Earth Solutions NW LLC

Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

August 3, 2021
ES-6481.01

BPLC Properties, LLC
10615 – 438th Street Court East
Eatonville, Washington 98328

Attention: Mr. Rich Hamilton

Subject: Detention Pond Liner & Pavement Section Recommendations
Best Parking Lot Cleaning Site Improvements
2512 Inter Avenue
Puyallup, Washington

Reference: Earth Solutions NW, LLC
Geotechnical Evaluation
Project No. ES-6481, dated February 19, 2019

Earth Solutions NW, LLC
Groundwater Monitoring Program Summary
Project No. ES-6481.01, dated April 27, 2021

Barghausen Consulting Engineers, Inc.
Civil Plans, dated February 2020

Greetings, Mr. Hamilton:

As requested by Barghausen Consulting Engineers, Inc., Earth Solutions NW, LLC (ESNW) has prepared this letter for the subject project. Recommendations provided herein concern lining the proposed detention pond and a pavement section for the heavier (truck) traffic anticipated on the new asphalt.

Detention Pond Liner

Per the referenced civil plans, a detention pond is proposed within the northeast site area. Because the detention pond will be constructed below the seasonal high groundwater table (GWT), a liner will be installed to resist hydrostatic uplift. Based on the pond sections depicted in the referenced plans as well as the results of our groundwater monitoring program through the 2020–2021 wet season (as summarized in the referenced letter), the following is a summary of the design parameters for the detention pond

- Top of pond elevation   64.5 feet

- Maximum water surface elevation   63.5 feet

- Static water surface elevation   57.5 feet

- Bottom of pond elevation   57.0 feet

- Seasonal high GWT elevation   62.2 feet

The seasonal high GWT elevation was based on the monitoring completed at boring B-1, which was installed within the detention pond area. It is noted that the seasonal high GWT elevation obtained at B-1 was the shallowest groundwater level obtained across the site; readings at B-2 and B-3 were 0.7 feet and 1.1 feet deeper, respectively.

The design parameters outlined in this section were incorporated into an equation to determine the required liner thickness to resist hydrostatic uplift. A calculation sheet is attached to this letter. Based on the computation results, the following recommendations are offered for the detention pond liner:

- A 40-mil PVC or HDPE liner should be placed continuously over the pond bottom.

- Atop the liner, at least four-and-one-half feet of ballast should be placed. If desired and/or required, the upper 12 inches of the ballast may be substituted as amended soil.

- An ESNW representative should be contacted to observe and document installation of the pond liner. Supplementary recommendations may be provided at the time of construction, where necessary.

The above recommendations incorporate a safety factor of about 1.1 with respect to hydrostatic uplift resistance. In our opinion, this safety factor is appropriate for the pond liner design from a geotechnical standpoint.

Pavement Section Recommendations

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas of unsuitable or yielding subgrade conditions may require remedial measures, such as overexcavation and replacement with structural fill or thicker crushed rock sections, prior to pavement.

In our opinion, the following pavement sections for heavier traffic (occasional truck traffic) areas may be considered:

- Three inches of hot-mix asphalt (HMA) placed over six inches of crushed rock base (CRB).

- Three inches of HMA placed over four-and-one-half inches of asphalt-treated base (ATB).

The HMA, ATB, and CRB materials should conform to WSDOT and/or City of Puyallup specifications, where applicable. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557. Road standards utilized by the City of Puyallup may supersede the recommendations provided in this section.

We trust this letter meets your current needs. Please call if you have any questions about this letter or if we can be of further assistance.

Sincerely,

EARTH SOLUTIONS NW, LLC

08/03/2021

Keven D. Hoffmann, P.E.
Geotechnical Engineering Services Manager

Attachment: Calculation Sheet

cc: Barghausen Consulting Engineers, Inc.
               Attention: Mr. Jason Hubbell, P.E. (Email only)

Earth Solutions NW LLC
CALCULATION SHEET

Name: KDH
Date: 07/27/2021
Project Number: 6481.01
Project Name: BPLC Improvements (Puyallup)

Detention Pond Liner Evaluation:

Req'd Amended Soil Thickness to resist Uplift

Assumptions / Design Parameters

(ref. Barghausen Consulting Engr., Storm Drainage Plan/Sections, Feb. 2020)

Top of pond = El. 64.5

Max. W.S. = El. 63.5

Static W.S. = El. 57.5

Bottom of pond = El. 57.0

Seasonal high GWE = El. 62.2

✱ NEED: Liner thickness/elevation req'd to resist uplift ✱ ("x")

NOTE: Pond liner assumed as ballast + amended soil, $\gamma = 135$ pcf

Solve the imbalance equation, need to resist uplift

Imbalance $= \Big[(\text{Seasonal high GWE}) - (\text{Liner elevation})\Big](\text{Unit wt. } H_2O)$

Resistance to uplift = Dead Storage

$= \Big[(\text{Static W.S.}) - (\text{Bottom of pond})\Big](\text{Unit wt. } H_2O) +$

$(\text{Liner thickness})(\text{Unit wt. liner})$

Where Imbalance = Resistance to uplift, FOS = 1.0. Solve equation...

$(62.2 - 57.0 + x)(62.4) = (57.5 - 57.0)(62.4) + (x)(135)$

$\Rightarrow x = 4.04'$, so 4.04' liner req'd for resistance.

Use min. FOS = 1.1 for design and round up: $4.04 (1.1) = 4.44 \doteq \boxed{4.5'}$

$\longrightarrow$ Use 4.5' Liner thickness $\longleftarrow$