Bennett Consulting, PLLC
Engineering and Mining Geology

August 13, 2021
Project No. GBC16-01

Bill Kombol
Palmer Coking Coal Company
31407 Highway 169
Black Diamond, Washington 98010

Subject: Summary of Ground Water and Slope Conditions
Hyde Pit Rezone Application
King County Department of Local Services

Dear Mr. Kombol,

This report summarizes the ground water and slope conditions underlying your Hyde gravel mine, as requested by the King County Department of Permitting for the rezone of your property. As proposed, the expanded Hyde mine will have a floor elevation of approximately 720 feet above sea level, which will match the floor elevation of the adjacent Franklin Ridge mine, as someday the two mines may join into a single entity. Ground water elevation monitoring, conducted in four wells since 2016 suggest that one well may have seasonal ground water elevations above the proposed floor elevation. Thus, this report discusses how ground water will be protected with the proposed mine plan. In addition, local areas within the plan contain slopes that have gradients in excess of the King County Code definition of a steep slope. Therefore, this report also addresses slope stability concerns. Additionally, appropriate operational measures are outlined to protect the surrounding surface and ground water during mine development.

Underlying Geology

The geology underlying the project area is characterized as Vashon age glacial deposits overlying sandstone bedrock. The bedrock is an Eocene age (about 45 million years old) fine grained sandstone that is relatively hard and typically impervious to ground water flow. The bedrock is overlain by advance outwash sand and gravel sediments that were deposited in a braided stream environment directly in front of an advancing Vashon ice sheet about 20,000 years ago. This unit is typically permeable to ground water flow and where saturated can form an aquifer. It has only been encountered on the property in the subsurface during monitor well drilling.

Overlying the advance outwash, Vashon lodgment till was also encountered in the subsurface during monitor well drilling. The till is an unsorted mixture of silt, sand and gravel deposited directly at the sole of the advancing ice sheet. Till is typically impervious to ground water flow, due to its high silt content and compact state, having been densely consolidated by the weight of the ice sheet.

At the surface across the site, recessional outwash consisting of coarse-grained sand and gravel was deposited by meltwater streams emanating from a stagnant glacial ice sheet

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about 10,000 years ago at the end of the Vashon glacial period. These sand and gravel sediments are commonly coarse grained and clean, and thus highly permeable to ground water flow.

The attached Figure 1 shows the topography of the subject site. What is noteworthy are the numerous enclosed topographic depressions as well as local dry channels. The enclosed topographic depressions are referred to as glacial kettles. Kettles form when isolated blocks of glacial ice get surrounded and covered by outwash gravels as a stagnant ice sheet melts away. When the encapsulated ice melts, the overlying gravel collapses onto itself creating the enclosed depression. The largest of these is Fish Lake, located on the southeast side of the mine area, which subsequently filled with water. Most of the other smaller kettles are dry or contain seasonally flooded wetlands.

The dry channels represent the ancient channels of the meltwater streams emanating from the melting ice sheet. It should be noted that the meltwater streams both scoured out and also filled in the pre-existing topography. Much of the underlying advance outwash and lodgment till was either eroded away by the meltwater streams, or perhaps never deposited, as typically the recessional outwash gravels lie directly atop the resistant sandstone bedrock. Figure 2 presents geologic cross sections through the subject site, as encountered during monitor well drilling, which display the scour and fill characteristics of the recessional outwash.

Ground Water Monitoring

In late 2015 five sonic core boreholes were completed to assess the gravel resources and ground water conditions underlying the proposed expansion. Ground water monitoring wells were installed in four of the bore holes (FR-1 through FR-4) and static water elevations have been monitored in these wells since January 2016. The locations of the wells are displayed on the attached Figure 1, and geologic cross sections through the wells are displayed on Figure 2. The ground water elevations displayed on Figure 2 were measured at the time of well completion. Please note that the vertical exaggeration on Figure 2 is five to one. Figure 3 displays the static water elevations from January 2016 through December 2019.

