOM COUNTY WASHINGTON

FIGURE 4

AVAILABLE HYDRANT FLOW (20-PSI)

Coordinate System:
State Plane Washington,
North FIPS 4601
North American Datum 1983

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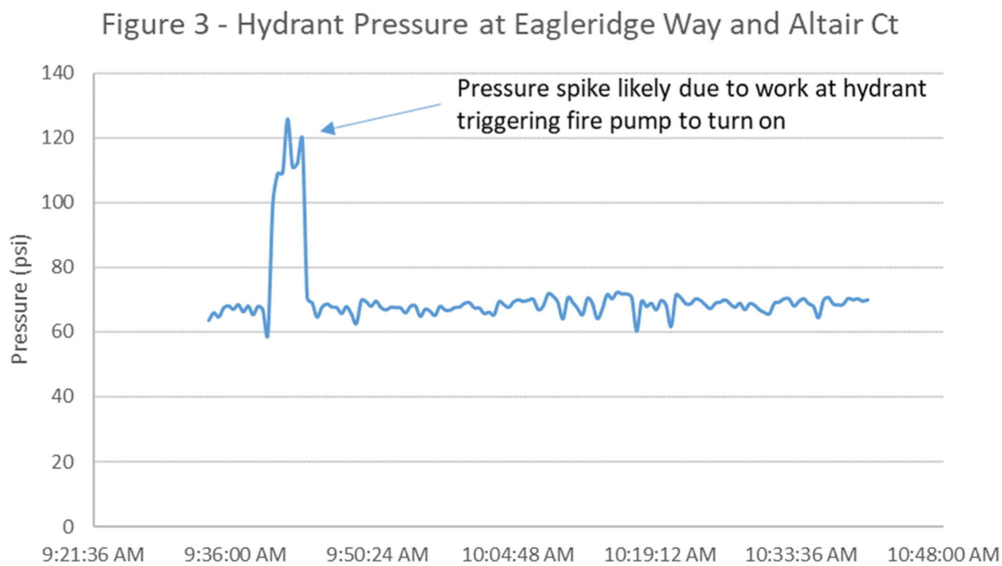
water hammer and potentially damaging the distribution system, services, or plumbing, causing leaks and water loss.



Since it appears that the fire pumps will remain necessary, we recommend replacing them with appropriately sized pumps (based on current suction-side pressures and fire flow needs) with VFD controls.

Attachments

- Correspondence with City of Bellingham
    - Node J1 Pressure at fire flow (539 gpm), with explanation of model workaround
    - Node J1 Pressure at PHD (130.5 gpm)

WILSON ENGINEERING

Brian Smith <bsmith@wilsonengineering.com>

LWWSD water intertie at Eagleridge

Bergner, Jim P. <jbergner@cob.org> Wed, Oct 14, 2020 at 1:43 PM
To: Brian Smith <bsmith@wilsonengineering.com>
Cc: Melanie Mankamyer <mmankamyer@wilsonengineering.com>, Ben Gibson <bgibson@wilsonengineering.com>

Hi Brian,

Here's what you can expect to see at J1 with a demand of 539gpm.

