ADDENDUM NO 2
RFQ City of Port Orchard and McCormick Woods Water System Intertie
2021-2022Ad Ready Design (PS&E)
PW2021-028

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Notice to all interested parties:

The City has made the following changes/modifications to the RFQ: *Attached Port Orchard Consolidation Feasibility Study for additional Data*

Final Project Report

Feasibility Study: Port Orchard & McCormick Woods Water System Consolidation

City of Port Orchard

Port Orchard, Washington
March 31, 2021

Certificate of Engineer

The material and data contained in this report were prepared under the direction and supervision of the undersigned, whose seal as a professional engineer, licensed to practice in the State of Washington, is affixed below.

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1 Project Information

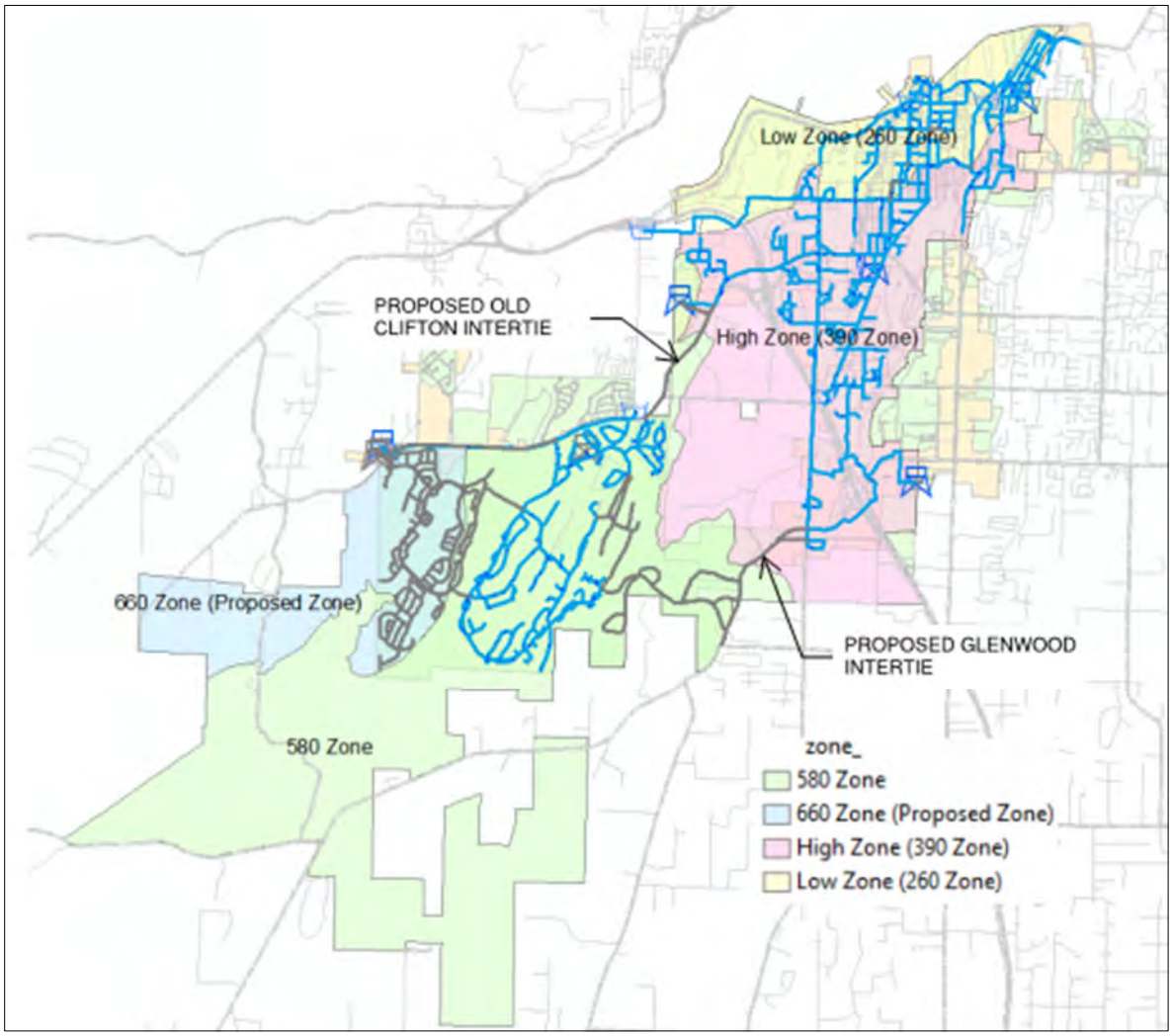
1.1 Background and Purpose

The City of Port Orchard (City) has obtained grant funding from the Washington State Department of Health (DOH) to study the feasibility of consolidating the McCormick Woods water system (McCormick Woods) with the City's water system.

The City purchased the McCormick Woods water system in 1998 and has been operating it as a satellite water system. The McCormick Woods water system comprises the 580 Pressure Zone (580 Zone). Additional development in the McCormick Woods area will also create a 660 Pressure Zone (660 Zone) that is fed from the 580 Zone (see Figure 1-1, which is from the City of Port Orchard 2020 Water System Plan (WSP)).

The purpose of this feasibility study is to evaluate consolidation of the McCormick Woods' water system with the City's water system by connecting the McCormick Woods 580 Pressure Zone to the City's 390 Pressure Zone. Consolidation will improve source redundancy and resiliency for both systems. The City is considering consolidation of these two systems through a pump station allowing flows to be boosted from the 390 Zone to the 580 Zone and with pressure reducing valves (PRVs) allowing flow to enter the 390 Zone from the 580 Zone. The connection will give both water systems an increased ability to withstand and recover from natural and man-made disturbances.

Figure 1-1. City of Port Orchard Water System Overview



1.2 Approach

This study includes the following:

- Assessment of existing infrastructure
- Identification of system connection alternatives
- Analysis of alternatives for functionality
- Estimation of costs for each alternative
- Identification of funding opportunities for the improvements

1.3 Design Standards

This section describes the relevant design standards as listed in the City of Port Orchard Water System Plan (2020).

1.3.1 Pump Station Design

The 580 Pressure Zone is an open system (includes gravity storage). The DOH Water System Design Manual (WSDM) calls for sources to an open system to meet the following criteria:

1. Meet average day demand with the largest source out of service
2. Meet maximum day demand with all sources online
3. Meet maximum day demand while replenishing depleted fire suppression storage within 72 hours with all sources online.

Per the City's WSP, items 1 and 2 are considered with an 18 hour per day capacity (more conservative than the WSDM's recommended 20 hour per day capacity). Item 3 can be considered with 24 hour per day capacity.

Additionally, the City's WSP requires the inlet side of the pump station to have a minimum pressure of 20 psi during peak hour demand (PHD) conditions or maximum day demand (MDD) conditions with fire flow. The distribution system must also maintain a minimum pressure of 30 psi during PHD with operational and equalizing storage depleted, and a minimum pressure of 20 psi during MDD with fire flow and operational, equalizing, and fire suppression storage depleted. Maximum pressures should stay below 100 psi, and when pressures exceed 80 psi individual costumer PRVs should be included at their connection point.

The demands for the proposed pump station were considered using the 2039 demands for the 580 and 660 Zones from the demand forecast in the WSP. (Note that the City's hydraulic model uses 2037 demands; however, for sizing of the pump station, 2039 demands were used). The total average day demand (ADD) for the 580/660 Zones is 736 gpm while the total MDD is 2,798 gpm.

The other sources into the McCormick Woods area includes the following:

- Well 1 (580 Zone)- Assumed to be offline as its water rights will transfer to Well 11 (580 Zone).
- Well 3 (580 Zone)- Assumed to be offline as its water rights will transfer to Well 11 (580 Zone).
- City of Bremerton Intertie (580 Zone) - Assumed to be an emergency supply as part of this study and not a permanent source.
- Well 11 (580 Zone) - Future well with an assumed capacity of 750 gpm.
- Well 12 (580 Zone) - Future well with an assumed capacity of 1,000 gpm.

Section 3.5.7 of the WSP discusses the interconnection between the 580 Zone and the City's system and states, "a booster station would need to be constructed with an initial pump capacity of 650+/- GPM (2 – 650 GPM pumps, with a future capacity of 1,200+/- GPM)".

