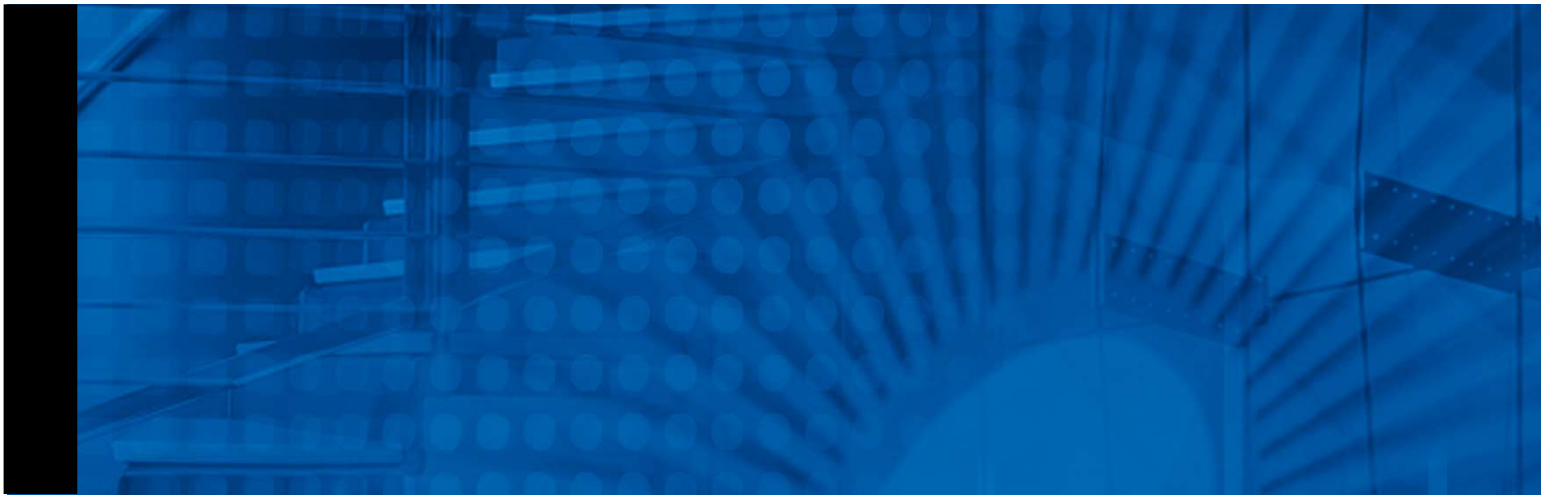
Orchard Street Extension

Pre-Design Study



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Pre-Design Study

September 2011

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Table of Contents

List of Figures

List of Tables

Appendices

1. Summary

The Orchard Street Extension project will provide two additional modal links for the City of Bellingham transportation system: an arterial linking the street grid east and west of Interstate 5 (I-5) and the construction of another segment of the Bay to Baker Regional Trail system. This pre-design study summarizes the alternative analysis and cost estimates performed for the extension of an arterial roadway and regional trail between Birchwood Avenue Northeast and East Orchard Drive. See the Vicinity Map, Figure 1-1, for the location of the project. Both the arterial and trail connections begin near Birchwood Avenue Northeast and continue east to James Street Road, passing underneath I-5. The freeway spans over a former railroad grade in this area. This project takes advantage of that by routing the arterial and trail via the existing underpass. An element that influences this study is the relocation of Squalicum Creek, a project currently under design that proposes to route the new creek channel through this same I-5 underpass.

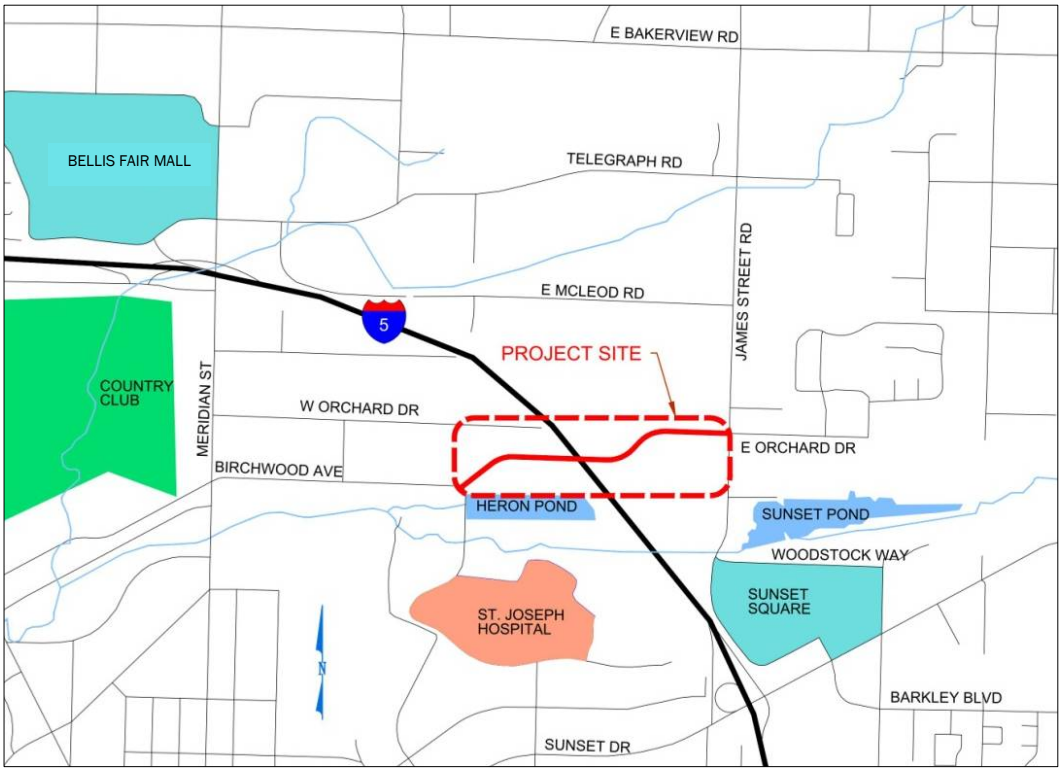

Figure 1-1: Vicinity Map

Based on initial criteria established by the City of Bellingham (City), arterial roadway connectivity, trail connectivity, and accommodating the Squalicum Creek relocation, KPFF Consulting Engineers (KPFF) came up with layouts for five alternatives. A workshop between KPFF and City staff narrowed the list to two alternatives for further study and cost estimates. From these two alternatives, a preferred

alternative was chosen. Plans of the two alternatives are included in Appendix A - Plans, Sections, and Profiles. Those alternatives dropped from consideration, as explained in Section 4 of this report.

Some of the key issues that affected the preferred alternative selection included accommodating the relocated Squalicum Creek channel beneath I-5, minimizing wetland impacts from the new roadway, and minimizing capital and maintenance costs.

The preferred alternative, Alternative 1, will construct a new roadway aligned through the middle span of the I-5 underpass, allowing room for the regional trail in the northern span and the relocated Squalicum Creek in the southern span. The preferred alternative includes a 32-foot wide road section that provides 11-foot wide lanes and 5-foot wide bike lanes, and sidewalks where the regional trail is not adjacent to the roadway. The preferred alternative includes a 12-foot wide Bay to Baker Trail alignment, following the existing railroad berm before diverging to an at-grade crossing of James Street Road between Sunset Pond Park and the new James Street Road Bridge. Total Design and Construction project costs for inclusion in the City's six-year TIP process are shown below.

Table 1-1: Preferred Alternative Costs

32' Roadway with Bike Lanes, 12' HMA Trail on Fill, Southern Route East of 1-5, At-Grade Crossing of James Street Road, Squalicum Creek Re-Routed Through Southern Span under 1-5.

Roadway Construction Subtotal	$4,350,000
Trail Construction Subtotal	$700,000
Total Construction, Including Contingencies (25%) and Right-of-Way	**$6,700,000**
Design, Permitting, and Construction Management (35%)	$2,300,000
Total Project Design and Construction	**$9,000,000**

Notes: Scour protection of Squalicum Creek through Southern Span, $270,000 is not included as part of Orchard Street Extension TIP Costs Above as that work would be funded by the creek relocation project.

2. Study Description and Background

PURPOSE AND NEED

This project will provide two new multi-modal links for the City: an arterial roadway linking the street grid east and west of I-5, as well as an extension of the Bay to Baker Regional Trail system. The purpose of the study is to take a comprehensive look at this area and create alternatives that safely serve all modes of users. This report explains the process and criteria used to arrive at two final alternatives that are outlined in this study.

Goals and Objectives

The goal of this report is to determine the City's preferred alternative and to provide an estimate of project costs. Costs are included so that the preferred alternative can be included in the City's Six Year Transportation Improvement Plan (TIP). A further discussion of the need for this project can be found in Appendix B –Connectivity Analysis and Appendix C – WCOG Travel Demand Forecast Model.

For reference, the project area can generally be split into three segments: a segment west of I-5, a segment under I-5, and a segment east of I-5. All three segments are generally undeveloped and vegetated. The segment west of I-5 is private property planned for a medical and office park development; agreements are in place that the development would dedicate right-of-way to accommodate the new arterial. The segment under I-5, owned by Washington State Department of Transportation (WSDOT), consists of an existing bridge overpass that is supported by columns on spread footings, situated such that three spans or corridors are available for crossing underneath I-5. East of I-5, the area is generally vegetated and classified as wetland or wetland buffer. The property is privately owned north of the railroad embankment and City owned to the south. Through all three of these areas exists a raised, former railroad embankment that is generally the planned route of the Bay to Baker Regional Trail. Figures 2-1 and 2-1 are photographs of these areas.

Figure 2-1: Existing Railroad Embankment East of I-5, Looking West

Figure 2-2: Existing Railroad Embankment under I-5, Looking East

3. Process

The pre-design study began with the review of past studies performed for this corridor. That understanding was integrated with new work planned in the vicinity of the corridor, including the James Street Road Bridge Replacement Project and the relocation of Squalicum Creek. From this, five alternative layouts were created that provided trail and arterial connectivity while allowing room for the relocation of Squalicum Creek. After a workshop between City staff and KPFF, the five alternatives were narrowed to two acceptable alternatives that met and bracketed the basic connectivity goals for further study. The analysis of these two alternatives, including the development of cost estimates and impacts, followed by a work session with City Council, lead to a project recommendation to be included in the City's Six Year TIP.

The topographic survey used in the development of the alternatives is an aerial LIDAR survey provided by the City that was supplemented by field survey along areas of James Street Road and portions of the railroad embankment.

This study builds upon three previous studies/documents in the area completed by David Evans and Associates:

- Summary of Wetland Reconnaissance for Railroad Right-of-Way Corridor: James Street to Orchard Place, Bellingham, WA – November 8, 2007.
- Orchard Drive Extension Engineering Design Feasibility Report – December 10, 2007.
- Orchard Street Extension Wetland Reconnaissance Map - May 2, 2008.

4. The Alternatives

The five alternatives developed for the initial workshop differed in three areas, alignment of roadway, trail, and creek beneath I-5, alignment of trail between I-5 and James Street Road, and the roadway section (including lane widths and inclusion of bike lanes and sidewalks). From these five, two alternatives were chosen and described as follows.

ALTERNATIVE 1

Alternative 1 consists of a 32-foot wide roadway made up of 11-foot wide lanes and 5-foot wide bike lanes in both directions. Sidewalks exist where the regional trail is not adjacent to the roadway. The multi-use Bay to Baker Trail is 12 feet wide with limestone crushed surfacing. Side slopes on the roadway are sloped at 2:1 (h:v) max, and are sloped for the trail at 3:1 (h:v) max.

The alignment begins at the 90 degree intersection of Birchwood Avenue Northeast and Squalicum Parkway, traveling northeast through a planned medical and office park development, and then proceeding east along the railroad grade through the center span, or bridge span, underneath I-5, before curving northeast and tying into the intersection at East Orchard Drive and James Street Road. The trail is generally adjacent to the roadway west of I-5; it shifts into the northern bridge span underneath I-5. Beyond that it crosses the roadway with a mid block, at-grade crossing. At this point, two variations are shown: the first continues south and east through a wetland buffer to a midblock, at-grade crossing of James Street Road near Sunset Pond Park. This is shown in the plans in Appendix A as variation 1A. A second variation, 1B, keeps the trail on the existing railroad embankment until an at-grade crossing of James Street Road closer to the new bridge. This variation was added at the request of City Council to have the straightest, most direct trail alignment feasible.

The relocated Squalicum Creek channel would be constructed in the southern bridge span underneath I-5. The roadway and trail would be built on imported fill, where necessary, and a trail bridge would be constructed at the crossing of the relocated Squalicum Creek. Plans, typical sections, and a profile of this alternative are shown in Appendix A.

ALTERNATIVE 2

Alternative 2 is a narrower 28-foot wide roadway section made up of 14-foot wide through lanes and no bike lanes. Sidewalks exist where the regional trail is not adjacent to the roadway. The multi use Bay to Baker Trail is 12 feet wide and paved. Side slopes on the roadway are sloped at 2:1 (h:v), and are sloped for the rail at 3:1 (h:v).

West of I-5, the alignment is very similar to Alternative 1 above, but the roadway alignment shifts into the northern bridge span underneath I-5 before curving north and tying into the intersection at East Orchard Drive and James Street Road. The trail is adjacent to the roadway west of I-5; it shifts north between the north bridge span and bridge abutment under I-5, and east of I-5 there is an at-grade, mid block crossing of the roadway before continuing east on the railroad grade toward James Street Road. At James Street Road it passes underneath a new raised bridge that would be constructed as part of the upcoming James Street Road Bridge Replacement Project. The bridge would need to be constructed higher than normally required in order to accommodate the trail clearance underneath the bridge.

Alternative 2 allows room for the relocated Squalicum Creek Channel in the central span under I-5. The trail alternative would be constructed on boardwalk where it is within the limits of a wetland. Plans, typical sections, and a profile of this alternative are shown in Appendix A.

OTHER ALTERNATIVES CONSIDERED

Some alternatives, and features of those alternatives that were dropped, include:

- Keeping the Bay to Baker trail alignment along the Orchard extension roadway east of I-5; the trail alignment would proceed north to an at-grade signalized intersection crossing at East Orchard Drive. This was eliminated due to a poor trail experience being adjacent to the roadway, an increased wetland impact by not utilizing existing railroad embankment, and less desirable connectivity to Sunset Pond Park.
- An alignment scenario under I-5 where the roadway and trail were flipped; the roadway would be in the north span, similar to Alternative 2, but the trail alignment would be south, in the central span, along the existing railroad embankment. The creek would then be in the southern span. Benefits of this alternative included greater flood overflow capacity for the creek and a trail crossing of James Street Road in the lower speed area of the future medical and office development. However, this alternative was ultimately ruled out because the larger impact facility (the roadway) would now be in the sensitive area (wetland) while the lesser impact facility (the trail) would be in the non-sensitive area.
- A typical section of 11-foot wide lanes with no shoulders or bike lanes making a 22-foot wide roadway; this was deemed too narrow to be a safe, curbed roadway section.
- Also dismissed were partial bike lane sections along the alignment. These were included only in those areas where the roadway and trail were separated. It was felt that bike facilities that stop or start mid block are ineffective and would not be utilized.
- At the request of City Council, a one-lane transit-and-bike-only corridor was considered. See Appendix A for the layout considered. The alignment would include bus pullouts where buses would pull over and yield to oncoming bus traffic. There would be 5-foot bike lanes in each direction. The construction costs of this alternative were approximately 10 percent less than a full roadway. This alternative was dropped from further consideration on the grounds that this would be an extremely expensive transit and bike only connection.
- An alternative that could be considered further during design would put the relocated creek in a box culvert as it crosses under I-5. This alternative was not pursued further, as it appears there is adequate room to fit the roadway, trail, and creek in independent bays beneath I-5. However, putting in a structure such as a three- or four-sided box would allow the relocated creek and trail to occupy the same southern span, minimizing the project footprint.

5. Design Criteria

The alternatives were developed using the following governing standards and the City of Bellingham design standards for arterials and trails.

GOVERNING STANDARDS

City of Bellingham Public Works Development Guidelines and Improvement Standards

City of Bellingham Parks and Recreation Department Design Standards for Park and Trail Development.

WSDOT Design Manual, Bridge Design Manual (BDM), and Standards

WSDOT Standard Specifications for Road, Bridge, and Municipal, Construction, 2010 Edition

AASHTO and Federal Highway Administration (FHWA) Standards

Washington Department of Fish and Wildlife (WDFW). Fish Passage Design at Road Culverts, a Design Manual for fish passage at road crossings. (WDFW 1999)

Bellingham Municipal Code 15.42 (Stormwater)

Department of Ecology's (DOE) Stormwater Management Manual for Western Washington (2005)

Low Impact Development Technical Guidance Manual for Puget Sound (2005)

ROADWAY AND TRAIL DESIGN STANDARDS

Table 5-1 lists the design criteria appropriate for this project, derived from applicable City and WSDOT design standards. The design standards are illustrated in Figures 5-1 and 5-2.

Table 5-1: Roadway and Trail Criteria

Design Criteria	Orchard Street Extension and Span-to-Baker Trail	Notes
Roadway Classification	Collector or Secondary Arterial	
ADT	6,000	WCOG Forecast for 2032 (Updated Jan 2011)
Design Speed (mph)	35	
Design Vehicle	WB-50	
Max Super Elevation	4 percent	
Max Grade	8 percent	Bellingham 4-5.01
Min Grade	0.5 percent	Bellingham 4-5.01
Trail Features		
Desirable Multi-Use Width	12 feet	10 feet min, 12 to 14 feet when substantial bicycle or pedestrian use. DM 1520.06 (1)
Min Radius with No Inside Widening	90 feet	2009 WDOT DM 1520.06 (7)
Min Radius with Inside Widening	25 feet with 4-foot Inside Widening	2009 WSDOT DM 1520.06 (8)
Min Trail Clearance	8 feet Minimum with Justification*	10 feet preferred, 2009 WSDOT DM 1520.06 (3)

Table 5-1: Roadway and Trail Criteria (continued)

Design Criteria	Orchard Street Extension and Span-to-Baker Trail	Notes
Roadway Features		
Lane Width – Exterior	11	Bellingham 4-3
Lane Width – Interior Through	11	Bellingham 4-3
Two-Way Left Turn	12	Bellingham 4-3
Exclusive Turn	11	Bellingham 4-3
Bike Lane (feet)	5	Bellingham ST-22
Sidewalk (Including curb)	5.5	Bellingham ST-22
Corner Radii		
Arterial to Arterial	25 feet (min), 25 feet (desired)	Bellingham 4-6.02
Arterial to Residential	20 feet (min), 25 feet (desired)	Bellingham 4-6.02

Bellingham references are taken from the City of Bellingham Public Works Development Guidelines and Improvement Standards. WSDOT references are taken from the WSDOT Design Manual.

* Communication with Bellingham Parks Department indicates 7-foot trail clearance would be acceptable.

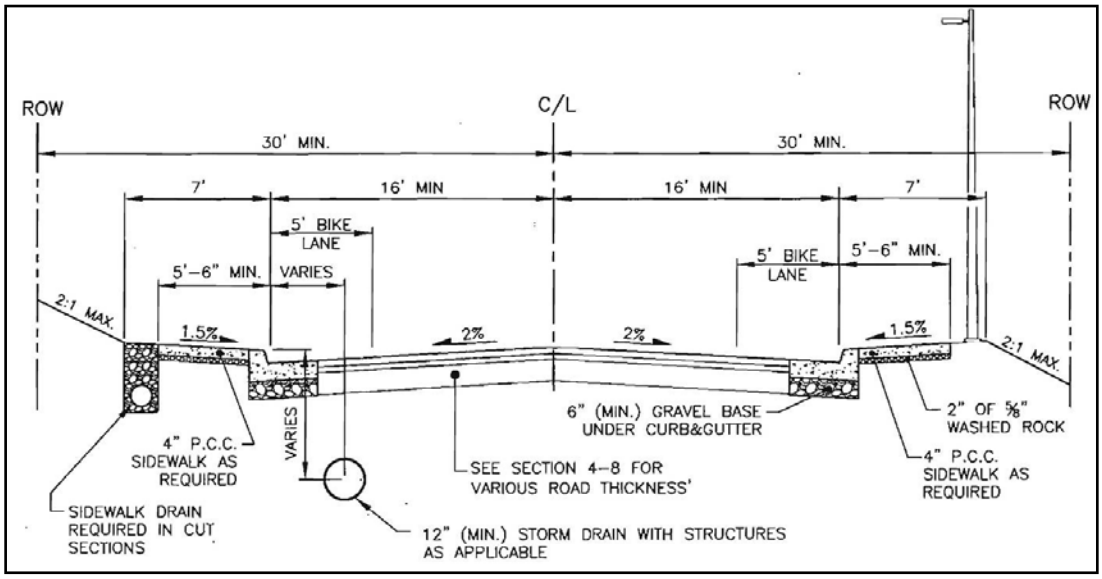

Figure 5-1: City of Bellingham Arterial Design Standard

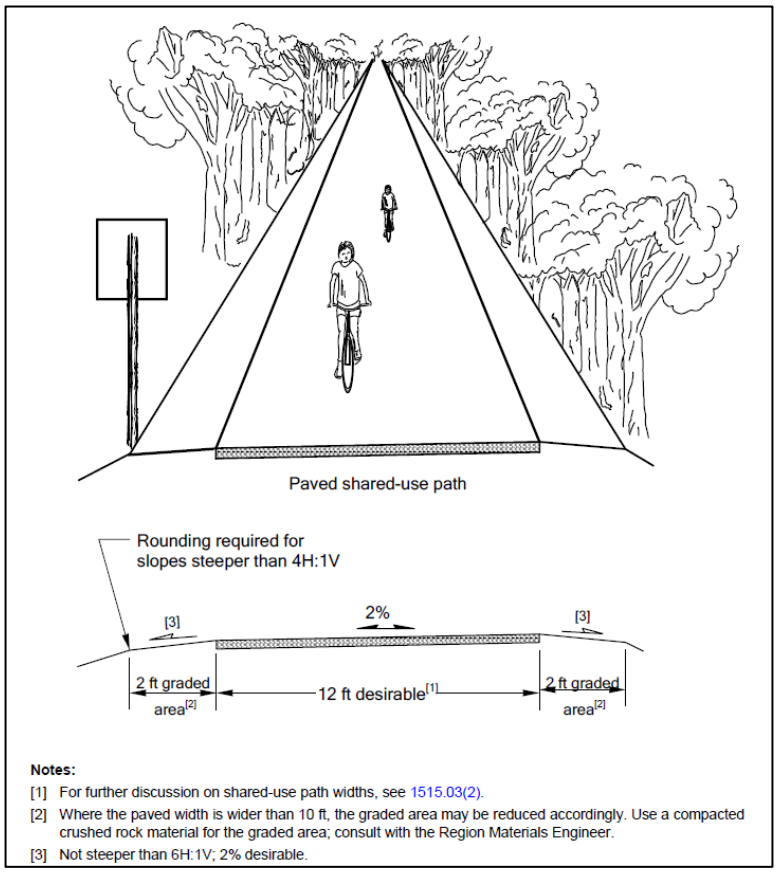

Figure 5-2: Two Way Shared-Use Path, WSDOT Design Manual

6. Alternatives Evaluation

The two alternatives were evaluated using several criteria including: typical design standards, alignments, traffic considerations, utility impacts, right of way considerations, stormwater management (flow control, runoff treatment, and other considerations), environmental, and cost considerations.

TYPICAL SECTION CONSIDERATIONS

Alternative 1 includes the full 32-foot wide roadway per the arterial street standard, allowing for 11-foot wide through lanes and 5-foot wide bike lanes in each direction. Alternative 2 includes a narrower 28-foot wide roadway consisting of 14-foot wide lanes in each direction and no bike lanes; this was the minimum lane width viewed as acceptable by City staff and KPFF, and is consistent with residential street standards. This alternative does not make provision for a bike lane. For both alternatives a curb and gutter section was proposed for the entire length, as well as a 5-1/2-foot sidewalk in those areas where the 12-foot wide multi-use trail would not serve the pedestrian circulation needs.

Both alternatives require guardrails beneath I-5 to protect errant vehicles from impacting the existing I-5 bridge columns.

