3.1 Earth

This section describes soil and geologic conditions and addresses potential hazard areas on campus as well. A Geotechnical Report (Geoengineers, 2023) was completed for the project and is included as **Appendix A** to this Draft EIS.

3.1-1 Affected Environment

Topography

The site is located on a glacial upland surface characterized by gently inclined elongated low ridges separated by elongated swales that are oriented in a generally north-south direction. The ground surface slopes gently, resulting in slightly rolling topography in an east-west direction. The Seattle Central College (SCC) MIO boundary is located on one of the low ridges with the axis located roughly along to slightly west of Broadway Avenue East. The overall grade of the land surface within the existing and proposed MIO boundary slopes gently to the south along the axis of the ridge, with grades generally sloping easterly to southeasterly along the east side of Broadway Avenue East and sloping westerly to southwesterly. The western slope descends down toward the I-5 corridor and thus the ridge forms the western limits of the uplands in the Capitol Hill district of Seattle.

The ground surface within the existing and proposed SCC MIO boundaries ranges from a minimum approximate elevation of 290 feet along the southern-most border to an approximate elevation of 335 feet along the northern border.

Surface Conditions

Much of the ground surface is covered with impervious surfaces consisting of buildings, parking areas, sidewalks and other hardscapes. While most surfaces are relatively flat, there are exterior steps, stairwells, and ramped walking surfaces. Near the southern end of the existing MIO boundary north of East Pine Street and between Harvard Avenue and Broadway Avenue East and close to the Performing Arts Center building, there is a landscape area with low terraces formed by block walls. This area is vegetated with a predominantly grass understory with trees planted in rows with near even spacing between trees. The surface slopes down toward East Pine Street from the crest of a berm that is up to about 10 to 12 feet vertically above the road surface near the intersection of East Pine Street and Harvard Avenue. A wall rises to about 6 feet high in a westward direction along the base of the slope. The wall height decreases northward along Harvard Avenue, corresponding to an increase in elevation of the street in a northward direction.

There are many scattered areas of landscaping along the streets, around buildings and parking areas.

The western side of the existing MIO boundary has a more noticeable slope to the west, with structures along east-west oriented streets. This is also evident in the vicinity of the Boylston properties and the Westminster Presbyterian Church properties. The Church building has a lower floor that is below adjacent grade, based on an exterior view; a similar condition exists at The Lenawee Apartment building along Olive Street.

The natural surface drainage follows the ground surface but has been modified by grading, road construction, other development, and construction of stormwater drainage systems.

Regional Geology

The topography and associated near-surface soils are the result of several episodes of advance and retreat of continental glaciers over the last approximately 2 million years. The most recent glaciation occurred roughly 13,000 to 15,000 years ago and is referred to as the Vashon Stade of the Fraser glaciation. The general geology of the site and surrounding area is shown in **Figure 3.1-1**.

Soil Types

The soils mapped within the project vicinity consist of Vashon recessional outwash (Qvr), Vashon glacial till (Qgt), and Vashon subglacial meltout till (Qvtm). Not mapped at the surface in the project area, but encountered in deeper subsurface explorations, are Vashon glacial advance outwash deposits (Qva) and areas where significant areas of grading and/or filling has occurred. These areas are depicted as an overlay to the underlying, pre-disturbance geology. Areas of man-made fill are anticipated in areas that have been previously developed. The following is a description of each of the soils.

- Modified Land (ml) consists of large areas of excavating, filling, clearing and/or grading. Man-made fill may consist of native soils that have been excavated and then placed in a new location, or imported soil that has typically been placed to regrade and shape the land. It may also include demolition rubble from removal of previous structures and could include, concrete, asphalt, metal, lumber or other matter. Larger quantities and thicknesses of fill are anticipated where structures were formerly present and subsequently demolished. In particular, man-made fill is anticipated beneath surface parking areas and areas that are presently landscaped. A large area of modified land is mapped across Cal Anderson Park (formerly Lincoln Park), located to the east of the SCC Campus.

