

**Southwest Corridor Plan**

**High Capacity Transit  
Technical Evaluation Results and  
Methodology Part 1:**

**South Portland, Hillsdale,  
and PCC-Sylvania Areas**

**Draft: May 11, 2015**



**Introduction ..... 3**

**Project Background and Decision Timeline ..... 5**

**Results Summary..... 8**

    South Portland and Hillsdale: LRT .....9

    South Portland and Hillsdale: BRT.....10

    PCC-Sylvania area: LRT .....11

    PCC-Sylvania area: BRT.....12

**General Assumptions .....13**

**Alignment Definitions.....15**

    South Portland and Hillsdale: LRT .....16

    South Portland and Hillsdale: BRT.....21

    PCC-Sylvania area: LRT .....25

    PCC-Sylvania area: BRT.....27

**Detailed Methodology and Results.....29**

    Transit performance.....29

    Access and development .....35

    Mobility .....42

    Cost.....53

    Engineering complexity .....57

    Community and environmental impacts.....62

**Appendix A: Project Goals in Relation to Evaluation Criteria .....73**

# Introduction

This document, the Technical Evaluation Results and Methodology, Part 1, has been produced by the Southwest Corridor project team to support the decisions of the Southwest Corridor Steering Committee. In July 2015, the Steering Committee will decide whether to continue studying certain alignments of the proposed high capacity transit (HCT) line through Southwest Portland. These alignments provide direct access to important destinations, but also increase the costs and risks of building the HCT system.

This document summarizes and compares the performance of the alignment options across a number of factors. A subsequent recommendation from project staff, due in early June 2015, will balance the importance of various factors and consider the data in a broader context.

## Project Purpose and Need

---

The purpose of the Southwest Corridor project is to interconnect Tualatin, Tigard, Southwest Portland and central Portland through high capacity transit and other transportation investments in the congested I-5 corridor in order to improve mobility and create the conditions that will allow communities in the corridor to achieve their established land use visions. The project is needed to address the following issues:

- Transit service to places where people need or want to go is limited;
- Limited street connectivity and gaps in pedestrian and bicycle networks create barriers and unsafe conditions for transit access and active transportation;
- Travel is slow and unreliable on congested roadways;
- There is increasing unmet demand for transit service in the corridor;
- There is a limited supply and range of housing options with good access to multimodal transportation networks;
- The corridor is rich in natural resources that need to be protected or enhanced; and
- Areas of the corridor lack access to parks, trails, and natural areas.

The factors analyzed in this document were selected for their relationship to the project's 13 goals. Appendix A lists these project goals and relates them to the studied factors.

## Using this document and the related Key Issues memos

---

The Southwest Corridor project partners are taking a place-based approach to understanding the key issues related to potential HCT and transportation investments as they relate to local concerns and community aspirations. Key Issues memos have been released for the South Portland, Hillsdale and PCC-Sylvania areas. Each memo describes in detail the HCT alignments under consideration in the area and describes them regarding transit performance, community development, mobility, capital cost estimates, engineering complexity and risk, and community impacts. The South Portland, Hillsdale and PCC-Sylvania Key Issues memos have recently been updated with new technical information developed for this analysis, including updated modeling results and cost estimates.

This document supplements the Key Issues memos by providing a greater level of data analysis. It also provides a series of summary tables allowing for a quick overview of how the alignments perform in comparison to one another.

The tables in this document are shaded to visually distinguish outcomes between alignment options. However, the reader should not extrapolate conclusions from these colors. Please keep the following in mind:

- The darkest color does not necessarily represent the best performing option. Some factors can be interpreted as good, bad, or a complex mix. One example is redevelopment potential, which can suggest either investment and better construction or unwanted change and displacement, depending on the reader's circumstances and personal perspective. The colors assigned to redevelopment potential outcomes simply distinguish between "more" and "less" without suggesting which is better.
- Outcomes reported are not weighted, rather all reported equally. In reality, certain factors may be more important or impactful than others.
- The document contains a mix of "rating" and "ranking" outcomes. Results for some measures are rated by comparing how they perform to some scale and others are ranked by how they perform compared to each other.
- The analysis in this document is preliminary in nature. The project is at approximately three percent of design, meaning a great deal of uncertainty still remains regarding details of construction and operations. As a result, some data may change significantly between issuance of this document and the preparation of the federally-required Draft Environmental Impact Statement.

### Next Steps and Opportunities for Input

---

This document is being released in conjunction with the Southwest Corridor Steering Committee meeting of May 11, 2015 and a community forum at Wilson High School in SW Portland on May 12, 2015. An online interactive map tool is also open for public review and input from May 8 through May 19. This map shows the locations of proposed HCT alignments in Southwest Portland, as well as other key locations throughout the project area. Clicking on locations will provide a brief summary of basic information, links to more detailed documents, and the opportunity to provide input on important factors for decision-makers to consider.

Public comments submitted through these opportunities will be factored into a recommendation report from project staff focusing on the HCT alignment options in the South Portland, Hillsdale and PCC-Sylvania areas. The recommendation report will summarize the major findings from the Key Issues memos, stakeholder feedback, and this document and provide a draft recommendation to the Steering Committee on alignment options to study further. This report will be available at least 30 days prior to the July 13 Steering Committee meeting.

In July, the Steering Committee will discuss each alignment option analyzed in this document and decide whether to continue studying it. Note that each segment further evaluated will cost money and time, and may require geotechnical investigations necessitating drilling or other physical action. In other words, there may be trade-offs to studying alignments deemed ineffective or undesirable.

The December Steering Committee decision will focus on the remaining HCT alignments in Tigard and Tualatin and terminus options as well as a decision to select light rail (LRT) or bus rapid transit (BRT) as the best mode to serve the corridor. Further technical analysis, place-based public outreach, and partner conversations will precede the December decisions. See the "Project Background and Decision Timeline" section in this document for more details.

This document is available on the project website at:

<http://www.oregonmetro.gov/public-projects/southwest-corridor-plan>



# Project Background and Decision Timeline

## Southwest Corridor Plan overview

---

The Southwest Corridor Plan is a comprehensive approach to achieving community visions through integrated land use and transportation planning. The Southwest Corridor Plan incorporates high capacity transit (HCT) alternatives, roadway, bicycle and pedestrian projects and adopted local land use visions, including the Barbur Concept Plan, the Tigard High Capacity Transit Land Use Plan, Linking Tualatin and the Sherwood Town Center Plan. The Plan is exploring Bus Rapid Transit (BRT) and Light Rail Transit (LRT) alternatives for several alignments that connect the Portland Central City, Southwest Portland, Tigard, and Tualatin.

In July 2013, the Southwest Corridor Plan Steering Committee recommended a Shared Investment Strategy that includes key investments in transit, roadways, active transportation, parks, trails and natural areas. A refinement study was initiated in August 2013 to narrow HCT options, identify a preferred alternative and create a subset of road and active transportation projects. In June 2014, the Steering Committee accepted the recommendation of a narrowed set of HCT design options and requested additional refinement work from staff.

In December 2014, the Steering Committee directed project staff to use these findings and further community input to develop a Preferred Package of transportation investments to support community land use goals. The Preferred Package is anticipated to be defined in spring 2016.

After the Steering Committee approves the Preferred Package, the identified HCT mode, alignment options, roadway, bicycle and pedestrian projects will receive full environmental review in a Draft Environmental Impact Statement (DEIS) under the National Environmental Policy Act (NEPA). It is anticipated that additional roadway, transit, bicycle and pedestrian projects will be further studied, funded and implemented through other collective federal, state, regional and local efforts.

## Desired outcome: Preferred Package

---

Project partners will work together to develop a Preferred Package by spring 2016 that addresses the needs and aspirations of Southwest Corridor residents and businesses. The Preferred Package will include the following components:

**HCT Preferred Alternative:** Preferred HCT alignments to study further in a DEIS, including mode, alignments, terminus, and associated roadway, bicycle, and pedestrian projects

**Corridor Connections:** Potential funding source and timeframe for each of the roadway, bicycle, and pedestrian projects identified in the Shared Investment Strategy

**Land use and development strategy:** Partnership agreements and other pre-development work to activate land use and place-making strategies identified in local land use visions

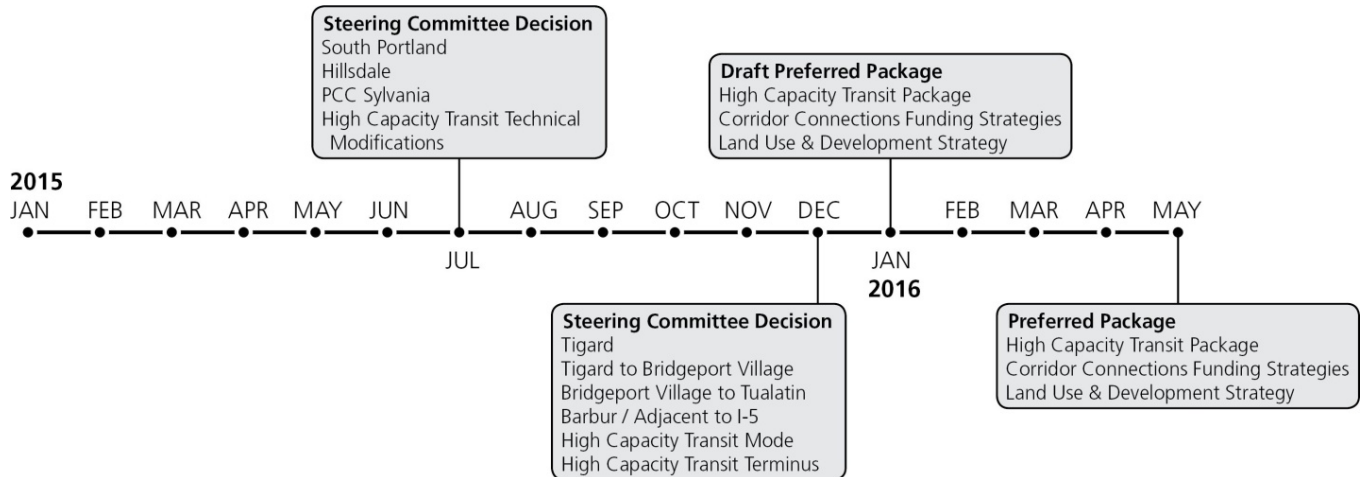
## Identifying the Preferred Package: 2015-2016 timeline overview

---

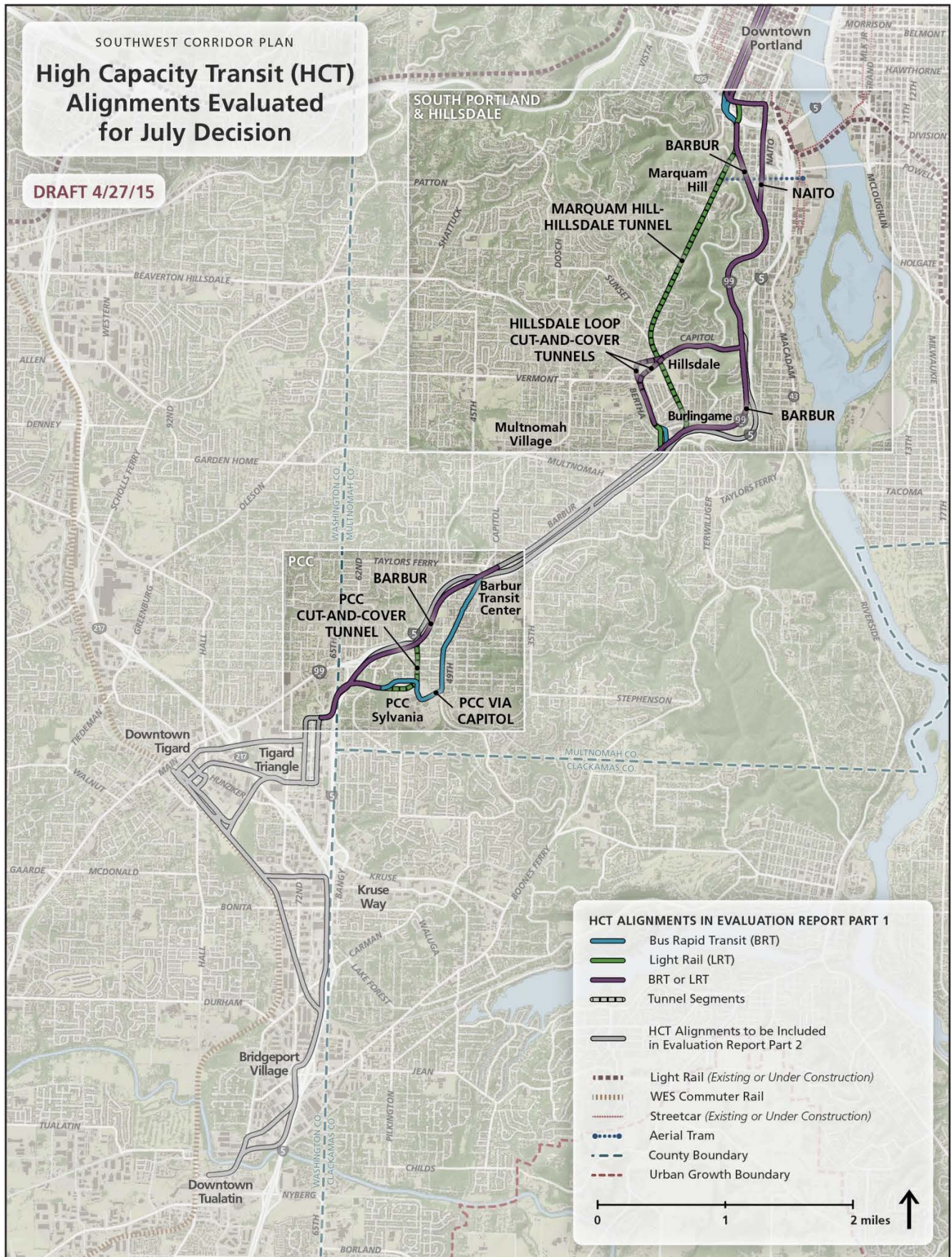
To reach a Preferred Package by spring of 2016, two key Steering Committee decision-making points have been identified in 2015: July and December. Technical analysis, place-based public outreach, and partner conversations will precede each Steering Committee decision. A draft recommendation report will be presented at community forums before each decision-making point, including public comment gathered during the place-based outreach period and any additional technical analysis compiled.

The July Steering Committee decision will focus on direct versus indirect access to key destinations in the corridor including Marquam Hill, Hillsdale, and the Portland Community College (PCC) Sylvania Campus, as well as technical modifications to other HCT alignments. The December Steering Committee decision will focus on

the remaining HCT alignments and terminus options as well as an HCT mode decision between LRT and BRT. In January 2016, the Steering Committee will identify a Draft Preferred Package, including HCT mode, alignment options, terminus options, and associated roadway and active transportation projects for further study in a DEIS, a funding strategy for additional priority roadway, bicycle, and pedestrian projects throughout the corridor, and integrated land use and development strategies.







# Results Summary

## Alignments evaluated

This report focuses on the alignments in the South Portland, Hillsdale and PCC-Sylvania areas, highlighted on the map on the previous page and listed in the table on the left below. These alignments are explained in more detail in the Alignment Definitions section of this document.

Alignment options in South Portland and Hillsdale were combined for the purpose of analysis because the Marquam Hill-Hillsdale deep-bored tunnel spans both areas. The resulting four surface and cut-and-cover tunnel alignments that were evaluated are defined in the maps on the right below.

|                                     | LRT | BRT |
|-------------------------------------|-----|-----|
| <b>South Portland and Hillsdale</b> |     |     |
| <i>Naito + Barbur*</i>              | ✓   | ✓   |
| <i>Barbur + Barbur*</i>             | ✓   | ✓   |
| <i>Naito + Hillsdale</i>            | ✓   | ✓   |
| <i>Barbur + Hillsdale</i>           | ✓   | ✓   |
| <i>MH-H tunnel</i>                  | ✓   |     |
| <b>PCC-Sylvania area</b>            |     |     |
| <i>Barbur*</i>                      | ✓   | ✓   |
| <i>PCC via tunnel</i>               | ✓   |     |
| <i>PCC via Capitol</i>              |     | ✓   |

\* No decision is expected on this alignment in July 2015.  
It will continue to be evaluated into the DEIS process.

## Key

The tables on the following tabloid pages summarize the results. As shown in the key below, darker colors in the tables indicate higher performance in each measure. Alignments that are significantly above or below the performance range of other options are highlighted with a black outline. See the Detailed Methodology and Results section at the end of this report for more information on how the information was developed and how colors were assigned.

higher performing

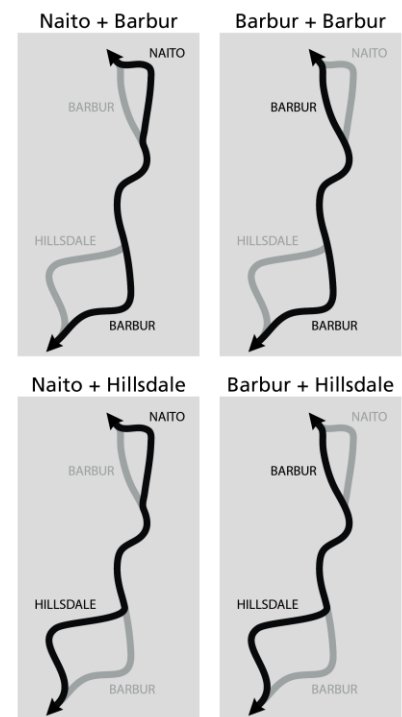


significantly above  
the range of other  
options

lower performing



significantly below  
the range of other  
options





South Portland and Hillsdale: LRT

|   | Surface alignments                              |   | Cut-and-cover tunnel alignments                  |  | Deep-bored tunnel                               |
|---|---|---|--|--|---|
|   | Naito + Barbur                                  | Barbur + Barbur                                 | Naito + Hillsdale                                | Barbur + Hillsdale                               | MH-H Tunnel                                     |
| Transit performance   |   |   |  |  |   |
| New system transit trips<br><i>2035 with HCT - 2035 low build</i>   | 15,700<br><i>daily new system transit trips</i> | 15,700<br><i>daily new system transit trips</i> | 14,200<br><i>daily new system transit trips</i>  | 14,200*<br><i>daily new system transit trips</i> | 16,900<br><i>daily new system transit trips</i> |
| Line ridership<br><i>2035 HCT in SW Corridor</i>  | 43,500<br><i>daily line riders</i>              | 44,100<br><i>daily line riders</i>              | 41,800<br><i>daily line riders</i>               | 42,400*<br><i>daily line riders</i>              | 52,400<br><i>daily line riders</i>              |
| Travel time<br><i>2035 Portland State University to Tualatin</i>  | 31.2 minutes                                    | 30.3 minutes                                    | 33.8 minutes                                     | 32.9 minutes                                     | 29.1 minutes                                    |
| Signalized intersections crossed<br><i>along segment</i>  | 14<br><i>intersections</i>                      | 12<br><i>intersections</i>                      | 15<br><i>intersections</i>                       | 13<br><i>intersections</i>                       | 3<br><i>intersections</i>                       |
| Access and development  |   |   |  |  |   |
| Equitable access to transit<br><i>areas with above-average rates of people of color, low income, and limited English proficiency</i>                                    | moderate access                                 | moderate access                                 | low to moderate access                           | low to moderate access                           | moderate to high access                         |
| Redevelopment potential<br><i>based on acres of redevelopable land within ¼ mile from stations along segment</i>  | 47 acres  | 43 acres  | 72 acres   | 69 acres   | 64 acres  |
| Support for existing plans<br><i>including Barbur Concept Plan</i>  | high support                                    | moderate support                                | moderate to high support                         | moderate support                                 | low to moderate support                         |
| Mobility  |   |   |  |  |   |
| Freight<br><i>based on overlap with local, regional and state freight networks</i>  | substantial local overlap                       | substantial local overlap                       | substantial local overlap                        | substantial local overlap                        | some local overlap                              |
| Traffic<br><i>based on V/C ratio, vehicle delays, and vehicle queuing</i>   | some opportunity for improvement                | negligible impact                               | some opportunity for improvement                 | negligible impact                                | negligible impact                               |
| Transportation safety<br><i>opportunity to address high-crash locations</i>   | low to moderate improvement potential           | low to moderate improvement potential           | low to moderate improvement potential            | low to moderate improvement potential            | negligible impact                               |
| Street connectivity<br><i>change in street connections, including bike and pedestrian connections</i>   | 9-11 new connections                            | 1 new connection                                | 9-11 new connections                             | 1 new connection                                 | no change                                       |
| Bike improvements<br><i>miles of bike gaps filled (included in project cost estimates)</i>  | 2.0 miles<br><i>along 3.4 mile segment</i>      | 0.4 miles<br><i>along 3.4 mile segment</i>      | 2.1 miles<br><i>along 3.7 mile segment</i>       | 0.4 miles<br><i>along 3.7 mile segment</i>       | 0 miles<br><i>along 2.9 mile segment</i>        |
| Pedestrian improvements<br><i>miles of sidewalks gaps filled (included in project cost estimates)</i>   | 3.3 miles<br><i>along 3.4 mile segment</i>      | 3.1 miles<br><i>along 3.4 mile segment</i>      | 3.3 miles<br><i>along 3.7 mile segment</i>       | 3.1 miles<br><i>along 3.7 mile segment</i>       | 0 miles<br><i>along 2.9 mile segment</i>        |
| Cost  |   |   |  |  |   |
| Capital cost: segment<br><i>millions of 2014 dollars</i>  | \$610 million                                   | \$440 million                                   | \$840 million                                    | \$670 million                                    | \$1,340 million                                 |
| Operations and maintenance costs<br><i>based on average weekday vehicle hours</i>   | moderate cost                                   | low to moderate cost                            | moderate to high cost                            | moderate cost                                    | low to moderate cost                            |
| Engineering complexity  |   |   |  |  |   |
| Construction impacts<br><i>qualitative analysis of temporary impacts that could occur during project construction</i>   | low to moderate impact                          | low impact                                      | moderate to high impact                          | moderate impact                                  | high impact                                     |
| Engineering risk<br><i>qualitative analysis of relative risks associated with special elements of design options</i>  | low to moderate risk                            | low risk  | moderate to high risk                            | moderate risk                                    | high risk                                       |
| Community and environmental impacts   |   |   |  |  |   |
| Property impacts<br><i>qualitative analysis of potential impacts to properties</i>  | moderate impact                                 | moderate impact                                 | moderate to high impact                          | moderate to high impact                          | high impact                                     |
| Property access impacts<br><i>changes to driveway access along alignment</i>  | 1-5 driveways<br><i>along 3.4 mile segment</i>  | 5-10 driveways<br><i>along 3.4 mile segment</i> | 15-20 driveways<br><i>along 3.7 mile segment</i> | 20-25 driveways<br><i>along 3.7 mile segment</i> | 1-5 driveways<br><i>along 2.9mile segment</i>   |
| Property impacts to historically under-represented populations<br><i>areas with above-average rates of people of color, low income, and limited English proficiency</i> | low impact                                      | low to moderate impact                          | low impact                                       | low to moderate impact                           | low impact                                      |
| Visual impacts<br><i>based on degree of visual change</i>   | moderate degree of change                       | moderate degree of change                       | moderate to high degree of change                | moderate to high degree of change                | moderate degree of change                       |
| Impacts to parks and historic properties<br><i>potential impacts to parks, wetlands, and historic properties</i>  | moderate impact                                 | moderate impact                                 | moderate to high impact                          | moderate to high impact                          | high impact                                     |