ROADWAY ALIGNMENT CONSIDERATIONS

The roadway horizontal and vertical alignments meet the design criteria requirements for a 35 mph design speed.

The roadway vertical alignments of both alternatives are similar. From the intersection of Birchwood Avenue Northeast and Squalicum Parkway, the alignment rises 0.5 percent up through the I-5 crossing, eventually increasing to 1.5 percent to get up to the intersection at East Orchard Drive and James Street Road. East of I-5, this profile results in a fill section, ensuring the roadway is above the 100-year flood elevation. The profile is shown on Sheet 4 of Appendix A. The 100-year water surface of Squalicum Creek is also plotted on the profile.

The horizontal alignments for both alternatives are similar west of I-5 through the future medical and office development.

Underneath I-5, Alternative 1 keeps the roadway on the existing railroad embankment through the central span, with the trail in the northern span and the relocated Squalicum Creek in the southern span. Alternative 2 differs in that the roadway is in the northern span, the trail is further north between the abutment and north span, and the relocated Squalicum Creek channel is in the central span, leaving the southern span open for additional flood capacity.

East of I-5, the horizontal roadway alignments are similar as they approach and connect into the intersection at East Orchard Drive and James Street Road.

TRAIL ALIGNMENT CONSIDERATIONS

The trail alignments were developed to meet the design standard of Chapter 15 – Pedestrian and Bicycle Facilities of the WSDOT Design Manual. Varying trail radii were used depending on the location of the curve. Larger radii were used in open areas, while the minimum 25-foot radius with a 4-foot inside widening was used near intersections where slow bicycle speeds are desirable.

West of I-5, the trail alignment generally follows the existing railroad embankment; both Alternative 1 and Alternative 2 keep the trail on the north side of the roadway, allowing room for the relocated Squalicum Creek on the south side where it is generally flowing west and south to Bug Lake (also called Heron Pond).

Approaching the I-5 underpass, Alternative 1 routes the trail in the northern span under I-5, the roadway in the central (railroad embankment) span, and Squalicum Creek into the southern span. In Alternative 2, that same relationship remains, but is shifted north. The trail would ramp up near the northern I-5 abutments, requiring some retaining walls and trail grades approaching five percent. The roadway would be in the northern span and the relocated Squalicum Creek would be in the central span. The southern span would be open as a wildlife corridor and to provide additional flood capacity. Plans and sections of these layouts are included in Appendix A.

While both Alternative 1 and Alternative 2 keep the same trail, roadway, and stream relationship under I-5, a variation that was discussed for future consideration moves the trail to the south side of the roadway. For Alternative 1, this would put the trail and Squalicum Creek in the same span, adding

complications discussed below. For Alternative 2, the southern span is open and would have room for the trail, although at least one new trail bridge would be required. A benefit of the trail shifting south of the roadway is that this would move the trail crossing of the Orchard Street Extension west into the lower speed future medical/office park development.

Regarding the trail and creek sharing the southern span under I-5 as mentioned above, the trail would either need to be cantilevered out over the creek or, more likely, the creek would need to be put into a fish passable culvert, allowing the trail to be above the creek in the southern span. A cantilevered trail off the side of a scour-protection wall is an expensive idea that did not get much support. A fish passable culvert appears to be more feasible. A 30-foot-wide, four-sided box culvert would need to be approximately 150 feet long to cross through the I-5 underpass area. Being an enclosed box, the I-5 bridge piers would be protected from the channel so scour is not a concern; however, the culvert would have to be tall enough that the bottom of the culvert would be filled with channel rock and designed for fish passage. The top would be preferably above the 100-year water surface. The estimated depth of the culvert is 10 to 12 feet.

East of the I-5 underpass, the Alternative 1A trail travels south through City-owned property, in what has preliminarily been identified as wetland buffer, and then east to an at-grade crossing of James Street Road near Sunset Pond Park. An alternative to this, shown as 1B, keeps the trail on the existing railroad berm before it curves south to an at-grade crossing of James Street Road approximately 150 feet south of the James Street Road Bridge. A gradual sweeping curve south is preferable for trail users, but a tighter curve allows the relocated stream channel more freedom to naturally meander in this area. Therefore, the curve radius needs to be a compromise between the two.

Alternative 2 keeps the trail on the existing railroad embankment east of I-5 and continues straight through James Street Road via a trail undercrossing. The proposed James Street Road Bridge would be designed high enough to provide clearance for pedestrians and bikes. The minimum recommended trail vertical clearance is 8 feet. While the City parks department has expressed willingness to consider lower clearances, closer to 7 feet, it turns out that the effect of a 1-foot different in height does not substantially alter costs or the profile of James Street Road. Trail connectivity to Sunset Pond Park, James Street Road, and West Orchard Drive would be provided on the east side of the James Street Road undercrossing.

TRAFFIC CONSIDERATIONS

Design year (2032) expected average daily traffic in the corridor is approximately 6,000 vehicles per day, according to the latest Whatcom Council of Governments (WCOG) Traffic model. See Appendix B for a discussion of the mobility benefits of this arterial connection and Appendix C for WCOG Traffic Model volumes in the area.

Left turn pockets would be included on both ends of the extension at Squalicum Parkway and James Street Road.

At the intersection with Birchwood Avenue and Squalicum Parkway, it is not expected a signal would be warranted during the design year projected.

The Orchard Street extension connection to the intersection at East Orchard Drive and James Street Road would warrant a traffic signal, due to the projected traffic volumes at James Street Road.

UTILITY IMPACTS

Major utilities in the project area include gas lines under the existing railroad embankment. A high pressure 10-inch gas main and intermediate pressure 4-inch gas main would remain in Alternative 1, but would need to be relocated in Alternative 2 when the railroad embankment is removed under I-5 to allow the Squalicum Creek channel construction.

RIGHT-OF-WAY CONSIDERATIONS

Right-of-way acquisition would be required along most of the corridor. If the proposed medical and office park private development proceeds at the west end of the corridor, required right-of-way would be dedicated and likely a portion of the alignment would be constructed as required by City development requirements.

The property under I-5 is owned by the Washington State Department of Transportation (WSDOT) so an easement would be required.

The property east of I-5 is private land north of the existing railroad embankment and City property south of the railroad embankment. A portion of the alignment east of I-5 would likely be built out by a future residential development to the north. An example of a past development concept is illustrated in Figure 6-1.

Figure 6-1: Future Land Use

STORMWATER MANAGEMENT

The project site is located in the Baker Creek Sub-Basin in Bellingham, Washington. The Orchard Street Extension corridor is generally within a floodplain. Today, the site is vegetated and stormwater

runoff either percolates into the ground or sheet flows into adjacent properties before eventually entering Tributaries V or W, which flow west into Squalicum Creek and Puget Sound.

Flow Control

Flow control is required for a site when there is 10,000 square feet or more new impervious surfaces. This project exceeds that threshold. The flow control facility must be sized to match developed discharge durations to predeveloped discharge durations for the range of 50 percent of the 2-year peak flow to the full 50-year flow in order to reduce the downstream erosion impacts from an increase in stormwater runoff. Western Washington Hydrology Model (WWHM) was used to size the facilities.

Detention and infiltration retention are two acceptable facility types. Detention involves the collection and storage of stormwater runoff while controlling the release rate to surface waters. Retention, or infiltration, involves the collection and storage of stormwater while it is released back into the ground. Infiltration is typically preferred when feasible, as it provides groundwater recharge and limits flow increases of downstream surface waters.

Runoff Treatment

Runoff treatment requirements apply when the project adds 5,000 square feet or more of new pollution generating impervious surfaces (PGIS). This project is well above that threshold. Full water quality treatment will be required for the roadway, but water quality treatment will not be required for the Bay to Baker Trail. The treatment facility shall be sized for a 6-month, 24-hour storm. Western Washington Hydrology Model (WWHM) will be used to size the facilities. If the existing roadway is planed and overlaid in some areas, the amount of new PGIS will decrease, but the PGIS will still be well over the thresholds requiring treatment. The result is treatment facilities that are slightly smaller.

Treatment from the enhanced treatment menu is required. Enhanced treatment is necessary when the project is located within an Urban Growth Management Area and the ADT is equal to or exceeds 7,500. The current ADT on James Street Road in the study area is approximately 11,300. This requires the use of an enhanced treatment option.

Alternatives Chosen for this Study

Both conventional and low impact development (LID) stormwater management solutions should be considered in this corridor as required by the City standards. The objective of LID design concepts is to provide stormwater management on a smaller, distributed approach that utilizes natural site features to more closely mimic the natural hydrologic processes.

The geotechnical site assessment for the James Street Road bridge replacement indicated areas of permeable soils favorable for infiltration and groundwater recharge, which is consistent with LID goals. However, the design challenge will be getting adequate separation from the groundwater. The James Street Road corridor was typically underlain by outwash soils with estimated long term infiltration rates of 2 inches per hour. There is generally a layer of fill soil above these outwash soils typically 6 feet to 7 feet thick with seasonal groundwater near that same elevation. This corridor is generally lower and still within the floodplain and we do not feel infiltration is a safe assumption at this preliminary stage without a geotechnical investigation. Therefore, for this study, LID alternatives were not included and the more conservative and conventional flow control and water quality treatment measures were assumed.

The cost estimates for both alternatives reflect the same system consisting of detention vaults for flow control and media filters for water quality treatment.

SQUALICUM CREEK RELOCATION AND HYDRAULIC CONSIDERATIONS

Northwest Hydraulic Consultants (NHC), the hydraulic modelers for the James Street Road bridge replacement project have been working with Inter-Fluve Inc, the designer of the Squalicum Creek re-route project to generate a model for this area as it pertains to both the James Street Road Bridge replacement project as well as the Squalicum Creek Relocation project. An overview of the Squalicum Creek Relocation project is shown in Figure 6-2, below. NHC has performed modeling runs with all the flow routed into the new creek channel. This maximum water surface is shown on the profiles in Appendix A, sheets 4 and 8. The output plot from the Hydraulic Model is also included in Appendix G. This shows the 100-year overtopping to the west near the intersection at Birchwood Avenue and Squalicum Parkway where the extension begins; however, it is assumed that the berm project constructed as part of the medical and office park development and improvements to the culverts crossing Squalicum Parkway would prevent that from happening. The roadway is well above the 100-year water surface elevation for the rest of the corridor. Similarly, the trail, being located on the north side of the roadway is also above the 100-year water surface elevation.

The I-5 bridges are supported by columns on shallow foundations, ensuring these shallow spread footings are protected from channel scour of the relocated Squalicum Creek is a paramount concern for WSDOT. WSDOT independently hired NHC to perform the scour analysis. The results indicate the piers are susceptible to scour unless countermeasures are proposed. The design team met with WSDOT on June 22nd and discussed likely countermeasures, as follows:

- On the embankment side (southern bank) of the reheated channel, a combination sheet pile/retaining wall system will likely be the best alternative to provide both scour protection and embankment protection.
- On the inside or north bank of the relocated creek channel, hard bank stabilization will likely be adequate for scour protection.

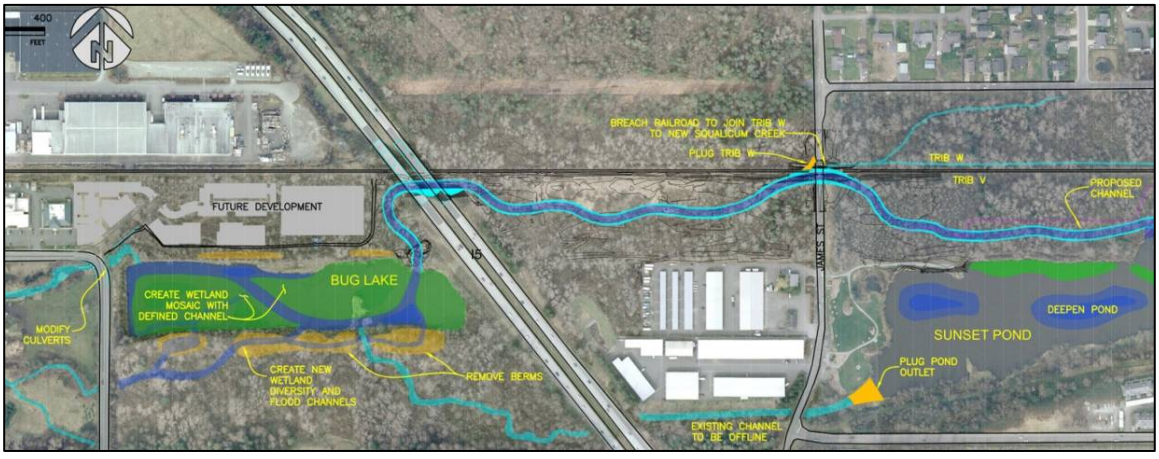

Figure 6-2: Overview of Squalicum Creek Relocation Project

ENVIRONMENTAL CONSIDERATIONS

A detailed memorandum regarding wetland impacts and environmental permitting for this project is included in Appendix E.

In summary, the total wetland impacts of Alternative 1 and 2 are 1.52 acres and 1.28 acres, respectively. The primary differentiator is that Alternative 2 decreases wetland impact by including a boardwalk in sensitive areas. Figures showing the wetland impact areas for the two alternatives are included in Appendix D.

Mitigation for unavoidable wetland impacts can be done in several ways, from creation and restoration to enhancement of existing wetlands. The ratios for this mitigation work to impact area vary from 3:1 to 12:1. The most cost effective approach appears to be creation or restoration at a 3:1 ratio, meaning 3 acres of new wetland will be created for every 1 acre of wetland impact. Due to project exemption from a critical areas permit, mitigation for buffer impacts may qualify for an exemption, although the project will need to demonstrate buffer impacts have been avoided wherever possible.

A detailed discussion of mitigation costs is also included in the memo. Mitigation costs for wetland impacts can vary from $170,000 to over $300,000 per acre. This cost includes design, permitting, construction, and maintenance and monitoring, and is based on 15 mitigation projects constructed in the last six years.

The following environmental permits will likely be required for this project:

- US Army Corps of Engineers Clean Water Act Section 404 permit
- Washington Department of Ecology Clean Water Act Section 401 – Individual 401 water quality certification
- Washington Department of Fish and Wildlife Hydraulic Project Approval (HPA)
- SEPA Determination of Non-Significance(DNS) or Mitigated Determination of Non-Significance(MDNS)
- City of Bellingham Shoreline Permit and Floodplain development Permit. This project is exempt from the Critical Areas Permit.

The memo points out that if one of the alternatives can be further revised to get the total wetland impact below 0.5 acres, the project could be permitted under the Nationwide Permit Process, decreasing permitting timeline and project costs.

DEVIATIONS FROM CITY DESIGN STANDARDS

Deviations anticipated for this project include:

- Omission of sidewalk in certain areas where the regional trail is adjacent and provides pedestrian mobility.
- The 14-foot lane widths in Alternative 2 are narrower than the City arterial standard.
- 2:1 side slopes on the trail embankment will need justification.
- 8-foot trail vertical clearance height under James Street Road will need justification.

COSTS

The design and construction costs of Alternative 1 are approximately $9.0 million.

The design and construction costs of Alternative 2 are approximately $9.7 million. The key differences between the top two alternatives and associated costs are shown in Table 6-1.

Detailed preliminary cost estimates can be found in Appendix F – Cost Estimates.

Table 6-1: Key Alternative Cost Comparisons (Preferred Alternative in Bold)

32' Roadway with Bike Lanes (Alt 1)	28' Roadway without Shoulders (Alt 2)
$4,300,000.00	$3,900,000.00
Trail-at-Grade Crossing of James St Rd (Alt 1)	**Trail Underpass Crossing of James St Rd (Alt 2)**
$10,000.00	$590,000
Crushed Surfacing Limestone Trail (Alt 1)	**HMA Paved Trail (Alt 2)**
$50,000.00	**$98,000.00**
Trail Constructed on Fill (Alt 1)	**Trail Boardwalk in Sensitive Areas (Alt 2)**
$150,000.00	$800,000.00
Squalicum Creek in Southern Bay (Alt 1)	**Squalicum Creek in Central Bay (Alt 2)**
$270,000.00	$1,000,000.00

TRIPLE BOTTOM LINE CONSIDERATIONS

The triple bottom line refers to factoring in environmental, social, and economic impacts in the decision making process. A full triple bottom line analysis was not included as part of this study, but an abbreviated summary of the triple bottom line components follows.

Environment

From an environmental perspective, the alternatives do not vary significantly. The overall wetland impact is slightly less for Alternative 2; however, the impacts from the roadway are actually greater. In the end, neither alternative separates itself from the other in the environmental category.

Social

Both alternatives provide significant improvements in pedestrian and vehicle connectivity in the area. With bike lanes through the entire corridor and the at-grade crossing of James Street Road near Sunset Pond Park, Alternative 1 ranks slightly higher in this category.

For pedestrian and bicycle safety, the grade-separated trail under-crossing at James Street Road would rank Alternative 2 above the mid block unsignalized trail crossing in Alternative 1.

For vehicle safety, a slight advantage goes to Alternative 1 as the arterial route is more direct and does not include horizontal reverse curves routing the roadway through the northern span under I-5.

Economic

Alternative 1 is less expensive for design and construction. This is primarily due to two items: the relocation of the high pressure gas main with the removal of the railroad embankment under I-5 and the increased costs of raising the James Street Road Bridge to accommodate a trail underneath. The long term maintenance costs of Alternative 1 are also expected to be less, as the boardwalk will need additional maintenance above and beyond a trail built upon fill.

7. Recommended Preferred Alternative

After a workshop including City Public Works staff and City Council members, the alternative recommended for inclusion into the City's Six-Year TIP is Alternative 1 with the trail 1B variation east of I-5. The key issues and advantages include:

- This alternative maximizes the re-use of the existing railroad embankment, the primary non wetland area in the corridor; it also keeps the trail in buffer areas to the greatest extent feasible.
- Provides the best bicycle connectivity with the inclusion of bike lanes the entire corridor.
- Lower capital construction costs and long term maintenance costs.
- Avoids costly gas main utility impacts due to removing the railroad embankment beneath I-5.

The trail 1B variation provides a middle ground alternative that seeks to keep the regional trail as direct and straight as possible while providing connectivity to Sunset Pond Park and the more cost-effective at-grade crossing of James Street Road.

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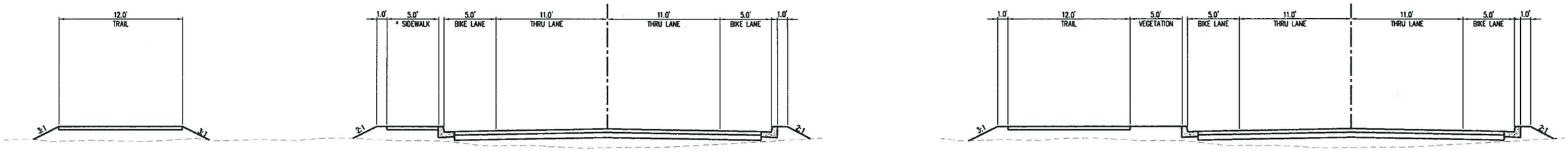
Appendix A

Plans, Sections, and Profiles



* SIDEWALK ONLY IN AREAS WHERE NO ADJACENT TRAIL

TYPICAL ROADWAY SECTIONS

ORCHARD STREET EXTENSION

CULVERT (TYP)
TRIB. W
BAY TO BAKER TRAIL
I-5
TRAIL TO KING MOUNTAIN
BAY TO BAKER TRAIL
GUARDRAIL
TRIB. W
ORCHARD STREET EXTENSION
±60 Parking Spaces
Medical / Office
9,200 sf/floor
Three Stories
27,600 sf
Drive-Thru
Retail
5,400 sf
BIKE LANES
Road
Section A
BIRCHWOOD AVE
SIDEWALKS
SQUALICUM PKWY
± 110 Parking Spaces
Pedestrian Circulation Path
FUTURE PRIVATE
DEVELOPMENT
Garage
Entrance
Parking Garage
180 Spaces/Level
Three Stories
500 Spaces/Total
Medical / Office
13,600 sf/floor
Four Stories
54,400 sf
Medical / Office
14,500 sf/floor
Four Stories
58,000 sf
Water
Access
ORDINARY
HIGH
Trail
BUFFER
50
WATER
Water
Access
HIGH
MARK
BUG LAKE
RE-ROUTE
NOTE: THE CITY MAY CONSTRUCT
STAIRS TO THE TOP OF THE BERM
IN THIS LOCATION.
CREEK
SQUALICUM
Trail To
Hospital
N
0 25 50 100
1 inch = 100 ft.
MATCHLINE NEXT SHEET

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CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

ALTERNATIVE 1
PRE DESIGN STUDY
PRELIMINARY - NOT FOR CONSTRUCTION

SHEET 1

SIDEWALKS (TYP)

ORCHARD STREET

ORCHARD STREET EXTENSION

JAMES STREET ROAD

15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 29+28

1B NORTHERN TRAIL ROUTE

TRIB. W

Bumper

TRAIL BRIDGE

SQUALICUM CREEK RE-ROUTE

Dense Brush

TRAIL BRIDGE

RETAINING WALL (TYP)

TRAIL BRIDGE

MATCHLINE PREVIOUS SHEET

1A SOUTHERN TRAIL ROUTE

BAY TO BAKER TRAIL

N

0 25 50 100

1 inch = 100 ft.

