

Chapter 2: Introduction and Background

The SR 164 Bypass Feasibility Study is a follow-on planning exercise resulting from recommendations from the State Route 164 Corridor Planning Study (WSDOT, September 2009) to further analyze the feasibility of adding a connector or access road between SR 164 and SR 18 in Auburn.

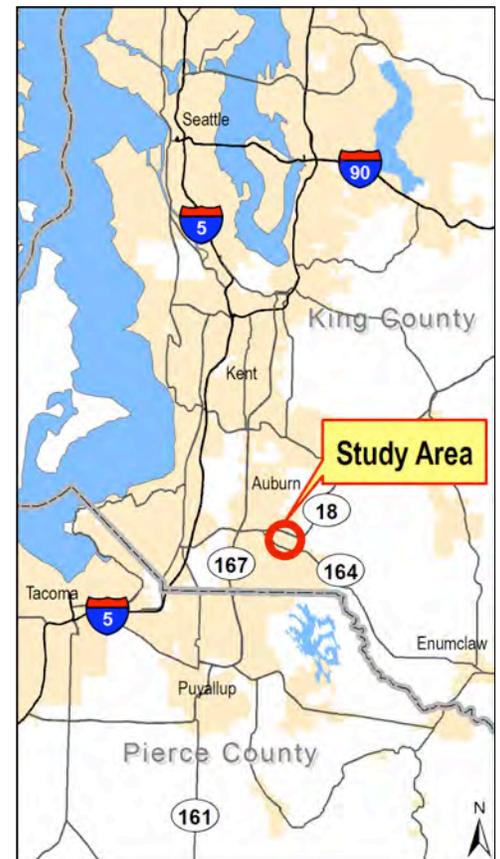
In 2004, the Washington State Legislature provided funding to evaluate potential improvements for SR 164 and recommend projects for implementation. Working with a stakeholders group comprised of representatives from jurisdictions along the corridor, WSDOT developed a list of potential improvements for the SR 164 corridor. The SR 164 Corridor Planning Study documents the process and provides recommendations that address existing and emerging safety, mobility, and preservation needs on a 15-mile stretch of SR 164 from Auburn to Enumclaw. The list of improvements identified in the CPS included a proposed bypass facility between SR 164 and SR 18 in Auburn. Refer to Exhibit 2. for a vicinity map. In 2006, the Legislature provided funding to further analyze this potential improvement option, resulting in this SR 164 Bypass Feasibility Study.

2.1. Purpose of the Study

The SR 164 Bypass Feasibility Study gathered additional technical information, introduced preliminary engineering analysis, and provided cost estimates to identify potential alignments and configurations for a new facility connecting SR 18 with SR 164. The interest in a bypass roadway has been driven by a need to reduce congestion on SR 164, the lack of access options to the plateau, and delay of emergency vehicle response due to congestion on SR 164. An additional benefit could be congestion relief at the SR 164/SR 18 interchange.

The results of this study are two general alignment concepts or bypass themes that could be evaluated in a more detailed alternative selection process, environmental review, and

Exhibit 2.1 SR 164 Vicinity Map



preliminary design effort. Additional alternatives and development of a preferred alternative would be part of a future environmental review process, if additional study on a bypass facility is pursued.

While the geographic focus of this bypass feasibility study is limited to a specific segment of SR 164, the scope of influence would likely be expanded to include impacts and benefits of the bypass options on the larger regional highway system that includes SR 18 and SR 167, if and when a formal environmental review is conducted.

Several project goals and guiding objectives were identified as part of the initial project definition phase to balance environmental, community, and transportation needs. These project goals and objectives included the following:

- Investigate and develop options that address both existing and future operational deficiencies at the key gateway interchange of Auburn Way (SR 164) and SR 18 and along the SR 164 corridor (within the study area) in a manner that is cost-effective.
- Enhance traffic movements and reduce congestion along the SR 164 corridor for all transportation users and conditions within the study area by establishing a new roadway or bypass to connect with SR 18.
- Develop access options that support a safe and efficient regional network and do not negatively impact traffic flow and operations or safety on nearby and adjacent highway facilities, such as SR 18.
- Develop alignments that are acceptable and beneficial to surrounding communities and are sensitive to environmental conditions.

The development of the two alignment options addressed safety, mobility, accessibility, and community and environmental contexts, as outlined below:

- **Safety:** Reduce the severity and frequency of collisions and injuries by proposing an alignment that reduces

conflicts and traffic congestion on SR 164 within the study area.

- **Mobility:** Enhance the performance of the SR 164 corridor within the study area through the addition of a new roadway to connect with SR 18. Mobility improvements should benefit existing and future operations for all transportation users and modes, including transit, freight, emergency vehicles, pedestrians, and other non-motorized uses.
- **Accessibility:** Develop access options that support a safe and efficient regional network. Identify an additional access route to and from the Plateau to improve access for all users, including emergency vehicles (e.g. fire, police, and ambulance).
- **Community and Environmental Context:** Develop an alignment that is acceptable to the surrounding communities and is environmentally sound.

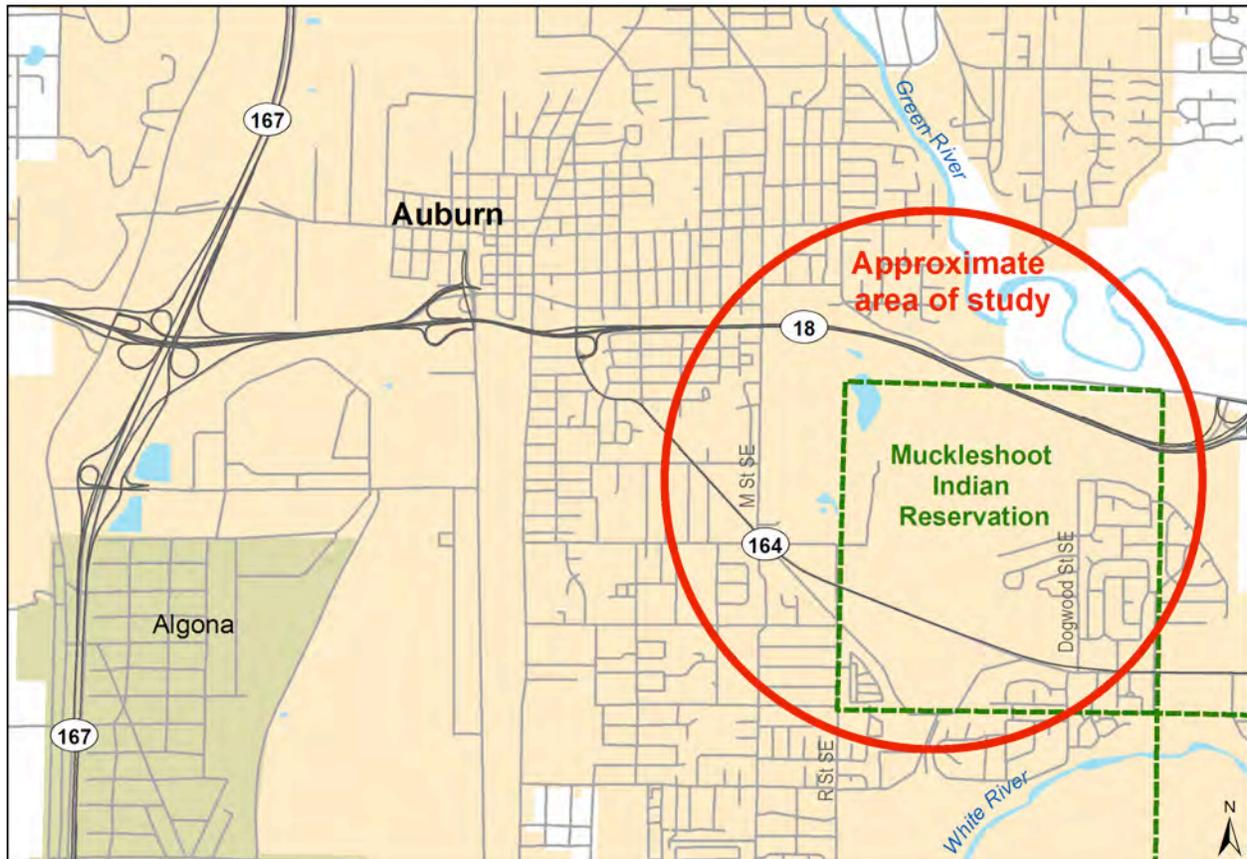
Exhibit 2. provides an overview map of the approximate project study area.

2.2. Description of Study Options

Two alignment options, the Dogwood Option and the Grid Option, were developed and evaluated in this SR 164 Bypass Feasibility Study. These two options are slightly different than the options recommended for further analysis in the SR 164 Corridor Planning Study (WSDOT, September 2009), despite similarities in terms of general connection points and capacity assumptions.

As described in the SR 164 Corridor Planning Study (WSDOT, September 2009), the CWG recommended Bypass Option #1 and Bypass Option #3 for further analysis as the locally-preferred options.

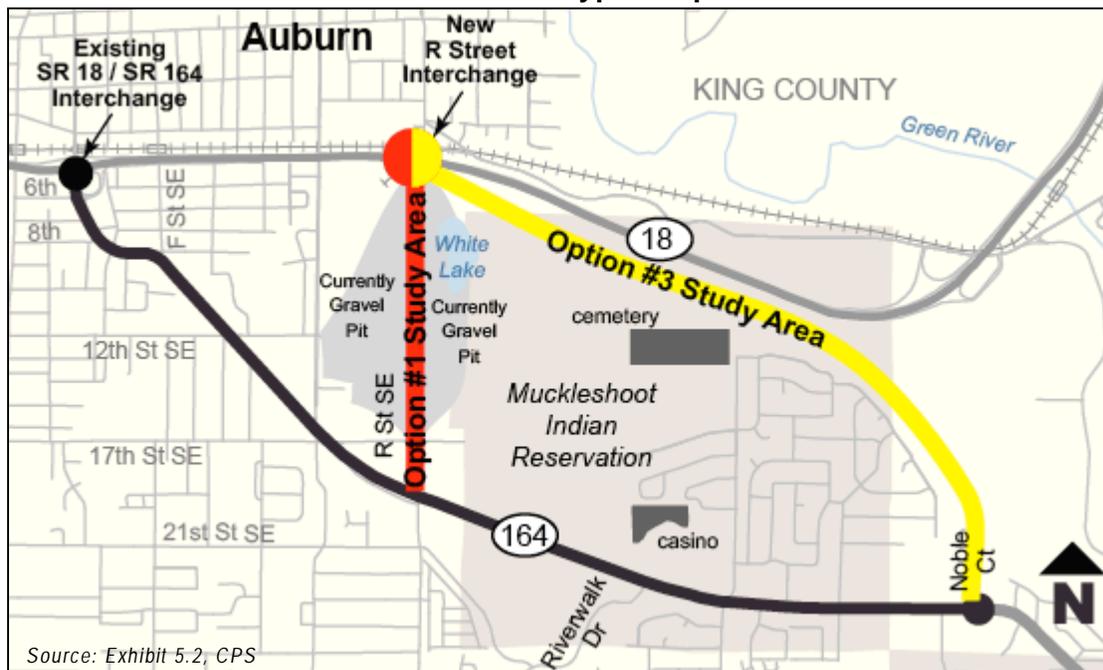
Exhibit 2.2 SR 164 Study Area Map



Option #1 represented the R Street Bypass, which would connect SR 164 to SR 18 via a new grade-separated R Street/SR 18 interchange and a new R Street/SR 164 interchange via R Street. Option #3 was the Noble Court to R Street Bypass, which would connect SR 164 to SR 18 via the Noble Court vicinity and a new R Street interchange. Refer to Exhibit 2. for a map of these proposed options.

Both Option #1 and Option #3 were initially carried into the SR 164 Bypass Feasibility Study. However, based on CWG feedback and internal project team decisions, Option #1 was refined and evolved into the Grid Option while Option #3 was modified to become the Dogwood Option. Additional information on the decisions that led to changes of the original two options into the Dogwood and Grid Options is provided in Section 3.1, Coordination.

Exhibit 2.3 SR 164 CPS Recommended Bypass Options

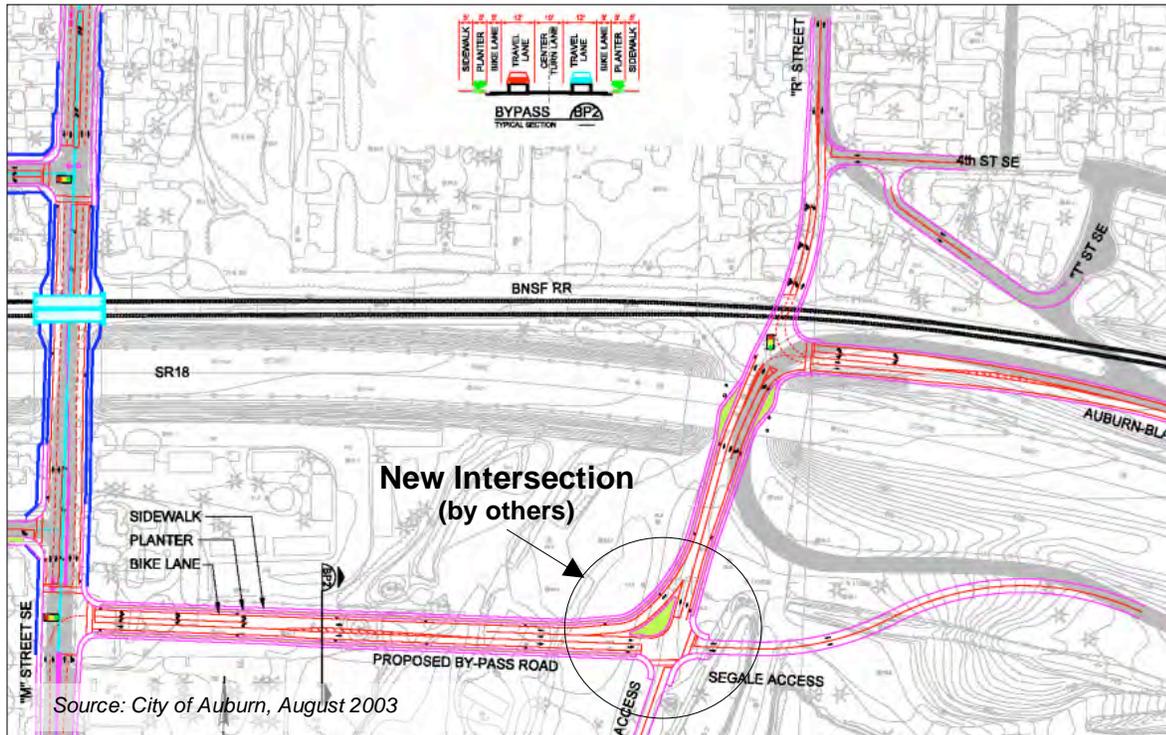


The new SR 18 interchange was assumed to be a full diamond interchange located approximately 1 mile east of the existing Auburn Way interchange (near V Street SE) consisting of a new SR 18 overcrossing with eastbound and westbound on- and off-ramps. This new interchange configuration and location would be the same for both the Dogwood and Grid Options to provide access to and from SR 18. It was assumed for this study that the M Street SE Improvements Project led by the City of Auburn would be constructed. One critical element of the M Street SE Improvements Project would be a new intersection south of the existing SR 18 bridge near R Street (refer to Exhibit 2.4).