Regards,

Jim Bergner

Utility Operations Engineer

Public Works - Engineering

104 W. Magnolia St., Suite 109, Bellingham, WA 98225

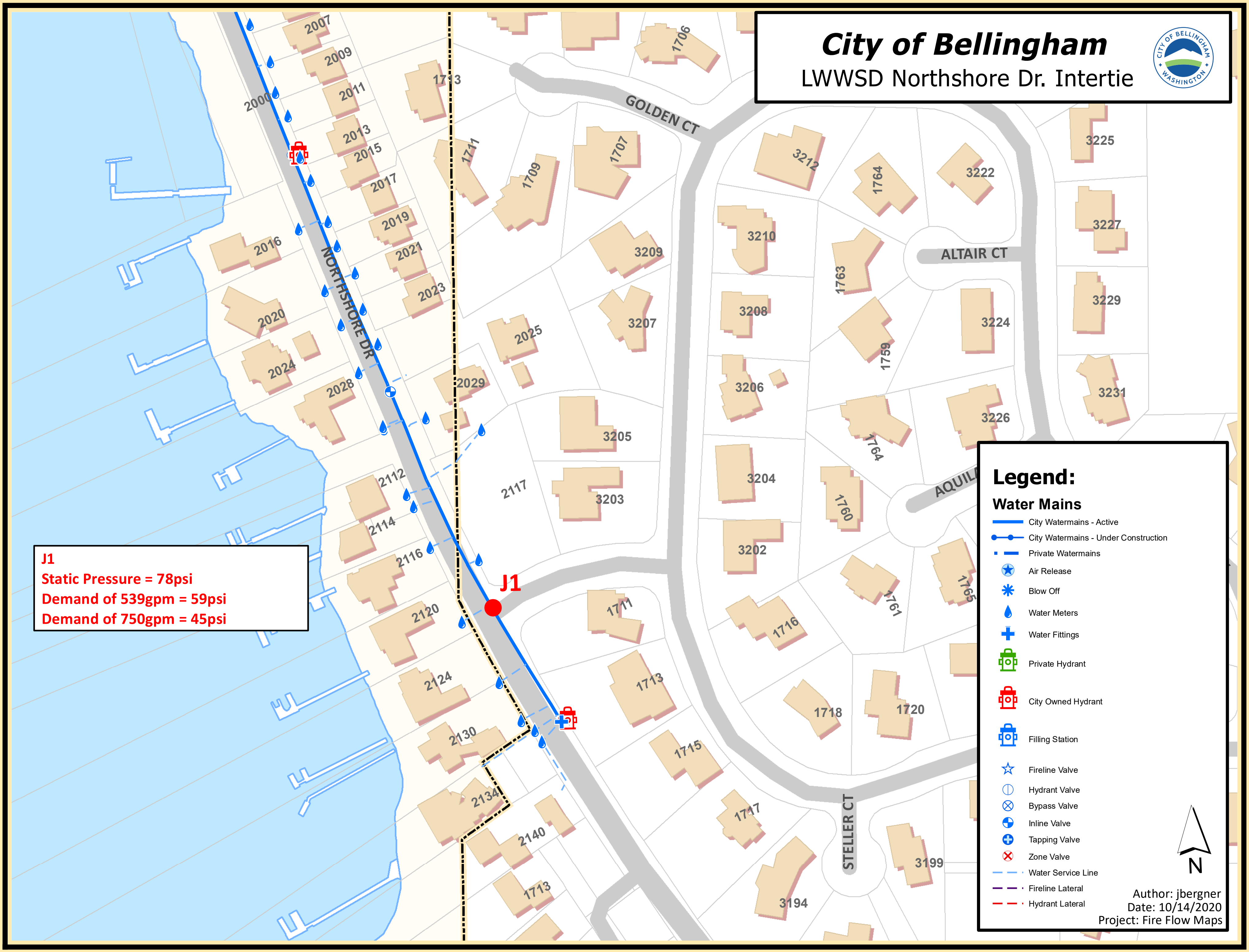
P: 360.778.7731

jbergner@cob.org

From: Brian Smith <bsmith@wilsonengineering.com>
Sent: Tuesday, October 13, 2020 4:22 PM
To: Bergner, Jim P. <jbergner@cob.org>
Cc: Melanie Mankamyer <mmankamyer@wilsonengineering.com>; Ben Gibson <bgibson@wilsonengineering.com>
Subject: Re: LWWSD water intertie at Eagleridge

Hi Jim,

Circling back with you on this. We did some field data collection last month, and have refined our analysis within the Eagleridge system. Now the key piece of the analysis depends on what the City-side pressure is.


City of Bellingham
LWWSD Northshore Dr. Intertie
J1
Static Pressure = 78psi
Demand of 539gpm = 59psi
Demand of 750gpm = 45psi
NORTHSHORE DR
GOLDEN CT
ALTAIR CT
STELLER CT
Legend:
Water Mains
City Watermains - Active
City Watermains - Under Construction
Private Watermains
Air Release
Blow Off
Water Meters
Water Fittings
Private Hydrant
City Owned Hydrant
Filling Station
Fireline Valve
Hydrant Valve
Bypass Valve
Inline Valve
Tapping Valve
Zone Valve
Water Service Line
Fireline Lateral
Hydrant Lateral
N
Author: jbergner
Date: 10/14/2020
Project: Fire Flow Maps

One thing we discovered as we were digging in is that the Eagleride fire flow standard is actually 500 gpm, not the 750 gpm we previously discussed. Could you re-check your scenario (where you got 45 psi at 750 gpm), and tell us pressure at J1 under 539 gpm (500 gpm fire flow plus 39 gpm MDD)?

Thanks,

Brian Smith, P.E.
Wilson Engineering, LLC

805 Dupont Street, Suite 7
Bellingham, WA 98225
Ph: (360) 733-6100 x216
www.wilsonengineering.com

Civil Engineering and Surveying Services Since 1967

On Wed, Aug 12, 2020 at 10:27 AM Bergner, Jim P. <jbergner@cob.org> wrote:

> Hi Brian,
>
> I'm still having issues with the MDD scenario in the model that I was trying to use. It got me thinking that maybe the scenario I was trying to use wasn't the best one to use. This particular scenario was created in 2004 with the development of our model. All the other MDD scenarios were also created in 2004. Well that was 16 years ago and as you are probably aware the system has changed a lot since then. Not only have we removed and added new reservoirs, but now all City water customers are now metered. This will all be addressed next year when we start the process to update our Water System Plan and model.
>
> So with that said here is what I ended up doing. I reached out to the Water Treatment Plant manager and got the lowest water levels for the 2 Dakin reservoirs that provide water to this zone. I took those levels and the levels that are used in the ADD scenario that were used for your fire flow request at J1. I calculated out the difference to come up with a pressure of 45psi when flowing 750gpm.
>
> I also ran a fire flow within that zone at Northshore and Academy to see what you should have available at J1. You are left with a pressure of 64psi but with only 450gpm.
>
> Let me know if you have any question or if you need any additional information.
>
> **Regards,**

WILSON ENGINEERING

Ben Gibson <bgibson@wilsonengineering.com>

RE: LWWSD water intertie at Eagleridge

Bergner, Jim P. <jbergner@cob.org> Thu, Oct 22, 2020 at 3:18 PM
To: Brian Smith <bsmith@wilsonengineering.com>
Cc: Melanie Mankamyer <mmankamyer@wilsonengineering.com>, Ben Gibson <bgibson@wilsonengineering.com>

Hi Brian,

Here's what you are looking at in the way of pressure with a demand at 130.5gpm at J1. I set the reservoir levels to 11.00 for Dakin 1 and 9.71 for Dakin 2. Those reservoirs typically don' go below 13' & 10'.