\* estimate based on related model runs

South Portland and Hillsdale: BRT

|  | Surface alignments                             |   | Cut-and-cover tunnel alignments                  |  |
|--|--|---|--|--|
|  | Naito + Barbur                                 | Barbur + Barbur                                 | Naito + Hillsdale                                | Barbur + Hillsdale                               |
| Transit performance  |  |   |  |  |
| <b>New system transit trips</b><br><i>2035 with HCT - 2035 low build</i>   | 8,400<br><i>daily new system transit trips</i> | 8,400*<br><i>daily new system transit trips</i> | 7,700*<br><i>daily new system transit trips</i>  | 7,700*<br><i>daily new system transit trips</i>  |
| <b>Line ridership</b><br><i>2035 HCT in SW Corridor</i>  | 30,800<br><i>daily line riders</i>             | 31,200*<br><i>daily line riders</i>             | 29,300*<br><i>daily line riders</i>              | 29,700*<br><i>daily line riders</i>              |
| <b>Travel time</b><br><i>2035 Portland State University to Tualatin</i>  | 34.1 minutes                                   | 33.3 minutes                                    | 36.9 minutes                                     | 36.1 minutes                                     |
| <b>Mixed traffic</b><br><i>miles of operations in mixed traffic</i>  | 1.4 miles<br><i>along 3.7 mile segment</i>     | 1.4 miles<br><i>along 3.5 mile segment</i>      | 0.2 miles<br><i>along 3.9 mile segment</i>       | 0.2 miles<br><i>along 3.8 mile segment</i>       |
| <b>Signalized intersections crossed</b><br><i>along segment</i>  | 14<br><i>intersections</i>                     | 12<br><i>intersections</i>                      | 18<br><i>intersections</i>                       | 16<br><i>intersections</i>                       |
| Access and development   |  |   |  |  |
| <b>Equitable access to transit</b><br><i>areas with above-average rates of people of color, low income, and limited English proficiency</i>                                    | moderate access                                | moderate access                                 | low to moderate access                           | low to moderate access                           |
| <b>Redevelopment potential</b><br><i>based on acres of redevelopable land within ¼ mile from stations along segment</i>  | 41 acres                                       | 39 acres  | 67 acres   | 64 acres   |
| <b>Support for existing plans</b><br><i>including Barbur Concept Plan</i>  | high support                                   | moderate support                                | moderate to high support                         | moderate support                                 |
| Mobility   |  |   |  |  |
| <b>Freight</b><br><i>based on overlap with local, regional and state freight networks</i>  | substantial local overlap                      | substantial local overlap                       | substantial local overlap                        | substantial local overlap                        |
| <b>Traffic</b><br><i>based on V/C ratio and vehicle queuing</i>  | some opportunity for improvement               | negligible impact                               | some opportunity for improvement                 | negligible impact                                |
| <b>Transportation safety</b><br><i>opportunity to address high-crash locations</i>   | low to moderate improvement potential          | low to moderate improvement potential           | low to moderate improvement potential            | low to moderate improvement potential            |
| <b>Street connectivity</b><br><i>change in street connections, including bike and pedestrian connections</i>   | 9-11 new connections                           | 1 new connection                                | 9-11 new connections                             | 1 new connection                                 |
| <b>Bike improvements</b><br><i>miles of bike gaps filled (included in project cost estimates)</i>  | 2.0 miles<br><i>along 3.4 mile segment</i>     | 0.4 miles<br><i>along 3.4 mile segment</i>      | 2.1 miles<br><i>along 3.7 mile segment</i>       | 0.4 miles<br><i>along 3.7 mile segment</i>       |
| <b>Pedestrian improvements</b><br><i>miles of sidewalks gaps filled (included in project cost estimates)</i>   | 3.3 miles<br><i>along 3.4 mile segment</i>     | 3.1 miles<br><i>along 3.4 mile segment</i>      | 3.3 miles<br><i>along 3.7 mile segment</i>       | 3.1 miles<br><i>along 3.7 mile segment</i>       |
| Cost   |  |   |  |  |
| <b>Capital cost: segment</b><br><i>millions of 2014 dollars</i>  | \$330 million                                  | \$140 million                                   | \$470 million                                    | \$280 million                                    |
| <b>Operations and maintenance costs</b><br><i>based on average weekday vehicle hours</i>   | moderate cost                                  | low to moderate cost                            | moderate to high cost                            | moderate cost                                    |
| Engineering complexity   |  |   |  |  |
| <b>Construction impacts</b><br><i>qualitative analysis of temporary impacts that could occur during project construction</i>   | low to moderate impact                         | low impact                                      | moderate to high impact                          | moderate impact                                  |
| <b>Engineering risk</b><br><i>qualitative analysis of relative risks associated with special elements of design options</i>  | low to moderate risk                           | low risk  | moderate to high risk                            | moderate risk                                    |
| Community and environmental impacts  |  |   |  |  |
| <b>Property impacts</b><br><i>qualitative analysis of potential impacts to properties</i>  | moderate impact                                | moderate impact                                 | moderate to high impact                          | moderate to high impact                          |
| <b>Property access impacts</b><br><i>changes to driveway access along alignment</i>  | 1-5 driveways<br><i>along 3.4 mile segment</i> | 5-10 driveways<br><i>along 3.4 mile segment</i> | 20-25 driveways<br><i>along 3.7 mile segment</i> | 25-30 driveways<br><i>along 3.7 mile segment</i> |
| <b>Property impacts to historically under-represented populations</b><br><i>areas with above-average rates of people of color, low income, and limited English proficiency</i> | low impact                                     | low to moderate impact                          | low impact                                       | low to moderate impact                           |
| <b>Visual impacts</b><br><i>based on degree of visual change</i>   | low to moderate degree of change               | low to moderate degree of change                | moderate to high degree of change                | moderate to high degree of change                |
| <b>Impacts to parks and historic properties</b><br><i>potential impacts to parks, wetlands, and historic properties</i>  | moderate impact                                | moderate impact                                 | moderate to high impact                          | moderate to high impact                          |

\* estimate based on related model runs

PCC-Sylvania area: LRT

|   | Walk to PCC                                      | Direct PCC access                                |
|---|--|--|
|   | Barbur   | PCC via tunnel                                   |
| Transit performance   |  |  |
| New system transit trips<br><i>2035 with HCT - 2035 low build</i>   | 15,700<br><i>daily new system transit trips</i>  | 17,800<br><i>daily new system transit trips</i>  |
| Line ridership<br><i>2035 HCT in SW Corridor</i>  | 43,500<br><i>daily line riders</i>               | 46,200<br><i>daily line riders</i>               |
| Travel time<br><i>2035 Portland State University to Tualatin</i>  | 31.2 minutes                                     | 31.9 minutes                                     |
| Signalized intersections crossed<br><i>along segment</i>  | 4<br><i>intersections</i>                        | 3<br><i>intersections</i>                        |
| Access and development  |  |  |
| Equitable access to transit<br><i>areas with above-average rates of people of color, low income, and limited English proficiency</i>                                    | moderate access                                  | high access                                      |
| Redevelopment potential<br><i>based on acres of redevelopable land within ¼ mile from stations along segment</i>  | 18 acres   | 2 acres  |
| Support for existing plans<br><i>including Barbur Concept Plan</i>  | moderate to high support                         | moderate support                                 |
| Mobility  |  |  |
| Freight<br><i>based on overlap with local, regional and state freight networks</i>  | substantial local overlap                        | substantial local overlap                        |
| Traffic<br><i>based on V/C ratio and vehicle queuing</i>  | some negative impact                             | some negative impact                             |
| Transportation safety<br><i>opportunity to address high-crash locations</i>   | low to moderate improvement potential            | low to moderate improvement potential            |
| Street connectivity<br><i>change in street connections, including bike and pedestrian connections</i>   | 1 new connection                                 | 1 new connection                                 |
| Bike improvements<br><i>miles of bike gaps filled (included in project cost estimates)</i>  | 1.7 miles<br><i>along 1.9 mile route</i>         | 1.1 miles<br><i>along 2.4 mile route</i>         |
| Pedestrian improvements<br><i>miles of RATP sidewalks gaps filled (included in project cost estimates)</i>  | 1.7 miles<br><i>along 1.9 mile route</i>         | 1.1 miles<br><i>along 2.1 mile route</i>         |
| Cost  |  |  |
| Capital cost: segment<br><i>millions of 2014 dollars</i>  | \$270 million                                    | \$520 million                                    |
| Operations and maintenance costs<br><i>based on average weekday vehicle hours</i>   | moderate cost                                    | moderate cost                                    |
| Engineering complexity  |  |  |
| Construction impacts<br><i>qualitative analysis of temporary impacts that could occur during project construction</i>   | low to moderate impact                           | high impact                                      |
| Engineering risk<br><i>qualitative analysis of relative risks associated with special elements of design options</i>  | low to moderate risk                             | high risk  |
| Community and environmental impacts   |  |  |
| Property impacts<br><i>qualitative analysis of potential impacts to properties</i>  | moderate impact                                  | high impact                                      |
| Property access impacts<br><i>changes to driveway access along alignment</i>  | 35-40 driveways<br><i>along 1.9 mile segment</i> | 25-30 driveways<br><i>along 2.1 mile segment</i> |
| Property impacts to historically under-represented populations<br><i>areas with above-average rates of people of color, low income, and limited English proficiency</i> | low impact                                       | low to moderate impact                           |
| Visual impacts<br><i>based on degree of visual change</i>   | moderate degree of change                        | moderate degree of change                        |
| Impacts to parks and historic properties<br><i>potential impacts to parks, wetlands, and historic properties</i>  | low to moderate impact                           | low to moderate impact                           |

PCC-Sylvania area: BRT

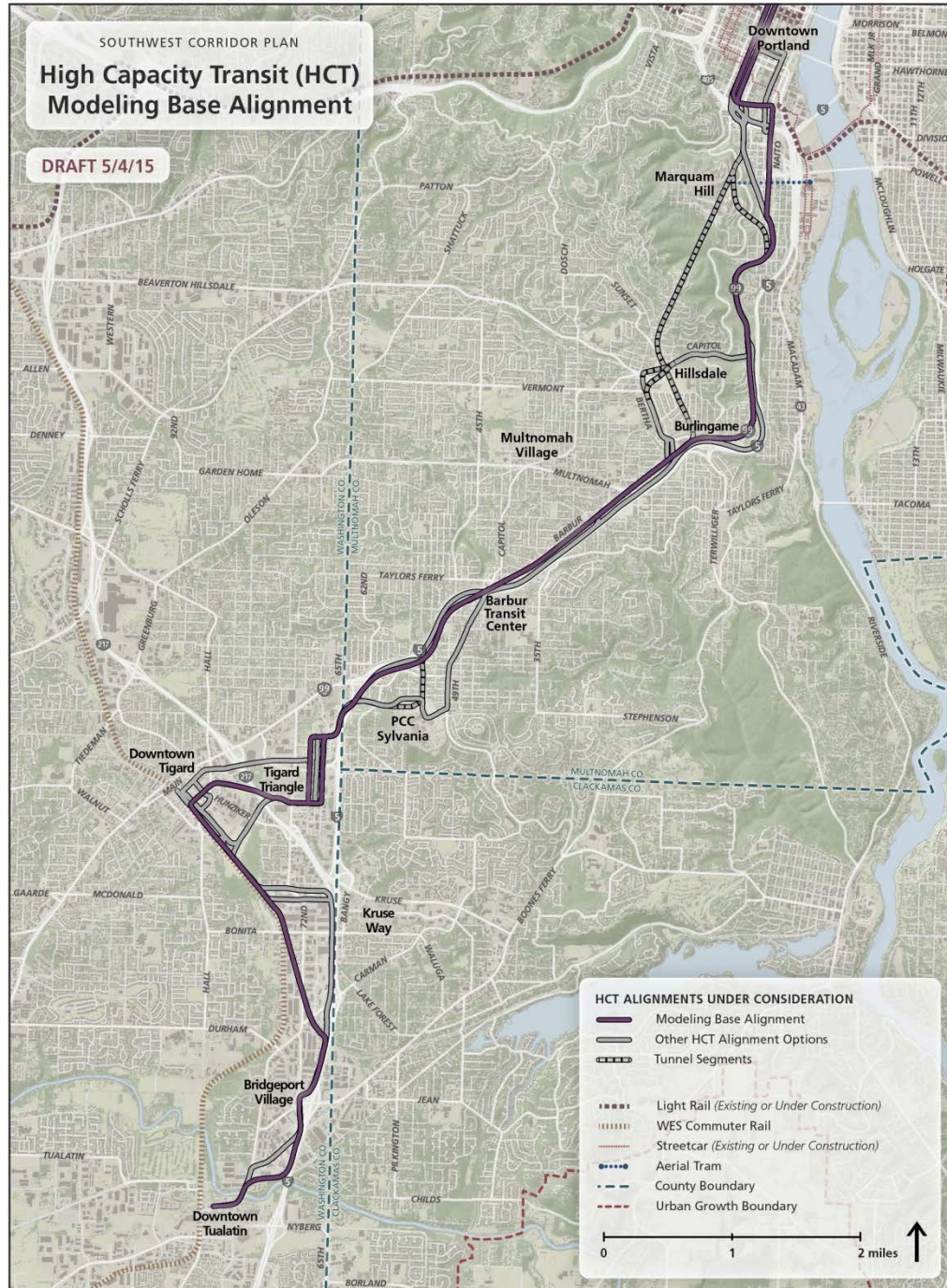
|  | Walk to PCC                               | Direct PCC access                         |
|--|---|---|
|  | Barbur                                    | PCC via Capitol                           |
| Transit performance  |   |   |
| New system transit trips<br>2035 with HCT - 2035 low build   | 8,400<br>daily new system transit trips   | 9,700<br>daily new system transit trips   |
| Line ridership<br>2035 Portland State University to Tualatin   | 30,800<br>daily line riders               | 32,900<br>daily line riders               |
| Travel time<br>PSU to Tualatin   | 34.1 minutes                              | 35.7 minutes                              |
| Mixed traffic<br>miles of operations in mixed traffic  | 0 miles<br>along 1.8 mile segment         | 0 miles<br>along 2.3 mile segment         |
| Signalized intersections crossed<br>along segment  | 4<br>intersections                        | 8<br>intersections                        |
| Access and development   |   |   |
| Equitable access to transit<br>areas with above-average rates of people of color, low income, and limited English proficiency                                    | moderate access                           | high access                               |
| Redevelopment potential<br>based on acres of redevelopable land within ¼ mile from stations along segment  | 18 acres                                  | 25 acres                                  |
| Support for existing plans<br>including Barbur Concept Plan  | moderate to high support                  | moderate support                          |
| Mobility   |   |   |
| Freight<br>based on overlap with local, regional and state freight networks  | substantial local overlap                 | minimal or no overlap                     |
| Traffic<br>based on V/C ratio and vehicle queuing  | some negative impact                      | negligible impact                         |
| Transportation safety<br>opportunity to address high-crash locations   | low to moderate improvement potential     | low to moderate improvement potential     |
| Street connectivity<br>change in street connections, including bike and pedestrian connections   | 1 new connection                          | 1 new connection                          |
| Bike improvements<br>miles of bike gaps filled (included in project cost estimates)  | 1.7 miles<br>along 1.9 mile route         | 1.1 miles<br>along 2.4 mile route         |
| Pedestrian improvements<br>miles of sidewalks gaps filled (included in project cost estimates)   | 1.7 miles<br>along 1.9 mile route         | 0 miles<br>along 2.4 mile route           |
| Cost   |   |   |
| Capital cost: segment<br>millions of 2014 dollars  | \$140 million                             | \$140 million                             |
| Operations and maintenance costs<br>based on average weekday vehicle hours   | moderate cost                             | moderate to high cost                     |
| Engineering complexity   |   |   |
| Construction impacts<br>qualitative analysis of temporary impacts that could occur during project construction   | low to moderate impact                    | low to moderate impact                    |
| Engineering risk<br>qualitative analysis of relative risks associated with special elements of design options  | low to moderate risk                      | low to moderate risk                      |
| Community and environmental impacts  |   |   |
| Property impacts<br>qualitative analysis of potential impacts to properties  | moderate impact                           | high impact                               |
| Property access impacts<br>changes to driveway access along alignment  | 35-40 driveways<br>along 1.9 mile segment | 40-45 driveways<br>along 2.4 mile segment |
| Property impacts to historically under-represented populations<br>areas with above-average rates of people of color, low income, and limited English proficiency | low impact                                | low to moderate impact                    |
| Visual impacts<br>based on degree of visual change   | low to moderate degree of change          | moderate degree of change                 |
| Impacts to parks and historic properties<br>potential impacts to parks, wetlands, and historic properties  | low to moderate impact                    | low to moderate impact                    |



# General Assumptions

## Base modeling alignments

While most evaluation measures focus on a particular segment of the full HCT alignment, certain measures are inherently corridor-wide. For these measures, the modeling base alignment is assumed beyond the segment in question. The following map illustrates the modeling base alignment, including slight differences between BRT and LRT.



## Mode

---

For many measures, such as capital cost and new system transit trips, there is a relatively broad gap between BRT and LRT performance. Because the purpose of this report is to inform alignment narrowing decisions and not a mode decision, BRT and LRT are colored according to a different scale when appropriate. In general, the coloration of evaluation measures should not be directly compared between the BRT and LRT tables.

A separate mode evaluation report will be completed in the fall of 2015, in anticipation of a December Steering Committee decision on which mode to carry forward into a DEIS.

## Alignment Definitions

The following maps illustrate what is assumed to be included with each alignment option for the purpose of analysis, including structures, stations, key roadway and active transportation projects, and mixed traffic segments. The alignments are currently at a three percent level of design, so these assumptions are subject to change upon further study.

