



**NELSON GEOTECHNICAL  
ASSOCIATES, INC.**

**17311-135<sup>th</sup> Ave. N.E. Suite A-500  
Woodinville, WA 98072  
(425) 486-1669  
[www.nelsongeotech.com](http://www.nelsongeotech.com)**

December 9, 2022

Mr. Ze Wen Hu  
VIA Email: [wenhu338@gmail.com](mailto:wenhu338@gmail.com)

cc: Mr. James Ma  
VIA Email: [jamesmark2001@gmail.com](mailto:jamesmark2001@gmail.com)

Geotechnical Plan Review Letter  
**Hu Residence Development**  
**30XX – 69<sup>th</sup> Avenue SE**  
**Mercer Island, Washington**  
NGA File No. 11448B20

Dear Mr. Hu:

This letter presents the results of our geotechnical engineering review of the plans for your proposed new residence project located at **30XX – 69<sup>th</sup> Avenue SE on Mercer Island, Washington.**

## **INTRODUCTION**

We understand that the proposed development plan will include construction of a new two-story residence with a basement that daylights toward the west, to be located in the central part of the site. We prepared a preliminary geotechnical engineering evaluation for the project dated December 12, 2019, a geotechnical engineering evaluation for the project dated July 10, 2020, and a shoring wall tieback memorandum dated November 11, 2020. In general, we concluded that the planned site development was feasible from a geotechnical standpoint.

For our use in preparing this plan review letter, we have been provided with the following documents:

- **Architectural plan sheets A-1.00 through A6.01 dated September 5, 2022.**
- **Structural plan sheets S0.1 through S5.5 dated January 8, 2021 prepared by DHS Engineering.**
- **Civil plan sheets C-1.00 through C-4.00 undated, prepared by Tandem Engineering Consultant Inc.**
- **Shoring plan sheets SH1.0 through SH5.2 dated August 22, 2022 prepared by Ground Support.**

We were also provided with City of Mercer Island review comments noted on an earlier plan set.

We provided additional recommendations to members of the design team during the process of our plan review. In the following sections, we present those recommendations and summarize the results of our geotechnical plan review and our responses to the City's geotechnical comments.

### **SHORING DESIGN VALUES**

The proposed excavation shoring has been designed using active earth pressures which vary based on the conditions behind the shoring. An active earth pressure of 40 pcf was used from Piles N1 through N7, N12, E9 through E12, S1 through S8, NA3 through NA5, and EU1 through EU2. An active earth pressure of 42.5 pcf was used from piles N10 through N11 and E3, and an active pressure of 45 pcf was used for piles EU3 through EU8. An active pressure of 50 pcf was used for piles NA1 through NA2, an active earth pressure of 57.5 pcf was used for piles N8 through N9, and an active earth pressure of 62.5 pcf was used for piles E1 through E2. For piles E4 through E8a, a rectangular pressure of 40H was used for the lower 80 percent of the shoring, which decreased linearly in the upper 20 percent of the shoring, reaching zero at the top. An active earth pressure of 40 pcf acts on one pile diameter on the buried portion of piles E4 through E8a. These forces are resisted by a passive pressure of 200 pcf on the buried portion of the soldier piles, neglecting the upper 2 feet. The shoring was designed to resist a seismic pressure of 8H, where H represents the height of the shoring, and a uniform lateral load of 50 psf.

Several tieback anchors 27.5 feet long will be installed in the lower shoring wall at the east side of the residence and one tieback anchor will be installed at the eastern pile of the northern shoring wall.

Some unshored excavations within the site and in the western right-of-way are shown to have an inclination of 1H:1V. In our opinion, such an inclination is appropriate for the planned cuts.

In our opinion, the above-described lateral pressures are appropriate for the conditions surrounding the proposed shoring, including surcharges from sloping conditions above the shoring.