- Vashon recessional outwash (Qvr) is described as moderately to poorly-graded, stratified sand and gravel that typically has a low percentage of fines content. The material was deposited in outwash channels that typically flowed south during retreat of the glacial ice sheet. This soil type includes materials deposited in or adjacent to recessional lakes and typically ranges from about 1 to 6 meters (3 to 20 feet) thick. These deposits may occur as lag deposits on glacial till uplands and are not mapped if less than about 3 feet thick. Glacial recessional outwash is mapped immediately east of the eastern part of the SCC campus within a former outwash channel. The outwash channel has been subsequently modified by grading and filling in the area now occupied by Cal Anderson Park and a City of Seattle water reservoir.

- Vashon glacial till consists of dense to very dense, poorly sorted, silty sand and subrounded to rounded gravel. The glacial till deposits were transported and deposited under the glacial ice and subsequently compacted by the weight of the overriding glacier. The till may include occasional cobbles and small to large boulders. Occasionally, there are lenses of relatively clean sand within the glacial till. Fractures can also be found in the glacial till, which is mapped across most of the SCC area (see **Figure 3.1-1**).

Figure 3.1-1

- Vashon subglacial meltout till (Qvtm) consists of dense sand and gravel in a silt matrix found with sand and/or gravel deposits which may be tabular in shape. Cobbles are described as common within this soil type. The coarser grained deposits may comprise 50 percent of the deposit. The deposits range from about 3 to over 30 feet in thickness. This soil may be gradational with glacial till and advance outwash.

- The Vashon advance outwash (Qva) is typically composed of dense to very dense, stratified sand with occasional gravel. Meltwater streams flowing from the advancing glacier deposited the advance outwash, which was then overridden by the advancing glacier. The advance outwash includes occasional interbeds of silt and has variable gravel content. Advance outwash is encountered in deeper subsurface explorations and crops out to the west.

Previously completed geotechnical studies prepared for SCC and subsurface exploration information from the Washington State Department of Natural Resources (WDNR) Geologic Data Portal Subsurface data (2022) were reviewed as well (see **Appendix A** for more detailed information). Additionally, information obtained from the WDNR Geologic Information Portal (2022) was also reviewed, which generally consisted of site plans with subsurface exploration locations and the exploratory logs from referenced reports or document sets. Relevant logs and site plans from these studies are included in **Appendix A** to this Draft EIS.

Based on review of these data, the soil conditions within the existing and proposed MIO boundary are anticipated to be similar. The soils encountered consist of dense glacial till at depths that vary from a few feet to depths of up to 17.5 feet. Cobble and small boulders were encountered in the glacial till. More permeable sandy layers were encountered in the glacial till at depths to at least 25 feet below the ground surface at the time of the explorations. Soil overlying the dense glacial till consists of material identified as weathered till, loose silty sand to medium stiff to stiff sandy silt. Fill was also encountered to a maximum depth of about 17.5 feet below existing ground surface. Fill material consisted of silty sand, gravel, cobbles, small boulders, concrete rubble, and some areas contain glass shards, wood fragments and occasional pockets of organic matter.

Groundwater

Both shallow and deep groundwater could be encountered during site development or redevelopment within the existing and proposed MIO boundary.

Based on a review of available reports, from publicly available data, and information from experience on previous projects, groundwater is typically encountered as perched water within weathered till or fill soils overlying dense to very dense less permeable glacial till, layers of sand and/or gravel within glacial till, or in more permeable deposits within subglacial meltout deposits (e.g., sand or gravel layers). It is anticipated that perched or shallow layers of groundwater will be present in response to extended periods of precipitation. Localized groundwater zones may also exist in more permeable layers within the glacial till soils. Therefore, excavations in the area mapped as Vashon subglacial meltout deposits may be more susceptible to encountering shallow groundwater. Loose/soft to medium stiff soils with oxidation were encountered in several explorations, which indicates shallow seepage is possible at depths up to about 10 feet below the ground surface. Deeper explorations with or without piezometers installed to depths of 32 feet intercepted seepage from sandy zones. However, nearby piezometers, drilled at the same time for the same project, were dry. This infers that some of the deeper layers with seepage may be limited in extent.