Regards,

Jim Bergner

Utility Operations Engineer

Public Works - Engineering

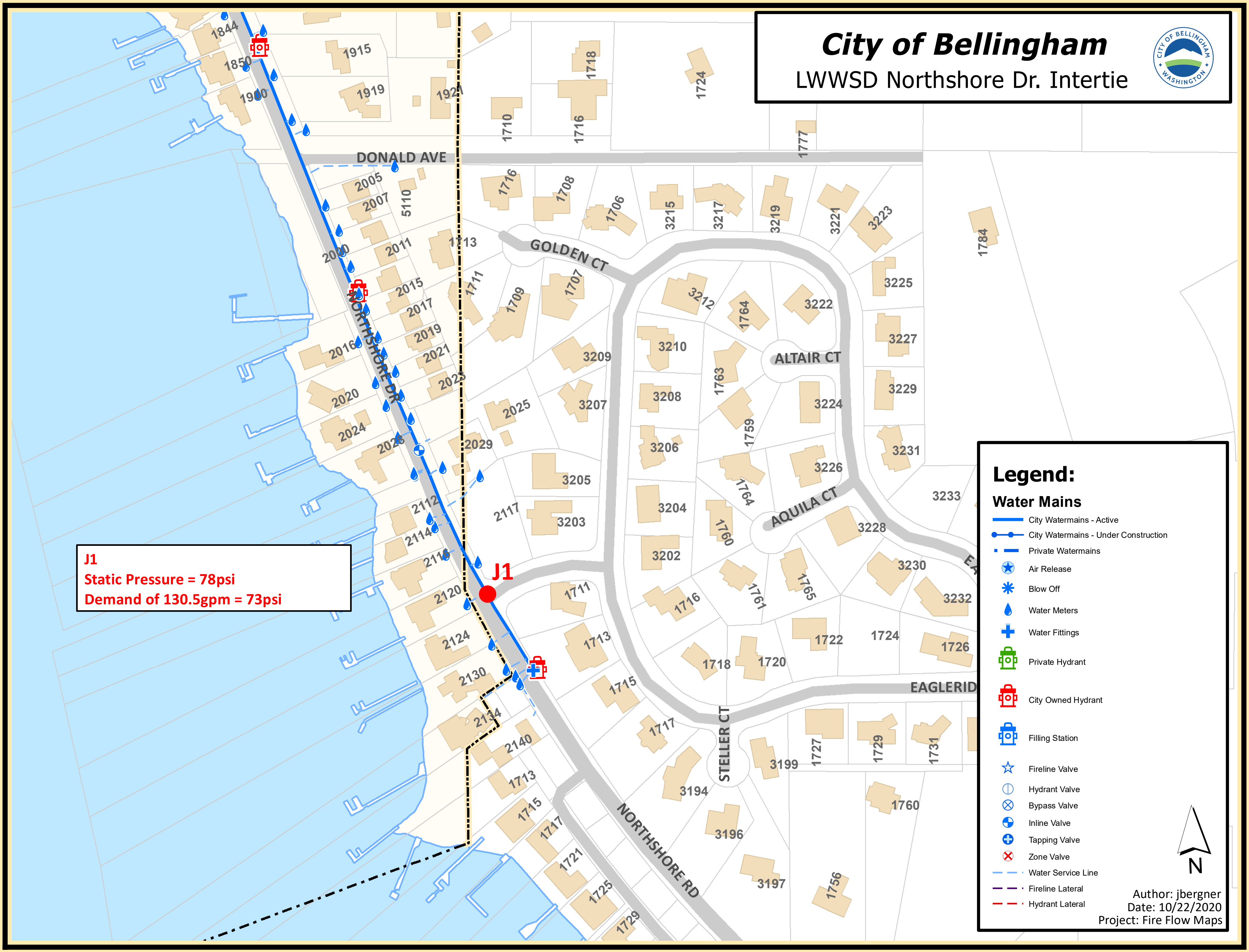
104 W. Magnolia St., Suite 109, Bellingham, WA 98225

P: 360.778.7731

jbergner@cob.org

From: Brian Smith <bsmith@wilsonengineering.com>
Sent: Wednesday, October 21, 2020 3:11 PM
To: Bergner, Jim P. <jbergner@cob.org>
Cc: Melanie Mankamyer <mmankamyer@wilsonengineering.com>; Ben Gibson <bgibson@wilsonengineering.com>
Subject: Re: LWWSD water intertie at Eagleridge