SUNSET POND PARK

1-4

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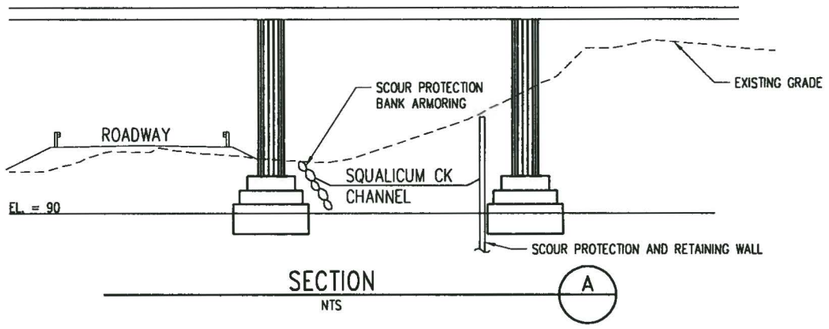
ORCHARD STREET EXTENSION

ALTERNATIVE 1
PRE DESIGN STUDY
PRELIMINARY - NOT FOR CONSTRUCTION

SHEET 2



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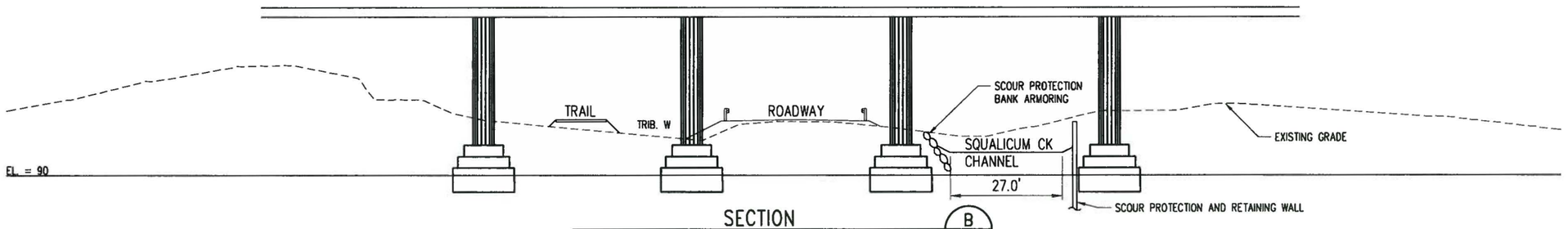
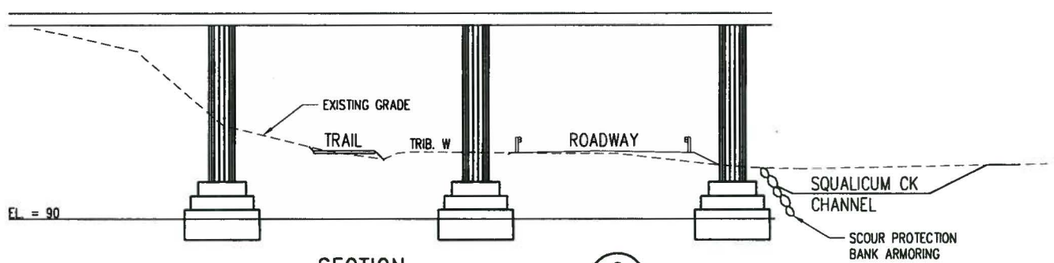
NTS



SECTION B
NTS



SECTION C
NTS

ELEVATION IS IN NAVD 88

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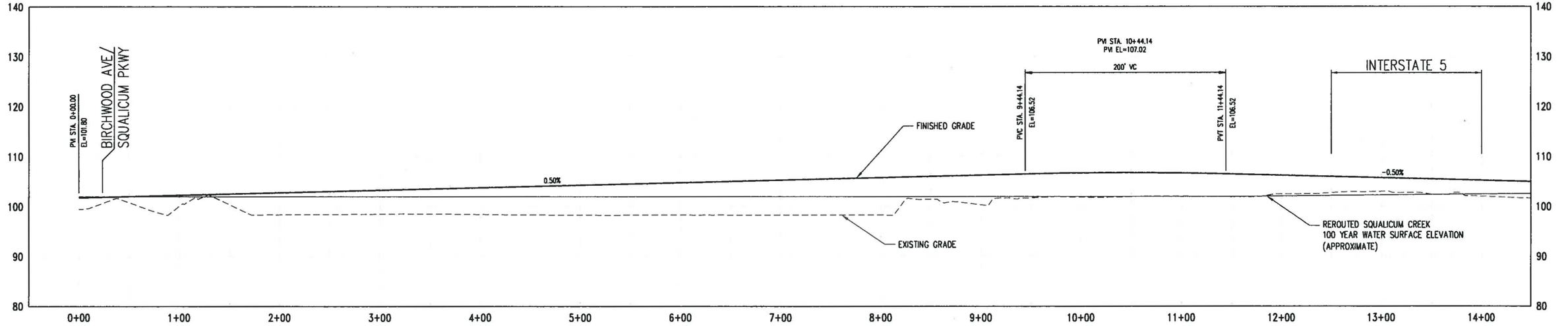
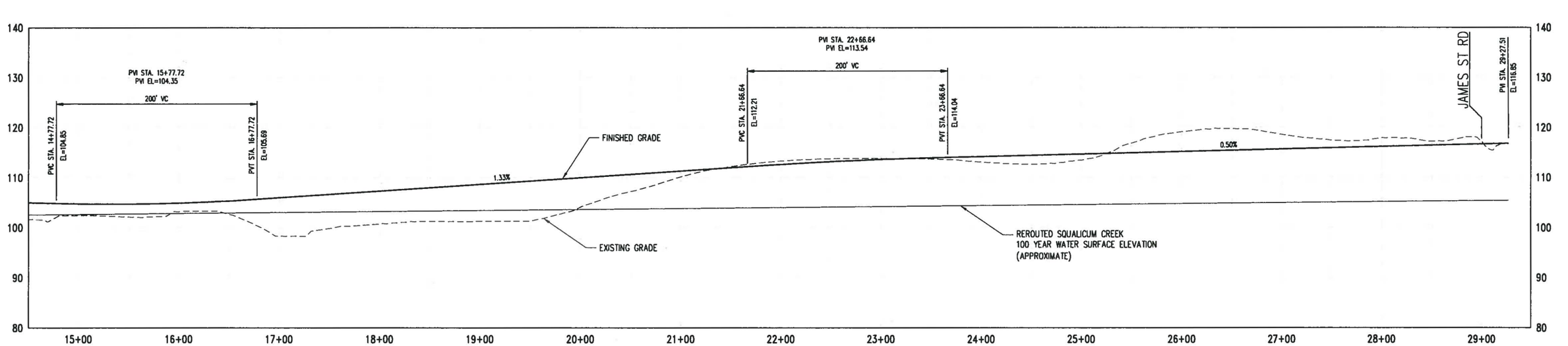
CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

ALTERNATE 1
PRE DESIGN STUDY
PRELIMINARY - NOT FOR CONSTRUCTION

SHEET 3





ELEVATION IS IN NAVD 88

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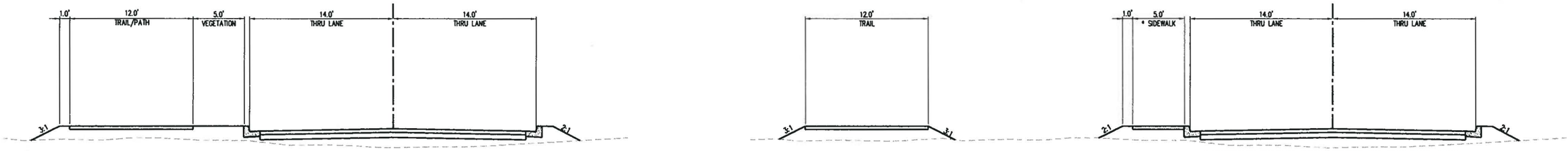
CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

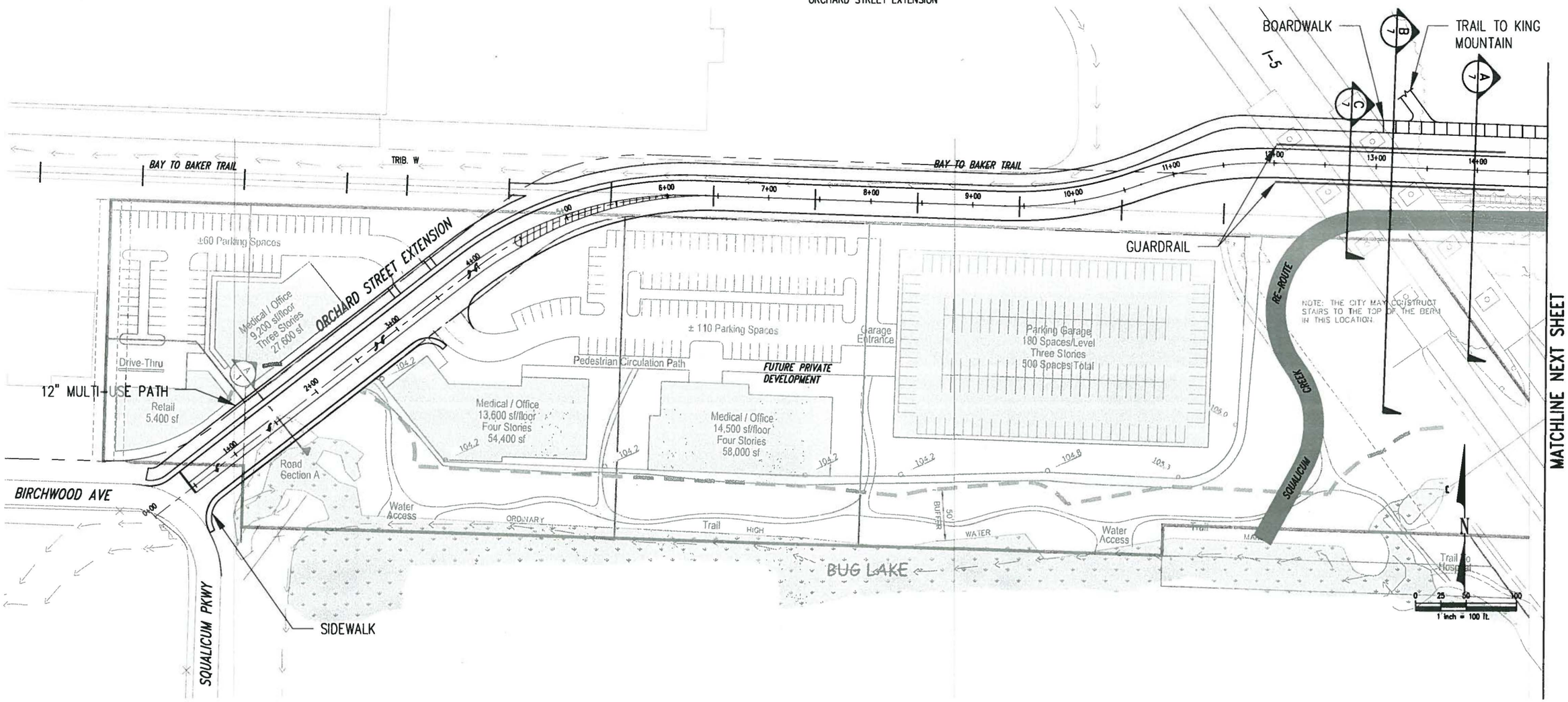
ALTERNATE 1
PRE DESIGN STUDY
PRELIMINARY - NOT FOR CONSTRUCTION

SHEET 4



* SIDEWALK ONLY IN AREAS WHERE NO ADJACENT TRAIL

TYPICAL ROADWAY SECTIONS
ORCHARD STREET EXTENSION



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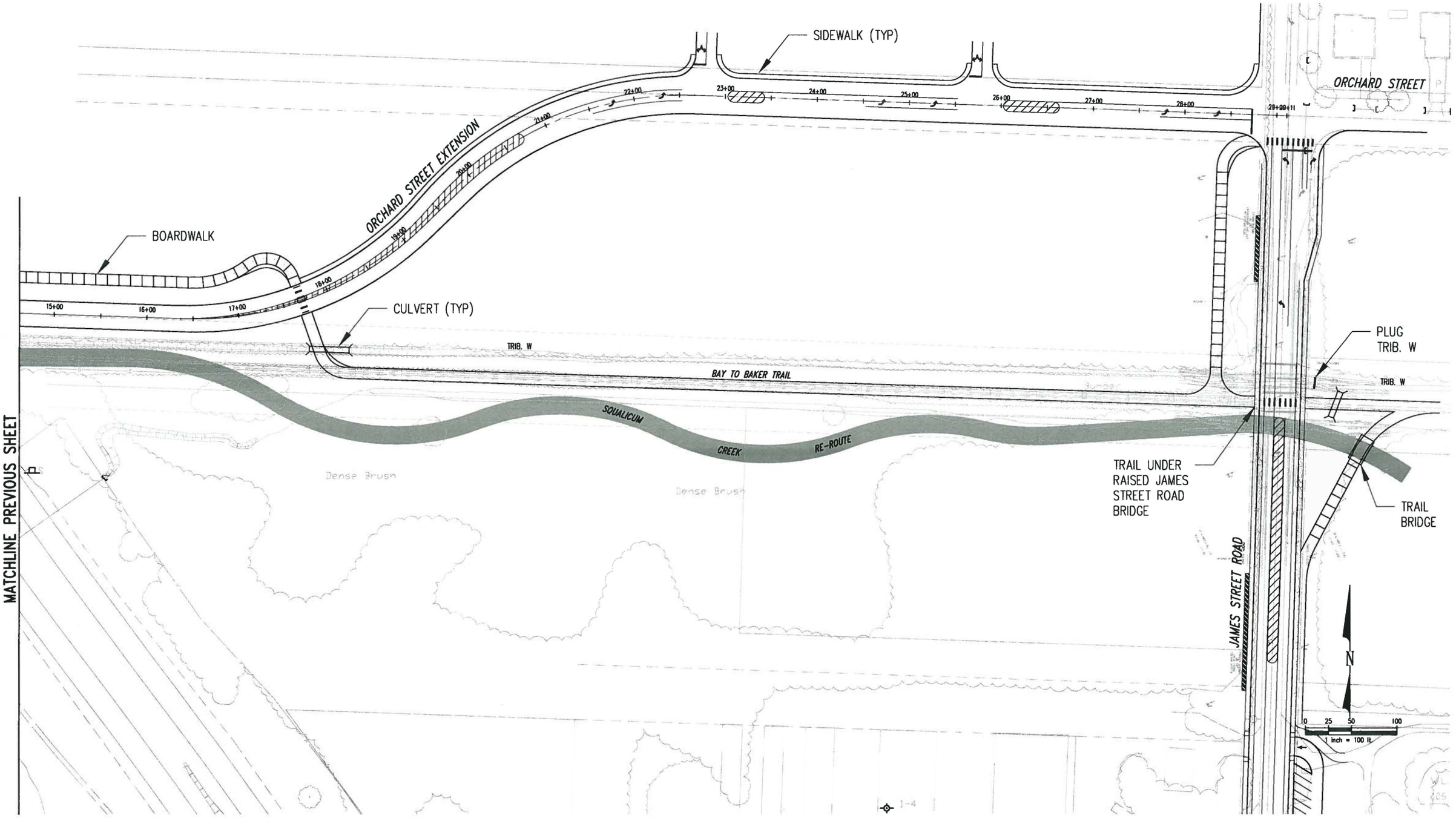
CITY OF BELLINGHAM - WASHINGTON

ORCHARD STREET EXTENSION
ALTERNATIVE 2
PRE DESIGN STUDY
PRELIMINARY - NOT FOR CONSTRUCTION

SHEET 5



MATCHLINE PREVIOUS SHEET

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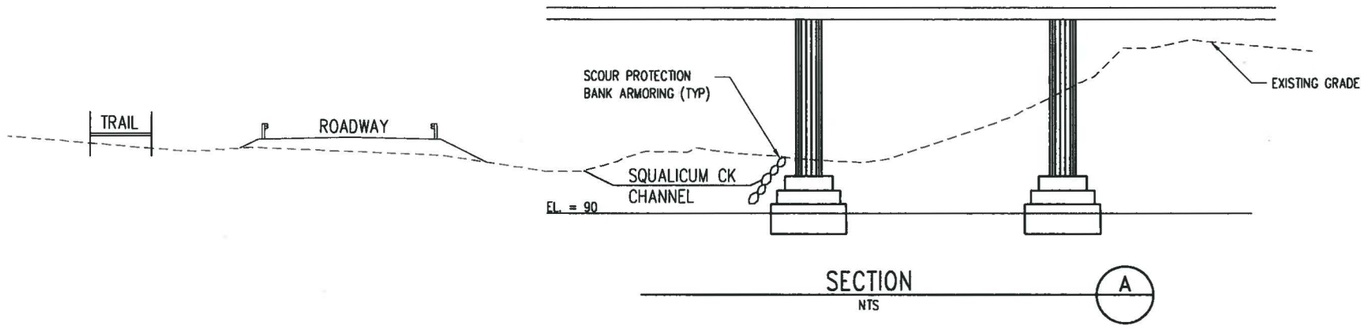
CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

ALTERNATIVE 2
PRE DESIGN STUDY
PRELIMINARY - NOT FOR CONSTRUCTION

SHEET 6



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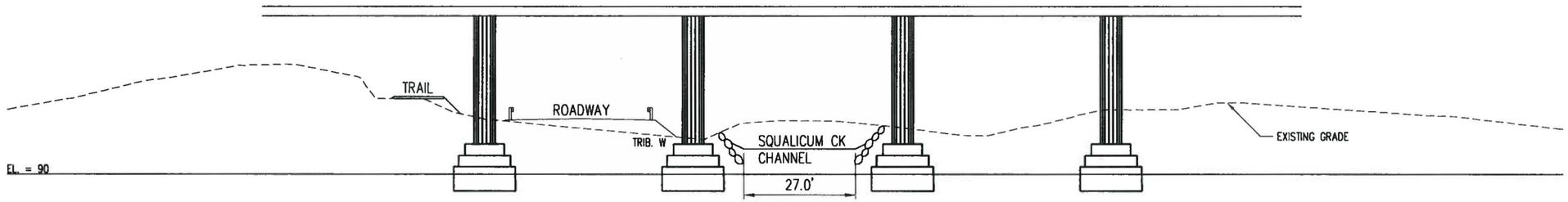

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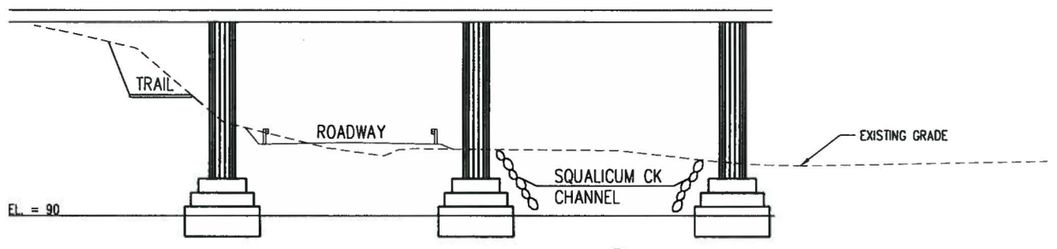

SECTION C
NTS

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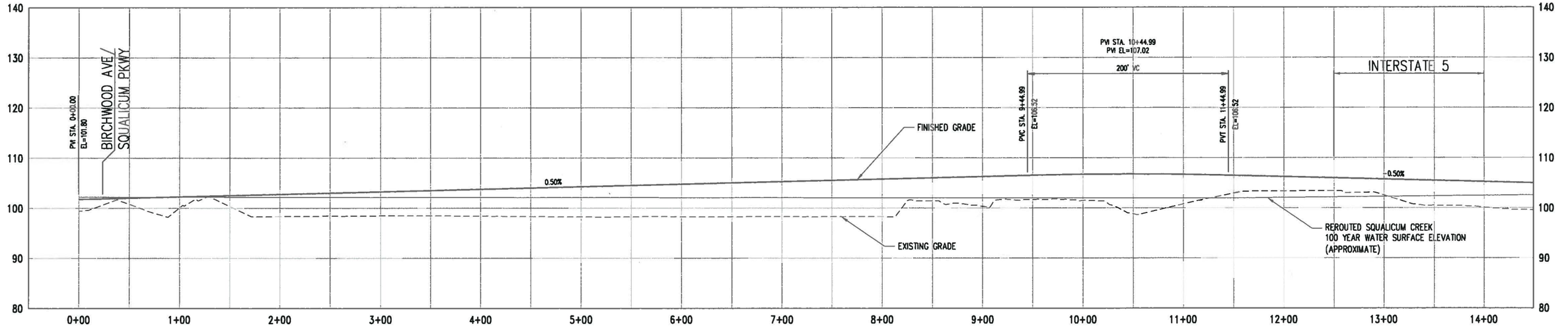
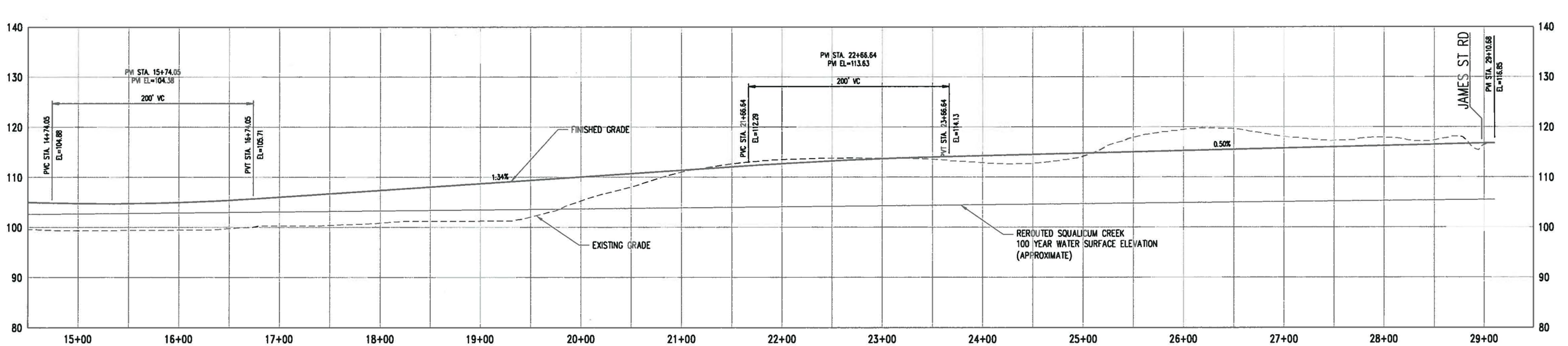
CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

ALTERNATIVE 2
PRE DESIGN STUDY
PRELIMINARY – NOT FOR CONSTRUCTION

SHEET 7





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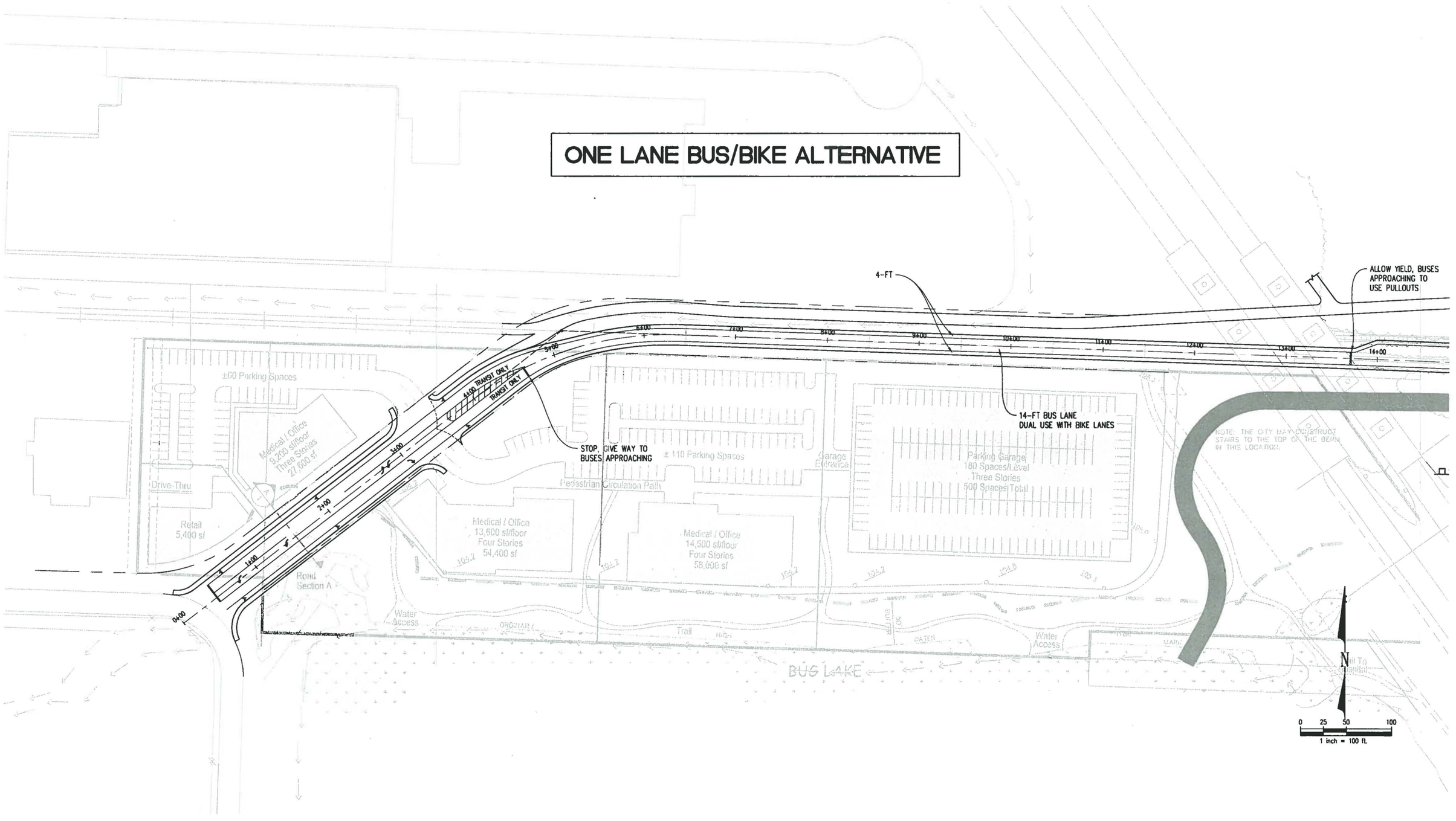
CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

ALTERNATE 2
PRE DESIGN STUDY
PRELIMINARY - NOT FOR CONSTRUCTION

SHEET 8

ONE LANE BUS/BIKE ALTERNATIVE



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CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

SHEET 9

ONE LANE BUS/BIKE ALTERNATIVE

STOP, GIVE WAY TO BUSES APPROACHING

YIELD, USE PULLOUT IF BUS APPROACHING

ORCHARD STREET

Dense brush

N

0 25 50 100

1 inch = 100 ft.

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CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

SHEET 10

Appendix B

Connectivity Analysis

Appendix B. Connectivity Analysis and User Mobility Benefit

Introduction

Connectivity is an often used, but also often undefined term and concept in transportation planning with no real value associated with what is being measured. Bellingham transportation planners are in the process of developing connectivity analysis at the parcel level to further integrate and prioritize transportation improvements with land use plans and intends to develop a connectivity metric to the Multimodal Transportation Concurrency Program.