Assuming a 1,950 gpm capacity pump station (three 650 gpm pumps), Table 1-1 provides a source capacity analysis of the 580 and 660 Zones for the year 2039.

Table 1-1. 580 / 660 Zone source capacity analysis for 2039 demands

Demand / Source	Flow (gpm)
580 / 660 Zone 2039 Projected Demand	
Average Day Demand	736
Maximum Day Demand	2,798
Flow to replenish fire suppression storage in 72 hr	42[1]
Sources	
Reduced Daily Operation (18 hours per day)	
City of Bremerton Intertie	0
Well 1	0
Well 3	0
Well 11	563
Well 12	750
390 to 580 BPS Pump 1	488
390 to 580 BPS Pump 2	488
390 to 580 BPS Pump 3	488
Total Capacity	2,775
Total Capacity with Largest Offline	2,025
24 Hour Daily Operation	
City of Bremerton Intertie	0
Well 1	0
Well 3	0
Well 11	750
Well 12	1,000
390 to 580 BPS Pump 1	650
390 to 580 BPS Pump 2	650
390 to 580 BPS Pump 3	650
Total Capacity	3,700
Total Capacity with Largest Offline	2,700
Source Surplus/(Deficiency) Checks	
Average Day Demand with Largest Pump Offline	1,289
Maximum Day Demand	**(23)**
Fire Storage Replenishment during MDD	861
Source Surplus/(Deficiency) Checks if assuming 20 hour capacity instead of 18 hour capacity	
Average Day Demand with Largest Pump Offline	722
Maximum Day Demand	286
Fire Storage Replenishment during MDD	861

[1]This is based off a 1,875 gpm x 2 hour fire flow.

Table 1-1 shows that when assuming an 18 hour per day pumping capacity, there is a slight deficiency of 23 gpm. If assuming 20 hour per day capacity (WSDM recommendation), the deficiency is resolved.

For this study, the full buildout pump station capacity was assumed to be 1,950 GPM (which includes three 650 GPM pumps), similar to the WSP. This allows sources into the 580 / 660 Zones to provide the 2,039 MDD with the largest source out of service and without the need for supply from the Bremerton intertie.

The McCormick Woods 580 Zone is currently served by a single 0.45 MG tank. A new 0.97 MG tank is proposed to be constructed in the 580 Zone to replace the existing tank. Once the new tank is online, the City of Bremerton will take ownership of the existing 580 Zone tank and it will be separated from the McCormick Woods 580 Zone system.

A McCormick Woods 660 Zone tank is proposed to be constructed and connected to the 660 Zone via a proposed 580 to 660 Zone pump station.

1.3.2 Pipeline Velocity

Per the WSP, maximum velocity in distribution pipelines shall not exceed 8 feet per second (fps) under PHD conditions and 10 fps during fire flow conditions.

2 Alternatives

Assessment of the existing infrastructure revealed two alternatives for connecting the two systems. Both alternatives require installation of a pump station and new distribution system piping.

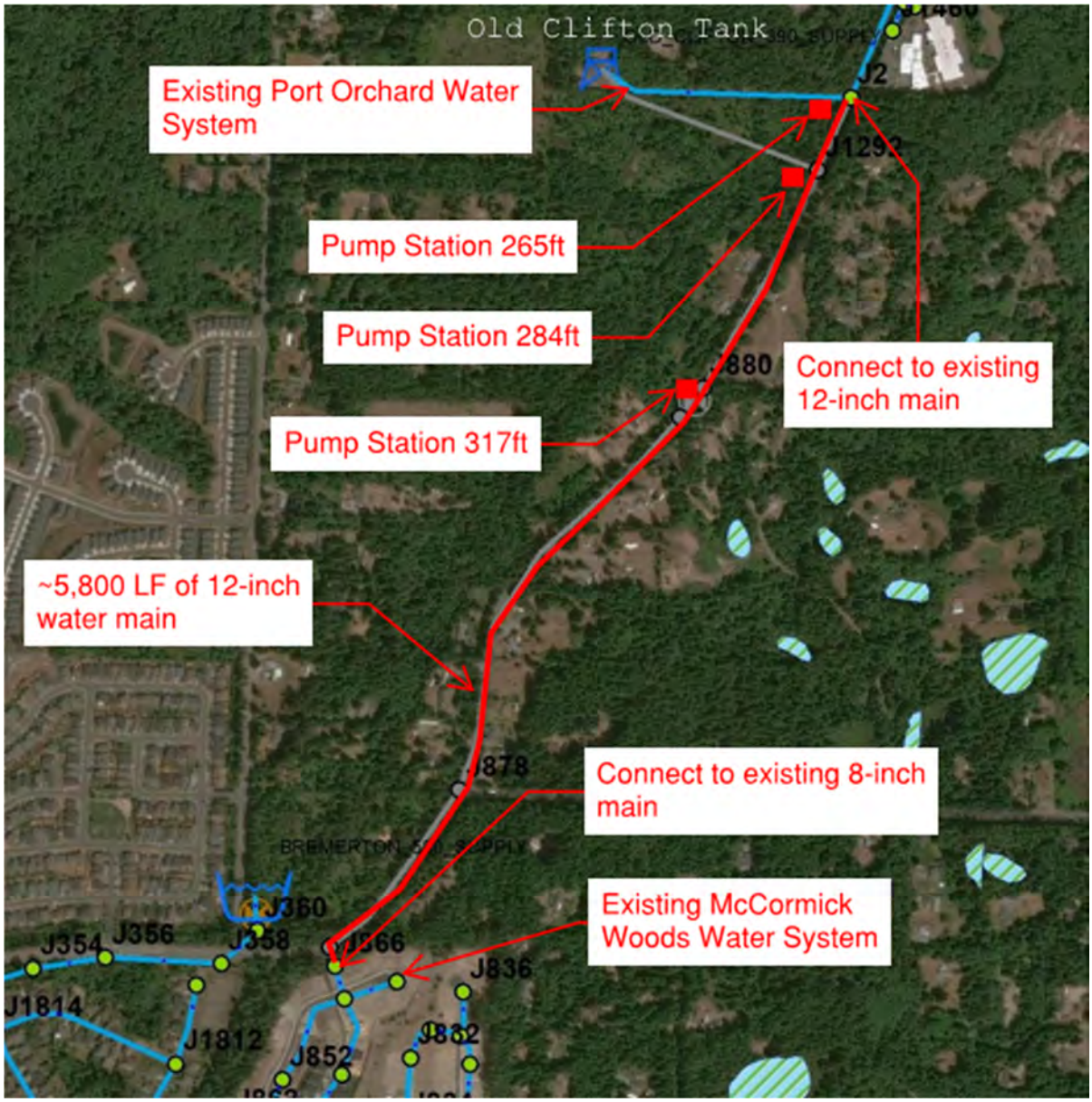
Two alternatives have been selected to be analyzed as part of this study:

- Alternative 1 - The first alternative is the northern route along SW Old Clifton Road.
- Alternative 2 - The second alternative is the southern route in the Glenwood Road SW area.

2.1 Alternative 1 - Old Clifton

The Old Clifton alternative connects the two systems by installing a new 12-inch diameter distribution main along SW Old Clifton Road from Old Clifton Tank road to an existing water main in the Eldon Trails community. This alternative requires installation of approximately 5,800 LF of piping and a 1,950 GPM pump station. To evaluate the impacts of elevation on the suction pressure, three pump station locations were evaluated corresponding to the elevation contours of 317 feet, 284 feet and 265 feet (see Figure 2-1).