Hi Jim,


City of Bellingham
LWWSD Northshore Dr. Intertie
CITY OF BELLINGHAM WASHINGTON
J1
Static Pressure = 78psi
Demand of 130.5gpm = 73psi
DONALD AVE
GOLDEN CT
NORTHSHORE DR
ALTAIR CT
AQUILA CT
EAGLERID
STELLER CT
NORTHSHORE RD
Legend:
Water Mains
City Watermains - Active
City Watermains - Under Construction
Private Watermains
Air Release
Blow Off
Water Meters
Water Fittings
Private Hydrant
City Owned Hydrant
Filling Station
Fireline Valve
Hydrant Valve
Bypass Valve
Inline Valve
Tapping Valve
Zone Valve
Water Service Line
Fireline Lateral
Hydrant Lateral
N
Author: jbergner
Date: 10/22/2020
Project: Fire Flow Maps

APPENDIX B

EQUIPMENT

CVCL 1 ② 3 4 DIST CODE 002 SHEET 1 OF 3

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

CATALOG NO. 60-12

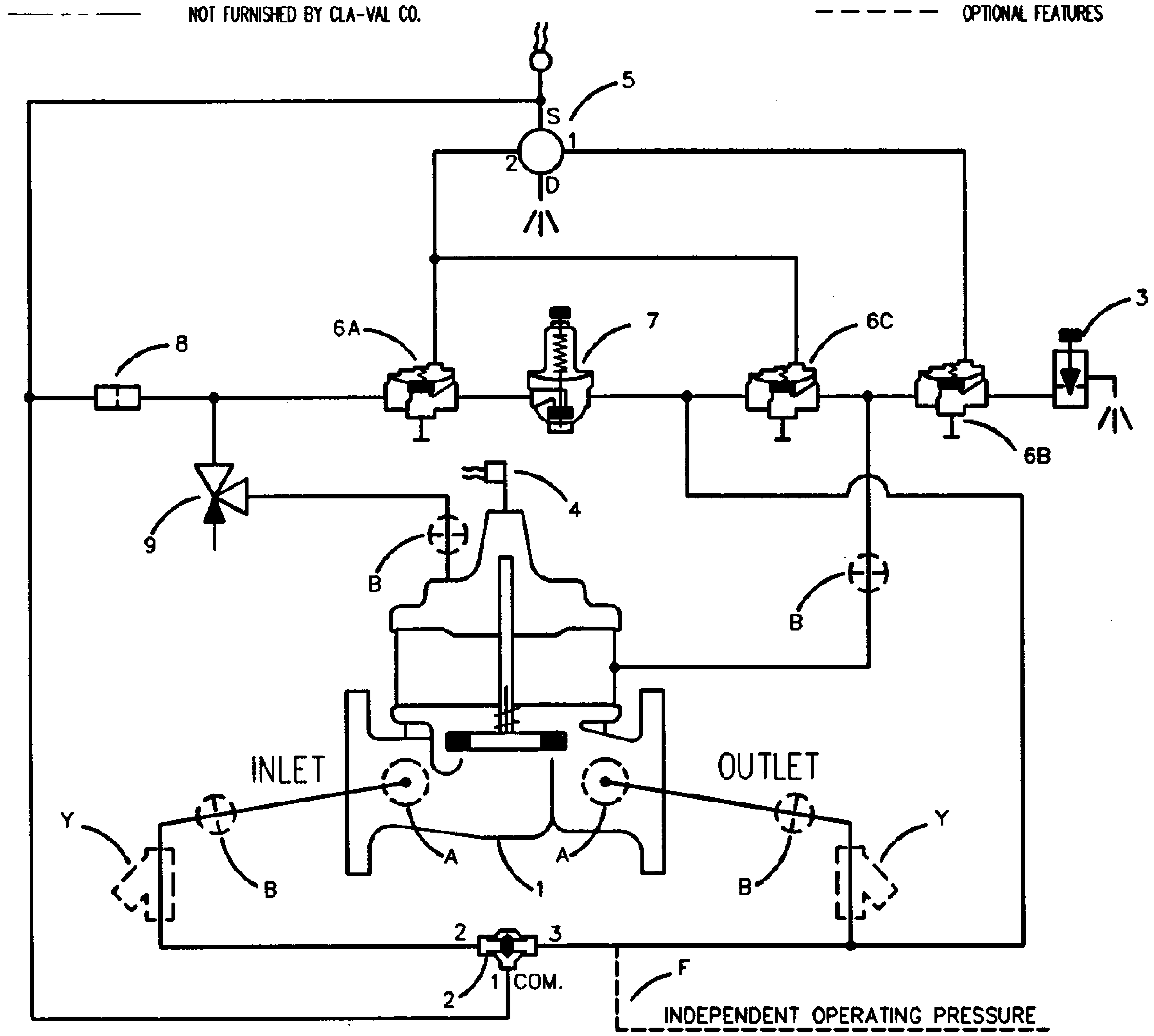
DRAWING NO. 95940 REV D

TYPE OF VALVE AND MAIN FEATURES

COMBINATION PUMP CONTROL AND PRESSURE REDUCING VALVE

DESIGN		
DRAW	MGR	3-4-81
CHK'D	KD	3-6-81
APV'D	CH	3-12-81

———— NOT FURNISHED BY CLA-VAL CO. - - - - - - OPTIONAL FEATURES



ITEM NO.	BASIC COMPONENTS	QTY
1	100-03 POWERCHECK (MAIN VALVE)	1
2	CVS-1 SHUTTLE VALVE	1
3	CNB NEEDLE VALVE (CLOSING)	1
4	X105LCW SWITCH ASSEMBLY	1
5	CSM11-A2-2 SOLENOID CONTROL	1
6	100-01 HYTROL (REVERSE FLOW)	3
7	CRD PRESSURE REDUCING CONTROL	1
8	X58C RESTRICTION ASSEMBLY	1
9	CV FLOW CONTROL (OPENING)	1

OPTIONAL FEATURE SUFFIX ADDED TO CATALOG NUMBER

A	X46A FLOW CLEAN STRAINER	2
B	CK2 COCK (ISOLATION VALVE)	4
F	INDEPENDENT OPERATING PRESSURE	
Y	X43 "Y" STRAINER	2

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
A-C	SEE REVISION FILE		
D	REDRAWN ON CAD AND ADDED CK2 COCK (ECO 17587)	AK	03-12-99

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA	CATALOG NO. 60-12	DRAWING NO. 95940	REV D
TYPE OF VALVE AND MAIN FEATURES: COMBINATION PUMP CONTROL AND PRESSURE REDUCING VALVE	DESIGN		
	DRAW	WEP	5-29-86
	CHK'D	CH	6-16-86
	APV'D	CH	6-16-86

OPERATING DATA