During the summer of 2010, a demonstration project was conducted to analyze mobility benefits associated with new transportation connections, including the proposed Orchard Street Extension. Bellingham hired TranspoGroup, Inc. consultants based in Kirkland , WA to demonstrate a" ViaCity" software application that they had created, which uses Route Directness Index (RDI) methodology to calculate the straight line (crow's flight) distance between two points or destinations and the actual route distance for a traveler. A higher RDI value indicates a more direct route with better connectivity to the traveler's destination while a lower RDI value indicates a less direct route that requires a traveler to go out of their way and thus has worse connectivity. ViaCity applies RDI to GIS maps and can be as accurate as the precision of the GIS data.

Summary of Findings

The results of the demonstration study specific to the proposed Orchard Street Extension are shown in Figures B.2. through B.6., below, and were presented to the Bellingham Transportation Commission in September 2010. The ViaCity software produces powerful visual graphics to demonstrate connectivity and mobility benefits from a users perspective and helps to integrate transportation planning with land use planning. Figure B.1. provides the overall regional land use context surrounding the proposed Orchard Street Extension. The color-coded text in the left column represents land use issues directly and indirectly affecting the project area and the colors match the graphic depictions on the aerial photograph, including 868 acres annexed to the City in 2009, referred to below as northeast Bellingham.

Figure B.2. shows the relative travel distance and accessibility from all parcels to Saint Joseph's Hospital . Travel distance from parcels in northeast Bellingham is significantly more than the straight line distance due to the barrier that Interstate 5 creates to east-west movement and the need to traverse one of two congested freeway interchanges at either Sunset or Meridian to reach the hospital. Figure B.3. shows the reduced travel distance and improved access to parcels in northeast Bellingham provided by the addition of the Orchard Street Extension.

Figure B.4. shows the direct relationship of reduced travel time and improved access to all parcels in northeast Bellingham, which directly translates to reduced response and delivery times for EMS, Fire, and police services from northeast Bellingham to Saint Joseph's Hospital. Figure B.5. shows similar travel distance reductions and accessibility improvements to the downtown Bellingham Library from parcels in northeast Bellingham. Figure B.6. shows travel distance reductions and accessibility improvements to Bellingham Technical College from parcels in northeast Bellingham.

Figure B.1. Regional Land Use Context Surrounding Orchard Street Extension

James Street Bridge Construction

2009 Annexations: 868 Acres estimated 1,930 homes

Orchard Estates Subdivision (205 homes)

Meadow Ridge Estates (350 homes planned)

James Street Estates Mobile Home Park (94 homes)

Sunset Pond Park

Sunset Square Shopping Center

Meridian St Commercial Area

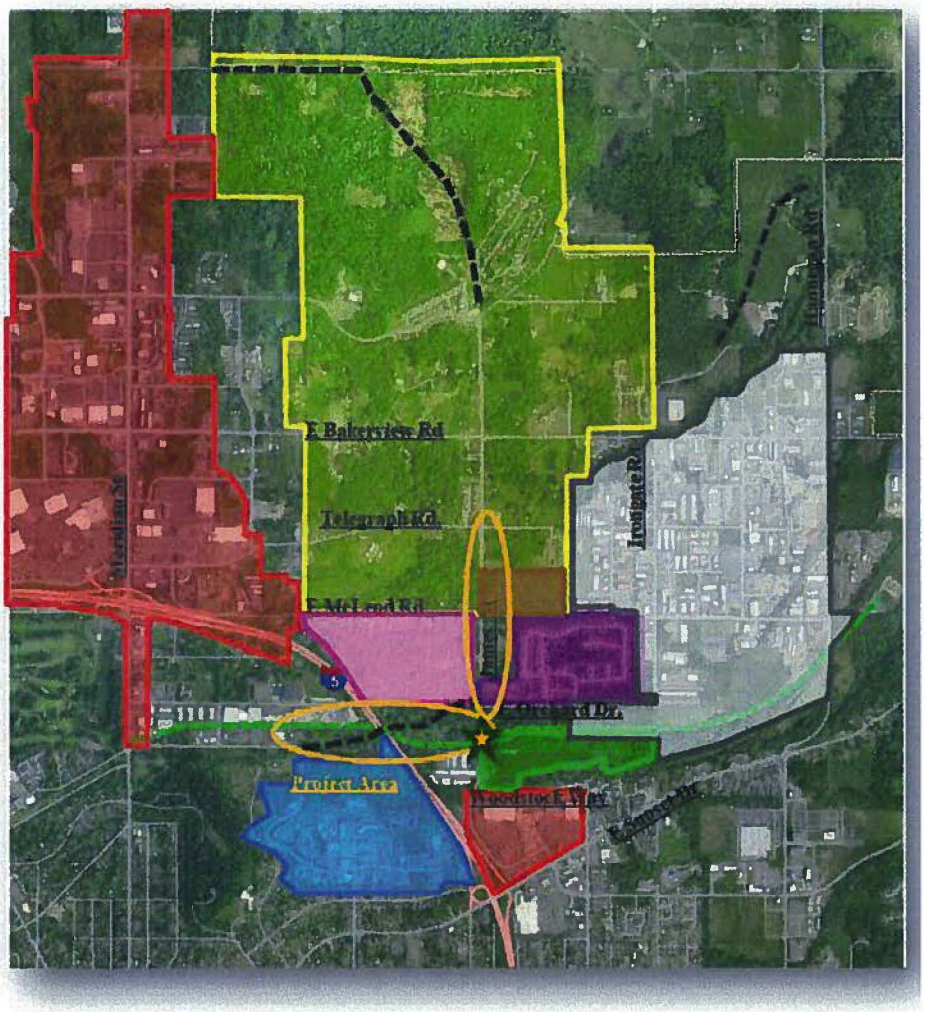
Hannegan Industrial Area

James Street – Phase 2

Planned Arterial Street Connections

St. Joseph's Hospital

Planned "Bay to Baker Trail"



Transportation-Land Use Connectivity Analysis for Orchard Street Extension (Parcel to Parcel)

- ✓ **Interstate 5 = Barrier**
- ✓ **Existing travel options = Congested interchanges at Sunset and Meridian**
- ✓ **Orchard Street = New grade-separated east-west arterial through railroad tunnel beneath Interstate 5**

MOBILITY BENEFITS

- ✓ **Connects Northeast Bellingham to City core**
- ✓ **New NE access to Hospital and medical facilities along Squalicum Parkway**
- ✓ **Eases traffic congestion on Sunset, Ellis, Telegraph, and Meridian**
- ✓ **Significant improvement in EMS, fire, and police response times to hospital**
- ✓ **MULTIMODAL: New sidewalk, bicycle lane, transit, auto connections**
- ✓ **In conjunction with physically separated off-street multi-use trail connecting City parks**

Figure B.2. Existing Mobility: Interstate 5 = East-West Barrier

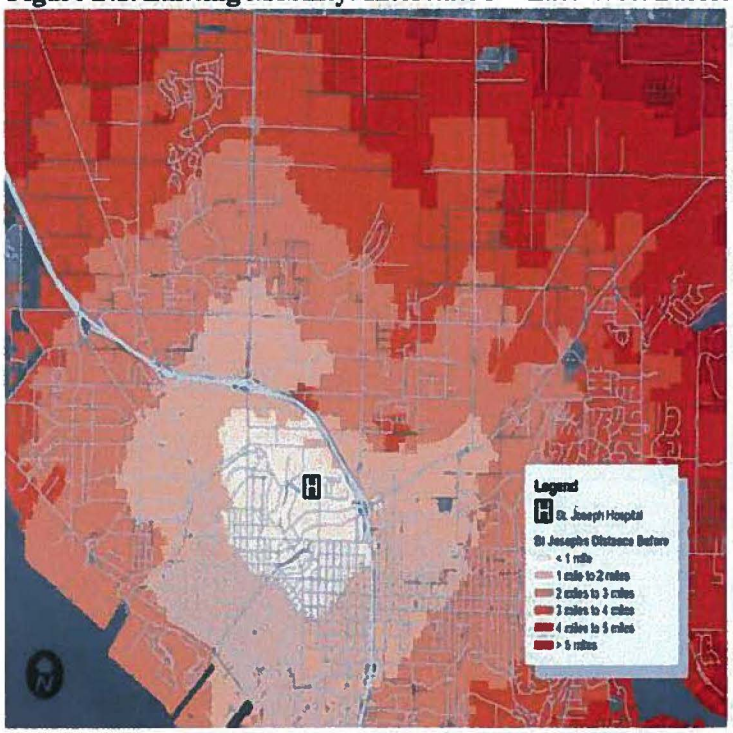
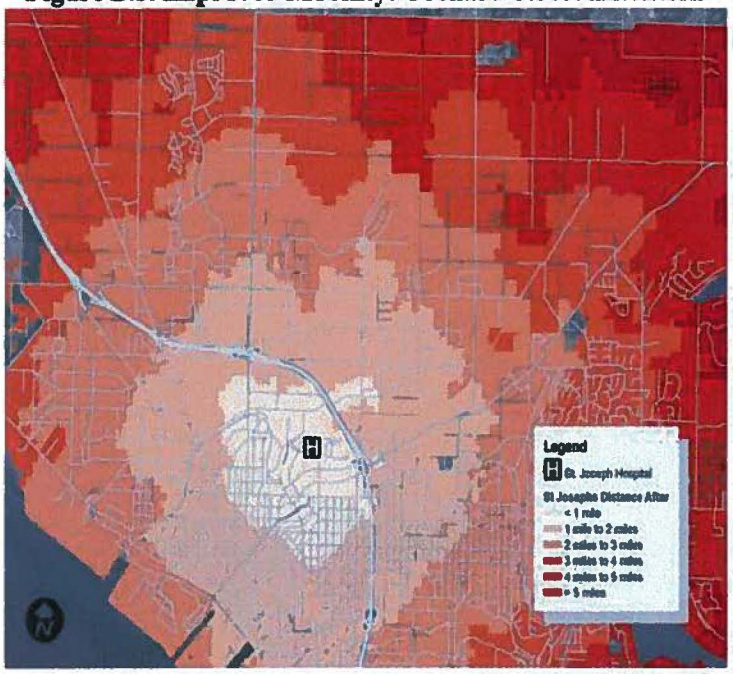


Figure B.3. Improved Mobility: Orchard Street Extension



Transportation-Land Use Connectivity Analysis for Orchard Street Extension (Link to Destination Examples)

Connectivity benefit SIGNIFICANT (darker blues) for all parcels in area recently annexed to City

Figure B. 4. Destination:

Saint Joseph's Hospital

- **Reduced response and delivery time for EMS, Fire, and Police**
- **Reduces Ellis Street congestion**
- **Increased access to medical facilities and services**

Figure B.5. Destination:

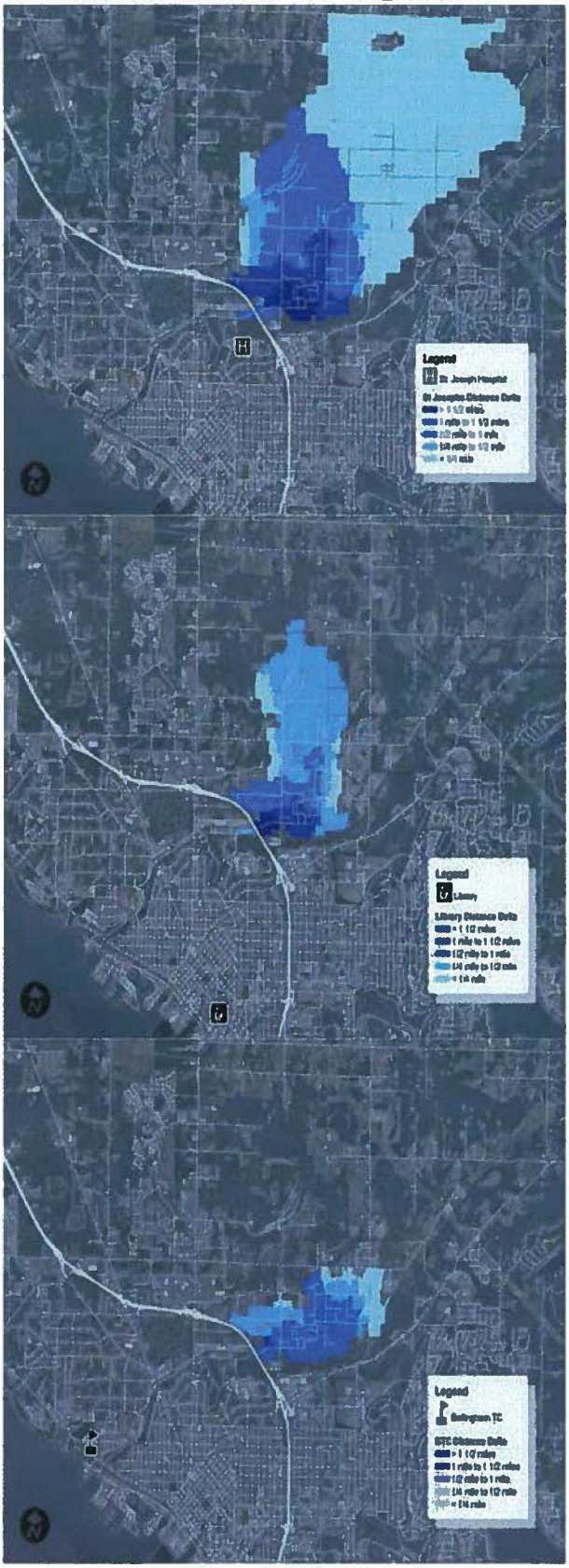
Downtown Library

- **Increased multimodal mobility (pedestrian, bike, transit, auto) into core of City**
- **Increased access to downtown library and municipal services**

Figure B.6. Destination:

Bellingham Technical College

- **Increased multimodal mobility (pedestrian, bike, transit, auto) and access to City waterfront**



Appendix C

WCOG Travel Demand Forecast Model

Appendix C.
Whatcom Council of Governments (WCOG) Travel Demand Forecast Model Analysis for Existing Conditions (2008), Mid-Term Future (2020), and Long-Term Future (2032)

Introduction

The Whatcom Council of Governments (WCOG) has developed a regional travel demand forecast model for comprehensive planning purposes and most jurisdictions in Whatcom County are utilizing this model for the update to the Transportation Element of their Comprehensive Plans, as required by the Washington Growth Management Act (GMA). The WCOG model includes the capability of examining existing conditions on arterial street segments based on vehicle traffic counts collected during 2008, short-term forecasts of vehicle traffic conditions for year 2020, and long-term forecasts of vehicle traffic conditions for year 2032. It should be noted that the WCOG model, and most travel demand forecast models, are primarily tools used to examine levels of vehicle traffic congestion during the heaviest demand periods of the day, usually the p.m. peak period (4:00 – 6:00pm) also known as the local evening rush hour. All computer-simulation travel demand models have limitations in their capabilities and in what type of results may be expressed in map form.

The WCOG model does not have the capability to examine specific conditions, congestion levels, vehicle queue lengths, or turning movement problems at intersections, which requires additional micro-simulation modeling tools. Travel demand models also may not show problems on arterial corridors due to signal timing issues that cause significant delay and long vehicle queue lengths. An example of this is the situation that exists on the segment of Telegraph Road at Meridian Street (SR 539). Due to the long green signal preferences given to north-south traffic on Meridian (SR 539), westbound traffic on Telegraph experiences significant delay and vehicle queues are long. Traffic counts cannot reflect the true volume or demand for capacity in this type of situation because when traffic does not move, vehicles are not being counted, and traffic count results are artificially depressed. The travel demand forecast model then shows this arterial segment as having a lower volume-to-capacity ratio and makes it appear as if there is not a congestion issue in this location, which is inaccurate.

The WCOG model also does not have the capability of modeling the existing conditions or benefits of new connections for non-motorized users of the multi-modal transportation network. Bellingham Public Works Transportation Planners are working to develop analytical tools to measure existing mobility conditions for non-motorized users, the mobility benefits of new connections for non-motorized users, cost-benefit considerations, and prioritization of non-motorized projects and funding. The Orchard Street Extension was the subject of a demonstration study of these new analytical tools and the results are included in ***Appendix B.*** of this document.

Summary of Findings - Traffic Volumes and Traffic Congestion

Overall, the WCOG travel demand model forecasts show that regardless of whether the Orchard Street Extension is constructed or not, traffic volumes and traffic congestion are expected to increase throughout northern Bellingham between the 2008 base year and the forecast years of 2020 and 2032 due to future land use development and population growth.

In comparing the 2020 and 2032 model forecasts for scenarios with and without the Orchard Street Extension, the WCOG model shows a reduction of traffic volumes on all surrounding arterial streets with the addition of the Orchard Street Extension (See Table 1), including Ellis Street, which is currently the primary entrance to Saint Joseph's Hospital and private practice and specialized medical offices on Squalicum Parkway.

The WCOG model also shows that the construction of the Orchard Street Extension between James Street and Birchwood Avenue would increase traffic volumes and traffic congestion on Woodstock Way, James Street, and Birchwood Avenue, but all at levels well within the City's standards. This is due to the attraction of vehicle trips to the Orchard Street Extension, which is directly connected to these arterial streets. With the addition of bicycle lanes to Birchwood Avenue between Squalicum and Meridian in 2011 and the reconstruction of James Street between Woodstock Way and Telegraph Road, all of these secondary arterial streets will be full standard urban streets with sidewalks, bicycle lanes, and the capability to accommodate high-frequency transit busses.

Although not shown by model analysis, the Orchard Street Extension also provides transportation benefit for all of these non-automotive modes as well. As stated above, the Orchard Street Extension was the subject of a demonstration study of these new analytical tools and the results are included in ***Appendix B.*** of this document.

Table 1. Travel Demand Model Traffic Volume Analysis – 2008, 2020, and 2032 – With and Without Orchard Street Extension

TRAFFIC VOLUMES		A. Forecasts WITHOUT Orchard Street Extension					B. Forecasts WITH Orchard Street Extension					Volume
Arterial	Street Segment	2008 w/o	2020 w/o	2032 w/o	08-'32 Change	08-'32 % Change	2008 w/o	2020 with	2032 with	08-'32 Change	08-'32 % Change	Reduction w/Orchard
Telegraph	James to Deemer	1,720	2,105	2,707	987	57%	1,720	1,819	2,415	695	38%	-19%
Telegraph	Deemer to Meridian	993	1,331	1,806	813	82%	993	1,036	1,471	478	46%	-36%
James	Orchard to Telegraph	1,945	2,352	3,027	1,082	56%	1,945	2,811	3,062	1,117	40%	-16%
Woodstock	James to Orleans	1,240	1,368	1,207	-33	-3%	1,240	1,488	1,410	170	11%	14%
E Sunset	Interstate 5 to Orleans	7,584	8,402	9,172	1,588	21%	7,584	8,040	8,575	991	12%	-9%
W Sunset	Interstate 5 to Ellis	2,389	2,623	2,749	360	15%	2,389	2,336	2,439	50	2%	-13%
Illinois	Ellis to Meridian	1,628	1,711	1,941	313	19%	1,628	1,623	1,889	261	16%	-3%
Ellis	Sunset to Squalicum	1,216	1,647	1,916	700	58%	1,216	1,681	1,927	711	42%	-15%
Squalicum	Birchwood to Ellis	1,216	1,647	1,916	700	58%	1,216	1,681	1,927	711	42%	-15%
Birchwood	Meridian to Squalicum	1,120	1,475	1,688	568	51%	1,120	1,951	2,158	1,038	53%	2%
Meridian	Illinois to Birchwood	3,066	3,451	3,612	546	18%	3,066	3,453	3,610	544	16%	-2%
Meridian	Birchwood to Telegraph	5,575	6,376	7,014	1,439	26%	5,575	6,229	6,921	1,346	22%	-4%

Table 2. Travel Demand Model Analysis – Arterial Traffic Congestion 2008, 2020, and 2032 – With and Without Orchard Street Extension

VOLUME-TO-CAPACITY TRAFFIC CONGESTION LEVELS		A. Model Forecasts WITHOUT Orchard Street Extension								B. Model Forecasts WITH Orchard Street Extension								% Change Congestion
		2008		2020		2032		V/C	08-'32 %	2008		2020		2032		V/C	08-'32 %	
Arterial	Street Segment	v/c	LOS	v/c	LOS	v/c	LOS	Change	Change	v/c	LOS	v/c	LOS	v/c	LOS	Change	Change	w/Orchard
Telegraph	James to Deemer WB	0.31	A	0.41	A	0.54	A	0.23	74%	0.31	A	0.33	A	0.47	A	0.16	52%	-23%
	EB	0.34	A	0.43	A	0.63	B	0.29	85%	0.34	A	0.33	A	0.55	A	0.21	62%	-24%
Telegraph	Deemer to Meridian WB	0.69	B/C	0.81	D	0.99	E/F	0.30	43%	0.69	B/C	0.74	C	0.92	E	0.23	33%	-10%
	EB	0.39	A	0.51	A	0.70	C	0.31	79%	0.39	A	0.40	A	0.59	A/B	0.20	51%	-28%
James	Orchard to Telegraph NB	0.49	A	0.73	C	0.90	E/F	0.41	84%	0.49	A	0.77	C	0.93	E	0.44	90%	6%
	SB	0.60	B	0.80	D	0.99	E/F	0.39	65%	0.60	B	0.80	D	0.98	E/F	0.38	63%	-2%
Woodstock	James to Orleans WB	0.44	A	0.53	A	0.49	A	0.05	11%	0.44	A	0.57	A	0.59	A/B	0.15	34%	23%
	EB	0.52	A	0.52	A	0.51	A	-0.01	-2%	0.52	A	0.57	A	0.59	A/B	0.07	13%	15%
E Sunset	Interstate 5 to Orleans EB	0.80	D	0.78	C	0.85	D	0.05	6%	0.80	D	0.76	C	0.92	E	0.12	15%	9%
	WB	0.76	C	0.77	C	0.87	D	0.11	14%	0.76	C	0.75	C	0.88	D	0.12	16%	1%
W Sunset	Interstate 5 to Ellis WB	0.69	B/C	0.75	C	0.82	D	0.13	19%	0.69	B/C	0.65	B	0.71	C	0.02	3%	-16%
	EB	0.80	D	0.89	D/E	0.90	E	0.10	13%	0.80	D	0.81	D	0.82	D	0.02	2%	-10%
Illinois	Ellis to Meridian WB	0.53	A	0.57	A	0.65	B	0.12	23%	0.53	A	0.54	A	0.63	B	0.10	19%	-4%
	EB	0.49	A	0.50	A	0.56	A	0.07	14%	0.49	A	0.47	A	0.55	A	0.06	12%	-2%
Ellis	Sunset to Squalicum NB	0.77	C	0.92	E	0.98	E/F	0.21	27%	0.77	C	0.89	D/E	0.98	E/F	0.21	27%	0%
	SB	0.95	E	1.16	F	1.20	F	0.25	26%	0.95	E	1.12	F	1.13	F	0.18	19%	-7%
Squalicum	Birchwood to Ellis NB	0.45	A	0.60	B	0.68	B	0.23	51%	0.45	A	0.62	B	0.69	B/C	0.24	53%	2%
	SB	0.31	A	0.43	A	0.51	A	0.20	65%	0.31	A	0.43	A	0.51	A	0.20	65%	0%
Birchwood	Meridian to Squalicum EB	0.31	A	0.57	A	0.42	A	0.11	35%	0.31	A	0.66	B	0.75	C	0.44	142%	106%
	WB	0.45	A	0.35	A	0.63	B	0.18	40%	0.45	A	0.75	C	0.60	B	0.15	33%	-7%
Meridian	Illinois to Birchwood NB	0.84	D	0.94	E	0.99	E/F	0.15	18%	0.84	D	0.95	E	0.98	E/F	0.14	17%	-1%
	SB	0.87	D	0.98	E/F	1.02	F	0.15	17%	0.87	D	0.97	E	1.02	F	0.15	17%	0%
Meridian	Birchwood to Telegraph NB	0.81	D	0.90	E	0.96	E	0.15	19%	0.81	D	0.88	D	0.95	E	0.14	17%	-1%
	SB	0.74	C	0.87	D	0.98	E/F	0.24	32%	0.74	C	0.85	D	0.97	E	0.23	31%	-1%

