Appendix H: Groundwater Modeling TM

March 22, 2019

Barbara Zaroff, PE, PMP
Kitsap County Public Works Sewer Utility
216 Prospect St
Port Orchard, WA 98366

Re: Kingston Reclaimed Water Facility Plan – Recharged Water Time-of-Travel Supplemental Information

Project No. 180243

Dear Barbara:

Aspect Consulting, LLC (Aspect) prepared this letter to provide additional information requested by the Washington State Department of Ecology (Ecology) during their review of the "Draft Kingston Reclaimed Water Facility Plan" (Draft FP). During a conference call on February 7, 2019, Ecology requested additional information for the proposed groundwater recharge alternatives, specifically related to travel time and distance between the recharge location and surface water features. The Draft FP included the "Hydrogeologic Site Characterization Report" (Aspect, 2018a) and "Kingston Groundwater Recharge Feasibility Assessment: Groundwater Modeling Report" (Aspect,2018b), that included a range of travel times. The results and recommendations from those reports are summarized in the following sections, as well as a general description of the recharge concepts.

Regulatory Framework

The Draft FP assessed feasibility and preliminary design considerations for treatment system improvements at the Kitsap County Kingston Wastewater Treatment Plant to produce reclaimed water for beneficial use and to decrease reliance on their outfall to Puget Sound. We assume that a reclaimed water permit for the proposed Kingston facility will meet both performance standards (WAC 173-219-330) and use-based requirements (WAC 173-219-390 Table 3) for water quality, similar to the reclaimed water permits for the LOTT Clean Water Alliance Martin Way Reclaimed Water Plant and the associated Hawks Prairie and Woodland Creek groundwater recharge sites (Permit # ST6206), or the City of Quincy's groundwater recharge and irrigation uses (Permit # ST5278).

- The primary beneficial use of reclaimed water from the Kingston facility will be irrigation of White Horse Golf Course (WAC 173-219-390 Table 3, Beneficial Use #2).
  - We assume that the regulatory point of compliance would be at the end of the treatment system for the primary beneficial use of golf course irrigation.
- A secondary beneficial use includes indirect aquifer recharge (WAC 173-219-390 Table 3, Beneficial Use #21) from an engineered infiltration basin. The proposed indirect aquifer recharge alternative has the potential to support increased base flows within the Grover's Creek Watershed.

- We assume that the regulatory point of compliance would be within a groundwater monitoring well network for the secondary beneficial use of indirect aquifer recharge.
- We assume that the indirect aquifer recharge alternative will require that State groundwater and surface water standards (173-200 and 173-218 WAC) are met at a groundwater monitoring point of compliance.

Methodology

The following information is provided to fulfill Ecology's request for additional aquifer travel times and distances to surface water from the proposed recharge basin location. The travel time estimates are advective transport and do not consider any biological or geochemical reactions, nor do they include mixing and dilution. Preliminary estimates of the distance traveled by infiltrated water, the residence time within the groundwater system, and its interactions with surface water were estimated using both a simple analytical model, and a more complex numerical model implemented using the groundwater modeling code MODFLOW (Panday et al., 2017). Both solutions assume only the advective transport of within the groundwater system. Advective transport assumes that infiltrated water does not disperse, mix, or react while traveling through the groundwater system. Advective transport is rare in natural systems, but provides a conservative estimate of residence times and travel distances.

Analytical Model

Initial estimates of time-of-travel were developed using a simple analytical model of advective groundwater transport from the potential infiltration facility to nearby streams under an estimated gradient caused by groundwater mounding at the facility. Travel distances from the potential infiltration facility to nearby streams were estimated as the straight-line distance from the infiltration location to the nearest point along a stream feature (Figure 1). The height of the groundwater mound caused by infiltration was estimated using methods developed in Zomorodi (2005). A range of aquifer hydraulic conductivities was estimated using grain size samples collected during site characterization (Aspect, 2018a). Effective porosity of the aquifer materials was assumed to be 30 percent.

Numerical Model

The numerical model used simulated groundwater level and flow data in conjunction with the particle tracking program mod-PATH3DU (Muffels et al., 2016) to simulate the flow paths and travel times of water infiltrated at the location shown in Figure 1. Simulated groundwater level and flow data for the analysis came from an updated version of groundwater flow model (documented in Aspect, 2018b). The documented groundwater flow model was developed as a comparative model (a model focused on capturing groundwater changes resulting from changing stresses) to provide feasibility-level estimates of groundwater flow, meaning transport estimates based on the flow model should also be viewed as feasibility-level estimates. The updated groundwater flow model resolved issues pertaining to flow within the shallow groundwater system to surface water. Two simulations were run:

- **Simulation 1 – Constant Infiltration**. Estimated the time-of-travel and flow paths of infiltrated water assuming a constant infiltration rate at the facility of 0.5 million gallons per day (MGD).

- **Simulation 2 – Seasonal Infiltration.** Estimated the time-of-travel and flow paths of infiltrated water assuming a seasonal (October through March) infiltration rate of 0.5 MGD.

Analytical particles representing infiltrated water were added to the saturated zone at the potential facility 1 year after the beginning of operation, then tracked over time to their discharge locations. This simulated the travel times once a groundwater mound had developed under the proposed facility. The developed mound condition is assumed to simulate the fastest travel times and provide a conservative estimate of the infiltrated water's residence time in the groundwater system.

Results

This section presents the results of the analytical model and the numerical model. Comparison of the times-of-travel and flow paths are also included. The travel times presented in the following tables do not include transport within the vadose zone, between the infiltration basin and underlying aquifer. Percolation through the vadose zone is estimated at approximately 2 weeks to 1 month. Estimated vadose zone transport is additive to the aquifer transport times noted below.

Analytical Model

The analytical model projects infiltrated water to travel an average of 1,387 feet over 590 days (averages exclude Mainstem Grover's Creek due to its extreme distance) before contacting surface water. Infiltrated water was estimated to reach the nearest surface water feature (a tributary of the westward-flowing stream) 116 days after the infiltrated water enters the saturated zone (Table 1).

Table 1. Time to Surface Water Capture (Analytical Model)

Capture Location	Distance to Stream (ft)	Estimated Groundwater Velocity (ft/d)			Estimated Time-of-Travel (d)		
		Min.	Avg.	Max.	Max.	Avg.	Min.
Mainstem Grover's Creek	6,171	1.00	2.35	5.25	6,171	2,626	1,175
South Fork Grover's Creek	1,694				1,694	721	323
South Fork Grover's Creek tributaries	1,836				1,836	781	350
Westward-flowing stream and tributaries	608				608	259	116
Southern Streams	1,408				1,408	599	268
Average[a]	1,387	NA	NA	NA	1,387	590	264

Notes:
a. Excludes Mainstem Grover's Creek due to its extreme distance
NA. Not applicable.

Numerical Model

Infiltrated water was estimated to first contact surface water bodies approximately 55 days after entering the saturated zone in both numerical simulations (Table 2 and Figure 2). Maximum residence time of infiltrated water in the groundwater system was estimated to be approximately 205 days, though nearly 10 percent of infiltrated water was lost to deeper aquifers (Table 3).

Table 2. Time to Surface Water Capture (Numerical Model)

Elapsed Time (days)[a]	Percent of Infiltration Captured by Surface Water	
	Constant Infiltration	Seasonal Infiltration
0	0%	0%
25	0%	0%
55	44%	41%
85	58%	59%
115	66%	63%
145	79%	74%
175	87%	85%
205	88%	89%
235	91%	90%
265	91%	90%
295	92%	90%
325	92%	91%
355	92%	91%

Notes:
a. Indicates time elapsed since infiltrated water entered the saturated zone.

Infiltrated water was forecast to discharge to three groups of streams. South Fork Grover's Creek and the small tributaries in northern North Kitsap Heritage Park (NKHP) feeding into it were projected to experience the greatest increase in flow (approximately 65 percent in both simulations). The westward-flowing stream to the west of the infiltration location and its tributaries were projected to capture approximately 20 percent of infiltrated water. It is important to note that the model does not project infiltrated water to begin entering the westward-flowing stream's tributaries at their uppermost headwaters, but instead enters near the confluence of the tributaries with the main channel of the westward-flowing stream (as noted on Figure 2). The two modeled streams to the south of the infiltration location were estimated to capture a modest 5 percent of infiltrated water. Mainstem Grover's Creek did not directly receive infiltrated water in either numerical simulation, though South Fork Grover's Creek and the westward-flowing stream are both tributaries to Mainstem Grover's Creek.

Table 3. Capture Locations (Numerical Model)

Capture Location	Percent of Infiltrated Water Captured by Location		Length of Seepage Zones along Streams (ft)
	Constant Infiltration	Seasonal Infiltration	
Mainstem Grover's Creek	0%	0%	0
South Fork Grover's Creek and tributaries	64%	67%	4,539
Westward-flowing stream and tributaries	21%	19%	4,335
Southern Streams	5%	4%	1,307
Deeper Aquifers	10%	10%	NA

Notes:
NA. Not applicable.

Infiltrated water was projected to seep into streams along segments totaling 10,181 feet. No new seepage zones along streams were expected to develop. Instead infiltrated water augmenting seepage flows along existing segments, though these estimates depend heavily on actual stream geometry.

Data Gaps and Uncertainty

The times-of-travel and capture locations presented in the above tables are preliminary analyses developed for feasibility-level discussion. Additional field data collection and site testing were recommended in both Aspect (2018a and 2018b). We anticipate this additional information will be collected during detailed design of the Kingston Facility and additional documents will be developed to satisfy the documentation requirements listed in Table 5-4 of the "Purple Book."

- Testing locations within NKHP were not accessible during the preliminary site characterization. Test borings and groundwater monitoring wells to the north of the proposed infiltration basin and within NKHP are recommended.
- Stream channel data for the Grover's Creek system within the groundwater flow model remains consistent with the generalizations developed by the U.S. Geological Survey for publication of the regional flow model and could be refined to watershed-specific characteristics.
- Estimated travel times reflect only the time-of-travel once infiltrated water has entered the saturated zone and does not include time spent traveling from the surface downwards to the water table.

Conclusions and Recommendations

The proposed Kingston Reclaimed Water Facility directly supports Ecology's Puget Sound nutrient removal initiative (Ecology, 2019) by minimizing the use of the existing wastewater outfall to Puget Sound. The proposed indirect aquifer recharge alternative has the potential to increase base flows for approximately 2 miles of tributary reaches within the Grover's Creek Watershed, directly supporting the WRIA 15 Watershed Restoration Act goals by enhancing a system that currently fails to meet seasonal instream flow requirements.

Drilling and geologic sampling, infiltration testing, and groundwater monitoring well installations provided the basis of design for the indirect aquifer recharge system described in the Draft FP, but additional site testing is needed to support final system design and permitting. Vadose zone transport is estimated at 2 weeks to 1 month between the proposed infiltration basin and the groundwater table. Within the groundwater system, the travel time to surface water is estimated to range from approximately 55 days to more than one year, with the potential to increase baseflow to approximately 2 miles of tributary reaches within the Grover's Creek Watershed.

While further study is needed to refine the groundwater travel time estimates, we assume that the proposed Kingston Reclaimed Water Facility will meet both performance standards (WAC 173-219-330) and use-based water quality requirements (WAC 173-219-390 Table 3) for the primary beneficial use of irrigation (Table 3, Beneficial Use #2) at WHGC and a secondary beneficial use of indirect aquifer recharge (Table 3, Beneficial Use #21). We assume that groundwater points of compliance will be established to monitor for water quality between the proposed infiltration basin and nearby tributaries that originate within WHGC and NKHP.

To confirm the assumptions made during the feasibility study for the Draft FP, we recommend the following tasks, particularly within NKHP in the vicinity of tributaries expected to receive increased baseflows:

- Test drilling and monitoring well construction within NKHP.
- An aquifer pumping test after completion of an expanded groundwater monitoring network.
- Contacting the WRIA 15 Planning Committee with a description of the project for consideration in the 2019 watershed restoration planning effort. Listing the project in WRIA 15 planning documents as a watershed enhancement opportunity could provide another source of funding or partnerships to accomplish the project goals.

References

Aspect Consulting, LLC (Aspect), 2018a, Hydrogeologic Site Characterization Report, Kingston Reclaimed Water Infiltration Alternatives, Kitsap County, WA, Prepared for Kitsap County Wastewater Utility and the Suquamish Tribe, August 15, 2018 Draft.

Aspect Consulting, LLC (Aspect), 2018b, Kingston Groundwater Recharge Feasibility Assessment: Groundwater Modeling Report, Kitsap County, WA, Prepared for Kitsap County Wastewater Utility and the Suquamish Tribe, October 18, 2018 Draft.

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Ecology, 2019, Response to Petition for Rulemaking to Adopt a Presumptive Definition of "AKART" as Tertiary Treatment for Municipal Sewage Discharges to Puget Sound and its Tributaries, Letter from Maia Bellon to Nina Bell, January 11, 2019.

Muffels, C., Tonkin, M., Ramadhan, M., Wang, X., Neville, C., and J. Craig, 2016, mod-PATH3DU version 1.1.0: A groundwater path and travel-time simulator, S.S. Papadapulos and Associates and University of Waterloo, Bethesda, MD and Waterloo, Canada, September.

Panday, S., C.D. Langevin, R.G. Niswonger, M. Ibaraki, and J.D. Hughes, 2017, MODFLOW-USG version 1.4.00: An unstructured version of MODFLOW for simulating groundwater flow and tightly coupled processes using a control volume finite-difference formulation, U.S. Geological Survey Software Release, October 27, 2017.

Zomorodi, K., 2005, Simplified Solutions for Groundwater Mounding Under Stormwater Infiltration Facilities, AWRA Annual Water Resources Conference, Seattle.

Limitations

Work for this project was performed for the Kitsap County Public Works Sewer Utility (Client), and this letter was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This letter does not represent a legal opinion. No other warranty, expressed or implied, is made.

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Sincerely,

Aspect consulting, LLC

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Attachments: Figure 1 – Streams in the Study Area
Figure 2 – Preliminary Travel Times

cc: Tadd Geisbrecht, PE, Brown and Caldwell
Bob Gatz, PE, Suquamish Tribe

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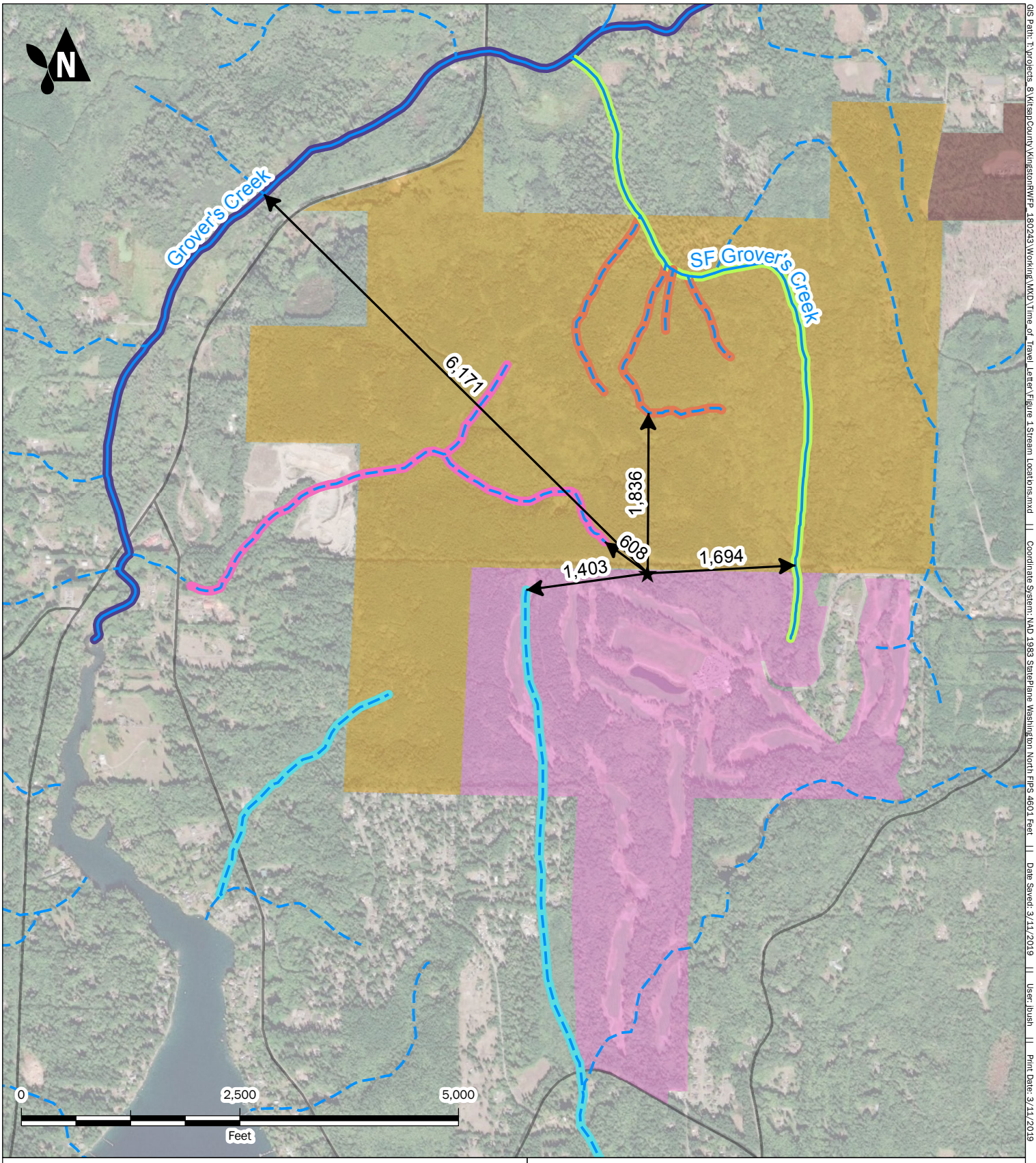


NAME

- Proposed Infiltration Site
- White Horse Golf Course
- North Kitsap Heritage Park

Streams

- Perennial
- Intermittent

- Distance to Stream (feet)

Zone

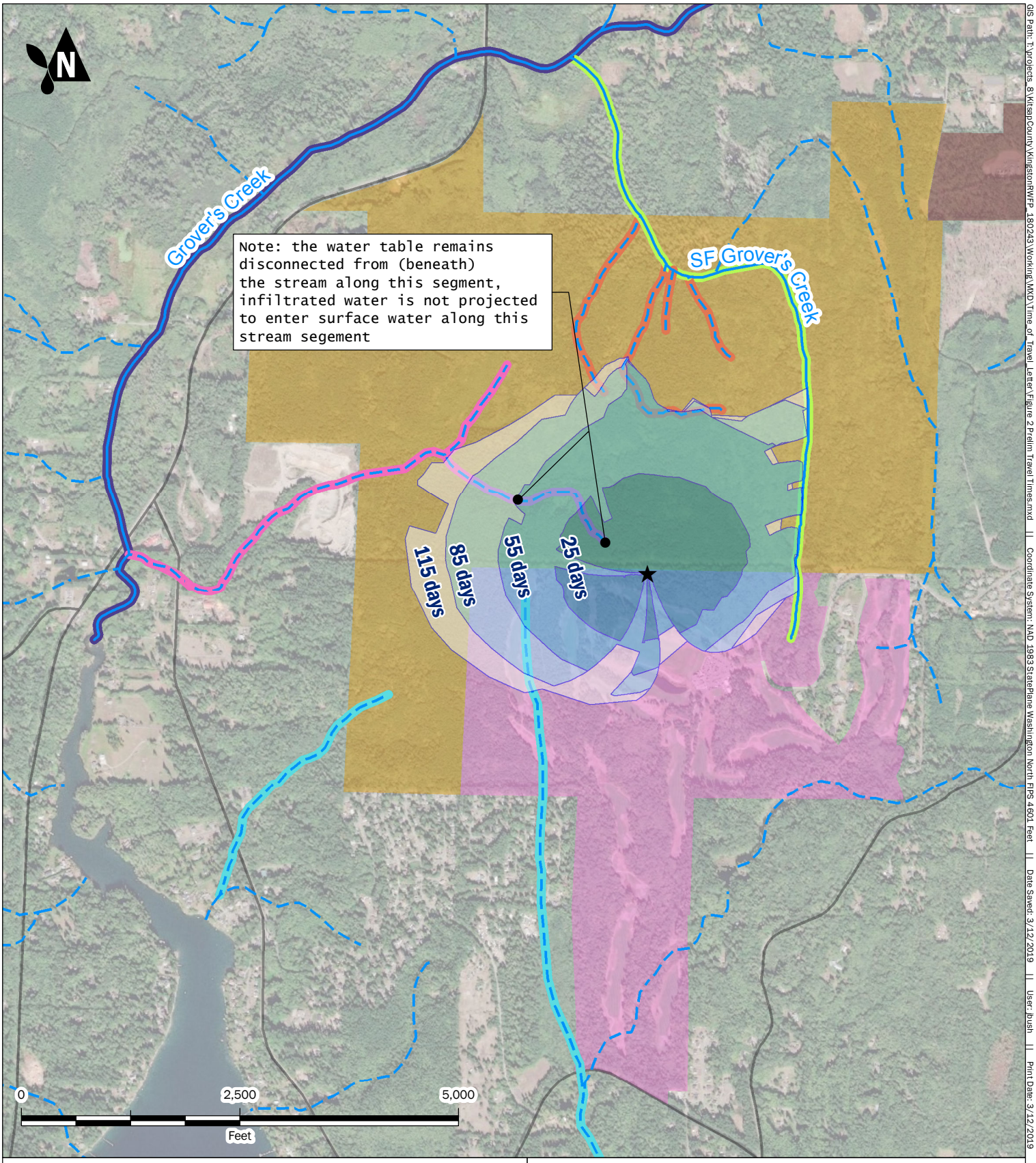
- Mainstem Grover's Creek
- South Fork Grover's Creek
- South Fork Grover's Creek Tributaries
- Southern Streams
- Westward-flowing stream

Streams in the Study Area

Time of Travel Letter
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	MAR-2019	BY: JB / ---	FIGURE NO. 1
	PROJECT NO. 180243	REVISED BY: ---	

GIS Path: T:\projects_8\KitsapCounty\KingstonRWFP_180243\Working\MXD\Time of Travel Letter\Figure 1 Stream Locations.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 3/11/2019 || User: jbush || Print Date: 3/11/2019



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Preliminary Travel Times

Time of Travel Letter
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	MAR-2019	BY: JB / ---	FIGURE NO. 2
	PROJECT NO. 180243	REVISED BY: ---	

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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KINGSTON GROUNDWATER RECHARGE FEASIBILITY ASSESSMENT

Groundwater Modeling Report

Prepared for: Kitsap County Sewer Utility and the Suquamish Tribe, under contract agreement with Brown and Caldwell

Project No. 180243 • October 18, 2018 Final

Aspect CONSULTING

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KINGSTON GROUNDWATER RECHARGE FEASIBILITY ASSESSMENT

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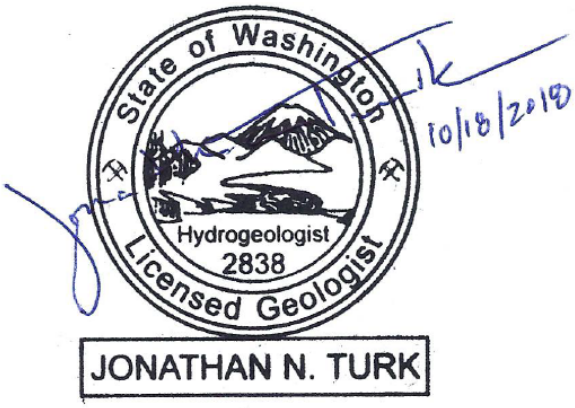
Aspect Consulting, LLC



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Executive Summary

To assess the feasibility of groundwater recharge and streamflow augmentation, Brown and Caldwell and Aspect Consulting, LLC (Aspect) completed site-specific testing and groundwater modeling for Kitsap County Sewer Utility. This report summarizes the adaptation of the 2016 U.S. Geological Survey (USGS) regional MODFLOW model to simulate the hydraulic effects of induced groundwater recharge from the proposed Kingston reclaimed water system. Results of the hydrogeologic characterization demonstrate that groundwater recharge and streamflow augmentation is feasible, and risks to local and regional drinking water supplies are minimal. The simulation results confirmed these assumptions and provide estimates of the groundwater flow paths and contributions to the Grover's Creek watershed.

After adapting the USGS model for project-specific purposes, the model was used to simulate a baseline scenario and two proposed groundwater recharge scenarios:

1. Baseline of no groundwater recharge
2. Seasonal groundwater recharge, outside of the irrigation season
3. Year-round groundwater recharge

Results from these simulations suggest that both scenarios result in net increases in baseflow within the Grover's Creek watershed, and that the magnitude and location of the increases in baseflow may be optimized based on the location of the proposed recharge basins.