I. PUMP CONTROL FEATURE:

PUMP STARTING:

SOLENOID CONTROL (5) IS ENERGIZED SIMULTANEOUSLY WITH PUMP STARTING. THIS RELIEVES CONTROL PRESSURE FROM VALVE (6A) AND (6C), PERMITTING THEM TO OPEN, AND APPLIES PRESSURE TO AND CLOSES VALVE (6B). THE MAIN VALVE (1) OPENS.

PUMP RUNNING:

WHEN DOWNSTREAM PRESSURE REACHES THE SETTING OF REDUCING CONTROL (7), THE MAIN VALVE STOPS OPENING AND BEGINS TO MODULATE IN RESPONSE TO COMMANDS FROM CONTROL (7). DOWNSTREAM PRESSURE ACTING ON THE DIAPHRAGM OF CONTROL (7) VARIES THE FLOW THROUGH THE CONTROL SYSTEM, AND HENCE, THE MAIN VALVE COVER PRESSURE. THE MAIN VALVE RESPONDS TO SLIGHT DOWNSTREAM PRESSURE CHANGES AND MAINTAINS A CONSTANT DELIVERY PRESSURE WHILE THE PUMP IS RUNNING.

PUMP STOPPING:

WHEN SOLENOID CONTROL (5) IS DE-ENERGIZED, CONTROL PRESSURE IS APPLIED TO AND CLOSES VALVES (6A) AND (6C), AND RELIEVES CONTROL PRESSURE FROM VALVE (6B) PERMITTING IT TO OPEN. MAIN VALVE STARTS CLOSING AT A RATE GOVERNED BY THE SETTING OF CLOSING SPEED CONTROL (3). DURING THIS OPERATION, THE PUMP IS KEPT RUNNING BY A RELAY IN THE ELECTRICAL CIRCUIT, WHICH IS HELD CLOSED BY MICRO SWITCH (4). WHEN THE VALVE IS ALMOST TIGHTLY CLOSED, THIS SWITCH OPENS RELEASING THE RELAY, SHUTTING OFF THE PUMP.

II. OPENING SPEED CONTROL:

FLOW CONTROL (9) CONTROLS THE OPENING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE OPEN SLOWER.

III. CHECK VALVE FEATURE:

THE MAIN VALVE (1) HAS A AN INTEGRAL CHECK FEATURE. WHEN OUTLET PRESSURE EXCEEDS INLET PRESSURE, THE MAIN VALVE CLOSES PREVENTING REVERSE FLOW.

IV. DUAL SUPPLY FEATURE:

WHEN MAIN VALVE (1) INLET PRESSURE EXCEEDS OUTLET PRESSURE, SHUTTLE VALVE (2) SHIFTS INTERCONNECTING PORTS "1" AND "2". WHEN MAIN VALVE (1) OUTLET PRESSURE EXCEEDS INLET PRESSURE, SHUTTLE VALVE (2) SHIFTS INTERCONNECTING PORTS "1" AND "3". THIS DIRECTS THE HIGHEST PRESSURE INTO THE PILOT SYSTEM.

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
	SEE SHEET 1.		