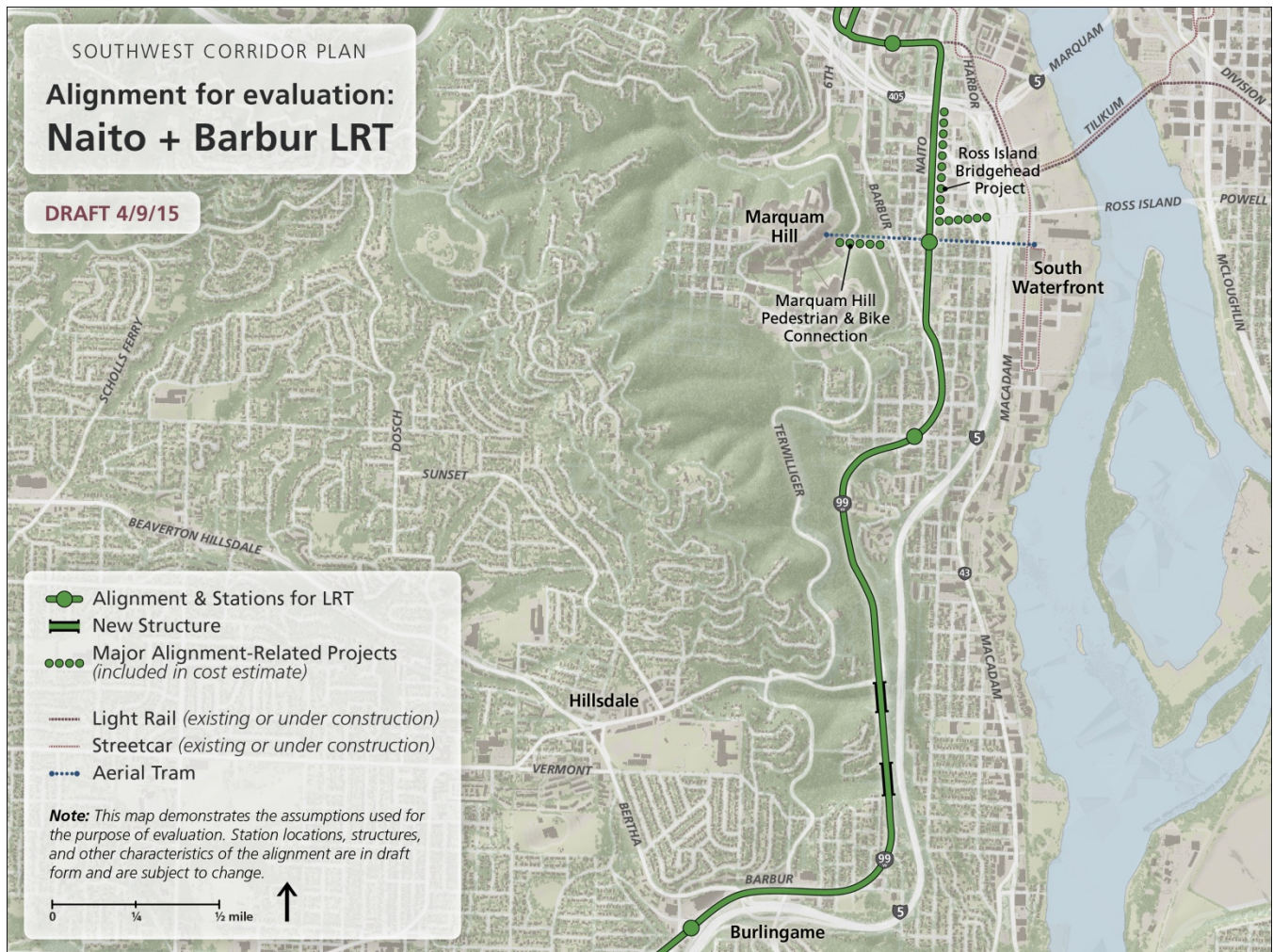


## South Portland and Hillsdale: LRT

### Naito Parkway and Barbur Boulevard

*Naito + Barbur*

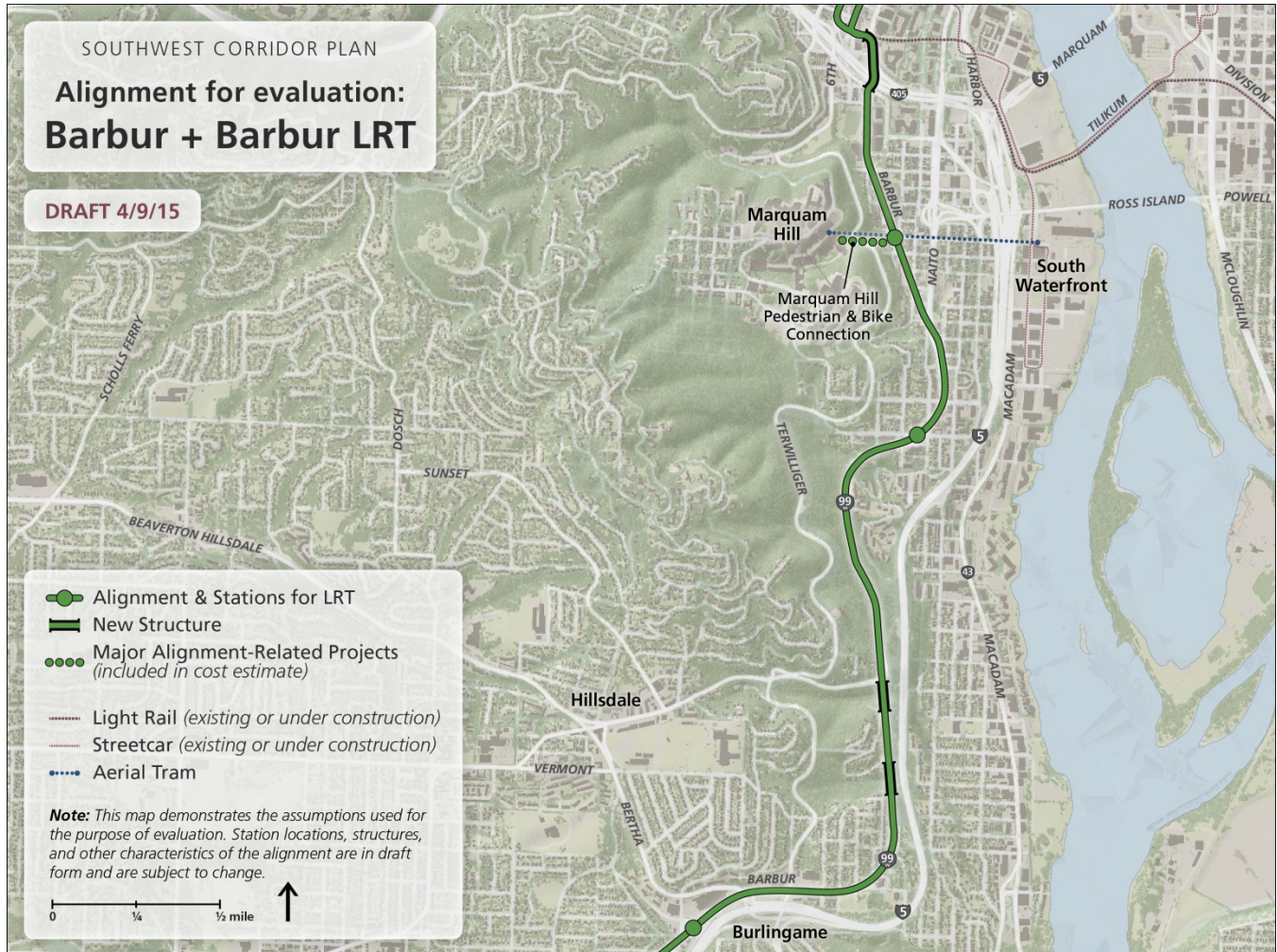
This alignment combines the Naito Parkway option in South Portland with the Barbur Boulevard alignment in the Hillsdale area. The alignment is assumed to include stations at Lincoln Street (currently under construction for Portland-Milwaukie Light Rail), Gibbs Street, Hamilton Street and 13<sup>th</sup> Avenue. The Ross Island Bridgehead project and a Marquam Hill bike and pedestrian connection are both included in the alignment for the purpose of analysis, including cost and mobility measures.





**Barbur Boulevard and Barbur Boulevard***Barbur + Barbur*

This alignment combines the Barbur Boulevard alignment in South Portland with the Barbur Boulevard alignment in the Hillsdale area. The alignment is assumed to include stations at Gibbs Street, Hamilton Street and 13<sup>th</sup> Avenue. The Marquam Hill bike and pedestrian connection is included in the alignment for the purpose of analysis, including capital cost and ridership measures.

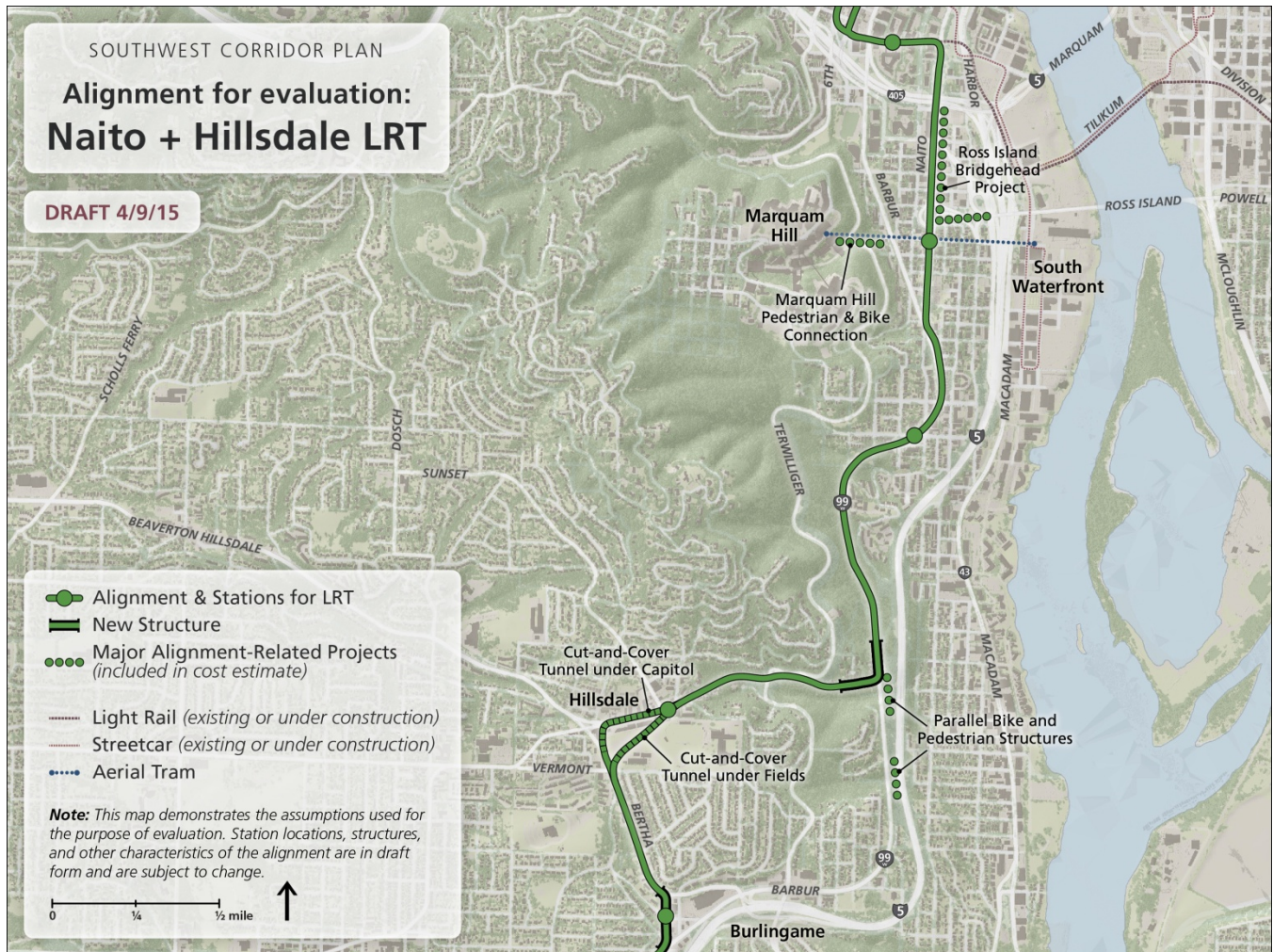




**Naito Parkway and Hillsdale loop with cut-and-cover tunnel***Naito + Hillsdale*

This alignment combines the Naito Parkway option in South Portland with the cut-and-cover tunnel that loops through Hillsdale. The alignment is assumed to include stations at Lincoln Street (currently under construction for Portland-Milwaukie Light Rail), Gibbs Street, Hamilton Street, the Hillsdale town center and 13<sup>th</sup> Avenue.

Unless noted otherwise, the results apply to both the tunnel under Capitol Highway and the tunnel that runs under the fields in between Capitol and Rieke Elementary School.

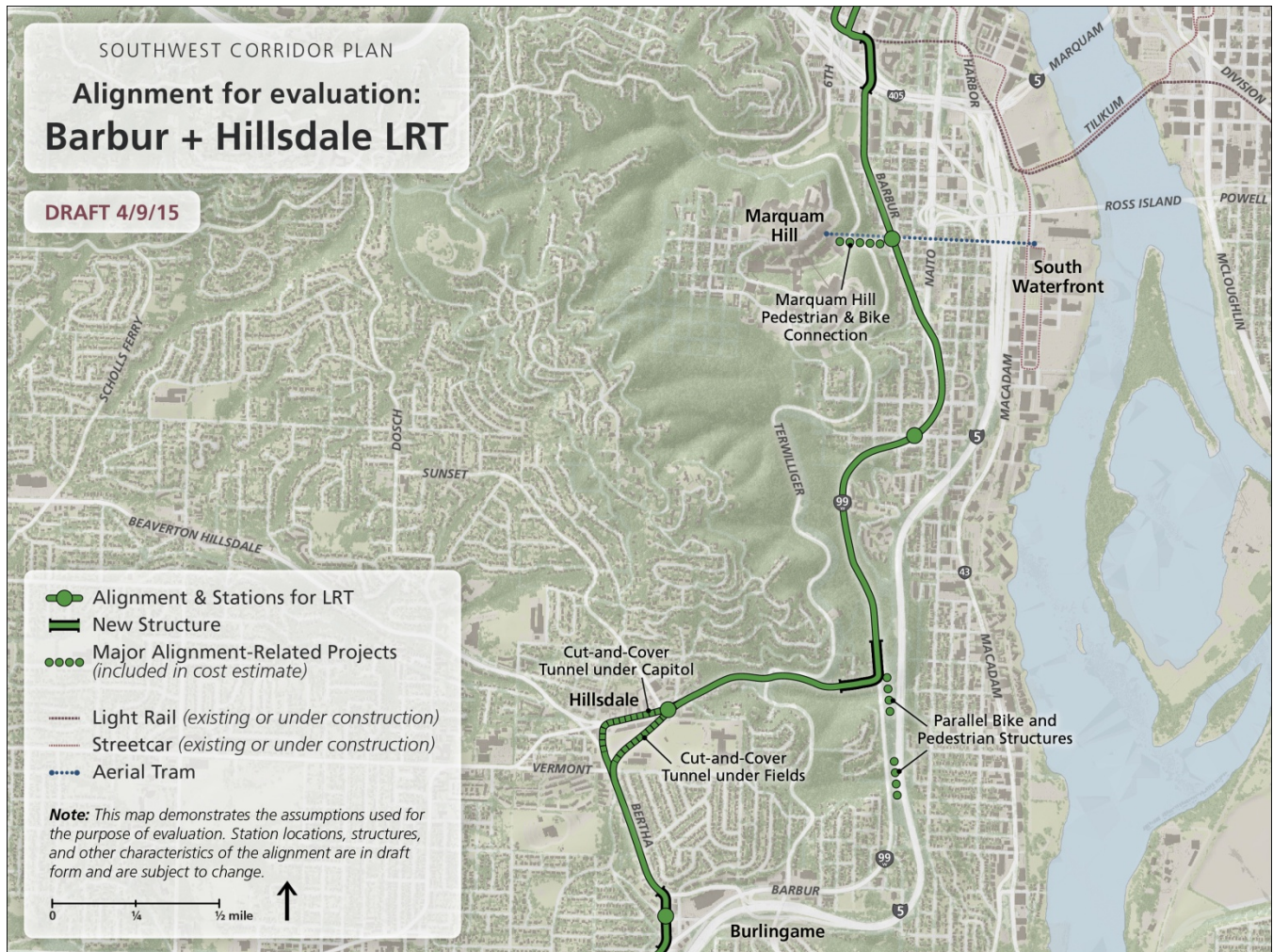




**Barbur Boulevard and Hillsdale loop with cut-and-cover tunnel***Barbur + Hillsdale*

This alignment combines the Barbur Boulevard option in South Portland with the cut-and-cover tunnel that loops through Hillsdale. The alignment is assumed to include stations at Gibbs Street, Hamilton Street, the Hillsdale town center and 13<sup>th</sup> Avenue.

Unless noted otherwise, the results apply to both the tunnel under Capitol Highway and the tunnel that runs under the fields in between Capitol and Rieke Elementary School.

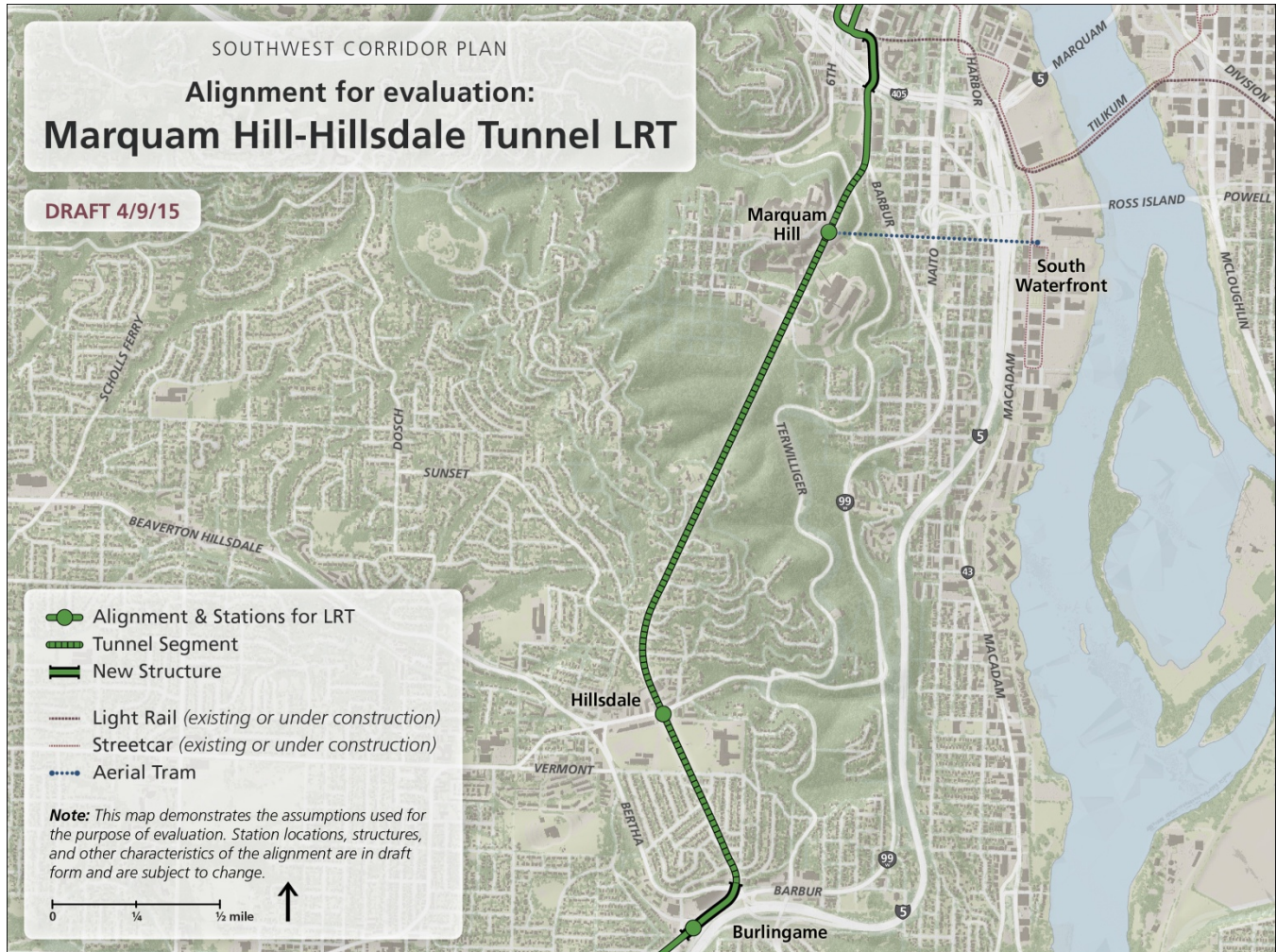




## Marquam Hill-Hillsdale tunnel

*MH-H tunnel*

The Marquam Hill-Hillsdale tunnel is a deep-bored tunnel that runs under the hills west of Barbur Boulevard between Hooker Street and Bertha Boulevard. The alignment is assumed to include an underground station at Marquam Hill, providing access to the Oregon Health & Sciences University (OHSU), the Veterans Affairs Hospital (VA), and other facilities, and a second underground station in the Hillsdale town center.