Year-round recharge of reclaimed water at the proposed location resulted in simulated streamflow increases of up to 18 percent at Grover's Creek mouth and 43 percent in South Fork Grover's Creek. Seasonal recharge resulted in simulated increases of up to 17 percent at Grover's Creek mouth and 26 percent in South Fork Grover's Creek. These results appear to be biased low compared to site conditions, suggesting that greater streamflow gains may be achieved than predicted by the model. Additionally, the model suggests that only one drinking water well will begin to intercept the recharge water after a period of approximately 30 years. No domestic wells were shown to have any potential of capturing the recharge water.

Supplemental recharge to the regional drinking water aquifer was considered a project benefit during preliminary planning. However, the benefit was dropped from consideration after developing the conceptual hydrogeologic model for the site that assumed little or no flow would migrate through the clay confining unit beneath the project area. Following the conceptual model, the recharge would spread horizontally until discharging as baseflow to the watershed. The numerical modeling results document a strong downward vertical gradient simulated by the calibrated USGS model. The simulated downward gradient contradicts local observations of the system and appears to be an artificial gradient forced during the original model calibration process.

1 Introduction

Brown and Caldwell (BC) was retained by Kitsap County to develop a facility plan and supporting documentation for new recycled water facilities associated with the Kingston Wastewater Treatment Plant. Potential recycled water uses from the project include golf-course irrigation and groundwater recharge, resulting in indirect streamflow augmentation. To assess the site infiltration capacity and feasibility of watershed augmentation, the project included site characterization and groundwater modeling tasks. These tasks were initiated by BC and completed by the same project staff later under subcontract with Aspect Consulting, LLC (Aspect). This report summarizes the results of the groundwater modeling tasks.

To assess the feasibility of groundwater recharge and streamflow augmentation, site-specific testing—including shallow test pits and infiltration testing, and test drilling and installation of a groundwater monitoring system—provided hydrogeologic data supporting system design and simulation modeling work.

The project activities and results summarized herein were developed for use in assessing the feasibility of recycled water recharge to a shallow aquifer system for baseflow augmentation in the Grover's Creek Watershed. Deeper aquifer units and bedrock boundary conditions were not assessed during site characterization activities and were assumed to be adequately represented by regional data within the existing U.S. Geological Survey (USGS) model for the scale and scope of this project.

1.1 Purpose and Scope

This modeling study was undertaken as part of facility planning for Kitsap County's Kingston Wastewater Treatment Plant (WWTP) to assess the feasibility and environmental benefits of groundwater recharge using recycled water near boundary between the Suquamish Tribe's White Horse Golf Course (WHGC) and North Kitsap Heritage Park (NKHP) (Figure 1-1). This report draws upon and complements the "Hydrogeologic Site Characterization" Report (Aspect, 2018a), which describes background data collection, field data collection and analysis, and development of a conceptual hydrogeologic model (CHM) of the study area. Elements contained within this report include:

- Definition of the model objectives
- Description of the model design
- Documentation of model results
- Explanation of model uncertainty
- Discussion of the implications for infiltration feasibility

1.2 Previous Investigations

The groundwater modeling tasks are based on the previous work of the USGS and the U.S. Bureau of Reclamation (USBR), summarized in:

Johnson, J. and K. Didricksen, 2009a, Simulation of Groundwater Flow System at Port Madison Indian Reservation and Vicinity, Kitsap County, Washington; **and** ***Johnson, J. and K. Didricksen, 2009b, Addendum to the Report: Simulation of Groundwater Flow System at Port Madison Indian Reservation and Vicinity, Kitsap County, Washington.*** Provides the conceptual hydrogeologic framework and completed groundwater flow model (MODFLOW) of the Port Madison Indian Reservation and vicinity, which includes much of the current project area. The Port Madison Indian Reservation model was used to simulate reduced precipitation, increased municipal pumping, and managed aquifer recharge into the Vashon advance outwash aquifer at a location to the west of Suquamish, Washington (approximately 4 miles southwest of the Kitsap County study area described by this report).

Welch, W.B., L.M. Frans, and T.D. Olsen, 2014, Hydrogeologic Framework, Groundwater Movement, and Water Budget of the Kitsap Peninsula. Provides the framework, data, and updated conceptual and analytical models of the hydrogeologic conditions throughout Kitsap County.

Frans, L.M. and T.D. Olson, 2016, Numerical Simulation of the Groundwater-flow System of the Kitsap Peninsula, West-Central Washington. Provides the completed groundwater flow model (MODFLOW), based on a period of record of 1985-2012, with annual stress periods from 1985-2004 and monthly stress periods from 2005 to 2012.

In addition to the USGS model files and reports, the model was updated based on site characterization activities summarized in the "Hydrogeologic Site Characterization" Report (Aspect, 2018a).

1.3 Description of the Study Area

The project area is located in northern Kitsap County (Water Resources Inventory Area [WRIA] 15), within the Grover's Creek Watershed. This area is within the Hansville-Indianola Subarea, the northernmost subarea described in the Kitsap County Ground Water Management Plan (GWMP; Kitsap County Ground Water Advisory Committee [GWAC], 1989 and 1991). The general area identified for infiltration is shown on Figure 1-1 and is surrounded by North Kitsap Heritage Park (NKHP to the north and WHGC to the south. The proposed infiltration area is on a topographic high; an east-west-oriented ridgeline with the northern and eastern sides grading into the deeply incised tributary channels of the Grover's Creek system (Figure 1-2) and sloping to the south across the WHGC. The western edge of the ridge terminates at the Arness aggregate mine and the main channel of Grover's Creek. Grover's Creek is the primary drainage system.

The regional hydrogeologic conditions are assumed to be consistent with those developed by the USGS (Welch et al, 2014 and Frans and Olsen, 2016), with the exception of additional details within the project study area. Desktop analyses and site-specific drilling and testing identified a shallow unconfined aquifer system beneath the topographic high in the area near the boundary between NKHP and WHGC. This shallow system lies

within the limited aerial extent of an upper glacial outwash sequence of fine sand and is underlain by a lower confining unit, discontinuous Permeable Interbeds, and the deeper regional Sea Level Aquifer. Based on the results of the desktop work, confirmed with on-site testing, the shallow unconfined system's primary discharge is base flow to the southeastern region of the Grover's Creek Watershed.

Site reconnaissance activities were completed by the project team and stakeholders to confirm proposed field testing locations. Site tours were facilitated through the County and Suquamish Tribe, NKHP, WHGC, and the Arness aggregate mine, and confirmed the presence of outwash sands at ground surface throughout the upland areas. Ecology's well log database was used to identify 223 wells within the vicinity of the project that were georeferenced for location and elevation (Figure 1-3). Additional borings and test pits installed in 2018 by BC during hydrogeologic site characterization (Aspect, 2018a) were added to the well database following completion of the preliminary desktop analyses that compared the GIS, well log, and MODFLOW model data to assist with fieldwork planning and documentation of initial project assumptions.

2 Numerical Simulation of the Groundwater Flow System

The Frans and Olsen (2016) model was adapted to meet project objectives through implementation of an unstructured grid (USG) approach, adding important local hydraulic features left out of the USGS' county-wide model, and adjusting model properties to more closely simulate hydraulic data gathered during the hydrogeologic characterization (Aspect, 2018b). USGs are a relatively new development within the MODFLOW code that allows refinement of discrete area of the finite difference (model) grid. This ability was used to refine and update the model grid in the study area while maintaining the features and properties of the USGS model outside of the refinement zone.

Implementing the unstructured grid approach required porting the Frans and Olsen, 2016 model from MODFLOW-NWT (Niswonger, Panday, and Ibaraki, 2011) to MODFLOW-USG (Panday et al., 2017).

2.1 Model Grid and Layering

The original 2016 MODFLOW model grid covered the entire Kitsap Peninsula and included 14 model layers used to represent the vertical layering of the regional hydrogeologic system (Table 2-1).

Table 2-1. Hydrostratigraphy (reproduced from Frans and Olsen, 2016)

Table 4. Hydrogeologic unit labels and terminology used in groundwater studies of the Kitsap Peninsula, west-central Washington.

[–, not defined]

Sceva, 1957 (Kitsap County)	Garling and others, 1965 (Kitsap Peninsula)	Dion and others, 1988 (Bainbridge Island)	Kitsap County Groundwater Advisory Committee and others, 1991 (Kitsap County)	Kato and Warren, Inc., and Robinson and Noble, Inc., 2000 (Bainbridge Island)	This study	Number of wells used to determine extent and thickness of unit
Alluvium	Alluvium	1	Qn1, alluvium and recessional deposits	Qvr, Shallow aquifer	Qvr, Vashon recessional aquifer	215
A, recessional outwash	Qvr, recessional outwash					
B, till	Qvt, till	2	Qg1, till	Qvt	Qvt, Vashon till confining unit	1,568
C, advance outwash	Qva, advance outwash	3	Qg1a, advance outwash/shallow aquifer	PA, perched aquifer system	Qva, Vashon advance aquifer	1,480
D, Puyallup sand	Qc, Colvos sand					
–	–	4	Qn2, 1st nonglacial deposits	C1, upper confining unit	QC1, Upper confining unit	1,368
			Qg2, 2nd glacial deposits	SPA, semi-perched aquifer system	QC1pi, Permeable interbeds	143
E, Kitsap Clay member	Qg/Qk, unnamed gravel/Kitsap formation		Qn3, 2nd nonglacial deposits	C2, lower confining unit	QC1, Upper confining unit	78
F, Orting gravel member	Qss, Salmon Springs (?) Drift	5	Qg3, 3rd glacial deposits/sea-level aquifer	SLA, sea level aquifer	QA1, Sea-level aquifer	1,109
–	Qpu, pre-Salmon Springs (?) deposits	6	Qn4, 3rd nonglacial deposits	C3, confining unit	QC2, Middle confining unit	387
		Pleistocene deposits (undifferentiated)	Qg4, 4th glacial deposits/deep aquifer; Qg4m marine glaciomarine deposits	GMA, glaciomarine aquifer system	QA2, Glacio-marine aquifer	289
G, Admiralty drift			Qn5, 4th nonglacial deposits	C4, confining unit	QC3, Lower confining unit	115
Pre-Orting deposits, undifferentiated			Qg5, 5th glacial deposits	FBA, Fletcher Bay Aquifer	QA3, Deep aquifer	69
			Qn6, ancient nonglacial deposits	C5, confining unit	QC4, Basal confining unit	29
Tertiary Blakeley Formation of Weaver, 1916	Tertiary Blakeley Formation of Weaver, 1916	Tertiary Blakeley Formation of Weaver, 1916	Tertiary Blakeley Formation of Weaver, 1916	Blakeley Harbor Formation of Fulmer, 1975	BR, Bedrock	46
				Blakeley Formation of Fulmer, 1975		

The 2016 model grid was modified in three ways to better meet model objectives:

1. The model domain was subset to only include the northernmost portion of the Kitsap Peninsula (Figure 2-1). Areas predicted by the USGS to have minimal influence on water levels and flows in the study area were removed from the simulation to allow for model refinement while maintaining manageable file sizes and processing times.
2. A nested grid (a smaller model grid within the original model grid) was established in Layers 1 through 4 covering the proposed location of the percolation basins, Grover's Creek, and their vicinity (Figure 2-2). Cell sizes within the nested grid are 50 feet by 50 feet and interface directly with 500-foot by 500-foot cells within the USGS grid.
3. Ground surface elevations, layer elevations, and layer thicknesses in and immediately surrounding the nested grid were updated to reflect conditions observed during detailed review of existing well logs as well as site characterization and testing results.

2.2 Temporal Discretization

Temporal discretization in the project MODFLOW-USG model is consistent with the original USGS model and includes:

- A simulation period from January 1985 to December 2012
- 117 stress periods to represent temporal changes in the model water budget:
  - An initial stress period of steady-state conditions
  - 20 1-year stress periods from 1985 through 2004, used to develop initial conditions
  - 24 monthly stress periods from January 2005 through December 2006, used as a transition into the calibration period
  - 72 monthly stress periods from January 2007 through December 2012, used as the calibration period for the model

2.3 Boundary Conditions

Outside of the nested grid, the boundary conditions remain consistent with the original USGS model. Within the nested grid, initial model updates were made to the model's recharge, drain, and streamflow routing packages to provide a framework for simulation modeling. After reviewing the results of initial test simulations, strong simulated vertical gradients were observed throughout the model domain. The magnitude of the vertical gradients decreased with additional drain boundaries (see Section 2.3.1.2) and stream boundaries (see Section 2.3.1.3). Model boundary conditions are mapped on Figure 2-3.

2.3.1 Head-Dependent Flux Boundaries

Head-dependent flux boundaries add or remove water in response to the head gradient between the boundary cell and adjacent cells. Surface water features and seeps were modeled as head-dependent flux conditions.

2.3.1.1 General Head Boundaries

General Head Boundaries are head-dependent flux boundaries that occupy cells within the model grid and operate similar to other head-dependent flux packages. General Head Boundaries in this model and the USGS model are used to simulate Puget Sound. Flux from the General Head Boundary cell into adjacent cells is calculated as the difference in head between the boundary cell and the adjacent cell multiplied by the conductance of the boundary cell. No changes from the USGS model were made to General Head Boundary locations or properties during the construction of this model.

2.3.1.2 Drain Boundaries

Seeps were simulated using the Drain Package (DRN). Drain boundaries were located along shorelines to simulate springs and groundwater seeps in coastal bluffs, and in areas where low hydraulic conductivity units outcrop at the surface to simulate overland flow of recharge to nearby streams. All drain cells were retained, unmodified, from the USGS model. Additional drains were placed near the mouth of Grover's Creek, as refinement of the hydrostratigraphy in that location indicated a low hydraulic conductivity unit (QC1) at the surface.

The DRN specifies head-dependent fluxes through the tops of cells where it is active. Unlike the General Head Boundary Package, water may flow only from the cell into the boundary and out of the model domain. The flux into the boundary is calculated in the same manner as for the General Head Boundary Package except the flux is equal to the difference between a specified drain elevation and the head in the cell multiplied by the conductance of the boundary. The drain elevation simulates the elevation at which water exits the model domain and was specified as the LiDAR-derived ground surface elevation at the drain location. Conductances for drain boundaries were set arbitrarily high (1,000,000 cubic feet per day [ft^3/day]) to allow the hydraulic properties of the cell to limit flux following the methods described by Anderson, Woessner, and Hunt (2015).

2.3.1.3 Streamflow Routing Boundaries

Flowing surface water bodies, such as rivers and streams, were simulated using the MODFLOW Streamflow Routing Package (SFR). The SFR combines a head-dependent boundary with a simple stream budgeting model. The head-dependent boundary portion of the package simulates the interaction of the stream system with the groundwater system, using head and conductance similar to other head-dependent boundaries. SFR's sophistication comes from the surface water model portion of the package. In contrast to simpler boundaries, where flow to and from the boundary completely enters or exits the simulation, SFR tracks the movement of flow downstream within the boundary. The package achieves this by using the calculated flow from groundwater as the groundwater flux term in a simple streamflow model at each boundary cell.

The SFR package for this model was heavily modified from the SFR package of USGS to match the refined conceptual hydrogeologic model of the study area and to accommodate additional surface water features not present at the scale of the USGS model. Changes to the SFR package included adding small streams along the northern and western edges of NKHP and WHGC, as well as repositioning stream features within the refined grid to more closely match their actual locations. The changes added surface water features that were recognized to provide flow to Grover's Creek from the NHKP/WHGC area (Aspect,

2018b) and because the refined grid allowed the model to simulate groundwater-surface water interactions at a more appropriate scale compared to the USGS model.

2.3.2 Specified-Flux Boundaries

Specified flux boundaries are cells that are instructed to add water to or remove water from the groundwater system at constant rates independent of other model conditions. Recharge from precipitation was modeled as a specified flux in the simulation.

2.3.2.1 Recharge

Recharge from precipitation and human sources, such as irrigation and septic system return flows, was simulated using the MODFLOW Recharge Package (RCH). Recharge was simulated as a specified flux into the cell occupying the highest active model layer. Recharge values from the USGS model were carried over directly into this model without modification, except in the predictive scenarios.

The Recharge Package was modified for the predictive scenarios to include the proposed infiltration. The recharge values at cells directly beneath the proposed infiltration basin was increased to include 0.5 million gallons per day (MGD) distributed evenly across the basin area. For the continuous (year-round) infiltration scenario, the additional 0.5 MGD was initiated after the lead-in period and maintained for the remainder of the simulation. For the seasonal infiltration scenario, the additional 0.5 MGD was applied from October through March of each year following the lead-in period. No additional recharge was applied from April through September.

2.3.2.2 Wells

Groundwater withdrawals by wells were simulated using the MODFLOW Well Package (WEL). The WEL package removes a constant flux from the model cell or cells from which the well draws water. The USGS WEL package was implemented without modification in this model.

2.3.2.3 No-flow Boundaries

A special type of specified flux boundary, called a no-flow boundary, was used to simulate impermeable boundaries. As the name implies, no-flow boundaries allow no water to pass into or through them. Examples of no-flow boundaries include bedrock and groundwater divides. Where no-flow boundaries occur within the model domain, such as at the flow divides in Puget Sound or at the western model edge, no-flow conditions are explicitly simulated using no-flow boundary cells located in the model domain. No-flow conditions located outside of, yet still acting on, the modeled system are simulated implicitly. Implicit no-flow boundaries occur along the edges and bottom of the model domain instead of occupying cells within the domain.

Additional no-flow boundary cells were added to the model to remove model cells outside the study area from the simulation. Cells converted to no-flow cells were simulated to occur past groundwater divides by the USGS model, and so were expected to have minimal impact on simulated groundwater levels and flows in the study area.

2.4 Initial and Modified Hydraulic Properties

Initial model properties were held consistent with the USGS model. Following initial model runs, the vertical hydraulic conductivity of Layer 4 (the Upper Confining Unit) was reduced by a factor of ten throughout the model domain. This change was implemented due to the unrealistically quick movement of water through the confining unit. The reduced hydraulic conductivity produced more realistic movement of water through the confining unit. The site hydrogeologic characterization, as well as the groundwater modeling from Johnson and Didricksen (2009a), provide supporting documentation for lowering the hydraulic conductivity of Layer 4.

3 Model Calibration

The USGS model was built using regional data and for the period of record from 1985 to 2005 using average annual conditions, followed by monthly conditions from January 2006 to December 2012 to which the model was calibrated to seasonal variations.

The introduction of model updates to match site hydrogeologic conditions within the nested grid resulted in changes to the regional flow system beyond the nested grid that affect overall model calibration. Based on these effects, the model calibration is assumed to be a function of the extent of the differences between the on-site observations and the regional model assumptions. This approach results in a lower overall fitness of the original model calibration data near the outside of the nested grid, and a better fitness of the model results to site specific data within the nested grid.

4 Model Limitations

The modeling approach assumes that the recharge water meets Washington State Department of Ecology (Ecology) water quality standards for Class A reclaimed water suitable for groundwater recharge as defined in Chapter 173-219 WAC and Chapter 90.46 RCW. To assess the fate and transport of recharged recycled water, conservative particle tracing was used to estimate advective groundwater velocities and flow fields beneath the proposed recharge area.

The model was developed as part of the feasibility assessment for the Kingston recycled water project. The model was used to assess the site hydrogeologic conditions within the broader regional USGS model and to estimate the potential changes in surface water and groundwater flow conditions that form the proposed groundwater recharge scenarios. The model results are based on the estimated monthly changes in surface water and groundwater conditions, relative to model period of record from November 2007 to December 2012.

5 Model Applications

This modeling work is intended to assess feasibility of groundwater recharge using recycled water based on risks from groundwater mounding and transport to sensitive receptors, and to quantify the potential benefits from increased base flow within the Grover's Creek watershed. The model was developed with the intent of assessing the changes in surface water and groundwater flow conditions that result from the proposed groundwater recharge scenarios. The 5-year period of record from the model simulations provides insight to the seasonal variation of model results.

5.1 Model-Derived Water Budget

To assess potential streamflow benefits within the Grover's Creek watershed, the increase in surface water flow was assessed for two scenarios compared to the baseline condition of no groundwater recharge. Results from the modeling, expressed in terms of the simulated volumetric water budget, provide the range of benefits to streamflow that could be expected from either seasonal or year-round groundwater recharge. The monthly water budget data from the model provides the basis for assessing the increases in streamflow with the Grover's Creek system.

The potential for localized and watershed-scale benefits were assessed based on the change in streamflow between the baseline scenario and the proposed recharge scenarios, at two locations along Grover's Creek. First, the localized benefits were assessed near the confluence of multiple small tributaries that capture much of the induced recharge, described as the South Fork Grover's Creek. Second, the changes in flows at the mouth of Grover's Creek near Miller Bay were assessed for potential downstream benefits. The proposed groundwater recharge alternatives result in either seasonal discharge or year-round discharge at 0.5 MGD.

5.2 Modeled Scenarios

Three scenarios were simulated to meet study objectives. The first scenario modeled "background conditions," in which no artificial percolation was simulated. This scenario served as the baseline simulation against which changes in water levels and flows caused by percolation in other scenarios were measured. The second scenario simulated continuous (year-round) artificial percolation at the proposed basin of 0.5 MGD of recycled water for 5 years. The third scenario simulated seasonal percolation of 0.5 MGD of recycled water for 5 years. In this scenario, percolation was simulated to occur from October through March and no percolation was applied during the irrigation season (April through September).

5.3 Particle Tracking Procedure

The flow paths and travel times of recharged water were simulated using mod-PATH3DU (Muffels et al., 2016). mod-PATH3DU is a publicly available particle tracking code for simulating the three-dimensional flow paths of purely advective particles. mod-PATH3DU is similar to the USGS' MODPATH code, except that mod-PATH3DU can be used to simulated particle tracks through nested grids.

For each scenario, 100 analytic particles were equally distributed within the footprint of the proposed percolation basin then simulated to move through the groundwater system until each particle was captured by a boundary condition. Five iterations of each scenario were run and the time of particle release (the time at which the particles are placed into the groundwater system) was adjusted to determine if flow paths changed if particles were released at different times. Simulations with particle release the month before the onset of percolation, and releases each year following the onset of percolation were completed. The boundary capturing each particle and the time of travel of each particle were logged.

6 Summary of Modeling Results

6.1 Changes in Streamflow in Grover's Creek and Tributaries

Streamflow in Grover's Creek and its tributaries increased during both artificial percolation scenarios compared to the no percolation scenario. In the continuous artificial percolation scenario, streamflow in South Fork Grover's Creek was simulated to increase up to 43 percent during the wet season 5 years after the beginning of artificial percolation (Figure 6-1 and Figure 6-2). Streamflow increased up to 26 percent in South Fork Grover's Creek 5 years after the beginning of artificial percolation in the seasonal percolation scenario.

Streamflow increases in the mainstem of Grover's Creek were more modest after 5 years. Streamflow at the mouth of Grover's Creek increased 18 percent in the continuous percolation scenario and 17 percent in the seasonal percolation scenario (Figures 6-3 and 6-4). The apparently smaller increases in flow within the mainstem of Grover's Creek are a product of the significantly higher starting flows in Grover's Creek than South Fork Grover's Creek. All flow increases in South Fork Grover's Creek are carried into Grover's Creek.

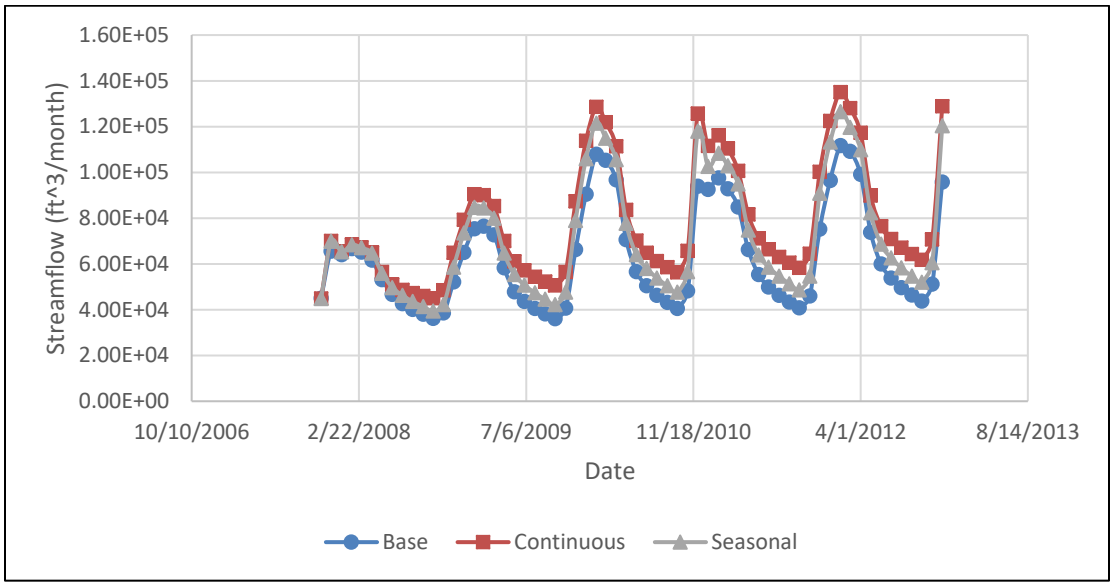

Figure 6-1. Streamflow at the confluence of South Fork Grover's Creek and mainstem Grover's Creek.