What is noteworthy on the Figure 3 data are the unusually large seasonal fluctuations in ground water elevations in wells FR-3 and FR-4 (FR-5 is dry). With few exceptions, the high water elevations closely match peak precipitation months. Reviewing Figure 2, cross section A-A' note that well FR-3 has an impermeable lodgment barrier at a depth of about 50 feet below the surface. This barrier is 50 feet above the static water level which is at a depth of about 100-feet below the surface. In such a situation, one would expect a significant lag time of several weeks or more between peak precipitation events and the seasonally high-water table. An alternative explanation could be a leaky well seal, which would account for both the unusually high fluctuations in water levels, as well as the near simultaneous response of the water table to precipitation.

A leaky well seal could also explain the unusually high seasonal fluctuation in the water table elevation in well FR-4. Cross section B-B' on Figure 2 shows that there is no impermeable barrier between the surface and water table in Well FR-4. Thus, a lack of lag time between precipitation events and high-water table is reasonable, especially if the well is hydraulically connected to a body of surface water such as Fish Lake. However, the elevation of Fish Lake is about 725 feet above sea level and the seasonal

fluctuation in ground water elevations in FR-4 ranges from a low of about 710 feet above sea level, to a high of about 740 feet in elevation. This suggests that this well is not directly connected to Fish Lake. The high-water mark in FR-4 is also well above the 720-foot floor elevation of the adjacent Franklin Ridge gravel mine, and well above the elevation where bedrock was encountered in FR-5 (Figure 2, B-B'). Therefore, if the recorded water levels represent a real water table, there must be a ground water barrier between FR-4 and Fish Lake, Well FR-5, and the Franklin Ridge pit.

For the purposes of this report, we must assume that the recorded water levels are real and represent actual water tables. In the case of FR-3, the highest recorded water level is still 30 feet below the proposed 720-foot floor elevation of the expanded Hyde pit, so it should not pose a problem for pit development. The recorded high-water mark for FR-4 is 745 feet in elevation, which will require careful consideration when developing the pit, as discussed below.

High Yield Wells near Fish Lake

King County personnel have reported high yield domestic water wells near Fish Lake to the southeast of the subject property. Such wells could easily be in hydraulic connection with the lake if their static water level is at or near the elevation of the lake. Since high-yield wells exist in areas with high permeability, they are also susceptible to ground water contamination. However, the monitoring data suggest that the proposed pit expansion area is either not hydraulically connected to Fish Lake or lies down gradient of Fish Lake. This is because a kettle only a few hundred feet north of Fish Lake is dry down to an elevation of about 710 feet, well below the elevation of Fish Lake. In addition, further north a similar kettle has a wetland at an elevation about 660-feet above sea level, or more than 60-feet below the elevation of Fish Lake.

If the water levels recorded in FR-4 represent an actual water table, there must be local, isolated pockets of high ground water not connected to surrounding areas. Because of the scour and fill nature of the recessional outwash, local subsurface bedrock highs undoubtedly control the direction and flow of ground water in this area. This could explain the variable elevations of ground water encountered beneath the project area. Measures to mitigate impacts of the proposed project to ground water during mining are discussed in the following section.

Mine Development

The proposed 720-foot elevation of the final pit floor of the expanded mine reflects the maximum depth to which mining will be conducted. Because the gravel outwash (Qvr) is filling in pre-existing, subsurface bedrock topography, there will be areas where bedrock will be encountered above this elevation. This will limit the pit floor depth in certain areas to the top of bedrock. Similarly, if the recorded water levels in FR-4 represent an actual water table, there will be areas where local seasonal high ground water conditions will be encountered above the desired pit floor elevation, and such occurrences will also limit the final pit depth.

If real, the ground water encountered in well FR-4 likely represents an isolated water table held up areas with a high silt content, or by subsurface bedrock highs. If a bedrock high is containing the water table, then bedrock would be encountered by the pit excavation before the isolated water table is reached. However, an area with a high silt

content is confining the water table, then precautionary measures will need to be taken to ensure that a local high-water table is not breached.