### **RESPONSE TO CITY GEOTECHNICAL REVIEW COMMENTS**

A City review comment on Sheet C3.00 concerns depths and inclination of temporary excavations for the removal and replacement of some sewer piping in the eastern part of the site. Where worker access is needed at the base of sewer excavations, any such excavation more than 4 feet deep should be shored using an excavation trench box or should be sloped at an inclination of 1.5H:1V or flatter. Trench boxes should be used in accordance with manufacturer's recommendations. Worker access in any excavation should comply with all applicable OSHA/WISHA regulations.

A City review comment on **Sheet SH2.0** concerns a proposed retaining wall protecting a tree in the southeast portion of the site, and the potential for the wall to impose a surcharge on excavation shoring. Plans show that the tree is 25 feet from the nearest excavation shoring and no retaining wall is shown between the tree and the shoring, thus no wall surcharge will be imposed on the shoring.

A City review comment on **Sheet SH4.0** concerns the depth to bearing soil along a retaining wall north of the residence. A previous note on the shoring plan stated “lower of base of excavation or depth to load bearing soils.” The comment questioned if the notation of “depth to load bearing soils” should be removed, and it has been removed.

A City review comment on **Sheet SH4.0** states that the geotechnical engineer of record should provide shoring design recommendations to account for surcharges, allowable end bearing, skin friction, and anchor design. We provided variable active earth pressures to account for sloping backslope conditions behind the planned shoring in the previous section of this letter. We provided geotechnical recommendations for the design and installation of shoring tieback anchors in our November 11, 2020 memo. Provided loose soil is removed from the bottom of the soldier pile holes before concrete placement, each pile will have an allowable end bearing capacity of 10 tons. We expect that end bearing capacity will be adequate to resist the downward component of the anchors, and no skin friction on the soldier piles will be needed.

A City review comment on **Sheet A-1.00** concerns a note on the site plan of our preliminary geotechnical study. On that site plan we noted a scarp-like feature in the northwest portion of the site. The City note requests more information about the origin of this feature and its potential impacts on the proposed development. As part of our geotechnical engineering evaluation dated July 10, 2020, we explored subsurface conditions in the northwest part of the site, downslope of the noted feature. That exploration encountered very loose fill to a depth of about 8 feet, which was underlain by stiff to dense or denser native soils. In our opinion, the noted feature was actually not a scarp, and there is no history of deep-seated slope instability within the site. Based on the presence of fill material, we believe the surface contours were shaped by past grading and not by slope instability. For this reason, it is our opinion that no mitigation measures are necessary.

A City review comment on **Sheet A-1.00** concerns proposed fill to be placed on existing fill in the northwest part of the site, where a concrete retaining wall is planned. The comment requests discussion about how the existing fill will impact the design and construction of proposed structural elements. The comment also requests wall and foundation recommendations and estimated wall footing settlements. Our geotechnical study recommended that foundations be placed on medium dense native soils. Any fill soil should be removed from the retaining wall foundation subgrade as recommended in our study. We should monitor preparation of this retaining wall subgrade and evaluate the need for any over-excavation, which can be addressed during construction. Because wall foundations will not be supported on fill, alternate wall and foundation recommendations are not warranted. Potential foundation settlement will be as estimated in our previous study. Up to about 4 feet of new fill will be placed to raise grades in the proposed western terrace, where some existing fill is likely present. We do not expect the placement of fill over existing fill in landscaping areas will be problematic.