The very dense glacial till is relatively impermeable and water that infiltrates through the ground surface typically flows down gradient over the dense till surface. This means that shallow subsurface flows will generally follow the ground surface. In general, subsurface flows will be to the east of Broadway Avenue East and to the west of Broadway Avenue East. There is also an overall gradient to the south within the existing and proposed MIO boundary. Subsurface utilities will also intercept subsurface flows and form conduits for subsurface flows that follow the gradient of the utility trench. Subsurface flows may also be intercepted or redirected as the result of streets, buildings and walls. Fractures are known to exist with Vashon glacial till, therefore, some vertical infiltration through glacial till soil is anticipated.

There is also the potential for encountering deeper, confined groundwater with Vashon Glacial advance outwash if excavations penetrate the glacial till. For example, a boring was completed to a depth of 61 feet as part of the geotechnical study for the Math and Science building in 2004 to aid in design and construction of an elevator shaft. In this boring, groundwater was encountered in the Vashon advance outwash at a depth of about 45 feet below the ground surface. The groundwater rose to within 10 feet of the ground surface within 15 minutes, reaching an elevation of approximately 308 feet.

<u>Geologic Hazard Areas</u>

City of Seattle Environmentally Critical Areas

The following are the types of geologic hazard areas designated in Seattle City Code Chapter 25.09, ECAs. The geologic hazard areas include liquefaction-prone areas, landslide-prone areas, peat settlement-prone areas, seismic hazards areas, and volcanic hazard areas. In addition, the City includes steep slope erosion hazard areas, flood-prone areas, wetlands, fish and wildlife habitat conservation areas, and abandoned landfills.

Landslide Hazard Areas

There are no mapped landslide hazards within the existing or proposed boundaries of the SCC Master Planning Areas. The site is located on terrain that is gently inclined.

Steep Slope Erosion Hazard Areas

Since there are no areas meeting the definition of a steep slope per subsection 25.09.012.A.3.b.5, there are no Steep Slope Erosion hazard areas within the existing or proposed SCC Master Planning Areas.

Seismic Hazard Areas

<u>Liquefaction</u>. Liquefaction is a phenomenon where strong vibration or ground shaking, usually from earthquakes, results in development of excess pore pressures in loose, saturated soils and subsequent loss of strength in the soil deposits so affected. Ground settlement, lateral spreading and/or sand boils may result from soil liquefaction. Structures supported on liquefied soils could suffer foundation settlement or lateral movement that could be severely

damaging to the structures. Conditions favorable for liquefaction occur in loose to medium dense, clean to moderately silty sand that is below the groundwater level.

The near-surface soils indicates that the area within the existing and proposed SCC MIO boundaries are underlain by granular soils that are typically medium dense to very dense, and the regional groundwater table is very deep. Therefore, potentially liquefiable soils are not present below the site.

Lateral Spreading. Lateral spreading is associated with liquefaction and involves lateral displacements of large volumes of liquefied soil. It can occur on near-level ground as "blocks" of surface soils displaced relative to adjacent "blocks" and generally requires a free face that allows the movement of the earth. There is no risk of lateral spreading at the site because potentially liquefiable soils are not present.

Strong Ground Motion. The area is subject to strong ground-shaking either from local shallow crustal earthquakes, Cascadia subduction zone earthquakes, or intra-slab earthquakes that may be relatively shallow to deep.

Surface Rupture. The SCC campus within the existing and proposed MIO boundary is located close to the Seattle fault zone, which represents an area with a significant potential for surface rupture. The Seattle fault zone is a 2- to 4-mile-wide, east-west trending zone consisting of at least three fault splays and is located about 1.3 miles south of the site. The dominant faulting within the Seattle fault zone consists of a south-dipping reverse fault, which is believed to have last ruptured about 1,100 years ago. This most recent event caused broad uplift and subsidence across the fault. The rate of occurrence of large earthquakes within the Seattle fault zone is thought to be on the order of thousands of years. The most recent fault event is believed to have been a magnitude 7 or greater. Based on review of available data, the potential for surface rupture is low.