To avoid breaching such zones the following is proposed:

- As mining progresses from west to east it is recommended that a perimeter trench be dug around a given mine segment down to the desired floor elevation. This should be done during late spring seasonal high-water conditions.
- If persistent ground water is encountered, the excavation depth for this portion of the mine should be raised to a level of 5-feet above where the ground water was encountered.
- If, as anticipated, the ground water high is localized, it may be possible to avoid this area and maintain the desired mine depth in other portions of a given mine segment.

Until a given area is actually mined, it will be difficult to anticipate the location of bedrock highs or local silty ground water barriers. Thus, depending on conditions encountered in the field, the final excavation plan could be somewhat different than what is presently planned.

The underlying permeable gravels do make the site susceptible to ground water contamination. The project will require a Washington State Department of Ecology (DOE) National Pollution Discharge Elimination System (NPDES) permit and will be subject to regular inspections by DOE personnel. The Best Management Practices (BMPs) required by DOE may overlap many County requirements, but will include the following:

- Any fueling done onsite will be conducted over a concrete pad with proper containment.
- All equipment will be maintained in good working order and will be inspected daily for leaks.
- Each piece of equipment will contain a spill kit with operators properly trained on how to use them.
- Equipment maintenance will be conducted within an appropriate enclosure or done offsite.
- To minimize offsite tracking the entryway will either be paved or armored with coarse crushed rock.
- A wheel wash or wheel bath with proper containment will be installed for trucks exiting the site, as needed.
- All containment facilities will be cleaned out on a regular basis.
- All lubricants, hydraulic oil, antifreeze, etc., if stored onsite will be contained inside an appropriate enclosure.

Slope Stability Concerns

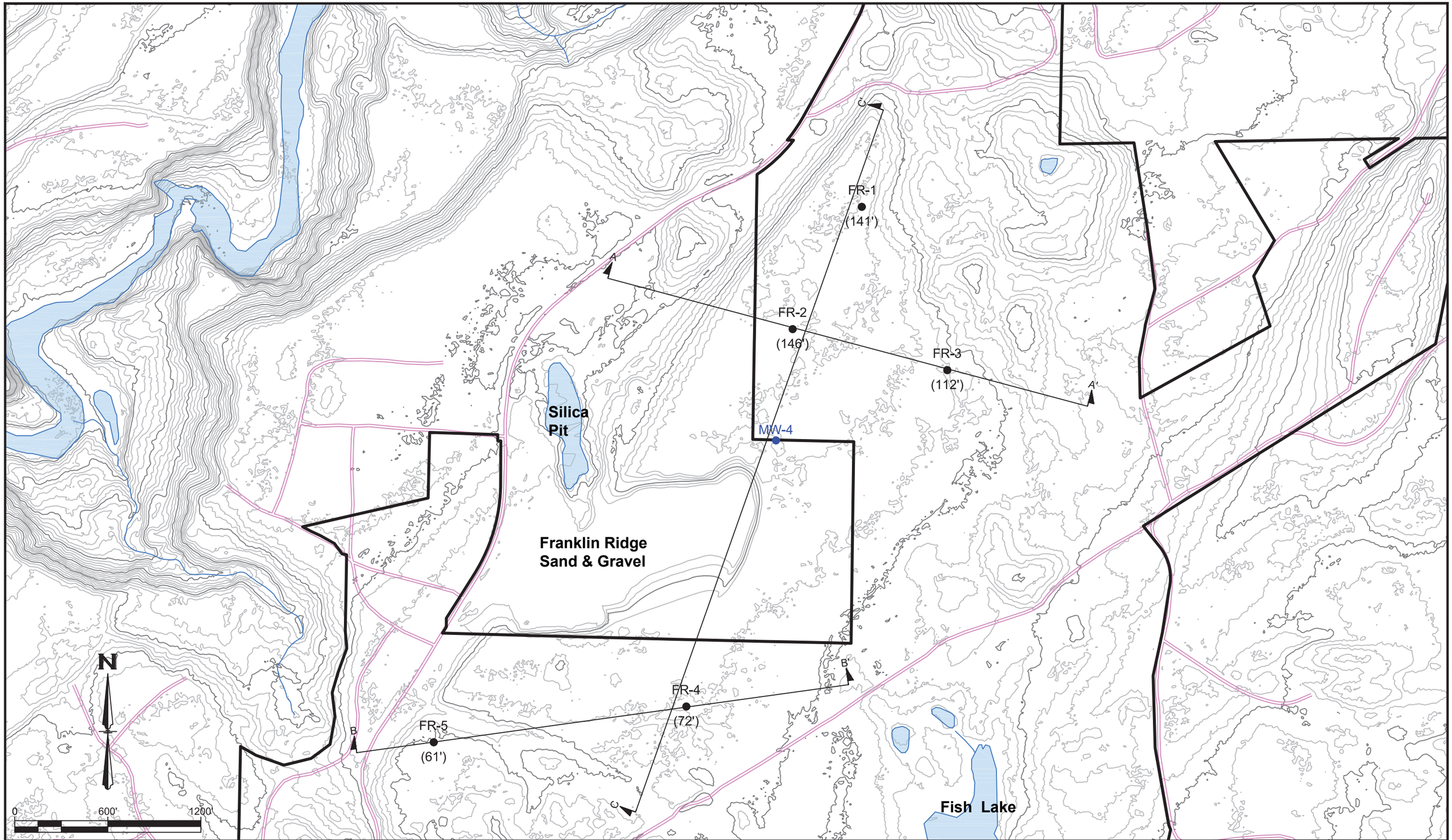
The attached Figure 4 displays areas shaded in green where slope gradients exceed 40% over a vertical height of 10 feet and thus fit King County's definition of a steep slope. The tallest of these onsite slopes occur in the northwest portion of the property and have a slope gradient of about 50 percent of a vertical height of about 100-feet. However, these slopes are underlain by coarse grained gravel outwash which have been at their natural

