Final Concept Development Report

ISSAQUAH-HOBART ROAD SE & SE MAY VALLEY ROAD INTERSECTION IMPROVEMENTS PROJECT #1129598

Prepared for:
King County
Department of Local Services
Road Services Division

King County
Department of Local Services
Road Services Division

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Introduction

The Issaquah-Hobart Road SE corridor is a main route connecting Interstate 90 (I-90) in the City of Issaquah to State Route 18 (SR-18), and the communities of Hobart and Maple Valley. The road, which is named Front Street in Issaquah, is a heavily used commute route, with a northbound peak direction during the morning peak period and the reverse in the afternoon peak period. It has experienced a substantial amount of growth in traffic volumes over the last several years. As a result, congestion in the corridor has worsened, leading to extended travel times and longer peak traveling hours. The City of Issaquah and the King County Road Services Division partnered on the *Issaquah Hobart/Front Street Corridor Study* (Transpo Group, 2018) which identified the need to improve the intersection of Issaquah-Hobart Road SE with SE May Valley Road to meet future traffic demand and improve safety. This Concept Development Report (CDR) documents the process used to identify and evaluate alternatives for improving this intersection and identifies the preferred alternative.

Reference Documents

The following studies and documents were used in the preparation of this CDR:

- Issaquah-Hobart Road/Front Street Corridor Study, prepared by Transpo Group, March 2018
- Issaquah-Hobart Road SE/May Valley Road Corridor Study, prepared by King County, August 2019, included as Appendix A
- King County Memorandum RE: Issaquah-Hobart Rd SE @ SE May Valley Rd Intersection Improvement Geotechnical Investigation, June 25, 2020, included as Appendix B
- Preliminary Critical Areas Report, prepared by King County, April 2023, included as Appendix C

Overview of Alternatives

Alternatives considered for improving the Issaquah-Hobart Road SE/SE May Valley Road intersection included constructing a multi-lane roundabout, adding capacity to the existing traffic signal, and a no build alternative.

The Multi-Lane Roundabout Alternative would construct a roundabout at the existing intersection and include two southbound lanes (one shared through/right lane, one through only lane), two eastbound lanes (one left-turn lane and one right-turn slip lane), and two northbound lanes (one shared left/through lane, one bypass lane for through movements). The eastbound right-turn lane would leave the intersection in a dedicated lane that would merge into the adjacent through lane. All lanes leaving the intersection in the north- and southbound direction would merge and tie into the existing two-lane roadway section.

The Traffic Signal Alternative would improve the capacity and geometry of the intersection and rebuild the traffic signal. Lane configurations would include two southbound lanes (one shared through/right lane, one through only lane), two eastbound lanes (one left-turn lane and one channelized right-turn lane), and three northbound lanes (one dedicated left-turn lane, two through lanes). Like the Multi-Lane Roundabout Alternative, the eastbound right-turn lane would leave the intersection in a dedicated lane that would merge into the adjacent through lane. All lanes leaving the intersection in the north- and southbound direction would merge and tie into the existing two-lane roadway section.

The No Build Alternative assumes the intersection would remain in its existing condition with only maintenance related improvements occurring through the design life of the project.

Evaluation Criteria

The following criteria were used to evaluate alternatives:

- Traffic Operations – Intersection delay and queues were estimated for design year traffic conditions for all alternatives, including the No Build option. The cost of delay to the travelling public was estimated using industry accepted cost values for individual driver's time.
- Safety – Expected frequency and severity of crashes were estimated for each alternative. Societal benefit due to the reduction of crashes for each alternative were estimated using industry standard estimates for average costs incurred for varying levels of crash severity.
- Soil and Geotechnical – Each alternative was evaluated with respect to impacts on the surrounding topography and the need for soil stabilization and retaining walls. Costs for this work were estimated for each alternative and included in the initial construction cost estimate.
- Environmental – Impacts to environmentally sensitive areas including wetlands, aquatic areas, and other critical areas were evaluated for each alternative. A cost for mitigation was estimated for each alternative for comparison.
- Stormwater/Drainage - Requirements for stormwater and drainage were evaluated and design needs were identified for each alternative. Costs for stormwater conveyance, treatment, and retention were estimated and included in the initial construction cost estimate.
- Utility Impacts – Impacts to existing utilities were evaluated for each alternative and a cost estimate for relocation was included in the initial construction cost estimate.
- Right-of-Way Requirements – Title reports were reviewed for properties potentially impacted by the project and a cost estimate for right-of-way acquisition was estimated for each alternative. This cost was included in the initial construction cost estimate. Right-of-Way impacts also include impacts to driveways, access to the properties, and structures.
- Construction and Maintenance Costs – Initial construction and ongoing maintenance costs were estimated for each alternative. The criteria include constructability of the project and impact to the traveling public.

The results of the evaluation were incorporated into a life cycle cost analysis that considered each criterion as described above. The preferred alternative was deemed to be the one with the lowest life cycle costs with respect to societal costs such as delay, crash frequency/severity, impacts to the environment, initial construction, and on-going maintenance.

Overview of Chosen Alternative and Key Factors

The alternatives were evaluated and scored based on the advantage each alternative presented for each evaluation criteria. The results of this analysis, including explanations for each score, are included in Appendix H. Based on this evaluation, the Multi-Lane Roundabout presents significant advantages over the Modified Traffic Signal and No Build Alternatives. Total scores for each alternative are:

- Multi-Lane Roundabout – 11
- Modified Traffic Signal – 5
- No Build – 0

In addition, a Life-Cycle Cost Analysis was developed for each alternative. The analysis considers three primary considerations: Project Costs, Maintenance Costs, and Societal Costs. Costs associated with each evaluation criteria were estimated and included in the life cycle cost analysis. Total Life Cycle Costs for each alternative are:

- Multi-Lane Roundabout - $11,428,000
- Modified Traffic Signal - $23,962,000
- No Build - $28,538,000

Based on the alternatives evaluation and life cycle cost analysis, it is recommended that the Multi-Lane Roundabout Alternative move forward into design and construction. This alternative is recommended for the following reasons:

- Based on the County's previous traffic studies as well as additional analysis performed as part of this study, the Multi-Lane Roundabout Alternative is expected to operate with less average delay than both the Modified Traffic Signal and No Build Alternatives. During the weekday AM peak hour, the Modified Traffic Signal Alternative operates at level of service (LOS) B with 15 seconds of delay, while the Multi-Lane Roundabout operates at LOS A with 8 seconds of delay. During the weekday PM peak hour, the Modified Traffic Signal and Multi-Lane Roundabout operate at LOS F with 115 and 76 seconds of delay, respectively.
- Based on the County's previous predictive safety analysis, the Multi-Lane Roundabout Alternative is expected to provide a higher anticipated reduction in collisions than the Modified Traffic Signal Alternative over the No Build condition.
- Based on the County's geotechnical investigation, the Multi-Lane Roundabout is expected to have less of an impact on steep slopes than the Modified Traffic Signal Alternative and require the construction of one third the amount of retaining wall.
- Due to its smaller footprint, it is anticipated that the Multi-Lane Roundabout Alternative will have a lower impact on critical areas than the Modified Traffic Signal Alternative. This includes lower impacts to stream buffers and the avoidance of impacts to potential fish passable culverts at the unnamed tributary just south of SE 132nd Way and at Nudist Camp Creek.
- Right-of-Way impacts and costs are expected to be lower for the Multi-Lane Roundabout Alternative. This includes the cost of acquisition as well as impacts to adjacent properties and driveways.
- Construction and maintenance costs of the Multi-Lane Roundabout Alternative are expected to be lower than the Modified Traffic Signal Alternative.

Existing Conditions

Project Vicinity

The project is located at the intersection of Issaquah-Hobart Road SE and SE May Valley Road. The area is located within unincorporated King County, south of the City of Issaquah, north of the City of Maple Valley, and east of the City of Renton. The general location of the study area is shown below in Figure 1 and an aerial view of the intersection is shown in Figure 2.

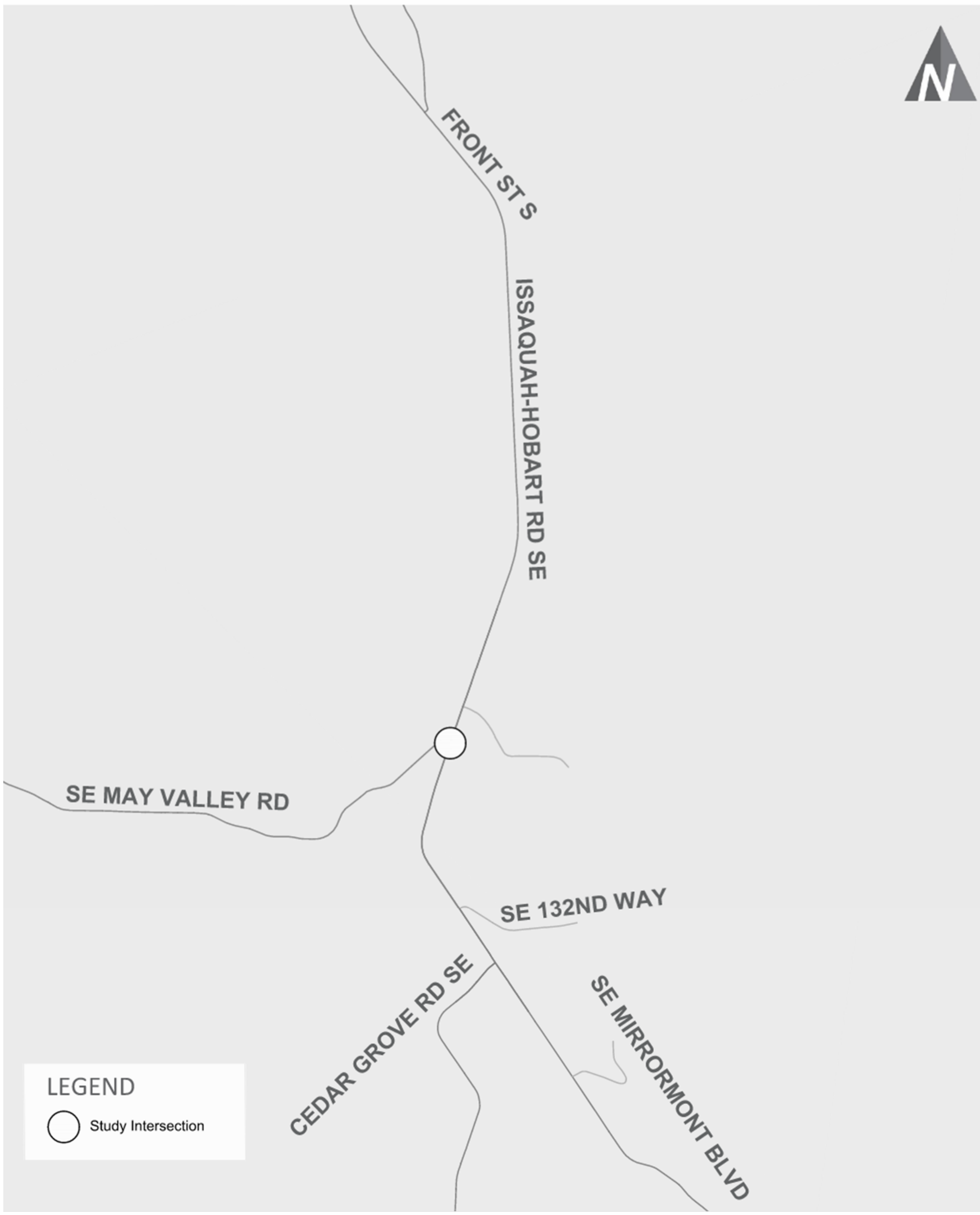

Figure 1 Study Area *(Source: Transpo Group, 2022)*

Figure 2 Aerial View of Study Intersection *(Source: Transpo Group, 2022)*

Existing Roadway Facilities

Street Network

The primary roadways within the study area and their characteristics near the study intersection are described in Table 1.

Table 1. Roadway Network Existing Conditions Summary

Roadway	Classification[1]	Speed Limit	# of Lanes	Parking	Pedestrian Facilities	Bicycle Facilities
Issaquah-Hobart Road SE	Principal Arterial	45 mph	2	No	Intermittent Sidewalk[2]	None
SE May Valley Road	Principal Arterial	35 mph	2	No	Intermittent Sidewalk[2]	None

1. Based on the King County Arterial Classification system
2. Sidewalks are present at the intersection and transition to a shoulder beyond the intersection along Issaquah-Hobart Road SE and Se May Valley Road.

Issaquah-Hobart Road SE is a two-lane north-south principal arterial with a posted speed limit of 45 miles per hour (MPH) in the study area. Near the subject intersection, the roadway generally consists of one 11-foot travel lane in each direction with 4- to 6-foot shoulders. The vertical alignment of the roadway is generally flat. The roadway surfacing is asphalt and appears generally in good condition, with only localized pavement distresses present including minor longitudinal cracking and rutting.

SE May Valley Road is a two-lane east-west principal arterial with a posted speed limit of 35 mph within the study area. Travel lanes are approximately 11 feet wide near the intersection. Shoulders are 8 to 10 feet wide near the subject intersection and eventually reduce to 4 to 6 feet wide further from the intersection. The vertical alignment is flat near the intersection but is generally rolling through most of its westward alignment. Asphalt pavement condition appears good with only minor distresses present.

There are no signed or marked bicycle facilities along Issaquah-Hobart Road SE or SE May Valley Road. Bicycle volumes are low and generally consist of recreational cyclists, based on King County's August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report*. Pedestrian facilities along the roadways consist of variable-width roadway shoulders along the roadways, and sidewalks, curb ramps, and pedestrian pushbuttons and signals at the intersection. The curb ramps and pedestrian signal facilities do not meet current Americans with Disabilities Act (ADA) standards.

The Issaquah-Hobart Road SE/SE May Valley Road intersection is a signalized three leg intersection operated and maintained by King County. The eastbound approach has an exclusive left turn lane and a 75-foot right turn pocket. The northbound approach has a through lane and a 140-foot left turn pocket. The southbound approach has a through lane and a 115-foot right turn pocket. The northbound left-turn movement has protected-permitted phasing.

Existing Traffic Conditions

The following sections summarize existing traffic conditions within the study area.

Existing Traffic Volumes

The study analysis focuses on the AM and PM peak periods when congestion on the corridor is at its highest. These peak periods range from roughly 5:00 a.m. to 9:00 a.m. for the morning peak and 2:30 p.m. to 6:30 p.m. for the evening peak. The existing AM peak hour is from 6:30 to 7:30 a.m. at Issaquah-Hobart Road SE/SE May Valley Road. The PM peak hour is 3:45 to 4:45 p.m. at Issaquah-Hobart Road SE/SE May Valley Road. Figure 3 summarizes 2019 weekday AM and PM peak hour traffic volumes at the intersection.

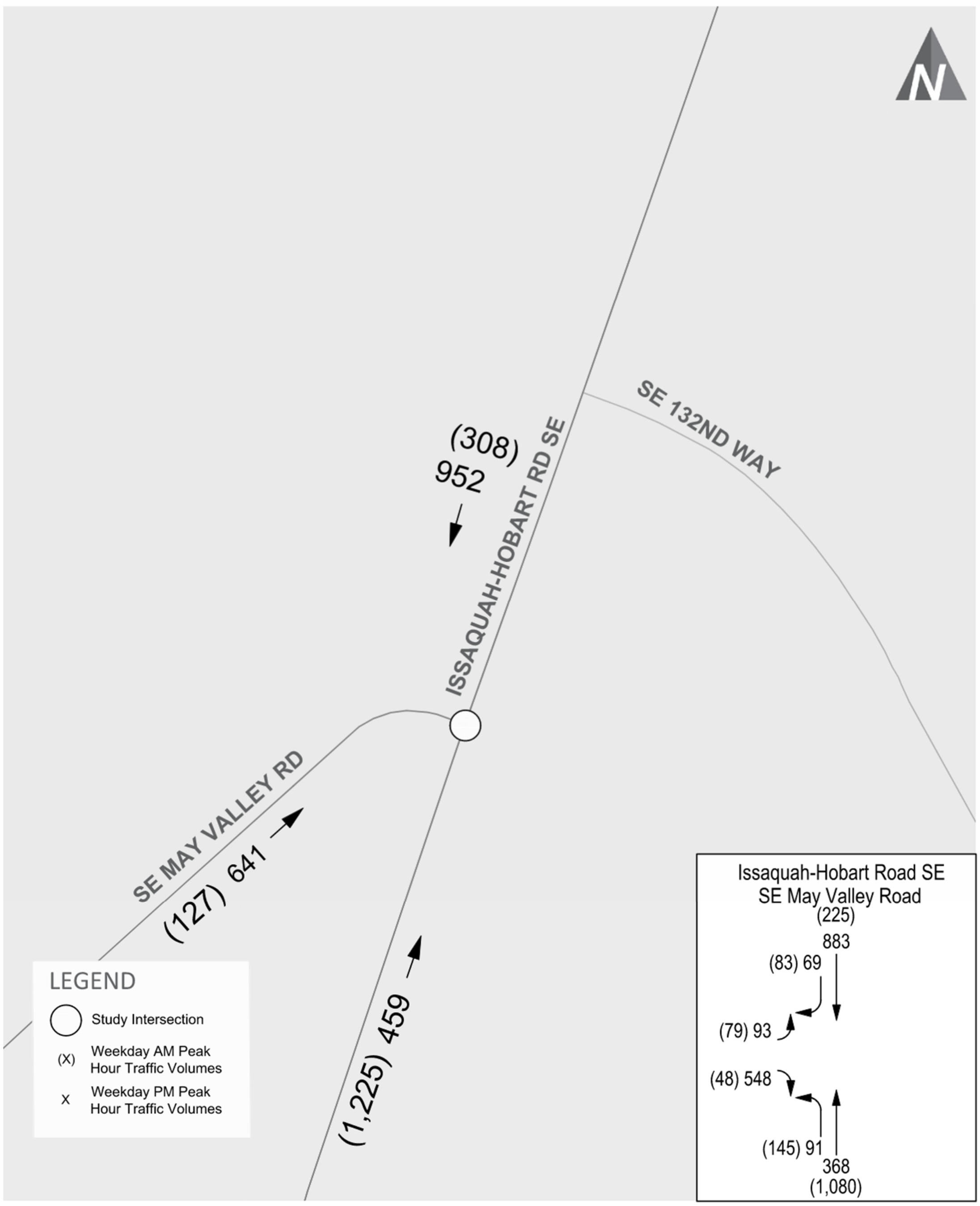

Figure 3 Existing (2019) Weekday AM and PM Peak Hour Traffic Volumes

Issaquah-Hobart Road carries a daily traffic volume of approximately 20,600 vehicles north of SE May Valley Road, 22,300 vehicles south of SE May Valley Road, 19,800 vehicles north of Cedar Grove Road, and 15,200 vehicles south of Cedar Grove Road. SE May Valley Road carries approximately 7,100 vehicles on an average weekday. These estimated volumes are based on 2019 existing conditions, per King County's August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report*.

The intersection carries approximately 2,052 and 1,660 total entering vehicles during the weekday AM and PM peak hours, respectively, based on 2019 existing conditions.

Along Issaquah-Hobart Road SE, travel patterns are directional throughout the day. Northbound is the peak direction during the weekday AM peak hour while southbound is the peak direction during the weekday PM peak hour.

Along SE May Valley Road, traffic peaks in the westbound direction in the morning and in the eastbound direction in the afternoon. There has been a significant increase in heavy vehicle volumes along SE May Valley Road since trucks were prohibited in downtown Issaquah and rerouted to use SE May Valley Road.

Primary Type of Use

In the past, the Issaquah-Hobart Road SE corridor served as a route for truck traffic from I-90 to SR 18 as well as for local access along the corridor. In the fall of 2016, the City of Issaquah updated their designated truck routes to prohibit trucks south of I-90 within the city limits. Trucks are re-routed to SR 900 and SE May Valley Road to bypass City of Issaquah's downtown restrictions. This re-routing changed traffic patterns in the study area, significantly increasing the truck traffic along SE May Valley Road corridor and creating congestion at the May Valley Road/Issaquah-Hobart Road SE intersection due to the increased truck turning movements.

In addition, school buses utilize Issaquah-Hobart Road SE with several stops along the corridor. Based on counts collected by King County in 2017, the study intersection experienced a reduction of 200 northbound vehicles during the weekday AM peak hour and a reduction of 80 southbound vehicles during the weekday PM peak hour due to school bus related delays in the vicinity of the intersection. The delays are primarily attributed to buses stopping within the lanes to load and unload passengers, resulting in queuing of vehicles behind the school buses, which in-turn increases the time it takes for vehicles to reach and enter the intersection. During periods when school is not in session, these delays attributed to school buses are not present.

Traffic Safety

Historical collision data and crash records along the corridor were reviewed by King County as part of the August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report*. Collision data for the three-year period between January 1, 2016 and December 31, 2018 were reviewed at the study intersection as well as along Issaquah-Hobart Road SE between SE May Valley Road and Cedar Grove Road SE to identify potential safety concerns. There were a total of 19 recorded collisions at the study intersection during this period, summarized by type and severity in Table 2.

Table 2. Three-Year Collision Summary by Collision Type and Severity

	Collision Type							Severity			
Location	Rear End	Angle	Fixed Object	Left-Turn	Side-swipe	Runoff Road	Other	Fatality	Injury	PDO	**Total Collisions**
Intersection											
Issaquah-Hobart Road SE/ SE May Valley Road	13	1	0	1	2	2	0	0	9	10	19
Roadway Segment											
Issaquah-Hobart Road SE between SE May Valley Road and Cedar Grove Road SE	7	1	6	0	1	0	1	0	6	10	16

Source: King County, August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report*.
Note: PDO = Property Damage Only

As shown in Table 2, most collisions at the study intersection were rear-end, indicating congestion along the Issaquah-Hobart Road SE corridor. A pattern of rear end collisions along a roadway corridor can indicate traffic congestion, with stop-and-go vehicles more likely to be the leading cause of collisions in the area. No fatalities occurred at the study intersection, with 53 percent of collisions resulting in property damage only and 47 percent resulting in injury.

Signal Warrant Analysis

A signal warrant analysis[1] was conducted for the Issaquah-Hobart Road SE/SE May Valley Road study intersection under existing (2019) and future (2043) conditions. Hourly traffic volume percentages were used from the National Cooperative Highway Research Program (NCHRP) Report 365. The hourly percentages were applied to the existing (2019) and future (2043) weekday PM peak hour turning movement volumes to develop an hourly volume distribution. Hourly volumes are included in Appendix D. The hourly volumes at the intersection were analyzed with Highway Capacity Software 7 (HCS7) to evaluate signal warrants. Existing channelization was assumed under existing (2019) conditions and the future signal concept channelization (as shown in Appendix E) was assumed under future (2043) conditions.

Signal warrants are **met** under existing (2019) and future (2043) conditions at the Issaquah-Hobart Road SE/SE May Valley Road intersection. Under both existing (2019) and future (2043) conditions, Warrant 1 (Eight-Hour Vehicular Volume), Warrant 2 (Four-Hour Vehicular Volume), and Warrant 3 (Peak Hour) are met.

Existing Project Setting

The following sections detail elements of the project setting and study area. The project is located within unincorporated King County, south of the City of Issaquah, north of the City of Maple Valley, and east of the City of Renton.

Surrounding Land Use

Surrounding land uses are zoned rural and consist mainly of single-family homes and undeveloped parcels. Other land uses in the vicinity of the intersection include parks/open space uses including Squak Mountain State Park and Tiger Mountain State Forest. The zoning designation in the study area is RA-5, based on the King County Zoning Map. The surrounding area primarily consists of residential and rural uses, but also includes several nearby small businesses to the north and south. There are no known land use issues within and/or adjacent to the project study area and surrounding community that would impact the project.

Non-Motorized Facility Linkages

The Issaquah-Hobart Road SE/SE May Valley Road intersection includes sidewalks at the intersection approaches on both sides of the roadway. Designated pedestrian facilities are not present outside of the study intersection; however, roadway shoulders could be available for non-motorized use. The sidewalks at the intersection connect to shoulders on Issaquah-Hobart Road SE and SE May Valley Road.

[1] *Manual on Uniform Traffic Control Devices* (MUTCD), Federal Highways Administration (2009).

Transit Service Facility Linkages

Public transit service does not currently serve the immediate vicinity of the study intersection. King County Metro provides bus service to downtown City of Issaquah, approximately 4 miles north of the Issaquah-Hobart Road SE/SE May Valley Road intersection.

Hydrology and Stormwater Management

A Technical Information Report for stormwater management and mitigation will be prepared per the *King County Surface Water Design Manual* at a later phase of project design.

A Preliminary Critical Areas Report was prepared by King County in August of 2022 and is included in Appendix C. This is a general review for most areas due to limited private property access within the vicinity of the subject intersection and future stormwater facility.

Per the Preliminary Critical Areas Report, the primary sources of surficial hydrology within the area potentially affected by the project include direct precipitation and stormwater runoff. Stormwater conveyances consisting of a mix of vegetated ditches/swales and piped segments, occur along the east and west sides of Issaquah-Hobart Road SE, as well as along the north and south sides of SE May Valley Road in the immediate vicinity of the intersection. Some of these conveyances discharge to Issaquah Creek, while others may infiltrate into the local soils. Fifteen Mile Creek and Issaquah Creek, both perennial streams, occur to the east of the project site. An intermittent stream flowing from the plateau to the east of Issaquah-Hobart Road SE provides an additional source of hydrology for parcels on the east side of Issaquah-Hobart Road SE, between SE May Valley Road and SE 132nd Way.

The project area for the build alternatives may necessitate impacts to Issaquah-Hobart Road SE further north of the intersection with SE May Valley Road than was assumed by the *Preliminary Critical Areas Report.* Nudist Camp Creek is a perennial tributary to Issaquah Creek that crosses Issaquah-Hobart Road SE north of SE 127th Street and may be impacted by the build alternatives. If the project design results in stream impacts, then a hydrology/hydraulics analysis is required to review existing stream conditions, including geomorphology and scour. The unmapped floodplains of impacted streams would need delineation and analysis. Stream impacts would need to be permitted and mitigated appropriately. If existing culverts are impacted by project improvements, they may need to be replaced with fish-passable culverts.

Geology

In 2020, King County Department of Local Services Road Services Division completed a geotechnical investigation for the Issaquah-Hobart Road SE at SE May Valley Road Intersection Improvements Project. A memorandum detailing this investigation is included in Appendix B. The purpose of the geotechnical investigation was to evaluate subsurface and roadway conditions to aid in selection and design of intersection improvement alternatives, which include either realigning the existing 3-way “T” intersection or replacing the “T” intersection with a roundabout.

Online geologic mapping of the project area was accessed from the Washington State Department of Natural Resources (DNR) Geologic Information Portal[2] and the United States Geologic Survey (USGS)[3] databases. Geologic mapping indicates the predominant surficial soil unit in the general site vicinity consists of Younger Alluvium (Qyal). This unit is described as alluvial sediment that was deposited in and along present streams that are subject to

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[2] “Geologic Information Portal: WA - DNR”, https://www.dnr.wa.gov/geologyportal.

[3] “United States Geological Survey”, https://www.usgs.gov/.

seasonal flooding and consists predominately of organic-rich, fine sand, silt, and clay that accumulated in the low energy parts of the stream valley. Locally, coarser-grained channel sediments (gravel and coarse sand) may underlie finer-grained floodplain sediments. The maximum thickness of the Younger Alluvium unit in the floodplain may be as much as 12 meters. Locally, glacial till underlies the Younger Alluvium.

King County's 2020 geotechnical investigation included seven geotechnical borings that were drilled in or near the intersection of Issaquah-Hobart Road SE and SE May Valley Road at the locations shown on Figure 2 of Appendix B. These borings were advanced to depths from 2.5 to 51.5 feet below the ground surface (bgs).

The upper four feet of soil at boring **B-1** consisted of a loose to medium dense sandy silt with numerous organics. Below the sandy silt, a loose to dense, silty sand was encountered to about 12 feet bgs. The silty sand was followed by medium dense sandy silt to the termination of the boring at 16.5 feet bgs.

Boring **B-2** indicates the asphalt concrete pavement (ACP) in this section of roadway is approximately 12 inches thick. The ACP was followed by a road gravel fill to about two feet bgs. Below the road gravel, a medium dense, silty sand with gravel fill was encountered to five feet bgs. The fill was followed by a loose to medium dense, silty sand to the termination of the boring at 16.5 feet bgs.

At the location of boring **B-3**, a loose, sandy silt with numerous organics was observed to about two feet bgs. Below the silt, the soil consisted of younger alluvium to the termination of the boring at 31.5 feet bgs. The younger alluvium ranged from very loose to dense silts, silty sands, and well graded sands with gravel, with interbedded layers of organics and peat to approximately 20 feet bgs. Below 20 feet bgs, the material consisted of a very dense, silty sand to sandy silt.

Two borings (**B-4a** and **B-4b**) were drilled at the south fog line of SE May Valley Road, approximately 80 feet west of the intersection. In Boring B-4a, the ACP in this section of roadway is about 14 inches thick followed by a medium dense road gravel fill to about two feet bgs. Below the fill, dense cobbles or boulders were encountered. The drill auger was only able to penetrate six inches into the apparent cobble/boulder layer before meeting refusal. The drill rig was moved approximately five feet west and another boring (B-4b) was attempted. Boring B-4b encountered the same materials as in B-4a with drilling refusal at approximately 2.5 feet bgs.

Boring **B-5** was drilled east of the intersection, in a private residential lot, 20 feet east of the edge of sidewalk. A loose, sandy silt with numerous organics was encountered to approximately one foot bgs. Below the silt, soils consisted of very loose to medium dense, silty sand to a poorly graded sand with gravel, with intermittent ½" to 1" layers of organics to about 20 feet bgs. Below 20 feet bgs, a very dense, well graded gravel, to well graded sand with gravel, was encountered to the termination of the boring at 31.5 feet bgs.

At the location of Boring **B-6**, three to four inches of grassy topsoil was encountered followed by medium dense to dense, silty gravel with sand fill to approximately seven feet bgs. Below the fill, dense to very dense, silty sand with gravel, to silty gravel with sand, was encountered to the termination of the boring a 31.5 feet bgs.

Boring **MW-1** encountered three inches of topsoil that was followed by a loose, silty sand with gravel fill to approximately two feet bgs. Below the fill, the material appeared to be disturbed younger alluvially-derived soil consisting of very loose to dense silts and silty sands with gravel, cobbles and boulders to approximately 25 feet bgs. Material in this zone is predominantly loose to very loose. Some higher blow counts in this zone may be overstated due to the presence of cobbles and boulders. Below a depth of 25 feet, a medium dense to dense, poorly graded sand with silt and gravel was encountered to the termination of the boring at 51.5 feet bgs.

At the time of exploration (late April and early May 2020), King County encountered groundwater in six of their seven geotechnical borings at depths ranging from 1 to 12 feet bgs. King County installed a monitoring well in one of their geotechnical borings (MW-1). Depth to groundwater was measured after well installation on May 6, 2020 and June 2, 2020. On these dates, depths to groundwater below the ground surface were reportedly measured to be 3.63 and 3.26 ft, respectively.

The King County iMap[4] interactive mapping tool and Washington State DNR Geologic Information Portal website were reviewed to determine whether geologic hazards are present in the general site vicinity. Geologic hazards shown in iMap indicate the project is in an area that could be susceptible to seismic and erosion hazards.

Geologic mapping from the DNR Geologic Information Portal indicates the site is within about a ¾ mile distance from the Seattle fault zone (Class A); however, the relative risk of surface fault rupture at the site is considered low.

Liquefaction occurs when loose, saturated granular soils lose their ability to support a load during a seismic event. Factors controlling liquefaction include seismic intensity and duration, soil characteristics, in situ stress conditions, and the depth to groundwater. Based on mapping provided in the Washington State DNR Geologic Information Portal, the site is considered to have a moderate risk for liquefaction.

Areas underlain by soils that may experience severe to very severe erosion are defined by the King County Critical Areas Ordinance as erosion hazard areas. Steeper slopes generally have higher susceptibility to erosion because surface water may achieve velocities and energy that are high enough to erode and transport soil. King County iMap indicates the project area is within a designated erosion hazard zone (see Figure 3 in Appendix B). However, due to the relatively flat topography of the site, the risk of erosion for this project is considered low.

Critical Areas

The Preliminary Critical Areas Report (CAR) (Appendix C) identified several critical areas within the project area. These areas include potential wetlands, streams, and other sensitive areas. Private property access was limited, and additional review of critical areas will be needed as the design progresses.

Wetlands

A review of the National Wetland Inventory[5] and King County iMap revealed no mapped wetlands within the project vicinity. However, a preliminary on-site investigation and review of titles by King County staff identified potential wetland areas on the east side of Issaquah-Hobart Road SE, north of the intersection and south of SE 132nd Way. Although no obvious indicators of wetlands were observed in aerial imagery or from the roadway, there may be potential for wetlands to occur west of Issaquah-Hobart Road SE on Parcels 5090300046 and 5090300056 which contain a large area of undeveloped land adjacent to Issaquah Creek. Right-of-entry access and further investigation is needed to identify and delineate any wetlands in these areas, as well as along Fifteen Mile Creek. Along Nudist Camp Creek,

[4] "King County iMap", https://kingcounty.gov/services/gis/Maps/imap.aspx.

[5] "National Wetlands Inventory: U.S. Fish & Wildlife Service", https://www.fws.gov/program/national-wetlands-inventory.

wetland conditions were not observed where it occurs on parcel 1523069045; however, there may be riparian wetlands further upstream.

Aquatic Areas (Streams)

Four streams were identified in the Preliminary CAR within the vicinity of the project area extending approximately 700 feet from the intersection along Issaquah-Hobart Road SE and SE May Valley Road: Fifteen Mile Creek, Issaquah Creek, Nudist Camp Creek, and an unnamed tributary to Issaquah Creek.

Fifteen Mile Creek is a Type F perennial stream that originates to the east of the project area between Tiger Mountain and West Tiger Mountain. The stream flows westerly toward the project site, crossing Issaquah-Hobart Road SE approximately 1,635 feet south of the subject intersection and crossing SE May Valley Road approximately 750 feet southwest of the intersection. Fifteen Mile Creek joins Issaquah Creek to the west of the project area. Within the vicinity of the project area, Fifteen Mile Creek is subject to a 165-foot aquatic area buffer. There is no mapped 100-year floodplain, floodway, or regulatory floodplain along Fifteen Mile Creek.

Issaquah Creek is a Type S perennial stream subject to Shoreline Management Act jurisdiction as a Shoreline of the State. The stream originates to the south of the project area, near Taylor Mountain, and discharges to the southern end of Lake Sammamish. Within the vicinity of the project area, Issaquah Creek has a mapped FEMA 100-year floodplain and floodway. At this location, the stream has a 165-foot aquatic area buffer, as well as a Conservancy Shoreline designation which extends 200 feet landward from the ordinary high-water mark, 200 feet landward from the edge of the floodway to the landward edge of the 100-year floodplain, or to the landward edge any associated wetlands, whichever distance is greater.

Nudist Camp Creek is a Type F perennial stream that originates to the east of the project area, southwest of West Tiger Mountain. The stream flows westerly toward the project site, crossing Issaquah-Hobart Road SE approximately 1,065 feet north of the subject intersection. The crossing is listed as fish passable in the WDFW Fish Passage Inventory; however, the steep constructed step-pool reach immediately upstream of the crossing is listed as a partial barrier to fish passage. Within the vicinity of the project area, Nudist Camp Creek has a 165-foot-wide aquatic area buffer. There is no mapped 100-year floodplain, floodway, or regulatory floodplain along Nudist Camp Creek.

Looking downstream, an unnamed right bank tributary to Issaquah Creek is within the study area. The unnamed tributary to Issaquah Creek is considered to be a Type F stream by the DNR based on their water type modeling. No fish have been documented in this tributary, but it has been deemed gradient accessible to fish migrating from Issaquah Creek. The stream originates on a terraced plateau to the east of the project area and flows northwesterly down a ravine on the western aspect of the plateau. The stream flows from the base of the ravine and onto what appears to be an historical alluvial fan just east of the subject intersection. The stream was dry during a site assessment conducted by King County staff on July 14, 2022. During a follow-up survey on February 22, 2023, the stream was flowing at or about the ordinary high-water mark. Two days later on February 24, 2023, the stream was dry. Based on these observations, it was determined the stream is intermittent,
flowing for relatively short durations primarily during the rainy season. In addition, evidence of past manipulation was observed by County staff and impenetrable vegetation prevented staff from following the main stream channel. Additional investigation is needed to determine where the main channel flows and whether it is connected to the potential wetlands east of the intersection and south of SE 132nd Way. Stormwater along the east side of Issaquah-Hobart Road SE may be comingled with this natural conveyance.

Other Critical Areas

Most of the project area from just south of the intersection travelling north occurs within a seismic hazard area, and the entirety of the project area occurs within an erosion hazard area. Steep slopes are present along much of the eastern side of the project area. North of the intersection, the steep slopes are generally well-removed from the areas potentially affected by the project. However, south of the intersection, steep slopes occur immediately adjacent to the east side of Issaquah-Hobart Road SE and could be affected by project activities. A potential landslide hazard area occurs on the eastern side of Issaquah-Hobart Road SE, south of its intersection with SE 127th Street. Geologic critical areas within the vicinity of the project location, including seismic hazard areas, erosion hazard areas, potential steep slope hazard areas, and potential landslide hazard areas, are shown on Figure 8 of the Preliminary CAR.

The majority of the project area lies within a Category 2 critical aquifer recharge area, while the northern portion of the project area occurs within a Category 1 critical aquifer recharge area (Figure 9 of the Preliminary CAR). Most parts of the project area are listed as highly susceptible to groundwater contamination, and the north portion of the project area, near SE 132nd Way is within a wellhead protection area with a ten-year time of travel.

Issaquah Creek is listed as part of King County's wildlife network which was established to link high quality streams and open space lands and to minimize habitat fragmentation.

Cultural Resources

A cultural resources screening was performed by King County staff in January of 2020 and found there are no recorded, reported or suspected cultural resources at the project location. Regarding cultural resources within ½ mile of the project location, KING 7269 is the ethnographically recorded placename for Squawk Mountain. It is recorded as *dxkayu?al?tx*, which is translated by Waterman (c. 1920) as "a building for corpses." There are no other recorded, reported or suspected cultural resources within ½ mile of the project location.

Alternatives Design Criteria and Analysis

Alternatives Description

The primary purpose of the Issaquah Hobart Road SE/SE May Valley Road Improvement Project is to improve vehicle operations and increase safety for users of the intersection, by expanding on previous analyses performed at the Issaquah Hobart Road SE/SE May Valley Road intersection. After reviewing the existing and future conditions and guidance from County staff, the following two alternatives from King County's August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report* were identified to be further developed and analyzed for potentially meeting the Project's primary purpose:

- **Multi-Lane Roundabout.** The Multi-Lane Roundabout Alternative would construct a roundabout at the existing intersection and include two southbound lanes (one shared through/right lane, one through only lane), two eastbound lanes (one left-turn lane and one right-turn slip lane), and two northbound lanes (one shared left/through lane, one bypass lane for through movements). The eastbound right-turn lane would leave the intersection in a dedicated lane that would merge into the adjacent through lane. All lanes leaving the intersection in the north- and southbound direction would merge and tie into the existing two-lane roadway section. A concept for the Multi-Lane Roundabout is shown in **Figure *4***.

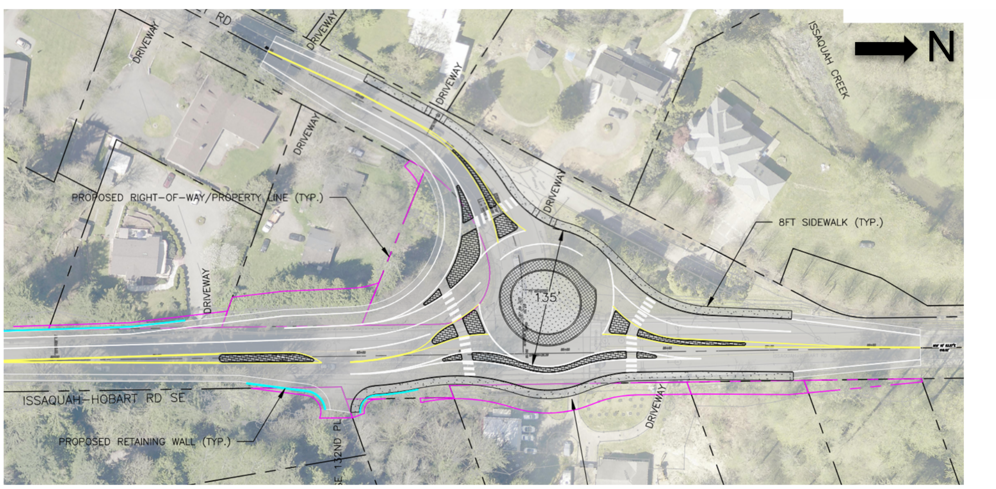


Figure 4 Multi-Lane Roundabout Concept

- **Modified Traffic Signal.** The Modified Traffic Signal Alternative would improve the capacity and geometry of the intersection and rebuild the traffic signal. Lane configurations would include two southbound lanes (one shared through/right lane, one through only lane), two eastbound lanes (one left-turn lane and one channelized right-turn lane), and three northbound lanes (one dedicated left-turn lane, two through lanes). Similar to the Multi-Lane Roundabout Alternative, the eastbound right-turn lane would leave the intersection in a dedicated lane that would merge into the adjacent through lane. All lanes leaving the intersection in the north- and southbound direction would merge and tie into the existing two-lane roadway section. A concept for the Modified Traffic Signal is shown in **Figure *5***.

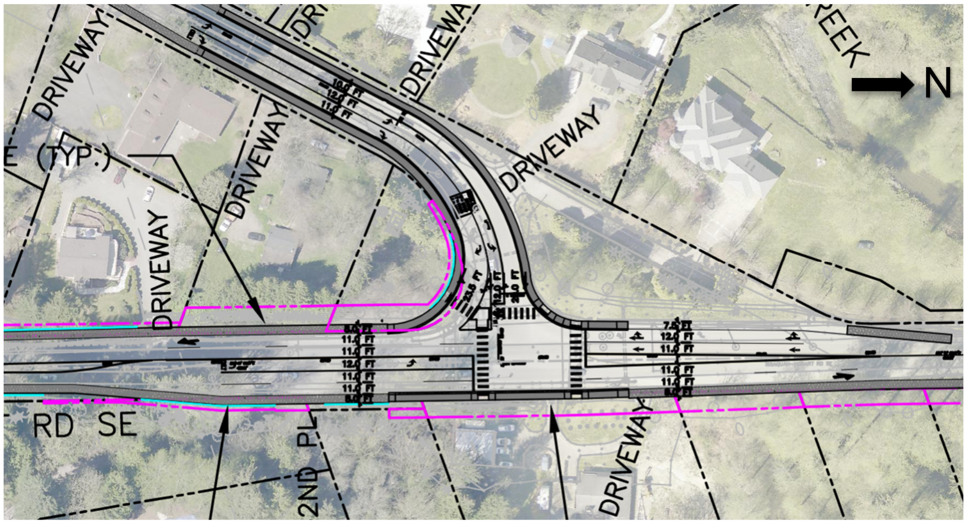


Figure 5 Modified Traffic Signal Concept

- **No Build.** The No Build alternative assumes the intersection would remain in its existing condition with only maintenance related improvements occurring through the design life of the project.

Conceptual layouts of the Multi-Lane Roundabout and Modified Traffic Signal Alternatives are shown in Appendix E.

Traffic Analysis

The following section summarizes the review and subsequent traffic analysis of the County-provided VISSIM model and operational characteristics of the intersection of Issaquah-Hobart Road SE and SE May Valley Road. After modifying the VISSIM network, the roundabout and signalized alternatives were run in VISSIM eleven times per scenario and averaged to obtain results. Simulations were run for two scenarios:

- Modified Traffic Signal
- Multi-Lane Roundabout

The Modified Traffic Signal and Multi-Lane Roundabout alternatives were chosen to be consistent with the traffic signal and roundabout alternatives developed in King County's August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report*. In the County's 2019 report, the Modified Traffic Signal alternative is identified as Alternative 14 and the Multi-Lane Roundabout alternative is identified as Alternative 20. The VISSIM model contained two different alternatives for the intersection. One alternative demonstrated the use of a roundabout (Alternative 20), and the other utilized a signal (Alternative 14) to control traffic at the intersection. The model was prepared for both the AM and PM peak hours with a horizon year of 2043, and included both upstream and downstream intersections along Issaquah-Hobart Road SE. The horizon year indicates the analysis year that the project will be evaluated under future conditions.

Future Traffic Conditions

Future traffic volumes were developed from the County's August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report*. As stated in the report future AM and PM period volumes in the Opening year 2023 and design year 2043 were projected based on the growth rates from the previous joint study (*Issaquah-Hobart Road/Front Street*

Corridor Study dated on March 2018) which was prepared for King County and The City of Issaquah by Transpo Group.

Table 3. Future AM and PM Peak Period Annual Vehicle Growth Rates

Time Period	Direction	Annual Growth Rate
AM Peak Period	Northbound	1.00%
	Southbound	1.90%
PM Peak Period	Northbound	1.40%
	Southbound	1.00%

Source: Issaquah-Hobart Road/Front Street Corridor Study, Transpo Group, March 2018.

As stated in the County's 2019 traffic report, during the AM peak period, the northbound direction is the peak direction and is already at capacity on several segments, the southbound direction would have more room for growth than the northbound direction. During the PM peak period, travel speeds are higher in the northbound direction than the southbound direction, indicating more room for growth for the northbound direction. There is not as much anticipated growth in the southbound direction as this is the peak direction of travel for the afternoon commute. The corridor is at or near capacity in the study area during this time period and there is very limited room for a high amount of growth.

Figure *6* summarizes future design year (2043) weekday AM and PM peak hour turning movements at the intersection.

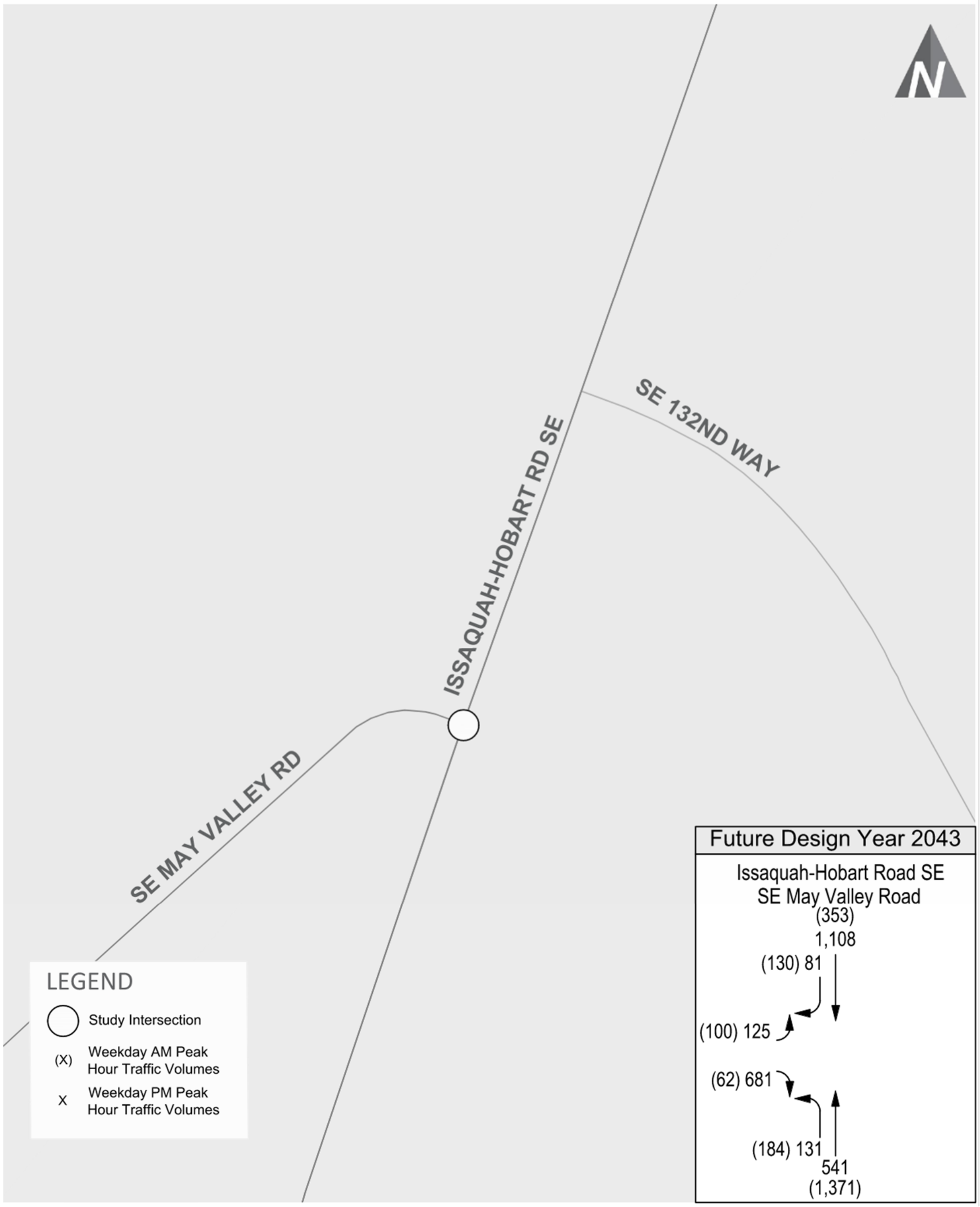


Figure 6 Future Design Year (2043) Weekday Peak Hour Traffic Volumes

Alternatives Traffic Analysis

The following section summarizes intersection operations analysis completed as part of the VISSIM review and traffic analysis.

Alternative 1 – No Build

The No Build Alternative maintains existing channelization, signalized traffic control, and signal timing parameters. The No Build Alternative was evaluated in Synchro 11 for intersection level of service (LOS) and delay using the future (2043) weekday peak hour traffic volumes summarized in **Figure *6***. Operations were evaluated at the Issaquah-Hobart

Road SE/SE May Valley Road intersection using Synchro and HCM 2000 methodology due to signal timing restrictions with the HCM 6th Edition. Table 4 summarizes the intersection operations results.

Table 4. 2043 Alternative 1 – No Build Traffic Signal LOS Summary (Synchro Analysis)

	Weekday AM Peak Hour		Weekday PM Peak Hour	
Intersection	**LOS**	**Delay (s)**	**LOS**	**Delay (s)**
Issaquah-Hobart Rd SE / SE May Valley Rd	F	155.4	F	287.9

As shown in Table 4, with the No Build Alternative, the intersection operates at LOS F under future (2043) weekday AM and PM peak hour conditions.

Alternative 14 – Modified Traffic Signal

The traffic signal alternative initially included a northbound slip/bypass lane, which was changed during the review phase to a standard northbound-through lane. The resulting channelization is generally shown in **Figure 7**.

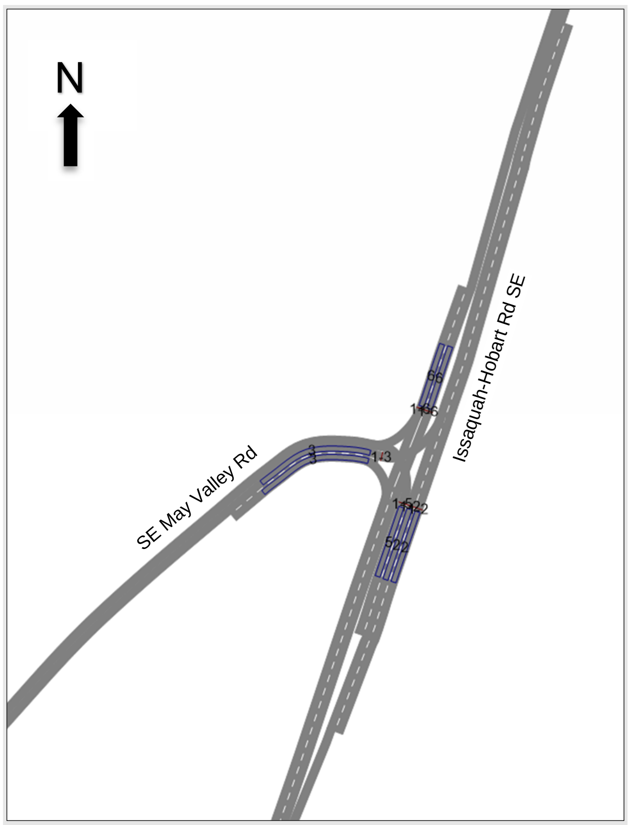


Figure 7 VISSIM Channelization for Signalized Option

The simulation for the 2043 horizon year was run for the AM and PM peak hours. The signal timing for each run was determined by putting the peak hour traffic volumes into Synchro 11 and optimizing the signal's cycle length and splits. The signal was set up in Synchro 11 as an actuated-uncoordinated signal.

Modified Traffic Signal Analysis Results

The volumes, delay, Level of Service (LOS), and queuing at the intersection are shown in Table 5.

Table 5. 2043 Alternative 14 – Modified Traffic Signal LOS Summary (VISSIM Analysis)

	Weekday AM Peak Hour				Weekday PM Peak Hour			
Intersection	Delay (s)[1]	LOS[2]	50th Percentile Queuing (WM)[3]	95th Percentile Queuing (WM)[3]	Delay (s)	LOS	50th Percentile Queuing (WM)	95th Percentile Queuing (WM)
Issaquah-Hobart Rd SE / SE May Valley Rd	15	B	10 ft (NB)	40 (SB)	115	F	1,940 ft (EB)	1,945 ft (EB)

1. Average delay in seconds per vehicle.
2. Level of service based on HCM 6th Edition methodology.
3. Movement with the longest queue reported. EB = eastbound, NB = northbound, SB = southbound.

As shown in Table 5, the signalized option operates at LOS B with 15 seconds of delay in the AM peak hour and LOS F with 115 seconds of delay during the PM peak hour. The failing LOS in the PM peak hour is largely due to the high volumes for the southbound through and eastbound right movements. The signal was set so that the eastbound right turns may overlap with the northbound left phase; however, this adjustment was not enough to handle the excessive volumes.

In addition, as part of King County's August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report,* future 2043 operations analysis of the Alternative 14 traffic signal were evaluated. Operations were evaluated at the Issaquah-Hobart Road SE/SE May Valley Road intersection using Synchro. Table 6 summarizes the intersection operations results.

Table 6. 2043 Alternative 14 – Modified Traffic Signal LOS Summary (Synchro Analysis)

	Weekday AM Peak Hour		Weekday PM Peak Hour	
Intersection	LOS	Delay (s)	LOS	Delay (s)
Issaquah-Hobart Rd SE / SE May Valley Rd	B	14.6	C	30.8

As shown in Table 6, the Synchro analysis shows the signal alternative operating at LOS B and C in the weekday AM peak hour and weekday PM peak hour, respectively. The Synchro and VISSIM analysis results show that the delays at the intersection are primarily due to downstream queueing.

Alternative 20 – Multi-Lane Roundabout

For the roundabout alternative, the northbound slip/by-pass lane was maintained. The eastbound right-turn movement was then modified via the addition of its own slip/by-pass lane to accommodate the high PM peak hour volumes. Additionally, reduced speed areas were introduced to the VISSIM model throughout the roundabout to ensure vehicles were driving at appropriate speeds through the roundabout. This resulted in the general channelization shown in **Figure *4***.

The same volumes were applied to the roundabout as the signalized alternatives, and the same simulation methodology was followed.

Multi-Lane Roundabout Analysis Results

The LOS summary for this alternative is shown in Table 7.

Table 7. 2043 Alternative 20 – Multi-Lane Roundabout LOS Summary (VISSIM Analysis)

	Weekday AM Peak Hour				Weekday PM Peak Hour			
Intersection	Delay (s)[1]	LOS[2]	50th Percentile Queuing (WM)[3]	95th Percentile Queuing (WM)[3]	Delay (s)	LOS	50th Percentile Queuing (WM)	95th Percentile Queuing (WM)
Issaquah-Hobart Rd SE / SE May Valley Rd	8	A	1 ft (EB)	5 ft (EB)	76	F	1,370 ft (EB)	1,410 ft (EB)

1. Average delay in seconds per vehicle.
2. Level of service based on HCM 6th Edition methodology.
3. Movement with the longest queue reported. EB = eastbound, NB = northbound, SB = southbound.

As shown in Table 7, the roundabout is forecast to operate at LOS A with 8 seconds of delay in the AM peak hour and LOS F with 76 seconds of delay in the PM peak hour. The failing PM peak hour is largely due to the same reasons as the signalized alternative, which are extremely high southbound through and eastbound right-turn volumes in combination.

In addition, as part of King County's August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report,* future 2043 operations analysis of the Alternative 20 multi-lane roundabout were evaluated. Operations were evaluated at the Issaquah-Hobart Road SE/SE May Valley Road intersection using Sidra. Table 8 summarizes the intersection operations results.

Table 8. 2043 Alternative 14 – Multi-Lane Roundabout LOS Summary (Sidra Analysis)

	Weekday AM Peak Hour		Weekday PM Peak Hour	
Intersection	LOS	Delay (s)	LOS	Delay (s)
Issaquah-Hobart Rd SE / SE May Valley Rd	B	10.4	D	25.3

As shown in Table 8, the Sidra analysis shows the roundabout alternative operating at LOS B and D in the weekday AM peak hour and weekday PM peak hour, respectively. The Sidra and VISSIM analysis results show that the delays at the intersection are primarily due to downstream queueing.

Traffic Safety

As stated in the August 2019 *Issaquah-Hobart Road SE/SE May Valley Road Corridor Study Traffic Analysis Report* (included in Appendix A), collisions within the study area were predominantly rear-end collisions. The following section summarizes potential mitigation for common collision types within the study area, as summarized in King County's 2019 report.

Rear end collisions occur when one vehicle following another vehicle crashes into the rear end of the leading vehicle. A typical scenario for rear end collisions includes sudden deceleration caused by the leading car and the following car not having enough time and failing to stop. Some potential improvements to mitigate rear end crashes are roundabouts, turn lanes, and high friction surface treatments. High friction surface treatments or HFST, involves the application of aggregates to the pavement surface to increase friction along the treated area which helps motorists maintain better control. This potentially reduces the braking distance required when there is a sudden need to stop, resulting in fewer rear end crashes. In general, the operating speed when going through a roundabout is significantly lower than that of a signal. Therefore, the braking distance required to safely stop a vehicle is dramatically reduced, which in turn reduces the likelihood of rear end crashes. Turn lanes move vehicles waiting to make a left turn into a driveway or side street out of the flow of traffic, which also reduces the likelihood of rear end crashes.

Angle collisions occur when the front of one vehicle hits the side of another vehicle. Angle collisions often occur when one of the two vehicles fails to yield when making a turning movement. Roundabouts and channelization improvements can reduce angle collisions. Roundabouts reduce the amount of conflict points between vehicles as compared to a comparable intersection which is signalized, which in turn reduces the likelihood of angle collisions. Also, roundabouts change the angle of entry, so it is more likely to be a sideswipe type of crash as opposed to an angle collision. Channelization improvements employ the idea of separating flows of traffic from the main lanes. Because certain movements are separate, the chances of an angle collision are reduced because different turning movements no longer interact and yield to one another.

Resources documenting crash reductions relevant to the Multi-Lane Roundabout and Modified Traffic Signal were consulted to determine appropriate crash reduction factors to help estimate the change in expected frequency and severity of crashes for these two alternatives.

For the Muti-Lane Roundabout alternative, information was readily available in FHWA'a Crash Modification Factor (CMF) clearinghouse[6]. Crash reductions were estimated for the following severity types:

- Property Damage Only: 48%
- Serious Injury: 78%
- Fatality: 90%

For the Modified Traffic Signal Alternative, research regarding the impact of these improvements on safety was very limited. No crash modification factors were available in FHWA's CMF clearinghouse for these improvements. NCHRP Report 707, *Guidelines on the Use of Auxiliary Through Lanes at Signalized Intersections*, provided general observations regarding the safety implications for adding additional through lanes to the signalized intersections. The authors of that report concluded, in general, the addition of Auxiliary Through Lanes (ATL) increased certain types of crashes while decreased other types. Specifically, the addition of ATL's would be expected to reduce congestion and rear-end crashes that are due to that congestion. In contrast, the introduction of a downstream merge condition would be expected to increase the number of sideswipe crashes. Based on this information, as well as the fact that most of the historic crashes experienced at the intersection were rear-end crashes, it was estimated that the Modified Traffic Signal Alternative would reduce overall crashes by 5%.

Soil and Geotechnical

Soil and Geotechnical Design Criteria

Provided below is a summary of the soil and geotechnical design criteria identified for the proposed intersection improvement project.

Slopes and Retaining Walls

Cut and fill slopes will likely be needed for improvements associated with the project. Where permanent cut and fill slopes cannot practically be graded at 2H:1V or flatter, reinforced slopes or retaining walls will be required. Reinforced slopes or retaining walls may also be required due to right-of-way restrictions or to limit possible encroachment into critical/sensitive areas. We anticipate retaining walls for this project will be less than 8 feet in

[6] "Crash Modification Factors Clearinghouse", https://www.cmfclearinghouse.org/.

total height. The following is a description of various walls that may be acceptable for use on this project:

Structural Earth Walls

Structural Earth Walls (SEW) are a cost-effective alternative to retain engineered fills. Many SEW systems are proprietary such as Hilfiker, ARES, or MESA. SEW are constructed by placing either metal or geosynthetic tensile members horizontally between lifts of compacted granular backfill to form a self-supporting gravity structure. These walls are well suited for areas of expected settlement due to their relatively large tolerance for differential settlement. Wide ranges of facing units are adaptable to most of the various SEW systems. The choice of facing is dependent on aesthetics and economic requirements. Design values for the various wall systems must be based on specific site conditions, geotechnical parameters, and manufacturer specifications. As with reinforced slopes, the metal or geosynthetic tensile members generally extend horizontally back behind the face of the slope, between 70 percent and 100 percent of the wall height. For preliminary planning purposes, it can be assumed that minimum base width/reinforcement length equal to the height of the wall will be required.

Gravity Block Walls

Gravity blocks depend on their weight for stability and can be used as erosion-resistant facing against stable native cuts up to eight feet in total height or designed to act as a gravity retaining structure. The walls are constructed of precast concrete blocks that are relatively simple to place. A variety of facings are available from the various manufactures of gravity blocks. Base widths for gravity retaining structures are on the order of 50 to 60 percent of the wall height. When used to retain cuts, it should be recognized that a temporary excavation slope will be required to install the blocks, and the required temporary excavation slopes may need to extend beyond the limits of the right-of-way, depending on site geometry and soil conditions.

Gabion Walls

A gabion wall is a flexible gravity structure that depends on its own weight for stability and can sustain relatively large differential settlements without serious distress. The walls are constructed using preformed baskets made of heavy galvanized wire that are backfilled with quarry spalls. Gabion walls can be terraced to allow for placement of topsoil and the establishment of vegetation to soften the appearance of the structure. Base widths for gravity retaining structures are on the order of 50 to 60 percent of the wall height. Gabion walls can be used to retain cuts and fills, but they are typically used to retain fills.

Soldier Pile Walls

A soldier pile wall system generally consists of steel H piles or wide flange sections for vertical elements that are placed in predrilled, concrete-filled holes. Typical vertical spacing of piles is 6 to 10 ft. Timber lagging is typically placed horizontally to temporarily retain the earth between piles as excavation proceeds. For permanent soldier pile walls, cast-in-place concrete fascia panels can be installed in front of the timber lagging. Soldier pile walls have the advantage of being adaptable to existing underground utilities or structures, which can be avoided by judicious layout of the piles. The system can also be adapted to an irregular wall alignment. Also, the system eliminates the need for temporary excavation slopes that could extend beyond the limits of the right-of-way. Solider pile walls with a maximum exposed height of 8 feet or less will likely not require tiebacks.

Pavement

In 2020, King County observed that the existing asphalt in all lanes of the intersection of Issaquah-Hobart Rd SE and SE May Valley Rd was generally in good condition with little to no distress visible in the pavement. Based on this observation, the County recommended that the existing asphalt pavement be left in place where feasible and overlaid during construction. Full depth pavement sections will be required for all newly widened road sections. Using the existing road shoulders as part of any new driving lane section is not recommended unless a pavement evaluation is performed. This evaluation should analyze the structural capacity of the shoulder pavement and determine if any improvement is needed before the shoulder pavement is incorporated into the new driving lane section.

The County's 2020 geotechnical document recommends the following pavement design sections for the intersection improvement project:

Full Depth Pavement Section
0.17 feet minimum compacted depth HMA, Class ½" PG58H-22 (Wearing Course)
0.50 feet minimum compacted depth HMA, Class ½" PG58H-22 (Leveling Course)
0.50 feet minimum compacted depth Crushed Surfacing Base Course (CSBC)

Overlay Pavement Section Existing Roadway
0.17 feet minimum compacted depth HMA, Class ½" PG58H-22

Stormwater Design

When using the Western Washington Hydrology Model to size infiltration facilities, the user must select one of three basic soil types: A/B (outwash soils), C (till), or SAT (saturated/ wetland/hydric soils). Because the predominate soil type that underlies the project alignment is saturated younger alluvium, soil type "SAT" may be used to preliminarily size stormwater facilities for the project.

Soil and Geotechnical Alternatives Analysis

The Multi-Lane Roundabout and Modified Traffic Signal Alternatives were evaluated from a geotechnical perspective. More specifically, the retaining wall, new pavement, and stormwater facilities needs for each alternative were evaluated. Provided below is a summary of this evaluation.

As currently envisioned, the roundabout alternative will require three cut walls and the Modified Traffic Signal Alternative will require five cut walls and one fill wall. The total length of walls required for the Modified Traffic Signal Alternative is about three times greater than the total length required for the Multi-Lane Roundabout Alterative. Based on the total length of walls required for each alternative, the estimated cost to construct the retaining walls for the roundabout alternative is anticipated to be significantly less than the estimated cost for the walls needed for the Modified Traffic Signal Alternative.

Environmental

Environmental Design Criteria

Impacts to critical areas in the vicinity of the project area will be avoided or minimized to the maximum extent possible through project design, construction timing, and use of Best Management Practices. Mitigation and restoration requirements will be developed in conjunction with project design and with the participation of applicable regulatory agencies. All areas temporarily disturbed during the project will be restored with a combination of amended soils, native vegetation, and cover measures (e.g., erosion-control matting and mulch) where applicable after construction. These areas will be monitored to ensure compliance with regulations, mitigation obligations, and permit conditions. If compensatory mitigation is required, on-site mitigation consisting of habitat enhancement will be prioritized. If on-site mitigation is not practicable, then off-site mitigation opportunities will be pursued.

Project impacts and mitigation will be documented in a mitigation and monitoring plan to be developed once a preferred alternative is chosen and design progresses.

The Preliminary CAR prepared by the County identified several critical areas as well as the need for additional field work to further delineate potential wetlands and aquatic areas. If found during subsequent investigations, regulated wetlands will be categorized and rated based on the adopted *Washington State Wetland Rating System for Western Washington: 2014 Update* (Hruby 2014; KCC 21A.24.318). The wetland ratings will be used to determine wetland buffer widths and mitigation ratios following KCC 21A.24.325 and 21A.24.340, respectively.

If determined necessary, the Ordinary High Water Mark (OHWM) will be mapped following guidance from the USACE (2005, 2014) and the Washington State Department of Ecology (2016). Stream buffer widths and mitigation ratios should be based on KCC 21A.24.358 and KCC 21A.24.380, respectively.

Development standards for seismic hazard areas are found at KCC 21A.24.290, and standards for erosion hazard areas are found at KCC 21A.24.220.

