Jones & Stokes

Technical Memorandum

Date: June 28, 2007

To: Kristen Overleese, PE, City of Shoreline

From: Heidi Tate

cc: Jennifer Barnes

Subject: Geology and Soils Analysis, Aurora Corridor Improvement Project: N 165th Street – N 205th Street

Introduction

What is the purpose of this memorandum?

The City of Shoreline (City) proposes to construct the Aurora Corridor Improvement Project, N 165th Street to N 205th Street (Project), which will improve a 2-mile-long segment of State Route (SR) 99, named Aurora Avenue North (N) within the City. This project must be developed in compliance with the National Environmental Policy Act (NEPA) and the Washington State Environmental Policy Act (SEPA).

This technical memorandum was prepared in general accordance with Section 420 of the Washington State Department of Transportation (WSDOT) Environmental Procedures Manual (WSDOT 2006). It describes the geology and soils within the study area. The existing geology and soil types are described and geologic hazard areas are identified. Potential effects of geology and soils on the Project and of the Project on geology and soils are also discussed.

Where is the Project located?

The project is located within the city limits of the City of Shoreline on Aurora Avenue N between N 165th Street and N 205th Street (See Figure 1, *Project Vicinity*).

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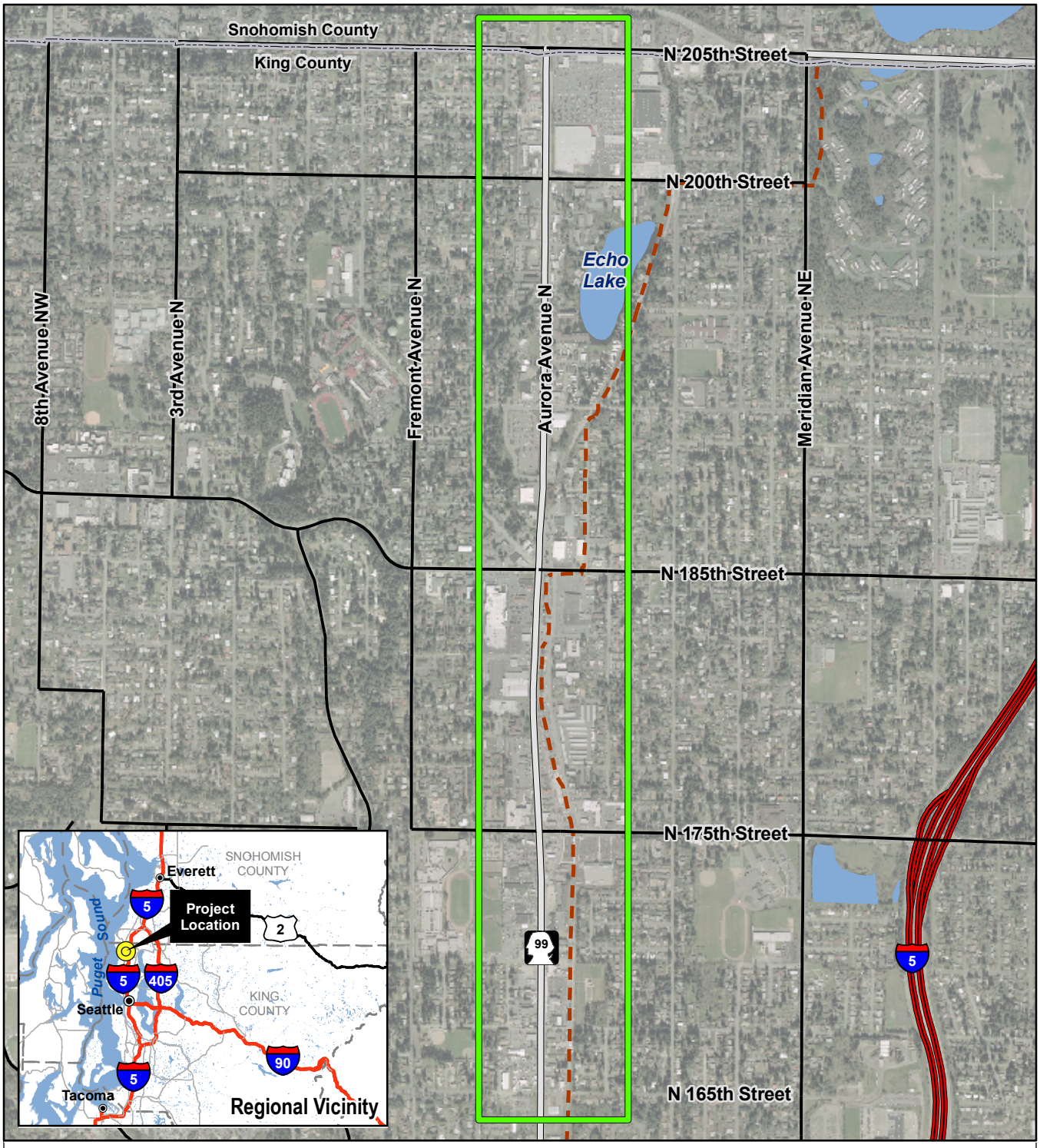

Sources: City of Shoreline (2006); Jones & Stokes (2007)

City Boundary
Project Area
Interstate
State Route
Arterial
Interurban Trail

N

Feet

0 1,000 2,000

Figure 1. Project Vicinity
Aurora Corridor Improvement Project
June 2007

What are the existing characteristics of the Aurora Avenue corridor?

Aurora Avenue N is a major north/south urban highway that serves both local and regional traffic within the City of Shoreline (see Figure 1, *Project Vicinity*). It is a key regional vehicular, transit, and truck corridor within the greater area of Puget Sound and serves as the City's primary arterial roadway, running approximately parallel to Interstate (I)-5 with connections at N 145th Street, N 175th Street, and N 205th Street. Development along the corridor is predominantly commercial, mixed with some multi-family housing. Echo Lake is located approximately 200 feet to the east of the roadway, north of N 192nd Street. The Interurban Trail, currently under construction, runs roughly parallel to Aurora Avenue N, to the east in the Project corridor. Aurora Avenue N has two general-purpose travel lanes in each direction, with a center two-way left-turn lane. Shoulder and sidewalk of varying widths are located sporadically along the corridor, with no curb or gutter, and little landscaping.

Under existing conditions, Average Daily Traffic (ADT) on the roadway is 33,000 to 39,000 vehicles per day. A steady level of pedestrian and bicycle travel occurs along and across the roadway, but the corridor is heavily oriented to vehicle travel and is generally not conducive to non-motorized travel. WSDOT has designated several areas of Aurora Avenue N between N 165th Street and 205th Street with poor safety ratings. The corridor is served heavily by public transit provided by King County Metro, with additional service at the north end of the corridor provided by Community Transit.

Why improve Aurora Avenue North?

The purpose of the Aurora Corridor Improvement Project, N 165th Street to N 205th Street, is to improve safety, circulation, and operations for vehicular and non-motorized users of the roadway corridor, to support multi-modal transportation within the corridor, and to support economic stability along the corridor.

Why consider geology and soils in planning this Project?

