



Consulting Engineers Environmental Scientists Construction Materials Testing

September 12, 2013

Valdez Construction
3157 N. Goldie Road, Suite 202
Gig Harbor, Washington, 98277

Attention: Mr. Ryan Valdez, President

Subject: **Limited Geotechnical Site Evaluation of Proposed Foundations Bearing Conditions**
Auto Tour Route St. #7 "Beaver Pond" / Little Pend Oreille National Wildlife Refuge
1310 Bear Creek Road
Colville, Stevens County, Washington

GN Northern Project # 213-412

Mr. Valdez,

This report presents the results of the limited geotechnical site evaluation conducted by GN Northern, Inc. (GNN) for the proposed boardwalk foundation system at the Auto Tour Route Station #7 "Beaver Pond" as referenced above. We understand that you intend to use Diamond Pier® Pin Foundations to support the boardwalk structure. As such, our services were completed in general accordance with Diamond Pier publication "PIER® Foundations Requiring Site Specific or Project Specific Review" (Step 1), which provides guidelines to determine the soil and site characteristic for a proposed project.

We understand that the project will include construction of a wooden boardwalk that will extend out over a portion of Beaver Pond and the associated wetlands. The project site consists of a relatively flat marsh area. Variations in the depths of standing water at the site should be anticipated on the order of several feet based on conversations with the park staff.

The field exploration was conducted by drilling two (2) boreholes using a manually operated hand auger, within the location of the boardwalk structure to observe subsurface soil characteristics pertinent to design of the Diamond Pier® Foundation System. Borehole B-1 was drilled at the current shoreline of

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Beaver Pond and encountered fully saturated soil conditions, whereas Borehole B-2 was drilled near the roadway and met near surface auger refusal.

Disturbed soil samples recovered from the boreholes were logged by our staff engineer and classified according to the Unified Soil Classification System (USCS), utilizing field classification procedures as outlined in ASTM D2488. Depths referred to in this report are relative to the existing ground surface elevation at the time of our field exploration.

Laboratory testing of the obtained soil samples was not included as part of our scope of services. A limited analysis of the observed onsite/subsurface soils was performed to estimate key soil parameters and therefore are approximate and represent our professional opinion based on previous experience with similar soil conditions. Recommended soil design parameters provided include unit weight, angle of friction, and cohesion. See Table 1 and 2 below for the observed subsurface soil conditions and the estimated soil parameters to be used for design of the Diamond Pier® Pin Foundation system.

Table 1: Borehole B-1

Depth (feet)	Description	Soil Parameters		
		Unit Weight, γ (PCF)	Friction Angle, ϕ	Cohesion, c (PSF)
0 - 1.5	Highly Organic Topsoil, black, saturated	90	15	150
1.5 - 3.5	Silty Clay (CL), whitish tan, saturated, stiff	105	22	300
3.5 - 5.5	Poorly Graded Sand (SP), brown, saturated, loose, with trace silt and gravel	110	33	0
5.5- 6.5*	Clay (CL), tan, saturated, very stiff	100	19	200

*Auger refusal at 6.5 ft / Groundwater encountered at surface at time of drilling

Table 2: Borehole B-2

Depth (feet)	Description	Soil Parameters		
		Unit Weight, γ (PCF)	Friction Angle, ϕ	Cohesion, c (PSF)
0 - 1	Organic Rich Topsoil, brown, dry	N/A	N/A	N/A
1-1.5	Silty Gravel, brown, dry, dense	125	36	0

*Auger refusal at ~ 1 1/2 ft. depth on gravels / No groundwater encountered

If you have any questions, please feel free contact us at 509-893-9400.

Sincerely,



Drew M. Flack, EIT
Staff Engineer





Karl A. Harmon, LEG, PE
Senior Geologist/Engineer

Digitally signed by Karl A. Harmon
DN: CN = Karl A. Harmon, C = US, O =
GN Northern, Inc., OU = GN Northern
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Date: 2013.09.12 16:06:54 -0700



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