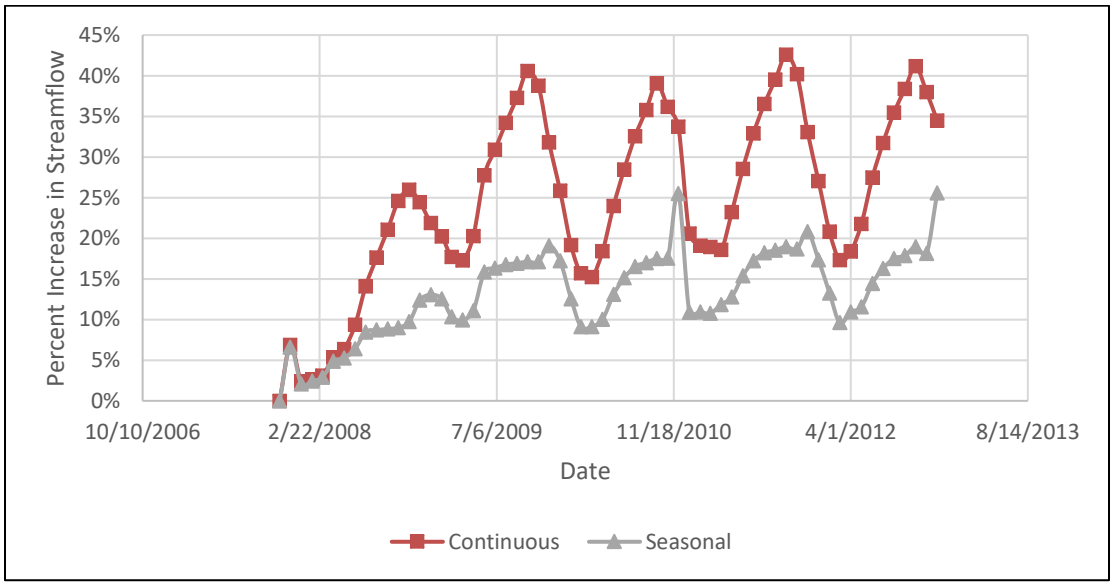

Figure 6-2. Percent Increase in Streamflow at the Confluence of South Fork Grover's Creek and mainstem Grover's Creek.

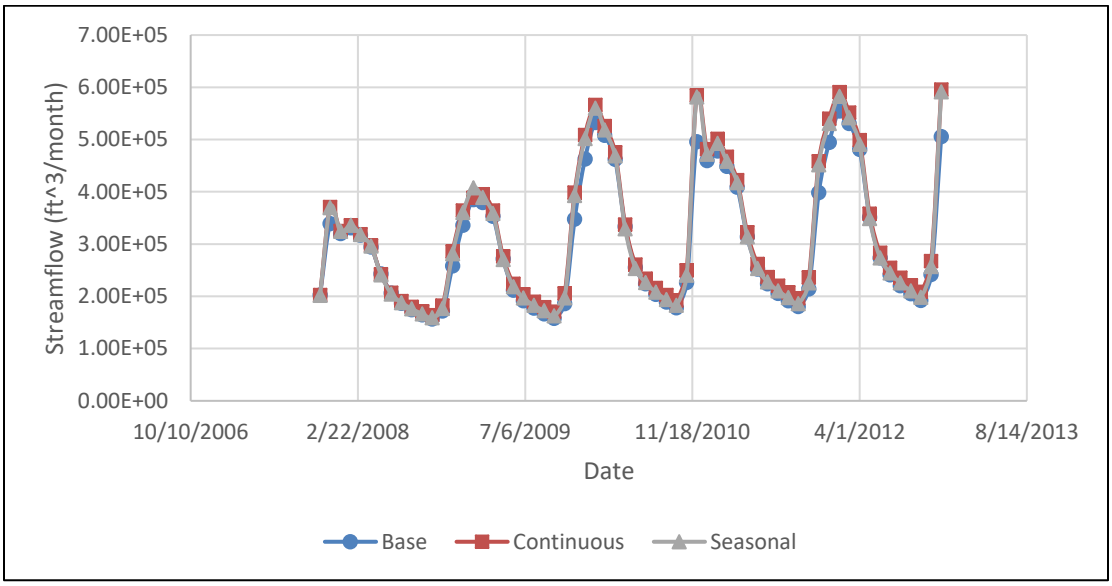

Figure 6-3. Streamflow at Grover's Creek mouth at Miller Bay.

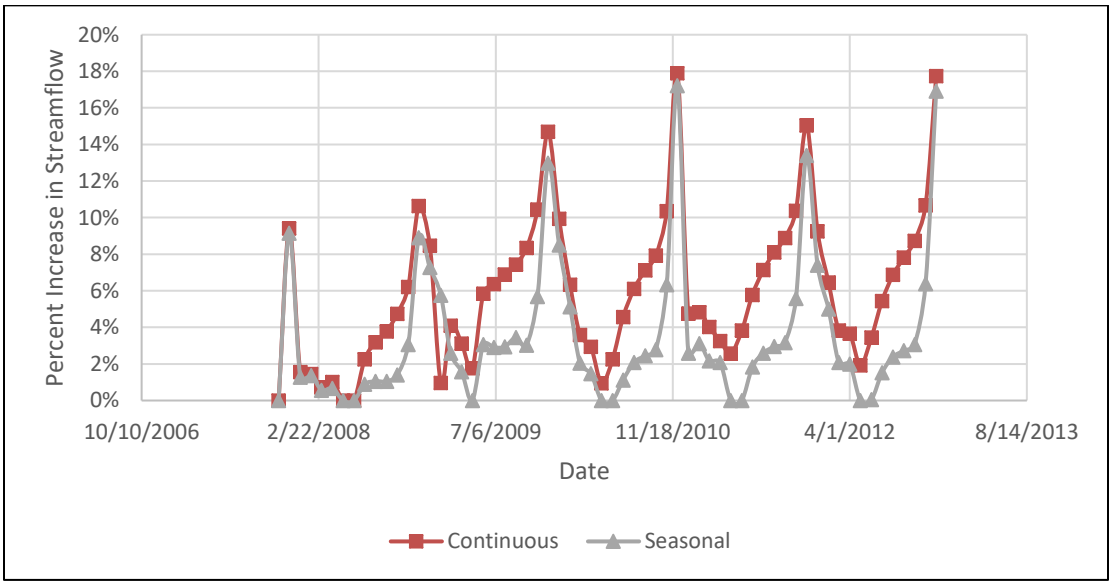

Figure 6-4. Percent Increase in Streamflow at Grover's Creek mouth at Miller Bay.

6.2 Fate of Recharged Water

The results from particle tracing within the model revealed the following results and conditions.

- Under baseline conditions (no recharge):
  - All the particles placed at the percolation basin moved vertically downward from ground surface into Layer 9 and deeper over 30 years before moving laterally towards Apple Tree Cove where the particles resurface into Puget Sound (Table 6-1).
  - The downward particle migration remains an artifact of the regional USGS model, and an artificially high hydraulic conductivity for Layer 4.
- Under year-round percolation conditions:
  - The particles move downward over a period of weeks to 1 month before hitting the water table.
  - Once within the groundwater flow system, 50 percent of particles reach South Fork Grover's Creek and its smaller tributaries within 1 to 3 months (Table 6-2).
  - The remainder of particles exhibited the same 30-year or more downward movement seen in the no percolation scenario.
  - Unlike the baseline (no recharge) scenario, 15 percent of the total particles are captured by Kingston Well 6 in greater than 30 years.
- Under seasonal percolation conditions:
  - The particles move downward over a period of weeks to 1 month before hitting the water table.
  - Once within the groundwater flow system, 35 percent of particles are captured by South Fork Grover's Creek and its tributaries within 1 to 2 months (Table 6-3).
  - Similar to the other scenarios, particles not captured by South Fork Grover's Creek migrated vertically downwards to Layer 9 and deeper, then laterally towards Apple Tree Cove.
  - After approximately 30 years, 23 percent of particles become captured by Kingston Well 9.
  - 42 percent of particles surfaced in Apple Tree Cover after more than 30 years migrating within the groundwater system.

Table 6-1. Fate of Water Infiltrated at the Proposed Percolation Basin – No Artificial Percolation

Boundary Name	Boundary Type	Percent Capture	Time of Travel
South Fork Grover's Creek	Stream	0%	Not applicable
Mainstem Grover's Creek	Stream	0%	Not applicable
Apple Tree Cove	General Head	100%	30+ yrs
Kingston Well 6	Well	0%	Not applicable

Table 6-2. Fate of Water Infiltrated at the Proposed Percolation Basin – Continuous Artificial Percolation

Boundary Name	Boundary Type	Percent Capture	Time of Travel
South Fork Grover's Creek	Stream	50%	35 d – 95 d
Mainstem Grover's Creek	Stream	0%	Not applicable
Apple Tree Cove	General Head	35%	30+ yrs
Kingston Well 6	Well	15%	30+ yrs

Table 6-3. Fate of Water Infiltrated at the Proposed Percolation Basin – Seasonal Artificial Percolation

Boundary Name	Boundary Type	Percent Capture	Time of Travel
South Fork Grover's Creek	Stream	35%	35 d – 65 d
Mainstem Grover's Creek	Stream	0%	Not applicable
Apple Tree Cove	General Head	42%	30+ yrs
Kingston Well 6	Well	23%	30+ yrs

The particle tracing results suggest that groundwater recharge at the proposed location is both feasible and likely to boost streamflow in the Grover's Creek system. The strong downward vertical gradient and high hydraulic conductivity of the upper clay (Layer 4) represent artifacts of the regional USGS model, resulting in artificially high seepage losses downward through the model layers. Seepage from the proposed recharge downward and into the deeper aquifer appears artificially high compared to site-specific conditions, and results in lower streamflow gains. As a result, the tabulated model results for streamflow gains from induced groundwater recharge are biased low, providing conservative estimates of the fraction of recharge estimated to migrate into Grover's Creek. Results from the particle tracing are shown on Figures 6-5 through 6-7.

The strong downward gradient produced by the model results in incidental capture of a portion of the recharged water starting approximately 30 years after the recharge enters the groundwater system. Only one well within the model domain was found to intercept any portion of the recharge, KPUD Well 6, located more than 1 mile from the proposed recharge area. The validity of this result is questionable and appears to be an artifact of an artificial downward gradient forced within the USGS model calibration. Nonetheless, capture by any drinking water well is worth considering for relative risks to the project.

Analytical estimates of travel times and flow paths, documented in the Hydrogeologic Site Characterization Report, contradict the numerical model's extreme downward hydraulic gradient results within the project area. This difference is based on the assumed hydraulic properties of the clay confining unit beneath the proposed discharge. The horizontal hydraulic conductivity of the sand aquifer unit is approximately 3 to 5 orders of magnitude greater than the underlying clay unit based on samples collected from the site. Under uniform hydraulic gradients within these units, no flow would be transmitted through the clay as the water would more freely move horizontally within the sand. Only extreme downward hydraulic gradients would be able to pull or push water into the clay given the difference in conductivity between it and the aquifer; there is little evidence to support such strong vertical gradients with the project area. Additional site testing has been recommended for future design phases of the project and could be used to support further modifications to the model to better represent the natural vertical gradients in the vicinity of the site.

Aquifer recharge to a regional drinking water source was considered a potential project benefit during preliminary planning. However, the benefit was later dropped from consideration after developing the conceptual hydrogeologic model for the site that assumed little or no flow would migrate through the clay confining unit beneath the project. Based on site observations and detailed study of local well logs, the recharge was predicted to spread horizontally until discharging as baseflow to the watershed. The numerical modeling results suggest that vertical seepage may occur and could result in additional benefits to regional groundwater supplies. The model-predicted incidental capture of recharge occurs at one well located more than a mile from the recharge site, with transport time of more than 30 years. Although we expect the captured recharge poses little risk to the well or drinking water source, it should be investigated further as both a potential project risk and benefit.

Year-round recharge of recycled water at the proposed location resulted in simulated streamflow increases of up to 18 percent at Grover's Creek mouth and 43 percent in South Fork Grover's Creek. Seasonal recharge resulted in simulated increases of up to 17 percent at Grover's Creek mouth and 26 percent in South Fork Grover's Creek. After migrating downward through the unsaturated zone during a period of less than 1 month, the induced recharge begins to migrate along the groundwater flow paths. Increases in stream flows were observed within the model results within 1 to 3 months of initiating groundwater recharge.

7 Recommendations

The numerical modeling results confirmed that groundwater recharge is feasible and provided benefits to the Grover's Creek watershed. The magnitude and location of benefits could be optimized through further study and refinements to the groundwater model.

Pilot infiltration testing at the proposed recharge basin location should be undertaken as a next step in project design. Additionally, the site groundwater monitoring network was constructed to support future aquifer pumping tests. Access to test locations within NKHP was restricted during the site investigation. Additional test borings and monitoring wells are recommended within the Park. One deep monitoring well is also recommended to assess water levels in the aquifer underlying the clay unit, to help quantify the real vertical hydraulic gradient at the site.

The hydraulic properties of Model Layers 3 (the Vashon advance aquifer) and 4 (the Upper Confining Unit) strongly influenced simulation results. The hydraulic conductivities of Layers 3 and 4 should be further tested to better understand the movement of water through those layers. Different real-world values of hydraulic conductivity in these layers compared to modeled values could mean that more water moves laterally through Layer 3 to Grover's Creek and its tributaries, as opposed to moving vertically downward to deep aquifers. Future work to support the final design phase should include the additional drilling and testing at the basin location, as well as updates to the model based on the site-specific hydraulic gradient across the clay unit.

Additional study of stream channels within the Grover's Creek system would further aid evaluation of the environmental benefit of recharge. Specific data that should be collected include stream channel geometry and seasonal gain-loss data. The model parameterization of the Grover's Creek system used a simplified process that relies on minimal data. Additional channel geometry, level, and flow data could be incorporated into the model from field data to assess habitat benefits at targeted areas within the watershed.

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Limitations

Work for this project was performed for Kitsap County (Client), under subcontract agreement with Brown and Caldwell, and supported by funding from the Suquamish Tribe and USBR. This report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

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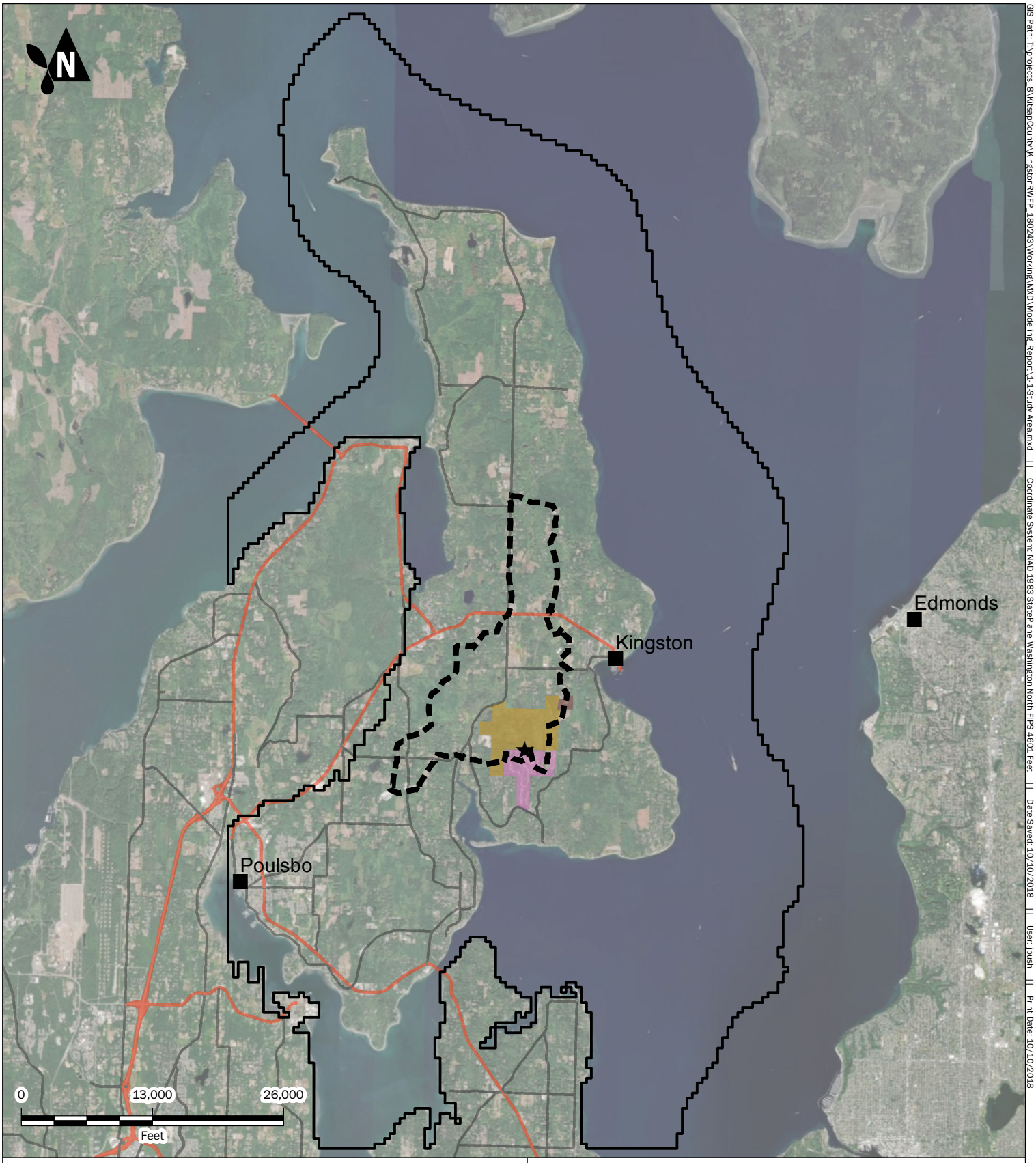
FIGURES



NAME

- ★ Proposed Infiltration Site
- Grover's Creek Watershed
- Active Model Area
- White Horse Golf Course
- North Kitsap Heritage Park
- State Highway
- Major Road

Location of the Study Area

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	OCT-2018	BY: JB / ---	FIGURE NO. 1-1
	PROJECT NO. 180243	REVISED BY: ---	

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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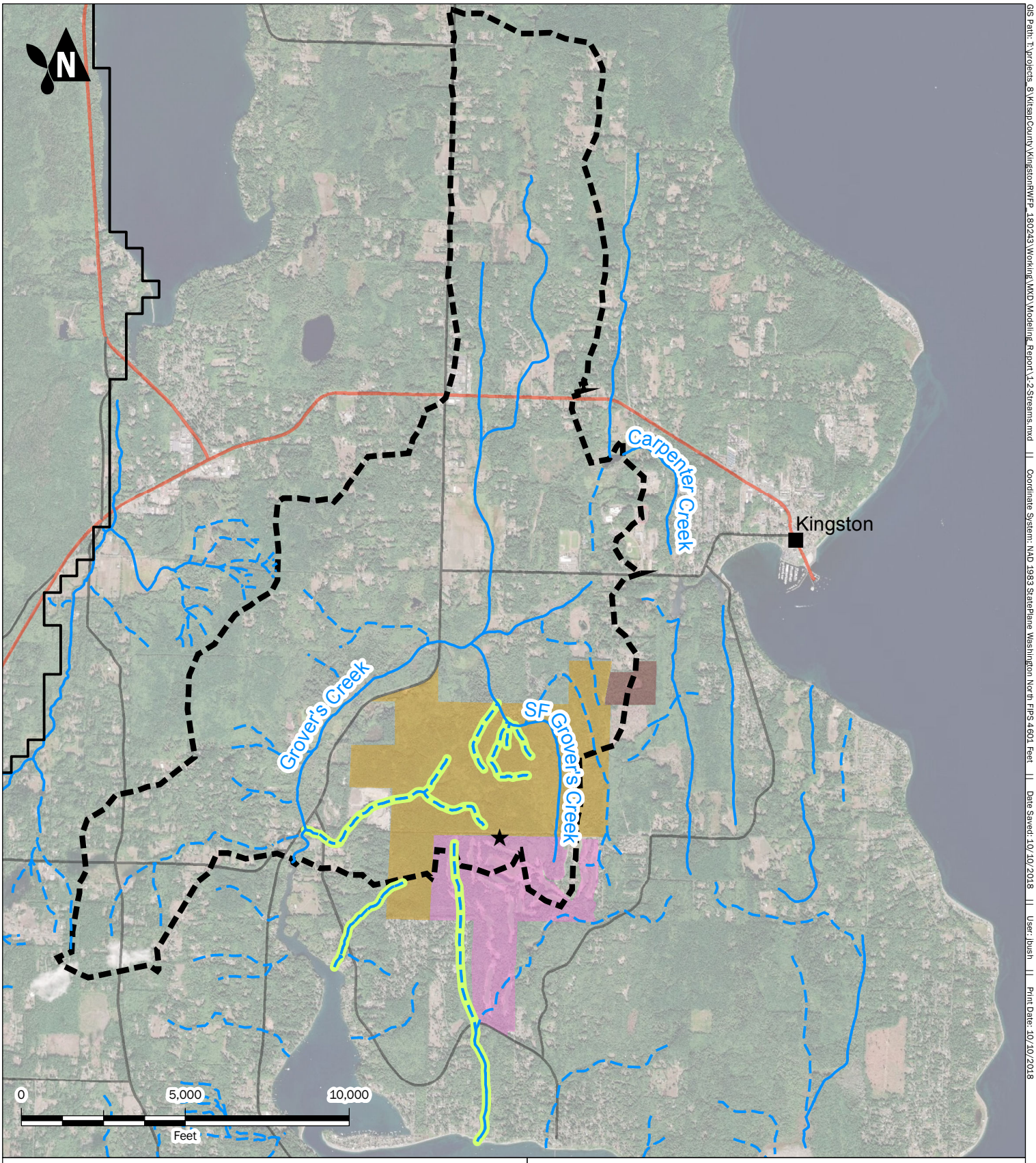

NAME

- Proposed Infiltration Site
- Grover's Creek Watershed
- Active Model Area
- White Horse Golf Course
- North Kitsap Heritage Park
- State Highway
- Major Road

Streams

NHD Classifcation

- Perennial
- Intermittent
- Stream added to this model

Streams in the Study Area

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	OCT-2018	BY: JB / ---	FIGURE NO. 1-2
	PROJECT NO. 180243	REVISED BY: ---	

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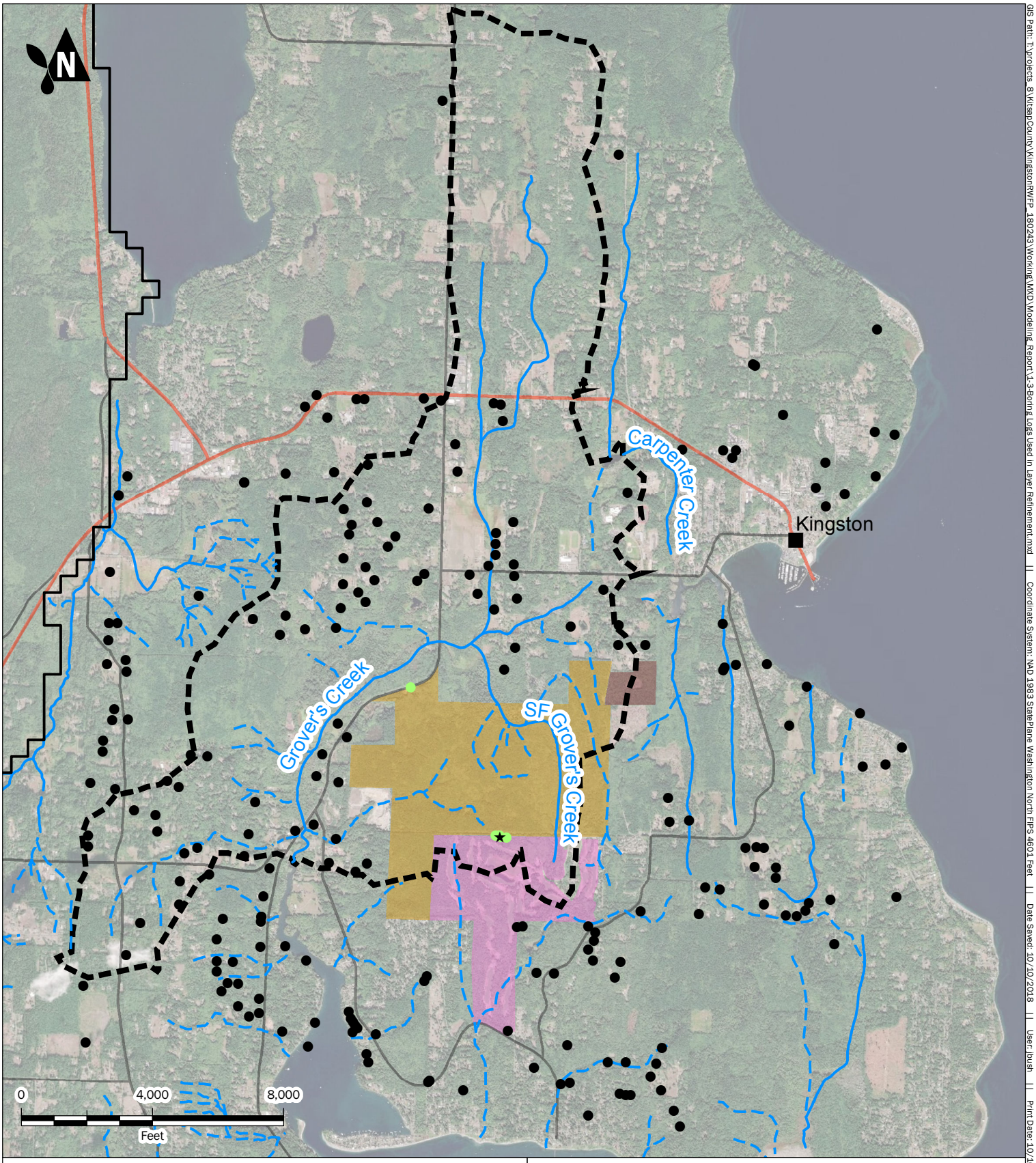