2.2.1. Dogwood Option

The Dogwood Option would connect to the overcrossing of SR 18 at a T-intersection, to the new intersection created by the M Street SE Improvements Project to the west, and to a new intersection at Dogwood Street SE to the east.

Exhibit 2.4 M Street SE Improvements Project by the City of Auburn



The Dogwood Option would use the existing Dogwood Street SE roadway south of the new intersection as a part of the new SR 18 to SR 164 bypass. Because traffic volumes associated with a new bypass would warrant additional capacity and more lanes than those existing on Dogwood Street SE, widening of Dogwood Street SE would be required. Refer to Exhibit 2.5 for an overview of the Dogwood Option. For a detailed layout and profile, refer to Appendices A-1a and A-1b.

Exhibit 2.5 Dogwood Option



2.2.2. Grid Option

The Grid Option would create a bypass route from the new SR 18 interchange to an existing signalized intersection at SR 164 and Muckleshoot Plaza. The Grid Option also would provide secondary roadway improvements, including the following:

- R Street SE would be extended from 17th Street SE northward to connect to the new intersection created by the M Street SE Improvements Project.
- 12th Street SE would be extended eastward from M Street SE to the new R Street Extension.

Refer to Exhibit 2.6 for an overview of the Grid Option. For a more detailed layout and profile, refer to Appendices A-2a and A-2b.

Exhibit 2.6 Grid Option





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Chapter 3: Approach

In coordination with the Corridor Working Group (CWG), the SR 164 Bypass Feasibility Study gathered additional technical information, introduced preliminary engineering analysis, and provided cost estimates for a potential future facility that would connect SR 18 with SR 164. The intent of the study was to compare options and identify issues for future consideration. The evaluation and comparison were not intended to result in the recommendation of a single option.

3.1. Coordination

The CWG was formed to help guide the bypass feasibility study effort. The CWG was largely carried forward from the Corridor Planning Study (CPS), with the same jurisdictions and agencies involved. The CWG developed and adopted goals to guide the development of the CPS, so it was beneficial to retain a similar group and provide continuity for this SR 164 Bypass Feasibility Study.

CWG members included the following:

- Steve Taylor, Muckleshoot Tribe
- Dennis Dowdy, City of Auburn
- Rand Black and Chris Searcy, City of Enumclaw
- David Gualtieri, King County
- Robin Mayhew, Puget Sound Regional Council
- Rob Brown and Rick Roberts, WSDOT
- Jean Mabry and Richard Warren, WSDOT

3.1.1. Decisions Prior to CWG Meeting Initiation

The SR 164 CPS recommended Bypass Option #1 and Bypass Option #3 for further analysis as the locally preferred options. Refer to Exhibit 2. in Chapter 2 for a map. Both options were revisited before being carried into the SR 164 Bypass Feasibility Study.

In March 2008, WSDOT reviewed the SR 164 Bypass Feasibility Study area with the City of Auburn and the Muckleshoot Tribe. It was agreed to blend the two

recommended options into one study area for the Bypass Feasibility Study. The resulting study area, shown on Exhibit 3., was a trapezoid area between R Street SE and Riverwalk Drive SE along SR 164 in the south to SR 18 between R Street SE and V Street SE in the north.

The trapezoid area captures a potential interchange with SR 18 at approximately V Street SE (midway between the Auburn Way and Black Diamond interchanges) that would be studied in addition to an interchange at R Street SE. The investigation of the V Street SE location was based on WSDOT's requirement for a minimum 1-mile separation between interchanges (per the *WSDOT Design Manual*, January 2009). V Street is approximately 1 mile from the SR 164/SR 18 interchange, while R Street is approximately 0.8 mile from the interchange. The southern interchange or connection point to and from SR 164 could be at or between R Street SE and Riverwalk Drive.

Based on the early discussion, some concerns were noted that Option #3 could affect the tribal cemetery and the hillside above SR 18 (north of the cemetery), which may have a high probability of archaeological findings. Additionally, the hillsides above SR 18 have very steep slopes, contributing to design and environmental concerns. Limiting the bypass options to the trapezoidal area avoids the cemetery and most of the steep-slope regions.

Based upon guidance from WSDOT and the CPS Summary Report, two alignment options were developed for discussion in the first CWG meeting in September 2008.

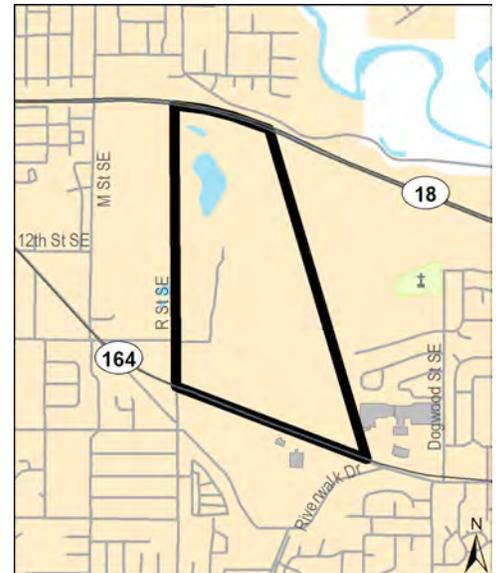
3.1.2. CWG Outcomes

Three meetings of the Corridor Working Group were held between autumn 2008 and spring 2009.

3.1.2.1 CWG #1, September 2008

The first CWG meeting was held on September 9, 2008. The meeting objectives included selecting conceptual alignment options for evaluation. For CWG meeting summaries, refer to Appendix G.

Exhibit 3.1 Initial Area of Consideration for Bypass Alignments



Steep slopes are present along the hillside south of SR 18

Two alignment options were presented for discussion:

- R Street Option: This option would use the existing undercrossing of SR 18, create a new interchange at R Street SE, and provide the missing link in R Street SE from approximately SR 18 to 17th Street SE (Exhibit 3.).
- One Mile Separation Option: This option would construct a new undercrossing of SR 18 at approximately V Street SE and connect to SR 164 at Riverwalk Drive (Exhibit 3.).

Exhibit 3.2 R Street Option



Exhibit 3.3 One Mile Separation Option



Interest in a third option, a No-Bypass Option that would reflect operational improvements at the SR 18 interchange, was also expressed. CWG members contributed additional alignment recommendations and the CWG had a productive discussion regarding potential alignments at the southern end of the proposed options (Muckleshoot Plaza, Riverwalk Drive/Casino Drive, Dogwood Street), right-of-way issues, property ownership, casino access, and the future development of tribal land. The importance of connectivity between the proposed SR 164 Bypass and 12th Street SE and 17th Street SE

also was discussed in the context of providing greater roadway network redundancy.

The CWG removed a southern connection point at the intersection with Riverwalk Drive/Casino Drive from further consideration due to geometric constraints (e.g., insufficient right-of-way and steep-grade issues) and intersection spacing requirements. The proposed location for the southern terminus of the two alignment options would be at the existing signalized intersection at Muckleshoot Plaza (location of the Bingo Hall and Smoke Shop). The R Street SE option would include access to 12th Street SE (via a new extension), but 17th Street SE would not be extended east of R Street SE to the new bypass alignment because of geographic and topographic constraints as well as future land use development uncertainties.

3.1.2.2 CWG #2, October 2008

The second CWG meeting was on Tuesday, October 28, 2008. Its primary purpose was to review and establish the bypass alignment options to carry forward for technical study and documentation.

Tribal Concerns

After the first CWG meeting in September, the designated CWG tribal representative discussed the proposed alignments with the Muckleshoot Tribal Council and property owners. The tribe was not supportive of a bypass that would affect R Street SE between 17th Street SE and SR 164 because of potential negative impacts the alignment could have on tribal residents living there. The council also stated that it did not support this bypass option since it would extend through the parcel west of the Muckleshoot Casino that is managed by a tribal trust, referred to as the King George property (refer to Exhibit 3.).

The consultant commissioned by the Tribe for engineering services presented an alternative alignment option (Exhibit 3.) that would not pass through the King George property or connect to the intersection at Muckleshoot Plaza. The new

Exhibit 3.4 King George Property



alignment would include a bypass roadway that heads southeast from either the proposed One Mile Separation or R Street Interchanges to connect to a new roundabout south of the cemetery at Dogwood Street SE and continue down that street to the existing traffic signal at SR 164.

Exhibit 3.5 Preliminary Dogwood Alignment



Need for the Project

The need for the SR 164 bypass roadway was discussed, including the possibility that a No-Action alternative could be the most viable path forward. A new bypass roadway, if built, would not be a new state route, but a local road.

The need for the bypass is related to reducing congestion on SR 164 (Auburn Way S.), the lack of redundant access to the plateau, and delay of emergency vehicle response due to

congestion on SR 164. A bypass route would provide a much-needed alternative and could reduce delays at the SR 164/SR 18 interchange.

Design Standards

WSDOT's King Area Assistant Traffic Engineer noted that a new interchange should be at the one mile separation location and not the R Street option location. The group agreed that a new interchange at SR 18 for the proposed new alignments should be at the one mile separation location.

Selected Conceptual Alignments

The three options that the group agreed to advance for further study were:

1. One Mile Separation Option with connection to R Street between 12th and 17th Streets SE to SR 164 (Exhibit 3.)
2. One Mile Separation Option with Dogwood Street Alignment (Exhibit 3.7)
3. SR 18/SR 164 Interchange Reconfiguration (No-Bypass Option)

3.1.2.3 CWG #3, March 2009

Based on decisions made at the second CWG meeting, two bypass options – the Dogwood and Grid Options – were studied and evaluated. These options were reviewed in detail at the third and final CWG meeting on March 24, 2009. These are the same two options that were evaluated and documented in this report. The previously proposed third option (No-Bypass Option) that included improvements at the existing SR 18/ Auburn Way interchange was also investigated based on previous traffic analysis related to potential SR 164 widening and interchange-ramp modifications. This option was removed from further consideration due to analysis findings (from previous and follow-on work) that suggested the improvements associated with this alternative would not provide reasonable

Exhibit 3.6 Revised One Mile Separation Option with Connections



Exhibit 3.7 Revised One Mile Separation Option with Dogwood Street Alignment



levels of traffic congestion relief. Confirmation of the decision to remove this option was made at the third CWG meeting.

The group acknowledged that both of the bypass options carried forward may not be acceptable to all in the group due to stakeholder-specific issues.

The main purpose of the third CWG meeting was to review the preliminary findings of the No-Bypass option and the two bypass options alignments. Elements of this review included the following:

- Traffic modeling and operational analysis of the Baseline (No-Action) alternative, the two bypass options, and the No-Bypass (SR 18/SR 164 interchange improvements) option.
- Potential environmental effects, constraints, and implementation issues for three options.

In addition, the evaluation measures (described in Section 3.3, Evaluation Criteria) were discussed and refined.

3.1.3. Other Decisions

A No-Bypass Option that targeted improvements at the existing Auburn Way/SR 164 interchange was originally discussed in early CWG meetings. The intent of this option was to ensure that the study would consider improvements that do not preclude non-bypass congestion relief measures (those that do not require a new access point on SR 18 or SR 164).

Previous analysis included as part of the SR 164 CPS examined a potential six-lane segment for SR 164 from the Auburn Way interchange to approximately M Street SE. The findings of this analysis indicated that a six-lane section would not be sufficient to handle future traffic growth along the corridor. Follow-up analysis by the project team confirmed the CPS findings and also identified other significant challenges related to potential future improvements at the existing Auburn Way interchange. The project team concluded the following:

- Capacity improvements at the Auburn Way/SR 164 interchange, while potentially effective in relieving some ramp-related traffic movements, would likely shift congestion from the interchange to points along SR 164 (little to no net change in congestion).
- Widening SR 164 (exclusively) from the Auburn Way interchange to M Street SE may enhance some travel patterns in the affected segment. However, the interchange would constrain the ability of the corridor to serve larger regional demands.
- Even with a combined approach of improving the existing interchange *and* widening the SR 164 corridor (to M Street), congestion levels would remain high at critical intersection points, such as the ramp termini.
- Major improvements at the Auburn Way interchange would require costly right-of-way acquisitions and may prove infeasible due to geometric requirements of a new (more conventional) interchange configuration.

The project team discussed these conclusions at length and conveyed these findings to the larger CWG. The project team

then determined that the conclusions, analysis findings, and supporting feedback from the CWG were sufficient grounds for removing the No-Bypass Option from further consideration. The final decision to remove this option was made at the third and final CWG meeting.