angle of repose since the time they were deposited. As discussed previously these slopes were created along ancient outwash channels or within enclosed kettle basins. The slopes are well drained, have been logged multiple times in the past and have not shown signs of instability such as raveling or slumping. Most importantly, these slopes contain the gravel resources which will be mined by the proposed project and are thus the principal asset of the proposed project. Under reclamation, backfilling will be done at a lower slope gradient than what presently exists, and ultimately reforested.

I trust that this information will serve your present needs. If you have questions or need further information, please let me know. Thank you.

Sincerely
Bennett Consulting PLLC

George H Bennett LHG
Licensed Hydrogeologist.



LEGEND

= Property Boundary
= Parcels
= Roads
= Drill Holes

DESIGNED	SCALE	1"=600'
DATE 01-27-16		
BY GHB		
DRAWN		
DATE 01-27-16		
BY JLL		

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Figure 1
Franklin Ridge
Site Map

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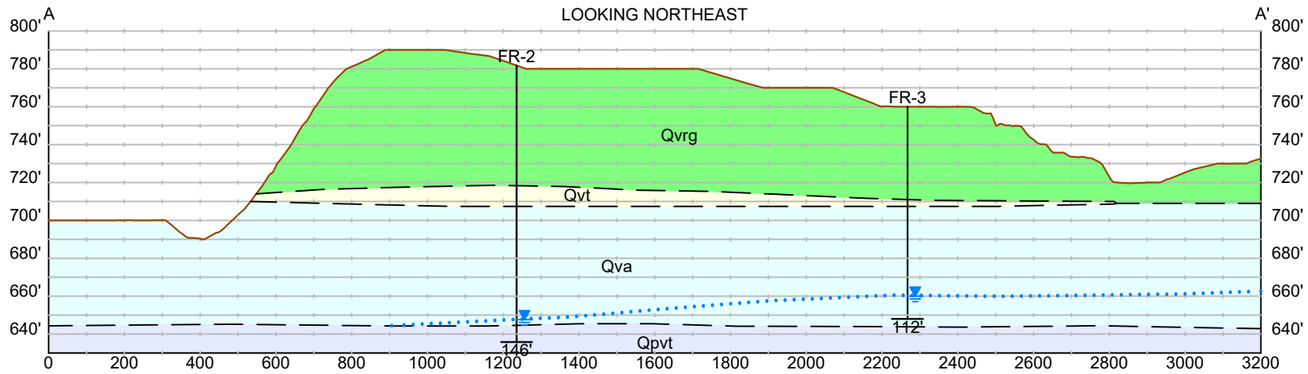