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA	CATALOG NO. 60-12	DRAWING NO. 95940	REV D
TYPE OF VALVE AND MAIN FEATURES: COMBINATION PUMP CONTROL AND PRESSURE REDUCING VALVE		DESIGN	
		DRAW WEP	5-29-86
		CHK'D CH	6-16-86
		APVD CH	6-16-86

OPERATING DATA-CONTINUED

V. OPTIONAL FEATURE OPERATING DATA:

SUFFIX A (FLOW CLEAN STRAINER)
A SELF-CLEANING STRAINER IS INSTALLED IN THE MAIN VALVE INLET AND OUTLET BODY BOSS WHICH PROTECTS THE PILOT SYSTEM FROM FOREIGN PARTICLES.

SUFFIX B (ISOLATION VALVES)
CK2 COCKS (B) ARE USED TO ISOLATE THE PILOT SYSTEM FROM MAIN LINE PRESSURE. THESE VALVES MUST BE OPEN DURING NORMAL OPERATION.

SUFFIX F (INDEPENDENT OPERATING PRESSURE)
PILOT SUPPLY PRESSURE IS OBTAINED FROM AN INDEPENDENT SOURCE. (PILOT SUPPLY PRESSURE IS OBTAINED FROM THE SHUTTLE VALVE (2) IF SUFFIX (F) IS NOT SPECIFIED.) NOTE: INDEPENDENT OPERATING PRESSURE MUST BE EQUAL TO OR GREATER THAN PRESSURE AT PORT 3 OF SHUTTLE VALVE (2).

SUFFIX Y (Y-STRAINER)
A Y-PATTERN STRAINER IS INSTALLED IN THE PILOT SUPPLY LINE TO PROTECT THE PILOT SYSTEM FROM FOREIGN PARTICLES. THE STRAINER SCREEN MUST BE CLEANED PERIODICALLY.

VI. CHECK LIST FOR PROPER OPERATION:

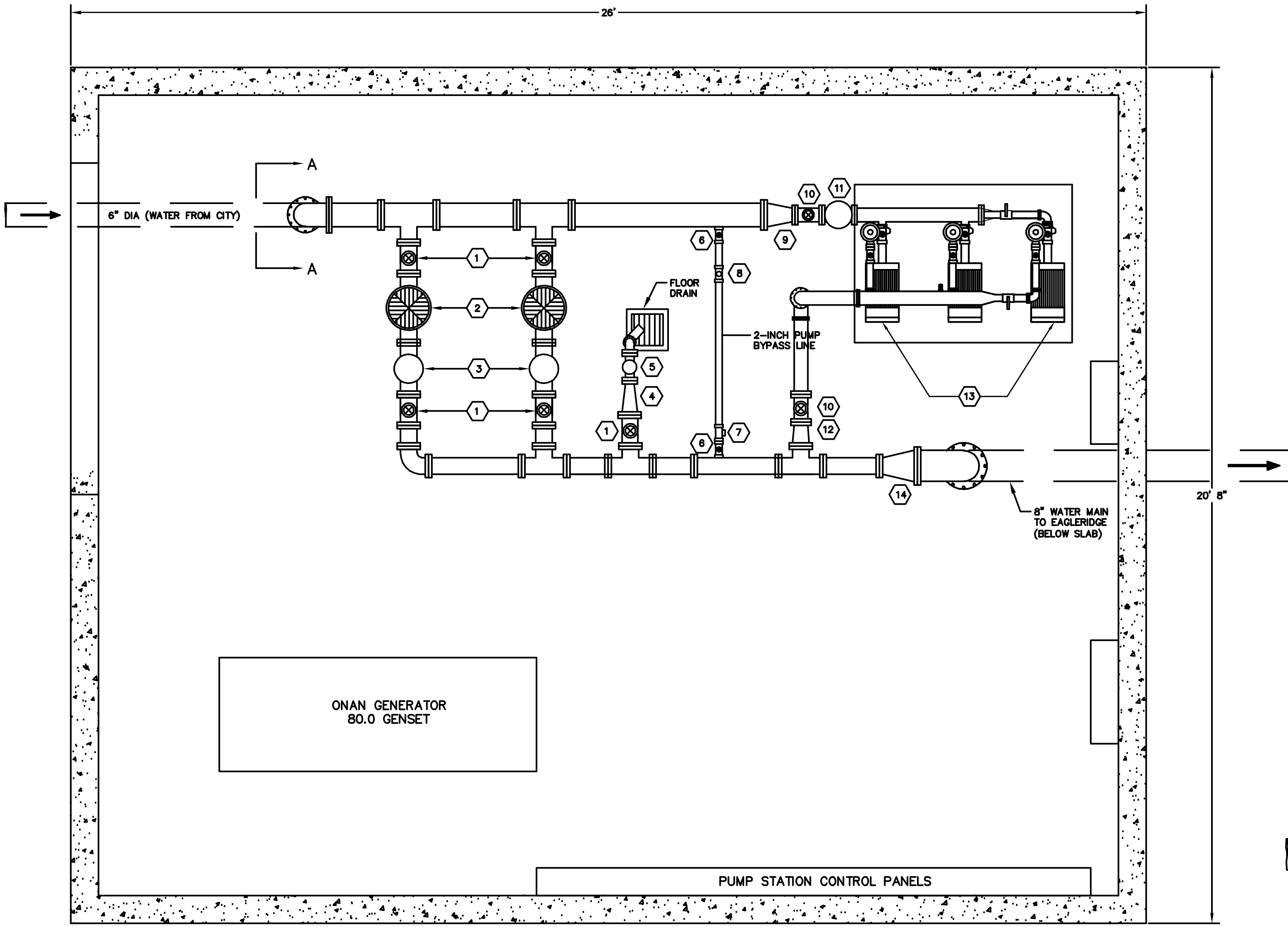
( ) SYSTEM VALVES OPEN UPSTREAM AND DOWNSTREAM.
( ) AIR REMOVED FROM THE MAIN VALVE COVER AND PILOT SYSTEM AT ALL HIGH POINTS.
( ) CK2 COCKS (B) OPEN DURING NORMAL OPERATION (OPTIONAL FEATURE).
( ) PERIODIC CLEANING OF STRAINER (Y) IS RECOMMENDED (OPTIONAL FEATURE).
( ) VALVE (3) OPEN AT LEAST 1/4 TURN.
( ) CORRECT VOLTAGE TO SOLENOID CONTROL (5).

