



**Stantec**

**Stantec Consulting Services, Inc.**  
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November 7, 2014

Green Seattle Partnership  
C/O Mary DeJong  
2809 South Alaska Place  
Seattle, Washington 98108

**RE: Preliminary Geotechnical Evaluation**  
Proposed Trail Expansion – Cheasty Greenspace  
28<sup>th</sup> Avenue South & South Columbian Way  
Seattle, Washington

Dear Ms. DeJong,

At your request and authorization, we have prepared this letter to discuss our initial findings and opinions regarding trail construction at the above referenced location. We conducted a site visit and site reconnaissance on September 1, 2014.

#### **SITE LOCATION AND DESCRIPTION**

##### **Site Conditions**

The site consists of a large portion of the Cheasty Greenspace located between Cheasty Boulevard and the Rainier Vista development (west and east) and South Columbian Way and South Bradford Street (south and north).

The site area generally slopes downward toward the east at variable magnitudes ranging from approximately 10 to 100 percent. Local slope areas along the east side of Cheasty Boulevard and around a City of Seattle maintenance area have been previously filled and are currently oversteepened up to 100 percent in magnitude. In general, local slope areas are 10 to 30 feet in height and the greenspace has gently sloping and nearly level areas within the central and east portions. The overall topographic relief within the site area is approximately 170 feet.

It is our understanding that several landslides have occurred in the north portion of the site and on adjacent properties within the last 20 years. These slides have been generally located within and adjacent to the north end of the greenspace.

The site area is vegetated with Himalayan Blackberries, English Ivy, ferns, and other shrubs; along with Alder, Maple, Hemlock-Fir, and Cedar trees. The site is bordered to the south by South Columbian Way, to the west by Cheasty Boulevard, to the north by South Bradford Street, and to the east by residential developments.

**Reference: Limited Geotechnical Investigation****Proposed Construction**

Based on our discussions, we understand that mountain bicycle and hiking trails along with access points from areas roadways may be constructed within and along the margins of the greenspace. The proposed development also includes invasive vegetation removal, vegetation replacement, and construction of one or more short-span timber bridges. Typically, a mountain bike or hiking trail has a maximum grade of 15 percent with a desired grade of 5 percent. Per the City of Seattle Parks Department trail construction standards, hiking trails with steps may have slopes up to a 50 percent magnitude.

We anticipate that hiking trails will be up to 4 feet in width and will switchback across the topography and/or utilize steps to maintain passable grades. Mountain bicycle trails will be up to 2 feet in width. We do not anticipate significant areas of fill placement or excavation work to create the trails, jumps, or access points.

**GEOLOGIC SETTING**

The site lies within the Puget Lowland. The lowland is part of a regional north-south trending trough that extends from southwestern British Columbia to near Eugene, Oregon. North of Olympia, Washington, this lowland is glacially carved, with a depositional and erosional history including at least four separate glacial advances/retreats. The Puget Lowland is bounded to the west by the Olympic Mountains and to the east by the Cascade Range. The lowland is filled with glacial and nonglacial sediments consisting of interbedded gravel, sand, silt, till, and peat lenses.

The Geologic Map of Seattle, indicates that the site is underlain by Vashon Glacial Till (Qvt), Vashon Advance Outwash (Qva), Lawton Clay (Qvlc), Vashon Recessional Outwash (Qvr). The primary units that underlie the greenspace include Vashon Advance Outwash and Lawton Clay.

Vashon Glacial Till is typically characterized by an unsorted, nonstratified mixture of clay, silt, sand, gravel, cobbles and boulders in variable quantities. These materials are typically dense and relatively impermeable. The poor sorting reflects the mixing of the materials as these sediments were overridden and incorporated by the glacial ice.

Vashon Advance Outwash consists of sand and gravel with local interbeds of silt and clay deposited in front of advancing glaciers during the most recent ice age. These materials are generally dense to very dense and typically have a high rate of permeability.

Lawton Clay is a sub-unit of Vashon Drift and is typically located below Vashon Advance Outwash. The contact between these two units is often marked by sand and silt/clay layers and interbeds of these materials. Lawton Clay generally consists of variable mixtures of silt and clay with variable degrees of plasticity. Spring activity is commonly found at the contact between the Outwash and Lawton Clay. Many Seattle area landslides are located at or above this contact.

Vashon Recessional Outwash typically consists of sand with variable amounts of gravel and silt deposited during glacial retreat. These materials are commonly located along the top of area ridges (till planes) and in valley areas. This unit is locally subdivided into coarse grained and fine grained sub-facies. The northeast portion of the site is located near the contacts between Lawton Clay and Vashon Recessional Outwash –

**Reference: Limited Geotechnical Investigation**

Lacustrine Deposits. These recessional deposits typically consist of interbedded silt and clay with variable amounts of sand, gravel, and locally, peat. All recessional deposits are loose to medium dense/stiff.