3.2. Methodology

Selecting and evaluating alignment options for the SR 164 bypass entailed the following process, working in coordination with CWG members:

1. Compiling and analyzing existing and projected conditions for traffic, existing roadway design compared to current design standards, the surrounding built and natural environments, and future population and employment growth.
2. In consideration of the above factors, identifying and developing alignment options in accordance with project goals.
3. Evaluating and comparing alignment options.
4. Documenting the findings of the evaluation.

The intent of the evaluation was to compare the options and identify issues for future consideration. The evaluation was not intended to result in the recommendation of a single option. Additional examination of alternatives and a preferred alternative would be developed as part of the environmental review process.

3.2.1. Traffic

The assessment of traffic analysis for the SR 164 Bypass Feasibility Study builds on the previous work conducted for the SR 164 Corridor Planning Study (WSDOT, September 2009). This traffic analysis followed a conventional planning analysis approach, which included basic data collection, an investigation of existing roadway and peak-hour traffic conditions, forecasts of future trip generation patterns, and analysis of future operational impacts and benefits. Most background data were taken from the previous analysis



Traffic along SR 164

conducted for the SR 164 Corridor Planning Study (WSDOT, September 2009). Additional data required for the traffic analysis were provided by the City of Auburn.

Although these data served as a sufficient foundation for conducting the analysis, refinements and/or further data collection were required to tailor the information to the specific context of the study area for this project. The additional data collected as part of this reconnaissance task were primarily related to cross-checking lane geometry along SR 164 and confirmation or updates to the existing signal system in the study area along SR 164.

After making refinements to the available background data, existing traffic conditions were examined through the use of the simulation analysis tool Synchro, which is the same tool used for the SR 164 Corridor Planning Study (WSDOT, September 2009). SimTraffic was integrated with Synchro to analyze intersections on the corridor. It provided validation for the analysis of new intersections.

The study area included intersections along SR 164 from the existing SR 164/SR 18 interchange up to SR 164 and Dogwood Street intersection in the east.

Future long-range 2030 Baseline peak-hour traffic forecasts for key intersections within the study area were then developed using the forecasts from the King County travel demand model. Growth rates between existing (model-generated) volumes and future 2030 forecasted volumes were applied to existing traffic counts to arrive at future intersection-level AM and PM peak-hour volumes.

Using the refined forecasted volumes and distribution patterns for the two bypass scenarios, future peak-hour traffic conditions were investigated for the two potential bypass options through further detailed operational analysis.

Additional traffic analysis would follow future design changes as alternative development continues.

Synchro is a traffic analysis tool developed by Trafficware. It is a macroscopic analysis tool used to analyze intersection/arterial traffic operations.

This tool also features optimization of intersection signal timings to obtain optimal signal cycle lengths, splits and offsets.

SimTraffic is a microscopic simulation tool that is integrated with Synchro and is used to analyze networks of signalized and unsignalized intersections including roundabouts that are not easily modeled macroscopically.

SimTraffic is especially valuable when analyzing closely spaced intersections, visual estimation of traffic backups/queues and operation of intersections under heavy congestion.

3.2.2. Environmental

The study area for the SR 164 Bypass Feasibility Study includes the area within approximately 500 feet of the project improvements for each of the two alignment options. The study area was reviewed for potential environmental effects and constraints that should be considered in the design option selection process. State and local data, maps, and reports were reviewed to establish the existing conditions and study context. A windshield survey of the study area was performed to verify the information that was collected.

The environmental review is divided into built and natural elements identified within the study area and is described in Chapter 4 for each of the two project design options.

Details are provided with the analysis methodology of each resource when the study area deviates from a 500-foot radius. If the footprint of a design option is located within the study area or near an area of concern as identified by GIS mapping, existing documentation, or field visits, the issue is identified and discussed. The evaluation focus is on differentiating the options and calling out any areas of potential environmental concern.

The analysis is based on information available at the time of the study. While the resulting assessment can be incorporated into future environmental documentation, additional project-level analyses will be required to complete the environmental review process.

3.2.3. Design

Three major components were conceptually designed in this study: the new SR 18 interchange, the Dogwood Option, and the Grid Option. The interchange and bypass/arterials were designed to standards per the *WSDOT Design Manual* (January 2009). Further analysis would be required as the design progresses to examine other options or refine these conceptual designs.

The location of the new SR 18 interchange was established according to the 1-mile separation that is required between



Surface water in the gravel mining site



Study area terrain includes natural and man-made steep slopes

interchanges. The proximity of the Burlington Northern Santa Fe Railroad and Auburn-Black Diamond Road north of SR 18, as well as the steep slopes south of SR 18, shaped the configuration of a diamond interchange with retaining walls. The steep slopes south of SR 18 also influenced the decision to design an overcrossing for the interchange.

The bypass alignments were designed to accommodate the existing topography and environmentally sensitive areas while maintaining design standards. The existing terrain in this study area includes steep slopes and elevations that vary from 90 to 280 feet, so the alignments were placed to minimize excessive amounts of excavation or embankment. The absence of existing developments in this study area provided sufficient clearance to grade for either of the bypass options. The Dogwood Option uses the existing Dogwood Street SE as part of the bypass to avoid disturbing the King George property and other specific tribal properties.

3.3. Evaluation Criteria

A set of criteria were developed by the project team to evaluate potential impacts and benefits associated with options identified in this study. These criteria are based on: 1) project goals and objectives, 2) the operational performance of each alignment option, and 3) potential environmental effects of each option.

The evaluation criteria provided a framework for assessing how well the options would improve safety, affect mobility and access, establish sufficient community support, affect the environment, and construction cost.

3.3.1. Mobility and Access

3.3.1.1 Traffic Operations

Traffic operations were represented by two primary measures, level-of-service (LOS) and point-to-point travel time. LOS, as presented in the 2000 Highway Capacity Manual (HCM), is used as the general measure of traffic operations for various transportation facilities ranging from freeway segments to pedestrian crosswalks. For signalized intersections, LOS is

specifically represented by average vehicle delays (seconds per vehicle) with grades of A through F that reflect low to high levels of delay and congestion, respectively. Travel time was measured between one or more sets of defined points within the transportation system and reflects average running speeds, delays at intersections, and queue effects due to traffic congestion.

3.3.1.2 Consistency with State Access Management Master Plan

This category assesses each option's consistency or inconsistency with the Access Management Master Plan – in this case, how well the option meets the access control requirements. Access management is defined in the *WSDOT Design Manual* as “the systematic regulation of the location, spacing and design, and operation of driveway, city street, and county road connections to state highways.”

SR 164 is classified as Managed Access Class 5 from SR 18 to R Street and Managed Access Class 4 from R Street to Poplar Street. However, SR 18 through central Auburn is classified as a Limited Access Full Control Facility. This classification was obtained from the WSDOT database, “Access Control Tracking System Limited Access and Managed Access Master Plan,” available at www.wsdot.wa.gov/design/accessandhearings.

Because the two bypass options would connect to SR 164 (in the south end) and SR 18 (in the north end), potential impacts to access control along SR 164 and SR 18 at the new interchange will be qualitatively assessed in this study and/or future environmental reviews.

3.3.2. Community Support

This category identifies agency and community support for a particular alignment option. Support was gauged through the participants of the Corridor Working Group. Local agencies provided initial community support opinions with regard to general project design. The formal community involvement process for the project would occur in the environmental phase during the project's alternative analysis.

3.3.3. Environmental

The built and the natural environments were evaluated in the context of potential environmental effects of project options identified in this study. If the footprint of a design option would be within or near an area of concern as identified by GIS mapping, existing documentation, or field visits, the issue was identified and discussed. The focus of the evaluation was on differentiating the options and calling out any areas of concern as applicable.

3.3.3.1 Built Environment

The built environment includes an assessment of the potential for effects on land use, tribal lands, farmland, public facilities, utilities, environmental justice populations, hazardous materials, air, and noise.

Additional consideration was given to assessing historic, cultural, and archaeological resources for this project since design options include tribal land. The evaluation was based on whether the footprint of potential roadways would cross or come close to areas where historic, cultural, or archaeological resources could be encountered, as identified by existing documentation and input from the Muckleshoot Tribe.

3.3.3.2 Natural Environment

This category identifies potential effects on plants and animals (wildlife and habitat), water resources such as surface water and wetlands, groundwater, and geologic hazard areas.

3.3.4. Right-of-Way Acquisitions and Residential/Business Displacements

Right-of-way acquisitions and residential/business displacements are generally evaluated as part of the built environment in NEPA documents; however, for ease of reference these elements are being considered separately from the built environment in this report.

This category measures the amount of additional right-of-way required to complete each of the proposed options. The areas are based on an estimation of private property required by a



Open space located adjacent to White Lake Cemetery, on Dogwood Street SE

concept's footprint measured in square feet of parcels affected (complete or partial parcels) for each option.

3.3.5. Construction Cost

This category measures the potential construction costs of the bypass options. Cost estimates are based on a specific set of construction elements for each option. These planning-level cost estimates are provided in 2009 dollars to demonstrate one method of differentiating the options and are not meant to provide programmatic budget estimation.

The construction costs cover broad categories such as preparation, grading, drainage, structures, and various traffic-related items. Engineering design and operations and maintenance (O&M) costs were used if suitable information was available. At this level of conceptual design, a conceptual design contingency is provided for items yet to be identified or designed in detail.

The resulting cost summaries for each option are intended to provide a relative basis for comparison – they are not deemed suitable as stand-alone estimates for design purposes or for determining funding requirements.

3.3.6. Cost-Effectiveness

The effectiveness of each option for meeting or achieving the goals and objectives related to traffic congestion reduction was measured through a general cost-effectiveness comparison of travel-time savings and construction cost. Cost-effectiveness was a useful and straightforward tool for providing a relative “value” comparison of the options by describing the potential performance benefits of each option in the context of projected costs.

A discussion of each option's effect on each of these criteria is included in Chapter 5.



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Chapter 4: Analysis

This chapter describes the potential effects and associated benefits and issues for each of the bypass options if built. An overview of existing conditions is provided for background information.

4.1. Traffic

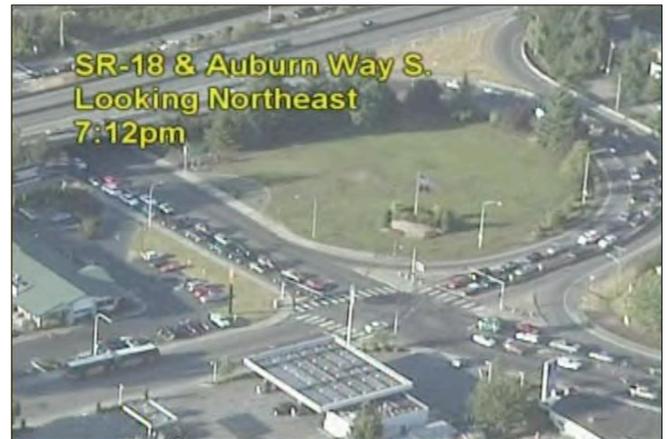
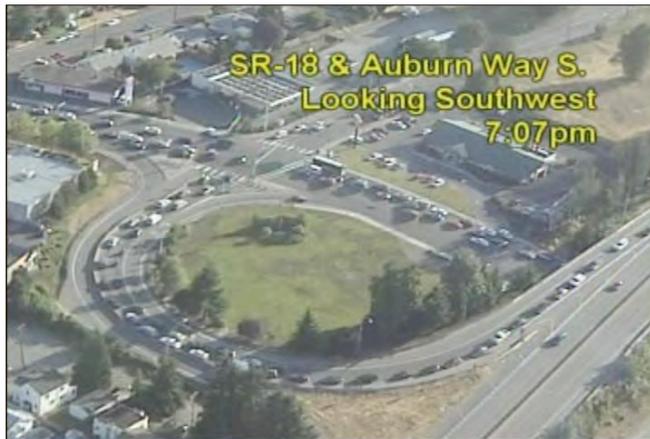
4.1.1. Existing Conditions

SR 164 is a key corridor serving east-west traffic from the City of Auburn to and from the Enumclaw Plateau. Currently, this corridor experiences moderate-to-severe traffic congestion during the morning and evening commute hours, primarily as a result of serving several travel markets throughout the region and the lack of alternative roadway facilities in the area. The interchange at SR 18 and Auburn Way is a well-known gateway and choke point for the SR 164 corridor. Backups on both SR 164 and SR 18 approaching this junction are frequently observed during heavy weekday traffic periods. High levels of traffic congestion at other hotspot locations on SR 164 have been observed as well.

The peak direction along SR 164 varies by time of day – during the typical AM peak commute period, traffic volumes are heaviest in the westbound direction traveling toward the SR18/SR164 interchange. During the PM peak commute period, the heaviest through volumes are in the eastbound direction. The SR 164 corridor often experiences breakdown or failing traffic conditions during concert events (typically during summer) at the White River Amphitheater located east of the study area.

Exhibit 4.1 shows two photographs of traffic backups at the current SR 164/SR 18 interchange taken prior to a concert at the White River Amphitheater in July 2003. While backups of this magnitude are frequent during such events, the focus of the operational analysis for this bypass feasibility study was on weekday peak-period conditions.

Exhibit 4.1 Backups prior to an Amphitheater Event



Although this report refers to a study area that is confined to where the bypass would be located, the traffic impacts were analyzed for an expanded zone along SR 164 to capture the traffic diversion patterns that would occur with a potential bypass option. The study area for the purposes of the traffic analysis is comprised of intersections along SR 164 extending from the current SR 18/Auburn Way interchange in the west to approximately Dogwood Street in the east.

If one of the bypass options is carried forward for further analysis, traffic impacts to SR 164 past Dogwood Street will likely need to be evaluated. This is because a longer peak period might impact unsignalized intersections beyond Dogwood Street. Impacts east of Dogwood Street may be mitigated with the improvements to widen SR 164 to Academy Drive that are proposed in the SR 164 Corridor Planning Study.