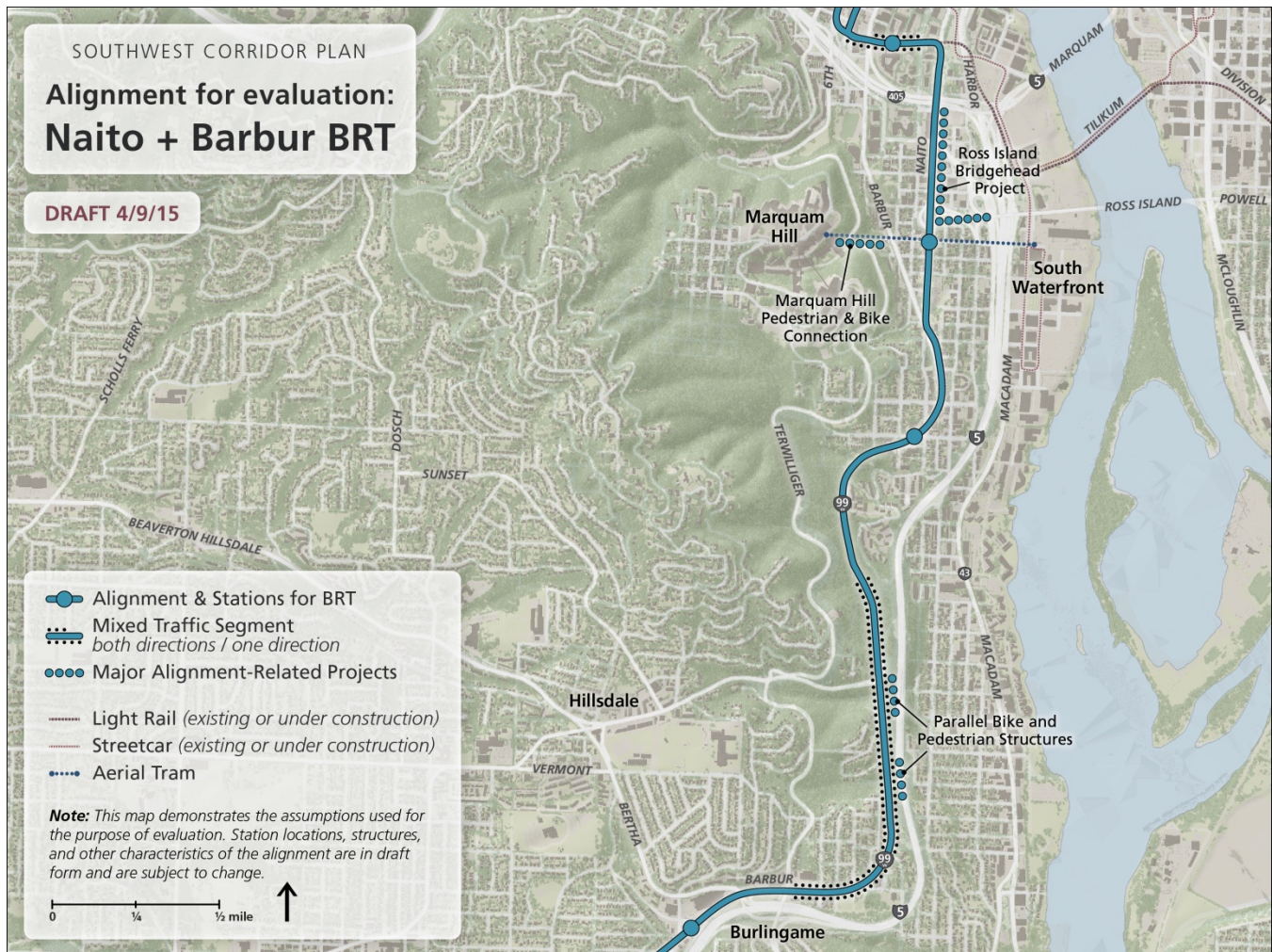


## South Portland and Hillsdale: BRT

## Naito Parkway and Barbur Boulevard

Naito + Barbur

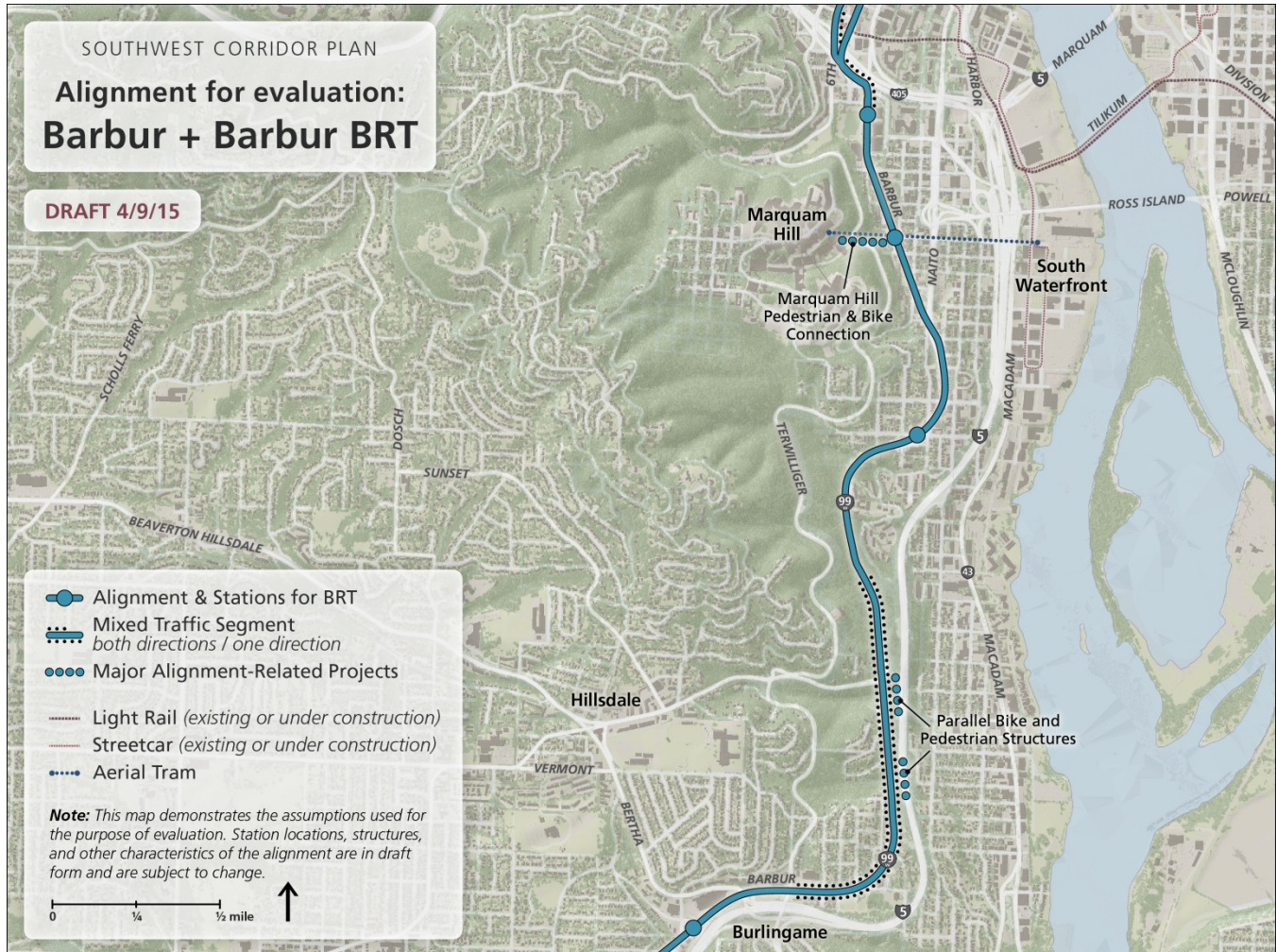
This alignment combines the Naito Parkway option in South Portland with the Barbur Boulevard alignment in the Hillsdale area. The alignment is assumed to include stations at Lincoln Street (currently under construction for Portland-Milwaukie Light Rail), Gibbs Street, Hamilton Street and 13<sup>th</sup> Avenue. The Ross Island Bridgehead project and a Marquam Hill bike and pedestrian connection are both included in the alignment for the purpose of evaluation, including cost and mobility measures.





**Barbur Boulevard and Barbur Boulevard***Barbur + Barbur*

This alignment combines the Barbur Boulevard alignment in South Portland with the Barbur Boulevard alignment in the Hillsdale area. The alignment is assumed to include stations at Gibbs Street, Hamilton Street and 13<sup>th</sup> Avenue. The Marquam Hill bike and pedestrian connection is included in the alignment for the purpose of analysis, including capital cost and ridership measures.



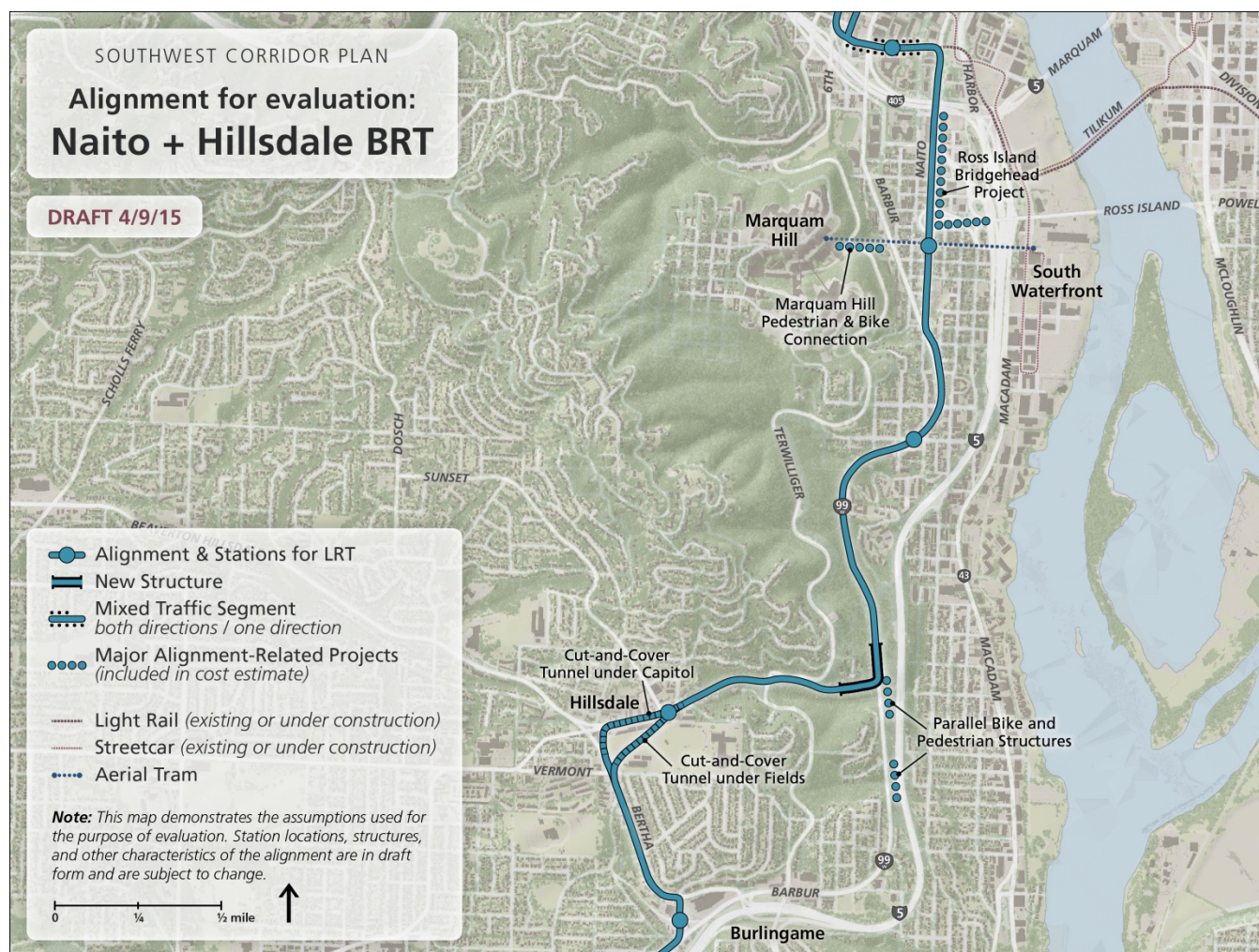


### Naito Parkway and Hillsdale loop with cut-and-cover tunnel

*Naito + Hillsdale*

This alignment combines the Naito Parkway option in South Portland with the cut-and-cover tunnel that loops through Hillsdale. The alignment is assumed to include stations at Lincoln Street (currently under construction for Portland-Milwaukie Light Rail), Gibbs Street, Hamilton Street, the Hillsdale town center and 13<sup>th</sup> Avenue. The Marquam Hill bike and pedestrian connection is included in the alignment for the purpose of analysis, including capital cost and ridership measures.

Unless noted otherwise, the results apply to both the tunnel under Capitol Highway and the tunnel that runs under the fields in between Capitol and Rieke Elementary School.

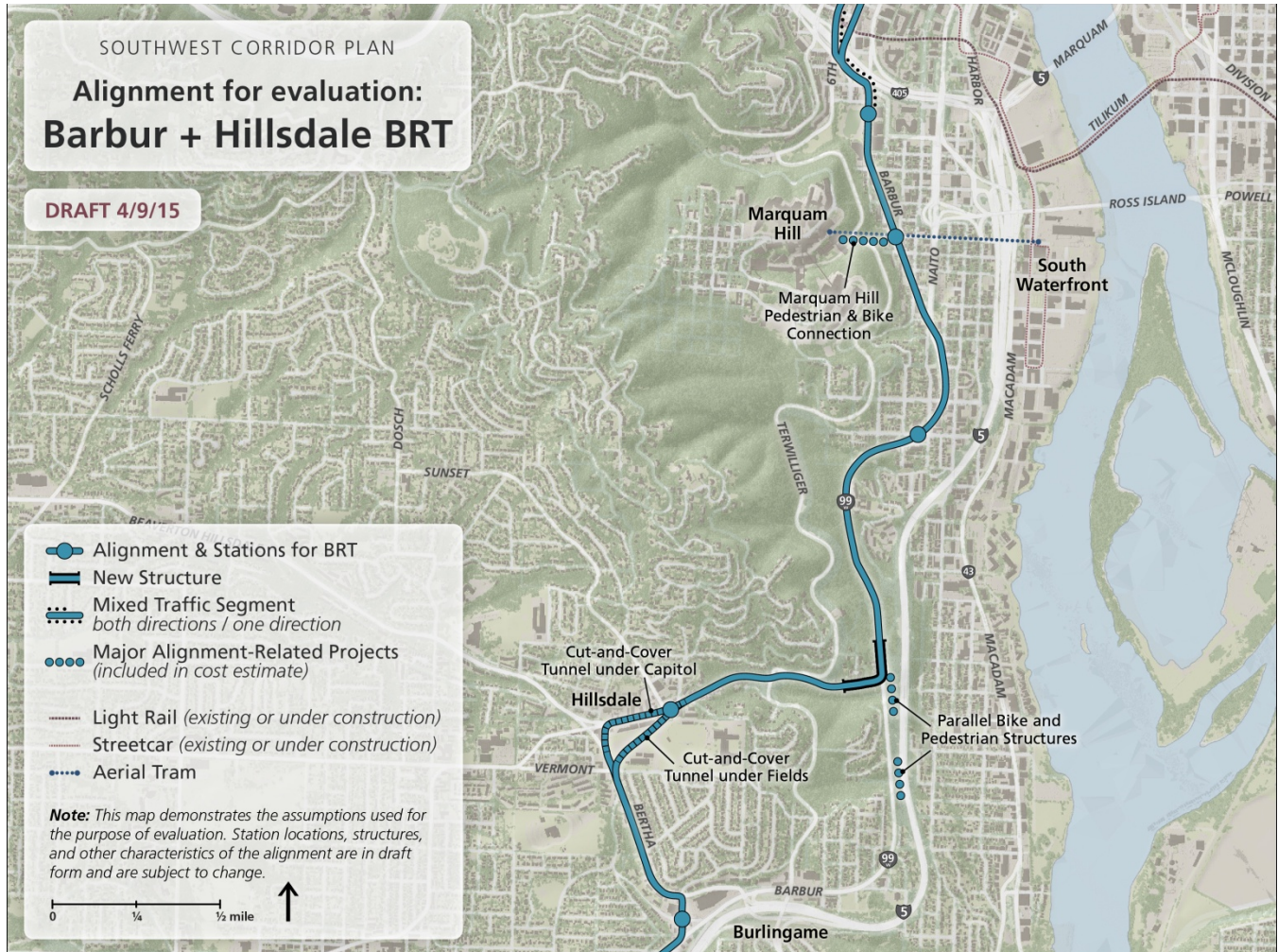




**Barbur Boulevard and Hillsdale loop with cut-and-cover tunnel***Barbur + Hillsdale*

This alignment combines the Barbur Boulevard option in South Portland with the cut-and-cover tunnel that loops through Hillsdale. The alignment is assumed to include stations at Gibbs Street, Hamilton Street, the Hillsdale town center and 13<sup>th</sup> Avenue. The Marquam Hill bike and pedestrian connection is included in the alignment for the purpose of analysis, including capital cost and ridership measures.

Unless noted otherwise, the results apply to both the tunnel under Capitol Highway and the tunnel that runs under the fields in between Capitol and Rieke Elementary School.



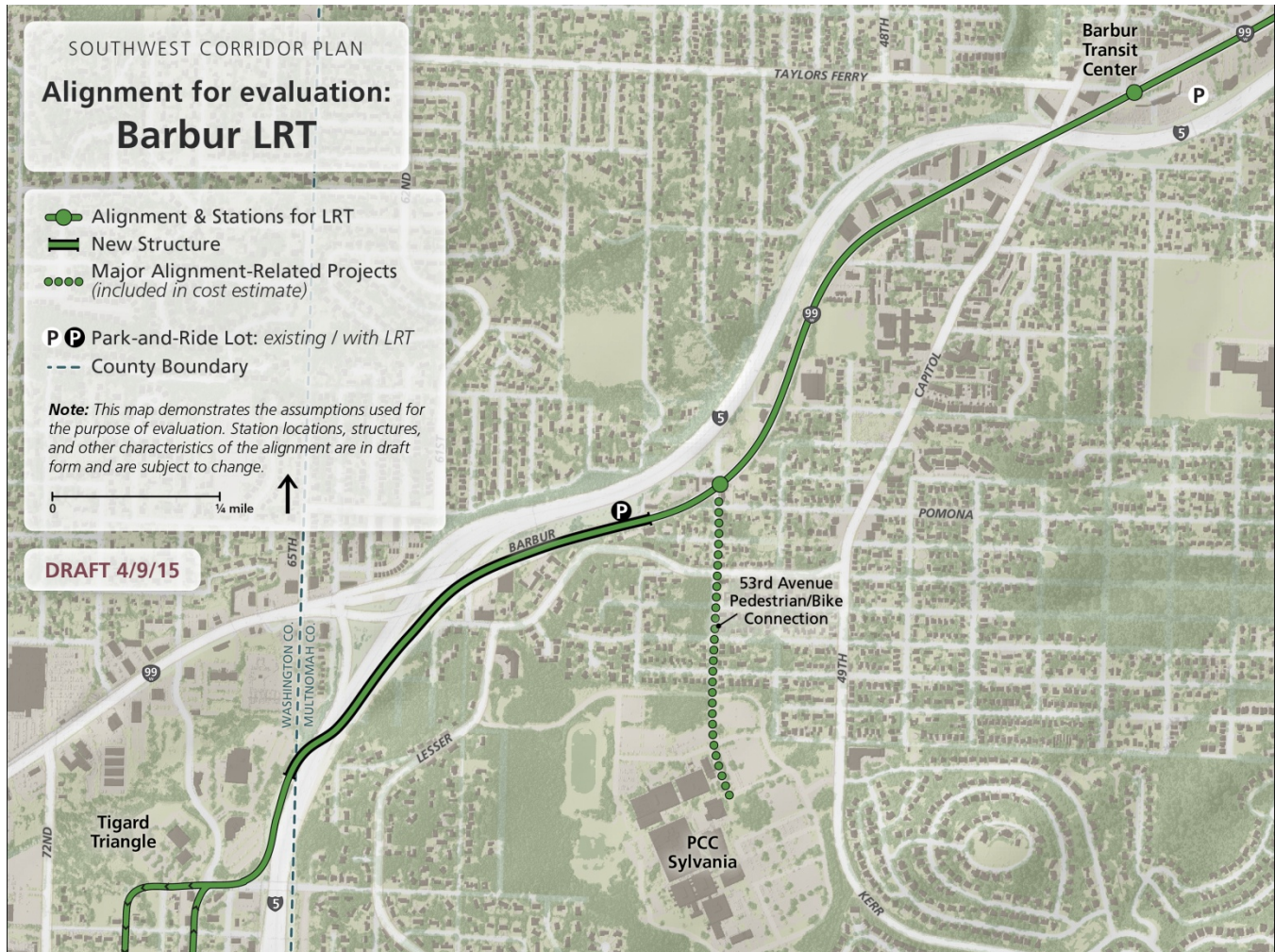


## PCC-Sylvania area: LRT

### Barbur Boulevard

*Barbur*

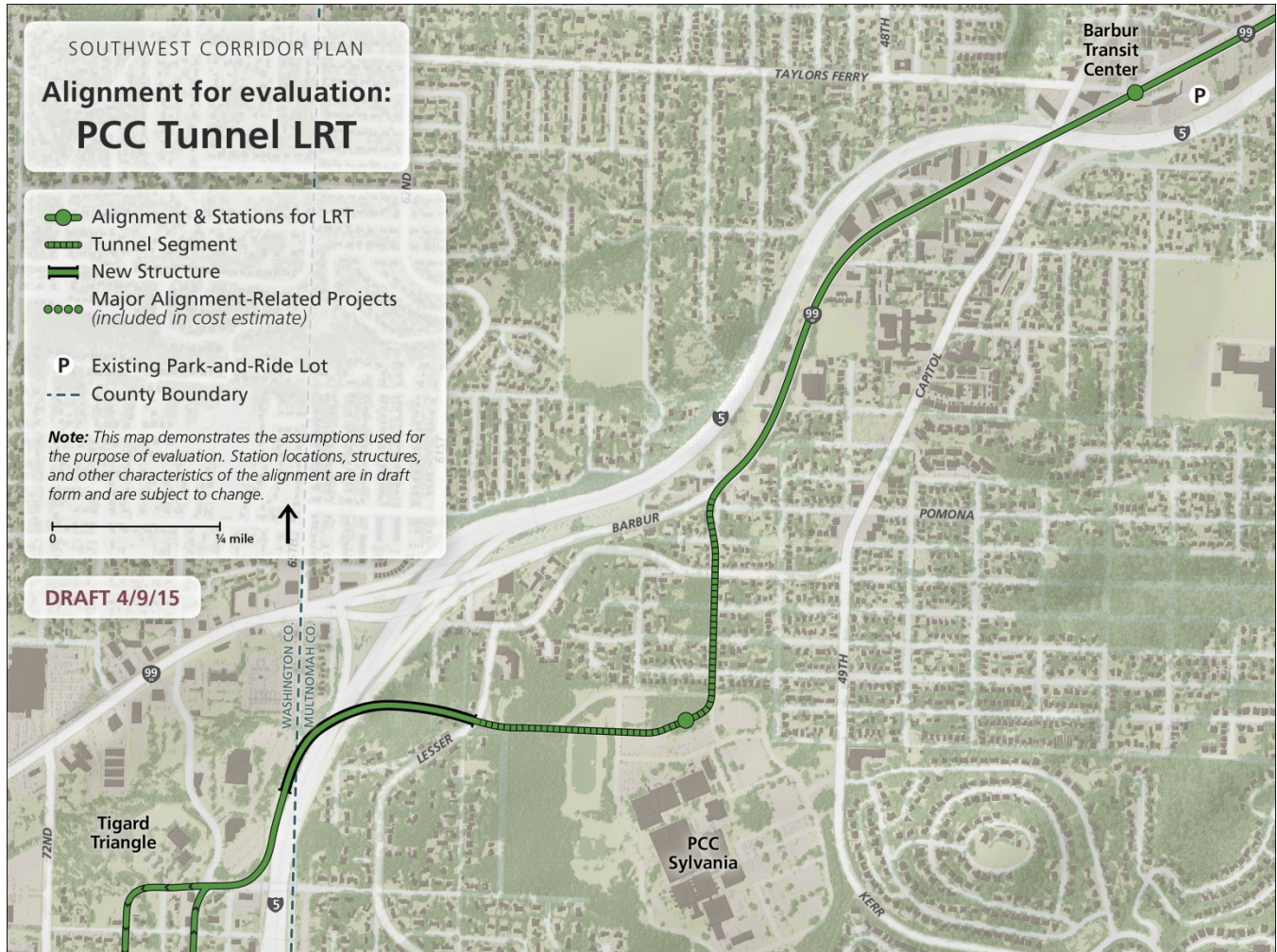
This alignment runs along Barbur Boulevard between Capitol Highway and 60<sup>th</sup> Avenue. The alignment is assumed to include a station at 53<sup>rd</sup> Avenue with a new 230-space park-and-ride lot nearby and an improved pedestrian and bike connection to the PCC-Sylvania campus along 53<sup>rd</sup> Avenue.





