Preliminary Design Flow Criteria for North Lake Sammamish Flow Diversion Project

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King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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1.0. EXECUTIVE SUMMARY

As part of its Conveyance System Improvement Program, King County's Wastewater Treatment Division (WTD) identified the need to direct wastewater flows originating in the North Lake Sammamish basin away from the Eastside Interceptor and South Treatment Plant and divert them to the new Brightwater Treatment Plant expected to start operating in 2012.

A conceptual working alternative has been developed that proposes to meet this objective by modifying flow volumes and directions through the York Pump Station. At least one other alternative should be developed to assure that conceivable means to achieve the objective have been considered and compared. These alternatives may involve modifications to facilities other than the York Pump Station.

This technical memorandum provides design flows for the conceptual working alternative and provides the basis for devising additional alternatives. The flow information in this memorandum takes precedence over information provided in previous documents. All locations, sizes, capacities, and other system information should be verified through fieldwork and through review of documents that WTD will provide.

The conceptual working alternative was designed to divert the following 20-year peak flows:

- 29 mgd by 2017
- 32 mgd by 2035
- 43 mgd by 2050 (buildout)

Other alternatives must meet the same design flow criteria. The population and flow projections that serve as the basis for these design flows are preliminary. WTD expects to complete updated flow projections by the end of 2013. The projections will be based on 2010 census data, new population forecasts from the Puget Sound Regional Council, updated winter flow data, and updated infiltration/inflow values. To account for a likely change in design flows, project design should allow for a $\pm$20 percent change in peak flow in 2050. Operating flow levels developed for the conceptual working alternative are also preliminary. Field verifications and hydraulic and engineering analyses will be required to identify, analyze, and select the best project alternative.

2.0. INTRODUCTION

As part of its Conveyance System Improvement Program, King County's Wastewater Treatment Division (WTD) identified the need to direct wastewater flows originating in the North Lake Sammamish basin away from the Eastside Interceptor and South Treatment Plant and divert them to the new Brightwater Treatment Plant expected to start operating in 2012.

A conceptual working alternative has been developed that proposes to meet this objective by modifying flow volumes and directions through the York Pump Station. At least one other alternative should be developed to assure that conceivable means to achieve the objective have been considered and compared. These alternatives may involve modifications to facilities other than the York Pump Station.

The purpose of this technical memorandum is to provide design flows for the conceptual working alternative and to provide the basis for devising additional alternatives. The flow information in this memorandum takes precedence over information provided in previous documents. All locations, sizes, capacities, and other system information should be verified through fieldwork and through review of documents that WTD will provide.

This chapter provides background information on existing and near-future York Pump Station flow configurations before the project is completed and on other projects planned to relieve flow to the Eastside Interceptor and South Plant. Chapter 2 describes the conceptual working alternative, assumptions used in developing the alternative, and parameters for development of other alternatives.

2.1 Existing Flow Through York Pump Station

In the winter, the York Pump Station sends flows from the North Creek Pump Station and from the North Lake Sammamish basin to the South Treatment Plant in Renton. In the summer, the Hollywood and Woodinville Pump Stations send North Lake Sammamish basin flows to the West Point Treatment Plant in Seattle. The York Pump Station does not operate in the summer unless there is an unusually heavy storm or the collection system between the Kenmore Pump Station and West Point is undergoing maintenance.

Figure 1 shows the locations of the York, North Creek, Hollywood, and Woodinville Pump Stations. It also shows the basins that feed flows into the stations either now or under the conceptual working alternative. Figure 2 and Figure 3 depict winter and summer configurations for North Lake Sammamish basin flows. Figure 4 gives a conceptual layout of the North Creek Junction, a collection of facilities near the North Creek Pump Station that direct flows to either West Point or South plant.

The following sections describe how the North Creek, Hollywood, Woodinville, and York Pump Stations coordinate their operation.[1] Appendix A shows existing flows through the stations.

[1] Existing pumping capacities given for each station are approximate and subject to verification.

2.1.1 North Creek Pump Station

The North Creek Pump Station, northwest of the York Pump Station, started operating in December 1999 to help minimize wet-weather overflows in the Kenmore Interceptor. The station is located near the junction of the North Creek Interceptor and the Bothell-Woodinville Interceptor. The estimated firm and peak pumping capacities are 26 and 36 mgd. In 2004, construction of a 6-million-gallon (MG) underground storage facility was completed on the site to further reduce overflows. During summer months, the station sits idle. In the winter, flows are diverted to the station from the North Creek Interceptor and Bothell-Woodinville Interceptor via the North Creek Diversion Structure. The station sends these flows through two force mains (west and east force mains), both 30 inches in diameter, to the York Pump Station.

2.1.2 Hollywood Pump Station

The Hollywood Pump Station, east of the York Pump Station in Redmond, was built in 1975. The estimated firm and peak pumping capacities are 14.4 and 21.6 mgd. The station sits idle in the winter. In the summer, it sends flows from the 72-inch-diameter North Lake Sammamish Interceptor to the Woodinville Pump Station via three 16-inch-diameter force mains and the 42-inch-diameter Sammamish Valley Interceptor. In the winter, flows from the North Lake Sammamish Interceptor, which carries all the flow from the North Lake Sammamish basin, bypass the Hollywood Pump Station at the station's bypass structure and travel via gravity to the York Pump Station through the 72-inch-diameter North Lake Sammamish Extension, which was completed in 1989.

2.1.3 Woodinville Pump Station

The Woodinville Pump Station, northwest of the Hollywood Pump Station in Woodinville, was built in 1975. The estimated firm and peak pumping capacities are 17.6 and 22 mgd. The station sends flows from the Hollywood Pump Station via three 16-inch-diameter force mains to the Bothell-Woodinville Interceptor, the North Creek Diversion Structure, the Kenmore Interceptor and Pump Station, and on to West Point. The Bothell-Woodinville Interceptor also receives flows from the Lower Bear Creek Trunk, North Creek Interceptor, and Bothell service basin. It is 30 inches in diameter at the Woodinville Pump Station, increasing to 60 inches where it connects to the Kenmore Interceptor.

2.1.4 York Pump Station

The York Pump Station went online in 1992. The station is located at the northeast corner of NE 124th Street and 140th Avenue NE in Redmond. It has six pumps with estimated combined firm and peak capacities of 58 and 68 mgd. The York Force Main consists of two pipelines, one 30 inches and the other 48 inches in diameter, that discharge via a discharge structure to the Redmond Interceptor, the northern terminus of the Eastside Interceptor (ESI) that carries the wastewater to South plant.