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
	SEE SHEET 1.		

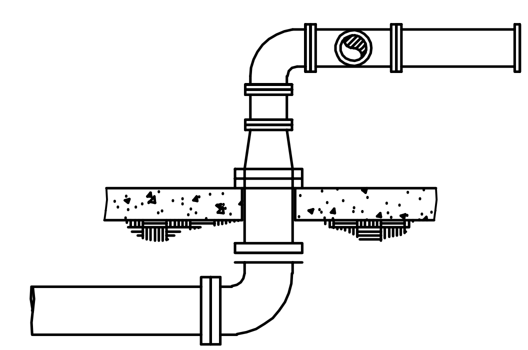
APPENDIX C

Domestic Pump Decommissioning Piping Modifications - Plans



EAGLERIDGE PUMP STATION LAYOUT
(EXISTING)

EXISTING PUMP STATION EQUIPMENT	
1	4-INCH GATE VALVE
2	STANDBY FIRE SUPPRESSION PUMP – PACO MODEL 4070-7 INLINE CENTRIFUGAL PUP, 30 BHP, 3500 RPM
3	PUMP CONTROL VALVE
4	REDUCER, 4-IN X 2-1/2 IN
5	CLA-VAL SURGE ANTICIPATION VALVE
6	2-INCH GATE VALVE
7	2-INCH X 2-INCH X 2-INCH TEE WITH 2-INCH GATE VALVE & SAMPLE TAP
8	2-INCH CHECK VALVE
9	REDUCER – 6-IN X 3-IN
10	3-INCH GATE VALVE
11	PACO FLOW SENSOR (TO BE REMOVED)
12	REDUCER – 4-IN X 3-IN
13	PACOFLO 9000 TRIPLEX BOOSTER SYSTEM, S/N 89A01443. TRIPLEX BOOSTER PUMPS (3 EA); 60 GPM @ 177 FEET TDH (77 PSI), IMPELLER DIA 6.75 INCHES (TO BE REMOVED)
14	REDUCER – 4-IN X 8-IN



SECTION A–A

0 3' 6'

