
To: Steve Bennett, Director of Community Development, City of Lake Forest Park

From: Sound Transit

Date: April 22, 2022

Subject: Geotechnical Investigation and Exploration - SR 522/145th Bus-Rapid Transit

Sound Transit proposes to conduct geotechnical site investigation fieldwork to support the SR 522/145th Bus-Rapid Transit project design activities. Proposed fieldwork includes 13 geotechnical boreholes and one pavement coring in the City of Lake Forest Park (LFP) that are within identified Environmentally Critical Areas (LFP Municipal Code [LFPMC] 16.16). LFP regulates the following critical areas per LFPMC 16.16: wetlands; streams; critical aquifer recharge areas; fish and wildlife habitat conservation areas; frequently flooded areas; and geologically hazardous areas such as erosion hazard areas, landslide hazard areas, seismic hazard areas, and steep slope hazard areas.

The proposed boring and pavement core locations (**BH-28, BH-29, BH-30, BH-31, BH-32, BH-33, BH-34, BH-35, BH-38, BH-44, BH-68, BH-78, BH-91, and C-13**) are intended to support final design of retaining walls, utilities, stormwater infrastructure, signal pole foundations, and other project-related roadway improvements. The purpose of this technical memorandum is to describe any alterations to critical areas resulting from these fieldwork activities. Work activities will not permanently impact critical areas or associated buffers. Temporary vegetation impacts will be minor and limited to brush clearing.

WORK ACTIVITIES AND EQUIPMENT

At each proposed boring location, soil samples will be obtained using Standard Penetration Tests at 2.5- or 5- foot intervals to the depth explored. Each boring will have a target depth between 10 to 90 feet, depending on the location, and will be about 4 to 8 inches in diameter. A limited-access drill rig with a hollow-stem auger will be utilized, which can be established on sloped conditions without grading required. The property access plan (PAP) associated with the proposed locations provides detailed descriptions of access, methods, and equipment. The site access and work zone preparation for each proposed location are summarized in the following sections.

Borings BH-32, BH-33, and BH-34

Three borings referred to as **BH-32, BH-33, and BH-34** are proposed to be located southeast of State Route (SR) 522, between NE 153rd Street and NE 155th Place within the Bsche'tla Creek ravine (see Map 2):

- **BH-32** is located on a Washington State Department of Transportation (WSDOT)-owned parcel on a gently sloped bench directly outside of the SR 522 right-of-way (ROW) beyond the pedestrian wall. **BH-32** is located within the stream buffer of Bsche'tla Creek and a landslide hazard area.

- **BH-33** is located on a WSDOT-owned parcel on a sloped area within the ravine within the stream buffer of Bsche'tla Creek and a landslide hazard area.
- **BH-34** is located on the adjacent private parcel (No. 6744700105) on the sloped area within the ravine within the stream buffer of Bsche'tla Creek and a landslide hazard area.

Workers access into the Bsche'tla Creek ravine locations will be via an existing path extending along the side slope from the southwestern corner of the ravine, which is relatively clear of existing vegetation. Equipment access will be from above the ravine using a crane truck parked on the adjacent SR 522 ROW. The drill rig will be disassembled and lowered from the top of the slope perpendicularly down to a work zones that will be approximately 15 by 15 feet.

The work zones will be cleared of obstructing vegetation prior to placement of the drill equipment. Any additional vegetation clearing needed for the existing path will be limited to trimming tree limbs and cutting the shrub and herbaceous layer at or above ground level for an area approximately 4 feet wide by 100 feet long. No tree trunks or critical root zones will be impacted and ground cover removal will not be significant. Brush clearing will be completed with brush trimmers and other light equipment for removing smaller branches. Ground disturbance will be minimized. Any disturbed vegetated areas in critical area buffers will be restored immediately using a native upland seed mix.