NAME

- ★ Proposed Infiltration Site
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- State Highway
- Major Road

Streams
NHD Classifcation

- Perennial
- Intermittent
- RWFP monitoring well
- Ecology boring log

Boring Logs Used in Layer Refinement

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

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	PROJECT NO. 180243	REVISED BY: ---	

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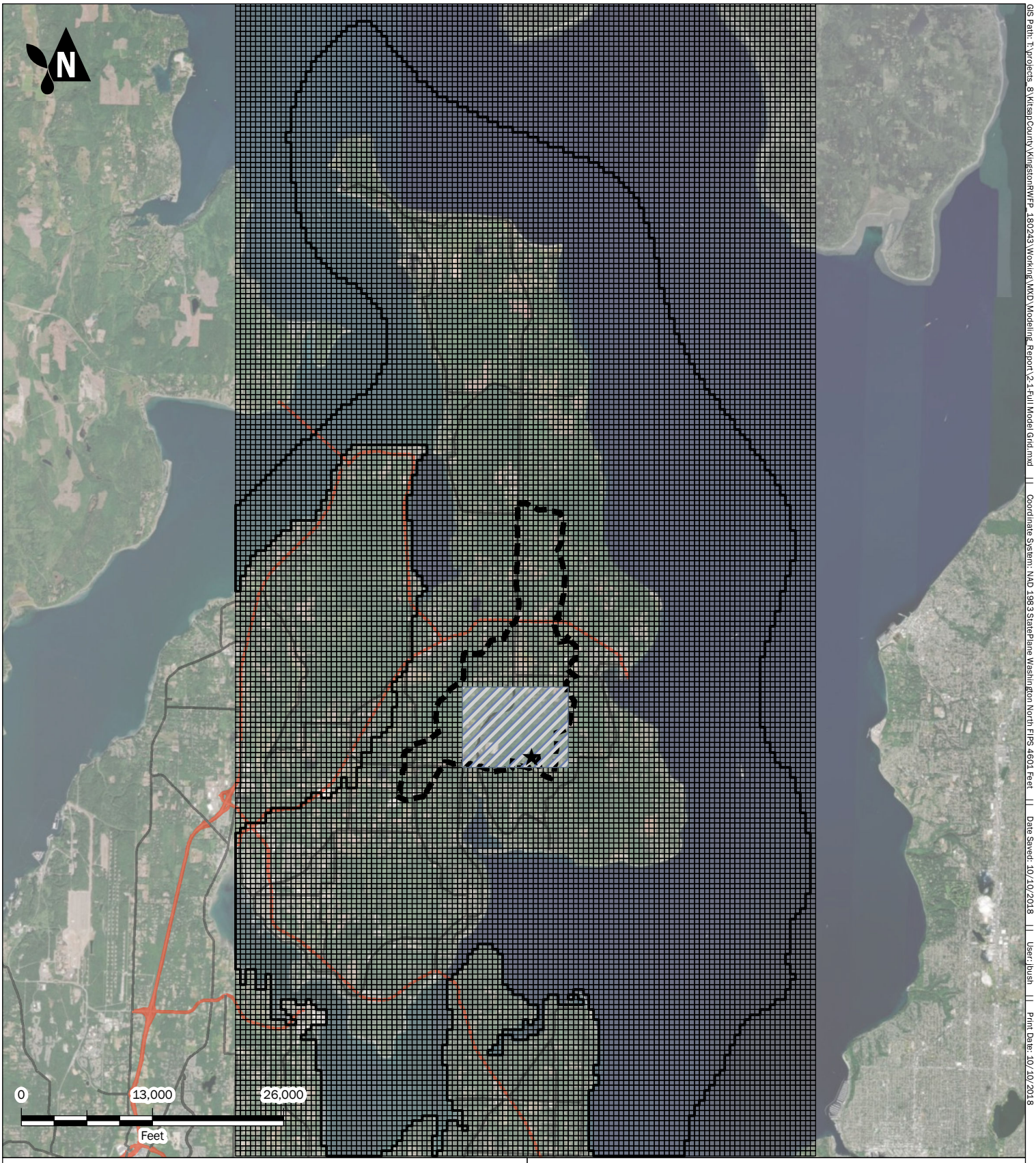

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NAME

- ★ Proposed Infiltration Site
- Grover's Creek Watershed
- Active Model Area
- State Highway
- Major Road
- Coarse Model Grid
- Grid Refinement Zone

Location of the Model Grid

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect CONSULTING	OCT-2018	BY: JB / ---	FIGURE NO. 2-1
	PROJECT NO. 180243	REVISED BY: ---	

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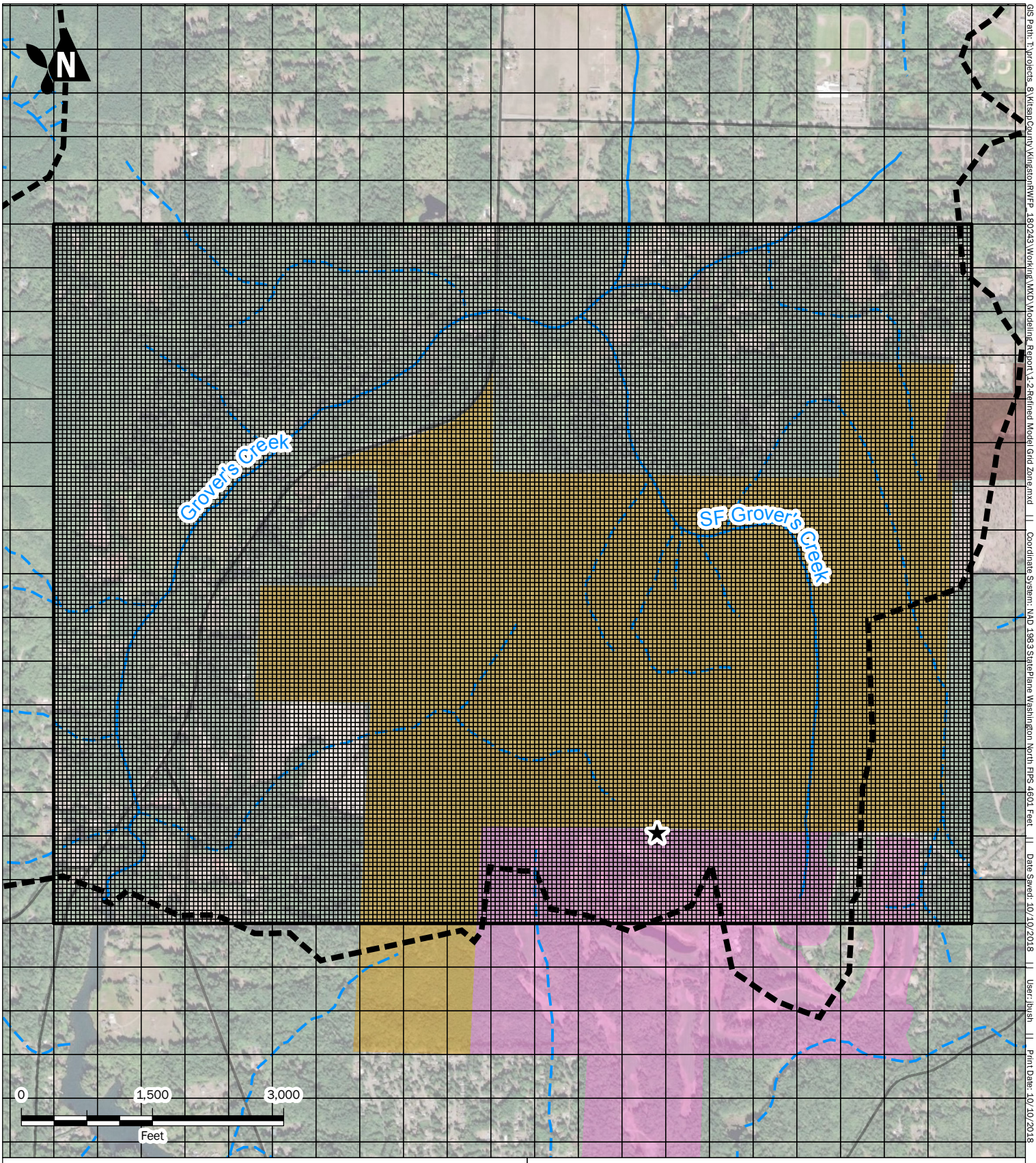

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NAME

- ★ Proposed Infiltration Site
- Grover's Creek Watershed
- White Horse Golf Course
- North Kitsap Heritage Park
- Kingston WWTP
- State Highway
- Major Road
- Model Grid
- Grid Refinement Zone

Location of the Refined Grid

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	OCT-2018	BY: JB / ---	FIGURE NO. 2-2
	PROJECT NO. 180243	REVISED BY: ---	

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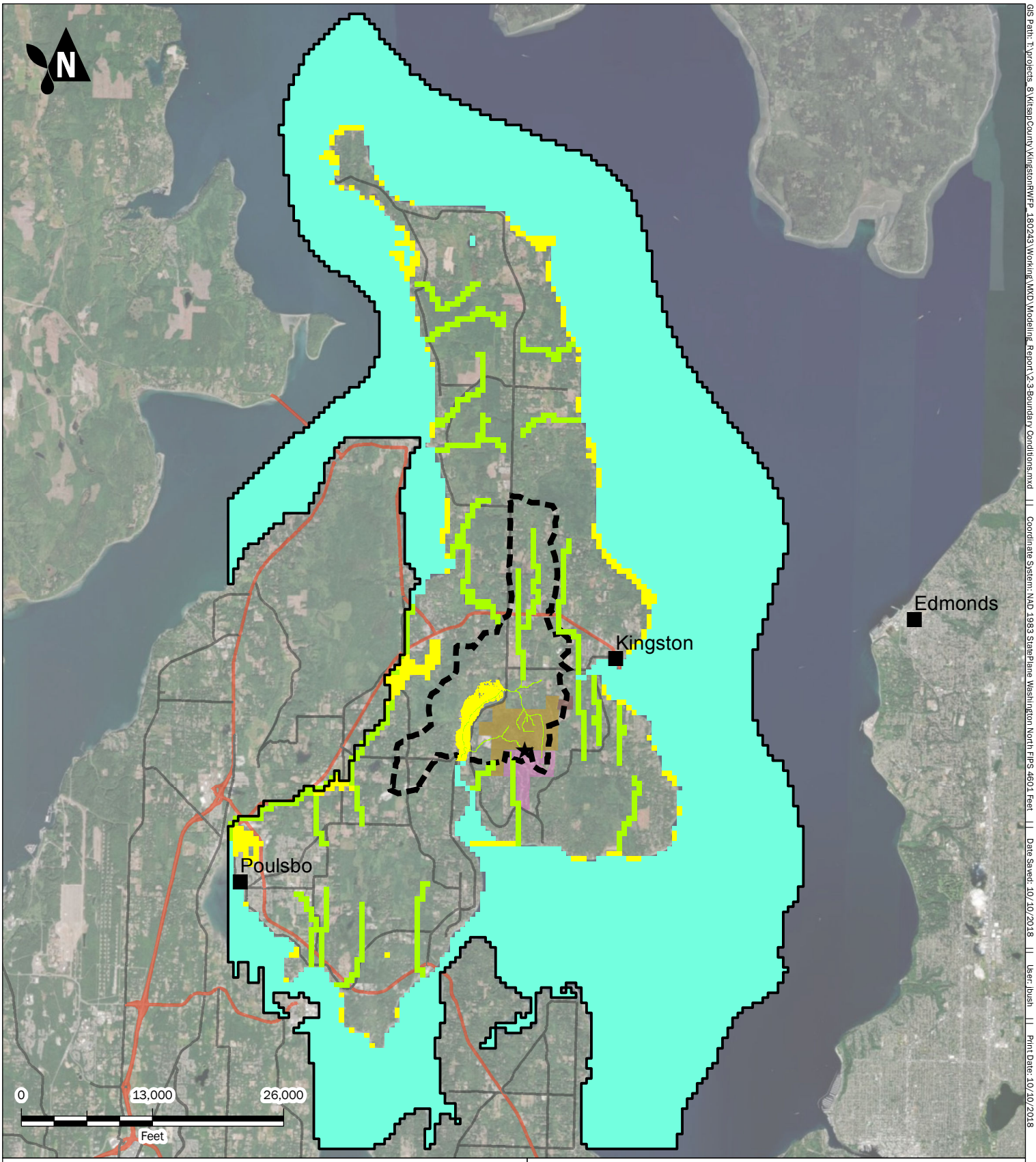

NAME

- Proposed Infiltration Site
- Grover's Creek Watershed
- Active Model Area
- White Horse Golf Course
- North Kitsap Heritage Park
- State Highway
- Major Road

Boundary Conditions

- Drain
- General Head
- Stream

Model Boundary Conditions

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	OCT-2018	BY: JB / ---	FIGURE NO. 2-3
	PROJECT NO. 180243	REVISED BY: ---	

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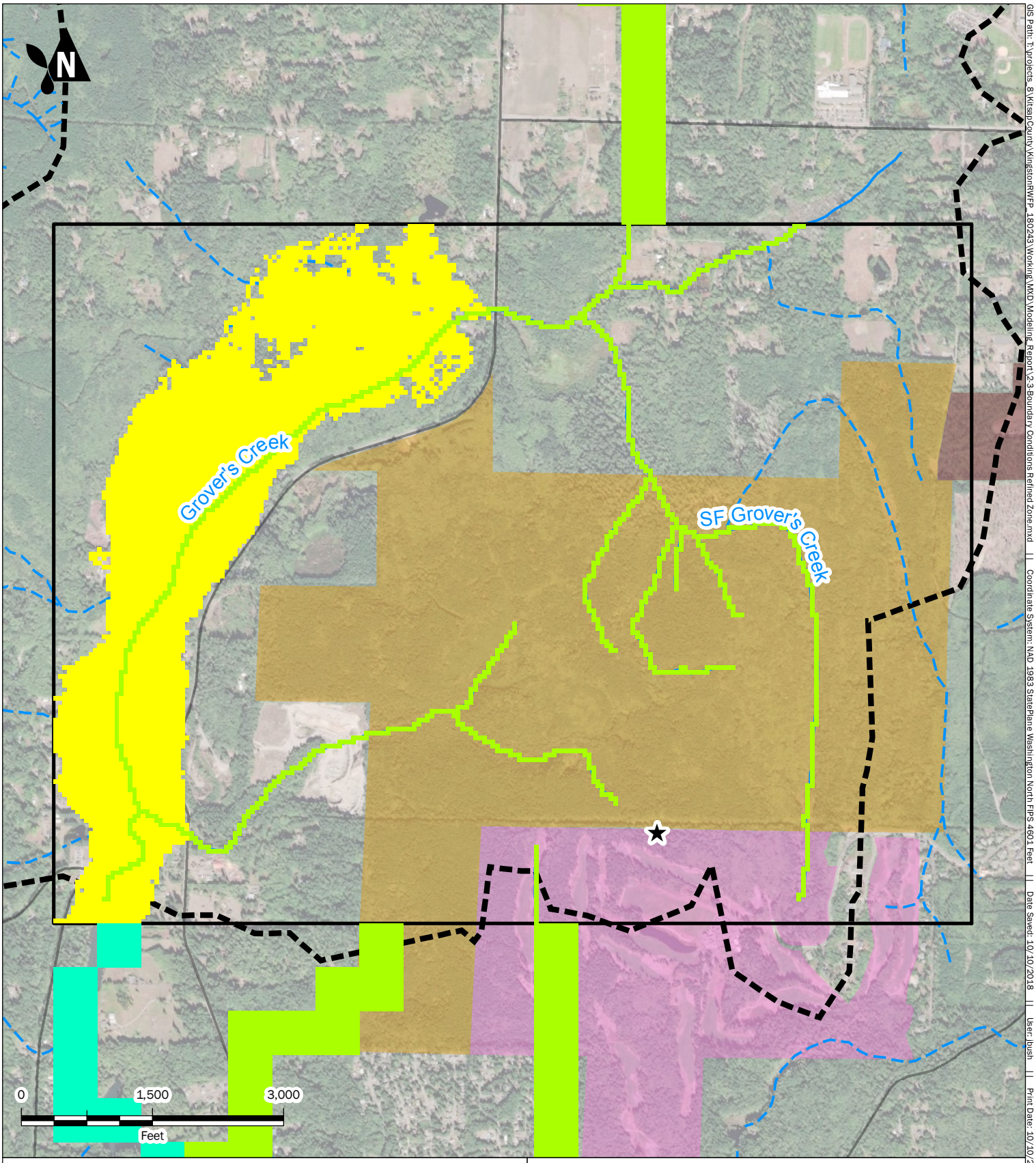

NAME

- Proposed Infiltration Site
- Grover's Creek Watershed
- White Horse Golf Course
- North Kitsap Heritage Park
- Kingston WWTP
- State Highway
- Major Road
- Model Grid
- Grid Refinement Zone

Boundary Conditions in the Refined Zone

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	OCT-2018	BY: JB / ---	FIGURE NO. 2-4
	PROJECT NO. 180243	REVISED BY: ---	

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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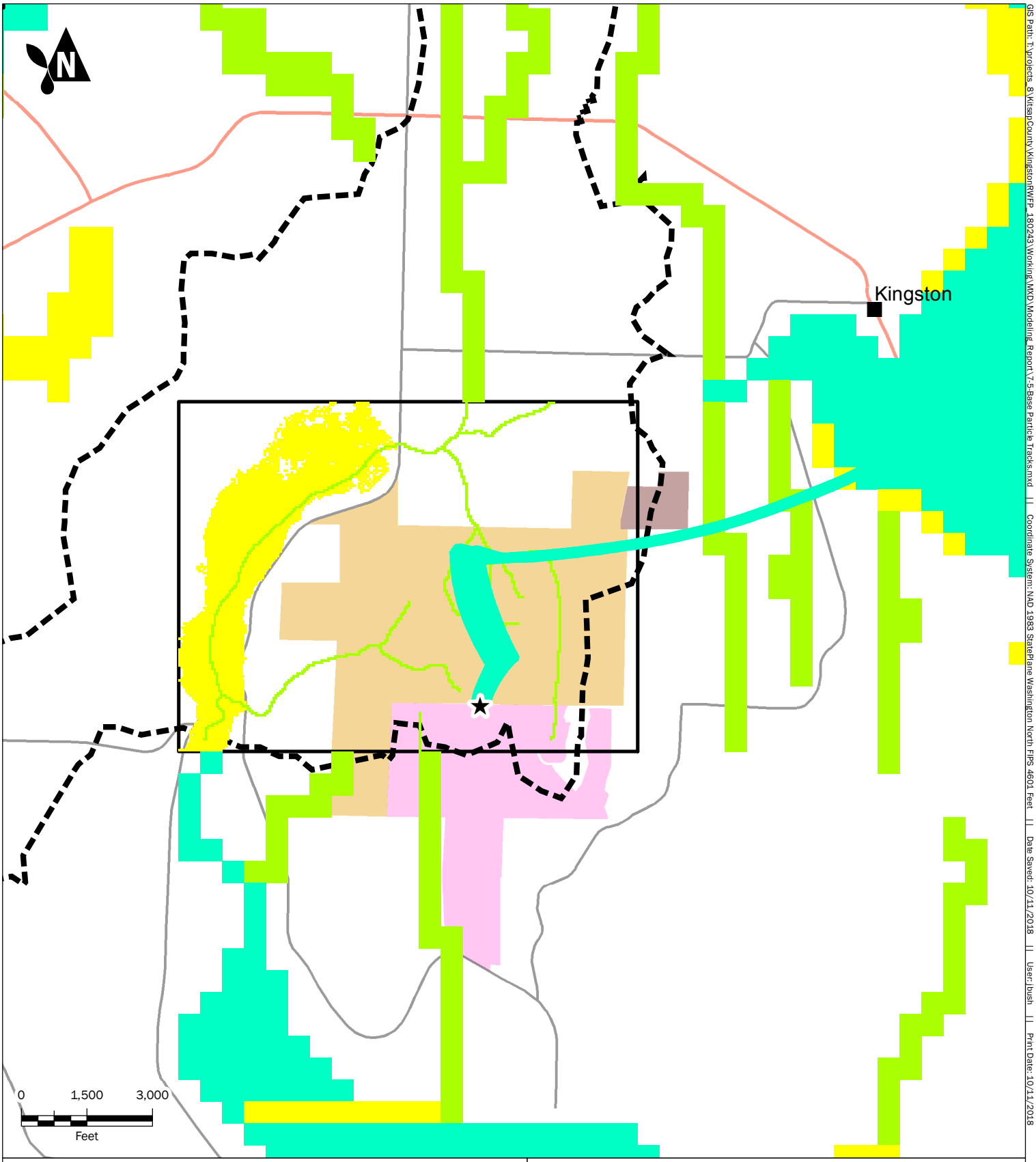


NAME

- Proposed Infiltration Site
- Grover's Creek Watershed
- White Horse Golf Course
- North Kitsap Heritage Park
- Kingston WWTP
- State Highway
- Major Road

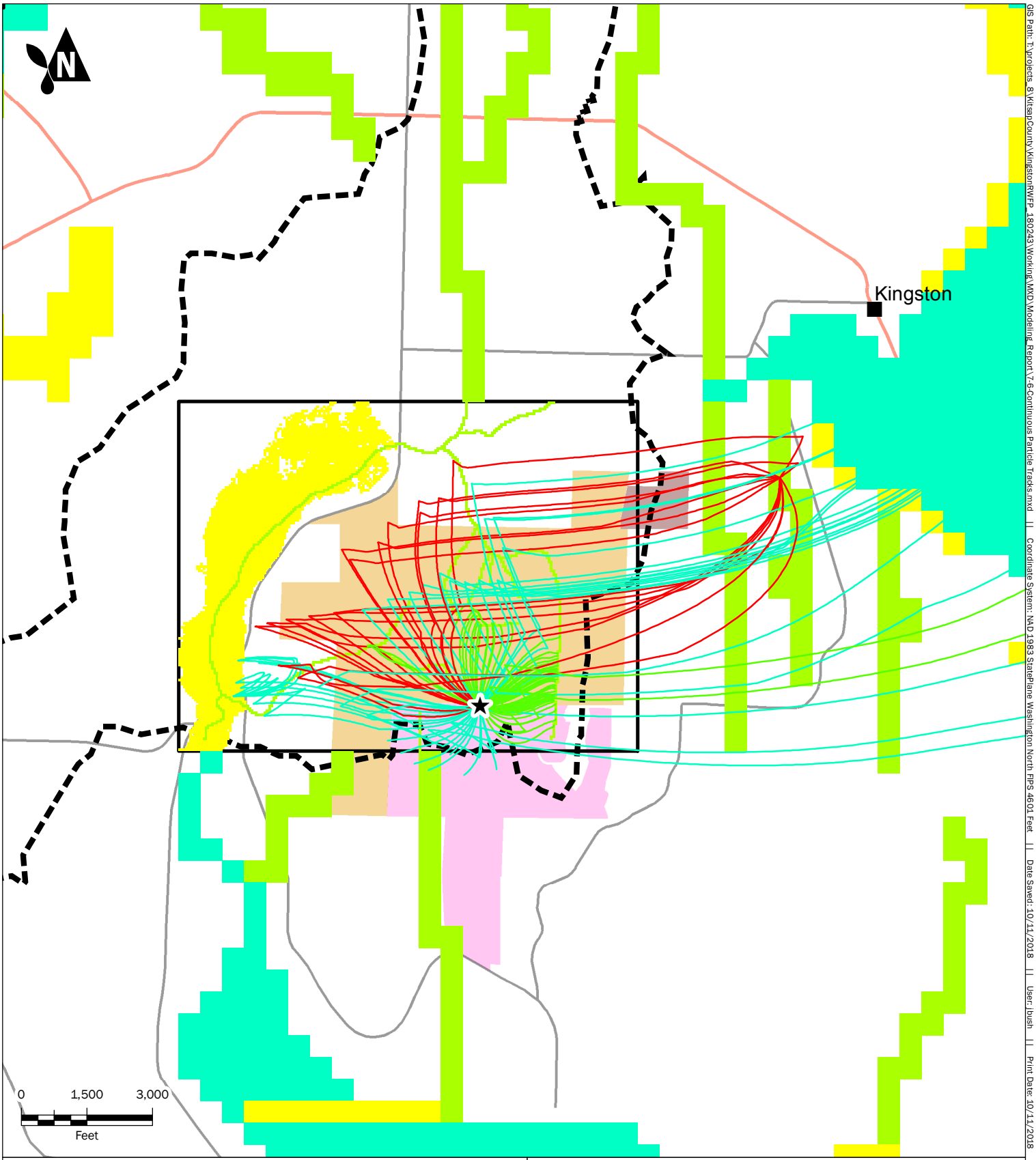
Particle Tracks (n=100)