Development standards for steep slopes and landslide hazard areas are found at KCC 21A.24.310 and KCC 21A.24.280, respectively.

Development standards related to protecting critical aquifer recharge areas are found at KCC 21A.24.314.

Development standards related to wildlife networks are set forth by KCC 21A.24.383 and KCC 21A.24.386. These standards are intended to ensure habitats remain connected across the landscape after development of any urban planned development or individual lots on the network. These standards do not apply to the public road right-of-way and no additional analysis is warranted.

The following permits and approvals are anticipated for the project, depending on the type of funding:

- National Environmental Policy Act Documentation/Approval (if federally funded)
- Endangered Species Act Section 7 Documentation/Approval (if federally funded or requires a federal permit)
- U.S. Army Corps of Engineers (USACE): Clean Water Act (CWA) Section 404 Authorization (if there are impacts to Waters of the U.S.)
- State Environmental Policy Act Documentation/Review
    - Environmental Checklist
    - Threshold Determination
    - Notice of Action Taken
- Washington State Department of Ecology:
    - CWA Section 401 Water Quality Certification (if a USACE permit is needed)
    - Construction Stormwater General Permit
- Washington State Department of Fish and Wildlife (WDFW):
    - Hydraulic Project Approval (if there are impacts to Waters of the State)
- King County Permitting Division
    - Clearing and Grading Permit
    - Critical Areas Alterations Exception (if stormwater treatment facilities are within critical area buffers)
- Shoreline Management Act Exemption (project is exempt if work in the Shoreline boundary does not occur below the ordinary high-water mark of Type S waters)

Environmental Alternatives Analysis

Determining the exact impacts to critical areas caused by each alternative were not quantifiable with the information currently available in the Preliminary CAR. However, a high-level assessment of potential impacts using the findings of the Preliminary CAR as well as further discussions with County staff was performed for each alternative. Proposed improvements for each alternative may result in the following impacts:

- Modified Traffic Signal
  - Substantial impacts to buffer areas of Issaquah Creek, the unnamed tributary to Issaquah Creek, Fifteen Mile Creek, and Nudist Camp Creek. Most of these impacts occur north of the intersection but impacts to buffer areas of Fifteen Mile Creek south of the intersection are also expected. Impacts to the north of the intersection include widening of the roadway as well as the potential need to locate stormwater facilities within stream buffer areas. Impacts south of the intersection include widening needed to facilitate the required lane reduction merge. This widening is expected to extend within 200 feet of Issaquah-Hobart Road SE crossing of Fifteen Mile Creek.
  - Impacts to existing stream crossings of Issaquah-Hobart Road SE with the unnamed tributary to Issaquah Creek and Nudist Camp Creek to the north. This will most likely require replacement of the existing crossing structures which may need to be fish passable. This would add significant costs to the project and significantly impact the schedule of the project due to the need to perform work within in-water work windows.
- Multi-Lane Roundabout
  - Impacts to buffer areas of Issaquah Creek and the unnamed tributary to Issaquah Creek. Most of these impacts occur north of the intersection but minor impacts to buffer areas of Fifteen Mile Creek south of the intersection may occur. Impacts to the north of the intersection include widening of the roadway as well as the potential need to locate stormwater facilities within stream buffer areas. Impacts are expected to be less than the Modified Signal Alternative due to the smaller footprint of the Multi-Lane Roundabout Alternative, the avoidance of impacts to the culverts of Nudist Camp Creek and the unnamed tributary to Issaquah Creek, and the ability to tie back into the existing roadway sooner.

As mentioned, additional fieldwork and analysis are needed to further delineate critical areas and define impacts in the Final CAR. While this information will be critical for the design of the preferred alternative, based on the information obtained in the Preliminary CAR as well as further discussions with County staff, it is not anticipated that this additional information will result in significant changes to the alternatives analysis.

In addition to critical areas, the project has the potential to reduce greenhouse gas emissions through the increased efficiency of the intersection and reduced idling and slow-moving traffic. Based on the traffic operations analysis, it is estimated that the Modified Traffic Signal Alternative will reduce fuel consumption by approximately 11.7% while the Multi-Lane Roundabout Alternative will experience an estimated 61.5% reduction.

It should be noted that, due to the likely inability to infiltrate 100% of the project's stormwater runoff due to the high groundwater table, it is highly likely that the project review under the Endangered Species Act (ESA) will require a formal consultation. This will impact the project schedule as presently it takes more than two years to assign an ESA reviewer of a project's biological assessment. This is the case for either the Multi-Lane Roundabout or Modified Traffic Signal Alternatives.

Finally, the general setting of the project within the valley of Issaquah Creek suggests a moderate likelihood for unknown buried intact prehistoric archaeological deposits. The presence of existing road prism, prior road alignments, drainage and utilities reduces this likelihood a great deal. As FHWA funds are anticipated for this project, then National Historic Preservation Act Section 106 procedures, beginning with the formal definition of an APE and consultation will be required. After the APE has been defined an archaeological survey and building inventory will need to be conducted within the APE. Section 106 exemptions for geotechnical borings and wetland delineation have already been obtained from WSDOT for this project. As for all Road Services Division (RSD) projects, if cultural resources or human remains are encountered during construction all work will cease and RSD policies will be followed.

Stormwater and Drainage

The preliminary layouts for both the Multi-Lane Roundabout and Modified Traffic Signal Alternatives were evaluated using the *King County 2021 Surface Water Design Manual* (KCSWDM)[7].

Stormwater Design Criteria

The preliminary layouts for the Multi-Lane Roundabout and Modified Traffic Signal Alternatives were used to determine the amount of existing, new, and replaced impervious surfaces within this project site. The impervious surface areas and thresholds calculated as part of this analysis are based on the preliminary concept drawings shown in Appendix E. This planning level analysis will need to be updated once an alternative is chosen, and final design begins. The calculated areas are detailed in Table 9 and Table 10.

Table 9. Impervious Surfaces – Multi-Lane Roundabout Alternative

	PGIS*		NPGIS**		Total Impervious	
	SF	Acres	SF	Acres	SF	Acres
Existing	75,965	1.74	2,000	0.05	77,965	1.79
New* **	22,512	0.52	18,006	0.41	29,138	0.67
Replaced	45,743	1.05	985	0.02	58,108	1.33

*Pollution Generating Impervious Surfaces
**Non-Pollution Generating Impervious Surfaces
***Sidewalk converted to pavement is new PGIS but NOT new impervious

Table 10. Impervious Surfaces – Modified Traffic Signal Alternative

	PGIS*		NPGIS**		Total Impervious	
	SF	Acres	SF	Acres	SF	Acres
Existing	140,745	3.23	2,000	0.05	142,745	3.28
New* **	39,980	0.92	7,180	0.16	41,560	0.95
Replaced	28,090	0.64	413	0.01	34,103	0.78

*Pollution Generating Impervious Surfaces
**Non-Pollution Generating Impervious Surfaces
***Sidewalk converted to pavement is new PGIS but NOT new impervious

[7] "King County 2021 Surface Water Design Manual", https://kingcounty.gov/services/environment/water-and-land/stormwater/documents/surface-water-design-manual.aspx.

Both the Multi-Lane Roundabout and Modified Traffic Signal Alternatives will result in greater than 2,000 square feet of new and replaced impervious area. Therefore, based on Figure 1.1.2.A of the KCSWDM, this project will meet the threshold for a Full Drainage Review. A full drainage review requires that the project be evaluated for compliance with or exemption from all nine Core Requirements and all five Special Requirements of the KCSWDM.

Stormwater Alternatives Analysis

Based on the calculated impervious surface areas, a preliminary assessment of the Core Requirements for both build Alternatives was completed and detailed below.

Core Requirement #1: Discharge at the Natural Location

The proposed stormwater improvements for either the Multi-Lane Roundabout Alternative or Modified Traffic Signal Alternative will be designed to ensure that stormwater runoff and surface water discharged from the project site will not create a significant adverse impact to downslope properties or drainage facilities. Further analysis will be completed during final design.

Core Requirement #2: Offsite Analysis

An offsite analysis for either the Multi-Lane Roundabout Alternative or Modified Traffic Signal Alternative will be completed during final design. The selected Alternative will be evaluated to determine whether a full downstream analysis is warranted, and which level of analysis will be required. The *Off-site Analysis Drainage System Table* from the KCSWDM will be filled out and analyzed during final design for the option selected.

Currently, runoff from the intersection, as well as runoff from upstream of the project site, is conveyed in a series of ditches and pipes to a natural low spot in a small, treed area within the County's right-of-way (Area A, see figure below). Stormwater runoff is collected here before running north along Issaquah Hobart Road SE in a ditch, with evidence that stormwater sometimes runs onto the shoulder of the roadway where the ditch ends, before reentering a shallow ditch running north to Issaquah Creek. Area A is likely providing some amount of treatment and flow control for the existing runoff, though the full extent of the benefit provided is unknown at this level of analysis.

For either Alternative, runoff from the project site will be conveyed to a stormwater facility to provide treatment and flow control before being discharged offsite (see Core Requirements #8 and #9 below for further discussion of these facilities). There is insufficient space within the County right-of-way for these facilities, so additional right-of-way will need to be purchased. Potential properties are shown in the figure below (Areas B, C, and D). These properties are most feasible due to the natural flow of stormwater and topography in the project area. However, there is potential for wetlands at these locations, and critical areas investigations must be completed before the final location of proposed stormwater facilities can be addressed during final design.

The Modified Traffic Signal Alternative leaves Area A untouched; if this Alternative is selected, site runoff will be routed to the proposed stormwater facilities (located at Areas B, C, or D), and any runoff from upstream of the project site will continue draining to Area A and discharge to Issaquah Creek as it does under existing conditions. During final design, the conveyance system should be designed to ensure that offsite runoff does not enter the proposed stormwater facilities and instead continues flowing to the existing low spot at Area A in order to impact the existing downstream system as minimally as possible.

The Multi-Lane Roundabout Alternative will pave over most of Area A. As with the Modified Traffic Signal Alternative, if this Alternative is selected, site runoff will be routed to the proposed stormwater facilities. However, any runoff from upstream of the project site will need to be conveyed to a modified conveyance system, as it can no longer flow to the low spot in Area A. Additional offsite analysis will be required to determine how this alternative impacts the downstream water quality and flows. It is possible that additional treatment and/or flow control may be needed to mitigate the impacts caused by removing the natural low spot at Area A. The additional costs of this mitigation could potentially make the stormwater portion of the Multi-Lane Roundabout Alternative much more expensive than the stormwater for the Modified Traffic Signal Alternative. This risk has been accounted for in the cost estimate.

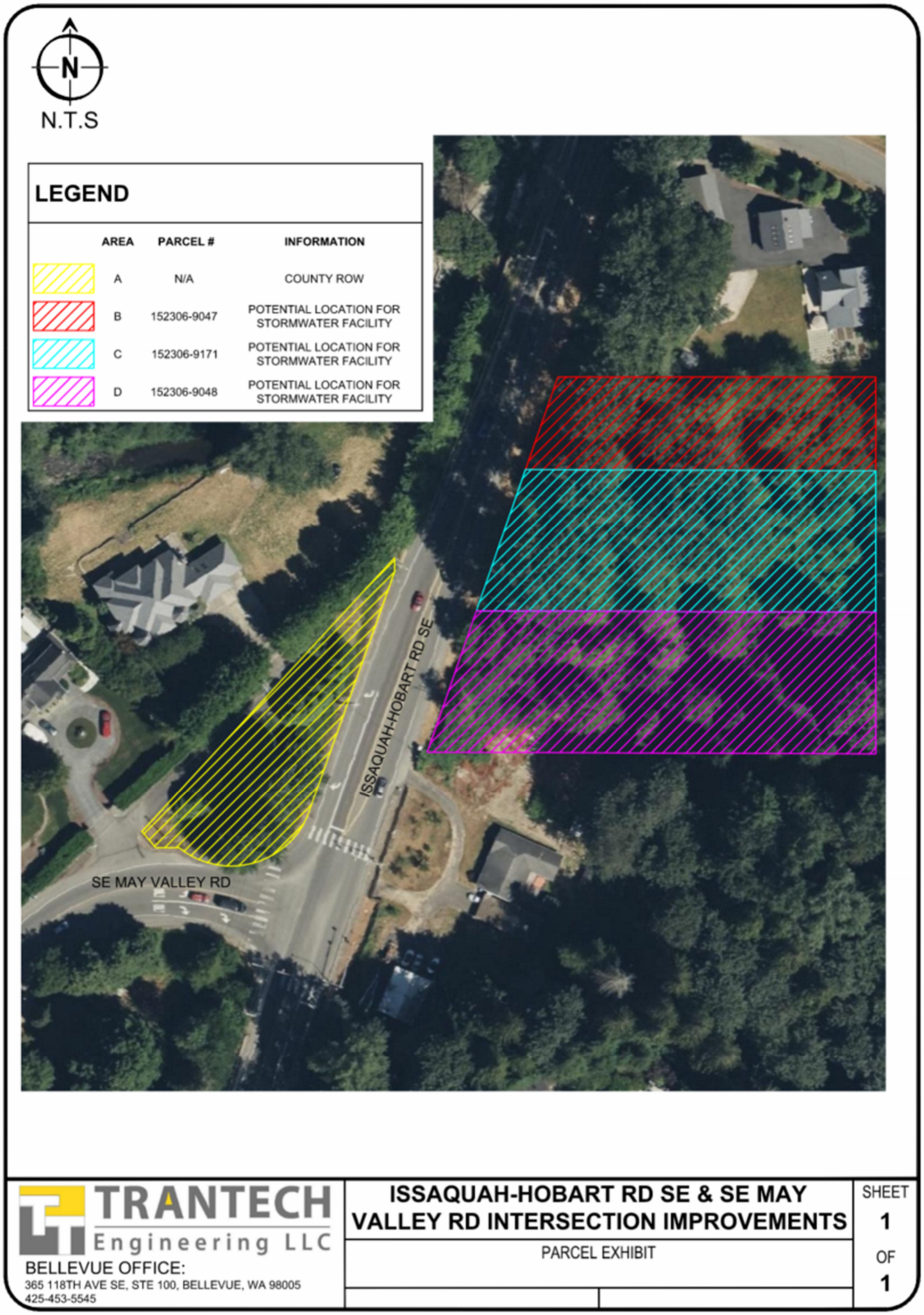


Figure 8 Potential Locations for Stormwater Facility

Core Requirement #3: Flow Control

Per the King County Flow Control Applications Map, this project is in a Conservation Flow Control Area. For this level of analysis, the requirements for Conservation Flow Control Area were used. This will be verified during final design. This project is not exempt from flow control requirements, as the stormwater runoff does not discharge to a Major Receiving Water listed on Table 1.2.3B of the KCSWDM.

Both the Multi-Lane Roundabout Alternative and Modified Traffic Signal Alternative add more than 5,000 square feet of new impervious surface and exemption from the flow control requirements do not appear to be achievable based on the preliminary design concepts; therefore, flow control is required for the new impervious surfaces for both Alternatives. The total area of new impervious surface is not greater than 50% of the existing area of impervious surface for either Alternative. Therefore, flow control is not required for the replaced impervious surface area.

Core Requirement #4: Conveyance System

A conveyance system for either the Multi-Lane Roundabout Alternative or Modified Traffic Signal Alternative will be evaluated during final design. It is anticipated that, at a minimum, a closed system utilizing catch basins will be constructed where there are walls and curb and gutter, and potentially along the length of the project. In some locations the natural ground slope is up to 1:4 so having ditches to convey stormwater would add excessive wall costs with drastic increases to the wall height being required if there was a roadside ditch for conveyance between the traveled way and the wall.

Core Requirement #5: Erosion and Sediment Control

A construction Stormwater Pollution Prevention Plan will be prepared during final design.

Core Requirement #6: Maintenance and Operations

Maintenance and operations will be addressed during final design. It may be feasible to use an existing plan.

Core Requirement #7: Financial Guarantees and Liability

Financial Guarantees and Liability will be addressed during final design.

Core Requirement #8: Water Quality

Per the King County Water Quality (WQ) Applications Map[8], this project is within a Sensitive Lake Water Quality Area. Per section 6.3.1 of the KCSWDM, the following facilities may be used for Sensitive Lake Protection:

- Large Wetpond
- Large Sand Filter
- Two-Facility Treatment Train

At this level of analysis, we recommend treating site runoff with a Large Wetpond before routing it to a stormwater detention vault. This will likely work best for the site's conditions and be the most economical option. King County Code does not allow stormwater facilities to be located within critical area stream buffers unless there are no other feasible alternatives. As

[8] "King County Water Quality Applications Map", https://your.kingcounty.gov/dnrp/library/archive-documents/wlr/dss/app_maps/h20qualt.pdf.

proposed stormwater facilities needs are further assessed and identified, they should be located to avoid critical area stream buffers, if feasible.

The Modified Traffic Signal Alternative adds more than 5,000 square feet of new PGIS, resulting in water quality treatment being required for the new PGIS. The total new area of impervious surface is not greater than 50% of the existing area of impervious surface so water quality treatment is not required for the replaced area of impervious surface. This Alternative results in 0.92 acres of new PGIS. For this level of design, water quality treatment was sized to accommodate all the runoff that requires flow control (0.95 acre). Western Washington Hydrology Model (WWHM2012)[9] was used to determine that a wetpond with a bottom area of 35 feet by 120 feet with a depth of three feet and 3:1 side slopes would be required.

The roundabout option adds more than 5,000 square feet of new PGIS, resulting in water quality treatment being required for the new PGIS. The total new area of impervious surface is not greater than 50% of the existing area of impervious surface so water quality treatment is not required for the replaced area of impervious surface. This Alternative results in 0.52 acres of new PGIS. For this level of design, water quality treatment was sized to accommodate all the runoff that requires flow control (0.67 acre). WWHM2012 was used to determine that a wetpond with a bottom area of 30 feet by 100 feet with a depth of three feet and 3:1 side slopes would be required.

Core Requirement #9: Flow Control BMPs

Due to high groundwater in the area, a stormwater detention pond is not feasible. For this analysis, it was assumed that a stormwater vault would be utilized to meet the flow control requirements. Using the soil type "SAT" in WWHM2012 for the predeveloped conditions, (see Soil and Geotechnical Analysis above), it was determined that a 55-foot by 55-foot by 7-foot vault would be needed for the Modified Traffic Signal Alternative and a 45-foot by 45-foot by 7-foot vault would be needed for the Multi-Lane Roundabout Alternative. Due to the groundwater levels within the project site and the depth requirements of vaults in the KCSWM, buoyancy will need to be addressed during final design.

Flow Control and Water Quality Treatment BMPs considered in this analysis were limited to those that are applicable in both the Sensitive Lake Water Quality Area and the Conservation Flow Control Area.

Special Requirements #1-5

The applicability of all five Special Requirements will be evaluated during final design.

Utility Impacts

Utility Design Criteria

Several utilities, including electrical, telephone, cable, communication, and gas are present within and/or adjacent to the project area. The primary routing for electrical appears to be overhead via power poles. Puget Sound Energy (PSE) has a project planned for summer 2023 to provide improvements to several of their utilities within the Issaquah-Hobart Road SE corridor, including within the project area. Undergrounding the high voltage electrical transmission lines is not feasible; so, overhead utilities are anticipated to remain within the project corridor. Project improvements appear to impact existing power poles; it is

[9] "Western Washington Hydrology Model", https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals/Western-Washington-Hydrology-Model.

recommended that King County coordinate proposed project improvements with PSE, if feasible. PSE may be able to design improvements to their system to accommodate the project and limit potential for utility rework.

Telephone, cable, and communication lines appear to be both overhead and underground. There are also several vaults, junction boxes, pedestals, and cabinets within the project limits. Gas lines appear to primarily be located on the west side of SE May Valley Road, running along the existing driveway on the NW corner of the intersection and connecting to and running along the west side of Issaquah-Hobart Road SE approximately 250-feet north of the intersection. No water or sanitary sewer lines have been identified within the project vicinity.

The costs for relocating impacted franchise utilities are expected to be borne by the providers; however, it is anticipated that the project will be responsible for costs to relocate impacted utilities on private property.

Utility Alternatives Analysis

Both the Modified Traffic Signal Alternative and the Multi-Lane Roundabout Alternative are anticipated to impact existing utilities to varying degrees. The estimated utility impacts for each alternative include:

- Modified Traffic Signal
    - Communication pedestals: **4 (within ROW)**
    - Power poles: **5 (within ROW); 1 (outside ROW)**
    - Feeder power poles: **1 (within ROW); 1 (outside ROW)**
    - Power pole anchor poles: **3 (within ROW)**
    - Communication vaults: **3 (within ROW)**
    - Power vaults: **1 (within ROW)**

- Multi-Lane Roundabout
    - Communication pedestals: **4 (within ROW)**
    - Power poles: **3 (within ROW); 1 (outside ROW)**
    - Feeder power poles: **1 (within ROW); 1 (outside ROW)**
    - Power pole anchor poles: **1 (within ROW)**
    - Communication vaults: **2 (within ROW)**
    - Power vaults: **1 (within ROW)**
    - Major communication vaults: **1 (outside ROW)**

When an alternative is selected and during final design, additional coordination will occur with utility providers to assess the extent of impacts, necessary mitigation, and potential options to lessen impacts where feasible.

Right-of-Way Requirements

General Requirements

While final construction funding is not currently identified for the project, it is anticipated that federal funding will be at least part of the final funding package. For federally funded projects, the acquisition process is regulated by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 and subsequent amendments. As implemented in Washington state, the following policies and procedures must be followed for federally funded projects:

- King County's approved ROW procedures
- WSDOT Local Agency Guidelines, Chapter 25
- WSDOT ROW Manual

Alternative Comparison of Requirements

ROW acquisition impacts were estimated for each alternative based on the conceptual layouts. The primary factors considered in assessing ROW impacts were the area of estimated ROW acquisition and number of parcels estimated to be impacted. Embankment slope grading and storm drainage should be further evaluated during detailed design to determine an accurate extent of ROW impacts and whether they can be further minimized. A detailed breakdown of ROW impacts by parcel are included in Appendix G. The estimated ROW impacts for each alternative include:

- Modified Traffic Signal
    - ROW acquisition: **36,850 square feet**
    - Number of parcels impacted: **12**
    - Notes: ROW impacts are anticipated to primarily result from the widening of Issaquah-Hobart Road SE. Most of the acquisition for the west side of the roadway occurs south of SE May Valley Road. Most acquisition for the east side of the roadway occurs north of SE May Valley Road.

- Multi-Lane Roundabout
    - ROW acquisition: **26,860 square feet**
    - Number of parcels impacted: **9**
    - Notes: ROW impacts are anticipated to primarily result from the construction of the roundabout at the Issaquah-Hobart Road SE and SE May Valley Road intersection. Most of the acquisition occurs at/near the intersection.

For each alternative, the full extent of ROW impacts resulting from stormwater needs is unknown and will be determined during final design.

Figure 9 Driveway to 13205 Issaquah-Hobart Rd SE

In addition to direct acquisition of ROW, each alternative will impact adjacent homeowners including impacts to driveways and access. Within the project limits there are 6 residential driveways along Issaquah-Hobart Road SE as well as accesses to SE 132nd Place and SE 132nd Way that provide access to several homes on the east side of the project area. Along SE May Valley Road there are 5 residential driveways within the project limits. All of these access points are anticipated to be impacted by the project due to regrading and short-term access limitations during construction. However, several access points are expected to have unique impacts as shown below in **Figure *10*** and described as follows:

- Driveway to parcel number 9058 (13205 Issaquah-Hobart Road SE) shown in **Figure 9** – The grade of this driveway will need to be reconstructed under both the Multi-Lane Roundabout and Modified Traffic Signal alternatives. This will most likely include reconstruction of a decorative security gate. Full access will be maintained under either alternative.

- SE 132nd Place – This roadway has a steep downgrade as it approaches Issaquah-Hobart Road SE. Both build alternatives will require widening of Issaquah-Hobart Road SE in this area and either alternative will require careful grading design to maintain access to this roadway. Both alternatives are anticipated to require retaining walls on both sides of this access. Full access will be maintained under either alternative.

- Driveway to parcel number 9049 (13030 Issaquah-Hobart Road SE) –There are currently two driveways serving this residence, one within the existing intersection area, and one approximately 65 feet north of the intersection. The access within the intersection is recommended to be closed under either the Multi-Lane Roundabout or Modified Traffic Signal alternatives due to difficult grading, the proximity of the access to the intersection, and considering the additional access north of the intersection. In addition, the geometry of the Multi-Lane Roundabout alternative would result in this driveway being located within the northbound through bypass lane and require the access to be restricted to right-in/right-out operation. The access to the north of the intersection will be maintained and have full access under each alternative. It should be noted that this access is very close to the intersection and maneuvers such as a left-turns in and out of the driveway could be difficult during heavy traffic. However, this is similar to the existing condition.

- Driveway to parcel numbers 0040 and 0046 (23426 and 23450 SE May Valley Road) – This driveway follows the old alignment of SE May Valley Road and serves two residents on the west side of the project. The driveway will remain similar to existing conditions under the Modified Traffic Signal alternative with minor grading adjustments. Under the Multi-Lane Roundabout alternative, this driveway will be realigned to access the roundabout directly, just north of the SE May Valley Road exit. This will maintain full access for both residences.

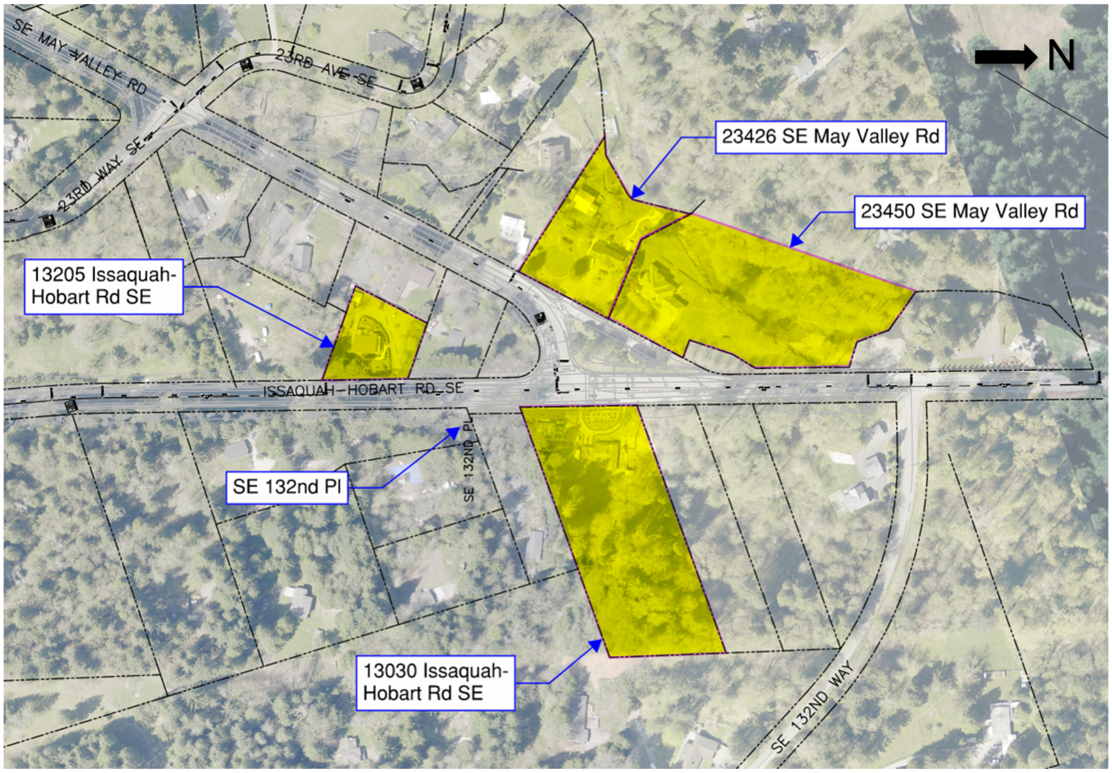


Figure 10 Potential Driveway/Access Impact Locations

Construction Risk Assessment and Costs

Constructability of Alternatives

Conceptual construction phasing figures have been provided in Appendix J. Detailed analysis for the constructability of the preferred alternative will occur during final design; however, a brief review has been performed and is summarized below.

Modified Traffic Signal

Construction of this alternative is anticipated to primarily occur over 4 phases. Most work could occur during Phases 1 through 3; “phase 4” is anticipated to consist of short duration lane closures, shoulder closures, and/or flagger/uniformed police officer (UPO) operations, as needed. Other than pre-leveling and isolated pavement repair where needed, significant changes to the roadway and horizontal and/or vertical alignments are not anticipated. Improvement to the existing pavement will largely consist of planing the existing pavement and providing a final overlay after the roadways have been widened. The planed pavement surface is anticipated to be drivable during construction, if necessary. The work areas for the construction of improvements, such as roadway widening, sidewalk construction, retaining walls, utilities, stormwater, and traffic signals are anticipated to primarily be located at the edges of the existing roadway while traffic continues to flow through the work area with minimal interruptions. Work to replace impacted creek crossing structures for the unnamed creek and Nudist Camp Creek will need to be coordinated with in-water work windows. It is anticipated that creek crossing structure work would be completed by implementing half-width construction methods whereby half of the roadway would be closed at a time; however, two-way traffic could continue to be maintained through the corridor with a one-lane operation (flaggers, temporary traffic signal, etc.). If necessary, existing lane widths may be reduced and/or lanes shifted to provide additional work zone area. While full and/or partial roadway closures may be needed and/or beneficial to implement improvements over short durations, it is expected that most work can occur while maintaining open traffic lanes through construction. It is anticipated that a temporary span-wire traffic signal may be required to construct road widening at the intersection.

Multi-Lane Roundabout

Construction of this alternative is anticipated to primarily occur over 5 phases. Most work could occur during Phases 1 through 4; “phase 5” is anticipated to consist of short duration lane/median closures, shoulder closures, and/or flagger operations, as needed. Construction of the new roundabout and widening is anticipated to require regrading of the entire intersection and modifications to the approach leg alignments and profiles. Given the anticipated need to re-grade the intersection, improvements to the existing pavement will largely consist of new pavement and base course. While a portion of the new roundabout will be constructed beyond the existing edges of pavement, the majority will be constructed within the existing intersection. It is anticipated that the roundabout will need to be constructed over several stages, each of which will result in shifting traffic as work area locations are moved. Like the traffic signal alternative, some of the work areas for the construction of other improvements beyond the intersection, such as retaining walls, stormwater, and utilities are anticipated to primarily be located at the edges of the existing roadway while traffic continues to flow through the work area with minimal interruptions. While full and/or partial roadway closures may be needed and/or beneficial to implement improvements over short durations, it is expected that most work can occur while maintaining open traffic lanes through construction.

Construction Timing of Alternatives

Detailed analysis of construction timing for the preferred alternative will be completed during final design. Although construction of the Multi-Lane Roundabout Alternative is expected to require multiple construction stages to implement, it is anticipated that construction of the Modified Traffic Signal Alternative will require more working days and will take an overall longer period to construct. The following are factors which contribute to the Modified Traffic Signal Alternative requiring more working days than the Multi-Lane Roundabout Alternative:

- The extent of roadway widening, including clearing and grubbing, roadway excavation, and borrow material is greater.
- The overall footprint and length of the project is greater, requiring more asphalt concrete pavement replacement and removal/installation of new guardrail where existing guardrail is impacted.
- The square footage of anticipated retaining walls is greater.
- Two culvert structures, potentially to be fish passable, are required to be constructed, which would need to be scheduled and sequenced with other improvements to occur within the in-water work window.

For the Modified Traffic Signal Alternative, the contractor may suspend their work for a period of time during construction to allow for obtaining long lead traffic signal poles, if needed. It is anticipated that the contractor would place orders for all equipment at the beginning of the project, complete most work, and if poles have not arrived by the time needed, then suspend work until traffic signal poles arrive. During work suspension, it is anticipated that the number of vehicle lanes, lane configurations for the roadway, and pedestrian accommodations would be established to match pre-construction conditions at a minimum. After work resumes, the contractor would complete the remaining work, which is anticipated to include the traffic signal system, channelization, punch list items, and final clean up.

Several factors go into establishing a construction schedule, many of which are unknown at the planning level of a project. Construction sequencing and methodologies may also be dependent on permitting requirements, contractor means and methods, the availability of materials, and agency requirements. A simplistic sequencing on a “typical” roadway and intersection construction project may include:

1. Construction contracting, material submittal approvals, procuring materials
2. Mobilization, traffic control setup, temporary erosion and sediment control setup
3. Site prep, clearing and grubbing, demolition, excavation
4. Relocation of utilities
5. Stormwater improvements
6. Subgrade preparation
7. Embankment, retaining wall, stormwater swale/ditch construction
8. Curb, gutter, sidewalk construction
9. Pavement construction
10. Barrier/Guardrail construction
11. Landscaping and stabilization
12. Channelization and signing
13. Final close out

The provided sequencing may vary from project to project and may include more or less of the steps provided. An engineer’s opinion of working days for each alternative is provided below. These estimates are based on other projects of a similar scale. These estimates are subject to change during detailed design and are only provided to assist in the comparison of alternatives.

- Modified Traffic Signal: **155 working days (see Table 11 below)**

- Multi-Lane Roundabout: **132 working days (see Table 12 below)**

Table 11. Working Days – Modified Traffic Signal Alternative

Work Item	Duration
Mobilization and TESC setup	5 days
Phase 1 traffic control setup and span wire signal	5 days
Completion of Phase 1	30 days
Phase 2 traffic control setup, adjustments to span wire signal	4 days
Completion of Phase 2	40 days
Phase 3 traffic control setup, adjustments to span wire signal	4 days
Completion of Phase 3	35 days
“Phase 4” traffic control setup, removal of span wire signal	4 days
Completion of “Phase 4”	12 days
Punch list, final project clean-up, and close out	10 days
TOTAL:	**149 days**

Table 12. Working Days – Multi-Lane Roundabout Alternative

Work Item	Duration
Mobilization and TESC setup	4 days
Phase 1 traffic control setup and span wire signal	4 days
Completion of Phase 1	25 days
Phase 2 traffic control setup, adjustments to span wire signal	2 days
Completion of Phase 2	35 days
Phase 3 traffic control setup, adjustments to span wire signal	3 days
Completion of Phase 3	10 days
Phase 4 traffic control setup, adjustments to span wire signal	5 days
Completion of “Phase 4”	25 days
“Phase 5” traffic control setup, removal of span wire signal	3 days
Completion of “Phase 5”	8 days
Punch list, final project clean-up, and close out	8 days
TOTAL:	**132 days**

Initial Construction Cost Estimate

Estimated quantities were calculated for each of the alternatives to allow for the development of construction cost estimates. The total cost estimate also includes a 10% contingency factor to cover unforeseen improvements that may be identified during detailed design. The proposed improvements/factors that are anticipated to contribute most to the construction costs for each alternative include:

- Modified Traffic Signal
    - Traffic signal system
    - Retaining walls
    - Widening Issaquah-Hobart Road SE
    - Nudist Camp Creek crossing structure impacts
    - Unnamed tributary crossing structure impacts
    - Utility impacts on private property
    - Stormwater enhancements
- Multi-Lane Roundabout
    - Realignment and reconstruction of intersection and approaches
    - Retaining walls
    - Roadway lighting system
    - Utility impacts on private property
    - Stormwater enhancements

Preliminary engineering cost for each alternative was estimated to be 20% of the total anticipated construction cost. Construction engineering cost for each alternative was estimated to be 20% of the total anticipated construction cost. Permanent ROW acquisition costs (except for stormwater improvements, as described previously) were evaluated for each anticipated parcel and included within the cost estimate. Project cost details for each alternative are included in Appendix F and summarized as follows:

- Modified Traffic Signal: **$12,249,730**
- Multi-Lane Roundabout: **$7,478,569**

Comparative Analysis

Choose by Advantage

The choose by advantages method of comparing alternatives identifies differentiating criteria between alternatives, and then identifies if, in isolation for a single criterion, an alternative provides an advantage or a significant advantage over the other alternatives, when compared to the existing conditions. Points are assigned to an option based on how much of an advantage is offered, typically 2 points for a significant advantage and 1 point for an advantage. In the end, a score is reached for each alternative, helping to guide the selection of a preferred alternative.

The alternatives were evaluated and scored based on the advantage each alternative presented for each evaluation criteria. The results of this analysis including explanations for each score is included in Appendix H and summarized in Table 13 below. Based on this evaluation, the Multi-Lane Roundabout presents significant advantages over the Modified Traffic Signal and No Build Alternatives. Total scores for each alternative are:

- Multi-Lane Roundabout – 11
- Modified Traffic Signal – 5
- No Build – 0

Table 13. Comparative Analysis

	Alternatives		
Criteria	**Multi-Lane Roundabout**	**Modified Traffic Signal**	**No Build**
Safety	2	1	0
Traffic Operations	2	2	0
Soil and Geotechnical	1	0	N/A
Environmental	2	1	N/A
Stormwater / Drainage	0	0	N/A
Utility Impacts	0	0	N/A
Right of Way Requirements	1	0	N/A
Constructability and Impacts to Travelling Public	1	0	N/A
Construction and Maintenance Costs	2	1	0

Life Cycle Cost Analysis

To assist in the evaluation of alternatives, a life cycle analysis was completed based on guidance provided by the County. The analysis takes into account three primary considerations: Project Costs, Maintenance Costs, and Societal Costs. Costs associated with each evaluation criteria were estimated and included in the life cycle cost analysis.

Project Costs
Project costs include preparation of environmental documentation, engineering design and Plans, Specifications, & Estimate (PS&E) development, right-of-way acquisition, construction engineering and management, and all labor, materials, and equipment necessary to construct project improvements.

Maintenance Costs
Maintenance costs include general maintenance activities, utility bills and maintenance of electrical equipment (traffic signal, lighting), upgrades to traffic signal systems, and replacement of the pavement wearing course (planing and overlay) over a period of 20 years at an annual interest rate of 4.5%. It is estimated that the annual maintenance cost for electrical equipment is $5,000, traffic signal system upgrades will be required in 15 years, and the life expectancy for the pavement wearing course is 10 years.

Societal Costs
Societal costs include estimated costs based on operational delay, collisions, and fuel consumption under each of the intersection alternatives. Operational delay costs are calculated using the number of vehicles entering the intersection per hour, the operational delay of the intersection during the weekday AM and PM peak hours, and assuming a 20-year life cycle of the intersection. Collision costs are calculated based on the number of property damage, injury, and fatality collisions at the intersection and the estimated reduction of collisions with the implementation of the Modified Traffic Signal or Multi-Lane Roundabout Alternatives. Fuel consumption costs are developed from the average vehicle fuel usage output from the Sidra analysis of each intersection alternative. Fuel consumption includes an assumed price of $4.00 per gallon.

Table 14. DRAFT Life Cycle Cost Analysis Summary

Alternative	Cost Type	Initial Cost	Life Cycle Cost Present Value	Total Cost Present Value (Rounded)
No Build	Project	-	-	-
	Maintenance	-	$594,948	-
	Societal	-	$27,943,331	-
	Total	-	*$28,538,279*	***$28,538,000***
Modified Traffic Signal	Project	$12,249,730	-	-
	Maintenance	-	$549,320	-
	Societal	-	$11,162,456	-
	Total	*$12,249,730*	*$11,711,777*	***$23,962,000***
Multi-Lane Roundabout	Project	$7,478,569	-	-
	Maintenance	-	$176,016	-
	Societal	-	$3,773,295	-
	Total	*$7,478,569*	*$3,949,311*	***$11,428,000***

Source: Transpo Group and King County

Risk Assessment

A risk assessment was performed relative to the evaluation criteria and based on information identified and developed as part of the alternatives analysis. The table below summarizes the risks identified through this project including the anticipated type and probability of impact.

Table 15. Risk Assessment Summary

Description	Eval. Criteria	Alternative	Impact (Scope, Schedule, Budget)	Probability (H, M, L)	Impact (H, M, L)	Mitigation Strategy
SB downstream merge may impact intersection operations in future.	Traffic Analysis	Both Build Alternatives	N/A	M	M	County to continue evaluation and plan for Issaquah-Hobart Road with potential future projects.
Steep slopes south of the intersection may require design changes as more detailed design is performed.	Soils and Geotechnical	Both Build Alternatives	Scope, Budget	L	M	County to collect additional survey data for future design efforts.
Culverts for unnamed tributary to Issaquah Creek and Nudist Camp Creek may be impacted, triggering replacement (new structure required to be fish passable).	Environmental	Modified Traffic Signal	Scope, Schedule, Budget	H	H	Impacts are unavoidable if risk occurs.
Impacts to critical areas may trigger off-site mitigation.	Environmental	Both Build Alternatives	Scope, Schedule, Budget	M	M	Depending on ROE's, additional survey data and final critical areas report will be used for 30% design efforts where more detailed impacts to buffers will be determined.
Inability to infiltrate 100% will trigger formal consultation for ESA review if federal funds or permits are involved.	Environmental	Both Build Alternatives	Schedule	H	H	Impacts are unavoidable if risk occurs. Project must follow ESA review process.
Potential for unknown buried intact prehistoric archaeological deposits.	Environmental	Both Build Alternatives	Schedule	L	L	Follow Section 106 procedures including definition of APE and archaeological survey and building inventory.
Placement of stormwater facilities may require additional ROW acquisition and impacts to critical area buffers.	Environmental	Both Build Alternatives	Scope, Budget	H	H	Additional survey data and final critical areas report will be used for 30% design efforts where stormwater facilities will be located and more detailed impacts to buffers will be determined.
Treatment of off-site flow may be required.	Environmental	Multi-Lane Roundabout	Scope, Budget	M	M	Additional analysis during final design will determine if risk is valid and what impact to the size of stormwater facilities will be required.
Construction easements may require impacts to trees and vegetation.	ROW	Both Build Alternatives	Budget	H	L	Construction easements will be identified in final design phase.
Unwilling property owners due to adverse impacts to property and driveways.	ROW	Both Build Alternatives	Schedule	M	L	Early identification of impacts and early coordination with property owners.

Source: Transpo Group
Note: H=high, M=medium, L=low

Conclusions and Recommendations

Based on the alternatives evaluation and life cycle cost analysis, it is recommended that the Multi-Lane Roundabout Alternative move forward into design and construction. This alternative is recommended for the following reasons:

- Based on the County's previous predictive safety analysis, the Multi-Lane Roundabout Alternative is expected to provide a higher anticipated reduction in collisions than the Modified Traffic Signal Alternative over the No Build condition.

- Based on the County's previous traffic studies as well as additional analysis performed as part of this study, the Multi-Lane Roundabout is expected to operate with less average delay than both the Modified Traffic Signal and No Build Alternatives. During the weekday AM peak hour, the Modified Traffic Signal Alternative operates at LOS B with 15 seconds of delay, while the Multi-Lane Roundabout operates at LOS A with 8 seconds of delay. During the weekday PM peak hour, both the Modified Traffic Signal and Multi-Lane Roundabout operate at LOS F with 115 and 76 seconds of delay, respectively.

- Based on the County's geotechnical investigation, the Multi-Lane Roundabout is expected to have less of an impact on steep slopes than the Modified Traffic Signal Alternative and require the construction of one third the amount of retaining wall.

- Due to its smaller footprint, it is anticipated that the Multi-Lane Roundabout Alternative will have a lower impact on critical areas than the Modified Traffic Signal Alternative. This includes lower impacts to stream buffers and the avoidance of impacts to two culverts on two streams identified by the DNR's Forest Practices Application Mapping Tool[10] as being fish-bearing, at the unnamed tributary just south of SE 132nd Way and at Nudist Camp Creek.

- Right-of-Way impacts and costs are expected to be lower for the Multi-Lane Roundabout Alternative. This includes the cost of acquisition as well as impacts to adjacent properties and driveways.

- Construction and maintenance costs of the Multi-Lane Roundabout Alternative are expected to be lower than the Modified Traffic Signal Alternative.

The Multi-Lane Roundabout did not provide a significant advantage over the Modified Traffic Signal or No Build Alternatives regarding the Stormwater/Drainage and Utility Impact evaluation criteria. Further, the Multi-Lane Roundabout did not provide an advantage over the No Build Alternative for criteria such as Soils and Geotechnical impacts, Environmental impacts, Right-of-Way impacts, and Construction Costs. However, the benefits provided by the Multi-Lane Roundabout in the areas of Traffic Operations and Safety outweigh the costs of these impacts as demonstrated by the life cycle cost analysis.

[10] "Forest Practices Application Mapping Tool", https://fpamt.dnr.wa.gov/.

Approvals

This CDR provides a feasible solution to the current and future transportation concerns by evaluating existing conditions; identifying alternative solutions; and recommending a preferred alternative, while taking into consideration the project budget. I also acknowledge that this CDR reflects the project team's consensus on the general scope of work for solving the given transportation problem.

Team Members and Individual Responsibilities:

- Joann Kosai-Eng, County Road Engineer
- Rose LeSmith, Engineering Section Manager
- Wally Archuleta, Managing Engineer
- Aileen McManus, Supervising Engineer
- Sayed Torak, Project Manager
- Susan Olive, Project Coordinator
- Katie Merrell, Environmental Lead
- Tanner Harris, Environmental Scientist (Wetlands)
- Tom Minichillo, Cultural Resources Archaeologist
- Casey Wagner, Geotechnical Engineer
- Trevor Cray, Survey Lead
- Wesley Kameda, Hydraulic Engineer
- Keith Brown, Traffic Engineer
- Dan Dovey, Traffic Engineer
- Leslie Drake, Lead Real Estate Manager
- Broch Bender, Communications Manager
- Victor Daggs, Construction Manager
- Jerry Brais, Contract Specialist
- John Kleinkopf, Landscape Architect
- Steve Conroy, Environmental Scientist (Streams)
- Hoda Sondossi, Environmental Scientist (Fluvial Geomorphologist)

I have reviewed this Concept Development Report and grant approval to the recommended alternative.

____ ____________
Rose LeSmith, P.E., Manager, Engineering Section Date

____ ____________
Joann Kosai-Eng, P.E., County Road Engineer, Road Services Division Date

Appendix A: Traffic Report

ISSAQUAH-HOBART ROAD SE/ SE MAY VALLEY ROAD CORRIDOR STUDY

Traffic Analysis Report

AILEEN MARIE MCMANUS
STATE OF WASHINGTON
54294
REGISTERED
PROFESSIONAL ENGINEER

8-16-2019

AUGUST 2019

King County
Department of Local Services
Road Services Division
Traffic Engineering Section

TABLE OF CONTENTS

LIST OF EXHIBITS

BACKGROUND AND INTRODUCTION

The Issaquah-Hobart Road corridor is a main route connecting Interstate 90 (I-90) in the City of Issaquah to State Route 18 (SR-18), and the communities of Hobart and Maple Valley. The road, which is named Front Street in Issaquah, is a heavily-used commute route, with a northbound peak direction during the morning peak period and the reverse in the afternoon peak period. It has experienced a substantial amount of growth in traffic volumes over the last several years. As a result, congestion on the corridor has worsened, leading to extended travel times and longer peak traveling hours. The City of Issaquah and the Road Services Division partnered on the Issaquah-Hobart/Front Street Corridor Study which evaluated and identified safety, mobility and other related improvements to provide the most efficient and reliable traffic flow possible along the corridor.

The study, released in March 2018, recommended several projects, including the construction of a roundabout or additional travel lanes with a traffic signal at the intersections with May Valley Road and Cedar Grove Road.

In order to find out the best alternative improvement to the two intersections at May Valley Road and Cedar Grove Road, the Road Services Division conducted this traffic analysis to study the Issaquah-Hobart Road corridor between May Valley Road and Cedar Grove Road. Due to congestion of the corridor, the analysis captured vehicles entering the system between SR-18 and the city limit.

Project Purpose

The purpose of this project is to evaluate and compare design alternatives to recommend the preferred design options which would meet the following project goals and objectives for safety, mobility, and constructability.

Safety

- *Reduce the rate and severity of collisions*
- *Address safety needs for all vehicles*
- *Improve unsafe conditions.*

Mobility

- *Reduce delays and queueing*
- *Reduce corridor travel times in the peak period*
- *Reduce corridor total hours of congestions*
- *Improve the intersection level of service*
- *Relieve bottlenecks*
- *Improve freight facilities*

Constructability

- *Construction Phasing Plan*

The objectives of this project include:

- Identify capacity bottlenecks and safety concerns for existing conditions;
- Investigate future conditions along the Issaquah-Hobart Road corridor;
- Evaluate and compare design alternatives; and

- Recommend preferred construction sequence and alternatives which improve safety, mobility, and travel time reliability along the corridor.

Analysis/modeling Software

The study approach is primarily focused on performing traffic macroscopic analysis, traffic micro-simulation, and detailed evaluation of mobility and safety at the two study intersections and the entire corridor.

SYNCHRO (version10.0), a macroscopic analysis and optimization program, is used as the intersection capacity software for the signalized intersections. SIDRA Intersection (version 7.0), a widely-use software tool for roundabouts (multi-lane and single-lane), is used as the capacity software program for roundabout alternatives. Both SYNCHRO and SIDRA are simple deterministic software packages which determine intersection capacity by comparing current volume to the ultimate capacity/saturation flow rate of intersections or approaches. They implement the procedures of the Highway Capacity Manual (HCM). As such, these tools quickly predict capacity, density, speed, delay, and queuing on a variety of transportation facilities. These tools are good for analyzing the performance of isolated or small-scale transportation facilities; however, they are limited in their ability to analyze network or system effects.

Issaquah-Hobart Road is a heavily congested corridor with some identified issues from the previous joint study such as long congested hours, extensive delays and queuing, school bus stops, and bypass traffic from Tiger Mountain Road. In order to further study the traffic conditions and congestions and better model the network bottleneck, queues, and spillbacks, VISSIM microsimulation was performed for the entire corridor with two study intersections and other four intersections in the study area. Microscopic simulation models simulate the movement of individual vehicles based on car-following and lane-changing theories. These models are effective in evaluating heavily congested conditions, complex geometric configurations, and system-level impacts of proposed transportation improvements that are beyond the limitations of other tool types.

In this report, VISSIM was used as the microsimulation tool for a detailed analysis of both existing and future concerns and issues along the corridor, which includes:

- School bus stops
- Merge traffic from SE Tiger Mountain Road
- Upstream and downstream queuing
- Driver behavior of heavy vehicles
- Existing bottlenecks
- Capacity of merge points for design alternatives
- Roundabout operation and driver behavior

Study Scope

Study Area

As shown in Exhibit 1, the 5.9 mile long Issaquah-Hobart Road corridor was modeled in VISSIM microsimulation from 2nd Avenue SE to SR-18. Six existing intersections were modeled in VISSIM for all the design alternatives, and two of them are the study intersections of Issaquah Hobart at May Valley Road and Cedar Grove Road.

Study Time Periods

The study analysis focuses on the AM and PM peak periods when congestion on the corridor is at its highest. These peak hours range from roughly 5a.m. to 9 a.m. for the morning peak and 2:30 p.m. to 6:30 p.m. for the evening peak.

Scenario

The study reports the existing corridor condition in the year 2019 which includes the summary of current traffic patterns, traffic volumes, speeds, collisions, congestion, travel time and delay. Future conditions for the opening year 2023 and design year 2043 are also evaluated for different design alternatives to compare the improvements on corridor safety and mobility.

Exhibit 1 is a vicinity map showing the study area along with its current channelization.

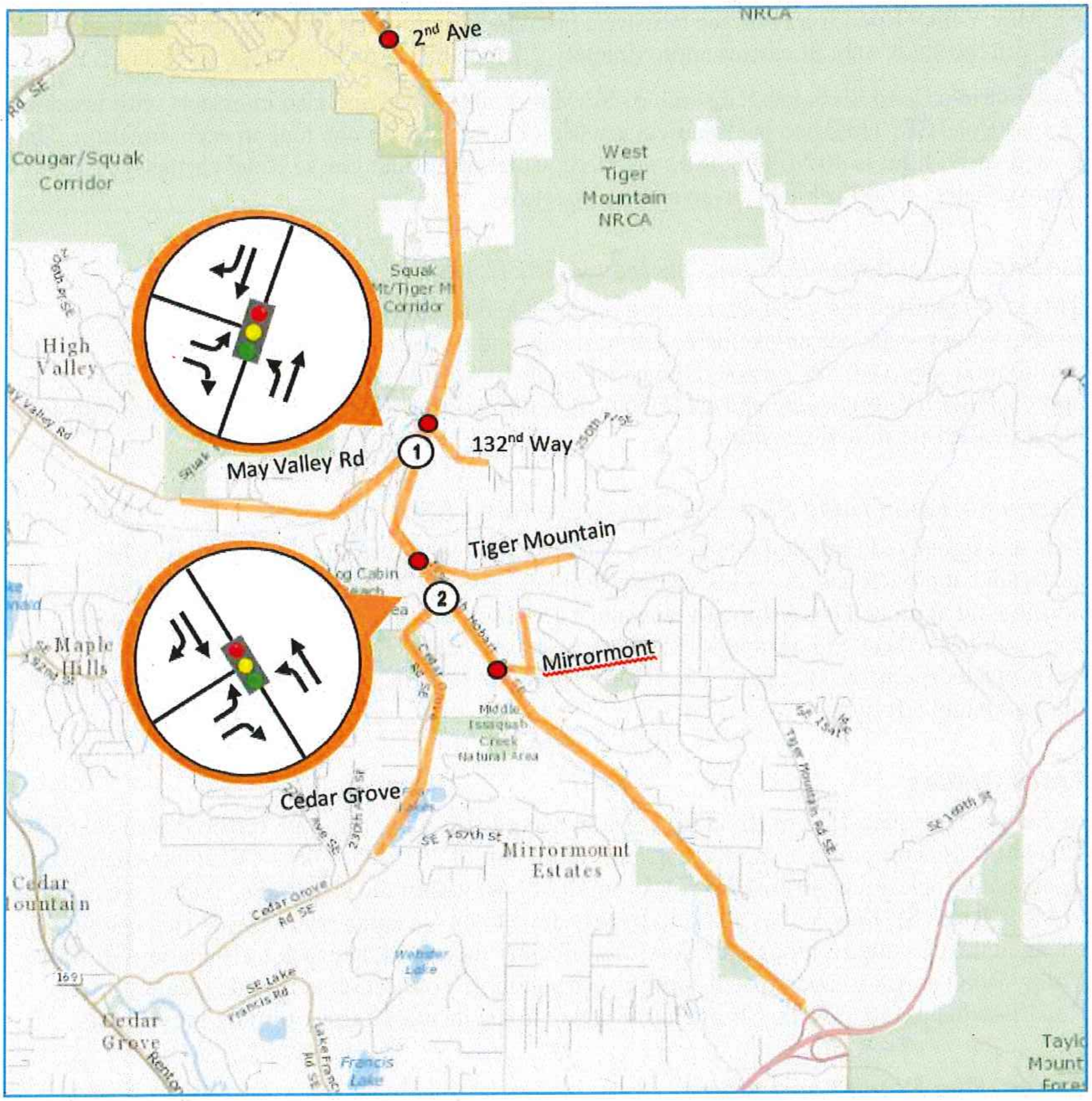


Exhibit 1: Vicinity Map Showing Study Area

EXISTING CONDITIONS

Roadway and Intersection Characteristics

Issaquah-Hobart Road SE is a two-lane north-south principal arterial with a posted speed limit of 45 miles per hour (MPH) in the study area. Road Services Division is expecting to lower the speed limit to 40 MPH for Issaquah-Hobart Road corridor within the County. The lower speed limit was used for all the future condition analysis. Issaquah-Hobart Road carries a daily traffic volume of approximately 20,600 vehicles north of SE May Valley Road, 22,300 vehicles south of SE May Valley Road, 19,800 vehicles north of Cedar Grove Road, and 15,200 vehicles south of Cedar Grove Road.

SE May Valley Road is a two-lane east-west principal arterial with a posted speed limit of 35 MPH in the study area. It carries approximately 7,100 vehicles on an average weekday.

Cedar Grove Road SE is located south of SE May Valley Road and also intersects with Issaquah-Hobart Road SE. This road is classified as a Minor Arterial with one lane in each direction. The posted speed limit is 40 MPH in the study area. Currently Cedar Grove Road carries approximately 5,600 vehicles on an average weekday.

Issaquah-Hobart Road SE and SE May Valley Road

This is a signalized three-leg intersection operated and maintained by King County. The eastbound approach has an exclusive left turn lane and a 75-foot right turn pocket. The northbound approach has a through lane and a 140-foot left turn pocket. The southbound approach has a through lane and a 115-foot right turn pocket. The northbound left-turn movement has protected-permitted phasing.

Issaquah-Hobart Road SE and Cedar Grove Road SE

This is a signalized three-leg intersection operated and maintained by King County. The eastbound approach has an exclusive right turn lane and a 200-foot left turn pocket. The northbound approach has a through lane and a 150-foot left turn pocket. The southbound approach has a through lane and a 185-foot right turn pocket. The northbound left-turn movement has protected-permitted phasing. The southbound right turn also has an overlapping phase with the eastbound left turn.

Truck Routes

In the past, Issaquah-Hobart Road SE corridor served as a route for truck traffic from I-90 to SR 18 as well as access sites along the corridor. In the fall of 2016, the City of Issaquah changed their designated truck routes to prohibit trucks south of I-90 within the city limits. Trucks are re-routed to SR 900 and SE May Valley Road to bypass downtown Issaquah restrictions. This re-routing changed traffic patterns along corridors, significantly increased the truck traffic along SE May Valley Road corridor, and created some issues and more congestion at the May Valley Road/Issaquah-Hobart Road SE intersection due to the increased truck turning movements.

School Bus Routes and Stops

Per the previous joint study, school buses utilize the corridor as several schools are located nearby. Issaquah High School and Middle School are located north of Front Street on 2nd Avenue SE and Clark Elementary is west of Front Street on Newport Way.

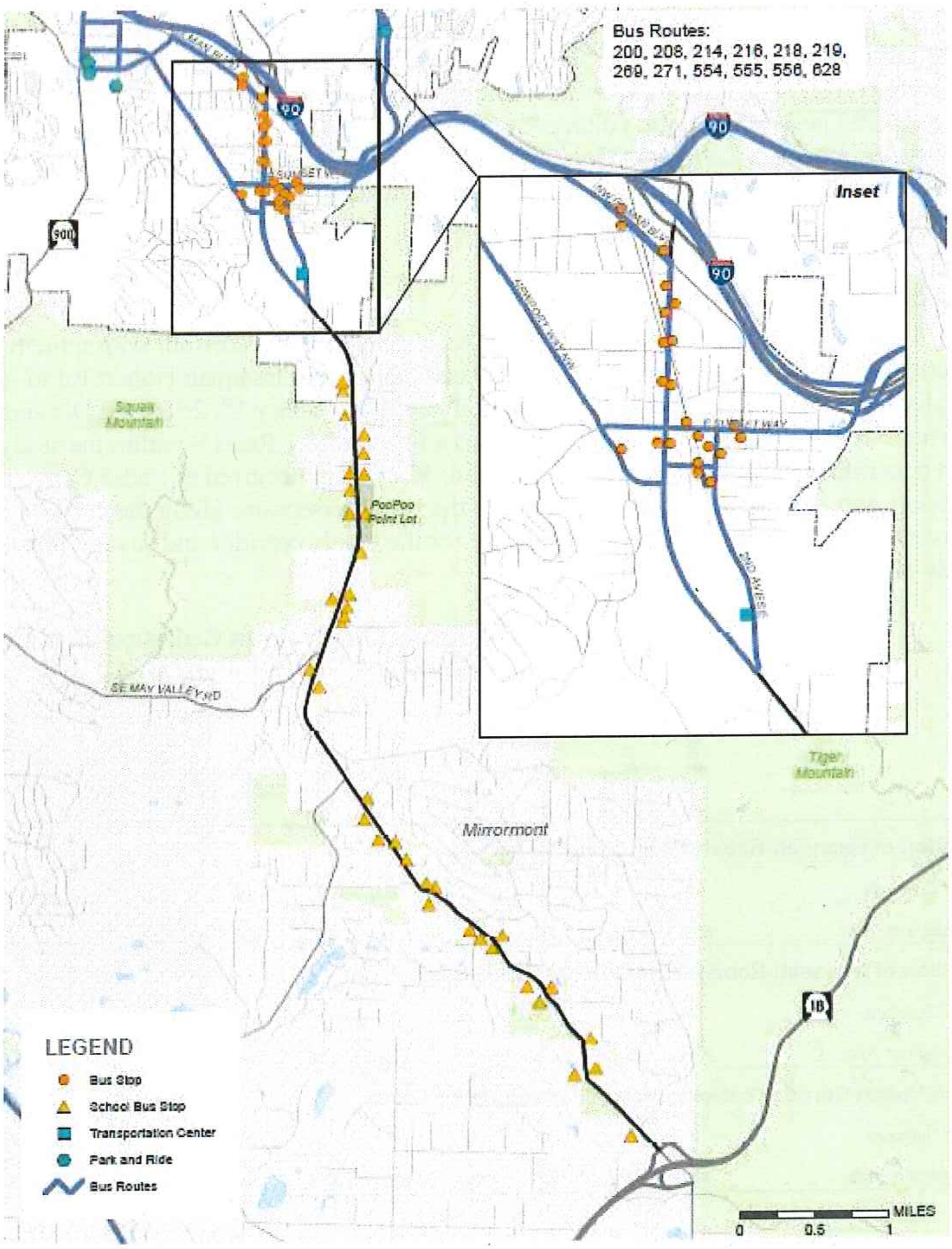


Exhibit 2: School Bus Stops

Source: Issaquah-Hobart/Front St Corridor Study

Based on the survey from previous joint study, the Issaquah School District runs about 51 scheduled stops AM and PM peak periods along the corridor within King County. Both northbound and southbound bus stops require both lanes of traffic to stop while loading or unloading passengers. The existing bus stops are illustrated in Exhibit 2.

In 2017, King County supplied data showing that while school is in session, 200 fewer vehicles progress through the corridor in the 7:00 to 8:00 AM peak hour, in the northbound direction. The counts were collected just north of the intersection of May Valley/Issaquah Hobart Road. The reduction in PM peak hour traffic volumes was not as great, but the difference was still around 80 fewer vehicles reaching the intersection of May Valley/Issaquah Hobart Road between 3:30 and 4:30 PM in the southbound direction. This reduction in vehicle throughput is directly related to the school buses stopping on Issaquah Hobart Road.

Traffic Safety and Collision History

Historical collision data and crash records were reviewed along the corridor within the two study intersections as well as the one mile stretch between them along Issaquah Hobart Rd to identify potential safety concerns for the three-year period between January 1st, 2016 and December 31st, 2018. There were a total of 50 recorded collisions along Military Road S within the study area, 19 of them occurred at May Valley Road intersection, 15 of them occurred at Cedar Grove Road intersection, and 16 collisions occurred between the two intersections along the corridor. Exhibit 3 summarizes the collisions by type and severity for the whole corridor and several hot spots in the study area.

Exhibit 3: Study Area Collision Summary

	Type of Collisions							Severity			
	Rear End	Entering at Angle	Fixed Object	Left Turn	Sideswipe	Runoff Road	Other	Fatal Collisions	Injury Collisions	Property Damage Only	TOTAL COLLISIONS
Intersection of Issaquah-Hobart Road & May Valley Road											
Number of Collisions	13	1	0	1	2	2	0	0	9	10	19
As Percentage of Total	*68%*	*5%*	*0%*	*5%*	*11%*	*11%*	*0%*	*0%*	*47%*	*53%*	
Intersection of Issaquah-Hobart Road & Cedar Grove Road											
Number of Collisions	12	2	0	1	0	0	0	0	9	6	15
As Percentage of Total	*80%*	*13%*	*0%*	*7%*	*0%*	*0%*	*0%*	*0%*	*60%*	*40%*	
Issaquah Hobart Corridor between May Valley and Cedar Grove											
Number of Collisions	7	1	6	0	1	0	1	0	6	10	16
As Percentage of Total	*44%*	*6%*	*38%*	*0%*	*6%*	*0%*	*6%*	*0%*	*38%*	*63%*	

The majority of collisions were rear-end at the two study intersections. Fixed objects and run-off road collisions were also common on the segment between those two intersections which includes collisions involving vehicles colliding with guardrails, utility poles, or trees, or driving into a ditch. Causes could include vehicles traveling at higher speeds than the speed limit or wet or icy road conditions.

No fatalities occurred at the two study intersections, 47% of collisions at the intersection at May Valley Road and 60% of collisions occurred at Cedar Grove intersections were injury collisions.

Along the rest of the corridor between SR18 to Cedar Grove and May Valley to I-90 there are a total of 288 collisions reported from 2012-2016. 2 fatalities occurred, 27% involved injuries, and the rest, 72% were property damage only. Of the 288 collisions, 145 of those or approximately

50% were rear end related. 18 (6%) were sideswipes, 43 (15%) were angle, 9 (3%) pedestrian related, 28 (10%) approach turns, and 45 (17%) classified as other.

Collisions on the corridor along Issaquah-Hobart Road further north of May Valley and south of Cedar Grove (more than 1,000 feet away) are not included as collisions at the study intersections, however, some of the collisions could have been potentially caused by congestion and queues related to the two study intersections especially the rear-end type collisions. By relieving corridor congestion and reducing queues, some construction alternatives would smooth traffic progression and potentially reduce the occurrence of frequent stops and rear-end collisions.

With a variety of different crash types, there are several potential mitigations, each with its own pros and cons, which can improve the current configuration.

Rear end collisions occur when a vehicle crashes into the one in front of it. A typical scenario for rear ends are sudden decelerations caused by the front car and the following car not having enough time and failing to stop. Some potential improvements to mitigate rear ends are roundabouts, turn lanes and high friction surface treatments. High friction surface treatments or HFST, involves the application of aggregates to increase friction along the treated area which helps motorists maintain better control. This potentially reduces the breaking distance required when there is a sudden stop resulting in fewer rear ends. In general, the operating speed when going through a roundabout is significantly lower than that of a signal. Therefore the braking distance required is dramatically reduced also reducing the likelihood of a rear end crash. Turn lanes move vehicles waiting to make a left turn into a driveway or side street out of the flow of traffic.