Borings BH-38, BH-44, BH-68, and BH-78

Four boreholes—**BH-38, BH-44, BH-68, and BH-78** (see Maps 3 and 4)—will require moderate preparation of the site for a work zone and access. Centered around each location, a work zone approximately 15 feet wide by 15 feet long will be set up. Site-specific access and work zone clearing activities for each are outlined below and detailed in the associated PAPs:

- **BH-38** will be drilled west of SR 522 between the intersections of NE 157th Lane and NE 157th Place on the privately owned Parcel No. 6744700303 adjacent to the SR 522 ROW on unimproved land outside of the fence line on the property. The surrounding area is heavily vegetated with brush and small trees, and the site slopes upward from SR 522 toward the house. BH-38 is located on a steep slope.
- **BH-44** will be drilled within a WSDOT-owned property adjacent to a staircase in vacated WSDOT ROW. The limited-access drill rig will be disassembled and manually transported to the location using the existing staircase. The boring will be advanced adjacent to the staircase. BH-44 is located on a steep slope.
- **BH-68** will be drilled west of SR 522 between the intersections of NE 165th Street and 41st Avenue NE on the privately owned Parcel No. 7740500090 adjacent to the SR 522 ROW. The proposed boring location is outside of the fence line on the property. From SR 522, the location slopes upward steeply above an approximately 4-foot-high rockery structure. The surrounding area is heavily vegetated with brush and small trees.
- **BH-78** will be drilled west of SR 522 between the intersections of 39th Avenue NE and NE 165th Street on the privately owned Parcel No. 7740100075 adjacent to the SR 522 ROW. The surrounding area is moderately vegetated with brush. The proposed boring is adjacent to the house on the northern end of the property. BH-78 is located in an erosion hazard area.

Borings BH-28, BH-29, BH-30, BH-31, BH-35, BH-91, and Pavement Core C-13

Six borings and one pavement core (BH-28, BH-29, BH-30, BH-31, BH-35, and C-13) are all located in improved areas, accessed by a paved ROW (see Map 2). The pavement will be restored once the geotechnical investigations are complete. All six borings are located in a landslide hazard area.

- **BH-30 and BH-35** are proposed on private parcels (No. 6744700101) within a relatively flat, paved parking lot adjacent to the SR 522 ROW.
- **BH-28, BH-29, BH-31, BH-91, and C-13** will be advanced within the paved SR-522 ROW.

CRITICAL AREAS STUDY

In accordance with LFPMC 16.16.230.A, work activities such as this geotechnical investigation require a Critical Areas Work Permit. Authorization of work under this permit is allowed if there is no construction of new access roads and if excavation activities are limited to no more than 10 cubic yards of material. The work in critical areas requires that impacts to critical areas and buffers be minimized and disturbed areas be immediately restored. A minor permit, as defined in LFPMC 16.16.080, requires a critical areas study. Per LFPMC 16.16.110, critical areas studies are to identify and characterize critical areas or buffers on or adjacent to the proposed work and to demonstrate that all reasonable efforts have been made to avoid, minimize, and restore temporary impacts. The PAPs referenced below for each location fill the requirement for a vegetation management plan (LFPMC 16.16.160.A) as clearing limits and methods of field marking are indicated.

This critical areas study was prepared under the direction of Emily Drew, who exceeds the requirements for a qualified professional as defined by LFPMC 16.16.040. Emily Drew is a trained wetlands professional and a WSDOT-certified biological assessment writer. She has 25 years of experience, including 8 years of permitting work in wetlands and streams.

Wetlands

LFP defines wetlands in LFPMC 16.16.040 as follows:

Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Methodology and Findings

As part of the State Environmental Policy Act (SEPA) process, David Evans and Associates, Inc. (DEA) biologists conducted a desktop analysis and a wetland reconnaissance and formal delineation in 2019 and 2020, documented in the Ecosystems Technical Report (DEA 2021). Wetlands were rated based on the Washington State Department of Ecology's (Ecology) 2014 wetland rating system (Hruby 2014).

