Bradley-Noble Geotechnical Services
A Division of The Bradley Group, Inc.
PO Box 12267, Olympia WA 98508-2267
Phone 360-357-7883 • FAX 360-867-9307

SUBSURFACE EVALUATION OF THE ROADWAY SLOPE AND OTHER GEOTECHNICAL ISSUES AT 1919 BERRY STREET NE, OLYMPIA

This report presents the results of our supplemental subsurface investigation of the existing roadway fill slope to the east of the platted lot at 1919 Berry Street and other geotechnical recommendations for the proposed construction of a new single-family residence at this site. This work was performed at the request of the project developer, Mr. Barend Van Zanten to form a response to the Hearing Examiner Decision in No. 03-0715 dated 28 January 2004 for this project. The following documents have been provided to us by Mr. Van Zanten; these had been prepared for this project or were part of the permitting process.

Hearing Examiner Decision in No. 03-0715.

Preliminary Drainage and Hydraulics Report dated October 2004 and prepared by Mr. Brian K. Matthews, P.E.

Geotechnical Report by Geotechnical Testing Lab, August 2, 2003.

Foundation Plan prepared by Ralph Fairbanks, P.E.

Topographic and Boundary survey prepared by Butler Surveying Inc.

SITE CONDITIONS

Surface Conditions

The project site is located on the west-facing slope above Budd Inlet. The lot is located to the west of Berry Street NE and is in a topographic low. Two City of Olympia catch basins located on the east side of Berry Street contain the surface storm water conveyed by culverts that discharge onto the slope above this lot. We also observe natural seepage into the area of proposed construction. Vegetation is mixed deciduous and evergreen with low-growing native vegetation.

Recent construction in the project area has resulted in underground utility lines being placed along the west edge of Berry Street along the top of slope. These are both telephone and power lines. The backfill of these lines is loose. The existing roadway fill slope is partially in the city right of way and partially onto this lot forming the east edge slope. We expect that the placement of this fill section for support of Berry Street NE was done by easement under the control of the City of Olympia Public Works Department.

Seepage was observed from the base of the fill slope. We expect that the volume of water seeping varies with the season and rainfall events. The discharge of city storm water from the catch basins during periods of heavy or prolonged rainfall will increase the volume of water flowing across this lot.

Subsurface Conditions

On 25 March 2005, we explored the subsurface conditions by two test borings at locations indicated on the attached site survey plan in the west traffic lane of Berry Street NE. These explorations were made using a continuous-flight, hollow-stem auger to advance the borings and to provide borehole support between sampling intervals. Samples were obtained at standard intervals using a two-inch outside diameter, split-spoon sampler driven by a pin-guided, 140-pound weight free falling 30 inches

The blows per six-inch interval were recorded. The first six-inch drive interval is allowed for seating the sampler. The blow counts for two six-inch intervals, when combined, yield the Standard Penetration Resistance (N-value) of the soils encountered in the sample interval. The number of blows required to drive the sampler the last 12 inches provides a measure of the relative density of granular soils or the consistency of cohesive soils. When the number of blows exceeds 50 for a six-inch or less advancement of the sampler, refusal is inferred. The results obtained from the Standard Penetration Test, along with other tests and geotechnical judgments, were used to develop the recommendations of this report.

Two major soil units are found at this site. The near-surface soils are a fill section placed to construct modern Berry Street. These soils were placed over the native soils. The native soils are firm to very dense granular soils older than Vashon age till.

Soils in this area above this site are Vashon age subglacial till with a thin layer of advance outwash sands and gravels. In the project area and extending down to East Bay Drive are soils older than Vashon age till. These soils are typically described as non-glacial and non-marine sediments older than Vashon age till. We typically assign these soils to the Lake Lawton series. These soils are older than Vashon age but younger than the underlying Kitsap silts which have been radiocarbon dated to 33,000 years B.P. These soils are overconsolidated due to loading by the Vashon lobe of the Cordilleran glacier during the Fraser glaciation in late Wisconsinan time. The thickness of the ice sheet is thought to have been from one-half to one mile thick in this area.