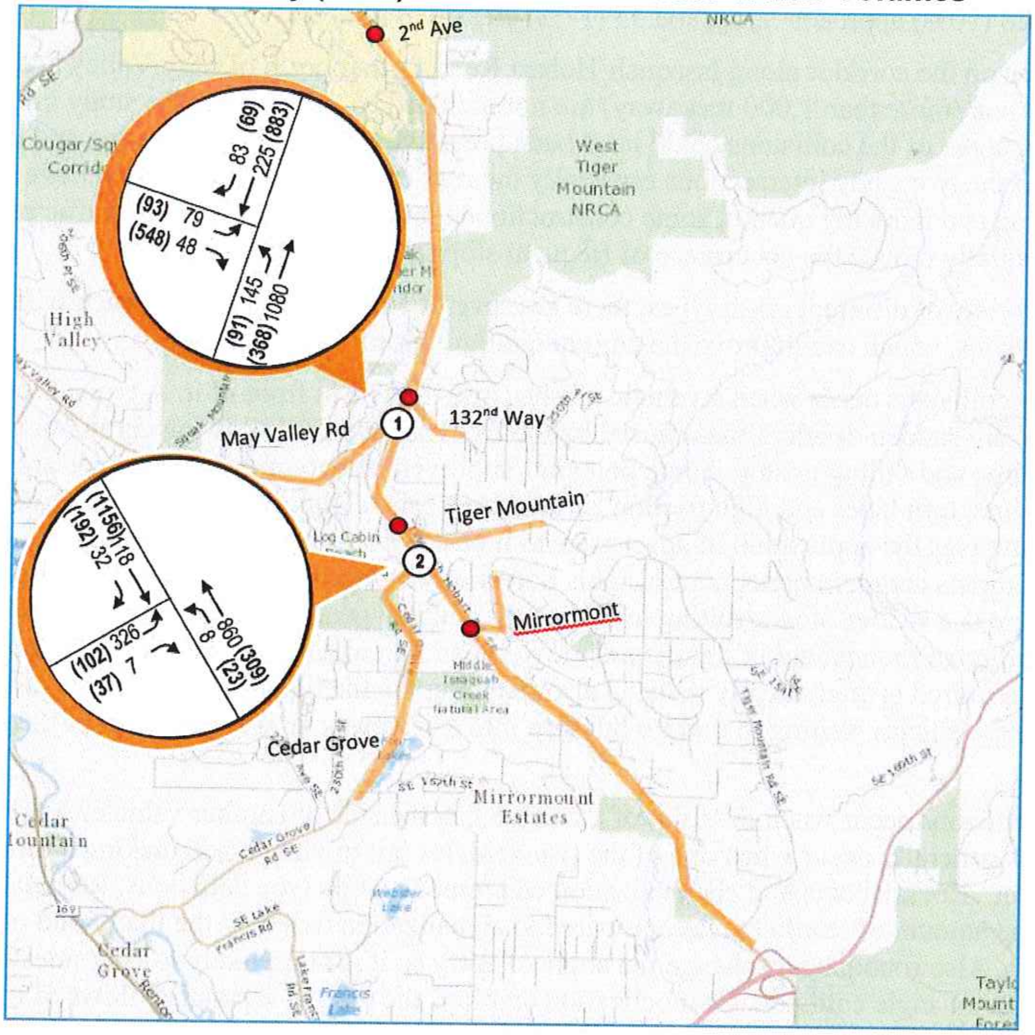
Angle collisions occur when the front of a vehicle hits the side of another vehicle. Angle collisions generally occur when one of the two vehicles fail to yield when making a turning movement. Roundabouts and channelization can remedy angle type collisions. Roundabouts reduce the amount of conflict areas compared to signalization reducing the likelihood of angle collisions. Also roundabouts change the angle of entry so it is more likely to be a sideswipe as opposed to an angle collision. Channelization employs the idea of separating flows of traffic from the main lanes. Because certain movements are separate, the chances of an angle collision are reduced because different turning movements no longer interact and yield to one another.

Existing Traffic Volumes and Traffic Patterns

Loop detector counts were collected at Issaquah-Hobart Road/SE May Valley Road and Issaquah-Hobart Road/Cedar Grove Road in 15-minute increments from 5 to 9AM and 2:30 to 6:30PM in March and April, 2019. MioVision turning movement counts were also collected at Issaquah-Hobart Road/SE 113th Street during 2:30PM-6:30PM, and Issaquah-Hobart Road/252nd Avenue SE during 5AM-9AM on March 5th, 2019 in order to capture actual vehicle arrival patterns, corridor queues, and vehicle throughput and demand levels for the congested corridor with bottlenecks. These time periods reflect typical weekday AM and PM peak hours (respectively) when traffic conditions would be greatest.

The existing AM peak hour is from 6:30 to 7:30 AM at Issaquah-Hobart Road SE/SE May Valley Road and 5:45 to 6:45 AM at Issaquah-Hobart Road SE/Cedar Grove Road SE. The PM peak hour is 3:45 to 4:45 PM at Issaquah-Hobart Road SE/SE May Valley Road and is 3:30 to 4:30 PM at Issaquah-Hobart Road SE/Cedar Grove Road SE. Exhibit 4 shows the AM and PM peak hour turning movement volumes at studied intersections.

Exhibit 4: Weekday (2019) AM & PM Peak Hour Traffic Volumes



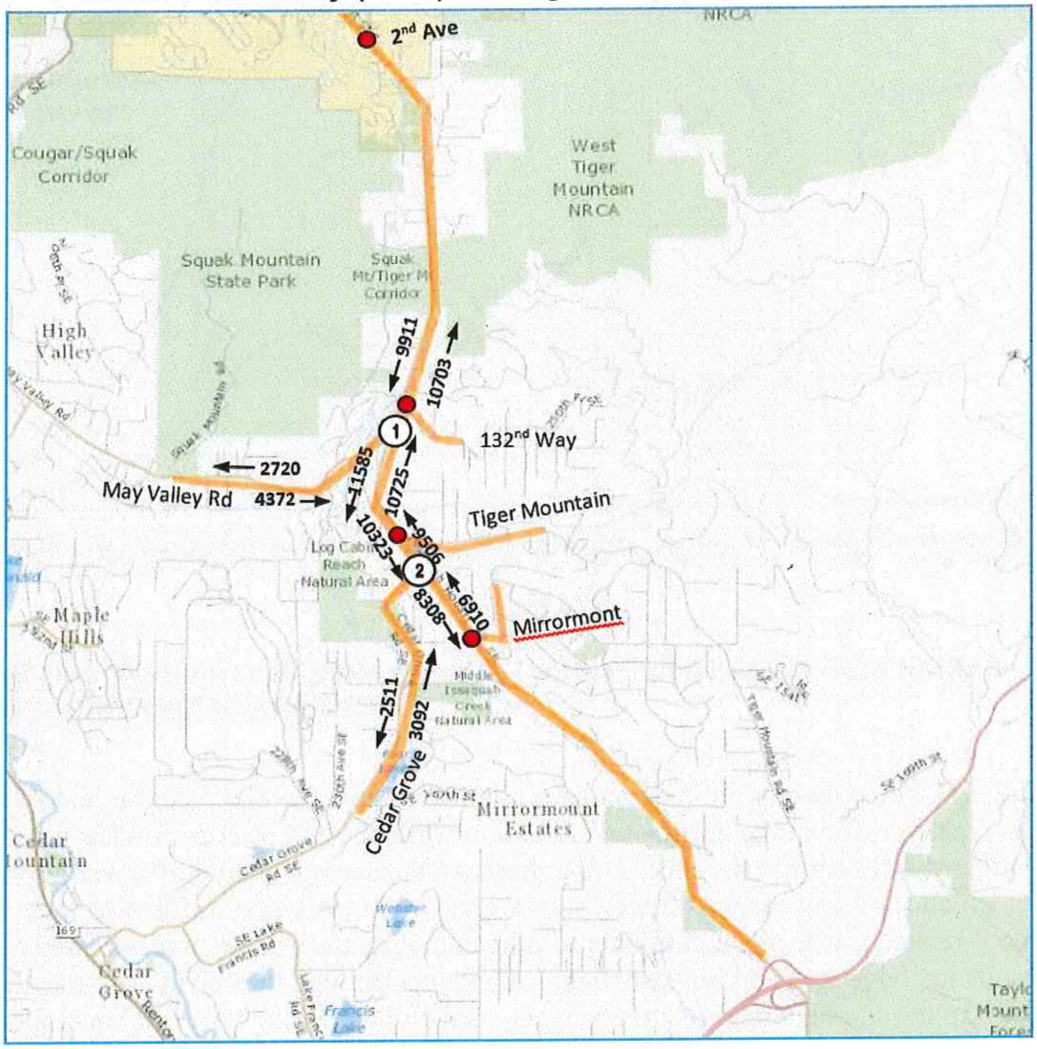
Along Issaquah-Hobart Road SE, the traffic volumes are directional. Northbound is the peak direction during the morning hours while southbound is the peak direction during the afternoon hours.

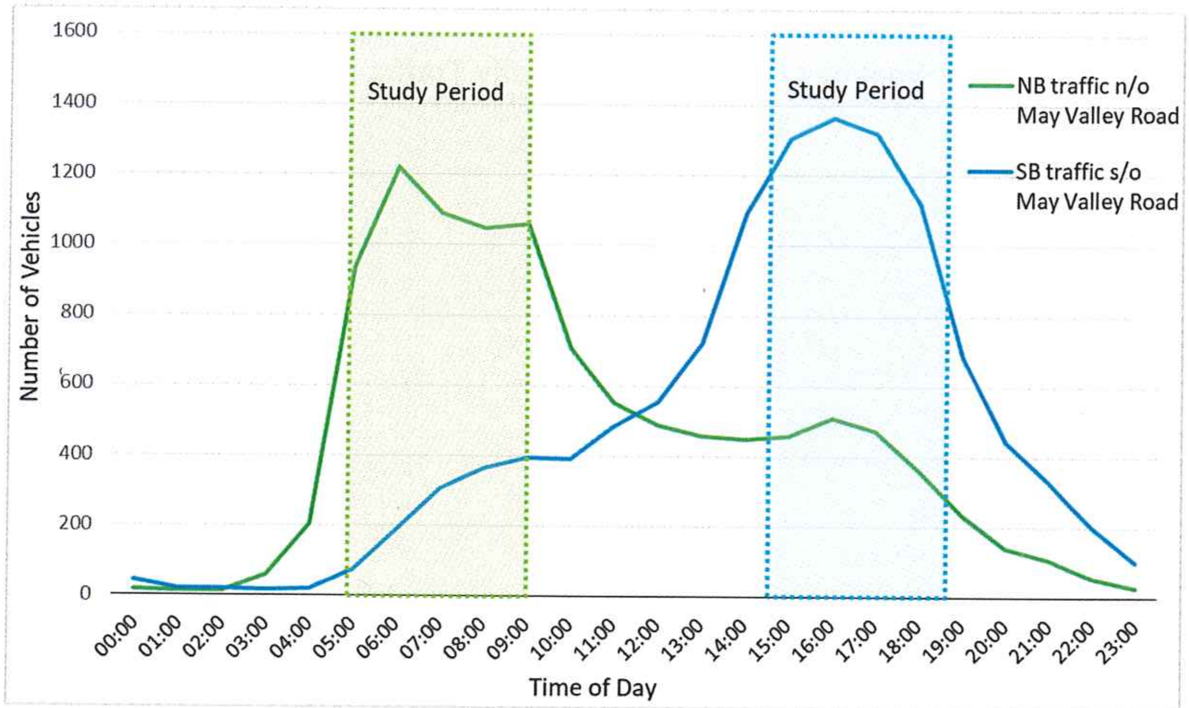
Along SE May Valley Road, traffic peaks in the westbound direction in the morning and eastbound direction in the afternoon. There has been a significant increase in heavy vehicle volumes along SE May Valley Road since trucks were prohibited in downtown Issaquah and re-routed to use May Valley Road.

On Cedar Grove Rd SE, the peak direction is eastbound in the morning. In the afternoon, the eastbound and westbound traffic volumes are very similar.

Exhibit 5 shows the directional average weekday daily volumes in the study area along the corridor, and weekday average daily traffic volumes are heaviest along the middle segment of the corridor between May Valley Road and Cedar Grove Road.

Exhibit 5: Weekday (2019) Average Daily Traffic Volumes





King County

Exhibit 6: Average Daily Traffic Volumes along Issaquah-Hobart Road Corridor at May Valley Road

During the peak hours there is a directional shift in the volumes. Exhibit 4 shows the AM peak period has greater traffic in the northbound direction while the PM peak period has greater traffic in the southbound direction. This shift is also shown in the average daily traffic volume graph in Exhibit 6, which shows an early AM peak hour around 6AM. Morning traffic dips after 7AM when school-related traffic and additional morning commute traffic start accessing the roadway, which results in congestion and less cars being able to get through the corridor. In the afternoon, traffic peaks in the southbound direction between 3 and 6PM. During the peak hour, about 548 eastbound vehicles from May Valley Road and 883 southbound vehicles on Issaquah-Hobart Road are driving through the signal at May Valley Road. The signal at May Valley Road is currently over-capacity during the PM peak hour, and consistent southbound queues were observed along Issaquah-Hobart Road starting from this signal in the afternoon.

Both the AM and PM peak periods on the corridor covers a long period (between 5-9AM and between 2:30-6:30PM), therefore, a four-hour time period was chosen for VISSIM simulation to ensure the model captures through the whole peak periods.

Travel Times and Queues

The previous joint study collected travel times along the corridor during 7-9AM and 4-6PM in 2017. The results showed the average travel time between SR-18 and north County limits was 31 minutes for the northbound direction and 9 minutes for the southbound direction in the AM peak hours, and 9 minutes for the northbound direction and 17 minutes for the southbound direction in the PM peak hours.

The average travel times are much longer in the northbound direction and shorter in the southbound direction during the morning peak hours, with the reverse for the afternoon peak hours. The average travel times are very similar for non-peak directions which is the southbound direction in the morning and the northbound direction in the afternoon for both segments. However, peak direction travelers are expected to spend longer commute time in the morning than the afternoon.

In the morning, extensive queues were observed for the northbound movement along Issaquah-Hobart Road and the eastbound movement on Cedar Grove Road around 6AM to 8AM. In the afternoon, the southbound queue which starts from May Valley Road intersection backed up to the north around 3PM to 6PM, sometimes even backed up to the city of Issaquah.

TRAFFIC OPERATIONS

AM and PM peak hour traffic operations were evaluated for both the two study intersections and corridor segments, and are measured with Level of Service (LOS). At two study intersections, traffic operation was evaluated with SYNCHRO, SIDRA and VISSIM. SYNCHRO LOS analysis method was based on Synchro reports. VISSIM and SIDRA analysis are based on the *Highway Capacity Manual (HCM)* (6th Edition). For corridor operations, LOS was evaluated with VISSIM and was analyzed using average travel speed in miles per hour and compared to the LOS standards outlined in section 14.70.220 of the King County Code.

Definitions and Methodology

SYNCHRO

Intersection level of service (LOS) is an evaluation of the operational characteristics of roadway intersections, and because intersections are typically the points of congestion, it is an evaluation of roadway network operations as a whole. Levels of service are given designations of A through F by the Transportation Research Board's Highway Capacity Manual (HCM) 6th Edition. LOS A represents ideal, free-flow conditions and LOS F represents a breakdown in traffic flow, characterized by excessive delay to motorists. At LOS E, an intersection has reached the physical capacity for which it was designed. The only way for operations to be improved at intersections with LOS F is either to reduce the number of vehicles using the intersection or to increase the intersection capacity by adding lanes, revising lane configurations, or modifying signal timing.

LOS for Signalized Intersections

LOS	Control Delay Per Vehicle (sec)
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

SIDRA INTERSECTION

The measurement of intersection LOS for roundabouts is done using procedures from the Highway Capacity Manual 6th Edition. The analysis for roundabouts is based on gap acceptance and queuing theory and share the same basic control delay formulation with two-way and all-way stop controlled intersections. The LOS is an F whenever the v/c ratio is over 1.

LOS for Stop Controlled Intersections

LOS	Control Delay Per Vehicle (sec)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Another measure of intersection performance is the 95th percentile queue length (95th % Queue). As used in this study for the signalized alternatives, this is the length of queued vehicles for a given movement with 95% of maximum traffic volume after two signal cycles. This method is called the cycle-average queue. Since roundabouts do not have a defined cycle length as it is unsignalized, Sidra uses a gap acceptance cycle which consists of a block period and an unblock period. So a cycle of a red period and a green period in a signalized intersection is equivalent to a block of waiting due to an acceptable gap then departing when an acceptable gap occurs in a roundabout scenario.

VISSIM Microsimulation

VISSIM (version 11), a microscopic, behavior-based, stochastic, multi-purpose traffic microsimulation program which has been used for modeling complex transportation projects, was selected as the traffic microsimulation tool to compare design alternatives and report analytical results in this study. WSDOT Protocol for VISSIM Simulation was used as the modeling guidance for VISSIM modeling and calibration. VISSIM base network was created and calibrated to reflect the existing traffic conditions along the study corridor in the field. All the following base data were collected and either programmed in VISSIM base model or used for network calibrations:

- Geometric data (intersection configuration, number and width of lanes, length of roadway segments, length of storage bays, etc.)
- Traffic control data (posted speed limits, intersection control, signal timing plan, detection zones, parking priority, etc.)
- Traffic volume data (traffic volumes and vehicle composition distribution)
- School bus stops
- Speed data (speed distribution)
- Travel time data
- Queuing data
- Saturation flow data (for bottleneck capacity calibration)

Per WSDOT Protocol for VISSIM Simulation, base network was coded with the field data and calibrated with both traffic volumes and travel times in the field. Vehicle inputs were coded in 15-minutes increments for the entire study period. All the scheduled school bus stops and bypass traffic from Tiger Mountain Road were programed in the base network. The goal of performing calibration is to create a model that replicates real world conditions including congestion, queuing, and travel times. The calibrated model can then be used with confidence to evaluate different construction alternatives.

Intersection operation results were collected in VISSIM through node evaluation, queue counters, and travel time measures. Both of the two study intersections have node boxes placed around them with node evaluation toggled on. The Measurements of Effectiveness (MOEs) for all nodes were collected and reported for each movements at the nodes which includes number of vehicles, average delay. Queue counters were placed at the stop line of each movement at all study intersections, and is able to collect queues back through multiple intersections.

Corridor travel time results were collected through travel time segments in VISSIM. Three northbound travel time segments and three southbound travel time segments along Issaquah-Hobart Road and two eastbound travel time segments along Cedar Grove Road and May Valley Road were coded in the VISSIM network to collect corridor travel times and delays. Corridor LOS was evaluated with VISSIM and was analyzed using average travel speed in miles per hour and compared to the LOS standards outlined in section 14.70.220 of the King County Code.

LEVEL OF SERVICE SPEEDS		
	Principal Arterials	Minor Arterials
LEVEL OF SERVICE	**AVERAGE TRAVEL SPEED (MILES PER HOUR)**	
A	>35	>30
B	>28 – 35	>24 – 30
C	>22 – 28	>18 – 24
D	>17 – 22	>14 – 18
E	>13 – 17	>10 – 14
F		<=13

(Ord. 18459 § 2, 2017: Ord. 16266 § 8, 2008: Ord. 15839 § 2, 2007: 15030 § 2, 2004: Ord. 14580 § 2, 2003: Ord. 14375 § 1, 2002: Ord. 14050 § 9, 2001

Existing Condition Levels of Service, Delay, and Queue Results

In this report, for signalized intersections, the intersection level of service, intersection delay, and queue lengths results were determined using Synchro 10 traffic analysis software program. For the construction alternatives with roundabouts, the intersection level of service, delay and queues were reported with Sidra Intersection 7.0. Those two traffic analysis software program were used to get the intersection operation results based on the control delay only.

VISSIM (version 11) was used as corridor simulation tool in this report to collect corridor travel times, queues, and volume throughput. All the study intersections were modeled with both the existing conditions and future conditions by King County Road Services Division staff. Existing signal timing and phasing information was collected from the King County Traffic Management Center (TMC).

SYNCHRO ANALYSIS RESULTS

Exhibit 7 shows the operation results of the levels of service, delays, and queue length calculations for the existing conditions with the existing traffic volumes, channelization, and signal timing and phasing in the AM and PM peak hour.

Exhibit 7: Existing LOS, Delay, and 95th Percentile Queue Lengths Results

	EXISTING CONDITION (2019)					
	AM Peak Hour			PM Peak Hour		
	LOS	Delay (sec)	95TH % Queue (feet)	LOS	Delay (sec)	95TH % Queue (feet)
Issaquah Hobart and May Valley						
Eastbound Left	F	109.8	168	F	83.7	207
Eastbound Right	C	21.2	16	F	172.8	#1000
Northbound Left	A	4.6	57	B	15.4	64
Northbound Through	F	98.0	#1929	B	11.5	257
Southbound Through	A	7.4	129	E	79.0	#1729
Southbound Right	A	2.6	21	B	13.3	63
Intersection Overall	**E**	**69.4**		**F**	**86.6**	
Issaquah Hobart and Cedar Grove						
Eastbound Left	F	555.2	#828	F	84.1	177
Eastbound Right	D	36.4	15	B	18.8	27
Northbound Left	A	6.6	8	A	4.6	10
Northbound Through	F	304.3	#1005	A	3.6	105
Southbound Through	A	9.0	75	C	31.0	#1547
Southbound Right	A	0.2	3	A	1.2	30
Intersection Overall	**F**	**314.6**		**C**	**25.1**	

Note: # - 95th percentile volume exceeds capacity, queue may be longer.

In order to better reflect real-life conditions, some parameters in the Synchro software were adjusted from the default values; these parameters were travel speed and saturation flow rate. Saturation flow rates were reduced for the peak direction to try to catch the downstream congestions, queues, and spillbacks. Vehicle headway survey were done to estimate the reduced saturation flow rate for the peak directions. Synchro model calibration was only done for the existing conditions. For all the construction alternatives, Synchro was used only to get the control delay based MOE, therefore, no parameter was calibrated for the construction alternatives.

During the AM peak hour, the two signalized intersections at Cedar Grove/Issaquah-Hobart Road and May Valley Road/Issaquah-Hobart Road operate at level of service (LOS) E or F which indicate congestion and long delays for the northbound through and eastbound left-turn movements. During the PM peak hour, the intersection of May Valley Road and Issaquah-Hobart Road operates at LOS F, and Cedar Grove/Issaquah-Hobart Road intersection operates at LOS C. With the calibrated Synchro parameter, existing models reported the intersection LOS which matched field observation, however, with the existing school bus stops and traffic merging from Tiger Mountain Road, longer queues and delays were observed in the field than Synchro results. Synchro is not able to analyze the downstream congestions, bottlenecks, and school bus stops. Therefore, in this report, VISSIM is used to report the simulation results of travel times and queue length.

VISSIM BASE MODEL CALIBRATION AND RESULTS

Exhibits 8 and 9 show the results of 11 VISSIM runs for intersection levels of service, delays, and queue length during the AM and PM peak periods for calibrated existing conditions.

Exhibit 8: Existing (2019) AM Peak Intersection LOS, Delay and Queues

		5:30-6:30 AM				6:30-7:30 AM				7:30-8:30 AM			
Intersection	Movement	Movement Delay	LOS	Avg. Queue	Max Queue	Movement Delay	LOS	Avg. Queue	Max Queue	Movement Delay	LOS	Avg. Queue	Max Queue
Issaquah Hobart and May Valley	EBL	84	F	30	138	82	F	33	140	70	E	39	197
	EBR	4	A	30	138	3	A	33	140	7	A	39	197
	NBL	70	E	291	1713	87	F	1381	2377	79	E	2611	3502
	NBT	70	E	291	1713	90	F	1381	2377	82	F	2611	3502
	SBT	6	A	1	84	10	A	8	241	14	B	16	332
	SBR	3	A	1	84	6	A	8	241	6	A	16	332
	Intersection Overall	**65.4**	**E**	-	-	**71.9**	**E**	-	-	**62.4**	**E**	-	-
Issaquah Hobart and Cedar Grove	EBL	106	F	175	799	240	F	609	1277	130	F	261	859
	EBR	23	C	175	799	117	F	609	1277	41	D	261	859
	NBL	51	D	2352	6450	96	F	5041	7241	46	D	783	2913
	NBT	76	E	2352	6450	137	F	5041	7241	65	E	783	2913
	SBT	16	B	5	124	22	C	23	316	17	B	21	304
	SBR	4	A	5	124	6	A	23	316	5	A	21	304
	Intersection Overall	**77.0**	**E**	-	-	**142.0**	**F**	-	-	**64.3**	**E**	-	-

Exhibit 9: Existing (2019) PM Peak Intersection LOS, Delay and Queues

		3:00-4:00 PM				4:00-5:00 PM				5:00-6:00 PM			
Intersection	Movement	Movement Delay	LOS	Avg. Queue	Max Queue	Movement Delay	LOS	Avg. Queue	Max Queue	Movement Delay	LOS	Avg. Queue	Max Queue
Issaquah Hobart and May Valley	EBL	89	F	201	1024	147	F	765	1847	81	F	190	981
	EBR	60	E	201	1024	121	F	765	1847	47	D	190	981
	NBL	40	D	26	361	60	E	51	549	37	D	29	426
	NBT	14	B	26	361	18	B	51	549	12	B	29	426
	SBT	43	D	1189	4409	65	E	2358	4792	37	D	995	4604
	SBR	33	C	1189	4409	52	D	2358	4792	29	C	995	4604
	Intersection Overall	**42.7**	**D**	-	-	**73.7**	**E**	-	-	**36.0**	**D**	-	-
Issaquah Hobart and Cedar Grove	EBL	59	E	34	189	66	E	38	179	53	D	35	193
	EBR	39	D	34	189	34	C	38	179	26	C	35	193
	NBL	30	C	8	279	34	C	9	290	30	C	11	326
	NBT	9	A	8	279	8	A	9	290	9	A	11	326
	SBT	58	E	695	4203	80	F	1833	4541	50	D	346	3020
	SBR	50	D	695	4203	70	E	1833	4541	44	D	346	3020
	Intersection Overall	**47.8**	**D**	-	-	**63.0**	**E**	-	-	**40.3**	**D**	-	-

Unlike Synchro, VISSIM is good at modeling and analyzing the road way network as a system to determine its MOE values in contrast to Synchro which determine its MOE values more on an intersection to intersection basis. In the study, Vissim was used to report the simulation results for three hours. During the AM peak period, May Valley intersection is operating a LOS E, and Cedar Grove intersection is operating a LOS E first, dropping to a LOS F soon, and back to a LOS E later. The results diverge slightly for the PM peak period. Vissim shows a LOS D for two of the three hours of the peak period with a LOS E for the peak hour at both May Valley and Cedar Grove.

In the AM peak hour (6:30-7:30AM), the average queue length is very short for the southbound direction since it's not the peak direction, the average queue length for the northbound direction is about 1,380 feet south of May Valley intersection, and about 5,040 feet south of Cedar Grove intersection. It's reversed in the PM peak hour (4-5PM), northbound queue is very minimum along the corridor at two study intersection. The May Valley intersection holds off most of the southbound queues, and the average queue length is about 2,360 north of May Valley and 1,830 feet north of Cedar Grove intersection.

Movement delay is defined as the difference between simulated travel times with the travel time in free flow for each movement on roadway segments or at intersection/nodes. There are many ways to summarize delay in VISSIM. The delay for the whole corridor would include the delay at the intersections/nodes and delay at roadway segments. Intersection/node evaluation usually only includes the delay occurring at the intersections within a certain distance away which includes control delay and queue delay, which depends on the size of the node. Intersection LOS Delay for roadway segments includes delays occurring within the defined travel time measurement segments which includes queue delays, and all the other delay related to lane changing, merging, diverging, school bus stops, slower vehicles, and other traffic control devices on the corridor.

It's not recommended to compare different construction alternatives with only the intersection delay and LOS since some traffic control devices might have more intersection control delay or have capacity bottleneck downstream which will reduce the travel time through the intersection, but it might improve the corridor progression and reduce the congestion and queues along the corridor. Therefore, corridor queues and travel times were used as the mobility rating criteria in construction alternatives evaluation and comparison.

Exhibits 10 & 11 summarize the results of 11 VISSIM runs for corridor travel time, speed and levels of service for existing conditions by segment during the AM and PM peak hours.

Exhibit 10: Existing (2019) AM Peak Corridor Travel Time and LOS

		5:30-6:30			6:30-7:30			7:30-8:30		
Corridor Segment	Corridor Length (Mile)	LOS	Travel Time (min)	Average Speed (mph)	LOS	Travel Time (min)	Average Speed (mph)	LOS	Travel Time (min)	Average Speed (mph)
Issaquah-Hobart Road					**Northbound**					
2nd Ave to May Valley Rd	2.46	C	5	27	C	5	27	C	6	26
May Valley Rd to Cedar Grove Rd	0.94	D	3	21	D	3	19	D	3	19
Cedar Grove Rd to SR-18	3.18	D	10	19	F	22	9	D	10	19
TOTAL Northbound	**6.58**	**D**	**18**	**22**	**E**	**30**	**13**	**D**	**18**	**21**
Issaquah-Hobart Road					**Southbound**					
2nd Ave to May Valley Rd	2.46	B	4	33	B	5	29	B	5	29
May Valley Rd to Cedar Grove Rd	0.94	B	2	29	C	2	26	C	2	27
Cedar Grove Rd to SR-18	3.18	B	6	32	B	7	29	B	7	29
TOTAL Southbound	**6.58**	**B**	**12**	**32**	**B**	**14**	**29**	**B**	**14**	**29**
May Valley Road					**Eastbound**					
223rd Ave SE to Issaquah-Hobart Rd	**0.84**	**A**	**2**	**31**	**B**	**2**	**30**	**B**	**2**	**29**
Cedar Grove Road					**Eastbound**					
236th Ave SE to Issaquah-Hobart Rd	**1.18**	**D**	**4**	**20**	**E**	**6**	**12**	**D**	**4**	**16**

Exhibit 11: Existing (2019) PM Peak Corridor Travel Time and LOS

Corridor Segment	Corridor Length (Mile)	3:00-4:00 LOS	3:00-4:00 Travel Time (min)	3:00-4:00 Average Speed (mph)	4:00-5:00 LOS	4:00-5:00 Travel Time (min)	4:00-5:00 Average Speed (mph)	5:00-6:00 LOS	5:00-6:00 Travel Time (min)	5:00-6:00 Average Speed (mph)
Issaquah-Hobart Road					**Northbound**					
2nd Ave to May Valley Rd	2.46	B	5	29	B	5	29	B	5	30
May Valley Rd to Cedar Grove Rd	0.94	C	2	26	C	2	25	C	2	27
Cedar Grove Rd to SR-18	3.18	B	7	29	B	7	29	B	6	30
TOTAL Northbound	**6.58**	**B**	**14**	**29**	**B**	**14**	**28**	**B**	**14**	**29**
Issaquah-Hobart Road					**Southbound**					
2nd Ave to May Valley Rd	2.46	C	7	23	D	8	19	C	6	23
May Valley Rd to Cedar Grove Rd	0.94	C	3	22	D	3	20	C	2	24
Cedar Grove Rd to SR-18	3.18	C	7	26	C	7	26	C	7	27
TOTAL Southbound	**6.58**	**C**	**16**	**24**	**D**	**18**	**22**	**C**	**16**	**25**
May Valley Road					**Eastbound**					
223rd Ave SE to Issaquah-Hobart Rd	**0.84**	**C**	**3**	**19**	**E**	**4**	**11**	**C**	**3**	**19**
Cedar Grove Road					**Eastbound**					
236th Ave SE to Issaquah-Hobart Rd	**1.18**	**C**	**3**	**25**	**B**	**3**	**25**	**B**	**3**	**26**

As shown in Exhibit 10 and 11, during the AM peak period in the northbound direction, Issaquah-Hobart Road corridor is operating a LOS C or D except the segment from SR-18 to Cedar Grove Road which is operating a LOS F during the AM peak hour. The average corridor travel time is 18 minutes between 5:30-6:30AM, 30 minutes between 6:30-7:30AM, and 18 minutes between 7:30-8:30AM for the northbound direction from SR-18 to the north County limit. May Valley Road is operating a LOS A and B with an average travel speed of about 30 mph in the eastbound direction in the morning. There is no eastbound congestion or queues observed at Issaquah-Hobart Road/May Valley intersection in the morning. The eastbound traffic is very light on May Valley Road in the morning, and the traffic signal stays green for Issaquah-Hobart Road during the majority of the AM peak period. Cedar Grove Road is operating a LOS E in the AM peak hour and a LOS D in the non-peak AM hours for the eastbound direction. The average speed reduced to 12 mph on Cedar Grove Road for the eastbound traffic in the AM peak hour which reflects the existing eastbound queues and congestions at Issaquah-Hobart Road/Cedar Grove intersection.

In the PM peak period, the non-peak direction is operating a LOS B or C with the average speed over 25 mph and average travel time of 14 minutes from SR-18 to north County limit in the northbound direction. Issaquah-Hobart Road corridor is operating a LOS C or D in the southbound direction with an average speed of 22 in the PM peak hour. May Valley Road is operating a LOS E with an average speed of 11 mph in the PM peak hour from 4-5PM when the eastbound traffic is heavy with also heavy school bus traffic. Cedar Grove Road is operating a LOS B or C in the afternoon with very light eastbound traffic and minimum queues.

During the AM peak period, the segment north of Cedar Grove road is at or near capacity, with school bus stops and the disturbance of merging traffic from NE Tiger Mountain Road causing the corridor capacity to dip and northbound queues. The corridor operation is affected not just by the volume of vehicles, but also by school bus stops along the corridor. There are more than 20 stops in each direction between roughly 7 AM and 9 AM, which require both lanes of traffic to stop while loading passengers. Another factor is the multiple drops in speed limit, going from 45 mph to 35 mph at the City Limit, then down again to 25 mph south of Newport Way. All of these factors slow traffic and cause queuing in the northbound peak direction.

In the PM peak hour, the signal at May Valley Road is the southbound bottleneck to serve the heavy southbound through and eastbound right-turn movements. From the north county limit to SR-18, the corridor operation is impacted more heavily in the southbound direction, the peak direction of travel. In addition to the high volumes of southbound vehicles, the heavy vehicles (trucks) with lower traveling speeds along the corridor, slow down the traffic and cause queueing in the peak commute direction. There is a high percentage of heavy vehicles making northbound left-turns and eastbound right-turns at the May Valley intersection. Other factors include, vehicles turning on and off the roadway and school bus stops leading up to and at the beginning of the PM peak hour, 22 of them between 2nd Avenue SE and May Valley Road. All of these factors impact corridor travel speeds.

FUTURE CONDITIONS

Traffic Forecasts and Assumptions

Future AM and PM period volumes in the Opening year 2023 and design year 2043 were projected based on the growth rates from the previous joint study (*Issaquah-Hobart Road/Front Street Corridor Study dated on March 2018)* which was prepared for King County and The City of Issaquah by Transpo Group.

Exhibit 12: Future AM & PM Peak Period Vehicles Annual Growth Rates

Time Period	Direction	Annual Growth Rate
AM	NB	1.00%
AM	SB	1.90%
PM	NB	1.40%
PM	SB	1.00%

Source: *Issaquah-Hobart Road/Front Street Corridor Study dated on March 2018*

During the AM peak period, the northbound direction is the peak direction and is already at capacity on several segments, the southbound direction would have more room for growth than the northbound direction. During the PM peak period, travel speeds are higher in the northbound direction than the southbound direction, indicating more room for growth for the northbound direction. There is not as much anticipated growth in the southbound direction as this is the peak direction of travel for the afternoon commute. The corridor is at or near capacity in the study area during this time period and there is very limited room for a high amount of growth.

Exhibits 13 and 14 show the future weekday AM and PM peak hour intersection volumes for the opening year 2023 and the design year 2043, respectively. The traffic patterns that exist under existing conditions will remain the same for future baseline conditions, with greater northbound volumes in the AM peak hour and greater southbound volumes in the PM peak hour.

Exhibit 13: Opening Year (2023) AM & PM Peak Hour Traffic Volumes

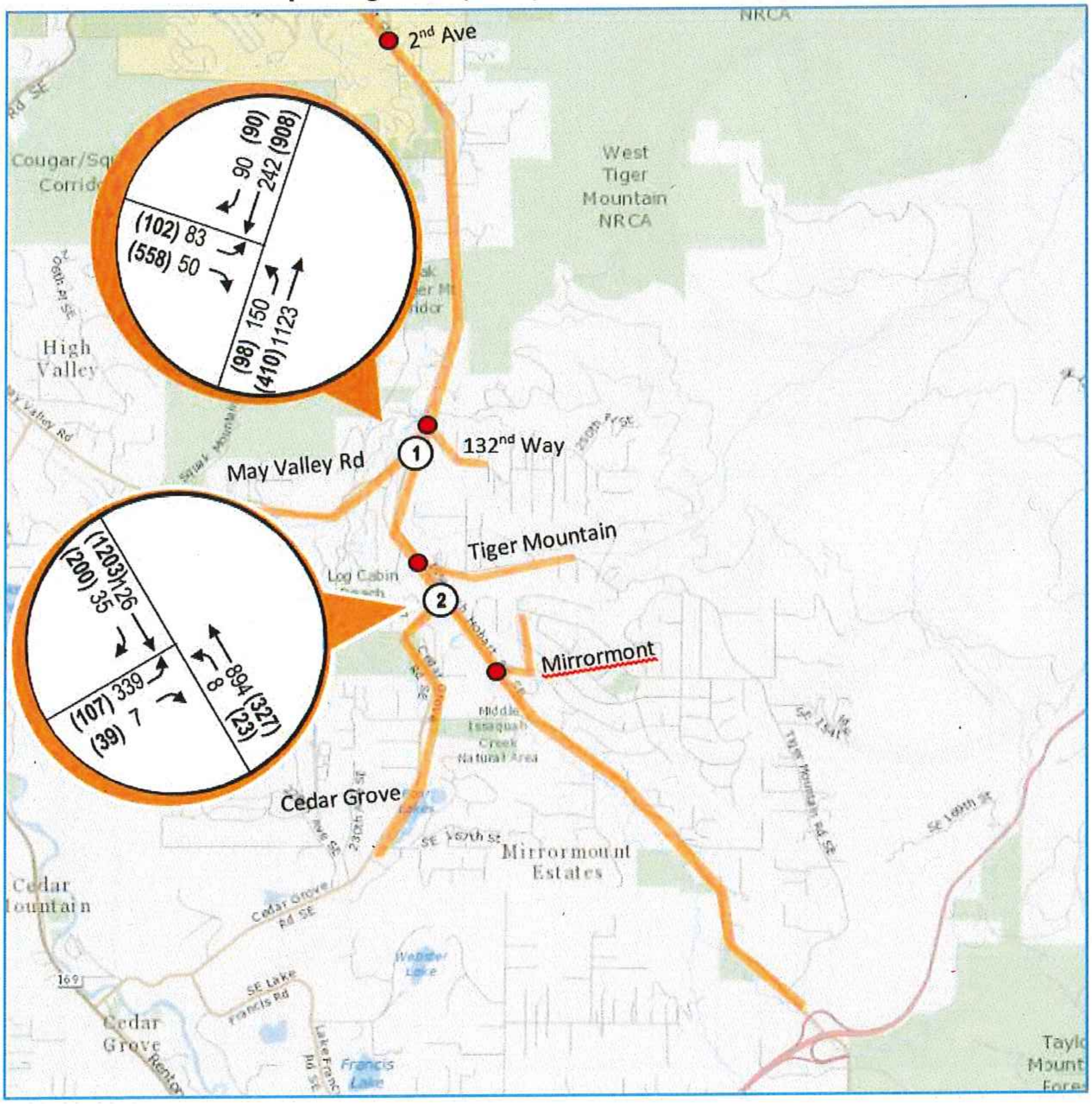
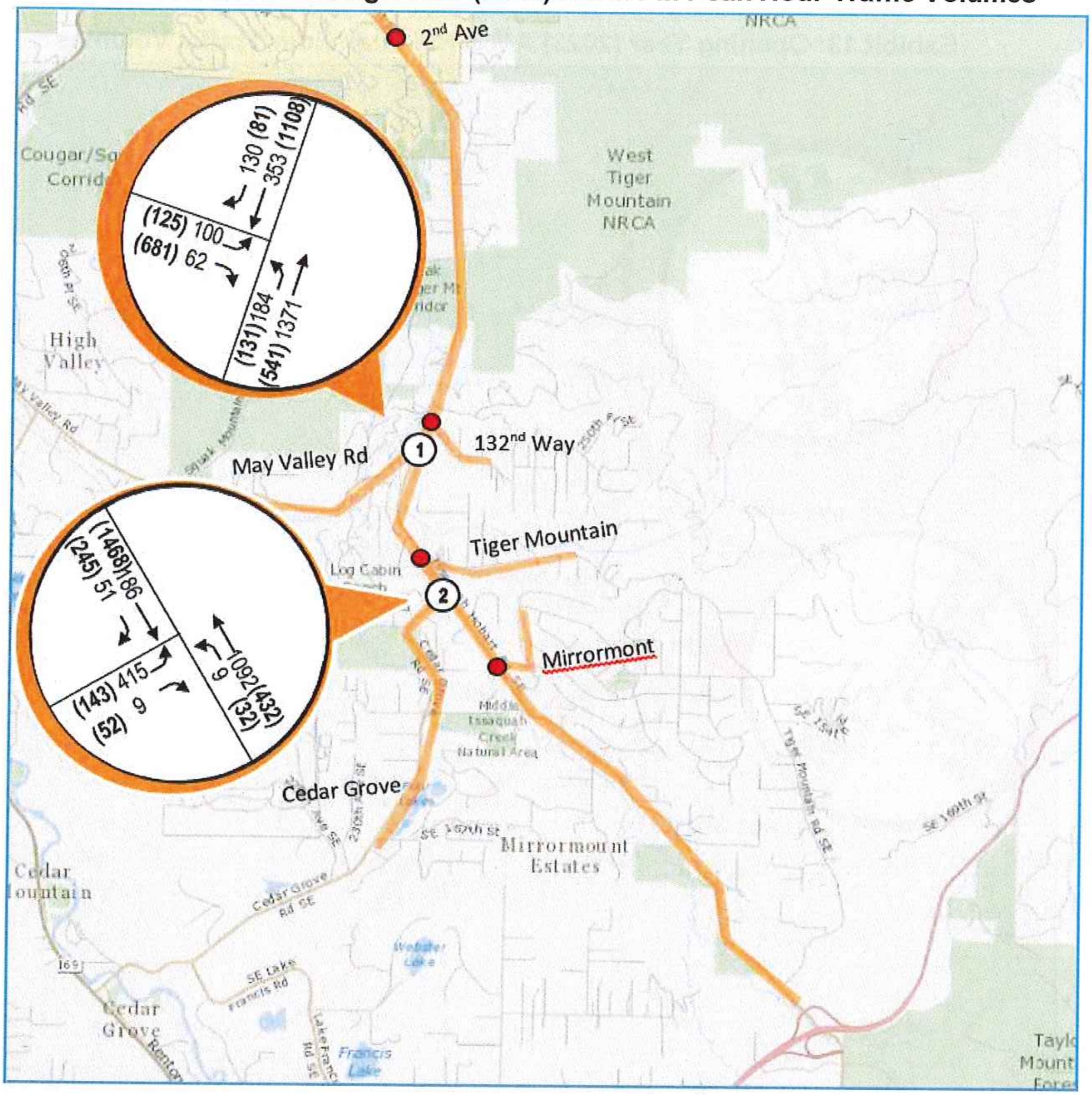


Exhibit 14: Design Year (2043) AM & PM Peak Hour Traffic Volumes



Construction Alternatives

This report studies and evaluates potential solutions for intersection improvements and corridor segment improvements. The goal of intersection improvements is to enhance the safety and mobility of vehicles and non-motorized users. Potential improvements include single lane roundabout, single lane roundabout with one or more slip lanes, hybrid roundabout, or maintaining existing signal with additional through lanes for northbound or/and southbound directions for the two study intersection. The goal of corridor segment improvements is to increase the capacity of the corridor, relieve corridor congestions, improve mobility, and smooth traffic moving along the corridor between intersections. This report also evaluates the results of adding northbound and southbound travel lanes to the corridor between May Valley and Cedar Grove intersections.

The purpose of this report is to compare the benefits of different construction alternatives and recommend a prioritized list of improvements. In order to compare and evaluate all the possible construction phasing plans and intersection improvement options, 26construction alternatives which represent 26 difference combinations of potential intersection improvements on the two study intersections were proposed and summarized in the following Exhibit 15:

Exhibit 15: Potential Construction Phasing Plans and Design Options

Alternative	May Valley	Cedar Grove	Issaquah Hobart Corridor
Alt 1	•No Action	•No Action	2 Lane
Alt 2	•Single Lane Roundabout •NB Slip Lane	•No Action	2 Lane
Alt 3	•No Action	•Single Lane Roundabout •NB Slip Lane	2 Lane
Alt 4	•Single Lane Roundabout •NB Slip Lane	•Single Lane Roundabout •NB Slip Lane	2 Lane
Alt 5	•Maintain Existing Signal •NB Slip Lane	•No Action	2 Lane
Alt 6	•No Action	•Maintain Existing Signal •NB Slip Lane	2 Lane
Alt 7	•Maintain Existing Signal •NB Slip Lane	•Maintain Existing Signal •NB Slip Lane	2 Lane
Alt 8	•Single Lane Roundabout •NB Slip Lane •EBR Slip Lane •SBR Slip Lane	•No Action	2 Lane
Alt 9	•Single Lane Roundabout •NB Slip Lane •EBR Slip Lane •SBR Slip Lane	•Single Lane Roundabout •NB Slip Lane	2 Lane
Alt 10	•Single Lane Roundabout •NB Slip Lane •EBR Slip Lane •SBR Slip Lane	•Maintain Existing Signal •NB Slip Lane	2 Lane
Alt 11	•Single Lane Roundabout •NB Slip Lane •EBR Slip Lane	•No Action	2 Lane
Alt 12	•Single Lane Roundabout •NB Slip Lane •EBR Slip Lane	•Single Lane Roundabout •NB Slip Lane	2 Lane
Alt 13	•Single Lane Roundabout •NB Slip Lane •EBR Slip Lane	•Maintain Existing Signal •NB Slip Lane	2 Lane
Alt 14	•Maintain Existing Signal •NB Slip Lane •Shared SB Through-Right	•No Action	2 Lane
Alt 15	•Maintain Existing Signal •NB Slip Lane •Shared SB Through-Right	•Single Lane Roundabout •NB Slip Lane	2 Lane
Alt 16	•Maintain Existing Signal •NB Slip Lane •Shared SB Through-Right	•Maintain Existing Signal •NB Slip Lane	2 Lane
Alt 17	•Maintain Existing Signal •NB Slip Lane •Shared SB Through-Right	•Maintain Existing Signal •Additional NB Through Lane	4 Lane
Alt 18	•Hybrid Roundabout	•Maintain Existing Signal •Additional NB Through Lane	4 Lane
Alt 19	•Hybrid Roundabout	•No Action	2 Lane
Alt 20	•Hybrid Roundabout with longer merge	•No Action	2 Lane
Alt 21	•Hybrid Roundabout with longer merge	•Maintain Existing Signal •NB Slip Lane	2 Lane
Alt 22	•Hybrid Roundabout	•Maintain Existing Signal •Shared SB Through-Right •Additional NB Through Lane	4 Lane
Alt 23	•Hybrid Roundabout	•Hybrid Roundabout	4 Lane
Alt 24	•Hybrid Roundabout with longer merge	•Maintain Existing Signal •NB Slip Lane •Shared SB Through Right	2 Lane
Alt 25	•Maintain Existing Signal •NB Slip Lane •Shared SB Through-Right	•Maintain Existing Signal •NB Slip Lane •Shared SB Through Right	2 Lane
Alt 26	•Maintain Existing Signal •NB Slip Lane •Shared SB Through-Right	•Maintain Existing Signal •NB Slip Lane •Shared SB Through Right	4 Lane

Future Condition Levels of Service, Delay, and Queue Results

The goal of this study is to identify preferred design solutions to improve corridor mobility, safety and reliability for the opening year 2023 and the design year 2043. All of the 26 construction alternatives were modeled and simulated in VISSIM. VISSIM simulation results including corridor travel time, intersection movement delay and queue length were collected, summarized and evaluated for those 26 construction alternatives.

Rating Criteria

In order to evaluate and compare 26 construction alternatives, evaluation criteria was developed to assess the effectiveness and benefit of each alternative. The criteria was based on the goal of this report, and would rate each alternative based on how they address the project goal and objectives for safety, mobility and constructability. The focus is can the alternative provide countermeasures for the existing collision patterns, and improve the reliability of travel and travel times.

Corridor queues and travel times in the peak direction were selected as the mobility rating criteria in construction alternatives evaluation and comparison since they better reflect the corridor operation as a system.

Evaluation Process

Based on the calibrated base model for existing conditions, VISSIM models were created for the 26 construction alternatives with future volumes in opening year 2023 and design year 2043. All 26 construction alternatives were modeled, simulated, and animated with VISSIM. Queues and congestions were monitored through VISSIM animation. Simulation results including corridor travel time, delay, and queue length were collected and summarized for the 26 construction alternatives.

The first step is to filter out all the alternatives which either had fatal flaws or failed to meet the project goals. This removes alternatives which do not improve travel times over baseline conditions, would improve one movement with the expense of increasing delays and queues to an unacceptable level for other movements, or would only provide limited benefit to the corridor. Corridor travel times and queue lengths in the peak direction were used as the rating scenario to evaluate and compare design alternatives about how they meet the goal of mobility. Step one screening generated a list of preferred construction sequence and feasible options.

Here is a list of findings and recommendations from Step-One screening:

- Alternative #1 is the no action option. In the design year 2043, the corridor would operate at or over capacity, and not able to serve the travel demand in the peak period. Of the demand volumes, approximately 330 northbound vehicles in the morning peak period and about 870 southbound vehicle in the afternoon peak period wouldn't be able to enter the network due to the congestion.
- Alternatives #2 and #4 are not preferred options since simulation shows extensive backups, queues and unacceptable travel time on May Valley Road in the PM peak, which indicates that the single lane roundabout without any slip lanes on the southbound and eastbound approaches at Issaquah-Hobart/May Valley intersection is not able to serve the heavy eastbound right-turn traffic. The throughput of eastbound right-turn is much less than the existing turning movement counts.

- Alternatives #3 and #6 are not preferred options since results of simulation shows little benefit for travel time saving along Issaquah-Hobart Road corridor or on May Valley Road in the afternoon. Improving Cedar Grove intersection itself is not expected to relieve the southbound congestion or queues in the afternoon since the May Valley intersection is the bottleneck for the southbound direction.
- As the following Exhibits #16 and 17 show, compared with alternative #1 which is the No Action on both intersections, alternative #3 which is a single-lane roundabout with northbound and southbound slip lanes at Cedar Grove/Issaquah-Hobart intersection, would increase travel times and queues for both southbound traffic along Issaquah-Hobart and the eastbound travel time along May Valley Road in the afternoon. Therefore, the single-lane roundabout improvement with northbound and southbound slip lanes is not recommended for Cedar Grove/Issaquah-Hobart intersection since existing intersection configuration and traffic control would provide better results for the peak direction in the afternoon.
- The simulation results comparison shows similar patterns for alternatives #8 vs #9, #13 vs #12, and #16 vs #15. These alternatives compare combinations of different improvements at the May Valley intersection with either the signal or single lane roundabout at Cedar Grove/Issaquah-Hobart intersection. The conclusion is that with/without increasing the capacity at May Valley/Issaquah-Hobart intersection, it's still preferred to maintain the traffic signal at Cedar Grove/Issaquah-Hobart intersection instead of constructing a single lane roundabout to provide better travel time and shorter queues for the peak direction in the afternoon. Therefore, alternatives #3, 9, 12 and 15 are not preferred.

Exhibit 16: Opening Year (2023) Comparison of Corridor Travel Time for Alternative #3 and No Action in PM Peak direction

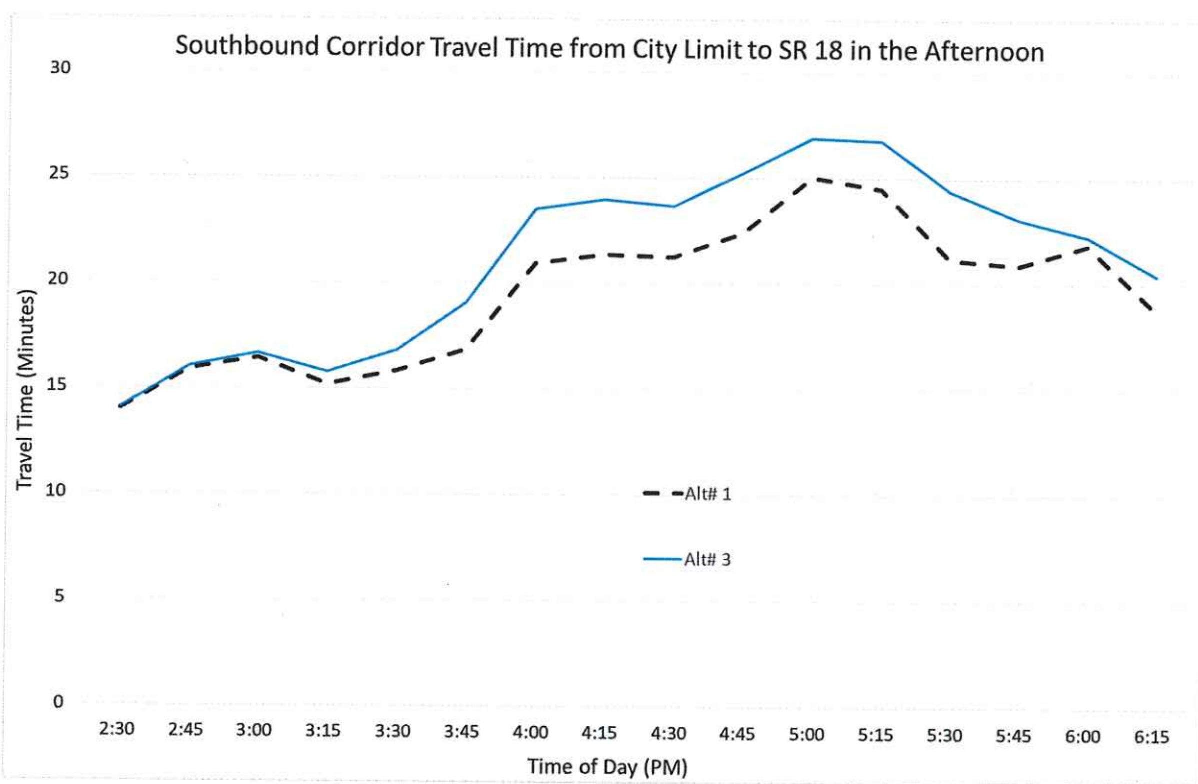
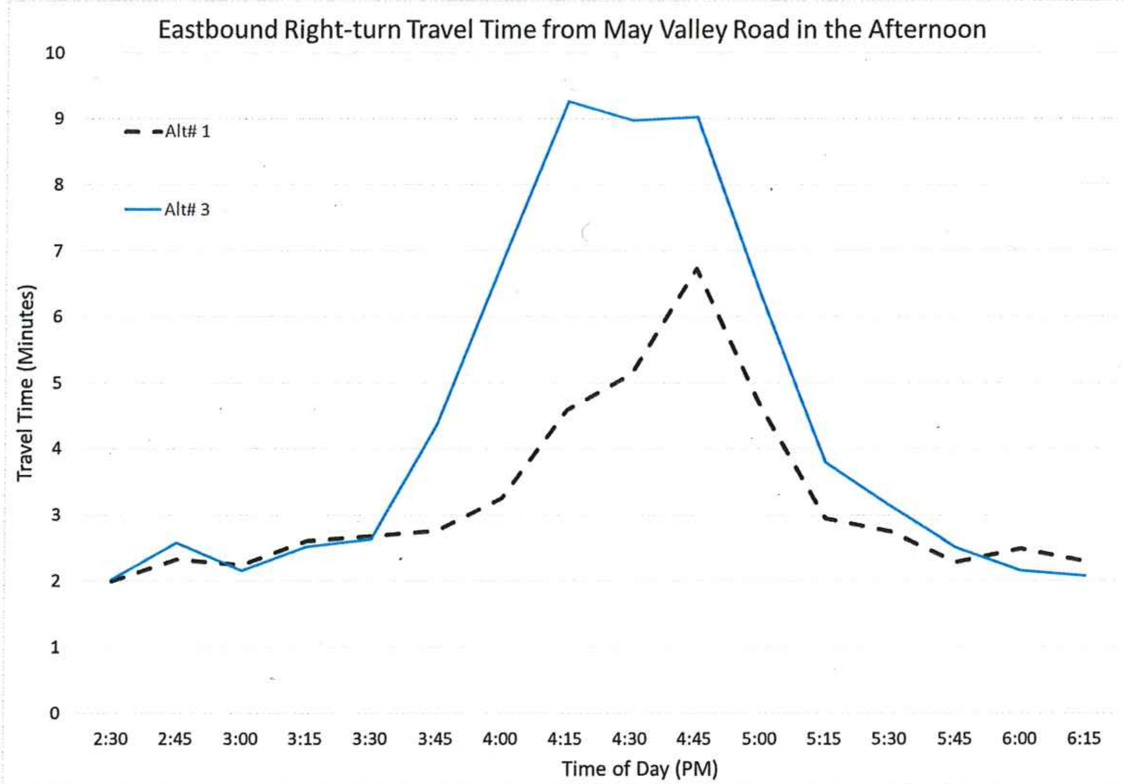


Exhibit 17: Opening Year (2023) Comparison of May Valley Road Travel Time for Alternative #3 and No Action in PM Peak direction



- The following Exhibits #18 and 19 compare the simulation results of corridor travel time in the peak direction during AM and PM peak for alternatives #5, 6, 7 which maintain existing traffic signals with an additional northbound through or slip lane at one or both study intersections. Alternatives #14 and 16 include an additional northbound and southbound through lane at one or both study intersections. Overall Alternatives #14 and #16 are preferred options since they would provide better travel time and shorter queues along the corridor for both peak directions.

Exhibit 18: Opening Year (2023) Comparison of Corridor Travel Time in AM Peak direction

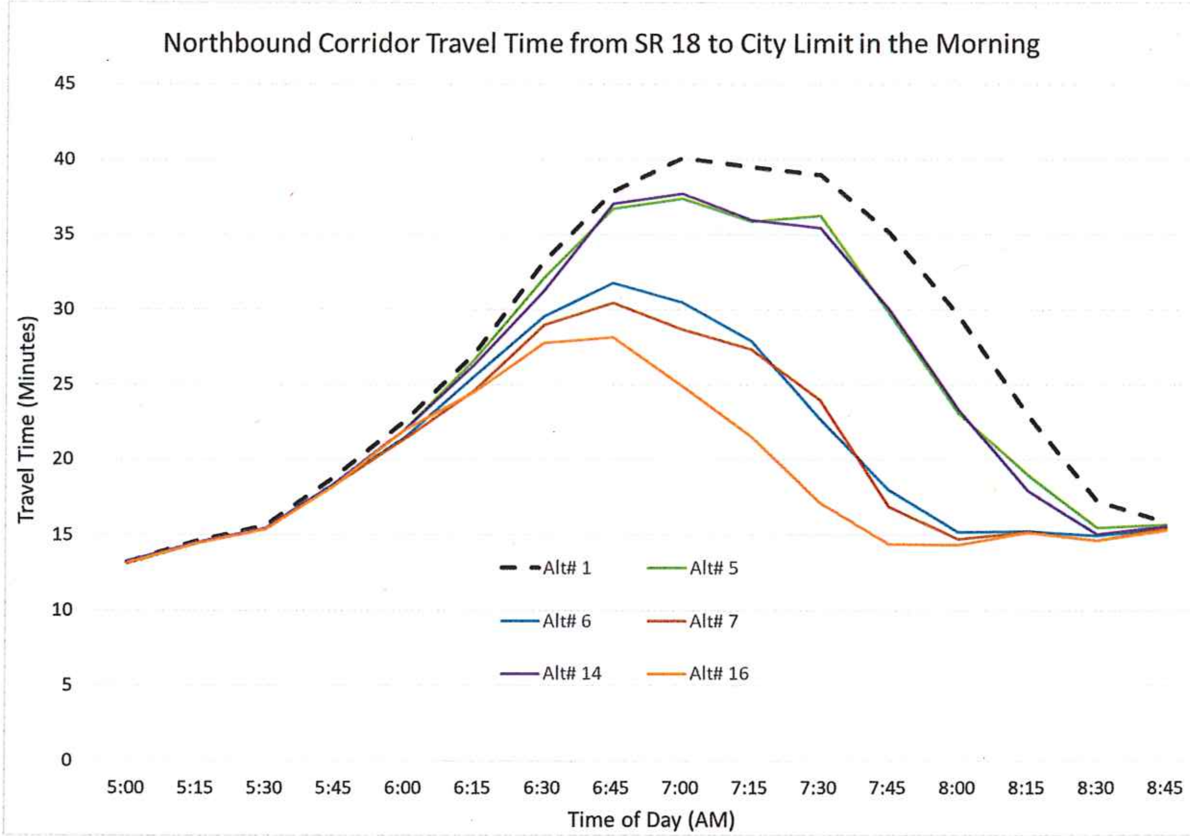
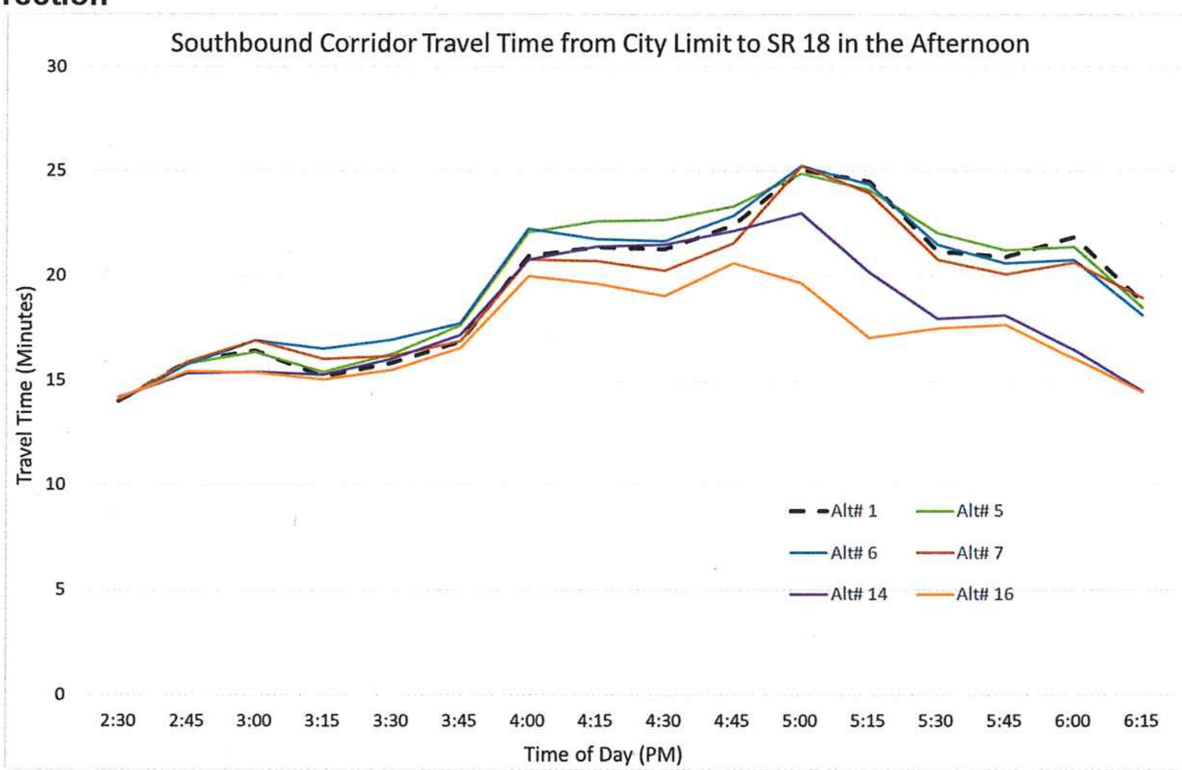


Exhibit 19: Opening Year (2023) Comparison of Corridor Travel Time in PM Peak direction



Since May Valley intersection is the bottleneck for the southbound direction in the afternoon, results of simulation show more benefit in reducing corridor travel time and queues by improving the capacity at May Valley intersection compared with Cedar Grove intersection. This will improve mobility as well as safety by relieving the congestion and queues in the southbound direction. May Valley intersection improvement is expected to reduce the occurrence of congestion related collisions such as rear-ends, which is the majority of the collisions along the corridor. Also, Alternative #8 and #10 provide better travel time and queue results than alternatives #11 and #13 since the additional southbound right-turn slip lane help the single-lane roundabout operate better. Therefore, alternatives #11 and #13 are not preferred.

Conclusion and Recommendations from Step One Screening:

The step one screening results in a recommendation to implement May Valley intersection improvement first, then evaluate the benefit of Cedar Grove intersection improvement and corridor capacity improvement:

- **May Valley Intersection Improvement**:
  As the first step, construct the May Valley Road intersection improvements to relieve the southbound congestion in the afternoon, improve the reliability of travel times in the AM peak and to maximize the safety and mobility benefits. The three preferred options from the first screening process are:
  - **Alternative 8**: A single-lane roundabout with slip lanes at all three approaches
  - **Alternative 14**: Maintaining existing signal with an additional northbound and southbound through lanes
  - **Alternative 20**: A hybrid roundabout
- **Cedar Grove Intersection Improvement or Corridor Improvement**:
  Evaluate the benefits of either different combinations of Cedar Grove intersection capacity projects, or adding a full 4 to 5 lane improvement between the study intersections with no improvement to Cedar Grove. The Cedar Grove intersection options include maintaining existing traffic signal with additional northbound and southbound through lanes and the assumption of May Valley intersection improvement. The purpose is to find which combination of intersection capacity improvements would provide better corridor travel times and shorter queues in the peak directions in the morning and afternoon.
- **Corridor Capacity Improvement**:
  Evaluate the benefit of improving both intersection capacity and the corridor capacity between May Valley Road and Cedar Grove Road.