The geologic map shows landslide scarps extending along the west margin of the greenspace, generally along the top of the overall slope system. The map also indicates that the greenspace is underlain by landslide debris and mass wastage deposits. An area excerpt of the geologic map is shown in Figure 1.

**LIDAR**

We also conducted a preliminary review of available LIDAR maps of the site area. The LIDAR images confirm the landslide scarp locations, indicate other localized scarp/landslide areas (dark shading), the existing hummocky terrain within the greenspace, and approximate outlines of severe landslide hazard areas. Figure 2 shows the LIDAR image along with area geology and greenspace limits. Further evaluation of aerial photographs and LIDAR images from multiple years could aid in delineating landslide areas further.

**Additional Geotechnical Information**

We reviewed excerpts of geotechnical reports, site plans, and boring logs from several site areas located near the greenspace. An Earth Consultants, Inc. report from 2000 included four drilled borings located along the toe of the slope of the greenspace, and was performed as part of a larger investigation for the Rainier Vista development. In general, these four borings encountered 12 to 18 feet of loose soils consistent with landslide debris.

**GENERAL GEOLOGIC HAZARDS**

The City of Seattle designates slopes with magnitudes greater than about 40 percent and vertical relief of at least 10 feet as geologically hazardous (steep slope/landslide hazards). Landslide hazard areas also include known landslide areas, areas where permeable sediments overlie relatively impermeable materials, and areas where spring activity occurs within a slope area.

From our review of available geologic information and our site visits, the entire greenspace is located within a Landslide Hazard/Steep Slope Area and likely within an Erosion Hazard Area. The most severe landslide hazard areas are generally located north of the picnic and gathering area. It is our opinion that erosion hazard areas are generally part of any landslide hazard area designation. However, for the purposes of this report, we have outlined the most significant erosion hazard areas based on anticipated soil composition and slope magnitude. Figure 3 shows the generalized locations of the most severe erosion and landslide hazard areas which should be studied further and in detail once trail alignments have been proposed.

The Seattle Landslide Study, prepared by Shannon and Wilson for the City of Seattle, includes mapped slides throughout the City limits. The map identified two slides located in the north portion of the greenspace. Due to the large scale, it was difficult to precisely locate these slides; however, we have estimated their location on Figure 3. The upper (more westerly) slide occurred between 1980 and 1990 and the lower slide occurred between 1940 and 1950, although a more recent slide occurred in this general area within the last decade. A majority of the slides located along the east side of Beacon Hill were described as shallow colluvial slides occurring at or near the contact between advance outwash and Lawton clay.

**Reference: Limited Geotechnical Investigation**

It is our understanding that a relatively shallow landslide occurred at a recent development located near S. Andover Street and Martin Luther King Boulevard South. We observed the area during our site visits and it appears that temporary excavations were made in landslide debris and allowed to remain open for an extended period of time at a relatively steep angle. These materials slid, requiring mitigation with large quarry rock as a buttress.

**CONCLUSIONS AND RECOMMENDATIONS****General****Conclusions and Recommendations**

The greenspace site is located within an older landslide complex located along a geologic contact well known for landslide activity in the City of Seattle. Several relatively recent slides have been documented north of, or in the north portion of the site. Figure 3 shows the approximate location of the most significant and severe geologic hazard areas. As shown on the figure, there are two significant erosion/steep slope hazard areas. Also, a majority of the north end of the greenspace is within a landslide hazard area.

It should be noted that this is a preliminary map based on our site reconnaissance, geologic map review, LIDAR image review, and historical information review only. Once a schematic trail plan has been developed and the proposed route flagged on site, we recommend that the geologist or geotechnical engineer walk the proposed alignment to evaluate specific hazards along the route and determine which geologic and geotechnical analyses are required in these locations.

Required analyses for specific sites may potentially include drilled borings, seepage analyses, erosion hazard analyses and cross sections. The results of these studies will help determine the most suitable route adjustments as well as setback considerations, surface water drainage recommendations, re-vegetation recommendations, and erosion control recommendations. In general, slopes located within 50 feet of the proposed trails and at a 2H:1V (horizontal to vertical) magnitude or higher with a topographic relief of at least 10 feet should be evaluated further. Typically, but not exclusively, slopes with magnitudes less than 3H:1V are considered suitable for trail development without further evaluation.

