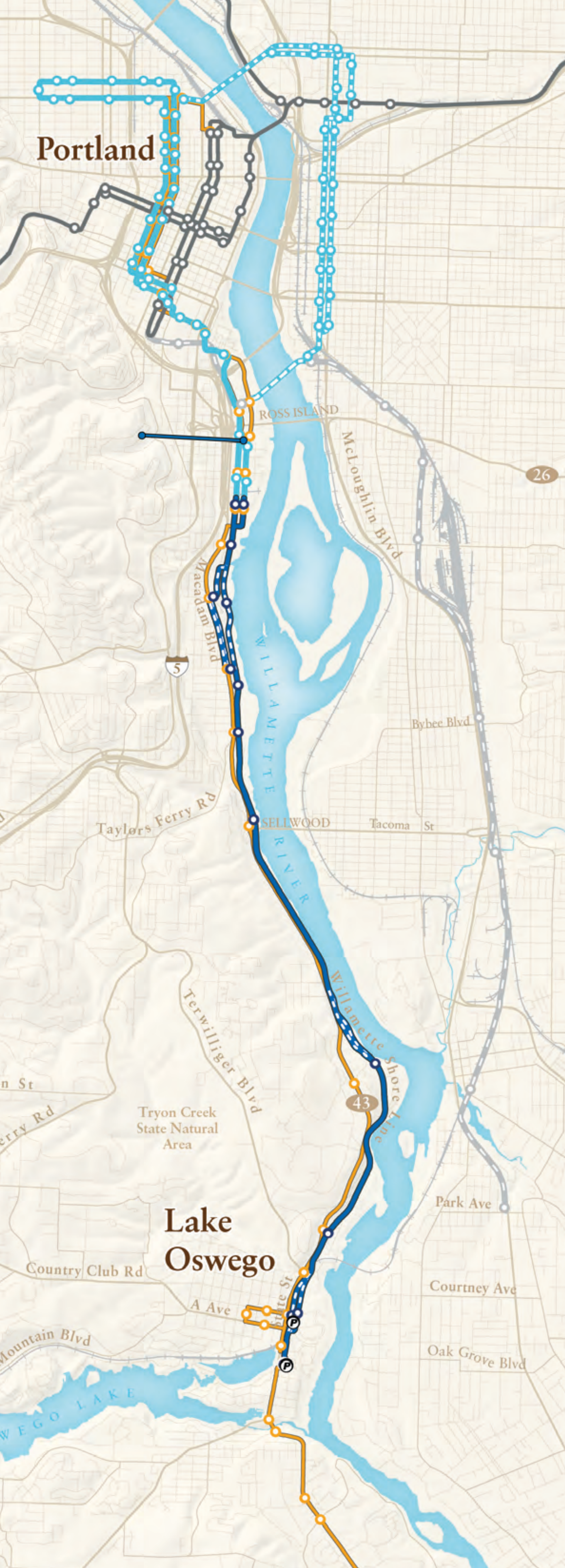
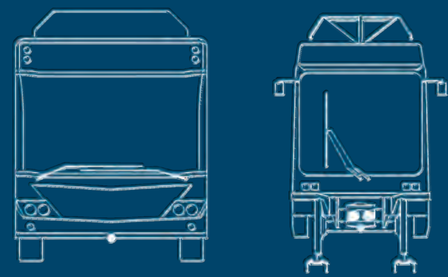


Lake Oswego to Portland

TRANSIT PROJECT

Draft Environmental Impact Statement

December 2010



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LAKE OSWEGO TO PORTLAND TRANSIT PROJECT
CLACKAMAS AND MULTNOMAH COUNTIES, OREGON

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared pursuant to the National Environmental Policy Act
42 U.S.C. 4322(2)(c)

by the

FEDERAL TRANSIT ADMINISTRATION

and

TRI-COUNTY METROPOLITAN TRANSPORTATION DISTRICT OF OREGON

and

METRO

in cooperation with the

U.S. ARMY CORP OF ENGINEERS, PORTLAND DISTRICT
FEDERAL HIGHWAY ADMINISTRATION

10 November 2010
Date of Approval

Linda M. Gehrke
for R.F. Krochalis, Region 10 Administrator
For the Federal Transit Administration

11 | 9 | 2010
Date of Approval

Neil McFarlane, General Manager
For the Tri-County Metropolitan Transportation District of Oregon

11/9/2010
Date of Approval

Carlotta Collette, Acting Council President
For Metro

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Abstract:
The proposed action is to improve public transit in the Lake Oswego to Portland transit corridor in the Portland, Oregon, metropolitan region. This Draft Environmental Impact Statement (DEIS) examines a No-Build Alternative, an Enhanced Bus Alternative, and a Streetcar Alternative. The DEIS analyzes the impacts of the alternatives on transit, roadways, freight movement, bicycle facilities, and pedestrian facilities and potential direct, indirect and cumulative effects of the alternatives on land use and planning; economic activity; neighborhoods, including displacements; visual quality and aesthetics; historic, archaeological and cultural resources; parks and recreational resources; geology, soils and seismic hazards; ecosystems, including wetlands, waterways, vegetation, wildlife, fisheries, and threatened and endangered species; hydrology and water quality; noise and vibration; air quality; energy; hazardous materials; safety and security; utilities; and environmental justice. The DEIS also contains estimated costs of constructing and operating the alternatives, a description of financing alternatives, and measurements of how well the alternatives meet project objectives and criteria. The DEIS will be used to select a locally preferred alternative (LPA) for the transit corridor.

FACT SHEET

Project Title:

Lake Oswego to Portland Transit (LOPT) Project Draft Environmental Impact Statement (DEIS).

Project Location:

The study corridor is located between the City of Lake Oswego, Clackamas County and the City of Portland, Multnomah County, Oregon. The corridor is generally defined by the Willamette River on the east and the hills west of the river, and generally encompasses the Oregon Highway 43 corridor between these two cities.

National Environmental Policy Act (NEPA) Responsible Official and Federal Lead Agency:

Richard F. Krochalis, Region 10 Administrator
Federal Transit Administration (FTA)
915 2nd Avenue, Room 3142
Seattle, Washington 98174

Project Proponents:

- City of Lake Oswego
- City of Portland
- Clackamas County
- Multnomah County
- Tri-County Metropolitan Transportation District of Oregon (TriMet)
- Metro
- Oregon Department of Transportation (ODOT)
- Portland Streetcar Inc. (PSI)

Alternatives Considered in the DEIS:

- No-Build Alternative
- Enhanced Bus Alternative
- Streetcar Alternative

Lake Oswego to Portland Transit Project DEIS Availability:

This DEIS and the Summary are available at the following link or from Jenn Tuerk at 503.797.1756 or trans@oregonmetro.gov:

www.oregonmetro.gov/lakeoswego

Date of Issue:

This DEIS is available for public review and comment beginning December 3, 2010.

Comment Due Date:

A 60-day comment period is provided until 5:00 p.m. PST Monday, January 31, 2011.

Comments:

Comments can be made in writing by sending a letter or email to:

Lake Oswego to Portland Transit Project
attn: Jamie Snook
Metro
600 NE Grand Avenue
Portland, Oregon 97232
503.797.1756
trans@oregonmetro.gov

Next Steps:

The project proponents intend to review the DEIS findings, consider the public comments after the end of the comment period and select a locally preferred alternative (LPA) for the Lake Oswego to Portland Transit Project. Following steps would then include development of preliminary engineering (PE), preparation of a Final Environmental Impact Statement (FEIS), completion of the record of decision (ROD) by FTA to conclude the planning process. The following steps would then include final design, construction and operations of the selected project.

Construction Dates:

The Lake Oswego to Portland Transit Project is planned to begin construction by 2015 and begin operations in 2017.

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A. No-Build Alternative

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C. Streetcar Alternative
1. Downtown Portland Segment
2. South Waterfront Segment
3. Johns Landing Segment
    - Willamette Shore Line Design Option
    - Macadam In-Street Design Option
    - Macadam Additional Lane Design Option
4. Sellwood Bridge Segment
5. Dunthorpe/Riverdale Segment
    - Willamette Shore Line Design Option
    - Riverwood Design Option
6. Lake Oswego Segment
    - UPRR Right of Way Design Option
    - Foothills Design Option

Streetcar Station Locations and Names (north to south)

Following is a list of the Streetcar Alternative stations. The station names are the same for all design options in the segment, except where noted.

South Waterfront Segment
- Bancroft Station
- Hamilton Station

Johns Landing Segment (includes 3 design options)
- Boundary Station (various locations based on design option)
- Pendleton Station (future/optional station)
- Carolina Station (Macadam In-Street and Macadam Additional Lane design options)
- Nebraska Station (Willamette Shore Line Design Option)
- Nevada Station

Sellwood Bridge Segment
- Sellwood Bridge Station

Dunthorpe/Riverdale Segment
- Riverwood Station

Lake Oswego Segment

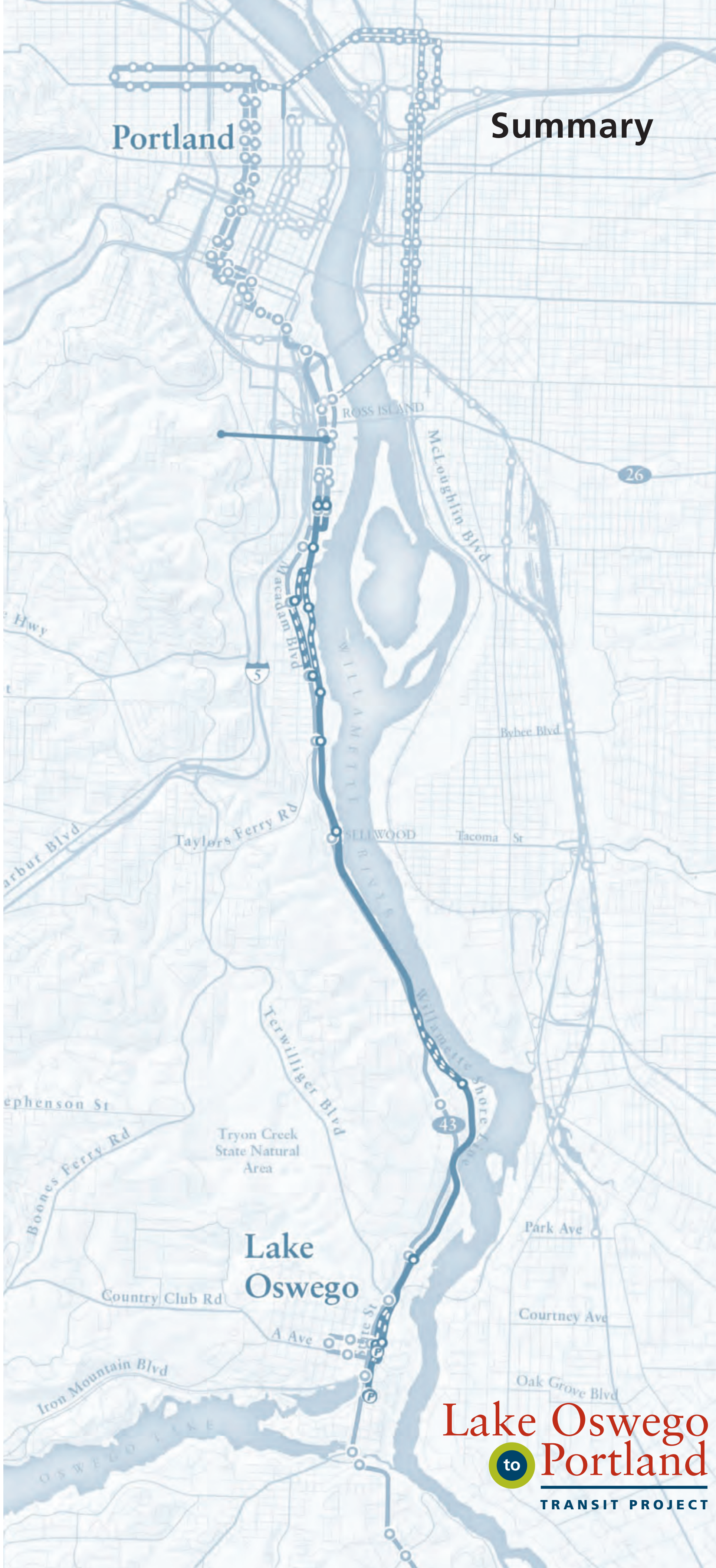
- Briarwood Station
- E Avenue Station (future/optional station)
- B Avenue Station (surface park-and-ride facility with 100 spaces)
- Lake Oswego Terminus Station (structured park-and-ride facility with 300 spaces)

LIST OF ACRONYMS AND ABBREVIATIONS

AA = Alternatives Analysis
ADA = Americans with Disabilities Act
ADT = average daily traffic
APE = area of potential effect
BA = biological assessment
BES = COP Bureau of Environmental Services
BMP = best management practices
BO = biological opinion
Btu = British thermal unit
CAC = Community Advisory Committee
CBD = central business district
CERCLA = Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS = Comprehensive Environmental Response, Compensation and Liability Information System
CEQ = Council on Environmental Quality
CFR = Code of Federal Regulations
CFS = cubic feet per second
CO = carbon monoxide
COP = City of Portland
Corps = U.S. Army Corps of Engineers
CPTED = crime prevention through environmental design
CRL = confirmed release list
CRLI = confirmed release list inventory
CSCS = confirmed and suspected contamination sites
CWA = Clean Water Act
dB = decibel
dBA = A weighted decibel
DEIS = Draft Environmental Impact Statement
DEQ = Oregon Department of Environmental Quality
DOE = determination of eligibility
DRC = Metro Data Resource Center
DSL= Oregon Department of State Lands
ECSI = environmental clean-up site information
EFH = essential fish habitat
EIS = Environmental Impact Statement
EJ = environmental justice
EO = Executive Order
ENVIRON = noise analysis subconsultant
EPA = U.S. Environmental Protection Agency
ESA = Endangered Species Act
ESA = environmental site assessment
ESU = evolutionary significant unit
FEIS = Final Environmental Impact Statement
FEMA = Federal Emergency Management Agency
FHWA = Federal Highway Administration
FINDS = Facility Index Notification System
FIRM = flood insurance rate maps
FPPA = Farmland Protection Policy Act
FRA = Federal Railroad Administration
FTA = Federal Transit Administration
FY = fiscal year
GHG = greenhouse gases
HC = hydrocarbons
HCT = high capacity transit
HOT = heating oil tank
IMPLAN = an economic model for forecasting jobs
JPACT = Joint Policy Advisory Committee on Transportation
LCDC = Land Conservation and Development Commission
L_{dn} = level of day-night sound
L_{eq} = level of equivalent sound
L_{max} = level of maximum noise
LOPAC = Lake Oswego to Portland Transit and Trail Project Advisory Committee
LOPT = Lake Oswego to Portland Transit Project
LOS = level of service
LPA = Locally Preferred Alternative
LRT = light rail transit
LUST = leaking underground storage tank
L_{xx} = statistical noise level descriptor
MAX = Metropolitan Area Express (the existing Portland metropolitan area light rail transit system)
MPO = Metropolitan Planning Organization
MSAT = mobile source air toxics
NAAQS = National Ambient Air Quality Standards
NEPA = National Environmental Policy Act

NHPA = National Historic Preservation Act
NMFS = National Marine Fisheries Service
NPDES = National Pollutant Discharge Elimination System
NRHP = National Register of Historic Places
NOx = nitrogen oxides
OAQPS = EPA Office of Air Quality Planning and Standards
OAR = Oregon Administrative Rules
O&M = operations and maintenance
ODEQ = Oregon Department of Environmental Quality
ODFW = Oregon Department of Fish and Wildlife
ODOT = Oregon Department of Transportation
OHSU = Oregon Health Sciences University
OPRD = Oregon Parks and Recreation Department
ORS = Oregon Revised Statutes
O3 = ozone
PM10 = particulate matter less than 10 microns in diameter
PM2.5 = particulate matter less than 2.5 microns in diameter
PE = preliminary engineering
PUC = Public Utilities Commission
RFP = Regional Framework Plan
ROD = Record of Decision
ROW = right of way
RTP = Regional Transportation Plan
SHPO = State Historic Preservation Officer
SIP = State Implementation Plan
STIP = Statewide Transportation Improvement Program
SQG = small quantity generators
TAZ = transportation analysis zone
TC = transit center
TES = threatened or endangered (or candidate) species
TIP = Transit Investment Plan (TriMet)
TriMet = Tri-County Metropolitan Transportation District of Oregon
UGB = Urban Growth Boundary
URS = URS Corporation (prime consultant to TriMet for this DEIS)
USC = United States Code
USDOI = U.S. Department of Interior
USDOT = U.S. Department of Transportation
USEPA = U.S. Environmental Protection Agency
USFWS = U.S. Fish and Wildlife Service
UST = underground storage tank
VOC = volatile organic compounds
VMT = vehicle miles traveled
WSL = Willamette Shore Line
YOE$ = year of expenditure dollars
2035 = the planning horizon year for this DEIS
Section 4(f) = USDOT parkland regulations

Summary



Lake Oswego to Portland

TRANSIT PROJECT

SUMMARY

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Summary

This Summary provides a brief description of the Lake Oswego to Portland Transit Project's ***Draft Environmental Impact Statement* (DEIS)**. More detailed information can be found in the Lake Oswego to Portland Transit DEIS. There are also technical reports and documents that have been prepared to support the DEIS or that are referenced in the DEIS; see Appendix B for a complete listing and for instructions on how to obtain or view copies of the referenced and supporting documents. All data in this summary are for a projected average weekday in 2035, unless noted.

The Lake Oswego to Portland Transit Project

Local and regional transportation and land use plans call for Metro, TriMet and the cities of Portland and Lake Oswego to implement improved transit service connecting activity centers along Highway 43 in the Lake Oswego to Portland Transit Corridor. Those plans recommend using reserved transit right of way to improve transit service in the corridor and to be a catalyst for improved land use and increased economic development and redevelopment. The result is the proposed Lake Oswego to Portland Transit Project.

Figure S-1
Looking West onto the Lake Oswego to Portland Transit Corridor

The Project Purpose

The Purpose of the Lake Oswego to Portland Transit Project is to optimize the regional transit system by improving transit within the Lake Oswego to Portland Transit Corridor, while being fiscally responsive and supporting regional and local land use goals. The project should maximize, to the extent possible, regional resources, economic development and garner broad public support. The project should build on previous corridor transit studies, analyses and conclusions and should be environmentally sensitive.

The Project Need

The Lake Oswego to Portland Transit Project is needed because of: 1) historic and projected increases in traffic congestion in the Lake Oswego to Portland corridor due to increases in regional and corridor population and employment; 2) lengthy and increasing transit travel times and deteriorating public transportation reliability in the corridor due to growing traffic congestion; 3) increasing operating expenses, combined with increasingly scarce operating resources, while demanding more efficient public transportation operations; 4) local and regional land use and development plans, goals and objectives that target the corridor for development to help accommodate regional population and employment growth; 5) previous corridor transit studies, analyses and conclusions; 6) the region's growing reliance on public transportation to meet future growth in travel demand in the corridor; 7) the topographic, geographic and built environment constraints within the corridor that limit the ability of the region to expand the highway and arterial infrastructure in the corridor; and 8) limited options for transportation improvements in the corridor caused by the identification and protection of important natural, built and socioeconomic environmental resources in the corridor.

Previous processes and conclusions

Three distinct but inter-related steps of alternative and design option development, evaluation and screening were taken by Metro and TriMet, leading to the current range of alternatives and options: 1) ***Consortium Formation and Right of Way Purchase*** in 1988, when a consortium of seven governments collectively purchased the Willamette Shore Line right of way to be preserved for future transit use; 2) ***Alternatives Analysis*** from 2004 to 2007, when Metro Council, in cooperation with local jurisdictions and the Oregon Department of Transportation, evaluated a wide range of alternatives, including river transit, light rail transit, bus, streetcar and roadway alternatives, and narrowed the range of alternatives to be studied in the DEIS to the No-Build, Enhanced Bus and Streetcar alternatives, based on various Purpose-and-Need-based screening criteria and measures; and 3) ***Scoping and Project Refinement Study*** in 2008 to 2009, when Metro Council and its partner jurisdictions and agencies narrowed the range of streetcar design options to be studied in the DEIS based screening criteria and measures, resulting in design options in the Johns Landing, Sellwood Bridge, Dunthorpe/Riverdale and Lake Oswego segments of the corridor (see Figures S-2 and S-3).

Alternatives evaluated in Detail in this DEIS

The DEIS examines three alternatives: the No-Build, Enhanced Bus and Streetcar alternatives. Table S-1 below summarizes key characteristics of the alternatives.

The ***No-Build Alternative*** includes the roadway capital improvements that are listed in the 20-year financially-constrained road network of the 2008 Regional Transportation Plan. The No-Build Alternative includes bus Line 35, which would operate every 15 minutes between Oregon City and downtown Portland via Lake Oswego, and service on Line 36, which currently operates between downtown Portland and Lake Oswego but would be extended to King City to improve connections to WES commuter rail from western Washington County.

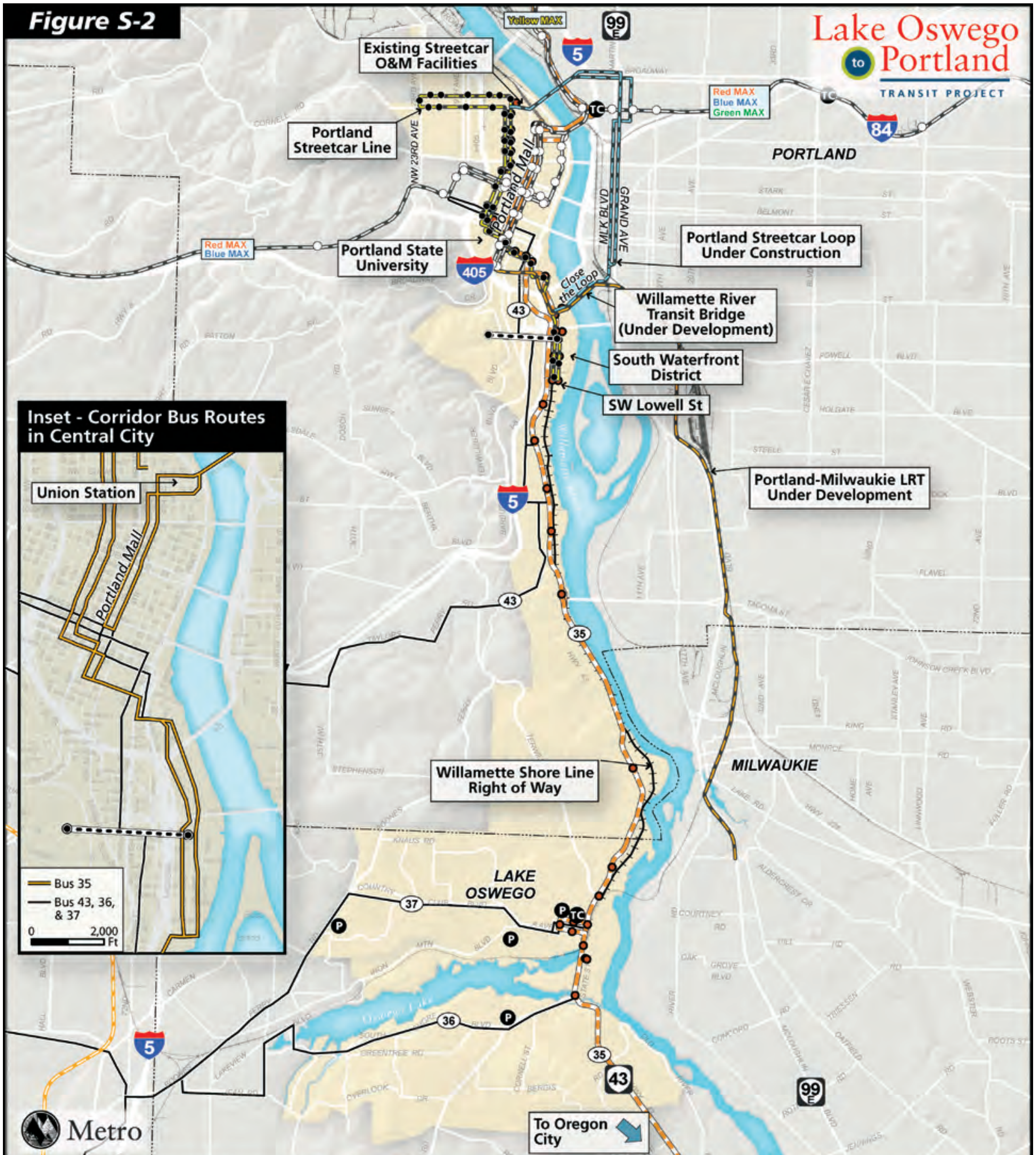
The ***Enhanced Bus Alternative*** (see Figure S-2) would result in modifications to lines 35 and 36, including removal of half of the bus stops between Lake Oswego and downtown Portland, mostly along Highway 43. Line 36 would run between King City and Lake Oswego. The alternative would also include a new 300-space park-and-ride lot in downtown Lake Oswego.

Table S-1 Summary Characteristics of the Alternatives

Attribute	No-Build	Enhanced Bus	Streetcar
Miles of New Streetcar Alignment	0.0	0.0	5.9 to 6.0
New One-Way Streetcar Track Miles	0.0	0.0	10.5 to 11.1
New Streetcar Stations	0	0	10
Line 35 Bus Stops North of Lake Oswego	26	13	0
Corridor Park-and-Ride Lots / Spaces	3 / 76	4 / 376	5 / 476
Streetcar Miles Traveled (systemwide)	2,180	2,180	3,200 or 3,230
Streetcar Revenue Hours (systemwide)	267	267	326 or 332
Bus Miles Traveled (systemwide)	76,560	77,560	75,520
Bus Revenue Hours (systemwide)	5,300	5,400	5,210
Systemwide Streetcars	22	22	33
Systemwide Buses	712	725	704

Source: Metro, TriMet; January 2010. Average weekday in 2035.

Figure S-2



Enhanced Bus Alternative Transportation Network

Line 35
Streetcar and Station
Portland Streetcar Loop Project
Portland-Milwaukie 2008 LPA
Portland Aerial Tram
Light Rail and Station
WES Commuter Rail
Corridor Bus Service
Park-and-Ride Lots
County Boundary
Willamette Shore Line
Transit Center
Lake Oswego to Portland Transit Corridor (see Figure 1.2-1)

12/15/2009

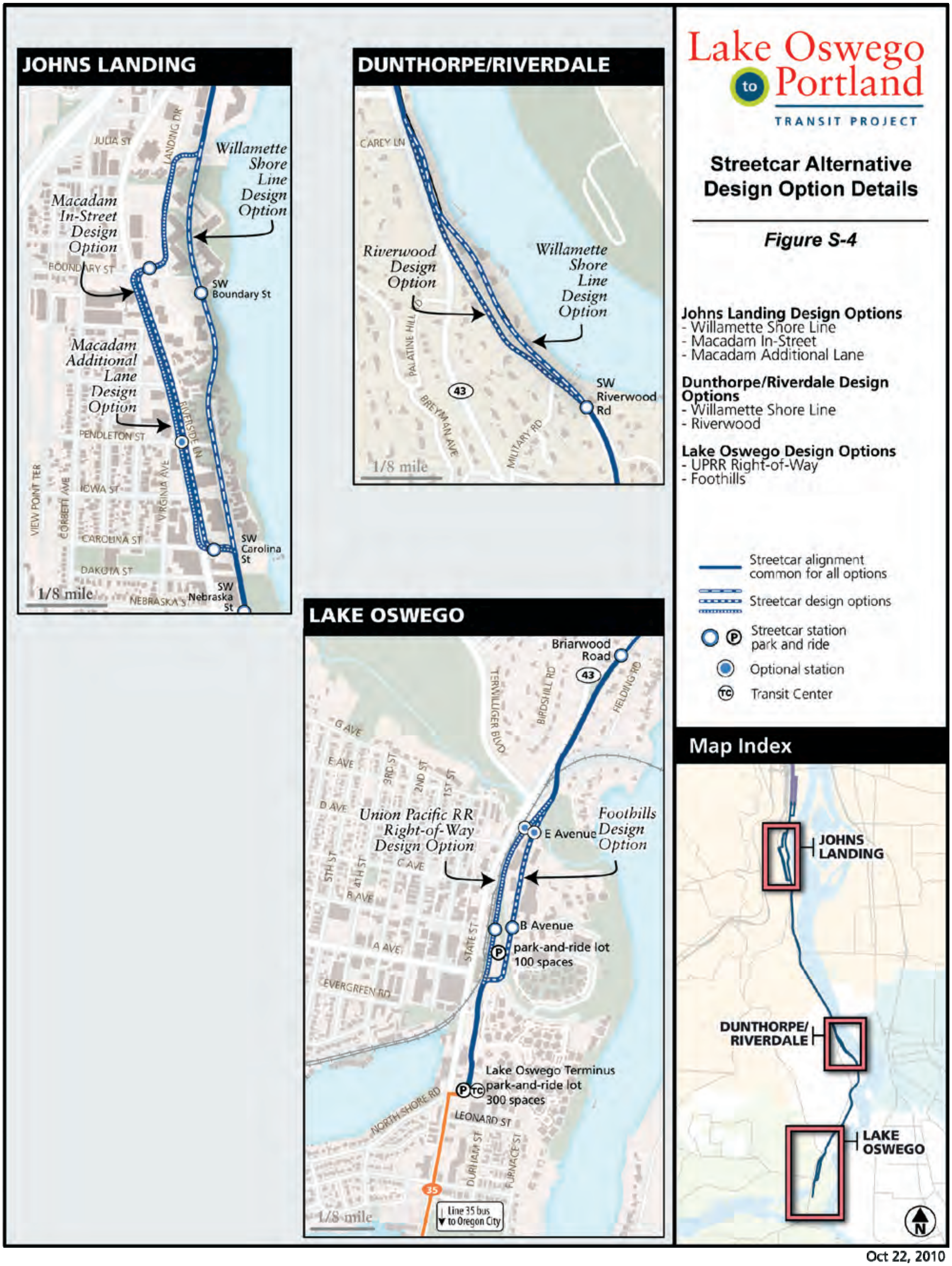

Figure S-3
Lake Oswego to Portland
TRANSIT PROJECT
Existing Streetcar O&M Facilities
Portland Streetcar Line
Portland State University
Portland Streetcar Loop Under Construction
Willamette River Transit Bridge (Under Development)
South Waterfront District
SW Lowell St
Portland-Milwaukie LRT Under Development
Willamette Shore Line Right of Way
Close the Loop
Portland Mall
PORTLAND
MILWAUKIE
LAKE OSWEGO
To Oregon City
Inset - Corridor Bus Routes in Central City
Union Station
Bus 35 & 43
Red MAX
Blue MAX
Green MAX
Yellow MAX
Metro
Streetcar Alternative Transportation Network
Streetcar Alternative Extension
Streetcar Alternative Optional Stations
Line 35
Streetcar and Station
Portland Streetcar Loop Project
Portland-Milwaukie 2008 LPA
Portland Aerial Tram
Light Rail and Station
WES Commuter Rail
Corridor Bus Service
Park-and-Ride Lots
County Boundary
Willamette Shore Line
Transit Center
Lake Oswego to Portland Transit Corridor (see Figure 1.2-1)
Miles
12/15/2009

The ***Streetcar Alternative*** (see Figure S-3) would extend existing streetcar tracks and service between Southwest Bancroft Street and downtown Lake Oswego, generally parallel to Highway 43, adding about six miles of new streetcar track, with 10 new streetcar stations and two new park-and-ride lots (100 and 300 spaces), using 11 new streetcars. Line 35 and 36 service and bus stops would both cease operations north of downtown Lake Oswego.

Streetcar Alignment and Design Options. For the most part, the streetcar tracks would be extended into exclusive right of way purchased by the Willamette Shore Line Consortium in 1988. In many of the design options, streetcars would operate in current or new traffic lanes, just like the existing Portland streetcar that connects Northwest 23rd Avenue with South Waterfront. Stations would be placed at various intervals (typically at activity centers and primary cross streets), with shelters, information displays and accessible platforms. The stations would be similar to the existing streetcar stations in downtown Portland and the Pearl District. There would also be a variety of changes to the streets that the streetcar would operate on (such as new or changed signals, lane striping changes, new sections of roadway), as well as new bicycle and pedestrian connections; see DEIS Section 2.2 and Appendix D for more detail. There are three design options for the Streetcar Alternative (see Figure S-4): the Willamette Shore Line, Macadam In-Street and Macadam Additional Lane options in Segment 3 – Johns Landing; the Willamette Shore Line and Riverwood options in Segment 5 – Dunthorpe/Riverdale; and the UPRR Right of Way and Foothills options in Segment 6 – Lake Oswego.

Effect of the Alternatives on the Environment

The Table S-2 lists several of the ways in which the alternatives would affect the built, natural and social environment. Some of these effects are expressed as a range for the Streetcar Alternative, which indicates that one or more sets of design options would result in changes to that effect. Chapters 3, 4 and 6 of the DEIS have a full listing and description of the effects of the alternatives and options and it provides a summary of how the effects were determined. Below describes some of the trade-offs, based on the project's evaluation measures (See Chapter 6 for more information), between alternatives and a comparison of design options.



JOHNS LANDING
Willamette Shore Line Design Option
Macadam In-Street Design Option
Macadam Additional Lane Design Option
SW Boundary St
SW Carolina St
SW Nebraska St
1/8 mile
DUNTHORPE/RIVERDALE
Riverwood Design Option
Willamette Shore Line Design Option
SW Riverwood Rd
1/8 mile
LAKE OSWEGO
Briarwood Road
Union Pacific RR Right-of-Way Design Option
Foothills Design Option
E Avenue
B Avenue
park-and-ride lot 100 spaces
Lake Oswego Terminus park-and-ride lot 300 spaces
Line 35 bus to Oregon City
1/8 mile
Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative Design Option Details
Figure S-4
Johns Landing Design Options
- Willamette Shore Line
- Macadam In-Street
- Macadam Additional Lane
Dunthorpe/Riverdale Design Options
- Willamette Shore Line
- Riverwood
Lake Oswego Design Options
- UPRR Right-of-Way
- Foothills
Streetcar alignment common for all options
Streetcar design options
Streetcar station park and ride
Optional station
Transit Center
Map Index
JOHNS LANDING
DUNTHORPE/ RIVERDALE
LAKE OSWEGO
Oct 22, 2010

Table S-2 Summary of Environmental Effects by Alternative (average weekday, 2035)

Measure	No-Build	Enhanced Bus	Streetcar
Households/Jobs within New Fixed-Guideway Station Areas	0 / 0	0 / 0	12,080 / 24,920
P.M. In-Vehicle Transit Travel Time Lake Oswego to PSU	42	39	33 or 29
Corridor Transit Place Miles[1]	190,600	222,220	242,000 or 244,760
Miles of New Exclusive Transit Right of Way	0	0	3.9 to 5.4
Annual Systemwide Transit Ridership (compared to No-Build)	N/A	730,550	1.18 to 1.28 million
Regional Vehicle Hours of Delay	49,400	49,200	49,000
New Congested Intersections(compared to No-Build)	N/A	3	2 or 4
Net Parking Spaces Removed	0	0	0 to 175
General Consistency with RTP and Local Plans	Inconsistent	Inconsistent	Consistent
Construction Jobs Created	0	240	1,430 to 1,530
Long-Term Jobs Created (from No-Build)	N/A	28	13
Available Floor Area in New Station Areas (millions of square feet)	0	0	42.825 or 44.492
Potential Displacements	0	0	0 to 7
Severe Noise Impacts (without / with potential mitigation)	0 / 0	0 / 0	1 / 0
Vibration Impacts (without / with potential mitigation)	0 / 0	0 / 0	23 to 28 / 0
Tons of CO_2 Released by Vehicles (regional from No-Build)	N/A	-25.40	-40.51 or -42.12
Historic Resources Adversely Affected	1	1	0 or 1
Acres of Parkland Used	0	0	0.7 or 1.0
Acres of Wetland Filled	0	0	0.10 to 0.11
Acres of Fill in Floodplain	0	1.3	6.5 to 10.1
Acres of New Impervious Surfaces	0	0.8	7.35 to 18.22

Source: Metro, TriMet: January 2010. Note: PSU = Portland State University; N/A = not applicable. Ranges for the Streetcar would result from different design options – see the DEIS and following four tables for additional detail.

[1] Place-miles refers to the total carrying capacity (seated and standing) of each bus or train type and is calculated by multiplying the vehicle capacity of each bus or light rail vehicle type by the daily VMT for each vehicle type.

A. Enhanced Bus Alternative Compared to the No-Build Alternative

The **Enhanced Bus Alternative** would result in:

- 1,800 more daily transit trips in the corridor;
- 730,550 annual systemwide transit person trips;
- A reduction of three minutes in in-vehicle transit travel time from Portland State University to downtown Lake Oswego during the peak period;
- 240 additional short-term construction jobs and 28 additional long-term jobs;
- 31,620 additional transit place miles;
- 41,000 fewer vehicle miles traveled, 3,300 fewer vehicle hours traveled and 200 fewer vehicle hours of delay;
- An increase of 0.1 corridor transit miles per hour; and
- A reduction of 25.40 tons of CO_2 released by vehicles.

In comparison, the **No-Build Alternative** would avoid:

- $37.8 million in capital costs (2010 dollars);
- $2.79 million additional annual operating costs (2010 dollars in 2035);
- Three additional congested intersections; and
- 1.3 acres of fill in the 100-year floodplain and 0.8 acres of new impervious surface.

B. The Streetcar Alternative Compared to the No-Build Alternative

The **Streetcar Alternative** would result in:

- 3,200-3,400 more daily transit riders in the corridor;
- Up to 1.18 or 1.28 million additional annual systemwide transit person trips;
- A reduction of up to 13 or 14 minutes in in-vehicle transit travel time from Portland State University and Southwest Lowell Street to downtown Lake Oswego during the peak period and a reduction of one minute of in-vehicle automobile travel time from PSU to downtown Lake Oswego during the peak period;
- Up to 1,530 additional short-term construction jobs and 13 additional long-term jobs;
- 12,080 households and 24,920 additional jobs within new streetcar station areas;
- The addition of up to 4.8 miles of exclusive transit right of way and up to 39,700 additional passenger miles within exclusive transit right of way;
- 200 fewer vehicles on Highway 43 during the peak hour in the peak direction in Johns Landing and in Lake Oswego;
- Up to 54,160 additional transit place miles per weekday;
- Up to 68,000 fewer vehicle miles traveled, up to 5,700 fewer vehicle hours traveled and 400 fewer vehicle hours of delay;
- An increase of up to 1.7 corridor transit miles per hour;
- Compliance with the RTP and local plans and policies related to the use of high-capacity transit links between major activity centers in the corridor;
- The addition of up to 42,830 square feet of available Floor Area Ration within new streetcar station areas; and
- A reduction of up to 42.12 tons per day of CO_2 released by vehicles.