Tsunamis. The site is away from the marine shoreline and well above any potential inundation from a tsunami.

Seiches. The site is away from the shoreline and well above any potential inundation from a seiche.

Volcanic Hazard Areas. The site is outside of and well above the mapped limits of volcanic mudflow. Ash fall can be expected, but the probability is approximately 0.02 percent on an annual basis for ash thickness greater than about 0.4 inches. The City of Seattle's draft 2022 All-Hazards Mitigation Plan (2022) does not have any guidance regarding ash fall.

Abandoned Landfill Areas.

1. Abandoned Landfills are considered as ECAs under Seattle City Code 25.09.012.E which states:
   "Abandoned landfills include those abandoned solid waste landfills identified by the Seattle-King County Health Department in its 1986 Abandoned Landfill Toxicity/Hazard Assessment Project, additional sites identified by public or historical research, and areas within 1,000 feet of methane-producing landfills."

2. The 1986 inventory is maintained and updated by the City of Seattle as a digital database, which was last updated December 23, 2022. The nearest landfill is about 1.5 miles to the northeast, which does not have a buffer for methane.

No further assessment or consideration is required.

3.1-2 Impacts of the Action Alternatives

Under the ***Draft MIMP***, five boundary adjustments are proposed (two boundary reductions and three boundary expansions) and height increases are proposed in areas within the expanded MIO boundary (see **Figure 2-5**). These boundary adjustments, as well as the public ROW within these areas, would add approximately 1.5 acres to SCC's existing MIO boundary for a total MIO boundary area of 11.5 acres. Under the ***No Boundary Expansion Alternative***, no boundary expansions would occur. This alternative would include the four planned projects that are part of the ***Draft MIMP***, with certain modifications. No potential development would occur because there would be no boundary expansions where this development is proposed under the ***Draft MIMP***. (See **Figure 2-9**.)

Soils

- Earthwork activities can impact adjacent structures and properties if not properly accounted for during design. Both fill and native glacial soils anticipated in areas of redevelopment contain a high percentage of fines and are highly moisture sensitive and susceptible to disturbance, especially when wet. Earthwork performed during the wet season can generate significant mud and turbid water.

- The erosion potential of on-site soils within the site boundary is generally low. Construction activities including stripping and grading will expose soils to the erosional effects of wind and water. The amount and potential impacts of erosion are partly related to the time of year that construction actually occurs. Wet weather construction will increase the amount and extent of erosion and potential sedimentation.

- Excavations can impact adjacent structures, roads, sidewalks, and utilities if not properly designed. The use of inadequately designed open cuts could also impact the stability of adjacent work areas and existing utilities and endanger construction workers. Therefore, excavations may require temporary shoring depending on site constraints, possible underpinning of adjacent buildings, and/or use of temporary open cut slopes.

- Permanent slopes must be designed and constructed to remain stable for the long-term and under wet weather. Improperly designed and/or constructed slopes can fail prematurely or erode during wet weather.

Groundwater

- Shallow, perched groundwater zones may be encountered during grading activities within native soils or fill soils, particularly during the wet winter and spring months. Excavations penetrating into the Vashon advance outwash may encounter artesian groundwater conditions with respect to the excavation. Permanent drainage measures will be needed to protect planned development.

Seismic Hazards

- The primary geological hazard as defined by the City of Seattle's ECA is for strong ground motions. Strong ground motions can affect structures and their foundations if not designed and constructed in accordance with applicable code. Taller structures perform differently than shorter buildings. The type of construction can also influence the type of impacts. For instance, brick or masonry buildings generally perform poorly in an earthquake. Taller buildings constructed with steel will tend to sway from the seismic waves and are designed and constructed accordingly.

