

August 16, 2018 File No. 17-014

Mr. Chris Niederman 6800 96th Avenue SE Mercer Island, WA 98040

Subject:Additional Surface Exploration and RecommendationsNiederman Residence Remodel6800 – 96th Avenue SE, Mercer Island, Washington

Dear Mr. Niederman,

As requested, PanGEO conducted additional subsurface exploration in the garage area at the above site. The intent of the additional exploration exploration was to explore the subsurface conditions at this location, after the existing garage foundations were exposed and poor existing garage foundation conditions were observed. Additionally, it was observed that the existing garage slabs appeared to be sloping from west to east, indicating up to approximately 4 to 5 inches of differential settlement. The following sections summarize results of our additional field exploration, and geotechnical opinions and recommendations:

ADDITIONAL FIELD EXPLORATION

Our additional subsurface exploration consisted of drilling two test borings, PG-3 and PG-4, to about 19 and 16¹/₂ feet below the surface, respectively. Boring PG-3 was drilled just east of the eat garage wall and boring PG-4 was drilled in the slab area. The approximate boring locations were located in the field from on-site features, and are shown on Figure 1. Previously drilled borings PG-1 and PG-2 were also shown on the Figure 1.

In general, both PG-3 and PG-4 encountered about 11 feet of very loose to loose, silty to slightly sand, which are interpreted as fill and lake deposits. A layer of very soft peat was encountered between $5\frac{1}{2}$ and $7\frac{1}{2}$ feet in PG-4. Below the fill and lake deposit, both borings encountered stiff to hard, clay that extended to the bottom of the borings at about 19 and $16\frac{1}{2}$ feet below the surface in PG-3 and PG-4, respectively. We interpret this clay layer as Pre-Olympia Fine-Grained Deposit. Perched groundwater was encountered between 5 to 10 feet in PG-3 and between $7\frac{1}{2}$ and $10\frac{1}{2}$ feet in PG-4 during drilling.

The soil samples were described and field classified in general accordance with the symbols and terms outlined in Figure A-1, and the summary boring logs including the previous borings are included as Figures A-2 through A-5.

GEOTECHNICAL OPINIONS AND RECOMMENDATIONS

GARAGE FOUNDATIONS

Based on the very loose and soft soil conditions encountered in the borings and observations of the existing garage foundation conditions, it is our opinion that the existing east garage footing should be reconstructed and be supported by deep foundations, such as pin piles or driven soldier piles. The existing garage foundations in other areas, if subject to additional structural loads, should also be considered to be underpinned to reduce the potential for future foundation settlement.

TEMPORARY EXCAVATIONS AND SHORING

PanGEO attended a site meeting with the design team and the general contractor on August 8, 2018 to review the temporary excavations and shoring design at the site. Based on the review, it was team's agreement that a more stringent shoring system than the ultrablock walls will likely be needed due to a combination of limited space to the property lines, limited space available for excavations/disturbance into the existing asphalt driveway, and site soil conditions exposed at the site. Based on the site access conditions, it is also agreed that the most appropriate shoring system will likely be driven soldier piles walls with timber lagging. The following presents our recommendations for the driven soldier pile wall design.

Design Earth Pressure – We recommend that the design parameters outlined in Figure 2 be used for the soldier pile wall design. Above the bottom of excavation, the recommended active earth pressure should be applied over the full width of the pile spacing. Below the bottom of excavation, the passive resistance should be applied over two times the pile diameter and the active and at-rest pressure applied over one single pile diameter. The recommended passive earth pressure assumes level ground surface at the bottom of the excavation. The soldier piles should have a minimum embedment of 10 feet.

If the soldier piles will be incorporated into the design of permanent walls, a uniform seismic earth pressure indicated in Figure 2 should be included in design calculations. The seismic pressure should be applied to the portion located above the bottom of the excavation.

Surcharge Loads – The shoring walls should be designed to accommodate surcharge pressures if surcharge loads are located within the height dimension of the wall. Depending on the shoring wall location, potential surcharge from the existing buildings to the west and north will need to be considered in the shoring wall design and can be estimated using Figure 2.

It should be noted that heavy point loads located close to the top of the walls, such as outriggers of heavy cranes or pump trucks, should be individually analyzed and incorporated into the wall design.