In general, it is our opinion that that an acceptable route for both a perimeter trail and cross trails can be located on the site, provided certain site-specific landslide hazard areas are avoided, proper analyses are performed after the trail has been laid out in the field based on preliminary design, and adequate precautions based on these analyses are taken to minimize additional erosion.

**Limitations**

The information presented herein is based upon professional interpretation utilizing standard practices and a degree of conservatism deemed proper for this project. We emphasize that this report is valid for this project as outlined above, and should not be used for any other site.

Sincerely,

# Stantec

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Cheasty Greenspace  
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**Reference: Limited Geotechnical Investigation**

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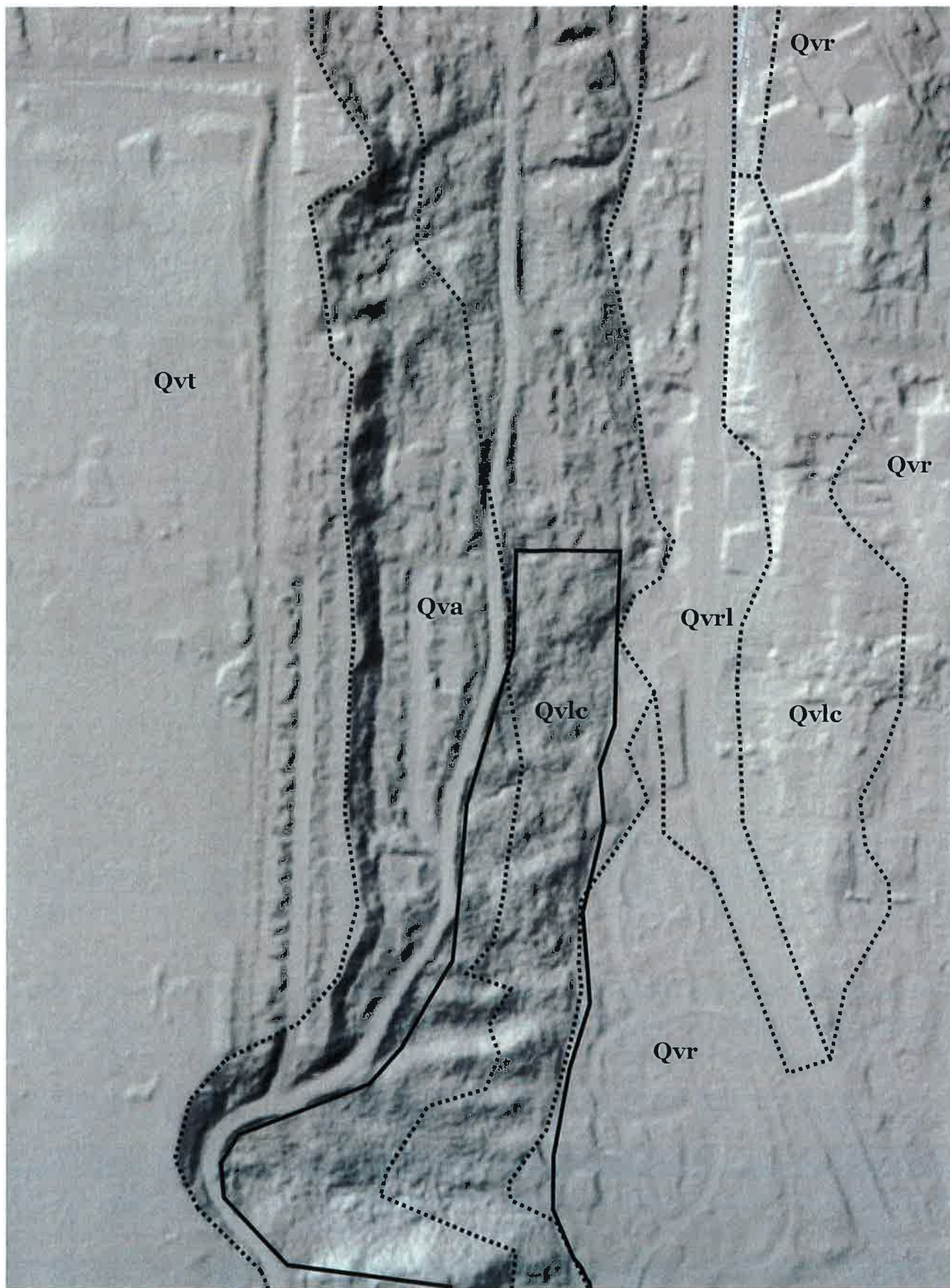