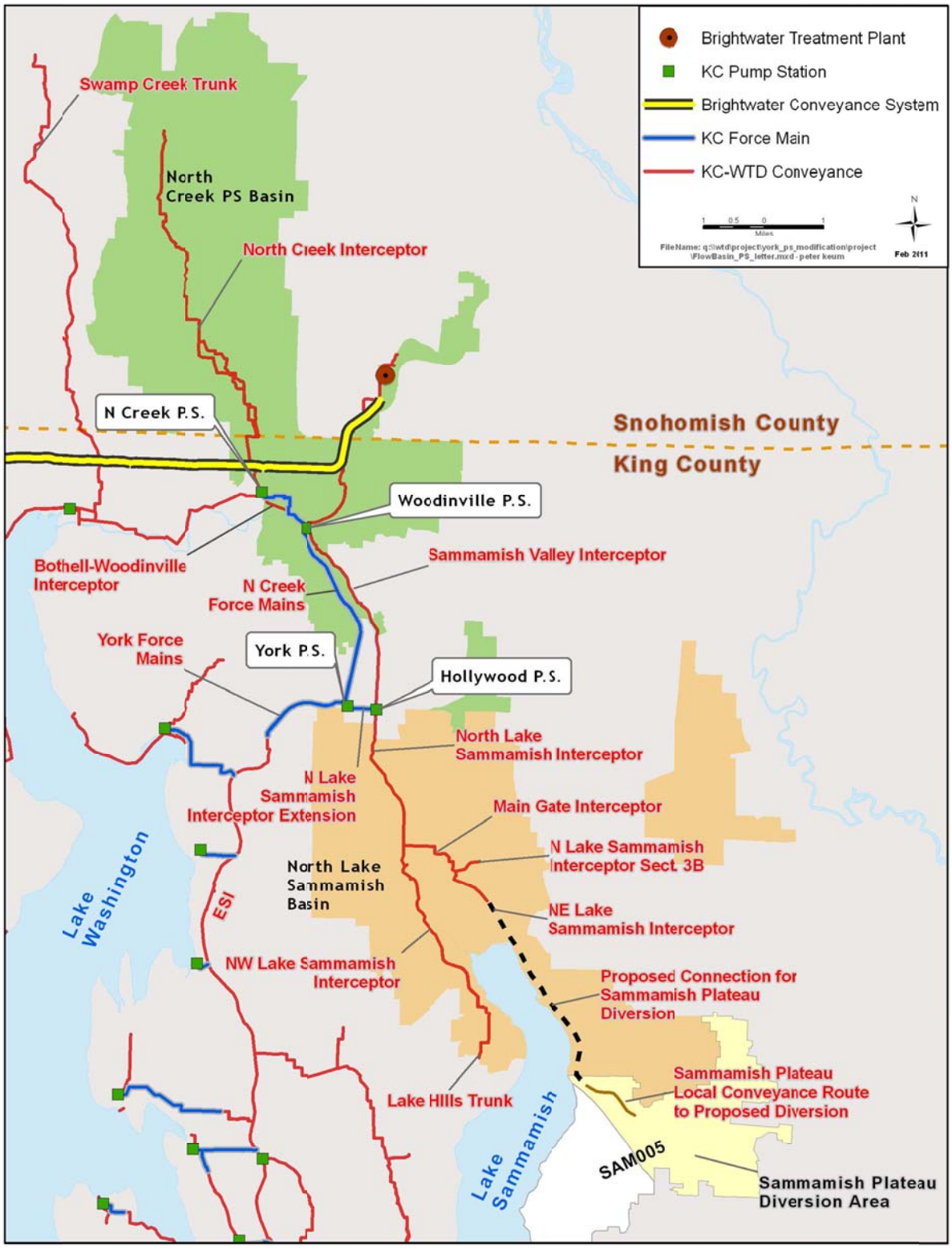


Figure 1. Basins and Facilities in the Vicinity of York Pump Station

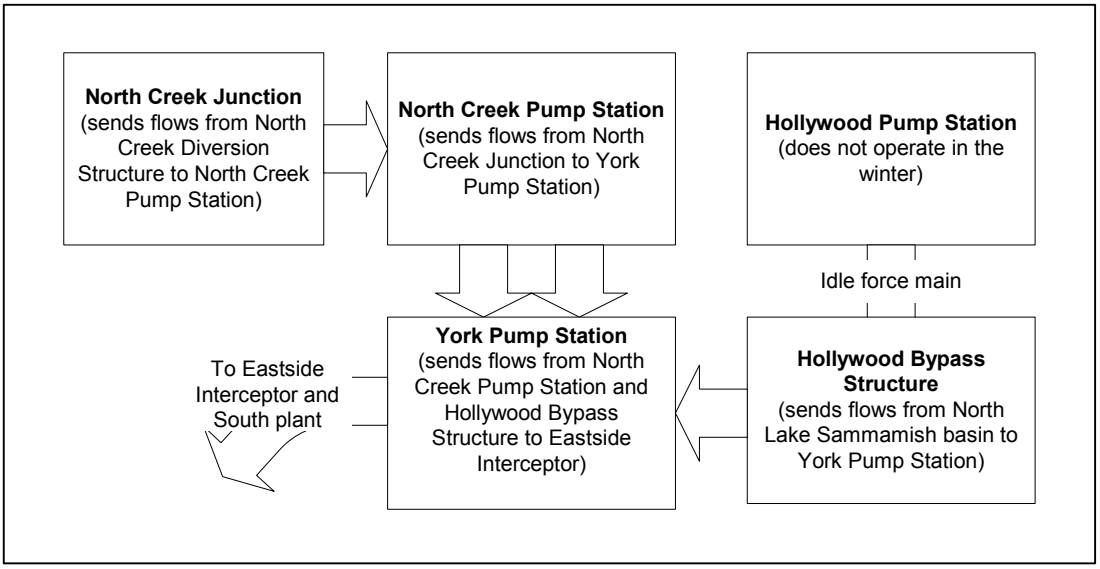


Figure 2. Existing Winter Configuration for North Lake Sammamish Basin Flows

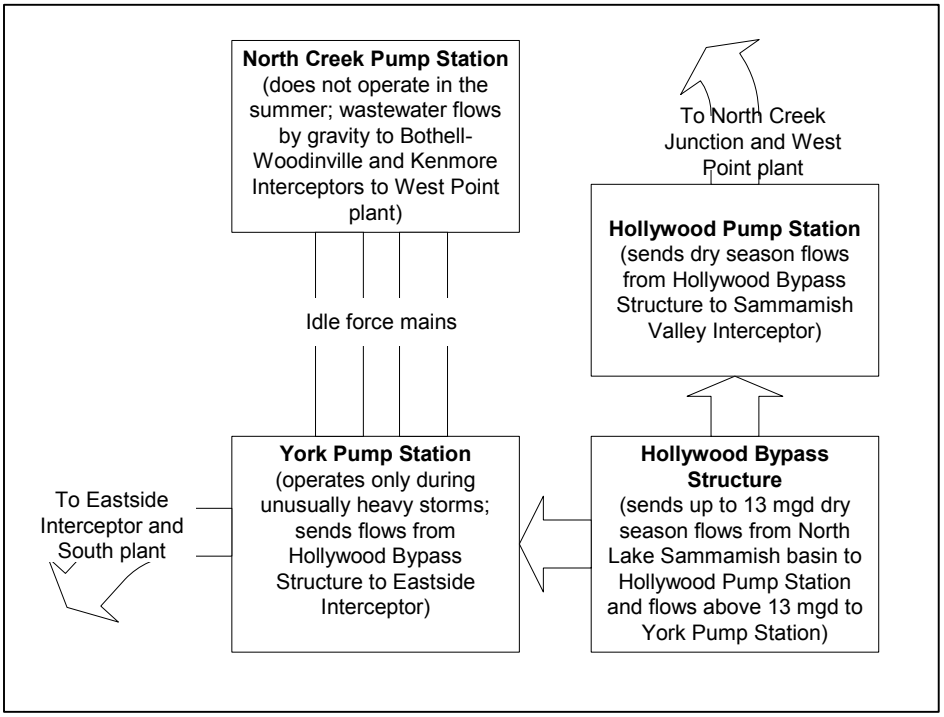


Figure 3. Existing Summer Configuration for North Lake Sammamish Basin Flows

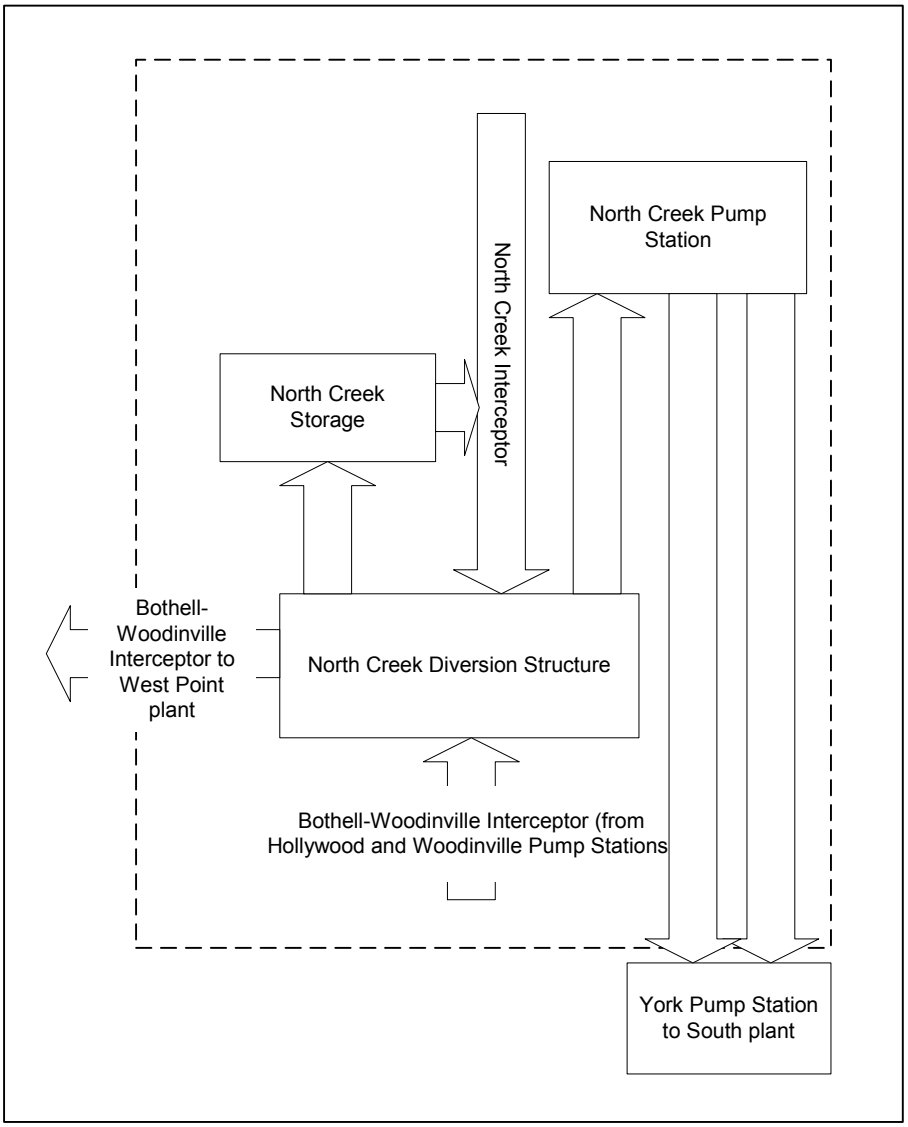


Figure 4. Conceptual Layout of North Creek Junction

2.2 Project Justification

Flow monitoring and modeling indicate that Section 1 of the ESI near South plant currently reaches its peak capacity during 20-year peak flow events, which is the design standard for King County's regional conveyance system. This capacity constraint will worsen as population and flow increase over time. The new Brightwater Treatment Plant is being constructed in south Snohomish County to address this and other capacity limitations in the regional wastewater system. Reducing flows in the ESI will also delay the need to expand South plant.

The 36-mgd Brightwater plant is expected to start running in 2012. The initial capacity of Brightwater will be 36 mgd, with provisions for expansion to 54 mgd in 2040. After the plant opens, some of the flows that go to the ESI through the York Pump Station will bypass the station and go to Brightwater instead. Even with these initial diversions to Brightwater, ESI Section 1 is expected to reach peak flow capacity again in 2017. The York Pump Station

Modifications project was identified as one means to address this constraint.[2] Under the conceptual working alternative for the project, the York Pump Station will pump up to 43 mgd of flows to Brightwater from the North Lake Sammamish basin and Sammamish Plateau. Other conveyance system improvement (CSI) projects are planned to further reduce peak flows to the ESI.

Table 1 shows the effects on 20-year peak flows to ESI Section 1 from initial diversions away from the York Pump Station to Brightwater in 2012 and from further diversions outlined in the conceptual working alternative. The table shows that without additional CSI projects, peak capacity in ESI Section 1 will be exceeded by 49 mgd in 2050 when the service area is expected to reach its maximum population and flow.

The remaining sections in this chapter describe how diversions to Brightwater starting in 2012 will affect operation of the Hollywood, York, and North Creek Pump Stations and how the planned CSI projects will divert more flow to Brightwater in the future.