Vertical Capacity – If soldier piles will be used as a permanent foundation system, the soldier piles should have a minimum embedment of 10 feet into the underlying native soil to achieve adequate axial capacities. Soldier piles incorporated into the permanent load bearing system may be designed using an allowable skin friction value of 1.0 ksf for the portion of the pile below the bottom of the excavation, and an allowable end bearing value of 10 ksf.

Permanent Walls – If soldier pile walls will be incorporated into the permanent walls, they should be properly protected against corrosion. This may include proper coatings or upsizing of piles. In addition, it should be noted that timber lagging between soldier piles have limited design life, and the installation of a permanent concrete facing in front of the timber lagging may be considered.

When placing timber lagging, the height of each lift may need to be limited to prevent the unshored soil from escaping through the base of the timber boards. We recommend that the soil exposed for timber lagging be no more than 4 to 5 feet deep. The actual allowable vertical cut for timber lagging placement should be determined in the field, based on the actual conditions observed.

We appreciate the opportunity to be of service.

Sincerely,

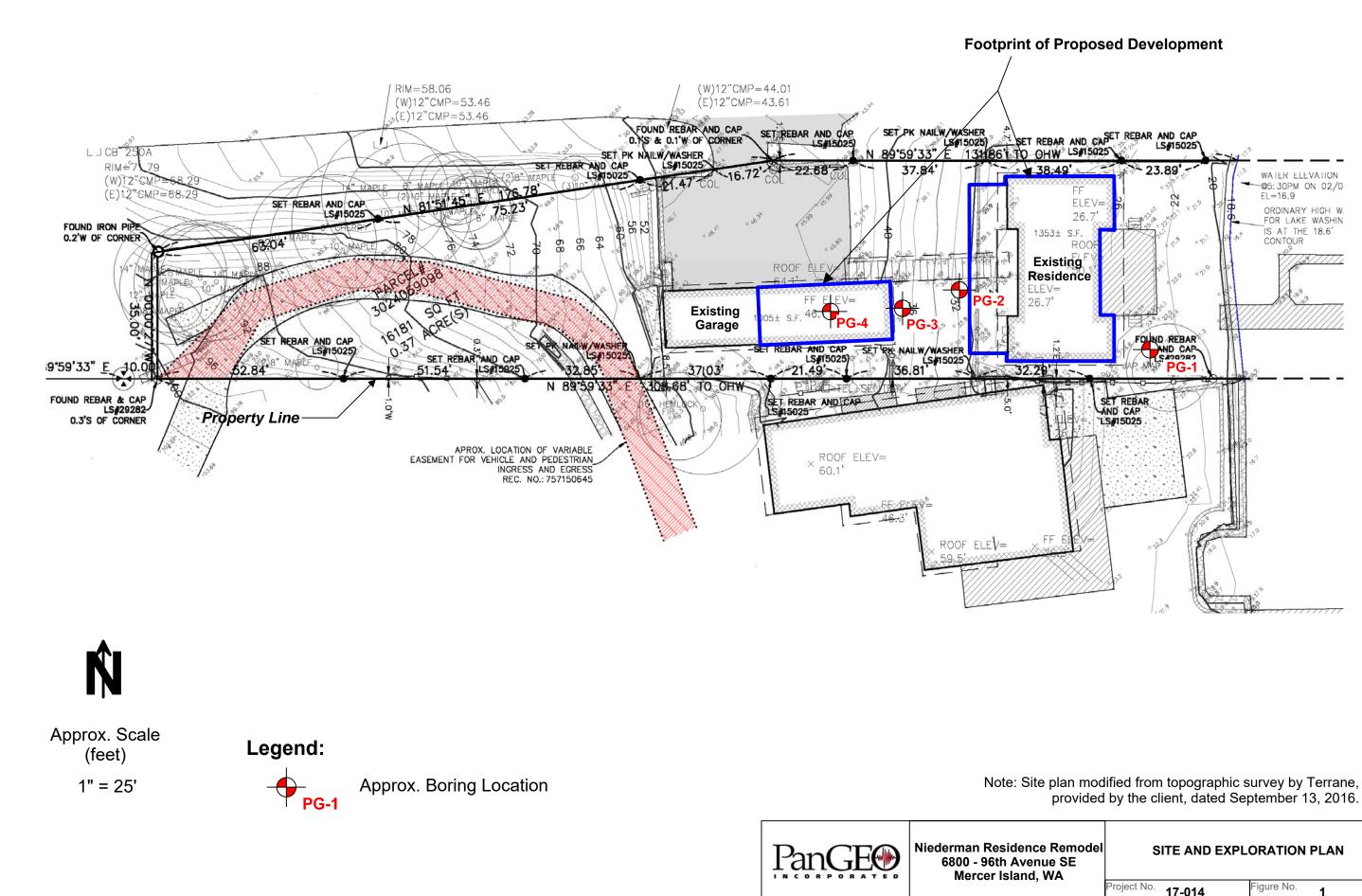


H. Michael Xue, P.E. Senior Geotechnical Engineer

Attachment:

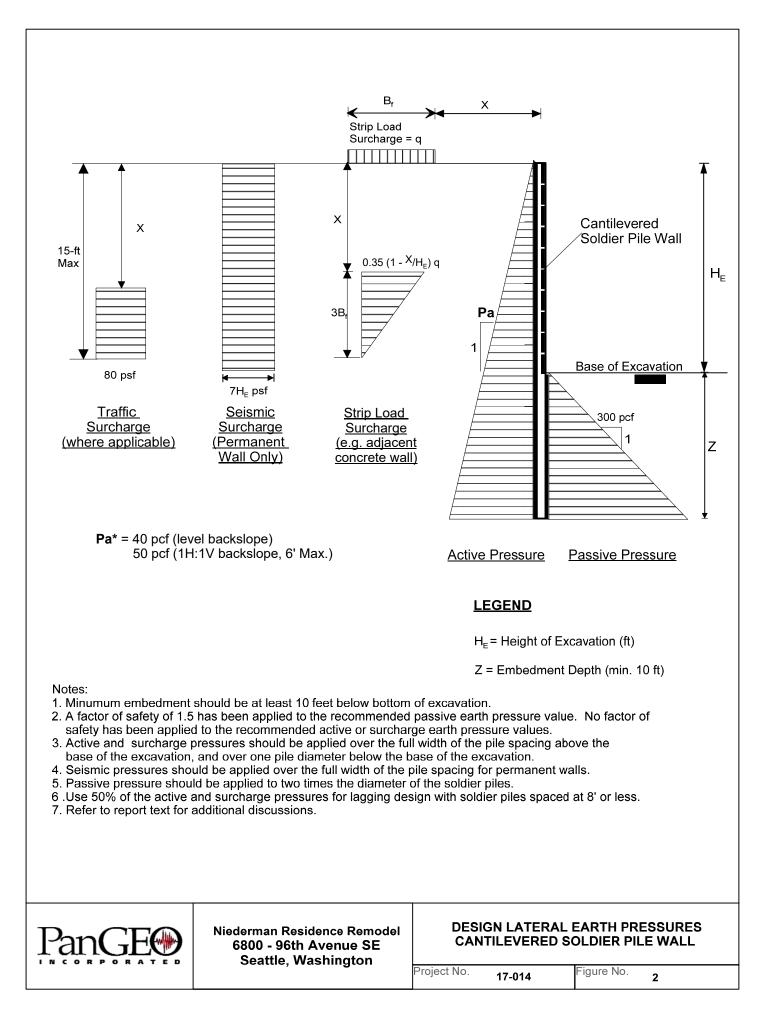
Figure 1	Site and Exploration Plan
Figure 2	Design Lateral Pressures, Cantilever Concrete Walls

Appendix A Summary Boring Logs



provided by the client, dated September 13, 2016.