May Valley Intersection Improvement

The following Exhibits 20 through 24 summarized the corridor travel time and LOS for alternatives 1, 8, 14, and 20 with future conditions in the opening year 2023 and design year 2043 from VISSIM:

Exhibit 20: Opening Year (2023) AM/PM Peak Corridor Speed and LOS

	AM Peak						PM Peak					
	5:30-6:30		6:30-7:30		7:30-8:30		3:00-4:00		4:00-5:00		5:00-6:00	
Corridor Segment	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)
Issaquah-Hobart Road-NB from SR-18 to 2nd Ave												
Alternative 1 (Baseline)	D	21	F	12	E	16	B	29	B	28	B	29
Alternative 8	D	21	F	12	D	18	B	29	B	29	B	29
Alternative 14	D	21	F	12	D	18	B	29	B	28	B	29
Alternative 20	D	21	F	12	E	16	B	29	B	29	B	29
Issaquah-Hobart Road-SB from 2nd Ave to SR-18												
Alternative 1 (Baseline)	B	32	B	29	C	28	C	22	D	19	D	20
Alternative 8	B	31	B	28	C	28	C	23	E	17	D	18
Alternative 14	B	31	B	29	C	28	C	24	D	21	C	23
Alternative 20	B	31	B	29	C	28	C	24	C	22	C	24
May Valley Road-EB from 223rd Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	A	31	B	30	B	29	D	16	F	7	E	11
Alternative 8	A	31	A	30	B	30	B	27	D	15	C	22
Alternative 14	A	32	A	31	A	31	C	22	F	6	F	8
Alternative 20	A	32	A	31	A	31	B	24	F	6	F	9
Cedar Grove Road-EB 236th Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	D	21	F	10	E	10	C	25	C	24	B	25
Alternative 8	D	20	E	11	D	14	C	25	B	24	B	24
Alternative 14	D	20	E	11	D	15	C	24	C	24	B	24
Alternative 20	D	20	F	8	F	9	C	24	C	24	B	24

Exhibit 21: Design Year (2043) AM/PM Peak Corridor Speed and LOS

Corridor Segment	AM Peak						PM Peak					
	5:30-6:30		6:30-7:30		7:30-8:30		3:00-4:00		4:00-5:00		5:00-6:00	
	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)
Issaquah-Hobart Road-NB from SR-18 to 2nd Ave												
Alternative 1 (Baseline)	E	17	F	8	F	6	C	28	C	27	C	27
Alternative 8	E	17	F	8	F	7	B	28	C	28	C	28
Alternative 14	E	17	F	8	F	7	B	28	C	27	B	28
Alternative 20	E	17	F	7	F	6	B	28	B	28	B	28
Issaquah-Hobart Road-SB from 2nd Ave to SR-18												
Alternative 1 (Baseline)	B	31	C	28	C	27	E	16	E	13	E	14
Alternative 8	B	30	C	27	C	26	E	16	F	11	F	12
Alternative 14	B	31	C	28	C	27	E	17	E	14	E	15
Alternative 20	B	31	B	28	C	27	D	19	D	19	D	21
May Valley Road-EB from 223rd Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	B	30	B	29	B	28	E	11	F	3	F	4
Alternative 8	A	31	B	30	B	30	D	15	F	5	F	5
Alternative 14	A	31	A	31	A	30	F	8	F	3	F	3
Alternative 20	A	32	A	31	A	31	F	6	F	1	F	2
Cedar Grove Road-EB 236th Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	E	15	F	4	F	2	C	24	C	24	B	24
Alternative 8	E	16	F	5	F	3	C	24	B	24	B	24
Alternative 14	E	16	F	5	F	3	C	24	C	24	C	24
Alternative 20	E	16	F	5	F	3	C	24	C	24	C	24

Exhibit 22: Opening Year (2023) Corridor Travel Time in AM Peak direction

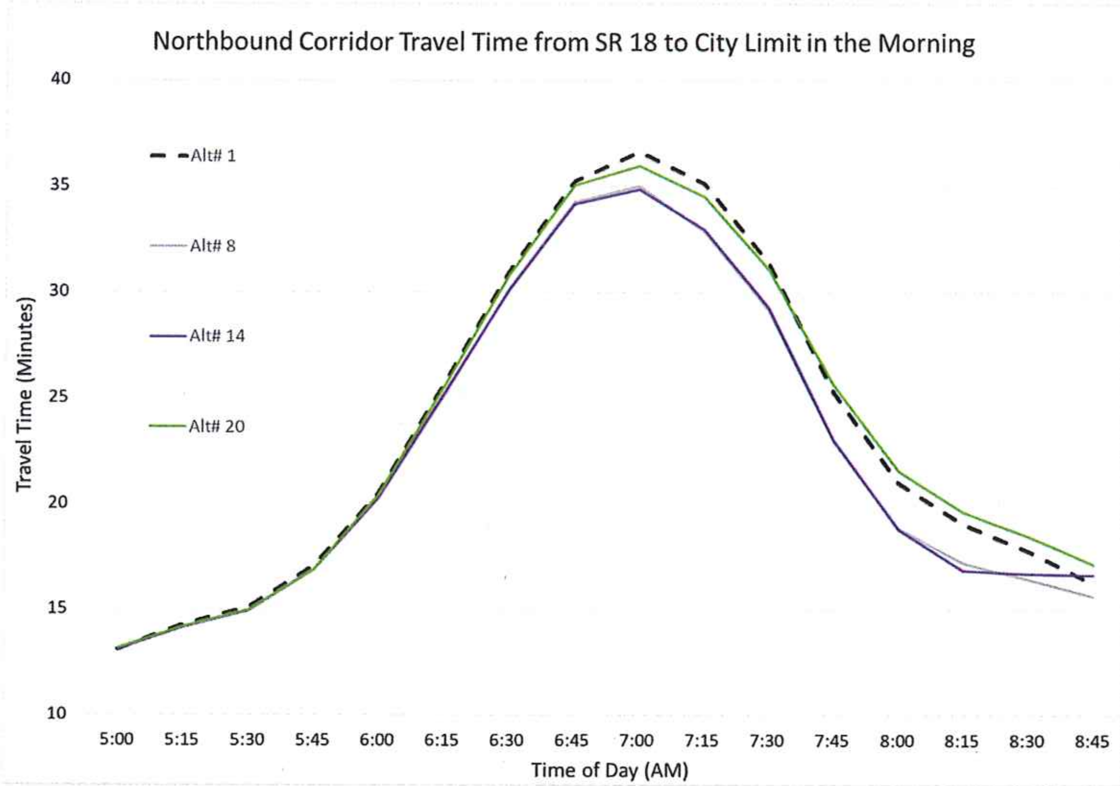


Exhibit 23: Opening Year (2023) Corridor Travel Time in PM Peak direction

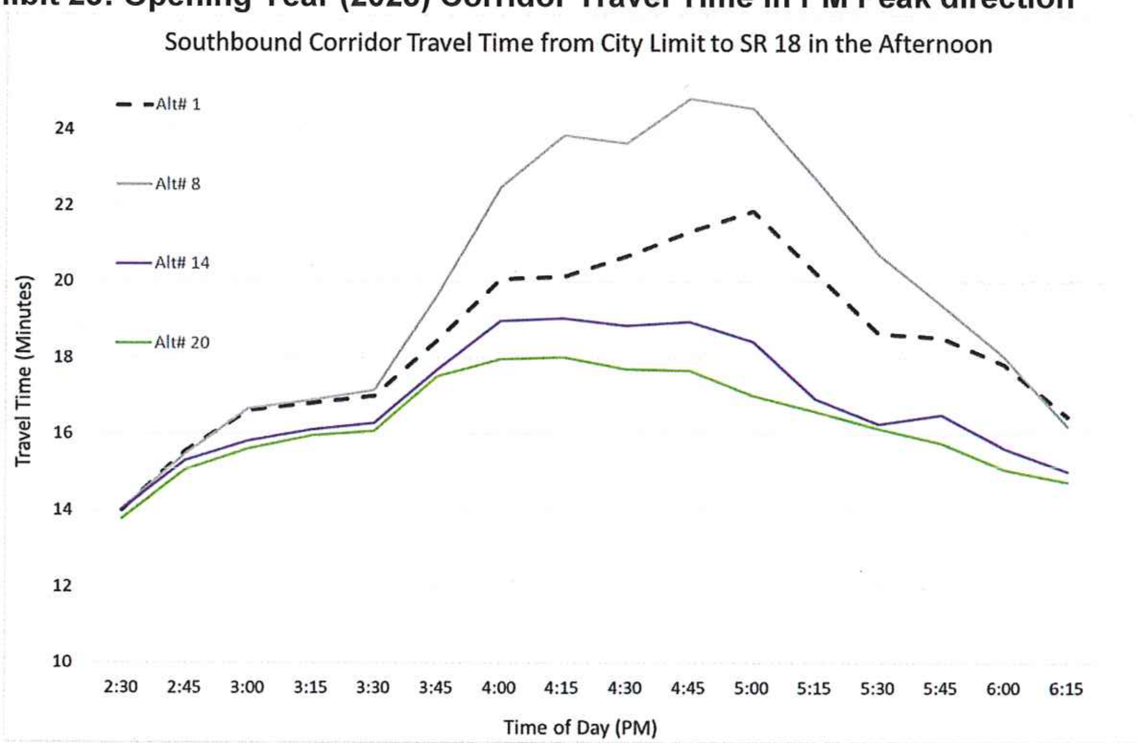
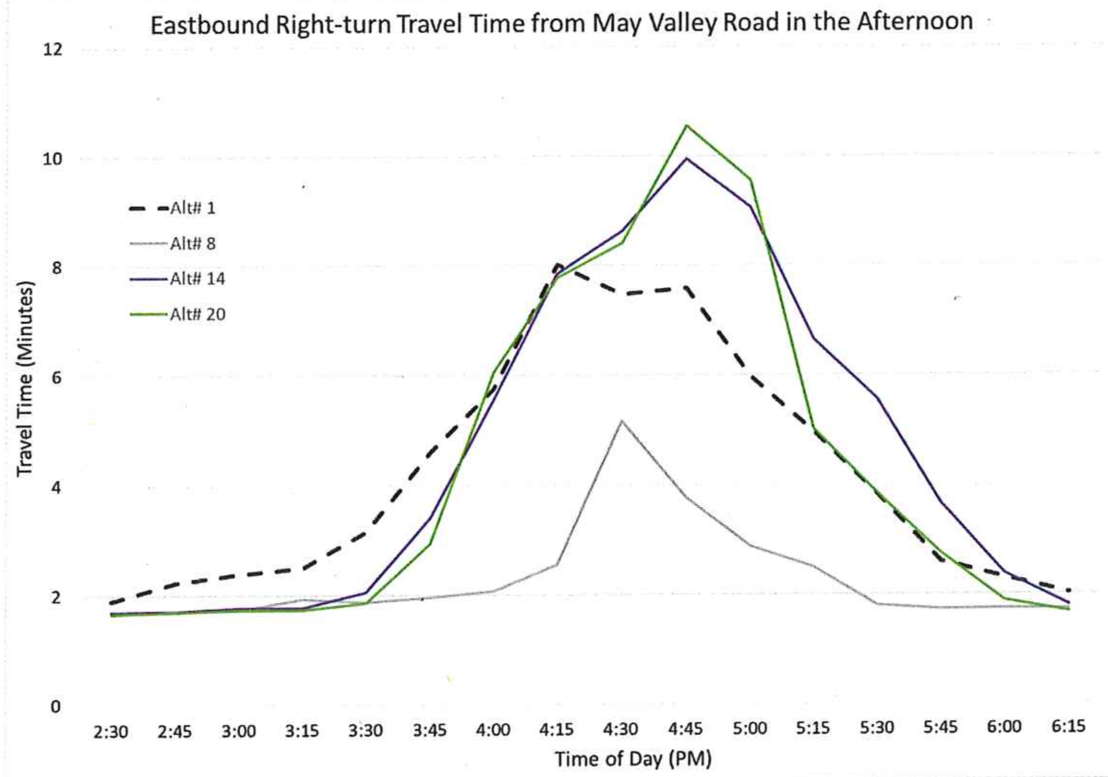


Exhibit 24: Opening Year (2023) May Valley Road Travel Time in PM Peak direction



In the opening year 2023, construction alternatives 14, and 20 are proposed to increase the intersection capacity at May Valley intersection to relieve the southbound congestion and improve southbound travel times in the afternoon. As shown in Exhibits 23 and 25, alternatives #14 and # 20 are expected to have the shortest southbound travel time with two southbound lanes through the intersection in the PM peak period. Compared with Alternative #1 (No Action), VISSIM results showed 10% and 13% travel time savings for vehicles traveling southbound along the corridor in the afternoon peak period for alternatives #14 and #20. Alternative #8 which is the single-lane roundabout with a slip lane on each approach will benefit the eastbound right-turn traffic but would reduce the throughput of the southbound through traffic from the north of May Valley and increase SB queueing and travel times. Alternative #8 is expected to reduce the eastbound travel time on May Valley Road by 48%, however, it would increase the southbound travel time by 6% in the afternoon. With all alternatives, the corridor segment south of May Valley Road at the merge point and the Cedar Grove intersection would limit the amount of southbound traffic throughput and function as the next bottleneck.

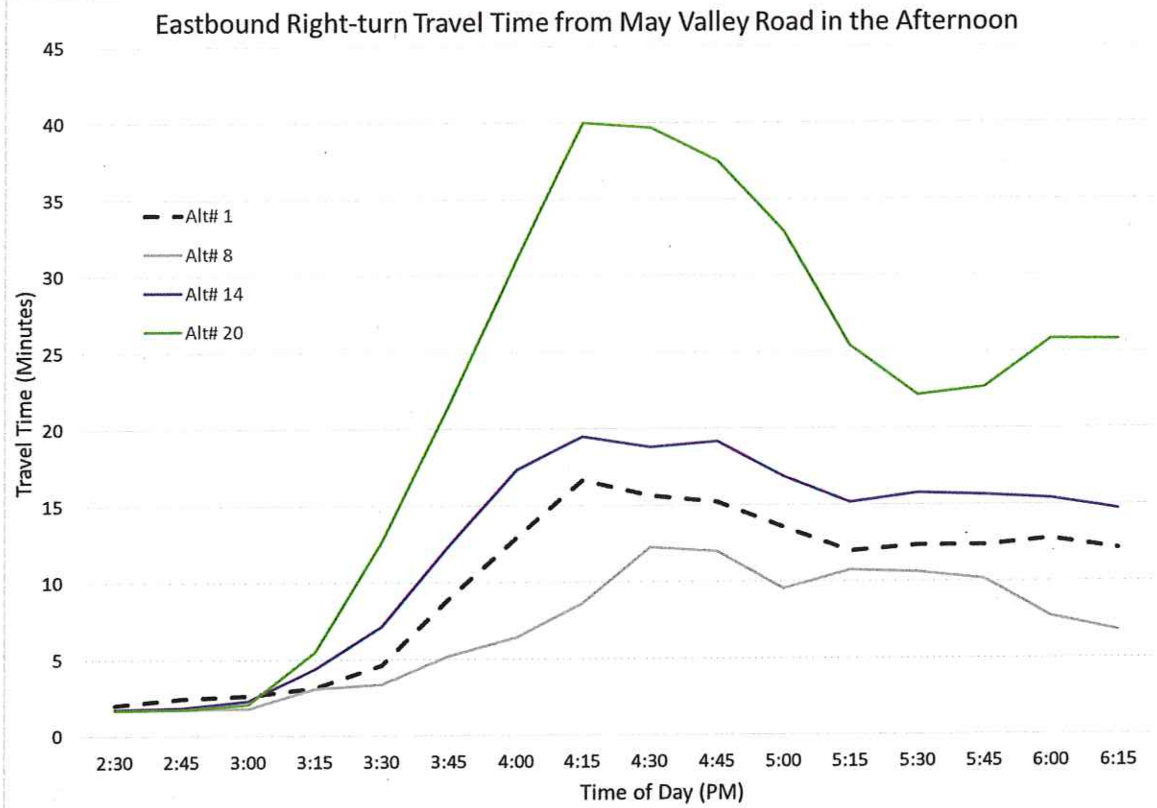
In the morning, the bottleneck for the northbound traffic is the segment north of Cedar Grove intersection. The improvement at May Valley intersection would improve the northbound congestion, but will not completely remove the morning travel bottleneck. Alternatives 8 and 14 are expected to smooth the northbound traffic and improve the northbound travel time by 4% in the AM peak period. Alternative 20 is expected to have similar travel time as No action.

Exhibit 25: AM/PM Peak Period Peak Direction Total Travel Time Comparison

Opening Year 2023	AM Peak			PM Peak		
Travel Time Reductions	NB Issaquah-Hobart	EB May Valley	EB Cedar Grove	SB Issaquah-Hobart	EB May Valley	EB Cedar Grove
Alternative 1 (Baseline)	0	0	0	0	0	0
Alternative 8	-4%	-4%	-13%	6%	-48%	0%
Alternative 14	-4%	-4%	-15%	-10%	10%	2%
Alternative 20	0%	-6%	13%	-13%	4%	2%
Design Year 2043	**AM Peak**			**PM Peak**		
Travel Time Reductions	NB Issaquah-Hobart	EB May Valley	EB Cedar Grove	SB Issaquah-Hobart	EB May Valley	EB Cedar Grove
Alternative 1 (Baseline)	0	0	0	0	0	0
Alternative 8	0%	-7%	-18%	14%	-28%	0%
Alternative 14	-1%	-7%	-14%	1%	9%	1%
Alternative 20	3%	-8%	-14%	-17%	22%	2%

In the design year 2043, with projected peak hour volumes, the corridor would be over capacity as a two-lane roadway. The corridor would operate at LOS E or F in the peak direction in year 2043 as shown in Exhibit #21. Alternative #20 is still expected to reduce southbound corridor travel time by 17%, however, eastbound traffic on May Valley Road would have difficulty entering the roundabout as shown in Exhibit #26.

Exhibit 26: Design Year (2043) May Valley Road Travel Time in PM Peak direction



The following Exhibits 27 and 28 summarize VISSIM results of average queue length for alternatives 1, 8, 14, and 20 with future conditions in the opening year 2023 and design year 2043:

Exhibit 27: Opening Year (2023) AM/PM Peak Average Queue Length (feet)

	5:30-6:30 AM				6:30-7:30 AM				7:30-8:30 AM			
Opening Year (2023) AM Peak Period	Alternative 1	Alternative 8	Alternative 14	Alternative 20	Alternative 1	Alternative 8	Alternative 14	Alternative 20	Alternative 1	Alternative 8	Alternative 14	Alternative 20
Northbound queues south of May Valley Roac	250	0	1	0	1279	0	3	0	2966	1189	7	0
Northbound queues south of Cedar Grove Ro	3045	3052	3041	3031	6718	6369	6337	6638	2384	1833	1809	2487
Eastbound Queues on May Valley Road	30	0	3	0	35	0	6	1	44	0	10	1
Eastbound Queues on Cedar Grove Road	167	192	179	200	835	717	702	1052	589	334	315	702
	3:00-4:00 PM				4:00-5:00 PM				5:00-6:00 PM			
Opening Year (2023) PM Peak Period	Alternative 1	Alternative 8	Alternative 14	Alternative 20	Alternative 1	Alternative 8	Alternative 14	Alternative 20	Alternative 1	Alternative 8	Alternative 14	Alternative 20
Southbound Queues north of May Valley	3555	1573	174	1	6229	7903	1831	6	6086	8688	1067	1
Southbound queues north of Cedar Grove	970	1388	1617	1588	2100	2310	4066	4609	791	1048	2606	3260
Eastbound queues on May Valley Road	364	48	160	84	1711	529	1907	1839	723	219	1337	1035
Eastbound Queues on Cedar Grove Road	39	39	43	41	43	41	44	43	44	46	46	48

Exhibit 28: Design Year (2043) AM/PM Peak Average Queue Length (feet)

	5:30-6:30 AM				6:30-7:30 AM				7:30-8:30 AM			
Design Year (2043) AM Peak Period	Alternative 1	Alternative 8	Alternative 14	Alternative 20	Alternative 1	Alternative 8	Alternative 14	Alternative 20	Alternative 1	Alternative 8	Alternative 14	Alternative 20
Northbound queues south of May Valley Road	478	0	2	0	2254	0	4	0	3929	1245	10	378
Northbound queues south of Cedar Grove Road	8772	8812	8657	8653	16146	15879	15871	16175	15726	15163	14869	15641
Eastbound Queues on May Valley Road	38	0	4	0	44	0	10	1	59	1	18	4
Eastbound Queues on Cedar Grove Road	428	375	362	369	2909	2403	2458	2571	4606	3530	3815	3768
	3:00-4:00 PM				4:00-5:00 PM				5:00-6:00 PM			
Design Year (2043) PM Peak Period	Alternative 1	Alternative 8	Alternative 14	Alternative 20	Alternative 1	Alternative 8	Alternative 14	Alternative 20	Alternative 1	Alternative 8	Alternative 14	Alternative 20
Southbound Queues north of May Valley	15077	10365	10366	2105	15890	15928	15884	12306	15932	15921	15852	12174
Southbound queues north of Cedar Grove	2524	2789	4412	4654	2852	3039	4736	4947	1396	2252	4571	4908
Eastbound queues on May Valley Road	1187	564	1678	2093	4189	3002	4275	4327	4143	3420	4217	4274
Eastbound Queues on Cedar Grove Road	55	57	59	58	53	53	55	56	63	64	67	67

In the Opening year 2023 AM peak period, alternative #8 and #14 are expected to have shortest average queues for two heavy movements (northbound through and eastbound Cedar Grove Road). In the PM peak period, alternative #8 would reduce the southbound queues during 3-4PM, but would cause longer queues along Issaquah-Hobart Road corridor with the average queue length of over 1 and a half miles in the PM peak hour. Both alternative #14 and 20 would reduce significantly the southbound queues north of May Valley Road. Alternatives #14 and 20 would increase the intersection capacity at May Valley and carry more southbound traffic to the intersection at Cedar Grove, therefore, there would be longer delays at Cedar Grove intersection until additional improvements are completed at the Cedar Grove intersection.

In the design year 2043, the corridor would operate at LOS E or F in the peak direction as shown in Exhibit #21. As shown in Exhibit #28, all the intersection capacity improvements would improve the southbound traffic operation in the non-peak hours in the afternoon before 4PM until the corridor reaches capacity in the PM peak hour from 4PM-5PM. Once the corridor is over capacity with a LOS E or F, although the design alternatives could carry more traffic through the intersection going southbound, the roadway segment south of May Valley intersection (the merge point and the Cedar Grove intersection) is over capacity and will limit the amount of traffic going through. Extensive queues were expected to generate from the bottleneck with all construction alternatives.

Evaluation and Ratings:

The overall ratings from alternatives 1, 8, 14 and 20 are summarized in Exhibit 29. The overall rating point is calculated based on the level of improvement (No/Low/Medium/High) for each rating criteria (Safety and Mobility). The alternative with the highest overall rating point is expected to have the most significant improvement for the corridor. The alternative with the lowest overall rating point is expected to have less benefit overall.

Exhibit 29: Comparison of Overall Ratings for Construction Alternatives

Comparison of Overall Ratings for Construction Alternatives					
	Mobility (NB) [1]	*Mobility (SB)* [1]	*Mobility (Side Street)* [1]	*Safety* [2]	*Overall Rating Point* [3]
Alternative 1	0	0	0	0	0
Alternative 8	1	-2	1	2	2
Alternative 14	1	3	0	2	6
Alternative 20	0	3	0	3	6

1 Mobility point is based on the improvement on travel time, delay and LOS

2 Safety point is rated for alternatives based on existing collision pattern and intersection improvement

3 Overall Impact point is the sum of rating points based on four levels of improvement (No=0, Low=1, Medium=2, High=3)

Alternatives #14 and #20 are the preferred alternatives based on the comparison of the safety benefit and operational analysis results of corridor travel times, corridor LOS, and queues for the peak direction and congested movements. Alternative #8 is not recommended since it would increase the travel time and queues and carry less throughput for the southbound movement along the corridor which is already congested. Alternatives #14 and #20 are expected to carry more southbound traffic from May Valley intersection to Cedar Grove intersection with the additional southbound through lane at May Valley intersection which will increase the intersection capacity. The southbound merge after May Valley and the Cedar Grove intersection would likely be the next bottlenecks for the afternoon traffic with traffic growth in the design year 2043. With more southbound arrival at Cedar Grove, the intersection at Cedar Grove is expected to experience longer intersection delay, queues, and lower LOS in the afternoon peak period.

The following Exhibits 30 and 31 summarize the Synchro intersection analysis for alternative #14 and the roundabout intersection analysis result from SIDRA 7.0 for alternative #20 in opening year and design year. Both options would provide enough capacity for the future demand except the eastbound movement for the hybrid roundabout in design year 2043 PM peak, which would operate a LOS F. Synchro and SIDRA provide better LOS than VISSIM since they both are planning level analysis tools and not able to take into consideration of the impact of bottleneck, queuing and congestion along the corridor. Both tables only show the control delay for both alternatives and would not include any delay from queues, congestions from downstream or delay related with vehicles slowing down, merging, diverging, or stops for school buses.

Both Alternatives #14 and #20 are expected to provide comparable benefit of corridor safety and mobility by providing better corridor LOS, reduce travel times and queue length in southbound direction in the opening year 2023. With the addition of another 20% growth in peak hour traffic volume in 2043, the study corridor would be over capacity as a two-lane roadway and operate at LOS E and F. The intersection capacity improvement alternatives would still improve the corridor safety and mobility during the non-peak hours in the AM and PM peak period, but are not expected to improve PM peak hour traffic operation. Both alternatives are expected to reduce the congested hours by improving the traffic operation in the non-peak hours in the peak period.

Exhibit 30: AM/PM Peak May Valley Intersection Delay and LOS for Alternative #14

	Alternative #14					
	AM Peak Hour			PM Peak Hour		
Opening Year (2023)	LOS	Delay (sec)	95TH % Queue (feet)	LOS	Delay (sec)	95TH % Queue (feet)
Issaquah Hobart and May Valley						
Eastbound Left	C	29.9	78	C	32.8	91
Eastbound Right	B	10.5	15	B	18.8	#197
Northbound Left	A	6.2	44	A	8.3	31
Northbound Through	A	6.4	164	A	5.1	52
Southbound Through	B	10.8	67	B	16.7	241
Intersection Overall	**A**	**8.5**		**B**	**15.4**	
Design Year (2043)	AM Peak Hour			PM Peak Hour		
Issaquah Hobart and May Valley						
Eastbound Left	E	78.5	#168	C	32.0	113
Eastbound Right	B	16.2	17	E	57.8	#397
Northbound Left	A	9.7	55	C	31.1	#115
Northbound Through	B	12.4	392	A	7.3	90
Southbound Through	A	9.2	120	C	26.1	371
Intersection Overall	**B**	**14.6**		**C**	**30.8**	

Exhibit 31: AM/PM Peak May Valley Intersection Delay and LOS for Alternative #20

	Alternative #20					
	AM Peak Hour			PM Peak Hour		
Opening Year (2023)	LOS	Delay (sec)	95TH % Queue (feet)	LOS	Delay (sec)	95TH % Queue (feet)
Issaquah Hobart and May Valley						
Eastbound Left	A	4.0	7.7	C	22.7	96.5
Eastbound Right	A	4.0	5	C	21.3	96.5
Northbound Left	B	12.1	165.6	A	5.4	34.5
Northbound Through	A	7.0	165.6	A	2.8	34.5
Southbound Through	A	4.4	16.5	A	7.1	64.3
Southbound Right	A	4.4	16.5	A	7.1	64.3
Intersection Overall	**A**	**A**		**B**	**10.7**	
Design Year (2043)	AM Peak Hour			PM Peak Hour		
Issaquah Hobart and May Valley						
Eastbound Left	A	4.7	10.4	F	69.9	298
Eastbound Right	A	4.6	6.9	F	66.7	315.5
Northbound Left	C	20.2	306.7	A	6.6	51.1
Northbound Through	B	11.5	306.7	A	3.4	51.1
Southbound Through	A	5.2	26.5	A	9.1	92.9
Southbound Right	A	5.2	26.5	A	9.1	92.9
Intersection Overall	**B**	**10.4**		**D**	**25.3**	

Next Step

Either Cedar Grove Intersection Improvement or Corridor Improvement

The preferred two alternatives #14 and #20 are expected to improve corridor safety and mobility by relieving the queues and congestion in southbound direction in the opening year 2023. The next step was to study improvements for the Cedar Grove/Issaquah Hobart intersection or adding 2 additional lanes between the study intersections with the May Valley improvements in place.

Three alternatives were evaluated and compared in this section:

- Alternative 17: maintain existing traffic signal with additional northbound and southbound through lanes at May Valley intersection, no action at Cedar Grove intersection, build additional travel times between two study intersections.
- Alternative 24: a hybrid roundabout at May Valley intersection and maintain existing traffic signal with additional northbound and southbound through lanes at Cedar Grove intersection, no additional travel lanes between study intersections.
- Alternative 25: maintain existing traffic signals with additional northbound and southbound through lanes at both study intersections, no additional travel lanes between study intersections.

The following Exhibits 32 and 37 summarized the VISSIM results of corridor travel time and LOS for alternatives 17, 24 and 25 for future conditions in the opening year 2023 and design year 2043 conditions compare with alternative 1 for No Action:

Exhibit 32: Opening Year (2023) AM/PM Peak Corridor Speed and LOS

Corridor Segment	AM Peak						PM Peak					
	5:30-6:30		6:30-7:30		7:30-8:30		3:00-4:00		4:00-5:00		5:00-6:00	
	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)
Issaquah-Hobart Road-NB from SR-18 to 2nd Ave												
Alternative 1 (Baseline)	D	21	F	12	E	16	B	29	B	28	B	29
Alternative 17	C	24	D	18	C	24	B	30	B	30	B	30
Alternative 24	D	21	E	15	C	24	B	29	B	29	B	29
Alternative 25	D	22	E	16	C	26	B	29	B	29	B	29
Issaquah-Hobart Road-SB from 2nd Ave to SR-18												
Alternative 1 (Baseline)	B	32	B	29	C	28	C	22	D	19	D	20
Alternative 17	B	32	C	23	C	25	C	25	D	20	C	23
Alternative 24	B	32	B	30	B	29	C	25	C	24	C	27
Alternative 25	B	32	B	29	B	29	C	25	C	24	C	26
May Valley Road-EB from 223rd Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	A	31	B	30	B	29	D	16	F	7	E	11
Alternative 17	B	27	B	28	B	26	B	28	B	29	B	29
Alternative 24	A	32	A	31	A	31	B	28	B	25	B	29
Alternative 25	A	32	A	31	A	31	B	26	C	22	B	28
Cedar Grove Road-EB 236th Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	D	21	F	10	E	10	C	25	C	24	B	25
Alternative 17	C	28	B	30	A	30	C	25	C	23	B	25
Alternative 24	C	25	C	21	B	28	B	28	B	28	B	29
Alternative 25	C	24	C	22	B	30	B	28	B	28	B	29

Exhibit 33: Design Year (2043) AM/PM Peak Corridor Speed and LOS

Corridor Segment	AM Peak						PM Peak					
	5:30-6:30		6:30-7:30		7:30-8:30		3:00-4:00		4:00-5:00		5:00-6:00	
	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)
Issaquah-Hobart Road-NB from SR-18 to 2nd Ave												
Alternative 1 (Baseline)	E	17	F	8	F	6	C	28	C	27	C	27
Alternative 17	D	19	F	11	E	14	B	29	B	28	B	29
Alternative 24	D	17	F	8	F	7	B	28	B	28	B	28
Alternative 25	D	17	F	8	F	7	B	29	B	28	B	28
Issaquah-Hobart Road-SB from 2nd Ave to SR-18												
Alternative 1 (Baseline)	B	31	C	28	C	27	E	16	E	13	E	14
Alternative 17	B	29	D	21	E	16	D	18	F	10	F	10
Alternative 24	B	31	C	28	C	26	D	22	D	20	C	22
Alternative 25	B	31	C	28	C	27	D	20	E	17	E	17
May Valley Road-EB from 223rd Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	B	30	B	29	B	28	E	11	F	3	F	4
Alternative 17	B	25	C	18	F	6	C	23	F	4	F	4
Alternative 24	A	32	A	31	A	31	E	11	F	3	F	3
Alternative 25	A	31	A	31	A	30	D	15	F	4	F	4
Cedar Grove Road-EB 236th Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	E	15	F	4	F	2	C	24	C	24	B	24
Alternative 17	C	23	F	5	F	8	C	23	C	24	C	24
Alternative 24	D	22	D	14	C	19	C	27	B	27	B	27
Alternative 25	D	22	D	14	D	17	C	27	B	27	B	26

Exhibit 34: Opening Year (2023) Corridor Travel Time in AM Peak direction

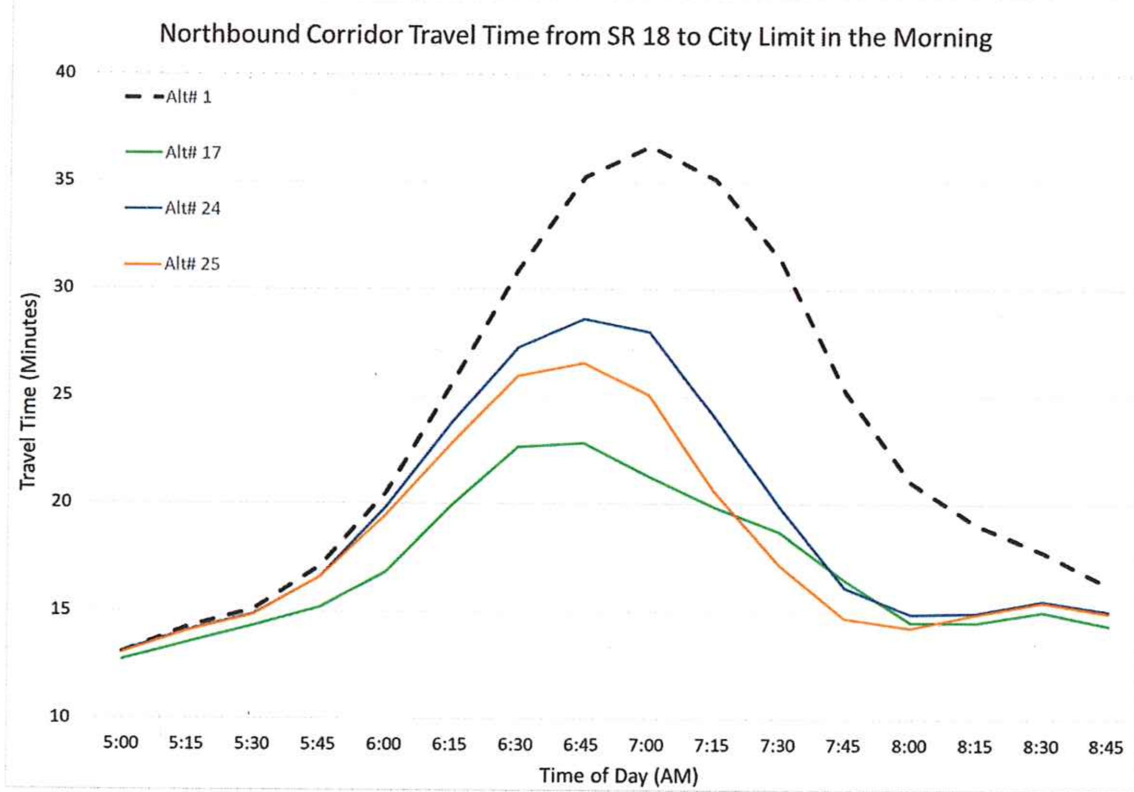


Exhibit 35: Opening Year (2023) Cedar Grove Road Eastbound Travel Time in AM Peak Period

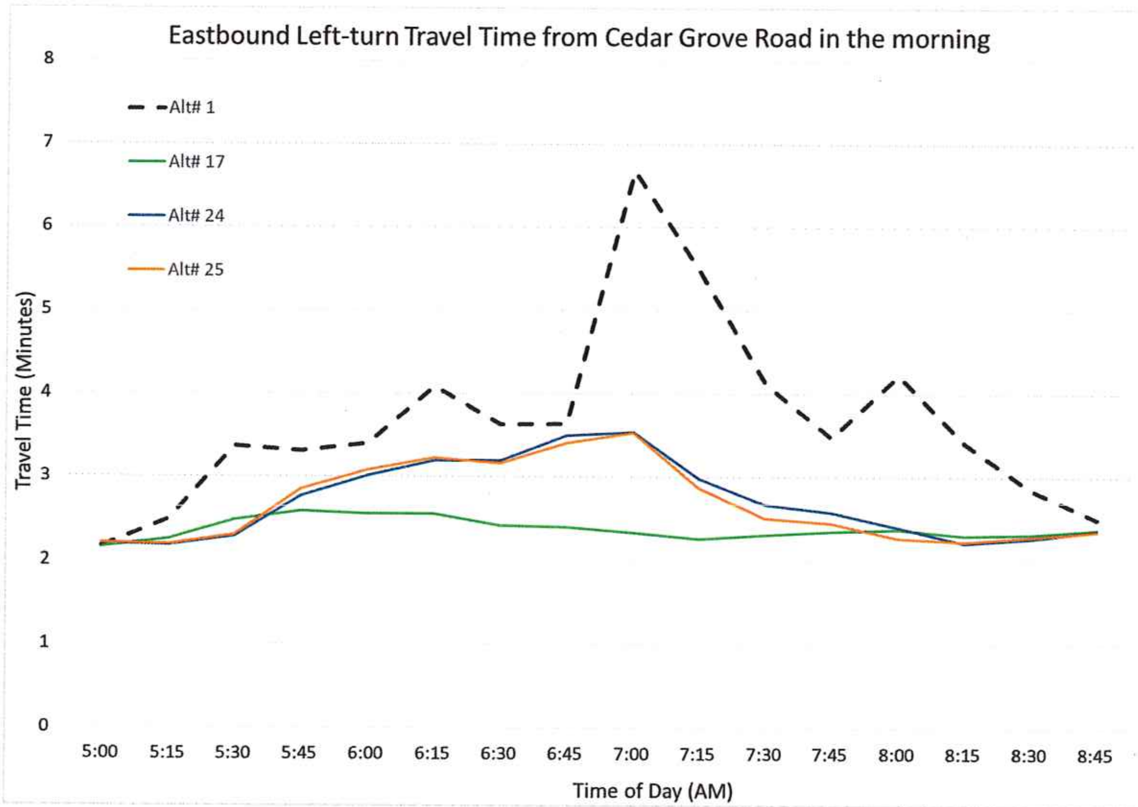


Exhibit 36: Opening Year (2023) Corridor Travel Time in PM Peak direction

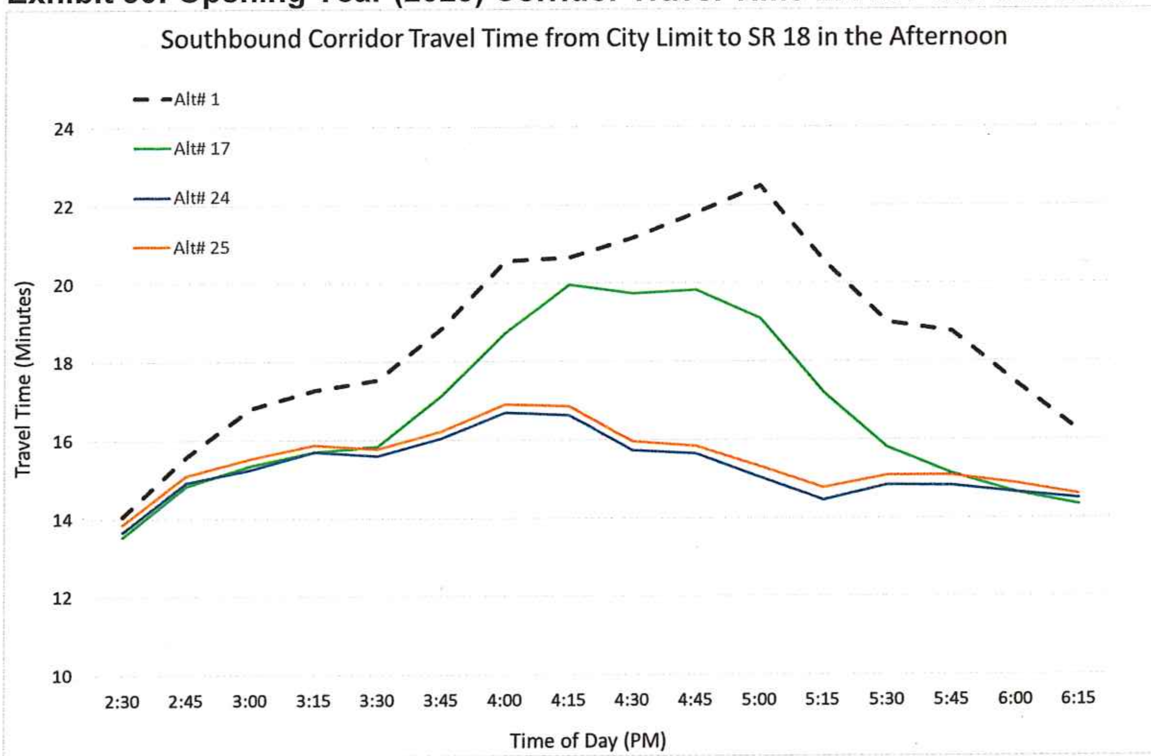
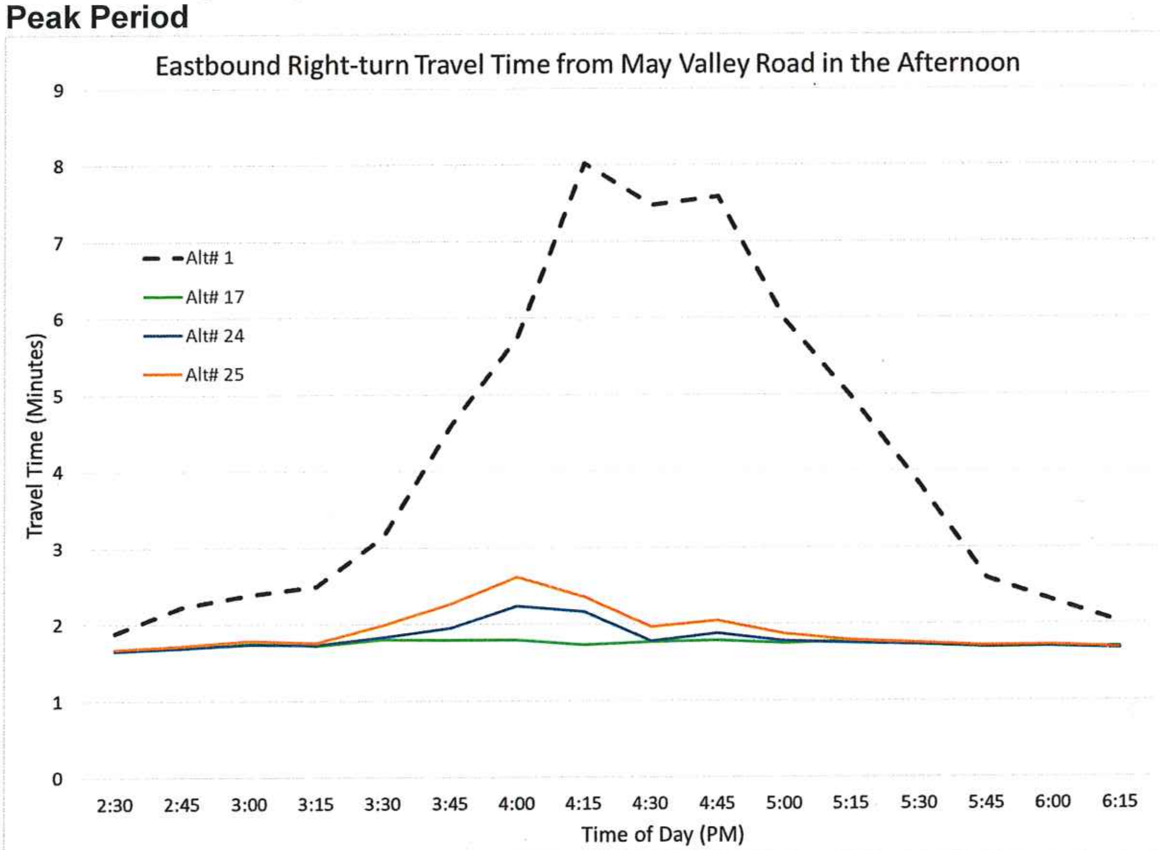


Exhibit 37: Opening Year (2023) May Valley Road Eastbound Travel Time in PM Peak Period



As shown in the Exhibit 38, alternatives #17 and #25 are expected to have the most travel time reduction of 26% and 22% in the northbound direction in the opening year 2023 morning peak period. Alternatives #24 and #25 would have the most travel time reduction of 18% and 17% in the southbound direction in the afternoon. Overall, alternative #25 would have the most benefit in travel time reduction in opening year 2023 AM and PM peak period.

Exhibit 38: AM/PM Peak Period Peak Direction Total Travel Time Comparison

Opening Year 2023	AM Peak			PM Peak		
Travel Time Reductions	NB Issaquah-Hobart	EB May Valley	EB Cedar Grove	SB Issaquah-Hobart	EB May Valley	EB Cedar Grove
Alternative 1 (Baseline)	0	0	0	0	0	0
Alternative 17	-26%	7%	-56%	-10%	-62%	0%
Alternative 24	-17%	-6%	-48%	-18%	-60%	-12%
Alternative 25	-22%	-4%	-49%	-17%	-57%	-12%
Design Year 2043	AM Peak			PM Peak		
Travel Time Reductions	NB Issaquah-Hobart	EB May Valley	EB Cedar Grove	SB Issaquah-Hobart	EB May Valley	EB Cedar Grove
Alternative 1 (Baseline)	0	0	0	0	0	0
Alternative 17	-34%	249%	-53%	27%	-13%	2%
Alternative 24	-1%	-8%	-77%	-18%	7%	-10%
Alternative 25	-3%	-7%	-76%	-5%	-8%	-9%

In the design year 2043, the corridor would be at capacity as a two-lane roadway. The merge point north of May Valley Road is expected be the capacity bottleneck for the northbound traffic in the morning. In the afternoon, the Cedar Grove intersection would operate at capacity for alternative #17, and the merge point south of May Valley Road would be the capacity bottleneck for the southbound traffic for alternatives #24 and #25.

All the three alternatives would increase the capacity for the southbound direction. In the design year 2043 PM peak period, all alternatives are expected to carry more southbound traffic through the corridor than the no action option (Alternative #1). Alternative #25 is expected to serve additional 500 southbound vehicles during the PM peak period, alternative #24 is expected to serve another 490 southbound vehicles, and alternative #17 would carry additional 280 southbound vehicles through the corridor. This additional entering traffic will be running through the network, but will have to wait in the queue at the capacity bottle neck which will result in longer queues, travel time, and delays. The MOE comparisons are complicated for the design year due to the fact that the corridor is over capacity. The vehicle throughputs and the number of unserved vehicles shows a better picture of the corridor operation.

Exhibits 39 and 40 summarize VISSIM results of average queue length for alternatives 1, 17, 24, and 25 with future conditions in the opening year 2023 and design year 2043:

Exhibit 39: Opening Year (2023) AM/PM Peak Average Queue Length (feet)

	5:30-6:30 AM				6:30-7:30 AM				7:30-8:30 AM			
Opening Year (2023) AM Peak Period	Alternative 1	Alternative 17	Alternative 24	Alternative 25	Alternative 1	Alternative 17	Alternative 24	Alternative 25	Alternative 1	Alternative 17	Alternative 24	Alternative 25
Northbound queues south of May Valley Road	250	481	0	2	1279	1819	0	3	2966	280	0	6
Northbound queues south of Cedar Grove Ro	3045	33	1866	1760	6718	20	3841	3089	2384	12	301	81
Eastbound Queues on May Valley Road	30	36	0	3	35	49	1	6	44	50	1	10
Eastbound Queues on Cedar Grove Road	167	62	22	20	835	52	54	43	589	34	20	18
	3:00-4:00 PM				4:00-5:00 PM				5:00-6:00 PM			
Opening Year (2023) PM Peak Period	Alternative 1	Alternative 17	Alternative 24	Alternative 25	Alternative 1	Alternative 17	Alternative 24	Alternative 25	Alternative 1	Alternative 17	Alternative 24	Alternative 25
Southbound Queues north of May Valley	3555	103	0	163	6229	55	0	275	6086	32	0	92
Southbound queues north of Cedar Grove	970	601	24	23	2100	2197	27	36	791	1022	20	21
Eastbound queues on May Valley Road	364	35	26	72	1711	36	71	153	723	32	16	33
Eastbound Queues on Cedar Grove Road	39	40	22	22	43	46	22	23	44	43	23	22

Exhibit 40: Design Year (2043) AM/PM Peak Average Queue Length (feet)

	5:30-6:30 AM				6:30-7:30 AM				7:30-8:30 AM			
Design Year (2043) AM Peak Period	Alternative 1	Alternative 17	Alternative 24	Alternative 25	Alternative 1	Alternative 17	Alternative 24	Alternative 25	Alternative 1	Alternative 17	Alternative 24	Alternative 25
Northbound queues south of May Valley Road	478	1870	0	2	2254	5393	0	4	3929	5418	405	9
Northbound queues south of Cedar Grove Ro	8772	198	7094	6923	16146	1800	15262	14857	15726	87	14597	14039
Eastbound Queues on May Valley Road	38	56	0	4	44	111	1	9	59	667	4	17
Eastbound Queues on Cedar Grove Road	428	178	48	45	2909	2303	330	325	4606	1152	96	124
	3:00-4:00 PM				4:00-5:00 PM				5:00-6:00 PM			
Design Year (2043) PM Peak Period	Alternative 1	Alternative 17	Alternative 24	Alternative 25	Alternative 1	Alternative 17	Alternative 24	Alternative 25	Alternative 1	Alternative 17	Alternative 24	Alternative 25
Southbound Queues north of May Valley	15077	12227	0	9140	15890	15604	26	15693	15932	15680	344	15165
Southbound queues north of Cedar Grove	2524	2569	60	55	2852	4741	861	225	1396	4712	1820	460
Eastbound queues on May Valley Road	1187	171	1037	616	4189	3668	4274	3789	4143	4181	4205	4186
Eastbound Queues on Cedar Grove Road	55	60	35	36	53	56	34	36	63	68	42	45

Exhibit 41 summarizes the Synchro analysis for alternative #17 and shows the Cedar Grove/Issaquah Hobart intersection would operate a LOS F in the design year 2043 PM peak hour. With May Valley intersection capacity improvement, the southbound travel demand would increase at Cedar Grove Road. An additional southbound through lane would be need to accommodate the increased travel demand as exhibit 42 shows. Exhibit 42 summarizes the Synchro analysis for alternatives #24 and #25 which would maintain the existing signal with additional northbound and southbound through lanes at Cedar Grove Road. Cedar Grove intersection would operate a LOS B or C in both opening year 2023 and design year 2043.

Again, both tables only show the control delay for traffic signal itself. Lower LOS and longer delay/queues are expected in the field which include any delay from queues, congestions from downstream or delay related with vehicles slowing down, merging, diverging, or stops for school buses.

Exhibit 41: AM/PM Peak Cedar Grove Intersection Delay and LOS for Alternative #17

	Alternative #17					
	AM Peak Hour			PM Peak Hour		
Opening Year (2023)	LOS	Delay (sec)	95^{TH} % Queue (feet)	LOS	Delay (sec)	95^{TH} % Queue (feet)
Issaquah Hobart and Cedar Grove						
Eastbound Left	C	24.4	#261	E	63.1	143
Eastbound Right	A	8.9	6	B	15.5	25
Northbound Left	A	8.5	7	A	5.7	8
Northbound Through	B	17.5	197	A	3.1	41
Southbound Through	B	14.3	73	D	45.3	#1322
Southbound Right	A	5.3	15	A	4.3	63
Intersection Overall	**B**	**18.3**		**C**	**32.8**	
Design Year (2043)	**AM Peak Hour**			**PM Peak Hour**		
Issaquah Hobart and Cedar Grove						
Eastbound Left	D	40.2	#407	F	123.7	#253
Eastbound Right	B	10.2	7	B	16.6	29
Northbound Left	B	11.7	11	B	10.5	9
Northbound Through	C	23.8	376	A	2.6	43
Southbound Through	B	18.2	131	F	130.1	#1709
Southbound Right	B	4.9	20	A	4.5	72
Intersection Overall	**C**	**25.9**		**F**	**86.9**	

Exhibit 42: AM/PM Peak Cedar Grove Intersection Delay and LOS for Alternatives #24 and #25

	Alternatives #24 and #25					
	AM Peak Hour			PM Peak Hour		
Opening Year (2023)	LOS	Delay (sec)	95^{TH} % Queue (feet)	LOS	Delay (sec)	95^{TH} % Queue (feet)
Issaquah Hobart and Cedar Grove						
Eastbound Left	C	24.8	#261	D	39.1	102
Eastbound Right	A	8.9	6	B	11.9	21
Northbound Left	A	8.6	7	A	4.1	7
Northbound Through	B	17.5	197	A	35.0	33
Southbound Through	B	11.5	37	B	12.9	388
Intersection Overall	**B**	**18.1**		**B**	**12.5**	
Design Year (2043)	**AM Peak Hour**			**PM Peak Hour**		
Issaquah Hobart and Cedar Grove						
Eastbound Left	D	40.2	#407	D	54.0	161
Eastbound Right	B	10.2	7	B	11.8	24
Northbound Left	B	11.7	11	A	7.4	14
Northbound Through	C	23.8	376	A	4.3	70
Southbound Through	B	14.9	70	C	23.3	#791
Intersection Overall	**C**	**25.7**		**C**	**20.9**	

Full Corridor Capacity and Intersection Improvements:

In this section, the report evaluates the benefit of adding additional travel lanes to increase the corridor capacity between May Valley Road and Cedar Grove Road with intersection improvements in place at the two study intersections. However, the rest of corridor north of May Valley and south of Cedar Grove Rd remains as a two-lane road which will limit the amount of traffic going through in the future.

Three alternatives were evaluated in this section to compare the combination of different intersection capacity improvements at study intersections with corridor improvements:

- ***Alternative 22***: Construct a hybrid roundabout at May Valley Road intersection; Maintain existing signal with additional northbound and southbound through lanes a Cedar Grove intersection, add two additional lanes between May Valley and Cedar Grove.
- ***Alternative 23***: Construct hybrid roundabouts at both May Valley and Cedar Grove intersections, two additional lanes between May Valley and Cedar Grove.
- ***Alternative 26:*** Maintain existing signal with additional northbound and southbound through lanes at both May Valley and Cedar Grove intersections, two additional lanes between May Valley and Cedar Grove.

The following Exhibits 43 through 46 summarize the VISSIM results of corridor travel time and LOS for alternatives 22, 23 and 26 with the opening year 2023 and design year 2043 conditions compared with alternative 1 which is the no action scenario:

Exhibit 43: Opening Year (2023) AM/PM Peak Corridor Speed and LOS

Corridor Segment	AM Peak						PM Peak					
	5:30-6:30		6:30-7:30		7:30-8:30		3:00-4:00		4:00-5:00		5:00-6:00	
	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)
Issaquah-Hobart Road-NB from SR-18 to 2nd Ave												
Alternative 1 (Baseline)	D	21	F	12	E	16	B	29	B	28	B	29
Alternative 22	C	24	D	18	C	24	B	30	B	30	B	30
Alternative 23	C	24	D	18	C	24	B	30	B	30	B	30
Alternative 26	C	24	D	18	C	24	B	30	B	30	B	30
Issaquah-Hobart Road-SB from 2nd Ave to SR-18												
Alternative 1 (Baseline)	B	32	B	29	C	28	C	22	D	19	D	20
Alternative 22	B	32	B	30	B	30	C	26	C	25	C	27
Alternative 23	B	32	B	31	B	30	C	26	C	25	C	28
Alternative 26	B	32	D	21	C	26	C	26	C	25	C	27
May Valley Road-EB from 223rd Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	A	31	B	30	B	29	D	16	F	7	E	11
Alternative 22	A	32	A	31	A	31	B	28	B	28	B	29
Alternative 23	A	32	A	31	A	31	B	29	B	28	B	29
Alternative 26	B	26	B	28	B	24	B	29	B	29	B	29
Cedar Grove Road-EB 236th Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	D	21	F	10	E	10	C	25	C	24	B	25
Alternative 22	C	28	A	30	A	31	B	31	B	30	A	31
Alternative 23	B	34	A	34	A	34	B	34	B	27	A	35
Alternative 26	C	28	A	30	A	31	B	31	B	30	A	31

Exhibit 44: Design Year (2043) AM/PM Peak Corridor Speed and LOS

	AM Peak						PM Peak					
	5:30-6:30		6:30-7:30		7:30-8:30		3:00-4:00		4:00-5:00		5:00-6:00	
Corridor Segment	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)	LOS	Speed (mph)
Issaquah-Hobart Road-NB from SR-18 to 2nd Ave												
Alternative 1 (Baseline)	E	17	F	8	F	6	C	28	C	27	C	27
Alternative 22	D	19	F	11	E	14	B	29	B	29	B	29
Alternative 23	D	19	F	9	F	12	B	29	B	29	B	29
Alternative 26	D	19	F	12	E	14	B	29	B	29	B	29
Issaquah-Hobart Road-SB from 2nd Ave to SR-18												
Alternative 1 (Baseline)	B	31	C	28	C	27	E	16	E	13	E	14
Alternative 22	B	32	B	29	B	28	D	21	E	15	E	15
Alternative 23	B	32	B	30	B	29	D	22	E	15	E	15
Alternative 26	B	29	D	21	D	19	D	21	E	14	E	14
May Valley Road-EB from 223rd Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	B	30	B	29	B	28	E	11	F	3	F	4
Alternative 22	A	32	A	31	A	30	B	26	E	13	F	10
Alternative 23	A	32	A	31	A	31	B	27	D	17	E	14
Alternative 26	B	25	C	21	F	8	B	28	B	25	B	26
Cedar Grove Road-EB 236th Ave SE to Issaquah-Hobart Rd												
Alternative 1 (Baseline)	E	15	F	4	F	2	C	24	C	24	B	24
Alternative 22	C	23	F	4	F	6	C	27	C	24	C	24
Alternative 23	B	30	C	19	C	23	C	27	D	17	F	9
Alternative 26	C	24	F	5	F	8	C	27	C	24	C	24

Exhibit 45: Opening Year (2023) Corridor Travel Time in AM Peak direction

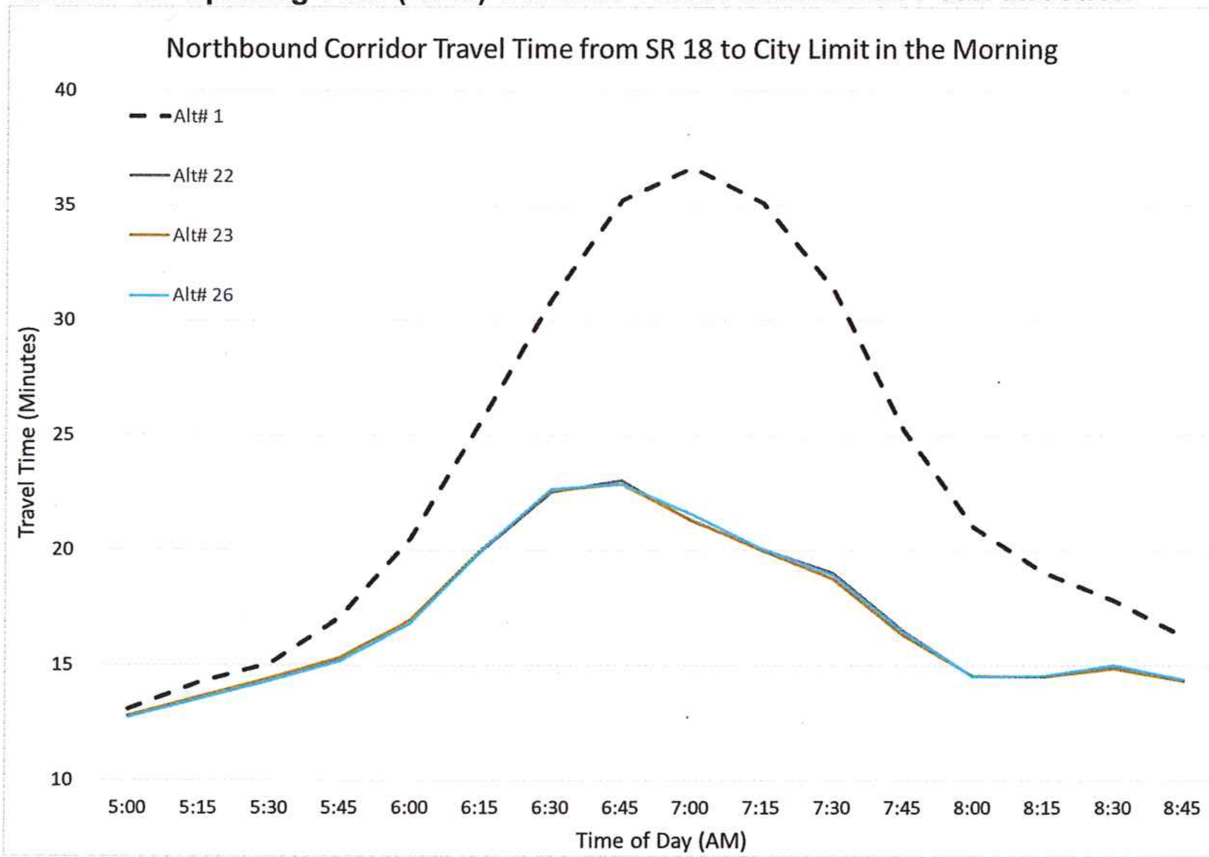
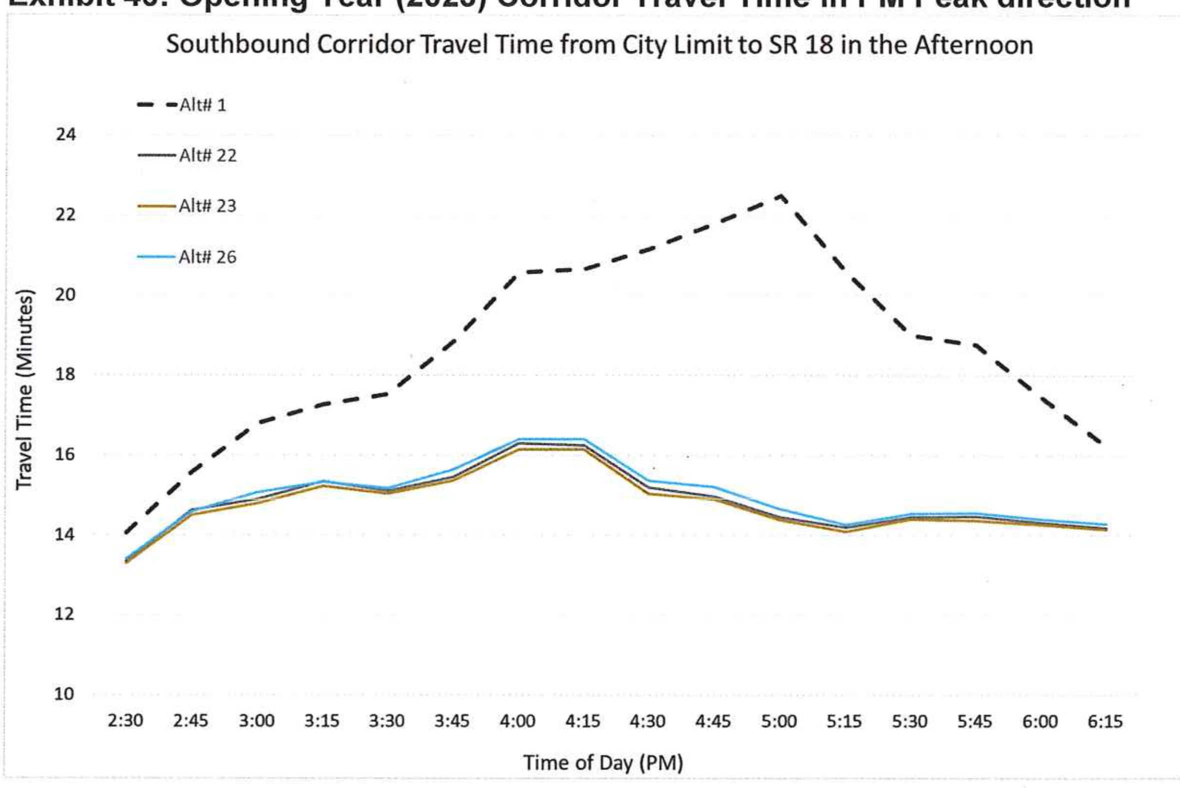


Exhibit 46: Opening Year (2023) Corridor Travel Time in PM Peak direction



The following Exhibits 47 summarized VISSIM results of travel time savings alternatives 22, 23 and 26 with the opening year 2023 and design year 2043 conditions. All three alternatives would reduce travel time by 26% and 22% in the northbound direction, and reduce eastbound travel time on Cedar Grove Road over 50% in the opening year 2023 morning peak period. In the PM peak period, they would reduce southbound travel time by 62%.

All the three alternatives would increase the capacity for the southbound direction. In the design year 2043 PM peak period, all alternatives are expected to carry more southbound traffic through the corridor than the no action option (Alternative #1). Alternatives #22, 23, and 23 are expected to accommodate additional 760 vehicles, 600 vehicles, and 700 vehicles going southbound during the PM peak period. All the additional entering traffic means higher volume throughput and longer queues at the capacity bottleneck, the southbound merge point south of Cedar Grove Road. Longer queues, travel time, and delays are expected since the rest of the corridor is still a two-lane highway. The MOE comparisons are complicated for the design year due to the fact that the corridor is over capacity. The vehicle throughputs and the number of unserved vehicles shows a better picture of the corridor operation.

Exhibit 47: AM/PM Peak Period Peak Direction Total Travel Time Comparison

Opening Year 2023	AM Peak			PM Peak		
Travel Time Reductions	**NB Issaquah-Hobart**	**EB May Valley**	**EB Cedar Grove**	**SB Issaquah-Hobart**	**EB May Valley**	**EB Cedar Grove**
Alternative 1 (Baseline)	0	0	0	0	0	0
Alternative 22	-26%	-6%	-56%	-20%	-62%	-18%
Alternative 23	-26%	-6%	-62%	-21%	-62%	-22%
Alternative 26	-26%	11%	-56%	-20%	-62%	-18%
Design Year 2043	AM Peak			PM Peak		
Travel Time Reductions	**NB Issaquah-Hobart**	**EB May Valley**	**EB Cedar Grove**	**SB Issaquah-Hobart**	**EB May Valley**	**EB Cedar Grove**
Alternative 1 (Baseline)	0	0	0	0	0	0
Alternative 22	-33%	-8%	-43%	8%	-67%	-3%
Alternative 23	-26%	-8%	-82%	6%	-74%	76%
Alternative 26	-34%	199%	-51%	9%	-81%	-3%

Exhibits 48 and 49 summarized VISSIM results of average queue length for alternatives 1, 22, 23, and 26 with future conditions in the opening year 2023 and design year 2043:

Exhibit 48: Opening Year (2023) AM/PM Peak Average Queue Length (feet)

	5:30-6:30 AM				6:30-7:30 AM				7:30-8:30 AM			
Opening Year (2023) AM Peak Period	Alternative 1	Alternative 22	Alternative 23	Alternative 26	Alternative 1	Alternative 22	Alternative 23	Alternative 26	Alternative 1	Alternative 22	Alternative 23	Alternative 26
Northbound queues south of May Valley Road	250	571	619	487	1279	2021	2029	1850	2966	361	351	282
Northbound queues north of Cedar Grove Road	3045	33	0	33	6718	20	0	20	2384	12	0	12
Eastbound Queues on May Valley Road	30	0	0	35	35	1	1	51	44	2	1	66
Eastbound Queues on Cedar Grove Road	167	63	0	61	835	50	1	49	589	28	1	31
	3:00-4:00 PM				4:00-5:00 PM				5:00-6:00 PM			
Opening Year (2023) PM Peak Period	Alternative 1	Alternative 22	Alternative 23	Alternative 26	Alternative 1	Alternative 22	Alternative 23	Alternative 26	Alternative 1	Alternative 22	Alternative 23	Alternative 26
Southbound Queues north of May Valley	3555	0	0	88	6229	0	0	83	6086	0	0	38
Southbound queues north of Cedar Grove	970	28	0	29	2100	54	9	60	791	25	0	23
Eastbound queues on May Valley Road	364	22	20	34	1711	23	22	36	723	17	17	33
Eastbound Queues on Cedar Grove Road	39	18	1	17	43	19	28	20	44	18	1	19

Exhibit 49: Design Year (2043) AM/PM Peak Average Queue Length (feet)

	5:30-6:30 AM				6:30-7:30 AM				7:30-8:30 AM			
Design Year (2043) AM Peak Period	Alternative 1	Alternative 22	Alternative 23	Alternative 26	Alternative 1	Alternative 22	Alternative 23	Alternative 26	Alternative 1	Alternative 22	Alternative 23	Alternative 26
Northbound queues south of May Valley Road	478	1949	2099	1875	2254	5285	5331	5391	3929	5374	5371	5414
Northbound queues north of Cedar Grove Road	8772	248	201	225	16146	2214	4154	1665	15726	106	1390	68
Eastbound Queues on May Valley Road	38	0	0	55	44	2	2	96	59	5	5	529
Eastbound Queues on Cedar Grove Road	428	184	6	161	2909	2802	109	2528	4606	1703	33	1125
	3:00-4:00 PM				4:00-5:00 PM				5:00-6:00 PM			
Design Year (2043) PM Peak Period	Alternative 1	Alternative 22	Alternative 23	Alternative 26	Alternative 1	Alternative 22	Alternative 23	Alternative 26	Alternative 1	Alternative 22	Alternative 23	Alternative 26
Southbound Queues north of May Valley	15077	0	0	9998	15890	1010	170	14213	15932	3426	1793	14132
Southbound queues north of Cedar Grove	2524	503	309	408	2852	4091	3640	3704	1396	4189	3900	3632
Eastbound queues on May Valley Road	1187	43	40	53	4189	780	466	132	4143	1138	624	92
Eastbound Queues on Cedar Grove Road	55	40	19	40	53	56	81	55	63	68	345	68

Previous exhibit 42 summarized the Cedar Grove intersection Synchro analysis for alternatives #22 and #26 which shows the intersection would operate a LOS B or C in both opening year 2023 and design year 2043. The following Exhibit 50 summarized Sidra analysis for alternatives #23 which would proposed a hybrid roundabout at Cedar Grove Road. Cedar Grove intersection would operate a LOS A in both opening year 2023 and design year 2043. The LOS in both tables are based on the control delay for the intersection itself. The corridor delay from queues, congestions from downstream or delay related with vehicles slowing down, merging, diverging, or stops for school buses were not included.