Geology and soils are evaluated in planning this Project because they are major factors in determining the types of foundations, pavement sections, subsurface drainage, and retaining walls required for the Project. Geology and soils refer to the physical materials that make up the ground. The characteristics of these physical materials determine the risk of landslides, liquefaction, erosion, and other types of soil behavior that can affect the environment. Geology and soils also influence groundwater retention and movement.

What are the key points of this memorandum?

- The topography along the southern portion of the Project is relatively flat and follows the top of a long ridgeline. Small areas of steep slopes are identified as landslide hazard areas.
- The area is characterized by glacial till, which consists of an unsorted, crudely stratified mix of very dense silt, sand, gravel, cobbles, and boulders deposited at the base of a glacier. Because the depositing glacier overrode the glacial till it is highly compacted and therefore is relatively impermeable to water.
- The northern portion of the Project runs parallel to the adjacent slope. There are several areas of steep slopes (per Shoreline Municipal Code 20.80.210) identified as landslide hazards near the roadway.
- The existing roadway alignment crosses an erosion hazard area. Soils in this area would be disturbed under all Build Alternatives.
- Alternative C would cross the erosion hazard area in an area with steep slopes (per Shoreline Municipal Code 20.80.210), which is considered a landslide hazard area.
- In areas where fill or native soils are permeable, groundwater may be perched above the underlying layer of relatively impermeable till.
- Soil and geology conditions are not unusual for the region. Risks would be minimized with best management practices (BMPs), and no significant impacts to geology or soils are expected.

Table 1 summarizes the potential geology and soils effects and mitigation measures, as identified in this technical memorandum.

Table 1. Potential Geology and Soil Effects and Mitigation

Potential Effects and Mitigation	Alternatives			
	No Build	A	B	C
Potential Operational Effects				
None				
Potential Construction Effects				
Degradation of the subgrade in areas of moisture sensitive soils from use of heavy equipment during wet weather or in areas of seepage or shallow groundwater.		X	X	X
Mitigation Measures: Limit major earthwork to drier late spring to early fall season. Maintain proper surface drainage. Minimize the area of ground disturbance. Limit the number of turns by heavy equipment on the subgrade.				

Potential Effects and Mitigation	Alternatives			
	No Build	A	B	C
Minimize the amount of tracking on the subgrade.				
Cover the final sub-grade elevation with a working mat of crushed rock and/or geotextile.				
Increased erosion due to exposure of erosion prone soils		X	X	X
Mitigation Measures: Implementation of a Temporary Erosion and Sedimentation Control (TESC) plan to control the movement of sediment. Measures in the TESC would include avoiding unnecessary vegetation clearing and installation of structures such as silt fences and sediment traps.				
Implementation of construction procedures identified in the geotechnical investigation that are designed to maintain or enhance slope stability.				
Increased erosion from unstable fill during a storm event.		X	X	X
Mitigation Measure: Implementation of a Temporary Erosion and Sedimentation Control (TESC) plan to control the movement of sediment. Measures in the TESC would include covering fill stockpiles and disturbed areas.				

Alternatives

What alternatives are considered?

This technical memorandum evaluates the potential effects of a No Build Alternative and three Build Alternatives, which are described in the following sections.

No Build Alternative

Under the No Build Alternative, Aurora Avenue N would remain exactly as it is today. The roadway has two general-purpose lanes in each direction with a center two-way left-turn lane. Shoulder and sidewalk of varying widths are located sporadically along the corridor with no curb or gutter and little landscaping. The corridor is served heavily by public transit provided by King County Metro, with additional service at the north end of the corridor provided by Community Transit. Buses on Aurora Avenue N would continue to travel and stop in the general-purpose lanes.

Build Alternatives

The City has proposed three Build Alternatives: Alternative A, Alternative B, and Alternative C. Table 2 provides an overview of Project features unique in an individual Build Alternative and features common among them.

Table 2. Common and Unique Features of the Aurora Corridor Improvement Project Build Alternatives

Features Common among Build Alternatives A, B, and C	
General-purposes lanes	Project design includes two general-purpose lanes in each direction.
BAT lane	Each Build Alternative would include one Business Access and Transit (BAT) lane in each direction.
Sidewalk	7-foot sidewalks would be constructed along both sides of the corridor.
Curb and Gutter	Curb and gutter would be constructed along both sides of the corridor. Curb ramps would be constructed at all intersections in accordance with ADA requirements.
Underground utilities	Utilities would be placed underground for each of the three Build Alternatives.
Vegetation	Each of the alternatives includes vegetative plantings. Extent and location vary as described below.
Center median	A center median would be added, with left-turn and u-turn pockets (width of the center median varies by alternative, as described below).
Traffic signals	New traffic signals proposed at Aurora Avenue N/N 182nd Street and Aurora Avenue N/Firlands Way N (north of N 195th Street). Signalized intersections will be widened to improve east-west capacity and traffic flow.
Road improvements	Improvements would be made to: ▪ Echo Lake Place (north of N 195th Street), including realignment and a connection to Aurora Avenue N at Firlands Way N; and ▪ Midvale Ave N (N 175th Street – N 183rd Street), including realignment, addition of a center turn lane, curb and gutter, and sidewalk on the east side of the roadway. The new Interurban Trail will serve as the walking path on the west side of the roadway.

Features that vary among Alternatives A, B, and C	Alternative A	Alternative B	Alternative C
Cross Section	Typically 98 feet from back-of-sidewalk to back-of-sidewalk. The cross section will be wider where utility vaults, light/signal poles, and bump outs are located, as described below. This dimension is 12 feet narrower than the cross sections proposed under Alternatives B and C, due to a narrower median (12 feet instead of 16 feet) and the absence of the 4-foot amenity zone on each side of the roadway. The City would also acquire a continuous 3-foot-wide easement behind the sidewalk on each side of the roadway for placement of utilities.	110 feet from back-of-sidewalk to back-of-sidewalk.	
Median Width	Center median would be 12 feet wide.	Center median would be 16 feet wide.	
Amenity Zone	No amenity zone provided. Utility vaults and light/signal poles would be located behind the sidewalks in the 3-foot easement area.	A 4-foot amenity zone would be located between the curb and sidewalk on each side of the street. Utility vaults, light/signal poles, bus stop signs, hydrants, and other pedestrian amenities would be located in this area.	
Bump Outs	Bump outs approximately 4 feet in additional width would be needed at u-turn and left-turn locations to achieve the turning radii needed to accommodate u-turns.	None needed. U-turns would be sufficiently accommodated within the standard roadway width.	
Placement of Alignment	Required widening would be shifted to the east of the existing right-of-way in the vicinity of N 175th Street, N 185th Street, and N 200th Street.	Required widening would be shifted to the east of the existing right-of-way in the vicinity of N 175th Street, N 185th Street, and N 200th Street.	Required widening would be shifted to the west of the existing right-of-way in the vicinity of N 175th Street, N 185th Street, and N 200th Street.
Vegetation	Limited vegetation would be provided in the median.	More vegetation accommodated by wider median. Vegetation could also be planted in areas within the amenity zone.	

Figures 2, 3, and 4 present plan views of the three build alternatives, respectively. Figure 5 presents more detailed schematic drawings of the proposed roadway configurations under each of the three alternatives. The drawing shows one direction of travel of the proposed roadway alternatives, which is typical of both directions.