During the retreat of the glacier, Budd inlet was eroded by the Deschutes River. Budd Inlet can be considered an extension of the Deschutes River valley. Volumes of melt water and precipitation amounts greater than are at present observed flowed down the valley walls to the Deschutes River. These flows created ravines in the valley walls. This project site is located in one of these ravines. Depth of the erosion of the ravines was limited by the very dense soils that resisted fluvial erosional processes. Many of these ravines have been filled in or modified during the development of modern Olympia. San Francisco Street to the south of this site has exploited a former ravine for the roadway. In other work in this immediate area, we found another filled-in ravine west of Arbutus Street and the alley to the immediate south of this site as part of an evaluation of slopes for a foundation repair. This filled-in ravine is the source of the seepage found flowing onto Berry Street in the grade up from East Bay Drive.

DISCUSSION AND RECOMMENDATIONS

Existing Fill Section

Page 8, item 13 of the Hearing Examiner Decision states that no evidence was offered that the Berry Street fill met the Uniform Building Code. The Hearings Examiner needs to be aware that two standards for placement of fill exist at this time. Under structures, the Uniform Building Code (UBC) Chapter 70 which was replaced with the International Building Code, Appendix J, Grading specifies the use of test method ASTM D 1557 for control of compaction. For roadways, the APWA specification would have been used by the City of Olympia Public Works for control of compaction of roadway subgrades. The APWA specification has in the past few years been incorporated into the WSDOT/APWA Standard Specification for Road and Bridge Construction. This specification uses the test method ASTM D 698 for control of compaction.

To understand the difference between these test methods the amount of compactive effort to mold the test specimens in ASTM D 698 is a compactive effort of 12,400 foot pounds per cubic foot. To mold test specimens in accordance with ASTM D 1557, 56,000 foot pounds per cubic foot is used. Compaction standard for D 698 is 95% of the laboratory maximum, where in the building codes you are required to meet 90% of ASTM D 1557. To achieve 95% of ASTM D 698 is not difficult as compared to achieving 90% of ASTM D 1557. We expect that Berry Street was constructed in conformance with the City of Olympia standards for compaction in place at the time of construction.

It is recognized that fill slope surfaces cannot be compacted to minimum requirements. The standard practice is to roll the slopes to densify the surface soils with no compaction requirement specified for the surface.

The existing fill slope has a factor of safety greater than one. The City of Olympia did not construct a unstable slope that would be prone to future failure with adverse effect on the downslope property owner. No indication of recent work by the City of Olympia is present to improve slope stability. We expect then that the City of Olympia Public Works considers this a safe slope. With a factor of safety greater than one, the slope is considered to be at stable. To improve slope stability and allow for safe construction of the residence, this fill slope will be supported by a buttress fill as part of the site development work.

Drainage

The two culverts that discharge onto the slope must be connected to a tightline collection system and preferable carried to the toe of slope for disposal into the City of Olympia storm water system on East Bay Drive. The project drainage plan has adequately addressed the collection and control of this storm water. We have reviewed the foundation plan and suggest an alternative method for control of the natural seepage. We recommend that the building pad be excavated to firm native soils. Onto these soils a geotextile fabric equal to Marifi 500X is to be placed and lapped per the manufacturer's recommendations. Onto the fabric, a minimum thickness of two feet of quarry spalls is to be placed and compacted to a firm and non-yielding surface. Onto the top of the spalls, a second layer of Marifi 500X is placed. Onto the fabric one foot of three- or six-inch minus crushed basalt is to be placed and compacted. Foundations then may be placed onto this surface of crushed rock.

Standard compaction control of either spalls or three- or six-inch minus crushed rock is not possible. The material contains more than 30% by weight above the ¾-inch screen. When more than 30% is retained, these tests are not possible to perform. For control of compaction, we recommend the development of a firm and non-yielding surface.

The natural seepage then can flow through the quarry spalls and not have an influence on the project. The geotextile fabric is required to prevent contamination of the spalls from native soils and prevent migration of fines from the structural fill section into the spall drainage blanket.

With construction of a drainage blanket and collection and disposal of the water from the roadway culverts, the volume of water that could flow to the new foundation wall will be reduced. This control of water will aid in reducing any possible build-up of hydrostatic pressures against the foundation wall that could overwhelm the indicated footing drain in the foundation plan. We do recommend that all piping be rigid plastic pipe with water tight joints.