A City review comment on **Sheet A-1.00** concerns potential settlement of an existing storm pipe in the western right-of-way resulting from construction of a concrete retaining wall near the west edge of the site and placement of fill on the east side of that wall. The comment requests an assessment of the potential settlement of the storm pipe and mitigation and design recommendations. The plan shows that the storm pipe is centered about 1.5 feet west of the western property line along approximately 12 feet of the north end of the proposed western retaining wall before veering off toward the southwest. That pipe drains a catch basin close to the northwest corner of the site. We do not know the depth of the storm pipe but anticipate that it is no more than 4 feet deep. The face of the proposed retaining wall will be 3 feet 2 inches east of the west property line and the retaining wall at that location will retain less than 5 feet of soil. Detail 1 on **Sheet S5.4** shows that the toe of a 6-foot retaining wall will extend 2 feet in front of the face of the retaining wall, so the west end of the toe would be 1 foot 2 inches east of the property line and about 2.5 feet east of the center of the storm pipe. To prevent the retaining from impacting that pipe, the retaining wall should extend downward below a 1H:1V plane extending upward from the bottom of the storm pipe. This may require some over-excavation of the retaining wall subgrade, which can be addressed during construction. We should monitor preparation of this retaining wall subgrade and evaluate the need for any over-excavation.

A City review comment on **Sheet A-1.00** concerns the proposed excavation of a planned 8-foot excavation for the site driveway west of the residence, and requests the geotechnical engineer review temporary and permanent grading plans. **Sheet SH2.0** shows that permanent shoring will be installed within the site along the south side of the proposed driveway and will extend very close to the west edge of the site. Shoring is also planned about 20 feet north of the driveway, along the north edge of proposed retaining walls and stairs that will access the residence. For permanent grading, **Sheet A-1.00** shows that the area south of the southern driveway retaining wall will slope down toward the northwest with an inclination of 2H:1V. That graded slope will not extend south of the southern property. The portion of the driveway excavation north and south of the driveway in the adjacent right-of-way will have a permanent inclination of 2H:1V.

Two City review comments on **Sheet A-1.00** concern a previously planned retaining wall southwest of the proposed residence, near a tree. A comment expresses concern about protecting the tree and its roots. Another comment how excavation for the retaining wall will be made without crossing the southern property line. The current plan shows that the retaining wall in question is no longer planned and no excavation will be close to that tree or the southern property line.

A City review comment on **Sheet A-3.01** concerns a retaining wall that will be constructed close to the residence basement and expresses concern that the retaining wall would surcharge the basement wall unless the upper wall is attached to permanent shoring. The retaining wall in question will be attached to permanent shoring and thus will not surcharge the basement wall.

A City review comment on **Sheet A-4.01** concerns drainage recommendations for permanent shoring walls and requests the geotechnical engineer to provide those recommendations. Drainage composite should be placed against the full height of the shoring lagging and should be hydraulically connected to weep holes that extend through the base of the permanent wall facing. Those weep holes should be spaced 8 feet on center and should be tightlined to the stormwater system. The shoring wall drainage recommendations are illustrated in Figure 10 which is attached to this letter. Detail 1 on Sheet **A4.01** incorporates those drainage recommendations into project plans.

A City review comment on **Sheet S0.1** concerns seismic earth pressure for retaining walls. The comment states that seismic earth pressure should be used for site retaining walls. The note in question has been revised to state that seismic earth pressure has been considered for the design of site retaining walls.

## **PLAN REVIEW**

We have reviewed geotechnical aspects of the provided plans and found the plans to be in general compliance with our geotechnical recommendations, including recommendations made during the plan review process that are documented in this letter. Our recommendations should be strictly followed.

Project plans show that the residence foundations will be supported on conventional foundations founded on native soils or structural fill extending down to those soils. Foundations have been designed for an allowable bearing capacity of 2,000 psf and with a coefficient of friction of 0.35. Retaining walls have been designed to resist an active pressure of 40 pcf or an at rest pressure of 60 pcf, and a passive pressure of 200 pcf. These soil parameters used in the foundation and retaining wall designs are consistent with the recommendations we have provided.

Timber lagged soldier pile shoring will be installed on the north, east, and south sides of the residence excavation, and further toward the west, where a driveway and entrance stairs are planned. There will be two levels of shoring on the north and east sides of the residence. Shoring tieback anchors will be installed on the lowest level of the eastern shoring and on the east end of the lowest level of the northern shoring.