In the LFP jurisdiction, four Category III wetlands within 300 feet of the project's corridor or project elements were identified, formally delineated and rated. Buffers were mapped around the wetland boundaries based on their Ecology ratings and LFPMC 16.16.320. These wetlands

are Category III under the Ecology 2014 rating system; LFP regulates 105-foot standard buffers around Category III wetlands.

Wetlands Impact Avoidance and Minimization

No impacts to wetlands or wetland buffers are proposed as a result of geotechnical borings for the project.

Streams

LFP defines streams in LFPMC 16.16. 040 as follows:

An area where open surface water produces a defined channel or bed, not including irrigation ditches, canals, storm or surface water runoff devices, or other entirely artificial watercourses, unless they are used by salmonids or are used to convey a watercourse naturally occurring prior to construction. A channel or bed need not contain water year-round, provided there is evidence of at least intermittent flow during years of normal rainfall.

Methodology and Findings

As part of the SEPA process, DEA biologists conducted a desktop analysis and a stream reconnaissance in 2019 and 2020 (DEA 2021). During the reconnaissance, information was collected about the condition of instream and riparian habitats and the ordinary high water mark of stream reaches that occurred within the study area were identified.

Proposed borings **BH-32**, **BH-33**, and **BH-34** are located within the stream buffer of Bsche'tla Creek, which drains from an area of seeps west of SR 522 and adjacent to the Acacia Memorial Park and Funeral Home (see Map 2). The stream is classified as Type F (fish-bearing) (DEA 2021). F-type streams have a 115-foot standard buffer in Lake Forest Park (LFPMC 16.16.355).

The SR 522 roadway prism is substantial and approximately 75 feet in height. The roadway prism contains native trees and shrubs; however, the ground cover includes more than 50 percent cover of English ivy (*Hedera helix*). Bsche'tla Creek's channel width averages 6 feet wide downstream of SR 522. The slope is 1 to 5 percent, the channel depth is 6 to 12 inches, and the substrate includes cobble and gravels with much wood and debris (DEA 2021). Flow was observed during DEA's reconnaissance site visit, and the stream is assumed to have perennial flow. The buffers are steep slopes to the north and south with the steep roadway prism extending to SR 522. The forest includes bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), and western red cedar (*Thuja plicata*) (DEA 2021).

Stream Impact Avoidance and Minimization

No long-term impacts to Bsche'tla Creek are anticipated due to borings **BH-32**, **BH-33**, and **BH-34**. The stream buffer will be temporarily impacted by limited vegetation removal as part of the work activities. Avoidance is not possible because the boreholes are required to evaluate the slope stability, and the slope is located within the buffer of Bsche'tla Creek. Boring **BH-32** is proposed on a gently sloped bench directly outside of the ROW and will not require significant vegetation removal. Borings **BH-33** and **BH-34** are located on steep sloped areas within the ravine. Personnel access and drill rig mobilization to the work zones for **BH-33** and **BH-34** will be along existing pathways, which may require obstructing vegetation be cleared of limited

surficial brush and small tree limbs. For a detailed description of the equipment mobilization down the ravine slope to the work zones, see PAPs 9 and 10. Impacts to vegetation in the stream buffer will be minimized as follows:

- Drill rigs will be lowered to the work zones from SR 522 using a crane and boom.
- Vegetation management will be accomplished using light equipment.
- Limited vegetation removal for paths and the work zones will cut the herbaceous and shrub layers at or above ground level.
- No trees will be removed, but some limbs will be trimmed.
- Ground disturbance will be minimized and will be reseeded with native upland species.

Consistency with Applicable Stream Buffer Code Requirements

LFPMC 16.16.360 states that alterations to streams and buffers may be allowed only as follows (the applicable standards for development are described below in italics followed by underlined text that describes how the Project would meet these standards):

A. *In accordance with a critical area study.*

This critical areas technical memorandum and supporting documentation meet this requirement.