Figure 2-1. Alternative 1 - Old Clifton



2.2 Alternative 2 - Glenwood

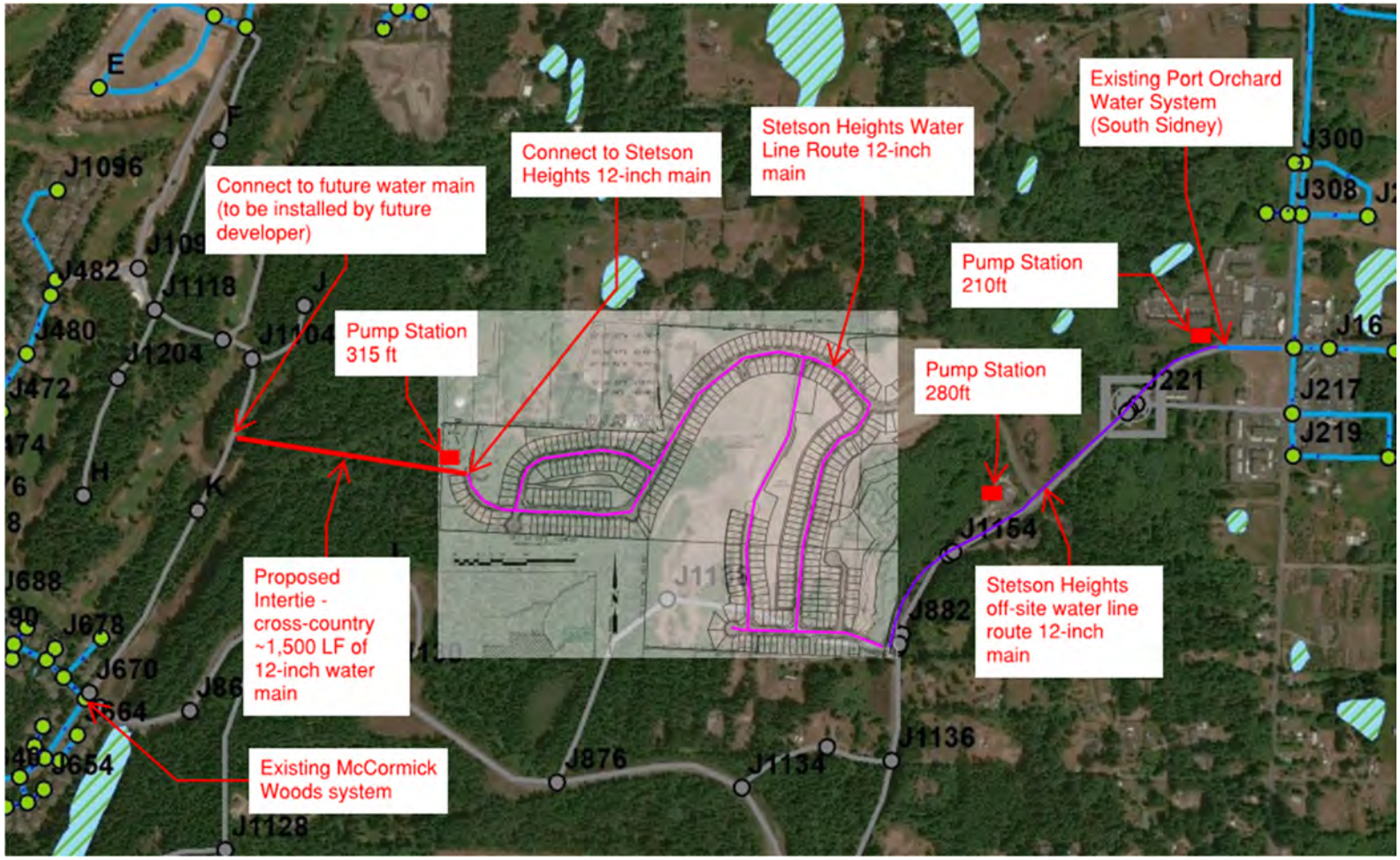
The Glenwood alternative provides a connection between the two systems by installing a new 12-inch diameter distribution main in an area that is currently undeveloped and outside of the City's right-of-way, between water mains currently being installed by the Stetson Heights developer and a future water main anticipated to be installed to the west of Stetson Heights by a future developer (northeast of the intersection of SW Dunraven Ln and McCormick Woods Dr SW). This alternative requires installation of approximately 11,700 LF of piping, approximately 10,000 LF of which is anticipated to be installed by a developer, and a 1,950 GPM pump station. To evaluate the impacts of elevation on the suction pressure, two pump station locations were evaluated corresponding to the elevation contours of 280 feet and 210 feet (see Figure 2-2).

The Stetson Heights developer is providing a 12-inch diameter distribution main from the existing end of the Port Orchard water system at South Sidney along SW Sedgewick Road/Glenwood Road SW to the entrance to the Stetson Heights development. The developer also proposes to install 12-inch diameter water mains within the Stetson Heights development, which extends the Port Orchard water system approximately 4,800 feet west of South Sidney.

This route also relies on installation of a new water main from the existing McCormick Woods system at the intersection of SW Dunraven Ln and McCormick Woods Dr SW approximately 2,000 LF to the northeast.

As discussed later in Section 4.3.3, to avoid high pressures in the Stetson Heights development, a secondary pump station scenario was evaluated (Pump Station 315 ft).

Figure 2-2. Alternative 2 - Glenwood



3 Modeling Scenarios

For completing the hydraulic analysis for this study, the City's InfoWater hydraulic model of the distribution system, developed by BHC Consultants, LLC for the WSP, was used which included demands for years 2017, 2027, and 2037. The 2027 facilities, tank set, reservoir set, valve set, pipe set and control set were used, as these items had not been developed for the 2037 scenario. Two minor modifications were made to the model, including opening a pipe near Lowes and closing a pipe that created an uncontrolled connection between the 390 Zone and 260 Sone. No additional validation or checks of the model were completed except for adding infrastructure and demands specific to this study.

The two alternative routes were added to the hydraulic model to determine required pump and distribution main sizing and to evaluate the impacts of the interconnection on the supply zone (Port Orchard 390 Zone) and the discharge zone (McCormick Woods 580 Zone).

For the Glenwood alternative two pump station scenario, demands were added to the model for the area of the Stetson Heights development, including 412 ERUs, 195 GPD/ERU, MDD/ADD ratio of 3.8 and PHD/MDD ratio of 1.65. This information was provided by BHC Consultants, LLC.

For each of the alternatives, the scenarios in Table 3-1 were used for the evaluation.

Table 3-1. Hydraulic modeling scenarios

Scenario	Assumptions				Supply Zone		Discharge Zone	
	Pump Station Capacity	Demand Year	Discharge Zone Well Status	Supply Zone Well Status	Demand Condition	Pressure Requirement	Demand Condition	Pressure Requirement
Baseline								
Baseline	N/A	2017	ON: Bremerton intertie Off: Well 11	ON: Wells 6, 7, 8, 9 Off: Well 13 (future)	PHD	30 PSI	PHD	30 PSI
					MDD+FF	20 PSI	MDD	20 PSI
	N/A	2037	ON: Wells 11, 12 OFF: Bremerton intertie	ON: Wells 6, 7, 8, 9, Off: Well 13 (future)	MDD+FF	20 PSI	MDD	20 PSI
					PHD	30 PSI	PHD	30 PSI
Alternative 1 - Old Clifton								
A	1,950 GPM	2037	ON: Wells 11, 12 OFF: Bremerton intertie	ON: Wells 6, 7, 8, 9, Off: Well 13 (future)	PHD	30 PSI	PHD	30 PSI
B					MDD + FF	20 PSI	MDD	30 PSI
C					MDD	30 PSI	MDD + FF	20 PSI
Alternative 2- Glenwood								
A	1,950 GPM	2037	ON: Wells 11, 12 OFF: Bremerton intertie	ON: Wells 6, 7, 8, 9, Off: Well 13 (future)	PHD	30 PSI	PDH	30 PSI
B					MDD + FF	20 PSI	MDD	30 PSI
C					MDD	30 PSI	MDD + FF	20 PSI

Assumptions:

Well 11 Capacity is 750 GPM

Well 12 capacity is 1,000 GPM

New Zone 580 Tank is online and supplying fire flow storage.

4 Analysis Results

This section summarizes the results of the hydraulic analysis, including baseline results and the results for the Old Clifton alternative and the Glenwood alternative.

4.1 Baseline Results

Baseline condition refers to the existing condition of the distribution system without the addition of a new pump station and connection between the 390 and 580 Zones, for 2017 PHD, 2017 MDD, 2037 MDD, and 2037 PHD. It also describes the baseline low-pressure and high-pressure areas in the 390 and 580 Zones that exist without the addition of new pump stations.