Structural Backfill and Buttress Fill

Our understanding of the foundation plan is that the foundation walls for the north, south and east sides will be constructed as a combination foundation/retaining wall. Structural fill will be placed between the foundation walls and existing roadway slope. This fill section will support driveway and landscape areas. This fill section will then buttress the existing Berry Street fill section and will provide confinement to this slope.

Included with this report is our Earthwork Criteria section. To ensure that the structural section will perform to both support driveway and landscape areas and to buttress the fill slope, we recommend that this section be used for control of material and compaction. Using a 95% minimum of ASTM D 1557 for the structural/buttress fill section will reduce active soil pressure against the foundation walls. This is due to reduction in pore volume and increasing the angle of internal friction by densification. Care must be exercised in placement of structural fill against the foundation walls to prevent overstressing.

We do recommend that the floor framing and floor diaphragm be installed prior to backfilling. This will brace the foundation/retaining wall.

The project structural engineer should analyze any surcharge loading against the foundation walls. With placement of footings for the retaining/foundation walls onto crushed rock, high coefficients of friction are permissible to resist sliding. Use of a coefficient of friction of 0.5 is permissible.

To ensure dry living spaces, attention to perimeter drainage and waterproofing of the foundation is required. We recommend that at the base of all foundation walls a footing drain be installed. We also recommend that the footing drain be constructed using rigid plastic pipe. Rigid pipe is more resistant to crushing and deflection than flexible ADS type of pipe. The roof rain leader collection system should be a separate tightline system isolated from the footing drains. The roof rain leader system and footing drains may be connected to the common discharge line at an elevation such that backup into the footing zone cannot occur.

We do not recommend the use of asphalt emulsion for damp proofing of the foundation walls. There are products on the market that are sprayed onto the foundation walls and form a flexible water proof membrane. The alternative is the use of Volclay panels to prevent water penetration of the foundation.

General Statement of Project Feasibility

The project site is an infill lot located in an area that offers territorial views and has city services available. Construction on this lot has challenges. Site access for construction will be difficult until the foundations can be backfilled. Overhead cable television and the Puget Energy neutral overhead wire will limit use of cranes or other similar types of equipment.

We believe that with the control of water, both natural seepage and storm water from the city street, significant improvement to the site by control of drainage will occur and general site soil stability and fluvial erosional processes will be controlled and improved.

Founding of foundations onto dense native soils or onto a drainage blanket as discussed in this report will provide suitable foundation support and provide long-term stability to the project. With construction of a buttress fill against the existing roadway fill slope, long-term stability of this slope will be improved and it will not have an adverse effect on the project. Good structural evaluation of the active and surcharge soil loads against the east foundation wall must be included in the design solution. We can work with the design engineer if additional information is needed.

Construction can occur on this lot without destabilizing adjacent properties or public right of ways if good construction and site development work practices are incorporated. With the site being underlain by overconsolidated soils, we do not expect that settlement or mass wasting events will have any effect on the residence.

Geotechnical Testing Laboratories has conducted exploration of the toe area of the roadway slope by two test borings. We have conducted two test borings in the City of Olympia right-of-way at the locations indicated. No boring has indicated that soil conditions exist at this site that would result in failure of the roadway section by the proposed construction. The proposed work will actually improve the long-term stability of the fill section supporting modern Berry Street NE.

Earthwork Criteria

In areas under structures, paving sections, and sidewalks, strip all topsoil and organic material. For structural fill in areas under footings and slab on-grade, we recommend that all soils be compacted to a minimum density of 95 percent of ASTM D-1557. This includes proof rolling native soils exposed in the bottom of the excavation before placing fill. This includes proof rolling in-place soils, soils that have been disturbed during construction, and all structural fill materials.

For imported structural fill, we recommend that a clean, six-inch minus, well-graded gravel or gravelly sand (classifying as GW or SW as determined by ANSI/ASTM test method D-2487), conforming to APWA specification 9-03.14 for gravel borrow, be used. We also recommend that no more than 7 percent by weight pass the number 200 screen as tested by ANSI/ASTM D-1140 test procedure.

All fill should be placed in uniform horizontal lifts of six- to eight-inch loose thickness. Each lift should be conditioned to the optimum moisture content and compacted to the specified minimum density before placing the next lift. We further recommend that all utility trench backfill be compacted as specified above. Earthwork should be performed under the continuous supervision and testing of an approved testing agency to ensure compliance with the compaction requirements.