In comparison, the **No-Build Alternative** would avoid:

- Up to $347.4 million in capital costs (2010 dollars);
- $1.25 million additional annual operating costs (2010 dollars);
- Up to seven potential displacements;
- The net loss of up to 175 parking spaces;
- Two additional congested intersections;
- One severe noise impacts without potential mitigation and up to 28 vibration impacts without mitigation (there would be no severe noise or vibration impacts with the potential mitigation measures);
- Up to 0.11 acres of filled wetland, 10.1 acres of fill in the 100-year floodplain and 18.22 acres of new impervious surface; and
- Up to 1.0 acres of parkland used in one parks.

Comparing the Effect of Streetcar Design Options on the Environment. There are three segments where design options would change the Streetcar Alternative's effects on the environment: Johns Landing, Dunthorpe/Riverdale and Lake Oswego. The following three tables and corresponding text summarize by segment how the Streetcar Alternative's effects on the environment would change by design option. Effects that would be the same under all design options within the same segment are not included in the tables.

A. Segment 3 – Johns Landing. In segment 3, there are three design options considered for the Streetcar Alternative: the Willamette Shore Line, Macadam In-Street and Macadam Additional Lane. The Table S-3 lists several of the ways in which the alternatives would affect the built, natural and social environment for the streetcar design options in segment 3.

The **Willamette Shore Line design option** would result in:

- 420 additional transit riders on Highway 43, Southwest Corbett Avenue and the Willamette Shore Line in the peak period and peak direction;
- 97,250 more annual transit person trips;
- An additional four minutes of transit in-vehicle travel time savings from Portland State University and Southwest Lowell Street to Lake Oswego during the peak period;
- An additional 0.8 miles of exclusive transit right of way and an additional 7,100 passenger miles in exclusive transit right -of way;
- The avoidance of up to $13.68 million in capital costs;
- $8.9 million more local match available from the use of the existing Willamette Shore Line right of way;
- Avoiding the potential removal of 148 on-street and 175 off-street parking spaces;
- The reduction of 1.61 tons of CO_2 emitted by vehicles;
- No displacements; and
- Approximately 5.5 to 6.5 fewer acres of new impervious surface.

The **Macadam In-Street design option**[1] would result in:

- Greater visibility within the Johns Landing activity center, thus providing better support to the desired land use and economic development objectives for the activity centers;
- 1.67 million more square feet of Available Floor Area within new station areas;
- 2,760 more transit place miles;
- Avoidance of one vibration impact (all vibration impacts in this segment would be eliminated with identified potential mitigation measures);
- Approximately 5.5 more acres of new impervious surface[2];
- No displacements; and
- 0.9 fewer acres of floodplain filled.

The **Macadam Additional design option**[1] would result in:

- Greater visibility within the Johns Landing activity center, thus providing better support to the desired land use and economic development objectives for the activity centers;
- 1.670 million more square feet of Available Floor Area within new station areas, thus providing for more development/ redevelopment opportunities;
- 2,760 more transit place miles;
- Avoidance of one vibration impact (all vibration impacts in this segment would be eliminated with the identified potential mitigation measures);
- One potential business displacement; and

---

[1] Than the Willamette Shore Line design option.

[2] Compared to the Willamette Shore Line design option. It would result in approximately one less acre of new impervious surface compared to the Macadam Additional Lane design option.

- Approximately 6.5 more acres of new impervious surface and 0.9 fewer acres of floodplain filled[1].

Table S-3 Environmental Effects and Capital Cost of Streetcar Design Options in Segment 3 – Johns Landing

Measure	Willamette Shore Line	Macadam In-Street	Macadam Additional Lane
Households/Jobs within New Fixed-Guideway Station Areas	4,190 / 11,950	4,600 /12,490	4,600 / 12,490
P.M. In-Vehicle Transit Travel Time Lake Oswego to PSU	29	33	33
Passenger Miles in New Exclusive Transit Right of Way	39,700	32,500	32,500
Station Visibility within Segment Activity Center	Low	High	High
Annual New Transit Ridership (compared to No-Build)	1,277,900	1,180,650	1,180,650
New Congested Intersections (compared to No-Build)	0	2	2
Net Parking Spaces Removed	0	148	175
Change in tons of CO_2 Released by Vehicles (regional from No-Build)	-42.12	-40.51	-40.51
Available Floor Area in New Segment Station Areas (millions of SF)	4.450	6.120	6.120
Potential Displacements	0	0	1
Vibration Impacts (without / with potential mitigation)	3 / 0	5 / 0	5 / 0
Acres of Fill in Floodplain	2.5	1.6	1.6
Acres of New Impervious Surfaces	0.69	6.15	7.20
Segment Capital Cost (2010 dollars)	$19.0	$27.9	$32.7

Source: Metro, TriMet: January 2010. Note: PSU = Portland State University. Average weekday, 2035. SF = square feet.

B. Segment 5 – Dunthorpe/Riverdale. In segment 5, there are two design options considered for the Streetcar Alternative: the Willamette Shore Line and Riverwood Road. The Table S-4 lists several of the ways in which the alternatives would affect the built, natural and social environment for the streetcar design options in segment 5.

The **Willamette Shore Line design option** would result in:

- $10.2 million more local match available from the use of the existing Willamette Shore Line right of way;
- An additional 0.3 miles of exclusive transit right of way;
- No displacements; and
- Approximately two fewer acres of new impervious surface.

In comparison, the **Riverwood Road design option** would result in:

- A savings of $500,000 in capital costs
- Three fewer vibration impacts (there would be no vibration impacts with potential mitigation under either option)
- One potential residential displacement
- Approximately two acres more of new impervious surface
- 2.7 fewer acres of floodplain filled

Table S-4 Environmental Effects and Capital Cost of Streetcar Design Options in Segment 5 – Dunthorpe/Riverdale

Measure	Willamette Shore Line	Riverwood
Potential Displacements	0	1
Vibration Impacts (without / with potential mitigation)	19 / 0	16 / 0
Acres of Fill in Floodplain	2.7	0.0
Acres of New Impervious Surfaces	0.37	2.46
Segment Capital Cost (2010 dollars)	$52.6	$52.1

Source: Metro, TriMet: January 2010. Average weekday, 2035.

C. Segment 6 – Lake Oswego. In segment 6, there are two design options being considered for the Streetcar Alternative: the UPRR right of way and Foothills. The Table S-5 lists several of the ways in which the alternatives would affect the built, natural and social environment for the streetcar design options in segment 6.

The **UPRR Right of Way design option** would result in:

- A savings of $21.3 million in capital costs;
- An additional 0.5 miles of exclusive transit right of way;
- 2.3 fewer acres of new impervious surface; and
- 0.3 fewer acres of parkland used.

In comparison, the **Foothills design option** would result in:

- Avoidance of four noise impacts without potential mitigation measures (there would be no noise impacts in this segment with any design option with the identified potential mitigation measures);
- Five potential business displacements; and
- Avoidance of any temporary impacts to culverted waters,

Table S-5 Environmental Effects and Capital Cost of Streetcar Design Options in Segment 6 – Lake Oswego

Measure	UPRR ROW	Foothills
Households/Jobs within New Fixed-Guideway Station Areas	3,630 / 4,970	3,590 / 4,920
Potential Displacements	0	5
Acres of Parkland Used	0.7	1.0
Acres of Temporary Jurisdictional Culverted Water Impacts	0.0	0.1
Acres of New Impervious Surfaces	2.75	5.02
Segment Capital Cost (2010 dollars)	$48.6	$69.9

Source: Metro, TriMet: January 2010. Average weekday, 2035. UPRR = Union Pacific Railroad; ROW = right of way.

Investment and Operations Cost and Funding

Table S-6 to the right summarizes the capital and operating costs for the Enhanced Bus and Streetcar alternatives. The year-of-expenditure costs, which account for future inflation and finance costs, correspond to the capital revenue needs for each alternative.

Table S-6 Summary Finance Plan for the Enhanced Bus and Streetcar Alternatives

Measure	Enhanced Bus	Streetcar Low	Streetcar High
Costs (millions)			
Capital Costs (2010$)	$37.8	$288.9	$347.4
Capital Costs (year-of-expenditure $)	$51.1	$379.6	$458.3
Increased Operating Costs (2010$)	$2.79	$1.25	$1.25
Capital Revenue (millions)			
Federal Small Starts Grant	$30.7	$0.00	$0.00
Federal New Starts Grant	$0.00	$227.7	$275.0
Local Match – ROW	$0.00	$94.5	$97.0
Local Match – Other	$20.4	$57.3	$86.3
Total	***$51.1***	***$379.6***	***$458.3***

Source: City of Portland and TriMet; January 2010. Average weekday, 2035, in millions. Year-of-expenditure costs account for inflation from 2010 and finance costs. Low and high costs for the Streetcar Alternative are the result of variations in design options (see tables on the previous page). Operating costs are change from the No-Build Alternative.

Under the current finance plan, the Enhance Bus Alternative would need approximately $31 million in Federal Small Starts funds and $20 million in local funds that have yet to be allocated (year-of-expenditure, 2017 dollars), pending selection of a Locally Preferred Alternative. The Streetcar Alternative would need between $380 and $458 million (year-of-expenditure, 2017 dollars), depending on design options under study. The Streetcar Alternative would be funded through approximately $228 to $275 million in Federal New Starts funds and a mix of local sources. Of those local sources, $95 to $97 million is currently available from the value of the existing Willamette Shore Line right of way where it would be used by the project, which would vary by design option. In segments 3 through 5, the Willamette Shore Line design options would result in greater amounts of this type of local match than the other design options. Approximately $57 to $86 million in other local revenue would be needed to fund the Streetcar Alternative (also affected by design options) and would be secured following selection of the Locally Preferred Alternative.

Evaluation Process

A summary of how the alternatives perform relative to the project’s evaluation criteria and measures can be found in Chapter 6 of the DEIS, reflecting the data in the tables included in this summary. The evaluation criteria and measures used in Chapter 6 are derived from the project’s Purpose and Need Statement and Goal and Objectives.

Social Equity

Detail behind the project’s finding that there are no social equity impacts (i.e., environmental justice) associated with any of the alternatives or options are available in Section 3.2 and Chapter 6 of the DEIS. Specifically, there would be no disproportionate high and adverse impacts from the project to low-income or minority populations.

Public Involvement in the Project

Project partners (i.e., Metro, TriMet, the cities of Portland and Lake Oswego, Multnomah and Clackamas counties, ODOT and Portland Streetcar Inc.) developed and implemented a multifaceted public involvement program for the Lake Oswego to Portland Transit Project. The project’s public outreach efforts included: public workshops; mailing of flyers to several thousand recipients located along the alignment; advertisements; presentations to neighborhood, business, the community advisory committee and special interest groups; public comment opportunities, both at meetings and via mail, e-mail and telephone; distribution of fact sheets and newsletters, by mail and e-mail; and informational open houses. Additional public involvement activities will continue as the project conducts the DEIS public comment period and hearing, selects a Locally Preferred Alternative, completes the Final EIS and advances into Final Design and construction.

Receive More Information or Comment on the DEIS

The DEIS is the best source of additional information; detailed supporting documents are listed in Appendix B of the DEIS. The DEIS is available on Metro's project web site at: www.oregonmetro.gov/lakeoswego or upon request; e-mail trans@oregonmetro.gov or call 503-813-7535. A comment period of 60 days starts on Friday, December 3, 2010. Comments on the DEIS must be received at Metro no later than 5:00 p.m. PST, January 31, 2011. Comments can be made at the project's public hearing, in writing by mail, by e-mail or through the project website or by telephone.

Metro
Lake Oswego to Portland Transit Project DEIS
Attention: Ms. Jamie Snook, Principal Planner
600 NE Grand Ave.
Portland, Oregon 97232
Email: Trans@oregonmetro.gov
Telephone: 503-797-1900

Federal Transit Administration
Lake Oswego to Portland Transit Project DEIS
Attention: Mr. John Witmer, Community Planner
915 2nd Ave., room 3142
Seattle, Washington 98714
Email: John.Witmer@dot.gov
Telephone: 206-220-7965

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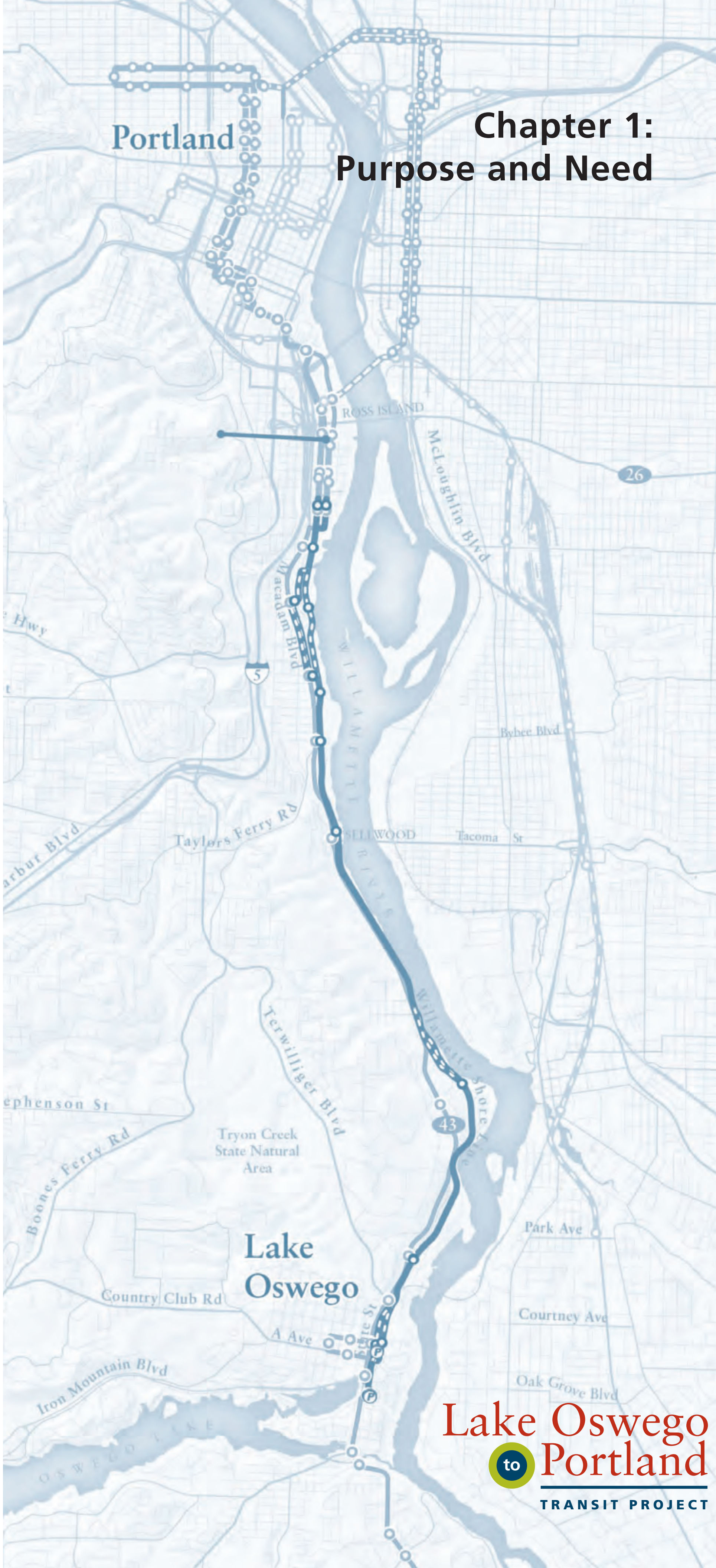
CHAPTER 1

Chapter 1: Purpose and Need



Lake Oswego to Portland

TRANSIT PROJECT

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1. PURPOSE AND NEED

This chapter describes the Lake Oswego to Portland Transit Project's purpose and need. It includes a statement of the project's goal and objectives, which form the structure of the evaluation of alternatives, as summarized in Chapter 6 of this Draft Environmental Impact Statement (DEIS), and which will help guide the selection of the Locally Preferred Alternative (LPA).It also describes the project's study area and summarizes the transportation, land use and development challenges and opportunities within the study area.

1.1 Purpose and Need and Goal and Objectives

The **Purpose** of the project is to optimize the regional transit system by improving transit within the Lake Oswego to Portland transit corridor, while being fiscally responsive and by supporting regional and local land use goals. The project should maximize, to the extent possible, regional resources, economic development and garner broad public support. The project should build on previous corridor transit studies, analyses and conclusions and should be environmentally sensitive.

The **Need** for the project results from:

- Historic and projected increases in traffic congestion in the Lake Oswego to Portland Corridor due to increases in regional and corridor population and employment;

- Lengthy and increasing transit travel times and deteriorating public transportation reliability in the corridor due to growing traffic congestion;

- Increasing operating expenses, combined with increasingly scarce operating resources, while demanding more efficient public transportation operations;

- Local and regional land use and development plans, goals and objectives that target the corridor for residential, commercial, retail and mixed-use development to help accommodate forecast regional population and employment growth and previous corridor transit studies, analyses and conclusions;

- The region's growing reliance on public transportation to meet future growth in travel demand in the corridor;

- The topographic, geographic and built environment constraints within the corridor that limit the ability of the region to expand the highway and arterial infrastructure in the corridor; and

- Limited options for transportation improvements in the corridor caused by the identification and protection of important natural, built and socioeconomic environmental resources in the corridor.

The project's Purpose and Need Statement was developed over the course of the project's various phases, which are described in Section 2.1 of this DEIS. In summary, a Purpose and Need Statement was developed as part of the project's alternatives analysis phase and was then revised in the Scoping process and Corridor Refinement Phase. The current Purpose and Need Statement reflects review and comment opportunities provided during the National Environmental Policy Act Scoping process, in compliance the project's *Section 6002 Coordination Plan* (Metro, September 2009).

The Goal of the Lake Oswego to Portland Transit Project is similar to its purpose:

The **Goal** of the project is to optimize the regional transit system by improving transit within the Lake Oswego to Portland transit corridor, while being fiscally responsive and by supporting regional and local land use goals. The project should maximize, to the extent possible, regional resources, economic development and garner broad public support. The project should build on previous corridor transit studies, analyses and conclusions and should be environmentally sensitive.

The **Objectives** of the Lake Oswego to Portland Transit Project are to:

- Maximize the ability of the transit system to accommodate future growth in travel demand in the corridor;

- Minimize the adverse effect of increased roadway congestion on transit operations, ridership and operating costs;

- Increase the quality, efficiency and effectiveness of transit;

- Provide for a fiscally stable and financially efficient transit system;

- Comply with and support existing regional and local land use and transportation policies, plans, goals and objectives; and

- Optimize the environmental sensitivity and engineering design of the project.

The Goal and Objectives help form the evaluation framework for the Lake Oswego to Portland Transit Project, which is outlined in Chapter 6 – Evaluation of the Alternatives. The introductory paragraphs to Chapter 6 provide a description of the linkage between the project's evaluation framework (i.e., criteria and measures) and the project's Purpose and Need Statement and Goal and Objectives. Section 6.1.1 provides a more detailed description of the listed measures and the methods used to calculate the measures.

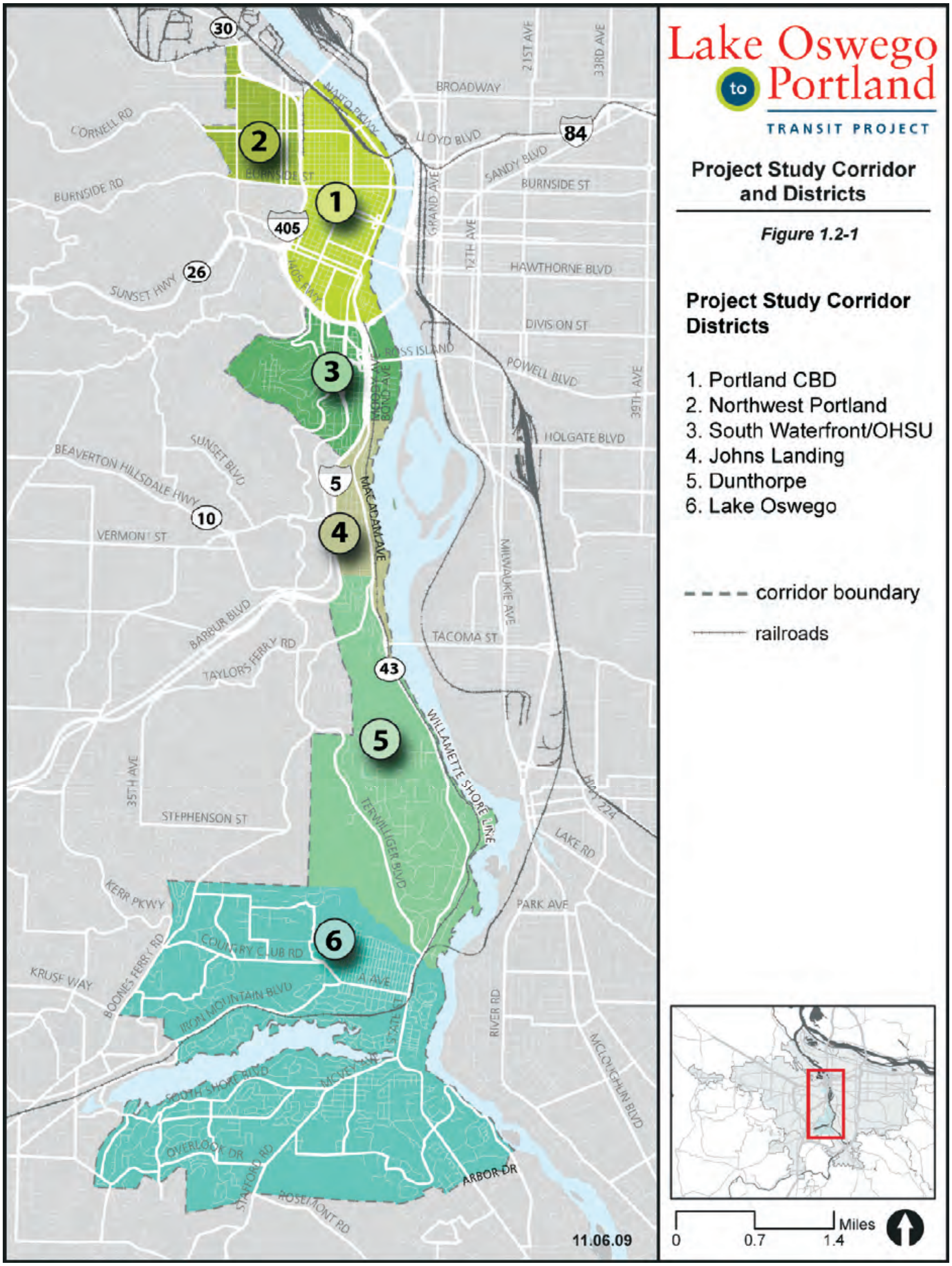
The following sections describe the project study area and provide a more detailed overview of the challenges and opportunities present in the study area.

1.2 Study Area: Lake Oswego to Portland Transit Corridor

The project study area for this DEIS is the Lake Oswego to Portland transit corridor, as illustrated in Figure 1.2-1. The corridor extends between the downtowns of Lake Oswego and Portland, Oregon.

The corridor is constrained to the east by the Willamette River and to the west by the relatively steep eastern slopes of the Portland West Hills. State Highway 43, which is located west of, and generally parallel to, the Willamette River, connects the two downtowns. The primary transit route serving the corridor is Line 35, which generally operates on Highway 43 between the two downtowns.

Downtown Portland is the region's premier mixed-use center, serving as a cultural, employment, retail and high-density housing center upon which the region's transit and highway system is focused. Downtown Lake Oswego is one of the region's most fully developed Town Centers. It is located on


Lake Oswego to Portland
TRANSIT PROJECT
Project Study Corridor and Districts
Figure 1.2-1
Project Study Corridor Districts
1. Portland CBD
2. Northwest Portland
3. South Waterfront/OHSU
4. Johns Landing
5. Dunthorpe
6. Lake Oswego
corridor boundary
railroads
Miles
0
0.7
1.4
11.06.09
BROADWAY
LLOYD BLVD
SANDY BLVD
BURNSIDE ST
BURNSIDE RD
CORNELL RD
SUNSET HWY
HAWTHORNE BLVD
DIVISION ST
POWELL BLVD
HOLGATE BLVD
BEAVERTON HILLSDALE HWY
SUNSET BLVD
VERMONT ST
MACADAM AVE
MILWAUKIE AVE
TACOMA ST
BARBUR BLVD
TAYLORS FERRY RD
WILLAMETTE SHORE LINE
TERWILLIGER BLVD
STEPHENSON ST
35TH AVE
LAKE RD
PARK AVE
KERR PKWY
COUNTRY CLUB RD
KRUSE WAY
BOONES FERRY RD
IRON MOUNTAIN BLVD
A AVE
RIVER RD
MCLOUGHLIN BLVD
SOUTH SHORE BLVD
OVERLOOK DR
STAFFORD RD
ROSEMONT RD
ARBOR DR
GRAND AVE
12TH AVE
21ST AVE
33RD AVE
39TH AVE
30
84
405
26
5
10
43

the west side of the Willamette River, approximately seven miles south of downtown Portland. Downtown Lake Oswego has traditional grid-based street network within the downtown core, connected to the region via various radiating highways. The Lake Oswego Transit Center, located at A Avenue and 4th Street, provides connections between Line 35 and other corridor routes.

In addition to the two downtowns, there are two primary activity centers in the Lake Oswego to Portland transit corridor: the South Waterfront District and Johns Landing, which are located immediately south of downtown Portland and west of the Willamette River and include a mix of medium to high-density residential, commercial, retail and institutional uses. The South Waterfront District includes the existing Portland Streetcar line, connecting Portland State University, downtown Portland and the Pearl and Northwest districts, and the Portland Aerial Tram, connecting the Oregon Health Sciences University (OHSU) campuses in the South Waterfront District and the Portland West Hills. Based on current timelines, the South Waterfront District is also expected to include a station on the Portland to Milwaukie Light Rail line with service beginning in 2015.

1.3 Population and Employment Growth

The Lake Oswego to Portland transit corridor includes six districts, illustrated in Figure 1.2-1: Portland central business district (CBD), Northwest Portland, South Waterfront/OHSU, Johns Landing, Dunthorpe and Lake Oswego. Tables 1.3-1 and 1.3-2 summarize historic, current and forecast (1990, 2005 and 2035, respectively) household and employment within the corridor districts, the Lake Oswego to Portland transit corridor and the Portland/Vancouver metropolitan area. In summary, the corridor currently includes approximately 15 percent of the region's employment and 4 percent of the region's households.

Table 1.3-1 Households and Employment in the Region and Lake Oswego to Portland Transit Corridor (1990 and 2005)

Area[1]	1990		2005		Household % Change	Employment % Change
	Households	Employment	Households	Employment		
Lake Oswego to Portland Transit Corridor						
Portland CBD	5,970	84,380	13,010	101,200	118%	20%
Northwest Portland	5,650	14,730	6,060	15,200	7%	3%
South Waterfront/OHSU	1,950	15,280	2,250	25,730	15%	68%
Johns Landing	1,050	6,350	1,150	8,080	10%	27%
Dunthorpe	1,040	1,150	1,140	1,560	10%	36%
Lake Oswego	7,120	4,340	7,580	5,420	6%	25%
Corridor Total	**22,780**	**126,220**	**31,190**	**157,190**	**37%**	**25%**
Region Total	**548,740**	**697,260**	**767,020**	**1,032,320**	**40%**	**48%**

Source: Metro, 2009.
Note: CBD = Central Business District.
[1] The Lake Oswego to Portland transit corridor and the districts that make it up are illustrated in Figure 1.2-1. The region is made up of Multnomah, Clackamas, Washington and Clark counties.

From 1990 to 2005, household growth in the corridor (37 percent) has been similar to household growth throughout the metropolitan region (40 percent), with the greatest household growth in the corridor occurring within the Portland CBD (118 percent). The corridor's employment growth rate during the same period has been about one-half of the region's, with the greatest employment growth occurring within the South Waterfront/OHSU and Dunthorpe areas (68 and 36 percent, respectively).

Table 1.3-2 Households and Employment in the Region and Lake Oswego to Portland Transit Corridor (2005 and 2035)

Area[1]	2005 Households	2005 Employment	2035 Forecast Households	2035 Forecast Employment	Household % Change	Employment % Change
Lake Oswego to Portland Transit Corridor						
Portland CBD	13,010	101,200	34,640	147,830	166%	46%
Northwest Portland	6,060	15,200	7,850	19,860	30%	31%
South Waterfront/OHSU	2,250	25,730	7,320	42,270	225%	64%
Johns Landing	1,150	8,080	3,690	12,940	221%	60%
Dunthorpe	1,140	1,560	1,520	2,380	33%	52%
Lake Oswego	7,580	5,420	11,480	10,240	51%	89%
Corridor Total	**31,190**	**157,190**	**66,500**	**235,510**	**113%**	**50%**
Region Total	**767,020**	**1,032,320**	**1,208,650**	**1,799,210**	**58%**	**74%**

Source: Metro, 2009.
Note: CBD = Central Business District.
[1] The Lake Oswego to Portland transit corridor and the districts that make it up are illustrated in Figure 1.2-1. The region is made up of Multnomah, Clackamas, Washington and Clark counties.

The future growth rate of households in the Lake Oswego to Portland transit corridor from 2005 to 2035 is projected to be double that of the region (113 percent compared to 58 percent, respectively), while the future employment growth rate in the corridor will be about two-thirds of the regional average. The districts within the corridor that are forecast to have household growth rates approximately equal to or greater than the regional average are the Portland CBD, the South Waterfront/OHSU, Johns Landing and Lake Oswego. The districts with the highest employment growth rates over the next 30 years are forecast to be Lake Oswego, South Waterfront/OHSU, Johns Landing and Dunthorpe (89, 64, 60 and 52 percent, respectively).

1.4 Growth in Traffic and Traffic Congestion

This section summarizes current and projected growth in traffic congestion in the Lake Oswego to Portland transit corridor, resulting from the corridor's and region's forecast growth in households and employment (see Section 1.3 for more detail on household and employment growth).

Highway 43 serves as the primary north/south highway for motor vehicles, transit and freight movement in the Lake Oswego to Portland transit corridor, serving the growing activity centers of downtown Portland, the South Waterfront, Johns Landing and Lake Oswego. Metro's *Regional Transportation Plan* designates Highway 43 as a Multi-Modal Major Arterial for the segment connecting the Lake Oswego town center with the Portland central city. Highway 43 also serves a local function of providing access to collector and local streets and abutting residential properties between and within the centers. Between Southwest Bancroft Street and Radcliffe Road (south of the Sellwood Bridge) in the northern portion of the corridor, Highway 43 is generally two lanes in each direction. Between Radcliffe and Greenwood roads, Highway 43 narrows to two southbound lanes and one northbound lane – the roadway shifts to two northbound lanes and one southbound lane between Greenwood Road and north of downtown Lake Oswego. Within downtown Lake Oswego, Highway 43 is known as State Street, which generally has two through lanes in each direction with an intermittent center turn lane.

Highway 43 between downtown Portland and downtown Lake Oswego is constrained through much of its alignment, either with existing development and/or with significant topographical features, such as steep hillsides, its proximity to the Willamette River and frequent creek and stream crossings. With roadway widenings for Highway 43 ruled out through prior regional studies (Metro and ODOT, 1999), there are no planned roadway projects in the corridor that would address the roadway's forecast congestion. Instead, regional policy is to address existing and future congestion in the corridor through transportation system management, transportation demand management, bicycle and pedestrian improvements and transit improvements, including the proposed Lake Oswego to Portland Transit Project.

By 2035, peak period traffic volumes on Highway 43 are forecast to increase by approximately 29 to 99 percent at nine select locations between Lake Oswego and downtown Portland, as presented in Table 1.4-1. The greatest increases in peak traffic volumes on Highway 43 would occur at: south of Southwest Terwilliger Boulevard (99 percent); north of McVey Avenue (94 percent); south of the Sellwood Bridge (85 percent); and south of the McVey Avenue (85 percent). For the nine select locations, Table 1.4-1 also notes where Highway 43 was congested in 2005 and would be congested in 2035 (i.e., where demand exceeds capacity). Of the nine locations in the table, four of the segments of Highway 43 had adequate roadway capacity to meet vehicular demand in 2005, while none of the segments would have adequate capacity to meet demand in 2035.

Table 1.4-1 Average Weekday Peak Period[1] Peak Direction Traffic Volumes and Congestion on Highway 43 at Select Locations (2005 and 2035)

Location on Highway 43	2005 Demand	2005 Capacity	2005 Congested[2]	2035 Demand	2035 Capacity	2035 Congested[2]	% Change in Demand
North of SW Boundary Street	3,320	3,600	No	4,280	3,600	Yes	29%
North of SW Taylors Ferry Road	3,550	3,600	No	4,690	3,600	Yes	35%
North of Sellwood Bridge	5,610	4,200	Yes	7,000	4,200	Yes	37%
South of Sellwood Bridge	2,830	3,600	No	5,280	3,600	Yes	85%
North of SW Terwilliger Boulevard	2,730	2,400	Yes	4,890	2,400	Yes	80%
South of SW Terwilliger Boulevard	3,190	2,800	Yes	6,210	2,800	Yes	99%
North of McVey Avenue	3,830	3,600	Yes	7,060	3,600	Yes	94%
South of McVey Avenue	2,430	2,400	Yes	4,390	2,400	Yes	85%
South of S Arbor Drive	2,440	2,200	Yes	4,070	2,400	Yes	70%

Source: Metro November 2009.
Note: SB = southbound; NB = northbound.
[1] The peak period is defined as the two peak p.m. hours.
[2] Yes = the demand exceeds the available capacity; No = there is capacity to meet demand.
[3] Percent change in forecast demand from 2005 to 2035.

In summary, Highway 43 in the Lake Oswego to Portland transit corridor will experience increases in traffic volumes due to increases in the corridor's and region's population and employment. Congestion in the corridor will also increase due to the increased traffic and the general inability of Highway 43 to be modified to increase roadway capacity. The following section addresses how this increased congestion has adversely affected transit operations in the corridor and how it will adversely affect future transit operations in 2035.

1.5 Effects of Congestion on Transit Operations, Ridership and Finance

As noted in Section 1.4, traffic counts and congestion on Highway 43, the only north/south major roadway in the Lake Oswego to Portland Transit Corridor, are forecast to increase between 2005 and 2035. TriMet Line 35, which primarily operates on Highway 43 in mixed traffic, is the primary trunk bus line in the corridor and between Lake Oswego and Portland. Line 35 transit travel times have, and are forecast to, increase over time as a result of increasing traffic congestion.

Table 1.5-1 includes peak-direction, in-vehicle transit and automobile travel times from downtown Portland and downtown Lake Oswego during the peak two-hour period for 2005 and 2035. In short, automobile travel time would increase by eight minutes by 2035, an approximately 36 percent increase from 2005, and transit travel times would increase by nine minutes, or 24 percent.

Table 1.5-1 Average Weekday PM Peak1 Period In-Vehicle Automobile and Transit Travel Times Between Downtown Portland (Pioneer Square) and Downtown Lake Oswego (2005 and 2035)

Mode	2005	2035	Percent Change
Automobile	22 minutes	30 minutes	36%
Transit	38 minutes	47 minutes	24%

Source: Metro 2009.
[1] The PM peak period is defined as the average weekday peak two hours.

As transit travel times increase over time, the cost of operating that service increases. Transit operating costs are generally dependent on three variables: vehicle miles traveled, vehicle hours traveled and peak vehicle requirements. Increased congestion generally increases the number of vehicle hours traveled and leads to increases in the number of required peak vehicles to operate the route.

Even with a deterioration of transit travel times, transit demand in the Lake Oswego to Portland transit corridor is forecast to increase at a rate similar to the regional average. As shown in Table 1.5-2, total average weekday transit ridership in the corridor and system are forecast to increase by approximately 124 percent between 2005 and 2035.

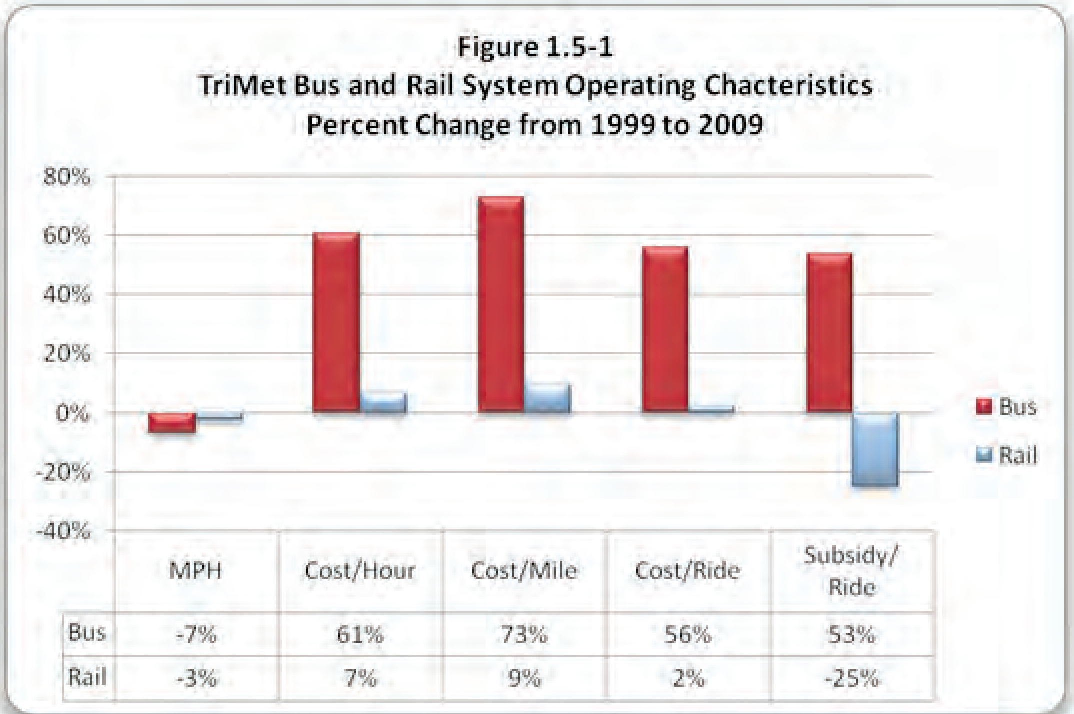
Table 1.5-2 Average Weekday Corridor and Systemwide Transit Ridership[1] (2005 and 2035)

	2005	2035	Percent Change
TriMet Systemwide	267,300	583,800	118%
Lake Oswego to Portland Corridor	103,600	231,900	124%

Source: Metro 2009.
[1] Ridership is measured in person trips (i.e. linked/originating trips) that originate from and/or are destined to the corridor, excluding intra-Portland CBD and NW Portland trips and trips between the Portland CB and Northwest Portland (districts 1 and 2; see Figure 1.2-1). Ridership in 2035 is based on the No-Build Alternative, described in Section 2.2.1).