Baseline scenarios are described in Table 3-1.

4.1.1 Baseline Results in Old Clifton Area

The Old Clifton alternative includes a pump station located along SW Old Clifton Road between the Old Clifton Tank (390 Zone) and McCormick Woods (580 Zone). Table 4-1 establishes the baseline pressure in the 390 Zone distribution system along SW Old Clifton Rd adjacent to the Old Clifton Tank (west of intersection with Highway 16). Figure 4-1 displays this area. These baseline pressures will be referred to in the results analysis section when evaluating the impacts of the new pump station on the existing distribution system pressures.

Figure 4-1. Baseline areas

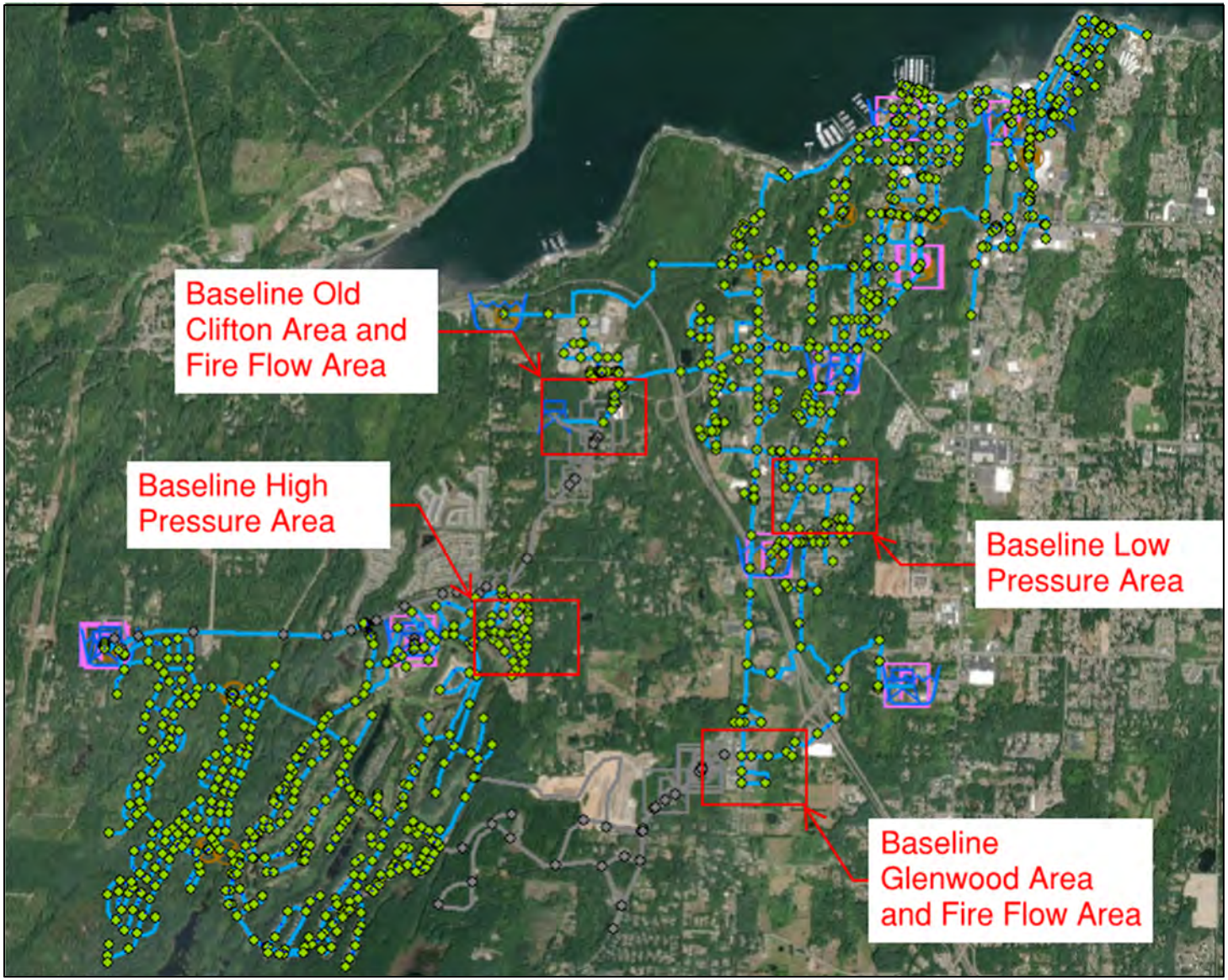


Table 4-1. Baseline at Old Clifton Tank area

Scenario	Pressure
2017 PHD	>52 psi
2017 MDD+FF	>46 psi
2037 PHD	>51 psi
2037 MDD+FF	>49 psi

4.1.2 Baseline Results in Glenwood Area

Alternative 2 includes a pump station on SW Sedgewick Road/Glenwood Road SW between the intersection of SW Sedgewick Road/Sidney Rd SW (390 Zone) and McCormick Woods (580 Zone). Table 4-2 establishes the baseline pressures in the 390 Zone at the intersection of SW Sedgewick Road/Sidney Rd SW. Figure 4-1 displays this area. These baseline pressures will be referred to in the results analysis section when evaluating the impacts of the new pump station on the existing distribution system pressures.

Table 4-2. Baseline at Glenwood area

Scenario	Pressure
2017 PHD	>73 psi
2017 MDD+FF	>59 psi
2037 PHD	>74 psi
2037 MDD+FF	>71 psi

Note: Glenwood Area refers to intersection of SW Sedgewick RD and SW Sidney Rd.

4.1.3 Baseline Low Pressure Areas in 390 Zone

At baseline conditions, there are areas of the 390 Zone that are modeled to already experience low pressures. Per the City's WSP Section 3.5.11, "Pressures below 40 psi existing at the following locations…In the 390 zone in the area along Sidney Ave. between Lippert Dr W and Alpha Ln. where elevations are above 300-feet. The model predicts static pressures in this area to be between 20-30 psi, with the Melcher pump station off. However, staff reported that no pressure complaints have been received from the area." It is important to note that these conditions are anticipated to occur in the system with or without the addition of the new pump station.

At baseline conditions, the model indicates pressures along Sidney Avenue from Well 9/Park Reservoir to Well 8 are lower than 30 psi, with pressures being below 20 psi at 1800 Sidney Avenue (Atlas Apartments). Figure 4-2 displays this area with 2037 PHD pressures, and Table 4-3 displays the pressures for multiple scenarios.

