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Planning Division
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1/17/2022
Project No. 161M128582.01

Jody A. Yates, P.E.
Senior Engineer, Site Development
City of Beaverton Community Development
12725 SW Millikan Way
Beaverton, Oregon 97076

Subject: Groundwater Seepage and Proposed Flood Storage Basin
Oregon Worsted Company
Allen Boulevard Commercial Property, Beaverton, Oregon

Dear Ms. Yates,

On behalf of the Oregon Worsted Company, Wood Environment & Infrastructure Solutions, Inc. (Wood) has prepared this letter addressing a question raised by Kittelson & Associates' (Kittelson) compliance review of our original estimate of the groundwater infiltration rate into the project's proposed flood storage basin. The rate of groundwater infiltration affects the size of pumps needed to maintain storage capacity in the basin.

Kittelson felt that the estimated pump capacity does not account for potential seepage inflow from Fanno Creek when the creek rises to an elevation of 182.5 feet. However, Wood's method for the estimate already includes such estimated seepage. The estimated steady-state seepage rate was based on idealized geometry for the basin which included seepage from the south. The analytical model used to develop the estimate assumed the basin was equivalent to a circle into which seepage entered from 360 degrees. Because a conservative value of 187 feet was used to estimate the water table elevation around the circle, the estimate thus includes seepage from direction of the creek even though the creek's water surface elevation is ordinarily much less than 187 feet.

To further address the reviewer's question, however, Wood has developed another estimate of potential seepage from the creek when the creek has risen to elevation 182.5 feet, above which the basin starts to "operate" for flood storage and groundwater pumping from the pond would cease. This estimate provides an additional test on whether the currently proposed pumping capacity is sufficient.

The estimate is based on the Dupuit Equation[1], which was used to estimate steady-state flow through a unit area between the creek and the basin. This is important to note, because flood elevations are transient and it is unlikely that a rise in creek level to 182.5 feet would last long enough for the water gradient in the stream bank to reach a steady-state profile for the 100-foot distance between the creek and the basin. The Dupuit analysis is thus conservative.

1 For example, see C.W. Fetter, 1980, Applied Hydrogeology. Charles E. Merrill Publishing.

The Dupuit Equation requires four inputs: soil permeability (hydraulic conductivity), the head at the creek, the head at the basin, and the distance between the creek and the basin:

- For hydraulic conductivity, this estimate used the moderate and worst-case hydraulic conductivity values of 2.5 and 9 feet/day, respectively, presented in the original report.
- The head in the creek was set at 4.8 feet, the difference in elevation between the stormwater basin floor elevation of 177.7 feet and the elevation of the creek during flood (182.5 feet). The basin floor was used as the top of an underlying low conductivity layer for the Dupuit Equation. Deeper (vertical) flow into the floor of the basin was accounted for from all directions in the original methodology.
- The head in the basin was set at 0.3 feet, the difference between the elevation of the pre-flood water level in the basin (178 feet) and the floor of the basin (177.7 feet).
- The distance from the creek to the pond was estimated as 100 feet.

The resulting estimates are shown in the attachment. The Dupuit estimates were then multiplied by the estimated length of the reach of Fanno Creek along which groundwater could potentially flow toward the basin. The resulting estimates were 0.4 and 1.4 gallons per minute (gpm), depending on soil permeability. This flow is not in addition to the prior method used but is an alternative method for estimating flow from the south.

Because this estimate is conservative and because the proposed pumping capacity is 400 gpm, Wood concluded that the proposed pumping capacity is enough to address potential seepage from Fanno Creek.

Finally, this conclusion assumes that the soil is not more permeable than assumed in this analysis, which means Woods here repeats its original recommendation that trench backfill for the drainage piping between the pond and the creek be constructed so that it is no less pervious than the existing soil.

Limitations

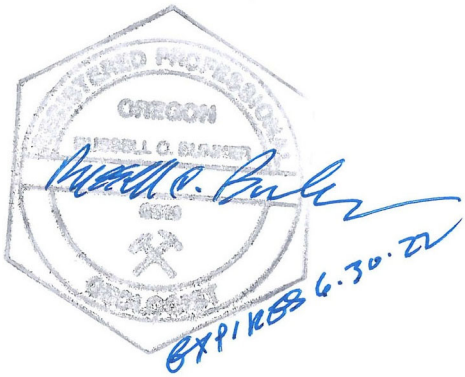
This letter was prepared exclusively for City of Beaverton Community Development by Wood Environment & Infrastructure Solutions, Inc. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in Wood services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This Groundwater Removal from Proposed Allen Blvd. Flood Storage Basin Report is intended to be used by Oregon Worsted Company for the Allen Boulevard Commercial Property, Beaverton, Oregon only, subject to the terms and conditions of its contract with Wood. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

The findings contained herein are relevant to the dates of the Wood Site visit and should not be relied upon to represent conditions at later dates. If changes in the nature, usage, or layout of the property or nearby properties are made, the conclusions and recommendations contained in this report may not be valid. If additional information becomes available, it should be provided to Wood so the original conclusions and recommendations can be modified as necessary.

If you have questions about this report, please contact Russ Bunker (russ.bunker@woodplc.com), Seth Jelen (seth.jelen@woodplc.com), or Dan Schall (daniel.schall@woodplc.com).

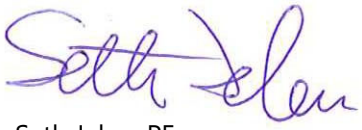
Sincerely,

Wood Environment & Infrastructure Solutions, Inc.



Russ Bunker, RG
Senior Associate Geologist

Reviewed by:



Seth Jelen, PE
Principal Engineer

Attachment 1: Dupuit Equation Calculation Parameters and Results

Attachment 1:
Dupuit Equation Input Parameters and Results

Attachment 1:
Dupuit Equation Calculation Parameters and Results

Estimate groundwater seepage rate from section of Fanno Creek south of stormwater storage excavation when creek rises to 182.5 feet elevation.

Find flux per unit width and then multiply flux by length of stream reach

Flux estimated using Dupuit equation: q = K(h2^2-h1^2)/2L

Moderate hydraulic conductivity

K	hydraulic conductity	2.5	ft/day	0.8	m/day
h1	head in creek	4.8	ft	1.5	m
h2	head in stormwater excavation	0.3	ft	0.1	m
L	distance from creek to stormwater excavation	100	ft	30.5	m
Stream length		270	ft	82.3	
q				0.0	m^2/day
Total discharge = q x stream length				2	m^3/day
				0.4	gallons per minute

Worst case hydraulic conductivity

K	hydraulic conductity	9	ft/day	2.7	m/day
h1	head in creek	4.8	ft	1.5	m
h2	head in stormwater excavation	0.3	ft	0.1	m
L	distance from creek to stormwater excavation	100	ft	30.5	m
Stream length		270	ft	82.3	
q				0.1	m^2/day
Total discharge = q x stream length				8	m^3/day
				1.4	gallons per minute