Figure 1. Existing Conditions – 2008 – Without Orchard Street Extension

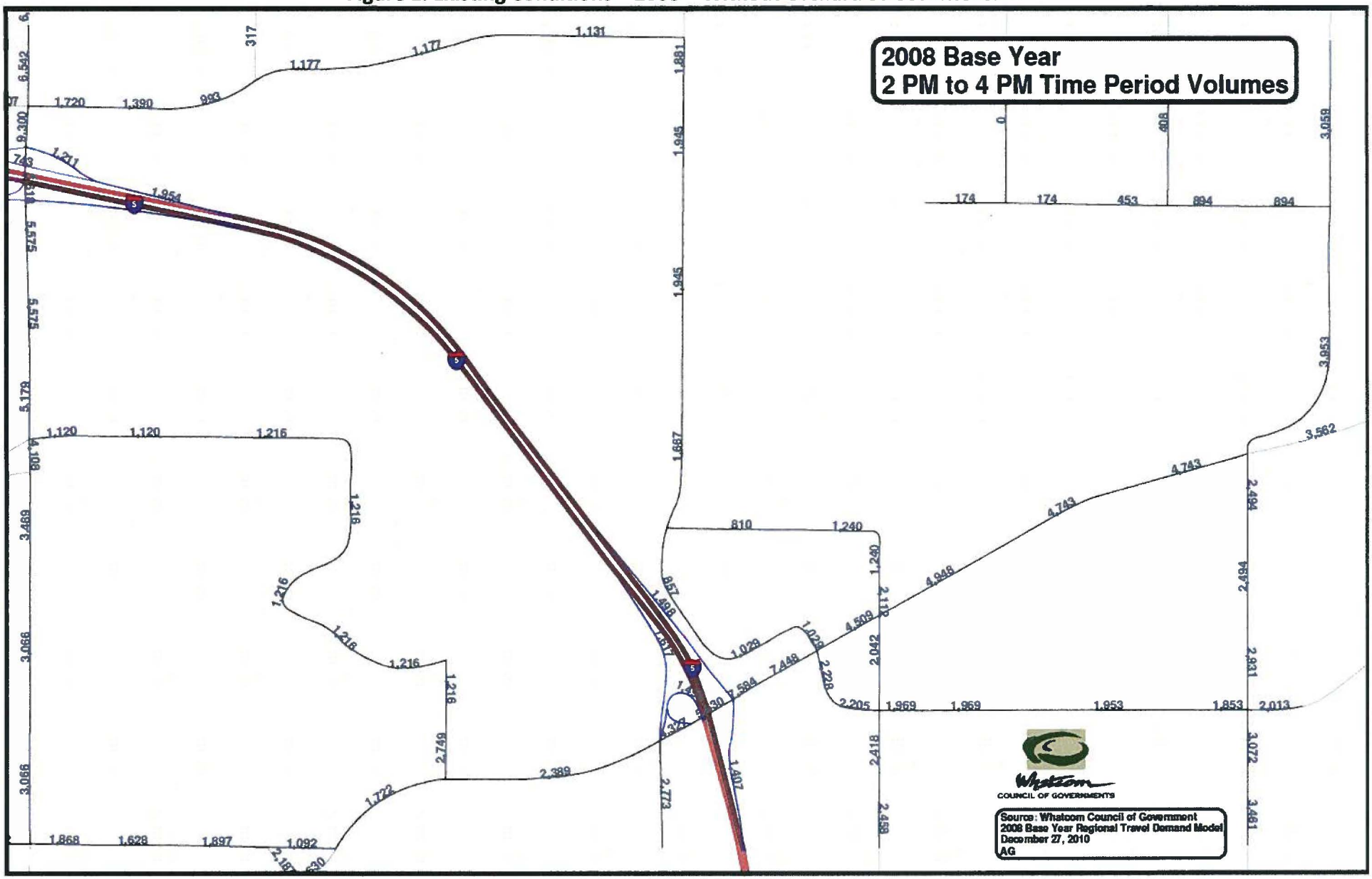


Figure 2. Mid-Term Future Forecast – 2020 – Without the Orchard Street Extension

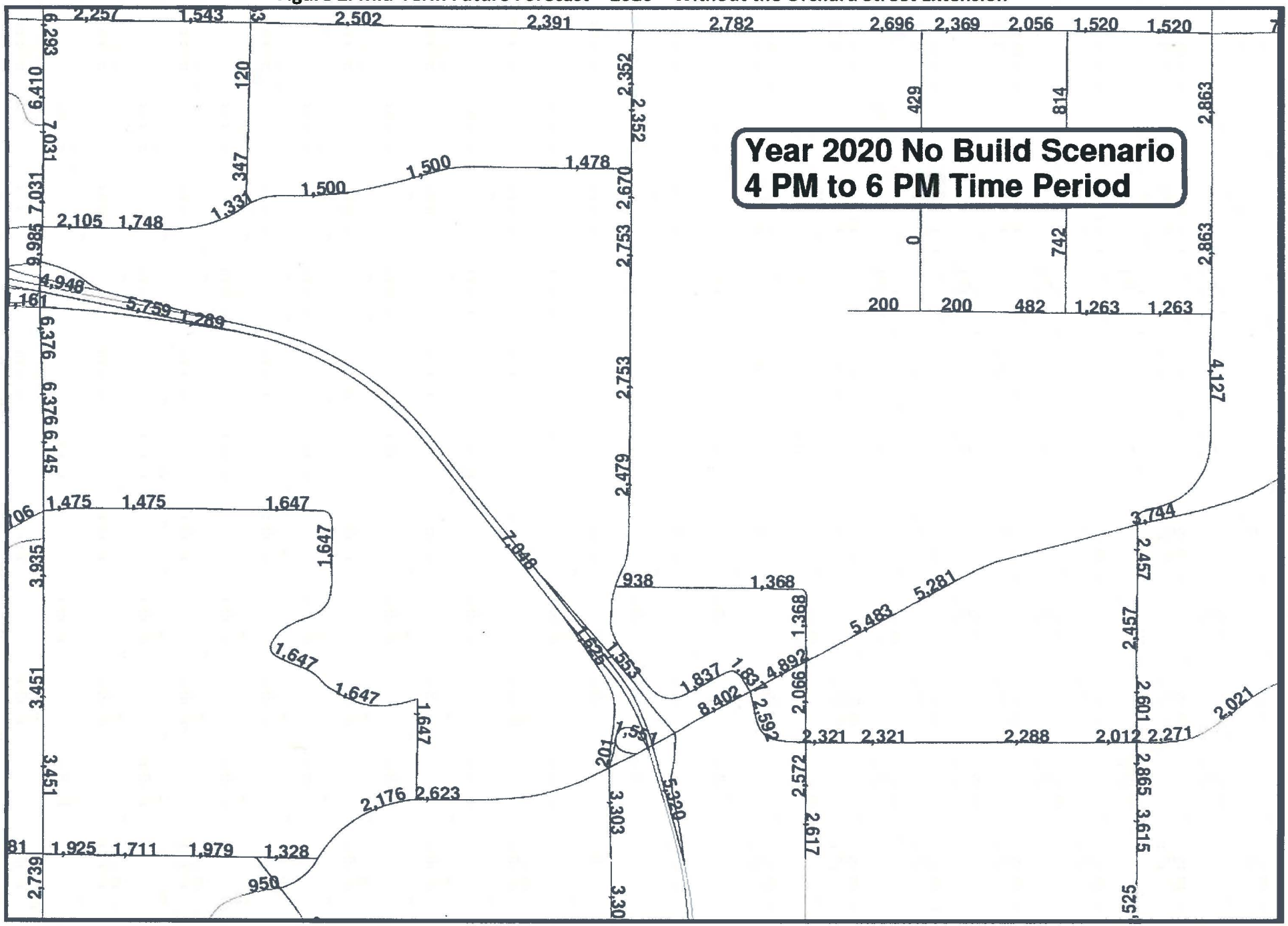


Figure 3. Mid-Term Future Forecast – 2020 – With the Orchard Street Extension

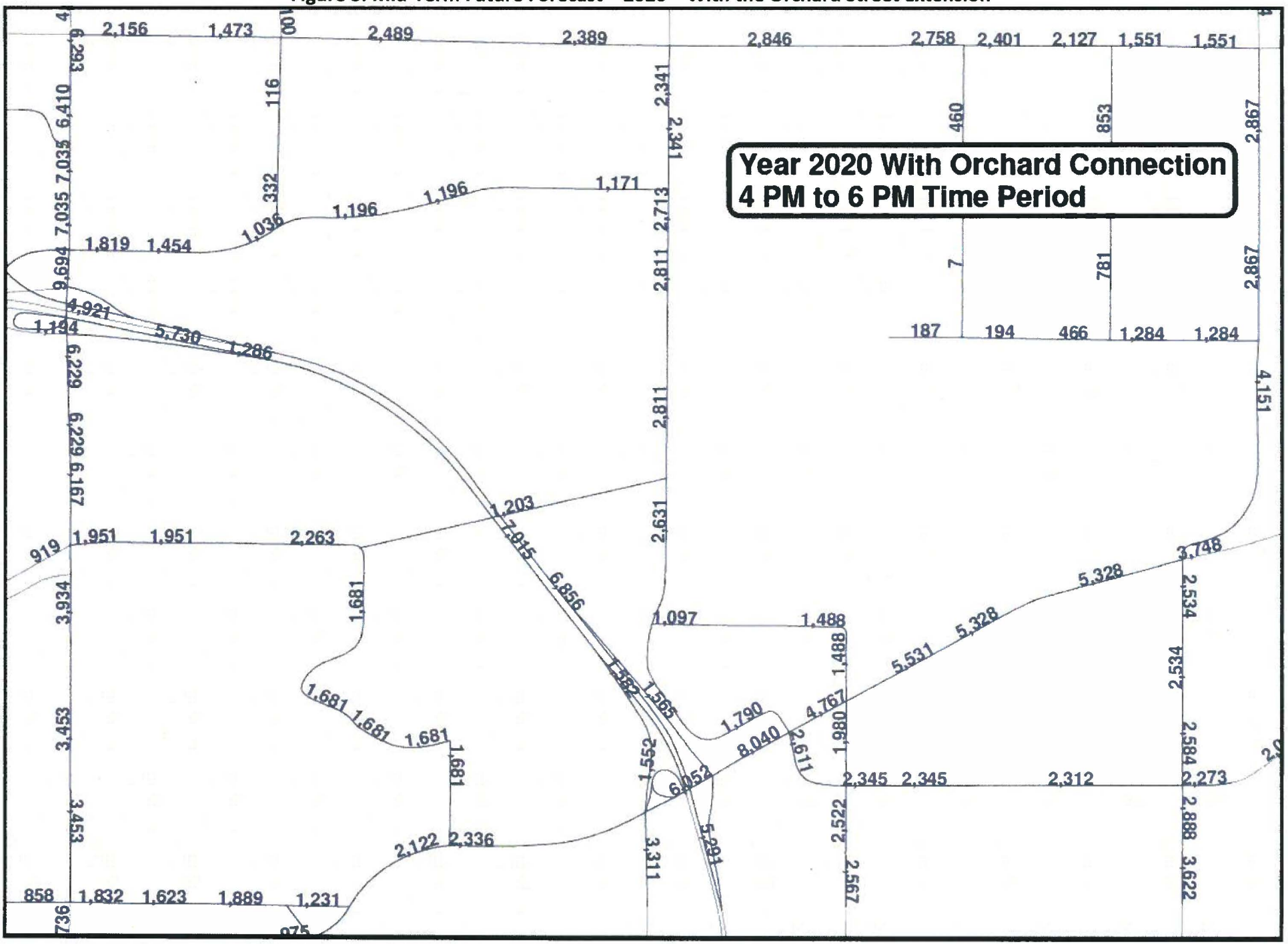


Figure 4. Long-Term Future Forecast – 2032 - Without the Orchard Street Extension

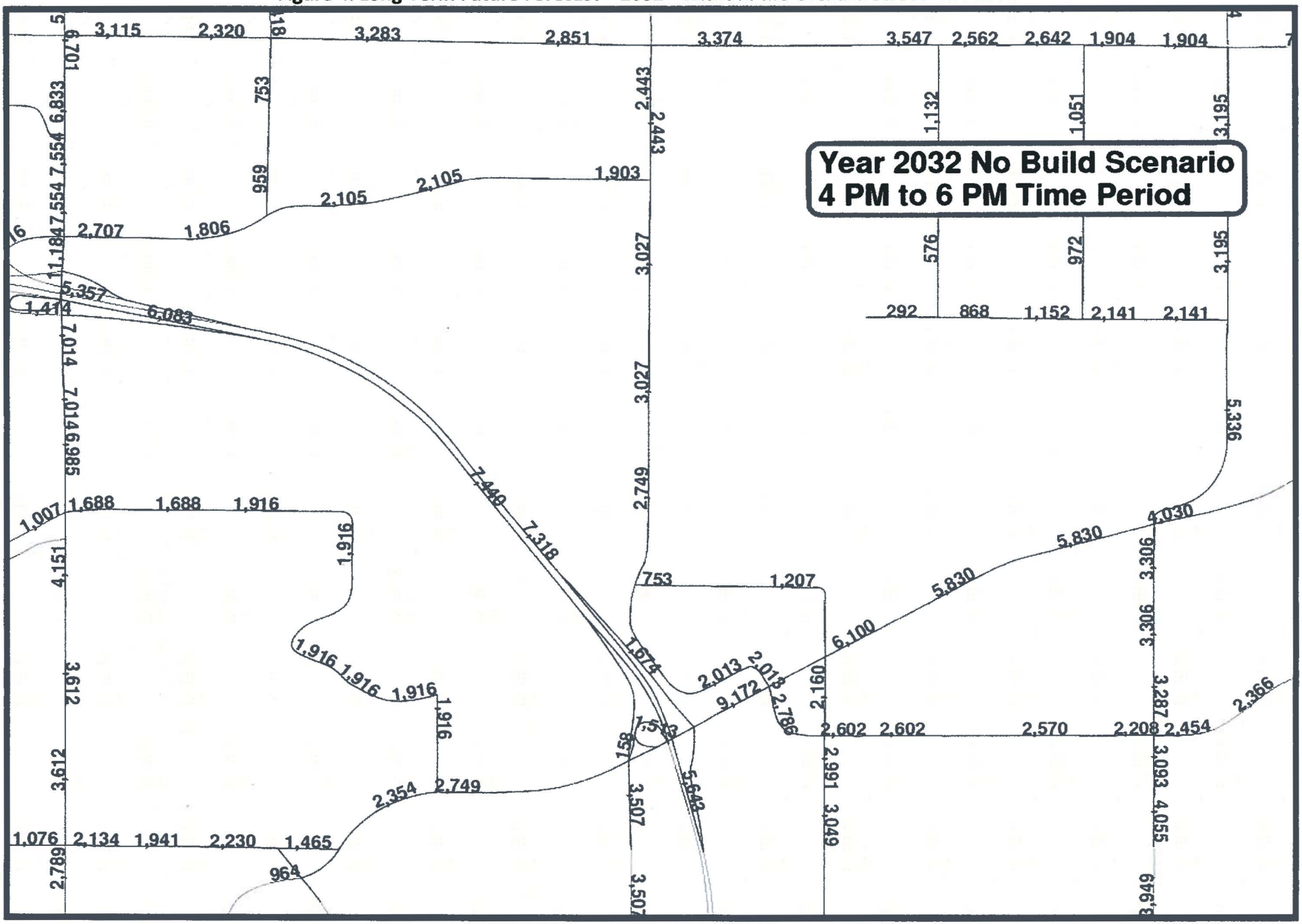
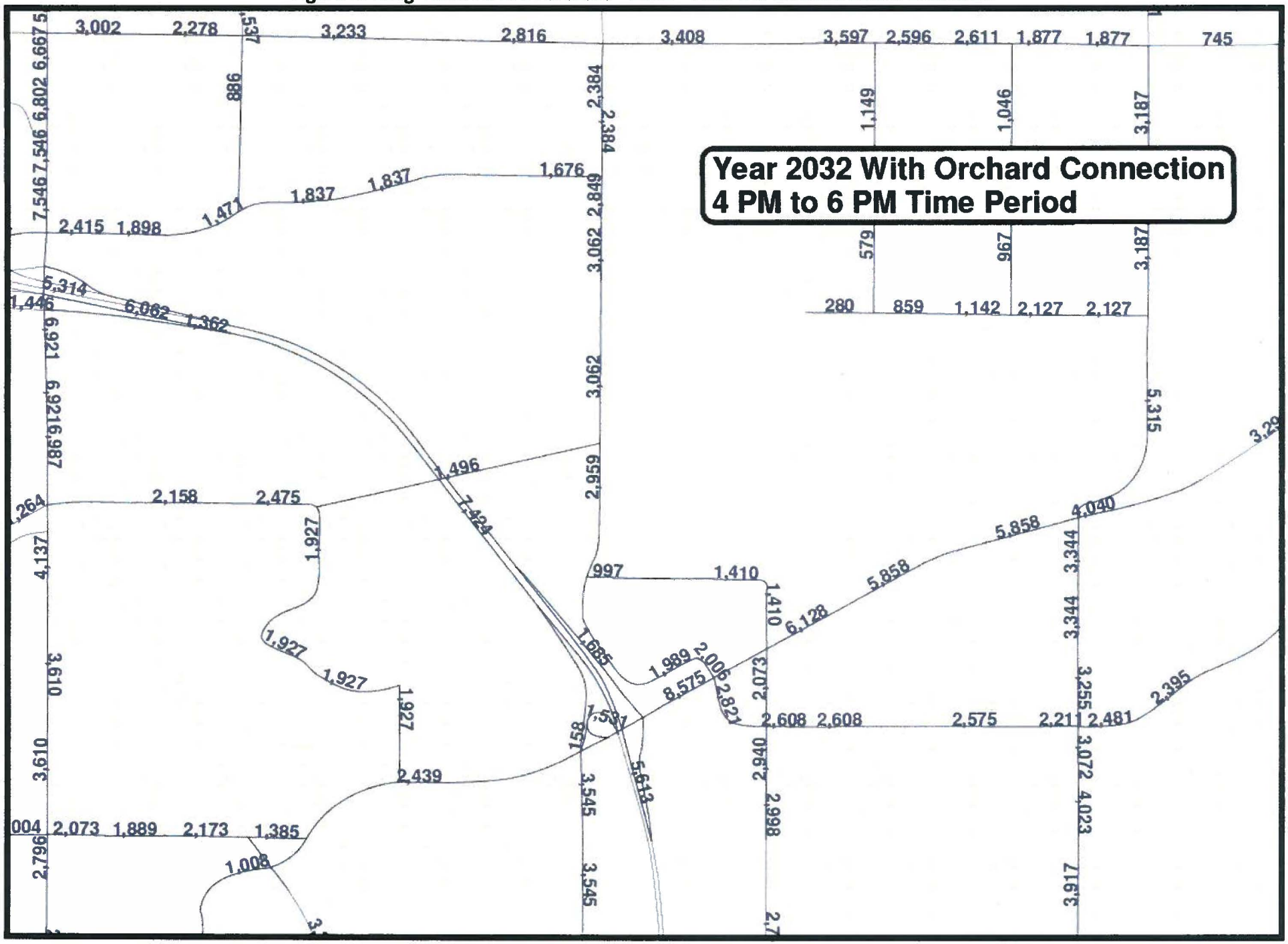
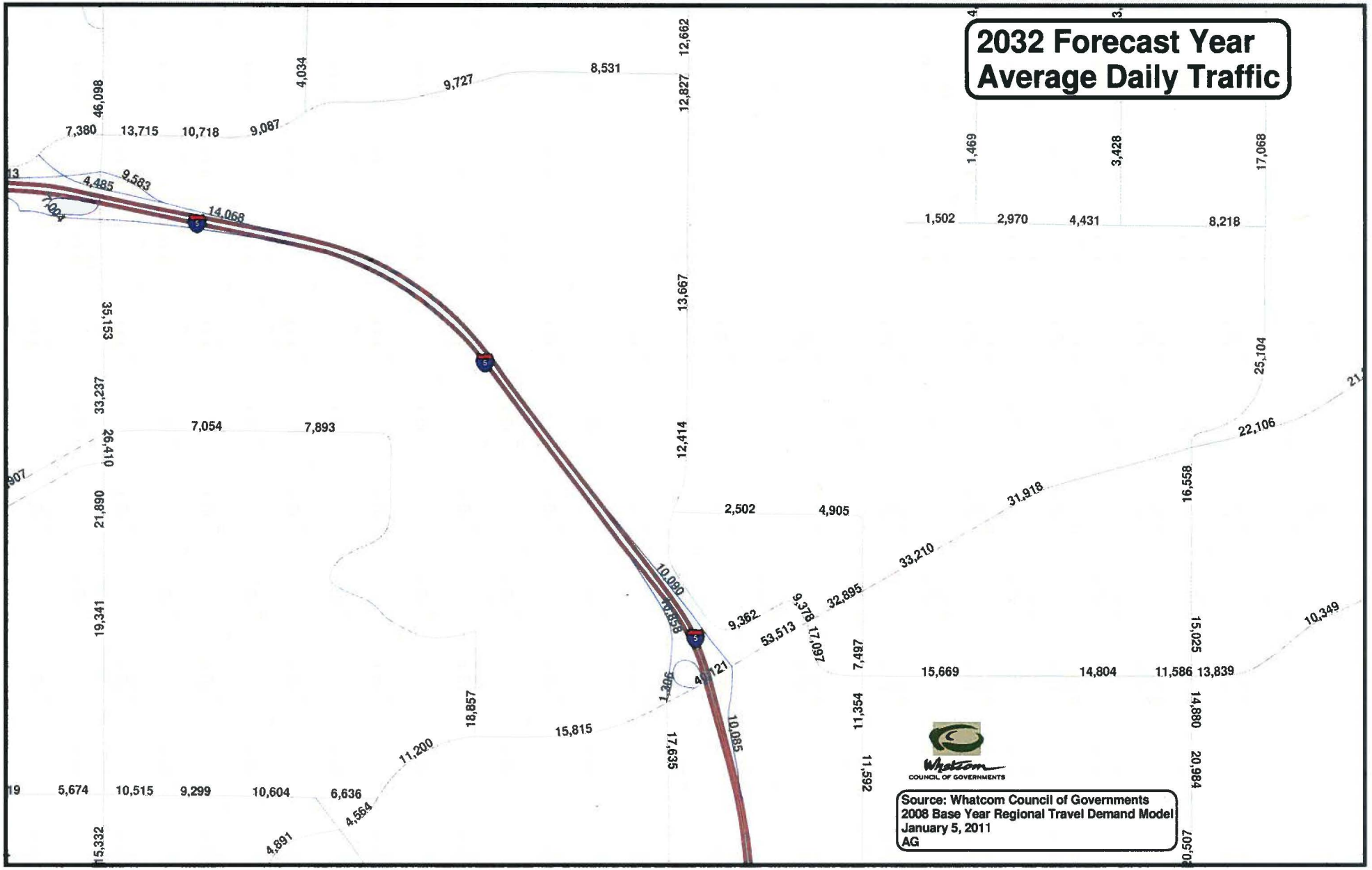
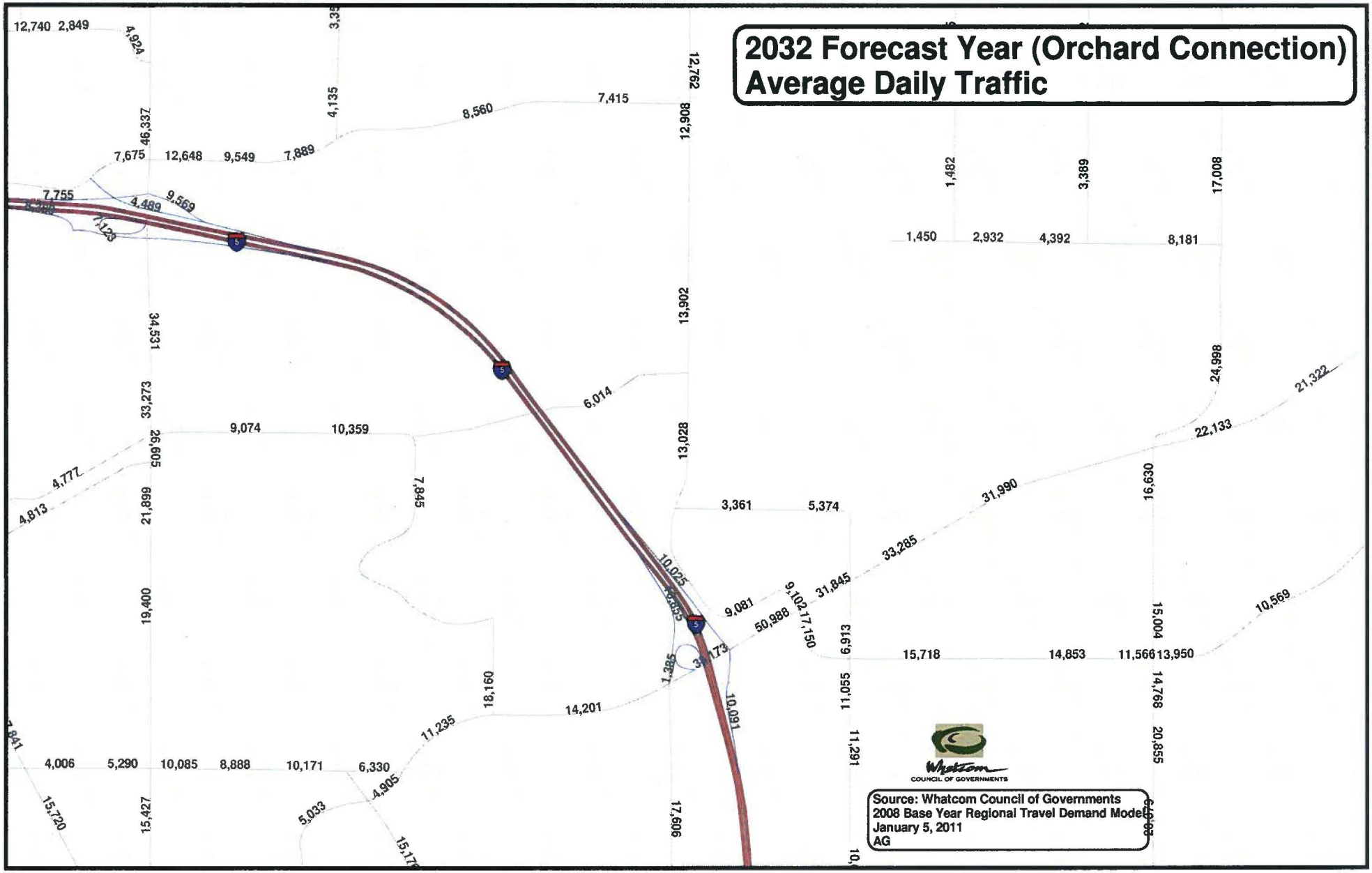