Placement of fill section on slopes greater than 4:1 (horizontal to vertical) will be benched as directed into the native soils. Height and width of the bench will be determined in the field by the soils engineer or engineering geologist.

Unrestricted slopes shall not exceed 2:1 (horizontal to vertical) for fill embankments and cuts that expose native soils. All fill slopes will be rolled. The project's civil engineer is responsible for the protection of the constructed fill slopes from uncollected runoff. We recommend that all cut-and-fill slopes be seeded as soon as possible after construction, so that vegetation can protect the slopes from sheet washing.

No fill is to be placed during periods of unfavorable weather or while the fill is frozen or thawing. When work is stopped by rain, placement of fill will not resume until the soils engineer or engineering geologist determines that the moisture content is suitable for compactive effort and that the previously placed fill has not been loosened. The contractor will take appropriate measures during unfavorable weather to protect the fill already placed. Measures that may be required include limiting wheeled traffic and grading to provide temporary drainage of the fill. At the direction of the soils engineer or engineering geologist, the contractor will be responsible for the removal and reworking of fill that has softened or has less than the required compaction.

Limits of Liability

BRADLEY-NOBLE GEOTECHINCAL SERVICES is responsible for the opinions and conclusions contained in this report. These are based on the data relating only to the specific project and locations discussed herein.

This report was prepared with the standard and accepted practices of our industry. In the event conclusions and recommendations based on these data are made by others, such conclusions and recommendations are not the responsibility of the soils engineer or engineering geologist unless he has been given an opportunity to review them and concurs in such conclusions or recommendations in writing.

The analysis and recommendations submitted in this report are based upon the data obtained in the explorations at the locations indicated on the attached plan and information provided to us by our client. This report does not reflect any variations that may occur between these explorations. The nature and extent of variations between explorations my not become evident until construction is underway.

Bradley-Noble is to be given the opportunity to review the final plans and specifications for soils work. This is to verify that our geotechnical recommendations have been correctly interpreted and implemented in the final design and specifications.

We also recommend that we be retained to provide geotechnical services during the foundation construction and trenching. These services would include review of backfill operations, excavations, and other geotechnical considerations that may arise during construction. We would observe compliance with the design concept and project specifications. If the subsurface conditions differ from those anticipated in our explorations, we would also evaluate changes in contraction specifications.

BRADLEY-NOBLE GEOTECHNICAL SERVICES

Report prepared by:

David C. Strong, L.E.G.

30 April 2005

GENERAL NOTES
FOR SOIL INVESTIGATIONS CONDUCTED BY AUGERED BORINGS

SAMPLE IDENTIFICATION

All sample classifcations are reviewed by a soils engineer in accordance with the Unified Soil Classification System ASTM D-2487. Field soil classifications are in accordance with ASTM D-2488.

SOIL PROPERTY SYMBOLS

Dd: Dry density, pcf
PL: Plastic limit
q_p: Penetrometer value, tsf
q_u: Unconfined compressive strength, tsf
LL: Liquid limit
W : Moisture content
q_s: Vane-shear strength, tsf
PI: Plasticity index

N: Penetration resistance per foot or fraction thereof, of standard 2-inch O.D., 1.3-inch I.D., split-spoon sampler driven with a 140-pound weight free falling 30 inches, in accordance with Standard Penetration Test Specifications ASTM D-1586
__: Apparent ground water level at the time noted after completion

SOIL STRENGTH CHARACTERISTICS

COHESIVE SOILS

Comparative Consistency	Blows/Foot	Unconfined Compressive Strength (tsf)
Very soft	0 - 2	0 - 0.25
Soft	2 - 4	0.25 - 0.50
Medium	4 - 8	0.50 - 1.00
Stiff	8 - 15	1.00 - 2.00
Very stiff	15 - 30	2.00 - 4.00
Hard	30+	4.00+

NON-COHESIVE (GRANULAR) SOILS

Relative Density	Blows/Foot (N-Value)
Very loose	0 - 4
Loose	4 - 10
Firm	10 - 30
Dense	30 - 50
Very dense	50+