Table 1. Eastside Interceptor, Section 1, Capacity and Projected Peak 20-Year Flows With and Without Initial and Conceptual Working Alternative Diversions to Brightwater

	Eastside Interceptor Section 1 (mgd)					
	20-Year Peak Capacity	Projected 20-Year Peak Flow				
		2000	2010	2020	2030	2050
Without Brightwater and planned diversions	210	191	239	265	287	310
With North Creek Pump Station flows sent to Brightwater instead of York and Eastside Interceptor (starting in 2012)	210		239	245	270	296
And with up to13 mgd from North Lake Sammamish basin sent via Hollywood Pump Station to Brightwater (starting in 2012)	210		239	235	261	286
And with flows above 13 mgd from North Lake Sammamish basin and Sammamish Plateau Diversion (2020) sent to Brightwater from York (2021) (conceptual working alternative)	210			215	241	259

2.3 Flow Diversions from York Pump Station and ESI, Starting in 2012

As a part of the Brightwater project, WTD recently made improvements at the Hollywood, York, and North Creek Pump Stations. Brightwater work at the Hollywood Pump Station consisted primarily of control system improvements and control strategy development. Work at the other two stations, also included control system and strategy changes in addition to facility improvements. Facilities were also constructed in the North Creek Junction to divert flows to

[2] The York Pump Station Modifications project was identified in the 1999 Regional Wastewater Service Plan. It has since been renamed to the North Lake Sammamish Flow Diversion Project to account for the possibility that other means may be identified to divert basin flows to Brightwater.

Brightwater (Figure 5). Projected flows for the configurations described below are given in Appendix A.

When Brightwater comes online, the Hollywood Pump Station will start sending flows year-round from the North Lake Sammamish basin to Brightwater (Figure 6). The North Creek Diversion Structure will send the flows to the Brightwater Influent Tunnel via the new Brightwater Diversion Structure and North Creek Connector Tunnel. The amount of flow from the Hollywood Pump Station will be restricted to 13 mgd, to accommodate the maximum capacity of the Sammamish Valley Interceptor. Flows above 13 mgd will bypass the Hollywood Pump Station, travel to York Pump Station, and discharge to the ESI. If the Hollywood Pump Station is not operating for any reason, all North Lake Sammamish basin flows will pass through the York Pump Station.

The North Creek Pump Station will operate only in emergencies. Flows that this pump station currently sends to the ESI via the York Pump Station will be sent to Brightwater via the Brightwater Diversion Structure and the North Creek Connector Tunnel. Another pipeline that runs parallel to the North Creek Connector Tunnel will deliver reclaimed water from Brightwater to the North Creek Pump Station during the summer. The reclaimed water will leave the station through the east force main and then connect to a new pipeline near the York Pump Station, which will deliver the water to the Sammamish Valley.

During extreme emergencies when Brightwater is offline, flows from the North Lake Sammamish basin will bypass the Hollywood Pump Station and go to the York Pump Station for discharge to the ESI. All other flows from the Brightwater service area will also be sent to the York Pump Station through the North Creek Pump Station and both its force mains (Figure 7).

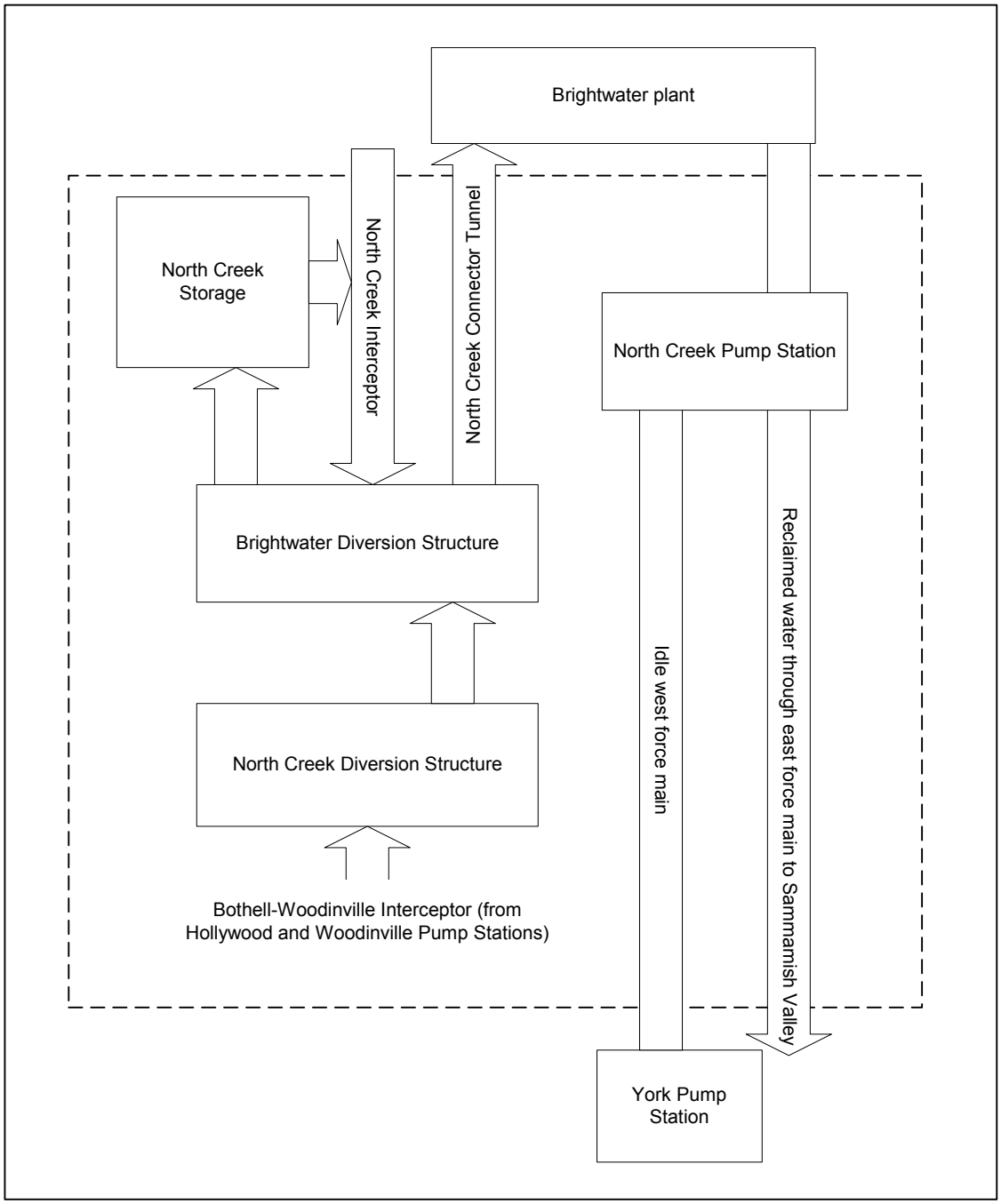


Figure 5. Conceptual Layout of Facilities in the North Creek Junction After Brightwater Comes Online (Routine Operation, 2012−2020)

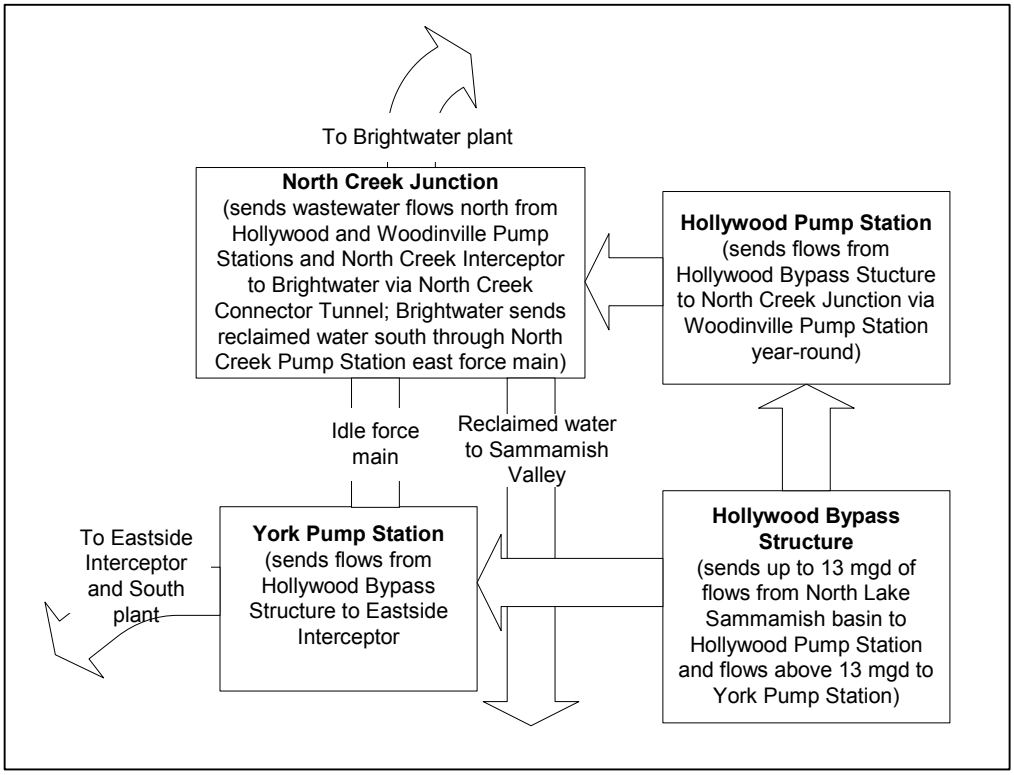


Figure 6. Routine Flows Through York Pump Station After Brightwater Comes Online (2012−2020)