**PCC via cut-and-cover tunnel***PCC via tunnel*

This alignment runs along Barbur Boulevard between Capitol Highway and 53<sup>rd</sup> Avenue. The alignment runs in a cut-and-cover tunnel under 53<sup>rd</sup> Avenue and along the northern edge of campus. West of Lesser Road, the alignment crosses I-5 on a new structure for transit, bicyclists, and pedestrians. The alignment is assumed to include an underground station on the northern edge of campus.



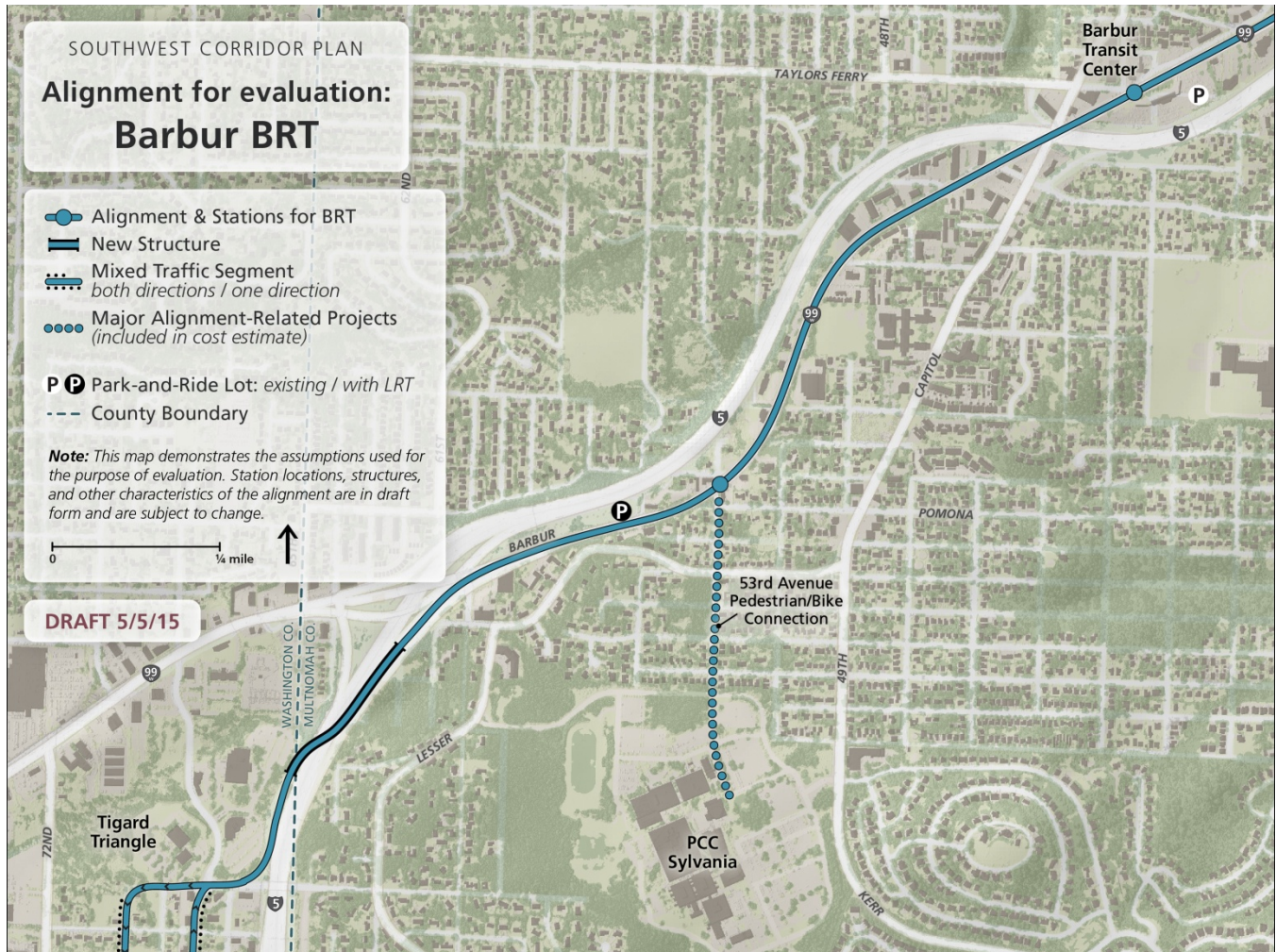


## PCC-Sylvania area: BRT

### Barbur Boulevard

*Barbur*

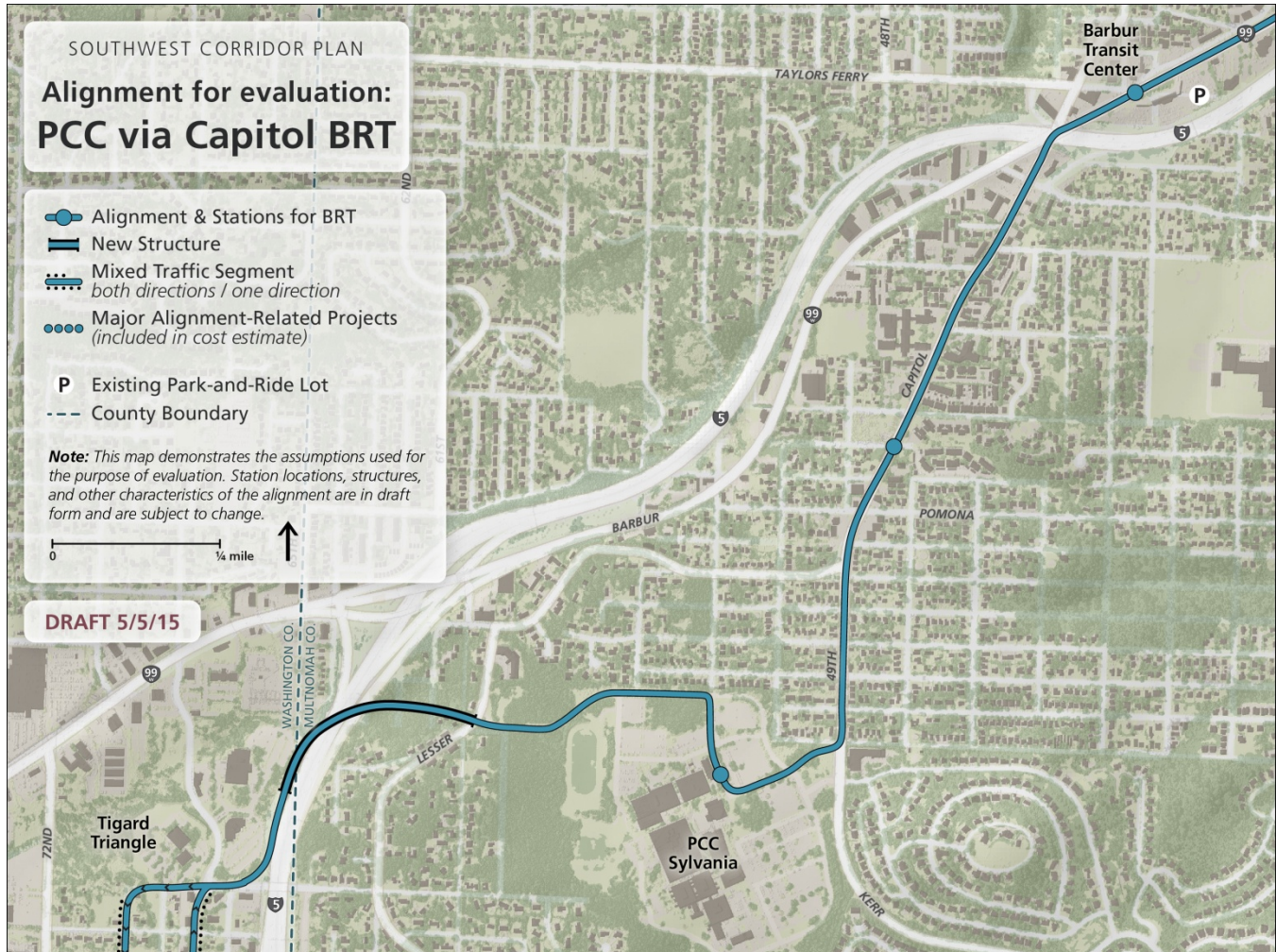
This alignment runs along Barbur Boulevard between Capitol Highway and 60<sup>th</sup> Avenue. The alignment is assumed to include a station at 53<sup>rd</sup> Avenue with a new 230-space park-and-ride lot nearby and an improved pedestrian and bike connection to the PCC-Sylvania campus along 53<sup>rd</sup> Avenue.





**PCC via Capitol Highway***PCC via Capitol*

This alignment runs on Capitol Highway and 49<sup>th</sup> Avenue between Barbur Boulevard and the PCC-Sylvania campus, along the northern edge of campus, and across I-5 on a new structure for transit, bikes, and pedestrians. The alignment is assumed to include stations at Comus Street on Capitol Highway and on the PCC campus.





# Detailed Methodology and Results

## Transit performance

|   | higher performing                              |   |  |   | lower performing                           |          |
|---|--|---|--|---|--|----------|
| <b>Change in system transit trips</b>   | #####<br><i>daily new system transit trips</i> | ####<br><i>daily new system transit trips</i> | ###<br><i>daily new system transit trips</i> | ##<br><i>daily new system transit trips</i> | #<br><i>daily new system transit trips</i> | corridor |
| <b>Line ridership</b>                   | #####<br><i>daily line riders</i>              | ####<br><i>daily line riders</i>              | ###<br><i>daily line riders</i>              | ##<br><i>daily line riders</i>              | #<br><i>daily line riders</i>              | corridor |
| <b>Travel time</b>                      | # minutes                                      | ## minutes                                    | ### minutes                                  | #### minutes                                | ##### minutes                              | corridor |
| <b>Mixed traffic (BRT only)</b>         | 0 miles<br><i>along # mile segment</i>         | # miles<br><i>along # mile segment</i>        | ## miles<br><i>along # mile segment</i>      | ### miles<br><i>along # mile segment</i>    | #### miles<br><i>along # mile segment</i>  | segment  |
| <b>Signalized intersections crossed</b> | #<br><i>intersections</i>                      | ##<br><i>intersections</i>                    | ###<br><i>intersections</i>                  | ####<br><i>intersections</i>                | #####<br><i>intersections</i>              | segment  |

smaller number

#

##

###

####

larger number

#####

## New system transit trips

### Methodology

New system transit trips, or new riders, measures the growth of the total transit system ridership with implementation of the proposed project compared to a transit no-build alternative (where no new HCT project is assumed). For the purpose of analysis, the modeling base alignment is used outside of the segment in question for all model runs and the local bus network remains constant between model runs (see page 13 for more information on the modeling base alignment).

Most alignment options are represented by model runs defined to isolate those options relative to the modeling base alignment. Some alignment options are not reflected in model runs; those alignments are assessed by estimates of ridership based on related alignments. Estimated ridership numbers are indicated with an asterisk.

Due to a combination of several factors, BRT has much fewer new system transit riders than LRT. In order to inform the July alignment decisions, BRT and LRT values have been colored based on their respective ranges. As a result, LRT and BRT tables are not directly comparable in terms of color.

Colors are assigned to reflect the differences between alignment options, rather than set numerical ranges.



### Results

#### LRT: South Portland and Hillsdale

|                    | <i>New system transit trips</i> |
|--------------------|---------------------------------|
| Naito + Barbur     | 15,700                          |
| Barbur + Barbur    | 15,700                          |
| Naito + Hillsdale  | 14,200                          |
| Barbur + Hillsdale | 14,200*                         |
| MH-H tunnel        | 16,900                          |

\*Estimate based on related model runs

#### BRT: South Portland and Hillsdale

|                    | <i>New system transit trips</i> |
|--------------------|---------------------------------|
| Naito + Barbur     | 8,400                           |
| Barbur + Barbur    | 8,400*                          |
| Naito + Hillsdale  | 7,700*                          |
| Barbur + Hillsdale | 7,700*                          |

\*Estimate based on related model runs

#### LRT: PCC-Sylvania area

|                | <i>New system transit trips</i> |
|----------------|---------------------------------|
| Barbur         | 15,700                          |
| PCC via tunnel | 17,800                          |

#### BRT: PCC-Sylvania area

|                 | <i>New system transit trips</i> |
|-----------------|---------------------------------|
| Barbur          | 8,400                           |
| PCC via Capitol | 9,700                           |

## Line ridership

### Methodology

BRT or LRT projected line ridership is an output of Metro's travel demand model. Model runs were performed for a 2035 horizon year. Line ridership measures the number of daily riders on the specific HCT line (between the terminus and downtown Portland).

Most alignment options are represented by model runs defined to isolate those options relative to the modeling base alignment (see page 13 for more information on the modeling base alignment). Some alignment options are not reflected in model runs; those alignments are assessed by estimates of ridership based on related alignments. Estimated ridership numbers are indicated with an asterisk.

Due to a combination of several factors, BRT has fewer line riders than LRT. In order to inform the July alignment decisions, BRT and LRT values have been colored based on their respective ranges. As a result, LRT and BRT tables are not directly comparable in terms of color.

Colors are assigned to reflect the differences between alignment options, rather than set numerical ranges.



### Results

#### LRT: South Portland and Hillsdale

|                    | Line ridership |
|--------------------|----------------|
| Naito + Barbur     | 43,500         |
| Barbur + Barbur    | 44,100         |
| Naito + Hillsdale  | 41,800         |
| Barbur + Hillsdale | 42,400*        |
| MH-H tunnel        | 52,400         |

\*Estimate based on related model runs

#### BRT: South Portland and Hillsdale

|                    | Line ridership |
|--------------------|----------------|
| Naito + Barbur     | 30,800         |
| Barbur + Barbur    | 31,200*        |
| Naito + Hillsdale  | 29,300*        |
| Barbur + Hillsdale | 29,700*        |

\*Estimate based on related model runs

#### LRT: PCC-Sylvania area

|                | Line ridership |
|----------------|----------------|
| Barbur         | 43,500         |
| PCC via tunnel | 46,200         |

#### BRT: PCC-Sylvania area

|                 | Line ridership |
|-----------------|----------------|
| Barbur          | 30,800         |
| PCC via Capitol | 32,900         |



## Mixed traffic (BRT only)

### Methodology

Mixed traffic measures the distance of mixed traffic operations within each segment, based on an average of the northbound and southbound miles in mixed traffic. Because light rail operates entirely in exclusive right-of-way, light rail options are not evaluated using the mixed traffic measure at this time.

Colors are assigned to reflect the differences between alignment options, rather than set numerical ranges.



### Results

| BRT: South Portland and Hillsdale |                                     |   |
|-----------------------------------|-------------------------------------|---|
|                                   | <i>Total segment length (miles)</i> | <i>Mixed traffic in segment (miles)</i> |
| Naito + Barbur                    | 3.7                                 | 1.4                                     |
| Barbur + Barbur                   | 3.5                                 | 1.4                                     |
| Naito + Hillsdale                 | 3.9                                 | 0.2                                     |
| Barbur + Hillsdale                | 3.8                                 | 0.2                                     |

| BRT: PCC-Sylvania area |                                     |   |
|------------------------|-------------------------------------|---|
|                        | <i>Total segment length (miles)</i> | <i>Mixed traffic in segment (miles)</i> |
| Barbur                 | 1.8                                 | 0.0                                     |
| PCC via Capitol        | 2.3                                 | 0.0                                     |

## Signalized intersections crossed

### Methodology

Crossing signalized intersections creates opportunities for unexpected delay for both BRT and LRT. This measure is a count of the number of signalized intersections each HCT alignment traverses along the segment in question.



### Results

| LRT: South Portland and Hillsdale |   |
|-----------------------------------|---|
|                                   | <i>Signalized intersections crossed</i> |
| Naito + Barbur                    | 14                                      |
| Barbur + Barbur                   | 12                                      |
| Naito + Hillsdale                 | 15                                      |
| Barbur + Hillsdale                | 13                                      |
| MH-H tunnel                       | 3                                       |

| BRT: South Portland and Hillsdale |   |
|-----------------------------------|---|
|                                   | <i>Signalized intersections crossed</i> |
| Naito + Barbur                    | 14                                      |
| Barbur + Barbur                   | 12                                      |
| Naito + Hillsdale                 | 18                                      |
| Barbur + Hillsdale                | 16                                      |

| LRT: PCC-Sylvania area |   |
|------------------------|---|
|                        | <i>Signalized intersections crossed</i> |
| Barbur                 | 4                                       |
| PCC via tunnel         | 3                                       |

| BRT: PCC-Sylvania area |   |
|------------------------|---|
|                        | <i>Signalized intersections crossed</i> |
| Barbur                 | 4                                       |
| PCC via Capitol        | 8                                       |

## Access and development

|                                    | higher performing |                          |                  | lower performing        |             |                 |
|------------------------------------|-------------------|--------------------------|------------------|-------------------------|-------------|-----------------|
| <b>Equitable access to transit</b> | high access       | moderate to high access  | moderate access  | low to moderate access  | low access  | <i>corridor</i> |
| <b>Redevelopment potential</b>     | ##### acres       | #### acres               | ### acres        | ## acres                | # acres     | <i>segment</i>  |
| <b>Support for existing plans</b>  | high support      | moderate to high support | moderate support | low to moderate support | low support | <i>segment</i>  |

smaller number

#

##

###

####

larger number

#####

## Equitable access to transit

### Methodology

This measure is based on the number of 2035 home-based system transit trips originating in areas with above average rates of low income, limited English proficiency, and people of color.

In order to sum transit trips in these areas, 2010 census data were spatially recalculated according to Metro's transportation analysis zones (TAZs), the boundaries by which the model outputs are organized. Low income and limited English proficiency data were based on census tracts, while people of color data were based on census blocks. In the process of reallocating population data to TAZs, non-residential areas were masked to achieve more accurate distribution. TAZs with a proportion of each group above the regional average were used to sum home-based system transit trips. Each build alternative was compared to the no-build model run in order to calculate the total number of new trips.

Some alignment options are not reflected in model runs; those alignments are assessed by estimates based on other related model runs. Estimated numbers are indicated with an asterisk.