Figure 1.5-1 illustrates the percent change from 1999 to 2009 for five operating efficiency measures for the TriMet bus and rail systems (source: TriMet's annual Section 15 reports). Each of the five measures demonstrates that the operating efficiency of the overall bus system declined in relationship to the rail system. In particular, the overall speed of the bus system declined by approximately 7 percent, compared to a 3 percent decline with the rail system. Further, the cost per revenue hour and the cost per revenue mile of service increased by 61 and 73 percent for the bus system, respectively, compared to 7 and 9 percent for the rail system – with the cost per mile change reflecting the relative decline in bus speeds compared to rail speeds. Similarly, the operating cost per boarding ride on the bus system increased by 56 percent over the past decade, compare to a 2 percent increase on the rail system. Finally, the subsidy per ride[1] has increased by 53 percent for the bus system, compared to a 25 percent decline for the rail system. By that measure, the rail system, which generally operates in reserved right of way, is becoming more efficient over time, while the bus system, which generally operates in mixed traffic, is becoming less efficient. The existing downtown Portland streetcar service, which generally operates in mixed traffic, is not accounted for in TriMet's Section 15 reports.

[1]The operating costs minus the operating revenue, divided by the number of boarding rides.



In conclusion, the region's strategic investment over the past decade in an expanding rail system has resulted in increased transit operating efficiencies, a trend that is likely to continue into the future. In general, by investing further in reserved right of way and rail lines within existing bus corridors with high ridership potential, the efficiencies of rail transit with reserved right of way would allow TriMet to provide more and faster transit service with its limited pool of operating funds.

Further illustrating the relative efficiency of rail transit service compared to bus service in the TriMet system, Table 1.5-3 summarizes the TriMet 2008 operating cost per boarding ride for regular bus, frequent service bus[2], streetcar and light rail. Streetcar and light rail have the lowest costs per boarding ride at $1.75, compared to frequent service bus and regular bus service, which cost $2.75 and $3.50 per boarding ride, respectively.

Table 1.5-3 TriMet Operating Cost per Boarding Ride by Transit Mode[1] (2008)

Transit Mode	Cost/Boarding Ride
Bus	$3.50
Frequent Service Bus	$2.75
Streetcar	$1.75
Light Rail	$1.75

Source: TriMet; 2008.
[1] Boarding ride is defined as each time a person boards a transit vehicle, independent of their mode of access.

[2] Frequent service bus is defined as bus routes with service frequency of 15 minutes or better throughout the day, every day of the week.

1.6 Corridor Transit Markets

This section addresses the primary transit markets within the Lake Oswego to Portland transit corridor, which were identified by reviewing the total person trip and transit's share of total person trips for travel between the various districts that make up the corridor. The market analysis focuses on links between districts, such as travel between primarily residential areas and areas that include employment centers.

As shown in Table 1.3-2, the corridor districts with the greatest number of employees in 2035 will be the Portland CBD, South Waterfront/OHSU, Northwest Portland, Johns Landing and Lake Oswego. Figure 1.2-1 illustrates the corridor's districts. Table 1.6-1 shows the number of average weekday commute trips (i.e., work and college) between the entire Lake Oswego to Portland transit corridor and those high-employment districts for 2005 and 2035 (based on the No-Build Alternative). The growth from 2005 to 2035 for all weekday commute trips from the corridor to the high-employment districts would range from 122 to 217 percent. Transit trips are expected to grow much more than other trips. The greatest growth rate in transit commute trips would occur from the corridor to Johns Landing, a 912 percent increase, followed by transit commute trips to the South Waterfront/OHSU and Portland CBD districts (456 and 419 percent increases, respectively). The greatest absolute gain in weekday transit trips would be from the corridor to the Portland CBD/Northwest Portland, with an increase of 10,350 trips.

Table 1.6-1 Lake Oswego to Portland Transit Corridor Commute[1] and Non-Commute[1] Market Analysis[2], No-Build Alternative (average weekday, 2005 and 2035)

	2005		2035 No-Build			
From the Corridor to:	**Commute**	**Non-Commute**	**Commute**	**Percent Change[3]**	**Non-Commute**	**Percent Change[3]**
Portland CBD/NW Portland						
Person Trips	5,420	38,840	13,780	191%	68,960	131%
Transit Trips	990	2,130	5,860	522%	9,500	439%
Transit Mode Share	18%	5%	43%	114%	14%	133%
South Waterfront/OHSU						
Person Trips	3,900	42,780	14,220	238%	107,420	127%
Transit Trips	680	2,090	5,140	663%	11,250	433%
Transit Mode Share	17%	5%	36%	1256	10%	134%
Johns Landing						
Person Trips	1,530	10,760	5,760	229%	36,840	204%
Transit Trips	150	230	1,820	1122%	3,210	1447%
Transit Mode Share	10%	2%	32%	271%	9%	409%
Lake Oswego						
Person Trips	3,850	17,800	11,700	149%	52,330	152%
Transit Trips	280	220	1,460	315%	840	295%
Transit Mode Share	7%	1%	12%	67%	2%	57%

Source: Metro, March 2010.
Note: OHSU = Oregon Health and Science University.
[1] Commute trips are work and college person trips; non-work trips are all other person trips.
[2] See Figure 1.2-1 for an illustration of the Lake Oswego to Portland transit corridor and the corridor districts.
[3] Percent change in mode split percent from 2005 to 2035.

Transit's mode share in these high-employment areas was greater for commute trips than for non-commute trips in 2005 and they will remain greater in 2035. For example, the transit mode split for corridor commute trips from the corridor to the Lake Oswego district in 2035 would be approximately six times greater than for non-commute trips (12 percent compared to 2 percent, respectively) and almost four times greater for commute trips from the corridor to the Johns Landing district than non-commute trips (32 percent, compared to 9 percent, respectively). In summary, transit competes best in the corridor for commute trips from and to the corridor's high-employment districts – both currently and in the future.

1.7 Planning and Policy Framework

This section provides an overview of the planning and policy framework at the state, regional and local levels that calls for consideration of a transit capital investment in the Lake Oswego to Portland transit corridor to address future growth and transportation problems in the corridor, while being environmentally sensitive.

1.7.1 State, Regional and Local Land Use and Transportation Plans

Oregon state law requires that the urban areas of the state define urban growth boundaries and that adequate urban plans and infrastructure be provided within those boundaries. Appropriate plans, zoning and infrastructure within urban growth boundaries promote the efficient use of urban land, thereby helping to preserve the state's non-urban land. The Portland metro region has had a defined strategy for managing growth and providing effective transportation within the adopted urban growth boundary since 1979. Metro's regional urban growth goals and objectives define the *2040 Growth Concept*, which is directly linked to the *Regional Transportation Plan* (Metro, 2009 – see Section 3.1 for additional detail). The RTP identifies the projects and transportation measures needed to meet the demand for future growth and it includes the Lake Oswego to Portland Transit Project.

This linked land use and transportation policy approach is critical to managing the urban growth boundary and achieving the focused development patterns that are needed to achieve the regional goals and objectives. The RTP is designed to accommodate the transportation needs of 720,000 additional residents into the Oregon portion of the metropolitan area, while limiting the expansion of the urban growth boundary.

The 2040 Growth Concept was established by Metro, in cooperation with its local government partners. The concept seeks to accommodate growth in a compact urban form, which reduces conversion of natural and resource lands. The concept includes strategies to protect and support existing residential neighborhoods, make more efficient use of existing urban lands, reduce dependence on the automobile and encourage mixed-use development in centers and corridors. Centers and corridors are areas within the urban growth boundary where much of the growth is planned and forecast to occur.

The Portland central city, which includes downtown Portland, is the region's high-capacity transit hub, providing current and future connections to regional centers and town centers. The role of the Portland central city as the region's financial, cultural, tourism, retail and commercial center is reinforced by the 2040 Growth Concept. Additionally, 2040 Growth Concept designates several regional centers and town centers, defining them as mixed-use areas consisting of moderate to high densities served by high capacity transit services and facilities. Within the project's corridor, Lake Oswego is defined as a town center.

In addition to the state requirements for managing growth within an urban growth boundary, there is an established framework of state, regional and local plans and policies that emphasize the link between land use and transportation decisions. In 1991, to strengthen the connections between land use policies and transportation policies, the state developed the Transportation Planning Rule to help implement the Statewide Planning Goal 12, requiring cities and counties to:

- Consider changes to land use densities and designs as a way to meet transportation needs;
- Adopt changes to their subdivision and development ordinances to encourage more transit- and pedestrian-friendly development street patterns; and
- Amend their comprehensive plans to allow transit-oriented development along transit routes. (*Note that applicable regional, city and county plans currently comply with this requirement*.)

Regionally and within the project corridor, there has been extensive public and private investment in support of these policies. For example:

- The 2040 Growth Concept calls for accommodating urban growth in centers and corridors and for connecting centers with high capacity transit; and
- The Lake Oswego to Portland transit corridor has land use development patterns that support transit use and town centers.

Further, all applicable local and regional land use plans and policies in the Oregon portion of the metropolitan area have been based on, among other things, providing high capacity transit in regional corridors such as the Lake Oswego to Portland transit corridor. Land use designations, zoning patterns and water, sewer and other infrastructure plans and investments in all local jurisdictions have been located and sized based on development forecasts in high-capacity transit corridors.

1.7.2 Willamette Shore Line Consortium Right of Way and RTP Refinement Plan

The Willamette Shore Line Consortium is made up of the Oregon Department of Transportation (ODOT), Metro, TriMet, the cities of Portland and Lake Oswego, and Clackamas and Multnomah counties. In 1988, the consortium formed and purchased the 6.3-mile Willamette Shore Line right of way from the Southern Pacific Railroad. Knowing that the Highway 43 corridor is very constrained, the purchase was made with the intent of preserving the right of way for future rail transit use. The value of the right of way could be counted as local match for federal funds to construct the project. Since 1990, the City of Lake Oswego has leased the Willamette Shore Line right of way from the consortium for the purpose of operating excursion trolley service between the South Waterfront and Lake Oswego.

The 2004 Regional Transportation Plan (RTP) identified the need for a Refinement plan for a high capacity transit option for the corridor, which included an analysis of several modal alternatives. Metro initiated the corridor Refinement in July 2005 and issued the *Lake Oswego to Portland Transit and Trail Alternatives Analysis Evaluation Summary Public Review Draft* in June 2007. On December 13, 2007, after reviewing and considering the alternatives analysis report, public comment and recommendations from the project's citizen advisory committee, project management group, steering committee and partner jurisdictions and agencies, the Metro Council approved Resolution No. 07-3887A, which adopted the *Lake Oswego to Portland Transit and Trail Alternatives Analysis – Alternatives to be Advanced into a Draft Environmental Impact Statement and Work Program Considerations*. (See Section 2.1 for additional detail on the process used to identify and narrow alternatives.)

1.7.3 Related Environmental Resources, Plans, Goals and Objectives

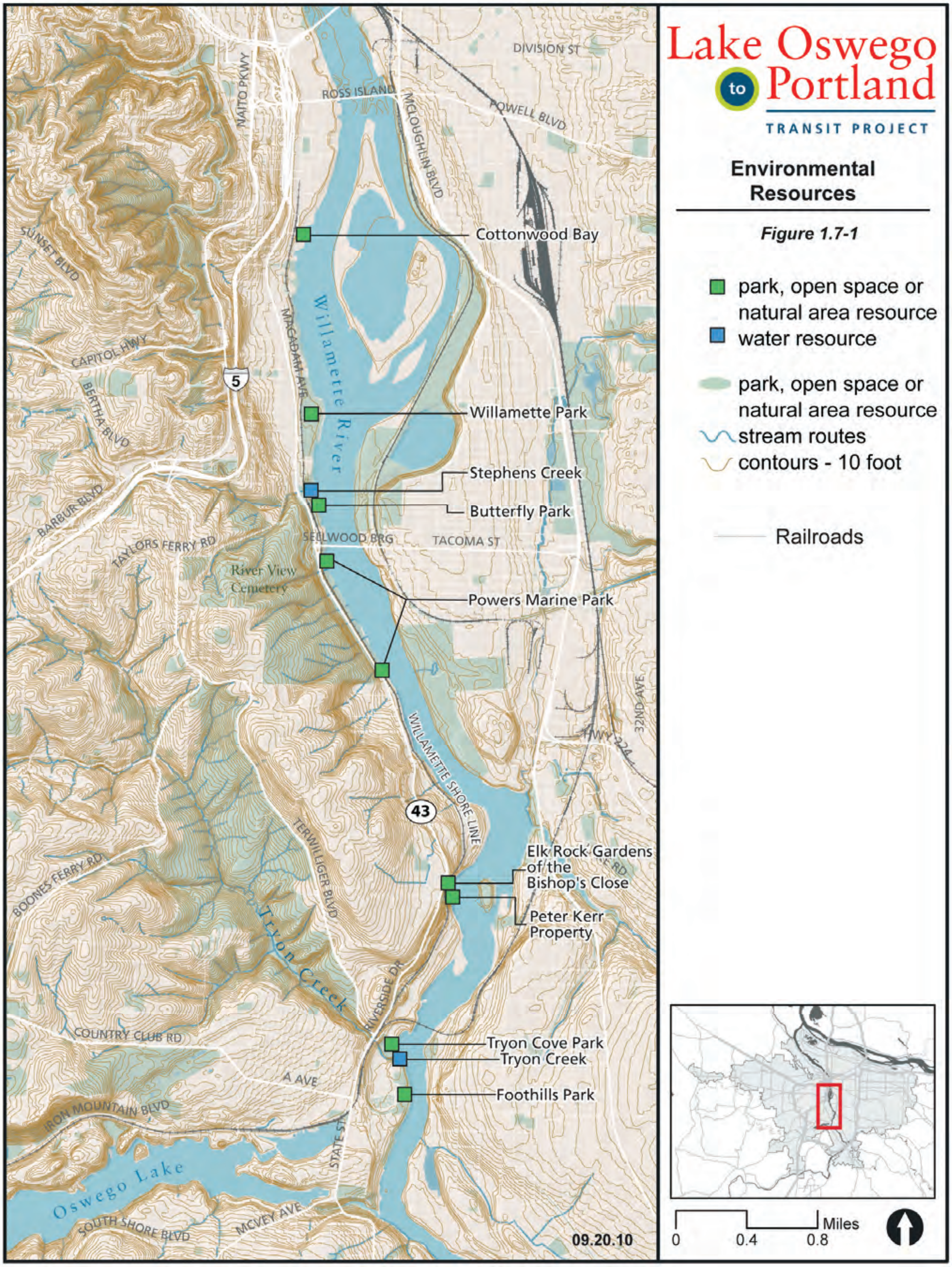
The Lake Oswego to Portland transit corridor contains a diverse variety of natural, open space, park and recreation resources, intermixed with the built urban and suburban environment. These resources create a set of constraints on the project, as well as important assets to the corridor that enhance its attractiveness in the region as a residential, commercial and employment area. Figure 1.7-1 illustrates the following waterways, natural areas, open spaces and parks (from north to south) in the corridor:

- **Willamette River.** Oregon's largest internal waterway, the Willamette River is approximately 187 miles long and it forms the eastern boundary of the Lake Oswego to Portland transit corridor. It floods periodically and is habitat for several federally-listed threatened and endangered species, including: Lower Columbia River coho salmon; Lower Columbia River steelhead; Upper Willamette River steelhead; Lower Columbia River chinook salmon; Upper Willamette River chinook salmon; bull trout; and green sturgeon. The river is the focus of the Willamette Greenway Plan.

- **Tryon, Stephens and Other Minor Creeks.** Tryon Creek is approximately seven miles long, with a watershed of approximately 4,200 acres, of which about 20 percent is protected as park, greenspace and natural area. Tryon Creek enters the Willamette River near the intersection of Highway 43 and Southwest Terwilliger Boulevard. Tryon Creek is the largest tributary watershed within the study area. The Oregon Department of Transportation (ODOT) completed the initial phase of a habitat enhancement project, which included modification the Highway 43 culvert to improve fish passage and enhancement work upstream and downstream of the culvert. The City of Portland is conducting a second phase that will enhance habitat from the confluence with the Willamette River to the work completed by ODOT in the initial phase. Stephens Creek enters the Willamette River near the intersection of Highway 43 and Southwest Taylors Ferry Road within the northern portion of Butterfly Park. Restoration of Stephens Creek is part of the City of Portland's off-channel habitat restoration efforts for coho and chinook salmon and lamprey. Both Tryon Creek and Stephens Creek are habitat for federally-listed threatened and endangered species, including: Lower Columbia River coho salmon; Lower Columbia River steelhead; and Lower Columbia River chinook salmon. Other creeks in the project corridor include Terwilliger Creek and 11 unnamed tributaries to the Willamette River (see Figure 3.8-1 in Chapter 3).

- **Cottonwood Bay Park.** Cottonwood Bay Park is approximately two-thirds of an acre and is located adjacent to the Willamette River and the Willamette River Greenway Trail at approximately Southwest Hamilton Street, which provides access to the park.

- **Willamette Park.** Willamette Park is a somewhat linear, multi-use facility of approximately 27 acres, located between the existing Shore Line right of way and the Willamette River. Entrances are via Southwest Nebraska and Nevada streets, Miles Place and Beaver Avenue. The park includes a boat ramp, sports fields, tennis courts, the Willamette Greenway Trail, picnic shelter, restrooms, natural areas, heritage oak trees and open space for passive recreation.



Lake Oswego to Portland
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Environmental Resources
Figure 1.7-1
park, open space or natural area resource
water resource
park, open space or natural area resource
stream routes
contours - 10 foot
Railroads
Cottonwood Bay
Willamette Park
Stephens Creek
Butterfly Park
Powers Marine Park
Elk Rock Gardens of the Bishop's Close
Peter Kerr Property
Tryon Cove Park
Tryon Creek
Foothills Park
Willamette River
Tryon Creek
Oswego Lake
River View Cemetery
DIVISION ST
ROSS ISLAND
POWELL BLVD
MCLOUGHLIN BLVD
NAITO PKWY
SUNSET BLVD
CAPITOL HWY
BERTHA BLVD
MACADAM AVE
BARBUR BLVD
TAYLORS FERRY RD
SELLWOOD BRG
TACOMA ST
WILLAMETTE SHORE LINE
32ND AVE
HWY 224
43
5
TERWILLIGER BLVD
BOONES FERRY RD
RIVERSIDE DR
COUNTRY CLUB RD
A AVE
IRON MOUNTAIN BLVD
STATE ST
SOUTH SHORE BLVD
MCVEY AVE
09.20.10
0
0.4
0.8
Miles

- **Butterfly Park.** Butterfly Park is a 1.07-acre linear park located between the existing Willamette Shore Line right of way and the Willamette River and between the Sellwood Bridge and Willamette Park. As its name indicates, it is habitat to butterflies and other riparian plants and animals. Access is via Willamette Park or off Highway 43.

- **Powers Marine Park.** Powers Marine Park is almost a mile long but at times less than 100 feet wide, covering approximately 13 acres between the existing Willamette Shore Line right of way and the Willamette River, immediately south of the Sellwood Bridge. The park is generally undeveloped and is accessed via Highway 43 across the Willamette Shore Line right of way. The park is the site of several salmon and steelhead restoration projects by the City of Portland.

- **Peter Kerr Property.** Peter Kerr property is approximately 3.3 acres, located between Highway 43 and the Willamette River in Dunthorpe. It is generally undeveloped and inaccessible to the public. The property is bisected by the Willamette Shore Line right of way, including a 1,400 foot long tunnel built through Elk Rock. The nearby Elk Rock Gardens of the Bishop's Close, owned by the Oregon Episcopal Diocese, is open to the public and was once a part of the original land owned by Peter Kerr before the property was donated to the City of Portland (1955) and the gardens donated to the diocese (1957).

- **Tryon Cove Park.** The 7.5-acre Tryon Cove Park, purchased by the City of Lake Oswego in 2002, is located at the mouth of Tryon Creek on the west bank of the Willamette River. The park provides an important connection between the Tryon Creek State Natural Area and Lake Oswego's Foothills Park.

- **Foothills Park.** The 9-acre Foothills Park, located immediately south of Tryon Cove Park, was purchased by the City of Lake Oswego in 2002 and opened to the public with a wide range of amenities (e.g., event space, pathways, river viewpoints, grass amphitheater, water play area and restrooms) in 2006.

There are numerous plans, goals and objectives in place within the state, region and corridor to ensure that governmental actions and projects are planned and implemented in a way that avoids or minimizes and mitigates impact of those actions and projects on the natural environment. These state, regional and local plans, goals and objectives provide a framework for the ongoing planning, design and evaluation of high capacity transit alternatives with in the corridor.

Following is a summary of the key related plans (see Section 3.1 for additional detail):

- **Willamette Greenway Plan.** The Willamette Greenway Plan was developed to protect, conserve, maintain and enhance scenic, natural, historic, economic and recreational qualities of lands along the Willamette River and meet Statewide Planning Goal 15. The plan also calls for a Greenway Trail along the Willamette River and the plan applies only within the City of Portland. It is divided into four specific concepts: a concept map, public access, setbacks and acquisition areas. In particular, the plan includes a 25-foot setback from the top of bank for all improvements, unless they are river dependent or river related.

- **Trail Plans.** There are several plans that address trails within the Lake Oswego to Portland corridor: Lake Oswego Trails and Pathways Master Plan, City of Portland Recreational Trails Strategy, Bicycle Facilities Strategy to reach Platinum Status in Southwest Portland; and

Southwest Urban Trails Plan. Several of these plans reference or include the Willamette Shore Line and Willamette Greenway trails.

- **Other Plans.** Other plans and regulations that include the need to address environmental resources in the corridor include the following: Metro Functional Plan – Title 3; City of Portland Environmental Zones; City of Lake Oswego Resource Protection and Resource Conservation Overlay Districts; City of Lake Oswego Comprehensive Plan Goals 5, 6 and 15; and City of Lake Oswego Tryon Creek at OR 43 Culvert Alternates Analysis.

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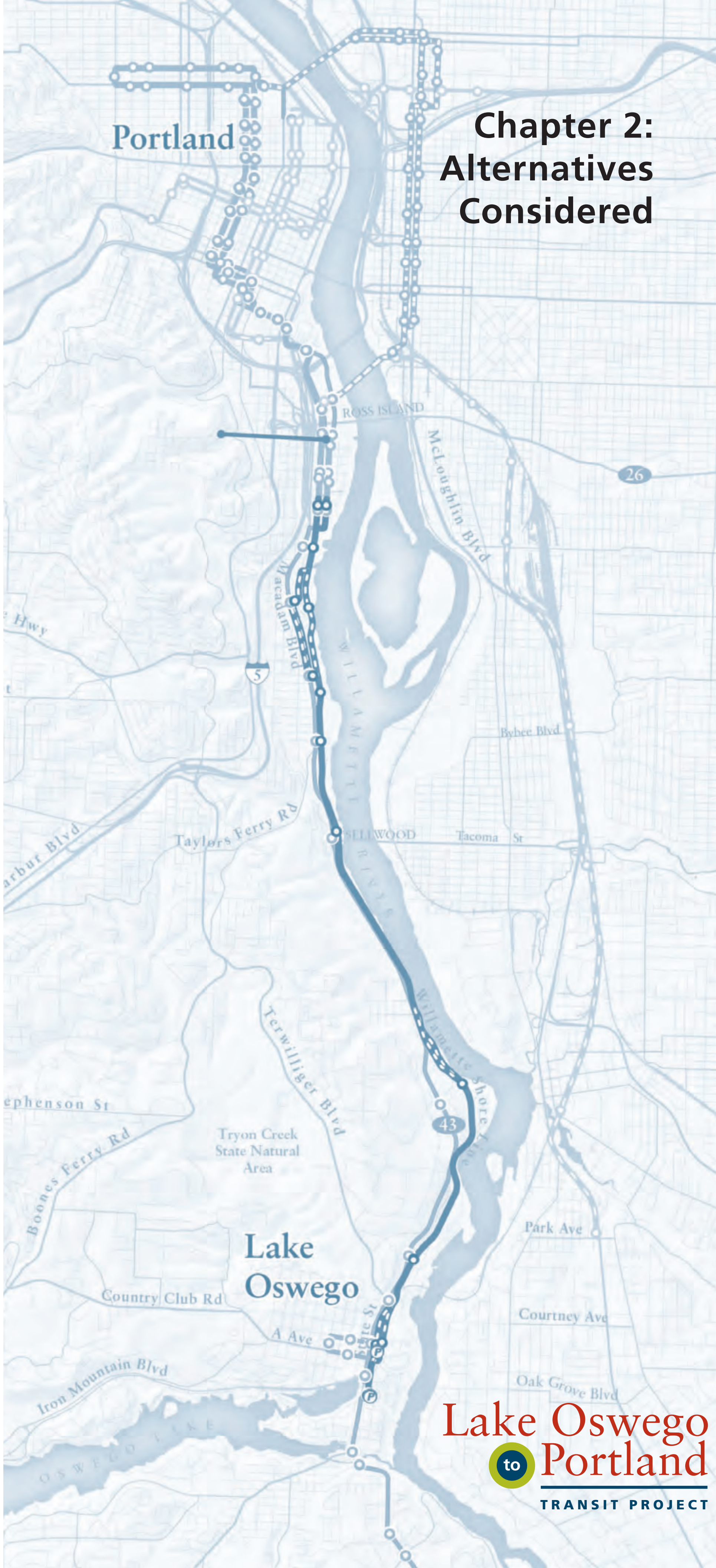
Chapter 2: Alternatives Considered



Lake Oswego to Portland
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2. ALTERNATIVES CONSIDERED

This chapter describes the alternatives considered for the Lake Oswego to Portland Transit Project Draft Environmental Impact Statement (DEIS). Section 2.1 summarizes the screening and selection process that resulted in the range of alternatives evaluated within this DEIS. Section 2.2 describes the roadway, bicycle and pedestrian and transit capital improvements and the transit operating characteristics of the alternatives. Sections 2.3 and 2.4 summarize the capital and operating and maintenance costs of the alternatives, respectively. A more detailed description of the alternatives may be found in the *Lake Oswego to Portland Transit Project Detailed Definition of Alternatives Report* (Metro/TriMet, January 2010). Detailed drawings of the streetcar alternative and design options can be found in the *Lake Oswego to Portland Transit Project: Streetcar Plan Set* (*Streetcar Plan Set*) (Metro/TriMet, November 2009). Detailed drawings of the Enhanced Bus alternative can be found in the *Lake Oswego to Portland Transit Project: Enhanced Bus Plan Set* (*Enhanced Bus Plan Set*, Metro/TriMet, December 2009). Appendix D of this DEIS contains a selection of cross sections and details from the *Streetcar Plan Set*. See Chapter 1 Purpose and Need for a description of the project's study area.

2.1 Screening and Selection Process and Alternatives and Options Previously Considered

This section first describes the process that Metro and TriMet used to develop, evaluate and screen alternatives and options within the Lake Oswego to Portland transit corridor. Second, this section documents the alternatives and options evaluated within each of the previous project phases and describes the rationale for selection of the current range of alternatives for further study in this DEIS.

2.1.1 Screening and Selection Process

This section describes the process that Metro and TriMet used to develop, evaluate and screen alternatives and options within the Lake Oswego to Portland transit corridor and why certain alternatives were not brought forward into the DEIS for evaluation. The alternatives fully evaluated within this DEIS resulted from the evaluation and screening processes, described below in Section 2.2. Those alternatives are: 1) No-Build Alternative, 2) Enhanced Bus Alternative, and 3) Streetcar Alternative, with several design options and construction phasing options.

Three distinct but inter-related steps of alternative development, evaluation and screening were taken by Metro and TriMet, leading to the current range of alternatives and options for the Lake Oswego to Portland Transit Project: 1) consortium formation and right of way purchase, 2) Alternatives Analysis, and 3) Scoping and Refinement Study.

A. Consortium Formation and Right of way Purchase. In 1988, the Willamette Shore Line rail right of way was purchased from the Southern Pacific Railroad for approximately $2 million by a consortium of local governments, which included Metro, the cities of Lake Oswego and Portland, Clackamas and Multnomah counties, the Oregon Department of Transportation (ODOT) and TriMet (title to the right of way is currently held by TriMet). Knowing that the Highway 43 corridor is and would remain very constrained, the purchase was intended to preserve the right of way for future transit use.

B. Alternatives Analysis. Metro's 2004 *Regional Transportation Plan* (RTP) identified the need for a refinement plan for a high capacity transit option for the corridor, which included an analysis of several modal alternatives. Metro initiated the alternatives analysis process in July 2005, which was supported by the *Lake Oswego to Portland Transit and Trail Alternatives Analysis Background*

Report (Metro: January 2006). Toward the conclusion of the study, Metro issued the *Lake Oswego to Portland Transit and Trail Alternatives Analysis Evaluation Summary Public Review Draft* (Metro: June 2007). The Lake Oswego to Portland Transit and Trail Project Steering Committee (Steering Committee) held a public hearing on July 16, 2007, to receive comment on the draft report. On December 13, 2007, after reviewing and considering the alternatives analysis report, public comment and recommendations from the Lake Oswego to Portland Transit and Trail Project Citizen Advisory Committee (LOPAC), the Lake Oswego to Portland Transit and Trail Project Management Group (PMG), the Steering Committee and partner jurisdictions and agencies, the Metro Council approved Resolution No. 07-3887A, which adopted the *Lake Oswego to Portland Transit and Trail Alternatives Analysis: Alternatives to be Advanced into a Draft Environmental Impact Statement and Work Program Considerations* (December 13, 2007). The resolution selected the No-Build, Enhanced Bus and Streetcar alternatives to advance into the project's DEIS for further study and it directed staff to conduct a refinement study to identify design options in the Johns Landing area and terminus options to advance into the project's DEIS.

C. Scoping and the Project Refinement Study. On September 12, 2007, in coordination with the Federal Transit Administration (FTA), Metro invited 19 agencies and jurisdictions to participate in a Scoping meeting for the Lake Oswego to Portland Transit Project. The meeting notification included an invitation to the agencies to comment on the proposed Purpose and Need Statement, range of alternatives and range of probable impacts. The letter of invitation included a copy of the proposed Purpose and Need Statement and a map illustrating the proposed alternatives. On April 16, 2008, FTA and Metro issued in the *Federal Register* notice of intent to publish an EIS for the Lake Oswego to Portland Transit Project. Metro, TriMet and FTA conducted a public Scoping meeting for the project on April 21, 2008 and public comment on Scoping concluded on July 18, 2008. A summary of the project's public Scoping process and comments received is included in the *Lake Oswego to Portland Transit Project Public Scoping Report* (Metro: August 2008). Additional Scoping review and comment opportunities were provided to the project's Participating Agencies in September and October 2009 as a part of the project's Section 6002 compliance process.

Metro initiated the Johns Landing Refinement Study in December 2008. The purpose of the study was to refine and potentially narrow the streetcar alignments and options through the Johns Landing neighborhood prior to the start of this DEIS. Additional streetcar alignments not previously studied were developed to potentially avoid or minimize impacts that could result from the proximity of the Willamette Shore Line right of way to residences in a portion of the Johns Landing neighborhood. Subsequently, the scope of the study was expanded to include the examination of the range of terminus options in Lake Oswego to advance into the DEIS. In March 2009, Metro and TriMet initiated the related Lake Oswego to Portland Trail Refinement Study, which had three main tasks: 1) a technical evaluation of trail alignment options, 2) stakeholder involvement, and 3) an action plan/next steps to move the trail forward including phasing and funding sources. In September 2009, the Steering Committee approved the strategy for future trail development.

In consultation with the FTA, and based on the results of the refinement study and comments received from agencies and the public during the Scoping and refinement phase, the Lake Oswego to Portland Transit Trail Project Steering Committee selected the range of alternatives and options selected to advance into this DEIS for further study. Those selected alternatives and options are described in Section 2.2. Detailed results of the Lake Oswego to Portland Refinement Study are documented in the *Lake Oswego to Portland Transit Project Refinement Project Study Report* (Metro, January 2010) and summarized below in Section 2.1.2.

2.1.2 Alternatives and Options Previously Considered

This section describes the alternatives and options that were developed, evaluated and screened in the project's previous phases: 1) Alternatives Analysis and 2) Scoping and the Alternative Refinement Study. Further, this section provides a summary of the rationale used to screen the alternatives for further study.

2.1.2.1 Alternatives/Options Considered: Alternatives Analysis

The project's Alternatives Analysis process developed a wide range of alternatives for evaluation and early screening, which included the No-Build Alternative, widening of Highway 43, reversible lanes on Highway 43, river transit (three options), bus rapid transit (three options), commuter rail, light rail, and streetcar (a wide range of alignment alternative and terminus alternatives and options).

Below describes the project's Purpose and Need Statement used in developing and screening alternatives and options for the alternatives analysis study phase.

The purpose of the Portland to Lake Oswego Transit Project is to develop a transit project that meets future travel demand and supports local and regional land use plans, which garners public acceptance and community support and will:

- Increase mobility and accessibility within the geographically-constrained Highway 43 corridor;
- Minimize adverse impacts such as increased traffic congestion and on-street parking displacement within corridor neighborhoods;
- Support and enhance the neighborhood character in an environmentally sensitive manner;
- Cost effectively increase corridor and system-wide transit ridership;
- Support transit oriented development in the Portland to Lake Oswego corridor where appropriate;
- Improve transit access to and connectivity among significant destinations and activity centers;
- Increase transportation choice in the corridor and access for persons with disabilities;
- Support community transportation, land use and development goals;
- Integrate effectively with other transportation modes; and
- Anticipate future needs and impacts and do not preclude future expansion opportunities.

Through a screening process that assessed the ability of the alternatives to meet the project's Purpose and Need Statement, the initial range of possible alternatives was narrowed. Appendix C of this DEIS provides a summary of the technical evaluation of the alternatives and options considered during the alternatives analysis phase.

The following alternatives were considered within the early screening step of the alternatives analysis:

- **Widening of Highway 43**. Based on previous ODOT studies, the project considered two variations of improvements that could be made to Highway 43, generally between the South Waterfront District and Lake Oswego: 1) widening to a four-lane cross section through the entire alignment and 2) the introduction of reversible lanes, which would provide two lanes in the northbound direction and one lane in the southbound direction during the morning peak period and two lanes in the southbound direction and one lane in the northbound direction during the morning peak period.

- **River Transit.** Based on Metro's evaluation of river transit in 2000 as a part of the South Corridor Transit Project, three variations of the River Transit Alternative were developed and evaluated: River 1: Portland to Lake Oswego via the Willamette River, River 2: Sellwood to Lake Oswego via the Willamette River and River 3: Portland to Oregon City via the Willamette River. Additional information on the River Transit Alternative was obtained through the *Willamette River Ferry Feasibility Study: City of Portland River Renaissance Initiative* (City of Portland, 2006).

- **Bus Rapid Transit .** Three bus rapid transit variations were developed and evaluated during the early screening: Bus 1: Portland to Lake Oswego via Highway 43, Bus 2: Portland to Lake Oswego via Terwilliger and Barbur boulevards, and Bus 3: Portland to Lake Oswego via Terwilliger/Boones Ferry/Taylor's Ferry. All of the bus rapid transit variations would provide faster and more reliable bus service through the use of transit priority treatments and would provide high-level transit amenities such as enhanced stations.

- **Rail Transit.** The rail transit mode examined three rail modes: 1) commuter rail, 2) light rail and 3) streetcar. In addition, it examined five potential rail alignments: Rail 1: Portland to Lake Oswego via the Willamette Shore Line right of way, Rail 2: Portland to Lake Oswego via Highway 43, Rail 3: Portland to Lake Oswego via the Willamette Shoreline right of way/Highway 43, Rail 4: Portland to Lake Oswego via Terwilliger and Barbur boulevards, and Rail 5: Portland to Lake Oswego via the Portland &Western Railroad Bridge to Milwaukie.

Based on consideration of the project's Purpose and Need Statement and objectives the project screened out the following alternatives:

- **Widening of Highway 43** was determined to be infeasible due to exceptionally high capital costs and adverse environmental impacts (e.g., property acquisition, visual) based on prior studies by the Oregon Department of Transportation (ODOT, April 1996, see Chapter 1 of this DEIS). Reversible lanes on Highway 43 were removed from further study because of the lack of peak directionality of travel demand in the corridor and safety concerns due to curvature and other geometric characteristics of the roadway. Therefore, this option would not meet key elements of the project's Purpose and Need Statement to enhance the neighborhood character in an environmentally sensitive manner, cost effectively increase transit ridership, support transit oriented development, and support community plans and development goals.

- **The River Transit Alternative** was not advanced further due to high operating cost, slow travel times, environmental impacts, poor access and limited ability to positively influence land use. As such, River Transit would not meet key elements of the project's Purpose and Need Statement to increase mobility and accessibility in the corridor, enhance the neighborhood character in an environmentally sensitive manner, cost effectively increase transit ridership, support transit oriented development, improve access to key destinations, support community plans and development goals, and integrate effectively with other transportation modes.

- **The Commuter Rail Alternative** was not advanced for further study due to the lack of a complete alignment that would connect all or most of the corridor's key activities centers and the relatively short distances between the corridor's targeted travel markets, thereby not meeting the following key elements of the Purpose and Need Statement to increase mobility and accessibility in the corridor, enhance the neighborhood character in an environmentally sensitive manner, cost effectively increase transit ridership, support transit oriented development, support community plans and development goals, and integrate effectively with other transportation modes.

- **The Light Rail Alternative** was not advanced for further study due to relatively high capital and operating costs and high level of impacts to adjacent properties compared to relatively low ridership for a light rail line. The four alignment options located on the west side of the Willamette River would not meet key elements of the project's Purpose and Need Statement to enhance the neighborhood character in an environmentally sensitive manner, cost effectively increase transit ridership, support community plans and development goals. The fifth alignment option that extends light rail from Milwaukie over the Portland &Western Railroad Bridge to Lake Oswego would not meet key elements of the Purpose and Need Statement including enhancing the neighborhood character in an environmentally sensitive manner, cost effectively increasing transit ridership, improving access to key destinations, and supporting community plans and development goals.