The following eight signalized intersections along SR 164 were selected for evaluation and detailed traffic operational analysis as they relate to existing conditions:

- SR 164 and SR 18 Westbound (WB) Ramps
- SR 164 and SR 18 Eastbound (EB) Ramps
- SR 164 and F Street SE
- SR 164 and 12th Street SE
- SR 164 and M Street SE
- SR 164 and Muckleshoot Plaza

- SR 164 and Riverwalk Drive (Casino Drive)
- SR 164 and Dogwood Street SE

Traffic operations on SR 18 (due to the new interchange at the bypass facility under the two bypass options) were not analyzed as part of this study but would be analyzed as part of any future detailed environmental and design study for this project in the future.

4.1.1.1 Data Collection and Refinement

Most of the input data for the technical analysis were obtained from the previous SR 164 CPS traffic analyses. The existing conditions data that were used from the previous study consisted of peak-hour intersection traffic volumes, signal timing data, roadway geometry, lane configuration, and heavy vehicle volumes.

As part of the field investigation process, a digital photo library was developed to serve as a reference tool for data verification. Some lane geometry data based on the digital photos were also modified to accurately match existing conditions in the field.

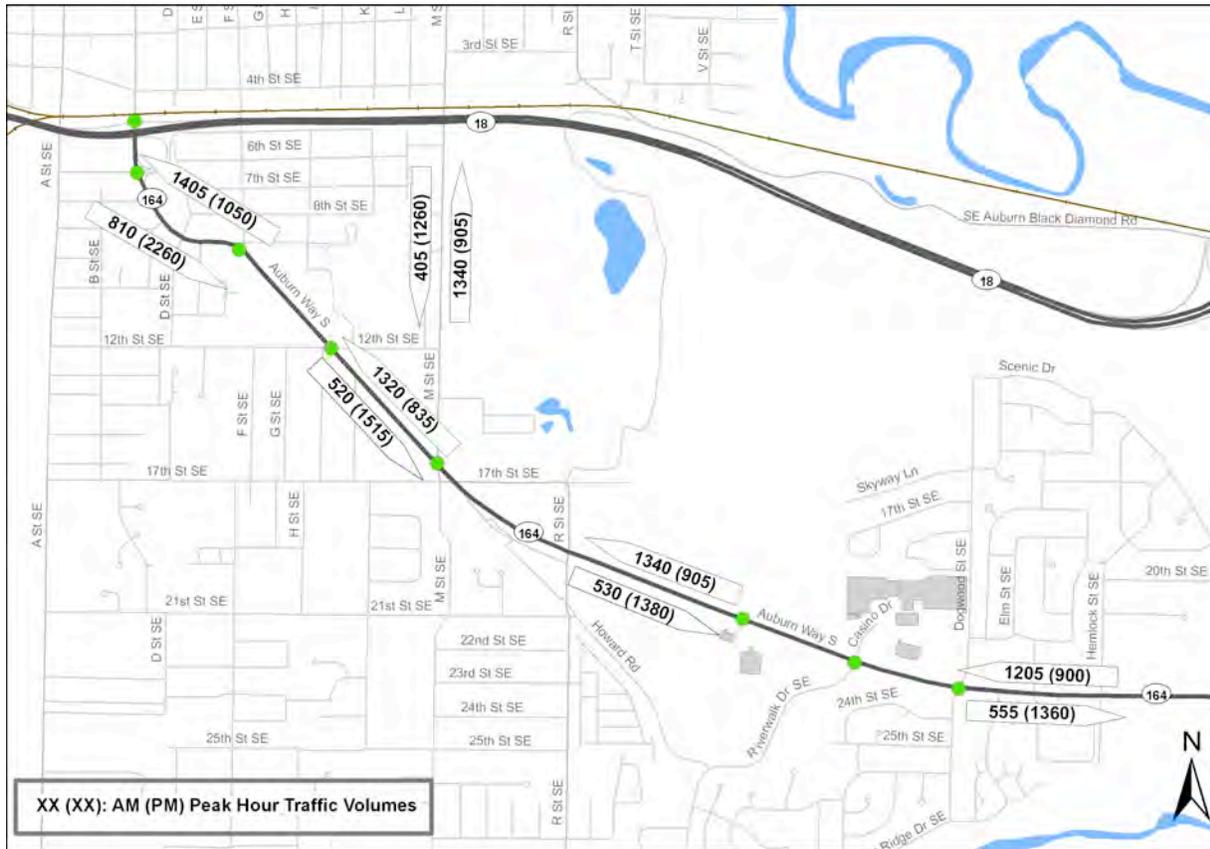
4.1.1.2 Peak-Hour Volumes

AM and PM peak-hour volumes for the eight targeted study intersections along SR 164 were obtained from the SR 164 CPS. These volumes were further updated based on the latest data received from the City of Auburn. Existing traffic count data for the analysis primarily reflected 2007 traffic conditions for the AM peak hour (8 to 9 AM) and PM peak hour (5 to 6 PM). Minor data refinements and post-processing were needed for the traffic count data to ensure reasonable consistency between intersections. The peak direction of traffic varies with the time of the day. The peak direction in the AM peak is the WB traffic on SR 164 heading to the SR 164/SR 18 interchange and vice versa in the PM peak. The intersection-level approach volumes for the AM and PM peak hours are shown in Exhibit 4.2 for a few selected locations in the study area.



Four lane section of SR 164 east of R Street SE

Exhibit 4.2 Existing Peak Hour Approach Volumes



4.1.1.3 Intersection Delay/Level-of-Service (LOS) Analysis

Operational analysis of AM and PM existing peak-hour conditions was performed for each of the eight study intersection locations using Synchro analysis software (version 7.0). The Synchro analysis was performed to determine LOS, which is a general measure of congestion for transportation facilities such as intersections and arterials.

LOS is a measure that characterizes the operating conditions expected by a driver or facility user of a highway, street, or other transportation facility. It is based on measures such as traffic density, average speed, or average vehicle delay. A range of six LOS designations, from “A” to “F,” is defined in the Transportation Research Board’s 2000 *Highway Capacity Manual* (Transportation Research Board 2000). LOS A represents ideal, uncongested operating conditions, while LOS F designates extremely congested or breakdown conditions.



Southbound queues at M Street SE

LOS B through LOS D designate intermediate operating conditions, while LOS E denotes congested conditions at the point of maximum service rate (i.e., near or at capacity).

The intersection analysis results in terms of average vehicle delays and LOS for the existing conditions are summarized in Exhibit 4.3. The results show that the study area reflects average delays from free flow conditions to failing conditions at certain locations along the study corridor.

Exhibit 4.3 Existing (2007) Conditions Delay/LOS Summary

Intersection Location on SR 164	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
SR 18 Westbound Ramps	14.5	B	128.8	F
SR 18 Eastbound Ramps	40.5	D	140.4	F
F Street SE	6.3	A	9.9	A
12th Street SE	6.2	A	20.4	C
M Street SE	69.7	E	80.4	F
Muckleshoot Plaza	4.3	A	17.3	B
Riverwalk Drive/Casino Drive	17.1	B	26.5	C
Dogwood Street SE	12.9	B	10.1	B

In the AM peak hour, three of the eight study intersections currently operate at LOS A, three intersections at LOS B, one intersection at LOS D, and one intersection at LOS E.

Locations with the highest delays include the intersection of SR 164 and M Street SE. Results for the PM peak hour indicate one of the eight intersections at LOS A, two intersections at LOS B, two intersections at LOS C, and the remaining three intersections at LOS F. The PM peak hour traffic experiences higher delays compared to the AM peak hour, especially at the SR 164/SR 18 interchange and at the M Street SE intersection. The detailed intersection level turning movement volumes along with delay/LOS data are provided in Appendix B-2.

4.1.2. 2030 Baseline Forecasts

Future year AM and PM peak-hour traffic forecasts for the 2030 Baseline scenario were developed using the King County travel demand model used previously for the SR 164 CPS analysis. The 2030 Baseline highway network was reviewed and screened to



Eastbound PM peak hour queues at M Street SE

ensure appropriate link attributes were coded in the SR 164 study area. The link attributes included number of lanes, free flow speed, and capacity assumptions. Additional refinements were made to reflect appropriate turning movement restrictions along the intersections on SR 164. Further, the highway network was updated to code the highway infrastructure projects listed in the City of Auburn's most recent transportation comprehensive plan.

SR 164 shows noticeable traffic growth along the corridor by the year 2030 and the growth compared to existing volumes (model estimated) reflected background growth of approximately 30 to 50 percent along SR 164 between the Auburn Way interchange and Dogwood Street SE for both the AM and PM peak hours. These growth rates were post-processed to achieve reasonable volume balancing between intersections along the corridor.

4.1.3. 2030 Build (Bypass Options) Forecasts

The refined network contained in the 2030 Baseline model described above was used as the background network for developing the two bypass options analyzed as part of this Bypass Feasibility Study (i.e., the Dogwood and Grid Options). A brief description of the two options is provided below.

Dogwood Option

The Dogwood Option consists of a new bypass roadway that would connect in the north at a new interchange on SR 18 approximately 1 mile east of the current SR 18/SR 164 interchange. In the south, it would connect to Dogwood Street SE at approximately 15th Street SE. The bypass facility would require a new T-intersection with Dogwood Street SE just north of Skyway Lane. This option would require widening of Dogwood Street SE to four travel lanes to accommodate the additional traffic estimated on the bypass facility. No additional street improvements or extensions are included in this option.

Grid Option

The Grid Option includes a bypass facility similar to the Grid Option in terms of the location of the new interchange in the north but connects to the Muckleshoot Plaza in the south. The Grid Option also includes an extension of R Street SE in the north from the M Street SE connector to 17th Street SE in the south. This



The Dogwood Option bypass roadway would connect to SR 164 at Dogwood Street (shown in this photo)

extension would serve as a new north-south connector. In addition, the Grid Option extends the current 12th Street SE from M Street SE to R Street SE.

The 2030 Baseline model highway networks were updated to incorporate the corresponding arterial changes specific to each of the two bypass options. The results from the two build options were primarily focused on looking at the traffic diversions from SR 164 to the bypass facility. The bypass options showed some substantial diversion in traffic from SR 164 to the bypass facility, which provided some congestion relief along SR 164 and delay reductions at the SR 164/SR 18 interchange.

The Grid Option showed a peak-hour volume reduction of 35 to 40 percent (compared to baseline volumes) in the segment along SR 164 between the Auburn Way interchange and the new bypass connection at the Muckleshoot Plaza. A reduction in traffic volumes on M Street SE also occurred because of traffic shifting to the new interchange at the SR 18/SR 164 bypass to the new R Street SE extension, which connects R Street SE from the M Street SE grade separation connection in the north to 17th Street SE in the south. This new connection provides additional access to north-south traffic along R Street SE.

The Dogwood Option showed similar reduction in traffic volumes on SR 164 as the Grid Option (again, as compared to baseline volumes) with a 30 to 40 percent decrease along SR 164 between the Auburn Way interchange and Dogwood Street).

Model-generated forecasts showed that the new bypass facility in either option will generate an additional 5 to 10 percent in traffic volume to and from the Enumclaw area primarily due to new users attracted to the bypass and the less congested SR 164 corridor.

4.1.4. Operational Analysis

Analysis of roadway and intersection operations for the future 2030 Baseline and bypass options were evaluated using the same LOS methodology described for the Existing Conditions analysis above.



The Grid Option bypass roadway would connect to SR 164 at Muckleshoot Plaza (shown in this photo)



Southbound queues at Dogwood Street SE

The Existing Conditions Synchro model was used as the background network for developing the 2030 Baseline Synchro model. The growth rates generated as part of the post-processing effort were then applied to existing count data to arrive at a set of 2030 Baseline intersection volumes for the eight intersections along SR 164. The signal timings were optimized to arrive at reasonable level-of-service operations in the study area. The approach-level link volumes for the 2030 Baseline are shown in Exhibit 4.4 for selected locations in the study area. With substantial growth along the corridor by the 2030 horizon, high levels of congestion would likely occur along SR 164 in the study area.

Exhibit 4.5 shows the delay/LOS summaries for 2030 Baseline conditions.