### Results

| LRT: South Portland and Hillsdale |  |                                |                 |                            |
|-----------------------------------|--|--------------------------------|-----------------|----------------------------|
|                                   | New home-based system transit trips<br>in areas with above average rates of... |                                |                 | Rating                     |
|                                   | low income   | limited English<br>proficiency | people of color |                            |
| Naito + Barbur                    | 4,100  | 2,000                          | 3,600           | moderate access            |
| Barbur + Barbur                   | 4,100  | 1,900                          | 3,700           | moderate access            |
| Naito + Hillsdale                 | 3,600  | 1,700                          | 3,200           | low to moderate<br>access  |
| Barbur + Hillsdale                | 3,500*   | 1,600*                         | 3,300*          | low to moderate<br>access  |
| MH-H tunnel                       | 4,600  | 2,100                          | 4,000           | moderate to<br>high access |

\*Estimate based on related model runs



**BRT: South Portland and Hillsdale**

|                    | <i>New home-based system transit trips<br/>in areas with above average rates of...</i> |                                |                 | <i>Rating</i>             |
|--------------------|--|--------------------------------|-----------------|---------------------------|
|                    | low income   | limited English<br>proficiency | people of color |                           |
| Naito + Barbur     | 2,500  | 1,000                          | 1,900           | moderate access           |
| Barbur + Barbur    | 2,400*   | 1000*                          | 1,900*          | moderate access           |
| Naito + Hillsdale  | 2,100*   | 900*                           | 1,700*          | low to moderate<br>access |
| Barbur + Hillsdale | 2,100*   | 800*                           | 1,700*          | low to moderate<br>access |

\*Estimate based on related model runs

**LRT: PCC-Sylvania area**

|                | <i>New home-based system transit trips<br/>in areas with above average rates of...</i> |                                |                 | <i>Rating</i>   |
|----------------|--|--------------------------------|-----------------|-----------------|
|                | low income   | limited English<br>proficiency | people of color |                 |
| Barbur         | 4,100  | 2,000                          | 3,600           | moderate access |
| PCC via tunnel | 4,800  | 2,600                          | 4,300           | high access     |

**BRT: PCC-Sylvania area**

|                 | <i>New home-based system transit trips<br/>in areas with above average rates of...</i> |                                |                 | <i>Rating</i>   |
|-----------------|--|--------------------------------|-----------------|-----------------|
|                 | low income   | limited English<br>proficiency | people of color |                 |
| Barbur          | 4,100  | 2,000                          | 3,600           | moderate access |
| PCC via Capitol | 4,800  | 2,600                          | 4,300           | high access     |

## Redevelopment potential

### Methodology

Redevelopment potential measures the total acreage of buildable and redevelopable land within a quarter mile from the HCT stations along the segment in question. This is merely a representation of the potential for land to have new construction on it during and/or after construction of an HCT line. This number does not represent an assurance that HCT will spur redevelopment on a particular location. An analysis of the impact of HCT on site-specific redevelopment parcels will occur later in the project.

The methodology for this calculation is:

- Step 1: Identify vacant tax lots (and complement developed tax lots) by zoning class
- Step 2: Remove tax lots from the BLI that don't have the potential to provide residential or employment growth capacity (e.g., parks)
- Step 3: Calculate deductions for environmental resources<sup>1</sup>
- Step 4: Calculate deductions for "future streets"<sup>2</sup>
- Step 5: Sum up total remaining acreage that is considered buildable/redevelopable

Because the South Portland and Hillsdale alignments cover a longer distance with more stations than the PCC area alignments, the acreage values differ greatly between the two areas. As a result, colors are assigned to reflect the differences between alignment options, rather than set numerical ranges.



<sup>1</sup> Environmental resources considered include Metro's Title 3, Title 13, FEMA flood way and steep slopes over 25%.

<sup>2</sup> The BLI accounts for future streets on a tax lot-by-tax lot basis. The buildable area of each tax lot is reduced on the basis of individual tax lot size.

## Results

| LRT: South Portland and Hillsdale |                            |
|-----------------------------------|----------------------------|
|                                   | <i>Redevelopable acres</i> |
| Naito + Barbur                    | 47                         |
| Barbur + Barbur                   | 43                         |
| Naito + Hillsdale                 | 72                         |
| Barbur + Hillsdale                | 69                         |
| MH-H tunnel                       | 64                         |

| BRT: South Portland and Hillsdale |                            |
|-----------------------------------|----------------------------|
|                                   | <i>Redevelopable acres</i> |
| Naito + Barbur                    | 41                         |
| Barbur + Barbur                   | 39                         |
| Naito + Hillsdale                 | 67                         |
| Barbur + Hillsdale                | 64                         |

| LRT: PCC-Sylvania area |                            |
|------------------------|----------------------------|
|                        | <i>Redevelopable acres</i> |
| Barbur                 | 18                         |
| PCC via tunnel         | 2                          |

| BRT: PCC-Sylvania area |                            |
|------------------------|----------------------------|
|                        | <i>Redevelopable acres</i> |
| Barbur                 | 18                         |
| PCC via Capitol        | 25                         |

## Support for existing plans

### Methodology

Qualitative analysis of the extent to which each alignment supports local plans, such as the Barbur Concept Plan and Tigard Triangle Strategic Plan.

| higher performing   |   | lower performing  |  |   |
|---|---|---|--|---|
| high support  | moderate to high support  | moderate support  | low to moderate support  | low support   |
| <i>Alignment identified in a local land use plan as integral to the successful implementation of the plan goals</i> | <i>Alignment still within the boundaries of the plan and will play a large role in the implementation of the plan goals</i> | <i>Alignment will serve some of the plan goals in one area, while possibly bypassing other areas altogether</i> | <i>Alignment will offer minimal support of a local adopted land use plan</i> | <i>Alignment offers no tangible benefit to local adopted land use plans</i> |

### Results

| LRT: South Portland and Hillsdale |   |                          |
|-----------------------------------|---|--------------------------|
|                                   | <i>Support for existing plans</i>   | <i>Rating</i>            |
| Naito + Barbur                    | This alignment is most supportive of the Barbur Concept Plan by offering direct access to the key nodes identified by the City of Portland along Naito and Barbur.  | high support             |
| Barbur + Barbur                   | Indirectly supports the Barbur Concept Plan in the S. Portland key area, but is consistent with the plan for the remaining portion of the alignment   | moderate support         |
| Naito + Hillsdale                 | Offers excellent support to the Kelly Focus Area of the Barbur Concept Plan, but also serves the Hillsdale Town Center when that plan calls only for enhanced bus service.  | moderate to high support |
| Barbur + Hillsdale                | Indirectly supports the Barbur Concept Plan in S. Portland. Hillsdale Town Center plan does not call for HCT, but for increased bus service. Remaining portion of Barbur alignment follows the Barbur Concept Plan.   | moderate support         |
| MH-H tunnel                       | This S. Portland alignment offers no support of the adopted Barbur Concept Plan. The tunnel portion accessing Hillsdale will offer limited support of the Hillsdale Town Center Plan, particularly as it's reflected in the limited redevelopment opportunities that exist there. | low to moderate support  |

**BRT: South Portland and Hillsdale**

|                    | <i>Support for existing plans</i>   | <i>Rating</i>            |
|--------------------|---|--------------------------|
| Naito + Barbur     | This alignment is most supportive of the Barbur Concept Plan by offering direct access to the key nodes identified by the City of Portland along Naito and Barbur.  | high support             |
| Barbur + Barbur    | Indirectly supports the Barbur Concept Plan in the S. Portland key area, but is consistent with the plan for the remaining portion of the alignment   | moderate support         |
| Naito + Hillsdale  | Offers excellent support to the Kelly Focus Area of the Barbur Concept Plan, but also serves the Hillsdale Town Center when that plan calls only for enhanced bus service.  | moderate to high support |
| Barbur + Hillsdale | Indirectly supports the Barbur Concept Plan in S. Portland. Hillsdale Town Center plan does not call for HCT, but for increased bus service. Remaining portion of Barbur alignment follows the Barbur Concept Plan. | moderate support         |

**LRT: PCC-Sylvania area**

|                | <i>Support for existing plans</i>  | <i>Rating</i>            |
|----------------|--|--------------------------|
| Barbur         | Alignment follows the desires of the Barbur Concept Plan.  | moderate to high support |
| PCC via tunnel | Tunnel offers direct service to PCC, but there is no current plan with either the City or PCC that calls for HCT to directly serve the campus. | moderate support         |

**BRT: PCC-Sylvania area**

|                 | <i>Support for existing plans</i>  | <i>Rating</i>            |
|-----------------|--|--------------------------|
| Barbur          | Alignment follows the desires of the Barbur Concept Plan.  | moderate to high support |
| PCC via Capitol | Alignment bypasses PCC focus area of the Barbur Concept Plan. Comus Street station is not identified by City as a key location. Alignment does serve PCC directly. | moderate support         |

## Mobility

|                                | higher performing                 |                                       |                               |                                | lower performing                      |         |
|--------------------------------|-----------------------------------|---------------------------------------|-------------------------------|--------------------------------|---------------------------------------|---------|
| <b>Freight</b>                 | minimal or no overlap             | some local overlap                    | substantial local overlap     | some state or regional overlap | substantial state or regional overlap | segment |
| <b>Traffic</b>                 | major opportunity for improvement | some opportunity for improvement      | negligible impact             | some negative impact           | major negative impact                 | segment |
| <b>Transportation safety</b>   | high improvement potential        | low to moderate improvement potential | negligible impact             | minor negative impact          | major negative impact                 | segment |
| <b>Street connectivity</b>     | ## new connections                | # new connections                     | no change                     | # connections eliminated       | ## connections eliminated             | segment |
| <b>Bike improvements</b>       | #### miles along # mile segment   | ### miles along # mile segment        | ## miles along # mile segment | # miles along # mile segment   | 0 miles along # mile segment          | segment |
| <b>Pedestrian improvements</b> | #### miles along # mile segment   | ### miles along # mile segment        | ## miles along # mile segment | # miles along # mile segment   | 0 miles along # mile segment          | segment |

smaller number

#

##

###

####

larger number

#####

## Freight

### Methodology

Overlap between freight networks and other modal improvements were identified by comparing project improvements with state, regional, and local freight designations. State designations include the OHP Freight Map and the ORS 366.215 Oversize Freight Map. Regional designations include the RTP Freight Map. Local designations include the Portland Freight Plan Maps. Any transit system would be design to maintain freight access and movement.

| higher performing     |                    |                           | lower performing               |                                       |
|-----------------------|--------------------|---------------------------|--------------------------------|---------------------------------------|
| minimal or no overlap | some local overlap | substantial local overlap | some state or regional overlap | substantial state or regional overlap |

### Results

| LRT: South Portland and Hillsdale |   |                           |
|-----------------------------------|---|---------------------------|
|                                   | <i>Freight route overlap</i>  | <i>Rating</i>             |
| Naito + Barbur                    | The portion of Naito north of the Ross Island Bridge and Barbur are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.          | substantial local overlap |
| Barbur + Barbur                   | Barbur is locally-designated as a Major Truck Street. No overlap with state or regional freight routes.   | substantial local overlap |
| Naito + Hillsdale                 | The portion of Naito north of the Ross Island Bridge, Barbur, and Bertha are locally-designated as Major Truck Streets. No overlap with state or regional freight routes. | substantial local overlap |
| Barbur + Hillsdale                | Barbur and Bertha are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.  | substantial local overlap |
| MH-H tunnel                       | Includes some overlap with Barbur, locally-designated as Major Truck Street, north and south of tunnel. No overlap with state or regional freight routes.                 | some local overlap        |

**BRT: South Portland and Hillsdale**

|                    | <i>Freight route overlap</i>  | <i>Rating</i>             |
|--------------------|---|---------------------------|
| Naito + Barbur     | The portion of Naito north of the Ross Island Bridge and Barbur are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.          | substantial local overlap |
| Barbur + Barbur    | Barbur is locally-designated as a Major Truck Street. No overlap with state or regional freight routes.   | substantial local overlap |
| Naito + Hillsdale  | The portion of Naito north of the Ross Island Bridge, Barbur, and Bertha are locally-designated as Major Truck Streets. No overlap with state or regional freight routes. | substantial local overlap |
| Barbur + Hillsdale | Barbur and Bertha are locally-designated as Major Truck Streets. No overlap with state or regional freight routes.  | substantial local overlap |

**LRT: PCC-Sylvania area**

|                | <i>Freight route overlap</i>   | <i>Rating</i>             |
|----------------|--|---------------------------|
| Barbur         | Barbur is locally-designated as a Major Truck Street. No overlap with state or regional freight routes.  | substantial local overlap |
| PCC via tunnel | Includes substantial overlap with Barbur, locally-designated as Major Truck Street, north of tunnel. No overlap with state or regional freight routes. | substantial local overlap |

**BRT: PCC-Sylvania area**

|                 | <i>Freight route overlap</i>   | <i>Rating</i>             |
|-----------------|--|---------------------------|
| Barbur          | Barbur is locally-designated as a Major Truck Street. No overlap with state or regional freight routes.                  | substantial local overlap |
| PCC via Capitol | Minimal overlap with Barbur, locally-designated as Major Truck Street. No overlap with state or regional freight routes. | minimal or no overlap     |



## Traffic

### Methodology

Impacts to traffic, both negative and positive, of a high-capacity transit project were considered, including volume-to-capacity (V/C) ratio and vehicle queuing, based on the July 2014 traffic analysis completed for the project. This analysis considered the potential for some mode shift to transit, the use of dedicated transit lanes where appropriate, signal pre-emption by transit, and potential lane configurations intended to optimize traffic performance while minimizing needed right-of-way acquisitions. The analysis looked at key bottleneck or capacity constraint locations in the corridor between Portland and Tualatin. Mitigation will be identified to address negative impacts during the environmental phase of the project.

| higher performing  |  |  | lower performing   |  |
|--|--|--|--|--|
| major opportunity for improvement  | some opportunity for improvement   | negligible impact  | some negative impact   | major negative impact  |
| <i>Alignment provides opportunities for improving motor vehicle traffic at key system motor vehicle bottlenecks.</i> | <i>Alignment provides opportunities for improving motor vehicle traffic at non-bottleneck locations.</i> | <i>Alignment results in negligible positive or negative impacts to motor vehicle traffic other than mode shift to transit.</i> | <i>Alignment results in minor negative impacts to motor vehicle traffic.</i> | <i>Alignment results in significant negative impacts to motor vehicle traffic.</i> |

### Results

| LRT: South Portland and Hillsdale |   |                                  |
|-----------------------------------|---|----------------------------------|
|                                   | <i>Traffic impact</i>   | <i>Rating</i>                    |
| Naito + Barbur                    | Alignment provides opportunity to address bottleneck at west end of Ross Island Bridge. Alignment travels through (possibly at-grade) the bottleneck at Barbur & Terwilliger, with minor reduction in V/C. Impacts at Ross Island Bridgehead and Barbur & Hamilton require further study. | some opportunity for improvement |
| Barbur + Barbur                   | Alignment travels through (possibly at-grade) the bottleneck at Barbur & Terwilliger, with minor reduction in V/C. Impacts at Barbur & Hamilton require further study.  | negligible impact                |
| Naito + Hillsdale                 | Alignment provides opportunity to address bottleneck at west end of Ross Island Bridge. Alignment avoids impacts in Hillsdale town center via grade separation. Impacts at Ross Island Bridgehead and Barbur & Hamilton require further study.  | some opportunity for improvement |
| Barbur + Hillsdale                | Alignment avoids impacts in Hillsdale town center via grade separation. Impacts at Barbur & Hamilton require further study.   | negligible impact                |
| MH-H tunnel                       | Alignment largely avoids impacts via grade separation.  | negligible impact                |

**BRT: South Portland and Hillsdale**

|                    | <i>Traffic impact</i>   | <i>Rating</i>                    |
|--------------------|---|----------------------------------|
| Naito + Barbur     | Alignment provides opportunity to address bottleneck at west end of Ross Island Bridge. Alignment travels through (possibly at-grade) the bottleneck at Barbur & Terwilliger, with minor reduction in V/C. Impacts at Ross Island Bridgehead and Barbur & Hamilton require further study. | some opportunity for improvement |
| Barbur + Barbur    | Alignment travels through (possibly at-grade) the bottleneck at Barbur & Terwilliger, with minor reduction in V/C. Impacts at Barbur & Hamilton require further study.  | negligible impact                |
| Naito + Hillsdale  | Alignment provides opportunity to address bottleneck at west end of Ross Island Bridge. Alignment avoids impacts in Hillsdale town center via grade separation. Impacts at Ross Island Bridgehead and Barbur & Hamilton require further study.  | some opportunity for improvement |
| Barbur + Hillsdale | Alignment avoids impacts in Hillsdale town center via grade separation. Impacts at Barbur & Hamilton require further study.   | negligible impact                |

**LRT: PCC-Sylvania area**

|                | <i>Traffic impact</i>   | <i>Rating</i>        |
|----------------|---|----------------------|
| Barbur         | Alignment results in minor negative impacts due to opportunity to convert travel lanes in a segment with low traffic volumes. | some negative impact |
| PCC via tunnel | Alignment results in minor negative impacts due to opportunity to convert travel lanes in a segment with low traffic volumes. | some negative impact |

**BRT: PCC-Sylvania area**

|                 | <i>Traffic impact</i>   | <i>Rating</i>        |
|-----------------|---|----------------------|
| Barbur          | Alignment results in minor negative impacts due to opportunity to convert travel lanes in a segment with low traffic volumes. | some negative impact |
| PCC via Capitol | Alignment results in negligible impacts in a segment with low traffic volumes.  | negligible impact    |

## Transportation safety

### Methodology

Construction of a project alignment would bring the opportunity to address high-crash locations along that alignment, as any high-capacity transit project will include consideration of safety improvements as appropriate, but would also introduce additional complexity with the introduction of a new mode. As a presumed median-running alignment for in-street segments, Highway Safety Manual principles were used to evaluate safety impacts on each alignment, with consideration of the additional complexity created by the new mode. Safety review is generally qualitative.

| higher performing   |   | lower performing   |   |   |
|---|---|--|---|---|
| high improvement potential  | low to moderate improvement potential   | negligible impact  | minor negative impact                                     | major negative impact   |
| <i>Alignment includes opportunity to address high-severity crashes, no additional complexity.</i> | <i>Alignment includes opportunity to address high-severity crashes, but introduces additional complexity.</i> | <i>Alignment has a negligible effect on high-severity crashes.</i> | <i>Alignment increases risk of high-severity crashes.</i> | <i>Alignment significantly increases risk of high-severity crashes.</i> |

### Results

| LRT: South Portland and Hillsdale |  |                                       |
|-----------------------------------|--|---------------------------------------|
|                                   | <i>Transportation safety</i>   | <i>Rating</i>                         |
| Naito + Barbur                    | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. High rate of high-severity crashes on Barbur east of Terwilliger.  | low to moderate improvement potential |
| Barbur + Barbur                   | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. High rate of high-severity crashes on Barbur east of Terwilliger.  | low to moderate improvement potential |
| Naito + Hillsdale                 | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Moderate rate of high-severity crashes along Capitol-Bertha route. | low to moderate improvement potential |
| Barbur + Hillsdale                | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Moderate rate of high-severity crashes along Capitol-Bertha route. | low to moderate improvement potential |
| MH-H tunnel                       | Alignment largely avoids interaction with traffic.   | negligible impact                     |

**BRT: South Portland and Hillsdale**

|                    | <i>Transportation safety</i>   | <i>Rating</i>                         |
|--------------------|--|---------------------------------------|
| Naito + Barbur     | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. High rate of high-severity crashes on Barbur east of Terwilliger.  | low to moderate improvement potential |
| Barbur + Barbur    | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. High rate of high-severity crashes on Barbur east of Terwilliger.  | low to moderate improvement potential |
| Naito + Hillsdale  | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Moderate rate of high-severity crashes along Capitol-Bertha route. | low to moderate improvement potential |
| Barbur + Hillsdale | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Moderate rate of high-severity crashes along Capitol-Bertha route. | low to moderate improvement potential |

**LRT: PCC-Sylvania area**

|                | <i>Transportation safety</i>  | <i>Rating</i>                         |
|----------------|---|---------------------------------------|
| Barbur         | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Low rate of high-severity crashes along route.                      | low to moderate improvement potential |
| PCC via tunnel | Alignment adds a median along in-street portion of route, reducing likelihood of injury crashes but introduces complexity. Low rate of high-severity crashes along route. | low to moderate improvement potential |

**BRT: PCC-Sylvania area**

|                 | <i>Transportation safety</i>   | <i>Rating</i>                         |
|-----------------|--|---------------------------------------|
| Barbur          | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Low rate of high-severity crashes along route. | low to moderate improvement potential |
| PCC via Capitol | Alignment adds a median along route, reducing likelihood of injury crashes but introduces complexity. Low rate of high-severity crashes along route. | low to moderate improvement potential |



## Street connectivity

This measure is an assessment of the potential impacts each alignment would have on street network connectivity, based on the number of roadway, bicycle and pedestrian connections added or eliminated.

| higher performing  |                   |           | lower performing         |                           |
|--------------------|-------------------|-----------|--------------------------|---------------------------|
| ## new connections | # new connections | no change | # connections eliminated | ## connections eliminated |
| larger number      | smaller number    |           | smaller number           | larger number             |

### Results

| LRT: South Portland and Hillsdale |  |                      |
|-----------------------------------|--|----------------------|
|                                   | Street connectivity  | Rating               |
| Naito + Barbur                    | Includes 8-10 new street connections as part of the Ross Island bridgehead project and a pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street | 9-11 new connections |
| Barbur + Barbur                   | Adds new pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street   | 1 new connection     |
| Naito + Hillsdale                 | Includes 8-10 new street connections as part of the Ross Island bridgehead project and a pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street | 9-11 new connections |
| Barbur + Hillsdale                | Adds new pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street   | 1 new connection     |
| MH-H tunnel                       | Does not change connectivity of network  | no change            |

| BRT: South Portland and Hillsdale |  |                      |
|-----------------------------------|--|----------------------|
|                                   | Street connectivity  | Rating               |
| Naito + Barbur                    | Includes 8-10 new street connections as part of the Ross Island bridgehead project and a pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street | 9-11 new connections |
| Barbur + Barbur                   | Adds new pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street   | 1 new connection     |
| Naito + Hillsdale                 | Includes 8-10 new street connections as part of the Ross Island bridgehead project and a pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street | 9-11 new connections |
| Barbur + Hillsdale                | Adds new pedestrian/bike connection between Barbur Boulevard and Terwilliger Boulevard near Gibbs Street   | 1 new connection     |

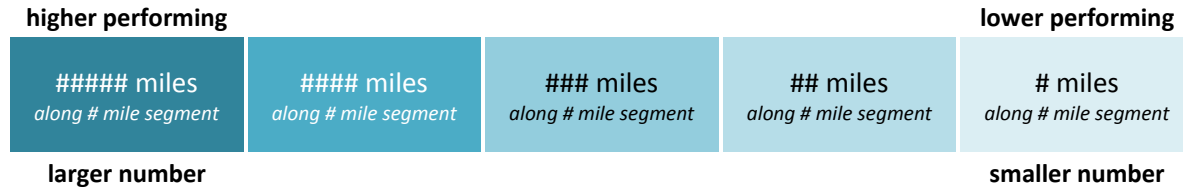
| LRT: PCC-Sylvania area |  |                  |
|------------------------|--|------------------|
|                        | <i>Street connectivity</i>   | <i>Rating</i>    |
| Barbur                 | Adds new pedestrian/bike connection between Barbur Boulevard and Tigard Triangle | 1 new connection |
| PCC via tunnel         | Adds new pedestrian/bike connection between PCC and Tigard Triangle              | 1 new connection |

| BRT: PCC-Sylvania area |  |                  |
|------------------------|--|------------------|
|                        | <i>Street connectivity</i>   | <i>Rating</i>    |
| Barbur                 | Adds new pedestrian/bike connection between Barbur Boulevard and Tigard Triangle | 1 new connection |
| PCC via Capitol        | Adds new pedestrian/bike connection between PCC and Tigard Triangle              | 1 new connection |

## Bike

### Methodology

The regional bicycle facility network was reviewed and compared to existing bicycle facility gaps. The amount of bicycle facility gaps on both sides of the street filled by the project within each project segment was evaluated, based on the working assumption that an in-street transit alignment would include bicycle facilities on both sides. For example, a five-mile segment could potentially have up to ten miles of bike improvements. While this analysis focused only on gaps, deficiencies should be identified in the subsequent design phases to identify needs and opportunities within the project constraints.