Figure 4-2. Baseline pressure at Atlas Apartments during 2037 PHD

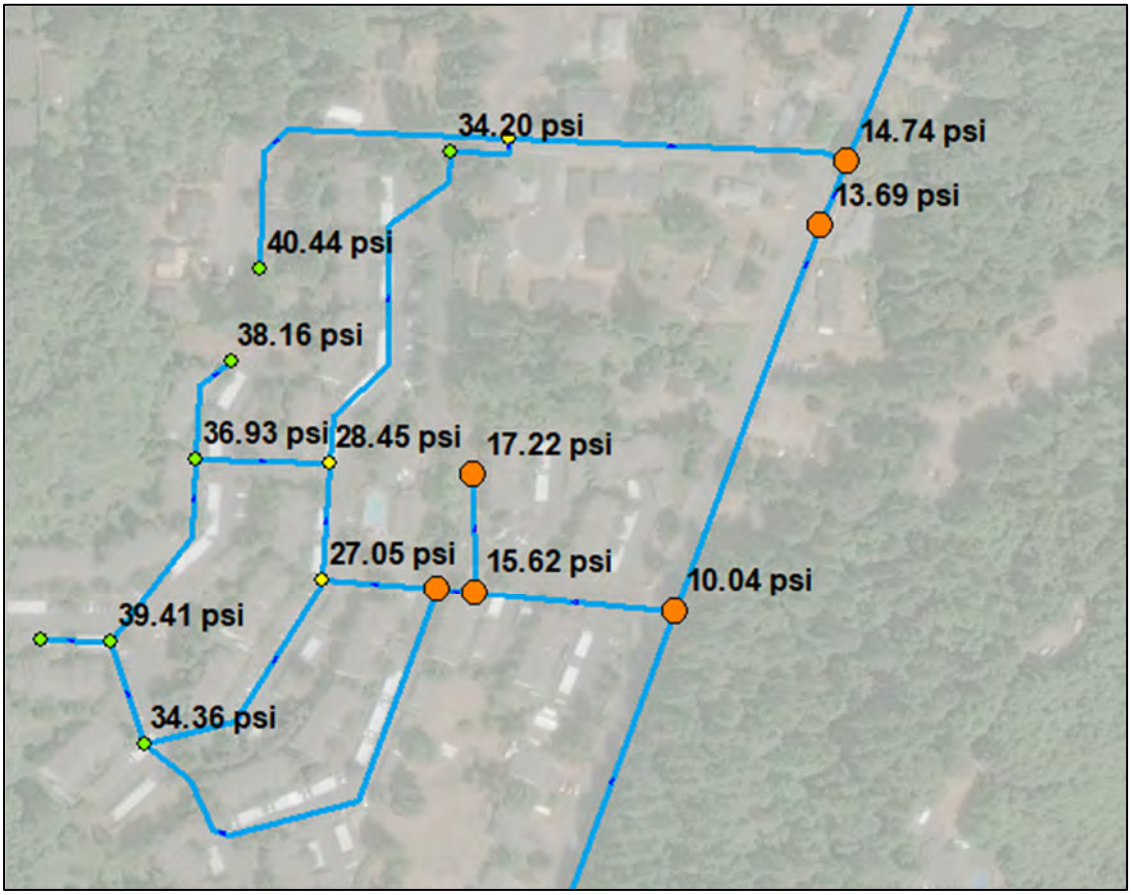


Table 4-3. Baseline at low pressure area

Scenario	Pressure
2017 PHD	>23 psi
2017 MDD+FF	>17 psi
2037 PHD	>10 psi
2037 MDD+FF	>23 psi

Note: Low Pressure Area refers to Atlas Apartments Area.

The model results also indicate low pressures in the following areas:

- Along Sherman Avenue south of intersection with W Melcher Street, and
- Near future Well 13.

On March 19, 2021, City staff took pressure readings in this area of the distribution system, to investigate this low pressure situation. The lowest pressure recorded in this area was 44 psi (at a hydrant). This indicates that the model may be representing lower pressures than actually exist in this small area. While outside the scope of this effort, the City may choose to further investigate and refine this area of the hydraulic model.

4.1.4 Baseline High Pressure Areas in 580 Zone

At baseline conditions, there are low elevation areas of the 580 Zone distribution system that experience high pressures. It is important to note that these conditions are anticipated to occur in the system with or without the addition of the new pump station.

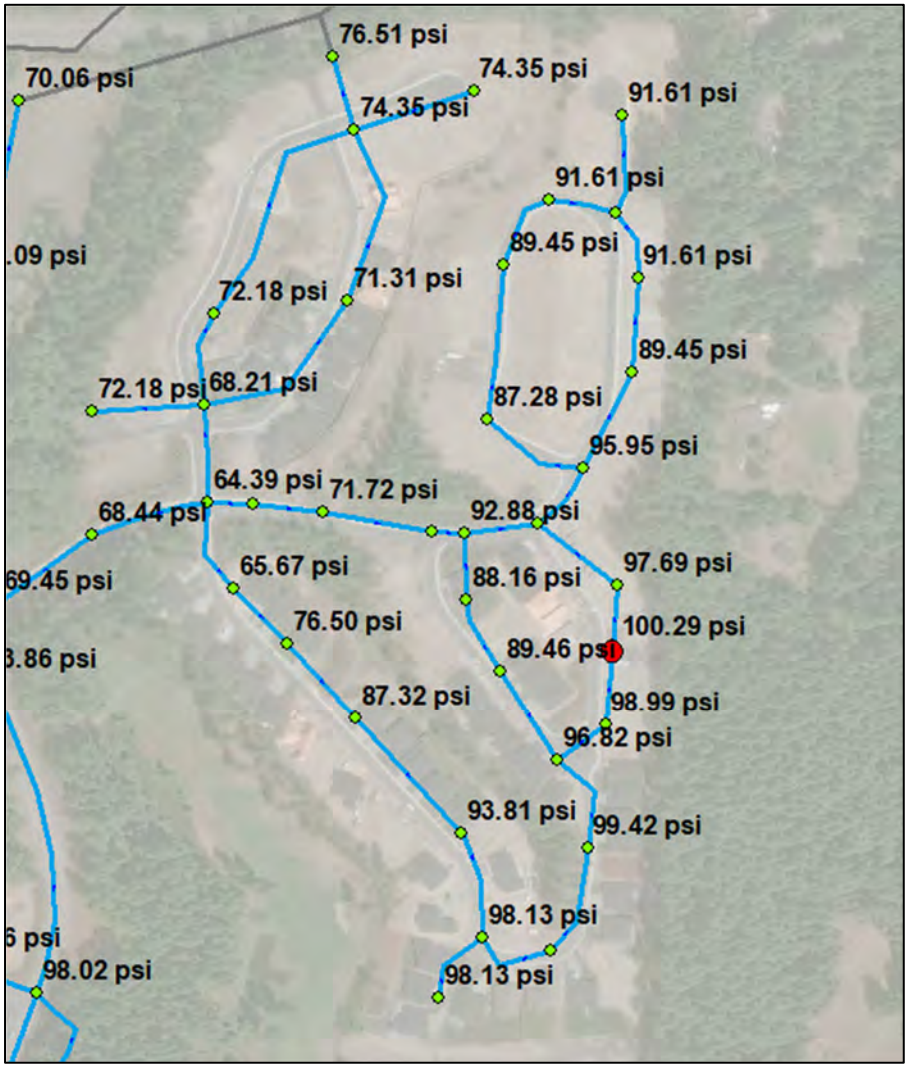
Pressures in the Eldon Trails community (Viridian Ave SW) approach or exceed 100 psi. Per the City's WSP Section 3.1.5, "when pressures exceed 80 psi, the customer should provide and maintain individual PRVs." It is anticipated that even without the addition of the new pump station, that PRVs will be needed in this area to maintain pressure below 80 psi. Figure 4-3 displays this area with 2037 PHD pressures, and Table 4-4 displays the pressures for multiple scenarios.

Table 4-4. Baseline at high pressure area

Scenario	Pressure
2017 PHD	103 psi
2017 MDD+FF	96 psi
2037 PHD	100 psi
2037 MDD+FF	103 psi

Note: High pressure area refers to Eldon Trails community.

Figure 4-3. Baseline pressure in Eldon Trails Community during 2037 PHD



4.2 Old Clifton Alternative Results

This section discusses the results for the Old Clifton alternative route.

Analysis of the pipelines at 1,950 GPM indicated a 12-inch pipe would experience 10 psi combined headloss on the suction and discharge distribution main, with 2 ft headloss per 1,000 ft on the discharge and 8 ft headloss per 1,000 ft on the suction. A 16-inch pipe would experience 3 psi headloss. A 12-inch pipe was selected for the analysis.

The velocity in the 12-inch water main at 1,950 GPM is approximately 6 fps, which is less than the maximum allowed 8 fps.

The pump station was evaluated at three elevation contours: 317 feet, 284 feet and 265 feet.

4.2.1 Pump Station at Elevation 317 Feet

The pump station was initially evaluated at 1,950 GPM for an elevation contour of 317 feet at 2037 PHD. See Figure 2-1 for location of this pump station. The results indicate

10 psi on the suction side of the pump station and 136 psi on the discharge side. At this flow rate, a lower elevation pump station would be required to meet City design standards.

Additional analysis was performed at 1,300 GPM. At 2037 PHD, the suction pressure is 16 psi. At this flow rate, a lower elevation pump station would be required to meet City design standards.