When will the Recommended Alternative be selected?

The Recommended Alternative will be selected after all of the environmental analysis has been completed for the No Build Alternative and three Build Alternatives. The discipline reports and technical memoranda that summarize the environmental analysis will be available for public review after they are finalized.

The boundaries of the three Build Alternatives encompass the maximum possible footprint of the Project. The Recommended Alternative ultimately selected for the Project may combine different elements from the different Build Alternatives. However, no part of the Project will occur outside of the boundaries of the footprint under study analyzed in this report.

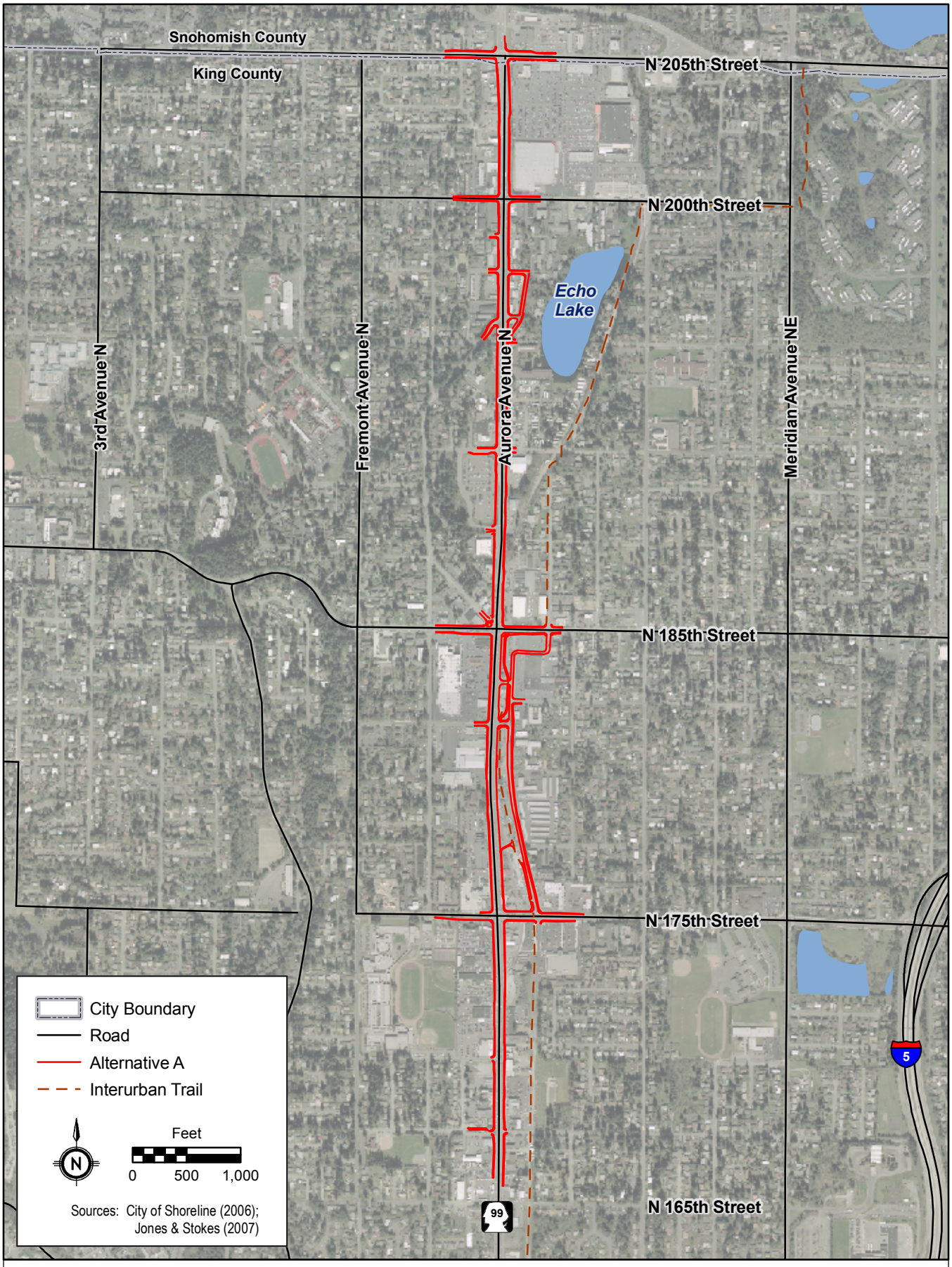

Figure 2. Alternative A
Aurora Corridor Improvement Project
June 2007

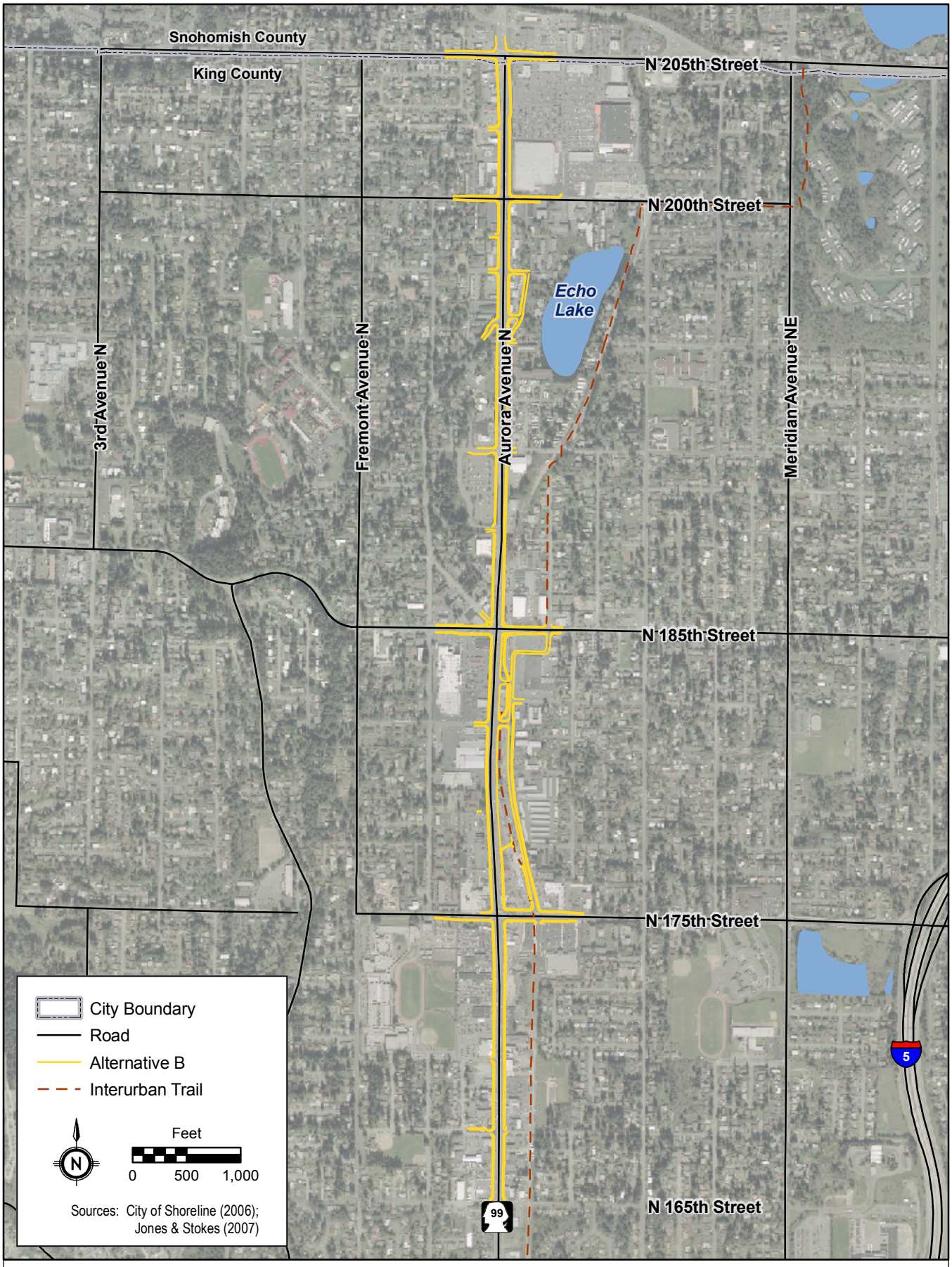

Figure 3. Alternative B
Aurora Corridor Improvement Project