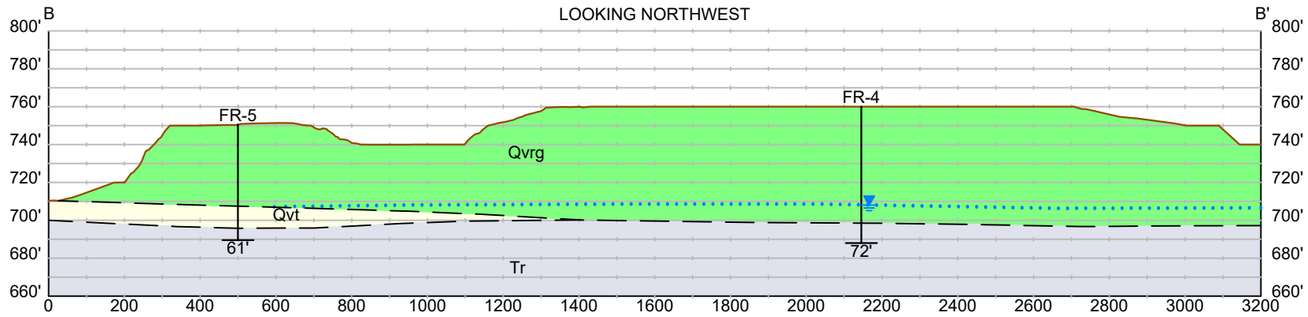

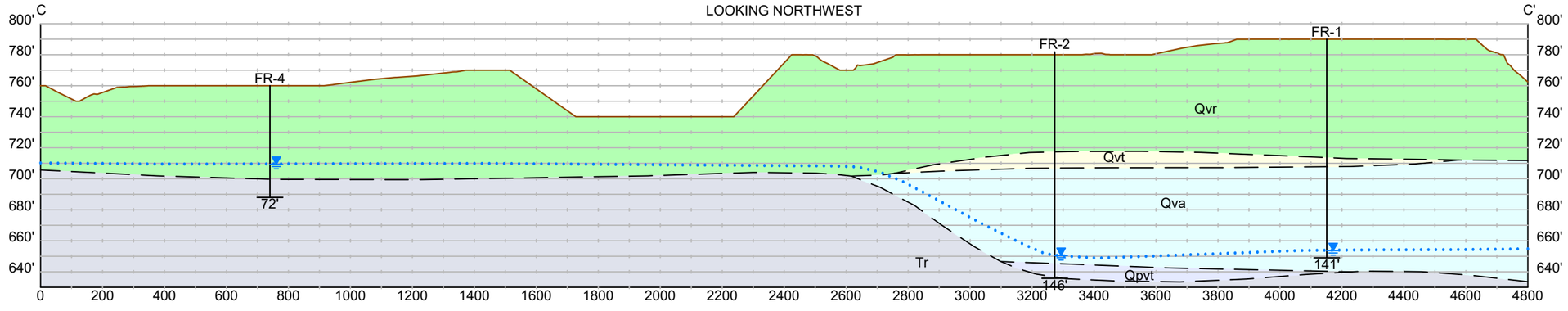

Vertical Exaggeration x5

LEGEND

= Existing Surface

= Ground Water Table

Qvr = Vashon Recessional Outwash

Qvrg = Vashon Recessional Gravel

Qvt = Vashon Lodgement Till

Qva = Vashon Advance Outwash

Qpvt = PreVashon Till

Tr = Renton Formation Sandstone Bedrock

DESIGNED		SCALE	H:1"=400' V:1"=80'
DATE	01-19-16		
BY	GHB		
DRAWN			
DATE	01-19-16		