Figure 5. Long-Term Future Forecast – 2032 - With the Orchard Street Extension




2032 Forecast Year
Average Daily Traffic
Whatcom
COUNCIL OF GOVERNMENTS
Source: Whatcom Council of Governments
2008 Base Year Regional Travel Demand Model
January 5, 2011
AG


2032 Forecast Year (Orchard Connection)
Average Daily Traffic
12,740
2,849
4,924
46,337
7,675
12,648
9,549
7,889
8,560
7,415
12,908
4,135
7,755
4,489
9,569
1,482
3,389
17,008
1,450
2,932
4,392
8,181
34,531
33,273
26,605
21,899
19,400
13,902
13,028
9,074
10,359
6,014
7,845
4,777
4,813
3,361
5,374
24,998
21,322
22,133
31,990
33,285
31,845
9,081
50,988
9,102
17,150
6,913
11,055
11,291
16,630
15,004
14,768
20,855
15,718
14,853
11,566
13,950
10,569
10,025
1,385
10,091
18,160
14,201
11,235
4,006
5,290
10,085
8,888
10,171
6,330
4,905
5,033
15,427
17,606
15,720
Whatcom
COUNCIL OF GOVERNMENTS
Source: Whatcom Council of Governments
2008 Base Year Regional Travel Demand Model
January 5, 2011
AG

Appendix D

Wetland Impacts

WETLAND

WETLAND

WETLAND

TRAIL

WETLAND BUFFER

N

LEGEND

- ROAD IMPACT 0.91-AC
- TRAIL IMPACT 0.08-AC
- ISOLATED WETLAND IMPACT 0.23-AC
- BUFFER IMPACTS - ROADWAY 1.4-AC
  TRAIL 0.73-AC

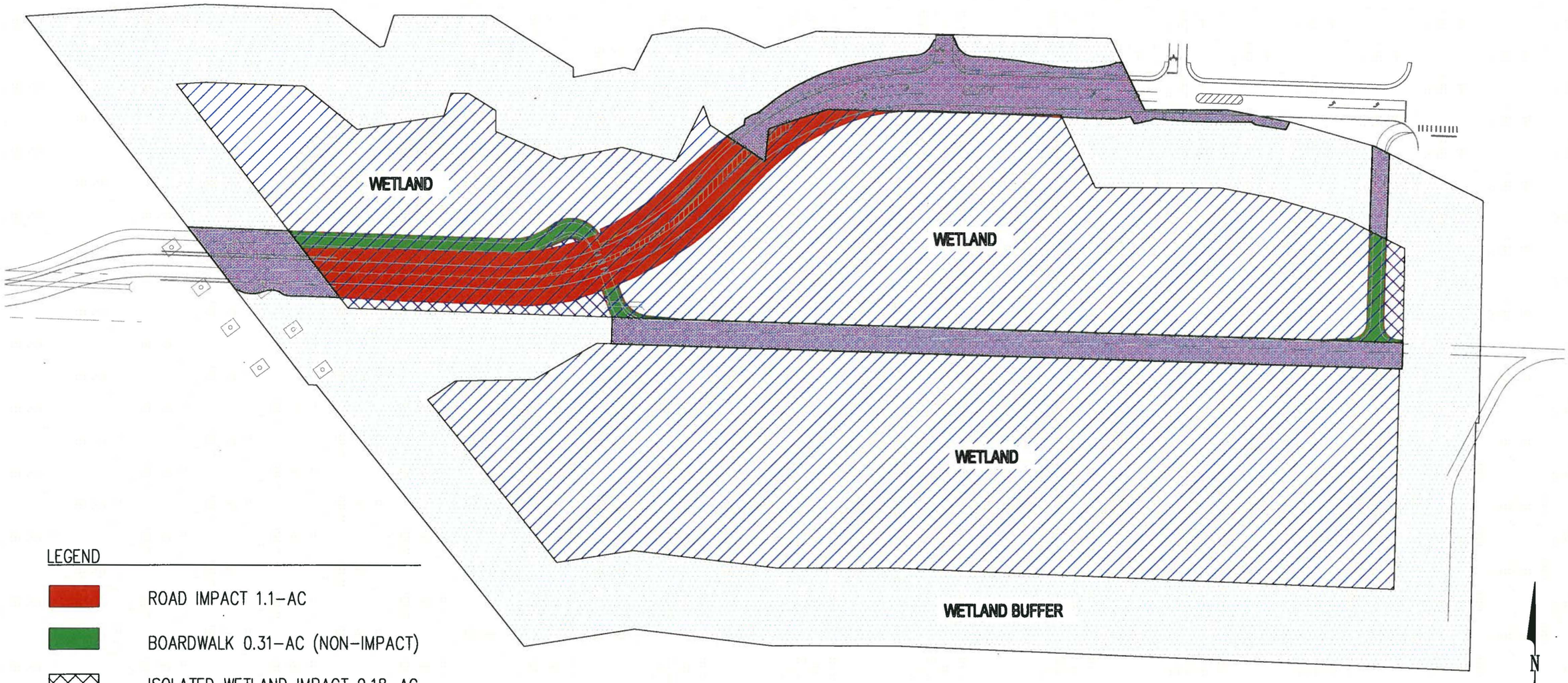
kpff Consulting Engineers
1601 Fifth Avenue, Suite 1600
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

WETLAND AND WETLAND BUFFER IMPACT

ALT NO. 1



LEGEND

- ROAD IMPACT 1.1-AC
- BOARDWALK 0.31-AC (NON-IMPACT)
- ISOLATED WETLAND IMPACT 0.18-AC
- BUFFER IMPACTS 1.9-AC

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CITY OF BELLINGHAM WASHINGTON

ORCHARD STREET EXTENSION

WETLAND AND WETLAND BUFFER IMPACT

ALT NO. 2

Appendix E

Environmental Memorandum

Memorandum

Date:	April 28, 2011
To:	Justin Matthews KPFF Consulting Engineers 1601 Fifth Avenue, Suite 1600 Seattle, WA 98101
From:	Chris Soncarty, Project Manager Torrey Luiting, Wetland Biologist
Subject:	**Orchard Street Extension – Wetland Memorandum**

Introduction

This Memorandum addresses potential wetland impacts and mitigation requirements associated with the City of Bellingham's (City) Orchard Street Extension project (proposed project). The proposed project would provide connectivity between the Guide Meridian to the west and James Street to the east. Interstate 5 currently bisects the City of Bellingham and limits connectivity between some neighborhoods, which increases to traffic congestion along Sunset Drive, Guide Meridian and Bakerview Road due to the limited east-west connectors. A primary reason the corridor for the proposed project was selected was that an existing underpass exists beneath Interstate 5 (I-5) that was constructed to accommodate a railroad corridor that has since been abandoned and is no longer in service. The City of Bellingham has identified this abandoned railroad corridor as a potential connector road for Orchard Street or Birchwood Street, as well as a segment of an extensive interurban trail system.

The City is currently considering two alternatives for the proposed project; Alternative 1 and Alternative 2. As described by KPFF, Alternative 1 consists of a 32 foot wide roadway with 11 foot lanes and 5 foot bike lanes in both directions. Sidewalks exist where the regional trail is not adjacent to the roadway. The multi-use Bay to Baker trail is 12 feet wide. Sideslopes on both the roadway and trail are sloped at 2:1 (h:v). The roadway alignment follows the railroad grade (center bay) underneath I-5 before curving north to Orchard Street. The trail is adjacent to the roadway west of I-5, it shifts into the northern bay underneath I-5, beyond that it crosses the Orchard Street extension with a mid block at grade crossing before continuing east toward James Street Road. This alternative curves south near James and crosses James Street Road with a midblock at-grade crossing. With the roadway in the central bay, the trail in the northern bay, the relocated Squalicum Creek channel would be constructed in the southern bay underneath I-5. The roadway and trail would be built on imported fill where necessary.

Alternative 2 is a narrower 28 foot wide roadway section with no bike lanes. Sidewalks exist where the regional trail is not adjacent to the roadway. The multi use Bay to Baker trail is 12 feet wide.

Sideslopes on both the roadway and trail are sloped at 2:1 (horizontal:vertical). The roadway alignment shifts into the northern bay underneath I-5 before curving north to Orchard Street. The trail is adjacent to the roadway west of I-5, it shifts north between the north-bay and bridge abutment under I-5, beyond that there is an at-grade mid block crossing of the Orchard Street Extension before continuing east on the railroad grade toward James Street Road. At James Street Road it passes underneath a new raised bridge. This alternative allows room for the relocated Squalicum creek channel in the central bay under I-5. The trail would be constructed on boardwalk where it is within wetlands.

The proposed project would affect wetlands located to the east of I-5. The wetlands were previously identified based on wetland reconnaissance efforts completed by David Evans & Associates (DEA) in 2007 (David Evans & Associates 2007). ICF has not field investigated the proposed project alignment to verify DEA's conclusions regarding the existence, nature, or extent of wetlands which may be impacted by the project. ICF did complete a wetland delineation of the eastern edge of wetlands within 50 feet of the edge of James Street in April, 2010, but ICF has not completed a wetland delineation of the portion of the wetlands within the proposed project alignment.

This memo describes the potential impacts to wetlands as identified and described by DEA based on impact calculations provided to ICF by KPFF Consulting Engineers. This memo identifies the mitigation ratios which are likely to be required by the U.S. Army Corps of Engineers (Corps) and the Washington State Department of Ecology (Ecology) based on current mitigation ratio guidance (Ecology 2006), as well as the mitigation ratios specified by the City of Bellingham Municipal Code (BMC). This memo also provides a summary of recently issued state and federal requirements for mitigation site selection (Ecology 2009) and of a new technique Ecology is using to determine if the acres of mitigation proposed by an applicant truly provide for functional replacement of wetland impacts (Ecology 2010). Finally, this memo provides an estimate of mitigation cost based on the likely mitigation requirements.

It should be noted that the Orchard Street Extension project has also been referred to in the past as the Orchard Street Connector Road Corridor and in BMC Title 16.55.080.D.11(3) as the "Birchwood Avenue – James Street Connector project". As such, the proposed project is one of the 'essential public facilities' specifically authorized to apply for an exemption from the requirement (BMC 16.55.070) to obtain a Critical Areas permit. Although the implications of this exemption are generally described in this memo, ICF strongly recommends that KPFF consult directly with the City of Bellingham's Planning and Community Development Department regarding this potential exemption and its implications for project design and permitting.

This memo does not discuss potential implications of other critical areas regulated by the City of Bellingham (i.e. geologically hazardous areas, critical aquifer recharge areas, frequently flooded areas, or fish and wildlife habitat conservation areas (see BMC 16.55.030) which may also exist within the proposed project corridor.

Wetlands

DEA completed a reconnaissance level survey of areas east and west of Interstate 5 in the vicinity of the proposed project in April 2007 and identified areas of wetlands associated with Tributaries W and V along both sides of the abandoned railroad corridor (David Evans & Associates 2007). The reconnaissance level survey did not delineate the precise boundaries of the wetlands, but rather examined visual indicators (e.g., hydrology, soils and vegetation) to estimate wetland boundaries according to the 1987 *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Washington State Wetlands Identification and Delineation Manual* (Washington State Department of Ecology 1997).

DEA observed large forested wetland areas located on the east side of Interstate 5 on both the north and south side of the abandoned railroad corridor in 2007. DEA determined that these forested wetlands would likely be rated as Category II wetlands based on Ecology's Wetland Rating System for Western Washington (Hruby 2006), which is the method stipulated in the BMC 16.55.280.

The 2007 reconnaissance indicated the wetlands along both the north and south sides of the railroad corridor extended all the way from I-5 east to the edge of James Street. This is consistent with the eastern edge of these wetlands as delineated by ICF in April 2010.

Thus, for the purposes of assessing potential impacts and mitigation associated with the Orchard Street Extension project, it is assumed that the wetlands located north and south of the railroad corridor, between Interstate 5 and James Street are Category II wetlands and that both of these wetlands span the area from I-5 to James Street, but are separated from each other by the railroad corridor.

Wetland Buffers

Per Bellingham Municipal Code 16.55.340, wetland buffers are dependent upon the Category of the wetland, the adjacent land use, and the number of points for habitat functions obtained by the wetland per the *Ecology Wetland Rating System for Western Washington* (Hruby 2006).

For Category II wetlands, the buffer width can vary from 50 feet to 200 feet. Because the proposed project would entail the construction of a new roadway in a relatively urban/suburban setting the adjacent land use intensity was considered high. Each wetland was rated for habitat function by ICF in 2010 based on conditions viewable from its eastern edge and each wetland was rated as less than 20 points (i.e. low) for habitat function due largely to its proximity to developed areas, proximity to I-5 and James Street, and single (albeit forested) vegetation class.

With high intensity land use and a low habitat score, both wetlands would be afforded 100 foot buffers (Table 1).

Table1. Anticipated Wetland Buffer Requirements

Wetland (and Category)	Habitat Function Score based on 2010 ICF delineation of eastern edge	Required Buffer for High Intensity Land Use
North Wetland (Category II)	19	100 feet
South Wetland (Category II)	16	100 feet

Wetland Impacts

During this feasibility study, every effort was made to identify ways to avoid and minimize impacts to wetland and wetland buffers and it is expected further consideration of ways to avoid and minimize impacts will be identified as the design progresses beyond this preliminary feasibility study.

Wetland impacts were calculated by KPFF based on Alternative 1 and Alternative 2 road and boardwalk configurations and are summarized in Table 2.

Table 2. Potential Direct and Indirect Wetland Impacts

Wetland (and Category)	Alternative 1 (acres)	Alternative 2 (acres)
Road Impacts	0.90	1.1
Trail/Boardwalk Impacts	0.39	0*
Total Direct Wetland Impacts	*1.29*	*1.1*
Indirect Wetland Impacts	0.23	0.18
Grand Total Wetland Impacts	**1.52**	**1.28**

*impacts from pin pile footings for the boardwalk will likely also be considered direct impact and will need to be included.

Alternative 1

Alternative 1 would result in a total of approximately 1.29 acres of direct wetland impact from the roadway and at-grade trail. Approximately 0.23 acres of impact would also likely be ascribed to the project as indirect impacts for the areas of wetland left sandwiched between the trail and the roadway, and between the trail and James Street under Alternative 1.

Alternative 1 thus results in a total wetland impact of approximately 1.52 acres.

Alternative 2

Alternative 2 would result in approximately 1.1 acres of direct wetland impact from the roadway and elevated boardwalk. The boardwalk is assumed to not create direct impacts due to its translucent decking and pin pile foundations. However, it is likely the Corps will consider the pin-piles to be fill and will consider this area a direct impact.

Approximately 0.18 acres of impact would also likely be ascribed to the project as indirect impacts for the area of wetland left sandwiched between the boardwalk and the roadway, and between the boardwalk and James Street under Alternative 2.

Alternative 2 thus results in a total wetland impact of approximately 1.28 acres.

Wetland Buffer Impacts

Wetland buffer impacts are currently anticipated to be approximately 4.1 acres.

Mitigation for Unavoidable Wetland Impacts

Mitigation is required to compensate for both the acres of wetlands impacted by the proposed project, as well as for the specific functions provided by the impacted wetlands. While the amount of mitigation required is directly related to the acres of anticipated wetland impacts, regulatory agencies have varying degrees of flexibility in determining what is an adequate mitigation proposal.

As described below, the amount of mitigation that will be approved by the regulatory agencies varies depending on the category (and in some cases the vegetation class) of the wetlands impacted and on the type and method of mitigation proposed. The amount of required mitigation can also vary depending on the process the applicant used to determine where to locate a mitigation site and on when the mitigation is constructed relative to the timing of the impact.

Mitigation Sequencing, Site Selection, and Timing Relative to Impacts

The amount of mitigation can vary depending on the process the applicant used to determine where to locate a mitigation site. Recent changes to the federal and state wetland permitting and mitigation regulations now require the Corps and Ecology to explicitly consider proper mitigation sequencing and to require applicants use a watershed approach to selecting a mitigation site location.

In 2008, the Corps and Ecology updated their standards and criteria for the use of compensatory mitigation to offset unavoidable impacts on waters of the U.S. (including wetlands). As detailed in 33 CFR Part 332 *Compensatory Mitigation for Losses of Aquatic Resources* (Federal Register (FR), Volume 73, page 19670), Corps standards now require the use of proper mitigation sequencing, the use of a watershed approach to choosing an appropriate mitigation site, and stipulate a preference for restoration and the use of banks or in-lieu fees (where such banks and programs exist) over other types of mitigation such as onsite or offsite "permittee responsible mitigation." A requirement for measurable performance standards, long-term success monitoring, and the use of mitigation banks and/or in-lieu fee programs is also stipulated.

Mitigation sequencing requires the applicant to demonstrate how impacts on waters of the U.S. (including wetlands) have been first avoided to the greatest extent possible then minimized, and finally how mitigation will compensate for any remaining unavoidable impacts. A watershed

approach is defined as an analytical process for making mitigation site selection decisions that supports the sustainability or improvement of aquatic resources in a watershed. It involves consideration of watershed needs and a landscape perspective to identify the types and locations of mitigation projects that will benefit the watershed and offset losses of aquatic resource functions and services. Such an approach may involve consideration of landscape scale, historic and potential aquatic resource conditions, past and projected future aquatic resource impacts in the watershed, and the terrestrial connections between aquatic resources (73 FR 19670).

In late 2009 Ecology produced a guide entitled *Selecting Mitigation Sites Using a Watershed Approach* (Washington State Department of Ecology 2009) to assist applicants in complying with these new federal standards for compensatory mitigation. The guide provides information on the types of considerations stipulated by the federal standards and how they can be applied to proper selection of a mitigation site. BMC 16.55.240.B similarly requires mitigation site selection be based on the site's ability to sustain the critical area in the long term.

This guidance also supports the establishment of wetland functions prior to or concurrent with wetland impacts, meaning the applicant should complete advance mitigation or mitigation for all impacts at one time even if the impacts will occur in phases. Both the Corps and Ecology now have the ability to allow the purchase of mitigation bank credits or the construction or use of advanced mitigation credits to reduce the risk of mitigation site failure and consequent net loss of wetland function if the timing of mitigation construction falls behind the timing of the impacts.

BMC 16.55.200A.1 and 16.55.250 similarly require impacts to critical areas be avoided and minimized according to mitigation sequencing, as do the requirements stated for 'Essential Public Facility' projects in BMC 16.55.080.D.11(3).

Wetland Category, Function, and Vegetation Class

BMC 16.55.190 stipulates that "no activity or use shall be allowed that results in a net loss of the functions or values of Critical Areas". Consequently, wetland functions will need to be evaluated in more detail prior to preparation of a compensatory mitigation plan.

Higher category wetlands require a higher ratio of mitigation acres to impact acres because they provide a higher level of function and that level of function can be more difficult to replicate via mitigation.

In conjunction with using a watershed approach to mitigation site selection, Ecology is also encouraging the use of a newly developed "credit-debit tool" to assess whether an applicant's compensatory mitigation plan could adequately replace the functions and values of the impacted wetlands. Ecology is currently testing this tool for a one-year period (ending February 2012).

Regulatory agencies more readily approve mitigation plans that can clearly show full functional replacement (as well as replacement of acres impacted) with mitigation. Based on the three wetland functions assessed in the *Ecology Wetland Rating System for Western Washington* (Hruby 2006) (i.e., water quality, hydrologic, and habitat), the credit/debit tool quantifies the degree of function in each impacted wetland and then quantifies the degree of function expected in a mitigation site wetland.

The scores for the credit/mitigation site needs to be equal to or higher than the score for each function at the debit/impact site for the mitigation site to be deemed sufficient by Ecology.

When calculating the acres of mitigation needed to compensate for the functions of the impacted wetlands, the debit/credit tool also incorporates a higher temporal loss multiplier for impacts on forested wetlands, such as these wetlands. Impacts on forested wetlands require higher ratios because of the forested wetland functions can take much longer to develop (i.e., there is more temporal loss) due to the slow development of a multiple-layer forest.

If applicant sponsored mitigation is proposed to compensate for wetland impacts, the City should work with a qualified wetland biology team to calculate the debit score for the project area wetlands. An iterative process will then be required to develop mitigation site(s) of sufficient size and complexity to generate a high enough credit score to support functional replacement for the proposed impacts.

Type of Mitigation Proposed

Mitigation ratios also vary depending on the type and method of mitigation proposed. Lower ratios are typically associated with wetland creation or restoration because the degree of potential wetland function can be directly modeled and designed and because these techniques inherently result in an increase in wetland functions (since no wetland exists on the mitigation site). For example, the depth of surface ponding and the density of vegetation can be designed to maximize water quality improvement functions to replace impacts on an emergent wetland with no outlet that provided high water quality functions to its subbasin.

The 2008/2009 federal/state guidance now also stipulates that the decision of offsite versus onsite mitigation be made based on use of a watershed approach to selecting mitigation sites (Washington State Department of Ecology 2009). These changes have allowed both the Corps and Ecology to permit applicants to use mitigation bank credits and in-lieu fee programs (where they exist) to accomplish their mitigation requirements. Banks and advance mitigation can now also be considered before or instead of permittee-responsible mitigation.

If permittee responsible mitigation is proposed, a combination of approaches (i.e., restoration, creation, enhancement) can be combined, so long as a watershed approach is used to select appropriate sites.

The debit/credit tool also incorporates a risk factor into the calculation of mitigation acres needed by reducing the acres required if the proposed mitigation is constructed in advance of the impact, if the mitigation site was selected based on existing basin plans or prioritizations which show wetland functions are needed in the area, or if the mitigation is of a type more likely to succeed (e.g., restoration or creation in a geomorphically appropriate area). Using this tool, enhancement of an existing wetland (e.g., by planting trees and shrubs into a primarily reed canarygrass wetland) is given a higher risk factor due to its low probability of success and the difficulty of adequately elevating the water quality or hydrologic function score by enhancement.