June 2007

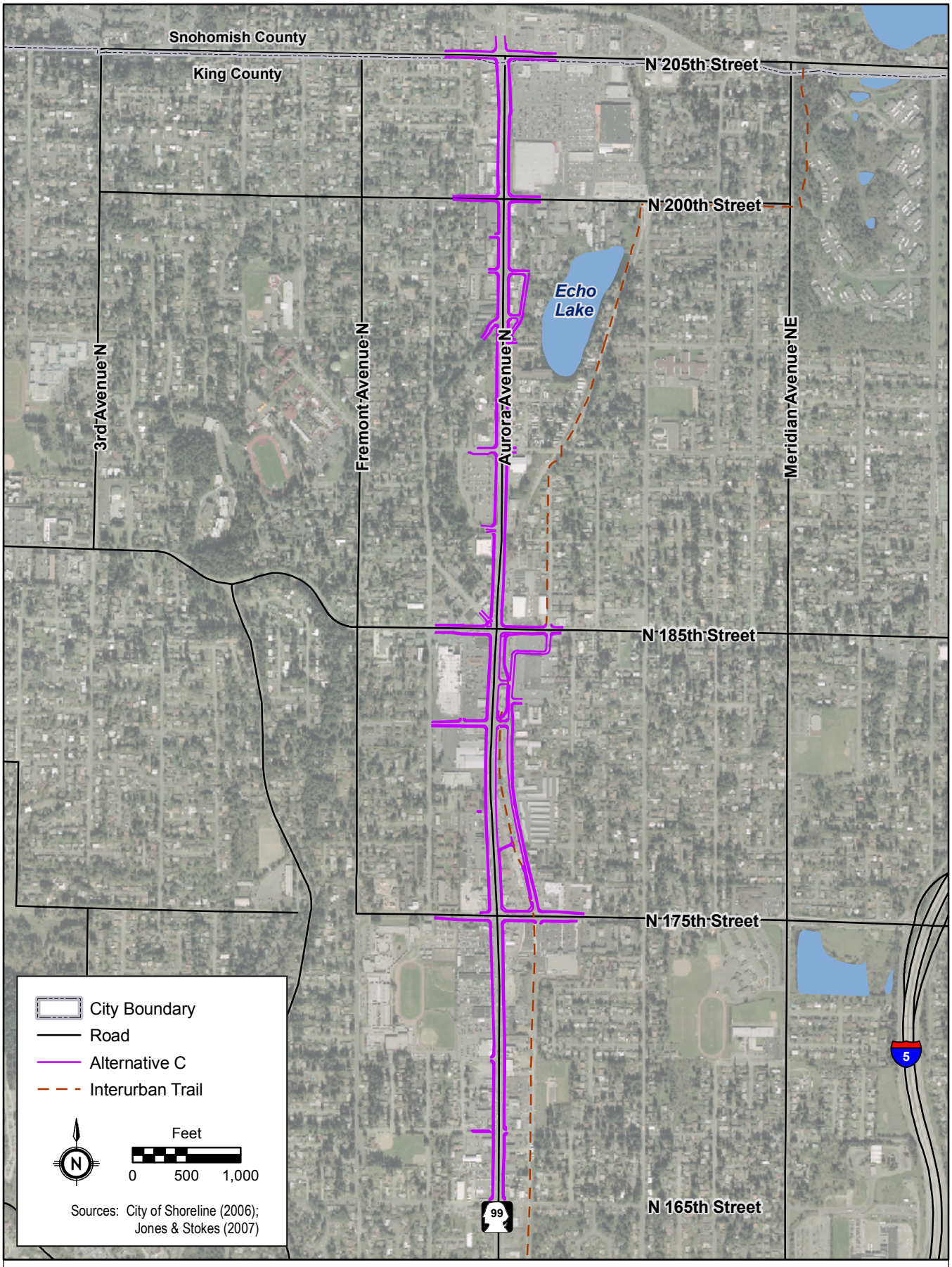

Figure 4. Alternative C
Aurora Corridor Improvement Project
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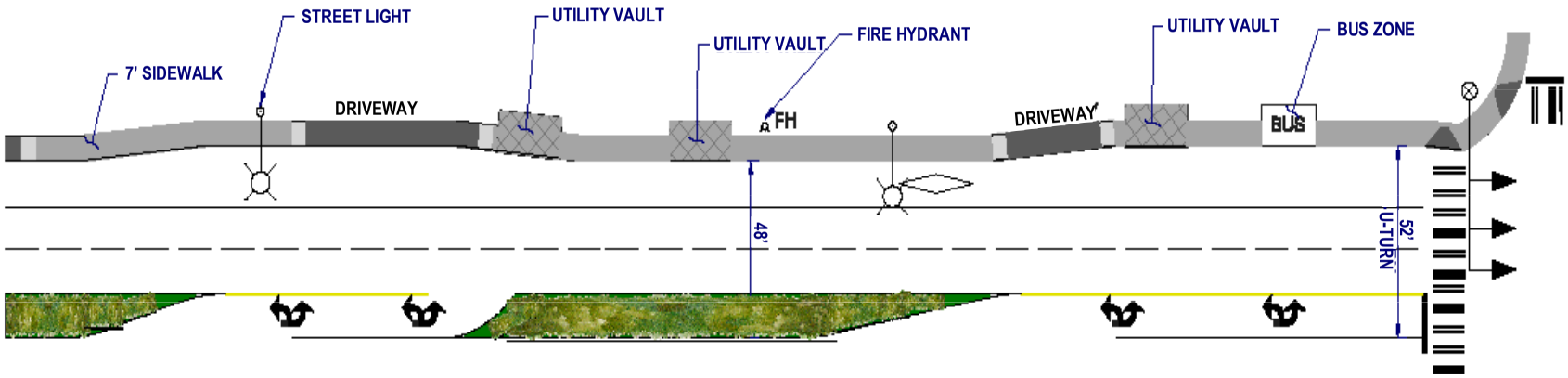
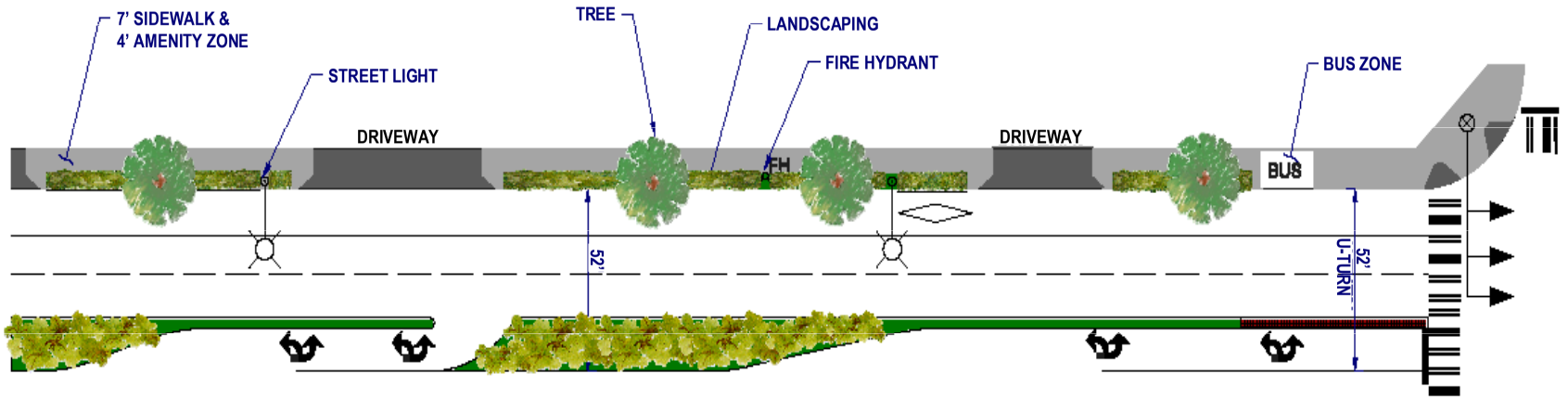
Alternative A



Alternatives B and C

Note: Drawing shows one direction of travel of the proposed roadway alternatives, which is typical of both directions



CITY OF SHORELINE AURORA CORRIDOR

Figure 5. Proposed Plan Detail for Build Alternatives
Aurora Corridor Improvement Project
June 2007

Affected Environment

How was information on geology and soils collected?

The Project lies within a heavily populated area for which topography and surface geology have been studied and mapped. Geographical Information System (GIS) topography and surface geology data were obtained from the City. The surface geology data provide information on soil types, which are