Project plans show that drainage composite will be placed against the shoring and will be connected to weep holes extending through the shoring facing at 8 feet on center. These shoring drains will be collected in a solid pipe and routed to the storm sewer in the adjacent 69<sup>th</sup> Avenue SE.

Temporary excavations are to have an inclination of 1H:1V or flatter. Permanent slopes will be 2H:1V or flatter.

A perforated footing drain is planned to be installed around the perimeter of the residence, and will route collected water to the storm sewer in the adjacent 69<sup>th</sup> Avenue SE

The side sewer for the adjacent eastern residence crosses the subject site, through the northeast corner of the proposed residence footprint. Project plans show that some of the side sewer will be removed and replaced with new piping that will be routed around the residence. The replacement sewer will be close to most of the eastern side of the residence. We have been informed that pipe will be no deeper than 4 feet below the ground surface.

NGA should be retained during construction to observe geotechnical aspects of the development, including the installation of the proposed shoring walls and evaluation of foundation subgrades.

### **MINIMUM RISK STATEMENT**

Based on our understanding of the proposed plans, and provided that the recommendations in our previous report and memorandum and this letter are strictly followed during construction and the foundations and shoring are constructed under the supervision of NGA, the areas disturbed by construction should remain stable meeting the criteria stated in **Mercer Island City Code 19.07.160.B.2.a-d**. In addition, the development has been designed so that the risk to the lot and adjacent properties is eliminated or mitigated such that the site is determined to be safe, meeting the requirements stated in **Mercer Island City Code 19.07.160.B.3.b**.

Provided that the recommendations in this letter, our geotechnical report, and our shoring tieback memorandum are followed during construction, the areas disturbed by construction should remain stable. Therefore, the risk of damage to the proposed development or to adjacent properties from soil instability should be minimal, and the proposed grading and development should not increase the potential for soil movement.

### **CLOSURE**

We recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities comply with contract plans and specifications.

O-O-O

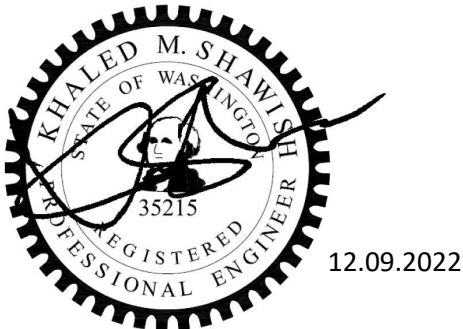
We appreciate the opportunity to provide service to you on this project. Please contact us if you have any questions regarding this letter or require further information.