Consequently, the acres of mitigation needed for restoration or creation calculated with this tool may be lower than the ratios that have been traditionally proposed based on the 2006 interagency

Wetland Mitigation in Washington State guidance put out by the Corps, Ecology, and EPA. In contrast, mitigation acres would likely need to be higher than the 2006 ratios if only enhancement is proposed.

Analysis of Potential Mitigation Requirements for this Project

The only mitigation bank with a service area that would include the project is the proposed Lummi Nation wetland and habitat mitigation bank, located in several sites at the mouths of the Lummi and Nooksack Rivers. However, the bank is not as of April 2011 approved by the Corps and Ecology to sell mitigation credits.

Consequently, in order to mitigate for the proposed wetland impacts, the City will likely need to propose permittee responsible mitigation in the form of wetland creation, restoration, rehabilitation, or enhancement. The City will need to ensure proposed mitigation for wetland impacts meets the ratios cited in BMC 16.55.350.E, as well as the typically higher ratios presented in the 2006 *Wetland Mitigation in Washington State* guidance. The City would also likely need to use Ecology's credit/debit tool to illustrate how proposed mitigation will replace not only the acres of wetland impacted, but the specific degree of function of those wetlands.

Wetland creation and restoration requires ratios of 3:1 for impacts on the Category II wetlands, based on both the BMC and the Ecology/Corps ratios (Table 3).

Wetland rehabilitation and enhancement require higher ratios of between 6:1 and 12:1 for Category II wetlands based on Ecology/Corps ratios and up to 8:1 for enhancement based on BMC ratios (Table 3). Higher ratios are required for these types of mitigation actions because these types of mitigation are conducted in areas that are already wetland, but of poor quality and low function. Thus they require mitigation techniques which substantially elevate functions above those already being performed. Similarly, because they do not result in an increase in wetland acres, higher ratios are required to prevent there being a 'net loss' of wetland acres as a result of a proposed impact.

Rehabilitation is defined as the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural or historic functions and processes of a degraded *wetland.* Rehabilitation results in a gain in wetland functions, but not a gain in wetland acres.

Enhancement is defined as the manipulation of the physical, chemical, or biological characteristics of a wetland site to heighten, intensify, or improve specific functions or to change the growth stage or composition of vegetation present. Enhancement results in a change in some wetland functions and can lead to a decline in other wetland functions, but does not result in a gain in wetland acres.

The regulatory agencies consider there to be a continuum between rehabilitation and enhancement and may negotiate ratios between those described in Table 3, depending on the nature and quality of the mitigation proposal. Proposals that fall within the 'gray area' between rehabilitation and enhancement typically result in a ratio that lies between the rehabilitation ratios and the enhancement ratios and is based on the ecological effectiveness of the proposed actions. For example, more effective actions to restore hydrology include actions such as removing dikes or removing roads, weirs, or tide gates; less effective actions include actions such as dike breaching, lowering outlet heights, or creating permeable corridors along utility lines.

Table 3 presents the range of potential mitigation need for the proposed project based on these different types of mitigation. Depending on the type of mitigation proposed, permittee responsible mitigation for the 1.52 acres of wetland impact under Alternative 1 would likely require a mitigation proposal of between 4.56 acres of mitigation if only creation/restoration is proposed up to 18.24 acres if only enhancement is proposed as mitigation (Table 3).

Under Alternative 2, permittee responsible mitigation for the 1.28 acres of wetland impact would likely require a mitigation proposal of between 3.84 acres of mitigation if only creation/restoration is proposed up to 15.36 acres if only enhancement is proposed as mitigation (Table 3).

Table 3. Mitigation Ratios and Acres of Mitigation needed under each Alternative for Impacts to Category II wetlands

	Creation or Restoration	Rehabilitation	Creation and Rehabilitation	Creation and Enhancement	Enhancement Only	Preservation Only
Mitigation Ratios						
Bellingham Code	3:1	4:1			8:1	16:1
Corps/ Ecology	3:1	6:1	1:1 Creation or Restoration AND 4:1 Rehabilitation	1:1 Creation or Restoration AND 8:1 Enhancement	12:1	Preservation only is not typically considered adequate
Alternative 1						
Mitigation Acres Required for 1.52 acres of impact	**4.56 acres**	**9.12* acres**	**1.52 acres Creation AND 6.08 acres Rehabilitation**	**1.52 acres Creation AND 12.16 acres Enhancement**	**18.24* acres**	
Alternative 2						
Mitigation Acres Required for 1.28 acres of impact	**3.84 acres**	**7.68* acres**	**1.28 acres Creation AND 5.12 acres Rehabilitation**	**1.28 acres Creation AND 10.24 acres Enhancement**	**15.36* acres**	

*Acres required is the minimum necessary to meet the more stringent Corps/Ecology ratio requirement.

Mitigation for Wetland Buffer Impacts

The BMC 16.55.340 allows the City's Director of Planning and Community Development Department (Director) to allow for the reduction of wetland buffers or to average standard wetland buffer widths on a case-by-case basis to allow for approved activities within a wetland buffer. Buffer

averaging reduces a buffer in one area, while increasing it in another to allow for development within the narrowed portion of the buffer.

Because the Orchard Street Extension project can apply for an exemption from the requirement to obtain a Critical Areas permit, it is possible that no direct mitigation for the approximately 4.1 acres of impacts to wetland buffers may be required, so long as such impacts are unavoidable and every effort has been made to avoid and minimize potential impacts. Any incidental damage to, or alteration of, a critical area that is not a necessary outcome of the exempted activity would need to be restored, rehabilitated, or replaced (BMC 16.55.080.D.11(3).

ICF strongly recommends that KPFF consult directly with the City of Bellingham's Planning and Community Development Department regarding this potential exemption and its implications for the potential need to mitigation for wetland (and stream) buffer impacts.

Even under such an exemption, the project would need to demonstrate that wetland buffer impacts have been avoided wherever possible and minimized where it is not possible to avoid buffer impacts.

Mitigation Cost

A number of factors can affect the amount of mitigation needed to create an adequate mitigation proposal to the regulatory agencies. Similarly, the cost to design, construct, maintain, and monitoring mitigation sufficiently to meet regulatory permit conditions can also vary depending on a number of factors. Mitigation cost is commonly estimated on a per acre basis and can vary significantly based on the existing conditions of the mitigation site, mitigation design complexity, and agency requirements specific to an individual project.

Other factors that can affect the cost of mitigation include:

- land acquisition costs,
- the type and extent of different habitat types to be included in the mitigation,
- the extent of negotiation with the regulatory agencies,
- local agency requirements for mitigation construction plans and specifications,
- degree of construction observation (particularly if the site design requires careful oversight by a hydraulic engineer),
- the degree and duration of performance monitoring (typically at least a 10-year period), and
- the nature and degree of maintenance activities necessary to achieve the mitigation site performance standards.

For example, a mitigation site that requires complex hydrologic and hydraulic modeling to design water levels; more clearing, grading, and contouring;, higher numbers, a greater variety, or unique plant species; and seasonally specific installation and/or multiple habitat types is generally more expensive. Mitigation efforts that restore historic wetland conditions, require minimal earthwork, and/or are located in an area where natural revegetation from an intact ecosystem can be expected

are generally less expensive. Similarly, mitigation projects that rely on enhancement of emergent areas dominated by invasive species such as reed canarygrass are typically more expensive to maintain and monitor than sites where few invasive species are established prior to the installation of targeted native plant species.

ICF assisted the City of Everett with estimating a reasonable cost range that could be expected for mitigation projects. In preparing the estimated cost range, ICF reviewed over 15 mitigation projects that have been constructed in both the public and private sector within the last 6 years to determine a reasonable range of mitigation cost that can be expected for permittee responsible mitigation. In developing a reasonable cost range, we focused on the type and magnitude of mitigation design that meets current agency standards. In so doing, we discounted projects and cost ranges at both ends of the spectrum. For example, projects that may have cost $15,000 to $20,000 per acre in the past and consisted of only planting shrubs and trees in a small wetland and installing a protection fence, were not considered applicable examples. Likewise, cost ranges such as WSDOT's $400,000 to $1,200,000 per acre were similarly considered higher than what would likely be considered "typical."

ICF estimates a range of approximately $170,000 to $350,000 per acre for permittee responsible mitigation. This cost estimate includes the costs to develop, design, permit, construct, maintain, and monitor for 5 to 10 years and is based on 15 mitigation projects implemented within the past six years. This cost range assumes consulting engineers and wetland biologists are primarily used for developing mitigation plans to meet agency requirements and does not include the value of City staff participation in mitigation planning and design.

This cost range includes an assumption of approximately $3,000 to $5,000 per acre to purchase undeveloped land. Cost for suitable sites within the Squalicum Creek subbasin may be higher given its urbanized nature.

Table 4 presents the range of potential mitigation costs for the proposed project based on the different types of mitigation outlined in Table 3. Depending on the type of mitigation proposed, permittee responsible mitigation for the 1.52 acres of wetland impact under Alternative 1 would likely cost between approximately $775,200 if only creation/restoration is proposed up to approximately $6.384 million if only enhancement is proposed as mitigation (Table 4).

Under Alternative 2, permittee responsible mitigation for the 1.28 acres of wetland impact would likely cost between $652,800 if only creation/restoration is proposed up to approximately $5.376 million if only enhancement is proposed as mitigation (Table 4).

Table 4. Estimated Cost of Mitigation under each Alternative

	Creation or Restoration	Rehabilitation	Creation and Rehabilitation	Creation and Enhancement	Enhancement Only
Alternative 1					
Mitigation Acres Required for 1.52 acres of impact	4.56 acres	9.12* acres	1.52 acres Creation AND 6.08 acres Rehabilitation	1.52 acres Creation AND 12.16 acres Enhancement	18.24* acres
Estimated Cost at $170,000 to $350,000 per acre	**$775,200 to $1.596 million**	**$1.55 million to $3.192 million**	**$1.292 million to $2.66 million**	**$2.326 million to $4.788 million**	**$3.192 million to $6.384 million**
Alternative 2					
Mitigation Acres Required for 1.28 acres of impact	3.84 acres	7.68* acres	1.28 acres Creation AND 5.12 acres Rehabilitation	1.28 acres Creation AND 10.24 acres Enhancement	15.36* acres
Estimated Cost at $170,000 to $350,000 per acre	**$652,800 to $1.344 million**	**$1.306 million to $2.688 million**	**$1.088 million to $2.240 million**	**$1.958 million to $4.032 million**	**$2.611 million to $5.376 million**

*Acres required is the minimum necessary to meet the more stringent Corps/Ecology ratio requirement.

Regulatory Compliance and Environmental Permitting

The City of Bellingham is the proponent for the proposed project. At this time, the suite of funding source(s) for the project has not been determined, but is likely to include federal funding. Federal funding triggers a suite of regulatory compliance requirements, as does the project's need to obtain a federal permit for impacts to wetlands. Wetlands are also regulated by Ecology and by local critical areas ordinances.

The follow sections describe the federal, state, and local environmental permitting requirements likely to be associated with the proposed project, assuming at least partial federal funding and that in-water work (including impacts to wetlands) would be required to construct the project.

This discussion of permits assumes the wetlands would be officially delineated and determined to be jurisdictional by the Corps and Ecology.

Environmental Permitting Requirements

The project would require in-water work and would impact waters of the U.S., including wetlands, and thus would require environmental permits from the following agencies/jurisdictions:

- U.S. Army Corps of Engineers Clean Water Act Section 404 Permit – anticipated to be an Individual Permit (requirements described below), unless wetland impacts can be reduced

to less than 0.5 acres of impact to qualify for Nationwide Permit 14 for Linear Transportation Projects;

- Washington Department of Ecology Clean Water Act Section 401 Water Quality Certification – anticipated to require an Individual 401 water quality certification;
- Washington Department of Fish and Wildlife Hydraulic Project Approval (HPA);
- SEPA determination of Non-Significance (DNS) or Mitigated Determination of Non-Significance (MDNS) issued by lead SEPA agency (likely the City of Bellingham); and
- City of Bellingham Shoreline Permit (Substantial Development or Conditional Use) and Floodplain Development Permit. Project is exempt from Critical Areas Permit review, as described below.

Environmental Regulatory Compliance

The following federal, state and local environmental regulations would likely be triggered by the project:

National Environmental Policy Act: Because the project will impact waters of the U.S. (i.e. wetlands) it will be required to obtain permits from a federal agency (i.e. the Corps) and will be required to comply with the National Environmental Policy Act (NEPA). NEPA compliance would similarly be triggered if the project were funded, wholly or partially with federal monies.

Demonstrating NEPA compliance is an aspect of obtaining a Clean Water Act Section 404 permit from the Corps for impacts to waters of the U.S. and typically requires an analysis of alternatives, including pertinent screening criteria, as well as a presentation of the project's purpose and need in order for the Corps to determine if the proposed project is the Least Environmentally Damaging Practicable Alternative (LEDPA), is in the public interest, and will not significantly affect the quality of the human environment.,

Clean Water Act, Section 404: Impacts to waters of the U.S. require a permit from the Corps, as well as a water quality permit from Ecology (discussed under Section 401 permit).

The Corps administers Section 404 of the Clean Water Act, which regulates the discharge of dredged or fill materials into waters of the U.S., including wetlands and streams, and potentially also some ditches. For projects requiring Section 404 permits, the Corps makes the final determination as to whether the area meets the definition of a jurisdictional feature and thus requires a permit to authorize impacts.

Two types of permits, individual and general, are issued by the Corps to authorize activities that would result in the discharge of dredge or fill material into waters of the U.S., including wetlands. Individual Permits are required for specific activities that require compliance with the Corps' formal review process. General permits are issued for certain projects that will cause only minimal adverse environmental effects. Nationwide Permits (NWP) are a type of general permit that has a set of national and regional conditions that must be met before the permit can be issued. Permit notification requirements and regional conditions are dependent on the specific activity.

Individual Permit Requirements

Because both Alternatives result in more than 0.50 acres of wetland impact, the proposed project would not qualify for NWP 14 for Linear Transportation Projects. The proposed project would thus require an Individual Permit for wetland impacts.

Individual Permits require the applicant clearly demonstrate the following:

- **Sequencing to Demonstrate Unavoidable Wetland Impacts**

  The Corps wetland permitting process under Section 404 requires the applicant to demonstrate they have followed the federal mitigation sequencing process of first avoiding, then reducing and minimizing wetland impacts on the extent practicable, and only then proposing compensatory mitigation for unavoidable impacts. This process dovetails with the NEPA process of developing project alternatives and selection of the Least Environmentally Damaging Practicable Alternative (LEDPA) that avoids and minimizes impacts on waters of the U.S.

  Clearly demonstrating the application of sequencing will be a critical component of a permit application. Project feasibility will increase if the Corps can determine there is sufficient information to document that the City has clearly followed the sequencing process, resulting in a permit application for truly unavoidable impacts. The City will need to clearly show why the extension requires a trajectory and corridor that impacts wetlands. The City's permit application should include a detailed alternatives analysis to explicitly demonstrate how and where impacts on wetlands have been avoided and minimized to the lowest impact footprint feasible for the project through design, location, engineering etc.

  The Individual Permit process includes public review and comment on the proposed project and its impacts. The City should anticipate thorough agency review and the need for a robust alternatives analysis and sequencing process given that the proposed extension would bisect a large forested wetland near a stream, lake, and park.

  The Corps and Ecology can be expected to maintain a detailed administrative record to demonstrate the proposed project was properly reviewed for all aspects of regulations associated with wetland protection. Both agencies are required to maintain an objective review of the permit and will likely ask the City questions and request detailed information to document in their files that all elements of the project and proposed project impacts have been adequately addressed for a legally defensive permit decision to be made.

- **Consideration of the Nature and Source of Fill Material and Potential for Indirect Wetland Impacts**

  The Corps requires the applicant to document the volume of fill and the source and nature of the proposed fill. A demonstration of inert fill material is needed to comply with state water pollution act, the listing of anadromous salmonids under the Endangered Species Act, and state water quality standards to satisfy the associated Section 401 Clean Water Act water quality certification.

The City will need to provide sufficient information to demonstrate to the Corps and Ecology that the fill will not have significant impacts on any avoided wetlands, including the remaining portions of the wetlands between the boardwalk and the roadway and the portion cut off between I-5 and the boardwalk, as well as in relation to water quality in Squalicum Creek.

In addition, for Individual Permits, the Corps is also required to:

- provide for public notice and comment,
- prepare an alternative analysis as per the U.S. Environmental Protection Agency (EPA) Section 404b(1) guidelines and NEPA, and
- comply with NEPA's environmental review process.

As part of these requirements, the Corps may need to prepare an EIS if the Corps' analysis indicates the proposed project has the potential to "significantly affect the quality of the human environment." Whether a proposed action has the potential to significantly affect the quality of the human environment is determined by considering the context and intensity of the proposed action and its potential effects.

Context is the physical situation or setting of the affected environment in which a proposed action would take place. The level of significance of a proposed action can vary with its context. The significance of the proposed Orchard Street extension is related to how the project would affect the local Bellingham community, regional transportation, and how other interests beyond the regional area may be benefited or negatively affected. Context can also be affected by prevailing socioeconomic, legal, and political circumstances taking place at the time the project is proposed.

Intensity refers to the severity of the impact on the environment. The Corps would be required to consider a number of environmental and social factors to determine whether the proposed project has the potential to produce significant effects, including:

- beneficial effects,
- public health and safety,
- unique characteristics of an area such as proximity to prime farmlands and wetlands or to cultural or historic resources,
- the degree of controversy likely to be generated by a project (controversy can be related to the project's context and magnitude),
- precedent setting aspects of the action (such as magnitude of proposed impacts),
- cumulative effects,
- degree of cultural resource and biological effects,
- potential to affect species protected under the Endangered Species Act (ESA),
- potential for violation of state or local laws if a federal permit were issued, and
- degree to which the potential effects are highly uncertain, or involve unique or unknown risks.

If the Corps determines that the Orchard Street Extension project does not require an EIS, but instead requires preparation of an Environmental Assessment (EA), they may decide to prepare the document internally, using information submitted by the City of Bellingham and its consultants through the permit process. If an EIS is determined to be necessary, the Corps will likely require a third party contractor to assist them in preparing the EIS.

Alternatives Analysis

As part of the Individual Permit process, the Corps will expect the City to prepare an alternatives analysis (per Section 404(b)(1) of the Clean Water Act) to identify the LEDPA for the project. The 404(b)(1) guidelines listed in 40 CFR Part 230 are intended to be consistent with and to implement policies in the Clean Water Act. Fundamental to the guidelines is the assumption that fill-material should not be discharged into waters of the U.S. unless it can be demonstrated that the discharge will not have an unacceptable adverse impact on wetlands and other aquatic ecosystems.

In preparing the alternatives analysis the City will need to work with the Corps in defining the following.

- **Project purpose and need.** The Corps expects this to be a succinct statement as the applicant states the purpose as they understand it and then the Corps verifies that it does not restrict potential alternatives pursuant to the 404(b)(1) Guidelines. The project need is basically the problem statement and the purpose is the solution to the problem.
- **Water dependency.** Based on the project purpose and need, the Corps will determine whether the proposed action requires access or proximity to, or siting within, an aquatic site in order to fulfill its basic project purpose.
- **Practicable alternative.** This is an alternative that is capable of meeting the project's purpose and need, taking into consideration the cost, existing technology, and logistics associated with the project purpose. For non-water dependent projects, the Corps assumes there is a practicable alternative that does not impact waters of the U.S., *unless the applicant proves otherwise* based on the project's purpose and need and relative to the three criteria of cost, technology, and logistics.

Once an acceptably detailed and narrow purpose and need statement is developed, the next challenge can be to justify the project as a water dependent use. The City will need to provide detailed information to refute the Corps' standard assumption that (1) there are practicable alternative configurations for the project which would not result in impacts on waters of the U.S., and (2) that there are alternatives would have less adverse impact on waters of the U.S. than the proposed alternative.

The City will need to refute the assumption by the Corps that the Orchard Street Extension project is not clearly a water dependent use (i.e., the Corps may feel that this roadway extension does not inherently need to be located in an aquatic site). Information regarding considerations of existing infrastructure, safety requirements such as line of sight, slope, and curve design, engineering, elevations, and necessary connection points will need to be presented in the project's application materials.

Clean Water Act, Section 401: Section 401 of the Clean Water Act requires applicants for Section 404 permits to obtain Section 401 Water Quality Certification from the certifying agency. In state of Washington, that agency is Ecology. Section 401 water quality certification ensures that projects discharging to waters of the United States, including wetlands, meet state water quality standards. Conditions of the 401 certification become conditions of the Corps 404 permit.

Given the presumed extent of unavoidable impacts on wetlands (i.e. greater than 0.50 acres), an individual 401 water quality certification should be anticipated for the proposed project. Project information should be submitted to Ecology at the same time it is submitted to the Corps for Section 404 and 401 verification and approval. Typically Ecology and the Corps work hand-in-hand to make sure the project permitted is the least environmentally damaging practicable alternative. The City should correspond with Ecology and the Corps throughout the permitting process to ensure the purpose and need, alternatives analysis, and mitigation are acceptable to both agencies.

National Historic Preservation Act – Section 106: Because the project will impact waters of the U.S. (i.e. wetlands) it will be required to obtain permits from a federal agency (i.e. the Corps) and will be required to comply with Section 106 of the National Historic Preservation Act (NHPA). NHPA compliance would similarly be triggered if the project were funded, wholly or partially with federal monies.

Compliance would be achieved through coordinating with lead federal agency (e.g. the Corps), completing a cultural and historic resource field survey and preparing the appropriate Cultural Resources Assessment documentation. Consultation with the Washington Department of Archaeology and Historic Preservation (DAHP) and potentially affected Native American Tribes would also be required. Such coordination is typically conducted through the Corps as part of the Section 404 permitting process.

Endangered Species Act: Because the project will impact waters of the U.S. (i.e. wetlands) it will be required to obtain permits from a federal agency (i.e. the Corps) and will be required to comply with Section 7 of the federal Endangered Species Act (ESA). ESA Section 7 compliance would similarly be triggered if the project were funded, wholly or partially with federal monies.

ESA compliance requires consultation with the National Marine Fisheries Service (NMFS) due to the presence of Chinook salmon of the Puget Sound Evolutionarily Significant Unit (ESU) and steelhead of the Puget Sound Distinct Population Segment (DPS) in Squalicum Creek and assumed presence of both species in Tributaries V and W due to connectivity between the Creek and tributaries. Both Puget Sound Chinook salmon and Puget Sound steelhead are federally listed threatened species. Consultation with the US Fish and Wildlife Service (USFWS) would likely not be necessary due to the absence of bull trout of the Coastal/Puget Sound DPS and the lack of suitable habitat for other wildlife species under the jurisdiction of the USFWS (i.e. northern spotted owl, gray wolf, grizzly bear, Canada lynx, and marbled murrelet) that may occur in Whatcom County.

A Biological Assessment would need to be prepared and consultation with NMFS would be initiated by the Corps as part of the Section 404 permitting process. Species under the jurisdiction of the USFWS could either be addressed within the BA or in a separate No Effect Letter.

State Environmental Policy Act: Because the project will impact wetlands, a permit from a state agency is required (i.e. Section 401 water quality certification from Ecology). The State Environmental Policy Act (SEPA) is triggered by this requirement for a state permit. SEPA would also be triggered if funding, wholly or partially were provided by a state agency. SEPA compliance would be achieved through coordination with the lead state agency and submittal of a SEPA checklist for public review and comment. SEPA compliance can sometimes be achieved as part of the NEPA compliance process, particularly if a project requires preparation of an Environmental Impact Statement (EIS).

Hydraulic Project Approval: Because the project will require work in Tributaries W and V, a Hydraulic Project Approval (HPA) permit from the Washington State Department of Fish and Wildlife (WDFW) is required. This permit is required for any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water or saltwater of the state.