referred to as geological units. Local soil data were not available from the National Resource Conservation Service (NRCS) because the Project lies within an area for which specific soil series have not been mapped (NRCS 2007). For this reason, the more general surface geology data were used for this analysis. A site visit was conducted on December 18, 2006 and to observe the general topography and landscape features in the study area.

What is the study area for geology and soils?

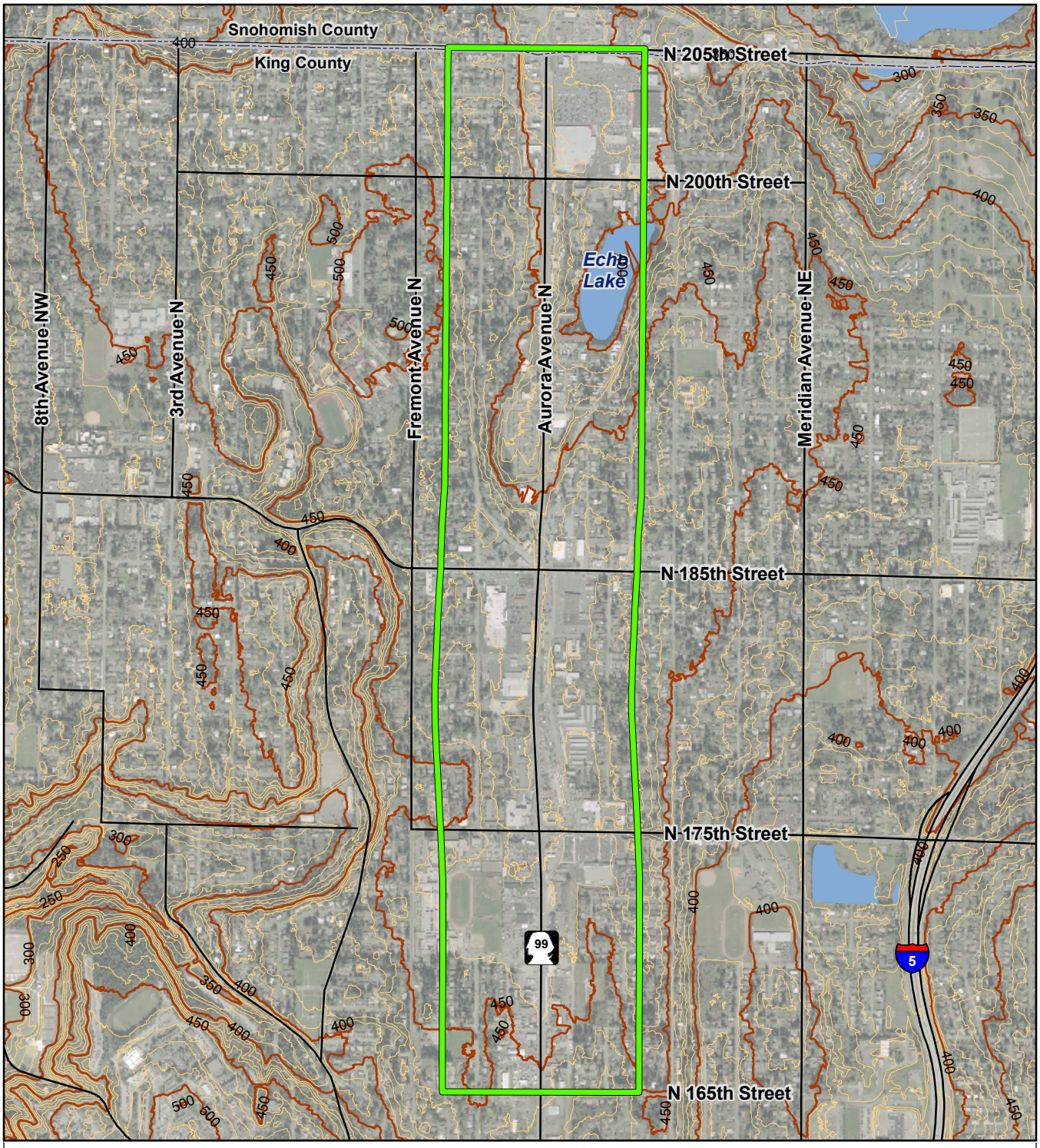
Geology and soil characteristics were studied within the footprint of the Build Alternatives for the Project. In addition, the study area was extended 1,000 feet outside of these limits to properly assess the relevant conditions. The 1,000-foot distance was selected because it encompasses the geologic features in the Project vicinity that may affect, or may be affected by, the proposed project.