3. Introduction of nonnative plant material or wildlife into any stream or buffer is prohibited unless authorized by a city-approved nonnative plant list or a state or federal permit or approval.

The PAP serves as a vegetation management plan and indicates best management practices. No non-native plant material or wildlife will be introduced into the stream buffer as part of the proposed project.

D. *LFPMC 16.16.330(B) applies to streams and buffers.*

LFPMC 16.16.330(B) states “Alterations to wetlands and their buffers may only be allowed for the following activities, in addition to any established in LFPMC 16.16.220 and 16.16.230, if the city determines that there is no practical alternative location for the proposed activity with less adverse impacts on the wetlands or its buffer, subject to mitigation requirements set forth in this chapter:”

No practical alternative locations exist for the proposed geotechnical activities with less adverse impacts to the stream buffer. The work activities are proposed to assess the slope conditions and ultimately inform project design.

Critical Aquifer Recharge Areas

LFP regulates designated critical aquifer recharge areas, which are defined as those areas within the 10-year, time-of-travel zones for Group A public water supply wells. These areas are identified in LFP's critical aquifer recharge area map (LFPMC 16.16.050). These areas are also visible in King County's iMap GIS database (n.d.) on LFP water district data. None of the boreholes proposed in critical aquifer recharge areas are located within known areas of contamination and therefore will not adversely affect recharging of the aquifer or cause contaminants to enter the aquifer, consistent with LFPMC 16.16.420.

Frequently Flooded Areas

LFP regulates flood hazard areas under LFPMC 16.20. Based on King County's iMap database (n.d.), a regulated floodplain is present along McAleer Creek and Lyons Creek in the project corridor. None of the proposed boreholes are located within these mapped floodplains.

Fish and Wildlife Conservation Areas

LFP defines fish and wildlife habitat conservation areas in LFPMC 16.16.040 as follows:

An area that is managed for maintaining populations of species in suitable habitats within their natural geographic distribution so that the habitat available is sufficient to support viable populations over the long term and isolated subpopulations are not created, as defined in WAC 365-190-130 and RCW 36.70A.030. Fish and wildlife habitat conservation areas also include nonaquatic areas that serve a critical role in sustaining needed habitats and species for the functional integrity of the ecosystem, and which, if altered, may reduce the likelihood that the species will persist over the long term. These areas may include, but are not limited to, rare or vulnerable ecological systems, communities, and habitat or habitat elements including seasonal ranges, breeding habitat, winter range, and movement corridors; and areas with high relative population density or species richness.

Methodology and Findings

The Ecosystems Technical Report (DEA 2021) prepared for the SEPA effort included analysis of fish and wildlife habitat. The report identified that most of the project corridor in Lake Forest Park is developed. There are forested patches in specific areas, such as the buffers of Bsche'tla Creek, McAleer Creek, and Lyon Creek. Forested area is also present along 41st Avenue NE along the Burke-Gilman Trail. Fish habitat is also present in these creeks.

Borings **BH-32** and **BH-33** are located in forested buffer along Bsche'tla Creek, as described in the stream discussion above. No borings will be conducted within the stream itself.

Fish and Wildlife Conservation Areas Impact Avoidance and Minimization

The streams section above provides the details for **BH-32** and **BH-33** avoidance and minimization measures to limit impacts to the vegetation in the Bsche'tla Creek buffer, such as the temporary impacts to the shrub and herbaceous layer and limited removal of tree limbs. Using these minimization measures, the boreholes are not expected to degrade the functions that this forested stream buffer provides to wildlife and will have no permanent impacts. Thus, the project will meet the general requirements for fish and habitat conservation areas listed in LFPMC 16.16.380.B.