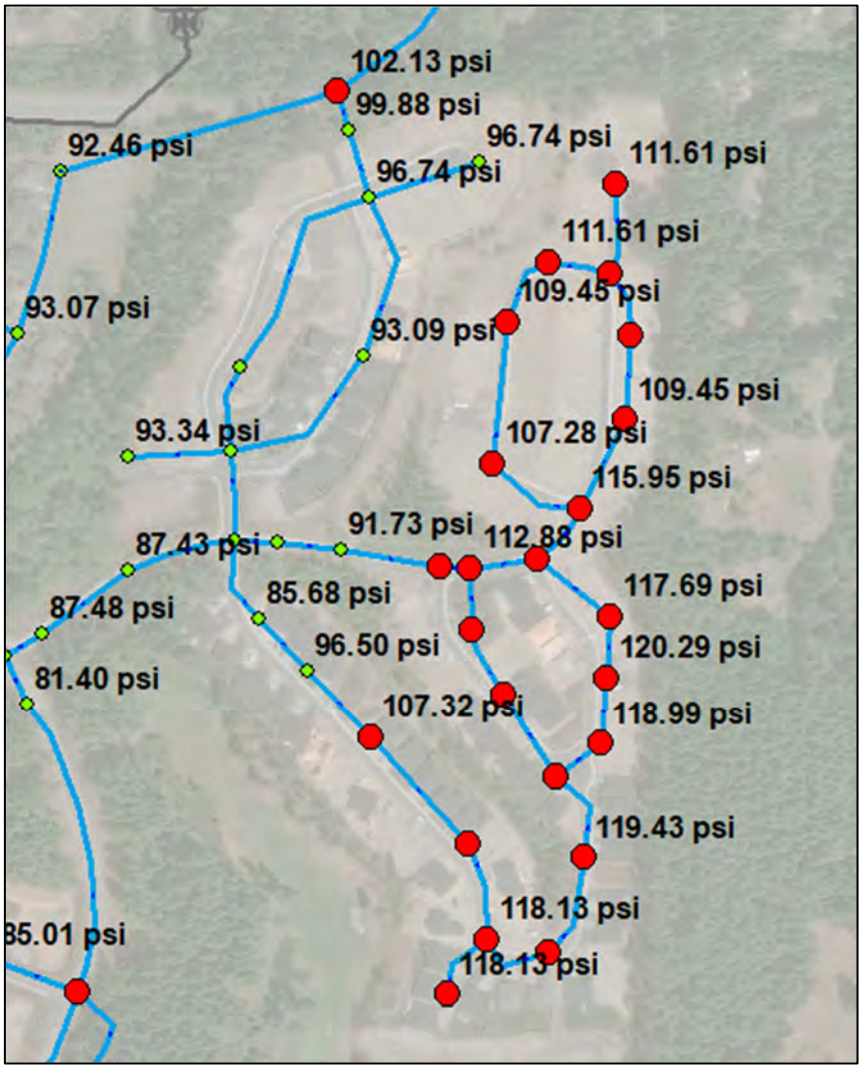
Additional analysis was performed at 650 GPM. At 650 GPM, the suction pressure is 21 psi and the discharge pressures is 109 psi. At 2037 MDD, with a fire flow of 1,000 GPM in the 390 Zone to the east of Old Clifton Tank, suction pressure at the pump station drops to 16 psi. At this flow rate, a lower elevation pump station would be required to meet City design standards.

4.2.2 Pump Station at Elevation 284 Feet

A pump station at an elevation contour of 284 feet (east of intersection with SW Chawla Ct, see Figure 2-1 for location) at 1,950 GPM at 2037 PHD results in approximately 27 psi on the suction side and 155 psi on the discharge size of the pump station.

Services between the discharge side of the pump station and the existing McCormick Woods system would require pressure reducing valves. Other than the high-pressure area in the Eldon Trails community (Figure 4-4), pressures within the 580 Zone are generally less than 100 psi.

Figure 4-4. 1,950 GPM Pump Station at 284 Ft, 2037 PHD High Pressure in Eldon Trails Community



At 2037 MDD, with a fire flow of 1,000 GPM in the 390 Zone to the east of Old Clifton Tank, suction pressure at the pump station drops to 22 psi. The pressures in the area of the 390 Zone adjacent to the fire flow are greater than 33 psi, which is a reduction of approximately 17 psi from baseline pressures.

In general, the addition of a fire flow at 2037 MDD in the McCormick Woods system results in insignificant impacts to pressure in the 580 Zone.

The results indicate that the pump station could be installed in this location, but that the new main connecting the existing Port Orchard system to the new pump station would need to be classified as a transmission main and would not be able to serve residential customers along SW Old Clifton Road. To serve these areas, a parallel distribution main would need to be installed from the discharge side of the pump station approximately 500 LF east along SW Old Clifton Road. This distribution main would require a pressure reducing valve to maintain pressures below 100 psi.

4.2.3 Pump Station at Elevation 265 Feet

A pump station at an elevation contour of 265 feet (just west of the intersection of the existing Old Clifton Tank main and SW Old Clifton Rd, see Figure 2-1 for location) at a flow rate of 1,950 GPM at 2037 PHD provides approximately 37 psi on the suction side and 165 psi on the discharge side of the pump station. Services off the discharge side of the pump station distribution main would require pressure reducing valves. Other than the high-pressure area previously described in the Eldon Trails community, pressures within the 580 Zone are less than 100 psi.

At 2037 MDD, with a fire flow of 1,000 GPM in the 390 Zone to the east of Old Clifton Tank, suction pressure at the pump station drops to 32 psi. The pressures in area of the 390 Zone adjacent to the fire flow are similar to the results of the pump station at an elevation contour 284 feet and are greater than 30 psi.

In general, the addition of a fire flow at 2037 MDD in McCormick Woods results in insignificant impacts to pressure in the 580 Zone.

This scenario meets the City's design standards for pump stations.

4.2.4 Low Pressure Areas in 390 Zone

The pressures in the baseline low pressure area identified in Section 4.1.3 decrease by approximately 5 psi at PHD and 15 psi at MDD+FF. At current model conditions, this decreases the pressures in this area to approximately 5 psi. Pressures in this area would need to be increased to a baseline of 45 psi such that the pressure drop from the pump station does not drop these areas below 30 psi.

Field information obtained by the City per Section 4.1.3 indicates that pressures in this area may be higher than pressures determined by the model. The City may choose to further investigate and refine the model results in this area to evaluate if these impacts are anticipated to be realized in the system.

4.2.5 High Pressure Areas in 580 Zone

The pressures in the baseline high pressure areas identified in Section 4.1.4 increase by approximately 20 psi. At current conditions, this increases the pressures in this area to 120 psi. As stated in the City's Water System Plan (2020), this area requires PRVs in any condition. As such, these high pressures are not a limiting factor on the design of the pump station.

4.3 Glenwood Alternative Results

This section discusses the results for the Glenwood alternative route.

Analysis of the pipeline at 1,950 GPM indicated a 12-inch pipe would experience 33 psi combined headloss on the suction and discharge distribution main, with 10 ft headloss per 1,000 ft on the mains on both the discharge and suction sides of the pump station. A 16-inch pipe would experience 10 psi combined headloss on the suction and discharge distribution main, with 3 ft headloss per 1,000 ft on the mains on both the discharge and suction sides of the pump station. A 12-inch pipe was selected for the analysis.

The velocity in the 12-inch water main is approximately 6 fps, which is less than the City's maximum allowed velocity of 8 fps.

The pump station was evaluated at two elevation contour locations: 280 feet and 210 feet.

An additional scenario evaluated the use of two pump stations in series.

4.3.1 Pump Station at Elevation 280 Feet

The pump station was initially evaluated at an elevation contour of 280 feet, with a pump flow rate of 1,950 GPM at 2037 PHD. See Figure 2-2 for location. The results indicate complete pressure loss on the suction side of the pump station. At this flow rate, a lower elevation pump station would be required to meet the City's design standards.

Additional analysis was performed at 1,300 GPM. At 1,300 GPM at 2037 PHD, the suction pressure is 10 psi. At this flow rate, a lower elevation pump station would be required to meet the City's design standards.

Additional analysis was performed at 650 GPM. At 650 GPM, the suction pressure is 22 psi and the discharge pressures is 127 psi. At 2037 MDD, with a fire flow of 1,000 GPM in the 390 Zone at the intersection of SW Sedgewick Rd and Sidney Road SW, suction pressure at the pump station drops to 12 psi. The pressures in the area of the 390 Zone adjacent to the fire flow remain above 50 psi with a decrease of approximately 20 psi from baseline conditions. A suction pressure of 12 psi is below the City's design standards; however, this option could be considered if the new main connecting the existing Port Orchard system to the new pump station were classified as a transmission main and would not be able to be used to serve residential customers along SW Sedgewick Rd. There currently does not appear to be residences in this area; however, to serve these areas in the future, a parallel distribution main would need to be installed from the discharge side of the pump station approximately 2,000 LF east along SW Sedgewick Road. This distribution main would require a pressure reducing valve to maintain pressures below 100 psi.