ce Remodel nue SE I, WA		ORATION PLAN
,	Project No. 17-014	Figure No. 1



APPENDIX A

SUMMARY BORING LOGS

S			ENSITY	/ COI			1		EST SYMBOLS Situ and Laboratory Tests in "Other Tests" column.
	AND / GR/					CLAY		listed	in "Other Tests" cólumn.
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Loose	4 to 10	15 - 35	Soft		2 to 4	250 -	- 500	DD	Dry Density
Med. Dense	10 to 30	35 - 65	Med. Stiff	f i	4 to 8	500 -		DS	Direct Shear
Dense	30 to 50	65 - 85	Stiff	:	8 to 15	1000 -		%F	Fines Content
Very Dense	>50	85 - 100	Very Stiff		15 to 30	2000 -		GS	Grain Size
			Hard		>30	>40		Perm	Permeability
	: :							PP	Pocket Penetrometer
		UNIFIED SOIL	LASSI					R	R-value
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2 Layere Laminate Interlayere Pock Homogeneou COMPO Boulder Cobbles Gravel	2. The graphic s Source Gravel: 2. The symbols material 2. Units of material 2. Composition 2. Layers of soil 2. Layer of soil 3. L	ymbols given above are ay be used where field o DESCRIPTION arial distinguished by col from material units abov il typically 0.05 to 1mm ti that pinches out laterally ayers of differing soil mai pontinuous deposit of limit form color and compositi COMPO SIZE / SIEVE R > 12 inches 3 to 12 inches 3 to 3/4 inches	not inclusive bservations in IS OF SC or and/or e and below hick, max. 1 c werial ed extent on throughou NENT DI ANGE	of all syndicated DIL S Cm SI tt EFINI COM Sand C M Silt Clay	mbols that may a mixed soil consi TRUCTUR Fissured: Bra Blocky: An Disrupted: So Scattered: Lee Numerous: Ma BCN: An BCN: An NOTIONS FIONS FONENT Coarse Sand: dedium Sand: Fine Sand S	appear on the borehole tituents or dual constitu ES eaks along defined plan acture planes that are p igular soil lumps that ree ill that is broken and mix ss than one per foot ore than one per foot igle between bedding pl mal to core axis SIZE / SIEV #4 to #10 sieve (4.5 t #10 to #40 sieve (2.0 #40 to #200 sieve (0. 0.074 to 0.002 mm	logs. ent materials. les olished or glossy sist breakdown ked lane and a plane VE RANGE to 2.0 mm) to 0.42 mm) 42 to 0.074 mm)	MO ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	Vane Shear NITORING WELL Groundwater Level at time of drilling (ATD) Static Groundwater Level Cement / Concrete Seal Bentonite grout / seal Silica sand backfill Slotted tip Slough Bottom of Boring STURE CONTENT Dusty, dry to the touch Damp but no visible wate



Terms and Symbols for Boring and Test Pit Logs

Γ	a a	ņ	G	E		LOG OF TEST	BORING PG-1			Fi	igure A-2
Cor Dat Dat Log		rehol rehol By:	e Starte e Comp	ed: oleted:	21.5ft 2/9/17 2/9/17 Nels F CN Dr	(SPT) sampler mechanism. B	ngs drilled using an Acker han driven with a 140 lb hammer o oring elevation estimated from	perated	with a rope	and cathe	ad
						Boring terminated at 21.5 feet below encountered from 2.5' to 18' at the tin	grade. Groundwater was ne of drilling.				
- 20 -	S-8	X	11 14 16				-Olympia Fine-Grained Depo	osit).			
- 15 -	S-7	X	9 11 13			-Decreased fines.					
	S-6	X	9 10 11			-Becomes medium dense.					
- 10 -	S-5	X	4 5 5			-Increased SILT.					
	S-4	X	4 5 6				(Lake Depos	its).			
- 5 -	S-3		5 5 4			Loose to medium dense, wet, gray sil occasional wood fibers and fine organ portion of unit.	nics, iron oxide staining in upp				
	S-2	X	2 2 2			-Becomes wet.	(r	ill).			
- 0 -	S-1	X	3 3 4			Grass and around 6 inches of topsoil to wet, dark brown to gray silty SAND occasional organics.	and SILT (SM-ML); trace clay	st ,			
Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DE	SCRIPTION			Moisture R 50	LL I ecovery
Co	ordina	ates:		hing: , Ea	asting:		Sampling Method:	SPT		N-Value ▲	
Job	oject: Num cation		17-0			Mercer Island, WA	Top of Casing Elev.:	23.0ft HSA			