What is the topography of the study area?

The general topography along the Project corridor is as follows:

- N 165th Street – N 185th Street: Aurora Avenue follows roughly the top of a long flat ridgeline, with a slight elevation gain from south to north and gentle slopes trending downhill to the east and west. At approximately N 185th Street the ridgeline trends away to the north-northwest and Aurora Avenue loses elevation as it enters the Echo Lake drainage basin.
- N 185th Street – N 192nd Street: Aurora Avenue drops into the Echo Lake basin, with relatively steep slopes trending uphill to both the east and west.
- N 192nd Street – N 205th Street: Aurora Avenue runs roughly parallel to the adjacent slope with higher elevation to the west and lower elevation to the east. There is also elevation gain going north between N 195th Street and N 198th Street, and elevation loss from N 198th Street to the Project terminus at N 205th Street.

Topography is shown in Figure 6.



Sources: City of Shoreline (2006); Jones & Stokes (2007)

City Boundary
Study Area
Road
Contour Line - 50' Interval
Contour Line - 10' Interval

N

Feet

0 1,000 2,000

CITY OF SHORELINE AURORA CORRIDOR

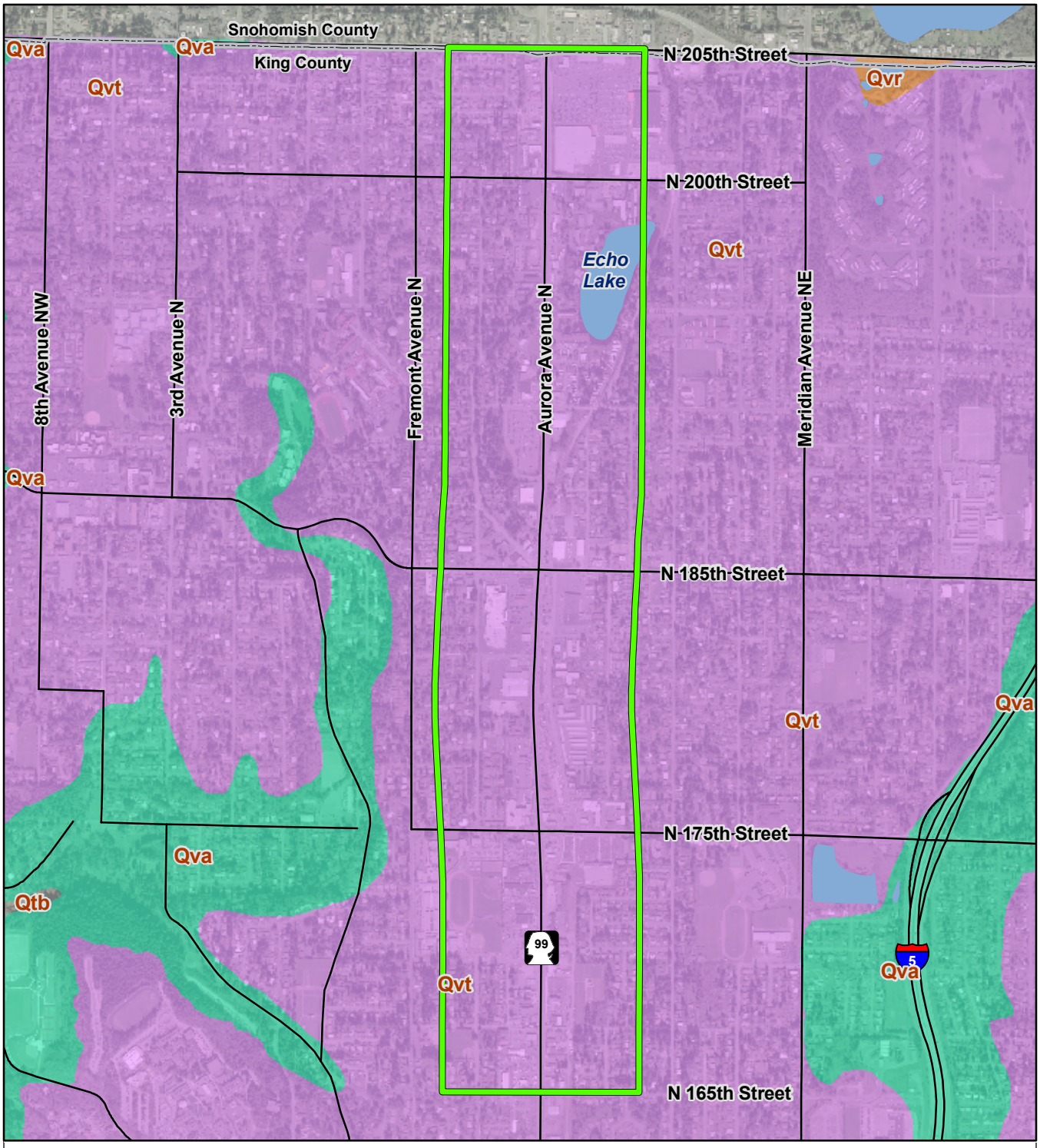
Figure 6. Topography
Aurora Corridor Improvement Project
June 2007

What is the geology of the study area?

The surface geology of the Puget Sound region is largely the result of glacial processes. Massive glaciers advanced south from Canada into the Puget Sound region at least four times during the Pleistocene epoch, between about 1.6 million and 10,000 years ago. The advance and retreat of these glaciers caused deep scouring in some areas and placed thick deposits of sediment in other areas. Human activities have also altered the landscape in the more recent past.

The study area is located in the glacial till geological unit (Qvt), which is also known as hardpan (Figure 7). Glacial till consists of an unsorted, crudely stratified mix of very dense silt, sand, gravel, cobbles, and boulders deposited at the base of a glacier. Because glacial till was over-ridden by the depositing glacier it is highly compacted and therefore is relatively impermeable to water. Specific soil data for overlying soils is not available, as soils in the area has not been mapped by the NRCS, however a mixture of native soils and fill are assumed to occur within the study area. Soil boring data collected for specific projects within the City of Shoreline support this assumption and also indicates that in some areas till is present at the soil surface (Shannon and Wilson 1990, AESI 1999). This is likely due to past excavation and/or erosion. In areas where the native soil or fill that overlies till is permeable, it is possible that groundwater may be perched in the upper soil layer, unable to permeate the till.

The weight of the overlying glacier, estimated to be more than 3,000 feet thick during the last ice age, compacted the till, causing it to become very dense and to resemble a rock-like material. Except for minor erosion, cuts in till are usually stable. Because of its high density and the wide range of sediment sizes that compose it, till is often difficult to excavate; likewise it can be difficult to place as fill in wet conditions due to its silt content.