The pressures in the Stetson Heights development area would exceed allowable pressures, resulting in the need for PRVs at each residence.

In addition, by 2039, another pump station would need to be installed at the Old Clifton location to meet MDD, due to the constrained pumping capacity of the Glenwood pump station if built at this location.

In general, fire flow in the McCormick Woods system results in insignificant impacts to pressure in the 580 Zone.

To improve the suction pressure, the Glenwood pump station could be located at the lower elevation (see next section).

4.3.2 Pump Station at Elevation 210 Feet

A pump station at an elevation contour of 210 feet (east of intersection with SW Hepburn Way, see Figure 2-2 for location) at a flow rate of 1,950 GPM at 2037 PHD, provides approximately 23 psi on the suction side and 203 psi on the discharge size of the pump station.

At 2037 MDD, with a fire flow of 1,000 GPM in the 390 Zone at the intersection of SW Sedgewick Rd and Sidney Road SW, suction pressure at the pump station drops to 12 psi. The pressures in the area of the 390 Zone adjacent to the fire flow drop to 21 psi with a decrease of approximately 30 psi from baseline conditions.

In general, fire flow in McCormick Woods results in insignificant impacts to pressure in the 580 Zone.

Additional analysis was performed at 1,300 GPM at this elevation. At 1,300 GPM and 2037 PHD, the pump station suction pressure is 27 psi and the discharge pressure is 196 psi.

At 2037 MDD, with a fire flow of 1,000 GPM in the 390 at the intersection of SW Sedgewick Rd and Sidney Road SW, suction pressure at the pump station is 30 psi. The pressures in area of the 390 Zone adjacent to the fire flow is 37 psi with a pressure decrease of approximately 13 psi from baseline.

The pressures in the Stetson Heights development area would exceed allowable pressures, resulting in the need for PRVs at each residence.

At an elevation contour of 210 feet, the maximum flow rate that meets the City's design standards is 1,300 GPM.

4.3.3 Two Pump Stations in Series

As described above, with a single pump station, the pressures in the area of the Stetson Heights development were higher than 100 psi and would likely require individual PRVs for each residence. To address the high pressures in this area, two pump stations could be installed in series to create a middle pressure zone (essentially in Stetson Heights) between the 390 Zone and the 580 Zone.

The scenario evaluated the following pump stations:

- Pump Station 1 (PS1): 1,300 GPM at an elevation of 210 feet, located as described above in Section 4.3.2.
- Pump Station 2 (PS2): 1,300 GPM at an elevation of 315 feet, located immediately west of the Stetson Heights development (see Figure 2-2).

The model results indicate it is possible to create a middle pressure zone, with PS1 discharge pressures of 127 psi, pressures in the Stetson Heights development ranging between 40 psi and 105 psi, and the suction pressure of PS2 approximately 20 psi higher than the lowest pressure in the middle zone.

It may be possible to design PS1 with a small jockey pump and a pressurized bladder tank sized to minimize the number of pump starts during low flow conditions. Alternatively, a small ground level tank could be constructed to serve as a hydraulic break. PS1 would pump into this tank, which then would establish the hydraulic grade of the new middle pressure zone, with PS2 pumping out of it. If this approach were taken, said tank would likely be best located in the northwest portion of the Stetson Heights area, based on elevations.

This scenario is required to meet the City's design standards.

4.3.4 Low Pressure Areas in 390 Zone

At 1,300 GPM (the largest flow rate that meets the City's design standards for a pump station in this area), the pressures in the baseline low pressure area in the 390 Zone identified in Section 4.1.3 decrease by approximately 12 psi at PHD and approximately 25 psi at MDD+FF. At current model conditions, this decreases the pressures in this area to approximately 0 psi. Pressures in this area would need to be increased to a baseline of 55 psi such that the pressure drop from the pump station does not drop these areas below 30 psi.

Field information obtained by the City per Section 4.1.3 indicates that pressures in this area may be higher than pressures determined by the model. The City may choose to further investigate and refine the model results in this area to evaluate if these impacts are anticipated to be realized in the system.

4.3.5 High Pressure Areas in 580 Zone

At 1,300 GPM (the largest flow rate that meets the City's design standards for a pump station in this area), the pressures in the baseline high pressure areas in the 580 Zone identified in Section 4.1.4 increase by approximately 18 psi at PHD and approximately 10 psi at MDD+FF. As stated in the Water System Plan (2020), this area requires PRVs in any condition. As such, these high pressures are not a limiting factor on the design of the pump station.

4.4 Reverse Flow Capacity

An evaluation was performed to determine the maximum capacity that can flow from the 580 Zone to the 390 Zone through a pressure reducing/sustaining valve.

The Old Clifton route is able to flow 2,300 GPM while maintaining greater than 20 psi in the 580 Zone.

The Glenwood route is able to flow 2,400 GPM while maintaining greater than 20 psi in the 580 Zone.

4.5 Results Summary

In summary, a 1,950 GPM pump station to connect the 390 Zone with the 580 Zone in the Old Clifton area would need to be located at 284 feet to meet the City's design standards and in combination with Well 11 and Well 12 will provide MDD for both the 580 Zone and 660 Zone with the largest pump offline and an assumed 20 hours of pumping per day. If this location were selected, the City may consider installing a 500 LF parallel distribution main to serve customers on the pipe between the City's existing system and the suction side of the pump station. To improve the suction pressures, a pump station could be installed at an elevation contour of 265 feet. This location would require installation of PRVs for customers on the discharge pipe between the pump station and the existing McCormick Woods water system.

For the Glenwood area, the pump station that meets the City's design standards is a 1,300 GPM pump station at an elevation contour of 210 feet. A pump station of this size will meet MDD through 2023; however, an additional pump station would need to be constructed along Old Clifton to meet future demands. The additional pumping capacity

needed to meet 2039 MDD is 650 GPM. In order to minimize high pressures in the Stetson Heights development area, a second pump station could be installed to the west of the development.

This analysis indicates that an area within the City's system that is currently predicted in the hydraulic model to have low operating pressures may see said pressures reduced even further with the addition of the proposed pump station (in either location). This area of potential concern is located near Atlas Apartments on Sidney Avenue. However, as noted above in Section 4.1.3, the City has not received low pressure complaints in this area and field information indicates actual pressures are higher than those resulting from the model, so it is unclear how significant an issue this presently is. Prior to proceeding with predesign efforts on the pump station, it is recommended that this issue be further evaluated, including field testing of current pressures and potentially recalibration of the model in this area.

5 Project Cost

This section summarizes the costs associated with each alternative.

5.1 Old Clifton Alternative

The preferred Old Clifton alternative includes installation of 5,800 LF of 12-inch ductile iron water main within Old Clifton Road and construction of a 1,950 GPM pump station at an elevation contour of 265 feet. The cost associated with this alternative, including construction and engineering fees, is estimated to be $3.7M. See Appendix A for details of the estimate.

5.2 Glenwood Alternative

The preferred Glenwood alternative includes two pump stations in series, including construction of a 1,300 GPM pump station at an elevation contour of 210 feet (including jockey pumps and a bladder tank), construction of a 1,300 GPM pump station at an elevation contour of 315 feet, and installation of 11,700 LF of 12-inch ductile iron water main, approximately 10,000 LF of which is anticipated to be installed by a developer. The cost for all water mains is included in the estimate. The cost associated with this alternative, including construction and engineering fees, is estimated to be $6.4M. See Appendix A for details of the estimate.

6 Funding Opportunities

Funding opportunities for both alternatives are the same. Funding opportunities that were evaluated are included in Table 6-1.

The Drinking Water State Revolving Loan (DWSRF) appears to be a potential option for this project. There is up to $5M available per jurisdiction, and the loan interest rate is 1.75% plus origination costs for a 20-year term. The funding cycle begins in October.