Shoreline Management Act: In 1971 the State of Washington passed the Shoreline Management Act (RCW 90.48) requiring all jurisdictions to adequately manage and protect shorelines of the state. Compliance would be achieved by coordinating with the City of Bellingham to determine the shoreline designation for Squalicum Creek in the vicinity of the project corridor and whether road construction is an allowed use under the City's 2009 (if adopted) or 1989 Shoreline Management Master Program.

Critical Areas Ordinance: The Birchwood Avenue – James Street Connector project (i.e. the proposed project) is specifically identified within BMC 16.55.080.D.11(3) as an 'Essential Public Facility'. Therefore the project proponent (in this case the City) can apply for an exemption from the requirement to obtain a Critical Areas permit.

If the proposed project were granted an exemption through demonstration of the below required information, it would not be required to obtain a Critical Areas permit. However, the project would still be required to mitigate for any unavoidable impacts to wetlands, via Clean Water Act section 404 and 401 permits from the Corps and Ecology. The project would also be required to restore any inadvertently impacted areas of wetland buffers. The Corps and Ecology require buffers as part of mitigation plans, but do not regulate impacts to buffers.

In order to obtain an exemption, the project team must document that:

1. There is no practical alternative to the proposed development with less impact on the City's critical areas;
2. Any proposed alteration of a critical area to construct the essential public facility is the minimum necessary to accommodate the essential public facility;
3. The construction of the essential public facility minimizes the adverse impacts on the critical area; and
4. The construction of the essential public facility utilizes best available science and results in no net loss of function to the type of critical area being impacted.

It should be noted that projects which are granted an exemption are still required to comply with BMC 16.55.08A through16.55.08.C as follows:

A. The Director may add conditions for exemption to ensure the level of activity remains consistent with the provisions of this Chapter.

B. All exempted activities shall use reasonable methods to avoid potential impacts to critical areas and their buffers. To be exempt from this Chapter does not give permission to degrade a critical area or ignore risk from natural hazards. Any incidental damage to, or alteration of, a critical area that is not a necessary outcome of the exempted activity shall be restored, rehabilitated, or replaced at the responsible party's expense within a reasonable time and in an appropriate manner.

C. All exempted activities shall be conducted using the best management practices that result in the least amount of impact to the critical areas. Best management practices shall be used for tree and vegetation protection, construction management, erosion and sedimentation control, water quality protection, and regulation of chemical applications. The City shall observe the use of best management practices to ensure that the activity does not result in degradation to the critical area. Any incidental damage to, or alteration of, a critical area shall be restored, rehabilitated, or replaced at the responsible party's expense within a reasonable time and in a reasonable manner.

Federal and State Permit Application Process

Section 404 and 401 Permits, as well as the HPA and Shoreline permits require the submittal of a Joint Aquatic Resources Permit Application (JARPA) to the above-mentioned agencies for approval before initiating any activities. A wetland delineation must be completed within 5 years of permit application and a Wetland Delineation Report and a complete Mitigation Plan demonstrating proper mitigation sequencing and compensation for unavoidable impacts on waters of the U.S. will be required by the Corps, Ecology, and by the City of Bellingham as part of the JARPA submittal.

In addition, demonstrated compliance with ESA Section 7 through the preparation of a Biological Assessment and with Section 106 of the NHPA through preparation of a Cultural Resources Assessment will also be required as part of the Section 404 permitting process and should be included in the JARPA package.

The SEPA checklist should be submitted to the City of Bellingham's Planning and Community Development Department concurrently with the JARPA submittal.

Agency Review and Permitting Timeline

The timeline for the environmental process can vary considerably depending upon the nature and magnitude of the proposed project, the project's funding source, and the timelines inherent in different federal and state agency review periods (e.g. duration of required public noticing and comment periods). The duration of permitting can also depend on the type of permit issued, the quality of the resource to be impacted, and the complexity of the proposed project.

Applications for Corps permits (i.e. the JARPA package) should be submitted when project alternatives have been evaluated, project impacts avoided and minimized to the maximum extent feasible, and the project is at approximately 60% design. At this point, impacts to wetlands and streams can be quantified and at least a conceptual mitigation plan prepared for presentation to the agencies.

The Corps permitting process can take upwards of 12 to 24 or more months for the Corps to complete the Individual Permit process. Ecology has 12 months from the time an application is deemed complete to make a Section 401 permit decision. WDFW typically issues a HPA permit within 45 days of application, but will not consider an application until the project has achieved a SEPA DNS or MDNS. The SEPA process can take several months to complete, depending on the duration of public review and the number and nature of public comments received.

Recommendations

ICF recommends the following actions be taken to assist the design and permitting team in providing an accurate estimate of wetland impacts, permitting requirements, and potential mitigation costs:

1. A wetland delineation should be conducted before the design is advanced further in order to determine more definitely the exact extent and configuration of wetlands within the project area. Wetland delineations are considered valid by the Corps, Ecology, and City of Bellingham for five years (BMC 16.55.290D);

2. Further refinement of Alternative 2 to reduce project impacts to less than 0.50 acres if possible is recommended to reduce the permitting timeline, cost, and mitigation needs/cost for the proposed project. Total wetland impacts of less than 0.5 acre may be able to be permitted via the NWP process, which does not require public notice or alternatives analysis; and

3. ICF strongly recommends that KPFF consult directly with the City of Bellingham's Planning and Community Development Department regarding the potential exemption from a Critical Areas permit and its implications for project design and permitting.

ICF also recommends the following be incorporated into the project if possible to streamline permitting feasibility:

- A clear demonstration to the regulatory agencies that the proposed project has actively incorporated sequencing into its design (i.e. avoidance, minimization, and mitigation);
- Careful consideration of the NEPA/individual permit alternatives analysis process to arrive at the most defendable project footprint;
- A pre-application meeting with the Corps, Ecology, WDFW, and City of Bellingham to establish a single, consistent point of contact for the project at the Corps and Ecology, verify the list of all the federal and state agencies that would be expected to participate in a permit process, determine potential data needs from the agencies, and agree on a proposed permitting schedule;
- Discussion at the pre-application meeting of the project's proposed approach for developing a purpose and need statement and a preliminary alternatives analysis to streamline the Individual Permitting process; and

- Proactively negotiate with the Corps, Ecology, and Bellingham's Planning and Community Development Department to determine an appropriate mitigation ratio early in the project's permitting process. Such a strategy can reduce permit review time and reduce the potential for a mitigation plan that does not adequately anticipate the potential for conflicting requirements from different regulatory agencies.

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Appendix F

Cost Estimates

kpff Consulting Engineers

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Engineer's Estimate of Probable Cost - Orchard Street Extention Pre-Design Study ALT 1

Alt 1 - 32' Roadway, 12' rock trail on fill, at grade James trail crossing, Creek through southern I-5 bay

Estimated % Complete: STUDY

ITEM NO.	ITEM	UNIT	UNIT PRICE	QTY	COST	NOTES
Part A Roadway						
	PREPARATION					Some bid items have no quantities; this means this particular alternative does not include that bid item.
1	ROAD MOBILIZATION (10%)	LS	$434,930.00	1	$434,930	
2	CLEARING AND GRUBBING	AC	$5,000.00	4.60	$23,000	
3	REMOVAL OF STRUCTURE AND OBSTRUCTION	LS	$10,000.00	1.00	$10,000	
	GRADING					
4	ROADWAY EXCAVATION INCL. HAUL	CY	$14.00	9,340	$130,760	
5	GRAVEL BORROW INCL. HAUL	TN	$12.00	31,250	$375,000	
6	EMBANKMENT COMPACTION	CY	$4.00	16,890	$67,560	
	DRAINAGE					
7	MEDIA FILTER	LS	$69,700.00	1	$69,700	
8	CATCH BASIN TYPE 1	EA	$1,000.00	20	$20,000	
9	CATCH BASIN TYPE 2 48 IN. DIAM	EA	$2,500.00	10	$25,000	
10	CL. II REINF. CONC. STORM SEWER PIPE 72 IN. DIAM	LF	$350.00	900	$315,000	
11	SCH A STORM SEWER PIPE 12 IN. DIAM.	LF	$40.00	3,320	$132,800	WSDOT price ~ $25/LF - $15/LF added for STRUCT EX CL B
12	DETENTION VAULT	LS	$558,600.00	1	$558,600	$6/cf
	SURFACING					
13	CRUSHED SURFACING BASE COURSE	TN	$20.00	10,200	$204,000	
14	CRUSHED SURFACING TOP COURSE	TN	$20.00	265	$5,300	
	HOT MIX ASPHALT					
15	HMA CL. 1/2 IN. PG 64-22	TN	$110.00	3,030	$333,300	
	EROSION CONTROL AND PLANTING					
16	EROSION/WATER POLLUTION CONTROL	LS	$100,000.00	1.0	$100,000	
17	SEEDING, FERTILIZING, AND MULCHING	AC	$1,500.00	2.0	$3,000	
18	SWPPP	LS	$3,000.00	1.0	$3,000	
19	LANDSCAPING	LS	$50,000.00	1.0	$50,000	

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Estimated % Complete: **STUDY**

ITEM NO.	ITEM	UNIT	UNIT PRICE	QTY	COST	NOTES
	TRAFFIC					
20	CEMENT CONC. TRAFFIC CURB AND GUTTER	LF	$35.00	5,890	$206,150	
21	STRIPING	LS	$23,000.00	1	$23,000	
22	PERMANENT SIGNING	LS	$15,000.00	1.00	$15,000	
23	ILLUMINATION SYSTEM	LS	$216,000.00	1	$216,000	
24	PROJECT TEMPORARY TRAFFIC CONTROL	LS	$50,000.00	1	$50,000	
25	TRAFFIC SIGNAL AT JAMES / ORCHARD	LS	$200,000.00	1	$200,000	
	OTHER ITEMS					
26	BEAM GUARDRAIL NON-FLARED TERMINAL	EA	$2,800.00	4	$11,200	
27	BEAM GUARDRAIL TYPE 31	LF	$15.00	450	$6,750	
28	ROADWAY SURVEYING	LS	$150,000.00	1	$150,000	
29	CEMENT CONC. SIDEWALK	SY	$50.00	1,125	$56,250	
30	CEMENT CONC. SIDEWALK RAMP TYPE _	EA	$1,500.00	10	$15,000	
31	SPCC PLAN	LS	$3,000.00	1	$3,000	
32	DEWATERING	LS	$50,000.00	1	$50,000	
33	WETLAND MITIGATION	AC	$180,000.00	2.70	$486,000	.9 AC of impact (3:1 ratio)
					$4,349,300	**<-SUBTOTAL PART A ROADWAY**
Part B Trail						
34	TRAIL MOBILIZATION (10%)	LS	$64,733.33	1	$64,733	
35	TRAIL CLEARING AND GRUBBING	AC	$10,000.00	1.25	$12,500	
36	ROADWAY EXCAVATION INCL. HAUL	CY	$20.00	710	$14,200	
37	GRAVEL BORROW INCL. HAUL	TN	$12.00	11,000	$132,000	
38	EMBANKMENT COMPACTION	CY	$5.00	6,000	$30,000	
39	TRAIL GRAVEL/LIMESTONE SURFACE	TN	$30.00	620	$18,600	
40	TRAIL CRUSHED SURFACING BASE COURSE	TN	$20.00	1,240	$24,800	
41	TRAIL HMA PAVING	TN	$130.00		$0	Not used, limestone surfaced trail
42	TRAIL BRIDGE	EA	$100,000.00	2	$200,000	TRAIL BRIDGES ON WEST AND EAST SIDE OF JAMES
43	BOARDWALK	SF	$70.00		$0	Unit cost is from James Street Study via Fraser Street
44	TRAIL CROSSING FLASHING/WARNING SIGNAGE	EA	$10,000.00	2	$20,000	
45	WETLAND MITIGATION	AC	$180,000.00	0.00	$0	ASSUME TRAIL STAYS IN BUFFER EAST OF I-5
46	DETENTION VAULT	LS	$143,000.00	1.00	$143,000	$6/cf
					$647,333	**<-SUBTOTAL PART C TRAIL**

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Alt 1 - 32' Roadway, 12' rock trail on fill, at grade James trail crossing, Creek through southern I-5 bay

Estimated % Complete: **STUDY**

ITEM NO.	ITEM	UNIT	UNIT PRICE	QTY	COST	NOTES
	Alt 1A Roadway				4,349,300	
	Alt 1C Trail (Alt 1C preferred over 1B)				647,333	
	Subtotal Roadway and Trail				**$4,996,633**	
	Design Contingency (15%)				$749,495	
	Construction Contingency (10%)				$499,663	
	Right of Way Acquisition				$400,000	
	Subtotal Roadway and Trail Construction Costs				**$6,645,792**	
	Design Costs (15%)				$996,869	
	Construction Management (20%)				$1,329,158	
	Total Orchard Street Extension Design and Construction Costs				**$8,971,819**	
	Adjacent project costs required for this alternative					
	Sheet pile wall -Scour protection + abutment retaining	LF	$900.00	300	**$270,000**	

(1) Cost in 2011 dollars.
(2) Cost does not include Sales Tax
(3) No known hazardous materials within the construction limits
(4) Pavement section per City of Bellingham is 3.5" HMA over 13" CSBC

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Engineer's Estimate of Probable Cost - Orchard Street Extention Pre-Design Study ALT 2

Alt 2 - 28' Roadway, 12' paved trail boardwalk in wetlands, trail undercrossing of James, Creek in central I-5 bay

Estimated % Complete: **STUDY**

ITEM NO.	ITEM	UNIT	UNIT PRICE	QTY	COST	NOTES
Part A - Roadway						
	PREPARATION					Some bid items have no quantities; this means this particular alternative does not include that bid item.
1	ROAD MOBILIZATION (10%)	LS	$391,259.00	1	$391,259	
2	CLEARING AND GRUBBING	AC	$5,000.00	5.90	$29,500	
3	REMOVAL OF STRUCTURE AND OBSTRUCTION	LS	$10,000.00	1.00	$10,000	
	GRADING					
4	ROADWAY EXCAVATION INCL. HAUL	CY	$14.00	10,670	$149,380	
5	GRAVEL BORROW INCL. HAUL	TN	$12.00	28,850	$346,200	
6	EMBANKMENT COMPACTION	CY	$4.00	15,590	$62,360	
	DRAINAGE					
7	MEDIA FILTER	LS	$58,500.00	1	$58,500	
8	CATCH BASIN TYPE 1	EA	$1,000.00	20	$20,000	
9	CATCH BASIN TYPE 2 48 IN. DIAM	EA	$2,500.00	10	$25,000	
10	CL. II REINF. CONC. STORM SEWER PIPE 72 IN. DIAM	LF	$350.00	740	$259,000	
11	SCH A STORM SEWER PIPE 12 IN. DIAM.	LF	$40.00	3,320	$132,800	WSDOT price ~ $25/LF - $15/LF added for STRUCT EX CL B
12	DETENTION VAULT	LS	$470,400.00	1	$470,400	
	SURFACING					
13	CRUSHED SURFACING BASE COURSE	TN	$20.00	8,740	$174,800	
14	CRUSHED SURFACING TOP COURSE	TN	$20.00	195	$3,900	
	HOT MIX ASPHALT					
15	HMA CL. 1/2 IN. PG 64-22	TN	$110.00	2,610	$287,100	
	EROSION CONTROL AND PLANTING					
16	EROSION/WATER POLLUTION CONTROL	LS	$100,000.00	1.0	$100,000	
17	SEEDING, FERTILIZING, AND MULCHING	AC	$1,500.00	2.5	$3,750	
18	SWPPP	LS	$3,000.00	1.0	$3,000	
19	LANDSCAPING	LS	$50,000.00	1.0	$50,000	

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Alt 2 - 28' Roadway, 12' paved trail boardwalk in wetlands, trail undercrossing of James, Creek in central I-5 bay

Estimated % Complete: **STUDY**

ITEM NO.	ITEM	UNIT	UNIT PRICE	QTY	COST	NOTES
	TRAFFIC					
20	CEMENT CONC. TRAFFIC CURB AND GUTTER	LF	$35.00	5,850	$204,750	
21	STRIPING	LS	$19,800.00	1	$19,800	
22	PERMANENT SIGNING	LS	$15,000.00	1.00	$15,000	
23	ILLUMINATION SYSTEM	LS	$216,000.00	1	$216,000	
24	PROJECT TEMPORARY TRAFFIC CONTROL	LS	$50,000.00	1	$50,000	
25	TRAFFIC SIGNAL AT JAMES / ORCHARD	LS	$200,000.00	1	$200,000	
	OTHER ITEMS					
26	BEAM GUARDRAIL NON-FLARED TERMINAL	EA	$2,800.00	2	$5,600	
27	BEAM GUARDRAIL TYPE 31	LF	$15.00	450	$6,750	
28	ROADWAY SURVEYING	LS	$150,000.00	1	$150,000	
29	CEMENT CONC. SIDEWALK	SY	$50.00	810	$40,500	
30	CEMENT CONC. SIDEWALK RAMP TYPE_	EA	$1,500.00	9	$13,500	
31	SPCC PLAN	LS	$3,000.00	1	$3,000	
32	DEWATERING	LS	$100,000.00	1	$100,000	
33	WETLAND MITIGATION	AC	$180,000.00	3.90	$702,000	1.3 AC of impact, 3:1 ratio
					$3,912,590	**<-SUBTOTAL PART A ROADWAY**
Part B - Trail						
34	TRAIL MOBILIZATION (10%)	LS	$150,127.78	1	$150,128	
35	ROADWAY EXCAVATION INCL. HAUL	CY	$20.00	400	$8,000	
36	GRAVEL BORROW INCL. HAUL	TN	$12.00	6,600	$79,200	
37	EMBANKMENT COMPACTION	CY	$5.00	3,600	$18,000	
38	TRAIL CRUSHED SURFACING TOP COURSE	TN	$20.00	385	$7,700	
39	TRAIL CRUSHED SURFACING BASE COURSE	TN	$20.00	1,150	$23,000	
39	TRAIL HMA PAVING	TN	$130.00	425	$55,250	
40	TRAIL BRIDGE	EA	$100,000.00	1	$100,000	Trail bridge East of James
41	BOARDWALK	SF	$70.00	10,800	$756,000	Unit cost is from James Street Study via Fraser Street
42	TRAIL CROSSING FLASHING/WARNING SIGNAGE	EA	$10,000.00	1	$10,000	
43	WETLAND MITIGATION	AC	$180,000.00	0.00	$0	TRAIL ON BOARDWALK, MINIMAL MITIGATION EXPECTED
44	DETENTION VAULT	LS	$294,000.00	1.00	$294,000	
					$1,501,278	**<-SUBTOTAL PART B TRAIL**

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Alt 2 - 28' Roadway, 12' paved trail boardwalk in wetlands, trail undercrossing of James, Creek in central I-5 bay

Estimated % Complete: **STUDY**

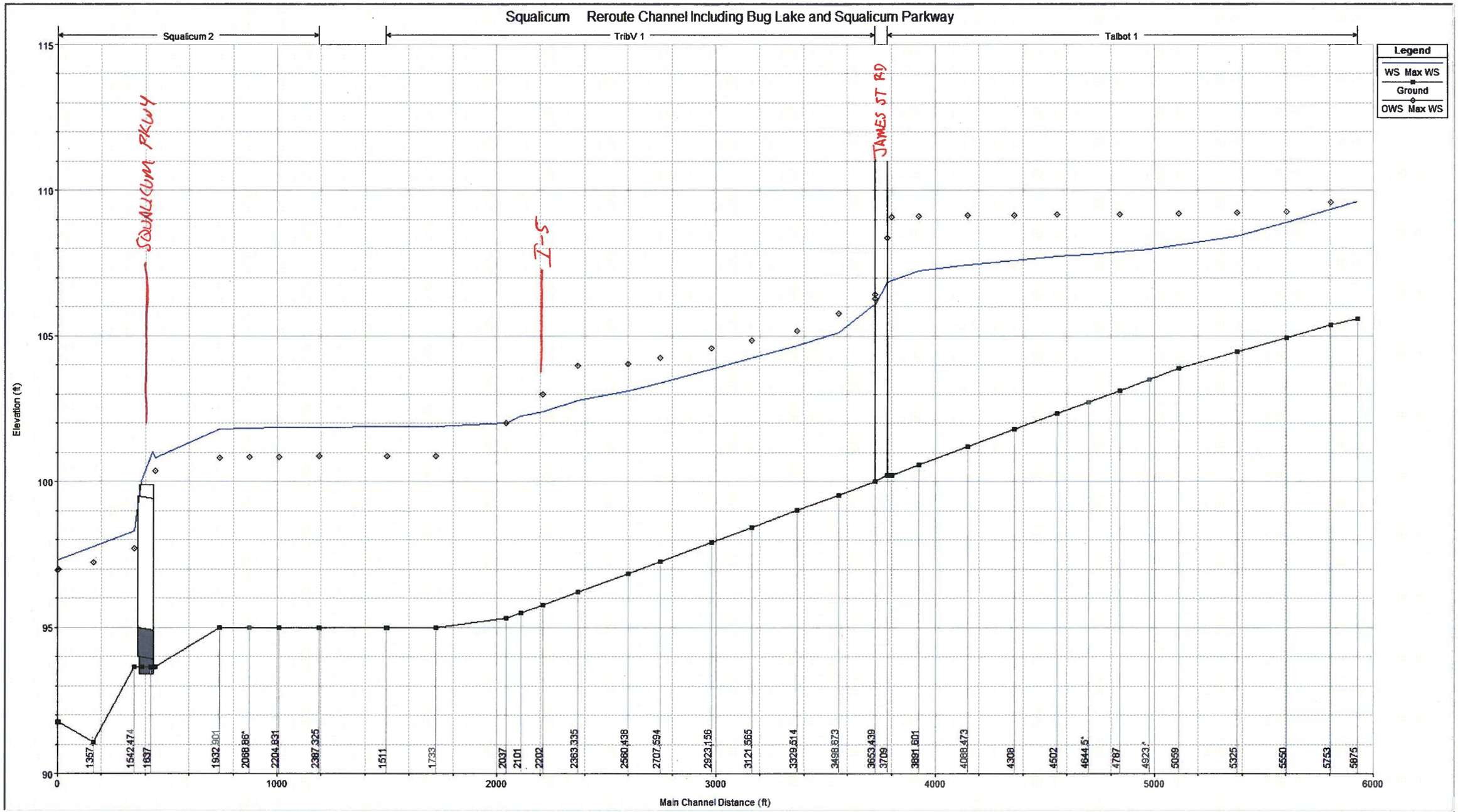
ITEM NO.	ITEM	UNIT	UNIT PRICE	QTY	COST	NOTES
	Part A Roadway			3,912,590		
	Part B Trail			1,501,278		
	Subtotal Roadway and Trail			**$5,413,868**		
	Design Contingency (15%)			$812,080		
	Construction Contingency (10%)			$541,387		
	Right of Way Acquisition			$400,000		
	Subtotal Roadway and Trail Construction Costs			**$7,167,335**		
	Design Costs (15%)			$1,075,100		
	Construction Management (20%)			$1,433,467		
	Total Orchard Street Extension Design and Construction Costs			**$9,675,902**		
	Adjacent project costs required for this alternative					
	Sheet pile wall -Scour protection (No abutment retaining)	LF	$700.00	300	**$210,000**	
	Relocate Gas Mains under I-5	LS	$800,000.00	1	**$800,000**	Cost based on recent CNG project in vicinity
	Raise James Street Road to accommodate trail undercrossing	LS	$340,000.00	1	**$340,000**	Additional wall height, fill, abutment, and increased footprint

Assumptions

(1) Cost in 2011 dollars.
(2) Cost does not include Sales Tax
(3) No known hazardous materials within the construction limits
(4) Pavement section per City of Bellingham is 3.5" HMA over 13" CSBC

Appendix G

100-Year Flood, Squalicum Creek Surface Water Profile


Squalicum Reroute Channel Including Bug Lake and Squalicum Parkway
Squalicum 2
TribV 1
Talbot 1
Legend
WS Max WS
Ground
OWS Max WS
SQUALICUM PKWY
I-5
JAMES ST RD
Elevation (ft)
115
110
105
100
95
90
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)
1357
1542.474
1637
1932.901
2068.86*
2204.831
2387.325
1511
1733
2037
2101
2202
2383.335
2560.438
2707.594
2923.156
3121.565
3329.514
3498.873
3653.439
3709
3891.601
4088.473
4308
4502
4644.5*
4787
4923.*
5059
5325
5550
5753
5875