Exhibit 50: AM/PM Peak Hour Cedar Grove Intersection Delay and LOS for Alternative #23

	Alternative #23					
	AM Peak Hour			PM Peak Hour		
Opening Year (2023)	LOS	Delay (sec)	95^{TH} % Queue (feet)	LOS	Delay (sec)	95^{TH} % Queue (feet)
Issaquah Hobart and Cedar Grove						
Eastbound Left	A	6.3	36.9	A	7.4	17.9
Eastbound Right	A	5.4	0.9	A	9.7	8.7
Northbound Left	A	6.5	46.3	A	3.8	15.2
Northbound Through	A	2.3	46.3	A	1.3	15.2
Southbound Through	A	3.1	9.3	A	8.9	146
Southbound Right	A	3.1	9.3	A	8.7	145.9
Intersection Overall	**A**	**3.4**		**A**	**7.4**	
Design Year (2043)	**AM Peak Hour**			**PM Peak Hour**		
Issaquah Hobart and Cedar Grove						
Eastbound Left	A	7.7	50.9	B	10.7	33
Eastbound Right	A	5.8	1.3	B	12.9	15.4
Northbound Left	A	7.9	64.2	A	4.3	21.7
Northbound Through	A	2.7	64.2	A	1.5	21.7
Southbound Through	A	3.4	14.6	B	12.1	240
Southbound Right	A	3.3	14.6	B	11.9	239.7
Intersection Overall	**A**	**4**		**A**	**10**	

CONCLUSIONS:

This traffic analysis report was completed to analyze the intersections of Issaquah Hobart Road at May Valley and Cedar Grove and the corridor between these two study intersections. Issaquah Hobart Road between Front Street and SR 18 outside of the limits of this study is a two lane principal arterial that is functioning at or near capacity. Capacity improvement recommendations outside the study limits are beyond the scope of this analysis.

The extensive modeling effort done for this analysis has shown that as a first step to help ease congestion and improve safety in the study area, improvements are recommended at the May Valley Road/Issaquah Hobart Road intersection. Both the hybrid roundabout and signal with additional northbound and southbound through lanes alternatives will improve intersection capacity and travel times in 2023 and will function with any future improvements at Cedar Grove and the corridor section between the two study intersections. Additional benefits of the roundabout includes safety and off peak travel time improvements. Additional preliminary design is necessary to study the two recommended alternatives relative to environmental, geotechnical, right of way, constructability, access and other potential project risks to determine the preferred alternative.

After the May Valley intersection improvement is implemented, it is recommended to improve the intersection of Cedar Grove and Issaquah Hobart prior to or with the corridor improvement (2 additional lanes) between the two study intersections. Adding lanes between the two study intersections will increase the travel demand at Cedar Grove intersection. The report shows that the intersection of Cedar Grove/Issaquah Hobart Road would fail without capacity improvements. The additional southbound lane between the two study intersections will move the bottleneck from May Valley intersection to Cedar Grove intersection in the PM Peak hour.

After the improvements are implemented at the two study intersections, the corridor between two study intersections will operate at or over capacity. Adding travel lanes between the two study intersections will greatly enhance the two intersections by improving travel times and vehicle throughput in both the northbound (AM Peak) and southbound (PM Peak) directions. This report will be updated as each improvement is made, to take into consideration the traffic pattern changes related to each improvement.

Appendix B: Geotechnical Report

King County
Road Services Division
Materials Laboratory
Department of Local Services

June 25, 2020

TO: Dan Sahagun, Engineer III, Project Management & Design Unit, Road Services Division, King County Department of Local Services

VIA: Douglas T. Walters, P.E., Materials Engineer, Drainage, Survey, Utility and Materials, Engineering Services Section, King County Department of Local Services

FM: Casey D. Wagner, EIT, Engineer II, Drainage, Survey, Utility and Materials, Engineering Services Section, King County Department of Local Services

RE: **Issaquah-Hobart Rd SE @ SE May Valley Rd Intersection Improvement Geotechnical Investigation**

1.0 INTRODUCTION

1.1 Background

As requested, we have completed a geotechnical investigation for the Issaquah-Hobart Rd SE @ SE May Valley Rd Intersection Improvement Project. We understand alternatives under consideration include realignment of the existing 3-way “T” intersection or replacement with a roundabout. The purpose of our geotechnical investigation is to evaluate subsurface and roadway conditions in order to aid in selection and design of the intersection improvement alternative. Soil borings were completed to characterize site soil and groundwater conditions. Based on information obtained and our analysis, we are providing geotechnical design parameters and construction recommendations for retaining walls and pavements.

The project is located at the intersection of Issaquah-Hobart Rd SE and SE May Valley Rd, approximately two miles south of the City of Issaquah, WA. A vicinity map showing the general project location is provided in Figure 1, following the conclusion of the text.

1.2 Project Setting

Within the project limits, the three-way intersection is composed of Issaquah-Hobart Rd SE and SE May Valley Rd. Issaquah-Hobart RD SE is a two-lane principal arterial that is generally aligned north to south. The roadway consists of two 11-foot asphalt concrete pavement (ACP) lanes with 5-foot-wide ACP shoulders. At the intersection, Issaquah Hobart Road SE has an additional center turn lane for northbound traffic, and a right-hand turn lane for southbound traffic.

SE May Valley Rd is also a two-lane principal arterial which consists of two 11-foot lanes with approximately 5-foot-wide shoulders constructed with ACP. The roadway proceeds west from the intersection before entering a curve and aligning to the SW. At the intersection, SE May Valley Rd consists of a14-foot-wide lane exiting the intersection along with 11-foot wide left and right turn lanes entering the intersection.

Two 85-foot-long sidewalk sections are located at the NW and SW corners of the intersection. In addition, a 200-foot-long section of sidewalk runs along the eastside of the intersection. Sidewalk at the subject site is constructed of Portland Cement Concrete (PCC) and is approximately 5 feet in width.

2.0 SUBSURFACE CONDITIONS

2.1 Geologic Mapping

Online geologic mapping (scale 1:24,000) of the project area was accessed from the Washington State Department of Natural Resources (DNR) Subsurface Geology Portal and the United States Geologic Survey (USGS) databases. Geologic mapping indicates the predominant surficial soil in the general site vicinity consists of the following:

Younger Alluvium (Qyal): Deposits in and along present streams; they are subject to seasonal flooding and consist largely of organic rich fine sand, silt, and clay, accumulated in the low energy parts of the stream valley. Locally coarser-grained channel sediments, gravel and coarse sand, may underlie finer-grained floodplain sediments. Till locally underlies younger alluvium at shallow depths. Maximum thickness of unit in the Sammamish River floodplain may be as much as 12 meters.

2.2 Soil Borings

Seven geotechnical borings were drilled in selected areas in or near the intersection to characterize site-specific soil and groundwater conditions. Borings were drilled to a range of depths between 2.5 and 51.5 feet below the ground surface (bgs). The borings were drilled utilizing a Diedrich D-50 track drill equipped with nominal 4.25” I.D. continuous flight hollow-stem auger. Standard Penetration Tests (SPT) were taken at selected vertical intervals as each boring was advanced below the ground level. The SPT provides a measure of compaction or relative density of granular soils, and consistency or stiffness of cohesive fine-grained soils.

Twenty soil samples were tested and used to further classify soils at various depths. The remaining collected soil samples will be stored in sealed plastic bags for additional testing if requested. Approximate boring locations are shown in Figure 2. Detailed copies of the boring logs, along with laboratory test results, are enclosed for your review in Appendix A.

Boring B-1

Boring B-1 was drilled 400 feet south of the intersection and approximately four feet east of the edge of pavement, at the toe of the slope. The boring indicated the upper four feet of soil consisted of a loose to medium dense sandy silt material with numerous organics. Below the sandy silt, a loose to dense silty sand was encountered to about 12 feet bgs. The silty sand was followed by medium dense sandy silt to the termination of the boring at 16.5 feet bgs. Groundwater was observed during drilling at approximately 12 feet bgs.

Boring B-2

Boring B-2 was drilled in the roadway shoulder at the SE corner of the intersection. The boring showed the ACP in this section of roadway was approximately 12 inches thick. The ACP was followed by a road gravel fill to about two feet bgs. Below the road gravel, a medium dense silty sand with gravel fill was encountered to five feet bgs. The fill was followed by a loose to medium dense silty sand to the termination of the boring at 16.5 feet bgs. Groundwater was observed during drilling at approximately 12 feet bgs.

Boring B-3

Boring B-3 was drilled in the vegetated area SW of the intersection. A loose sandy silt with numerous organics was observed to about two feet bgs. Below the silt, the soil consisted of younger alluvium to the termination of the boring at 31.5 feet bgs. The younger alluvium ranged from very loose to dense silts, silty sands, and well graded sands with gravel, with interbedded layers of organics and peat to approximately 20 feet bgs. Below 20 feet bgs, the material consisted of a very dense silty sand to sandy silt. Groundwater was encountered during drilling at approximately four feet bgs.

Boring B-4

Two borings (B-4a & B-4b) were drilled at the south fog line of SE May Valley Rd, approximately 80 feet west of the intersection. In Boring B-4a, ACP is about 14 inches thick followed by a medium dense road gravel fill to about two feet bgs. Below the fill, dense cobbles or boulders were encountered. The drill auger was able to penetrate only six inches into the apparent cobble/boulder layer before meeting refusal. The drill rig was shifted approximately five feet west and another boring (B-4b) was attempted. Boring B-4b encountered the same materials as in B-4a with drilling refusal at approximately 2.5 feet bgs. No groundwater was observed in either boring.

Boring B-5

Boring B-5 was drilled east of the intersection, in a private residential lot, 20 feet east of the edge of sidewalk. A loose sandy silt with numerous organics was encountered to approximately one-foot bgs. Below the silt, soils consisted of very loose to medium dense silty sand to a poorly graded sand with gravel, with intermittent ½” to 1“ layers of organics to about 20 feet bgs. Below 20 feet bgs, a very dense well graded gravel, to well graded sand with gravel, was encountered to the termination of the boring at 31.5 feet bgs. Groundwater was encountered during drilling at approximately 6 feet bgs.

Boring B-6

Boring B-6 was drilled in the vegetated area NW of the intersection. During drilling, three to four inches of grassy topsoil was encountered followed by medium dense to dense silty gravel with sand fill to approximately seven feet bgs. Below the fill, dense to very dense silty sand with gravel, to silty gravel with sand, was encountered to the termination of the boring a 31.5 feet bgs. Groundwater was observed during drilling at approximately one-foot bgs.

Boring MW-1

Boring MW-1 was also drilled in the vegetated area NW of the intersection. During drilling, three inches of topsoil was encountered followed by a loose silty sand with gravel fill to approximately two feet bgs. Below the fill the material appeared to be disturbed younger alluvium soil consisting of very loose to dense silts, and silty sands with gravel, cobbles and boulders to approximately 25 feet bgs. Material in this zone is predominantly very loose to loose. Some higher blow counts in this zone may be overstated due to the presence of cobbles and boulders. Below 25 feet, a medium dense to dense poorly graded sand with silt and gravel was encountered to the terminations of the boring at 51.5 feet bgs. Groundwater was observed during drilling at approximately four feet bgs.

In order to monitor groundwater over time, boring MW-1 was completed as a well. The monitoring well consists of a two-inch inside diameter blank PVC pipe with 20-slot well screen. The 20-slot well screen is installed from about 40 to 50 feet bgs. Blank PVC casing is installed above the screened well sections to almost the original ground surface. The annular space around the screens are filled with a clean 10-20 uniform sand filter to a depth of about 2 feet above the well screen sections. The remaining depth to the near surface elevation is backfilled with bentonite chips and capped with redi-mix concrete. The well is protected with a flush mount protective steel covers and was constructed in general accordance with the Washington State Department of Ecology (WSDOE) WAC 173-160 “Minimum Standards for Construction and Maintenance of Water Wells”. Monitoring well MW-1 is identified by WSDOE discrete well tag number BNF-217. Groundwater depths were measured twice after well installation and are provided below in Table 1.

Table 1: Measured Groundwater Depths

Monitoring Well	Date	Water Depth Below Ground Surface (ft)
MW-1	5/6/2020	3.63
MW-1	6/2/2020	3.26

3.0 HAZARD REVIEW

The King County Geographic Information Systems website (iMAP) and Washington State Department of Natural Resources Geologic Information Portal (DNR) website were reviewed to determine if geologic hazards are present in the site vicinity. Geological hazards shown in iMAP indicate the project is located in an area that could be susceptible to seismic and erosion hazards. DNR mapping of faults, liquefaction and erosion risk are discussed below in Sections 3.1, 3.2 and 3.3.

3.1 Geologic Faults

Geologic mapping from the Washington State DNR Subsurface Geology Portal shows the site is within a ¾ mile distance from the Seattle fault zone (Class A). In our opinion, the relative risk of surface fault rupture for this intersection improvement project should be considered low.

3.2 Liquefaction

Liquefaction occurs when loose, saturated granular soils such as fine sand and coarser silts lose their ability to support a load during a seismic event. The soils will flow like fluid, resulting in ground settlement and deformation. Factors controlling the development of liquefaction include seismic intensity and duration, soil characteristics, in situ stress conditions, and the depth to the groundwater. Based on mapping provided in the Washington State Department of Natural Resources online geologic portal, the site is considered to have a moderate risk for liquefaction.

3.3 Erosion Hazard

Erosion is the displacement of soil, mud, and rock by the processes of water, wind, ice, and gravity. The King County CAO defines erosion hazard areas as those soils that may experience severe to very severe erosion. Steeper slopes generally have higher susceptibility to erosion since surface water will achieve high velocities and energy to erode and transport soil. iMAP indicates the project is within a designated erosion hazard zone as shown in Figure 3. In our opinion, the risk of erosion would be low for this project due to the relatively flat topography of the site.

4.0 SLOPES AND RETAINING WALLS

Fill slopes will likely be needed for improvements associated with the intersection improvement project. Where the permanent slope of the embankments cannot practically be graded at 2H:1V or flatter, reinforced slopes or retaining walls will be required. Reinforced slopes or retaining walls may also be required due to right-of-way restrictions or to limit possible encroachment into sensitive areas. We anticipate walls for this project will be less than 10 feet in total height. The following is a brief description of various walls that may be acceptable for use on this project:

4.1 Structural Earth Walls

Structural Earth Walls (SEW) are a cost-effective alternative to retain engineered fills. Many SEW systems are proprietary such as Hilfiker, ARES, or MESA. SEW are constructed by placing either metal or geosynthetic tensile members horizontally between lifts of compacted granular backfill to form a self-supporting gravity structure. These walls are well suited for areas of expected settlement due to their relatively large tolerance for differential settlement. Wide ranges of facing units are adaptable to most of the various SEW systems. The choice of facing is dependent on aesthetics and economic requirements. Design values for the various wall systems must be based on specific site conditions, geotechnical parameters, and manufacturer specifications. As with reinforced slopes, the metal or geosynthetic tensile members generally extend horizontally back behind the face of the slope, between 70 percent and 100 percent of the wall height.

4.2 Gravity Block Walls

Gravity blocks depend on their weight for stability and can be used as erosion resistant facing against stable native cuts up to eight feet in total height or designed to act as a gravity retaining structure. The walls are constructed of preformed concrete blocks that are relatively simple to place. A variety of facings are available from the various manufactures of gravity blocks. Base widths for gravity retaining structures are on the order of 50 to 60 percent of the wall height.

4.3 Gabion Walls

A gabion wall is a flexible gravity structure that depends on its own weight for stability and can sustain relatively great differential settlements without serious distress. The walls are constructed using preformed baskets made of heavy galvanized wire that are backfilled with quarry spalls. Gabion walls can be terraced to allow for placement of topsoil and the establishment of vegetation to soften the appearance of the structure. Base widths for gravity retaining structures are on the order of 50 to 60 percent of the wall height.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Retaining Walls

5.1.1 Structural Earth Walls

Retaining walls may be needed on this project to support roadway embankment fills associated with the various intersection improvement alternatives. Based on the results of the subsurface investigation, we recommend structural earth walls (SEW) be utilized as the preferred wall alternative as long as they are founded in at least medium dense native granular soils or well compacted structural fill. A number of SEW walls are proprietary systems that are constructed on a “design-build” basis. Though the SEW design will be the responsibility of the contractor, we will be responsible for evaluation of the global wall stability. For preliminary planning purposes, we recommend utilizing a minimum base width/reinforcement length equal to the height of the wall.

5.1.2 SEW Design

Design of all SEW systems are to be in full accordance with the current WSDOT Standard Specifications, Federal Highway Administration (FHWA) Guidelines for the Design and Construction of Mechanically Stabilized Earth MSE Walls, and the current American Association of State Highway and Transportation Officials (AASHTO) Standards for MSE Walls. Geosynthetics proposed for design must be listed in the most recent Washington State Department of Transportation (WSDOT) Approved Product Listings. In addition, only WSDOT preapproved wall systems are acceptable for use on this project.

SEW design parameters are provided below in Table 2. The parameters are based on level ground conditions for the wall foundations.

Table 2: SEW Design Parameters			
	Reinforced	**Retained**	**Foundation**
Soil Zone	Gravel Borrow(1)	Gravel Borrow(1)	Medium Dense Granular Soils
Unit Weight	125 pcf	125 pcf	120 pcf
Friction Angle	34 degrees	34 degrees	32 degrees
Cohesion	0	0	0

WSDOT Standard Specification 9-03.14(4)

For the Service Limit State, the wall shall be designed to accommodate a differential settlement of 1-inch per 100 feet of wall length.

For the Extreme Event I Limit State, the wall shall be designed for a horizontal seismic acceleration coefficient k_h of 0.24g and a vertical seismic acceleration coefficient k_v of 0g.

5.1.3 Contractor SEW Submittals

As part of the acceptance criteria, we suggest incorporating the following requirements for contractor submittals of SEW designs:

- The contractor is to submit a full set of plans (cross section and plan view) and design calculations to King County for review and comment prior to wall approval.

- For plan changes during construction, the plans and design calculations must be provided to King County a minimum of 10 working days prior to the planned construction. Construction must not proceed until the design and calculations have been checked and approved.

- All designs are to be based on geotechnical parameters provided or approved by King County.

- Walls must be constructed in accordance with the condition of the approved submittal. Any planned deviation from the approved drawings must be submitted in writing and approved by the King County prior to implementing the change.

- The ultimate strength of all geosynthetics used for permanent structures is reduced by numerous factors for design considerations. Some of these factors include geosynthetic creep, chemical decomposition, construction damage and reduction for uncertainties. The various geosynthetic products all have different design reduction factors based on materials, manufacturing processes, and the construction environment. King County reserves the right to adjust geosynthetic reduction factors based on project specific circumstances.

5.1.4 Foundation Preparation

During construction, we recommend over excavation of wall foundations a minimum of one foot and extending the foundation pad one foot beyond the base of the wall. The resulting void should then be filled with a minimum of one foot of “Gravel Backfill for Foundations, Class A”, as specified in Section 9-03.12(1)A of the current WSDOT Standards. The Gravel Backfill should be placed and compacted in accordance with Section 2-09.3(1)E of the current WSDOT Standards. We recommend that a representative from the Materials Laboratory be on site during the foundation excavation to verify the foundation conditions prior to wall placement.

In cases where the excavation is anticipated to be below the water table, quarry spalls may be needed to provide a stable base. Sump pumps, well points, or other appropriate equipment should be readily available during construction to adequately dewater the excavation. In addition to quarry spalls, a geosynthetic for stabilization may be required in areas exhibiting soft or compressible soils. Once the foundation excavation has been stabilized, the resulting void should be filled with “Gravel Backfill for Foundations, Class A”, as specified in Section 9-03.12(1)A of the current WSDOT Standards. The structural material should be placed and compacted to a minimum 95% of the maximum dry density.

5.1.5 Wall Drainage

To reduce the potential for hydrostatic buildup in the reinforced fill zone, we recommend a six-inch underdrain pipe be placed at the base of the wall. The underdrain pipe should be surrounded by drainage fill and wrapped in a non-woven underground drainage geotextile. The drainage fill for the underdrain pipe shall meet the minimum requirements of “Gravel Backfill for Drains” as specified in Section 9.03.12(4) of the current WSDOT Standards. The non-woven geotextile should meet the specification for “underground drainage, moderate survivability, Class A or B” as specified in Table 1 and 2, Section 9-33 of the WSDOT Standards. The drain system should outlet to an appropriate location that will not impact the stability of the wall or adjacent slopes.

5.2 Construction Considerations

5.2.1 Earthwork/Temporary Excavation Slopes

Based on our subsurface borings and understanding of the project, the contractor should be able to complete site earthwork with standard construction equipment. Prior to beginning of earthwork activities, appropriate erosion and sedimentation control measures should be implemented in accordance with the local best management practices (BMPs).

Excavations can be cut back to temporary slopes no steeper than 1.5(H):1(V) as described for Type C soils by WAC 296-155-66503, Appendix B. Further flattening or possible shoring may be required based on the soils conditions observed during construction. Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. All temporary cuts in excess of 4 feet should be sloped in accordance with WAC 296-155.

The stability of temporary cuts can be reduced over time by the presence of moisture or vibration. Therefore, the contractor will need to perform ongoing monitoring of temporary slopes and take the necessary steps to ensure their stability throughout the life of the project. Additional care should be exercised when operating heavy equipment within 5 feet from the top of temporary cut slopes. The slope toe for any stockpiled materials should be a minimum of 2 feet away from the top of the excavation.

5.2.2 Construction Dewatering

Dewatering of the site will be the responsibility of the contractor. We recommend the contractor have sump pumps, well points, or other appropriate equipment readily available during construction to adequately dewater groundwater encountered in excavations. To limit wet work conditions, we recommend excavations be performed during the drier months, typically June through September.

5.2.3 Roadway Embankment Construction

We recommend all permanent embankments be graded at 2H:1V or flatter. Where permanent slopes of embankments cannot be practically graded at 2H:1V or flatter, retaining walls will be required. Gravel Borrow meeting the requirements of WSDOT 9-03.14(1) should be used to construct permanent embankments. The Gravel Borrow fill shall be placed by terracing into the slope excavations. Maximum lift thickness, minimum compaction levels and soil moisture content should be as specified by WSDOT 2-03.3(14)C – Method C.

5.3 Pavement

5.3.1 Existing Pavement

Existing asphalt in all lanes of the intersection of Issaquah-Hobart Rd SE and SE May Valley Rd is generally in good condition with little to no distress visible in the pavement. We recommended the existing asphalt pavement be left in place where feasible and overlaid during construction.

Full depth pavement sections will be required for all newly widened road sections, including the existing paved shoulders. We recommend not utilizing the existing road shoulders as part of any new driving lane section.

5.3.2 Full Depth and Overlay Pavement Sections

All materials to be used for the full depth and overlay sections shall meet the current Washington State Department of Transportation (WSDOT) Standard Specifications. Placement and compaction of Hot Mix Asphalt (HMA) shall generally be in accordance with Section 5-04 of the WSDOT Standard Specifications. However, HMA shall be compacted to a minimum of 92 percent of the maximum theoretical density as determined by King County Materials Laboratory (KCML) Test Method N-1. Proper placement of the following pavement design sections will provide for long-term pavement performance and support of future traffic loads:

<u>Full Depth Pavement Section</u>

- 0.17 feet minimum compacted depth HMA, Class ½" PG58H-22 (Wearing Course)
- 0.50 feet minimum compacted depth HMA, Class ½" PG58H-22 (Leveling Course)
- 0.50 feet minimum compacted depth Crushed Surfacing Base Course (CSBC)

<u>Overlay Pavement Section Existing Roadway</u>

- 0.17 feet minimum compacted depth HMA, Class ½" PG58H-22

5.3.3 Pavement Construction Recommendations

The following construction procedures are recommended for the new pavement and overlay sections within the proposed project limits:

- Sawcut the pavement at the fogline and remove the existing paved shoulders. If cracking is present along the edge of the driving lane, the sawcut shall be extended into the driving lane to encompass the cracked pavement sections.

- For areas requiring full depth pavement, excavate down to the subgrade elevation using a straight-edged bucket to minimize disturbance. Care should be taken to avoid disturbing potentially loose underlying soils.

- The base of the excavation should be leveled and the subgrade compacted in accordance with Section 2-03.3(14) C, Method C of the WSDOT Standard Specifications. We recommend the subgrade be proof rolled with a loaded dump truck or other similar equipment to confirm the base is firm and unyielding. A representative from our office should be on site during excavation and proof-rolling to recommend if further stabilization of the underlying soils is necessary.

- Any areas exhibiting deflection or excess moisture will require additional stabilization. Depending upon the severity of the deflection, additional excavation of the soils may be required along with the utilization of a geotextile and/or quarry spalls to obtain subgrade stabilization.

- When the subgrade has been stabilized, the Crushed Surfacing Base Course can then be placed and compacted in accordance with Section 2-03.3(14) C, Method C of the Standard Specifications.

- Prior to placement of the tack coat and overlay, the roadway shall be cleaned and prepared in accordance with Section 5-04 of the WSDOT Standard Specifications.

- Construction of the full depth and overlay HMA pavement sections to the proposed finished roadway elevation can then be completed as specified in Section 5-04 of the WSDOT Standard Specifications.

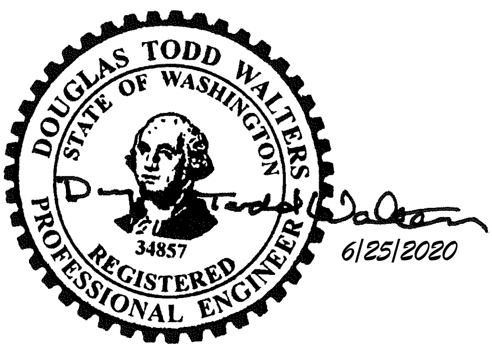
- Compaction testing and quality control testing of both CSBC and HMA materials shall be conducted to confirm the quality of materials and verify adequate required compaction. Our Laboratory is available to perform these tasks.

6.0 CONTINUING GEOTECHNICAL SERVICES

Once an intersection improvement alternative and concept design has been determined, we can provide an updated report detailing design specific parameters and recommendations. As the design develops, when requested, we are available to provide additional geotechnical analysis and construction recommendations for specific aspects of the project.

We appreciate the opportunity to have been of service on this project and trust this report addresses your current needs. Please call Casey Wagner at (206) 477-0304 or Doug Walters at (206) 477-2112 should you have any questions, concerns, or if we may be of further assistance.

Respectfully Submitted,
King County Materials Laboratory



Douglas T. Walters, P.E.
King County Acting Materials Engineer

7.0 REFERENCES

King County GIS Center, King County Interactive Mapping Tool; Available on the web at http://www.kingcounty.gov/operations/GIS/Maps/iMAP.aspx.

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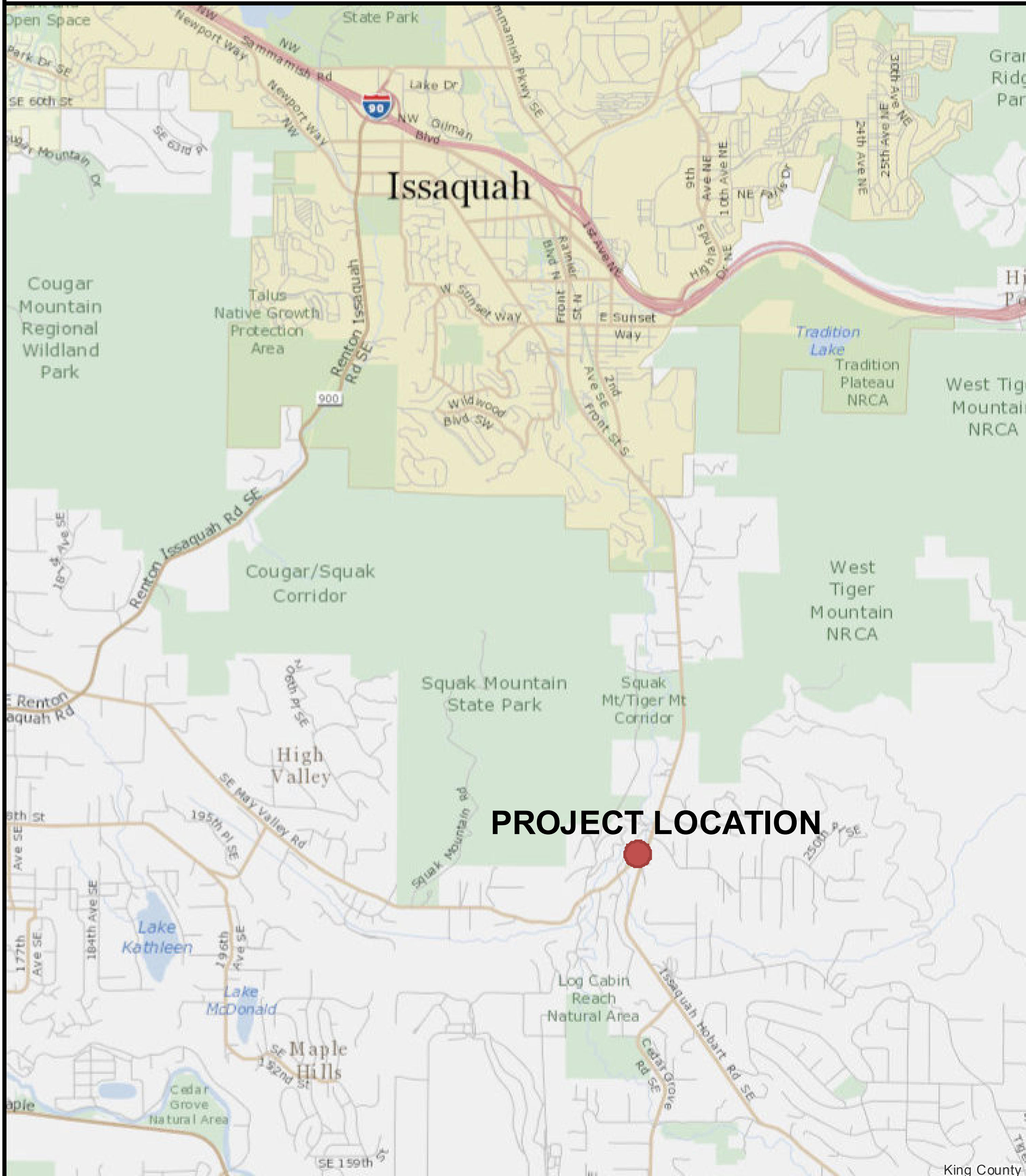
Washington State Department of Transportation, *Design and Standard Plans, Available on the web at* https://www.wsdot.wa.gov/Design/Standards/default.htm

Washington State Department of Transportation, *Geotechnical Design Manual M46-03.11,* 2015.

Washington State Department of Transportation, *Standard Specifications for Road, Bridge, and Municipal Construction, M41-10,* 2018

FIGURE 1 - VICINITY MAP



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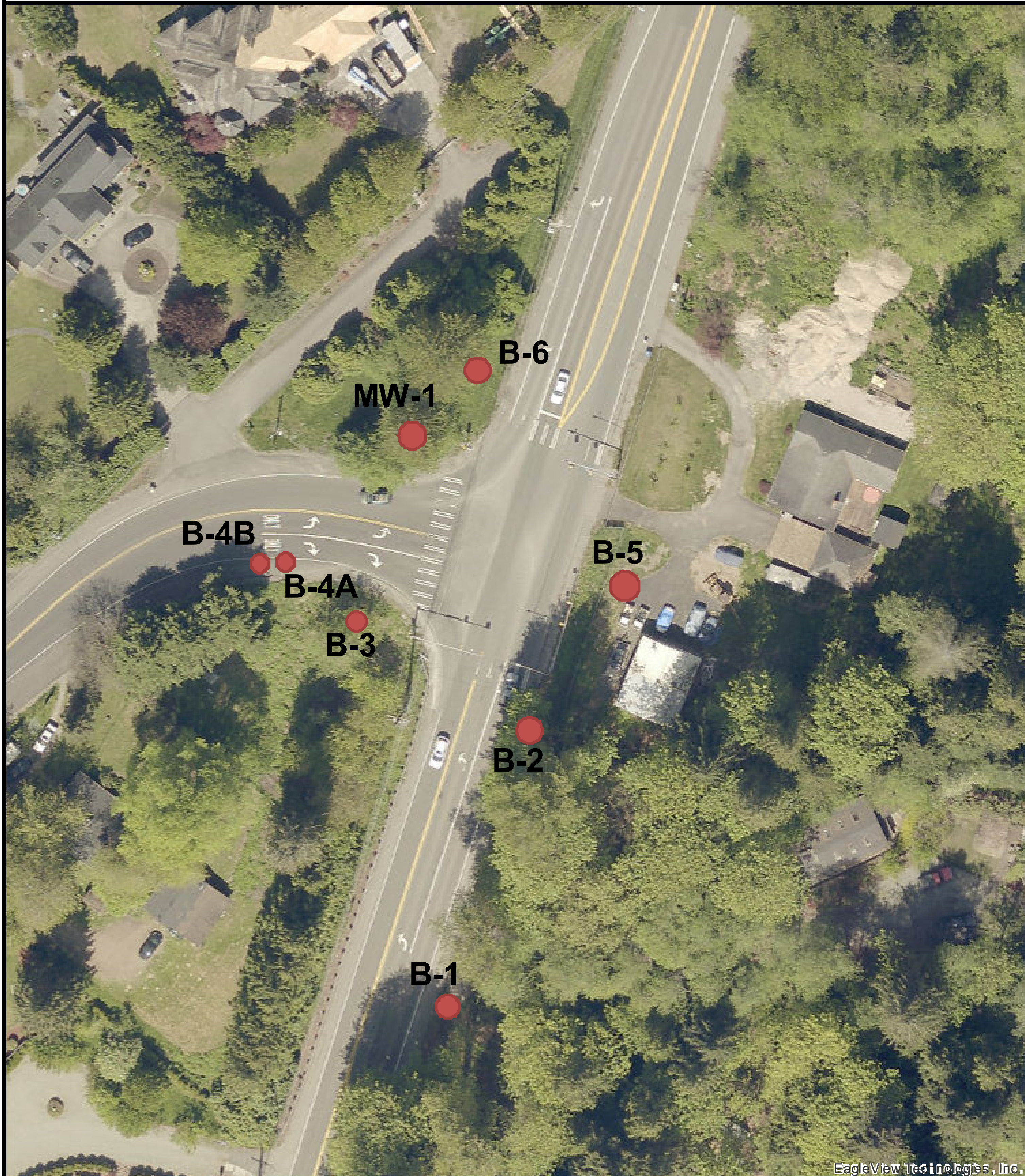
Date: 6/24/2020 Notes:

N

King County

FIGURE 2 - B0RING LOCATIONS



Date: 6/24/2020 Notes:

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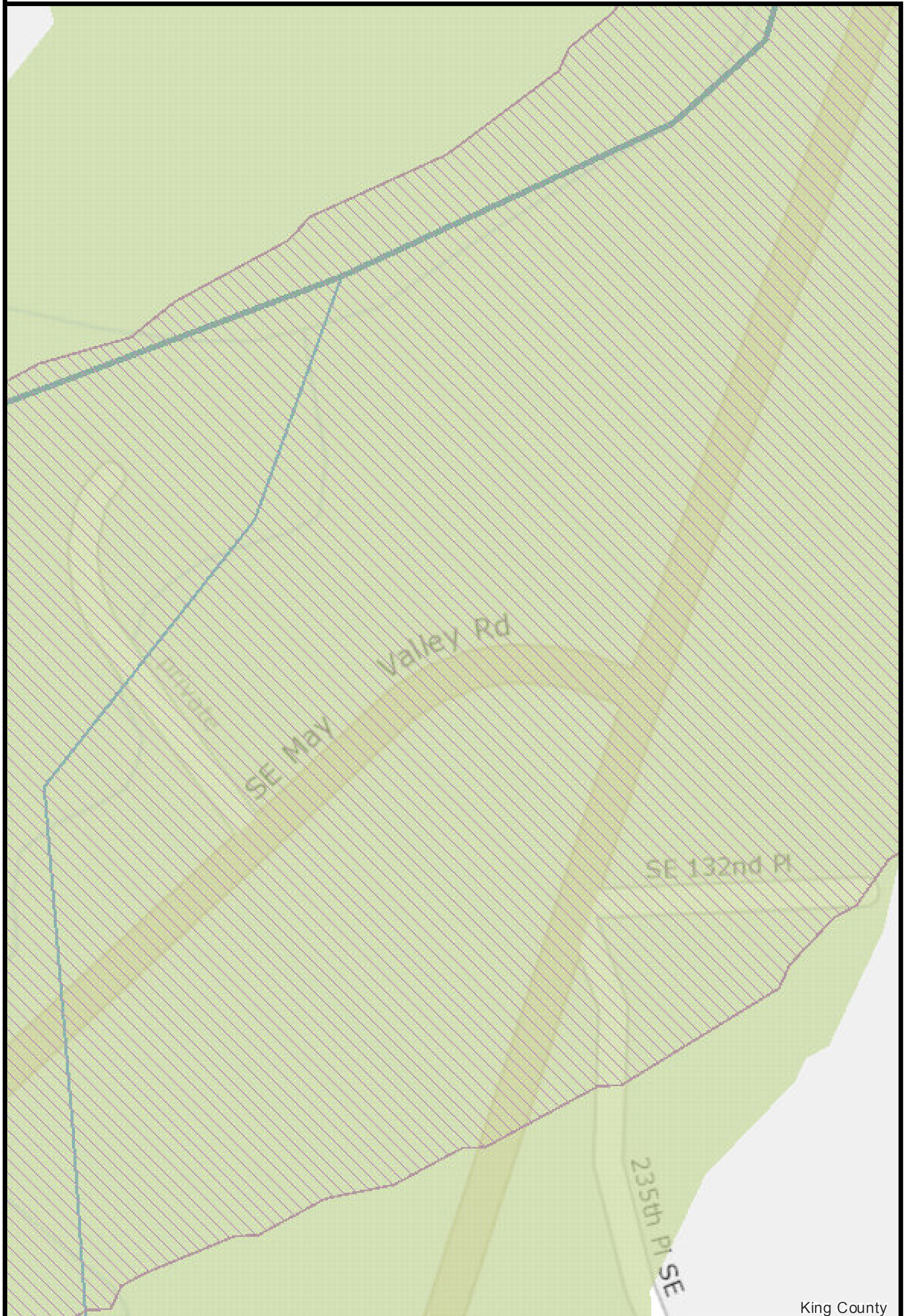
King County

FIGURE 3: HAZARDOUS AREAS



Legend

- Erosion hazard (1990 SAO)
- Seismic hazard (1990 SAO)

Stream (1990 SAO)

- class 1
- class 2 perennial
- class 2 salmonid
- class 3
- unclassified

Date: 6/12/2020 Notes:

N

King County

APPENDIX A
GEOTECHNICAL ENGINEERING REPORT
ISSAQUAH-HOBART RD SE @ SE MAY VALLEY RD
INTERSECTION IMPROVEMENT

BORING LOGS AND LABORATORY TEST RESULTS

FIGURE A-1 TO A-8: BORING LOGS FROM SOIL INVESTIGATIONS

FIGURE A-9 TO A-15: LABORATORY TESTING RESULTS PERFORMED ON SOIL SAMPLES

SURVEY MAPS WITH BORING LOCATIONS AND ELEVATIONS

LOG OF BORING
BORING B-1

PROJECT: **Issaquah-Hobart at SE May Valley Rd Intersection**
BORING LOCATION: **See Attached Boring Location Map**
DRILL METHOD: **Hollow Stem Auger**
DRILLER: **Holocene Drilling Inc.**
DEPTH TO - Water: **12'** Caving: **No**

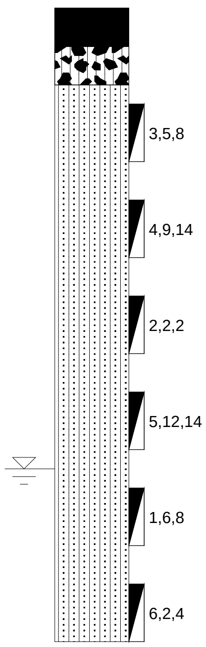
DATE: **5/1/2020**
START: **12:15**
FINISH: **13:00**
LOGGER: **Casey Wagner**
DATE CHECKED: **During Drilling**

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks
0 / 240		ML	Dark Brown sandy silt with numerous organics, moist, loose to medium dense.			
	1,2,10					6" Recovery
5 / 235	1,2,2	SM	Brown silty sand with gravel, occasional cobble, scattered organics, moist, loose to dense.	25.0	29.3	6" Recovery
	21,14,17					2" Recovery
10 / 230	11,11,10					2" Recovery
	4,6,7	ML	Light brown to gray sandy silt, wet, medium dense.	29.5	87.2	7" Recovery
15 / 225	6,7,7			26.4	77.9	10" Recovery
			Boring Terminated at 16.5'			
20 / 220						
25 / 215						
30 / 210						
35 / 205						

Boring B-1 was drilled approximately 4 feet east of the road shoulder of Issaquah-Hobart RD SE and 400 feet south of the intersection with SE May Valley Rd. See attached survey map for exact location of boring. Groundwater was observed during drilling at approximately 12 feet bgs. *Figure A1*

LOG OF BORING
BORING B-2

PROJECT: **Issaquah-Hobart at SE May Valley Rd Intersection**
DATE: **5/1/2020**
BORING LOCATION: **See Attached Boring Location Map**
START: **11:30**
DRILL METHOD: **Hollow Stem Auger**
FINISH: **12:15**
DRILLER: **Holocene Drilling Inc.**
LOGGER: **Casey Wagner**
DEPTH TO - Water: **12'** Caving: **No**
DATE CHECKED: **During Drilling**



ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks
0			Asphalt Pavement 12"			
230		GM	Tan silty gravel with sand, moist, medium dense (fill).			
	3,5,8	SM	Brown silty sand with gravel, moist, medium dense (fill).			4" Recovery
5 / 225	4,9,14	SM	Brown silty sand, scattered gravel, occasional cobble, moist, loose to medium dense.	15.6	32.0	10" Recovery
	2,2,2					1" Recovery
10 / 220	5,12,14	SM	Gray silty sand, scattered gravel, wet, loose to medium dense.	24.6	41.7	14" Recovery
	1,6,8					3" Recovery
15 / 215	6,2,4					6" Recovery
			Boring Terminated at 16.5'			
20 / 210						
25 / 205						
30 / 200						
35 / 195						

Boring B-2 was drilled approximately 3 feet east of the fogline in the road shoulder of Issaquah-Hobart RD SE and 20 feet south of the intersection with SE May Valley Rd. See attached survey map for exact location of boring. Groundwater was observed during drilling at approximately 12 feet bgs. *Figure A2*

LOG OF BORING
BORING B-3

PROJECT: **Issaquah-Hobart at SE May Valley Rd Intersection**
BORING LOCATION: **See Attached Boring Location Map**
DRILL METHOD: **Hollow Stem Auger**
DRILLER: **Holocene Drilling Inc.**
DEPTH TO - Water: **4'** Caving: **No**

DATE: **4/30/2020**
START: **15:00**
FINISH: **16:45**
LOGGER: **Casey Wagner**
DATE CHECKED: **During Drilling**

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks
0		ML	Dark Brown sandy silt, numerous organics, moist, loose.			
220	2,2,2	SM	Brown silty sand, seams of iron staining, scattered organics, moist, loose to medium dense.	30.4	42.2	12" Recovery
5	2,6,17					2" Recovery
215	19,24,12	SW-SM	Brown well graded sand with silt and gravel, occasional cobble, wet, very loose to dense.	18.1	5.5	6" Recovery
10	10,2,0					5" Recovery
		ML	Tan to gray sandy silt, scattered organics, wet, very loose to loose.			
210	2,2,1					3" Recovery
15	0,0,5			34.7	54.1	18" Recovery
205						
20	12,38,24	SM	Brown silty sand with gravel, occasional cobble, wet, very dense.			8" Recovery
200						
25	17,50/6					3" Recovery
195		ML	Brown sandy silt, scattered gravel, wet, dense.			
30	2,12,20			26.6	65.7	11" Recovery
			Boring Terminated at 31.5'			
190						
35						
185						

Boring B-3 was drilled in the vegetated area southwest of the intersection with SE May Valley Rd. See attached survey map for exact location of boring. Groundwater was observed during drilling at approximately 4 feet bgs.

Figure A3

LOG OF BORING
BORING B-4a

PROJECT: **Issaquah-Hobart at SE May Valley Rd Intersection** DATE: **5/1/2020**
BORING LOCATION: **See Attached Boring Location Map** START: **10:30**
DRILL METHOD: **Hollow Stem Auger** FINISH: **11:00**
DRILLER: **Holocene Drilling Inc.** LOGGER: **Casey Wagner**
DEPTH TO - Water: **N/A** Caving: **No** DATE CHECKED: **During Drilling**

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks
225 / 0			Asphalt Pavement 14"			
		GM-SM	Appreared to be road gravel beneath pavement (fill).			
			Large rock, cobble or boulder, possibly quarry spalls beneath road gravel.			
220 / 5			Boring Terminated at approximately 2.5'			
215 / 10						
210 / 15						
205 / 20						
200 / 25						
195 / 30						
190 / 35						

Boring B-4a was drilled approximately 16 feet south of the centerline of SE May Valley RD SE and 80 feet west of the intersection with Issaquah-Hobart RD SE. See attached survey map for exact location of boring. No Groundwater was observed during drilling. *Figure A4*

LOG OF BORING
BORING B-4b

PROJECT: **Issaquah-Hobart at SE May Valley Rd Intersection**
DATE: **5/1/2020**
BORING LOCATION: **See Attached Boring Location Map**
START: **10:45**
DRILL METHOD: **Hollow Stem Auger**
FINISH: **11:00**
DRILLER: **Holocene Drilling Inc.**
LOGGER: **Casey Wagner**
DEPTH TO - Water: **N/A** Caving: **No**
DATE CHECKED: **During Drilling**

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks
225 / 0			Asphalt Pavement 14"			
		GM-SM	Appreared to be road gravel beneath pavement (fill).			
			Large rock, cobble or boulder, possibly quarry spalls beneath road gravel.			
220 / 5			Boring Terminated at approximately 2.5'			
215 / 10						
210 / 15						
205 / 20						
200 / 25						
195 / 30						
190 / 35						

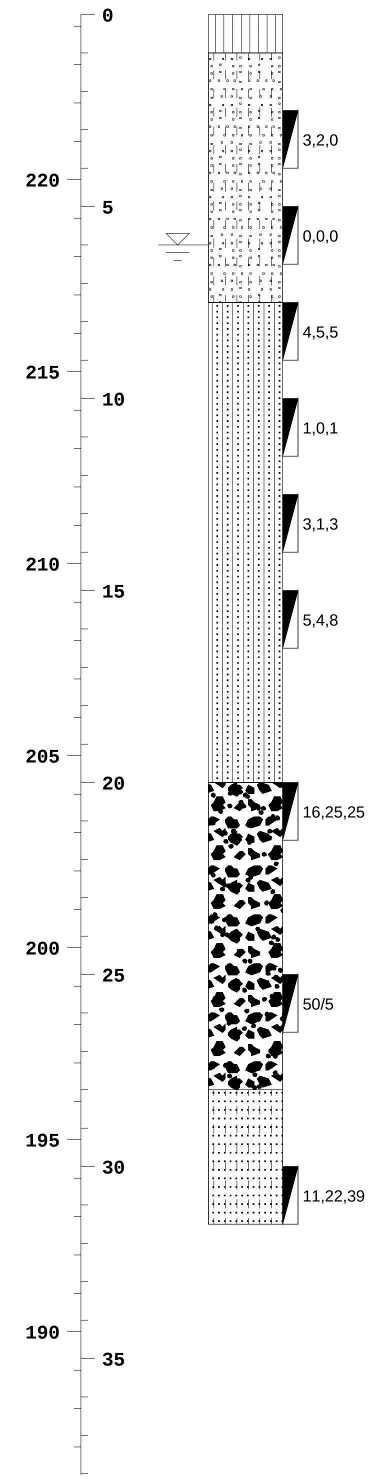
Boring B-4b was drilled approximately 16 feet south of the centerline of SE May Valley RD SE and 85 feet west of the intersection with Issaquah-Hobart RD SE. See attached survey map for exact location of boring. No Groundwater was observed during drilling.

Figure A5

LOG OF BORING
BORING B-5

PROJECT: **Issaquah-Hobart at SE May Valley Rd Intersection**
BORING LOCATION: **See Attached Boring Location Map**
DRILL METHOD: **Hollow Stem Auger**
DRILLER: **Holocene Drilling Inc.**
DEPTH TO - Water: **6'** Caving: **No**

DATE: **5/1/2020**
START: **13:45**
FINISH: **15:30**
LOGGER: **Casey Wagner**
DATE CHECKED: **During Drilling**



Field Test Data	USCS	Description	Moist (%)	-200 (%)	Remarks
	ML	Dark brown sandy silt, numerous organics, moist, very loose.			
3,2,0	SP-SM	Brown poorly grade sand with silt and gravel, scattered organics, moist, very loose.			2" Recovery
0,0,0			12.1	10.6	No Recovery
4,5,5	SM	Gray silty sand, 1" layer of brown silt, 1/2" seam of organics, scattered organics, wet, very loose to medium dense.	26.5	17.3	9" Recovery
1,0,1					5" Recovery
3,1,3					8" Recovery
5,4,8			24.7	26.0	8" Recovery
16,25,25	GW	Brown well graded gravel with silt and sand, occasional cobble and boulder, wet, very dense.			6" Recovery
50/5					5" Recovery
11,22,39	SW-SM	Brown well graded sand with silt, scattered gravel, wet, very dense.			14" Recovery
		Boring Terminated at 31.5'			

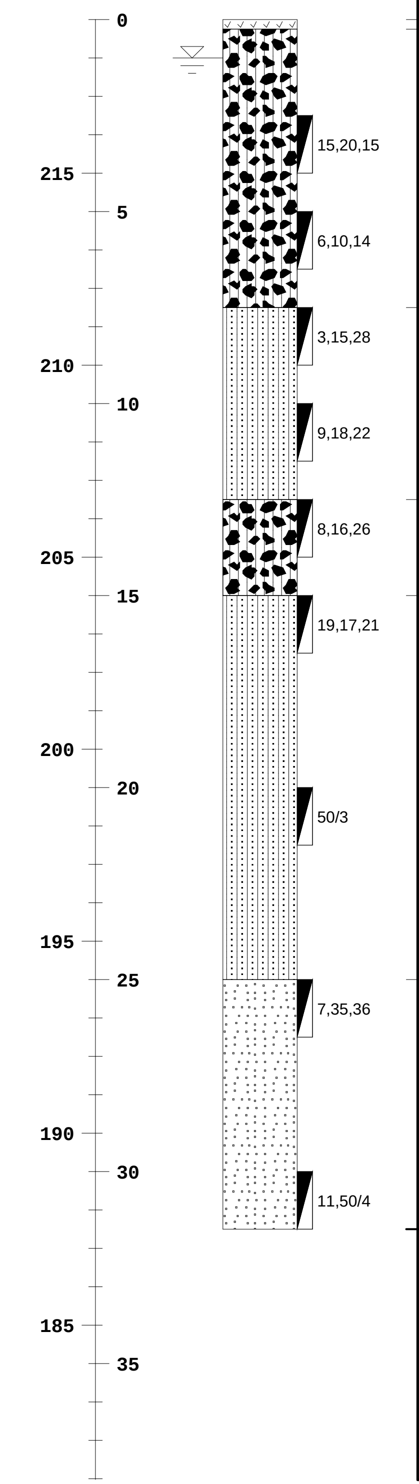
Boring B-5 was drilled east of the intersection in a private residential lot approximately 20 feet east of the edge of sidewalk. See attached survey map for exact location of boring. Groundwater was observed during drilling at approximately 6 feet bgs.

Figure A6

LOG OF BORING
BORING B-6

PROJECT: **Issaquah-Hobart at SE May Valley Rd Intersection**
BORING LOCATION: **See Attached Boring Location Map**
DRILL METHOD: **Hollow Stem Auger**
DRILLER: **Holocene Drilling Inc.**
DEPTH TO - Water: **1'** Caving: **No**

DATE: **4/30/2020**
START: **13:00**
FINISH: **14:45**
LOGGER: **Casey Wagner**
DATE CHECKED: **During Drilling**



USCS	Description	Moist (%)	-200 (%)	Remarks
GM	Topsoil approximately 3" Brown silty gravel with sand, wet, medium dense to dense (fill).			1" Recovery
				3" Recovery
SM	Gray silty sand with gravel, 7" layer of numerous organics, wet, dense.	37.1	29.9	18" Recovery
		20.5	13.2	9" Recovery
GM	Brown silty gravel with sand, occasional cobble, wet, dense.			3" Recovery
SM	Brown silty sand with gravel, scattered organics, wet, dense to very dense.			10" Recovery
				2" Recovery
SP	Gray poorly graded sand, wet, very dense.	20.8	3.4	12" Recovery
				18" Recovery
	Boring Terminated at 31.5'			

Boring B-6 was drilled in the vegetated area northwest of the intersection. See attached survey map for exact location of boring. Groundwater was observed during drilling at approximately 1 foot bgs.

Figure A7

LOG OF MONITOR WELL INSTALLATION
WELL NO. MW-1

PROJECT: **Issaquah-Hobart at SE May Valley Rd Intersection**
BORING LOCATION: **See Attached Boring Location Map**
DRILL METHOD: **Hollow Stem Auger**
DRILLER: **Holocene Drilling Inc.**
DEPTH TO - Water: **4'**

DATE: **5/1/2020**
START: **07:45**
FINISH: **10:00**
LOGGER: **Casey Wagner**
DATE CHECKED: **During Drilling**

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks	Monitor Well Construction Schematic
220 / 0		SM	Topsoil Approximately 3"				
	18,19,19	SM	Brown silty sand with gravel, numerous organics, moist (fill). Brown silty sand with gravel, trace charcoal, scattered organics, moist, loose to dense.	8.1	13.7	7" Recovery	
215 / 5	9,5,4					3" Recovery	
	2,0,1	ML	No Revovery, appeared to be silty material with organics, wet, very loose.			No Recovery	
210 / 10	2,7,16	SM	Brown to gray silty sand with scattered gravel, occasional cobble, trace organics, wet, medium dense to very dense.	28.1	18.7	7" Recovery	
	10.20,21					2" Recovery	
205 / 15	50/6					3" Recovery	
200 / 20	48,25,9			18.3	15.8	6" Recovery	
195 / 25	5,7,10					8" Recovery	
190 / 30	10,12,15	SP-SM	Brown poorly graded sand with silt, wet. medium dense to dense.			9" Recovery	
185 / 35	11,17,32			23.0	10.4	11" Recovery	

Monitoring well MW-1 was drilled in vegetated area NW of the intersection. See attached survey map for exact location of boring. Groundwater was observed during drilling at approximately 4 feet bgs. A 2" diameter PVC well was installed in the boring and is identified by the Washington State Department of Ecology discrete well tag number BNF-217.

Figure A8

LOG OF MONITOR WELL INSTALLATION
WELL NO. MW-1

PROJECT: **Issaquah-Hobart at SE May Valley Rd Intersection**
BORING LOCATION: **See Attached Boring Location Map**
DRILL METHOD: **Hollow Stem Auger**
DRILLER: **Holocene Drilling Inc.**
DEPTH TO - Water: **4'**

DATE: **5/1/2020**
START: **07:45**
FINISH: **10:00**
LOGGER: **Casey Wagner**
DATE CHECKED: **During Drilling**

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks	Monitor Well Construction Schematic
180 / 40	11,8,8					7" Recpvery	
175 / 45	10,12,32					9" Recovery	
170 / 50	10,17,22			24.3	8.5	11" Recovery	
			Boring Terminated at 51.5'				
165 / 55							
160 / 60							
155 / 65							
150 / 70							

Monitoring well MW-1 was drilled in vegetated area NW of the intersection. See attached survey map for exact location of boring. Groundwater was observed during drilling at approximately 4 feet bgs. A 2" diameter PVC well was installed in the boring and is identified by the Washington State Department of Ecology discrete well tag number BNF-217.

Figure A8

KEY TO SYMBOLS

Symbol	Description
	Strata symbols
	Topsoil
	Silty sand
	Silt
	Poorly graded sand with silt
	Paving
	Silty gravel
	Well graded sand with silt
	Silty gravel and sand
	Cobble frac
	Well graded gravel
	Poorly graded sand
	Misc. Symbols
	Water table during drilling

Symbol	Description
	Boring continues
	Drill rejection
	Soil Samplers
	Standard penetration test

Notes:

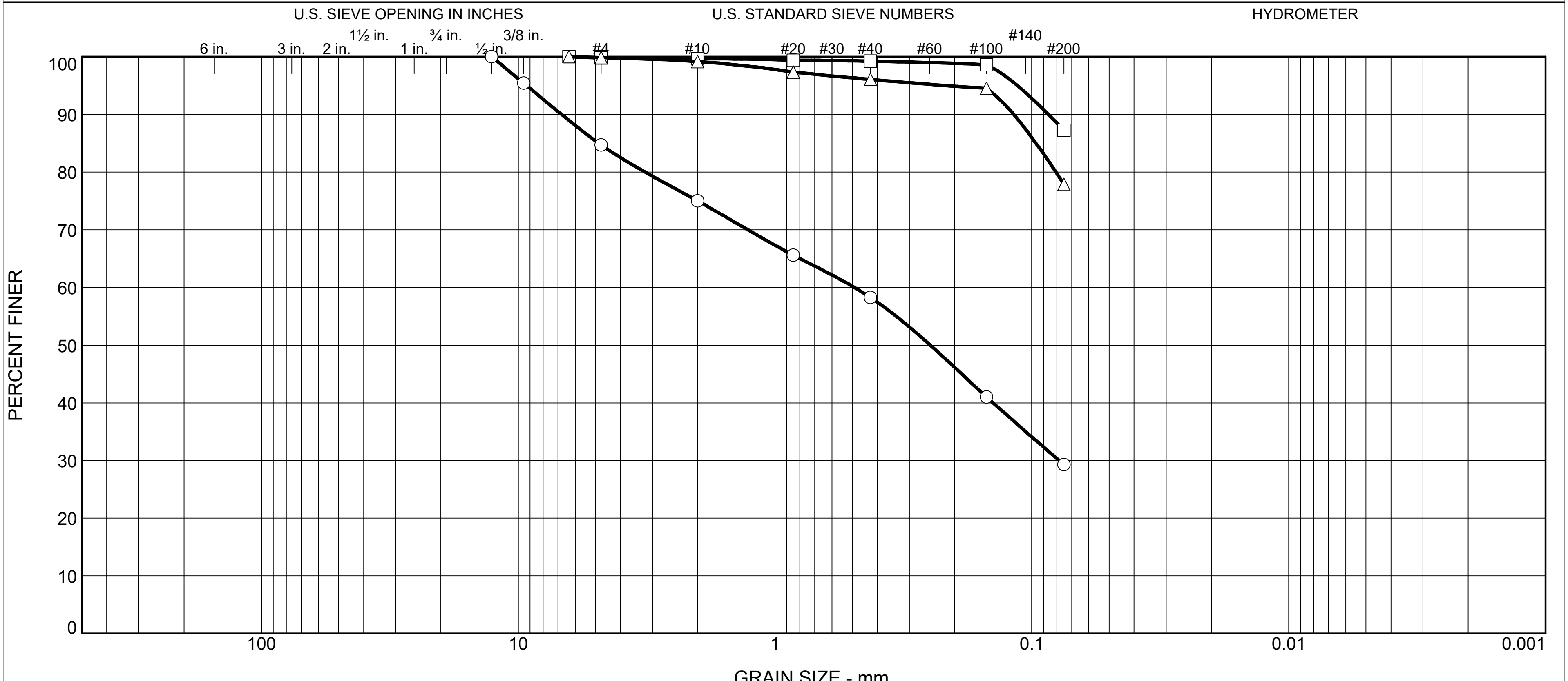
1. Exploratory borings were drilled on 4/30/2020 & 5/1/2020 using a 4-inch diameter continuous flight power auger.

2. Groundwater was encountered at the time of drilling in each boring besides B-4a & B-4b, ranging from approximately 1 to 12 feet bgs.