Job Loc	ject: Num ation: ordina	:	17-0 6800		ve SE	, Mercer Island, WA		Surface Elevation: Top of Casing Elev.: Drilling Method: Sampling Method:	31.0ff HSA SPT	t			
÷		e	. <u>.</u>	ts							N-Value		
Depth, (ft)	Sample No.	Sample Type	\$ / 9 i	Other Tests	Symbol	MA	ATERIAL DESC	RIPTION		PL	Moistur	e l	LL -
Dept	Samp	Samp	Blows / 6	Other	Syr							Recovery	
- 0 -			ш 1			Loose, moist to wet, c	lark brown silty SAI	ND (SM) [.] trace clav		0	50	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	100
	S-1	X	0 1			numerous organics in			(Fill).				
						7			().				
	S-2	\square	2 4			-Becomes wet, mediu	m dense.						
		А	6								<u>/////////////////////////////////////</u>	<u>/////////////////////////////////////</u>	
- 5 -	• •	\square	4			-Becomes gray, incre	ased clay, trace gra	avel.					
	S-3	Д	6 7										
			5			Very stiff moist gray	clavey SILT (ML-C	CL); medium plastic, bloc	kv				
	S-4	X	7 10			texture to massive be	low upper portion o	of unit. Inf unit.	-				
10		\square					(110-01		,posit).				
- 10 -	S-5	\square	11 14										
		А	15			Boring terminated at 2	11.5 feet below grad	de. Perched groundwate	r was		<u>/////////////////////////////////////</u>	<u>/////////////////////////////////////</u>	
						encountered from 2.5	' to 7.5' at the time	of drilling.					
- 15 -												· · · · · ·	· · ·
- 20 -													
05													
	npleti				11.5ft			drilled using an Acker h					n test
Dat	e Bor	ehole	e Starte e Comp	oleted:	2/9/17 2/9/17	,		ven with a 140 lb hamme g elevation estimated fro					GEO
	ged E ling C		any:		Nels F CN Dr								
Р	a	n	\mathbf{G}	FM		LOG C	OF TEST B	ORING PG-2					
Ť.												Figure	A-3

Job Loc	ject: Num ation: ordina		17-0 6800		ve SE,	Mercer Island, WA	Surface Elevation: Top of Casing Elev.: Drilling Method: Sampling Method:	37.0ft N/A HSA SPT		
Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESC	CRIPTION		PL Mo	alue ▲ isture LL • Recovery 2000 50 100
- 0 -	S-1	X	1 0 1			Very loose, dry to moist, light brown, me occasional rootlets.	-	ravel; (Fill).		
	S-2	X	1 0 1			Very loose, most, dark brown, slightly sil	ty SAND with gravel.	(Fill).		
5	S-3	X	1 1 3			Becomes loose and wet.				
	S-4	X	1 1 3			A piece of woven filter fabric. Loose, wet, gray, slightly silty, medium S	GAND. (Lake Depo	sits?).		
- 10 -	S-5	X	2 6 10			Very stiff, moist, gray CLAY; medium pla (Pre-Oly	asticity, massive. / mpia Fine-Grained De l	oosits).		
	S-6	X	3 6 10							
- 15 -	S-7	X	5 10 17							
	S-8	X	6 14 19			Becomes hard.				
- 20 -						Boring terminated at 19 feet below groun groundwater was encountered from abo	nd surface. Perched ut 5 to 10 feet during dri	lling.		
Date Date Log		ehol ehol 3y:	e Starte e Comp	pleted:	21.5ft 7/27/1 7/27/1 John M CN Dr	8 (SPT) sampler dr 8 mechanism. Borir M.	s drilled using an Acker h iven with a 140 lb hamm ng elevation estimated fro	er opera	ted with a rope and	cathead
P	ą		G	E		LOG OF TEST B	ORING PG-3			Figure A-4

Job Loc	ject: Num ation: ordina		17-0 6800		Ave SE,	Mercer Island, WA	Surface Elevation: Top of Casing Elev.: Drilling Method: Sampling Method:	46.0ft N/A HSA SPT			
o Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DES	CRIPTION			/alue ▲ bisture LL ● I Recovery [50	
	S-1		1 1 1			_Concrete: 4 inches thick. ∖Pea gravel. Very loose, very moist, dark gray-brow	n, silty SAND; woody debi	ris. (Fill).			
- 5 -	S-2 S-3	X	0 1 1 0			Very soft, moist, very dark brown PEA	г.				
	S-4	\square	0 1 0 1					(Peat). osits?).			
- 10 -	S-5		2 5 8			Stiff, moist, gray-brown CLAY; medium	ı plastic, massive. Dlympia Fine-Grained De	eposits.			
	S-6	X	3 7 13			Becomes gray.					
- 15 -	S-7		6 14 17			Becomes hard. Boring terminated at at 16.5 feet below groundwater was encountered from ab	ground surface. Perched				
- 20 -						drilling.		-			
Dat Dat Log	e Bor	ehol ehol 3y:	Depth: e Starte e Comp pany:		16.5ft 7/27/1 7/27/1 John M CN Dr	8 (SPT) sampler of mechanism. Boo M.	gs drilled using an Acker h Iriven with a 140 lb hamm ring elevation estimated fre	er operat	ted with a rope an	d cathead	
\Pr	ą		Ģ	E		LOG OF TEST E	BORING PG-4			Figure <i>i</i>	A-5