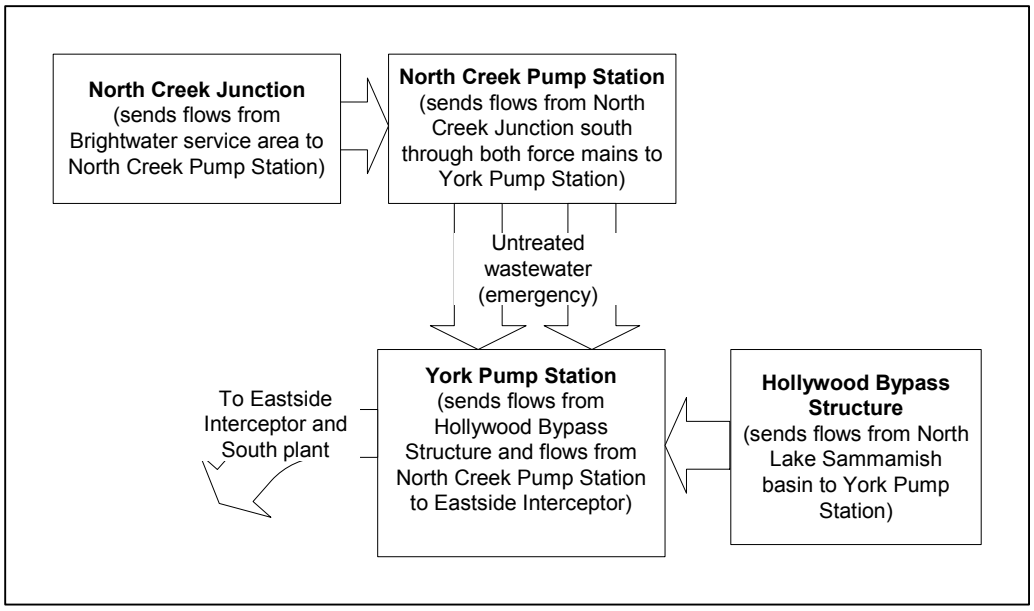


Figure 7. Emergency Flows Through York Pump Station After Brightwater Comes Online (2012−2020)

2.4 Planned CSI Projects to Relieve Peak-Flow Capacity in ESI, 2014–2030

The York Pump Station Modifications project was one of several CSI projects that WTD identified to help keep peak flows under the capacity of ESI Section 1. Some of the peak flows from basins east and south of Lake Washington that currently go to the ESI would either be stored until the ESI can handle them or sent to the new Brightwater plant. The *Conveyance System Improvements Program Update* (King County, 2007) indicates that these projects will be implemented sometime between 2014 and 2030 and assigns relative priorities for each:

- Issaquah Storage, underground parallel pipes with a combined capacity of 3.2 MG to be located near the entrance to Lake Sammamish State Park (lower priority).
- Sammamish Plateau Storage, a 3.3-MG inline storage tunnel to be located in Sammamish to accommodate growth in the Sammamish Plateau (medium priority).
- Sammamish Plateau Diversion, a pipeline that would send flows from the Sammamish Plateau (half of SAM005 basin) to the upstream end of the Northeast Lake Sammamish Interceptor and then to Brightwater (high priority).
- Eastgate Parallel Pipe Storage, two inline storage pipes with a combined capacity of 3.6 MG to be located in Bellevue (lower priority).
- Bryn Mawr Storage, a 0.33 MG underground offline storage pipe to be located in Skyway (lower priority). (This project is now being addressed by removing infiltration and inflow from the local sewer system.)
- Medina Storage, a 70,000-gallon inline storage pipe to be located in Bellevue (lower priority).
- Issaquah Creek Highlands Storage, a 0.2 MG storage facility in the City of Issaquah (lower priority).

One CSI project, in particular, will affect flows that are routed to the York Pump Station. The Sammamish Plateau Diversion project would divert half the flows from the SAM005 basin, east of Lake Sammamish, to the north in order to provide peak flow relief to the Sammamish Interceptor, Sunset/Heathfield Pump Stations, Eastgate Trunk, and Lake Hills Interceptor. These flows will be added to the flows from the North Lake Sammamish basin that will be conveyed by the Hollywood and York Pump Stations.

3.0. WORKING ALTERNATIVE AND PARAMETERS FOR DEVELOPING OTHER ALTERNATIVES

The objective of the North Lake Sammamish Flow Diversion project is to continue relieving peak flows in ESI Section 1 by redirecting a higher level of future flows to Brightwater from the North Lake Sammamish and SAM005 basins.

A conceptual alternative to accomplish this objective was included in the Regional Wastewater Services Plan (RWSP), adopted in 1999. This alternative is described in a Brightwater reclaimed water project memorandum titled *Working Draft, Conceptual Requirements and Budget for Modifications to York and North Creek Stations Facilities to Allow Flow Reversal in 2017* (May 29, 2009). The concept is to direct flows to Brightwater through the York Pump Station in the reverse direction through the existing west North Creek Force Main. Flows would be conveyed northward to a new discharge structure that will feed into the North Creek Connector and Brightwater Influent Tunnels. The concept requires that the west North Creek Force Main have the ability to convey flows in two directions— north to Brightwater under routine operation and south to the York Pump Station under the Brightwater emergency flow diversion scenario.

This chapter describes the conceptual working alternative and preliminary parameters for developing other alternatives. The conceptual working alternative is considered a working draft. The concept has not undergone detailed hydraulic analysis and engineering design. Some elements to complete a technically feasible concept, such as the discharge structure to tie into the North Creek Connector Tunnel and any necessary control strategy changes, are yet to be developed.

3.1 Conceptual Working Alternative

The following sections describe routine and emergency operation of the York Pump Station under the conceptual working alternative for two time periods: 2021−2034 (after the project is completed and before a new force main is constructed) and 2035−2050 (after construction of a new force main and to service area buildout). Design flows for these configurations are shown in Appendix A.

3.1.1 Routine and Emergency Operation 2021−2034

Once the York Pump Station has the capability to pump flows through the west North Creek Force Main, it will send all flows north to Brightwater from the North Lake Sammamish and SAM005 basins, except the 13 mgd that goes to Brightwater via the Hollywood Pump Station (Figure 8 and Figure 9). New piping and valving will direct the flow from the west force main near the North Creek Pump Station to a new discharge structure. The York Pump Station will send all flows in excess of the capacity of the west North Creek Force Main to the ESI. Reclaimed water from Brightwater will continue to run south through the east North Creek Pump Station Force Main to a reclaimed water pipeline near the York Pump Station.

The York Pump Station will operate intermittently, primarily in storm conditions, during the first 15 to 20 years. It will accommodate normal diurnal wastewater flow only when the Hollywood Pump Station is offline for maintenance. After the first 15 to 20 years, depending on the growth in base flows, operation during the peak of dry days may become necessary. It is likely that the station will be operated in a fill-and-draw mode to maintain a minimum velocity of 3 fps and minimum pump rate of about 9 mgd through the North Creek Force Mains. The North Lake Sammamish Interceptor will likely be used to store flows just slightly above 13 mgd to minimize the need for the fill-and-draw operation.

From about 2030 to 2040, the York Pump Station will send 3.3 to 7.6 mgd of average wet weather flow (AWWF) from the North Lake Sammamish and SAM005 basins to the ESI instead of to Brightwater in order to free up capacity at Brightwater and delay the need to expand the plant. After the Brightwater expansion in 2040, the AWWF through the York Pump Station to the ESI will no longer be required.

During emergencies when Brightwater is offline, the York Pump Station will receive flows from the North Lake Sammamish and SAM005 basins through the Hollywood Pump Station Bypass Structure and all remaining flows from the Brightwater service area through the two North Creek Force Mains (Figure 10). The York Pump Station will send these flows to the ESI.

3.1.2 Routine and Emergency Operation 2035−2050

In about 2035, it is assumed that increased flow volumes will require use of two force mains to send flows north from the York Pump Station to Brightwater (Figure 11 and Figure 12). WTD will build a new pipeline to allow use of one force main for reclaimed water and use of two force mains for routine flow north from the York Pump Station and for emergency flows south to the station. The conceptual working alternative does not specify whether the new force main will be used for reclaimed water and the existing east force main used for wastewater flows north, or whether the new force main will be used for wastewater flows north and reclaimed water will continue to flow through the east force main.

All other flow configurations would be the same as those described for 2021−2035.