3. Boring elevation and locations were surveyed and provided by King County Roads Survey Group

4. These logs are subject to the limitations, conclusions, and recommendations in this report.

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	15.3	9.7	16.7	29.0	29.3	
□	0.0	0.0	0.2	0.2	0.4	12.0	87.2	
△	0.0	0.0	0.1	0.7	3.1	18.2	77.9	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	B-1		5	5/13/2020	SM	Silty Sand with Gravel	25.0		
□	B-1		12.5	5/13/2020	ML	Silt	29.5		
△	B-1		15	5/13/2020	ML	Silt with Sand	26.4		

Client King County Roads

Project Issaquah-Hobart at SE May Valley Rd Intersection

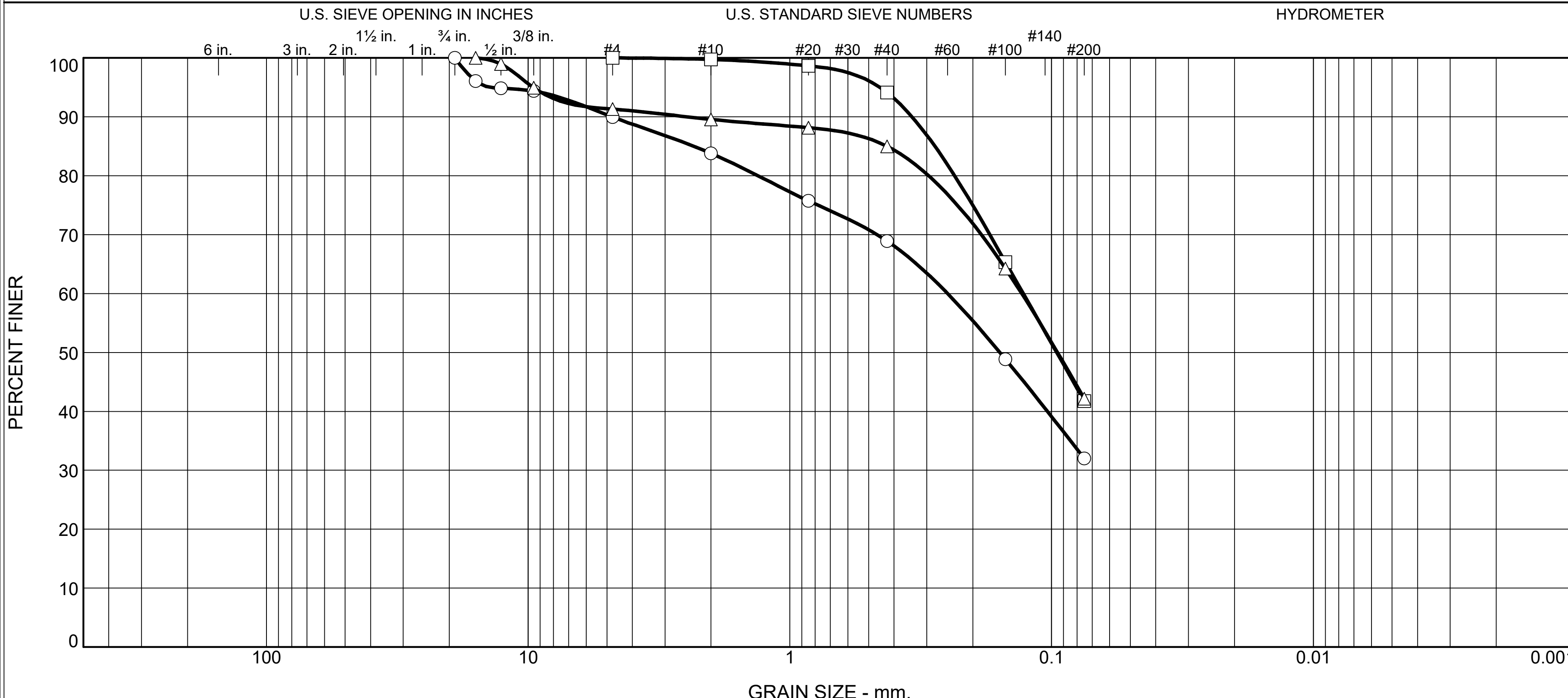
Project No. 1129598 Figure A9

KING COUNTY

MATERIALS LABORATORY

Tested By: Casey Wagner **Checked By:** DW

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	10.0	6.2	14.9	36.9	32.0	
□	0.0	0.0	0.0	0.3	5.6	52.4	41.7	
△	0.0	0.0	8.7	1.7	4.6	42.8	42.2	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	B-2		5	5/13/2020	SM	Silty Sand	15.6		
□	B-2		10	5/13/2020	SM	Silty Sand	24.6		
△	B-3		2.5	5/13/2020	SM	Silty Sand	30.4		

Client King County Roads

Project Issaquah-Hobart at SE May Valley Rd Intersection

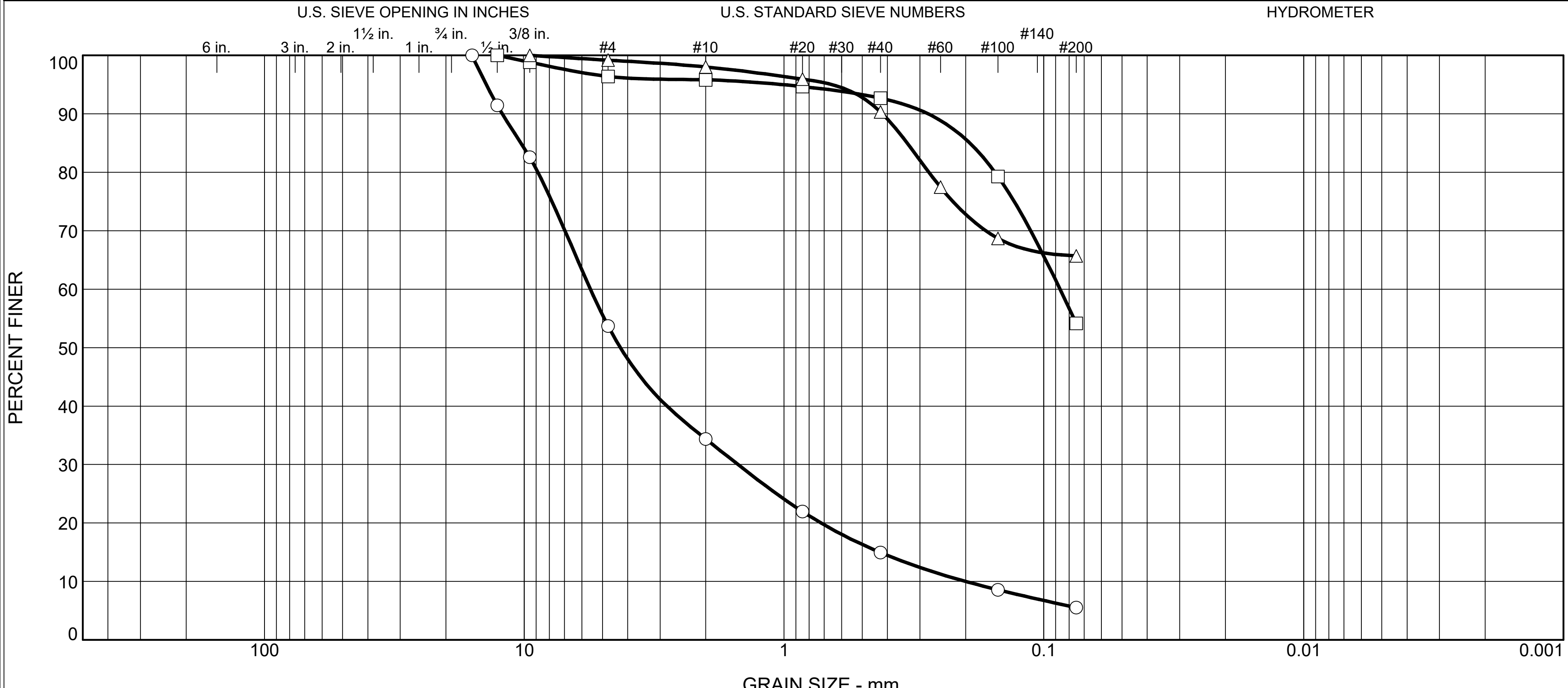
Project No. 1129598 Figure A10

KING COUNTY

MATERIALS LABORATORY

Tested By: Casey Wagner **Checked By:** DW

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	46.3	19.3	19.5	9.4	5.5	
□	0.0	0.0	3.6	0.6	3.1	38.6	54.1	
△	0.0	0.0	0.8	1.2	7.7	24.6	65.7	

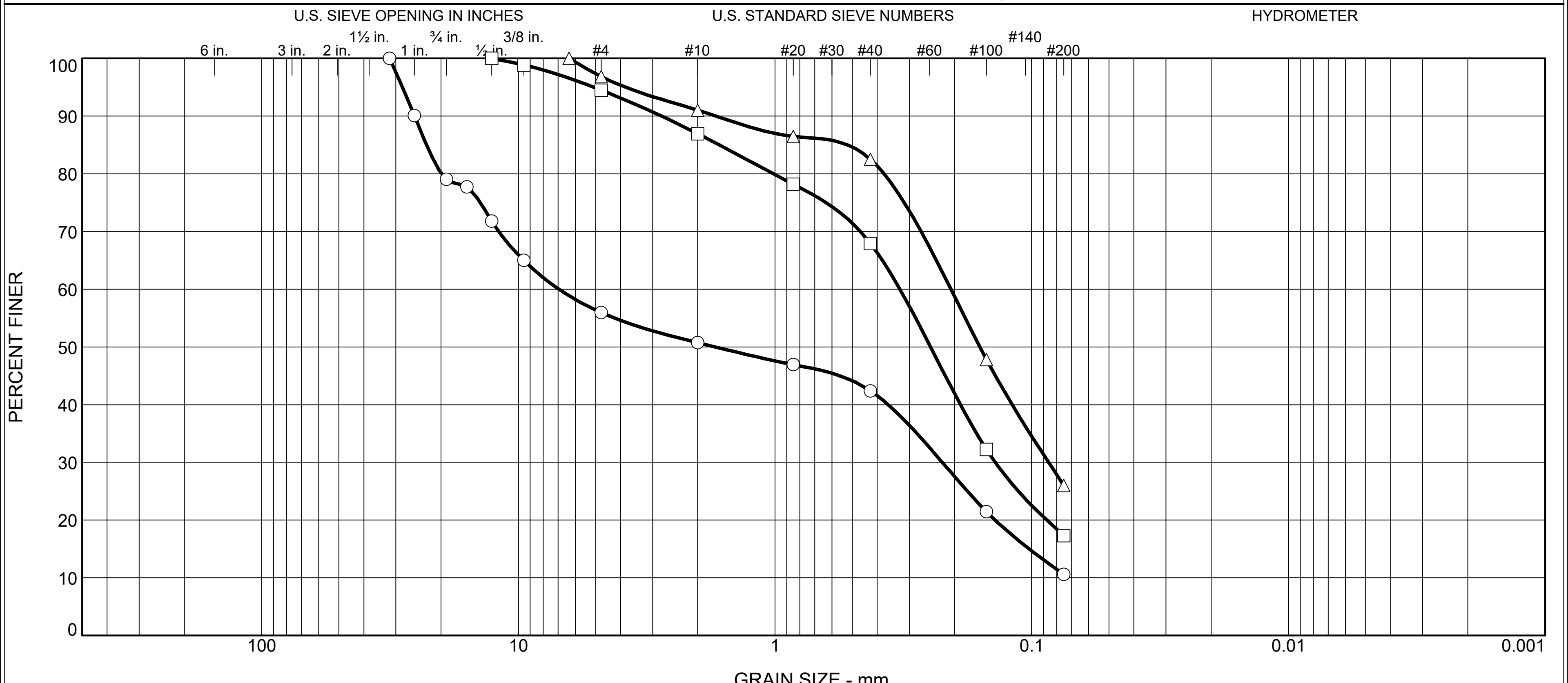
	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	B-3		7.5	5/13/2020	SW-SM	Well Graded Sand with Silt and Gravel	18.1		
□	B-3		15	5/13/2020	ML	Sandy Silt	34.7		
△	B-3		30	5/13/2020	ML	Sandy Silt	26.6		

Client King County Roads
Project Issaquah-Hobart at SE May Valley Rd Intersection
Project No. 1129598 Figure A11

KING COUNTY
MATERIALS LABORATORY

Tested By: Casey Wagner **Checked By:** DW

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	21.0	23.0	5.2	8.4	31.8	10.6	
□	0.0	0.0	5.5	7.6	19.0	50.6	17.3	
△	0.0	0.0	3.1	5.9	8.5	56.5	26.0	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	B-5		5	5/13/2020	SP-SM	Poorly Graded Sand with Silt and Gravel	12.1		
□	B-5		7.5	5/13/2020	SM	Silty Sand	26.5		
△	B-5		15	5/13/2020	SM	Silty Sand	24.7		

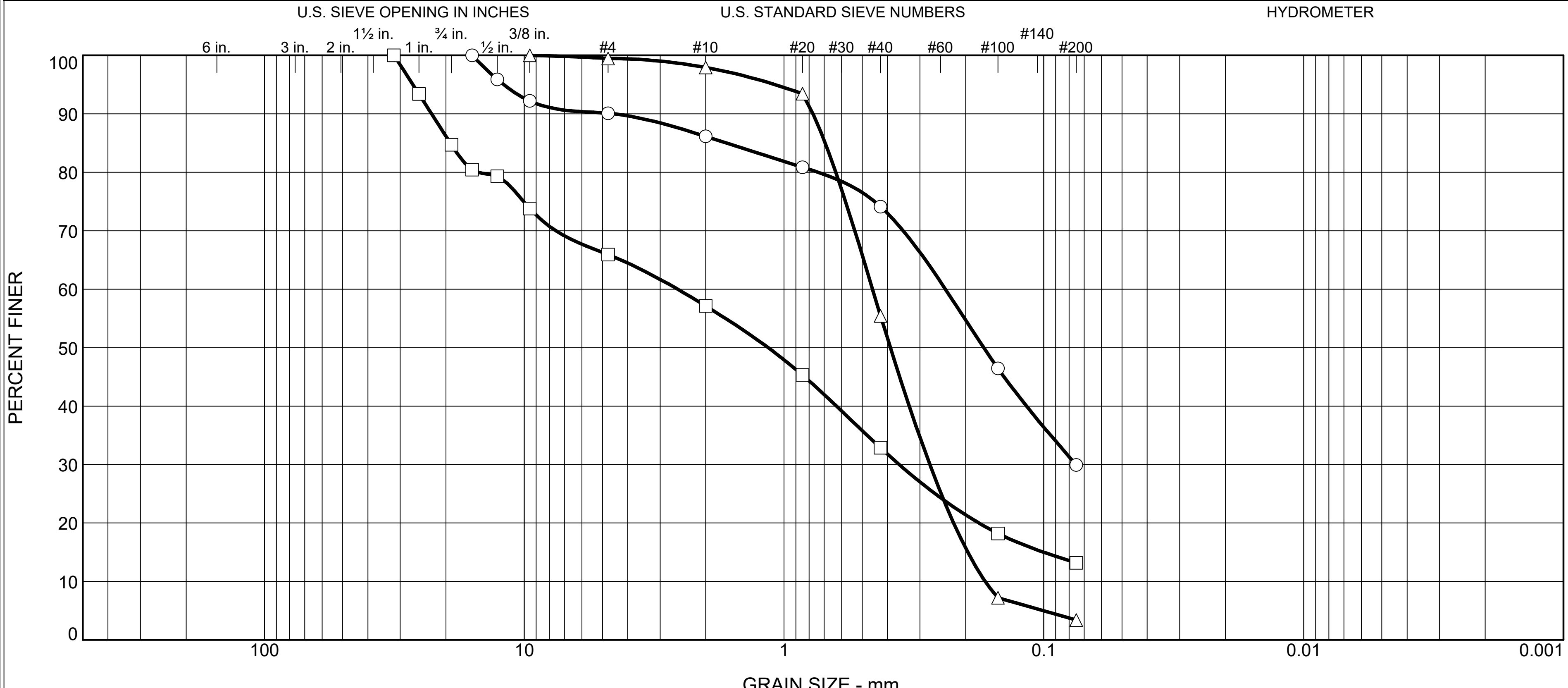
Client King County Roads
Project Issaquah-Hobart at SE May Valley Rd Intersection
Project No. 1129598 Figure A12

KING COUNTY

MATERIALS LABORATORY

Tested By: Casey Wagner **Checked By:** DW

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	9.9	4.0	12.0	44.2	29.9	
□	0.0	15.3	18.8	8.8	24.2	19.7	13.2	
△	0.0	0.0	0.5	1.6	42.5	52.0	3.4	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	B-6		7.5	5/13/2020	SM	Silty Sand	37.1		
□	B-6		10	5/13/2020	SM	Silty Sand with Gravel	20.5		
△	B-6		25	5/13/2020	SP	Poorly Graded Sand	20.8		

Client King County Roads
Project Issaquah-Hobart at SE May Valley Rd Intersection

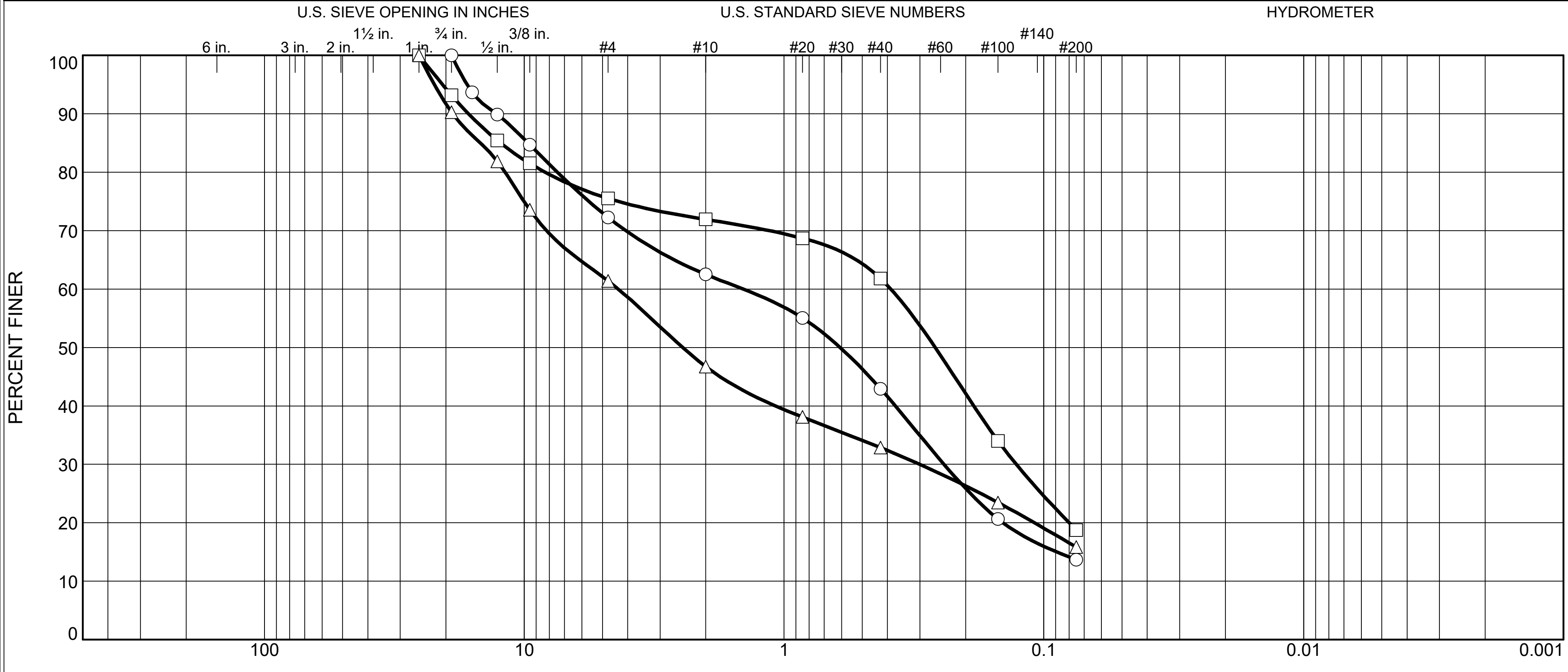
Project No. 1129598 Figure A13

KING COUNTY

MATERIALS LABORATORY

Tested By: Casey Wagner **Checked By:** DW

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	27.7	9.8	19.6	29.2	13.7	
□	0.0	6.8	17.7	3.6	10.1	43.1	18.7	
△	0.0	9.7	28.9	14.7	13.8	17.1	15.8	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	MW-1		2.5	5/13/2020	SM	Silty Sand with Gravel	8.1		
□	MW-1		10	5/13/2020	SM	Silty Sand with Gravel	28.1		
△	MW-1		20	5/13/2020	SM	Silty Sand with Gravel	18.3		

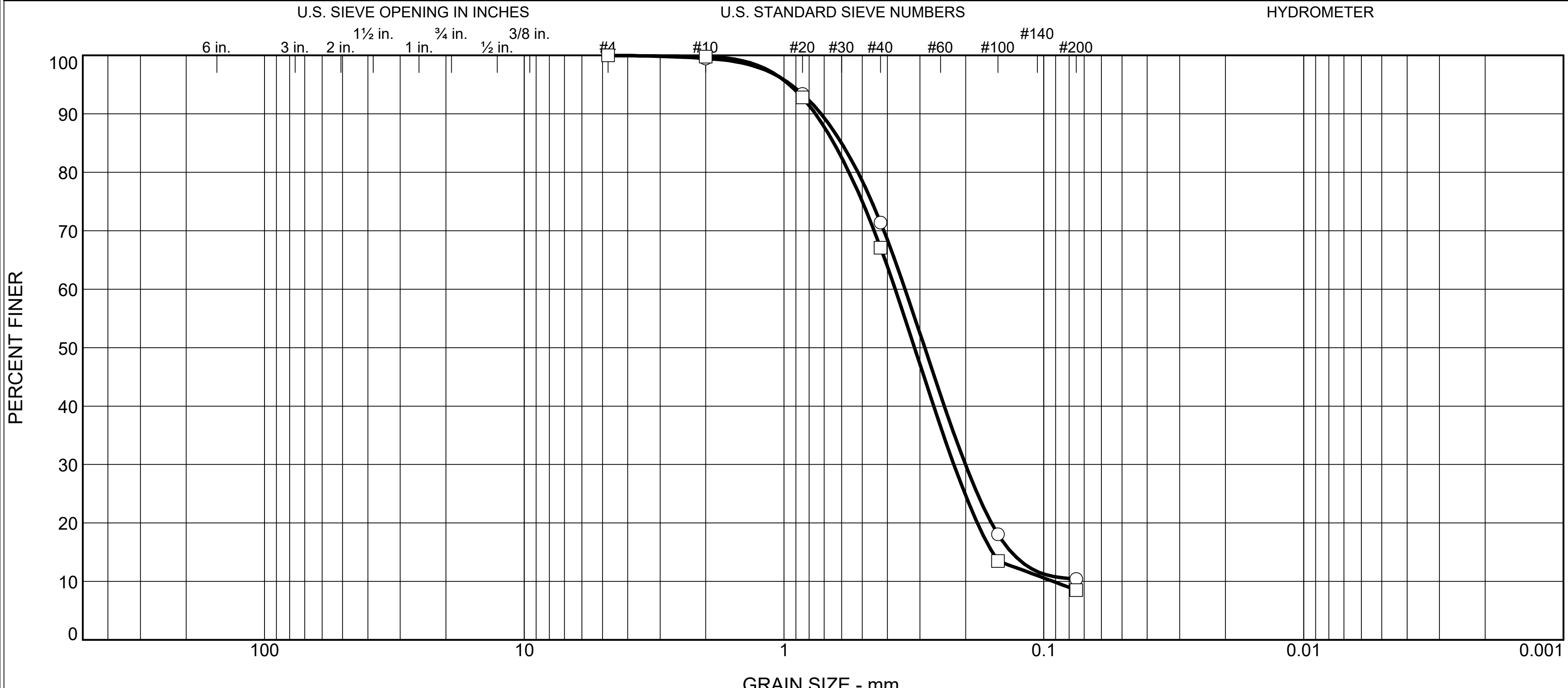
Client King County Roads
Project Issaquah-Hobart at SE May Valley Rd Intersection
Project No. 1129598 Figure A14

KING COUNTY

MATERIALS LABORATORY

Tested By: Casey Wagner **Checked By:** DW

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.5	28.1	61.0	10.4	
□	0.0	0.0	0.0	0.2	32.7	58.6	8.5	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	MW-1		35	5/13/2020	SP-SM	Poorly Graded Sand with Silt	23.0		
□	MW-1		50	5/13/2020	SP-SM	Poorly Graded Sand with Silt	24.3		

Client King County Roads

Project Issaquah-Hobart at SE May Valley Rd Intersection

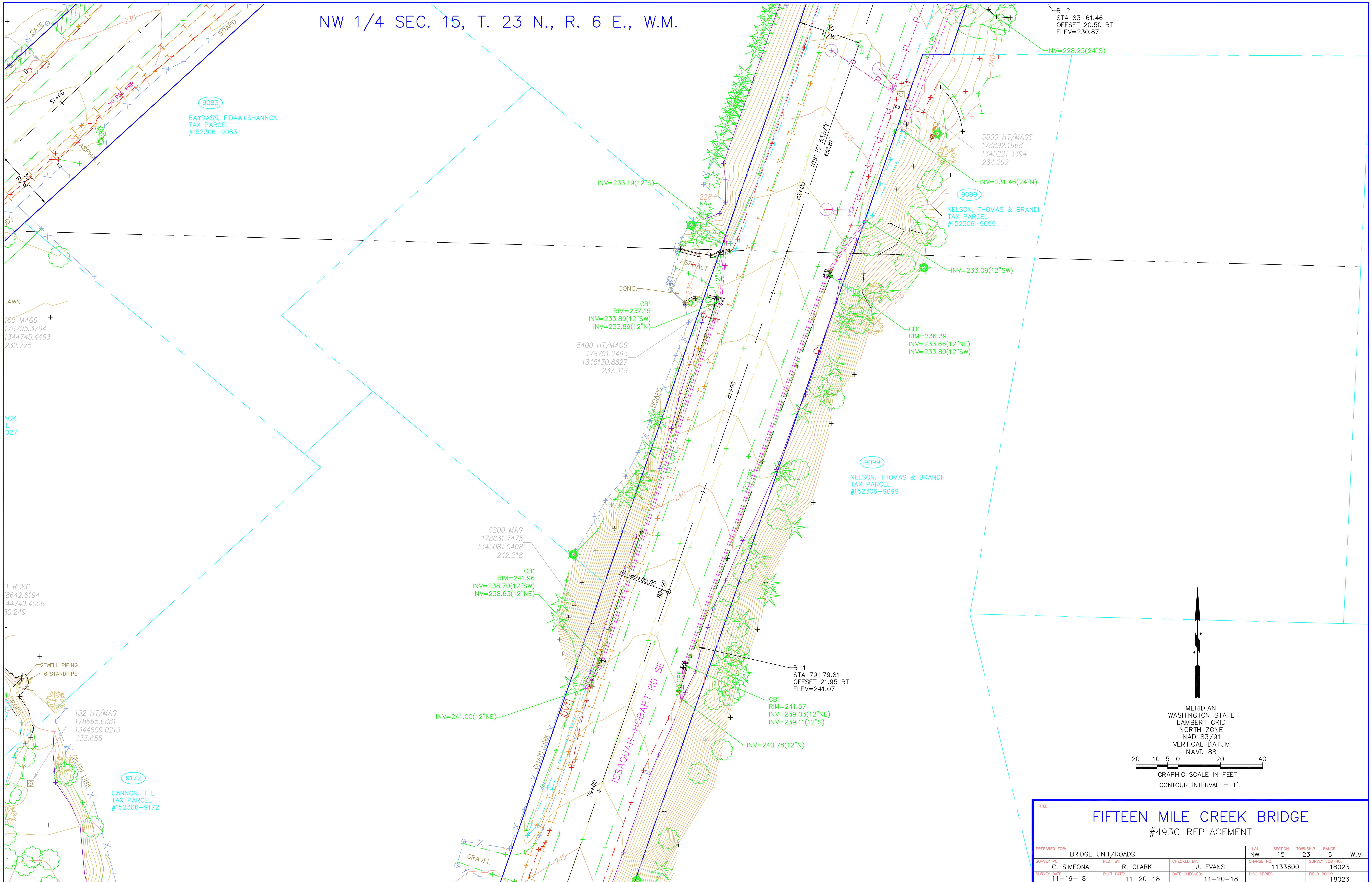
Project No. 1129598 Figure A15

KING COUNTY

MATERIALS LABORATORY

Tested By: Casey Wagner **Checked By:** DW

NW 1/4 SEC. 15, T. 23 N., R. 6 E., W.M.



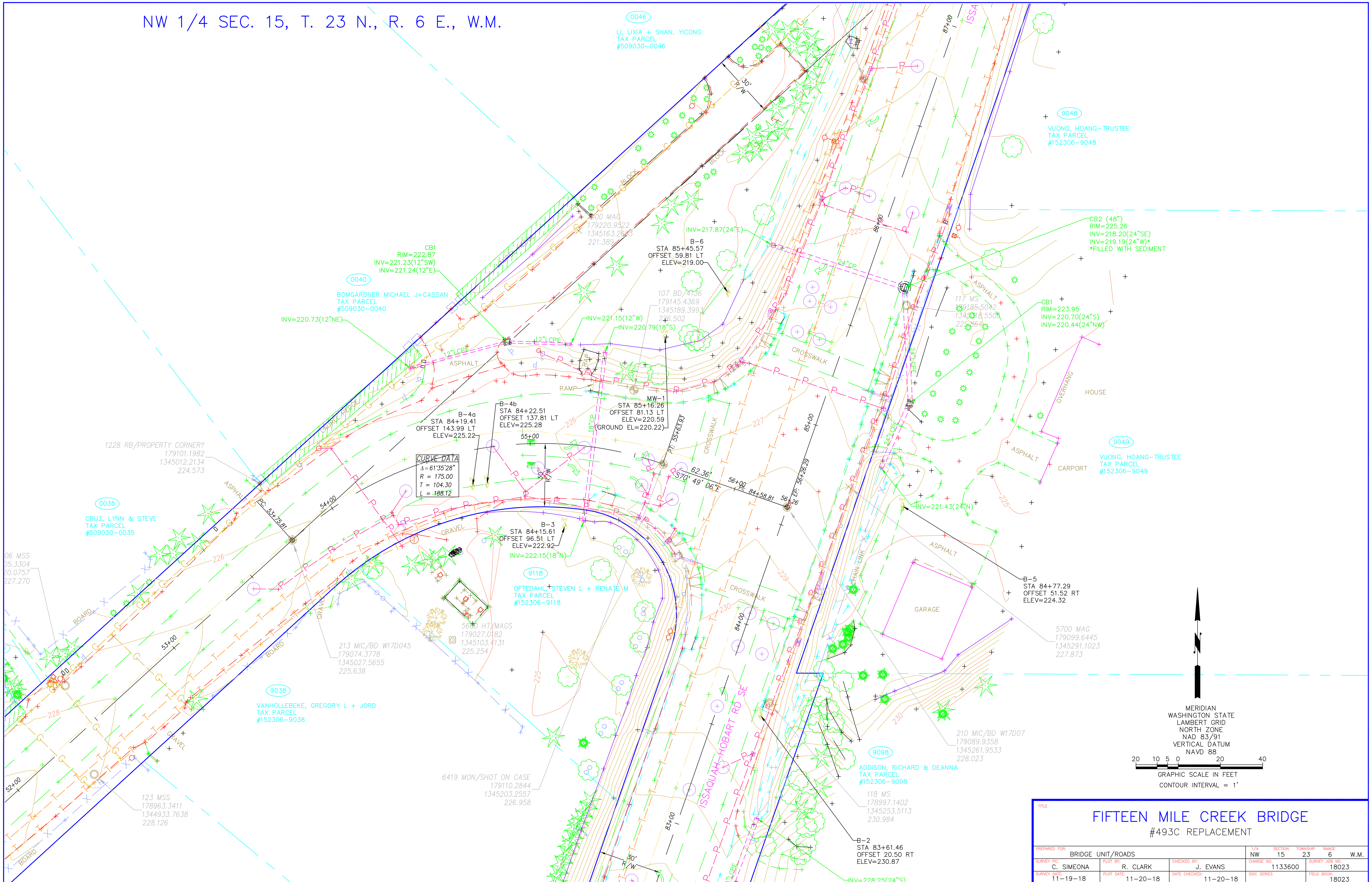
DATE	REVISION	BY
06-04-2020	ADDED BORINGS B1-B6 & MONITORING WELL MW1	RC
02-27-2020	COMBINED 19072 TOPO, RIGHT OF WAY, & PROPERTY LINES	RC / CS

TITLE:
FIFTEEN MILE CREEK BRIDGE
#493C REPLACEMENT

PREPARED FOR: BRIDGE UNIT/ROADS			1/4 NW · SECTION 15 · TOWNSHIP 23 · RANGE 6 · W.M.
SURVEY PC: C. SIMEONA	PLOT BY: R. CLARK	CHECKED BY: J. EVANS	CHARGE NO. 1133600 · SURVEY JOB NO. 18023
SURVEY DATE: 11-19-18	PLOT DATE: 11-20-18	DATE CHECKED: 11-20-18	DISC SERIES · FIELD BOOK: 18023
REFERENCES:			PROJECT MGR: J.EVANS · SCALE: 1"=20'

ROAD SERVICES DIVISION, SURVEY & MAPPING
KING COUNTY DEPT. OF TRANSPORTATION TEL 296-6508 FAX 296-7719

SHEET NO.: 6 OF 10



DATE	REVISION	BY
06-04-2020	ADDED BORINGS B1-B6 & MONITORING WELL MW1	RC
02-27-2020	COMBINED 19072 TOPO, RIGHT OF WAY, & PROPERTY LINES	RC / CS

FIFTEEN MILE CREEK BRIDGE

#493C REPLACEMENT

PREPARED FOR: BRIDGE UNIT/ROADS		1/4 NW, SECTION 15, TOWNSHIP 23, RANGE 6 W.M.	
SURVEY PC: C. SIMEONA	PLOT BY: R. CLARK	CHECKED BY: J. EVANS	CHARGE NO. 1133600 / SURVEY JOB NO. 18023
SURVEY DATE: 11-19-18	PLOT DATE: 11-20-18	DATE CHECKED: 11-20-18	DISC SERIES: / FIELD BOOK: 18023
REFERENCES:		PROJECT MGR: J.EVANS	SCALE: 1"=20'

ROAD SERVICES DIVISION, SURVEY & MAPPING
KING COUNTY DEPT. OF TRANSPORTATION TEL 296-6508 FAX 296-7719

SHEET NO. 4 OF 10

Appendix C: Preliminary Critical Areas Report

King County
Department of Local Services
Road Services Division

Preliminary Critical Areas Report

Issaquah-Hobart Road SE at SE May Valley Road Intersection Improvements CIP 1129598

April 2023

Prepared By:

Tanner Harris, PWS, Environmental Scientist III

Project Manager:

Sayed Torak, PE, Engineer III

Additional Contributors:

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Emily Davis, PE, Environmental Scientist III
Jenna Rheuben, Environmental Scientist I
Hoda Sondossi, Environmental Scientist III

For concerns or questions contact:

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King Street Center
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Seattle, WA 98104
206-477-3548
Katie.Merrell@kingcounty.gov

Executive Summary

King County Department of Local Services, Road Services Division is planning to conduct improvements at the intersection of Issaquah-Hobart Road SE and SE May Valley Road in unincorporated King County, south of the City of Issaquah. This report identifies and describes critical areas and other relevant environmental and ecological features and concerns in the vicinity of the proposed improvements.

King County critical areas and other regulated resources mapped or observed within the vicinity of the project include:

- Issaquah Creek (Type S; 165-foot-wide buffer)
- Fifteen Mile Creek (Type F; 165-foot-wide buffer)
- Nudist Camp Creek (Type F; 165-foot-wide buffer)
- Unnamed Type F stream (165-foot-wide buffer)
- FEMA 100-year floodplain and floodway (associated with Issaquah Creek)
- Shoreline jurisdiction (Conservancy, associated with Issaquah Creek)
- Potential unmapped, unrated wetlands (category and buffer width unknown)
- Seismic hazard
- Erosion hazard
- Potential steep slope hazard
- Potential landslide hazard
- Critical aquifer recharge area (Category 1 and 2)
- Wildlife network

The full scope of the project and its exact footprint are currently unknown. King County will work to avoid, minimize, and mitigate any impacts to critical areas and will determine the need for regulatory permits and approvals as the project design is developed.

Table of Contents

Figures

Tables

Appendices

1.0 Introduction

This report identifies and describes critical areas and other relevant environmental and ecological features and concerns in the vicinity of contemplated improvements at the intersection of Issaquah-Hobart Road SE and SE May Valley Road, located in unincorporated King County, south of the City of Issaquah. This report facilitates the King County Department of Local Services, Road Services Division's (Roads) efforts to:

- Identify critical areas and other sensitive resources within the project vicinity,
- Avoid or minimize impacts to critical areas during the design process, and
- Provide background information for the development of mitigation plans.

The project is in the conceptual development phase, and the full scope of the project and its exact footprint are currently unknown. This report is intended to support the preparation of the following documents, permits, and approvals (if needed, depending on funding sources and the final project footprint):

<u>Federal</u>:

- National Environmental Policy Act Documentation/Approval (if federally funded)
- Endangered Species Act Section 7 Documentation/Approval (if federally funded or requires a federal permit)
- U.S. Army Corps of Engineers (USACE) Clean Water Act (CWA) Section 404 Authorization (if there are impacts to Waters of the U.S.)

<u>State</u>:

- State Environmental Policy Act Documentation/Review
- Washington State Department of Ecology
  - CWA Section 401 Water Quality Certification (if a USACE CWA Section 404 permit is needed)
  - Construction Stormwater General Permit (if project construction requires one acre or more of ground disturbance)
- Washington State Department of Fish and Wildlife (WDFW) Hydraulic Project Approval (if there is potential to impact Waters of the State)

<u>Local</u>:

- King County Department of Local Services, Permitting Division
  - Clearing and Grading Permit
  - Critical Areas Alterations Exception (if non-allowed, unavoidable uses are proposed within critical area buffers)
  - Shoreline Management Act Exemption (project may be exempt if work in the Shoreline jurisdiction does not occur below the ordinary high water mark of Type S waters)
  - Flood Hazard Certification (if work occurs within the floodplain of any stream)
  - Floodplain Development Permit (if work occurs within the FEMA 100-year floodplain of Issaquah Creek)
  - FEMA No-Rise Certificate (if work occurs within the FEMA floodway of Issaquah Creek)

2.0 Proposed Project

2.1 Project Location

The project is located at the intersection of Issaquah-Hobart Road SE and SE May Valley Road in unincorporated King County, south of the City of Issaquah (Figure 1). The project area occurs in the NW quarter of Section 15 in Township 23N and Range 6E, Willamette Meridian. The project will occur largely within the existing King County road right-of-way but may also affect portions of the adjacent private parcels along Issaquah-Hobart Road SE and/or SE May Valley Road. Private parcels within the vicinity of the project location are shown on Figures 2 and 3. Private parcels to which King County was granted right-of-entry and were investigated on-site are listed in Table 1. Parcels identified for additional on-site investigation pending right-of-entry are listed in Table 2. Additional parcels may be affected by the project but were not identified for on-site critical areas investigation based on desktop analysis using the resources listed in Section 3.1 and what was visible from the public right-of-way.

Table 1. Private parcels investigated on-site for this report

Parcel Number	Owner	Street Address
1523069045	Issaquah Valley Family EDU	12820 Issaquah-Hobart Road SE
1523069048	Nghiem Nguyen	n/a
1523069049	Nghiem Nguyen	13030 Issaquah-Hobart Road SE
1523069118	Steven & Renate Oftedahl	n/a

Table 2. Private parcels recommended for additional on-site investigation pending right-of-entry

Parcel Number	Owner	Street Address
1023069027	William Erwin	12719 Issaquah-Hobart Road SE
1023069037	Jonathan & Claudia Labarge	12720 Issaquah-Hobart Road SE
1023069055	Timothy and Christine Short	n/a
1523069032	Gabriel & Lucia Albut	13417 Issaquah-Hobart Road SE
1523069047	Joseph & Aubrei Weaver	23605 SE 132nd Way
1523069081	William & Christine Durant	13520 Issaquah-Hobart Road SE
1523069128	Kristopher & Amer Constantine	13620 233rd Way SE
1523069171	Nghiem Nguyen	n/a
1523069173	Finn Christiansen	n/a
1523069232	Joan Scott	23506 SE 137th St
5090300046	Lixia Li & Yicong Shan	23450 SE May Valley Road
5090300056	James &Melissa Rey	12815 Issaquah-Hobart Road SE

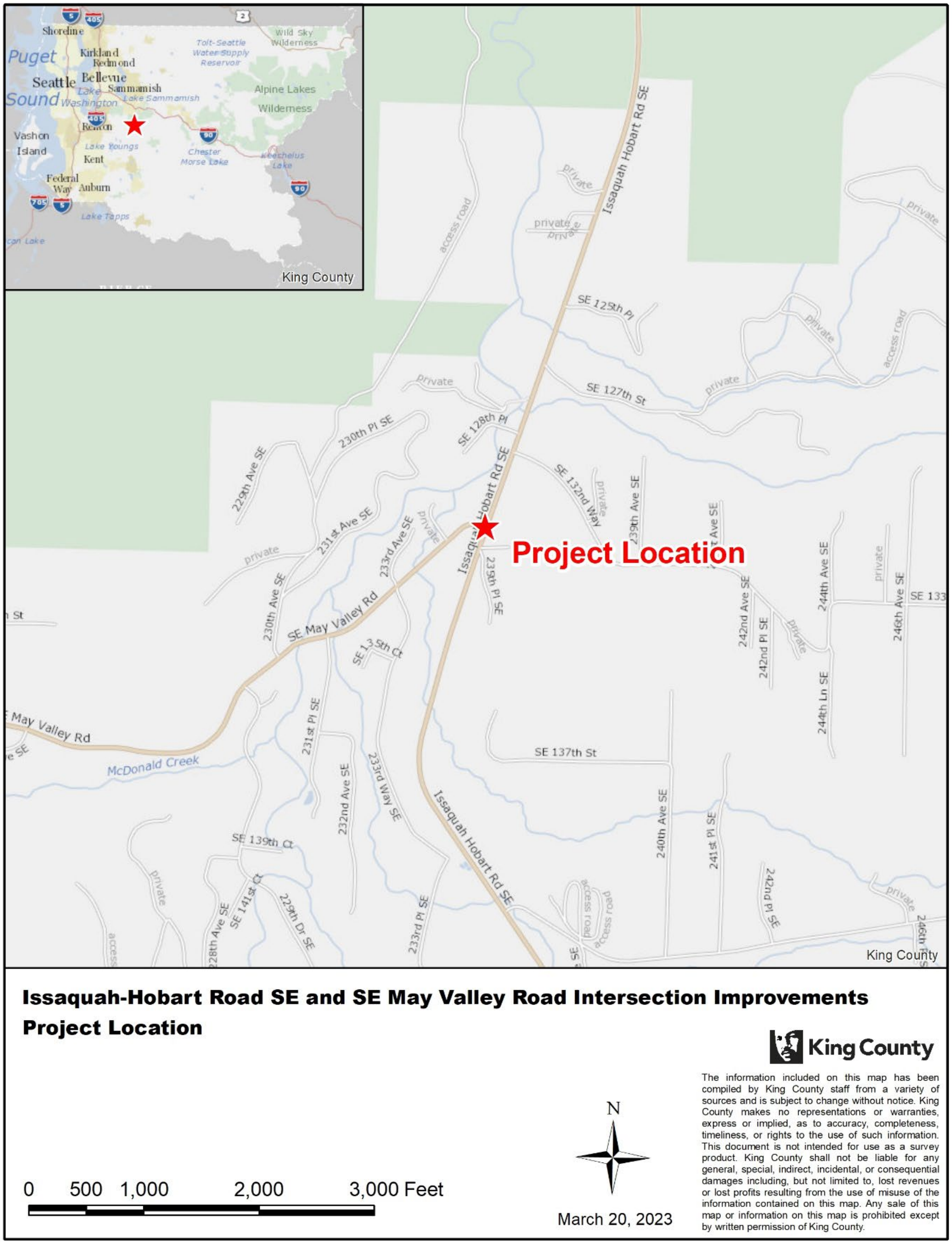

Figure 1. Project Location

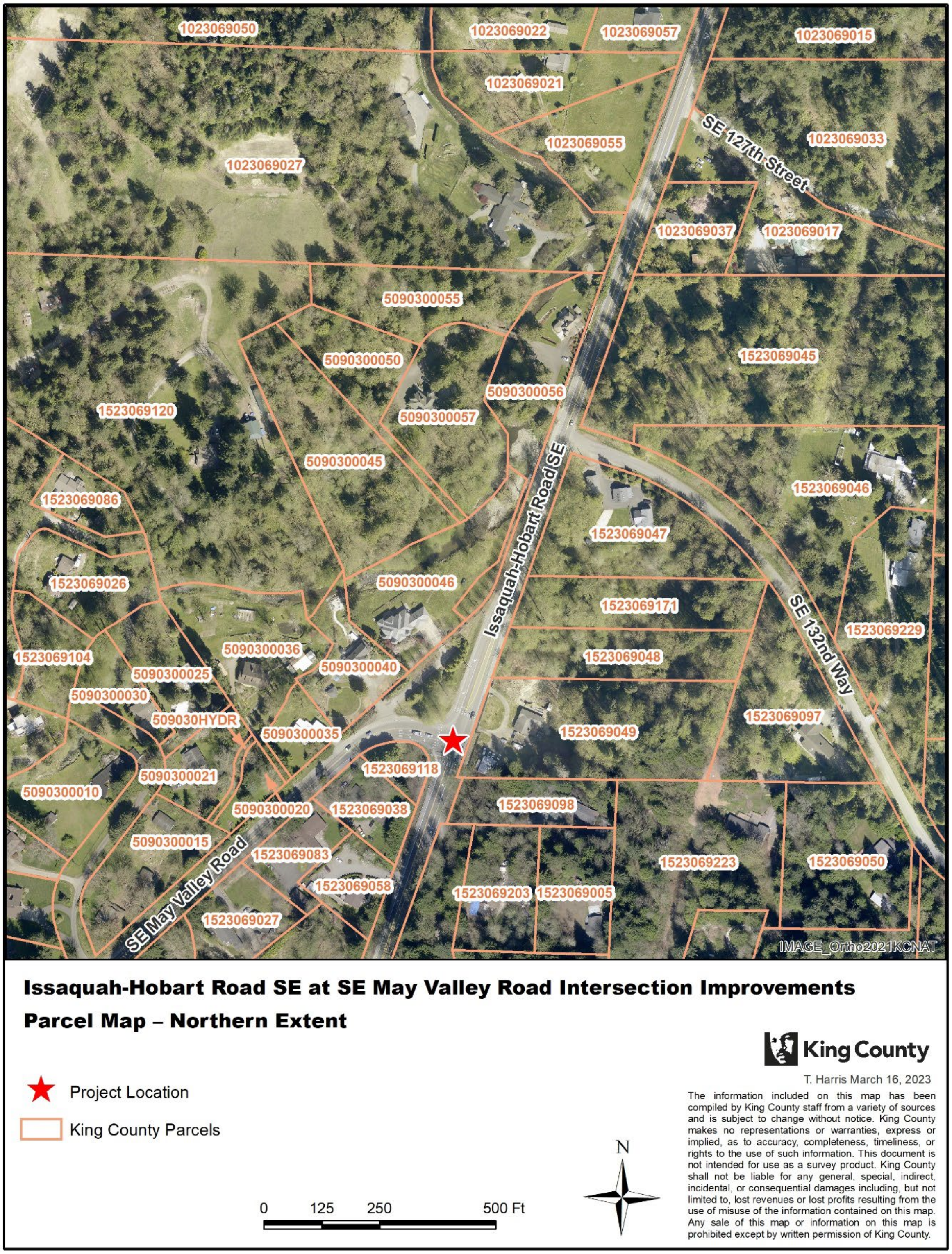

Figure 2. Parcel Map – Northern Extent

Figure 3. Parcel Map – Southern Extent

2.2 Project Purpose and Description

Roads is planning to conduct improvements at the intersection of Issaquah-Hobart Road SE and SE May Valley Road. Issaquah-Hobart Road SE, which is named Front Street in Issaquah, is a main route connecting Interstate 90 in the City of Issaquah to State Highway 18 and the communities of Hobart and Maple Valley. The road is a heavily used commuter route, with peak traffic heading northbound in the morning and southbound in the afternoon. Traffic volumes have grown substantially in recent years, worsening congestion along the corridor and leading to extended travel times and longer peak traveling hours. The City of Issaquah and King County Roads partnered on the *Issaquah-Hobart Road/Front Street Corridor Study* (Transpo Group 2018), which evaluated and identified safety, mobility, and other related improvements to provide the most efficient and reliable traffic flow possible along the corridor. The study recommended several projects to improve traffic flow, including a project at the intersection with SE May Valley Road. The exact scope of the project, its footprint, and the timing and duration of construction are presently unknown; however, the project will likely include the construction of a roundabout or additional travel lanes with a modified traffic signal. The project will also include utility work, drainage improvements, and site restoration.

3.0 Methods

This section summarizes the resources and methods used to identify critical areas and other environmental or ecological features associated with the project. See Appendix A for additional information.

3.1 Existing Conditions Literature Review

Roads environmental staff carried out a review of relevant literature, spatial databases, surveys, studies, and other works to document existing conditions within the project vicinity, sub-basin, and the larger watershed. The literature review focused on land use, the presence of known critical areas, sensitive species, and other relevant ecological characteristics. Resources evaluated included the following:

- U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (2022)
- U.S. Environmental Protection Agency WATERS GeoViewer (2022)
- U.S. Department of Agriculture (USDA) National Resources Conservation Service (NRCS) Web Soil Survey for King County (2022)
- Washington State Department of Ecology Water Quality Atlas web application (2022)
- Washington State Department of Natural Resources (DNR) Wetlands of High Conservation Value web application (2022a)
- Washington State DNR Geology Portal online mapper (2022b)
- Washington State DNR Forest Practices Application Mapping Tool (2022c)
- Washington State Department of Fish and Wildlife (WDFW) Stream Catalog (Williams et al. 1975)
- WDFW Priority Habitats and Species web application (2022a)
- WDFW SalmonScape web application (2022b)
- WDFW Washington State Fish Passage Inventory online mapper (2022c)

- Northwest Indian Fisheries Commission (NIFC) Statewide Integrated Fish Distribution (SWIFD) web application (2022)
- King County iMap interactive mapping tool (2022)

3.2 Wetlands

Roads environmental staff conducted wetland reconnaissance over multiple dates in 2022 and 2023. Investigations were conducted within the King County right-of-way and on private parcels to which right-of-entry was granted and were determined to have potential to contain wetlands (Table 1). For parcels to which King County was not granted right-of-entry, an assessment of the potential for wetlands to occur was conducted based on observations from the right-of-way, current aerial imagery, LiDAR-derived topographic data, and soil survey data.

Based on the results of the field reconnaissance and desktop assessment, Roads environmental staff identified portions of the anticipated project area warranting further investigation. On July 14, 2022, and February 24, 2023, Roads environmental staff conducted a routine wetland delineation on parcel 1523069048. Wetland identification followed the methods established in the USACE *Wetlands Delineation Manual* (Environmental Laboratory 1987) and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (USACE 2010). These USACE manuals are approved for wetland delineations in King County (KCC 21A.24.318, WAC 173-22-035).

Although no wetlands were identified during initial site visits for this project, if found during subsequent investigations, regulated wetlands will be categorized and rated based on the adopted *Washington State Wetland Rating System for Western Washington: 2014 Update* (Hruby 2014; KCC 21A.24.318). The wetland ratings will be used to determine wetland buffer widths and mitigation ratios following KCC 21A.24.325 and 21A.24.340, respectively.

3.3 Aquatic Areas (Streams)

Roads environmental staff completed a preliminary assessment of aquatic areas (streams) within the vicinity of the anticipated project area using online data sources listed in Section 3.1 and observations from the right-of-way. Roads environmental staff also conducted field reconnaissance on July 14, 2022, February 22 and 24, and March 17, 2023, to characterize streams on parcels 1523069049, 1523069048, and 1523069045.

The ordinary high water mark (OHWM) of observed streams was not delineated at this time but will be delineated at a future date if determined necessary based on the scope and footprint of the eventual project. The location and width of streams shown on figures in this report are based on aerial imagery and LiDAR-derived topographic data and have limited accuracy. If determined necessary, the OHWM will be mapped following guidance from the USACE (2005, 2014) and the Washington State Department of Ecology (2016). Stream buffer widths and mitigation ratios are based on KCC 21A.24.358 and KCC 21A.24.380, respectively.

3.4 Other Critical Areas

Other critical areas associated with specific hydrologic or geologic conditions, or wildlife corridors, within the vicinity of the project area were identified using the King County iMap online mapping tool (2022) and the *Preliminary Geotechnical Investigation* prepared for the project (King County 2020). A summary of these critical areas is provided here. A Technical Information Report describing existing conditions, project impacts, and proposed mitigation related to stormwater/hydrologic drainage features will be prepared at a future date.

4.0 Results

4.1 Existing Conditions

The following sub-sections provide a high-level overview of the landscape and watershed setting in which the project occurs based on a review of the resources listed in Section 3.1 and on-site investigations by Roads environmental staff.

4.1.1 Watershed and Sub-Basin Characterization

The project is located in the Cedar-Sammamish Water Resource Inventory Area (WRIA 8), which extends from the crest of the Cascade Range to Puget Sound and includes the Cedar River-Lake Washington and Lake Sammamish basins, which drain to Lake Washington. The project area lies within the Issaquah Creek sub-basin (HUC 171100120201), which encompasses a drainage area of approximately 36,069 acres and flows into the southern end of Lake Sammamish. The Lake Sammamish sub-basin is composed of a mix of urban development associated with the City of Issaquah; rural residential development associated with the communities of High Valley, Mirrormont Estates, and Hobart; and undeveloped forested land used for public recreation and commercial logging.

The project is located outside of the Urban Growth Boundary. Private properties within the vicinity of the project area are rural parcels with a RA-5 zoning (allowing one dwelling unit per five acres); however, many of the parcels in the immediate vicinity are significantly smaller than 5 acres, resulting in a higher density of housing.

4.1.2 Landscape and Geologic Setting

The project is located within the Puget Lowland physiographic region of western Washington. The project area occurs on the floor of a south-to-north running valley, near the confluence of several major streams, including McDonald Creek, Issaquah Creek, Fifteen Mile Creek, Nudist Camp Creek[1], and several smaller unnamed tributaries.

Surficial geology underlying the project area is predominantly Quaternary alluvium (Qyal) composed of moderately sorted deposits of cobble and gravel, pebbly sand, and sandy silt typically found along major rivers and stream channels. Outside of the influence of Issaquah Creek and Fifteen Mile Creek, surficial geology is dominated by Vashon Stade recessional outwash deposits (Stage 3, Qvr(3)) associated with the drainage of glacial Lake Snoqualmie. These deposits are composed of moderately to well-sorted,

[1] Although this stream is not named on current or historical maps reviewed by King County, it is identified as Nudist Camp Creek on multiple fish passage assessment reports by the WDFW, which also refer to it as Tributary 08.0206. There may be some confusion in the stream name due to previous work by King County Roads on the next stream to the north (between SE 127th Street and SE 125th Place), which was commonly referred to and may appear in some County records as Nudist Camp Creek. For the purposes of this report and other project documentation, Nudist Camp Creek refers to the stream located between SE 132nd Street and SE 127th Street as shown on Figure 4.

stratified sand and gravel and, less commonly, silty sand and silt. See Section 4.4 for a discussion of geologic critical areas found within the anticipated project area.

4.1.3 Vegetation, Soils, and Hydrology

Vegetation

Vegetation within the vicinity of the project area is dominated by second-growth mixed evergreen-deciduous forest of Douglas fir (*Pseudotsuga menziesii*) and bigleaf maple (*Acer macrophyllum*) in upland areas and with western red cedar (*Thuja plicata*) prevalent in wetter areas. In riparian areas, vegetation is dominated by a mix of black cottonwood (*Populus trichocarpa*) and red alder (*Alnus rubra*). Much of the native vegetation in the immediate area has been replaced by landscaped yards containing a mix of remnant native trees and shrubs mixed with lawns and non-native, ornamental plantings.

Invasive species are present in much of the project area, including reed canarygrass (*Phalaris arundinacea*), Himalayan blackberry (*Rubus bifrons*), English ivy (*Hedera helix*), and knotweed (*Fallopia* sp.). These species dominate the understory along the roadway and on undeveloped parcels. Tansy ragwort (*Jacobaea vulgaris*) has been documented at this location (as shown in King County iMap), but was not observed during site visits for this report. With the exception of tansy ragwort, which is a regulated Class B noxious weed, the invasive species found on-site are non-regulated Class B and C noxious weeds.

Soils

Soils within the area potentially affected by the project are mapped primarily as mixed alluvial land, which reflects the Quaternary alluvial surficial geology of the valley bottom. Other soils mapped within the vicinity include Kitsap silt loam, Everett very gravelly sandy loam, Puyallup fine sandy loam, Ragnar-Indianola association, and Alderwood gravelly sandy loam. These are all moderately to excessively drained soils with high infiltration capacity. No hydric soils have been mapped within the area potentially affected by the project. See Appendix B for a detailed map and summary of soils within the vicinity of the project area. Soil mapping conducted by the USDA NRCS is conducted at the landscape-scale, and specific soil conditions in localized areas may differ from the soil series mapped in the area. For more details on soils within the project area, see the Preliminary Geotechnical Investigation prepared for the project (King County 2020).

Hydrology

The primary sources of hydrology within the area potentially affected by the project include direct precipitation and stormwater runoff. Stormwater conveyances, consisting of a mix of vegetated ditches/swales and piped segments, occur along the east and west sides of Issaquah-Hobart Road SE, as well as along the north and south sides of SE May Valley Road in the immediate vicinity of the intersection. Some of these conveyances discharge to Issaquah Creek, while others appear to infiltrate to local soils. Fifteen Mile Creek and Issaquah Creek, both perennial streams, flow from the west and south, flowing northeast along the western edge of the project site. Nudist Camp Creek, a perennial stream, and an unnamed intermittent stream flow from the east of the project site and cross under Issaquah-Hobart Road SE, between SE May Valley Road and SE 127th Street. Issaquah Creek is the highest order stream and the ultimate receiving water of all surface water inflows to the project site. For more information on streams within the vicinity, see Section 4.3.

4.2 Wetlands

Neither the National Wetlands Inventory nor the King County iMap interactive mapping tool indicate the presence of wetlands within the project vicinity. However, these databases are not exhaustive and often omit small wetlands. Preliminary on-site investigations within the right-of-way and the parcels listed in Table 1 did not identify any regulated wetland features. Stormwater conveyances along the roadway are shallow and broad, likely allowing stormwater to influence a larger area than might typically occur in a traditional U- or V-shaped ditch. In some locations, these features met the criteria for hydrophytic vegetation, hydric soils, and wetland hydrology; however, these are maintained portions of the roadway, were excavated in uplands, and do not convey natural watercourses. Therefore, these areas should not be considered regulated wetlands.

Vegetation on the east side of Issaquah-Hobart Road SE on parcels 1523069048, 1523069171, 1523069047 appears to be hydrophytic, dominated by black cottonwood and red alder in the overstory and by salmonberry (*Rubus spectabilis*) and Himalayan blackberry in the understory. However, Roads environmental staff did not have access to parcels 1523069171 and 1523069047 and could not verify conditions on those parcels. Roads environmental staff investigated the western portion of parcel 1523069048 but did not investigate the steep slopes on the eastern portion of that parcel. The vegetation on portions of parcel 1523069048 investigated for this report met the criteria for hydrophytic vegetation, but did not contain indicators of hydric soils or primary indicators of wetland hydrology. Drainage patterns, a secondary indicator of wetland hydrology, were observed in these areas but appeared to be associated with overbank flow from the stream on the property. Based on the intermittent nature of the stream and the coarse, gravelly soils found on the site, any overbank flow is assumed to be short in duration and to infiltrate quickly, conditions that do not favor wetland development[2]. See Section 4.3 for a discussion of the stream found on this parcel.

Parcel 1523069047 contains a Sensitive Areas Notice on Title associated with the buffer of a wetland that is purportedly located to the south on parcel 1523069171. This wetland was documented by the King County Department of Development and Environmental Services (DDES; now the King County Department of Local Services, Permitting Division) in 2004. A portion of this wetland was hand-sketched by DDES and appears to occur in the middle of parcel 1523069171. A copy of the notice is provided as Appendix C. The exact location, extent, and current condition of this wetland are unknown. Additional wetland investigations may be required on parcels 1523069171 and 1523069047 depending on the scope and footprint of the final project. If necessary, any potential wetlands on these parcels will be delineated and rated following the methods outlined in Section 3.2.

Although Roads environmental staff had limited access to private parcels in the vicinity of the project area, most are developed parcels with residential structures and maintained landscaping and are unlikely to support wetlands. An exception may be parcels 5090300046 and 5090300056, which contain a large area of undeveloped land adjacent to Issaquah Creek. While there is potential for the undeveloped portions of these parcels to contain wetlands, no obvious indicators of wetlands (e.g., hydrophytic vegetation or depressional landforms) were visible from vantages of these areas along the

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[2] It is apparent from time series aerial imagery and observations on the ground that portions of parcel 1523069048 have been subject to fill and/or grading; however, when investigating the parcel for potential wetlands, Roads environmental staff examined areas that did not appear to have been subject to fill or alteration in recent times. The areas investigated were at the lowest elevations of the parcel, where wetlands would be most likely to occur if present. The lack of wetlands in the lowest portions of the parcel strongly suggest no wetlands were present in recently-altered portions of the parcel that occur at higher elevations.

right-of-way or on aerial imagery, and it is assumed these parcels do not contain wetlands landward of the OHWM of Issaquah Creek.

Riparian wetlands may be present along Fifteen Mile Creek, and although the project is not expected to reach the crossing of that stream under Issaquah-Hobart Road SE, portions of the riparian corridor may be impacted, notably on parcels 1523069032 and 1523069081. Roads environmental staff did not observe wetland conditions along Nudist Camp Creek where it occurs on parcel 1523069045; however, there may be riparian wetlands further upstream on parcel 1023069037 to which Roads environmental staff did not have access. If any of these parcels will be impacted by project construction, a more detailed on-site investigation should be undertaken to confirm the presence or absence of wetlands and associated buffers.

4.3 Aquatic Areas (Streams)

Four streams were identified within the area potentially affected by the project: Fifteen Mile Creek, Issaquah Creek, Nudist Camp Creek, and an unnamed tributary to Issaquah Creek. The approximate locations of these streams and their buffers are shown on Figures 4 and 5, and their flow duration, stream type, and buffer width are summarized in Table 3.

Table 3. Aquatic areas (streams) within the vicinity of the project area

Stream Name	Flow Duration	Stream Type	Buffer[3]
Fifteen Mile Creek	Perennial	Type F	165 ft.
Issaquah Creek	Perennial	Type S	165 ft.
Nudist Camp Creek	Perennial	Type F	165 ft.
Unnamed Tributary to Issaquah Creek	Intermittent	Type F	165 ft.

[3] KCC 21A.24.358

Fifteen Mile Creek is a Type F perennial stream that originates to the east of the project area between East Tiger Mountain and West Tiger Mountain. The stream flows westerly toward the project site, crossing Issaquah-Hobart Road SE approximately 1,630 feet south of the subject intersection and then crossing SE May Valley Road approximately 750 feet southwest of the intersection. Fifteen Mile Creek flows into Issaquah Creek to the west of the project area. Within the vicinity of the project area, Fifteen Mile Creek is subject to a 165-foot aquatic area buffer. There is no mapped 100-year floodplain, floodway, or regulatory floodplain along Fifteen Mile Creek.

Issaquah Creek is a Type S perennial stream subject to Shoreline Management Act jurisdiction as a Shoreline of the State. The stream originates to the southwest of the project area, near Taylor Mountain, and discharges to the southern end of Lake Sammamish. Within the vicinity of the project area, Issaquah Creek has a mapped FEMA 100-year floodplain and floodway. At this location, the stream has a 165-foot-wide aquatic area buffer, as well as a Conservancy Shoreline designation extending 200 feet landward from the OHWM to the landward edge of the 100-year floodplain, or to the landward edge any associated wetlands, whichever distance is greater. The approximate extent of Shoreline Management Act jurisdiction along Issaquah Creek is shown on Figure 6.

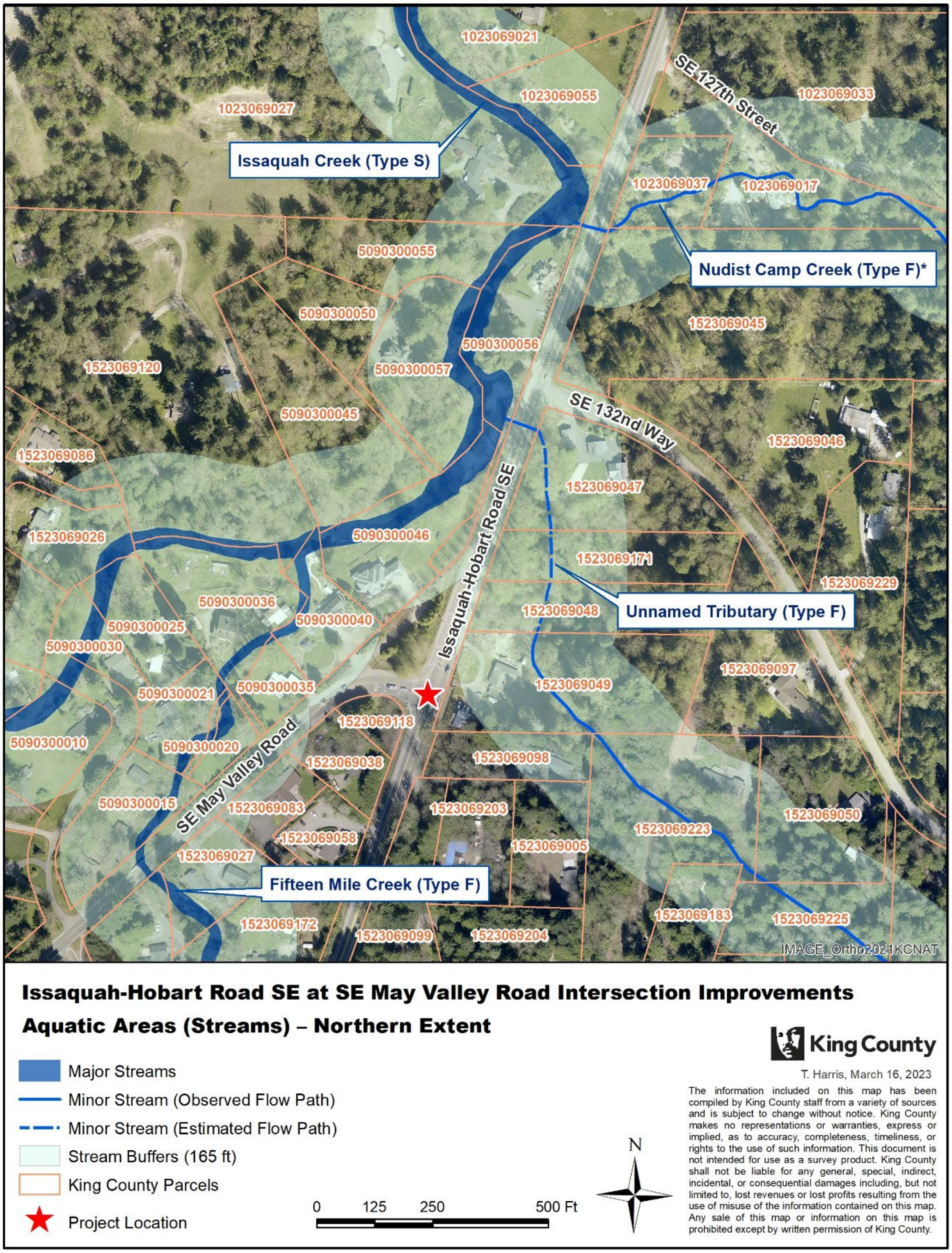

Figure 4. Aquatic Areas (Streams) – Northern Extent
*(*See footnote on page 8 regarding the naming of Nudist Camp Creek)*

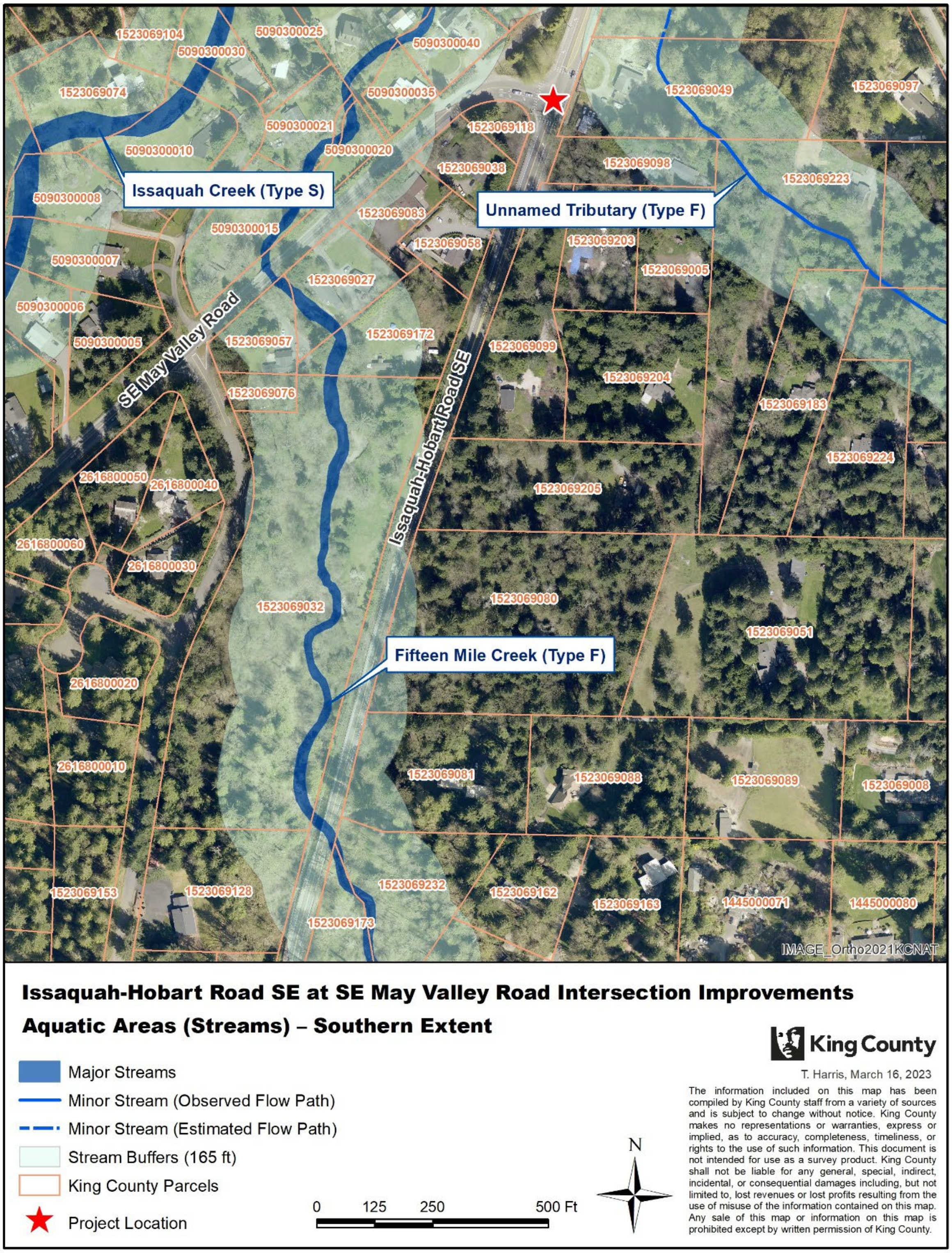

Figure 5. Aquatic Areas (Streams) – Southern Extent

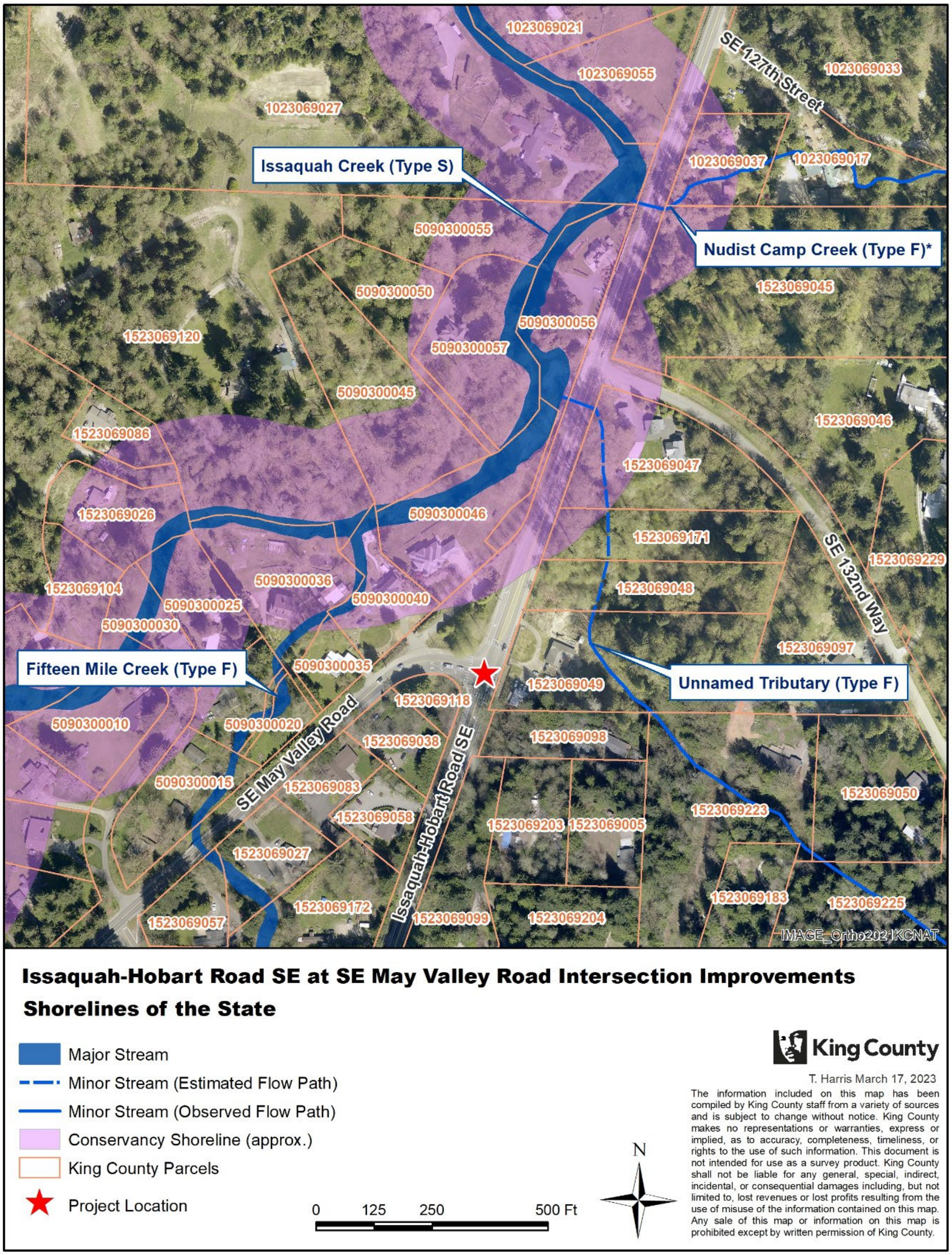

Figure 6. Shorelines of the State
*(*See footnote on page 8 regarding the naming of Nudist Camp Creek)*

During a major storm event in February 2020, a large tree fell into the channel of Issaquah Creek at the northern end of parcel 5090300046, altering flow paths and causing the channel to migrate east toward Issaquah-Hobart Road SE, just south of SE 132nd Way. This caused undermining of a privately-owned concrete wall and subsequent collapse of a section of the wall into the channel. This required emergency repairs by King County to prevent damage to the adjacent roadway. This channel change resulted in a new OHWM adjacent to the roadway, and as such, the existing mapping of the FEMA floodplain and floodway may not reflect current conditions, particularly along the right bank.