BY	JLL		

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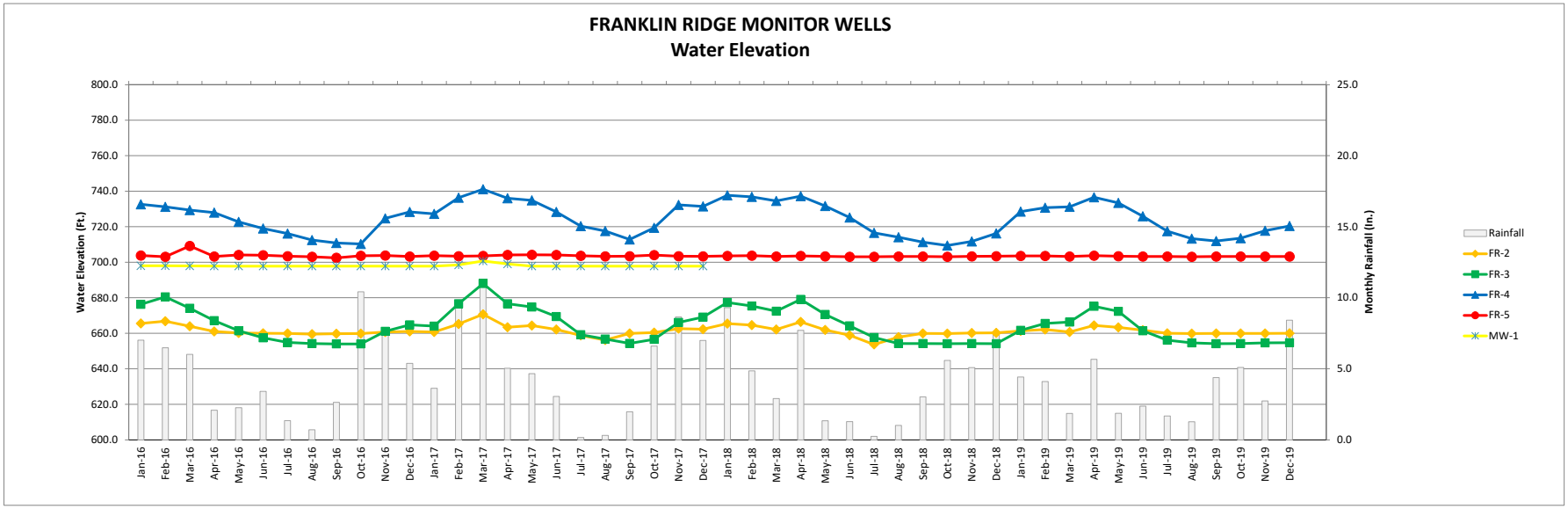
Figure 2
Franklin Ridge
Cross Sections


FRANKLIN RIDGE MONITOR WELLS
Water Elevation
Water Elevation (Ft.)
Monthly Rainfall (In.)
800.0
780.0
760.0
740.0
720.0
700.0
680.0
660.0
640.0
620.0
600.0
25.0
20.0
15.0
10.0
5.0
0.0
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Oct-19
Nov-19
Dec-19
Rainfall
FR-2
FR-3
FR-4
FR-5
MW-1