- Ends at Stream (n=0)
- Ends at Well (n=0)
- Ends at General Head (n=100)

Particle Tracks - Zero Percolation

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	OCT-2018	BY: JB / ---	FIGURE NO. 6-5
	PROJECT NO. 180243	REVISED BY: ---	



NAME

- Proposed Infiltration Site
- Grover's Creek Watershed
- White Horse Golf Course
- North Kitsap Heritage Park
- Kingston WWTP
- State Highway
- Major Road

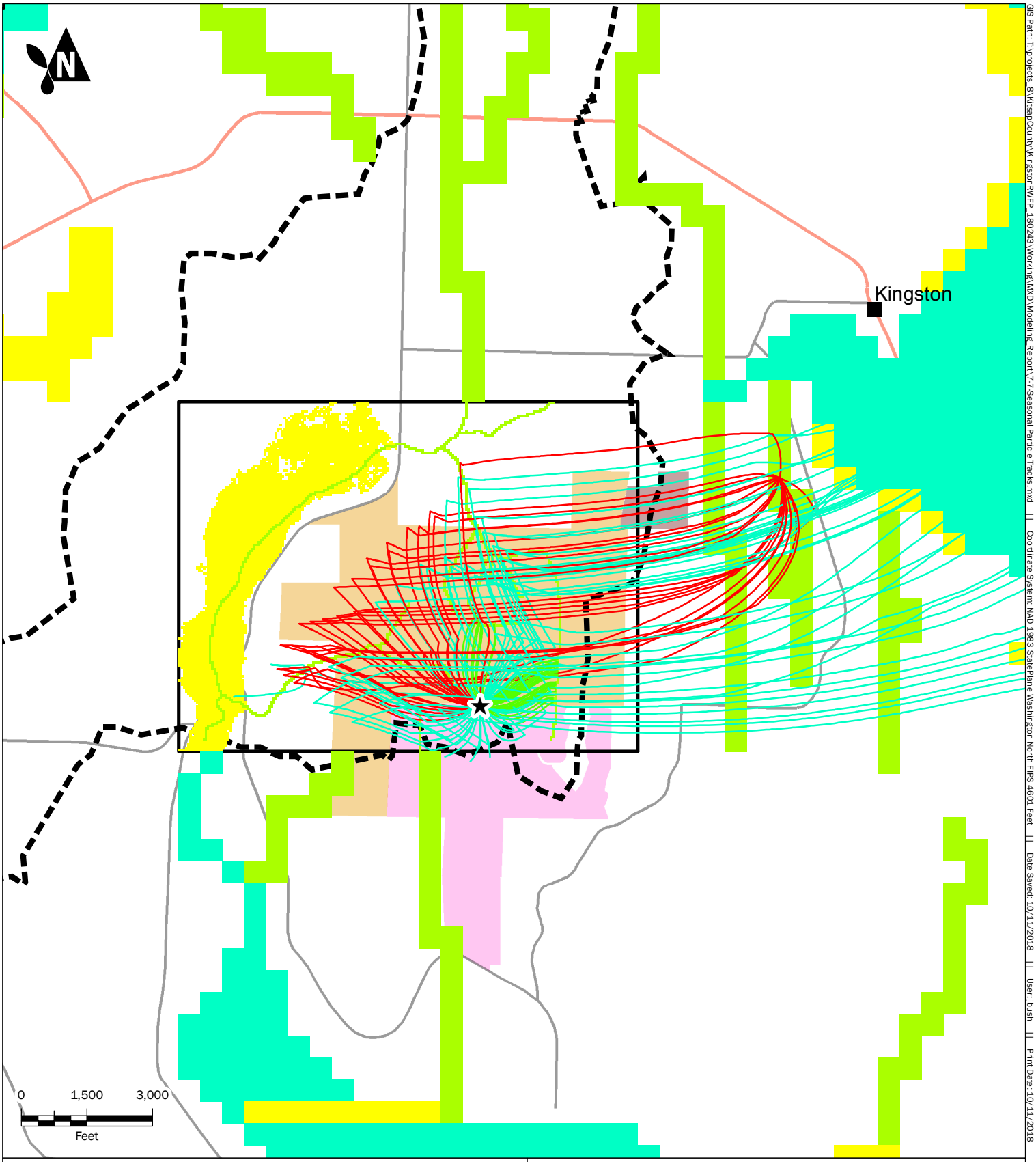
Particle Tracks (n=100)

- Ends at Stream (n=50)
- Ends at Well (n=15)
- Ends at General Head (n=35)

Particle Tracks - Year-round Percolation

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	OCT-2018	BY: JB / ---	FIGURE NO. 6-6
	PROJECT NO. 180243	REVISED BY: ---	



NAME

- ★ Proposed Infiltration Site
- Grover's Creek Watershed
- White Horse Golf Course
- North Kitsap Heritage Park
- Kingston WWTP
- State Highway
- Major Road

Particle Tracks (n=100)

- Ends at Stream (n=35)
- Ends at Well (n=23)
- Ends at General Head (n=42)

Particle Tracks - Seasonal Percolation

Groundwater Modeling Technical Memorandum
Kingston Reclaimed Water Infiltration Alternatives
Kingston, Kitsap County, Washington

Aspect Consulting	OCT-2018	BY: JB / ---	FIGURE NO. 6-7
	PROJECT NO. 180243	REVISED BY: ---	

Appendix I: SEPA Checklist

SEPA Checklist and DNS

SEPA Checklist Public Comments

KITSAP COUNTY DEPARTMENT OF COMMUNITY DEVELOPMENT

619 DIVISION STREET MS-36, PORT ORCHARD WASHINGTON 98366-4682 Jeff Rimack, DIRECTOR
(360) 337-5777 HOME PAGE - www.kitsapgov.com/dcd/

DETERMINATION OF NONSIGNIFICANCE

Description of Proposal: **Kitsap County Public Works, Kingston Recycled Water Facility Plan Programmatic SEPA review (Permit 19-02520).** Pursuant to WAC 197-11-060(5), this DNS is a non-project phased SEPA review for the Plan. This proposal is for the Kingston Recycled Water Facility Plan, addressing a recycled water planning document, which includes an analysis of existing and projected water quantity and quality concerns for Appletree Cove (Puget Sound) and the Grover's Creek watershed and aquifer. The plan addresses changes to the existing Kingston Wastewater Treatment Plant, both with onsite upgrades and off-site conveyance of Class A recycled water for use as seasonal irrigation and infiltration. No above-grade structures are expected outside of the Kingston Wastewater Treatment Plant site, with conveyance pipes located underground along existing power and road rights-of-way. Any future design or construction will complete an appropriate project-specific SEPA review, including but not limited to additional investigations for wetlands or streams. The plan must also be approved by the Washington State Department of Ecology and Washington State Department of Health, and a National Pollution Discharge Elimination (NPDES) permit is required for the project following completion of final design plans and specifications.

Proponent: Kitsap County Public Works Department, Sewer Utility Division, Barbara Zaroff, Capital Projects Engineer

Lead Agency: KITSAP COUNTY

Location of proposal, including street address, if any: The Kingston Recycled Water Facility Plan addresses the Kingston Wastewater Treatment Plant at 11000 NE White Horse Drive, Kingston, WA 98346. The plan also includes the area to the south of the KWTP, down to and including the White Horse Golf Club (Suquamish Tribe). Infiltration will be evaluated and selected as design progresses but is expected to be located in the general vicinity of the North Kitsap Heritage Park.

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

This DNS is issued under 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. Comments must be submitted by: October 11, 2019.

COMMENTS:
Pursuant to 197-11-060(5), this is a phased SEPA review. The Kitsap County Public Works Kingston Recycled Water Facility Plan is a programmatic decision. As project level design plans become available, individual projects will be subject to additional site-specific SEPA review and mitigation. All applicable local, state and federal permits will be obtained for individual projects. To review the complete Plan or the SEPA checklist, please contact the Department of Public Works at (360) 337-5777, or visit the Kitsap County Public Works project page: http://kitsap.paladinpanoramic.com/project/2233/55050.

Responsible Official / Scott Diener Contact Person: Steve Heacock
Position/Title: SEPA Administrator, Dept. of Community Dev. Phone: (360) 337-5777
Address: 614 Division Street, Port Orchard, WA 98366

DATE: September 27, 2019 Signature: Steve Heacock

Kingston Recycled Water Project

SEPA Checklist

August 2019

PREPARED FOR:

KITSAP COUNTY PUBLIC WORKS DEPARTMENT

PREPARED BY:

ESA

5309 SHILSHOLE AVENUE NW, STE. 200

SEATTLE, WA 98107

TABLE OF CONTENTS

ENVIRONMENTAL CHECKLIST

A. BACKGROUND

1. Name of the proposed project, if applicable:

Kingston Recycled Water Project

2. Name of Applicant:

Kitsap County Public Works Department

3. Address and phone number of applicant and contact person:

Barbara Zaroff
Capital Projects Engineer
Kitsap County Sewer Utility
Phone: (360) 337-5777
E-mail: bzaroff@co.kitsap.wa.us

4. Date checklist prepared:

August 2019

5. Agency requesting checklist:

Kitsap County Public Works

6. Proposed timing or schedule (including phasing, if applicable):

Construction is dependent upon funding, but is currently assumed in 2021 and 2022 with operation of the recycled water facility beginning in 2023.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

Space is set aside at the treatment plant for future reverse osmosis (RO) and advanced oxidation systems, if needed, to meet more stringent treatment requirements. These would be located next to the new UV system should they be needed. Following approval of the *Kingston Recycled Water Project Facility Plan* (Brown and Caldwell, 2019) by the Washington Department of Ecology and Health, additional studies will be conducted and design details will be prepared as the design and permitting processes progress.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

The *Kingston Recycled Water Project: A Preliminary Investigation of Recycled Water Opportunities in the Kingston Area* (Brown and Caldwell, 2016) and the *Kingston Recycled Water Project Facility Plan (*Brown and Caldwell, 2019) have been prepared for the project. Included as appendices to the Facility Plan are the *Hydrogeologic Site Characterization Report Kingston Reclaimed Water Infiltration Alternatives, Kitsap County, WA* (Aspect Consulting, LLC., 2018), and the *Kingston Reclaimed Water Conveyance Alignment Reconnaissance Memorandum* (Environmental Science Associates, Inc., 2018).

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

The Washington Departments of Ecology and Health will review and approve the Facility Plan and issue the National Pollution Discharge Elimination (NPDES) permit for the project following completion of final design plans and specifications.

10. List any governmental approvals or permits that will be needed for your proposal, if known:

- Wastewater Facility Plan and State Environmental Review Process approval - Washington Department of Ecology
- Water Reclamation Standards Compliance – Washington Departments of Ecology and Health
- National Pollution Discharge Elimination Systems (NPDES) wastewater discharge – Washington Department of Ecology
- NPDES Construction Stormwater General Permit – Washington Department of Ecology
- Building, Grading, and Right of Way Permits – Kitsap County

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

Kitsap County Public Works has been assessing the opportunities to use recycled water produced at the Kingston Wastewater Treatment Plant (WWTP) since 2003. Over the past 15 years, studies have been conducted and built upon previous

planning and stakeholder engagement efforts to select a preferred recycled water option. Kitsap County Public Works has undertaken these evaluations to reduce treated effluent discharges to surface waters, to provide groundwater recharge and irrigation with highly treated recycled water, and to help with increased demand for water sources. A preferred option has been selected based upon technical feasibility as well as input from the Suquamish Tribe and the community. This preferred option will be refined as part of future phases of the project.

Kitsap County is proposing to construct a recycled water conveyance and disposal system. The recycled water system will produce Class A recycled water for infiltrating in the winter and irrigating White Horse Golf Course (WHGC) in the summer. The recycled water system will have a capacity of approximately 0.7 million gallons per day (mgd). The new recycled water system consists of the following components:

- Treatment upgrades at the WWTP to produce Class A recycled water
- Pumping, conveyance, and equalization basin infrastructure to deliver Class A recycled water to the area north of WHGC
- Infiltration gallery to allow winter indirect groundwater recharge to the area north of WHGC
- Gravity flow from the equalization basin to WHGC to allow summer irrigation

Specifically, upgrades at the existing WWTP include the following components:

- New oxidation ditch to achieve nutrient removal for infiltration
- 95,000 gallon equalization tank
- Filtrate pump station
- Dynasand filtration system
- UV disinfection system

The treatment process will include tertiary treatment and consist of the following:

- Preliminary treatment with screening and grit removal followed by biological nutrient removal in the oxidation ditch
- Secondary sedimentation
- Sand filtration
- UV disinfection followed by chlorine addition for secondary disinfection and chlorine residual.

A recycled water pump station would be located at the WWTP site to provide recycled water to the WHGC and an infiltration basin located in the vicinity of North Kitsap Heritage Park. Approximately two miles of 8-inch forcemain would be constructed from the existing Kingston WWTP in a southern direction along power line right of way and NE White Horse Drive to the existing WHGC to be used for irrigation. When not irrigating the WHGC, recycled water will be sent to

an infiltration basin. Representative areas for infiltration and the conveyance pipeline are illustrated in Figure 2, but specific locations will continue to be evaluated during the design process. Additional potential recycled water irrigation users may be sought in the future, including nearby schools.

This SEPA checklist has been prepared based upon the information provided in the *Draft Final Kingston Recycled Water Facility Plan* (Brown and Caldwell, 2019). Following adoption and approval of the Facility Plan, further design details will be developed which will include additional site-specific geotechnical and hydrogeologic information, site surveys, and right-of-way development to further define the preferred alternative for construction. The project will comply with all applicable federal, state and local permitting requirements.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The project area is located in unincorporated Kitsap County, Washington, southwest of Kingston (Figure 1). The project is located in Township 27 N North, Range 2 E, Section 34, and Township 26 N, Range 2 E, Section 3. The general project area is illustrated in Figure 2.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site (underline):

Flat, rolling, hilly, steep slopes, mountainous, other _____

b. What is the steepest slope on the site (approximate percent slope)?

The Kingston WWTP and project area is generally flat. A topographic mound exists to the west of the White Horse Golf Course, and the topography slopes gently in all directions from that higher area. Ravines and steep slopes are present in portions of the North Kitsap Heritage Park.

c. What general types of soils are found on the site (for example clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

Within the broad area of the proposed infiltration area, soils are generally sandy loams derived from glacial deposits, with lowlands having increased fraction of loams derived from alluvium and flood deposits. Soils of the Grover's Creek watershed are predominantly Poulsbo, Ragnar, Kitsap, and Indianola soil complexes ranging from gravelly sandy loam to silt loams. These soil complexes occur across a broad range of slopes and are somewhat excessively drained to moderately well-drained, with depths to restrictive layers (lower permeability zones) greater than 80 inches (Aspect Consulting, LLC, 2018).

d. Are there any surface indications or a history of unstable soils in the immediate vicinity? If so, describe.

There are no surface indications or history of unstable soils in the proposed project area.

e. Describe the purpose, type, total area, and approximate quantities of total affected area of any filling or grading proposed. Indicate source of fill.

Soil would be cleared and excavated to lay the new 8-inch recycled water pipe. It is estimated that 3,600 cubic yards of excavated soil would be hauled off-site and 3,450 cubic yards of fill would be required for the conveyance system. Fine grading would be used to restore any roadway base and large paved areas on the WWTP site. Excavation for up to two infiltration galleries (approximately 100 feet by 400 feet in size) would result in an estimated 9,000 cubic yards of excavated material. Excavated materials would be used onsite to the greatest extent practicable, and any excess materials would be hauled off-site to a suitable disposal site.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

As with all projects, erosion could occur as a result of construction activities; however, the generally flat grade of the construction areas would limit the potential for erosion.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

The project would result in an increase of approximately 8,500 square feet of impervious surface area at the treatment plant, resulting in an overall increase of approximately 22 percent at the treatment plant site. The conveyance lines and infiltration gallery would not result in any additional impervious surface area.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Best Management Practices (BMPs) would be used to ensure that construction work does not result in erosion. BMPs are physical, structural, and/or managerial practices, that when used in combination prevent or reduce pollution of water caused by construction activities. BMPs may include timing of construction activities, covering exposed soils, installation of silt fences and straw bales, among other measures that would be determined prior to construction.

2. Air

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

During construction activities, there may be a small increase in exhaust emissions from construction vehicles and equipment, and a temporary increase in fugitive dust due to earthwork associated with trenching and other excavation. This increase in dust would be temporary and localized and not significant.

Emissions from construction vehicles, as well as emissions from construction workers' vehicles, would contribute greenhouse gases to the atmosphere over the approximately 8-month construction period.

Operation of the facility would not result in the production of greenhouse gases as the facility does not include a back-up generator of any kind. Class A recycled water is highly treated and is odorless. Because recycled water is odorless and very similar to tap water, operation of the recycled water facility is not expected to result in the generation of any additional odors.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

There are no off-site sources of odor that would affect the project.

c. Proposed measures to reduce or control emissions or other impacts to air, if any.

Measures that could be incorporated during construction to minimize impacts to air quality include:

- Watering construction surfaces to control dust, temporary ground covers, sprinkling the project site with approved dust palliatives, or use of temporary stabilization practices upon completion of grading.
- Wheel-cleaning stations could be provided to ensure construction vehicle wheels and undercarriages do not carry excess dirt from the site onto adjacent roadways.
- Streets would be regularly cleaned to ensure excess dust and debris is not transported from the construction-site to adjacent roads.
- Construction would be planned to minimize exposing areas of earth for extended periods.

3. Water

a. Surface Water:

1. Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The project area is located within the Grovers Creek watershed. Several unnamed tributaries and Grovers Creek are located in the project vicinity. Grovers Creek classified as a Class AA stream according to WAC 173-201A. The Suquamish Tribe operates a fall Chinook and chum hatchery near the mouth of Grovers Creek, which ultimately flows into Miller Bay. Grovers Creek is listed on the Washington State Department of Ecology's 303(d) listing for impaired water bodies because of low dissolved oxygen concentrations, elevated fecal coliform bacteria, and elevated temperature and turbidity. Grovers Creek also suffers from insufficient baseflow during the dry season. Implementation of this project would result in infiltration of an estimated 107 million gallons of recycled water per year into the shallow aquifer system

that recharges Grovers Creek and its tributaries (Brown and Caldwell, 2019). Miller Bay is currently closed for shellfish harvesting due to pollution.

A wetland delineation report was prepared for Heritage Park in 2007 (Otak, 2007). Several additional studies were conducted in 2010 (Golder Associates) to characterize the wetlands within the project area. For this project, a wetland reconnaissance was conducted in February 2018 along four potential pipeline alignments from the WWTP to the WHGC (ESA, 2018). Several wetlands and streams were identified between the treatment plant and the intersection of the Spine Line and White Horse trails. The conveyance alignment would likely follow existing power line and road rights of way from the WWTP to the golf course and infiltration gallery. Based upon published data and the wetland reconnaissance, it is anticipated that the selected conveyance alignment would not cross any streams or wetlands. Further wetland review will be conducted during project design, and refinements of the alignment would be considered to avoid wetlands, should wetlands be identified. The project will comply with all federal, state, and local permitting requirements, including wetland avoidance where possible.

The existing Kingston wastewater treatment plant discharges into Appletree Cove in Puget Sound. Implementation of this project would virtually eliminate the direct discharge of treated effluent to Appletree Cove, thereby reducing nitrogen loads in Puget Sound. The project would also help increase dissolved oxygen concentrations in Appletree Cove.

2. Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

Construction of the conveyance pipeline and the infiltration area may occur within 200 feet of wetlands; however, based on current understanding of wetland boundaries in the area, no direct wetland impacts are anticipated to occur. Any wetland or stream buffer areas impacted as a result of construction would be restored to existing conditions, and buffer mitigation would be conducted in accordance with Kitsap County requirements.

3. Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

No fill or dredge material would be placed in surface waters or wetlands.

4. Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities, if known.

The project would not require surface water withdrawals or diversions.

5. Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

According to FEMA Flood Insurance Rate mapping, the project does not lie within a 100-year floodplain.

6. Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

Water will be highly treated, to Class A recycled water standards, prior to discharge (Brown and Caldwell, 2019). Overall, water quality from the treatment plant and in the receiving waters is anticipated to improve as a result of the proposed action.

Completion of the project would ultimately result in greater use of recycled water for irrigation and ground water recharge instead of use of potable ground water for irrigation and discharging treated wastewater to Puget Sound. The project itself will not directly discharge waste materials to surface waters, and will help to offset increased wastewater discharge to Puget Sound in the future associated with population increases. By reducing the nitrogen load to Puget Sound, the project would help to increase the dissolved oxygen concentrations in Appletree Cove. Historically, low dissolved oxygen concentrations in marine waters have resulted in fish kills.

Infiltration of the recycled water through the soil column will result in a natural cooling of the water before discharge into Grovers Creek and associated tributaries. The increased discharge of cool water would help to reduce the temperatures in Grovers Creek. Reduced temperatures would also help increase the

concentrations of dissolved oxygen because cool water can hold more oxygen than warm water (Brown and Caldwell, 2019).

b. Ground Water:

1. Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

During construction, dewatering may be necessary at some locations along the conveyance line or at the treatment plant. Quantities of water to be withdrawn are unknown at this time, but are expected to be minimal. Withdrawn ground water would likely be discharged to a nearby tank prior to discharge. All dewatering would occur in accordance with Department of Ecology and Kitsap County requirements.

Groundwater monitoring wells are recommended to be installed as part of further design work. Minimal amounts of groundwater will be withdrawn for monitoring purposes that would be conducted in accordance with Departments of Ecology and Health permitting requirements.

As noted in question 3.a.1. above, implementation of this project would result in infiltration of an estimated 107 million gallons of Class A recycled water per year into the shallow aquifer system that recharges Grovers Creek and its tributaries (Brown and Caldwell, 2019).

Currently, irrigation water for the WHGC is purchased from the Kitsap Public Utility District (KPUD) and is sourced from groundwater wells in the area that pump from the sea-level aquifer. The sea-level aquifer is widely used and mostly confined. Therefore, the quantity of usable groundwater is limited and, eventually, as the local demands for groundwater supplies increases, this water source could decline because it is not being adequately replenished. The use of recycled water for irrigation would result in less demand of potable water for irrigation purposes (Brown and Caldwell, 2019).

2. Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

Highly treated recycled water, consistent with Washington State Class A Recycled Water Standards, would be surface applied as irrigation water at the Whitehorse Golf Course during the summer months and infiltrated during the winter months. The recycled water is treated to a very high level (tertiary treatment) that would not result in impacts to ground water quality. Use of recycled water for irrigation and other non-potable uses would reduce demands on ground water used for other purposes in the area. All uses of recycled water would be consistent with the Washington State recycled water standards which are designed to protect all beneficial uses, including aquatic habitat (Health and Ecology, 2018).

c. Water Runoff (including stormwater)

1. Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

During construction of the pump stations, conveyance pipeline, and infiltration gallery, work areas would be managed to control runoff and prevent erosion and sedimentation. All stormwater would infiltrate into the ground surface or flow into existing stormwater systems on the golf course; the stormwater system would not be modified from what currently exists. All runoff from the site will be managed consistent with Kitsap County requirements.

2. Could waste materials enter ground or surface waters? If so, generally describe.

Sediment generated during construction could enter ground water systems; however, BMPs (i.e., installation of temporary filter fabric in the existing catch basins) would be implemented to minimize sedimentation leaving the site, and potentially entering surface and ground waters.

3. Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe

The project would not impact drainage patterns in the area. The project would augment groundwater infiltration which would enhance nearby streams and tributaries, particularly in the dry summer months.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

During construction, BMPs would be implemented to ensure that sediment originating from disturbed soils would be retained within the limits of disturbance. BMPs may include installation of catch basin filters, interceptor swales, straw bales, sediment traps, and other appropriate cover measures. To the extent possible, equipment refueling will take place more than 200 feet from wetlands and streams. BMPs specific to the site and project will be specified in the construction contract documents, and the construction contractor will be required to implement them.