The following alternatives were selected for further study through the alternatives analysis phase: 1) No-Build Alternative, 2) Bus Rapid Transit Alternative, and 3) Streetcar Alternative. Following is a description of those alternatives as they were studied within the Alternatives Analysis (see the *Lake Oswego to Portland Transit and Trail Study Evaluation Summary Public Review Draft* for more information):

- **No-Build Alternative.** Similar to the project's current No-Build Alternative, described in Section 2.2.1.

- **Bus Rapid Transit Alternative.** This Bus Rapid Transit Alternative would generally operate frequent bus service with Line 35 on Highway 43 between downtown Portland and downtown Lake Oswego, generally in mixed-use traffic, with bus station spacing that would be longer than TriMet typically provides for fixed route bus service. Transit queue bypass lanes would be constructed at congested intersections where feasible. Signal priority could be implemented at signalized intersections to minimize delay. Stations would have a distinct look and provide shelters and pedestrian and bicycle circulation to and from the station. Vehicles would be low-floor, hybrid technology buses. The Bus 2 and Bus 3 alignments were removed from further study because they were outside of the corridor and would fundamentally not meet the project's Purpose and Need Statement.

- **Streetcar Alternative.** The Streetcar Alternative would extend the existing Portland Streetcar line, which currently operates between Northwest 23rd Avenue and Southwest Lowell Street, to downtown Lake Oswego. The six design options studied evaluated whether the Willamette Shore Line right of way would be used exclusively or whether it would be used in combination with Southwest Macadam Avenue. Under the Streetcar Alternative, Line 35 would continue to operate hourly between downtown Portland and downtown Lake Oswego only during weekday peak periods. The stations would be similar to the current streetcar stations located in Portland, including shelters, benches and lighting. The vehicles would be similar to the streetcars currently in operation. The Rail 4 and Rail 5 alignments were removed from further study because they were outside of the corridor and would fundamentally not meet the project's Purpose and Need Statement.

At the conclusion of the second phase of the Alternatives Analysis in December 2007, the Metro Council considered the results of the technical analysis (see Appendix C), public, committee and agency comment and the project's Purpose and Need Statement and concluded that the No-Build Alternative, an Enhanced Bus Alternative and a Streetcar Alternative should advance into the DEIS for further study, with the Enhanced Bus and Streetcar alternatives to be further refined before initiation of the DEIS. The Metro Council found that Streetcar alternatives should be advanced to the DEIS due to high ridership, reduced travel time, low operating cost and opportunities for transit-oriented development. The Bus Rapid Transit Alternative was removed from further consideration because of relatively high property impacts, high operating costs and poor reliability and, as such, would not meet key elements of the project's Purpose and Need Statement. The No-Build Alternative was advanced into the DEIS to satisfy National Environmental Policy Act (NEPA) requirements. Finally, the Enhanced Bus Alternative was advanced into the DEIS as a more practical bus-based alternative for this constrained corridor, compared to the Bus Rapid Transit Alternative, in that the Enhanced Bus Alternative would avoid the property impacts of the Bus Rapid Transit Alternative, while providing improved transit service in the corridor. The Metro Council also directed staff to refine streetcar alignment design options in the Johns Landing area and to select a preferred terminus location in Lake Oswego.

2.1.2.2 Streetcar Options Considered: Scoping/Project Refinement Study

This section describes the alignment and terminus options developed, evaluated and screened in 2009 as a part of the project's Scoping and Project Refinement Study phase, prior to preparation of this DEIS. This phase focused on refinements in two areas: 1) alignment options for the Johns Landing area and 2) terminus options in the Lake Oswego area. Maps illustrating the options evaluated and the resulting evaluation criteria and measures may be found in Appendix C of this DEIS. For additional detail, see the *Lake Oswego to Portland Transit Project Refinement Study Report* (Metro, January 2010).

In summary, the project's Purpose Statement during the refinement phase was to:

- Optimize the regional transit system;
- Be fiscally responsive and maximize regional resources;
- Maximize the economic development potential of the project;
- Be sensitive to the built and social environments; and
- Be sensitive to the natural environment.

The options, evaluation measures and results of the Johns Landing alignment refinement process and the Lake Oswego terminus refinement processes are summarized below.

A. Johns Landing Alignment Refinement. For the refinement of alignments within the Johns Landing area, the project used the following criteria: streetcar operations, streetcar performance, financial feasibility, traffic operations, accessibility and development potential, neighborhood sustainability, and adverse impacts to the natural environment. Measures for each of the criteria were developed and applied to each of the alignment options studied, which included:

- **Hybrid 1 – Macadam Avenue In Street** (Boundary Street to Carolina Street). With this option, the streetcar would continue south from South Waterfront until a transition to Southwest Landing Drive. Streetcar would operate in Landing Drive with traffic. From Landing Drive the streetcar would transition to Southwest Macadam Avenue via Southwest Boundary Street. The streetcar would operate in a shared traffic environment in Macadam Avenue between Boundary Street and Southwest Carolina Street. The streetcar would transition from Macadam Avenue to the Willamette Shore Line right of way at Carolina Street.

- **Hybrid 2: East Side Exclusive** (Boundary Street to Iowa Street). With this option, the streetcar alignment would continue south from South Waterfront until a transition from the Willamette Shore Line to Landing Drive. The streetcar would operate in Landing Drive with mixed traffic to Boundary Street. From Boundary Street, the streetcar would operate adjacent to Macadam Avenue (on the east side of Macadam Avenue) between Boundary and Southwest Iowa streets. The streetcar would transition from the east side alignment next to Macadam Avenue to the Willamette Shore Line at Iowa Street.

- **Hybrid 3: Macadam Avenue with New Northbound Lane** (Boundary Street to Carolina Street). With this option, the streetcar alignment would continue south from South Waterfront until a transition to Landing Drive. Streetcar would operate in Landing Drive with traffic. From Landing Drive, the streetcar would transition to Macadam Avenue via Boundary Street. The streetcar would operate in mixed traffic in the southbound direction on Macadam Avenue between Boundary and Carolina streets. In the northbound direction a new northbound lane would be added for streetcar and right turn only operations for automobiles. The streetcar would transition from Macadam Avenue to the Willamette Shore Line right of way at Carolina Street.

- **Willamette Shore Line**. With this option the streetcar alignment would continue south from the South Waterfront area generally within the existing Willamette Shore Line right of way.

- **Full Macadam In-Street** (Hamilton Street to Nevada Street)**.** With this option, the streetcar alignment would continue south from the South Waterfront area and utilize Bancroft Street or Southwest Hamilton Street to access Macadam Avenue. It would operate in mixed traffic on Macadam Avenue for approximately one and one quarter mile from Bancroft Street or Hamilton Street to Southwest Nevada Street. At Nevada Street the streetcar alignment would transition from Macadam Avenue to the Willamette Shore Line right of way.

B. Lake Oswego Terminus Option Refinement. For the refinement of terminus options in the Lake Oswego Area, the project used the following criteria: expansion potential and regional context, streetcar operations, streetcar performance, financial feasibility, traffic operations, accessibility and development potential, and neighborhood sustainability. Measures for each of the criteria were developed and applied to each of the three terminus options studied: 1) Safeway Terminus Option, 2) an Albertsons Terminus Option, and 3) Trolley Terminus Option.

On June 1, 2009, in consultation with FTA and based on the findings of the analysis (see Appendix C), public and agency comment and recommendations from the Lake Oswego to Portland Project Management Group, the Lake Oswego to Portland Transit Project Steering Committee selected the following options in the Johns Landing area to advance into the DEIS: Willamette Shore Line, Hybrid 1 – Macadam Avenue In-Street (Boundary Street to Carolina Street), and Hybrid 3: Macadam Avenue with New Northbound Lane (Boundary Street to Carolina Street). Following is a summary of the rationale for the removal of other alignment options from further study:

- The Full Macadam In-Street Alignment was eliminated from further study because it would have high operating costs, slower travel times and adverse affect on traffic operation and it would not be financially feasible. As such, it would not meet key elements of the project's Purpose and Need Statement to optimize the regional transit system, be fiscally responsive, maximize regional resources and minimize adverse impacts to the built and social environment.

- The Hybrid 2 – East Side Exclusive Alignment was eliminated from further study because, although it was similar to the Willamette Shore Line option, it would have more right of way acquisition, more parking and landscape displacements, greater costs, slower transit travel times and less potential for local match. Because it does not offer any significant advantage over other options that will be studied in the DEIS, this option does not need to advance into the DEIS for further study.

Further, the Steering Committee selected the Albertsons Terminus Option to advance into the DEIS for further study because it would allow for future extension of the line, be affordable, allow for redevelopment at the terminus, provide for multiple streetcar stations in the Foothills area, be consistent with local plans and policies, extend transit service into a new area of Lake Oswego, minimize adverse traffic impacts in downtown Lake Oswego, and distribute park-and-ride capacity over two locations. Following is a summary of the rational for the removal of other terminus options from further study:

- The Safeway Terminus Option was removed from further study because it would: limit future extension options for the line, have the longest travel times between the terminus station and downtown Portland, be the most expensive, bypass the Foothills area and the redevelopment opportunities there, and have significant adverse impacts on local traffic operations. Further, the streetcar alignment between the Willamette Shore Line right of way and the Safeway terminus may not be feasible due to its proximity to the existing United Pacific Railroad (UPRR) tracks, currently, UPRR generally requires a 50-foot offset between its active tracks and a new transit line. Therefore, the Safeway Terminus Option would not meet the project's Purpose and Need Statement in the areas of transit operations and performance, minimizing impacts to the built and social environment and being fiscally responsible.

- The Trolley Terminus Option was removed from further study because it would have the lowest streetcar ridership, have the least economic redevelopment potential and it would place all 400 spaces of park-and-ride lot capacity in one location, thereby concentrating associated impacts to traffic operations. Therefore the Trolley Terminus Options would not meet the project's Purpose and Need Statement to optimize the transit system, maximize economic development opportunities and be sensitive to the built and social environments.

2.2 Definition of Alternatives

This section summarizes the roadway and transit capital improvements and transit operating characteristics for the No-Build, Enhanced Bus and Streetcar Alternatives. Table 2.2-1 summarizes the transit capital improvements that would be associated with the alternatives and Table 2.2-2 summarizes the operating characteristics of the alternatives. A more detailed description of the alternatives may be found in the *Lake Oswego to Portland Transit Project Detailed Definition of Alternatives Report* (Metro/TriMet, January 2010). Detailed drawings of the streetcar alternatives can be found in the *Streetcar Plan Set*. As described in Section 2.1, other alternatives and options were evaluated and dismissed during prior phases of the project and they are not addressed within the remainder of this DEIS.

Table 2.2-1 Transit Capital Improvements for the No-Build, Enhanced Bus and Streetcar Alternatives (2035)

Capital Improvement	No-Build	Enhanced Bus	Streetcar[1]
New Streetcar Alignment Length[2]	N/A	N/A	5.9 to 6.0
One-Way Streetcar Track Miles			
Portland Streetcar System	15.7	15.7	26.2 to 27.0
Proposed Lake Oswego to Portland Project	0	0	10.5 to 11.3
Streetcar Stations			
Portland Streetcar System	69	69	79
Proposed Lake Oswego to Portland Project	0	0	10[3]
Streetcars (in service / spares / total)			
Portland Streetcar System	17 / 5 / 22	17 / 5 / 22	27 / 6 / 33
Proposed Lake Oswego to Portland Project	N/A	N/A	10 / 1 / 11
Streetcar Operations and Maintenance (O&M) Facilities			
Number of Facilities[4]	1	1	2
Maintenance Capacity (number of Streetcars)	36	36	36
Storage Capacity (number of Streetcars)	25	25	33
Line 35 Bus Stops (Lake Oswego to Bancroft St.)	26	13	0
Buses (in service / spares)			
TriMet Systemwide	607 / 712	619 / 725	601 / 704
Difference from No-Build Alternative	N/A	13	- 8
Transit Centers[5]	1	1	1
Park-and-Ride Facilities			
Joint Use Surface – Lots / Spaces	3 / 76	3 / 76	3 / 76
Surface – Lots / Spaces	0 / 0	0 / 0	1 / 100
Structured – Lots / Spaces	0 / 0	1 / 300	1 / 300

Source: TriMet – January 2010.
Note: LO = Lake Oswego; O&M = operating and maintenance.

1 The transit capital improvements of the Streetcar Alternative summarized in this table would not vary by design option, except when shown as a range and as noted for new streetcar alignment length and one-way track miles. The first number listed is under the Willamette Shore Line design option and the second number listed is under the Macadam design options (in the Johns Landing Segment).

2 Under the No-Build and Enhanced Bus alternatives, the Portland Streetcar System would include two streetcar lines: a) the existing Portland Streetcar Line, between NW 23rd Avenue and Lowell Street, and b) the Portland Streetcar Loop, which is currently under construction and that will be completed when the Milwaukie Light Rail and Streetcar Close the Loop project are constructed. The Streetcar Alternative would extend the existing Portland Streetcar line south, from Lowell Street to Lake Oswego. One-way track miles are calculated by multiplying the mileage of double-tracked sections and adding that to the mileage of single-track sections. Alignment length and one-way track miles are presented as a range, because they would vary by design option, as specified in Table 2.2-3. The number of streetcar stations, streetcars in service or as spares and the number and size of streetcar O&M facilities would not change by streetcar design option.

3 Two optional stations are also being considered for inclusion in the Streetcar Alternative (see Figure 2.2-3 and Figure 2.2-5): 1) the Pendleton Station under the Macadam In-Street and Macadam Additional Lane design options in the Johns Landing Segment and the E Avenue Station in the Lake Oswego Segment.

4 There is an existing streetcar operations and maintenance facility at NW 16th Avenue, between NW Marshall and NW Northrup streets; under the Streetcar Alternative, additional storage for eight vehicles would be provided at along the streetcar alignment under the Marquam Bridge. There would be no change in the number or size of bus O&M facilities under any of the alternatives or design options. Bus stops are those that would be served exclusively by Line 35 between Lake Oswego and SW Bancroft Street.

5 Under the No-Build and Enhanced Bus alternative, the Lake Oswego Transit Center would remain at its current location (on 4th Street, between A and B avenues); under the Streetcar Alternative, the transit center would be moved to be adjacent to the Lake Oswego Terminus Station.

2.2.1 No-Build Alternative

This section describes the No-Build Alternative, which serves as a reference point to gauge the benefits, costs and effects of the Enhanced Bus and Streetcar alternatives. In describing the No Build Alternative, this section focuses on the alternative's roadway, bicycle and pedestrian and transit capital improvements, and the alternative's transit operating characteristics. This description of the No-Build Alternative is based on conditions in 2035, the project's environmental forecast year. A description of existing conditions for the corridor's transportation system may be found in Section 4.2 of this DEIS.

Table 2.2-2 Streetcar and Bus Network Operating Characteristics of the No-Build, Enhanced Bus and Streetcar[1] Alternatives (2035)

Operating Characteristics by Vehicle Mode	No-Build	Enhanced Bus	Streetcar
Streetcar Network Operating Characteristics[1]			
Weekday Streetcar Miles Traveled			
Systemwide	2,180	2,180	3,200 or 3,230
Difference from No-Build Alternative	N/A	0	1,020 or 1,050
Weekday Streetcar Revenue Hours			
Systemwide	267	267	326 or 332
Difference from No-Build Alternative	N/A	0	59 or 65
Corridor Weekday Streetcar Place Miles[2]	N/A	N/A	89,000 or 91,320
Corridor Streetcar Round Trip Time[3]	N/A	N/A	37 or 44 minutes
Corridor Streetcar Headways[4]			
Lake Oswego to PSU	N/A	N/A	7.5 / 7.5 minutes
Bus Network Operating Characteristics			
Weekday Bus Miles Traveled			
Systemwide	76,560	77,560	75,520
Difference from No-Build Alternative	N/A	1,000	-1,040
Weekday Bus Revenue Hours			
Systemwide	5,300	5,400	5,210
Difference from No-Build Alternative	N/A	100	-90
Line 35 (bus) Weekday Place Miles[2]	37,000	57,840	0
Line 35 (bus) Headways[4]			
Lake Oswego to Downtown Portland	15 / 15 min.	6 / 15 min.	N/A
Oregon City to Lake Oswego	15 / 15 min.	15 / 15 min.	15 / 15 minutes

Note: N/A = not applicable; LO = Lake Oswego; O&M = operating and maintenance; PSU = Portland State University.

1 The operating characteristics of the Streetcar Alternative summarized in this table would not vary by design option, except when shown as a range and as noted for streetcar vehicle miles traveled, place miles and round trip time. The first number listed is under the Willamette Shore Line Design Option and the second number listed is under the Macadam design options (in the Johns Landing Segment).

2 Place miles are a measure of the passenger carrying capacities of the alternatives, similar to airline seat miles. Place miles equal transit vehicle capacity (seated and standing) of a vehicle type, multiplied by the number vehicle miles traveled for that vehicle type, summed across all vehicle types. The estimate of *bus place miles* under the No-Build Alternative is based on lines 35 and 36.

3 Round trip run time for the proposed streetcar line would include in-vehicle running time from SW Bancroft Street to the Lake Oswego Terminus Station and back to SW Bancroft Street; it does not include layover time at the terminus.

4 Headways are the average time between transit vehicles per hour within the given time period that would pass by a given point in the same direction, which is inversely related to frequency (the average number of vehicles per hour in the given time period that would pass by a given point in the same direction). Weekday peak is generally defined as 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m.; weekday off-peak is generally defined as 5:00 to 7:00 a.m., 9:00 a.m. to 4:00 p.m. and 6:00 p.m. to 1:00 a.m. There would be streetcar service every 12 minutes between SW Bancroft Street and the Pearl District (via PSU) under the No-Build and Enhanced Bus alternatives. The peak headways shown for the No-Build Alternative are the composite headways for lines 35 and 36.

Source: TriMet – January 2010.

2.2.1.1 Capital Improvements

Following is a brief description of the roadway, bicycle and pedestrian and transit (i.e., bus, light rail, excursion trolley, streetcar, operating and maintenance and park-and-ride lot) capital improvements that would occur under the No-Build Alternative. Table 2.2-1 provides a summary of the transit capital improvements associated with the No-Build Alternative and Figure 2.2-1 illustrates the location of those improvements.

- **Roadway Capital Improvements**. The No-Build Alternative includes the existing roadway network in the corridor, with the addition of roadway capital improvements that are listed in the financially-constrained road network of Metro's 2035 RTP. Following is a list of the roadway projects that would occur within the corridor by 2035:

    - *Moody/Bond Avenue Couplet* (create couplet with two lanes northbound on Bond Avenue and two lanes southbound on Moody Avenue);
    - *South Portal* (Phases I and II to extend the Moody / Bond avenues couplet to Hamilton Street and realign Southwest Hood Avenue to connect with Macadam Avenue at Hamilton Street);
    - *I-5 North Macadam* (construct improvements in the South Waterfront District to improve safety and access); and
    - *Macadam Intelligent Transportation Systems* – install system and devices in the Macadam Avenue corridor to improve traffic flow (see Appendix B of the *Lake Oswego to Portland Transit Project Detailed Definition of Alternatives Report* for a comprehensive project list).

- **Bicycle and Pedestrian Improvements**. The No-Build Alternative includes the existing bicycle and pedestrian network in the corridor, with the addition of bicycle and pedestrian capital improvements that are listed in the 2035 financially-constrained road network of Metro's 2008 RTP. Following is a list of the bicycle and pedestrian project's that would occur within the corridor by 2035:
    - *Lake Oswego to Portland Trail* (extension of a multiuse path between Lake Oswego and Portland);
    - *I-5 at Gibbs Pedestrian/Bicycle Overcrossing* (construct a bicycle and pedestrian bridge over I-5 in the vicinity of Southwest Gibbs Street); and
    - *Tryon Creek Bridge* (construct a new pedestrian/bicycle bridge near the mouth of Tryon Creek).

- **Bus Capital Improvements.** There are currently two primary bus capital facilities in the corridor: *Lake Oswego Transit Center* (on 4th Street, between A and B avenues), and *Portland Mall* (bus and light rail lanes and shelters on Northwest/Southwest 5th and 6th avenues between Northwest Glisan Street and Southwest Jackson Street). These bus facilities would remain as is under the No-Build Alternative (the financially-constrained transit project list of the 2035 RTP includes relocation of the Lake Oswego Transit Center to be adjacent to the Lake Oswego to Portland Streetcar alignment, which is also in the financially-constrained project list – neither would occur under the No-Build Alternative). No additional bus capital improvements are planned for the corridor under the No-Build Alternative by 2035.

- **Light Rail Capital Improvements.** Under the No-Build Alternative, TriMet's existing Yellow Line light rail service would continue to operate on the Portland Mall (with a station at Portland State University added), across the Steel Bridge and into North Portland. Yellow Line facilities and service would be extended north from the existing Expo Center Station, across the Columbia

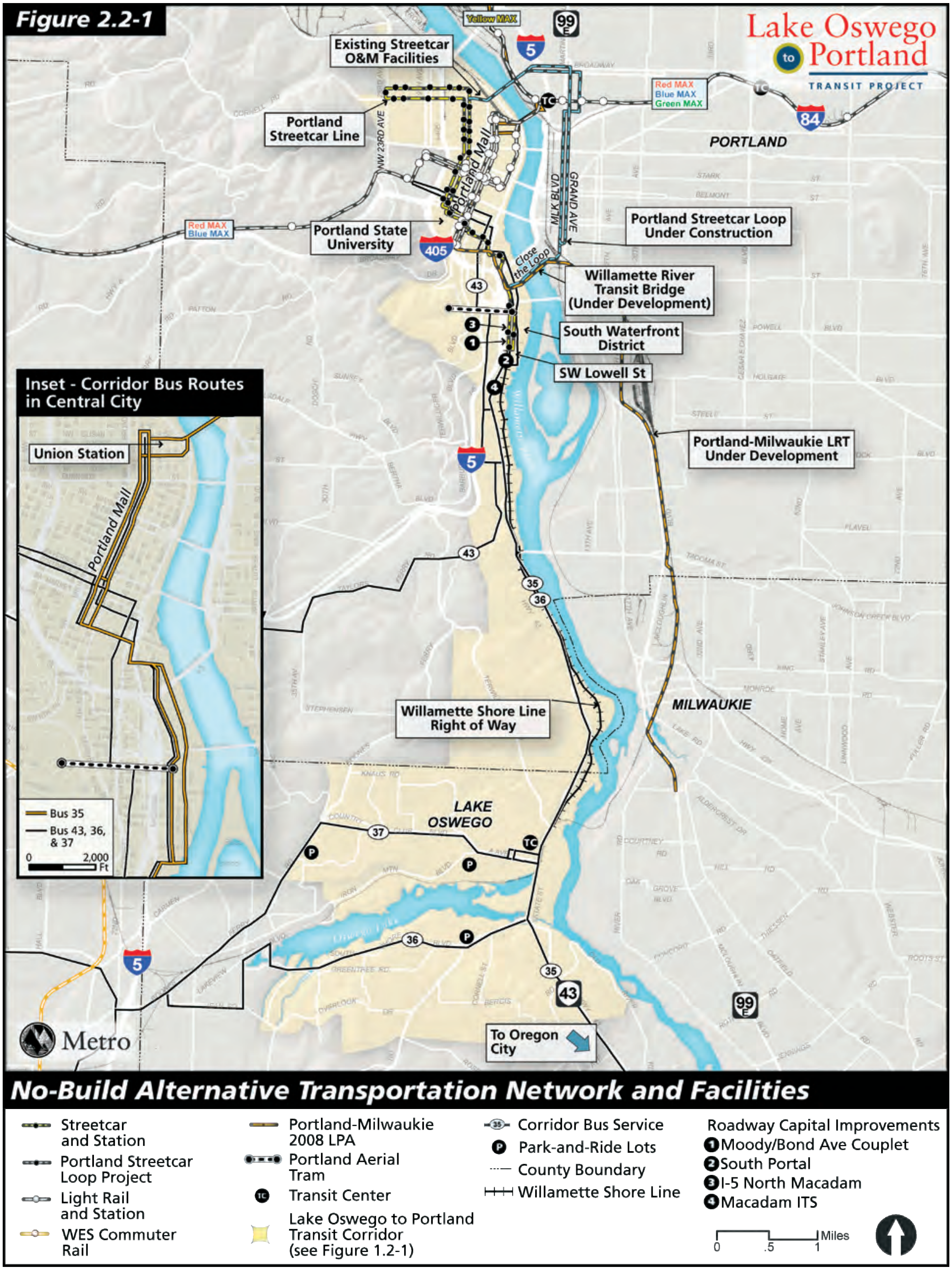

Figure 2.2-1

No-Build Alternative Transportation Network and Facilities

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River into Vancouver, Washington, and south from the Portland Mall, generally via SW Lincoln Street, across the Willamette River to Milwaukie, Oregon. In addition, downtown Portland would be served by the following TriMet light rail lines: Blue Line (Gresham to Hillsboro), Red Line (Beaverton to Portland International Airport, and Green Line (downtown Portland to Clackamas Town Center).

- **Interim Excursion Trolley Capital Facilities.** Under the No-Build Alternative there would be no changes to the existing interim excursion trolley capital facilities that are located within the corridor. The interim excursion trolley uses approximately six-miles of single-tracked Willamette Shore Line tracks and related facilities, including stations at SW Bancroft and Moody streets and at North State Street at A Avenue and a trolley barn at approximately State Street at A Avenue. The interim excursion trolley typically operates one vintage and/or other trolley vehicle propelled by externally attached diesel units. Since 1990, the right of way and related facilities have been used and maintained by the City of Lake Oswego, under agreement with the Willamette Shore Line Consortium, which owns all of the facilities, except for the vehicles. Excursion trolley vehicles are owned and operated by the Oregon Electric Railway Historical Society, under an agreement with the City of Lake Oswego.

- **Streetcar Improvements and Vehicles.** Under the No-Build Alternative, the existing Portland Streetcar Line would continue to operate between Northwest 23rd Avenue and Lowell Street. In addition, the No-Build Alternative includes the Eastside Streetcar Project (currently under construction), which would extend streetcar tracks and stations across the Broadway Bridge, serving Northeast and Southeast Portland on North and Northeast Broadway and Northeast and Southeast Martin Luther King Boulevard and Northeast and Southeast Grand Avenue to OMSI. With the Close the Loop Project, the Eastside Streetcar will be extended across the Willamette River, to complete the planned Streetcar Loop, via a new transit, bicycle and pedestrian bridge to be constructed under the Portland to Milwaukie Light Rail Project, connecting to the Streetcar line in the South Waterfront District. Under the No-Build Alternative in 2035, there would be 22 streetcars in the transit system (including spares), an increase of 11 compared to existing conditions.

- **Park-and-Ride Facilities.** Under the No-Build Alternative, the park-and-ride facilities in the corridor would be those that currently exist: shared-use 30-space park-and-ride lot at Christ Church (1060 SW Chandler Road), shared-use 34-space park-and-ride lot at Lake Oswego United Methodist Church (1855 South Shore Boulevard), and shared use 12-space park-and-ride lot at Hope Church (14790 SW Boones Ferry Road).

- **Operations and Maintenance Facilities.** Under the No-Build Alternative, there would be one operations and maintenance facility within the corridor, which would be the existing streetcar maintenance building and storage yard on Northwest 16th Avenue under I-405. With the Streetcar Loop and Close-the-Loop Projects, the storage yard could accommodate 25 streetcars and the maintenance facility would have the capacity to service 36 streetcars (an increase in capacity of 13 and 18 vehicles, compared to existing conditions, respectively).

2.2.1.2 Transit Operations

This section summarizes the transit operating characteristics that would occur under the No-Build Alternative, focusing on bus and streetcar operations (see Table 2.2-2). Figure 2.2-1 illustrates the transit network for the No-Build Alternative in the vicinity of the corridor.

- **Bus Operations.** Bus operations under the No-Build Alternative would be similar to TriMet's existing fixed-route bus network with the addition of improvements included in the 2035 RTP's 20-year financially-constrained transportation system (see Figure 2.2-1). Transit service improvements within the No-Build Alternative would be limited to those that could be funded using existing and readily-foreseeable revenue sources. Systemwide, those bus operations improvements would include increases in TriMet bus route frequency to avoid peak overloads and/or maintain schedule reliability, increases in run times to maintain schedule reliability, and incremental increases in TriMet systemwide bus service hours consistent with available revenue sources and consistent with the 2035 RTP's 20-year financially-constrained transit network, resulting in annual increases in service hours of approximately 0.5 percent per year. Specifically, the No-Build Alternative would include the operation of the TriMet bus route Line 35 between downtown Portland and Lake Oswego (continuing south to Oregon City). Under the No-Build Alternative, Line 35 and Line 36 would combine to operate every 15 minutes between downtown Portland and downtown Lake Oswego during the two-hour peak periods and Line 35 would operate every fifteen minutes during the off-peak (average weekdays in 2035). In addition, lines 36 and 37 would be extended west to King City and Sherwood, respectively, to increase connections to the Westside Express Service (WES) commuter rail line. Further, a new Line 41 would be added across the Sellwood Bridge, connecting the Beaverton and Clackamas Town Center transit centers.

- **Streetcar Operating Characteristics**. Under the No-Build Alternative, the City of Portland, through an operating agreement with the Portland Streetcar, Inc., would continue to operate the existing Portland Streetcar line. The Portland Streetcar line would operate between Northwest Portland and the South Waterfront District, via downtown Portland (see Figure 2.2-1). On average weekdays in 2035, the Streetcar line would operate every 12 minutes during the peak and off-peak periods. Further, the City of Portland would operate the Streetcar Loop Project, serving downtown Portland, the Pearl District, northeast and southeast Portland, OMSI and the South Waterfront District. Frequency on the line for an average weekday in 2035 would be every 12 minutes during the peak and off-peak periods.

2.2.2 Enhanced Bus Alternative

This section describes the roadway, bicycle and pedestrian and transit capital improvements and transit operating characteristic under the Enhanced Bus Alternative, generally compared to the No-Build Alternative. The intent of the Enhanced Bus Alternative is to address the project's Purpose and Need without a major transit capital investment.

2.2.2.1 Capital Improvements

This section summarizes the transit, bicycle and pedestrian and transit capital improvements that would occur under the Enhanced Bus Alternative, compared to the No-Build Alternative (see Table 2.2-1 and Figure 2.2-2).


Figure 2.2-2
Lake Oswego to Portland Transit Project
Existing Streetcar O&M Facilities
Portland Streetcar Line
Portland State University
Portland Mall
Portland Streetcar Loop Under Construction
Willamette River Transit Bridge (Under Development)
South Waterfront District
SW Lowell St
Portland-Milwaukie LRT Under Development
Willamette Shore Line Right of Way
Close the Loop
PORTLAND
MILWAUKIE
LAKE OSWEGO
To Oregon City
Red MAX
Blue MAX
Green MAX
Yellow MAX
Inset - Corridor Bus Routes in Central City
Union Station
Bus 35
Bus 43, 36, & 37
Metro
Enhanced Bus Alternative Transportation Network
Line 35
Streetcar and Station
Portland Streetcar Loop Project
Portland-Milwaukie 2008 LPA
Portland Aerial Tram
Light Rail and Station
WES Commuter Rail
Corridor Bus Service
Park-and-Ride Lots
County Boundary
Willamette Shore Line
Transit Center
Lake Oswego to Portland Transit Corridor (see Figure 1.2-1)
Miles
12/15/2009

- **Roadway Capital Improvements.** Except for the addition of a two-way roadway connection between the proposed 300-space park-and-ride lot and Foothills Road, there would be no change in roadway improvements under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Bicycle and Pedestrian Improvements.** There would be no change in bicycle and pedestrian improvements under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Bus Capital Improvements.** Under the Enhanced Bus Alternative, the 26 bus stops that would be served by Line 35 between downtown Lake Oswego and Lowell Street under the No-Build Alternative would be consolidated into 13 bus stops, which would continue to be served by Line 35 (the other 13 bus stops would be removed). The bus stops served by Line 35 between Lake Oswego and Oregon City would be unchanged under the Enhanced Bus Alternative, compared to the No-Build Alternative.
- **Light Rail Capital Improvements.** There would be no change in light rail capital improvements under the Enhanced Bus Alternative compared to the No-Build Alternative.

- **Interim Excursion Trolley Capital Improvements.** There would be no change in interim excursion trolley capital improvements under the Enhanced Bus Alternative from the No-Build Alternative.

- **Streetcar Improvements and Vehicles.** There would be no change in streetcar improvements and vehicles under the Enhanced Bus Alternative compared to the No-Build Alternative.

- **Park-and-Ride Facilities.** In addition to the park-and-ride facilities included under the No-Build Alternative, the Enhanced Bus Alternative would include a 300-space structured park-and-ride lot that would be located at Oswego Village Shopping Center on Highway 43 in downtown Lake Oswego (see Figure D-1 in Appendix D). The park-and-ride lot would be served by lines 35 and 36.

- **Operations and Maintenance Facilities.** There would be no changes to the region's operations and maintenance facilities under the Enhanced Bus Alternative, compared to the No-Build Alternative, except that the capacity of TriMet's bus operating and maintenance facilities at either the Center or Powell facility would be expanded to accommodate the additional 13 buses under the Enhanced Bus Alternative (see the *Detailed Definition of Alternatives Report* for additional information).

2.2.2.2 Transit Operations

This section summarizes the corridor's transit operations under the Enhanced Bus Alternative, focusing on bus and streetcar operations. Figure 2.2-2 illustrates the transit network for the Enhanced Bus Alternative in the vicinity of the corridor.

- **Bus Operations.** Except for changes to the routing, frequency and number of stops of Line 35 and the elimination of Line 36 service between downtown Portland and downtown Lake Oswego, bus operations under the Enhanced Bus Alternative would be identical to the bus operations under the No-Build Alternative. Under the Enhanced Bus Alternative, Line 35's routing between

Oregon City and Lake Oswego would remain unchanged relative to the No-Build Alternative. Further, between Lake Oswego and downtown Portland there would be two routing changes to Line 35, compared to the No-Build Alternative: 1) the bus would be rerouted to serve the new park-and-ride lot at the Oswego Village Shopping Center and 2) in downtown Portland, Line 35 would be rerouted to serve 10th and 11th avenues, generally between Southwest Market and Clay streets and Northwest Lovejoy Street and to Union Station to address the travel markets identified in Section 1.6 of this DEIS). In addition, Line 35 between Lake Oswego and downtown Portland would be more frequent during the weekday peak periods, changing from 15-minute frequencies (combined with Line 35) to six-minute frequencies, compared to the No-Build Alternative. Line 35 under the Enhanced Bus Alternative would have limited stops between Lake Oswego and Portland State University in order to improve travel times; the stops would serve areas similar to those that would be served by the new streetcar stations in the Streetcar Alternative. Average weekday bus vehicle miles and hours would increase by 1,000 miles and 100 hours, respectively, in 2035 under the Enhanced Bus Alternative, compared to the No-Build Alternative.

- **Streetcar Operating Characteristics.** Under the Enhanced Bus Alternative, there would be no change in streetcar operating characteristics, compared to the No-Build Alternative.

2.2.3 Streetcar Alternative

This section describes the roadway, bicycle and pedestrian and transit capital improvements and transit operating characteristic under the Streetcar Alternative, generally compared to the No-Build Alternative. The Streetcar Alternative has two phasing options that are described in Section 2.2.3.3.

2.2.3.1 Capital Improvements

This section summarizes the transit, bicycle and pedestrian and transit capital improvements that would occur under the Streetcar Alternative, generally compared to the No-Build Alternative (see Table 2.2-1 and Figure 2.2-3). This section provides a general description of the capital improvements that would occur under the Streetcar Alternative, independent of design option and it highlights the differences between design options within three of the corridor’s segments.

A. Summary Description

Following is a general description of the roadway, bicycle and pedestrian and transit improvements that would occur under the Streetcar Alternative. The next section provides a description of differences in capital improvements for design options that are under consideration in three of the project’s six segments – see Figure 2.2-3 for an illustration of the project segments and the design options under consideration.

- **Roadway Capital Improvements.** There would be no roadway improvements under the Streetcar Alternative in the following corridor segments: 1) Downtown Portland and 2) South Waterfront. The roadway capital improvements that would occur under the other corridor segments are described below for those segments. Changes to traffic controls at signalized and non-signalized intersections would occur throughout the corridor to accommodate the safe and efficient operation of the streetcar and local traffic. The *Detailed Definition of Alternatives Report* and the *Streetcar Plan Set* provide additional details on changes to traffic operations at intersections under the Streetcar Alternative.

Figure 2.2-3
Lake Oswego to Portland Transit Project
Existing Streetcar O&M Facilities
Portland Streetcar Line
Portland State University
Portland Mall
Red MAX Blue MAX
Red MAX Blue MAX Green MAX
Yellow MAX
PORTLAND
Portland Streetcar Loop Under Construction
Close the Loop
Willamette River Transit Bridge (Under Development)
South Waterfront District
SW Lowell St
Portland-Milwaukie LRT Under Development
Inset - Corridor Bus Routes in Central City
Union Station
Bus 35 & 43
0 2,000 Ft
Willamette Shore Line Right of Way
MILWAUKIE
LAKE OSWEGO
To Oregon City
Metro
Streetcar Alternative Transportation Network
Streetcar Alternative Extension
Streetcar Alternative Optional Stations
Line 35
Streetcar and Station
Portland Streetcar Loop Project
Portland-Milwaukie 2008 LPA
Portland Aerial Tram
Light Rail and Station
WES Commuter Rail
Corridor Bus Service
Park-and-Ride Lots
County Boundary
Willamette Shore Line
Transit Center
Lake Oswego to Portland Transit Corridor (see Figure 1.2-1)
0 .5 1 Miles

12/15/2009

- **Bicycle and Pedestrian Improvements.** There would be no change in bicycle and pedestrian improvements under the Streetcar Alternative, compared to the No-Build Alternative, except as noted in the following segment-by-segment description.

- **Bus Capital Improvements.** Under the Streetcar Alternative, 26 bus stops that would be served by Line 35 on Highway 43 between downtown Lake Oswego and the Sellwood Bridge and on Macadam Boulevard north of Southwest Corbett Street under the No-Build Alternative would be removed, because Line 35 service would be replaced by streetcar service. The bus stops served by Line 35 between Lake Oswego and Oregon City would be unchanged under the Streetcar Alternative, compared to the No-Build Alternative. In addition under the Streetcar Alternative, the Lake Oswego Transit Center would be relocated to be adjacent to the Lake Oswego Terminus Station, from its existing location on 4th Street, between A and B avenues. The changes to the bus capital improvements under the Streetcar Alternative would not vary by any of the design options under consideration.

- **Light Rail Capital Improvements.** There would be no change in light rail capital improvements under the Streetcar Alternative, compared to the No-Build Alternative.