Figure 3

A PORTION OF SECTION 30, T. 21 N., R. 7 E., W.M., KING COUNTY, WASHINGTON

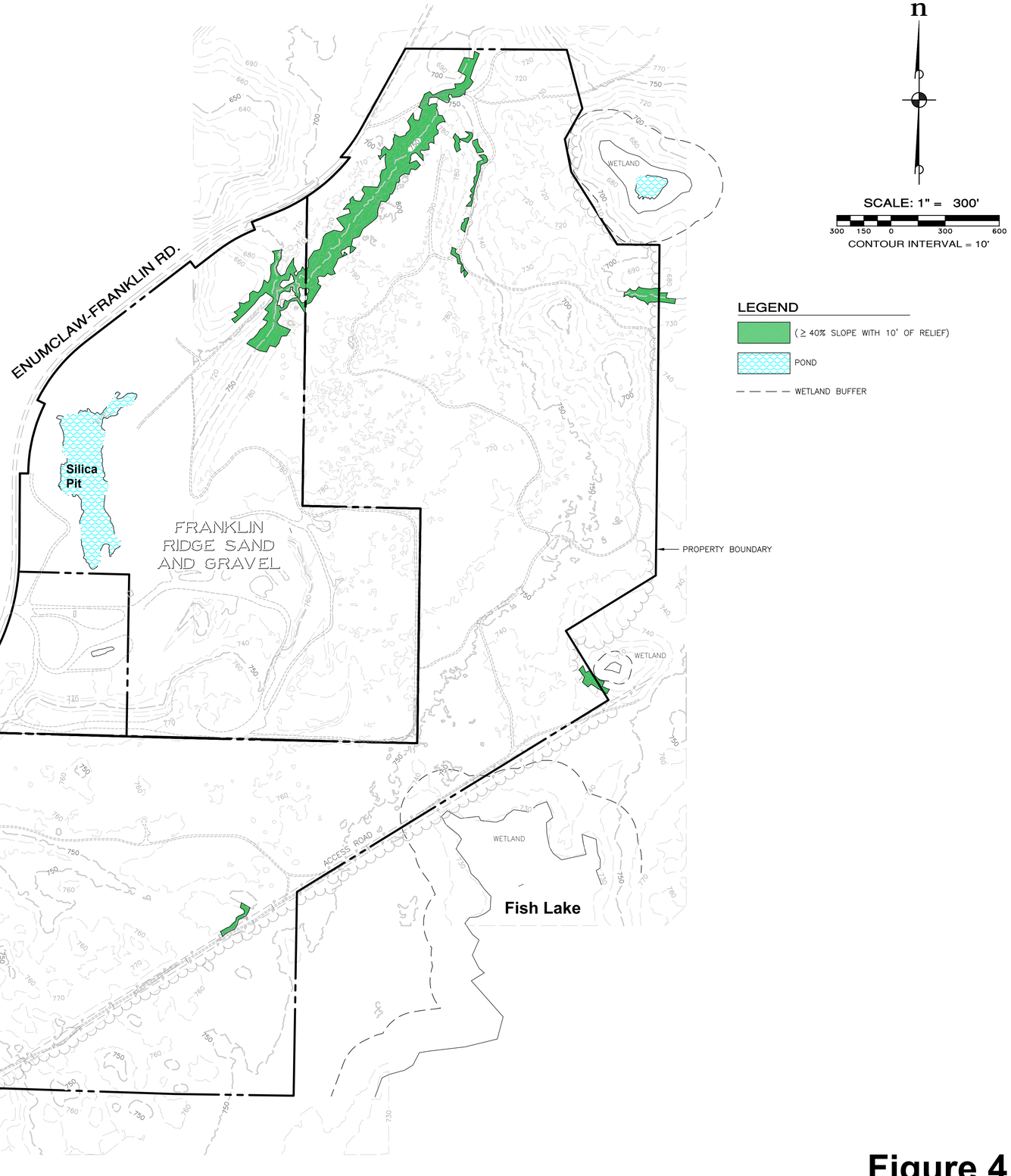

Figure 4

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REVISIONS

NO.	DESCRIPTION/DATE	BY

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HYDE MINE

SLOPE ANALYSIS PLAN

KING COUNTY, WASHINGTON

JOB NO.:	1960-001-017
DWG. NAME:	EN-01
DESIGNED BY:	LGB
DRAWN BY:	CJR
CHECKED BY:	
DATE:	03/29/2021
DATE OF PRINT:	

EN-01

1 OF 1 SHEETS