- Permanent slopes must be designed and constructed to remain stable for the long-term and under possible seismic events. Improperly designed and/or constructed slopes can fail prematurely.

3.1-3 Impacts of the No Action Alternative

Under the ***No Action Alternative***, no new planned or potential building development would occur other than renovation consistent with the current MIMP. The campus boundary would not be expanded.

In total, renovation activities associated with the ***No Action Alternative*** would not require substantial excavation activities on campus, and none of these activities would occur within a steep slope ECA/steep slope buffer and/or a potential landslide area ECA. Therefore, minimal earth-related impacts are anticipated under this alternative.

3.1-4 Mitigation Measures

Project-specific geotechnical studies will be required for each future project within the SCC MIO area.

Soils

- Earthwork impacts will be reduced if construction is performed during the dry season and will be mitigated by following the City of Seattle Department of Construction and Inspections (SDCI) requirements.

- It is anticipated that buildings can be supported on conventional spread footings bearing on undisturbed dense to very dense glacial soils.

- Structural fill placed to construct pavement areas, placed below foundations and slabs, to backfill retaining walls and utility trenches, and placed against foundations should consist of imported Gravel Borrow (City of Seattle Type 17) and should be mechanically compacted to a firm condition.

- Effective erosion and sedimentation control must be implemented during construction so that potential impacts to adjacent areas are reduced. Effective methods of erosion control at construction sites include efficient surface water management, minimization of the size of disturbed areas, and erosion resistant slope covers. Erosion and sedimentation control measures should include proper channeling of surface water runoff into lined diversion ditches that incorporate energy dissipaters, and use of straw bales, geotextile silt fences, and straw mulch, as appropriate for temporary protection of exposed soils. Disturbed areas should be finish graded, protected, and vegetated as soon as practicable to reduce the risk of erosion. Erosion and sedimentation control measures should be installed and maintained in accordance with the requirements of the City of Seattle.

- Stormwater entering excavation can likely be handled by digging interceptor trenches in the excavations and pumping from sumps. The seepage water if not intercepted and removed from the excavations will make it difficult to place and compact structural fill and may destabilize cut slopes.

- For permanent drainage control, all paved and landscaped areas should be graded so that surface drainage is directed away from buildings to appropriate catch basins. Water collected in roof downspout lines must not be routed to the footing drain lines. Collected downspout water should be routed to appropriate discharge points in separate pipe systems.

- If excavations are completed close to existing infrastructure, underpinning of adjacent buildings and temporary shoring will likely be required depending on the depth of the planned excavation.

- Perimeter footing drains should be installed around new buildings.

- On-grade floor slabs for buildings should be underlain by at least 4 inches of clean crushed rock for uniform support and as a capillary break.

- Permanent cut or fill slopes should be constructed at inclinations of 2H:1V or flatter. Permanent slopes constructed at 3H:1V or flatter provide better conditions for future maintenance. Structural fill placed to construct permanent fill slopes should be compacted.

- To reduce erosion, newly constructed permanent slopes should be planted or hydroseeded shortly after completion of grading. Until dense vegetation is established, some sloughing and raveling of the slopes should be expected. This may require localized repairs and reseeding. Temporary covering, such as clear heavy plastic sheeting, jute fabric, or erosion control blankets could be used to protect the slopes during periods of rainfall.

Groundwater

- Shallow, perched groundwater zones and artesian groundwater conditions may be encountered during grading activities within native soils or fill soils, particularly during the wet winter and spring months. If groundwater seepage is encountered during shallow excavations, excavating interceptor trenches and pumping from sumps would be used.

Seismic

- The City of Seattle has adopted the applicable 2018 International Building Codes for new and existing structures under Chapter 22 of the City Code. Chapter 22 or superseding codes will be updated over the period that this Master Plan is considered valid. Therefore, seismic hazards for new or remodeled structures and facilities will be mitigated by following the applicable codes that are valid at the time of design and construction.

3.1-5 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse earth-related impacts have been identified and none are anticipated.