Exhibit 4.4 2030 Baseline Peak-Hour Approach Volumes

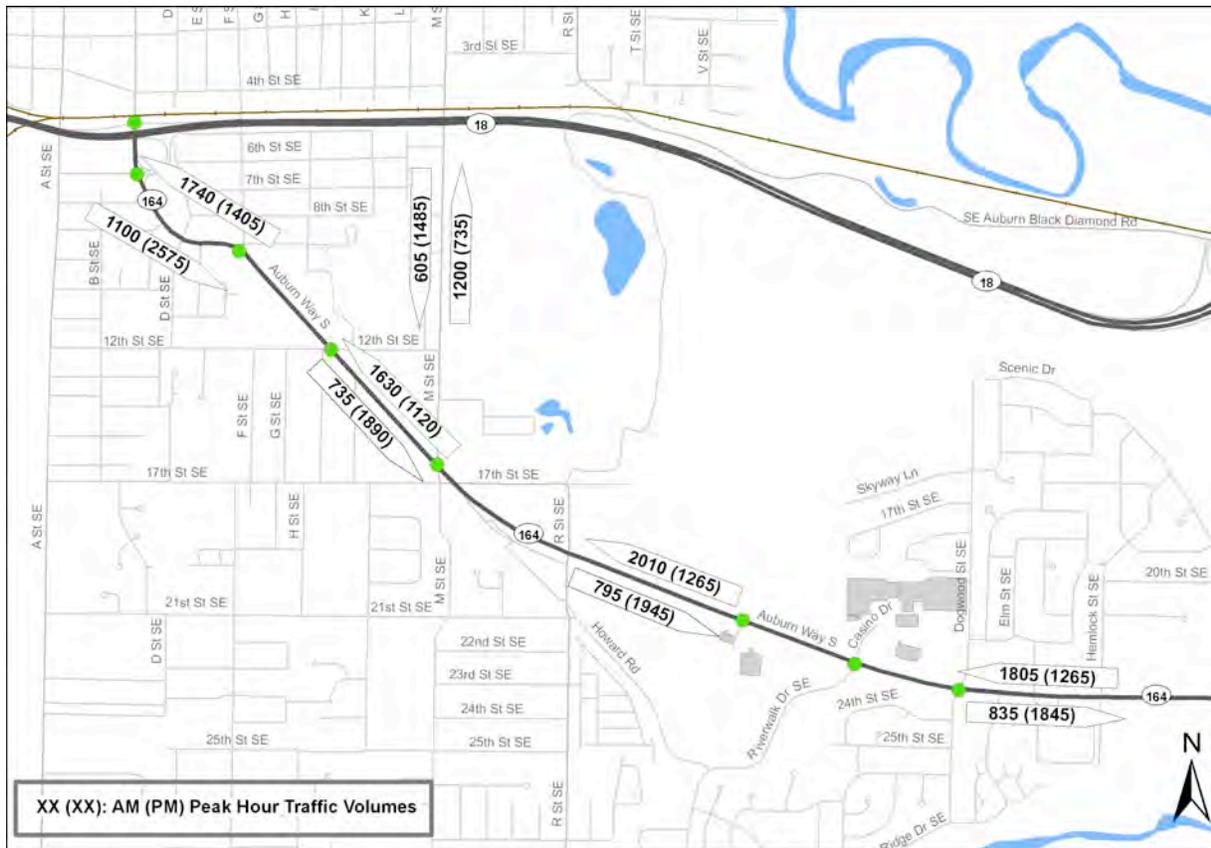


Exhibit 4.5 2030 Baseline Delay/LOS Summary

Intersection Location on SR 164	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
SR 18 Westbound Ramps	24.5	C	143.7	F
SR 18 Eastbound Ramps	121.2	F	212.6	F
F Street SE	9.6	A	14.1	B
12th Street SE	21.8	C	39.2	D
M Street SE	134.1	F	128.1	F
Muckleshoot Plaza	7.7	A	32.2	C
Riverwalk Drive/Casino Drive	18.7	B	45.6	D
Dogwood Street SE	28.7	C	20.6	C

For the AM peak hour, two of the eight study intersections currently operate at LOS A, one intersection at LOS B, three intersections at LOS C, and two intersections at LOS F. Results for the PM peak hour indicate one of the eight intersections operates at LOS B, two intersections at LOS C, one intersection at LOS D, and three intersections at LOS F. The intersections that fail include the SR 164/SR 18 interchange and M Street SE intersections. The detailed intersection-level turning movement volumes along with delay/LOS data for the 2030 Baseline are provided in Appendix B-3.

The 2030 Build Synchro networks for the two bypass options were developed using the 2030 Baseline as the background network. The Baseline network was modified to incorporate the geometric roadway changes assumed for the design concept of the two bypass options. This included the new SR 18/SR 164 bypass interchange ramp configuration. The 2030 Build intersection volumes for the two bypass options were developed by redistributing and adjusting specific traffic patterns based on the model-estimated diversion patterns compared to the 2030 Baseline scenario. The approach level link volumes for selected locations are shown in Exhibit 4.6 and Exhibit 4.7 for the Dogwood Option and Grid Option, respectively, for selected locations along the study corridor. Intersection signal timings along SR 164 between SR 18 and Dogwood Street and the new intersections along the bypass facility in the Build networks were adjusted and/or optimized to achieve reasonableness in terms of intersection delays and traffic progression.

Exhibit 4.6 2030 Dogwood Option Peak-Hour Approach Volumes

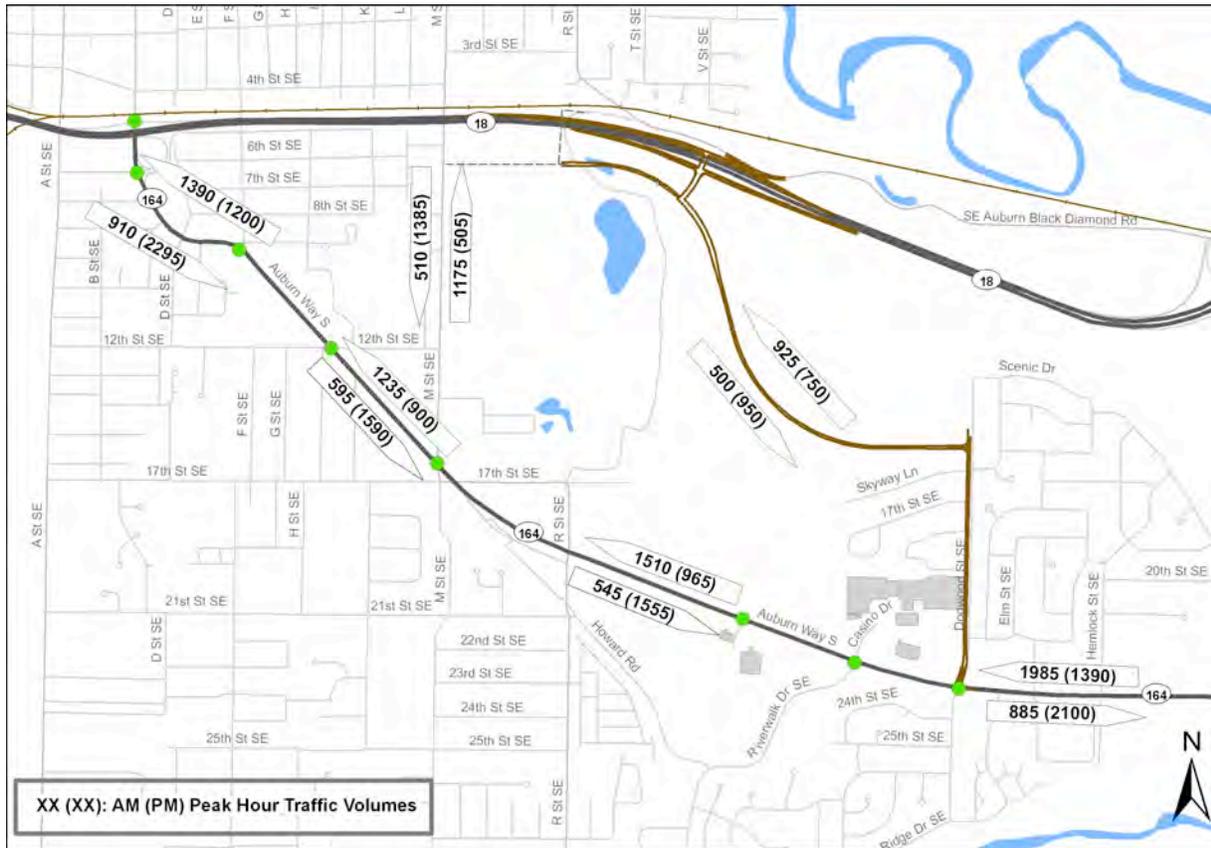


Exhibit 4.7 2030 Grid Option Peak-Hour Approach Volumes

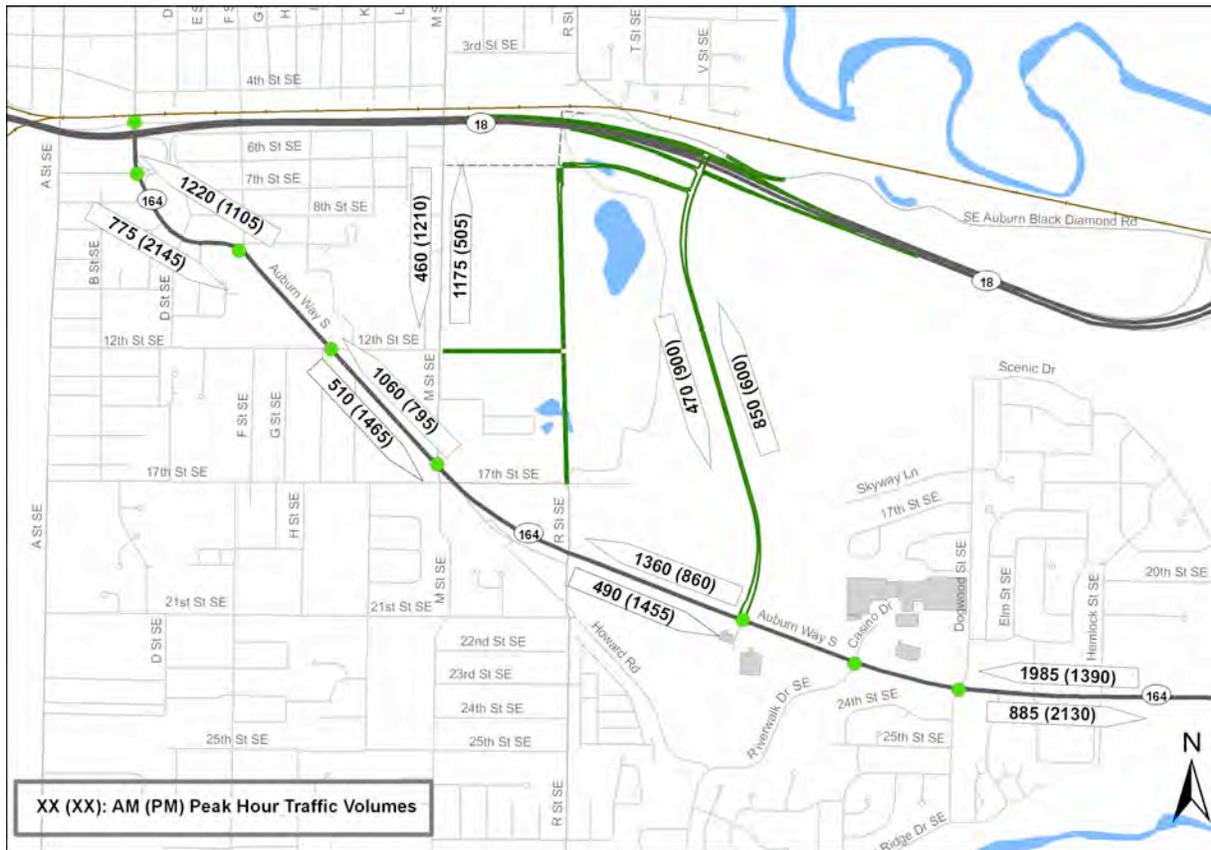


Exhibit 4.8 represents the intersection delays and corresponding LOS estimates for the Dogwood and Grid Options. Three additional intersections were added to the previously analyzed eight intersections (compared to existing conditions and the 2030 Baseline condition analysis) to capture the intersections along the bypass facility. These intersections are located near the new interchange with SR 18 and SR 164 bypass facility. Analysis results for the targeted key intersections indicate less congestion under the bypass option scenarios, especially at the most congested intersections along SR 164 (i.e., at the existing SR 18 interchange and M Street SE compared to the future baseline option).

Exhibit 4.8 2030 Build Delay/LOS Summary

Intersection Location	2030 Dogwood Option				2030 Grid Option			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
SR 164 and SR 18 WB Ramps	22.0	C	34.9	C	19.2	B	30.5	C
SR 164 and SR 18 EB Ramps	71.1	E	159.1	F	60.8	E	143.5	F
SR 164 and F Street SE	6.1	A	17.1	B	5.4	A	16.7	B
SR 164 and 12th Street SE	8.2	A	22.7	C	21.8	C	39.2	D
SR 164 and M Street SE	57.0	E	76.7	E	50.4	D	58.5	E
SR 164 and Muckleshoot Plaza	5.6	A	32.9	C	20.7	C	65.6	E
SR 164 and Riverwalk Drive/ Casino Drive	15.0	B	27.2	C	21.9	C	42.0	D
SR 164 and Dogwood Street SE	21.8	C	39.2	D	39.7	D	27.9	C
SR 164 Bypass and SR 18 WB Ramps (new I/C)	8.4	A	9.7	A	7.3	A	11.4	B
SR 164 Bypass and SR 18 EB Ramps (new I/C)	12.9	B	13.7	B	16.3	B	16.9	B
SR 164 Bypass and New Connector to M Street	9.3	A	10.3	B	10.1	B	7.4	A

The Dogwood Option analysis shows that in the AM peak hour five intersections would operate at LOS A, two at LOS B, two at LOS C, and two at LOS E. However, in the PM peak hour, there would be one intersection operating at LOS A, three at LOS B, four at LOS C, one at LOS D, one at LOS E, and one at LOS F.

The Grid Option analysis shows that in the AM peak hour two intersections would operate at LOS A, three intersections at LOS B, three intersections at LOS C, two intersections at LOS D, and one intersection at LOS E. For the PM peak, there would be one intersection operating at LOS A, three at LOS B, two at LOS C, two at LOS D, two at LOS E, and one at LOS F (failing) conditions.

Intersection delays along SR 164 would improve significantly compared to the Baseline scenario in the section west of R Street SE. Although the current interchange at SR 18 shows a reduction in delays for both bypass options, the intersection of SR 164 and the SR 18 EB ramps would likely fail during the PM peak hour. In terms of overall reduction in congestion, both options show similar performance benefits to the SR 164 corridor. The Grid Option would provide some additional

benefit in terms of relieving congestion on M Street SE because of additional east-west and north-south connections (the extension of R Street SE to the south and the 12th Street SE connection to R Street SE).

The Dogwood and Grid Options have the potential to stimulate new development in the study area, primarily along the new street connections included in the Grid Option that could result in additional traffic and delays in the study area. The impacts due to new developments under the two bypass options should be considered during future studies for this project (refer to Section 4.2.1.1 for details regarding future development of this area).

As discussed in Section 3.1.1, traffic impacts on SR 18 due to the new interchange were not analyzed in detail for the two bypass options and were reviewed at only a cursory level. Nonetheless, based on the findings of this analysis effort, the new intersections along the bypass facility near the new SR 18 interchange would likely operate at LOS B or better and would not experience substantial levels of congestion. The diversion of traffic from SR 164 to the bypass facility via SR 18 could, however, increase delays for through traffic on SR 18. A more detailed mainline analysis is required to review operations along SR 18 near the new interchange.

The detailed intersection-level turning movements along with delay/LOS summaries for the 2030 Dogwood and Grid Options are shown in Appendices B-4 and B-5, respectively.