The Water Infrastructure Finance and Innovation Act (WIFIA) funding applies to projects with greater than $25M. The City may consider combining multiple projects to meet this

minimum requirement. This loan comes with a 5-year debt service deferral after construction is complete. Interest rates vary and are currently between 1.2% to 2.0%. WIFIA will fund 49% of total project cost. Typical term is 30 years.

Building Resilient Infrastructure and Communities (BRIC) is a grant with a cost share element. This funding source may be an option and includes the requirement to be a sub-applicant through the State of Washington. Pre-applications for this grant are typically due to the State by October. $50M maximum per application with a 25% cost share.

The Public Works Board (PWB) - Construction Loan may be an option. This loan is a competitive process and funding occurs in six-month cycles. There is a maximum $10 million dollar award per jurisdiction per biennium limit.

Table 6-1. Funding Opportunities

Likely Rank of Applicability (1 = applicable, 2= likely applicable, 3=may be applicable)	Funding Source	Agency	Applicability	Eligibility	Amount Available	Terms	Funding Cycle	Website
1	Drinking Water State Revolving Fund (DWSRF)	WA DOH	DWSRF funds all types of drinking water projects. SRF typically provides low interest loans but offers some grants and principal forgiveness for low-income communities and green infrastructure projects.	Local Agencies. Must have an approved or pending Water System Plan. Must have construction component. Cannot address growth or fire flow.	$5M/jurisdiction. Potential subsidy for low-income areas based on affordability index.	1.75% interest rate, plus origination costs. 20-year term. 1 % loan fees.	Oct 1- Nov 30	https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/WaterSystemAssistance/DrinkingWaterStateRevolvingFundDWSRF
3	Water Infrastructure Finance and Innovation Act (WIFIA)	EPA	Eligible Projects: Projects eligible under CWSRF and DWSRF. Enhanced energy efficiency projects at drinking water facilities and wastewater facilities. Brackish or seawater desalination, aquifer recharge, alternative water supply, and water recycling projects. Drought prevention, reduction, or mitigation projects. Acquisition of property if it is integral to the project or will mitigate the environmental impact. A combination of projects secured by a common security pledge or submitted under one application by an SRF program. Funds can go towards pre-construction activities and construction activities.	Local agencies	Project must be greater than $25M. No maximum project size.	5-year debt service deferral after construction complete, interest rates vary, currently 1.2-2%, based on average weighted life of the loan. WIFIA will fund 49% of total project cost. Typical term is 30 years.	Prospective borrowers must submit a WIFIA Letter of Interest (LOI) to EPA that describes the project's eligibility, financial creditworthiness, engineering feasibility, and alignment with EPA's policy priorities. If selected by EPA the prospective borrower is invited to submit a WIFIA application. LOIs are typically due in early Fall (Oct 15, 2020)	https://www.epa.gov/wifia
2	Building Resilient Infrastructure and Communities (BRIC)	FEMA (through State)	Replaces former "Pre-Hazard Mitigation Grant Program", specifically geared towards resilient infrastructure funding	Local agencies are eligible, but as a "sub applicant" through the State.	$450M total, $50M per application	25% Cost Share Required	Check WA deadlines. FEMA accepts applications through January, but WA State applications are typically due by October	https://www.fema.gov/grants/mitigation/fy2020-nofo
1	Public Works Board (PWB) - Construction Loan	WA State Public Works Board	There is approximately $68 million set aside for construction applications. Award is based on a competitive process. Applications every six months starting in June 2019, until the appropriated funds are exhausted. There is a maximum $10 million dollar award per jurisdiction per biennium limit, with a loan term of 20 years, including 5 years for completion. Applications may be submitted for emergencies at any time.	Local agencies	$68M total, up to $10M per jurisdiction	Determined prior to funding cycle	June-July, Dec-Jan	https://www.commerce.wa.gov/building-infrastructure/pwb-financing/

Appendix A – Cost Estimates

City of Port Orchard
McCormick Woods Consolidation Study
Opinion of Probable Construction Cost
Old Clifton Alternative

31-Mar-21

Item #	Description	Unit	Unit Cost	Qty	Total
General					
1	MOBILIZATION	LS	6%	1	$ 88,500
2	PUMPS - 650 GPM	EA	$ 54,000	3	$ 162,000
3	PUMP STATION BUILDING (INCLUDES ELECTRICAL, I&C)	SF	$ 300	700	$ 210,000
4	PUMP STATION VALVES - 12-INCH GATE	EA	$ 12,000	6	$ 72,000
5	PUMP STATION VALVES - PRESSURE RELIEF VALVE	EA	$ 5,000	3	$ 15,000
6	PUMP STATION VALVES - 12-INCH CHECK	EA	$ 8,600	2	$ 17,200
7	12-INCH GATE - BURIED	EA	$ 8,200	4	$ 32,800
8	12-INCH DUCTILE IRON MAIN - INSTALLED	LF	$ 98	5800	$ 565,500
9	PAVEMENT REMOVAL, HAUL AND RESTORATION	SY	$ 78	3867	$ 299,700
10	GENERATOR - 200 kW	LS	$ 100,000	1	$ 100,000
11					$ -
12					$ -
	SUBTOTAL (INCLUDING MOB)				$1,562,700
	CONTRACTOR OH&P	15%			$234,400
	SALES TAX	9%			$161,700
	CONTINGENCY - CONSTRUCTION	50%			$979,400
	SUBTOTAL CONSTRUCTION				**$2,938,200**
	ENGINEERING DESIGN	10%			$293,820
	CONTINGENCY - DESIGN	50%			$146,910
	ENGINEERING - CONSTRUCTION MANAGEMENT	10%			$293,820
	SUBTOTAL ENGINEERING				**$734,550**
	GRAND TOTAL				**$3,673,000**

City of Port Orchard
McCormick Woods Consolidation Study
Opinion of Probable Construction Cost
Glenwood Alternative

31-Mar-21

Item #	Description	Unit	Unit Cost	Qty	Total
General					
1	MOBILIZATION	LS	6%	1	$ 152,300
2	PUMPS PS1 - 650 GPM, 100 HP	EA	$ 54,000	3	$ 162,000
3	PUMPS PS2 - 650 GPM, 100 HP	EA	$ 6,000	2	$ 12,000
4	BLADDER TANK	EA	$ 25,000	1	$ 25,000
5	PUMP STATION BUILDING 1 (INCLUDES ELECTRICAL, I&C)	SF	$ 300	700	$ 210,000
6	PUMPS PS2 - 650 GPM, 100 HP	EA	$ 54,000	3	$ 162,000
7	PUMP STATION BUILDING 2 (INCLUDES ELECTRICAL, I&C)	SF	$ 300	700	$ 210,000
8	PUMP STATION VALVES - 12-INCH GATE	EA	$ 12,000	12	$ 144,000
9	PUMP STATION VALVES - PRESSURE RELIEF VALVE	EA	$ 5,000	6	$ 30,000
10	PUMP STATION VALVES - 12-INCH CHECK	EA	$ 8,600	4	$ 34,400
11	12-INCH GATE - BURIED	EA	$ 8,200	8	$ 65,600
12	12-INCH DUCTILE IRON MAIN - INSTALLED (ASSUMES ALL PIPE TO CONNECT EXISTING SYSTEMS)	LF	$ 98	11,654	$ 1,136,300
13	PAVEMENT REMOVAL, HAUL AND RESTORATION (SW SEDGEWICK ROAD ONLY)	SY	$ 78	1900	$ 147,300
14	GENERATOR - 200 kW	LS	$ 100,000	2	$ 200,000
	SUBTOTAL (INCLUDING MOB)				$2,690,900
	CONTRACTOR OH&P	15%			$403,600
	SALES TAX	9%			$278,500
	CONTINGENCY - CONSTRUCTION	50%			$1,686,500
	SUBTOTAL CONSTRUCTION				**$5,059,500**
	ENGINEERING DESIGN	10%			$505,950
	CONTINGENCY - DESIGN	50%			$252,975
	ENGINEERING - CONSTRUCTION MANAGEMENT	10%			$505,950
	SUBTOTAL ENGINEERING				**$1,264,875**
	GRAND TOTAL				**$6,324,000**