Sources: City of Shoreline (2006); Jones & Stokes (2007)

City Boundary
Study Area
Road

Surface Geology

Qva (advance outwash)
Qvr (recessional outwash)
Qvt (glacial till)

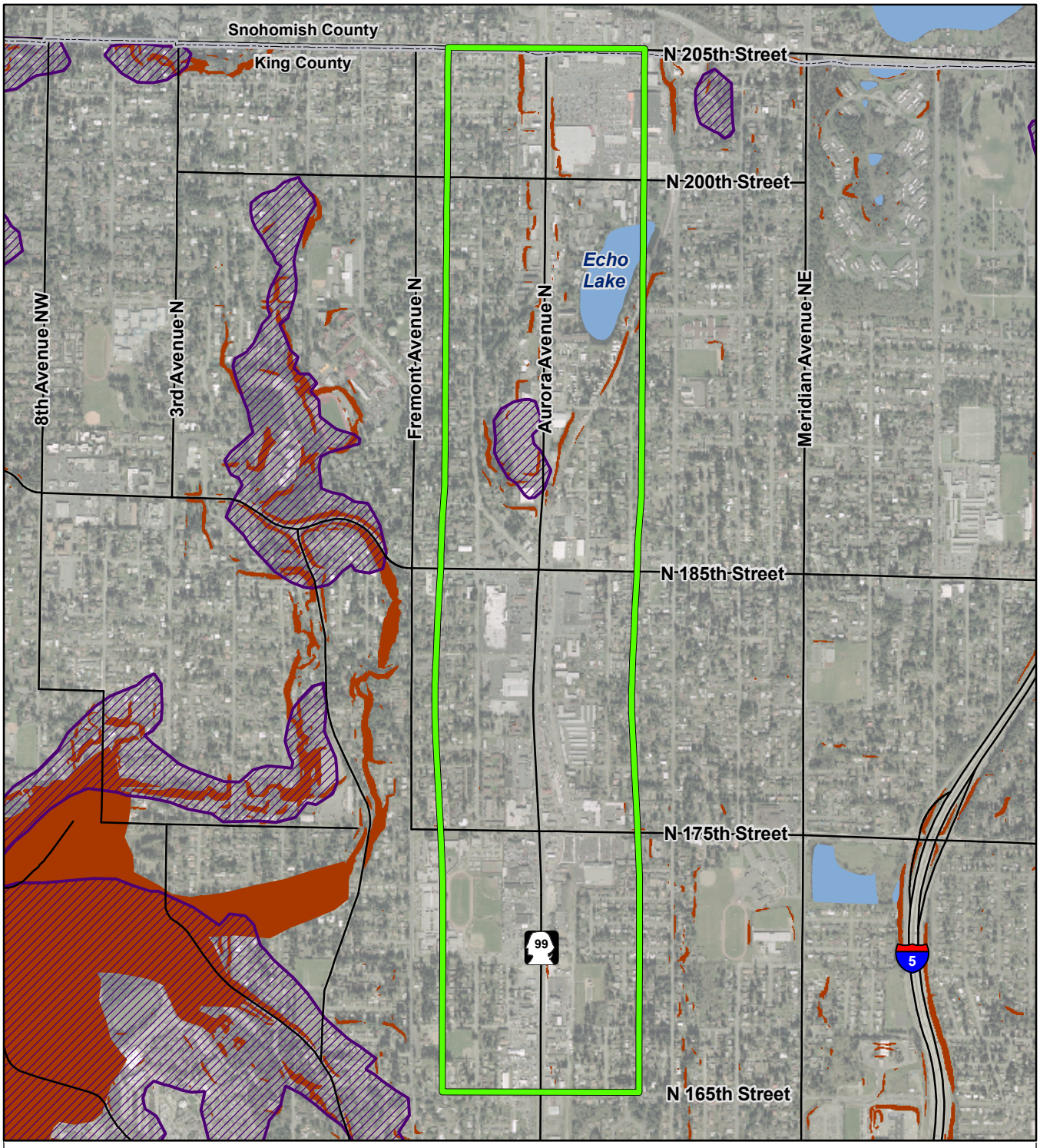
N

Feet

0 1,000 2,000

AURORA CORRIDOR

Figure 7. Surface Geology
Aurora Corridor Improvement Project
June 2007



Sources: City of Shoreline (2006); Jones & Stokes (2007)

City Boundary
Study Area
Road
Erosion Hazard Area
Landslide Hazard Area

N

Feet

0 1,000 2,000

AURORA CORRIDOR

Figure 8. Geologic Hazard Areas
Aurora Corridor Improvement Project
June 2007

What are geologic hazards and do any exist in the study area?

As defined in the Shoreline Municipal Code (20.80.210), geologic hazard areas are lands that are affected by natural processes that make them susceptible to geologic events, such as landslides, seismic activity, or severe erosion. Bluffs, ravines, and steep slopes are particularly susceptible to these processes. The Shoreline Municipal code describes three types of geologically hazardous areas: erosion hazard areas, landslide hazard areas, and seismic hazard areas. Of these, one erosion hazard area and several landslide hazard areas have been mapped within the study area. The locations of these geologic hazard areas are shown on Figure 8.

Erosion Hazard Areas

The City Critical Areas Ordinance (Shoreline Municipal Code 20.80.210) defines erosion hazard areas as areas underlain with soils that the NRCS has classified as severe or very severe erosion hazards. Soils that are classified as severe or very severe erosion hazards are specific types of soils that have a high potential for erosion and that occur on slopes with a gradient equal to or greater than 15%.

There is one area of erosion hazard mapped along the corridor, on the west side of Aurora Ave N between approximately N 188th Street and N 192nd Street. A small portion of this area is also on the east side of Aurora Avenue N in the vicinity of N 188th Street (Figure 8). Although not mapped as a separate geologic unit, the shape of this erosion hazard area, and its location within a natural topographic basin on the landscape, suggest that it may have historically been a wet area, such as a wetland, pond, or peat bog, therefore this erosion hazard area may contain wetland deposits (geologic unit Qw). Currently, the area is paved and is used as a Park and Ride. If this area contains wetland deposits, it may be underlain with soft peat or organic-rich deposits.

Landslide Hazard Areas

The City Critical Areas Ordinance (Shoreline Municipal Code 20.80.210) defines three types of landslide hazard areas: moderate hazard, high hazard, and very high hazard. These classifications are based on soil type and the steepness of the slope on which they occur. Within the study area, only very high hazard landslide hazard areas have been mapped. These are slopes with a gradient equal to or greater than 40%.

There are several small landslide hazard areas within the study area. One small area occurs to the east of Aurora Ave N at approximately N 167th Street, with additional areas near N 175th Street. The majority of the landslide hazard areas are located on the east and west sides of Aurora Ave N between N 192nd St and N 205th Street, although some of these are located within the erosion hazard area mentioned above. Landslide hazard areas are shown on Figure 8.

Landslide hazard areas parallel Aurora Avenue N in two locations: between N 192nd Street and N 195th Street and between N 200th Street and N 205th Street. These steep slopes are the result of past development, and are either over-steepened or are behind retaining walls.

Seismic Hazard Areas

Seismic hazard areas have also been mapped within the City; however these areas do not occur within the study area for geology and soils and they will not be discussed further in this technical memorandum.

Potential Effects

What methods were used to evaluate potential effects on geology and soils?