4. Plants

a. Check the types of vegetation found on the site:

_X__deciduous tree: alder, maple, aspen, other

_X__evergreen tree: fir, cedar, pine, other

_X__shrubs

_X__grass

____pasture

____crop or grain

____ Orchards, vineyards or other permanent crops.

_X_ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other

____water plants: water lily, eelgrass, milfoil, other

____other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

It is anticipated that the majority of the conveyance pipeline would be routed along right of way, which would minimize the amount of

vegetation clearing required for the project. Any disturbed vegetation would be replanted following completion of construction.

c. List threatened or endangered species known to be on or near the site.

No threatened or endangered plant species or critical habitat are known to be on or near the site.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Disturbed landscaped areas would be restored to existing conditions following construction using native vegetation.

e. List all noxious weeds and invasive species known to be on or near the site.

Himalayan blackberry and Scotch broom are present in the general project area adjacent to cleared areas.

5. Animals

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site. Examples include:

birds: hawk, heron, eagle, songbirds, other_____

mammals: deer, bear, elk, beaver, other _rodents_____

fish: bass, salmon, trout, herring, shellfish, other _____

other: amphibians, reptiles

b. List any threatened or endangered species known to be on near the site.

No federally listed species are present in the immediate project area. The Washington Department of Fish and Wildlife has mapped priority habitat for Cutthroat Trout in nearby streams. No other state endangered, threatened, sensitive, and candidate species; animal aggregations considered vulnerable; or species of recreational, commercial, or tribal importance that are vulnerable were found in the project vicinity. A bald eagle nesting area is located approximately a half mile northeast of the Kingston WWTP (Brown and Caldwell, 2019).

c. Is the site part of a migration route? If so, explain.

The project site is located within the Pacific Flyway, which is a flight corridor for migrating waterfowl and other avian fauna. The Pacific Flyway extends south from Alaska to Mexico and South America. No portion of the project would interfere with the Pacific Flyway.

d. Proposed measures to preserve or enhance wildlife, if any.

Implementation of the project is anticipated to result in increased base flow in Grovers Creek and associated tributaries, thereby providing additional physical habitat for fish, insects, and aquatic life. Water quality and aquatic species monitoring will be conducted in accordance with the facility's recycled water permit requirements.

e. List any invasive animal species known to be on or near the site.

Some invasive rodents are likely present in the project vicinity.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Construction and operation of the project would require utilities including electricity, communications, and water. Electrical energy would be required to provide lighting and run the pumps and treatment facilities at the WWTP. All new construction must conform to the current edition of the Washing State Energy Code. This code regulates energy efficiency in buildings and specifically addresses requirements for building envelope construction, thermal insulation values of building elements, heating, air-conditioning and ventilation systems, and lighting systems.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

The project would not affect the potential use of solar energy by adjacent properties.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The new facilities at the WWTP would be designed to operate efficiently in accordance with current energy standards.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

With any construction project, there is the risk of potential construction related spills or leaks. This project would face similar risks, but all risks would be well within the range of typical construction projects. No toxic chemicals would be used or stored at the construction sites, other than fuels and other construction-related fluids. Existing information does not indicate the presence of contaminated soils along the proposed pipeline route or at the reservoir site. Should suspected contaminated materials be encountered, appropriate testing would be done to determine containment and/or disposal requirements.

No new environmental health hazards are expected to occur as a result of operation of the recycled water project. See B.7.a.5 for a detailed discussion of measures to address environmental health hazards including measures to prevent human consumption of recycled water. The recycled water would meet Washington State Class A Recycled Water standards as required for irrigation of recreational areas where human access is not restricted. Water that meets these standards is approved for human contact, as long as it is for non-potable use.

1. Describe any known or possible contamination at the site from present or past uses.

There are no known sources of contamination present in the project area. The conveyance pipeline corridor is located primarily along right of way in largely undeveloped areas, and the White Horse Golf Course has been maintained and operated as a golf course for many years.

2. Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

There are no known hazardous chemicals/conditions in the project area.

3. Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

Chemicals are used and stored at the treatment plant as part of regular treatment plant operations. No new chemicals would be used at the WWTP as a result of this project.

4. Describe special emergency services that might be required.

Construction and operation of the facilities would comply with all applicable fire codes and Occupational Safety and Health Administration (OSHA) regulations. Special emergency services beyond those currently employed at the site would not be required.

5. Proposed measures to reduce or control environmental health hazards, if any:

Redundancy and reliability would be designed into the facility in order to comply with the Washington State Reclaimed Water Facilities Manual (Health and Ecology, 2019).

Recycled water end users would be required to operate irrigation systems in compliance with all state laws and regulations regarding the use of recycled water including the Washington State Reclaimed Water Facilities Manual (Health and Ecology, 2019). The end user would be required to do all of the following:

(1) Notify the public and the end user's employees of the use of recycled water at all use areas by posting advisory signs, approved by the Washington State Departments of Health and Ecology, or by other methods;

(2) Take adequate measures to prevent unplanned ponding of recycled water;

(3) Confine recycled water, including runoff and spray, to the designated and approved use area in accordance with the state discharge permit;

(4) Take adequate precautions to assure that recycled water not be sprayed on people or any facility or area not designated for reuse, including buildings, passing vehicles and drinking water fountains;

(5) Separate recycled water lines from potable water lines;

(6) Tag or label all recycled water piping, valves, outlets and other appurtenances to warn the public and employees that the recycled water is not intended for drinking with a warning colored purple with white or black lettering acceptable to the Departments of Ecology or Health marked CAUTION – RECYCLED WATER – DO NOT DRINK, or other wording as approved by the Departments of Ecology and Health;

(7) Color code all recycled water piping, valves, outlets and other appurtenances with purple with white or black lettering acceptable to the Departments of Ecology or Health to identify the source of the water as being recycled; and

(8) Make all recycled water valves and outlets secure such that they can only be operated by authorized personnel.

b. Noise

1. What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

There are no existing sources of noise in the area that would adversely affect the proposal.

2. What types and levels of noise would be created by or associated with the project on a short-term or long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Noise associated with construction equipment and vehicles would be temporary and localized, varying in noise levels throughout the construction period. Operation of the facility is not expected to produce any additional noise.

3. Proposed measures to reduce or control noise impacts, if any:

Aside from temporary noise increase during construction, noise impacts are not anticipated; therefore, mitigation measures have not been developed.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The Kingston Wastewater Treatment Plant is located on S Kingston Road. It is owned and operated by Kitsap County PUD and has been in operation since 2005. The area surrounding the treatment plant is largely undeveloped.

The White Horse Golf Course is located on Three Lions Road. The course was purchased by the Suquamish Indian Tribe in 2010. The area surrounding the golf course is largely undeveloped, with some single-family residential development to the southwest. North Kitsap Heritage Park, a 799-acre park is located north of the golf course. This park is largely undeveloped with several miles of developed trails and existing logging roads. This park is currently managed as a collaboration between Kitsap County and the North Kitsap Heritage Park Stewardship group.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

The majority of the project area is forested, and does not constitute prime or unique farmland. No uses will be converted.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

The project will not affect any working farms or forest land operations.

c. Describe any structures on the site.

The Kingston Wastewater Treatment Plant is an operational wastewater treatment facility with above-grade structures and equipment on the site. No above-grade structures are expected outside of the Kingston Wastewater Treatment Plant site. Conveyance pipelines would be located underground along the existing power line right of way and roads. Disturbed areas would be restored to current conditions following project completion. Infiltration galleries are envisioned to be at-grade facilities that discharge water through a series of pipes to a sand, gravel, and native soil infiltration area. .

d. Will any structures be demolished? If so, what?

No structures would be demolished.

e. What is the current zoning classification of the site?

The current zoning designation (2016) for the Kingston Wastewater Treatment Plant is rural residential (1 dwelling unit/5 acres), the potential conveyance route is located along areas zoned rural residential and Park, and the White Horse Golf Course is Tribal Land.

f. What is the current comprehensive plan designation of the site?

The current comprehensive plan designation (2016) for the Kingston Wastewater Treatment Plant and for the conveyance route is Public Facility, North Kitsap Heritage Park is Park, and the White Horse Golf Course is Tribal Land.

g. If applicable, what is the current shoreline master program designation of the site?

Not applicable. There are no regulated shorelines within the project area.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

Several streams and wetlands are present in the project vicinity, which are classified as critical areas by Kitsap County. Additional investigations for wetlands and streams will be conducted for the proposed project as project design progresses.

Aquifer recharge areas are portions of the land that contain hydrogeologic conditions that facilitate aquifer recharge and/or potentially transmit contaminants to an underlying aquifer. In Kitsap County, aquifer recharge areas are sorted into two categories, including Category I critical aquifer

recharge areas, which are defined as areas where the probability that groundwater may be adversely impacted by certain land use activities is high. The Kingston WWTP is located in a Category I critical aquifer recharge area, and each of the conveyance routes cross portions of Category I areas. Category II critical aquifer recharge areas are areas that that provide recharge to aquifers that are current or potentially will become potable water sources and are vulnerable to contamination based upon the type of land use activity. The Kingston Recycled Water Facility Plan describes how the project would provide additional treatment through infiltration and by the infiltration basin to supplement aquifer recharge and augment stream baseflows (Brown and Caldwell, 2019).

i. Approximately how many people would reside or work in the completed project?

No people will reside in the completed project. The recycled water project would be operated by treatment plant staff and White Horse Golf Course staff.

j. Approximately how many people would the completed project displace?

No one will be displaced as a result of this project.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Displacements would not occur as a result of this project; therefore, mitigation measures have not been developed.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

Improvements would be constructed at the existing treatment plant and would be compatible with plant operations. The remainder of the project would be largely underground. The specific location for the infiltration gallery would be evaluated and selected as design progresses, but is expected to be located in the general vicinity of the North Kitsap Heritage Park. The project would not impact any existing land uses and complies with applicable Kitsap County zoning requirements (Kitsap County Code Chapter 17.410); therefore, mitigation measures have not been developed.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

The proposal is not displacing any agricultural or forest lands.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Housing would not be created as a result of this project.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Housing would not be eliminated as a result of this project.

c. Describe proposed measures to reduce or control housing impacts, if any.

Impacts to housing are not anticipated; therefore, mitigation measures are not proposed.

10. Aesthetics

a. What is the tallest height of any of the proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Upgrades to the existing treatment plant would be needed to produce Class A recycled water. The current treatment system would need to be upgraded to meet the total nitrogen removal limit required for indirect infiltration, a new tertiary filtration system, and modified ultraviolet (UV) disinfection would be required. The maximum height of the upgraded facilities at the treatment plant would be approximately 22 feet (filter structure). A new pump station would be constructed within the existing WWTP site to convey recycled water and would be approximately 10 feet above grade. The treatment plant is located in a rural forested area, which is not visible from neighboring properties. The infiltration gallery would be constructed at ground level and located in the general vicinity of North Kitsap Heritage Park. The specific location for the infiltration gallery will be evaluated and selected during the design process.

b. What views in the immediate vicinity would be altered or obstructed?

No views would be obstructed. Improvements at the existing treatment plant will occur within the existing plant area. All conveyance pipelines will be completely underground. Views in the area of the infiltration gallery would be altered, but the gallery would be sited and designed to work into existing landscapes.

c. Proposed measures to control or reduce aesthetic impacts, if any:

Aesthetic impacts are not anticipated, therefore, mitigation measures have not been developed.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Construction will occur primarily during the daytime, negating the need to utilize artificial lighting. The treatment plant will be illuminated with only security lighting and would be similar to lighting at the existing facility.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Light or glare would not be a safety hazard and would not interfere with views.

c. What existing off-site sources of light or glare may affect your proposal?

No off-site sources of light or glare would affect this proposal.

d. Proposed measures to reduce or control light and glare impacts, if any:

Light and glare impacts are not anticipated; therefore, mitigation measures have not been developed.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

The project area has numerous opportunities for active and passive recreation activities. North Kitsap Heritage Park is a 799-acre park located in the project area. This park is largely undeveloped with several miles of developed trails and existing logging roads. This park provides opportunities for walking, hiking, or trail running along the trails and logging roads. The White Horse Golf Club, owned by the Suquamish Tribe, is an 18-hole golf course, with putting greens, chipping area, and club house. Kitsap County also has many popular bike routes throughout the county.

b. Would the proposed project displace any existing recreational uses? If so, describe.

During construction of the pipeline, some recreational activities may be temporarily displaced as a result of construction activities in and adjacent to the roadway and active construction areas. Detours would be placed were necessary and possible. Construction activities may also temporarily impact golfers using the golf course. During this time, temporary provisions would be made for golfers. Following construction, the golf course area would be completely restored. No permanent displacement of existing golf course users would occur as a result of this project.

Operation of the proposed project will not displace any recreational opportunities in the area. Irrigation with recycled water is commonly used for parks and recreation facilities, and is a permitted use of Class A recycled water (Health and Ecology, 2019).

c. Proposed measures to reduce or control impacts on recreation, including recreational opportunities to be provided by the project or applicant, if any:

Recreational impacts are not anticipated; therefore, mitigation measures have not been developed.

13. Historic and Cultural Preservation

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.

There are no buildings or structures over 45 years old and no other recorded cultural resources listed on or determined eligible for listing on the NRHP, WHR, or Kitsap County Register of Historic Places within or adjacent to the project site.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

According to the Washington State Department of Archaeology and Historic Preservation (DAHP) WISAARD online database, there are no recorded archaeological sites or cemeteries within or adjacent to the project area. The nearest recorded resources are approximately 0.5 mile from the proposed project including one cemetery (Kingston Cemetery)

and three archaeological sites (45KP1 [precontact shell midden], 45KP18 [precontact shell midden], and 45KP146 [historic-period bridge remnant]) (DAHP, 2018a; Snyder, 1954; Kent, 2006a; Lewarch, 1975). Sites 45KP1 and 45KP18 have not been evaluated. Site 45KP146 was Determined Not Eligible for listing on the NRHP (Whitlam, 2006).

Based on DAHP's Statewide Predictive Model used to assess the risk of encountering precontact archaeological resources, the project site is classified as primarily High Risk for the expansion at the existing WWTP and for the infiltration pond area, and with some portions along the conveyance alignment as Moderate to Low Risk (DAHP, 2018b).

One cultural resource survey has been conducted within the project area, at the existing WWTP. Two non-diagnostic ceramic fragments were identified near the former Nixon/Barry homestead location (Hartmann, 1999).

There is evidence of Native American occupation and land use in the vicinity of the project, along the shorelines of Appletree Cove and Miller Bay and a nearby marsh. The recorded place names relate to plant gathering and resource use locations (Hilbert et al., 2001).

Historic aerial photographs from 1951 through modern day show the project and vicinity as primarily forested land with nearby roads (NETR Online, 1951; 1969;1990; 2015). By the early 2000s, the White Horse Golf Club was constructed just south of the project, and the existing WWTP was also built. Today, the project vicinity remains heavily forested and the proposed conveyance portion is within the power line right of way and adjacent to NE White Horse Drive.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

GIS data layers for archaeological sites, cemeteries, historic properties, register-listed properties, cultural resource surveys, and predictive model, were reviewed on DAHP's WISAARD database (DAHP, 2018). Ethnographic sources and historic-period maps and aerial photographs were also examined (Anderson, 1909; GLO, 1888, 1894; Hilbert et al., 2001; Kroll, 1940; Metsker, 1926; NETR Online, 1951, 1969, 1990, 2015; USSG, 1860a, 1860b).

Parcel data was researched using the Kitsap County Assessor's online database (Kitsap County Assessor, 2018). Local historic register

information was reviewed online via Kitsap County Historical Society & Museum's website (2018).

The Suquamish Tribe was contacted in September 2018 to inquire about ethnographic and/or cultural information they may have and wish to share with regards to the project area. The information below was provided by the Suquamish Tribe's Tribal Historic Preservation Officer (THPO), Dennis Lewarch on October 1, 2018.

The Suquamish Tribe does not have specific ethnographic period references or place names for the potential project elements. Areas with wetland habitats may have been or may continue to be used by Suquamish people. The Suquamish Tribe's cultural resource sensitivity model incorporates soil types to estimate native vegetation that may have been used by hunter-fisher-gatherers and does not rely as heavily on distances to sources of fresh water, unlike the predictive model used by DAHP.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

When project design is at 60%, a professional archaeologist will review the plans and develop an archaeological survey strategy. If geotechnical investigations are conducted, an archaeologist should monitor the borings.

At a minimum, the County will develop an Inadvertent Discovery Plan (IDP) for use during the project. The IDP will set forth the procedures and protocols to follow in the event of an archaeological resources discovery. The IDP will include pre-construction briefings and on-call response if required. In the event that cultural resources were inadvertently discovered during the project, construction would be temporarily halted in the immediate vicinity of the identified resources and the County, DAHP, and affected tribes, would be notified. Mitigation and/or avoidance measures would be coordinated with the County, DAHP, and other stakeholders.

14. Transportation

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

Roadways in the project area include S Kingston Rd NE, NE White Horse Dr, Singingwood Pl NE Dr, and Miller Bay Rd NE. Construction of the conveyance line would result in temporary disruptions to NE White Horse Dr.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

The project area is not served by transit, however, Kitsap Transit provides service between Kingston and Suquamish along Miller Bay Rd.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

No parking spaces would be added or eliminated as a result of the project.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

The project will not impact the existing road system, and will not require any improvements to existing roads or streets. Conveyance pipeline would likely be constructed along existing rights of way and adjacent to NE White Horse Drive. Disturbed areas will be restored to existing conditions following construction.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

The project will not use, nor interfere with, water, rail, or air transportation.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

The completed project will not result in any additional trip generation.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

The proposed project will not interfere with nor be affected by the movement of agricultural or forest products.

h. Proposed measures to reduce or control transportation impacts, if any:

Construction will result in temporary disruptions along NE White Horse Dr. Long-term transportation impacts are not anticipated; therefore, mitigation measures have not been developed.

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

The proposal would not result in an increased need for public services.

b. Proposed measures to reduce or control direct impacts on public services, if any.

Since there are no impacts to public services, no mitigation measures have been developed.

16. Utilities

a. Underline utilities currently available at the site:

electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other _____

The project is located in a rural area of Kitsap County. Utilities are present at the treatment plant and at the golf course. The project will not impact any utilities.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Utility services will not change from existing conditions. Wastewater collection and treatment services will remain operational during construction. Overall, the recycled water facility will provide a more reliable wastewater treatment system that produces a higher quality effluent.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Barbara Zaroff, P.E

Name (print): Barbara Zaroff

Title: Capital Projects Engineer

Date Submitted: August 21, 2019

D. Supplemental Sheet for Nonproject Actions

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

The project would result in short-term emissions to air and noise from the use of construction equipment. No toxic chemicals would be used or stored at the construction sites, other than fuels and other construction-related fluids. The project will not result in increases in stormwater runoff.

Once the project is completed, Class A recycled water will be produced at the Kingston Wastewater Treatment Plant to be used for summer irrigation at the Whitehorse Golf Course and winter indirect groundwater recharge. Delivery of recycled water to the golf course would preserve 29 million gallons of potable water per year. Recycled water will also decrease the risk of saltwater intrusion within the regional sea-level aquifer (Brown and Caldwell, 2019).

Proposed measures to avoid or reduce such increases are:

BMPs would be implemented during construction:

- Watering construction surfaces to control dust, temporary ground covers, sprinkling the project site with approved dust palliatives, or use of temporary stabilization practices upon completion of grading.
- Wheel-cleaning stations could be provided to ensure construction vehicle wheels and undercarriages do not carry excess dirt from the site onto adjacent roadways.
- Streets would be regularly cleaned to ensure excess dust and debris is not transported from the construction-site to adjacent roads.
- Construction would be planned to minimize exposing areas of earth for extended periods.
- Installation of catch basins filters, interceptor swales, straw bales, sediment traps, and other appropriate cover measures.
- To the extent possible equipment refueling will take place more than 200 feet from wetlands and streams

More site specific BMPs will be developed and specified in the construction contract documents, and the selected construction contractor will be required to implement them.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

Some vegetation will be disturbed or removed for the installation of the conveyance pipeline and infiltration basins; however, all disturbed areas along the conveyance route will be restored following construction. The project will likely result in increased baseflow in Grovers Creek and associated tributaries nearby, improving aquatic habitat. More baseflow would provide additional physical habitat for fish, insects, and other aquatic wildlife. As recharged water travels through soil, it will undergo natural cooling. Reducing stream temperatures would help increase dissolved oxygen concentrations.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

As mentioned, disturbed vegetation will be restored following the completion of construction. Overall, the project will enhance fish habitat and improve water quality as described above, as well as reduce nutrient inputs to the marine environment. The project would virtually eliminate the direct discharge of treated effluent to marine waters, effectively reducing nitrogen loads by more than 6,000 pounds/year by 2040. This is aligned with Washington State's initiative to clean up and restore Puget Sound.

3. How would the proposal be likely to deplete energy or natural resources?

The proposed project would not be likely to deplete any energy or natural resources. The project will benefit surface and groundwaters.

Proposed measures to protect or conserve energy and natural resources are:

The new facilities at the Kingston Wastewater Treatment Plant will operate efficiently and reliably, in accordance with current energy standards.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

The project is not anticipated to impact any environmentally sensitive areas. It is anticipated that any direct impacts to wetlands and streams will be avoided. As noted above, the project is anticipated to enhance surface and groundwaters.

WDFW has listed nearby streams as priority habitat for Cutthroat Trout. No other critical habitat, endangered or threatened species are known to be in the project vicinity. Implementation of the project is anticipated to result in increased base flow into Grovers Creek and other associated tributaries which would provide additional physical habitat for fish, insects, and other aquatic life.

The Kingston Wastewater Treatment Plant is located in Category 1 critical aquifer recharge aquifer area and each of the conveyance routes cross portions of the Category I areas. In Kitsap county Category 1 critical aquifer recharge areas are defined as areas where the probability that groundwater may be adversely impacted by certain land use activities is high. The Kingston Recycled Water Facility Plan describes how the project will provide additional treatment through infiltration and by the infiltration basin to supplement aquifer recharge and augment stream base flows (Brown and Caldwell, 2019).

The project is not located in a floodplain or in an area where farmlands could be affected. No historic or cultural sites are known to be on or near the project site, therefore it is unlikely that there will be any impacts to cultural or historic resources.

Proposed measures to protect such resources or to avoid or reduce impacts are:

To prevent the loss of any cultural or historic resources when the project design is at 60%, a professional archaeologist will review the plans and develop an archaeological survey strategy. The county will also at minimum develop an Inadvertent Discovery Plan for use during ground disturbance activities.

Equipment fueling will take place more than 200 feet from wetlands and streams to the maximum extent possible. Additional investigations for wetlands and streams will also be conducted for the proposed project as part of the engineering report preparation process. Any wetland or stream buffer areas impacted as a result of construction would be restored to existing conditions.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

Improvements would be constructed at the existing wastewater treatment plant and would be compatible with the existing land and shoreline uses. Other aspects of the project would be constructed underground and would have no long term effects on land and shoreline uses.

Proposed measures to avoid or reduce shoreline and land use impacts are:

Due to the project not having an effect on any land and shoreline uses no mitigation measures have been developed at this time.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

The project would not result in any increased demands on transportation.

Proposed measures to reduce or respond to such demand(s) are:

Since it is unlikely that transportation demands will occur as a result of this project, mitigation measure have not been developed.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

The project will not conflict with any local, state, or federal laws or requirements for the protection of the environment.