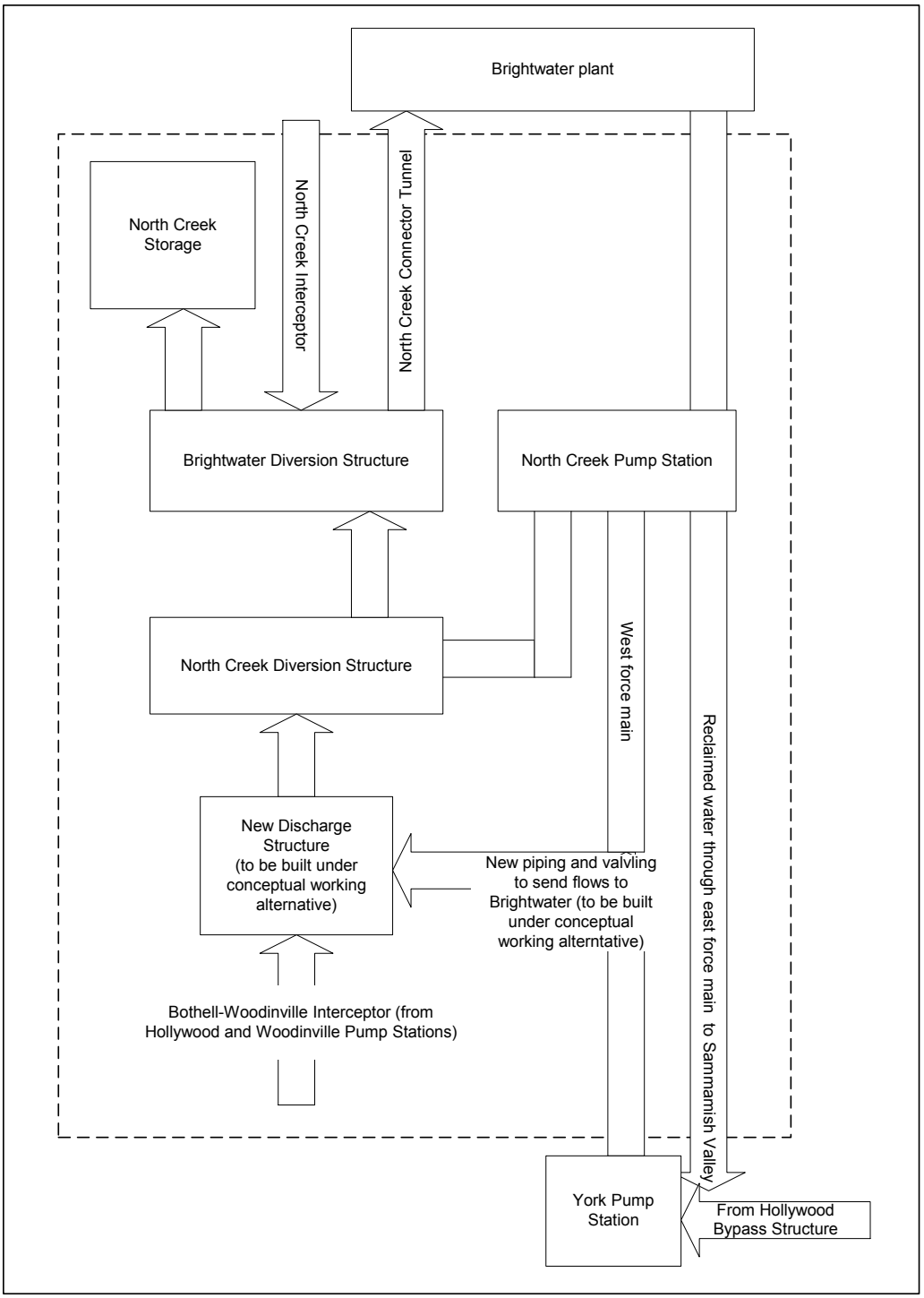


Figure 8. Conceptual Layout of Facilities in the North Creek Junction After Completion of the Conceptual Working Alternative (Routine Operation, 2021−2034)

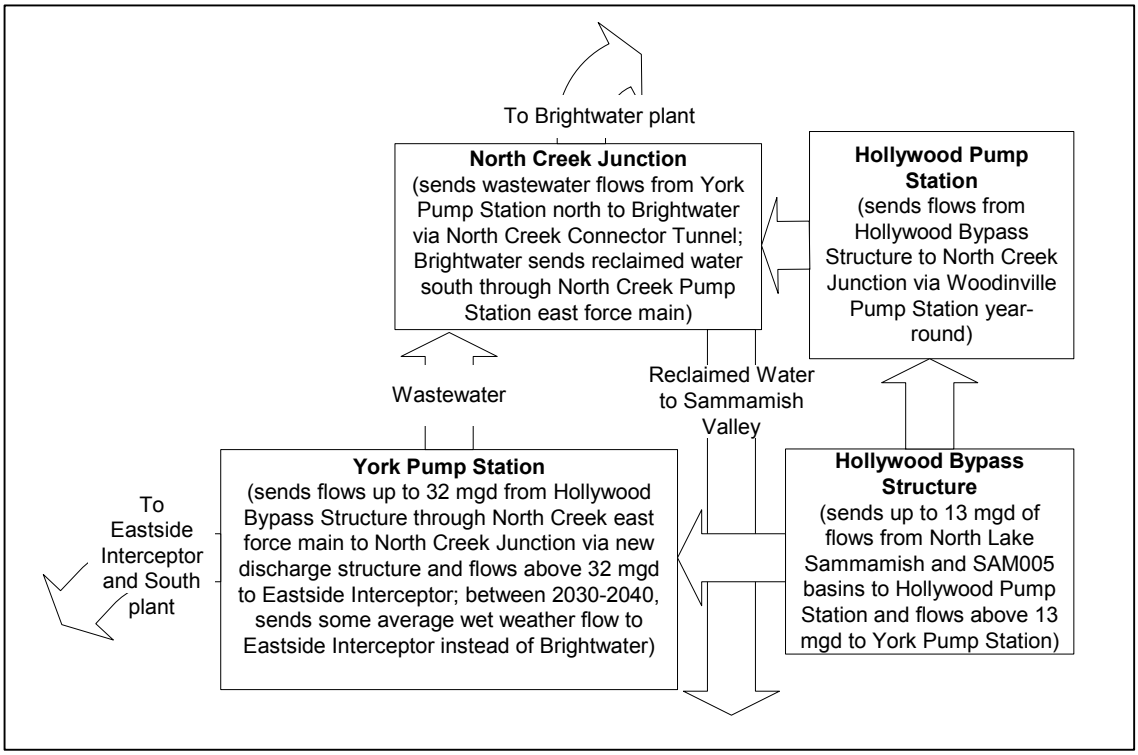


Figure 9. Routine Flows Through York Pump Station Under Conceptual Working Alternative (2021−2034)

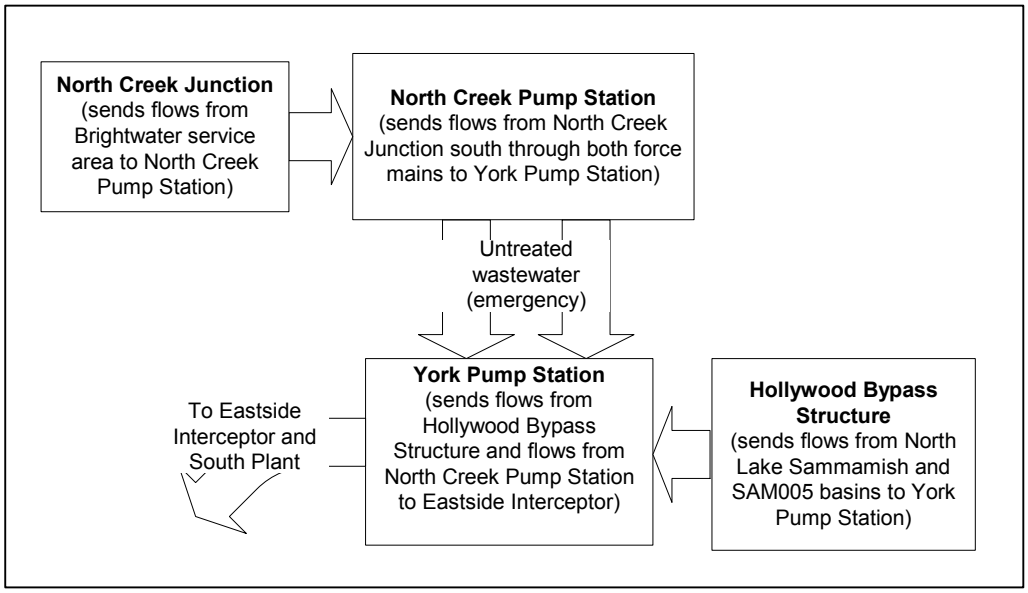


Figure 10. Emergency Flows Through York Pump Station Under Conceptual Working Alternative (2021−2034)

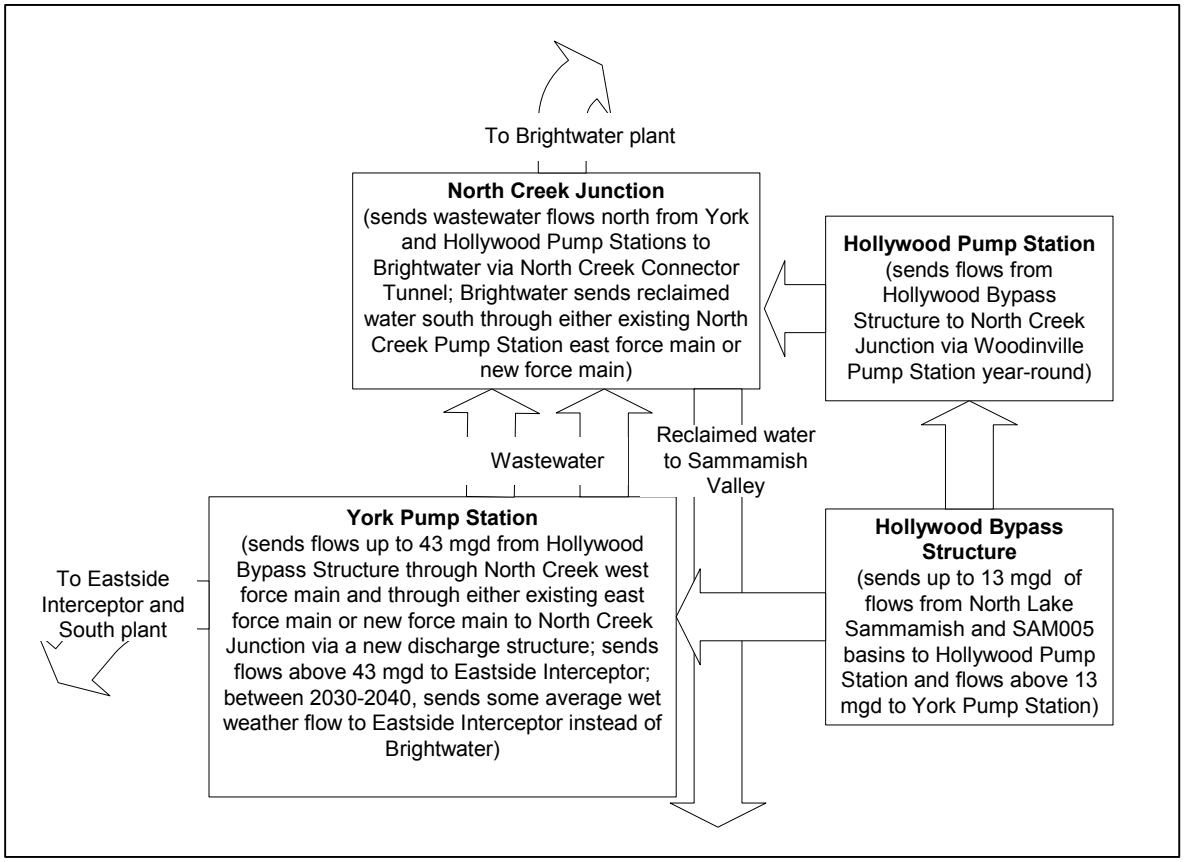


Figure 11. Routine Flows Through York Pump Station Under Conceptual Working Alternative and New Force Main (2035−2050)