Sincerely,

**NELSON GEOTECHNICAL ASSOCIATES, INC.**



Thor Christensen, PE  
Project Engineer



Khaled M. Shawish, PE  
Principal

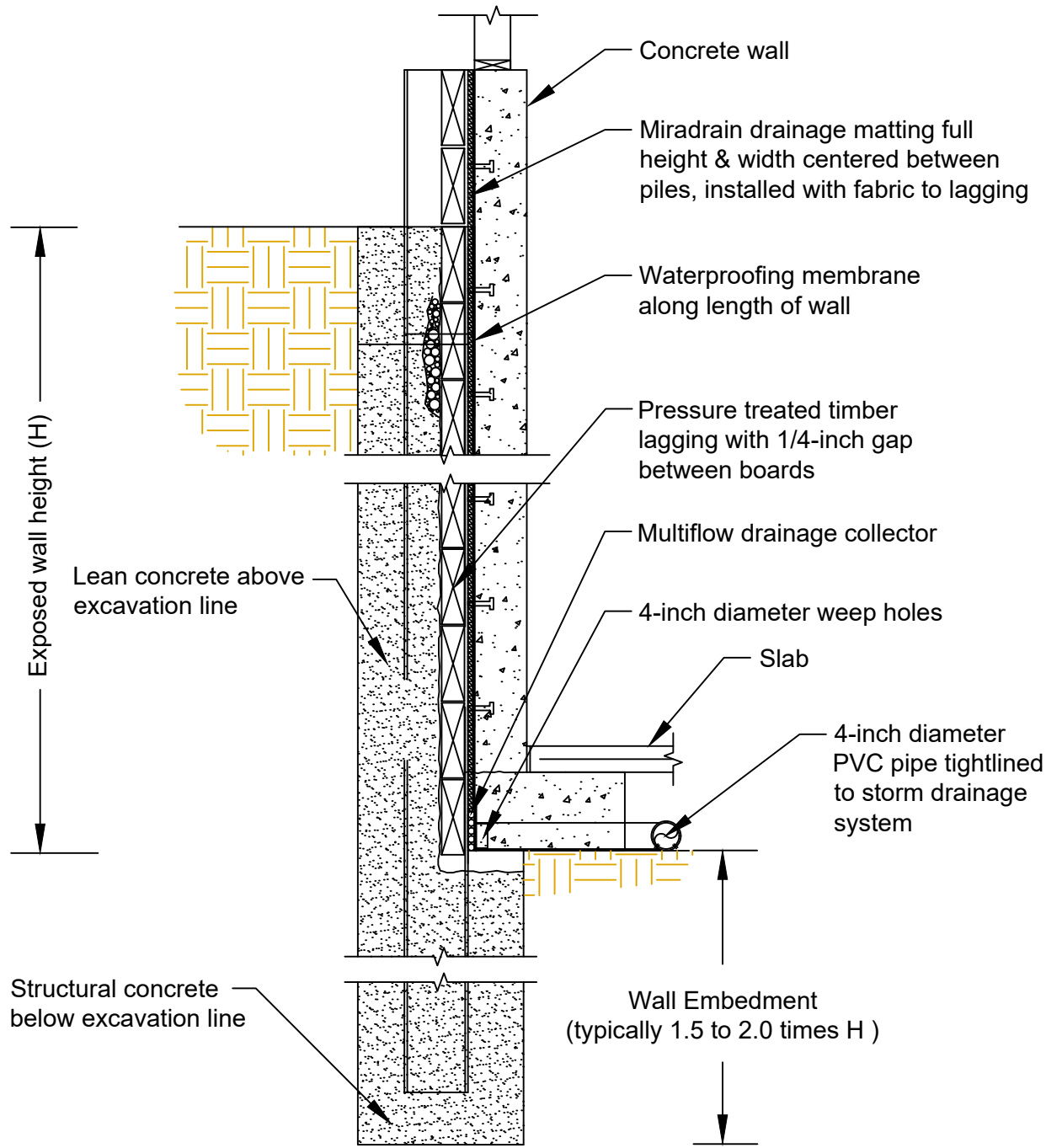
TRC:KMS:dy

Attachment: Figure 10



# Conceptual Soldier Pile Wall Detail

NOT FOR CONSTRUCTION USE



NOT TO SCALE

Project Number  
11448B-20

Hu Residence  
Soldier Pile Wall Detail

Figure 10



**NELSON GEOTECHNICAL ASSOCIATES, INC**

Woodinville Office  
17311-135th Ave. NE, A-500  
Woodinville, WA 98072  
(425) 486-1669 / Fax: 481-2510

Wenatchee Office  
105 Palouse St.  
Wenatchee, WA 98801  
(509) 665-7696 / Fax: 665-7692

www.nelsongeotech.com

(425) 486-1669 / Fax: 481-2510

(509) 665-7696 / Fax: 665-7692

No.	Date	Revision	By	CK
1	9/20/22	Original	FKS	TC

C:\Users\Danny\OneDrive\Nelson Geotechnical Associates, Inc.\Company\2020\NGA Project\11448B-20 Hu Residence\Additional Explorations\Drafting\Soldier Pile Wall Detail.dwg