In addition to the intersection delays and LOS results, travel times were also summarized for the bypass options (see Exhibit 4.9). During the AM peak, the time taken to travel in the peak direction (WB) along SR 164 from Dogwood Street SE to SR 164/SR 18 would be 9.4 minutes under the 2030 Baseline option. This travel time is reduced by approximately two minutes under the bypass options when travel times would be 7.5 minutes and 7.4 minutes for the Dogwood and Grid Options, respectively. During the PM peak, the reduction in EB travel times would be more than two minutes compared to the Baseline option. Travel times would be 11.2 and 11.4

minutes for the Dogwood and Grid Options, respectively, compared to 14.0 minutes for the Baseline option. The travel times were also measured for the same segment but via the new bypass facility for the two options. There would be a marginal difference in travel times between the two bypass options.

Exhibit 4.9 Travel Times (in minutes) from SR 164/SR 18 Interchange to Dogwood Street

Via SR 164 Corridor	AM Peak		PM Peak	
	EB	WB	EB	WB
2030 Baseline	6.2	9.4	14.0	7.7
2030 Dogwood Option	5.9	7.4	11.4	7.9
2030 Grid Option	6.2	7.5	11.2	7.1
Via SR 164 BYPASS	AM Peak		PM Peak	
	EB	WB	EB	WB
2030 Baseline	NA	NA	NA	NA
2030 Dogwood Option	6.5	6.3	6.3	6.3
2030 Grid Option	6.5	6.7	7.8	6.5

A graphic representing travel time routes between the two targeted end points is provided in Appendix B-6. The results shown in this section for the two bypass options are the foundation for future work. Additional analysis would be required when more formalized environmental and design studies are conducted in the future.

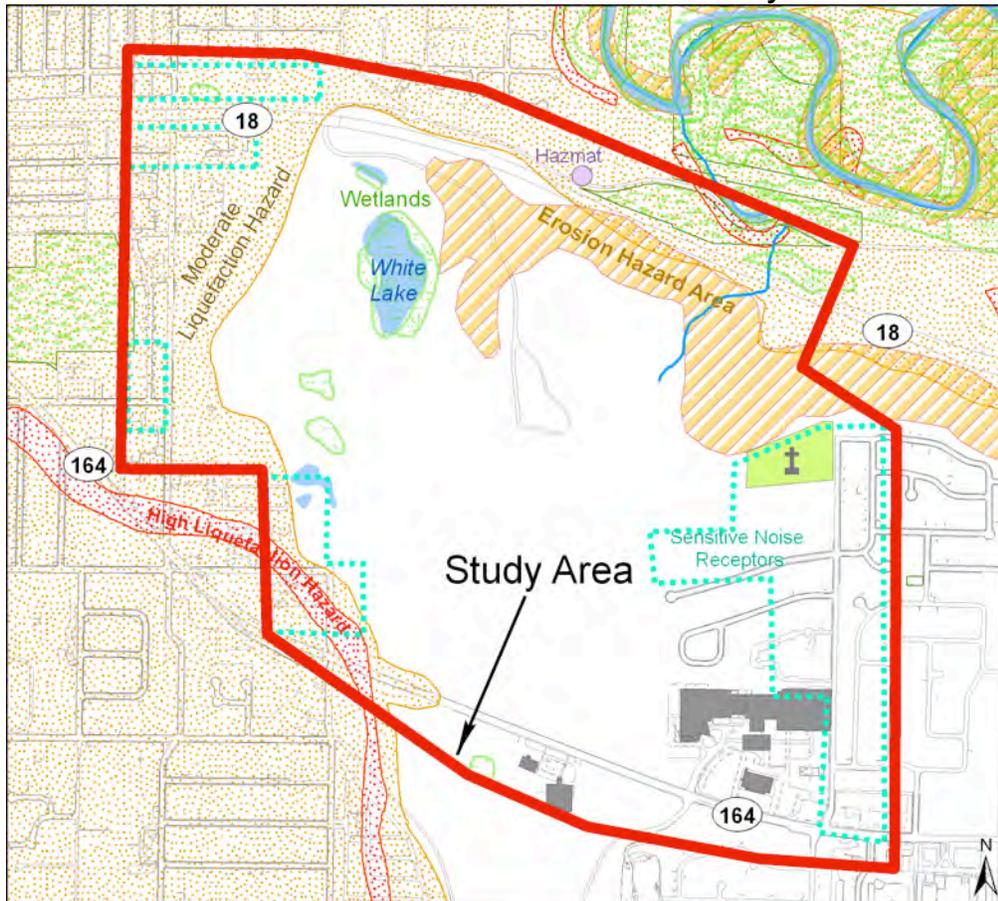
4.2. Environmental

This section discusses the potential environmental effects of the bypass options. For discussion purposes, environmental disciplines are divided into the built environment and the natural environment as listed in Exhibit 4.10. Exhibit 4.11 depicts the locations of environmental elements based on GIS mapping. Refer to Appendix C for an overview map of the environmental elements.

Exhibit 4.10 Environmental Discipline Categories

Category	Environmental Discipline
Built Environment	Land Use
	Historic, Cultural, and Archeological Resources
	Farmland
	Public Services
	Environmental Justice
	Air Quality
	Noise
	Hazardous Materials
Natural Environment	Wildlife, Fish, and Vegetation
	Surface Water and Wetlands
	Groundwater
	Geologic Hazards

Exhibit 4.11 Environmental Considerations in the Study Area



4.2.1. Built Environment

The built environment includes existing conditions and potential for effects on land use; planned development; historic, cultural, and archeological resources; farmland; public services; environmental justice populations; air quality; noise; and hazardous materials.

Additional consideration is given to assessing historic, cultural, and archaeological resources because both design options are mostly located on Muckleshoot tribal land. The evaluation is based on whether the footprint of potential roadways would cross or come close to areas where historic, cultural, or archaeological resources could be encountered, as identified by existing documentation and input from the Muckleshoot Tribe.

4.2.1.1 Land Use

This section describes existing land uses and planned future development in the study area, which is entirely within the City of Auburn. The City's comprehensive plan and policies, and land use maps were reviewed to determine existing land uses for the study area.

Existing Conditions

The study area includes a large portion of undeveloped Muckleshoot tribal land that is currently being used for mining operations. Other commercial land uses in the study area include the Muckleshoot Indian Casino, Forest Villa Shopping Center, two gas station and convenience stores, a car wash, and public storage. Public land uses include Les Gove Museum Park and White Lake Cemetery.

Other land uses within the study area include residential and commercial property with limited public lands. A Puget Sound Energy electrical substation is located at the intersection of 12th Street SE and M Street SE.

A majority of the study area is contained in the city of Auburn's Lake View Proposed Special Plan Area and the King County Urban Growth Area (UGA).



The two SR 164 bypass options would primarily be constructed on land currently used for mining operations

Planned Development

The Lake View Proposed Special Plan Area (shown in Exhibit 4.) is currently the site of two independent sand and gravel mining operations. The mining site in the eastern portion of the planning area is being actively mined while indications are that mining operations at the site in the western portion of the planning area have ceased. Activity at the western site is limited to a concrete batch plant and future site reclamation. Future use for the mining operation sites includes single-family residential housing with low-to-moderate urban density.

For land located outside the Lake View Proposed Special Plan Area, the City of Auburn has proposed to manage growth by promoting different land uses based on their functional relationship to the surrounding community.

The Muckleshoot Tribe plans future development at the mining operation sites in association with current casino properties and commercial development along Riverwalk Drive east to Noble Court SE; however, no development has been proposed to date.

As discussed in the operational analysis section of this report, the Dogwood and Grid Options could stimulate new developments in the study area, primarily along the new street connections included in the Grid Option.

Infrastructure Development

Planned infrastructure improvements in the study area include the grade separation of M Street SE at the Burlington Northern Santa Fe railroad line undercrossing that would connect with a new road alignment to Auburn-Black Diamond Road.

The City of Auburn plans to build a community center and teen center in 2009 at Les Gove Park between Auburn Way S. and M Street SE, between 9th and 12th Streets SE.

Dogwood Option

The Dogwood Option would convert 13.7 acres of land, zoned for single-family residential and public use, to roadway facilities use. Most of these conversions would occur in the Lake View Proposed Special Plan Area, which is currently zoned as single-family residential. Five single-family

**Exhibit 4.12 Lake View
Proposed Special Plan Area**



residential properties would need to be acquired along Dogwood Street SE. No other current land uses would be converted to roadway facilities.

Grid Option

This option would convert 22.8 acres of land, zoned primarily for single-family residential, residential office, and heavy industrial land uses, to roadway facilities use. Most of these conversions would occur in the Lake View Proposed Special Plan Area, which is currently zoned as single-family residential. No current land uses would be converted to roadway facilities.

4.2.1.2 Historic, Cultural, and Archaeological Resources

The bypass options would be constructed primarily on Muckleshoot Tribal Reservation land (Exhibit 4.). Coordination with the Tribe was conducted to identify potential design constraints. Early in the development of the alignment options, the Tribe provided input on critical areas that were to be avoided during the design of the two bypass options. Considerations were made to avoid the Tribe's cultural and archaeological resources.

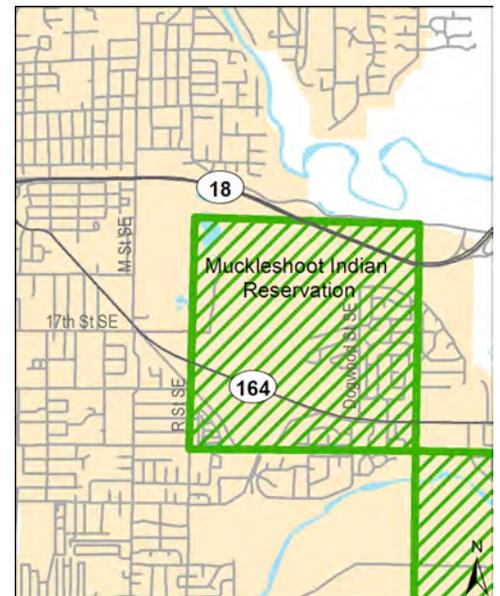
Existing Conditions

The Muckleshoot Indian Tribe is one of Washington State's larger tribes, with an on- or near reservation population of about 3,300. The Muckleshoot Tribal Council is responsible for providing a range of services to the reservation. The Tribe creates and adheres to its own land use and transportation plans and is not subject to GMA regulations.

Land in the study area is comprised of Muckleshoot tribal reservation land as well as the King George Allotment site. The King George site is held in trust by the federal government for the benefit of approximately 80 individual tribe members. Part of the parcel is currently being used for residences, a parking lot, and seasonal businesses.

Tribal-owned businesses in the study area include the Muckleshoot Casino; Muckleshoot Bingo; Muckleshoot Smoke Shop; and Muckleshoot Market and Deli, just east of the

Exhibit 4.13 Muckleshoot Reservation



The Muckleshoot Tribe has exclusive jurisdiction over development and land within tribal boundaries and that state and local land use and environmental laws do not apply on tribal land.

casino. West of the casino, approximately 478 acres of Muckleshoot Reservation land overlap the project area.

Additionally, numerous homes in residential neighborhoods along Dogwood Street SE are owned by the Tribe. Cultural and archaeological resources identified within the project study area include White Lake Cemetery on Dogwood Street SE.

Both alignments discussed below would need tribal environmental review and appeal prior to final design and construction.

Dogwood Option

This option would convert approximately 12.2 acres of Tribal land into roadway use. The five residential units would be acquired along Dogwood Street SE which could potentially be owned by the Muckleshoot Tribe. Benefits of this option to the tribe would include better access to Muckleshoot commercial facilities such as the casino.

Grid Option

This option would convert approximately 14.1 acres of Tribal land into roadway use. In addition, land owned by the Muckleshoot Tribe Realty Trust Services would be acquired. This would provide a challenge for the project considering the substantial number of land owners represented by the trust that would need to give their consent. Benefits of this option to the Tribe would include better access to Muckleshoot commercial facilities such as the Bingo Hall.

4.2.1.3 Farmland

Under the Farmland Protection Policy Act, federal projects must minimize effects on farmland and maximize compatibility with state and local farmland programs. Farmlands are classified as prime, unique, or of statewide or local importance. King County GIS data were used to identify farmland classifications in the project study area (Exhibit 4.).

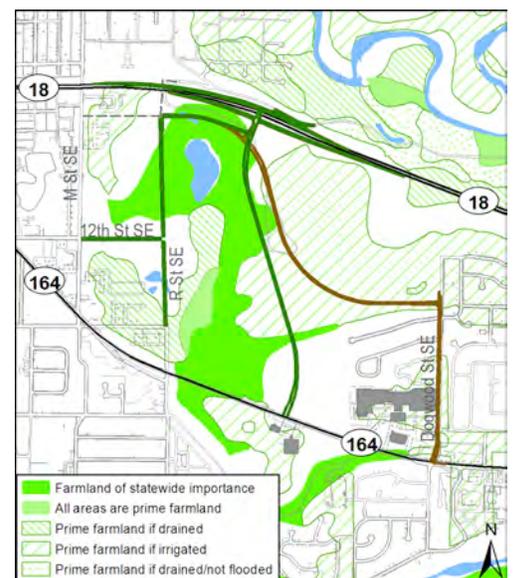
Existing Conditions

According to King County GIS data, the study area contains several designated farmland classifications. These include



Several tribal businesses are located in the study area, including the Muckleshoot Casino

Exhibit 4.14 Farmlands



farmland of statewide importance, prime farmland if irrigated, prime farmland, and prime farmland if drained. Designated soils that match these farmland classifications are located primarily in the area of the gravel pit. Further surveying would be necessary to verify the existence of these conditions.

Dogwood Option

This option could convert 3.8 acres of farmland of statewide importance and 8.9 acres of prime farmland, if irrigated, to roadway use.

Grid Option

This option could convert 12.2 acres of farmland of statewide importance, three acres of prime farmland, if irrigated, and 0.3 acres of prime farmland if drained, to roadway use.