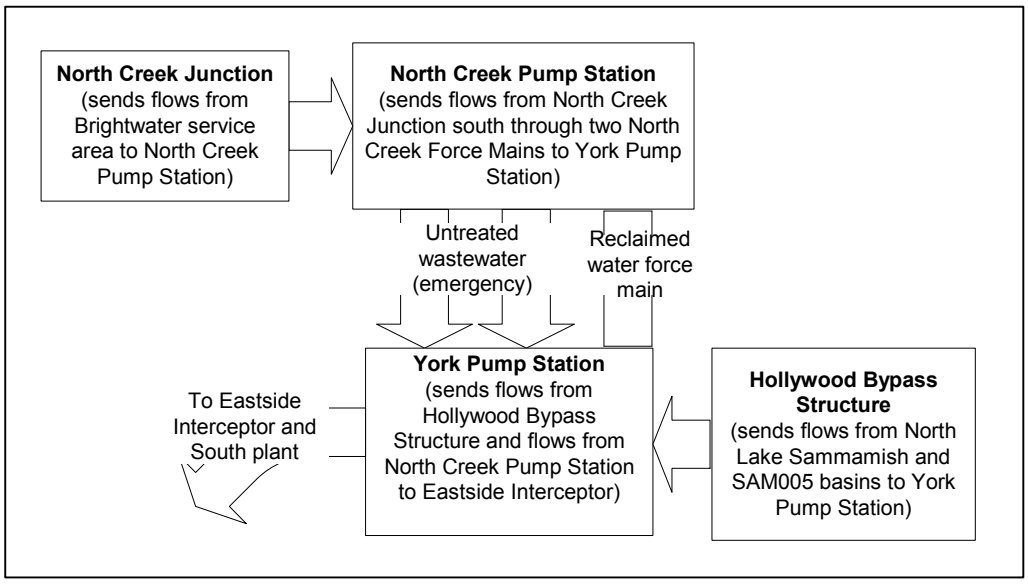


Figure 12. Emergency Flows Through York Pump Station Under Conceptual Working Alternative and New Force Main (2035−2050)

3.1.3 Assumptions and Design Considerations

This section outlines preliminary assumptions and design considerations for the conceptual working alternative.

New Facilities and Control Modifications

- The project would include control modifications—including ability to receive information on downstream conditions in the ESI during emergency pumping from Brightwater—and new piping, valving, and discharge structure for flows being sent to Brightwater. The condition/maintenance history of York Pump Station pumps and systems should be evaluated to determine whether new pumps and/or valves are needed for pumping flows both north and south.
- The conceptual working alternative assumes that equipment and controls to operate Brightwater emergency diversions and reclaimed water distribution are already in place or will be completed as part of the Brightwater project. The North Lake Sammamish Flow Diversion project will coordinate and integrate its design with these and other existing systems.

Flows

The following assumptions apply to flows that would be accommodated by the working conceptual alternative:

- The project area will reach population saturation (buildout) in 2050.
- The population and flow projections for the North Lake Sammamish and SAM005 basins are included in Appendix B. These projections are preliminary. WTD expects to complete updated flow projections by the end of 2013. The projections will be based on 2010 census data, new population forecasts from the Puget Sound Regional Council, updated winter flow data, and updated infiltration/inflow values. Although updated projections are expected to affect only the timing for construction of a new North Creek Force Main, design should allow for a $\pm$20 percent change in peak flow in 2050. Flow projections will be updated again in the early 2020s and 2030s.
- It is uncertain whether the Sammamish Plateau Diversion project will be undertaken. To ensure adequate capacity in case the diversion does occur, the conceptual working alternative assumes that half of SAM005 basin flows will be diverted through the York Pump Station starting in 2020 (see Appendix B).
- The project could be constructed in phases, with provisions for future modifications to accommodate increases in flow volumes. The initial project phase should be completed by around 2021 or sooner to relieve peak flow capacity in ESI Section 1. Although the 20-year peak capacity is expected to be reached in 2017, the initial probability and magnitude of a resultant overflow are anticipated to be low and would incrementally increase slowly for the first few years after 2017.
- It is estimated that 3.3 mgd of the North Lake Sammamish basin AWWF will go through the York Pump Station to the ESI in 2030, increasing to 7.6 mgd by 2040. After Brightwater expansion in 2040, this diversion will no longer be required.

Pipeline Capacities and Constraints

- Whether both North Creek Force Mains have bi-directional flow capability needs to be verified. An engineering analysis should be conducted to confirm that the force mains will be able to withstand the pressure of pumping in both directions. The volume of flow and head conditions will be different for the two pumping directions. The static head of the York Force Mains from the York Pump Station to the ESI is about 140 feet, while the static head of the North Creek Force Mains to the North Creek Pump Station is about 15 feet. (See Appendix C for profiles of the force mains.)
- The assumed capacity of each North Creek force main is 32 mgd, based on an infrequent, short-term, peak velocity of 10 fps. Until 2035, flows from the North Lake Sammamish basin exceeding 45 mgd (32 mgd through the west force main plus 13 mgd through the Hollywood Pump Station) will be pumped to the ESI.

York Pump Station Capacity

- The York Pump Station's assumed firm and peak pumping capacities are 58 mgd and 68 mgd, respectively. These capacities should be field-verified.
- The station will need to maintain its firm capacity of 58 mgd to the ESI after the flow modifications in order to offload the Brightwater system in case of an emergency.
- In addition, the station could receive as much as 36 mgd from the North Creek Pump Station and a 20-year peak flow of greater than 50 mgd from the North Lake Sammamish and SAM005 basins during an emergency, requiring the ability to pump 68 mgd to the ESI for a few hours.
- The North Creek Pump Station must be able to regulate its flow so as not to overwhelm the York Pump Station during the peak of a large storm event.
- Under emergency conditions, York Pump Station operation will need to be switched quickly from pumping north to pumping full capacity to the ESI.

Table 2 shows the York Pump Station capacities required to send flow north to Brightwater for each decade starting in 2020.

Table 2. Required York Pump Station Capacity to Send Flows to Brightwater

	2000	2010	2020	2030	2050
Projected peak 20-year flow (mgd)[a]	33	37	44	50	56
Required capacity (mgd)[b]			31	32[c]	43[d]

[a] Flows are from the North Lake Sammamish basin and, starting in 2020, the Sammamish Plateau Diversion (increases from 3 mgd in 2020 to 5 mgd in 2050).
[b] Assumes that 13 mgd is pumped north through Hollywood Pump Station and that York Pump Station pumps the rest.
[c] In 2030, 3.3 mgd of average wet-weather flow (AWWF) will be pumped through York to the Eastside Interceptor (ESI) to push out the expansion of Brightwater to year 2040. During the peak 20-year event, it is assumed that 5 mgd is pumped to the ESI by York Pump Station in 2030. The AWWF flow transfer to the ESI will increase to 7.6 mgd by 2040, just prior to Brightwater expansion.
[d] Assumes that the additional force main is built to increase capacity for flow north from York Pump Station.

3.2 Parameters for Developing Other Alternatives

As stated earlier, the primary purpose of the conceptual working alternative for the North Lake Sammamish Flow Diversion project is to divert peak flows to Brightwater that are currently sent to the ESI and South plant. The conceptual working alternative would accomplish this through diverting flows above 13 mgd from the North Lake Sammamish basin and from the Sammamish Plateau Diversion (half of SAM005 basin).

Other alternatives may be developed that accomplish the same purpose. Regardless of the alternative, the system changes made as part of the Brightwater project would still occur: (1) diversion of 13 mgd of flows to Brightwater via the Hollywood Pump Station, (2) use the east North Creek Force Main for reclaimed water, and (3) diversion of all flows during an emergency from the Brightwater service area and Hollywood Bypass Structure through the York Pump Station to the ESI.

One possible alternative to the conceptual working alternative is to increase the capacity of the Hollywood Pump Station and the Sammamish Valley Interceptor to convey all North Lake Sammamish basin and Sammamish Plateau Diversion flows to Brightwater via the Woodinville Pump Station and Bothell-Woodinville Interceptor. Because the most recent Hollywood Pump Station upgrade and its current control strategy do not include a future provision to increase pumping capacity, this alternative may not be cost-effective; however, alternatives such as this would be considered. The Hollywood Force Main Discharge Structure and downstream conveyance would also need upgrading if the pumping capacity at Hollywood were to increase. Profiles of the Sammamish Valley and Bothell-Woodinville Interceptors are provided in Appendix C.

Alternatives could be developed that divert flows to Brightwater from other basins that currently send flows to the ESI. To meet project goals, the following 20-year peak flows would need to be diverted:

- 29 mgd by 2017
- 32 mgd by 2035
- 43 mgd by 2050 (buildout)

Project design can incorporate phased implementation to accommodate increasing flows until buildout in 2050.

4.0. REFERENCE DOCUMENTS

King County. 2007. *Conveyance System Improvement Program Update.*

O&M manuals for Brightwater and York and North Creek Pump Stations.

King County. 2009. *Working Draft, Conceptual Requirements and Budget for Modifications to York and North Creek Stations Facilities to Allow Flow Reversal in 2017.* Technical memorandum dated May 29, 2009.