### Results

#### LRT: South Portland and Hillsdale

|                    |  |
|--------------------|--|
| Naito + Barbur     | 2.0 miles<br><i>along 3.4 mile segment</i> |
| Barbur + Barbur    | 0.4 miles<br><i>along 3.4 mile segment</i> |
| Naito + Hillsdale  | 2.1 miles<br><i>along 3.7 mile segment</i> |
| Barbur + Hillsdale | 0.4 miles<br><i>along 3.7 mile segment</i> |
| MH-H tunnel        | 0 miles<br><i>along 2.9 mile segment</i>   |

#### BRT: South Portland and Hillsdale

|                    |  |
|--------------------|--|
| Naito + Barbur     | 2.0 miles<br><i>along 3.4 mile segment</i> |
| Barbur + Barbur    | 0.4 miles<br><i>along 3.4 mile segment</i> |
| Naito + Hillsdale  | 2.1 miles<br><i>along 3.7 mile segment</i> |
| Barbur + Hillsdale | 0.4 miles<br><i>along 3.7 mile segment</i> |

#### LRT: PCC-Sylvania area

|                |  |
|----------------|--|
| Barbur         | 1.7 miles<br><i>along 1.9 mile segment</i> |
| PCC via tunnel | 1.1 miles<br><i>along 2.1 mile segment</i> |

#### BRT: PCC-Sylvania area

|                 |  |
|-----------------|--|
| Barbur          | 1.7 miles<br><i>along 1.9 mile segment</i> |
| PCC via Capitol | 1.1 miles<br><i>along 2.4 mile segment</i> |



## Pedestrian

The regional sidewalk and walkway network was reviewed to identify existing sidewalk gaps. The amount of sidewalk gaps on both sides of the street filled by the project within each project segment was evaluated, based on the working assumption that an in-street transit alignment would include sidewalk on both sides. For example, a five-mile segment could potentially have up to ten miles of sidewalk improvements. While this analysis focused only on gaps, deficiencies should be identified in the subsequent design phases to identify needs and opportunities within the project constraints.

### higher performing

##### miles  
along # mile segment

#### miles  
along # mile segment

### miles  
along # mile segment

## miles  
along # mile segment

### lower performing

# miles  
along # mile segment

larger number

smaller number

## Results

### LRT: South Portland and Hillsdale

|                    |                                     |
|--------------------|-------------------------------------|
| Naito + Barbur     | 3.3 miles<br>along 3.4 mile segment |
| Barbur + Barbur    | 3.1 miles<br>along 3.4 mile segment |
| Naito + Hillsdale  | 3.3 miles<br>along 3.7 mile segment |
| Barbur + Hillsdale | 3.1 miles<br>along 3.7 mile segment |
| MH-H tunnel        | 0 miles<br>along 2.9 mile segment   |

### BRT: South Portland and Hillsdale

|                    |                                     |
|--------------------|-------------------------------------|
| Naito + Barbur     | 3.3 miles<br>along 3.4 mile segment |
| Barbur + Barbur    | 3.1 miles<br>along 3.4 mile segment |
| Naito + Hillsdale  | 3.1 miles<br>along 3.7 mile segment |
| Barbur + Hillsdale | 3.1 miles<br>along 3.7 mile segment |

### LRT: PCC-Sylvania area

|                |                                     |
|----------------|-------------------------------------|
| Barbur         | 2.0 miles<br>along 1.9 mile segment |
| PCC via tunnel | 1.1 miles<br>along 2.1 mile segment |

### BRT: PCC-Sylvania area

|                 |                                     |
|-----------------|-------------------------------------|
| Barbur          | 2.0 miles<br>along 1.9 mile segment |
| PCC via Capitol | 0 miles<br>along 2.4 mile segment   |

## Cost

|                                  | higher performing |                      |                  |                       | lower performing       |          |
|----------------------------------|-------------------|----------------------|------------------|-----------------------|------------------------|----------|
| Capital cost: segment            | \$ million        | \$ \$ million        | \$ \$ \$ million | \$ \$ \$ \$ million   | \$ \$ \$ \$ \$ million | segment  |
| Operations and maintenance costs | low cost          | low to moderate cost | moderate cost    | moderate to high cost | high cost              | corridor |
|                                  | lower cost        |                      |                  |                       | higher cost            |          |
|                                  | \$                | \$ \$                | \$ \$ \$         | \$ \$ \$ \$           | \$ \$ \$ \$ \$         |          |

# Capital cost

## Methodology

Capital costs include all of the costs associated with planning, designing, permitting, securing right of way, constructing civil works associated with the defined alignment, and the vehicles necessary to operate the high capacity transit scenario. The conceptual cost estimates were developed using drawings that were developed to about a three percent level of design and are subject to change as alignments are refined and more detailed designs are completed. All cost estimates provided in this report are in 2014 dollars and do not include financing or escalation costs.

Cost estimates were developed using a three-step process. First, conceptual engineering drawings were used to define the nature of work and facilitate a "take-off" or measurement of the work to establish quantities. Where defined, actual quantities were used (e.g. feet of track, numbers of parking spaces). The second step was to apply initial cost data to the quantities established in step one, and then to develop unit cost and lump sum cost items. The third step was to consolidate these items into major project cost elements. Engineering and administration cost allocations as well as project contingencies are added on in this phase of the estimate.

The assignment of colors in the tables is based on a comparison of the full-corridor alignment cost for each option to the modeling base alignment. For BRT, the full corridor alignment costs range from \$680 million to \$1 billion for surface alignments and \$880 million to \$1.2 billion for alignments that include the Hillsdale cut-and-cover tunnel. For LRT, the full-corridor alignment costs range from \$1.8 billion to \$2 billion for surface alignments and \$2.1 billion to \$3.2 billion for alignments with tunnels.



## Results

| LRT: South Portland and Hillsdale |                      |
|-----------------------------------|----------------------|
|                                   | Segment capital cost |
| Naito + Barbur                    | \$610 million        |
| Barbur + Barbur                   | \$440 million        |
| Naito + Hillsdale                 | \$840 million        |
| Barbur + Hillsdale                | \$670 million        |
| MH-H tunnel                       | \$1,340 million      |

| BRT: South Portland and Hillsdale |                      |
|-----------------------------------|----------------------|
|                                   | Segment capital cost |
| Naito + Barbur                    | \$330 million        |
| Barbur + Barbur                   | \$140 million        |
| Naito + Hillsdale                 | \$470 million        |
| Barbur + Hillsdale                | \$280 million        |

| LRT: PCC-Sylvania area |                             |
|------------------------|-----------------------------|
|                        | <i>Segment capital cost</i> |
| Barbur                 | \$270 million               |
| PCC via tunnel         | \$520 million               |

| BRT: PCC-Sylvania area |                             |
|------------------------|-----------------------------|
|                        | <i>Segment capital cost</i> |
| Barbur                 | \$140 million               |
| PCC via Capitol        | \$140 million               |



## Operations and maintenance costs

### Methodology

This measure is a preliminary estimate of operating costs based on average weekday vehicle hours, which vary depending on travel time and vehicle headways. Actual operating cost estimates will be calculated at a later date. Because BRT and LRT vary in terms of travel time, ridership, vehicle capacity and operating cost, the two modes have been rated independently and should not be directly compared.

| higher performing |                      |               | lower performing      |           |
|-------------------|----------------------|---------------|-----------------------|-----------|
| low cost          | low to moderate cost | moderate cost | moderate to high cost | high cost |

### Results

| LRT: South Portland and Hillsdale |   |
|-----------------------------------|---|
|                                   | <i>Operations and maintenance costs</i> |
| Naito + Barbur                    | moderate cost                           |
| Barbur + Barbur                   | low to moderate cost                    |
| Naito + Hillsdale                 | moderate to high cost                   |
| Barbur + Hillsdale                | moderate cost                           |
| MH-H tunnel                       | low to moderate cost                    |

| BRT: South Portland and Hillsdale |   |
|-----------------------------------|---|
|                                   | <i>Operations and maintenance costs</i> |
| Naito + Barbur                    | moderate cost                           |
| Barbur + Barbur                   | low to moderate cost                    |
| Naito + Hillsdale                 | moderate to high cost                   |
| Barbur + Hillsdale                | moderate cost                           |

| LRT: PCC-Sylvania area |   |
|------------------------|---|
|                        | <i>Operations and maintenance costs</i> |
| Barbur                 | moderate cost                           |
| PCC via tunnel         | moderate cost                           |

| BRT: PCC-Sylvania area |   |
|------------------------|---|
|                        | <i>Operations and maintenance costs</i> |
| Barbur                 | moderate cost                           |
| PCC via Capitol        | moderate to high cost                   |

## Engineering complexity

|                      | higher performing |                        |                 |                         | lower performing |         |
|----------------------|-------------------|------------------------|-----------------|-------------------------|------------------|---------|
| Construction impacts | low impact        | low to moderate impact | moderate impact | moderate to high impact | high impact      | segment |
| Engineering risk     | low risk          | low to moderate risk   | moderate risk   | moderate to high risk   | high risk        | segment |

## Construction impacts

This measure is a qualitative assessment of the temporary impacts that will likely occur while the project is in construction and need to phase construction in order to minimize disruption caused by complex engineering activities. Types of impacts could include traffic diversion, changes to property access, noise and vibration impacts.

| higher performing   |                        | lower performing  |                         |   |
|---|------------------------|---|-------------------------|---|
| low impact  | low to moderate impact | moderate impact   | moderate to high impact | high impact   |
| <i>Includes minor traffic impacts, right-of-way and little noise or vibration impacts for shorter durations</i> |                        | <i>Traffic diversions and impacts, right of way access impacts and some noise and vibration</i> |                         | <i>Includes significant disruptions for long periods include noise and vibration impacts. Could include significant traffic disruptions</i> |

## Results

| LRT: South Portland and Hillsdale |  |                         |
|-----------------------------------|--|-------------------------|
|                                   | <i>Construction impacts</i>  | <i>Rating</i>           |
| Naito + Barbur                    | This option would include complex construction traffic staging for the Ross Island Bridgehead project in addition to the reconstruction of the SW Iowa and SW Vermont structures.  | low to moderate impact  |
| Barbur + Barbur                   | This option would include the reconstruction of the SW Iowa and SW Vermont structures  | low impact              |
| Naito + Hillsdale                 | This option would include the Ross Island Bridgehead project and structure to Hillsdale and a cut-and-cover tunnel through Hillsdale.  | high impact             |
| Barbur + Hillsdale                | This option would include the new structure to from Barbur to Hillsdale and a cut-and-cover tunnel through Hillsdale. Construction on Barbur is not complicated by the Ross Bridgehead project                                       | moderate to high impact |
| MH-H tunnel                       | A deep-bored tunnel is a substantial long-term mining operation that would have significant noise, vibration, dust and hauling impacts on the surrounding streets and at portal locations, station entries and vent point locations. | high impact             |

| BRT: South Portland and Hillsdale |   |                         |
|-----------------------------------|---|-------------------------|
|                                   | <i>Construction impacts</i>   | <i>Rating</i>           |
| Naito + Barbur                    | This option would include the Ross Island Bridgehead project and includes complex construction traffic staging for Ross Island Bridgehead.  | low to moderate impact  |
| Barbur + Barbur                   | Would include new ped/bike structures adjacent to the SW Iowa and SW Vermont structures. Generally there are few new structures, but would still require construction traffic staging.  | low impact              |
| Naito + Hillsdale                 | Significant construction traffic staging related to cut-and-cover tunnel and new structure from Barbur to Hillsdale. This alignment shares the aforementioned impacts associated with Naito.  | high impact             |
| Barbur + Hillsdale                | Significant construction traffic staging due to cut-and-cover tunnel and new structure from Barbur to Hillsdale. Less impacts than Naito. Would include new pedestrian/bike structures adjacent to the SW Iowa and SW Vermont structures. | moderate to high impact |

| LRT: PCC-Sylvania area |  |                        |
|------------------------|--|------------------------|
|                        | <i>Construction impacts</i>  | <i>Rating</i>          |
| Barbur                 | This option would have fewer construction impacts due to the location of the alignments.                     | low to moderate impact |
| PCC via tunnel         | A cut-and-cover tunnel through this area would have impacts on SW 53 <sup>rd</sup> Ave and on the PCC campus | high impact            |

| BRT: PCC-Sylvania area |  |                        |
|------------------------|--|------------------------|
|                        | <i>Construction impacts</i>  | <i>Rating</i>          |
| Barbur                 | This option would have fewer construction impacts due to the location of the alignment and could be reduced further if the traffic analysis suggests BRT can run in mixed traffic in this segment.           | low to moderate impact |
| PCC via Capitol        | This option would have moderate construction impacts due to the location of the alignment, but could be reduced significantly if the traffic analysis suggests BRT can run in mixed traffic in this segment. | moderate impact        |



## Engineering risk

Qualitative assessment of the relative risks associated with construction of special elements of the design options. Engineering risk could be unknown subsurface conditions, difficult structures, or complicated designs.

| higher performing  |   | lower performing   |  |   |
|--|---|--|--|---|
| low risk   | low to moderate risk                                | moderate risk  | moderate to high risk                            | high risk   |
| <i>Includes few engineering complications with few or no unknowns. A surface alignment with no right of way impacts, through an area where traffic is not concern would qualify as having low engineering risks.</i> | <i>Surface alignments with right-of-way impacts</i> | <i>Surface alignment with right-of-way impacts and significant traffic diversion</i> | <i>Cut and cover tunnels and long structures</i> | <i>Designs include complicated risks where there are many unknowns and difficult technical issues to resolve. Bored tunnels, long structures and significant geological concerns would decrease this rating</i> |

## Results

| LRT: South Portland and Hillsdale |  |                       |
|-----------------------------------|--|-----------------------|
|                                   | Engineering risk   | Rating                |
| Naito + Barbur                    | Includes replacement of SW Naito Parkway bridgehead, vertical connection from Barbur to OHSU and replacement of the Iowa and Vermont viaducts.   | low to moderate risk  |
| Barbur + Barbur                   | Less inherent risk due to fewer and less complicated structures. Includes replacement of the Iowa and Vermont viaducts.  | low risk              |
| Naito + Hillsdale                 | Includes utility relocation and the complexity/risk of a cut-and-cover tunnel in Hillsdale. This alignment shares the aforementioned impacts associated with Naito.  | moderate to high risk |
| Barbur + Hillsdale                | Engineering complexity is associated with cut-and-cover tunnel and new structure to Hillsdale. Complexity is less than Naito and the associated Ross Island Bridgehead construction.                         | moderate risk         |
| MH-H tunnel                       | A deep bored tunnel is a substantial long term mining operation which will have significant complexity and unknown risks inherent with crossing faults and encountering unexpected materials and conditions. | high risk             |

| BRT: South Portland and Hillsdale |  |                       |
|-----------------------------------|--|-----------------------|
|                                   | <i>Engineering risk</i>  | <i>Rating</i>         |
| Naito + Barbur                    | Includes replacement of SW Naito Parkway bridge head, vertical connection from Barbur to OHSU and new pedestrian and bicycle bridges adjacent to the Iowa and Vermont viaducts.      | low to moderate risk  |
| Barbur + Barbur                   | Less inherent risk due to fewer and less complicated structures. Includes new pedestrian and bicycle bridges adjacent to the Iowa and Vermont viaducts.                              | low risk              |
| Naito + Hillsdale                 | Includes utility relocation and the complexity/risk of a cut-and-cover tunnel in Hillsdale. This alignment shares the aforementioned impacts associated with Naito.                  | moderate to high risk |
| Barbur + Hillsdale                | Engineering complexity is associated with cut-and-cover tunnel and new structure to Hillsdale. Complexity is less than Naito and the associated Ross Island Bridgehead construction. | moderate risk         |

| LRT: PCC-Sylvania area |  |                      |
|------------------------|--|----------------------|
|                        | <i>Engineering risk</i>  | <i>Rating</i>        |
| Barbur                 | This option includes a new structure over I-5 would have low to moderate risk related to ground conditions for bridge supports.  | low to moderate risk |
| PCC via tunnel         | This option would result in a deep cut-and-cover station and new structure over I-5 with uncertainty related to the ground water and rock type in Mt Sylvania and ground conditions for bridge supports. | high risk            |

| BRT: PCC-Sylvania area |   |                      |
|------------------------|---|----------------------|
|                        | <i>Engineering risk</i>   | <i>Rating</i>        |
| Barbur                 | This option includes a new but shorter structure than LRT over I-5 would have low to moderate risk related to ground conditions for bridge supports.  | low to moderate risk |
| PCC via Capitol        | Widening for transit and to meet City sidewalk and bike standards will require retaining walls very close to existing properties resulting in additional engineering complexity. This risk could be eliminated if the traffic analysis supports BRT running in mixed traffic on Capitol Hwy in the segment. | low to moderate risk |

## Community and environmental impacts

|  | higher performing                   |                                      |                                       |  | lower performing                        |         |
|--|-------------------------------------|--------------------------------------|---------------------------------------|--|---|---------|
| Property impacts   | low impact                          | low to moderate impact               | moderate impact                       | moderate to high impact                | high impact                             | segment |
| Property access impacts  | # driveways<br>along # mile segment | ## driveways<br>along # mile segment | ### driveways<br>along # mile segment | #### driveways<br>along # mile segment | ##### driveways<br>along # mile segment | segment |
| Property impacts to historically under-represented populations | low impact                          | low to moderate impact               | moderate impact                       | moderate to high impact                | high impact                             | segment |
| Visual impacts   | low<br>degree of change             | low to moderate<br>degree of change  | moderate<br>degree of change          | moderate to high<br>degree of change   | high<br>degree of change                | segment |
| Impacts to parks and historic properties                       | low impact                          | low to moderate impact               | moderate impact                       | moderate to high impact                | high impact                             | segment |
|  | smaller number                      |                                      |                                       | larger number                          |   |         |
|  | #                                   | ##                                   | ###                                   | ####                                   | #####                                   |         |

**NOTE:** The measures within the community and environmental impacts category represent potential impacts based on a three percent level of design. These potential impacts would be discussed in much more detail during a Draft Environmental Impact Statement and beyond, including opportunities for revising designs and identifying mitigation strategies.