Geologic Hazard Areas

LFP defines erosion hazard areas in LFPMC 16.16.040.G as follows:

An area with soil characteristics that, according to the USDA Soil Conservation Service Soil Classification System, may experience severe to very severe erosion hazard, including slopes greater than 15 percent with erodible soils that are exposed. Any activity which exposes erodible soils to rainfall or running water

will create erosion hazard conditions on slopes greater than 15 percent. Soils which are particularly susceptible to erosion include fill constructed of virtually all soil types, loose sandy native soils such as Vashon recessional outwash (Qvr), Esperance sand (Qe), Vashon till (weathered Qvt), and the dense fine-grained clay (Qcl). Improper fill methods, especially near flowing water, can produce an erosion hazard in areas not identified as hazard areas.

LFP defines **steep slope hazard areas** in LFPMC 16.16.040.W as follows:

Slopes that are not composed of consolidated rock with slope gradients of 40 percent or greater within a vertical elevation change of at least 10 feet.

LFP defines **landslide hazard areas** as in LFPMC 16.16.040.J as follows:

Slopes that are potentially subject to landslides. All landslide hazard areas are classified as: "Class I": a slope that is less than 15 percent and is considered relatively stable; "Class II": a slope that is greater than 15 percent and is underlain by permeable soils that are relatively stable in their natural state but may become unstable if slope configurations or draining conditions are modified; "Class III": a slope that is greater than 15 percent and is underlain by impermeable soils, and may be characterized by springs or seeping groundwater during the wet season.

"Landslide hazard areas" include Class II and Class III if any of the following are present: a. Any area that has shown movement during the Holocene epoch (from 10,000 years ago to present) or which is underlain by significant waste debris of that epoch; or b. An area potentially unstable as a result of rapid stream incision, stream bank erosion or undercutting; or c. Any area located on an alluvial fan or delta potentially subject to inundation by debris flows; or d. Any area with a slope of 40 percent or greater and with a vertical relief of 10 or more feet except any area composed of consolidated rock.

LFP regulates the following buffer areas around geological hazard areas:

- **Erosion hazard areas** do not have a specified standard buffer (LFPMC 16.16.280).
- **Steep slope hazard areas** are to have a minimum buffer established at a horizontal distance of 50 feet from the top, toe, and sides of any slope 40 percent or greater. The buffer may be reduced to a minimum of 25 feet "when a qualified professional demonstrates to the planning director's satisfaction that the reduction will adequately protect the proposed development, adjacent developments, uses and the steep slope hazard area" (LFPMC 16.16.310).
- **Landslide hazard areas** are to have a minimum buffer of 50 feet from all edges of the area. These can be reduced to a minimum of 25 feet "when a qualified professional demonstrates to the planning director's satisfaction that the reduction will adequately protect the proposed development, adjacent developments, and uses and the landslide hazard area" (LFPMC 16.16.290).

Methodology and Findings

Jacobs reviewed the following sources to determine the presence of geologically hazardous areas within the Lake Forest Park project area:

- LFP GIS data (n.d.)
- Ecosystems Technical Report (DEA 2021)
- U.S. Department of Agriculture, Natural Resources Conservation Service soils data (n.d.)

Thirteen proposed borehole drilling locations and 1 pavement core location along the project route within Lake Forest Park meet the definition of geologic hazard areas and are summarized in **Table 1**.

Table 1. Proposed Drilling Locations in Geologic Hazard Areas

Borehole No.	Geologic Hazard Area
BH-78, BH-91	Erosion Hazard Area
BH-38, BH-44, BH-68	Steep Slope Hazard Area
C-13, BH-28, BH-29, BH-30, BH-31, BH-32, BH-33, BH-34, BH-35	Landslide Hazard Area

Geologic Hazard Areas Avoidance and Minimization of Impacts

The erosion hazard areas, landslide hazard areas, and steep slope hazard areas will be temporarily altered by limited vegetation removal and drilling of a 4- to 8-inch-wide borehole up to 50 to 90 feet deep.