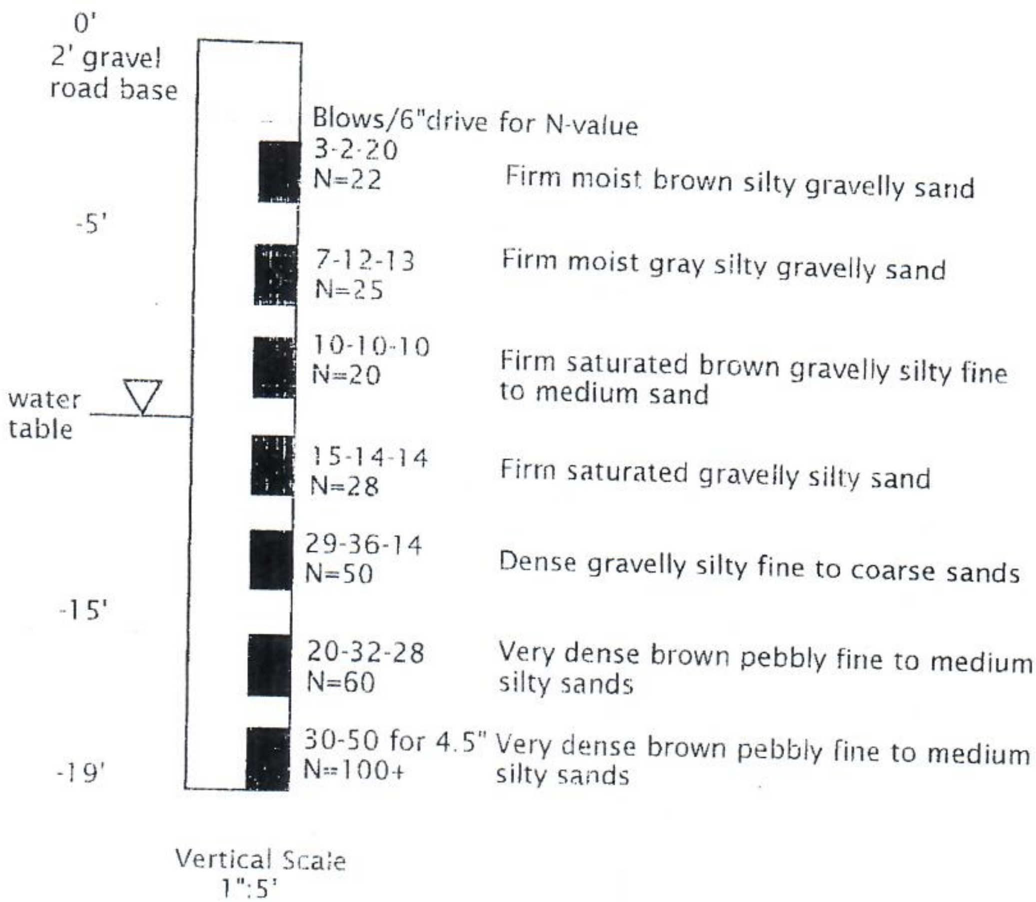
DRILLING AND SAMPLING SYMBOLS

SS: Split spoon
AU: Auger sample
WS: Washed sample
TC: Tri-core drilling
ST: Shelby tube - 3" O.D. (except where noted otherwise
DB: Diamond bit core
CB: Carbide bit core
RL: Ring-lined sampler

JOB#: 05.04-06
DATE: 3/25/2005
TESTING BY: D.Strong

1919 Berry Street NE

Boring 1, south



Bradley-Noble Geotechnical Services

JOB#: 05.04-06
DATE: 3/25/2005
TESTING BY: D.Strong

1919 Berry Street NE

Boring 2, north

	Blows/6" drive for N-value	
0'		Roadway surface, west traffic lane
1.5' gravel road base	Blows/6"drive for N-value	
	11-10-12 N=22	Firm gray gravelly silts (fill)
-5'		
	9-3-5 N=8	Loose brown and gray silt with gravels and wood (fill)
	7-9-4 N=13	Firm dark gray gravelly silts (fill)
-10'		
	2-2-3 N=5	Loose gray silty fine sands
water table -15'	2-3-6 N=9	Loose gray silty fine sands
	10-17-21 N=38	Dense gray silty fine sands
-19'	21-38-50 for 4" N=88+	Very dense gray pebbly silty fine sands

Vertical Scale
1":5'

Bradley-Noble Geotechnical Services