Appendix A—Existing and Design Flows for Conceptual Working Alternative

Flow Segment	Type of Operation	Existing Capacity (mgd)	2010 (Figures 2 & 3)	2012–2020 (Figures 6 & 7) N. Creek Pump Station flows and up to 13 mgd N. Lake Sammamish basin flows diverted from York Pump Station/Eastside Interceptor to Brightwater				2021–2034 (Figures 9 & 10) York Pump Station sends N. Lake Sammamish and half of SAM005 basin flows above 13 mgd north to Brightwater via west N. Creek force main				2035–2050 (Figures 11 & 12) York Pump Station sends N. Lake Sammamish and half of SAM005 basin flows above 13 mgd north to Brightwater through two N. Creek force mains			
			Low to Peak Range (mgd)	Low (mgd)	Average Dry Weather (mgd)	Average Wet Weather (mgd)	Peak 20-Year (mgd)	Low (mgd)	Average Dry Weather (mgd)	Average Wet Weather (mgd)	Peak 20-year (mgd)	Low (mgd)	Average Dry Weather (mgd)	Average Wet Weather (mgd)	Peak 20-year (mgd)
To Hollywood Bypass Structure	Routine		4 – 36	4 – 5		10.4 – 11.4	37 – 42	5 – 6	9.5 – 11.6	11.4 – 14.3	42 – 52	6 – 7	11.6 – 12.9	14.3 – 15.7	52 – 56
Hollywood PS to Brightwater TP	Routine	Limited by Sammamish Valley Interceptor capacity (13 mgd)	4 – 13	4 – 5	8.6 – 9.5	10.4 – 11.4	Limit is 13 mgd	5 – 6	9.5 – 11.6	11.4 – 13	Limit is 13 mgd	6 – 7	11.6 – 12.9	13	Limit is 13 mgd
Hollywood Bypass Structure to York PS	Routine (flows exceeding 13 mgd are sent to York PS)		0 – 37	0	Intermittent during rain events	Intermittent during rain events	24 – 29	0	Intermittent during rain events	Intermittent during rain events	29 – 39	0	Intermittent during rain events	Intermittent during rain events	39 – 43
	Emergency[a]		NA	NA	NA	NA	37 – 42	NA	NA	NA	42 – 52	NA	NA	NA	52 – 56
York PS to Eastside Interceptor	Routine	York PS: 68 mgd peak flow	0 – 64	0	Intermittent during rain events	Intermittent during rain events	24 – 29	0	0	Intermittent during large rain events	0 – 7	0	0	0	0
	Emergency[a]	York PS: 68 mgd peak flow	NA	NA	NA	NA	68 (58 firm)	NA	NA	NA	68 (58 firm)	NA	NA	NA	68 (58 firm)
York PS to Brightwater	Routine	Dual 30" FMs. west North Creek FM capacity is approx. 32 mgd (based on max. velocity of 10 fps)	NA	NA	NA	NA	NA	0	Intermittent during rain events	Intermittent during rain events	29 – 32	0	Intermittent during rain events	Intermittent during rain events	39 – 43
North Creek PS to York PS	Emergency[a]	36	NA	NA	NA	NA	36	NA	NA	NA	36	NA	NA	NA	36

[a] All flows from Brightwater service area are diverted to York Pump Station during emergencies.

Appendix B—Projected Population and Flow in North Lake Sammamish and SAM005 Basins

The Puget Sound Regional Council (PSRC) population forecasts were used for projecting flows in the North Lake Sammamish and SAM005 basins to be diverted north to Brightwater. The Transportation Analysis Zone (TAZ) forecasts in 2003 are the latest being used for King County wastewater projections. Later forecasts based on the larger Forecast Analysis Zones in 2006 did not substantively change the forecasts.

The population forecasts, adjusted based on TAZ forecasts and a GIS analysis of non-vacant parcels in each basin, are shown in Tables A-1 and A-2. Population is projected linearly past the PSRC forecast of 2030 to obtain what is considered a "saturation" value in 2050.

The following flow factors were used to convert population to average base flow projections, also shown in Tables A-1 and A-2:

- Residential population: 60 gallons per capita per day
- Commercial employment: 30 gallons per employee per day
- Industrial employment: 50 gallons per employee per day

These are the same flow factors that were used in King County's *Conveyance System Improvements Program Update* (King County, 2007).

Future average dry and wet weather flows and 5-year and 20-year peak flows, shown in Tables A-3 and A-4, were projected based on calibration of modeling basins done for King County's Infiltration/Inflow (I/I) Control Program in 2000–2005. Peak I/I values are assumed to increase by 7 percent per decade from 2000 through 2040, for a total degradation of 27 percent in areas that were sewered in 2000. Sewers constructed after 2000 are assumed to allow peak I/I to enter pipes at a rate of 1,500 gallons per acre per day. This rate is also assumed to increase at a 7 percent non-compounded rate for four decades. All sewerable area is assumed to be fully sewered by 2050, with 90 percent of the year 2000 unsewered but sewerable area to be sewered by 2030.

Table A-1. Population and Base Flow Projections for North Lake Sammamish Basin Area

Year	Total Area (acres)	Sewered Area	Sewered Residential Population	Commercial Employment	Industrial Employment	Base flow (mgd)
2010	16,954	9,654	76,825	44,271	11,191	6.5
2020	16,954	11,016	90,553	52,925	10,621	7.6
2030	16,954	12,379	100,754	58,898	9,914	8.3
2040	16,954	12,606	110,451	65,925	9,029	9.1
2050	16,954	12,833	119,124	72,696	8,226	9.7

Table A-2. Population and Base Flow Projections for Sammamish Plateau (SAM005) flows to be Diverted North

Year	Total Area (acres)	Sewered Area	Sewered Residential Population	Commercial Employment	Industrial Employment	Base flow (mgd)
2020	2662	1621	7,588	1,540	28	0.5
2030	2662	2212	10,263	1,706	38	0.7
2040	2662	2310	11,934	2,131	46	0.8
2050	2662	2409	13,521	2,478	54	0.9

Table A-3. Flow Projections for the North Lake Sammamish Basin

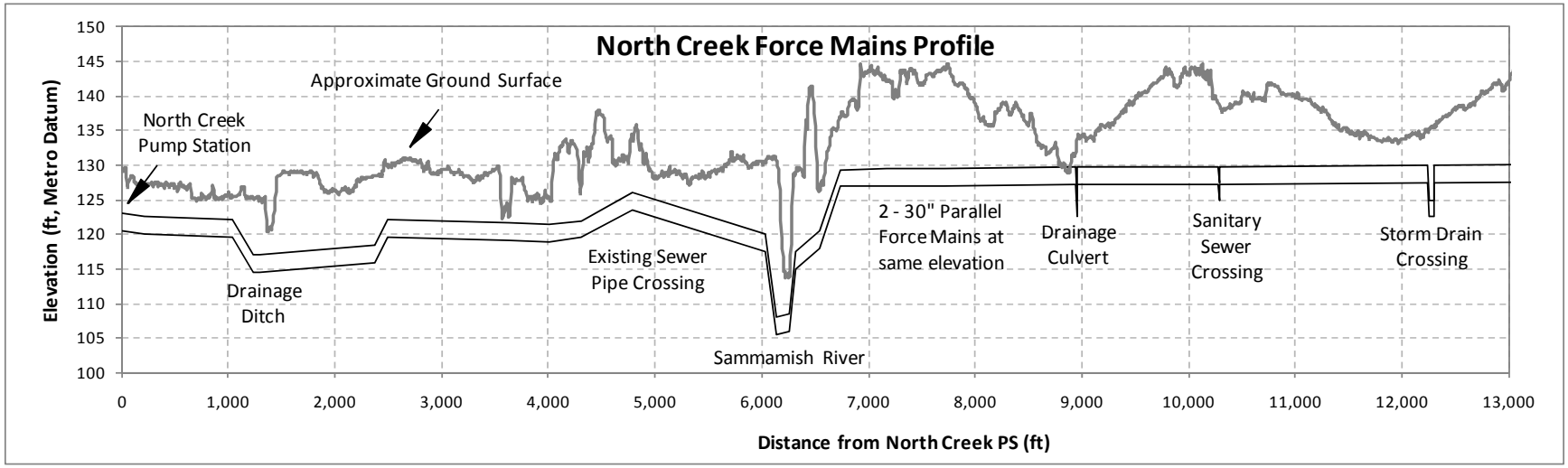
Year	Base flow (mgd)	ADWF (mgd)	AWWF (mgd)	Peak 5-year Flow w/ Sam. Plat. Diversion* (mgd)	Peak 20-year Flow (mgd)	Peak 20-Year Flow w/ Sam. Plat. Diversion* (mgd)
2010	6.5	8.5	10.2	30	37	37
2020	7.6	9.4	12.1	36	41	45
2030	8.3	11.2	13.7	41	47	51
2040	9.1	12.1	14.9	44	50	55
2050	9.7	12.9	15.7	46	51	56

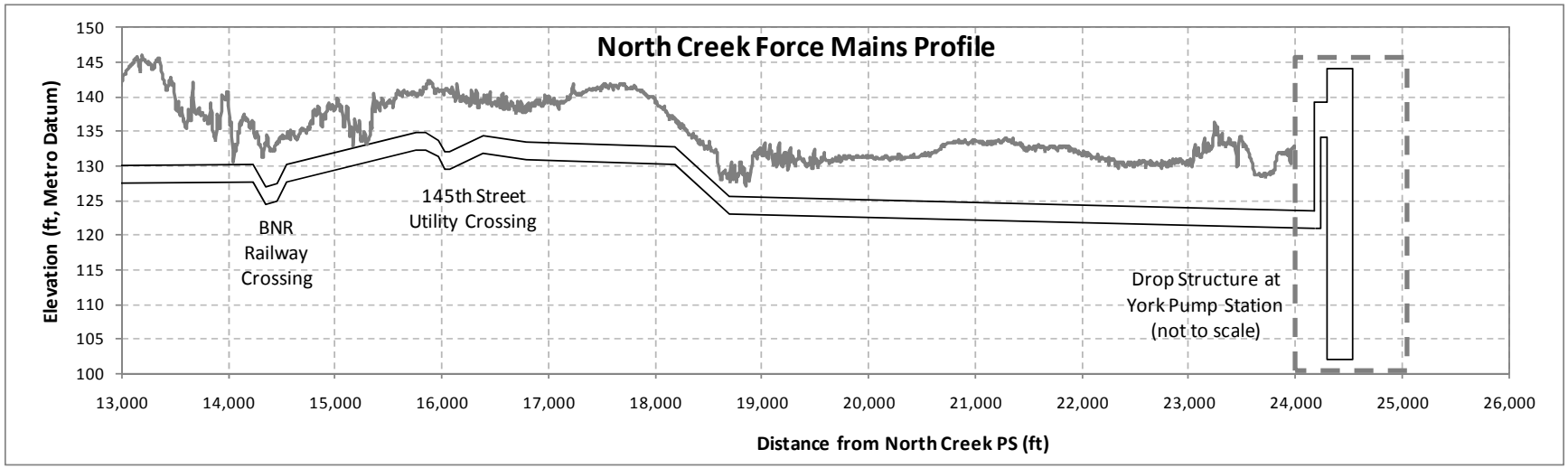
*Sammamish Plateau Diversion is assumed to be constructed by 2020.