- **Erosion Hazard Areas:** Work proposed at **BH-78** and **BH-91** will have temporary impacts to vegetation but will not have temporary or permanent impacts to slope stability.
- **Steep Slope Hazard Areas:** Work proposed at **BH-38**, **BH-44**, and **BH-68** will have temporary impacts to vegetation but will not have temporary or permanent impacts to slope stability. Tree impacts will be limited to minor branch trimming, and ground cover will be trimmed to the surface as needed with no grubbing. **BH-68** has been included in this analysis out of an abundance of caution. Its location was not identified as a steep slope hazard according to LFP data; however, based on site reconnaissance a retaining wall appears to meet the steep slope definition.
- **Landslide Hazard Areas:** There will be no temporary or permanent impacts to landslide hazard areas as a result of **BH-30** and **BH-35** because they are located in a paved parking lot. Work proposed at **BH-32**, **BH-33**, and **BH-34** will have temporary impacts to vegetation but will not have temporary or permanent impacts to slope stability. Temporary impacts will include trimming of vegetation on work zone and access paths. Work proposed at **C-13**, **BH-28**, **BH-29**, and **BH-31** will not have temporary or permanent impacts to landslide hazard areas because the work is located in existing paved travel lanes or shoulders.

Geologic Hazard Areas Impact Avoidance and Minimization

Avoidance is not possible because the boreholes are required to evaluate the slope stability. Impacts to vegetation in the geologic hazard areas will be minimized as follows:

- A licensed engineering geologist will observe the operation.
- Drill rigs will be lowered into place from SR 522 using a crane and boom.
- Clearing activity will be accomplished using light equipment.
- Slope stability will be maintained by limiting vegetation removal and ground disturbance and limiting alteration of the slope to the minimum necessary for the borehole.
- No trees will be removed, and temporary slope alteration will be limited to the small area of the borehole itself.
- Any disturbed areas will be reseeded with native upland species.

Consistency with Applicable Geologic Hazard Areas Code Requirements

The applicable standards for development are described below in italics, followed by underlined text, describing how the Project would meet these standards.

Erosion Hazard Areas: LFPMC 16.16.280 outlines specific standards related to the alteration of erosion hazard areas.

A. Clearing is allowed between April 1st and September 30th.

Clearing work for the geotechnical borings will occur within this required time frame.

B. Development proposals shall include a temporary erosion control plan approved by the planning director.

Temporary erosion control measures will be implemented in accordance with the 2020 Stormwater Management Program for LFP.

I. Erosion control measures including but not limited to hydroseeding shall be required.

Use of limited temporary erosion control measures, such as straw waddles and silt fences, will be employed if sediment migration is anticipated due to proposed work. Any disturbed area will be reseeded with native upland species.

J. All development proposals shall include an erosion control plan consistent with this chapter and other adopted requirements prior to plan approval.

Plans for temporary erosion control are included in the PAPs.

L. The use of pesticides, herbicides, fertilizers and hazardous substances in erosion hazard areas shall be prohibited unless demonstrated to the satisfaction of the planning director that special circumstances require their use. (Ord. 1150 § 1, 2017; Ord. 930 § 2, 2005)

Pesticides, herbicides, and fertilizers will not be used as part of the proposed work. Soil cuttings, drilling fluids, and other materials generated while drilling will be placed in drums and transported offsite for disposal. Although the spread of drilling fluids and cuttings beyond the work area are not anticipated, materials and equipment required for

containment will be kept on hand to minimize the spread of the drill fluids and cuttings, if a spill occurred.

Steep Slope Hazard Areas: LFPMC 16.16.310 outlines specific standards related to the alteration of steep slope hazard areas.

C. The following may be permitted:

- 1. Alteration of slopes that are 40 percent or steeper with a vertical elevation change of up to 20 feet; provided, that a soils report prepared by a qualified professional satisfies the planning director that no adverse impact will result from the exception;*

The slopes that are 40 percent or steeper do not exceed a vertical elevation change of up to 20 feet and will not have an adverse impact on soils.