The methods used to evaluate the Project's potential effects include:

- reviewing the proposed project design concept and likely construction methods;
- evaluating the potential effects of geology and soils on the Project, based on the existing site conditions and standard construction practices, and including the avoidance measures listed below; and
- evaluating the potential effects of the Project on geology and soils based on the existing site conditions and standard construction practices, and including the avoidance measures listed below.

How would geology or soils affect the Project?

Construction

Retaining walls may be required where landslide hazard areas are located parallel to Aurora Avenue N; however, the geology and soil conditions along the Project corridor are not unusual for the Puget Sound region and are routinely encountered in construction. If perched groundwater is encountered during construction, dewatering may be necessary. Assuming proper implementation of standard construction practices, BMPs, and Project-specific design elements, there will be no effects from geology and soils on the Project.

Operations

The geology and soil conditions along the Project corridor are not unusual for the Puget Sound region and are routinely encountered in operations. Assuming proper implementation of standard practices, BMPs, and Project-specific design elements, geology and soils should have no effects on the Project.

How would the Project affect geology or soils?

Construction

The construction conditions along the Project corridor are not unusual for the Puget Sound region and are routinely encountered and resolved with implementation of BMPs. Relevant construction conditions in the study area include the disturbance of moisture-sensitive soils and increased erosion potential.

Moisture-Sensitive Soils

Soils that would be encountered during construction include glacial till and, potentially, wetland deposits and areas of existing fill. Heavy earth-moving equipment tracking on these moisture-sensitive soils will tend to degrade the subgrade into a soft, unstable material during wet weather, in areas of seepage, or in areas of shallow groundwater. These types of conditions are routinely encountered and a variety of methods would be employed to avoid or minimize adverse affects, as described below.

Increased Erosion

Glacial till, which underlies the study area, is relatively stable, with minor erosion potential. Soils within the erosion hazard area are more susceptible to erosion. The Project alignment crosses the erosion hazard area. Exposing soils in this area could lead to increased erosion.

Erosion risk is assessed by looking at the steepness of a slope in combination with the soil type. Generally speaking, erosion risk increases with the steepness of the slope. The majority of the Project is on relatively flat ground; however, portions of it cross steeper slopes, and in some areas cut and fill may be required. Hillside cuts create a steep slope during construction and can become susceptible to erosion. Similarly, fill placed to widen existing embankments may also be susceptible to erosion during a storm event, particularly when stockpiled prior to its placement. Implementation of measures to avoid or reduce effects, described below, will minimize Project-related erosion to levels below the significance level, but will not completely eliminate it.

Operations

There should be no permanent effects from Project operations on geology or soils.

How would Project construction temporarily affect geology and soils?

Temporary Project impacts to geology and soils could include disturbances to moisture-sensitive soils, and would be addressed with the implementation of BMPs, as indicated previously.

How would potential effects of the Project differ by alternative?

No Build Alternative

Under the No Build Alternative there would be no construction and there would be no effects on geology and soils.

Build Alternatives

Because the Build Alternatives would all occur within and adjacent to the existing Aurora Avenue N alignment, potential effects of the build alternatives on geology and soils would be similar.

Alternative A

Alternative A has the narrowest cross section of the Build Alternatives, therefore it has a slightly reduced potential to affect geology and soils than Alternatives B or C. Where additional right-of-way would be necessary, Alternative A would shift the road alignment to the east, and therefore would have a greater potential to impact steep slopes on the east side of Aurora Avenue N. This would be of particular concern in the vicinity of N 188th Street, between N 192nd Street and N 195th Street, and between N 200th Street and N 205th Street, where landslide hazard areas are located directly parallel and adjacent to Aurora Ave N (Figure 8). These steep slopes may place constraints on construction, and retaining walls may be required in these areas. The existing retaining wall on the east side of Aurora Avenue N and north of N 200th Street (at Costco) may limit the potential to shift the alignment east in this area.

Alternative A would also entail constructing new roadway and sidewalks across the mapped erosion hazard area (Figure 8); however, steep slopes do not occur within the erosion hazard area on the east side of Aurora Avenue N, therefore the potential need to construct a retaining wall in this location is reduced as compared to Alternative C.

Alternative B

Alternative B would shift the alignment to the east in areas where additional right-of-way would be necessary. Therefore, Alternative B would have a greater potential to impact steep slopes on the east side of Aurora Avenue N. This potential impact would also be greater under Alternative B than Alternative A because of the wider right-of-way under Alternative B. This would be of particular concern in the vicinity of N 188th Street, between N 192nd Street and N 195th Street, and between N 200th Street and N 205th Street, where landslide hazard areas are located directly parallel and adjacent to Aurora Ave N (Figure 8). These steep slopes may place constraints on construction, and retaining walls may be required in these areas. The existing retaining wall on the east side of Aurora Avenue N and north of N 200th Street (at Costco) may limit the potential to shift the alignment east in this area.

Alternative B would also entail constructing new roadway and sidewalks across the mapped erosion hazard area (Figure 8); however, steep slopes do not occur within the erosion hazard area

on the east side of Aurora Avenue N, therefore the potential need to construct a retaining wall in this location is reduced as compared to Alternative C.

Alternative C

Alternative C would shift the alignment to the west in areas where additional right-of-way would be necessary. Therefore, Alternative C would have a greater potential to impact steep slopes on the west side of Aurora Avenue N. This would be of particular concern in the vicinity of N 188th Street, between N 192nd Street and N 195th Street, and to the north of 195th Street, where landslide hazard areas are located directly parallel and adjacent to Aurora Ave N (Figure 8). These steep slopes may place constraints on construction, and retaining walls may be required in these areas.

Alternative C would also entail constructing new roadway and sidewalks across the mapped erosion hazard area in an area where steep slopes also exist (Figure 8). Under Alternative C, a retaining wall may be necessary in this area.

Measures Taken to Avoid or Minimize Project Effects

The following sections describe the established design and construction practices that will be implemented to avoid or minimize effects on the various environmental resources during both the construction and operation of phases of the Project.

- A Temporary Erosion and Sedimentation Control (TESC) plan will be prepared and implemented. This plan will include operational and structural measures to control the transport of sediment. Operational measures include removing mud and dirt from trucks before they leave the site, covering fill stockpiles or disturbed areas, and avoiding unnecessary vegetation clearing. Structural measures are temporary features used to reduce the transport of sediment, such as silt fences and sediment traps.
- The degradation of moisture-sensitive soils will be minimized. Measures include limiting major earthwork to the drier construction season in the late spring through early fall; maintaining proper surface drainage to avoid surface water ponding; minimizing ground disturbance by limiting heavy equipment use, limiting turns, and/or not tracking directly on the subgrade; and by covering the final subgrade elevation with a working mat of crushed rock and/or geotextile for protection. Mixing a soil admix such as cement into the subgrade may also add strength and stabilize the ground.
- Construction procedures identified in the geotechnical investigation will be implemented. These are designed to maintain or enhance slope stability in areas potentially underlain by landslide-prone soils.
- Only clean fill will be imported and placed for the Project. This measure will require documentation from the supplier certifying that the fill does not exceed Washington State soil cleanup standards. If documentation is not available, imported fill soils will be tested prior to

placement. Suspect soils encountered during Project construction will be tested and, where necessary, removed from the site and disposed of in accordance with Washington State regulations.

References

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