4.2.1.4 Community Facilities, Public Services, and Utilities

The presence of community facilities, public services, and utilities in the SR 164 bypass study area are identified in this section.

Community facilities include schools, libraries, religious institutions, and cemeteries. Public services include fire suppression, emergency medical, law enforcement, and government operations. Utilities include electrical power, water, sanitary sewer and storm drainage, natural gas, petroleum, and telecommunications.

Information on community facilities, public services, and utilities was obtained through review of the City of Auburn's comprehensive plan, local agencies and jurisdiction's websites, and GIS data.

Existing Conditions

White Lake Cemetery and Zion Lutheran Church are the only community facilities within the study area. White Lake Cemetery is located at the end of Dogwood Street SE. Zion Lutheran Church is located at the intersection of M Street SE and 17th Street SE. There are no public services present within the study area.

Prime farmland is land that has the best combination of physical and chemical characteristics for producing agricultural crops.

Unique farmland is land other than prime farmland with a special combination of qualities to produce specific high-value crops.

Farmland of statewide importance is land other than prime or unique farmland, important for the production of agricultural crops as determined by the state.



White Lake Cemetery is located at the end of Dogwood Street SE

Public utilities are located along M Street SE in the project area, including Washington Natural Gas pipelines, Puget Sound Energy power lines, King County sewer lines, and Comcast cable television lines. Data from the City of Auburn’s Comprehensive Plan showed only Comcast cable television lines present along Dogwood Street SE and its connecting streets; however, other utilities may be present in this area. In addition, there is a Puget Sound Energy substation located in the northeast quadrant of the intersection of 12th Street SE and M Street SE.

Dogwood Option

This option would have no substantial effects on community facilities, public services, or utilities. Operations of the White Lake Cemetery are expected to continue unaffected. The widening of Dogwood Street SE as part of this option may require installation of new cable television utility lines or adjustment to existing lines.

Grid Option

The Puget Sound Energy substation property is located adjacent to the Grid Option at 12th Street SE and M Street SE. Future coordination with Puget Sound Energy would be needed to ensure that the alignment maintains necessary setbacks at the substation. Any adjustments to the existing utilities would result in minor adverse effects from relocation or temporary disruptions in service.

Operations of the Zion Lutheran Church would be expected to continue unaffected. There would be no substantial effects on community facilities or public services.

4.2.1.5 Environmental Justice Populations

Environmental Justice (Executive Order 12898) requires that fair treatment and meaningful involvement be given to all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Census data from 2000 were used to identify the proportion of minority and



Puget Sound Energy substation

low-income populations in the two census tract block groups that comprise the study area.

A minority is defined as a person who is black (a person having origins in any of the black racial groups of Africa), Hispanic (a person of Mexican, Puerto Rican, Cuban, Central or South American, or the Spanish culture or origin, regardless of race), Asian/Pacific Islander (a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands), American Indian or Alaskan Native (a person having origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition). Low-income persons are those living at or below the federal poverty level as defined by the Department of Health and Human Services.

Existing Conditions

The study area is closely represented by the following U.S. Census Tract (CT) Block Groups (BG), CT 311 BG 3 and CT 311 BG 4. Exhibit 4. identifies the locations of census block groups. Exhibit 4. summarizes the demographic characteristics of these census block groups.

Exhibit 4.16 Minority and Low Income, 2000

Census Tract Block Groups	Total Population	Percent Minority	Percent Low Income
CT 311 BG 3	819	14.5%	4.2%
CT 311 BG 4	1,202	42.3%	22.5%
Study Area	2,021	32.6%	14.5%

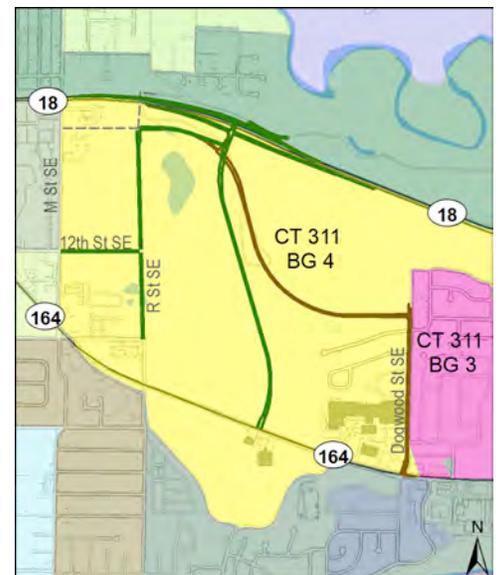
Source: U.S. Census Bureau, 2000, SF1 Tables P1, P3, P4, and SF3 Table P87

Based on this information, the population of the study area is 32.6 percent minorities and 14.5 percent low-income households. Both percent of minorities and percent low-income in the study area were higher than that of King County, which had 27 percent minority and 8.4 percent low-income in 2000.

Dogwood Option

Under this option, five single-family residences would be acquired. It is uncertain whether minority or low-income

Exhibit 4.15 Census Block Groups



persons own or rent any of the dwellings that would be purchased. Residences on the east side of Dogwood Street SE are represented by CT 311 BG 3. The census data indicate a small percentage of the population is minority (14.5 percent) and low-income (4.2 percent), so it is possible minority and/or low-income persons could be displaced.

All populations would experience similar project-related effects, such as increases in traffic noise, for both minority and non-minority persons and low-income and non-low-income persons.

Grid Option

Under this option, no residences would be acquired. All populations would experience similar project-related effects, such as increases in traffic noise, for both minority and non-minority persons and low-income and non-low-income persons.

4.2.1.6 Air Quality

EPA-designated air quality maintenance areas were reviewed for this analysis. As the project develops, air quality standards should be reviewed to ensure compliance with air quality emissions standards that are currently under revision.

Existing Conditions

The study area is located within a carbon monoxide maintenance area and a former 1-hour ozone maintenance area. Project improvements and alternatives under consideration were reviewed to evaluate potential air quality effects.

Dogwood and Grid Options

The Dogwood and Grid Options are in transportation conformity as neither option would substantially increase traffic volumes that would contribute to any new violation of any standards in the area.

Project construction may create temporary localized emissions. State law and WSDOT standard contract provisions require fugitive dust control during construction.

Areas that have experienced long-term air quality problems are designated by EPA as **nonattainment areas**.

Once an area meets air quality standards and has a 10-year plan for continuing to meet air quality standards, EPA redesignates the area to attainment and the area is called a **maintenance area**.

The **PSRC** is a regional planning organization that develops policies and makes decisions about transportation planning.

The PSRC is currently working with the EPA to test a new emissions model called MOVES to estimate on- and off-road mobile source emissions that would cover a broad range of pollutants and allow for multi-scale evaluations.

Open burning of slash material that would be generated by project clearing or grading is prohibited within the King County UGA.

4.2.1.7 Noise

General consideration of potential sensitive noise receptor locations in the study area was reviewed. Sensitive noise sites include residences, churches, schools, libraries, medical facilities, parks, and other land uses where a quiet environment is desired.

Existing Conditions

Noise-sensitive land uses in the study area include residences and the White Lake Cemetery, Zion Lutheran Church, and Les Gove Museum Park. The residential areas are located north and south of SR 18 at M Street SE, west of M Street SE and 12th Street SE, along Dogwood Street SE, and at the 17th Street SE and R Street SE intersection. The residences are primarily single-family with multi-unit apartment complexes located west of Dogwood Street SE and west of R Street at 17th Street SE. White Lake Cemetery is located west of Dogwood Street SE and shown along with the residential areas in Exhibit 4..

Zion Lutheran Church is located within the study area at the intersection of M Street SE and 17th Street SE. The church is not located near either design option and is not likely to experience a noticeable change in traffic noise levels.

Les Gove Museum Park and nearby neighborhood playground are located along the western study area boundary. A noticeable change in traffic noise levels is not anticipated at these areas.

No schools, libraries, medical facilities, or other noise-sensitive receptors are located within the study area.

Dogwood Option

White Lake Cemetery and residential areas located at SR 18 and M Street SE and along Dogwood Street SE would likely experience an increase in traffic noise levels as a result of the Dogwood Option.

Exhibit 4.17 Noise-Sensitive Locations



FHWA requires an analysis of noise impacts for any project receiving federal funding.

WSDOT requires a noise analysis for any new highway or any highway improvement that changes the horizontal or vertical alignment of the highway.

Construction of the Dogwood Option would result in temporary noise effects at the noise-sensitive sites listed above and at any additional sites near construction activities.

Grid Option

Residential areas located at SR 18 and M Street SE, west of M Street SE and 12th Street SE, and at the 17th Street SE and R Street SE intersection would likely experience an increase in traffic noise as a result of the Grid Option.

Construction of the Grid Option would result in temporary noise effects at the noise-sensitive sites listed above and at any additional sites near construction activities.

4.2.1.8 Hazardous Materials

Documented hazardous materials in the study area were reviewed through a search of state and federal regulatory database information provided within King County GIS data. Areas of potential hazardous materials were evaluated in terms of sites that have had documented releases to the environment and sites that have handled, treated, or stored hazardous materials without having a documented environmental release.

Existing Conditions

No superfund sites or sites with large-scale contamination were identified in the study area. Ten hazardous materials sites are located within the study area. Nine of the ten sites are not considered a concern because they are not located near the footprint of either design option; are not associated with an active environmental release; or are sites that treat, store, or handle hazardous materials but are not involved in a documented hazardous material release or environmental violation. All ten sites are detailed in Appendix H, Table H-1.

One site, Continental Dirt Contractors, located within the footprint of both design options north of SR 18 along Auburn-Black Diamond Road, has one active Underground Storage Tank (UST) and one inactive Leaking Underground Storage Tank (LUST) case that was closed in accordance with the Washington State Department of Ecology in 1996 (Exhibit 4.).

Exhibit 4.18 Potential Hazardous Material Site



Dogwood and Grid Options

One inactive LUST site, Continental Dirt Contractors, is located within the analyzed interchange along Auburn-Black Diamond Road for both the Dogwood and Grid Options. Contamination at this site is not anticipated; however, undocumented contamination may be encountered from the former LUST and UST currently in operation.

Burlington Northern Santa Fe Railroad right-of-way is located north of SR 18 within the study area for both alignment options. No documented environmental releases have occurred along this section of the railroad right-of-way; however, soil contamination may be present from typical railway operations.

With much of the area included in both alignment options undeveloped, it is unlikely that hazardous materials would be encountered; however, undocumented spills or unknown dumping may have occurred in the past.

4.2.2. Natural Environment

The discussion of the natural environment describes the existing conditions and potential for project effects to plants and animals (wildlife, fish, and vegetation); water resources, including surface water, wetlands, and groundwater; and geologic hazards, which include steep slopes and potential liquefaction zones.

4.2.2.1 Effects to Wildlife, Fish, and Habitat

The presence of threatened or endangered plant or animal species is considered during roadway planning to avoid effects harmful to their survival. GIS files from the Washington Department of Fish and Wildlife (WDFW) were reviewed to determine whether threatened or endangered species and their habitat are present in the study area.

Existing Conditions

The study area does not contain protected species or habitat. The majority of the study area has limited opportunities for wildlife since most of the land has been disturbed by mining operations. White Lake and nearby ponds and wetlands



Ponds located near White Lake

provide limited habitat due to their size and placement within surrounding mining operations and urban areas.

The northeastern portion of the study area that includes Muckleshoot Tribal land contains the Duwamish-Green Stream and forestland that could provide habitat for local species. The Duwamish-Green Stream could contain Chinook, Coho, and pink salmon; bull trout; and steelhead.

Dogwood and Grid Options

Protected species or habitat are not expected at either alignment option as both areas consist primarily of disturbed mining land or developed urban land.

Prior to project construction, a Biological Assessment would be completed in order to survey the area and consultation would be required from WDFW to determine any in-water or in-stream construction constraints. Emphasis would be placed on White Lake and the Duwamish-Green River as these areas are within 300 feet of both design options.

4.2.2.2 Surface Water and Wetlands

Construction adjacent to streams, water bodies, and wetland areas may affect plant and animal habitat and could result in water quality issues associated with roadway runoff and related pollutants. Floodplain areas may pose potential hazards for development.

Existing Conditions

White Lake and nearby ponds and wetlands are located within the mining operations area in the northern portion of the study area, south of SR 18. The Duwamish-Green Stream flows south to north from the hillside in the northeastern portion of the Muckleshoot Reservation and flows to the Green River approximately one-quarter mile north of the study area.

National Wetland Inventory maps identify two wetland areas north of SR 18 and one wetland area south of SR 164 as shown on Exhibit 4..

During a windshield survey of the study area, wetlands that were mapped north of SR 18 and south of SR 164 were not

Exhibit 4.19 Surface Water and Mapped Wetland Locations



observed. Wetlands mapped within the area of the mining operation were reviewed; however, the wetlands did not appear of high quality. Some mapped wetland areas were not visible.

The nearest 100-year floodplain is along the Green River, north of the study area.

Dogwood Option

White Lake and the Duwamish-Green Stream are located outside the Dogwood Option. A pond north of White Lake and adjacent wetlands are within the Dogwood Option, but should be field-verified as field observations for this study did not confirm their presence in the mapped location.

The approximate acreages of surface water and wetland effects at both options are shown in Exhibit 4.20.

Exhibit 4.20 Effects to Surface Water and Wetlands by Option

Water Resource	Dogwood Option (acres)	Grid Option (acres)
Surface Water ¹	0.35	0.62
Wetlands ²	0.17	0.97

¹ King County Open Water, GIS Data 2005, received in May 2008.

² King County Sensitive Area Ordinance Wetland Areas GIS Data, 2004, received in May 2008.

All other wetland areas mapped within the study area are outside the Dogwood Option footprint; however, the location of all wetland areas within the study area would be delineated to determine their exact location and value as these areas may not qualify as jurisdictional wetlands.