Nudist Camp Creek is a Type F perennial stream that originates to the east of the project area, southwest of West Tiger Mountain. The stream flows westerly toward the project site, crossing Issaquah-Hobart Road SE 1,065 feet north of the subject intersection. The crossing is listed as fish passable in the WDFW Fish Passage Inventory; however, the steep constructed step-pool reach immediately upstream of the crossing is listed as a partial barrier to fish passage. Within the vicinity of the project area, Nudist Camp Creek has a 165-foot-wide aquatic area buffer. There is no mapped 100-year floodplain, floodway, or regulatory floodplain along Nudist Camp Creek.

During a reconnaissance conducted by Roads environmental staff on March 17, 2023, a sediment wedge with a near-vertical crest was observed at the inlet to the culvert conveying Nudist Camp Creek under Issaquah-Hobart Road SE. This wedge is made of loosely interlocked cobbles and coarse gravel and is blocking the culvert inlet except for a small opening. This wedge likely formed due to the abrupt slope transition of the channel at the culvert inlet (the culvert appears to have been designed with zero slope), and also due to the culvert potentially being undersized. The culvert inlet may become completely blocked during a large flood event capable of transporting enough bedload to overwhelm the culvert. The solution to this issue would be ideally addressed by replacing the existing culvert with a larger one set at an appropriate slope. Re-grading the steep constructed reach designed to function as a fishway would also reduce the likelihood of sediment accumulation at the culvert inlet, but may not be possible due to private property constraints.

The unnamed tributary to Issaquah Creek is considered a Type F stream by the DNR based on their water type modeling. No fish have been documented in this tributary, but it has been deemed gradient accessible to fish migrating from Issaquah Creek (NWIFC 2022; WDFW 2022a). The stream originates on a terraced plateau to the east of the project area and flows northwesterly down a ravine on the western aspect of the plateau. The stream flows from the base of the ravine and onto what appears to be an historical alluvial fan on parcel 1523069049. The stream was dry during an initial site assessment conducted by Roads environmental staff on July 14, 2022. During a follow-up survey on February 22, 2023, the stream was flowing at or about the ordinary high water mark. Two days later on February 24, 2023, the stream was dry. Based on these observations, it was determined the stream is intermittent, flowing for relatively short durations primarily during the rainy season.

During site assessments, Roads environmental staff observed evidence of past manipulation of the stream where it occurs on parcel 1523069049. A large berm appears to have been constructed to direct the stream to the northwest onto parcel 1523069048. Soils on parcels 1523069049 and 1523069048 contained large amounts of rounded and sub-rounded alluvial gravel and cobble and evidence of recent out-of-bank flow across the fan surface, consistent with typical channel behavior on an alluvial fan. Due to impenetrable blackberries and other dense vegetation, Roads environmental staff could not follow the main stream channel more than 20 to 30 feet onto parcel 1523069048, and no clear channel is evident in the LiDAR elevation data. Therefore, it is unclear where the main channel flows. The stream is not shown in the WDFW Stream Catalog, and online databases show the main channel in varying locations. The DNR's Forest Practices Application Mapping Tool shows the stream flowing north through the middle of parcels 1523069048 and 1523069171 and across the southwest portion of parcel 1523069047 where it crosses under Issaquah-Hobart Road SE approximately 160 feet south of SE 132nd Way (Figure 7); however, Roads environmental staff did not observe any indications of a stream channel entering the roadside ditch at this location, and there is no cross culvert where the stream is shown crossing Issaquah-Hobart Road SE. The National Hydrography Dataset (NHD) shows the stream entering the roadside ditch along the eastern side of Issaquah-Hobart Road SE at the northwest corner of parcel 1523069049 and flowing north to a cross culvert just south of SE 132nd Way (Figure 7). Although the location of the cross culvert shown in the NHD is accurate, Roads environmental staff did not observe any indicators of stream flow along the broad, shallow ditch that occurs there.

During the February 22, 2023, site assessment, Roads environmental staff observed stream flow exiting from the northwest corner of parcel 1523069047 and entering a pipe leading to a catch basin at the northern end of the ditch along the east side of Issaquah-Hobart Road SE, south of SE 132nd Way. Although Roads environmental staff were not able to follow the stream channel along its entire length, it was assumed the flow leaving the northwest corner of parcel 1523069047 is the same stream. Roads environmental staff estimated the flow leaving the northwest corner of parcel 1523069047 was one third to one half less in volume than what was observed coming out of the ravine on parcel 1523069049, suggesting rapid infiltration into the local soils and/or potentially some type of impoundment or diversion occurring on parcels 1523069047 and 1523069171, to which King County did not have access. The difference in flow rate at the two locations would be insignificant at flood stage because flows would exceed infiltration rates and overwhelm any diversion or impoundment small enough to not be visible in aerial imagery.

The stream outlets to Issaquah Creek on the west side of Issaquah-Hobart Road SE at the location of the emergency roadway repairs conducted in 2020. The outlet is perched several feet above the bed of the stream, and although the crossing is not included in the WDFW fish passage inventory, the culvert is assumed to be at least a partial barrier to fish passage and would necessitate remediation should the project affect it.

To confirm the alignment of and further characterize the stream, it may be necessary to conduct a more detailed investigation on parcels 1523069171 and 1523069047. Without additional investigation, it is assumed the area on the east side of Issaquah-Hobart Road SE fronting parcels 1523069048, 1523069171, and 1523069047 is within the 165-foot aquatic area buffer for Type F streams. It is also assumed the cross culvert under Issaquah-Hobart Road SE conveys a fish-bearing stream, and any modification to or replacement of the culvert must meet fish passage requirements found at WAC 220-660-200.

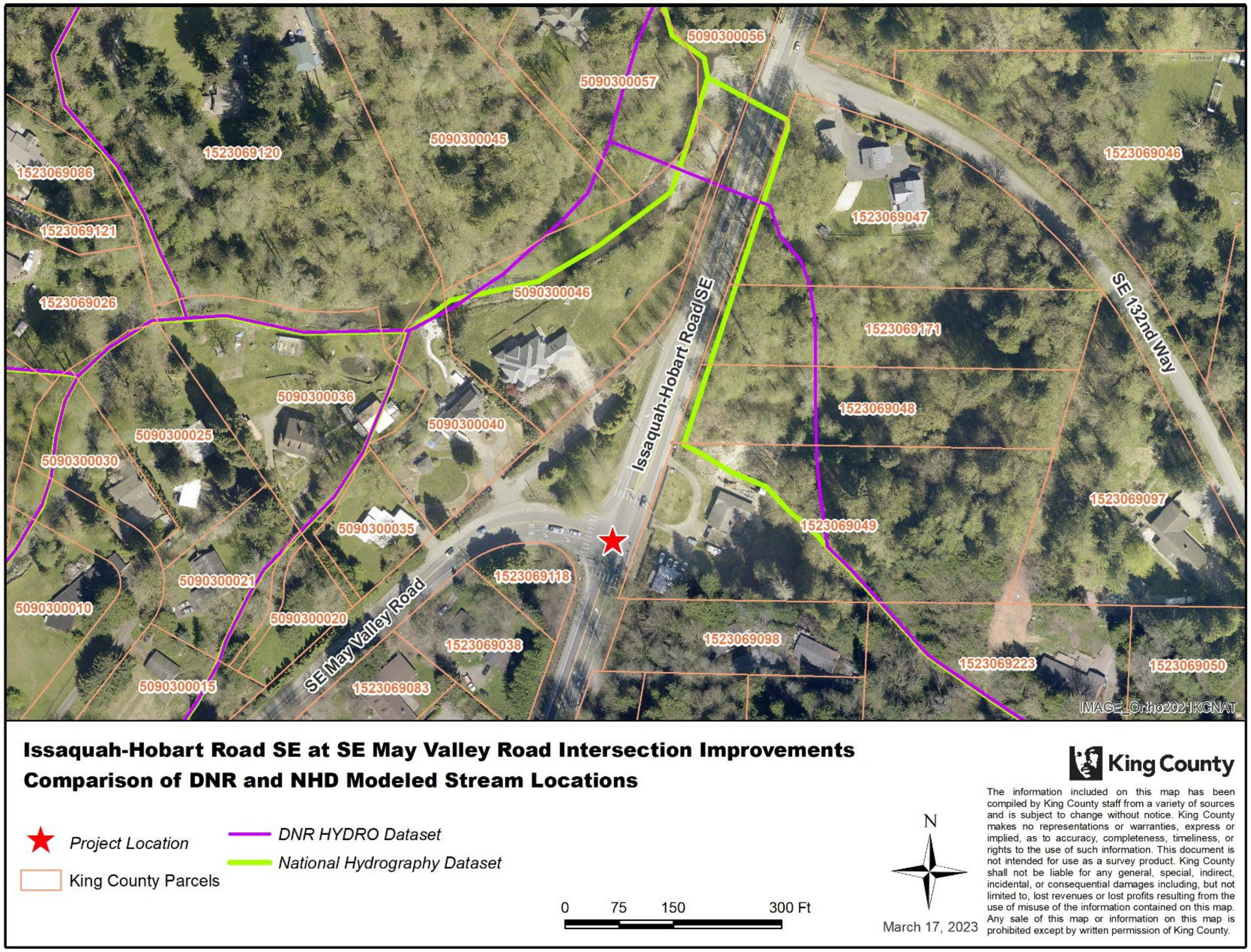

Figure 7. Comparison of DNR and NHD Modeled Stream Locations

4.4 Other Critical Areas

Other critical areas mapped within the vicinity of the project area include:

- Seismic hazard
- Erosion hazard
- Potential steep slope hazard
- Potential landslide hazard
- Critical aquifer recharge area (Category 1 and 2)
- Wildlife network

Geologic critical areas within the vicinity of the project location are shown on Figure 8. Most of the project area north of parcel 1523069058 occurs within a seismic hazard area, and the entirety of the project area occurs within an erosion hazard area. Development standards for seismic hazard areas are found at KCC 21A.24.290, and standards for erosion hazard areas are found at KCC 21A.24.220. Steep slopes are present along much of the eastern side of the project area. North of the intersection, the steep slopes are generally well-removed from the areas potentially affected by the project; however, south of the intersection, steep slopes occur immediately adjacent to the east side of Issaquah-Hobart Road SE and could be affected by project activities. Development standards for steep slopes are found at KCC 21A.24.310. A potential landslide hazard area occurs on the eastern side of Issaquah-Hobart Road SE, south of its intersection with SE 127th Street. Development standards associated with potential landslide hazard areas are found at KCC 21A.24.280.

Critical aquifer recharge areas are shown on Figure 9. The majority of the project area lies within a Category 2 critical aquifer recharge area, while a portion of the northern end of the project area occurs within a Category 1 critical aquifer recharge area. Most parts of the project area are listed as highly susceptible to groundwater contamination, and the north portion of the project area, near SE 132nd Way, is within a wellhead protection area with a ten-year time of travel. Development standards to protect critical aquifer recharge areas are found at KCC 21A.24.314.

Issaquah Creek is listed as part of King County's wildlife network, which was established to link high quality streams and open space lands and to minimize habitat fragmentation. The applicability of development standards within the network is set forth by KCC 21A.24.383. Development standards are outlined by KCC 21A.24.386 and are intended to ensure habitats remain connected across the landscape after development of any urban planned development or individual lots on the network. These standards do not apply to the public road right-of-way and no additional analysis is warranted.

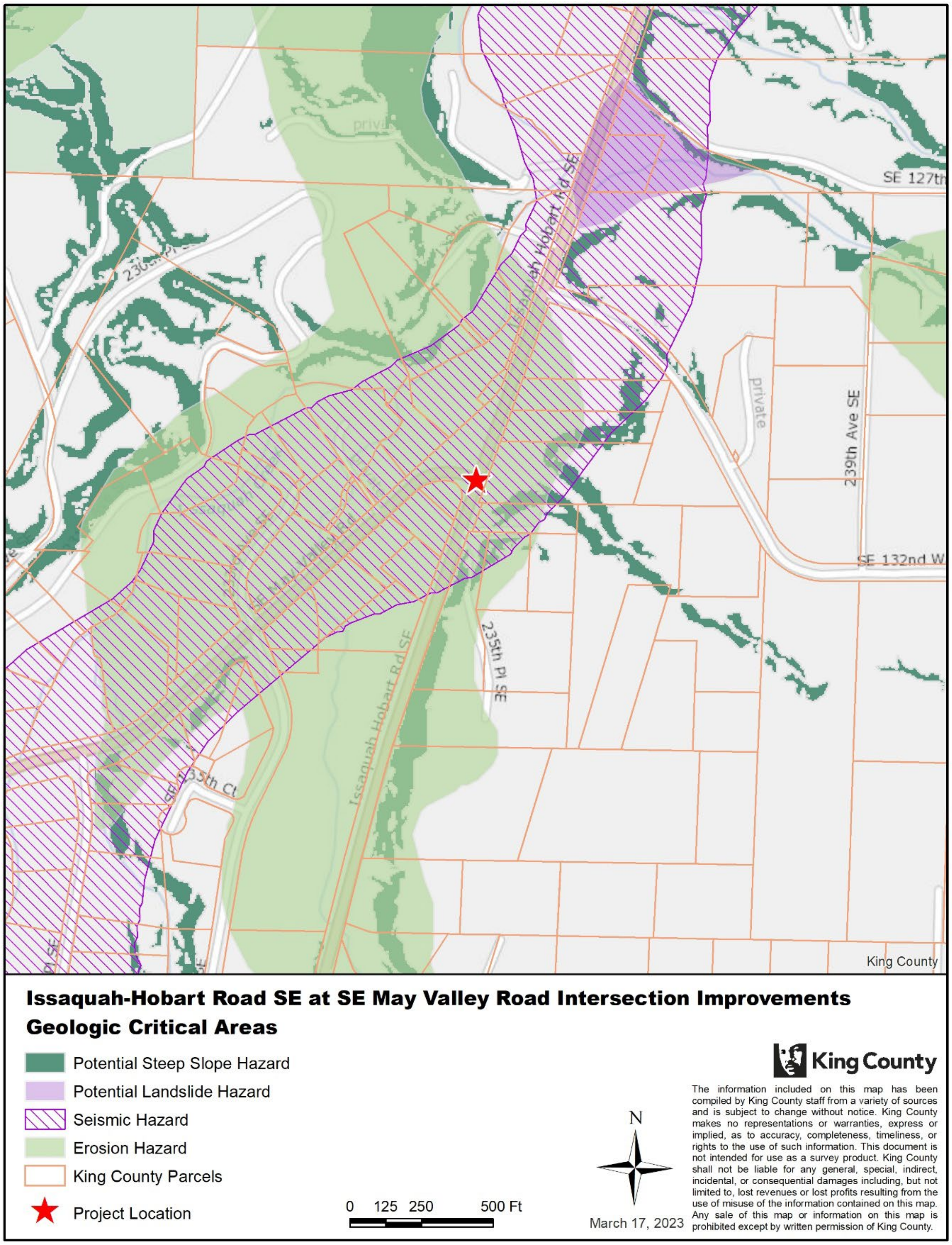

Figure 8. Geologic Critical Areas

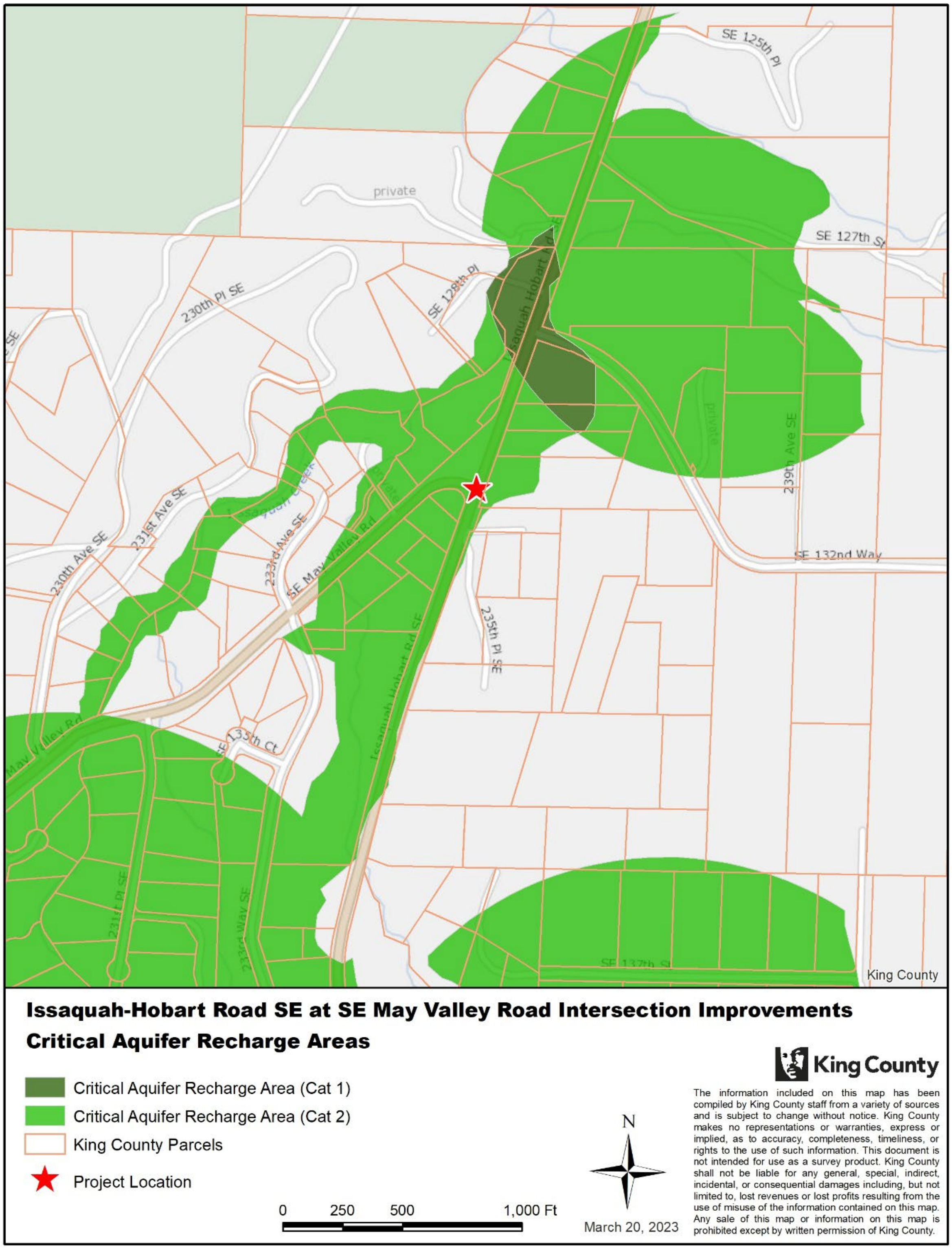

Figure 9. Critical Aquifer Recharge Areas

5.0 Impacts and Mitigation

The scope and footprint of the project are currently unknown; therefore, it is not possible to determine impacts to critical areas at this point. Impacts to critical areas in the vicinity of the project area will be avoided or minimized to the maximum extent possible through project design, construction timing, and use of Best Management Practices (BMPs). Mitigation and restoration requirements will be developed in conjunction with project design and with the participation of applicable regulatory agencies. All areas temporarily disturbed during the project will have temporary cover measures (e.g., erosion control BMPs) and be restored with a combination of amended soils, native vegetation, and other permanent cover measures where applicable after construction. These areas will be monitored to ensure compliance with regulations, mitigation obligations, and permit conditions. If compensatory mitigation is required, on-site mitigation consisting of habitat enhancement will be prioritized. If on-site mitigation is not practicable, then off-site mitigation opportunities will be pursued. Project impacts and mitigation will be documented in a mitigation and monitoring plan to be developed when the full scope and footprint of the project are known.

6.0 References

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Appendix A — Methods and Tools

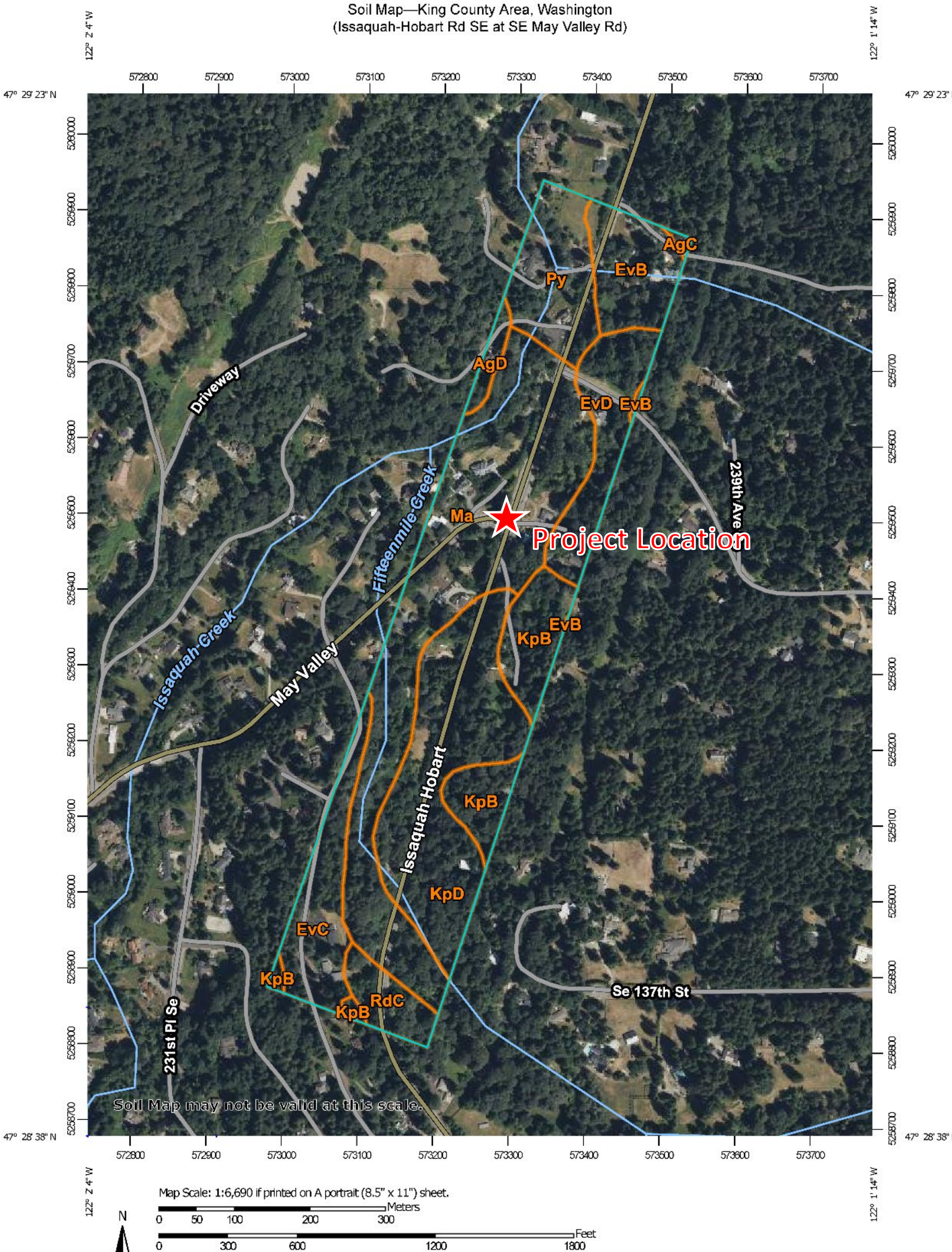
Table A-1. Methods and tools used to prepare the report.

Parameter	Method or Tool	Website	Reference
Wetland Delineation	Washington State Wetland Delineation Resources	https://ecology.wa.gov/Water-Shorelines/Wetlands/Tools-resources/Delineation-resources	Multiple sources cited on website.
	USACE Regional Supplement to the Corps Wetland Delineation Manual	https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1046494.pdf	U.S. Army Corps of Engineers. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)
	USACE Wetlands Delineation Manual	http://www.cpe.rutgers.edu/Wetlands/1987-Army-Corps-Wetlands-Delineation-Manual.pdf	Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Wetlands Research Program Technical Report Y-87 (Online Edition)
Wetland Classification	USFWS / Cowardin Classification System	https://www.fgdc.gov/standards/projects/wetlands/nwcs-2013	Federal Geographic Data Committee. 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition.
	Hydrogeomorphic Classification (HGM) System	https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_010784.pdf	U.S. Department of Agriculture Natural Resources Conservation Service. 2008. Hydrogeomorphic Wetland Classification System: An Overview and Modification to Better Meet the Needs of the Natural Resources Conservation Service (Technical Note No. 190-8-76).
Wetland Rating	Washington State Wetland Rating System for Western Washington, 2014 Update	https://fortress.wa.gov/ecy/publications/documents/1406029.pdf	Hruby, T. 2014. Washington State Wetland Rating System for Western Washington: 2014 Update. Washington State Department of Ecology Publication # 14-06-029.
	King County Code 21A.24	http://www.kingcounty.gov/council/legislation/kc_code/24_30_Title_21A.aspx	King County Code, Title 21A Zoning, Chapter 24 Critical Areas
Stream Delineation	USACE Ordinary High Water Mark (OHWM) Delineation Guide	https://usace.contentdm.oclc.org/digital/collection/p266001coll1/id/3691/	Mersel, M.K., Lichvar, R.W. 2014. A Guide to Ordinary High Water Mark (OHWM) Delineation for Non-Perennial Streams in the Western Mountains, Valleys, and Coast Region of the United States.
	USACE Regulatory Guidance Letter 05-05	https://www.usace.army.mil/missions/civil-works/regulatory-program-and-permits/guidance-letters/	U.S. Army Corps of Engineers. 2005. Regulatory Guidance Letter 05-05.
	Ecology OHWM Guidance for Shorelines	https://apps.ecology.wa.gov/publications/summarypages/1606029.html	WA Department of Ecology. 2016. Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State. Publication 16-06-029.

Parameter	Method or Tool	Website	Reference
Stream Classification	DNR Water Typing System	Forest Practices Water Typing: https://www.dnr.wa.gov/forest-practices-water-typing WAC 222-16-030: http://apps.leg.wa.gov/WAC/default.aspx?cite=222-16-030 Water Type Mapping: https://fpamt.dnr.wa.gov/default.aspx	Washington Administrative Code (WAC) 222-16-030/031. DNR Water typing system.
	King County Code 21A.24	http://www.kingcounty.gov/council/legislation/kc_code/24_30_Title_21A.aspx	King County Code, Title 21A Zoning, Chapter 24 Critical Areas
Wetland Indicator Status	USACE National Wetland Plant List	http://wetland-plants.usace.army.mil/nwpl_static/v33/home/home.html	Website – 2018 Update
Soils Data	USDA/NRCS Soil Survey Data – Web Soil Survey	http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx	Website
	Washington Hydric Soils Lists by County	https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/	Website
Threatened, Endangered, and Priority Species	Washington Natural Heritage Program	https://www.dnr.wa.gov/natural-heritage-program	Washington Natural Heritage Program Endangered, Threatened, and Sensitive plants of Washington. Washington State Department of Natural Resources, Washington Natural Heritage Program, Olympia, WA
	Washington Priority Habitats and Species	http://wdfw.wa.gov/hab/phspage.htm	Priority Habitats and Species (PHS) Program Map of priority habitats and species in project vicinity. Washington Department of Fish and Wildlife (WDFW).
	USFWS Information for Planning and Consultation	https://ecos.fws.gov/ipac/	Website.
	NOAA Protected Resources App	https://www.webapps.nwfsc.noaa.gov/portal/apps/webappviewer/index.html?id=7514c715b8594944a6e468dd25aaacc9	Website.
Critical Habitat and Essential Fish Habitat	USFWS Critical Habitat Mapper	https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77	Website.
	NOAA Protected Resources App	https://www.webapps.nwfsc.noaa.gov/portal/apps/webappviewer/index.html?id=7514c715b8594944a6e468dd25aaacc9	Website.
	NOAA Essential Fish Habitat Mapper	https://www.habitat.noaa.gov/application/efhmapper/index.html	Website.

Appendix B — Soils Map and Report

Soil Map—King County Area, Washington
(Issaquah-Hobart Rd SE at SE May Valley Rd)



Map Scale: 1:6,690 if printed on A portrait (8.5" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

Natural Resources Conservation Service | Web Soil Survey National Cooperative Soil Survey | 3/20/2023 Page 1 of 3

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 18, Sep 8, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 31, 2022—Aug 8, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	0.1	0.2%
AgD	Alderwood gravelly sandy loam, 15 to 30 percent slopes	0.8	1.2%
EvB	Everett very gravelly sandy loam, 0 to 8 percent slopes	4.1	6.8%
EvC	Everett very gravelly sandy loam, 8 to 15 percent slopes	4.8	7.9%
EvD	Everett very gravelly sandy loam, 15 to 30 percent slopes	4.8	7.8%
KpB	Kitsap silt loam, 2 to 8 percent slopes	5.3	8.6%
KpD	Kitsap silt loam, 15 to 30 percent slopes	12.6	20.7%
Ma	Mixed alluvial land	21.3	34.9%
Py	Puyallup fine sandy loam	5.1	8.4%
RdC	Ragnar-Indianola association, sloping	2.0	3.4%
Totals for Area of Interest		**60.9**	**100.0%**

Appendix C — Sensitive Areas Notice on Title

3228 NW 75th St
Seattle, WA 98117

20041213001649
RILEY, COLIN NOSA 22 00
PAGE001 OF 004
12/13/2004 15 16
KING COUNTY, WA

Document Title(s) (or transactions contained herein): SENSITIVE AREAS NOTICE-ON-TITLE

Reference Number(s) of Documents assigned or released. B04L1670

Additional reference numbers on page _______ of document(s)

Grantor(s) (last name, first name, initials): RILEY, COLIN, CR

Additional names on page _______ of document(s)

Grantee(s) (last name, first name, initials): KING COUNTY, DDES

Additional names on page ____ of document(s): ____________

Legal description (abbreviated):

Lot:______ Block:______ Plat/Section 15 Township: 23 Range: 06E

Additional legal is on page 5 of document(s)

Lot:______ Block:______ Plat/Section:______ Township:______ Range:_____

Additional legal is on page _______ of document(s)

Lot:______ Block ______ Plat/Section:______ Township:______ Range:_____

Additional legal is on page _______ of document(s)

Lot:______ Block:______ Plat/Section.______ Township:______ Range:_____

Additional legal is on page _______ of document(s)

Assessor's Property Tax Parcel/Account Number(s): 152306-9047

DO NOT WRITE IN MARGINS

The Auditor/Recorder will rely on the information provided on this form. The staff will not read the attached document to verify the accuracy or completeness of the indexing information provided herein.

F96/LegalCov.Sht 3/28/97-10:04 AM/dj

Pg. 2

King County
Dept of Development and Environmental Services
Land Use Services Division
900 Oakesdale Avenue Southwest
Renton, Washington 98055-1219

LEGAL DESCRIPTION

I, (*print*) Colin Riley, hereby certify that I am the owner of the above- referenced property.

____
(Owner's Signature)

SUBSCRIBED AND SWORN TO before me this _______ day of __________, 19___.

notary seal

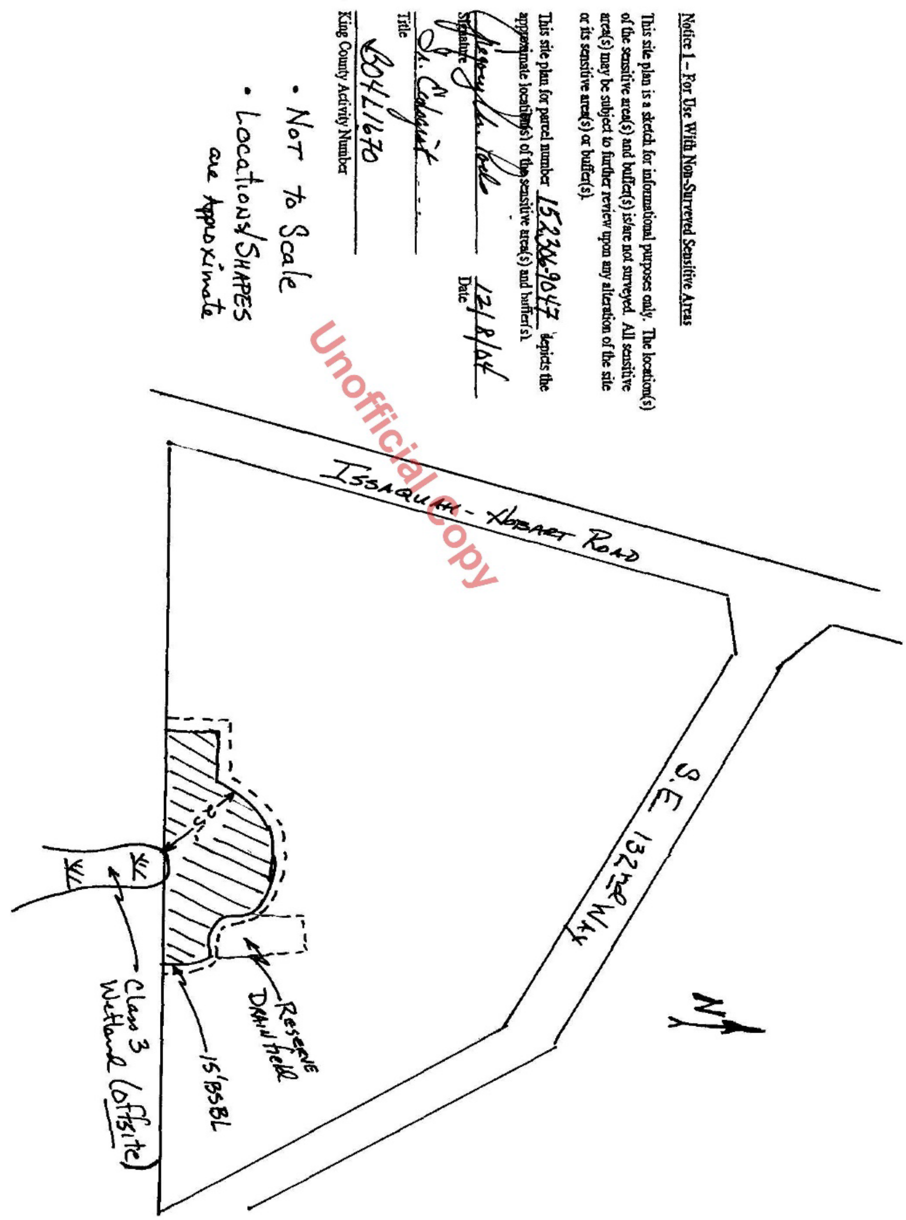
____
Notary Public in and for the State of Washington, residing at

____

____
(owner's signature)

F96/SDSS/Descript.Leg 07/29/97/mh

Pg 3


Notice 1 – For Use With Non-Surveyed Sensitive Areas
This site plan is a sketch for informational purposes only. The location(s) of the sensitive area(s) and buffer(s) is/are not surveyed. All sensitive area(s) may be subject to further review upon any alteration of the site or its sensitive area(s) or buffer(s).
This site plan for parcel number 1523069047 depicts the approximate location(s) of the sensitive area(s) and buffer(s).
Signature
Date 12/8/04
Sr. Ecologist
Title
B04L1670
King County Activity Number
• Not to Scale
• Locations/Shapes are Approximate
Issaquah-Hobart Road
S.E. 132nd Way
N
15'
WL
WL
Reserve Drainfield
15' BSBL
Class 3 Wetland (offsite)

Pg 4

Legal Desc. for 1523069047:

152306 47
BEG ON N & S C/L OF SEC
401.16 FT S OF N 1/4 COR TH S
62-20-00 E 154.55 FT TH S
43-19-00 E 262.19 FT TH N
88-42-00 W 541.42 FT TO CO RD TH
N 20-15-00 E ALG SD RD 317.33 FT
TH S 88-42-00 E 28.91 FT TH S
62-20-00 E 101.60 FT TO BEG LESS
CO RD LESS C/M RGTS

Taxpayer/Mailing Address:

RILEY COLIN

328 NW 75TH ST
SEATTLE WA 98117

Pg. 5

Appendix D: Signal Warrant Analysis

Warrants Summary

Information

Analyst	Transpo Group	Intersection	IHR/May Valley
Agency/Co	King County	Jurisdiction	King County
Date Performed	12/19/2022	Units	U.S. Customary
Project ID	Concept Development Report	Time Period Analyzed	Existing
East/West Street	SE May Valley Road	North/South Street	Issaquah-Hobart Road SE
File Name	Existing.xhy	Major Street	East-West

Project Description *Concept Development Report*

General / **Roadway Network**

Major Street Speed (mph)	45	[ ]	Population < 10,000	Two Major Routes	[ ]
Nearest Signal (ft)	4850	[ ]	Coordinated Signal System	Weekend Count	[ ]
Crashes (per year)	0	[ ]	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	1	0	1	0	0	0	1	1	0	0	1	1
Lane usage	L		R				L	T			T	R
Vehicle Volume Averages (vph)	68	0	404	0	0	0	67	271	0	0	651	50
Peds (ped/h) / Gaps (gaps/h)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--
Delay (s/veh) / (veh-hr)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--

Warrant 1: Eight-Hour Vehicular Volume	[x]
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	[x]
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	[ ]
1 (56%) Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	[ ]
Warrant 2: Four-Hour Vehicular Volume	[x]
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	[x]
Warrant 3: Peak Hour	[x]
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	[ ]
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	[x]
Warrant 4: Pedestrian Volume	[ ]
4 A. Four Hour Volumes --or--	[ ]
4 B. One-Hour Volumes	[ ]
Warrant 5: School Crossing	[ ]
5. Student Volumes --and--	[ ]
5. Gaps Same Period	[ ]
Warrant 6: Coordinated Signal System	[ ]
6. Degree of Platooning (Predominant direction or both directions)	[ ]
Warrant 7: Crash Experience	[ ]
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	[ ]
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	[ ]

7 C. (56%) Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☑
Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐
Warrant 9: Grade Crossing	☐
9 A. Grade Crossing within 140 ft --and--	☐
9 B. Peak-Hour Vehicular Volumes	☐

 HCS7™ Warrants Version 7.2.1 Generated: 12/19/2022 6:54 PM

Warrants Summary

Information			
Analyst	Transpo Group	Intersection	IHR/May Valley
Agency/Co	King County	Jurisdiction	King County
Date Performed	12/19/2022	Units	U.S. Customary
Project ID	Concept Development Report	Time Period Analyzed	Future
East/West Street	SE May Valley Road	North/South Street	Issaquah-Hobart Road SE
File Name	Future 2043.xhy	Major Street	East-West

Project Description *Concept Development Report*

General				Roadway Network	
Major Street Speed (mph)	45	☐	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	4850	☐	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	0	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	1	0	1	0	0	0	1	2	0	0	2	0
Lane usage	L		R				L	T			TR	
Vehicle Volume Averages (vph)	92	0	502	0	0	0	96	399	0	0	817	59
Peds (ped/h) / Gaps (gaps/h)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--
Delay (s/veh) / (veh-hr)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--

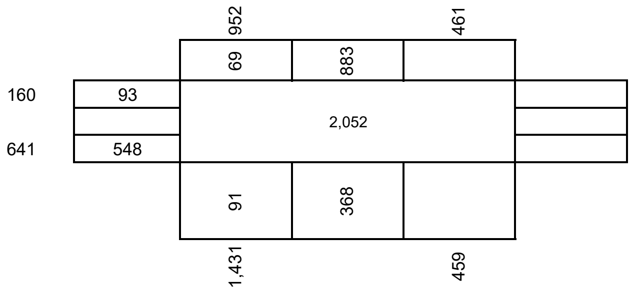
Warrant 1: Eight-Hour Vehicular Volume	☑
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☑
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☐
1 (56%) Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 2: Four-Hour Vehicular Volume	☑
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 3: Peak Hour	☑
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 4: Pedestrian Volume	☐
4 A. Four Hour Volumes --or--	☐
4 B. One-Hour Volumes	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☐
6. Degree of Platooning (Predominant direction or both directions)	☐
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☐

7 C. (56%) Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☑
Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐
Warrant 9: Grade Crossing	☐
9 A. Grade Crossing within 140 ft --and--	☐
9 B. Peak-Hour Vehicular Volumes	☐

 HCS7™ Warrants Version 7.2.1 Generated: 12/19/2022 6:48 PM

Issaquah-Hobart Road SE/SE May Valley Road

Existing 2019 Weekday PM Peak Hour Volumes

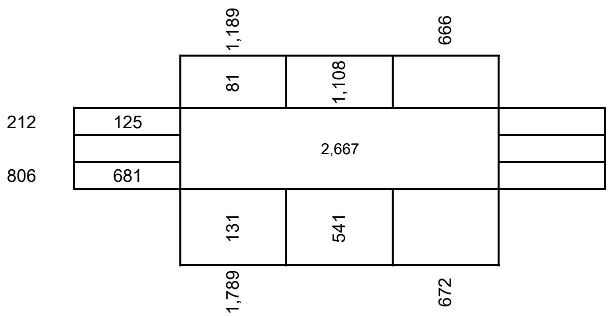


Time		EB				NB				SB			
		LT	Th	RT	Approach	LT	Th	RT	Approach	LT	Th	RT	Approach
12:00 AM	0.41%	4	0	25	29	4	17	0	21	0	40	3	43
1:00 AM	0.12%	1	0	7	8	1	5	0	6	0	12	1	13
2:00 AM	0.33%	3	0	20	23	3	14	0	17	0	33	3	36
3:00 AM	0.27%	3	0	17	20	3	11	0	14	0	27	2	29
4:00 AM	0.36%	4	0	22	26	4	15	0	19	0	36	3	39
5:00 AM	1.01%	10	0	62	72	10	42	0	52	0	100	8	108
6:00 AM	3.30%	34	0	202	236	34	136	0	170	0	326	25	351
7:00 AM	7.06%	73	0	432	505	72	290	0	362	0	697	54	751
8:00 AM	5.25%	55	0	321	376	53	216	0	269	0	518	40	558
9:00 AM	3.80%	39	0	233	272	39	156	0	195	0	375	29	404
10:00 AM	4.68%	49	0	287	336	48	192	0	240	0	462	36	498
11:00 AM	5.44%	57	0	333	390	55	224	0	279	0	537	42	579
12:00 PM	7.13%	74	0	437	511	72	293	0	365	0	703	55	758
1:00 PM	6.12%	64	0	375	439	62	252	0	314	0	604	47	651
2:00 PM	6.71%	70	0	411	481	68	276	0	344	0	662	52	714
3:00 PM	8.70%	90	0	533	623	88	358	0	446	0	858	67	925
4:00 PM	8.95%	93	0	548	641	91	368	0	459	0	883	69	952
5:00 PM	8.85%	92	0	542	634	90	364	0	454	0	873	68	941
6:00 PM	6.55%	68	0	401	469	67	269	0	336	0	646	50	696
7:00 PM	5.01%	52	0	307	359	51	206	0	257	0	494	39	533
8:00 PM	3.47%	36	0	212	248	35	143	0	178	0	342	27	369
9:00 PM	3.10%	32	0	190	222	32	127	0	159	0	306	24	330
10:00 PM	2.02%	21	0	124	145	21	83	0	104	0	199	16	215
11:00 PM	1.37%	14	0	84	98	14	56	0	70	0	135	11	146
Total	**100.01%**	**1,038**	**0**	**6,125**	**7,163**	**1,017**	**4,113**	**0**	**5,130**	**0**	**9,868**	**771**	**10,639**

1) Hourly distribution is taken from NCHRP Report 365; Travel Estimation Technques for Urban Planning for general purposes.

Issaquah-Hobart Road SE/SE May Valley Road

Future 2043 Weekday PM Peak Hour Volumes

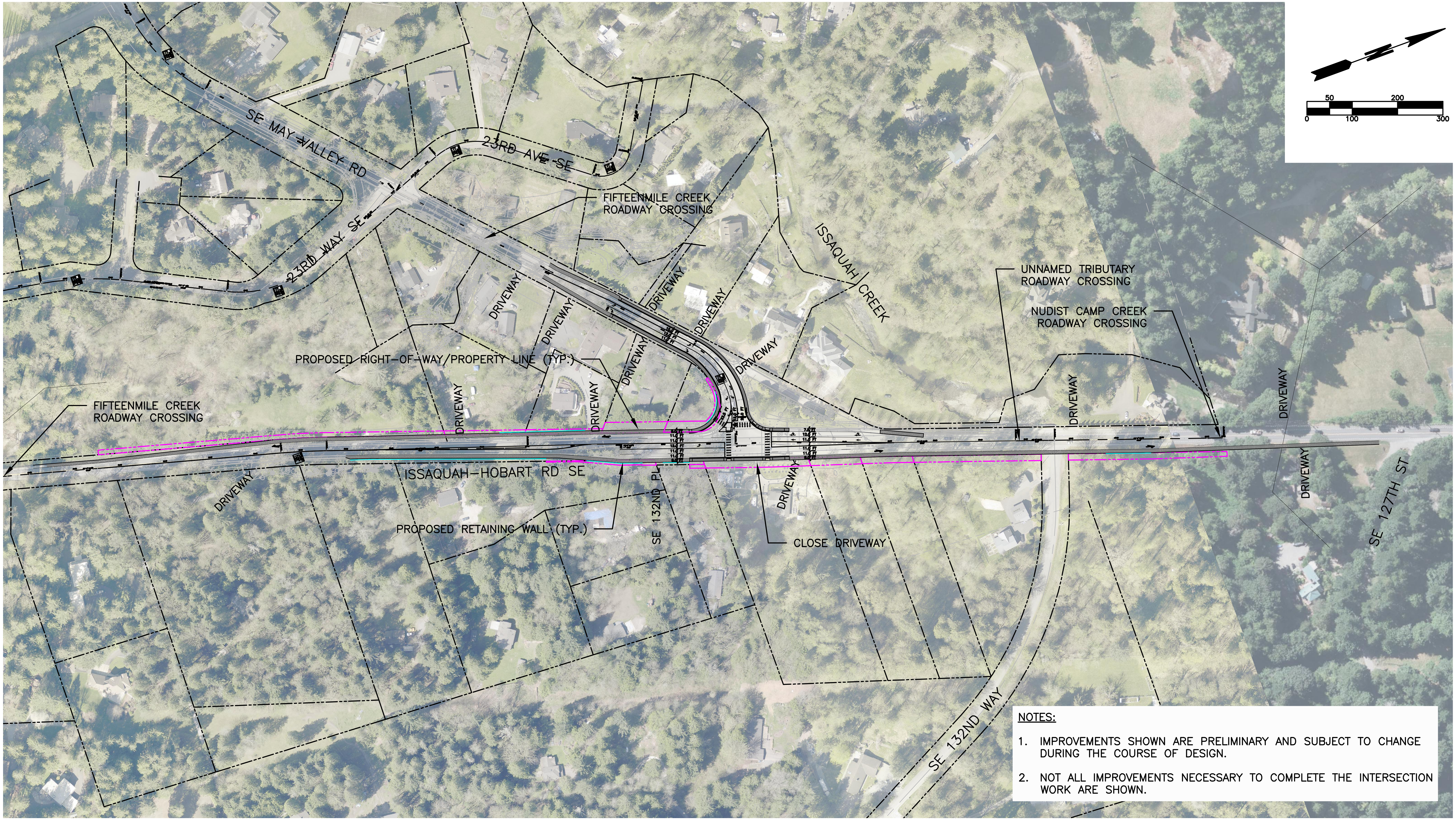


		EB				NB				SB			
Time		LT	Th	RT	Approach	LT	Th	RT	Approach	LT	Th	RT	Approach
12:00 AM	0.41%	6	0	31	37	6	25	0	31	0	51	4	55
1:00 AM	0.12%	2	0	9	11	2	7	0	9	0	15	1	16
2:00 AM	0.33%	5	0	25	30	5	20	0	25	0	41	3	44
3:00 AM	0.27%	4	0	21	25	4	16	0	20	0	33	2	35
4:00 AM	0.36%	5	0	27	32	5	22	0	27	0	45	3	48
5:00 AM	1.01%	14	0	77	91	15	61	0	76	0	125	9	134
6:00 AM	3.30%	46	0	251	297	48	199	0	247	0	409	30	439
7:00 AM	7.06%	99	0	537	636	103	427	0	530	0	874	64	938
8:00 AM	5.25%	73	0	399	472	77	317	0	394	0	650	48	698
9:00 AM	3.80%	53	0	289	342	56	230	0	286	0	470	34	504
10:00 AM	4.68%	65	0	356	421	69	283	0	352	0	579	42	621
11:00 AM	5.44%	76	0	414	490	80	329	0	409	0	673	49	722
12:00 PM	7.13%	100	0	543	643	104	431	0	535	0	883	65	948
1:00 PM	6.12%	85	0	466	551	90	370	0	460	0	758	55	813
2:00 PM	6.71%	94	0	511	605	98	406	0	504	0	831	61	892
3:00 PM	8.70%	122	0	662	784	127	526	0	653	0	1,077	79	1,156
4:00 PM	8.95%	125	0	681	806	131	541	0	672	0	1,108	81	1,189
5:00 PM	8.85%	124	0	673	797	130	535	0	665	0	1,096	80	1,176
6:00 PM	6.55%	91	0	498	589	96	396	0	492	0	811	59	870
7:00 PM	5.01%	70	0	381	451	73	303	0	376	0	620	45	665
8:00 PM	3.47%	48	0	264	312	51	210	0	261	0	430	31	461
9:00 PM	3.10%	43	0	236	279	45	187	0	232	0	384	28	412
10:00 PM	2.02%	28	0	154	182	30	122	0	152	0	250	18	268
11:00 PM	1.37%	19	0	104	123	20	83	0	103	0	170	12	182
Total	**100.01%**	**1,397**	**0**	**7,609**	**9,006**	**1,465**	**6,046**	**0**	**7,511**	**0**	**12,383**	**903**	**13,286**

1) Hourly distribution is taken from NCHRP Report 365; Travel Estimation Technques for Urban Planning for general purposes.

\\srv-dfs-wa\Projects\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Traffic Analysis\Signal Warrants\Signal Warrant Volumes_IHR
12/21/2022, 3:40 PM

Appendix E: Conceptual Layouts



NOTES:

1. IMPROVEMENTS SHOWN ARE PRELIMINARY AND SUBJECT TO CHANGE DURING THE COURSE OF DESIGN.
2. NOT ALL IMPROVEMENTS NECESSARY TO COMPLETE THE INTERSECTION WORK ARE SHOWN.

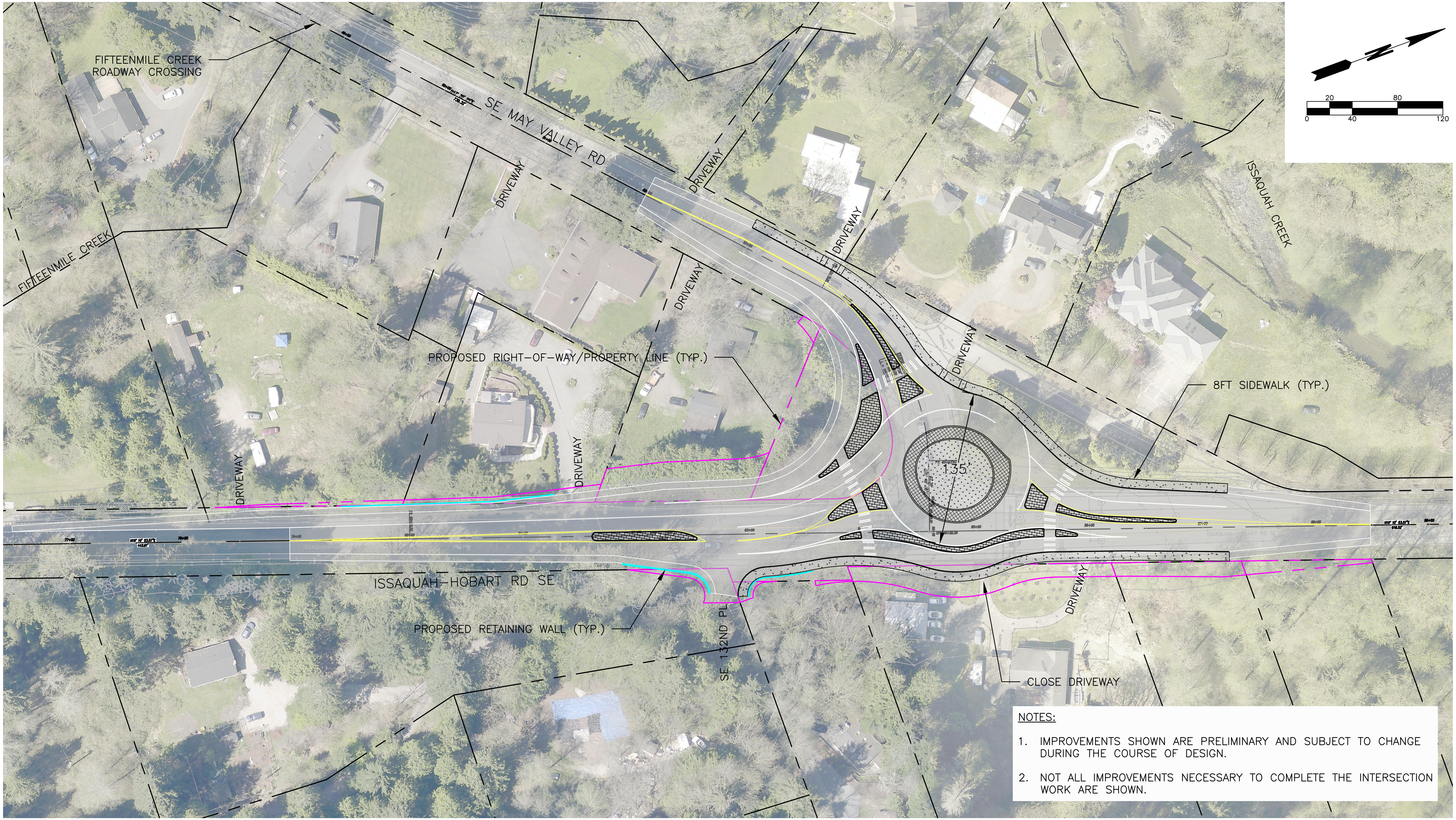
Issaquah-Hobart Rd SE & SE May Valley Rd - Modified Traffic Signal Concept

December 21, 2022

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

Jan 30, 2023 - 5:57pm chrisc \\srv-dfs-wa\Projects\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-SGNL.dwg Layout: Fig 2

transpogroup WHAT TRANSPORTATION CAN BE.



Issaquah-Hobart Rd SE & SE May Valley Rd - Multi-Lane Roundabout Concept

December 21, 2022

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

Dec 20, 2022 - 1:51pm victorm M:\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-RAB.dwg Layout: Fig 1

transpogroup
WHAT TRANSPORTATION CAN BE.

Appendix F: Cost Estimates

transpogroup
WHAT TRANSPORTATION CAN BE.

Engineer's Opinion of Probable Costs - Alternative: Modified Traffic Signal

Transpo Job No.: 1.21304.00

Description of Work

Intersection improvements and traffic signal at Issaquah-Hobart Road SE and SE May Valley Road intersection, including widening of Issaquah-Hobart Road SE at the intersection.

Item No.	Spec. Section #		Unit	Quantity	Unit Price	Amount
1		Project Temporary Traffic Control	LS	1	$ 122,000	$ 122,000
2		Mobilization	LS	1	$ 100,000	$ 100,000
3		Removal of Structures and Obstructions	LS	1	$ 60,000	$ 60,000
4		Removing Cement Conc. Sidewalk	SY	272	$ 40	$ 10,893
5		Removing Cement Conc. Curb and Gutter	LF	835	$ 15	$ 12,525
6		Clearing and Grubbing	AC	1.60	$ 20,000	$ 32,006
7		Roadway Excavation Incl. Haul	CY	2,663	$ 20	$ 53,262
8		Planing Bituminous Pavement	SY	7,700	$ 9	$ 69,300
9		Borrow Incl. Haul	CY	12,181	$ 25	$ 304,515
10		Crushed Surfacing Base Course	TON	2,463	$ 50	$ 123,169
11		HMA PG 58H-22	TON	4,213	$ 175	$ 737,190
12		Retaining Wall - Fill	SF	600	$ 100	$ 60,000
13		Retaining Wall - Cut	SF	7,240	$ 200	$ 1,448,000
14		High-Density Polyethylene (HDPE) Pipe 12 In. Diam.	LF	4,310	$ 160	$ 689,600
15		Catch Basin Type 1	EA	44	$ 4,000	$ 176,000
16		Stormwater Vault	LS	1	$ 537,000	$ 537,000
17		Stormwater Wetpond	LS	1	$ 90,000	$ 90,000
18		Structure Excavation Class B Incl. Haul	CY	102	$ 38	$ 3,876
19		Fish Passage Structure (Issaquah Creek)	EA	2	$ 850,000	$ 1,700,000
20		Temporary Erosion & Sediment Control	LS	1	$ 80,000	$ 80,000
21		Seed, Fertilize, Mulch	AC	0.64	$ 10,000	$ 6,396
22		Removing Guardrail	LF	725	$ 10	$ 7,250
23		Beam Guardrail Type 31	LF	946	$ 60	$ 56,760
24		Beam Guardrail Terminal	EA	4	$ 6,000	$ 24,000
25		Cement Conc. Sidewalk	SY	704	$ 100	$ 70,378
26		Cement Conc. Traffic Curb and Gutter	LF	1,168	$ 60	$ 70,080
27		Cement Conc. Curb Ramp Type Parallel	EA	5	$ 5,000	$ 25,000
28		Cement Conc. Sidewalk/Shoulder Transitions	EA	6	$ 4,000	$ 24,000
29		Pavement Markings	LS	1	$ 30,000	$ 30,000
30		Traffic Signal System	LS	1	$ 750,000	$ 750,000

Subtotal	$ 7,473,201
Contingency (10%)	$ 747,320
Utility Adjustments	$ 65,000
TOTAL CONSTRUCTION COST	**$ 8,285,521**
Construction Eng (20%)	$ 1,657,104
Design & Enviro. (20%)	$ 1,657,104
ROW	$ 650,000
TOTAL PROJECT COST	**$ 12,249,730**

transpogroup
WHAT TRANSPORTATION CAN BE.

Engineer's Opinion of Probable Costs - Alternative: Multi-Lane Roundabout

Transpo Job No.: 1.21304.00

Description of Work

Intersection improvements to install a multi-lane roundabout at Issaquah-Hobart Road SE and SE May Valley Road intersection, including widening of Issaquah-Hobart Road SE at the intersection.