- **Interim Excursion Trolley Capital Improvements.** Under the Streetcar Alternative, there would no longer be an operating and maintenance agreement between the City of Lake Oswego and the Willamette Shore Line Consortium that would allow for the operations of the interim excursion trolley between Lowell Street and Lake Oswego. Further, the Oregon Electric Railway Historical Society would no longer operate a trolley on the Willamette Shore Line alignment under agreement with the City of Lake Oswego, as they currently do and as they would under the No-Build and Enhanced Bus alternatives.

- **Streetcar Improvements and Vehicles.** The Streetcar Alternative would extend streetcar tracks and stations south from the existing Portland Streetcar line that operates between 23rd Avenue and Lowell Street. Compared to existing conditions and the No-Build Alternative, the Streetcar Alternative would add approximately 5.9 to 6.0 of new streetcar alignment, including tracks and catenary (overhead electrical wiring and support), and ten new streetcar stations between Lowell Street and Lake Oswego (with two additional optional stations under consideration). There would be 10.5 to 11.3 miles of new one-way track miles in the corridor (miles of double-tracked alignment times two, plus miles of single-tracked alignment). Except when crossing over waterways, roadways or freight rail lines or through an existing tunnel, the new streetcar line would generally be at the same grade as existing surface streets. Of the approximately six miles of new streetcar tracks, 5.3 miles would be double-tracked (i.e., two one-way tracks) and 0.7 miles would be single-tracked (i.e., inbound and outbound streetcars would operate on the same tracks) (see Figure 2.2-4 for a schematic illustration of the location of single and double-track segments). The new streetcar stations would be of a design similar to the existing streetcar stations in downtown Portland and the Pearl District. The streetcar design options under consideration within three of the project's six segments would lead to relatively minor changes in the alignment length and one-way miles of new streetcar track (see Table 2.2-3), but the design options would not affect the number of new streetcar stations (some station locations would change within a segment dependent upon the design option, as described in the next section). Compared to the No-Build Alternative, the Streetcar Alternative would require 11 additional streetcars to meet demand in 2035. The next section provides a segment-by-segment description of the proposed streetcar alignment under the Streetcar Alternative, which would vary by design option within three of those six segments.

- **Park-and-Ride Facilities.** In addition to the park-and-ride facilities included under the No-Build Alternative, the Streetcar Alternative would include a 100-space surface park-and-ride lot served by the proposed streetcar line at the B Avenue Station and a 300-space structured park-and-ride lot that would be served by the proposed streetcar line at the Lake Oswego Terminus Station. The size and location of these park-and-ride lots would not vary by any of the design options under consideration.

- **Operations and Maintenance Facilities.** With the Streetcar Alternative, a new storage facility that would accommodate eight streetcars would be located adjacent to the streetcar alignment under the Marquam Bridge. The size and location of the streetcar operating and maintenance facilities would not vary by any of the design options under consideration.

Table 2.2-3 Corridor Streetcar Alignment Length and One-Way Track Miles by Design Option[1]

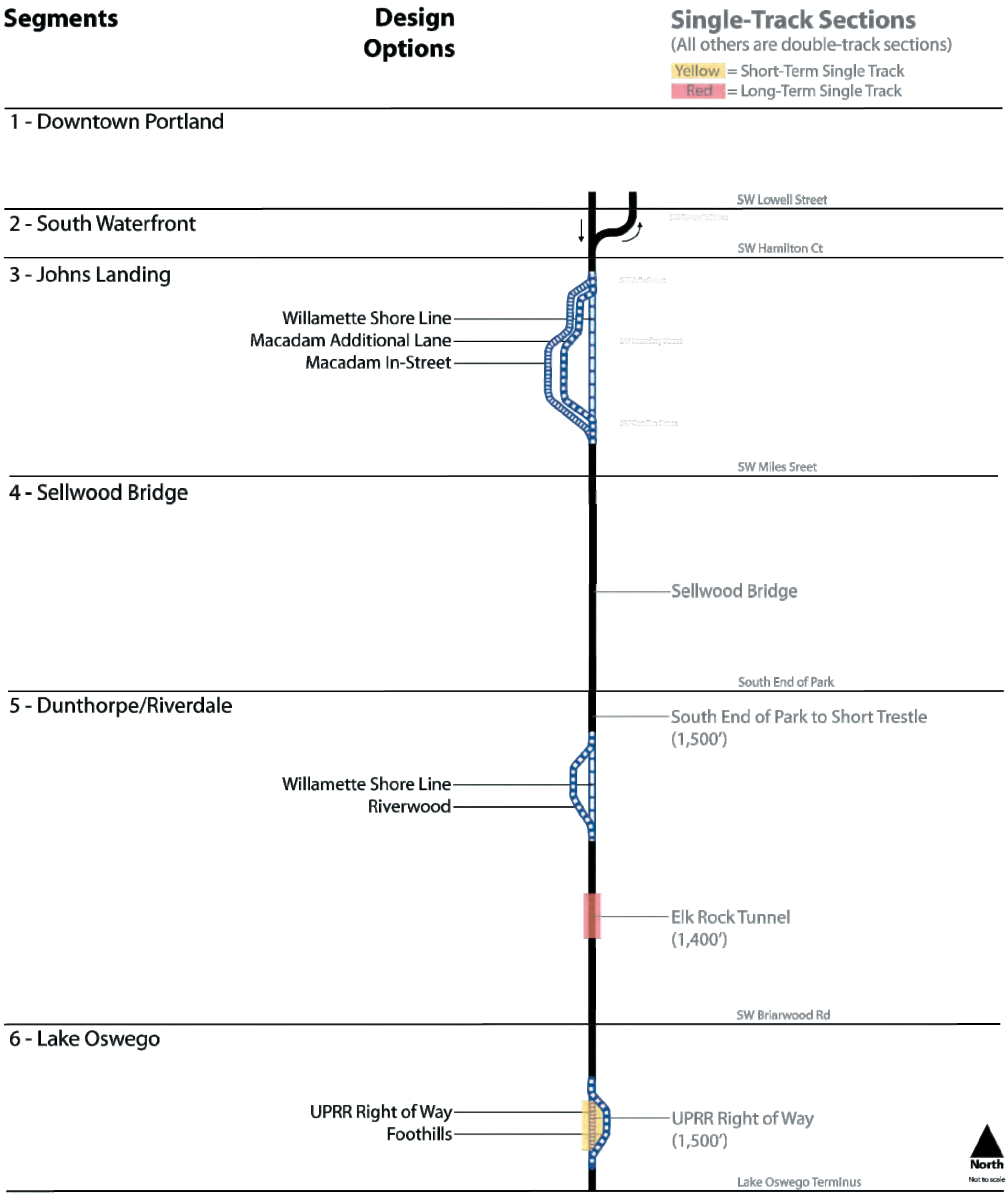
Segment	Design Option	New Streetcar Alignment Length	One-Way Track Miles
1 – Downtown Portland	None	less than 0.1	less than 0.1
2 – South Waterfront[2]	None	0.4	0.8
3 – Johns Landing	Willamette Shore Line	1.2	2.4
	Macadam In-Street	1.3	2.6
	Macadam Additional Lane	1.3	2.6
4 – Sellwood Bridge[2]	None	1.4	2.7
5 – Dunthorpe/Riverdale	Willamette Shore Line	2.0	3.3
	Riverwood	2.0	3.4
6 – Lake Oswego	UPRR ROW	0.9	1.5
	Foothills	0.9	1.8
Total		5.9 to 6.0	10.7 to 11.3

Source: TriMet – January 2010.

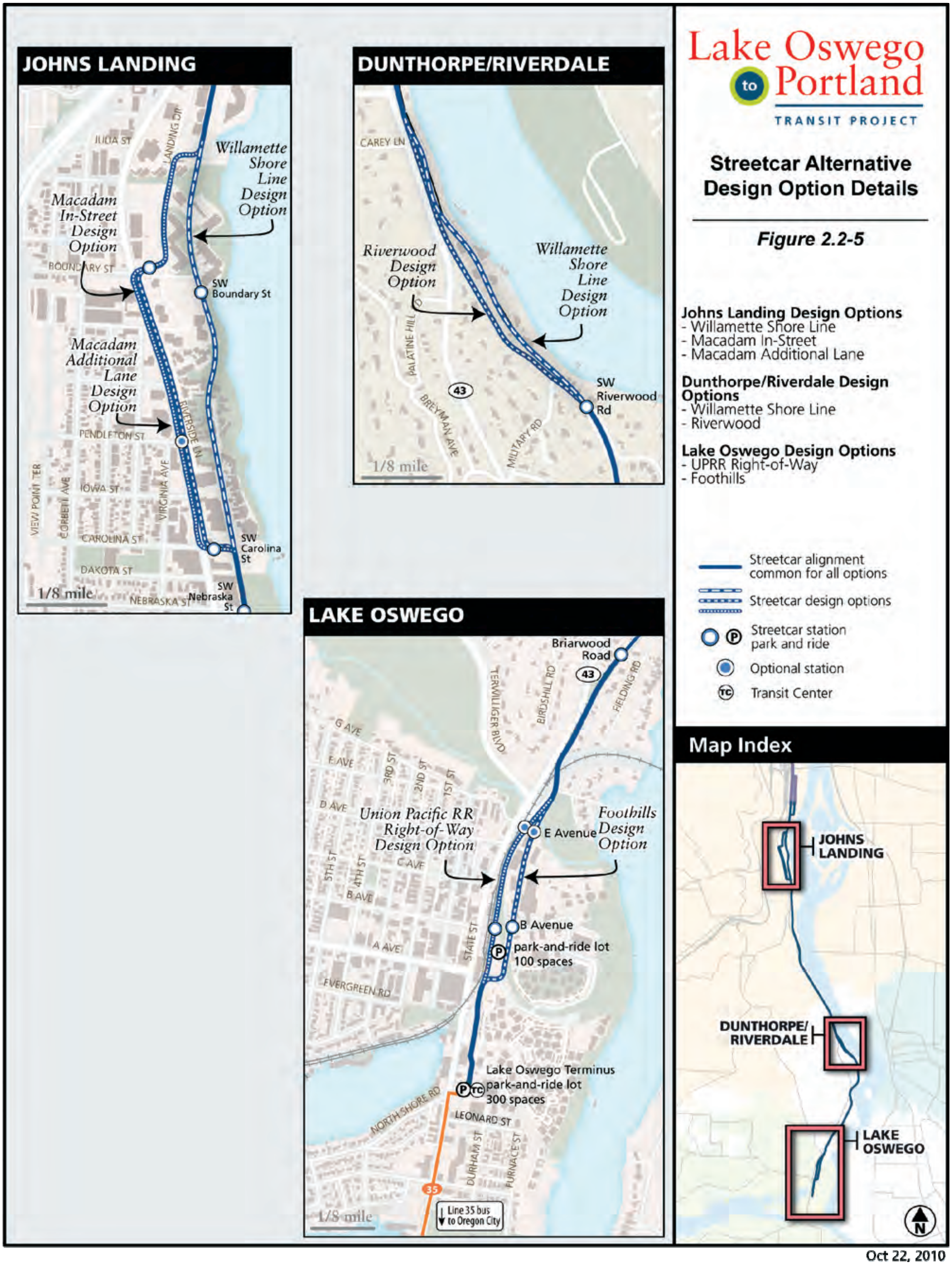
[1] The sum of the miles of alignment and one-way track miles per segment equal the total streetcar alignment and one-way track miles in Table 2.2-1: the shortest design option for each segment was used to calculate the shortest route-mile length for the full streetcar line and the longest design option for each segment was used to calculate the longest route-mile length for the full streetcar line. The Streetcar Alternative would extend the existing Portland Streetcar line south, from Lowell Street to Lake Oswego. The new alignment length is the length of the new streetcar alignment in miles from Lowell to the Lake Oswego terminus station. One-way track miles are calculated by multiplying the mileage of double-tracked sections and adding that to the mileage of single-track sections.

B. Segment-by-Segment Description and Design Option Differences

This section provides a description of the Streetcar Alternative by segment, generally working north to south from downtown Portland to Lake Oswego. For the purposes of description and analysis, the Lake Oswego to Portland corridor has been divided into six segments for the Streetcar Alternative – those segments and design options within three of the segments are illustrated schematically in Figure 2.2-4. Figure 2.2-4 also illustrates where the streetcar alignment would be double and single tracked. Figure 2.2-3 illustrates the proposed roadway improvements, streetcar alignment, stations and park-and-ride lots that would occur in the corridor under the Streetcar Alternative. Construction phasing options for the Streetcar Alternative, which could affect the South Waterfront and the Sellwood Bridge segments, are described within Section 2.2.3.3. Figure 2.2-5 provides more detailed illustrations of the streetcar design options currently under study. For additional detail see the *Detail Definition of Alternatives Report* and the *Streetcar Plan Set*. A sample of details and cross sections



Schematic of Streetcar Alternative Segments, Alignments and Design Options ***Figure 2.2-4***



Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative Design Option Details
Figure 2.2-5
Johns Landing Design Options
- Willamette Shore Line
- Macadam In-Street
- Macadam Additional Lane
Dunthorpe/Riverdale Design Options
- Willamette Shore Line
- Riverwood
Lake Oswego Design Options
- UPRR Right-of-Way
- Foothills
Streetcar alignment common for all options
Streetcar design options
Streetcar station park and ride
Optional station
Transit Center
Map Index
JOHNS LANDING
DUNTHORPE/RIVERDALE
LAKE OSWEGO
JOHNS LANDING
Willamette Shore Line Design Option
Macadam In-Street Design Option
Macadam Additional Lane Design Option
SW Boundary St
SW Carolina St
SW Nebraska St
1/8 mile
DUNTHORPE/RIVERDALE
Riverwood Design Option
Willamette Shore Line Design Option
SW Riverwood Rd
1/8 mile
LAKE OSWEGO
Briarwood Road
Union Pacific RR Right-of-Way Design Option
Foothills Design Option
E Avenue
B Avenue
park-and-ride lot 100 spaces
Lake Oswego Terminus park-and-ride lot 300 spaces
Line 35 bus to Oregon City
1/8 mile
Oct 22, 2010

from the *Streetcar Plan Set* is provided in Appendix D. In addition, Section 3.4.3 provides visual simulations of select locations, comparing existing conditions to improvements that would be made under the Streetcar Alternative.

1. **Downtown Portland Segment.** There would be no roadway or bicycle and pedestrian improvements within the Downtown Portland Segment under the Streetcar Alternative, compared to the No-Build Alternative. Under the Streetcar Alternative, a connection would be added between westbound streetcar tracks on Market Street to southbound tracks on 10th Avenue, which would allow inbound streetcars from Lake Oswego to turn back toward Lake Oswego, providing increased operational flexibility. There are no streetcar alignment design options within this segment and there would be no new streetcar stations within this segment.

2. **South Waterfront Segment.** The South Waterfront Segment extends from Lowell Street to Hamilton Court. Streetcar tracks would be extended south of their existing southern terminus at Lowell Street, within the right of way of the planned Moody/Bond couplet extension (which is included in Metro's current financially constrained 2035 RTP project list – see Section 2.2.1), to Hamilton Street. There would be two new streetcar stations within this segment (Bancroft and Hamilton stations).

3. **Johns Landing Segment.** The Johns Landing Segment extends between Hamilton Court to Southwest Miles Street. This segment includes three design options: Willamette Shore Line, Macadam In-Street and Macadam Additional Lane. Under all options, the streetcar alignment would extend south from Hamilton to near Southwest Julia Street, generally within the existing Willamette Short Line right of way. The three design options would include two new streetcar stations at varying locations, described below. To the south, all three options would share a common alignment between Carolina and Miles streets, generally via the existing Willamette Shore Line right of way and they would share one common station at Nevada. Following is a description of how the design options would differ:
   a. ***The Willamette Shore Line Design Option*** would continue the extension of streetcar tracks south within the existing Willamette Shore Line right of way from Julia Street to Carolina Street (extending to Miles Street) (see Figure 3.4-2, in Chapter 3). There would be three new streetcar stations (Boundary, Nebraska and Nevada stations).
   b. ***The Macadam In-Street Design Option*** would locate the new streetcar tracks generally within the existing outside lanes of SW Macadam Avenue, approximately between Boundary and Carolina streets (see Figures 3.4-4 and 3.4-5, in Chapter 3). Between approximately Julia and Boundary streets, the streetcar alignment would be within the right of way of Landing Drive, which would be converted from a private to a public street. There would be three new streetcar stations (Boundary, Carolina and Nevada stations) – an optional station at Pendleton Street is also under consideration.
   c. ***The Macadam Additional Lane Design Option*** would be similar to the Macadam In-Street design option, except that the new northbound streetcar tracks would be located within a new traffic lane just east of the existing general purpose lanes – streetcars would share the new lane with right-turning vehicles (see figures 3.4-4 and 3.4-6, in Chapter 3). Between at approximately Julia and Boundary streets, the streetcar alignment would be within the right of way of Landing Drive, which would be converted from a private to a public street. There would be three new streetcar stations (Boundary, Carolina and Nevada stations) – an optional station at Pendleton Street is also under consideration.

Under the Willamette Shore Line design option, the Willamette Shoreline right of way would not be available as a possible alignment for the Lake Oswego to Portland Trail, which would also occur under the two Macadam Design Options, except between Boundary and Carolina streets.

4. **Sellwood Bridge Segment**. The Sellwood Bridge Segment extends from Miles Street to the southern end of Powers Marine Park. Generally, the streetcar alignment would be located in the Willamette Shore Line right of way, except for the area between Stephens Creek and approximately 1,200 feet south of the Sellwood Bridge. In this area, the streetcar alignment would be constructed in conjunction with the planned west interchange improvements with the Sellwood Bridge (the streetcar would be located slightly east of the existing Willamette Shore Line right of way). The design and construction of the streetcar alignment under this design option would be coordinated with the design and construction of the new interchange for the Sellwood Bridge. There would be one new streetcar station within this segment (Sellwood Bridge Station).

5. **Dunthorpe/Riverdale Segment.** The Dunthorpe/Riverdale Segment extends between the southern end of Powers Marine Park and Southwest Briarwood Road. There are two design options in this segment: Willamette Shore Line design option and Riverwood In-Street design option. Both options would share a common alignment within the Willamette Shore Line right of way, generally north of where Riverwood Road intersects with Highway 43 and generally south of the intersection of Southwest Military Road and Riverwood Road. There would be one new streetcar station within this segment, generally common to both design options (Riverwood Station). Following is a description of how the design options would differ:

  a. ***The Willamette Shore Line Design Option*** would generally locate the new streetcar alignment in the existing Willamette Shore Line right of way between the intersections of Riverwood Road and Highway 43 and Riverwood Road and Military Road.
  b. ***The Riverwood Design Option*** would locate the new streetcar alignment generally adjacent to Highway 43, south of Riverwood Road, and within the right of way of Riverwood Road, generally between where it intersects with Highway 43 (that intersection would be closed) and where it intersects Military Road). Except for the closure of the Highway 43 and Riverwood Road intersection, Riverwood Road would remain open to traffic with joint operations with streetcars.

6. **Lake Oswego Segment.** The Lake Oswego Segment extends between Briarwood Road and the Lake Oswego Terminus Station. There are two design options within this segment: the UPRR ROW design option and the Foothills design option. Both options would generally be the same in two sections: 1) the new streetcar line alignment would extend south from SW Briarwood Road to where the alignment would cross under the existing UPRR tracks, and 2) the new streetcar alignment would be located within a new roadway that would extend south from A Avenue to the alignment's terminus near the intersection of North State Street and North Shore Boulevard. Both options would provide for a new bicycle and pedestrian connection under the existing UPRR tracks. There would be two stations within this segment, one that would be common to the two design options (Lake Oswego Terminus Station) – an optional station at E Avenue is also under consideration. This segment would include two park-and-rides, both of which would be generally common to the two design options. Following is a description of how the design options would differ:

  a. ***The UPRR ROW Design Option*** would extend the streetcar alignment south, generally in the UPRR right of way, from its under crossing of the existing UPRR tracks to A Avenue. The B Avenue Station would be located on the west side of the 100-space surface park-and-ride lot.

b. ***The Foothills Design Option*** would extend the streetcar alignment south from its under crossing of the UPRR tracks to A Avenue generally within the right of way of a new general purpose roadway (Foothills Road), which would be built as part of the Streetcar Alternative.

2.2.3.2 Transit Operations

This section describes transit operations under the Streetcar Alternative, generally compared to the No-Build Alternative (see Table 2.2-2). Figure 2.2-3 provides an illustration of the transit lines in the vicinity of the corridor under the Streetcar Alternative. Finance-related phasing options, which could affect transit operations of the Streetcar Alternative in interim years before 2035, are described in Section 2.2.3.3 and assessed in Section 3.17.

The Streetcar Alternative would extend the existing Portland Streetcar line from its current southern terminus at Lowell Street to the Lake Oswego Terminus Station in downtown Lake Oswego, expanding the streetcar length from 4 miles to 9.9 to 10 miles (depending on design option). The total round trip running time of the streetcar line between 23rd Avenue and downtown Lake Oswego (10 miles) in 2035 would be 105 or 112 minutes, excluding layover (based on the Willamette Shore Line and Macadam design options in the Johns Landing Segment, respectively). In comparison, under the No-Build Alternative the round trip running time for the streetcar line between 23rd Avenue and Lowell Street (4 miles) would be 68 minutes. The extension of streetcar by 6 miles will increase streetcar operating costs.

However, as the streetcar would replace bus service, there are corresponding reductions of bus operating costs. With the extension of streetcar service to Lake Oswego, Line 35 service between Lake Oswego and downtown Portland would be eliminated. The remainder of Line 35 between Oregon City and Lake Oswego would be combined with Line 78, in effect to create a new route between Oregon City and Beaverton. The new bus route and other TriMet transit routes serving downtown Lake Oswego would be rerouted to serve the relocated Lake Oswego Transit Center, which would be adjacent to Lake Oswego Terminus Station.

During average weekday peak periods in 2035, streetcars would operate every 12 minutes between 23rd Avenue and the Lake Oswego Terminus Station. In addition, there would be two streetcars per hour that would operate between Portland State University (PSU) and the Lake Oswego Terminus Station, reflecting greater demand during the peak periods south of PSU, compared to demand north of PSU. The result would be average 7.5-minute streetcar frequencies between PSU and the Lake Oswego Terminus Station during peak periods. During off-peak periods, streetcars on the Portland Streetcar Line would on average operate every 15 minutes between 23rd Avenue and the Lake Oswego Terminus Station. During weekday peak and off-peak periods in 2035, frequencies on all other transit lines (including the Streetcar Loop Line) would remain unchanged with the Streetcar Alternative, compared to the No-Build Alternative. Average weekday streetcar vehicle miles and hours would increase by 1,020 or 1,050 miles and 59 or 65 hours, respectively, in 2035 under the Streetcar Alternative (for the Willamette Shore Line and Macadam design options, respectively), compared to the No-Build Alternative.

2.2.3.3 Construction Phasing Options

This section summarizes Streetcar Alternative construction phasing options currently under consideration – neither the No-Build Alternative nor the Enhanced Bus Alternative include construction phasing options. Currently, there are two types of construction phasing options or scenarios under consideration: 1) finance-related and 2) external project related. The Streetcar Alternative evaluated under this DEIS is as Full-Project Construction. Should the Streetcar Alternative with phasing be selected as the Locally Preferred Alternative, during preliminary engineering (PE) additional analysis of environmental impacts resulting from the interim project alignment (as opposed to Full-Project Construction) will be conducted and additional opportunity for public review and comment may be required.

A. Finance-Related Phasing Options

Following is a description of the two finance-related phasing options currently under consideration. The finance related phasing options are illustrated in Figure 2.2-6.

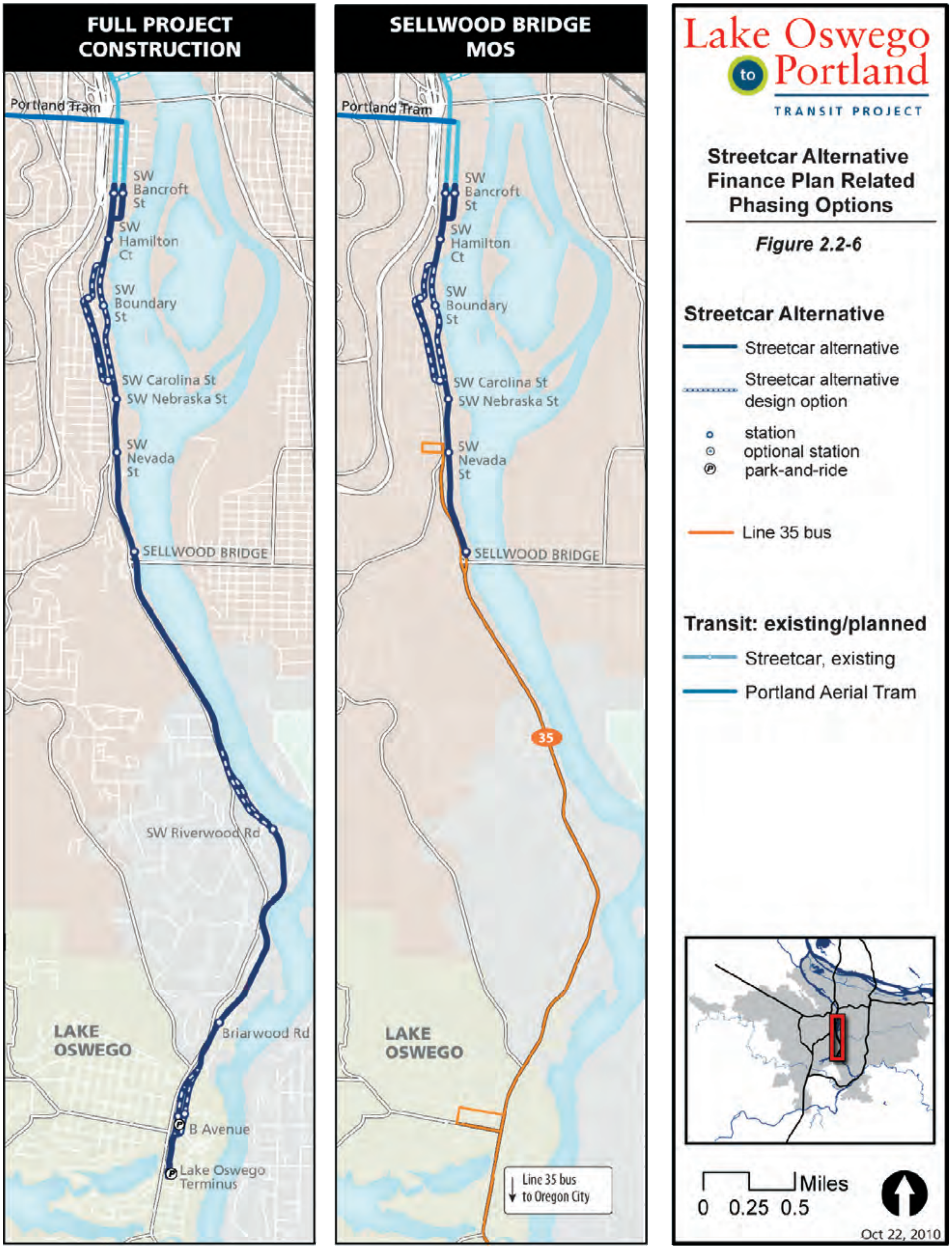
- **Full-Project Construction.** Under the first construction phasing option, the project would be constructed and opened in its entirety as described within Section 2.2.2.

- **Sellwood Bridge Minimum Operable Segment (MOS).** Under the Sellwood Bridge MOS phasing option, the Streetcar Alternative would be initially constructed between SW Lowell Street and the Sellwood Bridge, with a second construction phase between the Sellwood Bridge and the Lake Oswego Terminus Station occurring prior to 2035. Figure 2.2-6 illustrates the alignment and station configuration at what would be the interim southern terminus of the project. Under this construction phasing option, there would be no additional park-and-ride facilities in the corridor, compared to existing conditions. Under this phasing option, Line 35 would operate between Oregon City and the Nevada Street Station; frequencies would be adjusted to meet demand. Service and bus stops served exclusively by Line 35 would be deleted between the Nevada Station and downtown Portland.

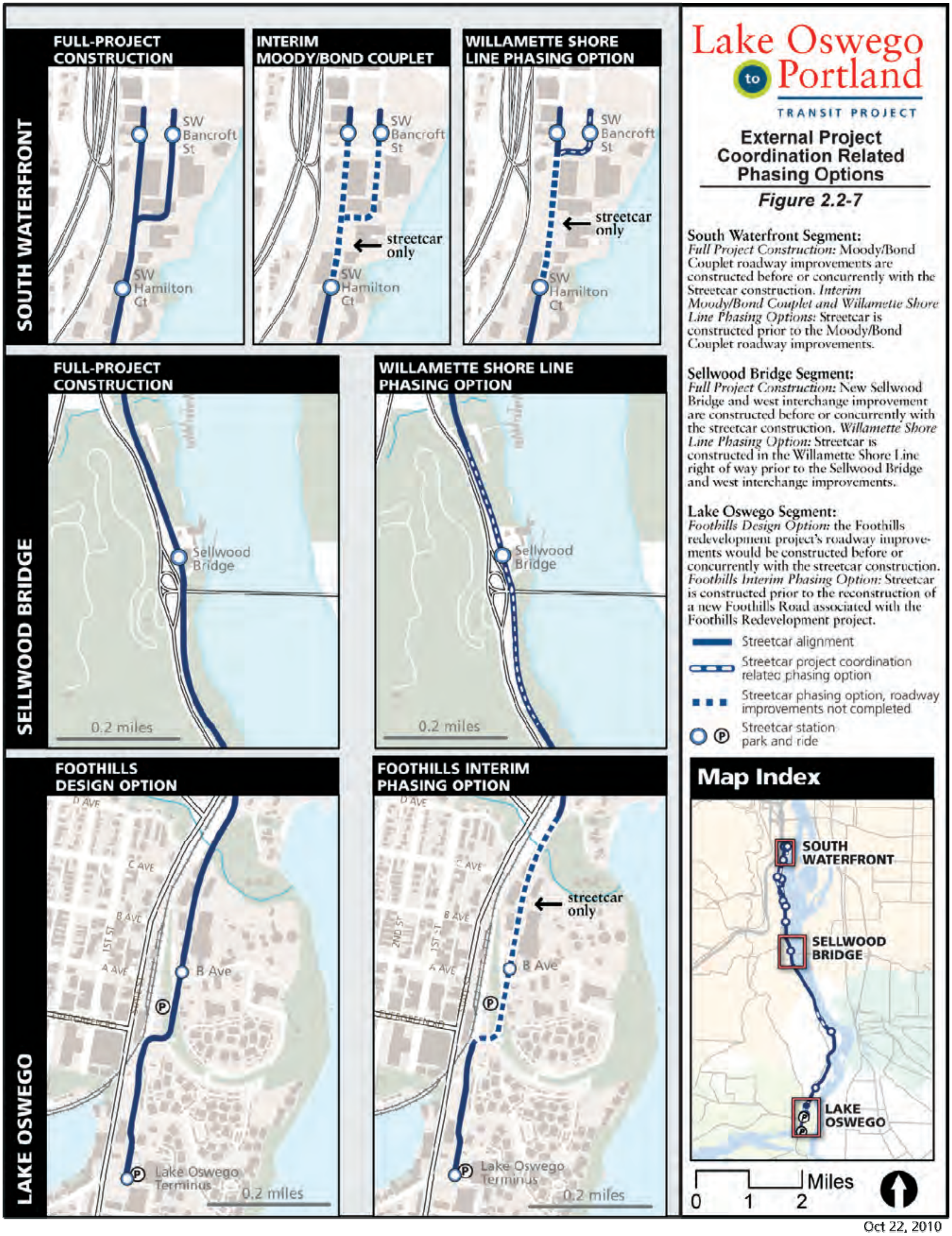
B. External Project Coordination Related Phasing Options

Following is a description of phasing options related to the coordination of the Streetcar Alternative, if it is selected as the LPA, and other external projects. These external project coordination related phasing options represent interim steps in the construction process that would be taken to implement the Streetcar Alternative, as defined in Section 2.2.3. The external project coordination related phasing options are illustrated in Figure 2.2-7.

- **South Waterfront Segment Phasing Options.** If the planned and programmed South Portal roadway improvements are not in place or would not be constructed concurrently with the Streetcar Alternative, there would be two options for proceeding with construction of the streetcar alignment in the segment: 1) a different streetcar alignment using the Willamette Shore Line right of way would be initially constructed within the South Waterfront Segment, as illustrated in Figure 2.2-7; or 2) the streetcar alignment and its required infrastructure improvements would be constructed consistent with the alignment under the Full-Project Construction phasing option (see Figure 2.2-7), but other non-project roadway improvements would be constructed at a later date by others. If the Willamette Shore Line right of way were to be used, then, when the South Portal roadway improvements were made, the streetcar alignment would be reconstructed consistent



FULL PROJECT CONSTRUCTION
SELLWOOD BRIDGE MOS
Portland Tram
SW Bancroft St
SW Hamilton Ct
SW Boundary St
SW Carolina St
SW Nebraska St
SW Nevada St
SELLWOOD BRIDGE
SW Riverwood Rd
Briarwood Rd
LAKE OSWEGO
B Avenue
Lake Oswego Terminus
35
Line 35 bus to Oregon City
Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative Finance Plan Related Phasing Options
Figure 2.2-6
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
station
optional station
park-and-ride
Line 35 bus
Transit: existing/planned
Streetcar, existing
Portland Aerial Tram
Miles
0 0.25 0.5
Oct 22, 2010



Lake Oswego to Portland
TRANSIT PROJECT
External Project Coordination Related Phasing Options
Figure 2.2-7
South Waterfront Segment:
Full Project Construction: Moody/Bond Couplet roadway improvements are constructed before or concurrently with the Streetcar construction. Interim Moody/Bond Couplet and Willamette Shore Line Phasing Options: Streetcar is constructed prior to the Moody/Bond Couplet roadway improvements.
Sellwood Bridge Segment:
Full Project Construction: New Sellwood Bridge and west interchange improvement are constructed before or concurrently with the streetcar construction. Willamette Shore Line Phasing Option: Streetcar is constructed in the Willamette Shore Line right of way prior to the Sellwood Bridge and west interchange improvements.
Lake Oswego Segment:
Foothills Design Option: the Foothills redevelopment project's roadway improvements would be constructed before or concurrently with the streetcar construction. Foothills Interim Phasing Option: Streetcar is constructed prior to the reconstruction of a new Foothills Road associated with the Foothills Redevelopment project.
Streetcar alignment
Streetcar project coordination related phasing option
Streetcar phasing option, roadway improvements not completed
Streetcar station
park and ride
Map Index
SOUTH WATERFRONT
SELLWOOD BRIDGE
LAKE OSWEGO
0 1 2 Miles
SOUTH WATERFRONT
FULL-PROJECT CONSTRUCTION
INTERIM MOODY/BOND COUPLET
WILLAMETTE SHORE LINE PHASING OPTION
SW Bancroft St
SW Hamilton Ct
streetcar only
SELLWOOD BRIDGE
FULL-PROJECT CONSTRUCTION
WILLAMETTE SHORE LINE PHASING OPTION
Sellwood Bridge
0.2 miles
LAKE OSWEGO
FOOTHILLS DESIGN OPTION
FOOTHILLS INTERIM PHASING OPTION
D AVE
C AVE
B AVE
A AVE
1ST ST
2ND ST
B Ave
Lake Oswego Terminus
0.2 miles
Oct 22, 2010

with the alignment described in Section 2.2.2 (i.e., generally within the right of way of the new Bond / Moody couplet, between Bancroft Street and Bond Avenue). The transit operating characteristics of the Streetcar Alternative would not be affected by this phasing option. See Section 3.17.2.1 for additional detail.

- **Sellwood Bridge Segment Phasing Options.** The Sellwood Bridge Segment includes two design options for the Streetcar Alternative that reflect two potential phasing options or scenarios for construction of the project in relationship to construction of a proposed new interchange that is planned to occur with the Sellwood Bridge replacement project (see Figure 2.2-7). If the new interchange is constructed prior to or concurrently with the Streetcar Alternative, the initial and long-term streetcar alignment would be based on the New Interchange design option. If the proposed interchange is constructed after the Streetcar Alternative, then the initial streetcar alignment to be constructed would be based on the Willamette Shore Line design option. Subsequently, when the proposed interchange is constructed, the Sellwood Bridge replacement project would relocate the streetcar alignment to the New Interchange design option. Therefore, the long-term streetcar alignment would be the New Interchange design option and the Willamette Shore Line design option would only be implemented as an interim alignment. Therefore, the two design options in this segment do not constitute a choice of alignments – instead they represent two construction phasing scenarios, dependent upon how external conditions transpire. See Section 3.17.2.2 for additional detail.

- **The Foothills Design Option.** The Foothills design option of the Streetcar Alternative is based on roadway improvements that would occur under the City of Lake Oswego's Foothills redevelopment project. If those roadway improvements are not constructed prior to or concurrently with construction of the streetcar alignment, then the Lake Oswego to Portland Transit Project would construct the streetcar alignment and required infrastructure improvements using the same alignment (see Figure 2.2-7) and the roadway improvements would be added at a later date by others (see Section 3.17.2.3 for additional detail).

None of the external project related phasing options would change the capital improvements or operating characteristics that would be in place by 2035 under the Streetcar Alternative as described in Section 2.2.2. The environmental implications of the phasing options are discussed in Section 3.17.

2.3 Capital Costs

This section summarizes the project's current year capital costing methodology and results. The current year capital cost estimates (2010 dollars) included in this section do not account for inflation that would occur between now and when the project would actually be constructed or financing costs. See Chapter 4 for a description of the project's finance plan, which includes year of expenditure cost estimates, which account for inflation and financing costs. The cost estimates for the Enhanced Bus Alternative and Streetcar Alternative and related design options are based upon conceptual engineering plan and profile sheets (see the *Enhanced Bus Plan Set* and *Streetcar Plan Set*) and on the project's finance plan as reflected in Chapter 5 – Financial Analysis. Each plan sheet is composed of many different elements that would contribute to project capital costs. Nine different cost categories were used by cost estimators, five of which are fixed-facility costs that were applied to the plan sheets. The remaining four cost categories are systemwide in nature, which span several plan sheets or are not specific to plan sheets (e.g., vehicles).

As shown in Table 2.3-1, the Enhanced Bus Alternative would result in capital costs of $37.8 million (2010 dollars), a majority of which would be due to the proposed park-and-ride lot in downtown Lake Oswego and the purchase of 13 additional buses. Tables 2.3-2 and 2.3-3 break down the total current year capital costs of the Enhanced Bus and Streetcar alternatives by segment (excluding systemwide costs and unallocated contingency).