## Property impacts

### Methodology

This measure is based on impacts to properties due to temporary construction easements or displacement. Since this is a simplified methodology and because designs are preliminary, results are reported as order of magnitude estimates.

| higher performing |                        |                 | lower performing        |             |
|-------------------|------------------------|-----------------|-------------------------|-------------|
| low impact        | low to moderate impact | moderate impact | moderate to high impact | high impact |

### Results

#### LRT: South Portland and Hillsdale

|                    | <i>Property impacts</i> |
|--------------------|-------------------------|
| Naito + Barbur     | moderate impact         |
| Naito + Hillsdale  | moderate to high impact |
| Barbur + Barbur    | moderate impact         |
| Barbur + Hillsdale | moderate to high impact |
| MH-H tunnel        | high impact             |

#### BRT: South Portland and Hillsdale

|                    | <i>Property impacts</i> |
|--------------------|-------------------------|
| Naito + Barbur     | moderate impact         |
| Naito + Hillsdale  | moderate to high impact |
| Barbur + Barbur    | moderate impact         |
| Barbur + Hillsdale | moderate to high impact |

#### LRT: PCC-Sylvania area

|                | <i>Property impacts</i> |
|----------------|-------------------------|
| Barbur         | moderate impact         |
| PCC via tunnel | high impact             |

#### BRT: PCC-Sylvania area

|                 | <i>Property impacts</i> |
|-----------------|-------------------------|
| Barbur          | moderate impact         |
| PCC via Capitol | high impact             |



## Property access impacts

### Methodology

This measure assesses potential changes to access that might result from a transit alignment on each alignment option were reviewed. A median-running transit alignment would not require driveway closures, but would require re-routing of left turns in some cases. The approximate number of driveways with access changes was identified for each alignment option compared to the length of the segment.

| higher performing                          |   |  | lower performing                              |  |
|--|---|--|---|--|
| # driveways<br><i>along # mile segment</i> | ## driveways<br><i>along # mile segment</i> | ### driveways<br><i>along # mile segment</i> | #### driveways<br><i>along # mile segment</i> | ##### driveways<br><i>along # mile segment</i> |
| smaller number                             |   |  | larger number                                 |  |

### Results

| LRT: South Portland and Hillsdale |  |
|-----------------------------------|--|
| Naito + Barbur                    | 1-5 driveways<br><i>along 3.4 mile segment</i>   |
| Barbur + Barbur                   | 5-10 driveways<br><i>along 3.4 mile segment</i>  |
| Naito + Hillsdale                 | 15-20 driveways<br><i>along 3.7 mile segment</i> |
| Barbur + Hillsdale                | 20-25 driveways<br><i>along 3.7 mile segment</i> |
| MH-H tunnel                       | 1-5 driveways<br><i>along 2.9 mile segment</i>   |

| BRT: South Portland and Hillsdale |  |
|-----------------------------------|--|
| Naito + Barbur                    | 1-5 driveways<br><i>along 3.4 mile segment</i>   |
| Barbur + Barbur                   | 5-10 driveways<br><i>along 3.4 mile segment</i>  |
| Naito + Hillsdale                 | 20-25 driveways<br><i>along 3.7 mile segment</i> |
| Barbur + Hillsdale                | 25-30 driveways<br><i>along 3.7 mile segment</i> |

| LRT: PCC-Sylvania area |  |
|------------------------|--|
| Barbur                 | 35-40 driveways<br><i>along 1.9 mile segment</i> |
| PCC via tunnel         | 25-30 driveways<br><i>along 2.1 mile segment</i> |

| BRT: PCC-Sylvania area |  |
|------------------------|--|
| Barbur                 | 35-40 driveways<br><i>along 1.9 mile segment</i> |
| PCC via Capitol        | 40-45 driveways<br><i>along 2.4 mile segment</i> |

## Property impacts to historically under-represented populations

### Methodology

This measure is based on potential property impacts to historically under-represented populations, focused on areas with rates of limited English proficiency, people of color and low-income above the regional average, based on 2010 census data. The assessment focuses on impacts to residential properties and does not account for commercial property impacts.

Because this assessment is based on 2010 census data at the tract and block level, it does not identify whether the impacted properties are in fact owned or occupied by someone who is of limited English proficiency, low income or person of color. The assessment only identifies if there is an impact in an area where there is a potential for impact to those sensitive populations.

| higher performing  |                        |                 |                         | lower performing   |
|--|------------------------|-----------------|-------------------------|--|
| low impact   | low to moderate impact | moderate impact | moderate to high impact | high impact  |
| <i>No residential property displacements in areas with above-average people of color, low income, and limited English proficiency.</i> |                        |                 |                         | <i>Many residential property displacements in areas with above-average people of color, low income, and limited English proficiency.</i> |

### Results

| LRT: South Portland and Hillsdale |   |                             |                 |                        |
|-----------------------------------|---|-----------------------------|-----------------|------------------------|
|                                   | Potential residential displacements in areas with above average rates of... |                             |                 | Rating                 |
|                                   | low income  | limited English proficiency | people of color |                        |
| Naito + Barbur                    | 0   | 0                           | 0               | low impact             |
| Barbur + Barbur                   | 1-5   | 1-5                         | 0               | low to moderate impact |
| Naito + Hillsdale                 | 0   | 0                           | 0               | low impact             |
| Barbur + Hillsdale                | 1-5   | 1-5                         | 0               | low to moderate impact |
| MH-H tunnel                       | 0   | 0                           | 0               | low impact             |

**BRT: South Portland and Hillsdale**

|                    | <i>Potential residential displacements<br/>in areas with above average rates of...</i> |                                |                 | <i>Rating</i>             |
|--------------------|--|--------------------------------|-----------------|---------------------------|
|                    | low income   | limited English<br>proficiency | people of color |                           |
| Naito + Barbur     | 0  | 0                              | 0               | low impact                |
| Barbur + Barbur    | 1-5  | 1-5                            | 0               | low to moderate<br>impact |
| Naito + Hillsdale  | 0  | 0                              | 0               | low impact                |
| Barbur + Hillsdale | 1-5  | 1-5                            | 0               | low to moderate<br>impact |

**LRT: PCC-Sylvania area**

|                | <i>Potential residential displacements<br/>in areas with above average rates of...</i> |                                |                 | <i>Rating</i>             |
|----------------|--|--------------------------------|-----------------|---------------------------|
|                | low income   | limited English<br>proficiency | people of color |                           |
| Barbur         | 0  | 0                              | 0               | low impact                |
| PCC via tunnel | 0  | 0                              | 1-5             | low to moderate<br>impact |

**BRT: PCC-Sylvania area**

|                 | <i>Potential residential displacements<br/>in areas with above average rates of...</i> |                                |                 | <i>Rating</i>             |
|-----------------|--|--------------------------------|-----------------|---------------------------|
|                 | low income   | limited English<br>proficiency | people of color |                           |
| Barbur          | 0  | 0                              | 0               | low impact                |
| PCC via Capitol | 0  | 0                              | 1-5             | low to moderate<br>impact |

## Visual impacts

### Methodology

**The results of the built environment are qualitative; the process of avoiding or minimizing the impacts to the built environment has not been completed.** If impacts cannot be avoided or minimized, potential mitigation would be discussed as part of the conceptual design and environmental analysis conducted during the NEPA process.

For each design option, there is a potential for **visual impacts or degree of change** created by the physical improvements required by the HCT designs. This qualitative assessment does not reflect the quality or benefit of the change but rather the degree of the change. This assessment of the potential visual impacts is defined as low, moderate or high degree of change. For example, HCT within an existing transportation facility may be a low degree of change. However, introduction of a new transit guideway where a transportation facility does not exist today, may be high degree of change. The table below describes the methodology used in the qualitative assessment of the potential visual impacts.

**NOTE:** This is a qualitative assessment. Current designs are not completed at a level detail appropriate for an in-depth technical assessment. The most promising concepts will be designed in a manner to avoid or minimize potential impacts in the next phase of study. Additionally, potential mitigation measures would be evaluated during the NEPA process.

| higher performing   |                                     |  | lower performing                        |   |
|---|-------------------------------------|--|---|---|
| low<br>degree of change   | low to moderate<br>degree of change | moderate<br>degree of change   | moderate<br>to high<br>degree of change | high<br>degree of change  |
| Low displacements of structures or buildings                                      |                                     | Moderate displacements of structures or buildings                                  |   | Significant displacements of structures or buildings                                  |
| Limited new structures (e.g. elevated structures, tunnel portals)                 |                                     | Moderate new structures (e.g. elevated structures, tunnel portals)                 |   | Significant new structures (e.g. elevated structures, tunnel portals)                 |
| Limited new parking (surface or structured), especially where there is none today |                                     | Moderate new parking (surface or structured), especially where there is none today |   | Significant new parking (surface or structured), especially where there is none today |
| Minor removal of vegetation (e.g. screening to residential areas)                 |                                     | Some removal of vegetation (e.g. screening to residential areas)                   |   | Significant removal of vegetation (e.g. screening to residential areas)               |



## Results

| LRT: South Portland and Hillsdale |   |  |
|-----------------------------------|---|--|
|                                   | <i>Visual impacts</i>   | <i>Rating</i>                                  |
| Naito + Barbur                    | Light rail operations in Naito would widen the road and change some of the adjacent streets around the Ross Island Bridge. Includes new pedestrian and bicycle connection to Marquam Hill. Few instances where vegetation between road and neighborhoods is removed. Rebuilds two structures along Barbur   | moderate<br><i>degree of change</i>            |
| Barbur + Barbur                   | Includes a new structure over I-405. Existing roadway would be expanded for light rail operations. Includes new pedestrian and bicycle connection to Marquam Hill. Few instances where vegetation between road and neighborhoods is removed. Rebuilds two structures along Barbur.  | moderate<br><i>degree of change</i>            |
| Naito + Hillsdale                 | Light rail operations in Naito would widen the road and change some of the adjacent streets around the Ross Island Bridge. Includes new pedestrian and bicycle connection to Marquam Hill. Few instances where vegetation between road and neighborhoods is removed. New structures from Barbur to Capital Hwy and from Bertha to Barbur. Two portal entrances in Hillsdale. Also includes two new bike pedestrian structures adjacent to Barbur. | moderate<br>to high<br><i>degree of change</i> |
| Barbur + Hillsdale                | Includes new structure of I-405. Existing roadway would be expanded for light rail operations. Includes new pedestrian and bicycle connection to Marquam Hill. Few instances where vegetation between road and neighborhoods is removed. Two portal entrances in Hillsdale. Also includes two new bike pedestrian structures adjacent to Barbur.  | moderate<br>to high<br><i>degree of change</i> |
| MH-H tunnel                       | Includes a new structure over I-405. Light rail while in a tunnel would not have a visual impact; the portals into the tunnel would be a significant change. Includes a structure from south tunnel portal to Barbur.   | moderate<br><i>degree of change</i>            |

| BRT: South Portland and Hillsdale |   |  |
|-----------------------------------|---|--|
|                                   | <i>Visual impacts</i>   | <i>Rating</i>                                  |
| Naito + Barbur                    | BRT would be operating within Naito. Some widening would be required. Includes some changes to the street network around the Ross Island Bridge. Few instances where vegetation between road and neighborhoods is removed. Includes new pedestrian and bicycle connection to Marquam Hill and parallel bike and pedestrian structures along Barbur.   | low to moderate<br><i>degree of change</i>     |
| Barbur + Barbur                   | BRT would be operating within Barbur. Some widening would be required. Few instances where vegetation between road and neighborhoods is removed. Includes new pedestrian and bicycle connection to Marquam Hill and parallel bike and pedestrian structures along Barbur.   | low to moderate<br><i>degree of change</i>     |
| Naito + Hillsdale                 | Includes some changes to the street network around the Ross Island Bridge. BRT would operate in Naito and Barbur with a new structure from Barbur to Capital Hwy and two tunnel portals within Hillsdale. Includes new pedestrian and bicycle connection to Marquam Hill and parallel bike and pedestrian structures along Barbur. Includes a new structure from Barbur to Capital Hwy and two portal entrances in Hillsdale. | moderate<br>to high<br><i>degree of change</i> |
| Barbur + Hillsdale                | BRT would operate in Barbur with a new structure from Barbur to Capital Hwy and two tunnel portals within Hillsdale. Includes new pedestrian and bicycle connection to Marquam Hill and parallel bike and pedestrian structures along Barbur.   | moderate<br>to high<br><i>degree of change</i> |

| LRT: PCC-Sylvania area |  |                                     |
|------------------------|--|-------------------------------------|
|                        | <i>Visual impacts</i>  | <i>Rating</i>                       |
| Barbur                 | Existing roadway would be expanded for light rail operations. Few instances where vegetation between road and neighborhoods is removed. Includes a new surface park and ride facility at the 53 <sup>rd</sup> Avenue station and new structure from approximately SW 55 <sup>th</sup> Ave to the Multnomah/Washington County line. Includes a new pedestrian and bike connection to PCC. | moderate<br><i>degree of change</i> |
| PCC via tunnel         | Light rail would operate along Barbur to a tunnel at SW 53 <sup>rd</sup> Avenue which includes two portals to tunnel. The alignment crosses I-5 on a structure from SW Lesser Rd to the Multnomah/Washington County line.  | moderate<br><i>degree of change</i> |

| BRT: PCC-Sylvania area |   |  |
|------------------------|---|--|
|                        | <i>Visual impacts</i>   | <i>Rating</i>                              |
| Barbur                 | BRT would be operating within Barbur. Some widening would be required. Few instances where vegetation between road and neighborhoods is removed. Includes a smaller structure over I-5 (compared to the light rail alignment). Also includes pedestrian and bike connection on SW 53 <sup>rd</sup> Avenue and a new surface park and ride along Barbur. | low to moderate<br><i>degree of change</i> |
| PCC via Capitol        | BRT would be operating within Capitol Hwy. Some widening would be required. Includes a new transportation mode through campus. Few instances where vegetation between road and neighborhoods is removed. Also includes a new structure over I-5 from SW Lesser Rd to the Multnomah/Washington County line.  | moderate<br><i>degree of change</i>        |

## Natural areas and historic properties

### Methodology

For this measure, parks, wetlands and historic properties were identified along each alignment. A low to high impact rating was assigned to each option based on the number, duration and severity of potential impacts. Though some impacts may potentially be avoided or mitigated, changes to the alignment design could result in an increase in other property impacts or add cost to the project. Potential impacts to natural areas and historic properties will be evaluated in more detail in the DEIS, including avoidance or mitigation strategies.

| higher performing |                        |                 | lower performing        |             |
|-------------------|------------------------|-----------------|-------------------------|-------------|
| low impact        | low to moderate impact | moderate impact | moderate to high impact | high impact |

### Results

| LRT: South Portland and Hillsdale |  |                         |
|-----------------------------------|--|-------------------------|
|                                   | <i>Potential impacts to natural areas and historic properties</i>  | <i>Rating</i>           |
| Naito + Barbur                    | Potential partial impacts to Water & Gibbs Community Garden, Terwilliger Boulevard Parkway and George Himes Park. Potential for a historic property impact.  | moderate impact         |
| Barbur + Barbur                   | Potential partial impacts to Lair Hill Park, Terwilliger Boulevard Parkway and George Himes Park. Potential for a historic property impact.  | moderate impact         |
| Naito + Hillsdale                 | Potential partial impacts to Water & Gibbs Community Garden, Terwilliger Boulevard Parkway, George Himes Park and Stephens Creek Natural Area. Impacts to Terwilliger Boulevard Parkway or George Himes Park along Capitol Highway would be challenging to avoid due to the constrained space between the two parks. Potential for a historic property impact. | moderate to high impact |
| Barbur + Hillsdale                | Potential partial impacts to Lair Hill Park, Terwilliger Boulevard Parkway, George Himes Park and Stephens Creek Natural Area. Impacts to Terwilliger Boulevard Parkway or George Himes Park along Capitol Highway would be challenging to avoid due to the constrained space between the two parks. Potential for a historic property impact.                 | moderate to high impact |
| MH-H tunnel                       | Potential major temporary impacts to Duniway Park for construction staging. Potential partial impacts to Terwilliger Boulevard Parkway between Terwilliger and Barbur at the northern tunnel portal.   | high impact             |

**BRT: South Portland and Hillsdale**

|                    | <i>Potential impacts to natural areas and historic properties</i>  | <i>Rating</i>           |
|--------------------|--|-------------------------|
| Naito + Barbur     | Potential partial impacts to Water & Gibbs Community Garden, Terwilliger Boulevard Parkway and George Himes Park. Potential for a historic property impact.  | moderate impact         |
| Barbur + Barbur    | Potential partial impacts to Lair Hill Park, Terwilliger Boulevard Parkway and George Himes Park. Potential for a historic property impact.  | moderate impact         |
| Naito + Hillsdale  | Potential partial impacts to Water & Gibbs Community Garden, Terwilliger Boulevard Parkway, George Himes Park and Stephens Creek Natural Area. Impacts to Terwilliger Boulevard Parkway or George Himes Park along Capitol Highway would be challenging to avoid due to the constrained space between the two parks. Potential for a historic property impact. | moderate to high impact |
| Barbur + Hillsdale | Potential partial impacts to Lair Hill Park, Terwilliger Boulevard Parkway, George Himes Park and Stephens Creek Natural Area. Impacts to Terwilliger Boulevard Parkway or George Himes Park along Capitol Highway would be challenging to avoid due to the constrained space between the two parks. Potential for a historic property impact.                 | moderate to high impact |

**LRT: PCC-Sylvania area**

|                | <i>Potential impacts to natural areas and historic properties</i>                | <i>Rating</i>          |
|----------------|--|------------------------|
| Barbur         | Potential for a partial historic impact.   | low to moderate impact |
| PCC via tunnel | Potential temporary partial impacts to Sylvania Park during tunnel construction. | low to moderate impact |

**BRT: PCC-Sylvania area**

|                 | <i>Potential impacts to natural areas and historic properties</i>      | <i>Rating</i>          |
|-----------------|--|------------------------|
| Barbur          | Potential for a temporary partial historic impact during construction. | low to moderate impact |
| PCC via Capitol | Potential for a partial historic impact.                               | low to moderate impact |



# Appendix A: Project Goals in Relation to Evaluation Criteria

This appendix shows how the evaluation criteria employed in the High Capacity Transit Technical Evaluation Results and Methodology, Part 1, relate to the established goals of the Southwest Corridor project.

## Project Goals

---

The purpose of the Southwest Corridor project is to interconnect Tualatin, Tigard, Southwest Portland and the region's central city through a high capacity transit project and appropriate community investments in a congested corridor to improve mobility and create the conditions that will allow communities in the corridor to achieve their land use vision.

The thirteen goals of the project are:

- Serve the existing and projected transit demand in the corridor
- Improve transit service reliability in the corridor
- Improve transit frequency and travel times
- Provide options that reduce overall transportation costs
- Improve multimodal access to a range of housing types and business in growing communities
- Improve potential for housing and commercial development in the corridor and encourage development in centers and transit-oriented development at stations along the corridor
- Ensure benefits and impacts promote community equity
- Increase multimodal transportation options and improve mobility in the corridor
- Complete multimodal transportation networks in the corridor
- Advance transportation projects that increase active transportation and encourage physical activity
- Provide transit service that is cost effective to build and operate with limited local resources
- Advance transportation project that are sensitive to the environment, improve water and air quality and help reduce carbon emissions
- Catalyze improvements to natural resources, habitat and parks in the corridor

## Evaluation Criteria

---

Potential alignments and other variable components of the HCT line will be evaluated across a variety of criteria, including transit performance, access and development, mobility, cost, engineering complexity, and community and environmental impacts. This document, along with the Key Issue memos, attempts to evaluate the relative performance of the South Portland alignment options against these criteria, using a number of objective measures.

The following table shows how these criteria and measures relate to the project goals. Note that some goals apply to multiple criteria.

| Goals  | Criteria                          | Measures  |
|--|-----------------------------------|---|
| <ul style="list-style-type: none"> <li>Serve the existing and projected transit demand in the corridor</li> <li>Improve transit service reliability in the corridor</li> <li>Improve transit frequency and travel times</li> </ul>   | Transit performance               | New system transit trips<br>Line ridership<br>Travel time<br>Mixed traffic<br>Signalized intersections crossed  |
| <ul style="list-style-type: none"> <li>Provide options that reduce overall transportation costs</li> <li>Improve multimodal access to a range of housing types and business in growing communities</li> <li>Improve potential for housing and commercial development in the corridor and encourage development in centers and transit-oriented development at stations along the corridor</li> <li>Ensure benefits and impacts promote community equity</li> </ul> | Access and development            | Equitable access to transit<br>Redevelopment potential<br>Support for existing plans  |
| <ul style="list-style-type: none"> <li>Increase multimodal transportation options and improve mobility in the corridor</li> <li>Complete multimodal transportation networks in the corridor</li> <li>Advance transportation projects that increase active transportation and encourage physical activity</li> </ul>  | Mobility                          | Freight<br>Traffic<br>Transportation safety<br>Street connectivity<br>Bike improvements<br>Pedestrian improvements  |
| <ul style="list-style-type: none"> <li>Provide transit service that is cost effective to build and operate with limited local resources</li> <li>Provide options that reduce overall transportation costs</li> </ul>   | Cost                              | Capital cost<br>Operations and maintenance costs  |
| <ul style="list-style-type: none"> <li>Provide transit service that is cost effective to build and operate with limited local resources</li> <li>Ensure benefits and impacts promote community equity</li> </ul>   | Engineering complexity            | Construction impacts<br>Engineering risk  |
| <ul style="list-style-type: none"> <li>Advance transportation project that are sensitive to the environment, improve water and air quality and help reduce carbon emissions</li> <li>Catalyze improvements to natural resources, habitat and parks in the corridor</li> <li>Ensure benefits and impacts promote community equity</li> </ul>  | Community & environmental impacts | Property impacts<br>Property access impacts<br>Property impacts to historically under-represented populations<br>Visual impacts<br>Impacts to natural areas and historic properties |

Note that the purpose, goals, objectives and measures may be refined through the Draft Environmental Impact Statement (DEIS) process.