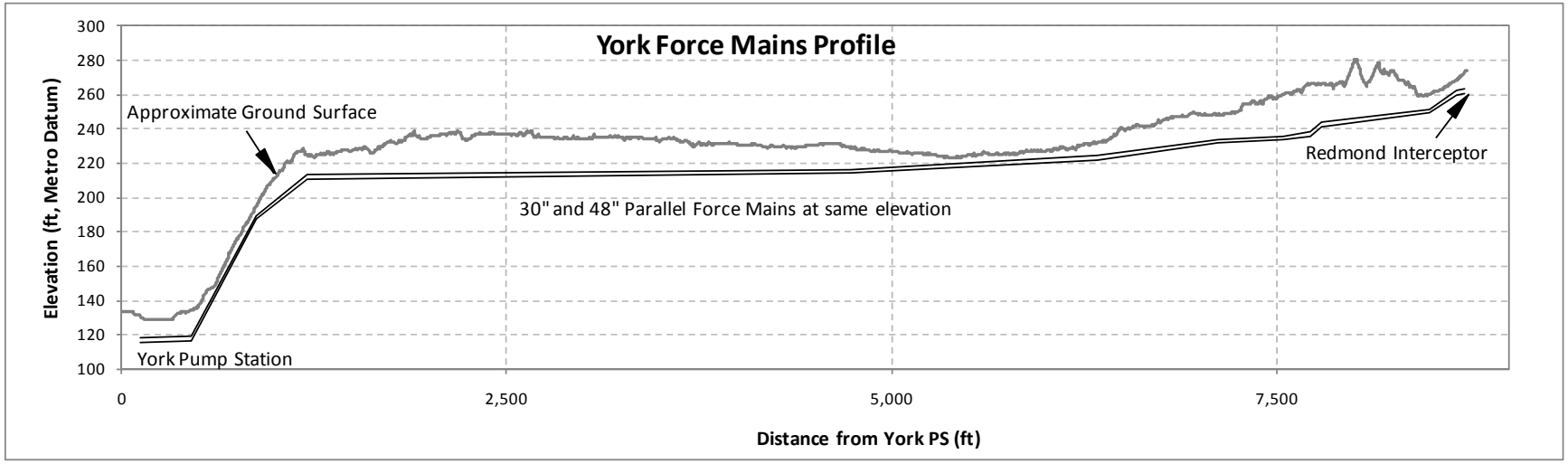
Table A-4. Projected Sammamish Plateau (SAM005) Flows to be Diverted North

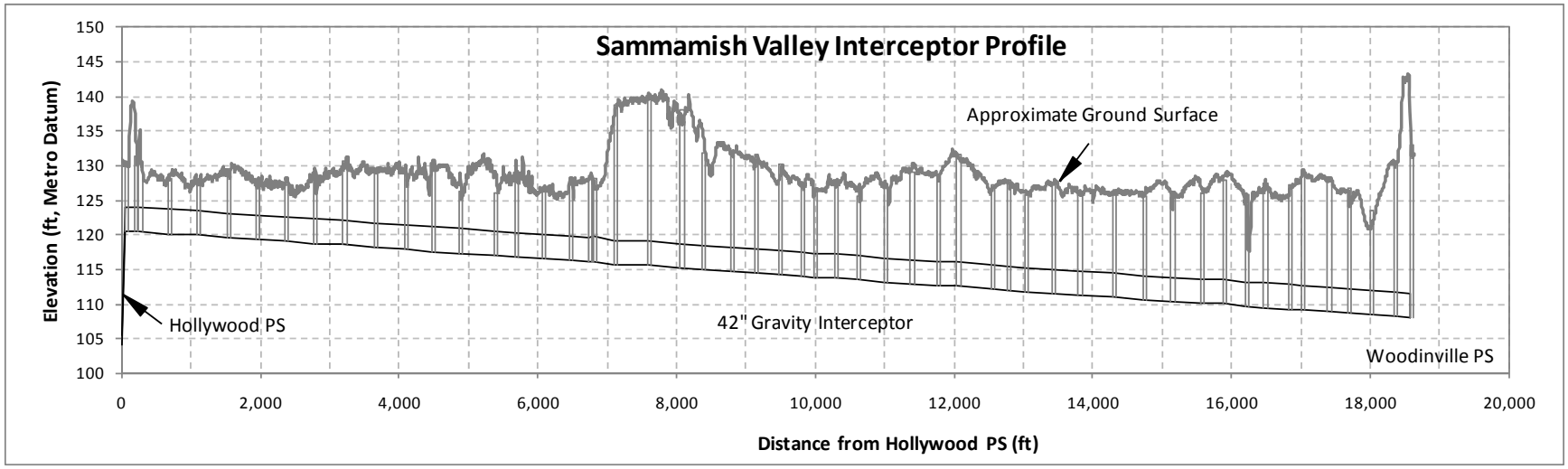
Year	Base Flow (mgd)	ADWF (mgd)	AWWF (mgd)	Peak 5-Year Flow (mgd)	Peak 20-Year Flow (mgd)
2020	0.5	0.9	1.2	2.6	3.1
2030	0.7	1.2	1.6	3.7	4.4
2040	0.8	1.3	1.8	4.1	4.9
2050	0.9	1.5	2.0	4.5	5.4

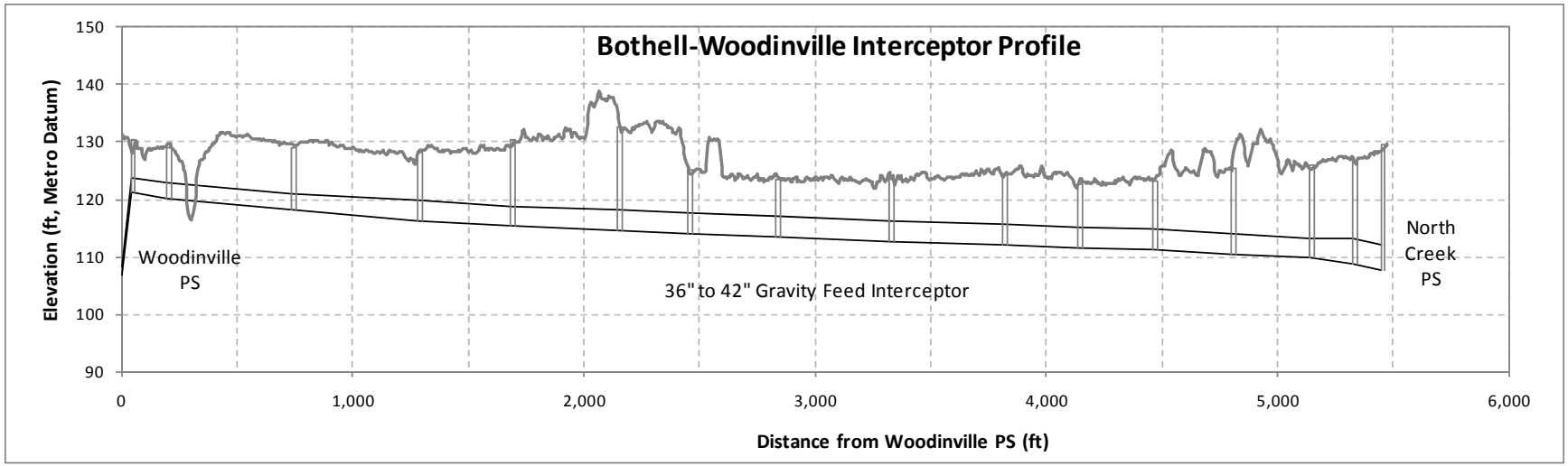
Appendix C—Pipeline Profiles






York Force Mains Profile
Elevation (ft, Metro Datum)
300
280
260
240
220
200
180
160
140
120
100
Approximate Ground Surface
Redmond Interceptor
30" and 48" Parallel Force Mains at same elevation
York Pump Station
0
2,500
5,000
7,500
Distance from York PS (ft)


Sammamish Valley Interceptor Profile
Elevation (ft, Metro Datum)
150
145
140
135
130
125
120
115
110
105
100
Approximate Ground Surface
Hollywood PS
42" Gravity Interceptor
Woodinville PS
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
Distance from Hollywood PS (ft)


Bothell-Woodinville Interceptor Profile
Elevation (ft, Metro Datum)
150
140
130
120
110
100
90
0
1,000
2,000
3,000
4,000
5,000
6,000
Distance from Woodinville PS (ft)
Woodinville PS
36" to 42" Gravity Feed Interceptor
North Creek PS