Table 2.3-1 summarizes the capital costs of the Streetcar Alternative, which includes ranges (i.e., low and high), reflecting the cost variations of the various design options under consideration. As shown, the capital cost of the Streetcar Alternative would range from $288.9 to $347.4 million. Table 2.3-3 breaks down the total current year capital costs of the Streetcar Alternative by segment (excluding systemwide costs and unallocated contingency). Where there are Streetcar Alternative design options within a segment, Table 2.3-3 provides the cost of the segment under each design option. In the Johns Landing Segment, the Willamette Shore Line design option of the Streetcar Alternative would cost $19.0 million, while the Macadam In-Street and Macadam Additional Lane design options would cost $27.9 and $32.7 million. The higher costs associated with the two Macadam design options reflect the longer alignment, more costly facility improvements (e.g., the additional lane on Macadam with the Macadam Additional Lane design option) and additional right of way purchases. There would be relatively small differences in capital costs between the Streetcar Alternative's design options in Sellwood Bridge and Dunthorpe/Riverdale segments (approximately 1 percent). In the Lake Oswego Segment, the UPRR Right of Way design option would cost $48.6 million to construct, compared to $69.9 million for the Foothills design option, which generally reflects the greater amount of roadway improvements and right of way purchases that would be required under the Foothills design option.

Table 2.3-1 Line Item[1] and Total[2] Capital Costs of the Enhanced Bus and Streetcar Alternatives[3] (2010 dollars, in millions)

Cost Category[1]	Enhanced Bus	Streetcar[3] Low Cost[6]	Streetcar[3] High Cost[6]
Guideway and Track Elements	$0.0	$48.7	$53.2
Stations/Transit Stops	$9.9	$14.4	$14.8
Support Facilities[4]	$3.5	$6.0	$6.0
Sitework	$2.1	$36.8	$41.7
Systems	$0.1	$19.0	$21.5
Right of Way	$2.2	$76.4	$107.7
Vehicles[4]	$9.6	$48.4	$48.4
Professional Services	$8.6	$29.0	$41.2
Unallocated Contingencies[5]	$1.8	$10.2	$12.9
Total	**$37.8**	**$288.9**	**$347.4**

Source: TriMet – September 2010. Note: costs are in constant (2010) dollars, in millions and may not sum due to rounding.

1 Based on the Federal Transit Administration's Standard Cost Categories as specified in the Reporting Instructions for the Section 5309 New Starts Criteria (FTA: June 2009).

2 Total costs do not reflect inflation or finance costs. See Chapter 5 – Finance for year-of-expenditure cost estimates, which do reflect inflation and finance costs. Also, total costs for the Streetcar Alternative do not reflect a savings of $6.8 million resulting from fewer bus purchases, compared to the No-Build Alternative (see Table 2.2.2 for information on the bus fleet requirements under the various alternatives).

3 The ranges of cost estimates for the Streetcar Alternative are the result of various combinations of design options under study in five of the six segments of the corridor – see Table 2.3.2 for a summary of Streetcar Alternative costs by segment and by design options with each segment, where applicable.

4 Support facilities (e.g. operating and maintenance facility) and vehicles are considered system costs and they do not vary by Streetcar Alternative design option.

5 Unallocated contingencies are 5 percent of the total of the other line items, excluding the value of the Willamette Shore Line right of way.

6 The Streetcar Alternative "Low Cost" assumes the following options by segment- South Waterfront: Willamette Shore Line, Johns Landing: Willamette Shore Line, Sellwood Bridge: New Interchange, Dunthorpe/Riverdale: Riverwood In-Street, Lake Oswego: UPRR ROW. The Streetcar Alternative "High Cost" assumes the following options by segment- South Waterfront: South Portal, Johns Landing: Macadam Additional Lane, Sellwood Bridge: Willamette Shore Line, Dunthorpe/Riverdale: Willamette Shore Line, Lake Oswego: Foothills.

Table 2.3-2 Summary of Capital Costs[1] by Segment for the Enhanced Bus Alternative (in millions, 2010 dollars)

Segment	Cost[2]
1 – Downtown Portland	$0.0[3]
2 – South Waterfront	$0.0[3]
3 – Johns Landing	$0.0[3]
4 – Sellwood Bridge	$0.0[3]
5 – Dunthorpe/Riverdale	$0.0[3]
6 – Lake Oswego	$17.8

Source: TriMet – September 2010.[1] In millions of 2010 dollars and does not include finance costs. Based on operations in 2035. See Chapter 5 for a capital cost estimate in year-of-expenditure dollars, which includes adjustments for inflation and finance costs. Figure 2.2-5 illustrates the project's segments.

2 All Enhanced Bus capital costs are based on meeting demand in 2035. Segment costs do not include any system costs (e.g., O&M facility, vehicles), or unallocated contingency, which would be 5 percent of costs (see Table 2.3-1).

3 There would be negligible capital costs in these segments due to the removal of bus stops.

Table 2.3-3 Summary of Capital Costs[1] for the Streetcar Alternative by Segment and Design Option (in millions, 2010 dollars)

Segment	Design Option	Cost[2]
1 – Downtown Portland[3]	None	$1.0
2 – South Waterfront[4]	None	$21.1
3 – Johns Landing	Willamette Shore Line	$19.0
	Macadam In-Street	$27.9
	Macadam Additional Lane	$32.7
4 – Sellwood Bridge[5]	None	23.7
5 – Dunthorpe/Riverdale	Willamette Shore Line	$52.6
	Riverwood	$52.1
6 – Lake Oswego	UPRR ROW	$48.6
	Foothills	$69.9

Source: TriMet – September 2010.

[1] In millions of 2010 dollars and does not include finance costs. Based on operations in 2035. See Chapter 5 for a capital cost estimate in year-of-expenditure dollars, which includes adjustments for inflation and finance costs. The ranges of cost estimates for the Streetcar Alternative are the result of various combinations of design options under study in three of the six segments of the corridor. Figure 2.2-5 illustrates the project's segments and the alignment or design options with each segment.

[2] All Streetcar capital costs are for the Lake Oswego Terminus based on meeting demand in 2035. Segment costs do not include any system costs (e.g., O&M facility, vehicles), which would be unaffected by the design options under consideration, or unallocated contingency, which would be 5 percent of costs, excluding the value of the Willamette Shore Line right of way (see Table 2.3-1).

[3] The capital cost of the proposed track connection near PSU in the Downtown Portland Segment has not been prepared because the location and design of the connection has not been determined. The cost of the connection would be covered within contingency.

[4] Capital cost estimates are based on the full project construction which assumes the Moody/Bond Couplet is built prior to the streetcar alignment. The low capital cost estimates in Table 2.3-1 and in Chapter 5 – Financial Analysis are based on the Willamette Shore Line phasing option in the South Waterfront Segment, which would have a capital cost of $8.02 million (2010 dollars).

[5] Capital cost estimates are based on the full project construction which assmes the Sellwood Bridge west interchange is built prior to or concurrently with the streetcar alignment. The low capital cost estimate in Table 2.3-1 and in Chapter 5 – Financial Analysis are based on the Willamette Shore Line phasing option in the Sellwood Bridge Segment, which would have a capital cost of $23.4 million (2010 dollars).

2.4 Operations and Maintenance Costs

This section summarizes the operating and maintenance cost methodology and results. TriMet developed operating costs, summarized in Table 2.4-1, based on travel demand forecasting model outputs prepared by Metro. The operating and maintenance costs are derived from a model in which labor and material costs were calculated as a function of streetcar and bus service levels. TriMet's bus operating cost savings for the Streetcar Alternative relative to the No-Build Alternative, which would result from the reduced length of bus Lines 35 and 36, are accounted for in these operating and maintenance cost estimates. All operating and maintenance cost estimates are expressed in 2010 dollars and are based on service levels in the year 2035. Operating and maintenance costs are factored into the financial analysis found in Chapter 5.

Table 2.4-1 Change in Annual Operating and Maintenance Costs[1] of the Enhanced Bus and Streetcar Alternatives Relative to the No-Build Alternative (2010 dollars, in millions)

Cost Category	Enhanced Bus	Streetcar[2]
Bus	$2.79	– $2.53
Streetcar	$0.00	$3.78
Net Increase[1]	**$2.79**	**$1.25**

[1] Costs are in constant (2010) dollars, in millions, based on operations in 2035. Costs are the change from the No-Build Alternative.
[2] Operating and maintenance costs for the Streetcar Alternative would not vary by design options under consideration.
Source: TriMet – January 2010.

The Enhanced Bus Alternative would cost $2.79 million more per year to operate in 2035, compared to the No-Build Alternative, primarily due to the increased frequency of service on Line 35. In comparison, the Streetcar Alternative would cost up to $1.25 million more per year to operate than the No-Build Alternative, reflecting a reduction in bus operating costs in the corridor of $2.53 million and an increase in Streetcar operating costs of $3.78 million.

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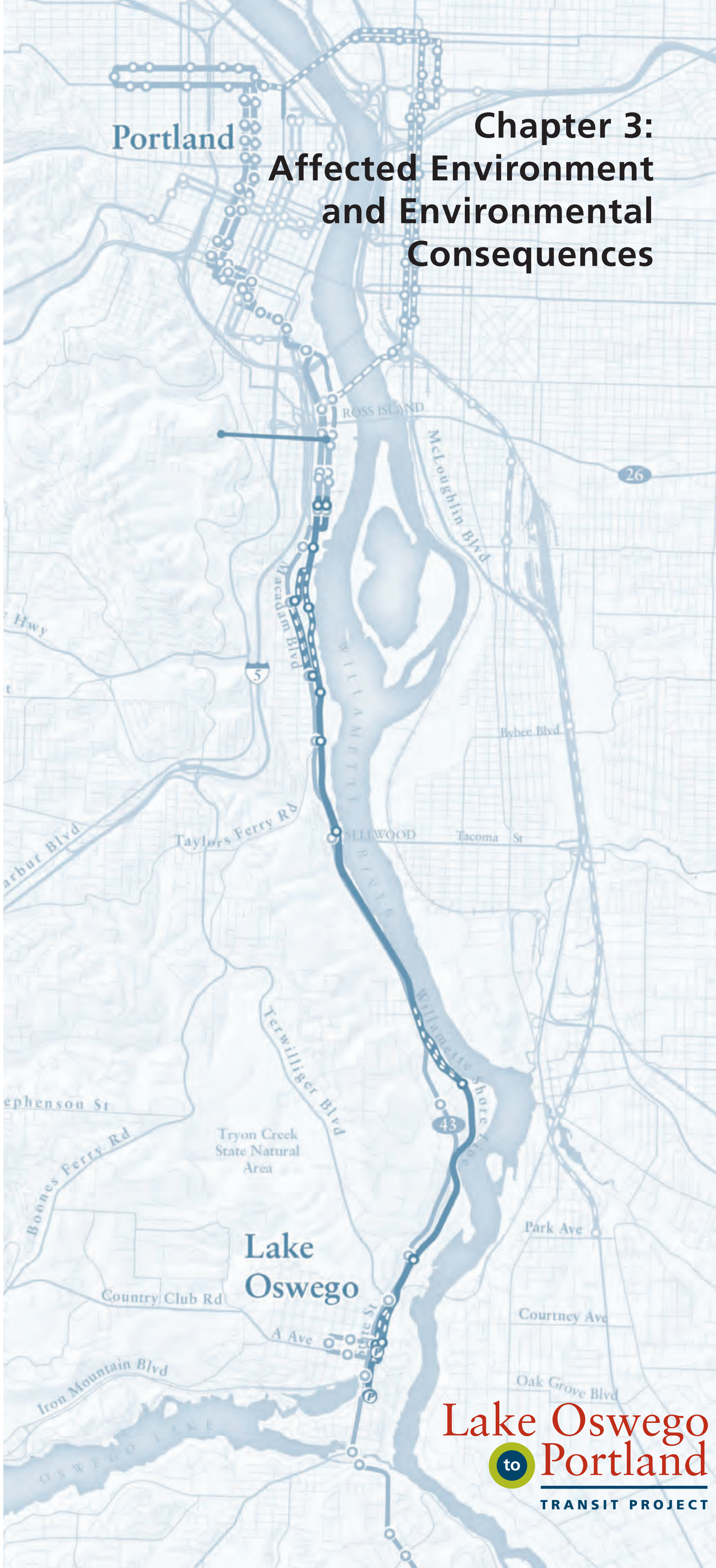
Chapter 3: Affected Environment and Environmental Consequences

CHAPTER 3



Lake Oswego to Portland

TRANSIT PROJECT

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3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the likely effects of the study alternatives on the community, natural environment and cultural resources in the corridor. The chapter is organized by topic as listed below. The sections are:

Each section describes the existing environment that could be affected by the study alternatives in the corridor. It then identifies the expected environmental impacts of the three alternatives as described in Chapter 2 of this DEIS, including the:

- No-Build Alternative,
- Enhanced Bus Alternative and
- Streetcar Alternative.

Where there are differences between the effects of the Streetcar Alternative options, the sections describe the differences. Each section addresses direct, indirect and cumulative impacts[1] of the alternatives, as defined in the box to the right. Where appropriate, section introductions include a summary of the relevant regulations and analysis methods. Short-term effects (effects related to construction activities) are addressed at the end of the chapter, in Section 3.16, and Section 3.17 discusses the effects of phased development of the Streetcar Alternative.

What are Direct, Indirect and Cumulative Effects of the Study Alternatives and Design Options?

Direct impacts are effects caused by the proposed action that occur at the same time and location as the action.

Indirect impacts are effects caused by the proposed action that occur later in time and/or farther away, but are still foreseeable. Indirect effects may include growth-inducing effects and associated effects on the natural environment.

Cumulative impacts are effects of the project added to other current and future projects and actions in the area regardless of what entity undertakes those other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time.

[1] Regulations for Implementing NEPA, http://ceq.hss.doe.gov/nepa/regs/ceq/toc_ceq.htm, Sec. 1508.7

3.1 Land Use and Planning

This section addresses land use impacts and compliance with plans and policies. Section 3.1.1 describes existing land use and planning in the corridor. Section 3.1.2 identifies the potential effects on land use of the alternatives and design options. Section 3.1.3 describes potential mitigation measures. Section 3.1.4 identifies where study alternatives do not comply with applicable comprehensive plan policies. The *Land Use and Planning Technical Report* (URS and TriMet /Metro, November 2010) contains further details, including citations to sources and all plan policies applicable to the study alternatives.

Direct, indirect and cumulative effects are defined in general terms on the previous page. Direct *land use* impacts are defined as conversions of land to transportation use. The methodology for direct land use impacts was to use a geographic information system to estimate the amount of land converted to transportation use based on preliminary design information. For this project, indirect land use impacts are defined as changes in land use resulting from how alternatives affect the likelihood that land would be redeveloped. The methodology relied on mapping the amount of unused allowed floor area and the ratio of the value of land improvements to the value of the land near proposed streetcar stations and referring to studies of how the original Portland Streetcar system affected redevelopment. The methodology also took into account other factors that influence redevelopment, such as interventions by local government, like use of urban renewal. For cumulative impacts, the analysis considered in qualitative terms the interaction of the project alternatives and options with other identified projects and actions.

The principal regulation relevant to land use is that transportation projects must comply with applicable comprehensive plans.

3.1.1 Affected Environment

As stated above, this section describes existing land use and planning in the corridor. Figure 3.1-1 shows existing land use in the parts of the corridor where land use impacts would occur. Figure 3.1-2 shows generalized comprehensive plan designations, and Figure 3.1-3 shows generalized zoning.[2]

Segment 1 includes downtown Portland, which is the central city of the region, and part of the South Waterfront District. Study alternatives would not include construction of improvements in this segment, but all alternatives would include transit connections into Segment 1.

Segment 2 is toward the south end of Portland's South Waterfront District, which has seen extensive redevelopment since 2000. This redevelopment has included an office and health services tower that is part of Oregon Health Sciences University (OHSU), a tram linking the tower to the main OHSU campus on the hilltop to the west, five high-rise condominium and apartment buildings, a new local street network, and the extension of the existing Portland streetcar from downtown Portland. The redevelopment resulted from collaboration among landowners, land developers, the City of Portland, and other parties. The city's role has included creation and use of the North Macadam Urban

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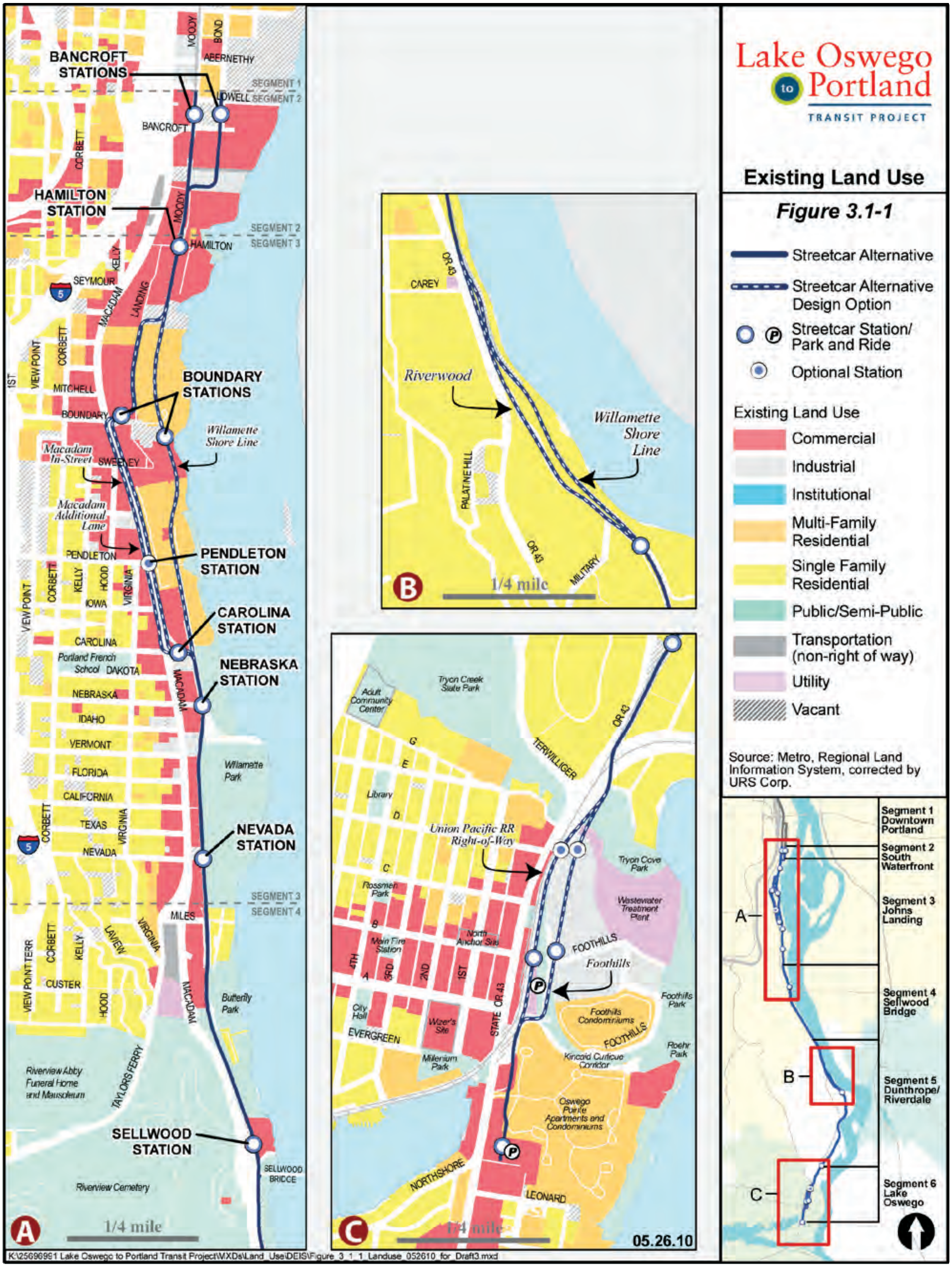
[2] "Generalized" means that the figures do not show actual comprehensive plan designation and zoning districts. Instead, they show categories to which Metro has assigned the plan designations and zoning districts. This because four different comprehensive plans and three zoning codes apply to the project area, Portland's, Multnomah County's, Clackamas County's, and Lake Oswego's (Portland's zoning code applies to the Multnomah County portion of the project area).


Lake Oswego to Portland
TRANSIT PROJECT
Existing Land Use
Figure 3.1-1
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar Station/ Park and Ride
Optional Station
Existing Land Use
Commercial
Industrial
Institutional
Multi-Family Residential
Single Family Residential
Public/Semi-Public
Transportation (non-right of way)
Utility
Vacant
Source: Metro, Regional Land Information System, corrected by URS Corp.
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
BANCROFT STATIONS
HAMILTON STATION
BOUNDARY STATIONS
PENDLETON STATION
CAROLINA STATION
NEBRASKA STATION
NEVADA STATION
SELLWOOD STATION
Willamette Shore Line
Macadam In-Street
Macadam Additional Lane
Riverwood
Union Pacific RR Right-of-Way
Foothills
1/4 mile
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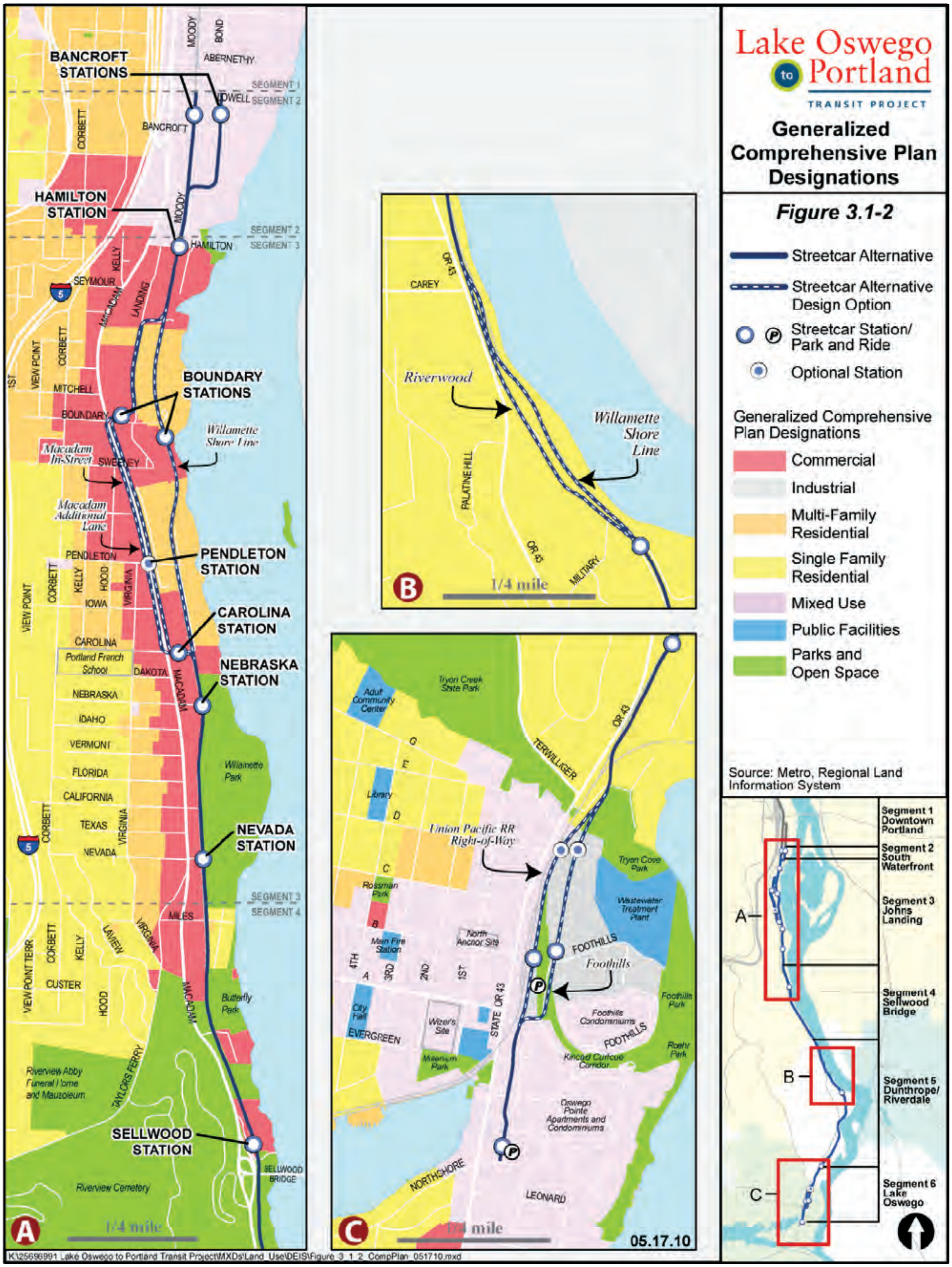
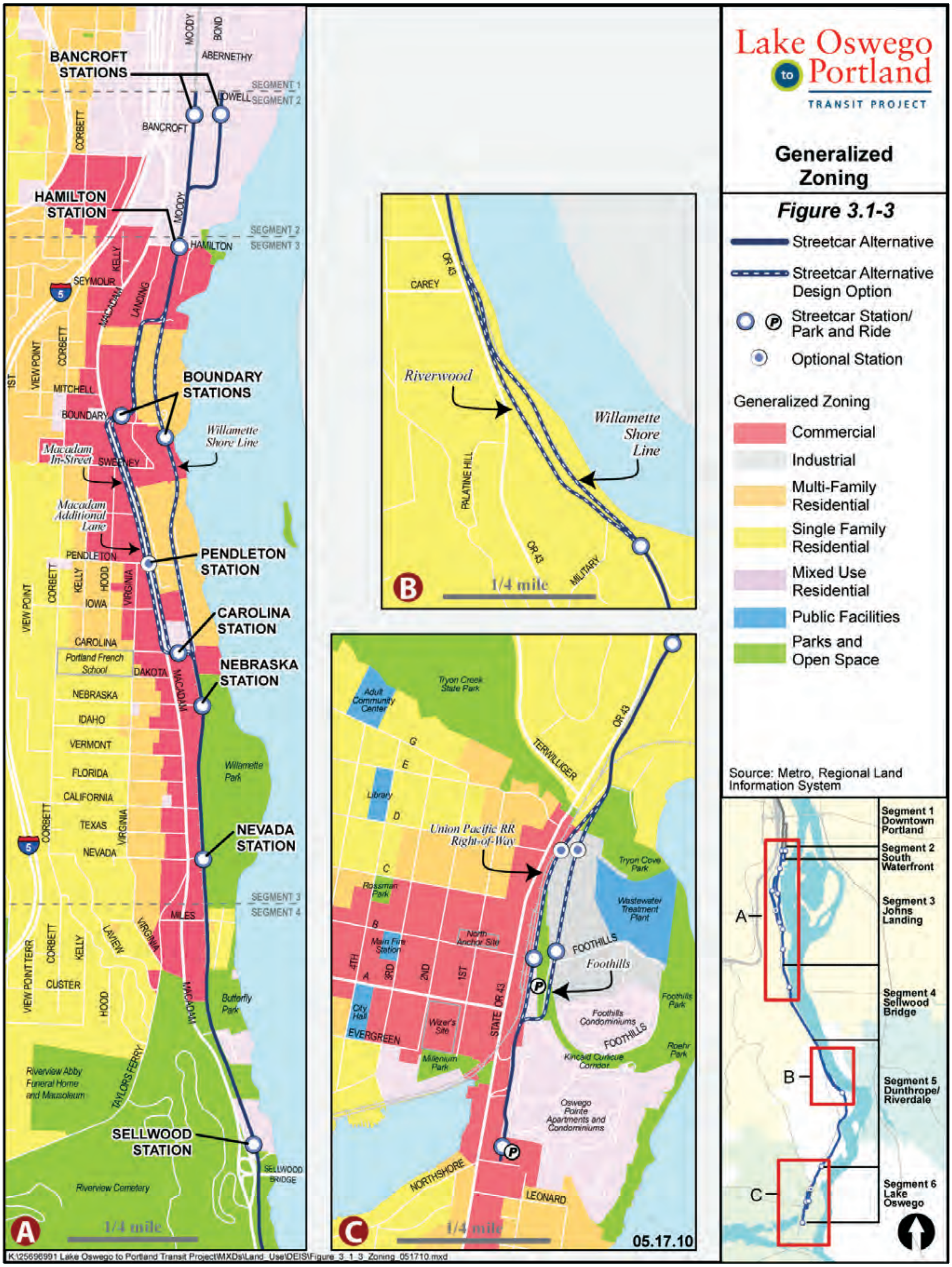


Lake Oswego to Portland
TRANSIT PROJECT
Generalized Comprehensive Plan Designations
Figure 3.1-2
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar Station/ Park and Ride
Optional Station
Generalized Comprehensive Plan Designations
Commercial
Industrial
Multi-Family Residential
Single Family Residential
Mixed Use
Public Facilities
Parks and Open Space
Source: Metro, Regional Land Information System
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
BANCROFT STATIONS
HAMILTON STATION
BOUNDARY STATIONS
PENDLETON STATION
CAROLINA STATION
NEBRASKA STATION
NEVADA STATION
SELLWOOD STATION
Macadam In-Street
Macadam Additional Lane
Willamette Shore Line
Riverwood
Union Pacific RR Right-of-Way
Foothills
1/4 mile
05.17.10



Lake Oswego to Portland
TRANSIT PROJECT
Generalized Zoning
Figure 3.1-3
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar Station/ Park and Ride
Optional Station
Generalized Zoning
Commercial
Industrial
Multi-Family Residential
Single Family Residential
Mixed Use Residential
Public Facilities
Parks and Open Space
Source: Metro, Regional Land Information System
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
BANCROFT STATIONS
HAMILTON STATION
BOUNDARY STATIONS
PENDLETON STATION
CAROLINA STATION
NEBRASKA STATION
NEVADA STATION
SELLWOOD STATION
Willamette Shore Line
Macadam In-Street
Macadam Additional Lane
Riverwood
Union Pacific RR Right-of-Way
Foothills
1/4 mile
05.17.10
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Renewal District to assemble properties and to fund and build public improvements. While the 2008-2009 economic recession slowed development, several projects are under construction or pending. The Matisse, which consists of 270 market-rate apartments and about 15,500 square feet of ground-floor commercial space, is under construction on the block bounded by Southwest Moody Avenue, Bond Avenue, Lowell Street, and Abernethy Street. The Mirabella, a high-rise retirement center, is under construction north of the area the figures cover. The City of Portland is seeking to build 40 units of housing for low-income veterans on the block bounded by Moody Avenue, Bond Avenue, Lowell Street and Bancroft Street. A school is considering redevelopment of the block immediately to the south and the school and U.S. General Services Administration are both considering development on the south side of the parcel between Moody and Macadam avenues south of Bancroft Street. The city plans to extend Moody Avenue south to the vicinity of the proposed Hamilton Court station, as shown on Figure 3.1-1. It also plans to connect the extended street to Macadam Avenue at a new intersection, referred to as the “South Portal.” The intersection is intended to provide safer access between the South Waterfront and Macadam Avenue than the existing intersection at Bancroft Street.

Segment 3 includes the Johns Landing. Land uses east of Macadam Avenue are multi-family residential and office, mostly developed in the 1980s. Most of the multifamily housing units are two- and three-story condominiums and are separate from the office buildings, which are four and five stories high. Development is more suburban in character and less mixed-use than development in South Waterfront. Willamette Park, a large park with a heavily-used boat landing, is located in this area. Storefront commercial uses predominate along the west side of Macadam Avenue. West of Macadam Avenue lies a neighborhood of single-family residential uses. The comparatively small amount of vacant land is mostly near Interstate 5 and is impacted by proximity to it. Johns Landing has seen only limited redevelopment since the 1980s. Notable exceptions are a supermarket and condominiums built in the 1990s on the west side of Macadam Avenue near its intersection with Taylors Ferry Road. There are no pending amendments to the comprehensive plan provisions applicable to Segment 3 and no planned interventions, such as use of urban renewal authority.

Segment 4 includes the area in the vicinity of the Sellwood Bridge. The predominate land use is public and semi-public, made up of parks east of Macadam Avenue and Riverview Cemetery west of Macadam Avenue. The single-family residential use shown south of Butterfly Park in Figure 3.1-1 is the parking lot for a boathouse moorage. The north end of Segment 4 contains single-family homes west of Macadam Avenue and commercial uses on its east side. The utility use is an electric power substation. Multnomah County, which owns the Sellwood Bridge, has selected a Locally Preferred Alternative for the replacement of the bridge, which is structurally deficient. Issuance of a Final Environmental Impact Statement is expected in 2010. Construction is expected to begin in 2012 and reach completion in 2015. There are no pending proposals for amending comprehensive plan provisions or any planned interventions applicable to Segment 4.

Segment 5 includes the Dunthorpe/Riverdale area. Single-family residential is the predominate use, comprehensive plan designation and zoning in all of Segment 5, including portions of these neighborhoods not shown on the maps. Lot sizes are typically large. There is little vacant land.

Segment 6 includes the eastern end of downtown Lake Oswego and the residential area to the north. The alternatives and design options are located between the downtown to the west and an area containing residential, commercial and industrial uses to the east. Both have seen substantial redevelopment since the mid-1990s, much of it carried out under the auspices of the City of Lake

Oswego Redevelopment Agency. To the west, redevelopment included Oswego Pointe, built on a former cement plant site. It comprises 522 multifamily housing units (labeled on Figure 3.1-1 as the Oswego Pointe Apartments and Condominiums) 20,000 square feet of office space, a 10,500 square foot restaurant, a waterfront public pathway, a water sports center, an amphitheater and a boat dock. To the east, one project was the complete redevelopment of the block bounded by State Street, A Avenue, 1st Street, and the Union Pacific railroad tracks. It includes over 84,000 square feet of retail and office space and a 366-space parking structure. Another project was the creation of Millennium Park, as shown on Figure 3.1-1.

Two projects are in the planning stages:

- **Foothills redevelopment.** The City of Lake Oswego is partnering with owners of the industrial land shown on Figures 3.1-1, 3.1-2 and 3.1-3 to formulate a plan for what may include eight- to ten-story residential buildings and some commercial uses. The land owners have retained a development consultant. Implementation would require an amendment to the Lake Oswego Comprehensive Plan and zoning map. Build-out would occur over a 20- to 30-year period.

- **North Anchor site**. The City of Lake Oswego Redevelopment Agency is formulating a plan for redeveloping the North Anchor site, identified on Figure 3.1-1, with a 50,000 to 60,000 square foot replacement of the existing library and 35,000 square feet of commercial space.

City officials believe the Wizer's grocery store site shown on Figure 3.1-1 is likely to be redeveloped because of its location and the age of the existing improvements. The City of Lake Oswego expects to prepare a new street system plan for the area near the streetcar line options. No major improvements are planned for State Street. According to the city, it may consider changes in the future to improve pedestrian crossings between downtown and the Foothills area.

3.1.2 Land Use Impacts

This section presents a summary of long-term direct, indirect and cumulative effects of the study alternatives on land use. The effects include acquisition of property and catalyzed redevelopment within existing zoning and policies. Section 3.1.4 addresses compliance with plan policies. Section 3.16 discusses short-term (construction) effects.

3.1.2.1 No-Build Alternative

The No-Build Alternative would not have any direct, indirect, or cumulative land use impacts in the corridor.

- In **Segment 1,** development and redevelopment of the central city would continue to occur as in the past.
- In **Segment 2**, development of the vacant land north of Bancroft Street would occur over time because of the coordinated efforts to promote redevelopment in the South Waterfront area described above. These efforts included the extension of the streetcar system to its existing terminus near Lowell Street. Redevelopment of land south of Bancroft Street would also occur, because of the City of Portland's plans to extend Moody Avenue south and build the South Portal, also described above, and because, like the rest of the South Waterfront District, it is centrally located in the region.
- In **Segment 3**, the pace of redevelopment would be slow, as it has been since the 1980s.

- In **Segment 4**, improved access to the area immediately north of the bridge resulting from the replacement of the Sellwood Bridge would encourage its redevelopment.
- In **Segment 5** there would be very little redevelopment because of the stable, single-family uses there.
- In **Segment 6** some redevelopment of the areas near the alignments of the design options would occur, as indicated by redevelopment that has occurred in the area in the past, as described above.

3.1.2.2 Enhanced Bus Alternative

The Enhanced Bus Alternative would not have any direct, indirect or cumulative land use impacts in Segments 1, 2, 3, 4 and 5.

- In **Segments 1, 2, and 3**, the Enhanced Bus Alternative would not include stations or otherwise require the acquisition of land, and these segments already have regional transit access. While the Enhanced Bus Alternative would improve transit access from the project's transportation corridor to the south, the corridor south of the Lake Oswego to Portland transit corridor is only a fraction of the entire region.
- In **Segment 4**, while the Enhanced Bus Alternative would increase bus frequency, such improvements do not have a material effect on decisions to redevelop commercial uses. The only land with potential for redevelopment is the land in commercial use just north of the Sellwood Bridge, in the north end of Segment 4. The cemetery and park land is unlikely to be redeveloped under any alternative. The same is true of the land in single-family use, because the single-family zoning would be difficult to change in face of opposition from its residents. No mitigation measures are proposed.
- In **Segment 5**, the applicable single-family zoning would not allow changes to other uses. Changes to bus service would not alter land uses in the area.

The Enhanced Bus Alternative would have direct land impacts in **Segment 6**, but not indirect or cumulative impacts. Tables 3.1-1, 3.1-2, and 3.1-3 show the direct impacts of the Enhanced Bus Alternative in downtown Lake Oswego by existing land use, comprehensive plan designation and zoning, respectively. The impacts would result from the park-and-ride lot. The Enhanced Bus Alternative would not change land uses and would not have a material effect on the intensity of land uses resulting from redevelopment. Greater bus frequency to and from downtown Portland would make residential uses in the B Avenue and Lake Oswego terminus station areas more attractive. However, the effect would be insufficient to encourage redevelopment to occur that would not occur under No-Build Alternative.[3] In addition, the amount of residential and commercial redevelopment would be the same as under the No-Build Alternative. Cumulative impacts would be similarly limited.

[3] Unlike streetcar lines, as discussed in Section 3.1.1.3, enhanced bus service has not been documented to result in intensification of development. One reason may be the absence of major capital improvements, making enhanced bus perceived as being more susceptible to being scaled back or eliminated.