D. When steep slope alterations are allowed by this section, the proposal shall:

- 1. Not decrease slope stability on the site or on adjoining properties; and*
- 2. Be subject to certification by a qualified professional that the landslide hazard area can be modified safely or that the development proposal eliminates or mitigates the landslide hazard risk to the property or adjacent property; and*
- 3. Not adversely impact other critical areas, such as streams; and*
- 4. Not result in an increase in peak surface water flows or sedimentation to adjacent properties. (Ord. 1150 § 1, 2017; Ord. 930 § 2, 2005)*

Attachment 1 contains a technical memorandum from a qualified geologist professional indicating the landslide hazard area can be safely modified and that any landslide hazard risk to property will be mitigated.

Landslide Hazard Areas: LFPMC 16.16.290(D)(2) outlines specific standards related to the alteration of landslide hazard areas.

Alteration of landslide hazard areas located on slopes of less than 40 percent are permitted only under the following conditions or circumstances:

- a. The development proposal will not decrease slope stability on the site or on adjoining properties;*
- b. A licensed geologist or geotechnical engineer certifies that the landslide hazard area can be safely modified or the development proposal designed so the landslide hazard risk to the property or adjacent property is eliminated or mitigated;*

Attachment 1 contains certification that the landslide hazard area can be safely modified and that any landslide hazard risk to property will be mitigated.

c. The alteration will not adversely impact other critical areas, such as streams; and

The proposed work activities will not decrease slope stability onsite and will not result in an increased risk of landslides in the stream buffer.

d. The alteration will not result in an increase in peak surface water flows or sedimentation to adjacent properties;

The proposed work activities will not increase peak surface water flows or sedimentation to adjacent properties.

CONCLUSION

There are 14 drilling or coring locations in critical areas in Lake Forest Park. These include 2 within an erosion hazard area, 3 within steep slope areas, and 9 within landslide hazard areas. Three of the locations in landslide hazard areas are also located within Type F stream buffer, which is considered a fish and wildlife conservation area. Only temporary impacts to allow geotechnical drilling are proposed. No permanent impacts to stream buffer or geologic hazard areas are anticipated. There is no tree removal or grubbing proposed in critical areas and associated buffers. Work will be completed to minimize work area disturbance and vegetation removal will use lightweight equipment. In conclusion, the proposed geotechnical investigations will not impact critical areas.

REFERENCES

David Evans and Associates, Inc. (DEA). 2021. *Bus Rapid Transit SR522 Corridor Ecosystem Resources Technical Report*. Prepared for Sound Transit. March 2021.

Hruby, T. 2014. Washington State Wetland Rating System for Western Washington – 2014 Update. Publication #14-06-029. Olympia, WA: Washington State Department of Ecology.

King County. n.d. iMap Application, LFP water district data. Website.
<https://kingcounty.gov/services/gis/Maps/imap.aspx>. Accessed March 2022.

U.S. Department of Agriculture, Natural Resources Conservation Service. n.d. Website.
<https://websoilsurvey.sc.egov.usda.gov>. Accessed March 2022.

ATTACHMENTS

Attachment 1. Qualified Professional Memorandum – Geologic Hazards

ATTACHMENT 1
QUALIFIED PROFESSIONAL MEMORANDUM -
GEOLOGIC HAZARDS

March 25, 2022
HWA Project No. 2021-133-21

Jacobs
1100 112th Ave NE, Suite 500
Bellevue, WA 98004

Attn: **City of Lake Forest Park Community Development**
Subject: **CRITICAL AREA PERMIT JUSTIFICATION MEMORANDUM**
CUD #6 (NE 145th/SR 522 Road Improvements) 60% Design
Task Order Number: 007

HWA GeoSciences (HWA) has reviewed the following proposed alterations to steep slopes and landslide hazard areas for geotechnical investigations. Twelve proposed exploration borings and one pavement core location along the project route within the City of Lake Forest Park meet the definition of geologic hazard areas and are summarized in **Table 1**.