Grid Option

White Lake and the Duwamish-Green Stream are located outside the Grid Option. Ponds north and south of White Lake and adjacent wetlands are within the Grid Option but should be field-verified as field observations for this analysis did not confirm their presence in the mapped location. All other wetland areas mapped within the study area north of SR 18 and south of SR 164 are outside the Grid Option; however, the location of all wetland areas within the study area would be delineated to determine their exact location and value as these areas may not qualify as jurisdictional wetlands.



The Duwamish-Green Stream flows south to north from the hillside on Muckleshoot Reservation

4.2.2.3 Groundwater

The introduction of impervious surfaces can affect groundwater systems, including aquifer recharging areas and sole source aquifers, which provide important sources of potable water for local communities.

Existing Conditions

The entire study area is a designated Critical Aquifer Recharge Area (CARA), which is located above multiple shallow aquifers that serve as a water source for the City of Auburn and a portion of water used at the Muckleshoot Reservation. King County GIS data identify the CARA as having a high recharge rate and a high susceptibility for contamination. Based on topography, the direction of groundwater flow is estimated north-northwest toward the Green River.

Dogwood and Grid Options

The CARA includes the entire area of both bypass options. The presence of a CARA is not considered a substantial constraint if favorable water quality results are provided.

Prior to project construction, a water quality report must demonstrate why the roadway improvements would not substantially increase pollutants entering area groundwater. Installation of stormwater collection, detention, and/or treatment facilities would minimize the increased pollutant loadings and prevent groundwater quality degradation.

4.2.2.4 Geologic Hazards

Steep slopes and potential liquefiable soils may represent unstable surfaces for roadway construction. Landslides and earth movement associated with these features may pose potential constraints to placing structures on or near these areas.

Existing Conditions

The study area is in an area of deep proglacial stratified drift within a sequence of valley train and deltaic deposits (NRCS and USDA 1973). Area deposits are primarily sandy, gravelly cobbles mapped as “Everett Gravel Series.” Clean sands and

CARA – a designated zone, specified by Critical Area Ordinances, that surround public drinking water wells.

Hydrogeologic and water quality reports must be submitted for County approval before pollutant-generating facilities (including roadway projects) can be constructed within CARAs.



Mining operations have defined local topography

gravels are present to depths of 40 to 70 feet, below which silt and clay layers encounter a low permeability till-like drift (Bureau of Indian Affairs 2002).

Mining operations throughout much of the study area have defined local topography. Depressions 50 feet deep and several hundred feet wide are present in multiple areas. Elevation peaks in the northeast quadrant of the study area at approximately 275 feet. From this high point, terrain slopes north to the Green River, south to SR 164, and west to 12th Street SE.

As shown in Exhibit 4., both moderate and high liquefaction hazard areas are located within the study. An erosion hazard area is located along the hillside south of SR 18.

Dogwood and Grid Options

Exhibit 4. provides the approximate acreage of erosion and liquefaction hazard areas by design option.

Exhibit 4.22 Geologic Hazard Acreage by Option

Geologic Resource	Dogwood Option (acres)	Grid Option (acres)
Erosion Hazard ¹	5.35	6.61
Liquefaction Hazard ² (moderate)	16.9	26.0
Liquefaction Hazard ² (high)	0.0	0.73

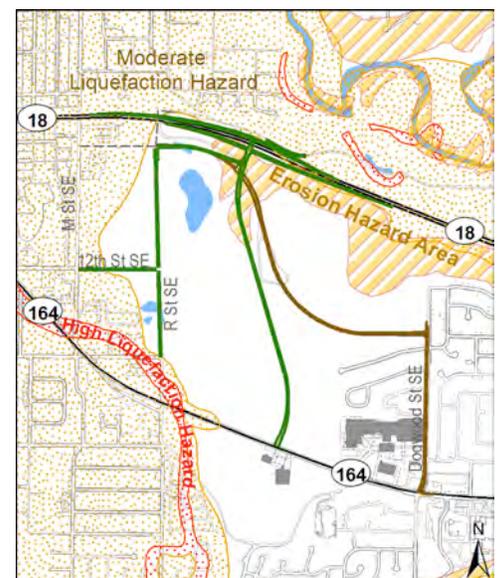
¹ King County Erosion Hazards GIS Data, 1990, received in May 2008.

² Washington State Department of Natural Resources, Liquefaction Zones GIS data, 2004, received in May 2008.

Both options would pass through the erosion hazard area shown south of SR 18. Both options also include moderate liquefaction hazard areas along SR 18, west of R Street SE. The Grid Option also includes a small area of road improvements at 12th Street SE within a moderate liquefaction hazard area.

Project construction within a geological hazard area is regulated by the adopted King County Sensitive Areas Ordinance. A ground survey would be required prior to final

Exhibit 4.21 Potential Geologic Hazard Areas



Erosion Hazard Area – an area where the land surface is wearing away, most commonly from falling and running water.

Liquefaction Hazard Area – areas where wet sediment behaves like liquid.

project design and construction to more accurately qualify the level of each hazard.

4.3. Design

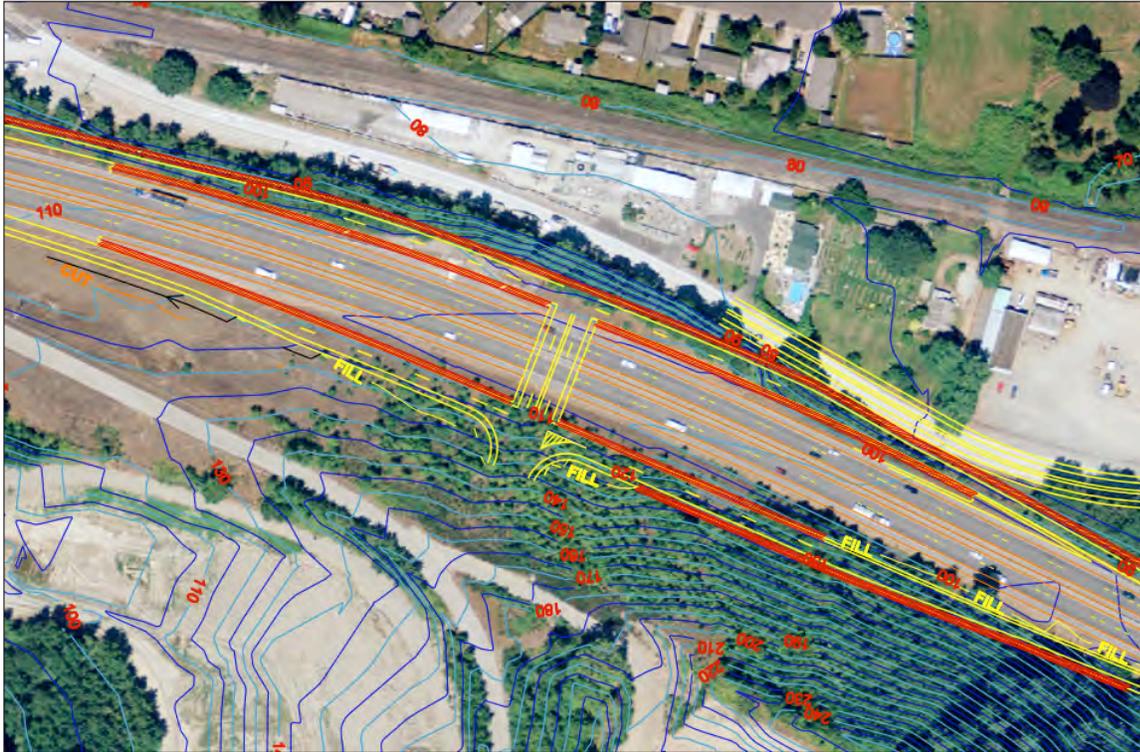
The interchange and arterials were conceptually designed to standards in the *WSDOT Design Manual* (January 2009). The interchange connections assumed a design speed of 70 mph on SR 18. The arterials followed WSDOT's urban, undivided minor arterial criteria with design speeds of 35 to 40 mph and a 6 percent maximum grade. Required deceleration and acceleration lengths, horizontal curves, vertical curve lengths, grades, superelevation, superelevation transitions, lane widths, lane transitions, and cut and fill slopes were examined in this conceptual design.

The new SR 18 interchange was assumed to be the same for both options. Both options would also connect to the future M Street SE Improvements Project by the City of Auburn.

4.3.1. SR 18 Diamond Interchange

Several locations for a new interchange were evaluated for suitability and cost-effectiveness. The proposed interchange was placed at approximately V Street SE to provide a minimum 1-mile separation between the existing Auburn Way interchange and the new interchange (a *WSDOT Design Manual* requirement). This location also was found to be advantageous as the slopes south of SR 18 continue to rise east of V Street SE. For the conceptual layout of the interchange, refer to Exhibit 4.23. As the design process moves forward, the location and type of interchange should be refined and validated as part of an Interchange Justification Report.

Exhibit 4.23 SR 18 Diamond Interchange



North of the interchange studied, Auburn-Black Diamond Road parallels SR 18 and is approximately 20 to 30 feet below SR 18. The terrain south of the new interchange rises steeply to more than 100 feet above the freeway. To reduce the amount of cut required south of the proposed interchange, it was determined that a new structure crossing over SR 18 was preferred over a tunnel option. The proposed bridge overcrossing was assumed to be a box girder approximately 140 feet long with a structure depth of approximately 6 feet. The structure would be 67 feet wide to provide for four 12-foot lanes, 8-foot shoulders, and 1.5-foot barriers.

The proximity of SR 18 to the railroad and Auburn-Black Diamond Road was considered when laying out the interchange configuration. For this conceptual design, a tight diamond interchange is proposed. The interchange configuration would need to undergo further analysis as part of an Interchange Justification Report.

As determined by the traffic analysis, the on-ramps would be two lanes at the overcrossing and then taper down to one lane before merging onto SR 18. To help manage future congestion, on-ramps would be designed to accommodate ramp metering. The off-ramps would diverge from SR 18 and widen to two lanes at the overcrossing. Per the *WSDOT Design Manual* (January 2009), the single lane ramp would be 15 feet wide and have 2-foot left shoulders and 8-foot right shoulders. The two-lane ramp would be 25 feet wide and have 4-foot left shoulders and 8-foot right shoulders. See Appendix A-4 for typical sections of the ramps.

The ramps for the proposed tight diamond interchange would require retaining walls because of the large differences in elevation both to the north and south, and would range from heights of 4 to 20 feet. The eastbound on-ramp on the south side of SR 18 would have a cut wall and the remaining ramps would be supported by fill walls. Guardrails, concrete barriers, or other roadside safety measures should be considered in future design. For cost-estimating purposes in this conceptual design, concrete barriers were assumed at retaining walls and guardrails were assumed for fill slopes steeper than 4-to-1.

A small portion of Auburn-Black Diamond Road would be realigned to accommodate the new westbound off-ramp.

4.3.2. Dogwood Option

The Dogwood Option would create a new bypass roadway and use a segment of the existing residential Dogwood Street SE to connect to SR 164. The existing Dogwood Street SE is approximately 36 feet wide with a contiguous sidewalk on the west side of the road. Because the bypass traffic volumes would require four 12-foot lanes on Dogwood Street SE, widening for the additional lane and a 6-foot sidewalk would require partial or full right-of-way acquisition of some residential properties. The design assumed that the majority of the widening would be towards the east on Dogwood Street SE.

In addition to the widening, the requirements of a bypass would change the design speed and characteristics of Dogwood



As part of the Dogwood Option, Dogwood Street SE would be widened for additional lanes and sidewalk

Street SE. Depending on the specific design standards used, a modification of the roadway designation could trigger modifications such as the maximum number of access points (private driveways and intersections) that is safely allowed.

The bypass road between the new SR 18 interchange overcrossing and the Dogwood Street SE connection would have two 12-foot lanes and 8-foot shoulders. At the Dogwood Street SE intersection, a northbound left-turn lane would be provided. At the SR 18 interchange overcrossing, four lanes would be provided to accommodate the amount of traffic to and from the interchange. See Exhibit 4. for the Dogwood Option, and see Appendix A-4 for typical sections of the Dogwood Option.

Dogwood Street SE would maintain its existing vertical alignment. The bypass road west of the Dogwood Street SE connection would follow the existing terrain where possible to minimize the amount of excavation or embankment required. The bypass would connect to the intersection created by the M Street SE Improvements Project at the western end. The elevation difference between the western end of the bypass road and Dogwood Street SE would be approximately 200 feet. To establish a conceptual footprint and for cost-estimating purposes, several items were assumed in this conceptual design. The bypass (not including Dogwood Street SE) followed the roadway sections (from the *WSDOT Design Manual*, (January 2009) and includes 2-to-1 cut-and-fill slopes. Guardrails were assumed for fill slopes steeper than 4-to-1; ditches were provided for cut slopes; and no retaining walls were used. Additional geotechnical investigation is required to determine the appropriate slopes that would be allowed for this project.

Exhibit 4.24 Dogwood Option



4.3.3. Grid Option

The Grid Option proposes a shorter bypass route from SR 18 to SR 164 than the Dogwood Option. This option includes extensions of R Street SE and 12th Street SE (secondary roadways). A connection at the new intersection created by the M Street Improvements Project to the Grid Option bypass would link the secondary roadways to the bypass.

The bypass at the SR 18 overcrossing (four lanes wide) would taper down to two lanes heading southbound, and then widen to provide turn movements at the SR 164 intersection. The secondary roadways would have two 12-foot lanes and 8-foot shoulders. See Exhibit 4. for the Grid Option and Appendix A-4 for typical sections of the Grid Option. Vertically, the bypass and secondary roadways would follow the existing terrain where possible to minimize the amount of excavation and embankment required. Similar to the Dogwood Option, the Grid Option bypass and secondary roadways included the following assumptions to establish a conceptual footprint for cost-estimating purposes: the roadway section would include cut and fill slopes of up to 2-to-1; guardrails would be provided when fill slopes are steeper than 4-to-1; and a ditch would be provided where there are cut slopes. No retaining walls were proposed for the Grid Option.



The Grid Option also would connect here at R Street SE and 17th Street SE

Exhibit 4.25 Grid Option





**Washington State
Department of Transportation**