Table 3.1-1 Conversion of Land to Transportation Use by Existing Use in Acres

Alternative, Segment and Option	Comme-rcial	Indus-trial	Multi-Family Residential	Single Family Residential	Public/ Semi-Public	Utility	Vacant	Total
Enhanced Bus Alternative[1]	**0.5**		**0.5**					**1.0**
Streetcar Alternative								
2 - South Waterfront[2]								
3 - Johns Landing								
Willamette Shore Line	0.0		0.1				0.1	0.2
Macadam In-Street	1.4		0.5				0.3	2.2
Macadam Add. Lane	2.5		0.6				0.5	3.6
4 - Sellwood Bridge[2]								
5 - Dunthorpe/Riverdale								
Willamette Shore Line								
Riverwood				0.7			0.0	0.7
6 - Lake Oswego								
UPRR	1.0	0.1	0.6	0.0	1.3	0.4	0.0	3.3
Foothills	1.0	10.8	0.6	0.0	1.6	0.8	0.0	14.8
Streetcar Alternative Total[3]								
From	**1.0**	**0.1**	**0.7**	**0.0**	**1.3**	**0.4**	**0.1**	**3.5**
To	**3.5**	**10.8**	**1.2**	**0.7**	**1.6**	**0.8**	**0.5**	**19.1**

Sources: Prepared by URS Corp. Data from the Metro Data Center, corrected by URS Corp. GIS analysis by David Evans and Associates.
Notes: Land use categories come from the Metro Data Center Regional Land Information System, except for utility. No conversions in Segment 1. 0.0 indicates less than .05 acre. No number indicates zero. Numbers may not add across because of rounding. Table does not include land used for the alternatives that already are in transportation use.
[1] With the Enhanced Bus Alternative, the only conversions would occur in Segment 6 – Lake Oswego.
[2] The South Waterfront and Sellwood Bridge segments contain potential construction phasing options associated with the Streetcar Alternative. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.
[3] Totals do not add across to 3.5 and 19.1 because the column totals sum ranges.

Table 3.1-2 Conversion of Land to Transportation Use by Comprehensive Plan Designation Category in Acres

Alternative, Segment and Option	Commer-cial	Indus-trial	Mixed-Use	Multi-Family Residential	Single Family Residential	Parks and Open Space	Total
Enhanced Bus Alternative[1]			**1.0**				**1.0**
Streetcar Alternative							
2 - South Waterfront[2]							
3 - Johns Landing							
Willamette Shore Line	0.0		0.2	0.1			0.2
Macadam In-Street	1.7			0.5			2.2
Macadam Add. Lane	2.9			0.6			3.6
4 - Sellwood Bridge[2]							
5 - Dunthorpe/Riverdale							
Willamette Shore Line							
Riverwood					0.7		0.7
6 - Lake Oswego							
UPRR		0.4	1.5		0.0	1.3	3.3
Foothills		11.5	1.5		0.0	1.7	14.8
Streetcar Alternative Total[3]							
From	**0.0**	**0.4**	**1.5**	**0.1**	**0.0**	**1.3**	**3.5**
To	**2.9**	**11.5**	**1.7**	**0.6**	**0.7**	**1.7**	**19.1**

Sources: Prepared by URS Corp. with data from Metro Data Resource Center and GIS analysis by David Evans and Associates.
Notes: Zoning categories are generalized and come from the Metro Data Resource Center Regional Land Information System. No conversions in Segment 1. 0.0 indicates less than .05 acre. No number indicates zero. Numbers may not add across because of rounding. Table does not include land used for the alternatives that already is in transportation use.
[1] With the Enhanced Bus Alternative, the only conversions would occur in Segment 6 – Lake Oswego.
[2] The South Waterfront and Sellwood Bridge segments contain potential construction phasing options associated with the Streetcar Alternative. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.
[3] Totals do not add across to 3.5 and 19.1 because the column totals sum ranges.

Table 3.1-3 Conversion of Land to Transportation Use by Zoning Category in Acres

Alternative, Segment and Option	Commer-cial	Industrial	Mixed-Use Residen-tial	Multi-Family Residen-tial	Single Family Residen-tial	Parks and Open Space	Total
Enhanced Bus Alternative[1]	**0.5**		**0.5**				**1.0**
Streetcar Alternative							
2 - South Waterfront[2]							
3 - Johns Landing							
Willamette Shore Line			0.2	0.1			0.2
Macadam In-Street			1.7	0.5			2.2
Macadam Add. Lane			2.9	0.6			3.6
4 - Sellwood Bridge[2]							
5 - Dunthorpe/Riverdale							
Willamette Shore Line							
Riverwood					0.7		0.7
6 - Lake Oswego							
UPRR	1.0	0.1	0.9		0.0	1.3	3.3
Foothills	1.0	11.2	0.9		0.0	1.7	14.8
Streetcar Alternative Total[3]							
From	**1.0**	**0.1**	**1.2**	**0.1**	**0.0**	**1.3**	**3.5**
To	**1.0**	**11.2**	**3.9**	**0.6**	**0.7**	**1.7**	**19.1**

Source: Prepared by URS Corp. with data from Metro Data Resource Center and GIS analysis by David Evans and Associates.
Note: Zoning categories are generalized and come from the Metro Data Resource Center Regional Land Information System. No conversions in Segment 1. 0.0 indicates less than .05 acre. No number indicates zero. Numbers may not add across because of rounding. Table does not include land used for the alternatives that already is in transportation use.
[1] With the Enhanced Bus Alternative, the only conversions would occur in Segment 6 – Lake Oswego.
[2] The South Waterfront and Sellwood Bridge segments contain potential construction phasing options associated with the Streetcar Alternative. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.
[3] Totals do not add across to 3.5 and 19.1 because the column totals sum ranges.

3.1.2.3 Streetcar Alternative and Design Options

Regional Impacts. The Streetcar Alternative would not alter total population or employment region-wide. Transportation infrastructure investments like the Streetcar Alternative do not cause additional population or employment growth within a region. Instead, such transit improvements influence the location and characteristics of new development and redevelopment within a region and specifically in the vicinity of the transit investment.

Segment 1 Direct, Indirect and Cumulative Impacts of the Streetcar Alternative. The Streetcar Alternative would have no direct, indirect, or cumulative impacts in Segment 1.

Segment 2 Direct, Indirect and Cumulative Impacts of the Streetcar Alternative. The Streetcar Alternative would have no *direct impacts* in Segment 2 because there would be no acquisition of property. The *indirect land use impacts* of the Streetcar Alternative would likely be more land redevelopment, redevelopment to more intense uses, and redevelopment sooner than under the No-Build Alternative in the south half of Segment 2. The effect on the north half would be marginal because it already benefits from the existing streetcar system; the proposed Bancroft Street stations are very close to the existing station adjoining Lowell Street. The reasons for the effects on the south half of Segment 2 are:

- As a public infrastructure investment, Portland's experience with the original Portland streetcar project was that it encouraged redevelopment and more intense redeveloped uses. Starting after streetcar funding was committed in 1997 until 2004, the amount of square footage of new development within one block of the streetcar line, as a percentage of existing building square footage, was 46 percent.[4] This compared to 14 percent within two blocks and 8 percent within three blocks. Also, the percentage of allowed square footage developed from 1997 to 2004 within one block of the streetcar line was over 50 percent, compared to about 10 percent within two and three blocks. Some of this redevelopment can be attributed to public infrastructure investments other than the streetcar, especially street improvements and parks in the Pearl District, and to strong market demand. In addition, the Portland streetcar was routed in part to be close to property slated for redevelopment. Similarly, all of Segment 2, including its south half, is within the North Macadam Urban Renewal District, which the City of Portland has used to make infrastructure investments in the project area. With the original streetcar project, little redevelopment occurred west of Interstate 405, which is attributable in part to the scarcity of redevelopment opportunities and absence of other new infrastructure investments there. However, this contrasts with Segment 2, as described in the next two items.

- There is a large amount of capacity for redevelopment in the south half of Segment 2. Table 3.1-4 shows the amount of unused allowed square footage of development within the Hamilton Court station area, as well as the Bancroft Street station area. Allowed floor area is the amount of square footage allowed by applicable zoning regulations. Existing floor area is from city records or estimates. Unused allowed floor area is the difference between allowed and existing floor area. Eighty-six percent of the allowed square footage within the Hamilton Court station area is unused. The *Land Use and Planning Technical Report* (URS, August 2010) contains maps of the data in Table 3.4-1 and a description of the methodology used, including how the station areas were defined.

- At many properties in the project area, the ratio of the value of improvements to the value of the land is low, which suggests that many properties are ripe for redevelopment. Table 3.1-4 shows the percentage of properties by range of this ratio in the Hamilton Court station area. The ratio of improvement value to land value is widely used to indicate likelihood of redevelopment. In central city locations like Segment 2, it can be cost-effective to redevelop properties with ratios as high as four to one. As Table 3.1-4 shows, 75 percent of properties in the Hamilton Court station area have ratios under four to one. Almost half the properties have ratios under one to one.

- Portland's central city has experienced a large amount of the mixed-use development, which the zoning in the Hamilton Court station area allows.[5] While the 2008-2009 recession slowed development in Segment 2 and elsewhere in the region, the life of a large public infrastructure facility like the Streetcar Alternative is much longer than such markets cycles.

The **cumulative land use impacts** of both the Streetcar Alternative and the extension of Moody Avenue and the South Portal project described in Section 3.1.1, above, would likely be greater combined than alone. Redevelopment would likely occur sooner and be more intense if all three are combined, especially if they occur within the same timeframe. "More intense" means more square footage and more likely to be mixed use, rather than separate commercial, office, and residential uses. This is because all three would strengthen the market appeal of properties in the area.

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[4] E.D. Hovee & Company, LLC, Portland Streetcar Development Impacts, November 2005, p. 9.

[5] The zoning is Central Commercial north of Hamilton Street and Storefront Commercial south of Hamilton Street. Both zones allow commercial, office and residential uses.

Segment 3 Direct, Indirect and Cumulative Impacts of the Streetcar Alternative. Tables 3.1-1, 3.1-2, and 3.1-3 show the *direct impacts* of the Segment 3 options by existing land use, comprehensive plan designation and zoning, respectively. They would result from the acquisition of property. The Macadam Additional Lane Option would convert to project use an estimated 3.6 acres of land, compared with 2.2 acres under the Macadam In-Street Option and 0.2 acres under the Willamette Shore Line Option. The property acquisition figures in Appendix G of this DEIS show the location of the direct impacts. Most the land converted to project use is currently used as private roads and would remain in use to provide access to adjacent properties.

The Streetcar Alternatives would likely result in *indirect impacts* such as redevelopment of some commercial uses near Macadam Avenue, based on redevelopment experiences on the first Portland streetcar project, as described in the section on Segment 2, above. There is both a large potential for redevelopment and substantial capacity to accommodate intensification of land uses along Macadam Avenue. Table 3.1-4 shows that existing private property improvements represent less than two times the value of the land they occupy on about 85 percent of station area properties. Improvement values are less than land values on about 60 percent of the properties. These percentages indicate high redevelopment potential. Table 3.1-4 also shows that existing development uses only about 65 percent of allowed floor area in the station areas. At the same time, the extent of redevelopment would be less than along the original Portland streetcar route because there are no plans for the kinds of city interventions to foster redevelopment that there were in the Pearl District. In addition, the extent of redevelopment and intensity of uses would be less than in Segment 2. This is because there is virtually no vacant land near the stations in Segment 3 and allowed floor area is lower. In addition, in comparison to Segment 2 and to the Pearl District example, the development in this area would primarily be small-scale redevelopment.

The redevelopment mainly would be of existing commercial uses because, among commercial uses, improvement to land value ratios are lower and unused floor area percentages higher, compared to residential uses. In addition, many of the existing residential uses are condominium complexes, which are unlikely to redevelop during the planning period. At the same time, some of the redevelopment of existing commercial uses would likely including housing over commercial uses, because the applicable Storefront Commercial zoning allows mixed residential and commercial uses.

There would be more redevelopment under the Macadam In-Street and Macadam Additional Lane Options than under the Willamette Shore Line Option. One reason is that more land with low improvement to land value ratios would be close to the Boundary Street station under the Macadam In-Street and Macadam Additional Lane Options, compared to the Willamette Shore Line Option (51 acres with a ratio under two compared to 39 acres). Similarly, there would be nearly twice as much unused allowed floor area in the Boundary Street station area under the Macadam Avenue options as under the Willamette Shore Line Option. See Table 3.1-4. Likewise, while the amount of unused allowed floor area in the Carolina Street and Nebraska Street station areas is nearly the same, 25 acres in the Carolina Street station area have an improvement to land value ratio under two, compared with 14 acres in the Nebraska Street station area. In addition, the location of the Boundary Street and Carolina Street stations on or near Macadam Avenue under the Macadam In-Street and

Table 3.1-4 Station Area Redevelopment Potential

Station Area[1] by Segment	Floor Area: Square Feet (X 1,000) Allowed[2]	Existing	Unused	Unused As % of Allowed	Ratio of Value of Improvements to Value of Land[3,4]: Under 1 Acres	Under 1 %	1 to 1.99 Acres	1 to 1.99 %	2 to 2.99 Acres	2 to 2.99 %	3 to 3.99 Acres	3 to 3.99 %	4 and Over Acres	4 and Over %	Total Acres	Total %
2-South Waterfront																
Bancroft[5]	8,477	755	7,722	91	25	83	4	13	0	0	0	0	1	4	30	100
Hamilton	5,513	776	4,736	86	12	47	6	23	1	5	0	0	6	25	25	100
Total	13,990	1,532	12,458	89	37	67	10	17	1	2	0	0	7	13	55	100
3-Johns Landing																
Boundary, Wil. Sh. L.	3,601	1,524	2,077	58	30	71	9	21	3	8	0	0	0	0	42	100
Boundary, Mac. Opts.	5,741	1,936	3,805	66	40	69	11	19	4	7	0	1	3	4	58	100
Carolina	2,188	846	1,342	61	17	58	8	26	2	7	1	4	1	4	29	100
Nebraska	2,008	604	1,404	70	9	48	5	30	2	11	1	5	1	6	18	100
Nevada	1,478	504	974	66	7	39	7	40	1	8	0	1	2	13	18	100
Total, Wil. Sh. L.	7,086	2,632	4,454	63	45	58	21	27	7	9	1	1	3	4	77	100
Total, Mac. In-St.	9,406	3,286	6,121	65	64	61	26	25	8	7	2	2	6	6	105	
Total, Mac. Ad. Ln.	9,406	3,286	6,121	65	64	61	26	25	8	7	2	2	6	6	105	
4-Sellwood Bridge																
Sellwood Bridge	383	16	367	96	2	100	0	0	0	0	0	0	0	0	2	100
6-Lake Oswego[6]																
B Avenue	16,179	2,673	13,505	83	18	37	8	17	8	17	2	4	13	25	50	100
Lake Oswego Terminus	14,664	2,623	12,040	82	7	48	2	12	2	12	2	16	2	12	15	100
Total, Both Options	30,842	5,296	25,546	83	26	39	10	16	10	16	5	7	15	22	65	100
TOTAL[7]																
From	52,302	9,476	42,826	82	110	55	41	21	18	9	6	3	25	13	200	100
To	54,622	10,130	44,492	81	126	55	50	22	19	8	6	3	28	12	230	100

Note: Wil. Sh. L. means Willamette Shore Line; Mac. In-St means Macadam In-Street; Mac. Ad. Ln. means Macadam Additional Lane; L.O. Trm. means Lake Oswego Terminus; MOS means Minimum Operable Segment.

Numbers exclude land zoned for parks and open space.

[1] Redevelopment potential measurement area, as shown on Figures 3.1-4 through 3.1-9.

[2] Allowed by the floor area ratio specified in the applicable zoning regulations, but see footnote 6.

[3] Ratios in Segments 2, 3, and 4 are based on assessed market values in 2008. Ratios in Segment 6 are based on assessed values in 2009.

[4] The ratios of the value of improvements to the value of land do not include residential or commercial condominiums because tax assessments do not separately assess the value improvements and land for them. Figure 3.1-5 identifies the properties that are excluded from the ratios because they are residential or commercial condominiums.

[5] The ratios of the value of improvements to the value of land do not include the lock bounded by Moody, Bond, Lowell, and Abernethy because the apartment buildings on it are under construction. The floor area square footages include the block.

[6] The allowed floor area numbers assume that the City of Oswego rezones to Multi-Family Residential/East End Commercial the land now zoned Industrial. The existing Industrial zoning would not allow the type of commercial and residential uses that make up mixed-use development and allows only one-third as much floor area.

[7] Totals do not add across because the column totals sum ranges.

Sources: Data provided by Metro. Portland data from City of Portland Bureau of Planning and Sustainability "Development Capacity Analysis." Lake Oswego data from Metro. Table prepared by URS Corp. with GIS analysis by David Evans and Associates.

Macadam Additional Lane options would strengthen the perception of Macadam Avenue being served by streetcar. This would improve the marketability of commercial real estate along Macadam, making redevelopment more likely. The Nevada Street Station area would be the same under all the options. A future optional station could be located at Pendleton Street. While the land on the east side of Macadam Avenue near Pendleton Street is mainly residential and unlikely to redevelop, uses on the west side are commercial and would be more likely to redevelop if this station were built.

Application of Section 0060 of the State of Oregon's Transportation Planning Rule (TPR)[6] would not constrain the potential redevelopment in Segment 3 described above. TPR Section 0060 places conditions on amendments to comprehensive plans and zoning if they would contribute to violations of standards for congestion levels on state highways contained in the Oregon Highway Plan (OHP). Macadam Avenue in Segment 3 is a state highway. However, Section 0060 would not apply in Segment 3, because the existing Storefront Commercial zoning allows as permitted uses the commercial, residential and mixed uses that would comprise the redevelopment; amendments to Portland's comprehensive plan or zoning would not be necessary.

No *cumulative land use impacts* of the Streetcar Alternative in Segment 3 have been identified. No other identified projects, plans, policies or trends would combine with the Streetcar Alternatives in a way that would materially alter their land use impacts.

Segment 4 Direct, Indirect, and Cumulative Impacts of the Streetcar Alternative. The Streetcar Alternative would not, in itself, have *direct impacts* in Segment 4, as it would not require the conversion of land to project use. Construction of the Sellwood Bridge new interchange, which is part of the preferred alternative for the new bridge, would necessitate the realignment of the streetcar right of way and a different station configuration. The bridge project would acquire the right of way needed for the streetcar realignment. It would do the same under the No-Build Alternative, because the Willamette Shore Line alignment could be retained as a bicycle and pedestrian path, if rail use were discontinued. This makes land conversion in Segment 4 a consequence of the bridge project, not the Streetcar Alternative.

Indirect impacts of the Streetcar Alternative would include encouraging the redevelopment of the commercial properties on the north end of Segment 4. Some are within two blocks of the Nevada Street station, increasing the attractiveness of the property in the same way as described in the discussion of Segment 3 impacts. Existing development on the properties uses only 4 percent of allowed floor area and has a value less than the value of the land it occupies. These indicate that owners could substantially increase return on investment by redeveloping the properties, making redevelopment more likely.

The Streetcar Alternative would have a similar effect on the commercial property immediately north of the Sellwood Bridge. The property is a family-owned recreational boating dealership was in continuous operation at the site between 1929 and 2010. Table 3.1-4 shows that existing improvements use less than 25 percent of allowed floor area and have a value less than the value of the land. The proposed station adjoining the property would make the property the only waterside location in the region with adjacent access by motor vehicle, streetcar and boat.

[6] Oregon Administrative Rule 660-012-0060.

The *cumulative impact* of the Streetcar Alternative and replacement of the Sellwood Bridge would be to encourage redevelopment of the boating dealership property even more than the Streetcar Alternatives alone. The reason is that the new interchange built in conjunction with bridge replacement would improve motor vehicle access to the property. Under existing conditions and without the new interchange, direct access and egress are limited to northbound traffic. Southbound traffic access and egress are via a local street several blocks to the north of the property, which has an unsignalized intersection with Macadam Avenue. With the new bridge, the interchange would provide the site signalized routing for traffic coming from and going to all directions.

Segment 5 Direct, Indirect and Cumulative Impacts of the Streetcar Alternative. Tables 3.1-1, 3.1-2 and 3.1-3 show the *direct impacts* of the Segment 5 options by existing land use, comprehensive plan designation and zoning, respectively. The impact of the Riverwood design option would result from the acquisition of a 0.7-acre property. The Willamette Shore Line design option would not have any direct land use impacts. The property acquisition figures in Appendix G of this DEIS show the location of the direct impact under the Riverwood design option.

The Streetcar Alternative would not *indirectly* cause any land uses to change, because the area is already developed in compliance with its single-family residential zoning and its residents oppose rezoning to allow other uses. There is no proposal for such rezoning.

No *cumulative impacts* on land use would occur in Segment 5. No other identified projects, plans, policies or trends would combine with the Streetcar Alternative in a way that would alter the direct impact of the Riverwood design option or have indirect land use impacts.

Segment 6 Direct, Indirect and Cumulative Impacts of the Streetcar Alternative. Tables 3.1-1, 3.1-2, and 3.1-3 show the *direct impacts* of the Segment 6 options by existing land use, comprehensive plan designation and zoning, respectively. The Foothills design option would convert to project use a total of an estimated 5.4 acres of land, compared to an estimated 2.3 acres under the Union Pacific Railroad Right of Way design option. The extension of Foothills Road accounts for most of the difference between the two options. The streetcar would operate in mixed traffic in a rebuilt Foothills Road.

The *indirect impacts* of the Streetcar Alternative options would be the same because the B Avenue and Lake Oswego terminus station areas are the same. The locations of the B Avenue station under both options are close to each other and the Lake Oswego terminus station location is the same under both options.

Under both options, the Streetcar Alternative would likely result in more land redevelopment, redevelopment to more intense uses, and redevelopment sooner in the B Avenue and Lake Oswego terminus station areas than under the No-Build Alternative. The following three reasons are similar to the reasons the Streetcar Alternative would have similar effects in Segment 2:

- Portland’s experience with the original streetcar project encouraging redevelopment and more intense redeveloped uses, as describe in item in Section 3.1.2.3. Like the Pearl District in Portland, the City of Lake Oswego has made street improvements and built new parks in and near the station areas and plans additional street improvements. As with the Pearl District, the City of Lake Oswego is partnering with land owners and developers to facilitate redevelopment of the

Foothills industrial area. It is likely to similarly partner with the owner of the Oswego Village commercial center that includes the Albertsons grocery store and adjacent land near the Lake Oswego terminus station.

- There would be a large amount of capacity for redevelopment in Segment 6, if the City Lake Oswego carries out its plans for Foothills redevelopment, as described in Section 3.1.1. Table 3.1-4 on page 3-13 assumes that the land now zoned Industrial in the Foothills area is rezoned to Multi-Family Residential/East End Commercial. It shows that 83 percent of the floor area allowed by existing and planned zoning of the B Avenue and Lake Oswego terminus station areas is unused by existing development.[7] It should be noted that city officials think that only a fraction of allowed square footage is likely because of parking requirements and because the scale of development likely to be proposed is lower than the floor area regulations would allow.

- Many properties in the station areas are ripe for redevelopment, as indicated by their improvement to land value ratios. Table 3.1-4 shows that 39 percent have ratios of less than one, 55 percent less than two, and 71 percent less than three.

Realization of the redevelopment potential described above is contingent on the City of Lake Oswego finding a way to comply with Section 0060 of the State of Oregon TPR.[8] As described in Section 3.1.2.3, the provision places conditions on changes to comprehensive plans and zoning if they would contribute to violations of congestion standards on state highways. It would apply to the Foothills redevelopment project because of the need for plan and zoning map amendments and because development there would increase traffic on Highway 43, a state highway. The city may be able to comply using approaches available under the TPR and the OHP, such as by establishing a "special transportation area," which allows higher congestion levels. In addition, Metro is working with the Oregon Department of Transportation to formulate OHP amendments that would provide new ways to achieve TPR compliance for development in town centers like downtown Lake Oswego.[9]

The Streetcar Alternative would not impact land use in the vicinity of the Briarwood Road station because the area is already developed in compliance with its single-family residential zoning and its residents oppose rezoning to allow other uses. There is no proposal for such rezoning.

The indirect and *cumulative land use impacts* would be the same because, as analyzed above, the indirect impacts take into account the combined land use impacts of the Streetcar Alternative, planned Foothills redevelopment, the city's plans to amend the comprehensive plan and zoning map as they apply to the Foothills area, and the city's plans to formulate a street plan for the area near the alignments of the Union Pacific Railroad and Foothills options. No other actions have been identified that would combine with the land use impacts of the Streetcar Alternative in an identifiable way.

3.1.3 Potential Land Use Impact Mitigation Measures

No potential mitigation measures are proposed because neither the Enhanced Bus Alternative nor the Streetcar Alternative would have adverse land use impacts. The redevelopment the Streetcar

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[7] The existing Industrial zoning would not allow the type of commercial and residential uses that make up mixed-use development and allows only one-third as much floor area.

[8] Oregon Administrative Rule 660-012-0060.

[9] Referred to as "Safe Harbors," the concept is to waive the TPR requirement as applied to designated town centers, etc., (like downtown Lake Oswego) and possibly entire corridors in exchange for meeting criteria addressing, for example, parking, transit, other alternative modes, and mixed-use zoning.

Alternative would encourage would comply with applicable plans and zoning or with planned changes in them. In the Foothills industrial area in Segment 6, the City of Lake Oswego plans to amend the comprehensive plan and zoning map to allow the residential and commercial redevelopment the Streetcar Alternative would encourage.

3.1.4 Compliance with Applicable Plans Policies

This section has two subsections. The first subsection compares the alternatives and options in terms of whether they comply with regional and city policies that specifically mention an alternative or address what mode of transportation is appropriate in the corridor. The second subsection identifies instances where alternatives and options would not comply with other applicable regional, city and county policies. It also describes how an alternative or option could be modified to comply or how the policy could be modified to make the alternative or option comply with it.

The two subsections summarize detailed analysis contained in the *Land Use and Planning Technical Report* (URS, August 2010). The technical report quotes all applicable policies and explains why the alternatives and options comply or do not comply with them. It and this section address only policies in plans state law requires compliance with. These are the Oregon Transportation Plan, Oregon Highway Plan, Oregon Bicycle and Pedestrian Plan, Regional Transportation Plan (RTP), Portland Transportation System Plan (TSP), Portland South Waterfront Plan, Portland North Macadam Transportation Development Strategy, Portland Willamette Greenway Plan, Lake Oswego Comprehensive Plan, Clackamas County Comprehensive Plan, and Multnomah County Comprehensive Framework Plan.

This section does not address compliance with the Statewide Planning Goals because they do not apply to project alternatives. Oregon's statewide land use planning laws and regulations, first enacted in 1973, require all regional and local governments, including Metro, to adopt and periodically update comprehensive plans. These plans must comply with Oregon's 19 Statewide Planning Goals. The plans must include maps of planned land use, urban growth boundaries to delineate the boundary between urban and rural lands, and TSPs. TSPs must provide for transportation facilities that support planned land use.[10] Projects like the Lake Oswego to Portland Transit Project must comply with applicable TSPs. Once the Land Conservation and Development Commission (LCDC) has "acknowledged" a plan as consistent with the Statewide Planning Goals, the goals no longer apply directly to projects such as the lake Oswego to Portland Transit Project. LCDC has acknowledged all the plans applicable to the project.

3.1.4.1 Policies that Address the Alternatives or the Appropriate Mode of Transportation

Regional Transportation Plan

The Streetcar Alternative would comply with the RTP, but neither the Enhanced Bus nor No-Build Alternative would comply with it. Relevant provisions are:

- The RTP's financially-constrained project list.
- Objective 1.1, Compact Urban Form and Design, states:

[10] Oregon Administrative Rule 660-012-0015(3)(a).

Use transportation investments to reinforce growth in and multimodal access to 2040 Target Areas and ensure that development in 2040 Target Areas is consistent with and supports the transportation investments.[11]

- The definition of "target areas" includes town centers, main streets and corridors.[12] The 2040 Growth Concept map:
  - Classifies downtown Lake Oswego as a town center.
  - Classifies downtown Portland as part of the central city.
  - Classifies as "main streets" an area along the Willamette Shore Line alignment from Hamilton Court south to near Pendleton Street and west along Boundary Street to west of Corbett Avenue.[13]

- Policies in the 2035 RTP's "Regional Transit Network Vision," which include "build the total system and transit-supportive land uses to leverage investments" and "expand high capacity transit."

- Figure 2.15, Regional Transit Network, which shows "rapid streetcar" in the Lake Oswego to Portland transit corridor. The RTP describes "rapid streetcar" as "streetcars running in mostly exclusive right-of-way so that they are able to travel faster safely."[14]

The Streetcar Alternative would comply with the RTP because it is on the financially constrained project list, would meet Objective 1.1, and would provide "rapid streetcar" in the Lake Oswego to Portland transit corridor. It would meet Objective 1.1 because extension of the streetcar system would encourage the types and intensities of development the 2040 Growth Concept designations call for. See the analyses of indirect land use impact, above. The Streetcar Alternative design options would not materially differ regarding Objective 1.1. The Enhanced Bus Alternative would not comply with the RTP because it is not on the financially constrained project list and would not encourage 2040 Growth Concept development types and intensities. Similarly, the No-Build Alternative would not comply with Objective 1.1 because it would not encourage 2040 Growth Concept development types and intensities.

Lake Oswego Comprehensive Plan

Both the Enhanced Bus and Streetcar Alternatives would comply with City of Lake Oswego Comprehensive Plan policies, but not the No-Build Alternative. Below are the policies that specifically address the alternatives or the appropriate mode of transportation for the corridor.

- Three policies under Goal 8, Transit System, and an associated Recommended Action Measure. The three policies are:
  1. Transit shall be a viable alternative to the single-occupant automobile in the City's highest density employment and housing areas. The City shall develop, in conjunction with Tri-Met, a network of transit routes to connect these areas with Main Streets, Town Centers, Employment Centers, downtown Portland and major transit and transfer stations. * * *

[11] Metro, 2035 Regional Transportation Plan Final Draft, March 2010, p. 2-8.
[12] *Ibid*., p. 2-5.
[13] Metro, 2040 Growth Concept Map, last amended November, 17, 2005.
[14] Metro, 2035 Regional Transportation Plan Final Draft, March 2010, p. 2-47.

2. Develop transit centers in Town Centers and Employment Centers where there is a need for transfer points between bus lines and local shuttle services or transit trunk routes. Transit centers will be conveniently located for all modes of transportation, in particular pedestrian, bike and transit.

* * *

6. The City shall work to preserve existing railroad rights-of-ways and other easements to maintain opportunities for future mass transit, bike and pedestrian paths.[15]

The Plan identifies downtown Lake Oswego as having a main street and being a town center.[16] One of the Recommended Action Measures for the Goal 8 policies states:

> Coordinate with Metro, Tri-Met, Multnomah County, Clackamas County, the City of Portland and other regional partners in the planning and design of high capacity transit on the Willamette Shore Rail line to ensure:
> a. Adequate access to the regional transportation system;
> b. Adequate termini facilities; and
> c. Adequate access to the line for all modes of travel.[17]

- Figure 20D of the Plan, Transit Network and Facilities Plan, shows:
  - the Willamette Shore Line alignment as "Right-of-Way Preservation, Future High Capacity Transit"
  - "Frequent Bus Network (High Frequency, Frequent Stops)"along State Street/Highway 43 through downtown
  - A park and ride lot and "major transit stop" near the park-and-ride structure under both the Enhanced Bus and Streetcar Alternatives[18]

- The Comprehensive Plan's "Public Facilities Plan: Transportation Improvement Program 1-10 Years," includes "Track/trestle rehabilitation" of the "Willamette Shores Trolley"[19] and "Park and Ride/relocated transit center" in "Downtown Lake Oswego - East of State Street."[20]

The Enhanced Bus would comply with City of Lake Oswego Comprehensive Plan policies because it would provide the "Frequent Bus Network (High Frequency, Frequent Stops)" the plan calls for. The Streetcar Alternative would comply because it would provide the "high capacity transit on the Willamette Shore Rail" the plan calls for. The Streetcar Alternative design options would be the same in this respect. Both the Enhanced Bus and Streetcar Alternatives would provide the "Park and Ride/relocated transit center" in "Downtown Lake Oswego – East of State Street." The No-Build Alternative would provide none of these and so does not comply with the Lake Oswego Comprehensive Plan.

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15 City of Lake Oswego, Comprehensive Plan, December 1994, as amended, p. 12-18, ff.
16 *Ibid*., Figures 26 – 28.
17 *Ibid*., measure vi., p. 12-19.
18 *Ibid*., Figure 20D.
19 *Ibid*., p. 12-28.
20 *Ibid*., p. 12-34.

Portland Transportation System Plan, South Waterfront Plan and Portland Streetcar System Concept Plan

Of the policies in the Portland TSP and South Waterfront Plan specifically applicable to them or addressing the appropriate mode of transportation in the corridor, the Streetcar Alternative would comply with more of the policies than the Enhanced Bus Alternative. The No-Build Alternative would not comply with these policies. Similarly, the Streetcar Alternative is in Portland Streetcar System Concept Plan; the Enhanced Bus and No-Build alternatives are inconsistent with the plan. The policies that specifically apply to the Streetcar Alternative or Enhanced Bus Alternative or address the appropriate mode of transportation in the corridor are quoted or described below.

- TSP Policy 6.17, Coordinate Land Use and Transportation, of the TSP states, "Implement the Comprehensive Plan Map and the 2040 Growth Concept through long-range transportation and land use planning and the development of efficient and effective transportation projects and programs."[21] See the description of 2040 Growth Concept classifications in the RTP discussion, above.

- Two objectives under TSP Policy 6.24, Public Transportation, are:
  - C. Expand primary and secondary bus service to meet the growing demand for work and non-work trips, operate as the principal transit service for access and mobility needs, help reduce congestion, and support the economic activities of the City.
  - H. Develop streetcar lines in Portland to connect new or redeveloping neighborhoods to employment opportunities and other destinations, including shopping, education, and recreation.[22]

- Objective A under TSP Policy 6.41, Southwest Transportation District, states:

  Use the Willamette Shore Line right-of-way, the corridor identified in the Macadam Corridor Improvement Plan, or other alignment as appropriate to provide future streetcar commuter service or light rail in the Macadam corridor.[23]

- Two objectives under the transportation policy of the South Waterfront Plan (which applies to Segment 2 south to Southwest Hamilton Court) are:
  - 3. Support the development of the Central City streetcar and a regional streetcar line that connects the district to downtown, Lake Oswego, and adjacent neighborhoods.
  - 9. Encourage increased transit service in the district while maintaining existing service levels in adjacent districts and neighborhoods.[24]

- The Portland Streetcar System Concept Plan includes "Lake Oswego to Portland: Lake Oswego to SW Lowell St" as a Planned Regional Project in its table of "Existing Streetcar Corridors and System Concept Corridors."[25]

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[21] *Ibid*., p. 2-28
[22] City of Portland, Transportation System Plan, op. cit., p. 2-32.
[23] *Ibid*., p. 2-99.
[24] City of Portland, South Waterfront Plan, November 13, 002, p. A-5.
[25] City of Portland, Portland Streetcar System Concept Plan, Public Review Draft, July 1, 2009, p. 45. The Portland City Council "accepted" September 9, 2009, and the City plans to adopt it as part of its TSP.

The Streetcar Alternative would comply with all of the TSP and South Waterfront Plan policies quoted above except objective C under TSP Policy 6.24, Public Transportation. The Segment 3 design options would be the same in this respect. The Enhanced Bus Alternative would comply with only objective C under TSP Policy 6.24. The No-Build Alternative would comply with none of these policies. The Streetcar Alternative is in the Portland Streetcar System Concept Plan. The No-Build and Enhanced Bus Alternatives are inconsistent with inclusion of the Streetcar Alternative in the Portland Streetcar System Concept Plan.

3.1.4.2 Other Policies

As described above, this subsection summarizes: a) instances where design features of the build alternatives and options would not comply with applicable regional, city, and county policies; b) how an alternative or option could be modified to comply; and c) how the policy could be modified to make the alternative or option comply with it. Except in the instances listed here, the build alternatives would comply with policies addressing design features. This subsection summarizes analysis contained in the *Land Use and Planning Technical Report* (URS, August 2010).

Enhanced Bus Alternative

- Would not meet 2035 RTP Objective 6.1, which states, "Avoid or minimize undesirable impacts on fish and wildlife habitat conservation areas, wildlife corridors, significant flora and open spaces." This is because the Enhanced Bus Alternative would adversely impact aquatic habitat, while the Streetcar Alternative would not. See Section 3.8 Ecosystems.

- Would be inconsistent with a provision of Portland TSP Policy 6.6, which states, "Employ transit-preferential measures, such as signal priority and bypass lanes."[26] Adding bypass lanes to the Enhanced Bus Alternative would not be feasible in much of the corridor. Analysis conducted during the alternatives analysis concluded that such lanes would have to be continuous, because of the length of traffic queues. Adding additional lanes was found to be infeasible in much of the corridor. Adding signal priority without bypass lanes would achieve partial compliance. While it would not substantially improve speeds without adding bypass lanes, it would achieve compliance with TSP Policy 6.10, described below. To avoid noncompliance, "where feasible" could be added to the TSP Policy 6.6 sentence quoted above, so that it would read, "<u>Where feasible</u>, employ transit-preferential measures, such as signal priority and bypass lanes."

- Would not comply with Portland TSP Policy 6.10, which states "Design treatments on Major Emergency Response Streets should enhance mobility for emergency response vehicles by employing preferential or priority treatments."[27] The TSP classifies Macadam Avenue/Highway 43 as a major emergency response route.[28] As with Policy 6.6, discussed above, adding signal priority would achieve compliance. Alternatively, as with Policy 6.6, to avoid noncompliance, "where feasible" could be added to the SP Policy 6.10 sentence quoted above, so that it would read, "<u>Where feasible</u>, design treatments on Major Emergency Response Streets should enhance mobility for emergency response vehicles by employing preferential or priority treatments."

[26] *Ibid*., p. 2-10.
[27] *Ibid*., p. 2-15.
[28] *Ibid*., Map 6.41.6, p. 2-106.

Streetcar Alternative

- Would be in substantial, but not technical, compliance with providing an "Off-Street Path" in the vicinity of the existing Willamette Shore Line alignment south of Miles Street. This is because there would be no off-street path for about 600 feet of the length of the path, as shown on the Portland TSP bicycle and pedestrian classifications maps for the Southwest District.[29] A draft report prepared for Metro has identified how an off-street trail could be routed, if a streetcar alternative were implemented, including in conjunction with the replacement of the Sellwood Bridge.[30] It shows the path as the "Greenway Off-Street Path," which would parallel the WSL alignment south to a point north of Radcliffe Road. South of this point, the report shows only an "On-Street Facility" on Highway 43. This point is a short distance north of the Portland city limits, where the city's comprehensive planning jurisdiction ends.[31] This implies that only the Willamette Shore Line alignment is feasible as an "Off-Street Path" for the approximately 600-foot distance to the city limits. Regarding Off-Street Paths, TSP Policy 6.7.B states:

    Off-Street Paths are intended to serve as transportation corridors and recreational routes for bicycling, walking, and other non-motorized modes.