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Not to Scale



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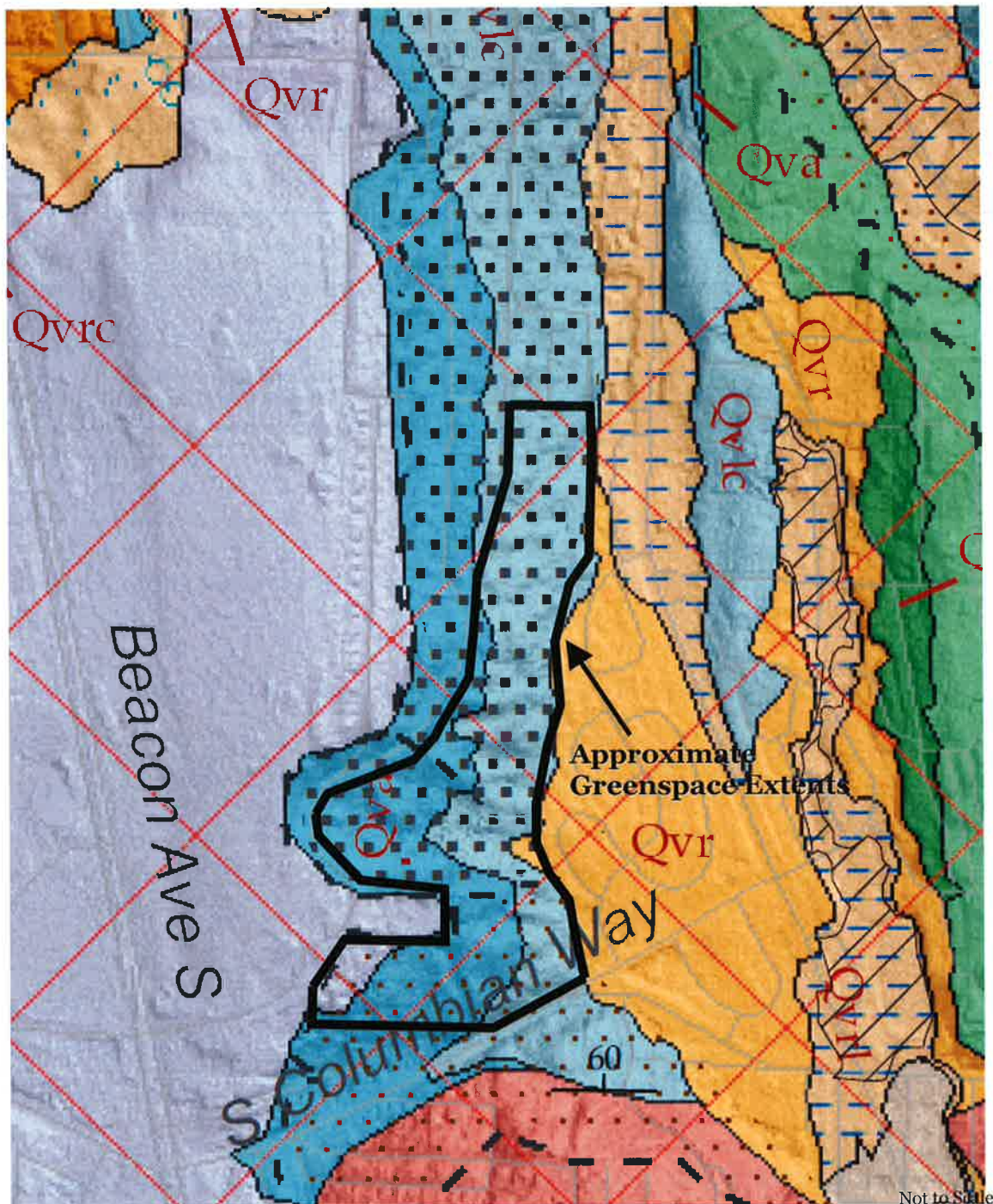
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**LIDAR MAP**

**FIGURE 2**





- Qvr Vashon Recessional Outwash
- Qvrl Vashon Recessional Lacustrine Deposits
- Qvt Vashon Glacial Till
- Qva Vashon Advance Outwash
- Qvlc Vashon Drift - Lawton Clay
- Small Dot Overprint - Mass Wastage Deposits
- Large Dot Overprint - Landslide Deposits
- - Dashed Lines - Landslide Scarps

Ref: Geologic Map of Seattle



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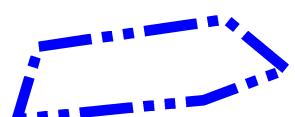
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**GEOLOGIC  
 MAP  
 FIGURE 1**





**Primary Landslide Hazard Area (Generalized)**



**Significant Erosion Hazard Area/Steep Slope Area**



**Approximate Location of Documented Landslide**

Not to Scale



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**SITE PLAN**

**FIGURE 3**