Table 1. Proposed drilling locations in geologic hazard areas

Borehole #	Geologic Hazard Area
BH-78	Erosion Hazard Area
BH-38, BH-44, BH-68	Steep Slope Hazard Area
C-13, BH-28, BH-29, BH-30, BH-31, BH-32, BH-33, BH-34, BH-35	Landslide Hazard Area

Alterations to Geologic Hazard Areas

The erosion hazard, landslide hazard and steep slopes will be altered by limited vegetation removal and by drilling of 4 - 8 inch boreholes up to 50-90 feet in depth.

Erosion Hazard Areas : Work proposed at **BH-78** will have minor temporary impacts to vegetation but will not require removal substantial amounts of vegetation and are extremely unlikely to result in temporary or permanent impacts to slope stability. Native vegetation will remain mostly intact and best management practices will be implemented as appropriate. Additionally, the work will occur after April 1, when clearing and grading operation are allowed by the City of Lake Forest Park as stated in the Lake Forest Park Municipal Code. HWA will be onsite at the time to monitor the work as it progresses and confirm the stability of the work area and surrounding slopes.

Steep Slope Hazard Areas: Work proposed at **BH-38, BH-44, and BH-68** will have temporary impacts to vegetation but will not require removal of substantial amounts of vegetation and are extremely unlikely to result in temporary or permanent impacts to slope stability. Tree impacts will be limited to minor branch trimming and ground cover will be trimmed to the surface as

needed with no grubbing. Out of an abundance of caution, **BH-68** is included. It was not identified as a steep slope hazard according to LFP hazard maps but based on site reconnaissance a retaining wall appears to meet the steep slope definition. Typically, retaining walls do not classify as a steep slope hazard. Explorations in the steep slope hazard areas will require only temporary access to the exploration locations and HWA will be onsite to monitor the work as it progresses and confirm the stability of the work areas and surrounding slopes.

Landslide Hazard Areas: Temporary or permanent impacts to landslide hazard areas are extremely unlikely in the vicinity of **BH-30** and **BH-35** because they are in a paved parking lot. Likewise the impact to the landslide hazard areas in the vicinity of **C-13, BH-28, BH-29, BH-31** are extremely unlikely because they are located in existing paved travel lanes or shoulders. Work proposed at **BH-32, BH-33** and **BH-34** will have temporary impacts to vegetation but are extremely unlikely to have temporary or permanent impacts to slope stability as most vegetation will remain in place. Temporary impacts will include trimming of vegetation on work zones and access paths. Additionally, HWA will be onsite to monitor the work as it progresses and confirm the stability of the work areas and surrounding slopes.

Avoidance and Minimization of Impacts to Geologic Hazard Areas

- Avoidance is not possible because the boreholes are required in order to evaluate the stability of the slope. Impacts to vegetation in the geologic hazard areas will be minimized as follows:
 - A licensed engineering geologist or geotechnical engineer will observe the operation;
 - Drill rigs will be lowered into the ravine adjacent to Bschet'la Creek from SR 522 using a crane and boom truck;
 - Clearing activity will be accomplished using light equipment and will not substantially impact the root structures of local vegetation;
 - Slope stability will be maintained by limiting vegetation removal and ground disturbance and limiting alteration of the slope to the minimum necessary for the borehole;
 - No trees will be removed, and slope alteration will be limited to the very small area of the borehole itself; and,
 - Any disturbed areas will be re-seeded with native upland species.

Conclusion

The slope and landslide hazard alterations necessary for the proposed limited geotechnical investigations can be completed safely and are extremely unlikely to result in hazard risk to the property or adjacent property and slope stability on the site or adjacent properties. HWA will be onsite to monitor this operation and confirm compliance with Lake Forest Park Municipal Code subsections 16.16.290.D.2A and 16.16.310.D.2.

Sincerely,

HWA GEOSCIENCES INC.



Sean Schlitt, P.E.
Geotechnical Engineer



Michael Place, P.E.
Senior Geotechnical Engineer