LAKE WHATCOM • WATER & SEWER DISTRICT
lake whatcom

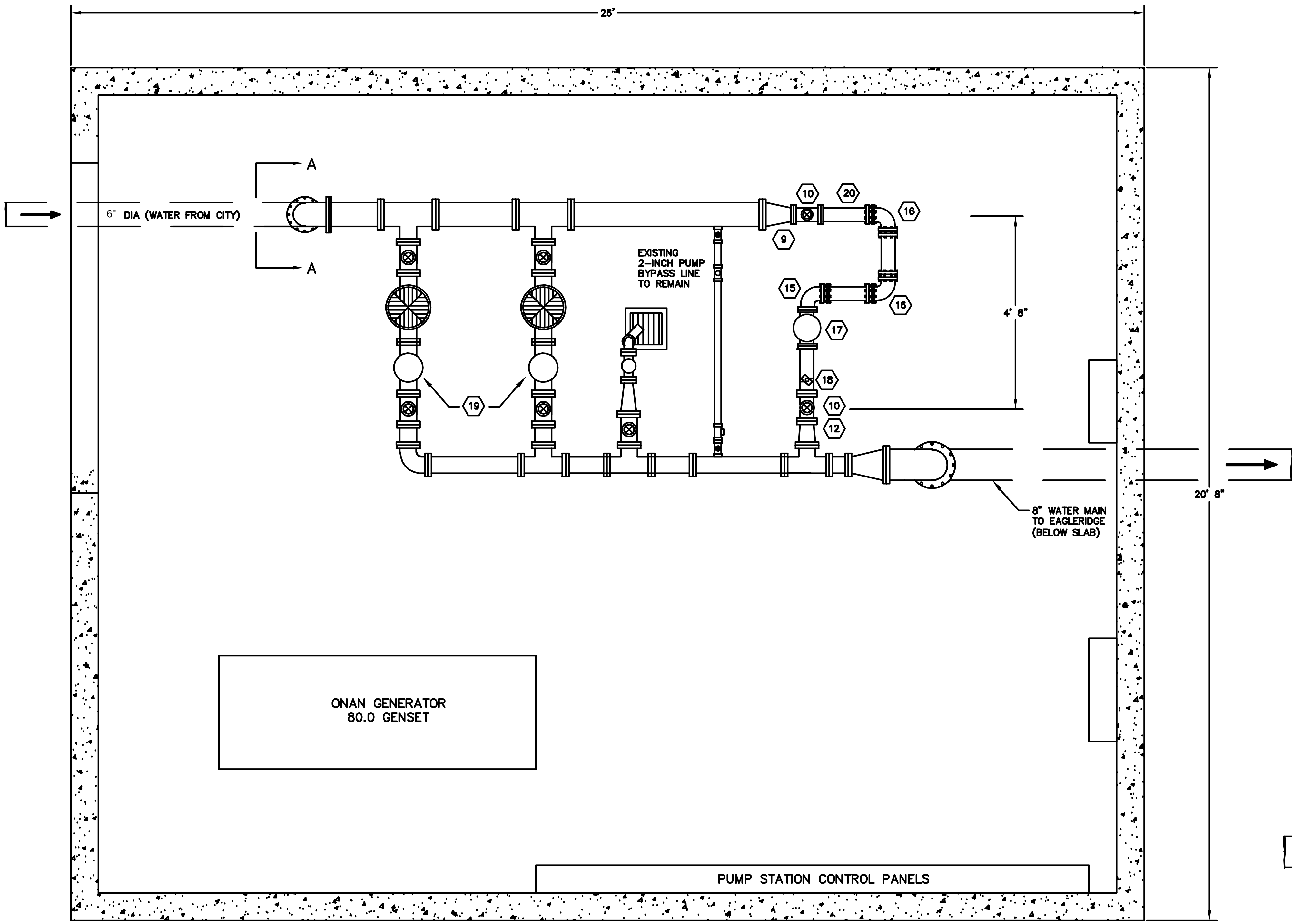
DATE: AUGUST 2021
SCALE: NOTED
DRAWN BY: KH
REVISION: N/A

BRIAN MARRIN SMITH
STATE OF WASHINGTON
54321
REGISTERED PROFESSIONAL ENGINEER
8/11/21

LAKE WHATCOM WATER & SEWER DISTRICT
WHATCOM COUNTY, WA

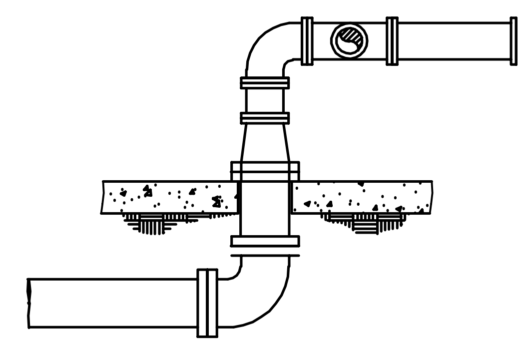
EAGLERIDGE PUMP STATION
EXISTING SITE PLAN

SHEET C-1
1 OF 2



EAGLERIDGE PUMP STATION LAYOUT
(PROPOSED)

PUMP STATION MODIFICATIONS	
9	REDUCER – 6-IN X 3-IN (EXISTING)
10	3-INCH GATE VALVE (EXISTING, NORMALLY OPEN)
12	REDUCER – 4-IN X 3-IN (EXISTING)
15	3-IN DUCTILE IRON PIPE 90-DEGREE BEND, FLXMJ WITH WEDGE RESTRAINT KIT.
16	3-IN DUCTILE IRON PIPE 90-DEGREE BEND, MJXMJ WITH WEDGE RESTRAINT KITS, AND 3-INCH DUCTILE IRON PIPE STUBS FIELD CUT TO FIT.
17	3-IN SWING CHECK VALVE, M&H AWWA C508 RUBBER FACED
18	3-INCH X 12-INCH DUCTILE IRON PIPE SPOOL, WITH ROMAC 101S SERVICE SADDLE W/ 3/4" OUTLET, 3/4"x6" BRASS NIPPLE & 0-100 PSI PRESSURE GAUGE W/ ISOLATION VALVE.
19	ADD PRESSURE REDUCING FUNCTIONALITY TO EXISTING PUMP CONTROL VALVES.
20	3-INCH X 18-INCH DUCTILE IRON PIPE SPOOL, FLXPE, CUT TO FIELD FIT.



SECTION A–A

0 3' 6'

LAKE WHATCOM • WATER & SEWER DISTRICT

DATE: AUGUST 2021
SCALE: NOTED
DRAWN BY: KH
REVISION: N/A

BRIAN MARRIN SMITH
STATE OF WASHINGTON
54321
REGISTERED PROFESSIONAL ENGINEER
8/11/21

LAKE WHATCOM WATER & SEWER DISTRICT
WHATCOM COUNTY, WA

EAGLERIDGE PUMP STATION
PROPOSED SITE PLAN

SHEET C-2
2 OF 2