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FIGURES

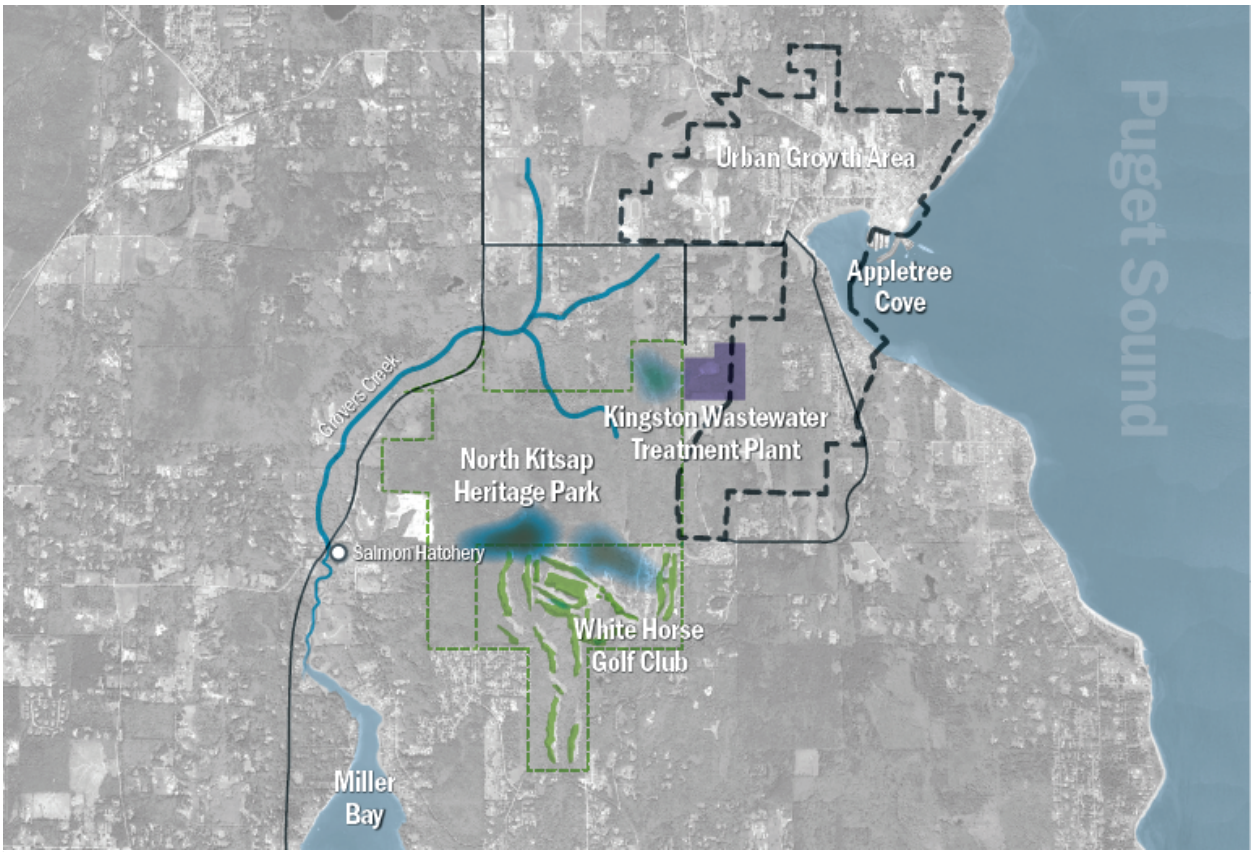

Figure 1
Kingston Recycled Water Planning Area

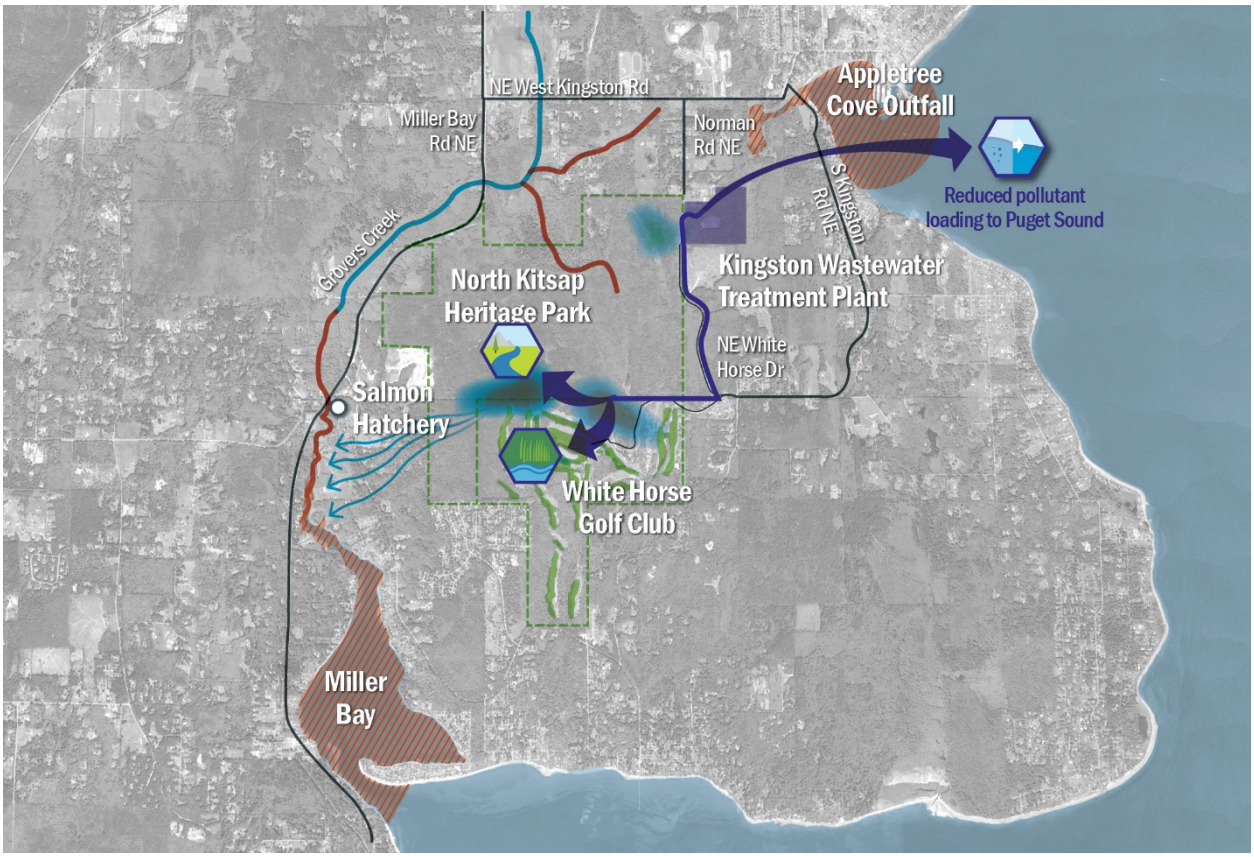

Figure 2
Baseline Option Summary

From: Alison Osullivan <aosullivan@suquamish.nsn.us>
Sent: Friday, September 27, 2019 7:26 PM
To: Kathlene Barnhart
Cc: Mark Fisher
Subject: RE: 19-02520 Kingston Recycled Water Facility Plan Programmatic SEPA DNS

Follow Up Flag: Follow up
Flag Status: Flagged

The Tribe has the following comments regarding the project referenced above.

- The Tribe needs more information to better understand any proposed potable water offsets/credit issues especially as it may relate to the Kingston Recycled Water project.
- Bob Gatz has retired and no longer works for the Tribe. The contacts for this project at this time are Mark Fisher and Alison O'Sullivan.
- The draft we have is dated September 24, 2018 and we are unsure if this is the most recent draft.
- As per previous comments the Tribe has not made any financial commitments towards construction of this project.
- An MBR is preferred over a sand filter as it provides more assurances and consistency.
- The document should discuss inclusion of evolving best available science in the monitoring and contingency sections especially with regard to nutrients, pathogens and personal care products to ensure protection of Tribal Treaty natural resources.

Thanks,

Alison O'Sullivan
Senior Biologist, Suquamish Tribe Fisheries Department

P.O. Box 498 (mailing)
18490 Suquamish Way
Suquamish, WA 98392
phone: (360) 394-8447

From: Joseph Lubischer <jslubischer@gmail.com>

Sent: Friday, September 27, 2019 8:47 PM

To: Kathlene Barnhart; Steve Heacock

Cc: sepaunit@ecy.wa.gov; Barbara Zaroff; betsycooper1@gmail.com; stollel@comcast.net; thomas-doty@comcast.net; djkott@hotmail.com; shawbob2000@yahoo.com; EdwardC@KitsapTransit.com; SteffaniL@kitsaptransit.com; smith@nkfr.org; communications@nkschools.org; jrhoads@nkshcools.org; amy.tousley@pse.com; mark@kpud.org; Cynthia Rossi; aosullivan@suquamish.nsn.us; strudel@suquamish.nsn.us; Dennis Lewarch; Roma Call, PGST (romac@pgst.nsn.us); Samuel J. Phillips; rlumper@skokomish.org; emarbet@squaxin.us; russ.ladley@puyalluptribe.com; sepacenter@dnr.wa.gov; sepa.reviewteam@doh.wa.gov; sepa@dahp.wa.gov; Chris Waldbillig; Siu, Nam (DFW); Brown, Adam B (DFW); Gordon, Brittany N (DFW); Hennessey, Diane (ECY); kcachair@gmail.com; scacchair@gmail.com; Niki Quester; Stephen Weagant; Jay Zischke; Rotegard, Laura; Jayne Larson; Paul Larson; Mark E Libby; carolina veenstra; John F. Williams; Dave Haley; Nancy DeArchangel; Jim Halstead; Kathryn Thompson (kathryn078@icloud.com); Craig Jacobrown; Bobbie Moore

Subject: Re: 19-02520 Kingston Recycled Water Facility Plan Programmatic SEPA DNS

Follow Up Flag: Follow up

Flag Status: Flagged

Kathlene,

Thank you for sending out the notification for SEPA review of the Kingston recycled water plan. There are a few questions you may be able to help with.

1. To whom and in what formats may comments be submitted?

2. Having reviewed previous SEPA checklists, is a red-line version of the revised August 2019 checklist available?

3. The checklist cites the January 2019 version of the Facility Plan (Brown and Caldwell, 2019). I am aware of November 2018, January 2019, and May 2019 versions of the Plan with an additional version expected in response to Ecology and DOH comments. What version will DCD be working from?

4. The Facility Plan is the basic underlying document for this project. The document should have been made available to the public before the public comment period commenced. No version of the Plan has ever been posted on the Public Works website. The public as well as commenters should be notified that a single copy of the May 2019 version was placed in the Kingston library, although one, reference-only copy will likely be insufficient given the multiple commenters.

5. The hydrogeology memorandum (Aspect, 2018) also needs to be made available to the public.

6. There are substantial and significant differences between the SEPA checklist and the Facility Plan. These differences present difficulties in submitting cogent comments and raise the question as to whether the project is ripe for SEPA evaluation. Will one of the documents have precedence? How will DCD identify and address the differences?

7.It would be appropriate for DCD to delay, or extend, the comment period until after the issues raised in points 4, 5, and 6 above have identified been addressed.

Yours,

Joe Lubischer

On Fri, Sep 27, 2019 at 3:52 PM Kathlene Barnhart <KBarnhar@co.kitsap.wa.us> wrote:

> Good afternoon,
>
> Attached are the SEPA checklist and Programmatic SEPA Determination of Non-Significance for the Kitsap County Public Works, Kingston Recycled Water Facility Plan, as published today, September 27, 2019. Comments must be submitted by **October 11, 2019**. This is a programmatic decision only for the facility *plan*. Comments will help to guide project level design plans, which will be subject to additional, site-specific SEPA review, local/state/federal permits and mitigation.
>
> Please let me know if you have any questions.
>
> **Kathlene Barnhart**
>
> Senior Environmental Planner

Kitsap County Dept. of Community Development

kbarnhar@co.kitsap.wa.us

(360)337-5777

--

Joe Lubischer

360-860-1075

jslubischer@gmail.com

From: Jayne Larson <2jaynenkhp@gmail.com>

Sent: Sunday, September 29, 2019 9:26 AM

To: Joseph Lubischer

Cc: Kathlene Barnhart; Steve Heacock; sepaunit@ecy.wa.gov; Barbara Zaroff; betsycooper1@gmail.com; stollel@comcast.net; thomas-doty@comcast.net; djkott@hotmail.com; shawbob2000@yahoo.com; EdwardC@KitsapTransit.com; SteffaniL@kitsaptransit.com; smith@nkfr.org; communications@nkschools.org; jrhoads@nkshcools.org; amy.tousley@pse.com; mark@kpud.org; Cynthia Rossi; aosullivan@suquamish.nsn.us; strudel@suquamish.nsn.us; Dennis Lewarch; Roma Call, PGST (romac@pgst.nsn.us); Samuel J. Phillips; rlumper@skokomish.org; emarbet@squaxin.us; russ.ladley@puyalluptribe.com; sepacenter@dnr.wa.gov; sepa.reviewteam@doh.wa.gov; sepa@dahp.wa.gov; Chris Waldbillig; Siu, Nam (DFW); Brown, Adam B (DFW); Gordon, Brittany N (DFW); Hennessey, Diane (ECY); kcachair@gmail.com; scacchair@gmail.com; Niki Quester; Stephen Weagant; Jay Zischke; Rotegard, Laura; Paul Larson; Mark E Libby; carolina veenstra; John F. Williams; Dave Haley; Nancy DeArchangel; Jim Halstead; Kathryn Thompson (kathryn078@icloud.com); Craig Jacobrown; Bobbie Moore

Subject: Re: 19-02520 Kingston Recycled Water Facility Plan Programmatic SEPA DNS

Follow Up Flag: Follow up

Flag Status: Completed

good comments Joe.

Thanks for keeping us in the loop on this project.

On Fri, Sep 27, 2019 at 8:44 PM Joseph Lubischer <jslubischer@gmail.com> wrote:

> Kathlene,
>
> Thank you for sending out the notification for SEPA review of the Kingston recycled water plan. There are a few questions you may be able to help with.

1. To whom and in what formats may comments be submitted?

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Yours,

Joe Lubischer

On Fri, Sep 27, 2019 at 3:52 PM Kathlene Barnhart <KBarnhar@co.kitsap.wa.us> wrote:

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Please let me know if you have any questions.

Kathlene Barnhart

Senior Environmental Planner

Kitsap County Dept. of Community Development

kbarnhar@co.kitsap.wa.us

(360)337-5777

--

Joe Lubischer

360-860-1075

jslubischer@gmail.com

From: Donna and Jon Kott <djkott@hotmail.com>

Sent: Wednesday, October 9, 2019 5:40 PM

To: Kathlene Barnhart

Subject: Fwd: 19-02520 Recycled water facility

Follow Up Flag: Follow up

Flag Status: Completed

Sent from my iPad

Begin forwarded message:

> **From:** Donna and Jon Kott <djkott@hotmail.com>
> **Date:** October 8, 2019 at 2:23:06 PM PDT
> **To:** "kbarnhar@kitsap.wa.us" <kbarnhar@kitsap.wa.us>
> **Cc:** Donna and Jon Kott <djkott@hotmail.com>, "jslubischer@gmail.com" <jslubischer@gmail.com>, "shawbob2000@yahoo.com" <shawbob2000@yahoo.com>
> **Subject: Re:19-02520 Recycled water facility**
>
> Ms. Barnhart:
>
> I live on a hillside, perhaps 1200 feet west of the proposed infiltration site. The Suquamish hatchery is slightly to the north and west. For location purposes, my home is adjacent to the south side of the Arness sand pit at about 170 feet above sea level. I have two wells on the property that draw from an unconfined aquifer at around 130 feet above sea level.
>
> According to your SEPA and DNS documents , there are no above sea levels water wells along the northern portion of Indianola Rd. ——- this is a tragic error! I would argue that many of the existing wells draw from above sea level. I would be happy to suggest some if you wish.
>
> According to your documents, potential contaminates from the proposed infiltration ponds would reach my wells in less than one year. Will you regularly monitor my wells for potential contamination? When my wells do become contaminated, well you provide me with a new source of water?

As an additional objection, a branch of an unnamed tributary of Grover's Creek heads on my property. This branch does not appear on any of your maps; and is much closer to your proposed infiltration site than any of the branches that do appear.

Sincerely,
Jon N. Kott

Sent from my iPad

From: Carol Price <carol9price@comcast.net>
Sent: Tuesday, October 15, 2019 12:03 PM
To: Kathlene Barnhart
Subject: Kingston Recycled Water Facility

Follow Up Flag: Follow up
Flag Status: Completed

Ms. Barnhart,

I am interested in info about the proposed Kingston Recycled Water Facility; what impact would it have on the North Kitsap Heritage Park?

Thanks for your time,

Carol Price

From: thomas-doty <thomas-doty@comcast.net>

Sent: Tuesday, October 15, 2019 9:08 PM

To: Kathlene Barnhart

Cc: Joe Lubischer

Subject: I am sharing 'SEPA, recycled water project(1).docx' with you

Attachments: SEPA, recycled water project(1).docx

Kathlene:

Attached is our updated response to the SEPA checklist we recently received. We note a few changes but our concerns remain as stated.

Respectfully,

Tom.

North Kitsap Heritage Park (NKHP) Stewardship Group response to the Kingston Recycled Water Project (KRWP) SEPA Checklist. General comments first (1-10) followed by specific, annotated references to the SEPA Checklist.

The KRWP SEPA Checklist appears to have omitted important information regarding the project and the effect on NKHP (hereinafter, the "Park"). This information includes a planned expansion of NKHP on the south and east sides of the Kingston Waste Water Treatment Plant (KWWTP); coordination with road and pipeline routes on the adjacent (and permitted) Arborwood development; and environmental, user and habitat impacts to the Park by construction and maintenance activities. Proposed work includes drilling in the Park (nowhere discussed), pipeline installation (across delineated wetlands), infiltration basin construction within the Park, and future maintenance, modification and possible expansion projects affecting the Park.

Nowhere in this checklist is there a list of materials in recycled water known to be toxic to humans or to other vertebrates. The designation as Class A recycled water, requiring signage to deter human exposure, begs the question as to the effects on other vertebrates, with whom we share the basics of vertebrate cellular physiology. Concerns include possible toxins (acute and epigenetic effects), carcinogens, CEC's, etc. in the recycled water

Our **general concerns** include, but are not limited to, the following list of ten:

01. It appears that two separate pipelines will be required. We note that two types of water (Hi and Low N content) will be conveyed, necessitating greater excavation activity and habitat disturbance.

02. Damage to trails and trailside vegetation seems inevitable. Powerline trail is mostly re-vegetated – a trail constructed, maintained, and cleared of invasive Scotch Broom over 100's of volunteer hours.

03. Direct impact to wetlands and streams. The conveyance routes all cross professionally-delineated wetlands, including headwaters of fish-bearing Bear and Beaver Creeks, both tributary to Grover's Creek.

04. Loss of an unspecified amount of terrestrial habitat, increasingly subdivided locally as a result of public and private land-altering projects.

05. Vehicular access into the Park, traffic during construction and maintenance over time; specifically, effect on Powerline trail (at last considered a pleasant single track trail).

06. Well-drilling equipment access into the Park and eventual well-decommission are nowhere discussed (vehicular traffic infrastructure through the Park is limited in an effort to retain a contiguous habitat for Park residents).

07. We are concerned about the steady flow of proposals for the infrastructural use of our Park land that do not conform to our goal of preserving natural (often 'critical') habitat rapidly vanishing elsewhere in Kitsap County.

08. Water quality concerns have arisen as a result of a steward-initiated environmental inventory of the Park – specifically, indications of depauperate communities of FW aquatic macro-invertebrates, fish and larval amphibians in Bear and Beaver Creeks.

09. It appears that this project, as it affects the Park, is a zoning violation (Kitsap Co. Code 17.0340.010 suggests this is an unsanctioned use of NKHP land).

10. All of the above, and the annotated commentary that follows, suggest to us that there are better ways to handle the tertiary-treated effluent during winter (non-irrigation periods at the White Horse Golf Course) than dumping it on the Park including; infiltration on-site at the KWWTP property (seemingly large enough) or, if in fact it is safe enough for endemic FW fish and larval amphibians, there would seem to be no reason not to dispose (your word) of it into Puget Sound.

Specific Comments on KRWP SEPA Checklist:

A.8 North Kitsap Heritage Park Stewards have conducted a professional wetland delineation of the entire NKHP (~818 acres), identifying 81 acres of wetlands, 3.3 miles of fish bearing (F) streams, 1.2 miles of seasonal streams, active beaver ponds, hillside seeps, numerous vernal ponds and intermittent streams. All are biologically significant habitats.

A.9 Kitsap County Department of Community Development (DCD) has approved the Arborwood proposal that would transfer 104 acres, on the south and east sides of the KWWTP, to NKHP.

A.11 The hydrogeology recommendation for "deep boring and monitoring wells within NKHP" is neither mentioned nor evaluated anywhere in the checklist.

B.1.a, B.1.b Slopes within NKHP are not "generally flat", but include gradients (eg. 25% east of Bear Creek) that can be expected to have erosion and siltation issues.

B.1.e, B.1.g Where will 9000+ yards of NKHP native soil go? It is expected that excavation and haulage equipment for the pipeline will result in soil compaction, reduced infiltration rates and erosion risk.

B.1.h Pipeline construction, especially on the steeper slopes in NKHP (eg. Powerline Trail) is expected to create long-term erosion and re-vegetation issues. Remediation will likely devolve to volunteer stewards, reducing their effectiveness in general Park maintenance.

B.2.c Bullet two: Stewards have devoted hundreds of volunteer hours removing Scotch Broom from Powerline Trail. Construction equipment is a notorious conveyor of Broom seed.

B.3.a.1, B.3.a.2 The statements that the Powerline alignment "would not cross any streams or wetlands" and "no direct impacts will occur" are absolutely incorrect. All the proposed alignments would impact streams, beaver ponds, wetlands and buffers.

B.3.a.6 Current scientific research has indicated that residual chemicals in effluent can result in adverse developmental effects in fish or amphibians at parts per trillion (ppt) concentrations, including combinatorial, synergistic, antagonistic and epigenetic effects. No risk assessment for stream and wetland habitats has been performed. The claimed benefits of reduced temperature and increased DO in Grover's Creek are probably overstated. Hydrogeology suggests 100% capture of effluent by streams over 6-33 months while the USGS model predicts only 35% would make it to streams in 1-2 months with the remainder to the Kingston aquifer. The timing suggests near zero augmentation in the critical late summer and fall period.

B.3.b.2 The project is contradictory regarding the amount of infiltration to confined aquifers (as opposed to the surficial, unconfined aquifer expected to augment Grover's Creek flow). No human risk assessment for the effects of residual chemicals in ground water has been performed.

B.4.b For NKHP, two 1-acre infiltration basins and over 3000' of pipeline are proposed. Construction of the basins will also require access roads, fencing and cleared buffers. The Powerline alignment has been partially to completely re-vegetated over time, such that placing the pipe(s) will require significant disturbance. We estimate a minimum of 5 acres of Park habitat will be directly destroyed, with a considerably larger area of adverse impact to wildlife habitat.

B.4.c Populations of all salmonids and all amphibians are in global decline. All of the fishless wetlands, and the immediately adjacent terrestrial uplands, are 'critical' to the survival of amphibians. Amphibian decline can be taken as indicative of declining water quality for sympatric juvenile salmonids downstream.

B.5.b The statement that "no…animal aggregations considered vulnerable…were found in the project vicinity" reveals a major oversight. Amphibians are disappearing globally exactly because of such local dismissive attitudes re: their important role in ecosystem dynamics. The small (<0.25 acre) ephemeral wetlands upon which they depend for reproductive activities are not protected by Washington State or Kitsap County forestry regulations.

B.5.c No mention of amphibian migratory pathways.

B.5.e Not all Kitsap County rodents are invasives.

B.7.a.5 Reclaimed water is not considered safe for human consumption. How is it then appropriate for wildlife (aquatic and terrestrial)? The basics of vertebrate cellular physiology were established over 500 million years ago with the first large scale production of biotoxins, and consequent introduction into the environment, occurring barely 80 years ago. Chemical contaminants are cross-specific. All we vertebrates are at risk.

B.7.a.5(6) Can ducks read?

B.8.e Kitsap County Code (17.0340.010) states that "Parks properties are intended for the development of parks, open space areas and recreational facilities for the benefit of the citizens of Kitsap County. Uses for these properties should be limited to those serving this purpose." The construction, operation and maintenance of utility infrastructure does not fall within this zoning prescription.

B.10.c, B.12 The proposed project would have long-term negative aesthetic, user, and habitat impacts on NKHP. The Park is a desirable recreation location precisely because of its' native forests; the natural, often narrow, and re-vegetated trails; a commitment to wetland protection and forest restoration; and a lack of motorized activities. NOTE: NKHP is 818 acres.

Finally, Pipeline installation and proposed well drilling access and activities would destroy trails, threaten wetlands, and create rehabilitation tasks and expenses for Park Stewards. Stream crossings and wetlands are especially vulnerable. Future maintenance and/or modification activities would bring undesirable traffic to the Park and require permanent tracks for construction vehicles. The infiltration basin(s) would be at best regarded as an unsightly addition, at worst as an affront to the Park. These

types of industrial activities are, simply stated, at complete odds with the purpose and nature of North Kitsap Heritage Park.

Respectfully submitted,

Thomas Doty, Ph.D., Emeritus Professor of Biology, Roger Williams University. Vice-Chair NKHP Stewardship Group.

From: Joseph Lubischer <jslubischer@gmail.com>

Sent: Thursday, October 17, 2019 1:18 PM

To: Kathlene Barnhart; Steve Heacock

Cc: sepaunit@ecy.wa.gov; betsycooper1@gmail.com; stollel@comcast.net; thomas-doty@comcast.net; djkott@hotmail.com; shawbob2000@yahoo.com; EdwardC@KitsapTransit.com; SteffaniL@kitsaptransit.com; smith@nkfr.org; communications@nkschools.org; jrhoads@nkshcools.org; amy.tousley@pse.com; mark@kpud.org; Cynthia Rossi; aosullivan@suquamish.nsn.us; strudel@suquamish.nsn.us; Dennis Lewarch; Roma Call, PGST (romac@pgst.nsn.us); Samuel J. Phillips; rlumper@skokomish.org; emarbet@squaxin.us; russ.ladley@puyalluptribe.com; sepacenter@dnr.wa.gov; sepa.reviewteam@doh.wa.gov; sepa@dahp.wa.gov; Chris Waldbillig; Siu, Nam (DFW); Brown, Adam B (DFW); Gordon, Brittany N (DFW); Hennessey, Diane (ECY); kcachair@gmail.com; scacchair@gmail.com; Niki Quester; Stephen Weagant; Jay Zischke; Rotegard, Laura; Jayne Larson; Paul Larson; Mark E Libby; carolina veenstra; John F. Williams; Dave Haley; Nancy DeArchangel; Jim Halstead; Kathryn Thompson (kathryn078@icloud.com); Craig Jacobrown; Bobbie Moore; Vic Ericson

Subject: Comments on Kingston Recycled Water Facility Plan SEPA

Attachments: Email_Zaroff response to Lubischer_011819_Review comments on Kingston RW Feasibility Study.pdf; Lubischer_comments_KRWFP_050819.pdf

Ms. Barnhart and Mr. Heacock,

This email presents comments on the DNS (9/27/19) for the Kingston Recycled Water Facility Plan Programmatic SEPA (Permit 19-02520). The areas of concern raised here include (1) procedural deficiency in the SEPA process; (2) substantive technical, human health, and environmental issues; and (3) clarification of the appeal process.