Item No.	Spec. Section #		Unit	Quantity	Unit Price	Amount
1		Project Temporary Traffic Control	LS	1	$ 122,000	$ 122,000
2		Mobilization	LS	1	$ 100,000	$ 100,000
3		Removal of Structures and Obstructions	LS	1	$ 40,000	$ 40,000
4		Removing Cement Conc. Sidewalk	SY	272	$ 40	$ 10,893
5		Removing Cement Conc. Curb and Gutter	LF	835	$ 15	$ 12,525
6		Clearing and Grubbing	AC	1.06	$ 20,000	$ 21,292
7		Roadway Excavation Incl. Haul	CY	297	$ 35	$ 10,409
8		Planing Bituminous Pavement	SY	150	$ 9	$ 1,350
9		Borrow Incl. Haul	CY	7,631	$ 35	$ 267,083
10		Crushed Surfacing Base Course	TON	2,597	$ 50	$ 129,861
11		HMA PG 58H-22	TON	3,465	$ 175	$ 606,397
12		Retaining Wall - Cut	SF	2,736	$ 200	$ 547,200
13		High-Density Polyethylene (HDPE) Pipe 12 In. Diam.	LF	4,270	$ 160	$ 683,200
14		Catch Basin Type 1	EA	43	$ 4,000	$ 172,000
15		Stormwater Vault	LS	1	$ 370,000	$ 370,000
16		Stormwater Wetpond	LS	1	$ 80,000	$ 80,000
17		Structure Excavation Class B Incl. Haul	CY	100	$ 38	$ 3,800
18		Off-Site Drainage Analysis Extras (40%)	LS	1	$ 523,600	$ 523,600
19		Temporary Erosion & Sediment Control	LS	1	$ 50,000	$ 50,000
20		Central Island Landscaping and/or Features	LS	1	$ 75,000	$ 75,000
21		Seed, Fertilize, Mulch	AC	0.35	$ 10,000	$ 3,500
22		Removing Guardrail	LF	255	$ 10	$ 2,550
23		Beam Guardrail Type 31	LF	200	$ 60	$ 12,000
24		Beam Guardrail Terminal	EA	2	$ 6,000	$ 12,000
25		Cement Conc. Sidewalk	SY	892	$ 100	$ 89,222
26		Roundabout Truck Apron Cement Concrete Curb	LF	283	$ 100	$ 28,300
27		Roundabout Central Island Cement Concrete Curb	LF	203	$ 135	$ 27,405
29		Roundabout Cement Conc. Curb and Gutter	LF	2,469	$ 60	$ 148,140
30		Roundabout Splitter Island Nosing Curb	EA	6	$ 1,000	$ 6,000
31		Textured Cement Conc. Truck Apron (12")	CY	94	$ 375	$ 35,417
32		Textured Cement Conc. Splitter Islands (6")	CY	82	$ 750	$ 61,861
33		Cement Conc. Curb Ramp Type Parallel	EA	4	$ 5,000	$ 20,000
34		Cement Conc. Sidewalk/Shoulder Transitions	EA	4	$ 4,000	$ 16,000
35		Pavement Markings	LS	1	$ 25,000	$ 25,000
36		Illumination System Complete	LS	1	$ 100,000	$ 100,000

Subtotal	$ 4,414,006
Contingency (10%)	$ 441,401
Utility Adjustments	$ 165,000
TOTAL CONSTRUCTION COST	**$ 5,020,407**
Construction Eng (20%)	$ 1,004,081
Design & Enviro. (20%)	$ 1,004,081
ROW	$ 450,000
TOTAL PROJECT COST	**$ 7,478,569**

Appendix G: Right of Way Impacts

RIGHT OF WAY FUNDING ESTIMATE

Agency:	**King County**
Project Title:	**Issaquah - Hobart Road** **Signal Alignment**
Date of Estimate	**December 13, 2022**
Estimate Completed By:	**Universal Field Services, Inc.**
Name:	**Steve Reinhart**
Title:	**ROW Project Manager**
LAC Concurrence:	
Name:	
Title:	

Estimated Total:	$633,651
Year Estimate Completed:	2022
Year Acquisition to be Completed:	2023
Inflation Factor (Calculated):	1.02
Total Right of Way Costs:	**$646,324**

														Select Valuation Process						
Assessor's Tax Parcel Number	**Fee TE or PE**	**Owner Name**	**Area (Sq Ft)**	**Assessed Value-Sq Ft (reduce for easements)**	**TE Total (from other sheet)**	**Improvement Value**	**Damages**	**Relocation**	**Acquisition Subtotal**	**Confidence Level (1 - 10)**	**Confidence Factor (Calculated)**	**Factored Subtotal**	**Title & Escrow Costs**	**Appraisal/ Appraisal Review Cost**	**AOS (under $25,000) Cost**	**Labor**	**Misc. Fees (including PM)**	**Statutory Evaluation Allowance (SEA-$750)**	**Subtotal All**	**Condemnation Enter Percentage**	**Total**
1523069045	Fee	Issaquah Valley Family	4600	$1.35	$0	$2,950	$0	$0	$9,160	5	0.88	$17,221	$2,950	$0	$1,600	$7,000	$0	$750	$29,521	20%	$35,274.96
1523069045	TE	Issaquah Valley Family	0	$0.13	$0	$0	$0	$0	$0	5	0.88	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069047	Fee	Joseph Weaver	4000	$3.70	$0	$1,080	$0	$0	$15,880	7	0.57	$24,932	$3,310	$5,000	$0	$7,000	$0	$750	$40,992	20%	$49,039.92
1523069047	TE	Joseph Weaver	0	$0.37	$0	$0	$0	$0	$0	7	0.57	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069171	Fee	Nghiem Nguyen	1700	$4.08	$0	$7,375	$0	$0	$14,311	5	0.88	$26,905	$3,310	$5,000	$0	$7,000	$0	$750	$42,965	20%	$51,407.62
1523069171	TE	Nghiem Nguyen	0	$0.40	$0	$0	$0	$0	$0	5	0.88	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069048	Fee	Nghiem Nguyen	2000	$4.08	$0	$2,950	$0	$0	$11,110	5	0.88	$20,887	$3,310	$0	$1,600	$7,000	$0	$750	$33,547	20%	$40,106.16
1523069048	TE	Nghiem Nguyen	0	$0.40	$0	$0	$0	$0	$0	5	0.88	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069049	Fee	Nghiem Nguyen	4600	$2.56	$0	$8,650	$0	$0	$20,426	4	1.03	$41,465	$3,310	$5,000	$0	$7,000	$0	$750	$57,525	20%	$68,879.74
1523069049	TE	Nghiem Nguyen	0	$0.25	$0	$0	$0	$0	$0	4	1.03	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069098	Fee	Richard Addison	300	$7.03	$0	$7,375	$0	$0	$9,484	8	0.41	$13,372	$2,950	$0	$1,600	$7,000	$0	$750	$25,672	20%	$30,656.93
1523069098	TE	Richard Addison	0	$0.70	$0	$0	$0	$0	$0	8	0.41	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069099	Fee	Thomas Nelson	1650	$4.05	$0	$5,900	$0	$0	$12,583	5	0.88	$23,655	$3,310	$5,000	$0	$7,000	$0	$750	$39,715	20%	$47,508.12
1523069099	TE	Thomas Nelson	0	$0.40	$0	$0	$0	$0	$0	5	0.88	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069118	Fee	Steven Oftedahl	3500	$1.74	$0	$3,500	$0	$0	$9,590	8	0.41	$13,522	$2,950	$0	$1,600	$7,500	$0	$750	$26,322	20%	$31,436.28
1523069118	TE	Steven Oftedahl	0	$0.17	$0	$0	$0	$0	$0	8	0.41	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069038	Fee	Gregory Vanhollebeke	3300	$9.92	$0	$30,000	$0	$0	$62,736	9	0.26	$79,047	$3,310	$5,000	$0	$7,500	$0	$750	$95,607	20%	$114,578.83
1523069038	TE	Gregory Vanhollebeke	0	$0.99	$0	$0	$0	$0	$0	9	0.26	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069058	Fee	Kaveh Kazemi	1700	$10.43	$0	$1,700	$0	$0	$19,431	9	0.26	$24,483	$3,310	$5,000	$0	$7,500	$0	$750	$41,043	20%	$49,101.67
1523069058	TE	Kaveh Kazemi	0	$1.04	$0	$0	$0	$0	$0	9	0.26	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069172	Fee	T L Cannon	1800	$5.22	$0	$0	$0	$0	$9,396	8	0.41	$13,248	$2,950	$0	$1,600	$7,500	$0	$750	$26,048	20%	$31,108.03
1523069172	TE	T L Cannon	0	$0.52	$0	$0	$0	$0	$0	8	0.41	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069032	Fee	Gabriel Albut	7700	$1.08	$0	$30,000	$0	$0	$38,316	8	0.41	$54,026	$3,310	$5,000	$0	$7,500	$0	$750	$70,586	20%	$84,552.67
1523069032	TE	Gabriel Albut	0	$0.10	$0	$0	$0	$0	$0	8	0.41	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
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RIGHT OF WAY FUNDING ESTIMATE

Agency: King County
Project Title: Issaquah - Hobart Road Roundabout Alignment
Date of Estimate December 13, 2022
Estimate Completed By: Universal Field Services, Inc.
Name: Steve Reinhart
Title: Project Manager
LAC Concurrence:
Name:
Title:

Estimated Total: $441,179
Year Estimate Completed: 2022
Year Acquisition to be Completed: 2023
Inflation Factor (Calculated): 1.02
Total Right of Way Costs: **$450,003**

Select Valuation Process

Assessor's Tax Parcel Number	Fee TE or PE	Owner Name	Area (Sq Ft)	Assessed Value-Sq Ft (reduce for easements)	TE Total (from other sheet)	Improvement Value	Damages	Relocation	Acquisition Subtotal	Confidence Level (1 - 10)	Confidence Factor (Calculated)	Factored Subtotal	Title & Escrow Costs	Appraisal/ Appraisal Review Cost	AOS (under $25,000) Cost	Labor	Misc. Fees (including PM)	Statutory Evaluation Allowance (SEA-$750)	Subtotal All	Condemnation Enter Percentage	Total
1523069171	Fee	Nghiem Nguyen	900	$4.08	$0	$0	$0	$0	$3,672	5	0.88	$6,903	$2,950	$0	$1,600	$7,000	$0	$750	$19,203	20%	$22,894.03
1523069171	TE	Nghiem Nguyen	0	$0.40	$0	$0	$0	$0	$0	5	0.88	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069048	Fee	Nghiem Nguyen	1500	$4.08	$0	$0	$0	$0	$6,120	5	0.88	$11,506	$2,950	$0	$1,600	$7,000	$0	$750	$23,806	20%	$28,416.72
1523069048	TE	Nghiem Nguyen	0	$0.40	$0	$0	$0	$0	$0	5	0.88	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069049	Fee	Nghiem Nguyen	4300	$2.56	$0	$15,600	$0	$0	$26,608	4	1.03	$54,014	$3,310	$5,000	$0	$7,000	$0	$750	$70,074	20%	$83,939.09
1523069049	TE	Nghiem Nguyen	0	$0.25	$0	$0	$0	$0	$0	4	1.03	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069098	Fee	Richard Addison	350	$7.03	$0	$14,750	$0	$0	$17,211	8	0.41	$24,267	$3,310	$5,000	$0	$7,000	$0	$750	$40,327	20%	$48,242.17
1523069098	TE	Richard Addison	0	$0.70	$0	$0	$0	$0	$0	8	0.41	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069099	Fee	Thomas Nelson	1200	$4.05	$0	$5,900	$0	$0	$10,760	5	0.88	$20,229	$3,310	$0	$1,600	$7,000	$0	$750	$32,889	20%	$39,316.56
1523069099	TE	Thomas Nelson	0	$0.40	$0	$0	$0	$0	$0	5	0.88	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069118	Fee	Steven Oftedahl	11714	$1.74	$0	$5,000	$0	$0	$25,382	8	0.41	$35,789	$3,310	$5,000	$0	$7,000	$2,500	$750	$54,349	20%	$65,068.95
1523069118	TE	Steven Oftedahl	0	$0.17	$0	$0	$0	$0	$0	8	0.41	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069038	Fee	Gregory Vanhollebeke	5000	$9.92	$0		$0	$0	$49,600	9	0.26	$62,496	$3,700	$5,000	$0	$7,000	$0	$750	$78,946	20%	$94,585.20
1523069038	TE	Gregory Vanhollebeke	0	$0.99	$0	$0	$0	$0	$0	9	0.26	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069058	Fee	Kaveh Kazemi	1400	$10.43	$0	$1,700	$0	$0	$16,302	9	0.26	$20,541	$3,310	$0	$1,600	$7,000	$0	$750	$33,201	20%	$39,690.62
1523069058	TE	Kaveh Kazemi	0	$1.04	$0	$0	$0	$0	$0	9	0.26	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
1523069172	Fee	T L Cannon	500	$5.22	$0	$0	$0	$0	$2,610	8	0.41	$3,680	$2,950	$0	$1,600	$7,000	$0	$750	$15,980	20%	$19,026.12
1523069172	TE	T L Cannon	0	$0.52	$0	$0	$0	$0	$0	8	0.41	$0	$0	$0	$0	$0	$0	$0	$0	20%	$0.00
									$0		Error	$0							$0		$0.00
									$0		Error	$0							$0		$0.00
									$0		Error	$0							$0		$0.00
									$0		Error	$0							$0		$0.00
									$0		Error	$0							$0		$0.00
									$0		Error	$0							$0		$0.00
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									$0		Error	$0							$0		$0.00
									$0		Error	$0							$0		$0.00
									$0		Error	$0							$0		$0.00

Appendix H:Alternatives Analysis Summary Matrix

Appendix H
Issaquah-Hobart Road SE and SE May Valley Road Alternatives Analysis Summary

Evaluation Criteria	Alternatives		
	Multi-Lane Roundabout	**Modified Traffic Signal**	**No Build**
Traffic Operations	**2**	**2**	**0**
	Estimated average delay at the Multi-Lane Roundabout during the 2043 AM and PM Peak hours is expected to be 10.4 and 25.3 seconds, respectively. This corresponds to a Level of Service (LOS) of B in the AM and D in the PM peak hours. Maximum 95-percentile queue lengths in the PM Peak Hour are expected to be 1,400ft on the EB approach during the PM Peak Hour. This represents a significant advantage over the No Build alternative and meets the purpose of the project with respect to improved traffic operations.	Estimated average delay at the Modified Traffic Signal during the 2043 AM and PM Peak hours is expected to be 14.6 and 30.8 seconds, respectively. This corresponds to a Level of Service (LOS) of B in the AM and C in the PM peak hours. Maximum 95-percentile queue lengths in the PM Peak Hour are expected to be 1,900ft on the EB approach during the PM Peak Hour. This represents a significant advantage over the No Build alternative and meets the purpose of the project with respect to improved traffic operations.	Estimated average delay assuming the No Build alternative during the 2043 AM and PM Peak hour is expected to be 155 and 288 seconds, respectively. Maximum 95-percentile queue lengths are expected to be 2775ft on the NB approach in the AM Peak Hour. These estimates would not represent an advantage over other alternatives and would not meet the purpose of the project with respect to improved traffic operations.
Safety	**2**	**1**	**0**
	The multi-lane Roundabout alternative is expected to experience a significant reduction in frequency and severity of crashes based on Crash Modification Factors published by FHWA and research conducted by WSDOT. Crash reductions were estimated for the following severity types: Property Damage Only: 48% Serious Injury: 78% Fatality: 90% This represents a significant advantage over the Modified Traffic Signal and No Build alternatives and meets the purpose of the project with respect to safety.	Based on research documented in NCHRP Report 707, Guidelines on the Use of Auxiliary Through Lanes at Signalized Intersections, it was estimated that the Modified Traffic Signal alternative would reduce overall crashes by 5%. This represents an advantage over the No Build Alternative but is not as significant a reduction as what is expected for the Multi-Lane Roundabout alternative.	Crash rates under the No Build alternative are expected to remain the same or even increase as traffic volumes continue to rise and congestion worsens. This does not represent an advantage over other alternatives and does not meet the purpose of the project with respect to safety.
Soil and Geotechnical	**1**	**0**	
	The Multi-Lane Roundabout alternative is expected to require approximately 2,750 SF of retaining wall (cut) due to steep slopes located south of the intersection. This represents an advantage over the Modified Traffic Signal alternative.	The Modified Traffic Signal alternative is expected to require approximately 7,200 SF of retaining wall (cut) and 600 SF of retaining wall (fill). This is approximately three times what is required for the Multi-Lane Roundabout alternative.	
Environmental	**2**	**1**	
	A qualitative analysis of potential impacts to critical areas suggests that the Multi-Lane Roundabout alternative will have impacts to buffer areas of Issaquah Creek and an unnamed tributary to Issaquah Creek to the north and may have impacts to the buffer area of Fifteen Mile Creek to the south. These impacts are expected to be less than the Modified Traffic Signal alternative. This alternative is not expected to impact creek crossings. In addition, carbon emissions are expected to be less for the Multi-Lane Roundabout due to less anticipated delay and idling of motor vehicles. This alternative provides a significant advantage over the Modified Traffic Signal alternative.	The Modified Traffic Signal alternative is expected to have significant impacts to buffer areas of Issaquah Creek, the unnamed tributary to Issaquah Creek, and potentially Fifteen Mile Creek and Nudist Camp Creek. In addition, this alternative is expected to impact two creek crossings that will most likely require replacement with a fish passable structure. This alternative does not provide an advantage over the Multi-Lane Roundabout alternative.	
Stormwater/ Drainage	**0**	**0**	
	The Multi-Lane Roundabout alternative is expected to add approximately 0.67 acres of new impervious surfaces that will require both flow control and water quality treatments. For water quality, it is estimated that this alternative would require a 30'x100'x3' wetpond, and for flow control a 45'x45'x7' vault would be required for this alternative. In addition, a conveyance system would be required. It is also possible that offsite flow would be impacted with this alternative and require increasing the size of both the wetpond and vault. For the purposes of this alternatives analysis, it was assumed that this requirement would increase the cost of stormwater infrastructure by 40%. Due to the anticipated size of flow control and water quality infrastructure, and the potential impact to offsite flow, this alternative does not provide an advantage over the Modified Traffic Signal alternative.	The Modified Traffic Signal alternative is expected to add approximately 0.95 acres of new impervious surfaces that will require both flow control and water quality treatments. For water quality, it is estimated that this alternative would require a 35'x120'x3' wetpond, and for flow control a 55'x55'x7' vault would be required for this alternative. In addition, a conveyance system would be required. Due to the anticipated size of flow control and water quality infrastructure, this alternative does not provide an advantage over the Multi-Lane Roundabout alternative.	
Utility Impacts	**0**	**0**	
	Utility impacts for the Multi-Lane Roundabout alternative are anticipated to be focused on the overhead and underground electrical and communication facilities. Of particular note, this alternative has the potential of impacting a large communication vault on the southwest corner of the intersection. However, this may be mitigated through refinement of the geometry of the May Valley approach. This alternative does not provide an advantage over the Modified Traffic Signal alternative.	Utility impacts for the Modified Traffic Signal alternative are expected to include required modifications to the overhead and underground electrical power and communication lines. However, these impacts are similar to those expected for the Multi-Lane Roundabout alternative. No advantage is provided by this alternative with regards to utility impacts.	
ROW Requirements	**1**	**0**	
	The Multi-Lane Roundabout alternative will require the acquisition of 26, 860 SF of ROW from an estimated 9 parcels. This is an advantage over the Modified Traffic Signal alternative.	The Modified Traffic Signal will require the acquisition of approximately 36,850 SF of ROW from an estimated 12 parcels.	
Constructability and Impact to Travelling Public	**1**	**0**	
	The Multi-Lane Roundabout alternative will require approximately 132 working days. This is an advantage over the Modified Traffic Signal alternative.	The Modified Traffic Signal alternative will require approximately 155 working days, may require a period of time with one-lane two way traffic control implemented for half-width construction of waterway crossings, and long lead traffic signal equipment may result in a period of suspended work.	
Construction and Maintenance Costs	**2**	**1**	0
	The construction costs of the Multi-Lane Roundabout Alternative are estimated at approximately $10 Million. This provides an advantage over the Modified Traffic Signal alternative.	The construction costs of the Modified Traffic Signal alternative are estimated at $16,250,000.	Maintenance costs under the No Build alternative are expected to remain the same and would be greater than those for the Multi-Lane Roundabout Alternative. This does not represent an advantage over other alternatives .
Total Score	**11**	**5**	**0**

Appendix I:Life Cycle Cost Analysis

SUMMARY

	Initial Cost	Life Cycle Cost Present Value	Total Cost Present Value	% of Roundabout
No Build	**$ -**	**$ 28,538,279**	**$ 28,538,000**	**250%**
Project	$ -			
Maintenance		$ 594,948		
Societal		$ 27,943,331		
Modified Traffic Signal	**$ 12,249,730**	**$ 11,711,777**	**$ 23,962,000**	**210%**
Project	$ 12,249,730			
Maintenance		$ 549,320		
Societal		$ 11,162,456		
Multilane Hybrid Roundabout	**$ 7,478,569**	**$ 3,949,311**	**$ 11,428,000**	**100%**
Project	$ 7,478,569			
Maintenance		$ 176,016		
Societal		$ 3,773,295		

Interest Rate	**5%**
Life Cycle, years	**20**

PROJECT COSTS

	No Build		Signal		Roundabout	
Right-of-Way (2024 Cost)				$650,000		$450,000
Civil features			$6,782,292		$4,464,006	
Signal & Illumination System			$750,000		$100,000	
Contingency			$753,229		$456,401	
Total				$8,285,521		$5,020,407
Design			$1,642,104		$989,081	
Permiting			$15,000		$15,000	
Total				$1,657,104		$1,004,081
Construction Engineering			$1,380,920		$836,734	
Construction Admin			$276,184		$167,347	
Total				$1,657,104		$1,004,081
		$0		**$12,249,730**		**$7,478,569**

Contingency 10%

MAINTENANCE COSTS

						Present Value	% of Alt 3	
No Build				$	45,737	$594,948	338%	
Maintenance & Operating Cost		$	5,000	$	5,000			
Signal System Upgrades	Replacement	$	250,000	$	23,278			
	Life Expectancy, years		15					Assume existing signal will need to be replaced within 15 years
Asphalt Grind and Overlay	Initial Cost	$	187,500	$	17,459			~100,000 SF; 2" Depth; 1,250 Tons HMA @ $150/Ton
	Life Expectancy, years		15					
Modified Traffic Signal				$	42,230	$549,320	312%	
Maintenance & Operating Cost		$	5,000	$	5,000			
New Signal System	Initial Cost	$	250,000	$	15,348			
	Life Expectancy, years		30					Assume new signal will have a life of 30 years
Asphalt Grind and Overlay	Initial Cost	$	235,000	$	21,882			~125,000 SF
	Life Expectancy, years		15					
Multilane Hybrid Roundabout				$	13,531	$176,016	100%	
Maintenance & Operating Cost		$	2,000	$	2,000			
Asphalt Grind and Overlay	Initial Cost	$	150,000	$	11,531			~$80,000 SF Asphalt area including truck apron
	Life Expectancy, years		20					

Interest Rate	4.5%
Life Cycle, years	20

SOCIETAL COSTS

				Life Cycle Cost	Annual Cost	Present Value	Ratio	
No Build						$27,943,331	741%	
Operational Delay	AM Peak Hour	155	secs	$ 8,422,700	$ 421,135			
	PM Peak Hour	288	secs	$ 18,971,971	$ 948,599			
Collisions	Property damage	28	0%	$ 476,000	$ 23,800			
	Injury	30	0%	$ 7,905,000	$ 395,250			
	Fatality	0	0%	$ -	$ -			From SIDRA Fuel Consumption and Emissions and Cost Output Repor
Fuel Consumption		89,848	gal/year	$ 7,187,840	$ 359,392			186.4 gal/hr PM Peak
				$ 42,963,511	$ 2,148,176			89,484 gal/year
Modified Traffic Signal						$11,162,456	296%	
Operational Delay	AM Peak Hour	15	secs	$ 815,100	$ 40,755			
	PM Peak Hour	31	secs	$ 2,042,122	$ 102,106			
Collision	Property damage	26.6	5%	$ 452,200	$ 22,610			
Reduction	Injury	28.5	5%	$ 7,509,750	$ 375,488			
	Fatality	0.0	5%	$ -	$ -			From SIDRA Fuel Consumption and Emissions and Cost Output Repor
Fuel Consumption		79,292	gal/year	$ 6,343,360	$ 317,168			165.2 gal/hr PM Peak
				$ 17,162,532	$ 858,127			79,292 gal/year
Multilane Hybrid Roundabout						$3,773,295	100%	
Operational Delay	AM Peak Hour	7.9	secs	$ 429,286	$ 21,464			
	PM Peak Hour	9.0	secs	$ 592,874	$ 29,644			
Collision	Property damage	14.6	47.8%	$ 248,472	$ 12,424			
Reduction	Injury	6.7	77.7%	$ 1,762,815	$ 88,141			
	Fatality	0.0	90%	$ -	$ -			From Dan Dovey
Fuel Consumption		34,601	gal/year	$ 2,768,080	$ 138,404			72.1 gal/hr PM Peak; 60.4 gal/hr for AM Peak
				$ 5,801,527	$ 290,076			34,601 gal/year

Interest Rate	4.5%	AM Peak Hour Volume	2200
Life Cycle, years	20	PM Peak Hour Volume	2667
PDO cost	$ 17,000	Vehicle Delay Cost, $/hr	16
Injury cost	$ 263,500	Truck Delay Cost, $/hr	71
Fatal cost	$ 11,295,400	Pump Price of fuel, $/gal	4.00

Delay Cost, $ = (# cars X 16$/hour + # trucks X 71$/hour) (Delay, secs) (1 hour / 3,600 secs) (260 peaks/year) (life cycle, years)

Fuel Consumption Cost, $ = (average usage, gals/peak hr) (260 peak hrs/year) (life cycle, years) (pump price, $/gal)

FUEL CONSUMPTION, EMISSIONS & COST

Site: 101 [2043 Modified Signal PM (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Pretimed) Isolated   Cycle Time = 255 seconds (Site Practical Cycle Time)

Fuel Consumption, Emissions & Cost (Total)							
Mov ID	Turn	Fuel Total gal/h	CO2 Total kg/h	CO Total kg/h	HC Total kg/h	NOX Total kg/h	Cost Total $/h
South: Issaquah Hobart Road SE							
3	L2	14.6	135.4	0.20	0.023	0.627	373.52
8	T1	21.3	190.2	0.21	0.020	0.190	579.46
Approach		35.9	325.6	0.41	0.042	0.816	952.97
North: RoadName							
4	T1	70.6	631.7	0.63	0.076	0.768	2428.63
14	R2	6.5	59.4	0.06	0.007	0.139	197.49
Approach		77.2	691.0	0.69	0.083	0.907	2626.13
West: SE May Valley Road							
5	L2	13.7	125.5	0.17	0.020	0.520	368.17
12	R2	38.5	355.1	0.35	0.030	1.776	573.14
Approach		52.1	480.6	0.52	0.051	2.296	941.30
Pedestrian Movements (Signalised)							
South: Issaquah Hobart Road SE							
2P	Ped						48.24
North: RoadName							
6P	Ped						47.75
West: SE May Valley Road							
4P	Ped						47.26
All Pedestrians							143.24
All Vehicles		165.2	1497.2	1.61	0.176	4.019	4520.41
Intersection		165.2	1497.2	1.61	0.176	4.019	4663.65

Fuel Consumption, Emissions & Cost (Annual Values)						
	Fuel Total gal/y	CO2 Total kg/y	CO Total kg/y	HC Total kg/y	NOX Total kg/y	Cost Total $/y
Vehicles	79,292	718,641	775	85	1,929	2,169,795
Pedestrians						68,755
Persons						2,238,550

Fuel Consumption, Emissions & Cost (Rate)

Mov ID	Turn	Fuel Efficiency mpg	CO2 Rate g/km	CO Rate g/km	HC Rate g/km	NOX Rate g/km	Cost Rate $/mi
South: Issaquah Hobart Road SE							
3	L2	6.1	947.7	1.37	0.159	4.385	4.21
8	T1	17.4	319.6	0.36	0.033	0.319	1.57
Approach		12.8	441.2	0.55	0.057	1.106	2.08
North: RoadName							
4	T1	9.9	558.6	0.55	0.067	0.679	3.46
14	R2	8.6	658.7	0.65	0.078	1.544	3.53
Approach		9.8	565.9	0.56	0.068	0.743	3.46
West: SE May Valley Road							
5	L2	6.6	861.8	1.19	0.139	3.572	4.07
12	R2	11.7	489.3	0.48	0.042	2.447	1.27
Approach		10.4	551.5	0.60	0.058	2.635	1.74
Pedestrian Movements (Signalised)							
South: Issaquah Hobart Road SE							
2P	Ped						6.96
North: RoadName							
6P	Ped						7.02
West: SE May Valley Road							
4P	Ped						7.07
All Pedestrians							7.02
All Vehicles		10.6	529.0	0.57	0.062	1.420	2.57
Intersection		10.6	529.0	0.57	0.062	1.420	2.65

FUEL CONSUMPTION, EMISSIONS & COST

Site: 101 [May Valley & IHRd 2043 AM (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Fuel Consumption, Emissions & Cost (Total)							
Mov ID	Turn	Fuel Total gal/h	CO2 Total kg/h	CO Total kg/h	HC Total kg/h	NOX Total kg/h	Cost Total $/h
South: Issaquah Hobart Rd SE							
3u	U	0.0	0.3	0.00	0.000	0.000	0.56
3	L2	5.6	50.3	0.06	0.005	0.077	104.79
8	T1	39.5	354.4	0.43	0.031	0.548	711.16
Approach		45.2	404.9	0.49	0.036	0.625	816.51
North: Issaquah Hobart Rd SE							
7u	U	0.0	0.2	0.00	0.000	0.000	0.48
4	T1	9.9	88.3	0.11	0.008	0.139	170.74
14	R2	3.7	32.8	0.04	0.003	0.052	63.86
Approach		13.5	121.4	0.15	0.011	0.191	235.07
West: SE May Valley Rd							
5	L2	2.8	24.9	0.02	0.002	0.036	52.18
12	R2	1.6	14.3	0.01	0.001	0.021	30.42
Approach		4.4	39.2	0.04	0.003	0.057	82.59
All Vehicles		63.1	565.5	0.68	0.050	0.873	1134.18
Intersection		63.1	565.5	0.68	0.050	0.873	1134.18

Fuel Consumption, Emissions & Cost (Annual Values)						
	Fuel Total gal/y	CO2 Total kg/y	CO Total kg/y	HC Total kg/y	NOX Total kg/y	Cost Total $/y
Vehicles	30,284	271,425	329	24	419	544,407
Persons						544,407

Fuel Consumption, Emissions & Cost (Rate)							
Mov ID	Turn	Fuel Efficiency mpg	CO2 Rate g/km	CO Rate g/km	HC Rate g/km	NOX Rate g/km	Cost Rate $/mi
South: Issaquah Hobart Rd SE							
3u	U	22.9	242.3	0.30	0.022	0.317	0.83
3	L2	22.2	251.3	0.30	0.023	0.385	0.84
8	T1	23.4	238.0	0.29	0.021	0.368	0.77
Approach		23.2	239.6	0.29	0.021	0.370	0.78
North: Issaquah Hobart Rd SE							

7u	U	25.2	220.1	0.28	0.019	0.291	0.71
4	T1	24.1	230.6	0.29	0.020	0.362	0.72
14	R2	23.8	234.0	0.29	0.021	0.368	0.73
Approach		24.1	231.5	0.29	0.020	0.363	0.72
West: SE May Valley Rd							
5	L2	24.6	226.5	0.22	0.018	0.326	0.76
12	R2	25.9	214.9	0.22	0.017	0.315	0.74
Approach		25.1	222.1	0.22	0.018	0.322	0.75
All Vehicles		23.5	236.5	0.29	0.021	0.365	0.76
Intersection		23.5	236.5	0.29	0.021	0.365	0.76

FUEL CONSUMPTION, EMISSIONS & COST

Site: 101 [May Valley & IHRd 2043 PM (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Fuel Consumption, Emissions & Cost (Total)							
Mov ID	Turn	Fuel Total gal/h	CO2 Total kg/h	CO Total kg/h	HC Total kg/h	NOX Total kg/h	Cost Total $/h
South: Issaquah Hobart Rd SE							
3u	U	0.0	0.2	0.00	0.000	0.000	0.49
3	L2	3.7	33.5	0.04	0.003	0.052	65.67
8	T1	15.0	134.3	0.17	0.012	0.210	258.64
Approach		18.8	168.1	0.21	0.015	0.262	324.81
North: Issaquah Hobart Rd SE							
7u	U	0.0	0.2	0.00	0.000	0.000	0.50
4	T1	31.4	281.7	0.35	0.025	0.440	556.30
14	R2	2.3	20.6	0.03	0.002	0.032	41.23
Approach		33.8	302.5	0.37	0.027	0.472	598.03
West: SE May Valley Rd							
5	L2	4.3	38.8	0.04	0.004	0.052	101.56
12	R2	23.0	206.0	0.20	0.019	0.280	540.25
Approach		27.3	244.8	0.23	0.023	0.332	641.81
All Vehicles		79.8	715.4	0.82	0.064	1.067	1564.64
Intersection		79.8	715.4	0.82	0.064	1.067	1564.64

Fuel Consumption, Emissions & Cost (Annual Values)						
	Fuel Total gal/y	CO2 Total kg/y	CO Total kg/y	HC Total kg/y	NOX Total kg/y	Cost Total $/y
Vehicles	38,317	343,380	392	31	512	751,027
Persons						751,027

Fuel Consumption, Emissions & Cost (Rate)							
Mov ID	Turn	Fuel Efficiency mpg	CO2 Rate g/km	CO Rate g/km	HC Rate g/km	NOX Rate g/km	Cost Rate $/mi
South: Issaquah Hobart Rd SE							
3u	U	24.5	226.2	0.29	0.020	0.298	0.73
3	L2	23.7	235.2	0.29	0.021	0.366	0.74
8	T1	24.4	228.4	0.28	0.020	0.357	0.71
Approach		24.2	229.7	0.28	0.020	0.358	0.71
North: Issaquah Hobart Rd SE							

7u	U	24.7	224.2	0.28	0.020	0.296	0.73
4	T1	23.8	234.0	0.29	0.021	0.365	0.74
14	R2	23.7	234.7	0.29	0.021	0.367	0.75
Approach		23.8	234.0	0.29	0.021	0.365	0.74
West: SE May Valley Rd							
5	L2	19.4	286.9	0.27	0.027	0.385	1.21
12	R2	19.8	280.9	0.27	0.026	0.382	1.19
Approach		19.7	281.9	0.27	0.026	0.382	1.19
All Vehicles		22.5	247.3	0.28	0.022	0.369	0.87
Intersection		22.5	247.3	0.28	0.022	0.369	0.87

Project: M:\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Traffic Analysis\Traffic Operations \Synchro and Sidra Models\May Valley Rd Multilane hybrid_Transpo edit_12-2022.sip9

FUEL CONSUMPTION, EMISSIONS & COST

Site: 101 [2043 No Build PM (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Pretimed) Isolated   Cycle Time = 255 seconds (Site Practical Cycle Time)

Fuel Consumption, Emissions & Cost (Total)

Mov ID	Turn	Fuel Total gal/h	CO2 Total kg/h	CO Total kg/h	HC Total kg/h	NOX Total kg/h	Cost Total $/h
South: Issaquah Hobart Road SE							
3	L2	16.5	152.6	0.23	0.028	0.684	453.60
8	T1	26.4	235.8	0.24	0.025	0.222	802.24
Approach		42.9	388.5	0.47	0.053	0.906	1255.84
North: RoadName							
4	T1	78.6	701.4	0.62	0.082	0.554	2926.80
14	R2	4.9	45.4	0.04	0.003	0.252	60.39
Approach		83.5	746.8	0.66	0.085	0.805	2987.18
West: SE May Valley Road							
5	L2	15.6	143.3	0.21	0.025	0.572	453.84
12	R2	44.4	409.7	0.45	0.044	1.951	804.68
Approach		60.0	553.0	0.65	0.069	2.523	1258.52
Pedestrian Movements (Signalised)							
South: Issaquah Hobart Road SE							
2P	Ped						47.26
North: RoadName							
6P	Ped						47.26
West: SE May Valley Road							
4P	Ped						47.26
All Pedestrians							141.77
All Vehicles		186.4	1688.3	1.79	0.208	4.234	5501.54
Intersection		186.4	1688.3	1.79	0.208	4.234	5643.31

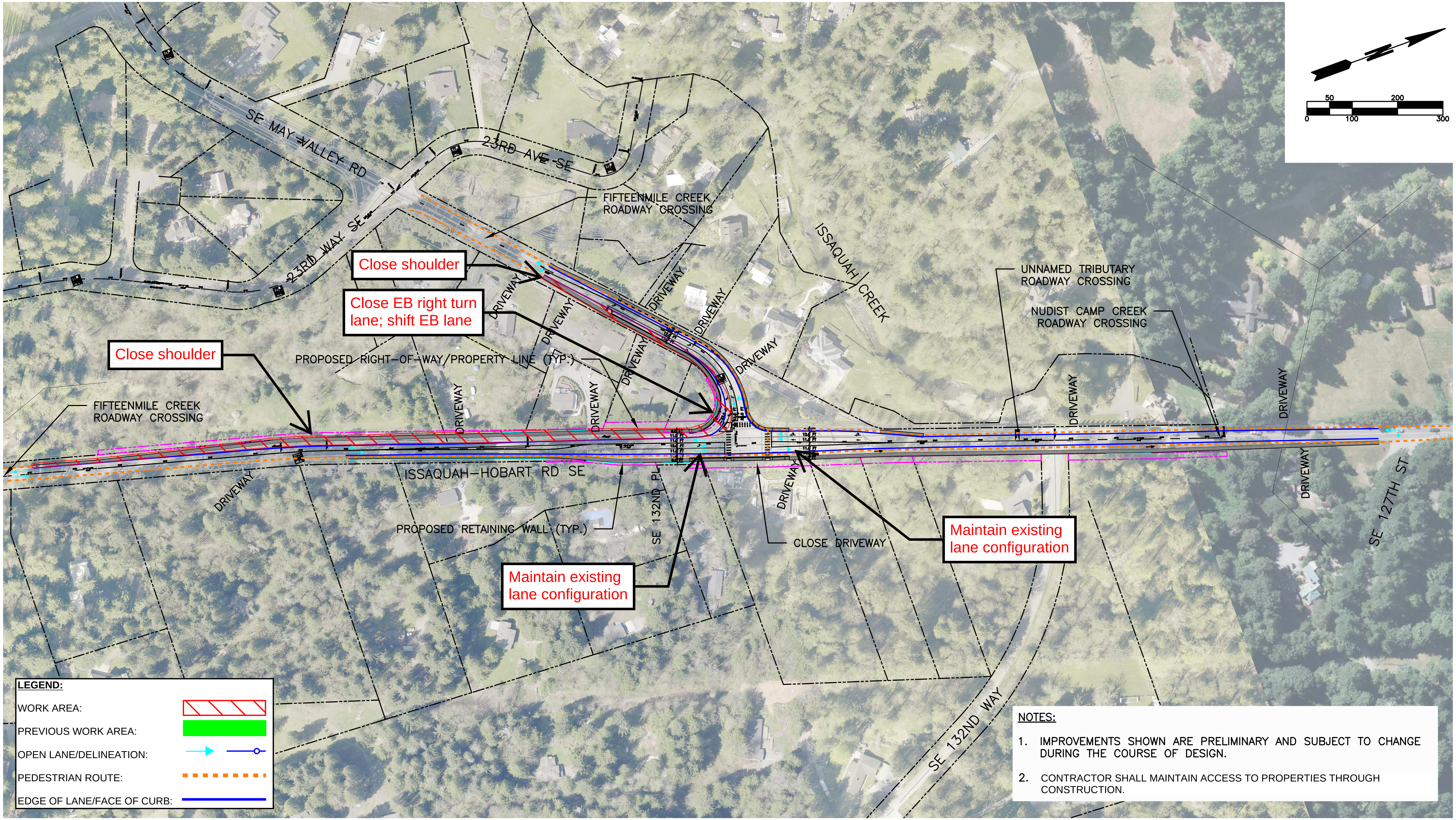
Fuel Consumption, Emissions & Cost (Annual Values)

	Fuel Total gal/y	CO2 Total kg/y	CO Total kg/y	HC Total kg/y	NOX Total kg/y	Cost Total $/y
Vehicles	89,484	810,368	860	100	2,032	2,640,738
Pedestrians						68,051
Persons						2,708,790

Fuel Consumption, Emissions & Cost (Rate)

Mov ID	Turn	Fuel Efficiency mpg	CO2 Rate g/km	CO Rate g/km	HC Rate g/km	NOX Rate g/km	Cost Rate $/mi
South: Issaquah Hobart Road SE							
3	L2	5.4	1070.8	1.64	0.195	4.803	5.12
8	T1	14.0	396.3	0.40	0.043	0.372	2.17
Approach		10.7	526.6	0.64	0.072	1.228	2.74
North: RoadName							
4	T1	8.9	620.2	0.55	0.073	0.489	4.17
14	R2	11.5	503.9	0.44	0.036	2.790	1.08
Approach		9.1	611.6	0.54	0.070	0.659	3.94
West: SE May Valley Road							
5	L2	5.8	984.0	1.42	0.171	3.929	5.02
12	R2	10.1	564.6	0.62	0.061	2.688	1.78
Approach		9.0	634.7	0.75	0.079	2.895	2.32
Pedestrian Movements (Signalised)							
South: Issaquah Hobart Road SE							
2P	Ped						7.07
North: RoadName							
6P	Ped						7.07
West: SE May Valley Road							
4P	Ped						7.07
All Pedestrians							7.07
All Vehicles		9.4	596.6	0.63	0.073	1.496	3.13
Intersection		9.4	596.6	0.63	0.073	1.496	3.21

Appendix J:Conceptual Construction Phasing



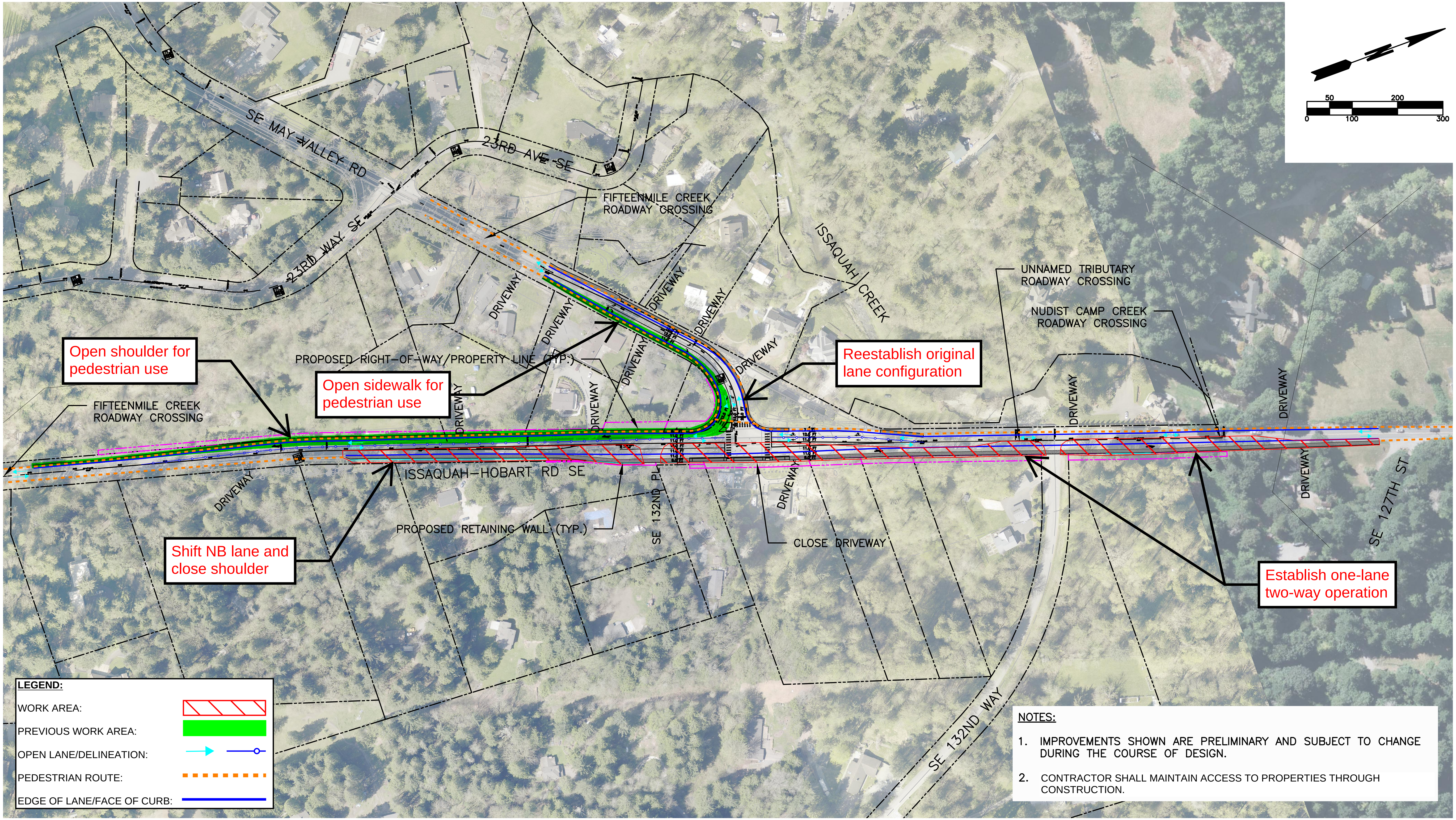
Issaquah-Hobart Rd SE & SE May Valley Rd - Modified Traffic Signal - Conceptual Phasing - Phase 1

March 10, 2023

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

Jan 30, 2023 - 5:57pm chrisc \\srv-dfs-wa\Projects\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-SGNL.dwg Layout: Fig 2

transpogroup WHAT TRANSPORTATION CAN BE.



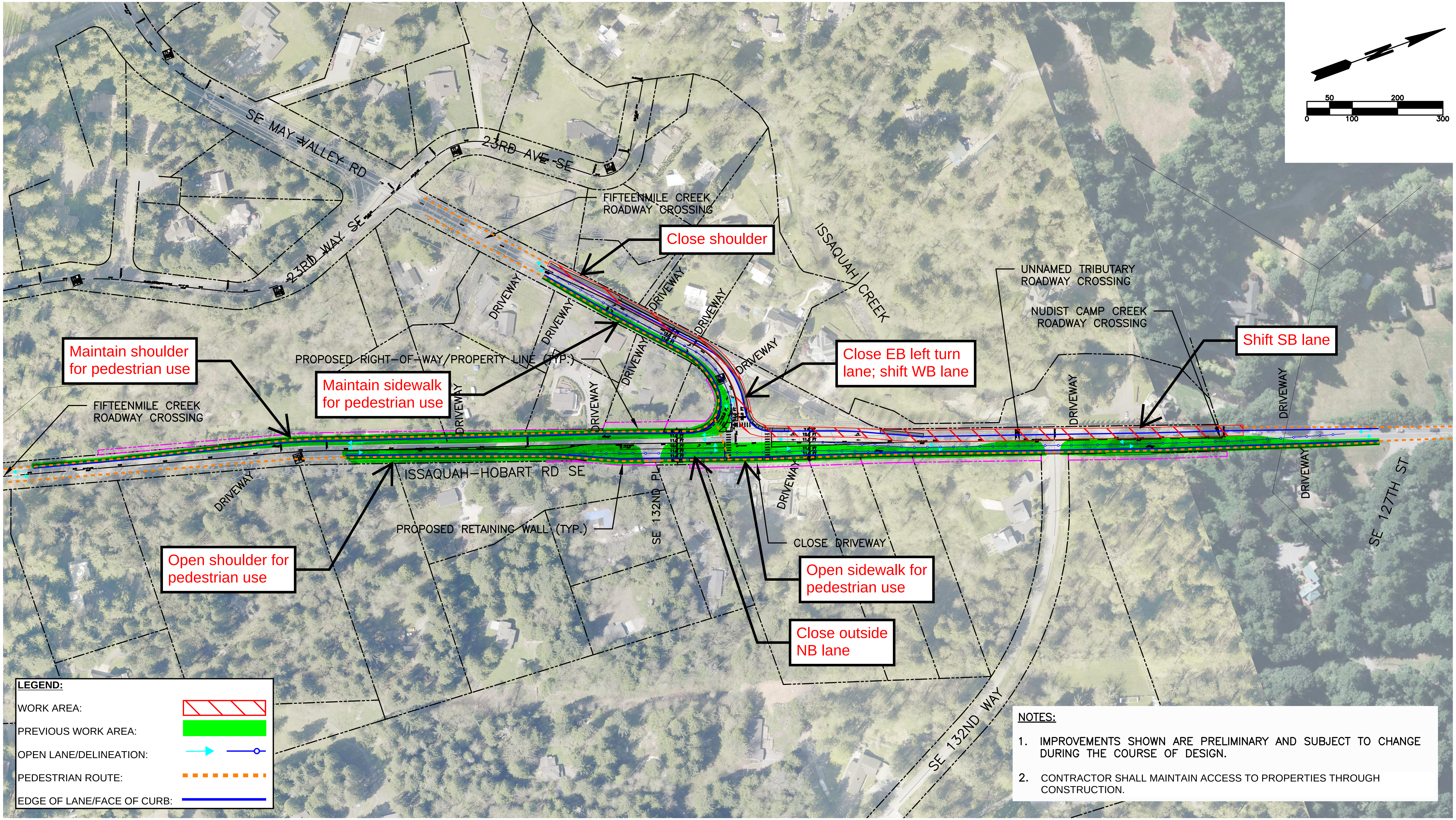
Issaquah-Hobart Rd SE & SE May Valley Rd - Modified Traffic Signal - Conceptual Phasing - Phase 2

March 10, 2023

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

Jan 30, 2023 - 5:57pm chrisc \\srv-dfs-wa\Projects\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-SGNL.dwg Layout: Fig 2

transpogroup
WHAT TRANSPORTATION CAN BE.



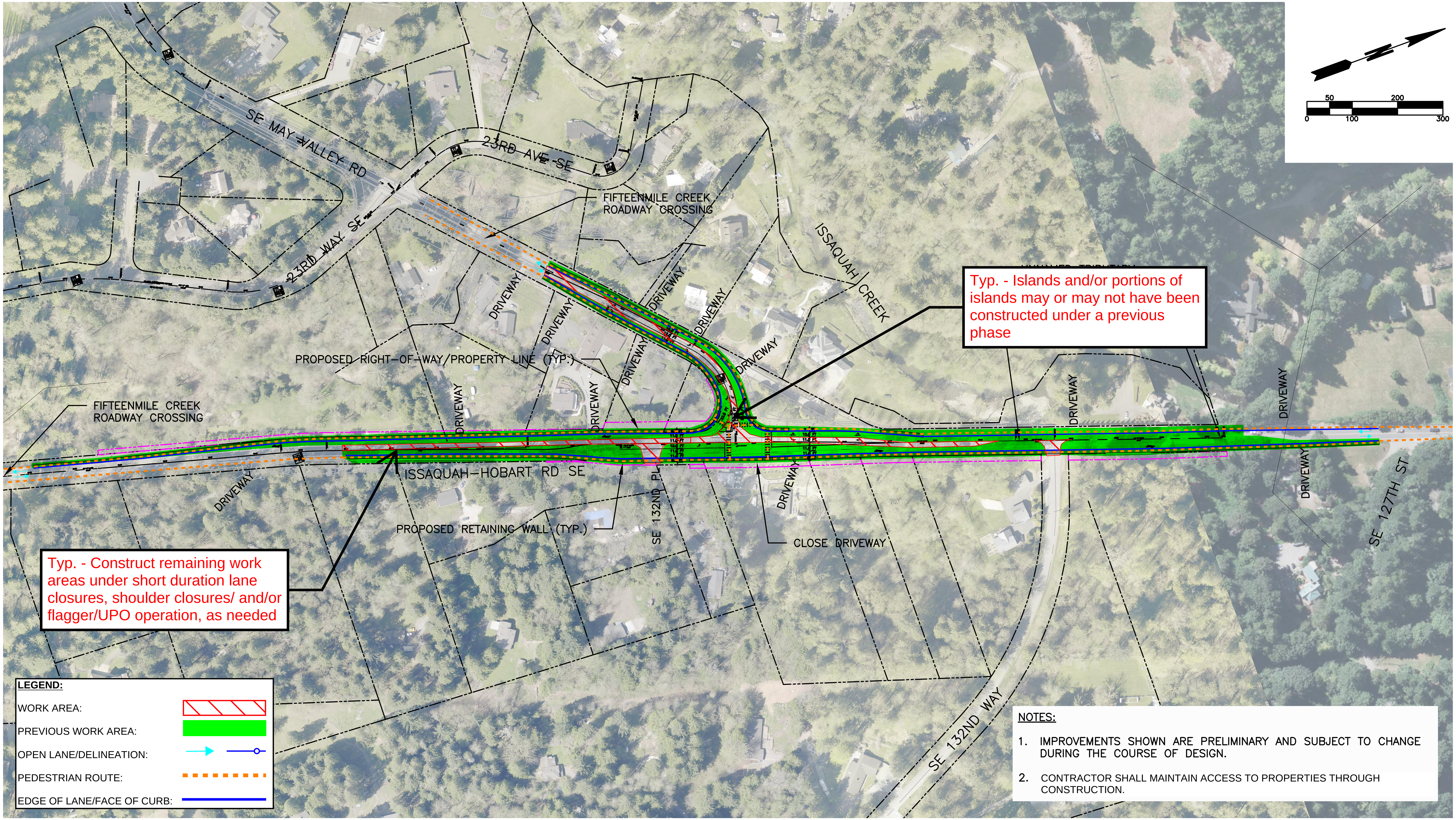
Issaquah-Hobart Rd SE & SE May Valley Rd - Modified Traffic Signal - Conceptual Phasing - Phase 3

March 10, 2023

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

Jan 30, 2023 - 5:57pm chrisc \\srv-dfs-wa\Projects\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-SGNL.dwg Layout: Fig 2

transpogroup WHAT TRANSPORTATION CAN BE.



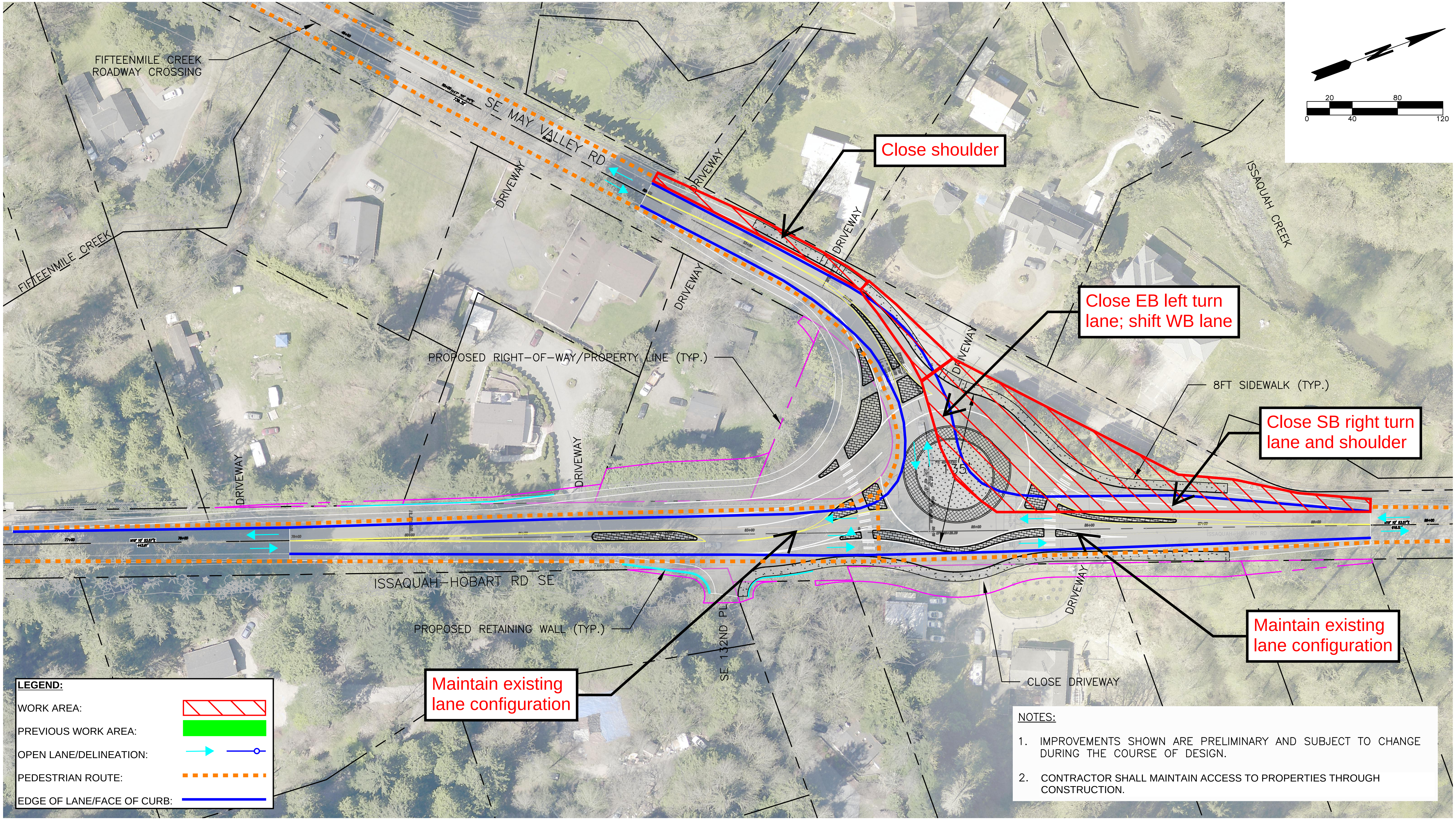
Issaquah-Hobart Rd SE & SE May Valley Rd - Modified Traffic Signal - Conceptual Phasing - Phase 4

March 10, 2023

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

Jan 30, 2023 - 5:57pm chrisc \\srv-dfs-wa\Projects\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-SGNL.dwg Layout: Fig 2

transpogroup WHAT TRANSPORTATION CAN BE.



Issaquah-Hobart Rd SE & SE May Valley Rd - Multi-Lane Roundabout - Conceptual Phasing - Phase 1

March 10, 2023

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

Dec 20, 2022 - 1:51pm victorn M:\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-RAB.dwg Layout: Fig 1

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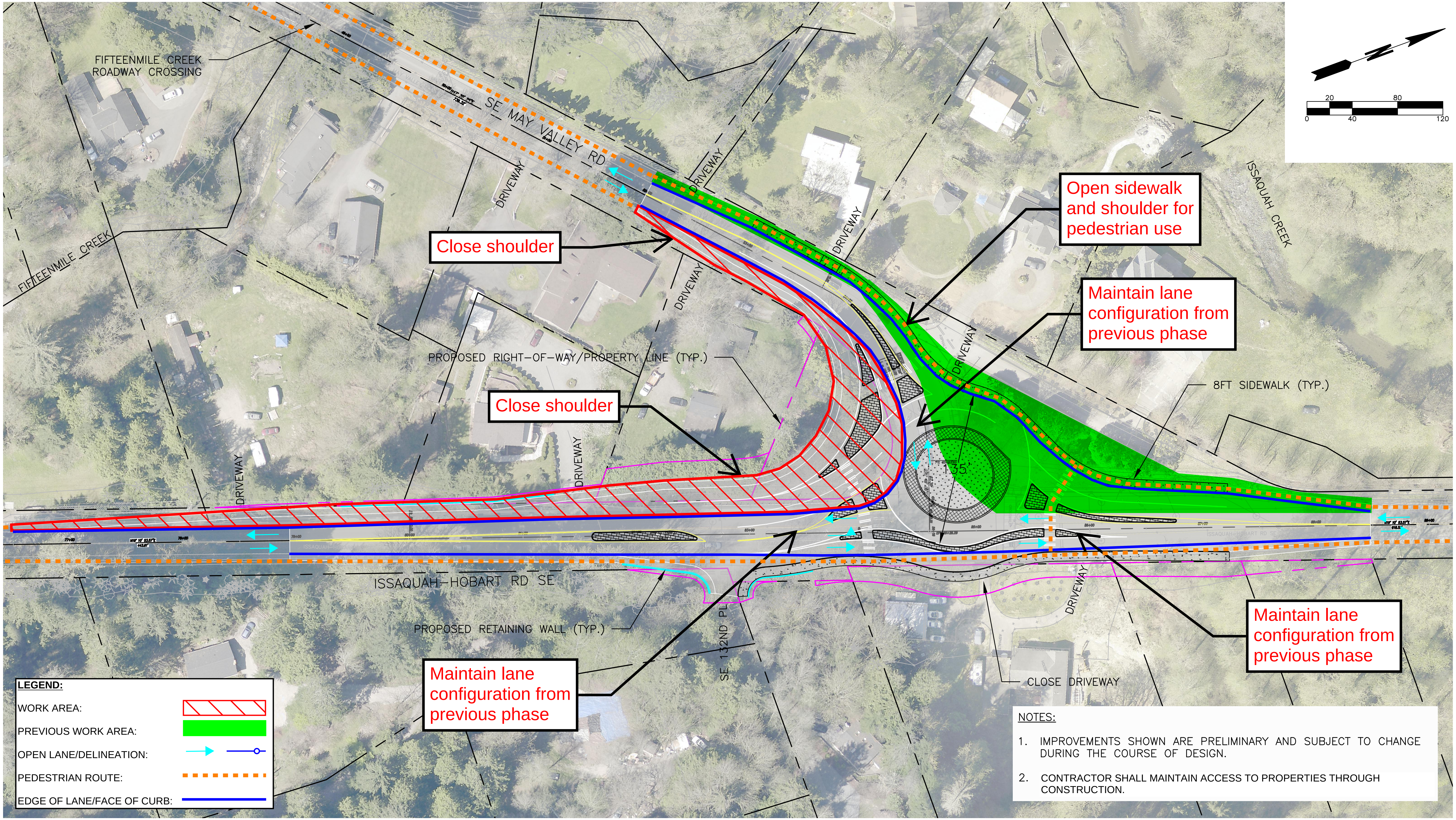


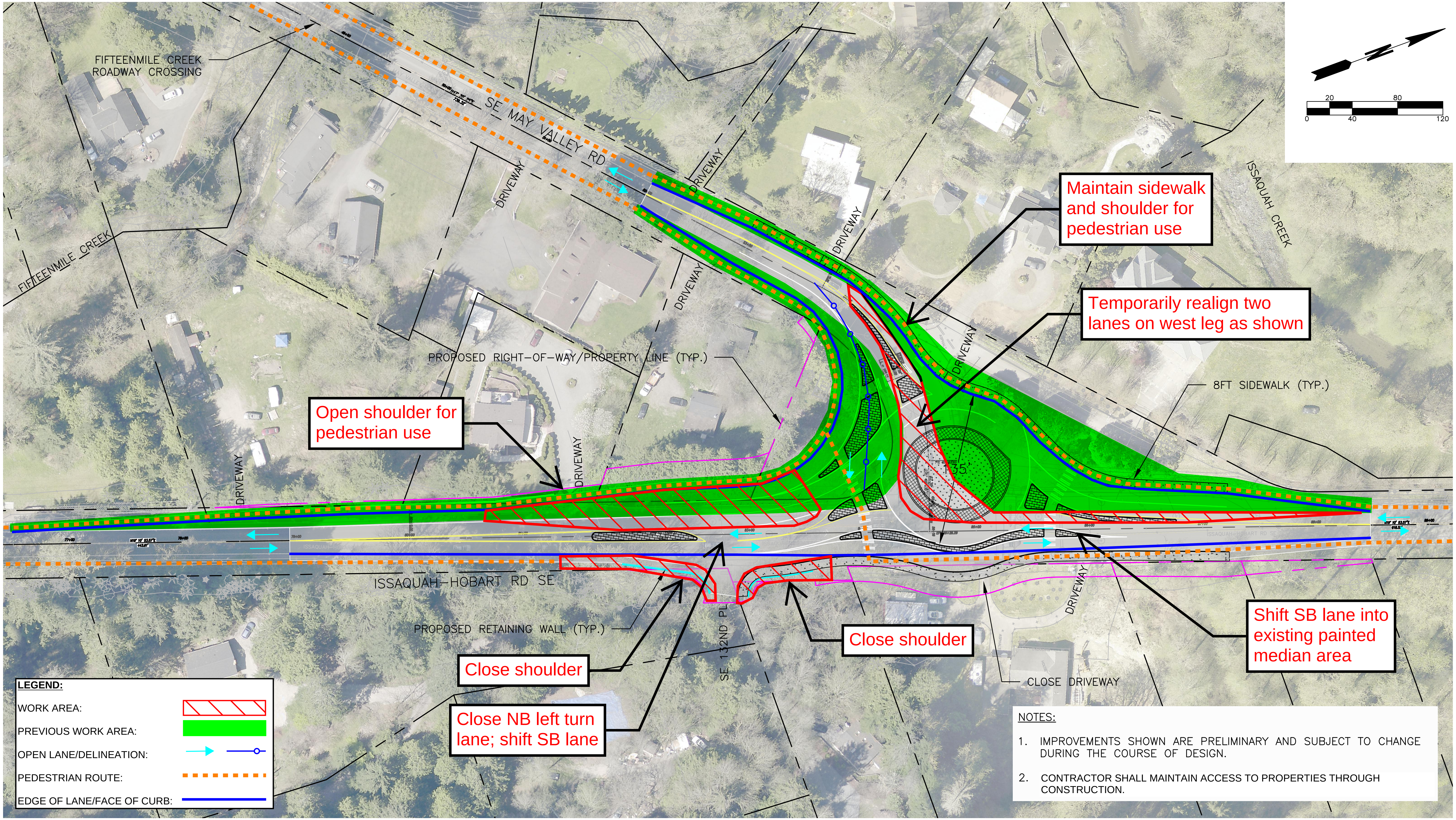
Issaquah-Hobart Rd SE & SE May Valley Rd - Multi-Lane Roundabout - Conceptual Phasing - Phase 2

March 10, 2023

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

Dec 20, 2022 - 1:51pm victorm M:\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-RAB.dwg Layout: Fig 1

transpogroup WHAT TRANSPORTATION CAN BE.



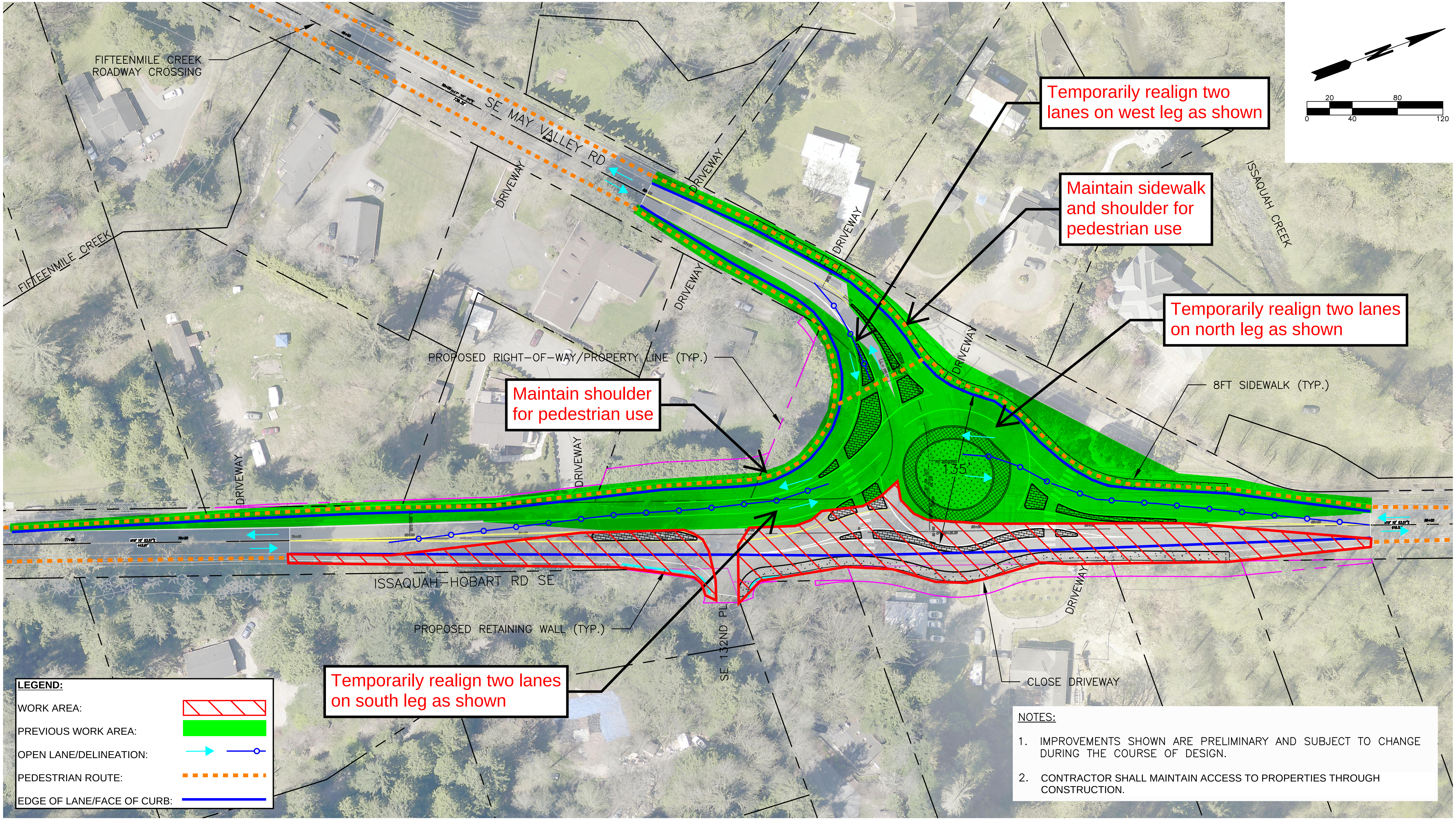
Issaquah-Hobart Rd SE & SE May Valley Rd - Multi-Lane Roundabout - Conceptual Phasing - Phase 3

March 10, 2023

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

transpogroup WHAT TRANSPORTATION CAN BE.

Dec 20, 2022 - 1:51pm victorm M:\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-RAB.dwg Layout: Fig 1



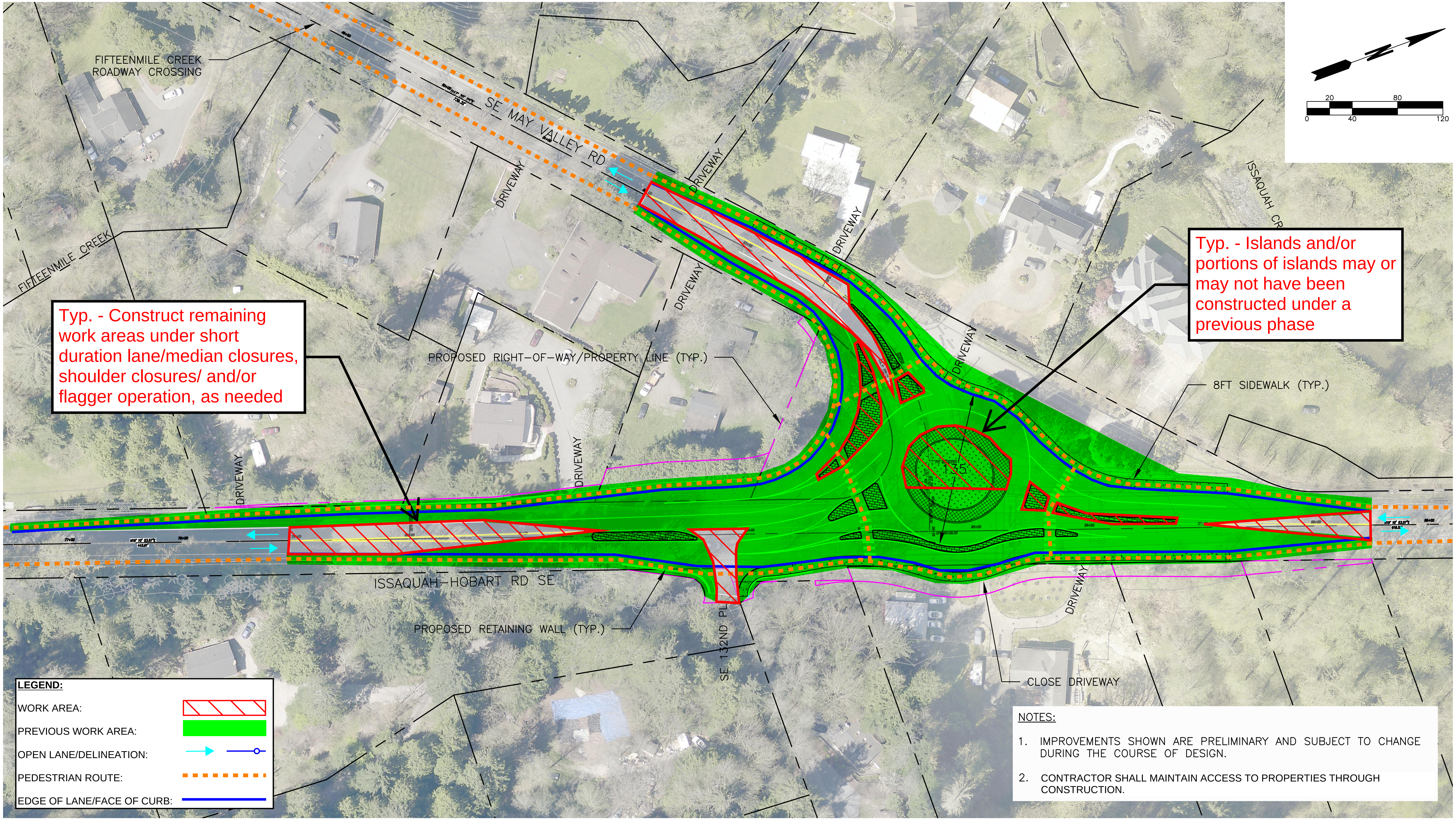
Issaquah-Hobart Rd SE & SE May Valley Rd - Multi-Lane Roundabout - Conceptual Phasing - Phase 4

March 10, 2023

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

transpogroup WHAT TRANSPORTATION CAN BE.

Dec 20, 2022 - 1:51pm victorm M:\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-RAB.dwg Layout: Fig 1



Issaquah-Hobart Rd SE & SE May Valley Rd - Multi-Lane Roundabout - Conceptual Phasing - Phase 5

March 10, 2023

1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements

transpogroup
WHAT TRANSPORTATION CAN BE.

Dec 20, 2022 - 1:51pm victorm M:\21\1.21304.00 - King County Issaquah-Hobart RD SE and SE May Valley Rd Intersection Improvements\Engineering\CAD\Conceptual\21304-TG-CONCEPT-RAB.dwg Layout: Fig 1