1. This SEPA process appears to have been procedurally deficient. I question whether adequate public notice has been given. As you are aware, the critical supporting document (the Facility Plan 5/17/19) was never made available to the general public, except for an unpublicized copy in the Kingston library. A link to the document was provided via Ms. Barnhart's email (10/3/19) only to a small group who had previously expressed interest in the project. Also, Public Works removed earlier historical documents from its website at about the beginning of the comment period and no documents about this project are currently available on the project web page. The appropriate remedy for this deficiency of notice is two-

fold: All relevant documents should be made accessible to the general pubic (including via the Public Works project web page) and the public comment period should be repeated.

2. The DNS states that the "decision was made after review of a completed environmental checklist and other information..." The stated review has clearly been inadequate. There exist significant discrepancies between the Checklist and the Facility Plan, technical deficiencies in the Facility Plan, errors about the safety of reclaimed water (public meeting 6/26/18), errors in the Checklist, and, most importantly, unaddressed human health and environmental concerns from the proposed discharge of treated effluent to groundwater and surface water.

In support, attached are an email correspondence (1/18/19) and a group letter of concern (5/8/19) that have been previously provided to Public Works. Reviews of the latest versions of the Facility Plan and Checklist indicate that none of the points raised, small or large, have been addressed by Public Works. Therefore, the attached comments are still relevant.

In addition, it is not clear whether Ecology and DOH have been properly informed of the human health concern.

Although future project-level SEPA Checklists may be required, it is appropriate and timely that the important technical, human health, and environmental issues be addressed at the beginning of the SEPA process. The issues are significant and have not been adequately addressed by the project proponent. Therefore an EIS should be required.

3. I request information on how to appeal the DNS, including administrative and judicial options and deadlines for appeal.

Sincerely,

Joe Lubischer

360-860-1075

jslubischer@gmail.com

From: Joseph Lubischer <jslubischer@gmail.com>

Sent: Friday, October 25, 2019 8:37 AM

To: Scott Diener

Cc: Steve Heacock; Amanda Walston; Kathlene Barnhart

Subject: Re: Comments on Kingston Recycled Water Facility Plan SEPA

Follow Up Flag: Follow up

Flag Status: Flagged

The question of appeals came up in conversations with your staff. Be that as it may, I am trying to understand the county process in this matter. Could you help with the following?

The DNS says lead agency will not act for 14 days from date below. What is the action? Which date is referred to, the end of public comment period or the date of DNS?

The DNS states a review was made. Can you clarify the extent of this review and provide the findings, staff report, or other documentation?

Can you provide a copy of the SEPA review permit 19-02520?

Have you received approvals from Ecology or DOH?

Yours, Joe

On Mon, Oct 21, 2019 at 5:07 PM Scott Diener <SDiener@co.kitsap.wa.us> wrote:

Joseph:

My reply does not consider the merit of your comments. Rather it addresses the appeal of non-project SEPA determinations. Non-project SEPA decisions are not administratively appealable to the hearing examiner. See KCC 21.04.290 . DCD cannot provide any additional information regarding appeal deadlines or standards since doing so would be considered legal advice. If you have additional questions regarding appeals, we encourage you to talk with an attorney.

Regards,

Scott Diener

Manager, Development Services and Engineering
SEPA Responsible Official

Dept of Community Development

Kitsap County

614 Division St, MS-36

Port Orchard, WA 98366

sdiener@co.kitsap.wa.us

t: 360-337-5777

kitsapgov.com/DCD

From: Joseph Lubischer <jslubischer@gmail.com>
Sent: Thursday, October 17, 2019 1:18 PM
To: Kathlene Barnhart <KBarnhar@co.kitsap.wa.us>; Steve Heacock <SHeacock@co.kitsap.wa.us>
Cc: sepaunit@ecy.wa.gov; betsycooper1@gmail.com; stollel@comcast.net; thomas-doty@comcast.net; djkott@hotmail.com; shawbob2000@yahoo.com; EdwardC@KitsapTransit.com; SteffaniL@kitsaptransit.com; smith@nkfr.org; communications@nkschools.org; jrhoads@nkshcools.org; amy.tousley@pse.com; mark@kpud.org; Cynthia Rossi <crossi@pnptc.org>; aosullivan@suquamish.nsn.us; strudel@suquamish.nsn.us; Dennis Lewarch <dlewarch@suquamish.nsn.us>; Roma Call, PGST (romac@pgst.nsn.us) <romac@pgst.nsn.us>; Samuel J. Phillips <sphillips@pgst.nsn.us>; rlumper@skokomish.org; emarbet@squaxin.us; russ.ladley@puyalluptribe.com; sepacenter@dnr.wa.gov; sepa.reviewteam@doh.wa.gov; sepa@dahp.wa.gov; Chris Waldbillig <chris.waldbillig@dfw.wa.gov>; Siu, Nam (DFW) <Nam.Siu@dfw.wa.gov>; Brown, Adam B (DFW) <Adam.Brown@dfw.wa.gov>; Gordon, Brittany N (DFW) <Brittany.Gordon@dfw.wa.gov>; Hennessey, Diane (ECY) <diah461@ecy.wa.gov>; kcachair@gmail.com; scacchair@gmail.com; Niki Quester <nikiquester@gmail.com>; Stephen Weagant <sweagant@embarqmail.com>; Jay Zischke <jzischke@centurytel.net>; Rotegard, Laura <lmrotegard@gmail.com>; Jayne Larson <2jaynenkhp@gmail.com>; Paul Larson <2pclarson@gmail.com>; Mark E Libby <mklibby@earthlink.net>; carolina veenstra <cavnkhp@gmail.com>; John F. Williams <jw@stillhopeproductions.com>; Dave Haley <davehaly@comcast.net>; Nancy DeArchangel <darchangel@embarqmail.com>; Jim Halstead <jhalstead@ix.netcom.com>; Kathryn Thompson (kathryn078@icloud.com) <kathryn078@icloud.com>; Craig Jacobrown <cjacobrown@gmail.com>; Bobbie Moore <elliottmoore@comcast.net>; Vic Ericson <vcericson@aol.com>
Subject: Comments on Kingston Recycled Water Facility Plan SEPA

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Although future project-level SEPA Checklists may be required, it is appropriate and timely that the important technical, human health, and environmental issues be addressed at the beginning of the SEPA process. The issues are significant and have not been adequately addressed by the project proponent. Therefore an EIS should be required.

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Sincerely,

Joe Lubischer

360-860-1075

jslubischer@gmail.com

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Appendix J: Financial Capability Assessment

MEMORANDUM			
Project: Kitsap USBR Feasibility Study			
Prepared by:	Ms. Jane Lindsey, Lindsey Consulting	Date:	September 4, 2018
Reviewed by:	Ms. Barbara Zaroff, Kitsap County Mr. Dean Brown, Kitsap County Mr. Tadd Giesbrecht, Brown and Caldwell	Revised:	September 14, 2018 November 6, 2018
Subject: Financial Capability Assessment			

The purpose of this Memorandum is to document the information required by the US Bureau of Reclamation (Reclamation) to complete the Financial Capability Assessment, as set forth in the Reclamation Manual Directive and Standard (D&S) *Title XVI Water Reclamation and Recycled Program Feasibility Study Review Process*. The following is a summary of the primary analysis and supporting data as described in the D&S for the Title XVI Financial Capability Determination Process. The primary analysis will determine the level of secondary analysis required, as described below and in Appendix A and B.

Financial capability is the likelihood of a County being able to provide its share of the non-federal portion of project construction costs and all necessary project operation, maintenance and replacement (OM&R) costs. Financial capability is often used interchangeably with the terms capability to pay and ability to pay.

Information Necessary to Analyze Financial Capability.

For Reclamation to make a determination of financial capability, the following information is required:

A. bond rating and issuer credit rating (See Primary Analysis);

B. calculated debt service coverage ratio (See Primary Analysis);

C. estimated non-Federal portion of the costs of the project associated with construction and annual operation, maintenance and replacement (OM&R) activities (See Primary Analysis);

D. financial statement analysis (See Primary Analysis. Previous 3 years of financial statements in Appendix C);

E. primary source of revenue to fund the Title XVI project construction (See Primary Analysis).

F. information on socio-economic indicators of the project region (See Secondary Analysis), including:

(1) unemployment;

(2) median household income; and

(3) property values (if project supported by property assessments);

G. estimated average monthly cost of water for the County with and without the project in place (See Secondary Analysis); and

H. estimated average monthly cost of water for other water entities within the region (See Secondary Analysis);

The Reclamation D&S identifies a two-step approach to develop the financial capability assessment to determine if the County is financially capable of funding the non-federal share of a project's construction and OM&R costs. Step 1 is a primary analysis and Step 2 is a secondary analysis as described below.

Primary Analysis.

The primary analysis is the first step in determining financial capability through analysis of a County's bond rating or issuer credit rating and the debt service coverage ratio. A review of financial statements, for consistency with the bond rating or issuer credit rating and debt service coverage ratio, is shown below. This information will help establish what type of secondary analysis must be performed.

Bond or Credit Ratings.

The County **bond rating is A1**. See Appendix D for details.

Debt Service Coverage Ratio Analysis.

A debt service coverage (DSC) ratio for the County must be at least 1.0 for 5 years beginning when the project is placed in service or repayment begins, to meet the minimum requirements for financial capability. If a ratio is currently or projected to be less than 1.0 within the initial 5-year period, a plan to meet the shortfall during this initial period and additional analysis must be provided to document that the ratio will increase to 1.0 or greater and remain above 1.0 for an additional 5-year period. The DSC ratio range of ratings are shown in Appendix A.

The formula to calculate the DSC ratio is:

Debt Service Coverage Ratio = Net Cash Operating Income[1] / Annual Debt Service

Project Cost

The Title XVI Feasibility Study (Feasibility Study) project will treat wastewater from the Kingston Wastewater Treatment Plant (WTP) to a level that can it can be recycled for various potential uses. The Suquamish Tribe (Tribe) has expressed an interest in using recycled water from the project, for irrigation of the White Horse Golf Course during the summer and for infiltration during the winter. The County is considering the feasibility of the project, to modify to its existing WTP operations, to ultimately provide groundwater recharge and recycled water supply via its sewer system. The annual construction and OM&R costs for the Feasibility Study project are shown on Table 1.

Table 1. Feasibility Study Capital and Annual Project Costs

Year Ending	2022	2023	2024	2025	2026	2027
Captial costs(a)						
constuction cost	$10,140,000					
allied costs	$3,550,000					
Total capital costs	$13,690,000					
Annual project O&M(b)		$83,000	$85,000	$88,000	$91,000	$94,000
Annual project debt(c)		$1,050,000	$1,050,000	$1,050,000	$1,050,000	$1,050,000
Annual non-federal project debt(d)		$790,000	$790,000	$790,000	$790,000	$790,000
Total annual project cost without fed. assistance		$1,133,000	$1,135,000	$1,138,000	$1,141,000	$1,144,000
Total annual project cost with fed. assistance		$873,000	$875,000	$878,000	$881,000	$884,000

(a)Class 4 preliminary construction cost estimate.

(b)Inflated 3 percent per year.

(c)Represents total capital cost with a 4.5 percent interest rate and a 20-year term.

(d)Represents 75 percent of capital cost as non-federal share with a 4.5 percent interest rate and a 20-year term.

Financial Analysis and Revenues

The **primary source of revenue for the Feasibility Study construction project will be recycled water rates** when grants and direct customer contributions are unavailable. Water is provided to County residents by multiple water purveyors and the water system is not operated by the County. If the County issues debt for the Feasibility Study project, it would be backed by operating revenues from the sewer fund, recycled water rates and/or customer contributions. The County anticipates completing a water marketing analysis as the project moves forward, to identify all beneficiaries and potential users that could pay for the recycled water costs. The Tribe has been identified as a potential user of the Feasibility Study project and could provide an equitable portion of the non-federal project cost share, through recycled water rates or direct capital contributions, via a water purchase agreement. A review

Prepared By: Lindsey Consulting
Telephone: 206-669-5474

of the County's financial statements for the last 3 years presented on Table 2, shows that the **historic debt service coverage ratio is in the acceptable range**.

Table 2. Historic Revenues, Expenses and Debt Service Coverage Ratio

Kitsap County Sanitary Sewer Fund	----------Historic----------		
Year Ending	2015	2016	2017
Revenues			
Charges for services	$21,603,200	$21,870,000	$21,403,500
Recycled water rates			
Miscellaneous	$607,100	$1,100	$31,900
Total operating revenues	$22,210,300	$21,871,100	$21,435,400
Expenses			
Personal services	$5,429,100	$5,882,600	$5,981,900
Contractual services	$887,400	$976,900	$992,000
Utilities	$1,208,600	$1,375,700	$1,625,100
Repair and maintenance	$137,800	$180,200	$325,300
Other supplies and expenses	$1,735,800	$2,573,900	$2,359,900
Insurance claims and expenses	$25,200	$25,400	$29,200
Additional project O&M			
Total operating expenses	$9,423,900	$11,014,700	$11,313,400
Net operating income	$12,786,400	$10,856,400	$10,122,000
Interest and investment revenue	$222,300	$305,100	$377,300
Miscellaneous revenue	$90,100	$1,115,600	$3,183,300
Miscellaneous expense			
Total nonoperating revenue	$312,400	$1,420,700	$3,560,600
Net income available for debt	$13,098,800	$12,277,100	$13,682,600
2010 sewer revenue bonds	$2,621,200	$2,614,300	$2,623,200
2015 sewer revenue bonds	$428,200	$658,800	$1,538,800
Non-parity loans	$1,034,200	$1,032,900	$1,031,500
Project debt			
Total annual debt service	$4,083,600	$4,306,000	$5,193,500
Income for capital and other expenses	$9,015,200	$7,971,100	$8,489,100
Parity debt service coverage ratio	**4.3**	**3.8**	**3.3**
Total debt service coverage ratio	**3.2**	**2.9**	**2.6**

Source: County data

The analysis above is based the County's sewer system net income and sewer system debt for 2015 through 2017 and the related financial statements are included in Appendix C.

To determine the DSC ratio for 5 years, following the beginning of when the project is placed in service or repayment begins (2023), revenues and annual costs are projected as shown on Table 3. Sewer system revenues are projected to follow customer growth at 3 percent per year based on an annualized sewer-ed population forecast from Table 3-3 of the Feasibility Study. Operating expenses are expected to increase with inflation at 3 percent per year. Revenue projections also include annual recycled water rates, to fund additional O&M and the non-federal capital financing costs plus County bond covenant costs, for recycled water provided. The County and/or Tribe could to pursue low cost grant and loan funding, in addition to Title XVI grant funding, to offset capital costs and reduce the annual customer cost for providing recycled water. Title XVI grant funding is assumed to be 25 percent of the total capital project costs shown on Table 1 ($3.4 million). The analysis shown on Table 3 is based on bond financing for the non-federal share ($10.3 million) of the Title XVI project capital costs with 4.5 percent interest and a 20-year term. If the County and/or Tribe are successful in securing lower cost financing, or a large user like the Tribe makes a direct capital contribution to fund a portion of the non-federal cost share, the annual financing cost will decrease, from that shown on Table 3. **The projected debt service coverage ratio is in the acceptable range**.

Table 3. 5-Year Debt Service Coverage Ratio Projection

Kitsap County Sanitary Sewer Fund	----------Projected(a)----------				
Year Ending	2023	2024	2025	2026	2027
Revenues					
Charges for services	$23,679,100	$23,679,100	$24,388,900	$24,388,900	$25,120,000
Recycled water rates(b)	$1,070,500	$1,072,500	$1,075,500	$1,078,500	$1,081,500
Miscellaneous					
Total operating revenues	$24,749,600	$24,751,600	$25,464,400	$25,467,400	$26,201,500
Expenses					
Personal services	$7,145,900	$7,145,900	$7,360,300	$7,360,300	$7,581,100
Contractual services	$601,000	$601,000	$619,100	$619,100	$637,600
Utilities	$2,011,700	$2,011,700	$2,072,000	$2,072,000	$2,134,200
Repair and maintenance	$257,100	$257,100	$264,800	$264,800	$272,700
Other supplies and expenses	$3,660,600	$3,660,600	$3,770,500	$3,770,500	$3,883,600
Insurance claims and expenses	$41,900	$41,900	$43,100	$43,100	$44,400
Additional project O&M	$83,000	$85,000	$88,000	$91,000	$94,000
Total operating expenses	$13,801,200	$13,803,200	$14,217,800	$14,220,800	$14,647,600
Net operating income	$10,948,400	$10,948,400	$11,246,600	$11,246,600	$11,553,900
Interest and investment revenue	$100,000	$100,000	$100,000	$100,000	$100,000
Miscellaneous revenue					
Miscellaneous expense					
Total nonoperating revenue	$100,000	$100,000	$100,000	$100,000	$100,000
Net income available for debt	$11,048,400	$11,048,400	$11,346,600	$11,346,600	$11,653,900
2010 sewer revenue bonds	$1,779,800	$1,779,800	$1,779,800	$1,779,800	$1,779,800
2015 sewer revenue bonds	$1,853,500	$1,854,600	$1,850,400	$1,854,900	$1,852,700
Non-parity loans	$873,100	$872,400	$566,400	$260,400	$259,800
Project debt(c)	$790,000	$790,000	$790,000	$790,000	$790,000
Total annual debt service	$5,296,400	$5,296,800	$4,986,600	$4,685,100	$4,682,300
Income for capital and other expenses	$5,752,000	$5,751,600	$6,360,000	$6,661,500	$6,971,600
Parity debt service coverage ratio	**2.5**	**2.5**	**2.6**	**2.6**	**2.6**
Total debt service coverage ratio	**2.1**	**2.1**	**2.3**	**2.4**	**2.5**

(a)2018 budget revenues inflated 3 percent per year for customer growth and expesnses inflated 3 percent per year for inflation.

(b)Recycled water rate revenue equal to 1.25 x project debt plus additional project O&M.

(c)Equal to non-federal project debt from Table 1.

Primary Analysis Summary

Prepared By: Lindsey Consulting
Telephone: 206-669-5474

The bond rating or issuer credit rating comparison shown in Appendix A includes the credit rating agencies from which Reclamation will accept ratings from and the corresponding acceptable versus unacceptable ratings. The debt service coverage ratio range shown in Appendix A describes an acceptable and unacceptable range of ratios.

If the bond rating or issuer credit rating is in the acceptable medium range, the debt service coverage ratio is in the acceptable medium range, or the financial statement shows inconsistency with these results with a qualified opinion, then a rigorous secondary analysis will be performed to evaluate financial capability. If the bond rating or issuer credit rating is unacceptable, the County will be found not financially capable of funding the non-Federal share of the Title XVI project. If the debt service coverage ratio is unacceptable (below 1.0), an additional analysis must be completed. If, during this additional analysis, the debt service coverage ratio stays below 1.0 for the entire 5-year period beginning when the project would be placed in service or repayment begins, then a determination will be made that the project County is not financially capable. However, if the analysis shows the debt service coverage ratio rising above 1.0 within the initial 5-year period and remaining there for an additional 5 consecutive years, then a rigorous secondary analysis must be performed to determine financial capability. If the bond rating or issuer credit rating for the project County is in the acceptable high range, the debt service coverage ratio is in the acceptable high range, and the financial statement analysis shows consistency with these results without a qualified opinion, then a cursory secondary analysis will be performed to confirm that the project area is not experiencing severe adverse conditions that could negatively affect financial capability.

Financial statements of the County verify that the **credit rating and the debt service coverage ratio is in the acceptable high range**. Given that these two factors are acceptable, Reclamation may be satisfied with a cursory secondary analysis that includes an analysis of the socio-economic indicators in the project region.

Secondary Analysis

The secondary analysis will be cursory or rigorous depending on the outcome of the primary analysis above. In a cursory secondary analysis, an analysis of the socio-economic indicators in the project region will be conducted. In addition to analyzing the socio-economic indicators of the project region, a rigorous secondary analysis includes water service affordability, rate comparison, and rate shock analyses. The results of the secondary analysis on the overall determination will depend on the outcome of the following additional and financial indicators.

(1) **Socio-economic Indicators of the Project Region.** The relative importance of general economic conditions depends, to some degree, on the source of funds for the proposed project and the professional judgment of Reclamation. Since the primary source of revenue for the County project is from fees and charges, income and unemployment data and trends are most relevant. Since property-based assessments are not primary sources of revenue for the project, the property values and trends in property values are less relevant. Ratings by economic indicator are shown below in Appendix B.

Kitsap County Socio-economic Data (current and 10-year trend)

Unemployment:

On average, the County unemployment (UE) rate shown on Table 4 is below the state UE rate and declining, so the **UE rate indicator is good** as defined in Appendix B.

Table 4. Current and 10-Year County and State Unemployment Rate

Unemployment Rates	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	10-year Average
Kitsap	7.8%	8.6%	8.4%	7.9%	7.3%	6.1%	5.6%	5.8%	4.9%	4.6%	6.7%
State	9.2%	10.0%	9.3%	8.1%	7.0%	6.1%	5.6%	5.4%	4.8%	4.6%	7.0%
Kitsap % Below State	18%	16%	11%	3%	-4%	0%	0%	-7%	-3%	0%	5%

Source: WA State Employment Security Department. 2017 data based yearly average from homefacts.com.

Median Household Income:

The County median household income (MHI) shown on Table 5 is consistently above the state MHI, so the **MHI indicator is good** as defined in Appendix B.

Table 5. Current and 10-Year County and State Median Household Income

Median Household Income	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
State	$64,302	$62,649	$60,631	$60,459	$60,105	$60,174	$62,283	$64,895	$67,106	$68,550	$67,106
Kitsap	$65,692	$67,451	$61,363	$64,159	$61,671	$64,570	$62,718	$66,880	$69,171	$69,495	$69,171
Kitsap % Above State	2%	8%	1%	6%	3%	7%	1%	3%	3%	1%	3%

Source: WA State Employment Security Department. 2017 and 2018 estiamtes from Washington OFM.

Property Values:

The Feasibility Study project is not anticipated to be supported by property assessments, so property values are not included. If required, property values and an analysis of the indicator range described in Appendix B, can be provided to Reclamation upon request.

Rigorous Secondary Analysis

Prepared By: Lindsey Consulting
Telephone: 206-669-5474

The following information is also needed if the County is required to provide a rigorous secondary analysis. At this time, the cursory secondary analysis above may be adequate and the data below will be provided if required.

(2) **Water Service Affordability.** The U.S. Environmental Protection Agency (EPA) has indicated in previous studies that a combined water and sewer bill in excess of 4.5 percent of annual median household income is considered the benchmark for affordability, with 2.5 percent of annual median household income allowed for water supply costs. An estimated percentage of 2.5 percent of annual median household income does not necessarily indicate the maximum amount households could pay for water supplies but is an indicator of the threshold above which the potential for economic hardship increases. The criterion for water service affordability is shown in Appendix B. The following criteria apply to water service affordability:

(a) Water supply costs below 2.5 percent of annual median household income have a water service affordability rating of good.

(b) Reclamation considers an amount between 2.5 and 6.5 percent of annual median household income to have a water service affordability rating of medium and could be affordable, but payment of these costs could reduce other types of household spending.

(c) An affordability rating above 6.5 percent is considered poor, and a determination will be made that the County is not financially capable.

(3) **Rate Comparison.** In a rate comparison analysis, rates of feasible alternative sources for water are examined; where they are less than the proposed project rates, a medium or poor rating is given and further justification for the project will be required. Where proposed project rates are competitive or below rates of alternative sources of water, a good rating is given. The criterion for the rate comparison analysis is shown in Appendix B.

(4) **Rate Shock.** In a rate shock analysis, potential negative public reactions to potential rate shocks are assessed by evaluating estimated percentage changes in rates, not necessarily rate levels. Reclamation's criteria on rate shock analysis are shown in Appendix B, which classifies water rate increases of more than 200 percent as medium or poor indicators, regardless of the percentage of annual median household income necessary to pay water bills. This indicator must be considered in combination with socio-economic indicators, water service affordability, and rate comparison.

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[1]In addition to the project County's Net Cash Operating Income, all income and revenues that could be used toward repayment of a water supply project will be included in the debt service coverage ratio analysis.

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