    - Connections. Use Off-Street Paths as convenient shortcuts to link urban destinations and origins along continuous greenbelts such as rivers, park and forest areas, and other scenic corridors, and as elements of a regional, citywide, or community recreational trail plan.
    - Location. Establish Off-Street Paths in corridors not well served by the street system.[32]

To avoid this instance of technical noncompliance, the TSP could be amended to indicate that substantial provision of an "Off-Street Path" would comply with the plan, even if the path is not provided for along the entire length shown on classification maps.

Streetcar Design Options

- The Macadam In-Street and Macadam Additional Lane design options would not comply with the provision of Portland TSP Policy 6.6 which states, "Employ transit-preferential measures, such as signal priority and bypass lanes."[33] As with the Enhanced Bus Alternative, adding bypass lanes would not be feasible. Analysis conducted during the alternatives analysis concluded that such lanes would have to be continuous, because of the length of traffic queues. Adding additional lanes was found to be infeasible. Adding signal priority without bypass lanes would achieve partial compliance. While it would not substantially improve speeds without adding bypass lanes, it would achieve compliance with TSP Policy 6.10, described below. To avoid this noncompliance, "where feasible" could be added to the TSP Policy 6.6 sentence, to read, "<u>Where feasible</u>, employ transit-preferential measures, such as signal priority and bypass lanes."

- The Macadam In-Street and Macadam Additional Lane design options would not comply with Portland TSP Policy 6.10, which states "Design treatments on Major Emergency Response

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[29] City of Portland, Transportation System Plan, April 5, 2007, Map 6.41.3, p. 2-103, and Map 6.41.4, p. 2-104. Because the TSP map and the Metro map referred to are schematic, the 600-foot figure is a rough estimate.
[30] Alta Planning and Design, Lake Oswego to Portland Trail, Draft, July 2009, Map 3.
[31] Under contract with Multnomah County, the City of Portland exercises land use regulatory authority in an area south of the city limits which extends to the boundary between Multnomah and Clackamas Counties. However, Multnomah County retains comprehensive planning authority over the area.
[32] Ibid., p. 2-13.
[33] Ibid., p. 2-10.

Streets should enhance mobility for emergency response vehicles by employing preferential or priority treatments."[34] The TSP classifies Macadam Avenue/Highway 43 as a major emergency response route.[35] As with Policy 6.6, discussed above, adding signal priority would achieve compliance. Alternatively, as with Policy 6.6, to avoid noncompliance, "where feasible" could be added to the SP Policy 6.10 sentence reading, "Design treatments on Major Emergency Response Streets should enhance mobility for emergency response vehicles by employing preferential or priority treatments, where feasible."

[34] Ibid., p. 2-15.
[35] Ibid., Map 6.41.6, p. 2-106.

3.2 Economic Activity

This section addresses the economic impacts of the project's proposed alternatives. Most transportation projects help to provide the mobility necessary for economic activity in an area, but most have a relatively small direct impact on economic conditions. Direct economic effects are defined as jobs or spending caused by the project. Indirect effects are defined as jobs or spending that the project may cause or contribute to causing by changing the level of access and mobility within the corridor and region. For additional detail see the *Lake Oswego to Portland Transit Corridor Economic Activity Technical Report* (BGY and TriMet/Metro, November 2010).

The analysis of employment impacts within this section is based on economic data for the four-county metropolitan area, capital and operating cost estimates for the project (see Sections 2.3 and 2.4, respectively) and use of the IMPLAN[36] economic impacts assessment model to estimate the number of jobs generated as a result of this project.

3.2.1 Affected Environment

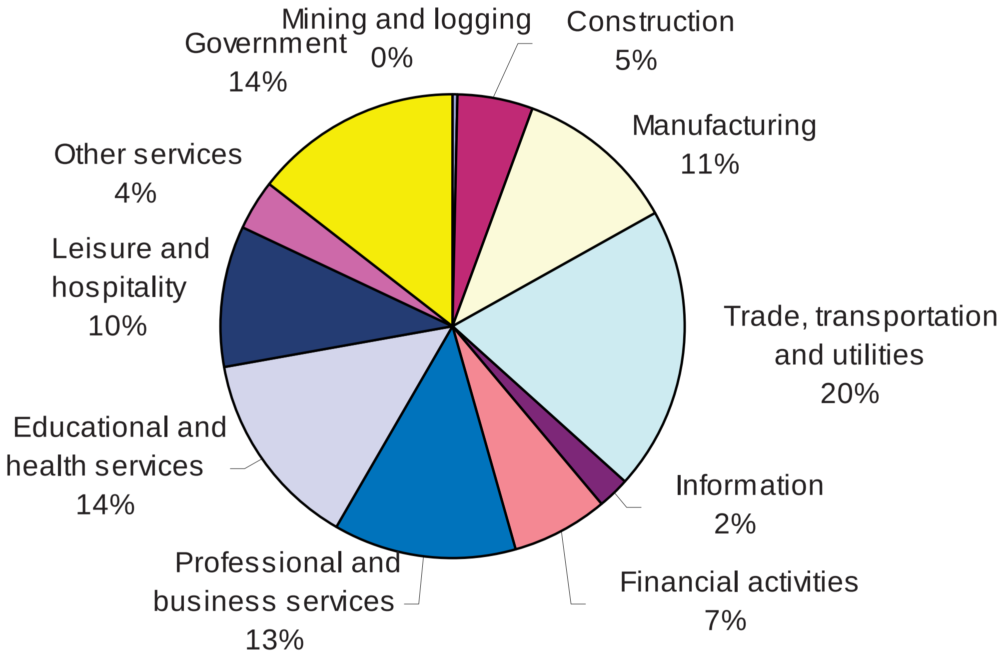
The Portland/Vancouver metropolitan area is the economic center of an extensive area that includes most of Oregon, Southwest Washington and portions of Idaho. The metro region, with downtown Portland as its urban center, is located near the confluence of the Columbia and Willamette rivers. The Portland/Vancouver metropolitan area is defined as the four-county region, which is made up of Multnomah, Clackamas and Washington counties in Oregon and Clark County in Washington. Between 1980 and 2005, the area's population grew by approximately 56 percent, to a population of approximately 1.9 million, as shown in Table 3.2-1. Over the same period, households increased by 61 percent to a total of approximately 767,000. Population and household growth in Portland, which contains the northern portion of the Lake Oswego to Portland transit corridor, were lower than in the wider Portland/Vancouver metropolitan area. However, the South Corridor and Johns Landing Districts are experiencing faster population and employment growth than the rest of the City of Portland, as described later in this section. Population and household growth in Lake Oswego, which contains the southern end of the transit corridor, were higher than in the wider Portland/Vancouver metropolitan area.

In 2005, there were over 1 million jobs within the metropolitan area, with 424,000 and 19,300 jobs within the cities of Portland and Lake Oswego, respectively. Metropolitan area employment grew by approximately 110 percent from 1980 to 2005, outpacing state employment growth (45 percent). The recent economic downturn has resulted in increasing levels of unemployment within the region, estimated at a seasonally adjusted 11.1 percent for the Metropolitan Statistical Area in September 2009, up from 6.1 percent the previous year, compared to the Oregon average unemployment rate of 11.0 percent and the United States average of 9.8 percent. The Oregon Employment Department estimated total nonfarm employment in the Metropolitan Statistical Area in September 2009 of approximately 975,800 jobs, across a wide range of industry groups. The largest employment sectors are trade, transportation and utilities (20 percent); education and health services (14 percent); and

[36] IMPLAN is a static equilibrium input-output model first developed in 1979 by the U.S. Forest Service in cooperation with the Federal Emergency Management Agency and the U.S. Bureau of Land Management to assist the Forest Service in land and resource planning and management. The program has been updated and improved over subsequent years and is now one of the most commonly-used economic modeling tools for measuring the economic impacts of development projects. This analysis utilizes year 2007 data for Multnomah, Washington, and Clackamas counties in Oregon, and Clark County, Washington.

government (14 percent). Figure 3.2-1 illustrates the breakdown of employment for the Metropolitan Statistical Area.

Figure 3.2-1 Portland/Vancouver Regional Employment by Industry, September 2009



Source: Oregon Employment Department; September 2009

The Lake Oswego to Portland transit corridor includes six districts: Portland Central Business District (CBD), Northwest Portland, South Waterfront/OHSU, Johns Landing, Dunthorpe/Riverdale, and Lake Oswego (see Figure 1.2-1). Table 3.2-1 summarizes historic household and employment growth from 1990 to 2005 within the corridor districts, the Lake Oswego to Portland transit corridor, and the Portland/Vancouver metropolitan area. The corridor comprises approximately 15 percent of the region's employment and approximately 4 percent of the region's households. From 1990 to 2005, household growth in the corridor (37 percent) was comparable to household growth in the region (40 percent), with the greatest household growth in the corridor occurring within the Portland CBD (118 percent). The corridor's employment growth rate of 25 percent during the same period has been slower than the metropolitan area's (at 48 percent), though employment growth in the South Waterfront/OHSU area was greater at 68 percent.

Table 3.2-1 Local, Regional and State Population and Households 1980 through 2005

Location	1980	1990	2000	2005	Change 1980 to 2005 Percent	Change 1980 to 2005 Actual
Population						
City of Portland[1]	366,400	437,300	529,100	556,400	52	190,000
City of Lake Oswego[2]	22,900	30,600	35,300	40,900	79	18,100
Portland/Vancouver area [2,3]	1,242,600	1,412,300	1,759,100	1,946,000	57	703,400
State of Oregon[1]	2,633,100	2,842,300	3,421,400	3,638,900	38	1,005,800
Households						
City of Portland[1]	158,900	187,300	223,800	235,200	48	76,300
City of Lake Oswego[2]	8,500	12,600	14,800	17,200	102	8,700
Portland/Vancouver area[2,3]	477,800	548,700	696,700	767,000	61	289,200
State of Oregon[1]	991,600	1,103,300	1,333,700	1,425,300	44	433,700
Employment						
City of Portland[1]	173,800	218,800	276,100	424,000	144	250,100
City of Lake Oswego[2]	11,800	16,600	18,300	19,300	64	7,500
Portland/Vancouver area[2,3]	491,200	697,300	906,800	1,032,200	110	541,000
State of Oregon[1]	1,138,400	1,320,000	1,627,800	1,654,400	45	516,000

[1] Source: US Census except for 2005 (PSU Population Research Center, 2008).
[2] Source: Metro, 2009.
[3] The four-county Portland/Vancouver metropolitan area includes all of Multnomah, Clackamas, and Washington Counties in Oregon, and Clark County in Washington.

The future growth rate of households in the Lake Oswego to Portland transit corridor from 2005 to 2035 is projected to be double that of the region (i.e., 113 percent compared to 58 percent, respectively), with the number of households in the corridor reaching nearly 66,500 from the 2005 estimate of 31,200. Comparatively, the number of households in the region is expected to grow from 767,000 to over 1,208,600. The future employment growth rate in the corridor will be about two-thirds of the regional average (estimated at nearly 157,200 in 2005, employment in the corridor is expected to grow to 235,500 by 2035 for a growth rate of 50 percent, compared to regional employment growth to nearly 1,799,200 from 1,032,300, or a regional rate of 74 percent). See Table 3.2-2.

Table 3.2-2 Households and Employment, 2005 Estimate and 2035 Forecast

District	Households 2005	Households 2035	Households Growth Number	Households Growth Percent	Employment 2005	Employment 2035	Employment Growth Number	Employment Growth Percent
Portland CBD	13,013	34,637	21,624	166	101,203	147,834	46,631	46
Northwest Portland	6,058	7,852	1,794	30	15,198	19,858	4,660	31
South Waterfront/OHSU	2,246	7,324	5,078	226	25,730	42,267	16,537	64
Johns Landing	1,145	3,688	2,543	222	8,083	12,937	4,854	60
Dunthorpe	1,136	1,518	382	34	1,564	2,377	813	52
Lake Oswego	7,578	11,477	3,899	51	5,415	10,235	4,820	89
Corridor Total	**31,176**	**66,496**	**35,320**	**113**	**157,193**	**235,508**	**78,315**	**50**
Region Total	**767,016**	**1,208,649**	**441,633**	**58**	**1,032,316**	**1,799,212**	**766,896**	**74**

Source: Metro, 2009.

The corridor's districts that are forecast to have household growth rates approximately equal to or greater than the regional average are the Portland CBD (166 percent), the South Waterfront/OHSU (226 percent), Johns Landing (222 percent), and Lake Oswego (51 percent). The districts with the greatest employment growth rate over the next 25 years are forecast to be Lake Oswego (89 percent), South Waterfront/OHSU (64 percent), Johns Landing (60 percent), and Dunthorpe/Riverdale (52 percent).

3.2.2 Economic Impacts

Transit-related projects generate distinct economic impacts during both the construction and operations phases. Project construction results in a one-time increase in economic activity, while operations produce long-term economic benefits to the local community. Both sources of economic activity result in increased economic output, employee compensation and employment throughout the region. There are additional long-term economic impacts, including changes to jurisdictions' tax bases that would occur due to acquisition of property and the displacement of residences and businesses. These fiscal impacts are also evaluated in this section.

Total economic effects include direct[37] effects of the transit employment, as well as indirect[38] and induced[39] effects resulting from resulting spending in the economy. Table 3.2-3 summarizes economic impacts by alternative in terms of economic output, employee compensation, and employment.

Table 3.2-3 Summary of Economic Impacts, By Alternative

	Enhanced Bus		Streetcar	
Economic Impact	**O&M (annual)**	**Construction (one-time)**	**O&M (annual)**	**Construction (one-time)**
Output (millions 2009$)				
Direct	$3.54	$26.00	$2.64	$154.6 to $165.6
Indirect	$1.53	$6.80	$1.14	$40.2 to $43.1
Induced	$1.84	$6.30	$1.38	$37.5 to $40.2
Total Output	**$6.92**	**$39.10**	**$5.16**	**$232.3 to $248.8**
Employee Compensation (millions 2009$)				
Direct	$2.34	$6.30	$1.74	$37.7 to $40.4
Indirect	$0.51	$2.10	$0.38	$12.7 to $13.6
Induced	$0.55	$1.90	$0.41	$11.3 to $12.1
Total Employee Compensation	**$3.40**	**$10.40**	**$2.54**	**$61.6 to $66.0**
Employment (Jobs)				
Direct	36	137	27	810 to 870
Indirect	11	49	8	290 to 310
Induced	16	55	12	320 to 350
Total Employment	**63**	**240**	**47**	**1,430 to 1,530**

Source: Metro/TriMet; January 2010, and IMPLAN Pro 2.0.1025.

The IMPLAN economic impact assessment model estimates that every $10 million in transit operations costs would result in 101 direct long-term jobs, including vehicle operators, maintenance staff, and administrative and supervisory staff. Because the analysis compares the operating costs of

[37] Direct economic effects refer to changes in output, income, and employment attributable to expenditures and/or production values specified as direct final demand.
[38] Indirect economic effects refer to changes in output, income, and employment resulting from iterations of businesses making expenditures initially caused by the direct economic effects.
[39] Induced economic effects refer to changes in output, income, and employment caused by expenditures associated with increased household income generated by the direct and indirect effects.

each build alternative to the No-Build Alternative, the Enhanced Bus Alternative operating cost of $2.79 million over the No-Build Alternative yields roughly 28 jobs, while the Streetcar Alternative operating cost of $1.25 million over the No-Build Alternative yields approximately 13 jobs. See Section 2.4 for a summary of the operating cost estimates for each alternative. Design options under consideration would not affect the long-term employment resulting from the Streetcar Alternative. The degree to which these jobs would be an actual economic benefit would depend on the source of funding for the project. Locally funded operations yield a smaller economic benefit than federally funded operations, because the local funds would be otherwise be spent on other projects in the region. According to the finance report summarized in Chapter 5, funding for construction would largely be from federal sources and as-of-yet-undetermined state, regional, and local funds, other than a local right of way match.

Also according to Chapter 5, operations and maintenance (O&M) costs relating to the No-Build Alternative at 2035 service levels is estimated at $28.41 million in 2010 dollars, compared to $31.20 million for the Enhanced Bus Alternative or $29.66 million for the Streetcar Alternative. In other words, corridor O&M costs for the Streetcar Alternative would be $2.64 million higher than the No-Build Alternative, due to the increased service levels. The corridor O&M costs for the Enhanced Bus Alternative would be $1.54 million higher than those for the Streetcar Alternative, as shown in Table 3.2-4.

Table 3.2-4 Long-Term Operating Costs and Estimated Employment Resulting from the No-Build, Enhanced Bus, and Streetcar Alternatives

	No-Build	Enhanced Bus	Streetcar
Operating Costs over No-Build	0	$2.79	$1.25
Long-Term Employment[1]	0	28	13

Source: Metro/TriMet; January 2010, and IMPLAN Pro 2.0.1025.
[1] Based on increases in annual transit operating costs in 2035, compared to the No-Build Alternative. See Section 2.4 and Section 5.1 for the operating cost estimates by alternative. Streetcar design options under consideration would not affect long-term employment estimates.

Because operating costs are estimated to be lower for the Streetcar Alternative than the Enhanced Bus Alternative, the long-term employment would also be lower for that alternative. The No-Build Alternative would not result in any increase in long-term employment, compared to the Enhanced Bus and Streetcar alternatives that would result in 28 and 13 long-term jobs, respectively, estimated using the IMPLAN factors.

Another notable economic impact of the alternatives would result from the removal of private property from the property tax rolls through public acquisition for the project. Additional issues include land use or market changes that affect assessed values of private properties surrounding streetcar stations.

The No-Build Alternative would not require the acquisition of any properties, while the Enhanced Bus Alternative would potentially require the partial acquisition of seven parcels and the full acquisition of one parcel. The Streetcar Alternative could potentially result in TriMet's acquisition of approximately 26 to 63 partial or full parcels (see Section 3.3 and Appendix A of this DEIS for additional detail on property acquisitions). Property acquired for the project would result in the removal of private property from the local tax base. Table 3.2-5 shows the estimates of assessed value and estimated property tax impacts of removing the properties that would be displaced by the alternatives, by jurisdiction.

Table 3.2-5 Estimate of Assessed Value and Estimated Taxes[1] from Displaced Properties, by Jurisdiction and Alternative

Alternative	Assessed Value (millions)	Estimated Annual Loss in Tax Revenue		
		Portland	Lake Oswego	Total
No-Build	$0	$0	$0	$0
Enhanced Bus	$1.18	$0	$6,710	$6,710
Streetcar	$1.8 to $10.1	$1,600 to $37,400	$8,800 to $22,920	$10,500 to $67,900

Source: Metro/TriMet; January 2010.
[1] This analysis applies an estimated tax rate by jurisdiction to the assessed value in the GIS database to estimate the impact on assessed value and the resulting annual impact on property tax revenue. It applies a per-square-footage value based on the assessed land value and the square footage of the parcel. It adds the value of the building if the building is identified as a building "take" in the right-of-way analysis. The analysis further applies an estimated tax rate of 0.007392 percent for Portland and 0.005683 percent for Lake Oswego (including bonds). These values were derived from the *2008-09 Oregon Property Tax Statistics Supplement*, a companion document to the *2008-09 Oregon Property Tax Statistics*, published by the Oregon Department of Revenue. Actual property taxes are levied on the net assessed value of the property. The estimated tax impacts would be distributed among the various taxing districts within the areas where the properties would be acquired.

In summary, the Streetcar Alternative would result in the loss of approximately $10,500 to $67,900 in annual tax revenues for the applicable taxing districts ($1,600 to $45,000 for the City of Portland, up to $7,570 for unincorporated Multnomah County, and $8,800 to $22,920 for the City of Lake Oswego), depending on the Streetcar design option (see Table 3.2-6).

Table 3.2-6 Summary of Estimated Assessed Value of Displaced Property and Estimated Annual Tax Impact[1] by Segment and Streetcar Design Option

Alternative / Segment	Design Option	Displaced Property Value	Annual Loss in Tax Revenues
Enhanced Bus Alternative	None	$1,180,310	$6,710
Streetcar Alternative			
1 – Downtown Portland	None	$0	$0
2 – South Waterfront[2]	None	$100,520	$740
3 – Johns Landing	Willamette Shore Line	$122,430	$910
	Macadam In-Street	$2,663,410	$19,690
	Macadam Additional Lane	$5,058,760	$37,390
4 – Sellwood Bridge[3]	None	$0	$0
5 – Dunthorpe/Riverdale	Willamette Shore Line	$0	$0
	Riverwood	$1,024,060	$7,570
6 – Lake Oswego	UPRR[4]	$1,548,490	$8,800
	Foothills[5]	$4,033,750	$22,920

Source: URS and Oregon Department of Revenue; January 2010.
[1] These estimates do not include right-of-way and other property already owned or controlled by public entities or railroads.
[2] These displacements are in addition to those related to the south portal project, whose right-of-way will also be made available to streetcar. The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and Moody/Bond Couplet are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.
[3] The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and New Interchange are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.
[4] In addition to acquisition of property from UPRR.
[5] Streetcar would be responsible for $4,033,750 of the $12,648,030 total value of displaced property in the foothills area, which results in an estimated $71,880 total loss in annual tax revenue.

Many of the displaced businesses and residences would likely relocate and/or rebuild within the same area, thereby increasing assessed value and property tax revenue elsewhere. Despite a short-term loss in assessed value and property tax revenue caused by displacement of properties, properties close to streetcar stations would likely experience an increase in value upon completion of the project, thereby increasing property tax revenue in the long term. The likely impact of this type of activity is described more fully in the *Land Use Technical Report* (URS, August 2010).

The Streetcar Alternative could also result in the potential loss in business tax revenue to the City of Portland if businesses within the Portland city limits are required or decide to close or relocate out of the taxing district due to property acquisitions. Lake Oswego does not collect business taxes. The Streetcar Alternative would result in between one and six building acquisitions, depending on the design options chosen (see Section 3 for additional detail). Of these, one of the building displacements is within the Portland city limits and designated for commercial land uses. According to the City of Portland Revenue Bureau, the displaced property has four business accounts associated with it. Most likely these businesses pay the city business license fee and county income tax;[40] however, the displaced businesses would likely relocate within the same area, thereby offsetting the loss of business revenues and business tax revenues.

The Enhanced Bus Alternative would result in approximately 240 construction-related, short-term jobs and about $10.5 million in additional regional income, compared to the 1,430 to 1,530 jobs and $61.6 to $66.0 million in additional personal income that would be generated by the Streetcar Alternative (see Table 3.2-7), depending on the design option. Table 3.2-8 summarizes construction costs and short-term jobs for the Streetcar Alternative by segment and design option.

Table 3.2-7 Short-Term Employment1 and Change in Personal Income by Alternative

Alternative	Short-Term Jobs[2]	Personal Income[2] (millions)
No-Build	0	$0.0
Enhanced Bus	240	$10.5
Streetcar	1,430 to 1,530	$61.6 to $66.0

Source: TriMet, URS Corporation, and IMPLAN Pro 2.0.1025.
[1] Short-term employment are those jobs created during construction of the project.
[2] The IMPLAN economic impacts assessment model estimates that every $10 million in streetcar or enhanced bus construction would result in an estimated 92.3 jobs, with direct average compensation of $28.500.

The overall effects of the Lake Oswego to Portland Transit Project would be minor in the context of the number of jobs and income generated in the metropolitan area. With approximately 1 million jobs in the metropolitan area, the high end of employment generated by streetcar construction would represent less than two-tenths of one percent of all employment in the area, with the Enhanced Bus Alternative representing less than one-tenth of that estimate. As compared to the No-Build Alternative, cumulative effects of the project could include redevelopment along the proposed streetcar line, particularly station areas in established commercial areas, including Johns Landing and downtown Lake Oswego. The likely impact of this type of activity is described more fully in the *Land Use Technical Report* (URS, November 2010).

[40] Confidentiality rules prevent the disclosure of business tax and license revenue data as it relates to specific businesses.

Table 3.2-8 Summary of Streetcar Alternative Construction Costs (2010 dollars)[1] and Total Short-Term Employment[2] by Segment and Design Option

Segment	Design Option	Construction Costs[1] (millions)	Short-Term Jobs
1 – Downtown Portland	None	$1.0	30
2 – South Waterfront[3]	None	$21.1	70
3 – Johns Landing	Willamette Shore Line	$19.0	90
	Macadam In-Street	$27.9	170
	Macadam Additional Lane	$32.7	210
4 – Sellwood Bridge[4]	None	23.7	220
5 – Dunthorpe/ Riverdale	Willamette Shore Line	$52.6	220
	Riverwood	$52.1	490
6 – Lake Oswego	UPRR	$48.6	460
	Foothills	$69.9	470
Storage Facility Allowance		$2.5	400

Source: URS Corporation (for capital costs provided to TriMet to prepare the finance plan summarized in Chapter 5), and IMPLAN Pro 2.0.1025 (economic analysis).

Note: There is an additional $48.4M estimated for the purchase of 11 streetcar vehicles. These vehicles are expected to be manufactured by Oregon Iron Works, resulting in an additional quantifiable local economic impact. Streetcar manufacturing is classified as NAICS code 336510 (Railroad rolling stock manufacturing), which corresponds to IMPLAN industry code 289 (Railroad rolling stock manufacturing). IMPLAN estimates that $48.4M in streetcar manufacturing results in 144 jobs in this industry, with an estimated aggregated compensation of $8.7M.

[1] All amounts exclude property acquisition costs.

[2] Short-term jobs are those that are associated with the construction of a project. The IMPLAN economic impacts assessment model estimates that every $10 million in streetcar construction results in an estimated total impact of 92.3 jobs, with direct average compensation of $28.500.

[3] The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and Moody/Bond Couplet are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

[4]The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and New Interchange are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

3.2.3 Potential Mitigation Measures

The effects of the project's proposed alternatives would be relatively minor in the context of the number of jobs and income generated by the metropolitan region; additionally, the project has been designed to minimize the extent and number of residences, businesses, jobs and property access that would be permanently adversely affected. Compensation for partial acquisitions and easements would be provided at fair market value and relocation of displaced residences or businesses would be determined through negotiations with the property owners. Any acquisition of property and relocation of displaced residents will follow the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

For the Enhanced Bus Alternative and more for the Streetcar Alternative, public information relating to the project's construction timing and proximity would help to mitigate some of the potential temporary effects of the project on local businesses. A comprehensive package of public information and business assistance measures would be developed, which could include conducting public information campaigns to encourage patronage of businesses during construction. A primary goal of construction planning is to maintain adequate access to all businesses so their operations can continue during the construction phase of the project.

3.2.4 Potential Economic Development and Redevelopment Effects

Section 3.1.2 Land Use Impacts, describes the redevelopment effects of the alternatives. These redevelopment effects are part of the economic development impact of the alternatives. Another part of the economic development impact of the alternatives is how they would affect employment and economic activity; Section 3.2.2 addresses these impacts.

3.3 Neighborhoods, Displacements and Relocations

This section summarizes the effects that the alternatives and options would have on community resources, focusing on neighborhoods within the six segments of the Lake Oswego to Portland transit corridor. Community impacts are generally categorized as changes to neighborhood cohesion, neighborhood quality of life and neighborhood mobility. Potential property acquisitions and displacements/relocations are also considered community impacts and are included in this section. Section 3.18 addresses the project's compliance with environmental justice regulations. Additional information on the assessment of community impacts is included in the *Lake Oswego to Portland Transit Project: Community Impact Assessment Technical Report* (URS and TriMet/Metro, November 2010).

The analysis within this section has been conducted pursuant to the following laws and regulations:

- Americans with Disabilities Act of 1990;
- Title VI of the Civil Rights Act of 1964;
- Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended;
- 49 CFR Part 24, titled Uniform Relocation Assistance and Real Property Acquisition.

The analysis units for this evaluation are the neighborhoods that are located fully or predominantly within the project corridor and recognized by the cities of Portland and Lake Oswego. In addition to the recognized neighborhoods, this analysis includes areas of unincorporated Clackamas and Multnomah counties that are located between the cities of Portland and Lake Oswego, adjacent to the Willamette River, generally encompassing the suburban communities in the area known as Dunthorpe or Riverdale. The neighborhoods are illustrated in Figure 3.3-1. Locations of community facilities were obtained from Metro's Regional Land Information System data set and via fieldwork in the area.

This section first describes the affected community environment. It is followed by an assessment of long-term, direct, indirect and cumulative effects of the alternatives and options on that environment, and an assessment of potential mitigation measures that could address effects of the alternatives and options on neighborhoods and communities in the vicinity of the project.

3.3.1 Affected Environment

This section provides a general description of each neighborhood in the project area, highlighting sensitive demographic groups that exceed the regional average percentile and key community facilities. The region is defined as Multnomah, Washington and Clackamas counties. Details on the specific urban amenities and affordable housing units within each neighborhood can be found in the *LOPT Community Impact Assessment Technical Report* (URS and TriMet/Metro, November 2010). Tables 3.3-1 and 3.3-2 summarize the demographic characteristics, including total population and household, racial/ethnic composition, housing tenure, income, age and disability, of the corridor's neighborhoods. Figures 3.3-2 to 3.3-4 illustrate the locations of community facilities and urban amenities within the corridor's neighborhoods.[41] Impacts to the neighborhoods to the south are not analyzed because there would be no direct, physical impacts there and their residents would access transit to downtown Portland by transferring to faster, more reliable routes.

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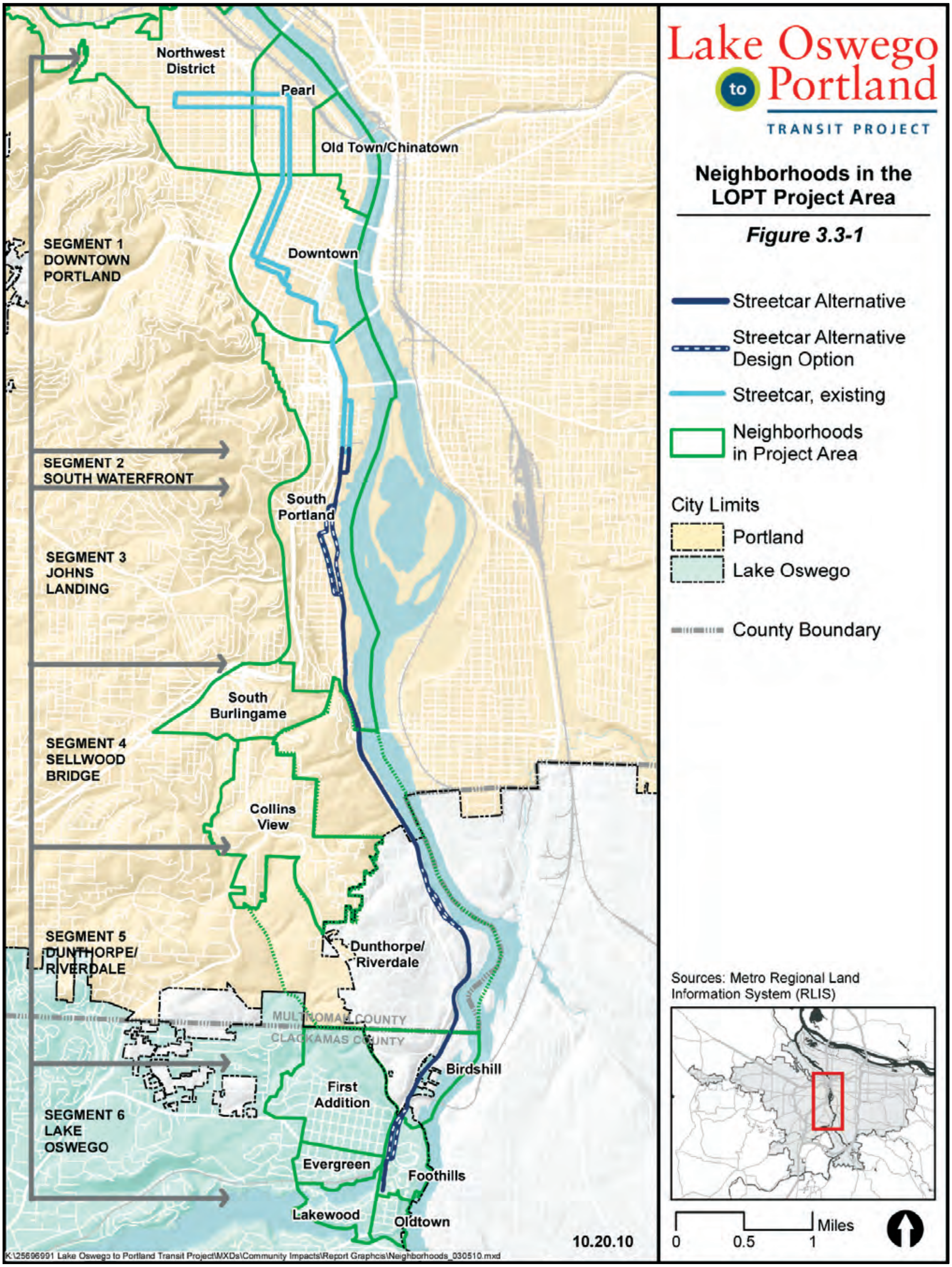
[41] Urban amenities are defined in the 2007 report by Johnson Gardner: *An Assessment of the Marginal Impact of Urban Amenities on Residential Pricing.*


Lake Oswego to Portland
TRANSIT PROJECT
Neighborhoods in the LOPT Project Area
Figure 3.3-1
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar, existing
Neighborhoods in Project Area
City Limits
Portland
Lake Oswego
County Boundary
Sources: Metro Regional Land Information System (RLIS)
0
0.5
1
Miles
Northwest District
Pearl
Old Town/Chinatown
Downtown
SEGMENT 1 DOWNTOWN PORTLAND
SEGMENT 2 SOUTH WATERFRONT
South Portland
SEGMENT 3 JOHNS LANDING
South Burlingame
SEGMENT 4 SELLWOOD BRIDGE
Collins View
SEGMENT 5 DUNTHORPE/ RIVERDALE
Dunthorpe/ Riverdale
MULTNOMAH COUNTY
CLACKAMAS COUNTY
Birdshill
First Addition
SEGMENT 6 LAKE OSWEGO
Evergreen
Foothills
Lakewood
Oldtown
10.20.10
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Demographic data for this analysis of neighborhoods and communities were obtained through the 2000 U.S. Census. Poverty statistics for each neighborhood refer to the percentage of households with incomes below the Federally-defined poverty level, based on the 2000 U.S. Census. Demographic statistics are presented below by neighborhood and are compared to the regional average.

Table 3.3-1 Demographic Characteristics of Neighborhoods within in the City of Portland, Unincorporated Multnomah County and City of Lake Oswego (2000)

Jurisdiction Neighborhood[1]	Persons	Households	Residents 65 or older	Renter Occupied	Disabled	Below Poverty	Minority[2]
City of Portland							
Northwest District	10,309	4,388	**13%**	37%	12%	10%	10%
Pearl District	1,702	858	**33%**	**56%**	9%	9%	9%
Old-Town/Chinatown	603	284	**12%**	**41%**	9%	**12%**	14%
Downtown	7,653	4,987	**11%**	**80%**	12%	**16%**	13%
South Portland	6,877	4,390	10%	**88%**	13%	**31%**	**22%**
South Burlingame	1,829	1,065	**12%**	**62%**	12%	**17%**	14%
Collins View	726	407	9%	**49%**	10%	**11%**	11%
Unincorporated Multnomah County							
Dunthorpe/Riverdale	1,025	592	**11%**	11%	11%	8%	10%
Unincorporated Clackamas County							
BirdsHill[3]	213	97	**11%**	13%	14%	2%	11%
City of Lake Oswego							
BirdsHill	21	9	**11%**	13%	14%	2%	11%
First Addition	2,879	1,004	10%	21%	9%	6%	11%
Foothills	413	171	**11%**	11%	10%	4%	9%
Old Town	186	76	**11%**	10%	10%	4%	9%
Evergreen	795	357	7%	24%	8%	**11%**	11%
Lakewood	424	174	**11%**	10%	10%	4%	9%
Tri-County Region[4]	*1,444,219*	*569,461*	*10%*	*39%*	*17%*	*10%*	*17%*

Source: U.S. Census Bureau. Census 2000, Summary File 1 and Summary File 3.
Note: **Bold** percentages indicate that that census tract had a percentage greater than the Tri-County Region for that demographic characteristic.
[1] See the *Community Impacts Technical Report* for a description of the method used to define the neighborhood boundaries relative to census block group boundaries for this analysis.
[2] See Table 3.3-2 for additional detail by minority group. The total of minority groups shown in Table 3.3-2 does not equal the minority data in this table because individuals may be members of two or more minority groups.
[3] The Birdshill neighborhood encompasses portions of the City of Lake Oswego and portions of unincorporated Clackamas County.
[4] The Tri-County Region includes all of Multnomah, Clackamas and Washington Counties.

Northwest District. The Northwest District is a densely populated mixed-use neighborhood with large residential and commercial areas. It is bordered by West Burnside Street to the south, Interstate 405 and the Willamette River to the east and northeast, and the base of the West Hills to the west and northwest. It is roughly bordered by Northwest Nicolai Street and St. Helens Road to the north. It is an older neighborhood containing many structures dating over 80 years. Two streets in this neighborhood, 21st Avenue and 23rd Avenue, are well established shopping and dining districts. Zoning in this neighborhood is primarily multi-family residential, employment, commercial and mixed-use. The Northwest District is currently served by the Portland streetcar along Northrup and Lovejoy streets, and 23rd Avenue. Community facilities in this neighborhood include Forest Park, Legacy Good Samaritan Hospital, Portland Fire and Rescue (17th Avenue and Johnson Street), the Metropolitan Learning Center, Cathedral School, the Northwest Library, Wallace Park and Couch Park. The Northwest District contains an above-average concentration of residents age 65 or older.

Pearl District. The Pearl District is one of Portland's newly redeveloped communities. It is bounded by West Burnside Street to the south, Interstate 405 to the west and northwest, and the Willamette River, the Broadway Bridge and Northwest Broadway Street to the east. The district is primarily zoned mixed-use and contains a mix of high-density residences and higher-end retail and dining establishments. The Pearl District is currently served by the Portland streetcar along Northrup and Lovejoy streets, and 10th and 11th avenues. Community facilities in the Pearl District include the Pacific Northwest College of Art, the Emerson School, Oregon Council for Hispanic Advancement, Tanner Springs Park, Jamison Square, the North Park Blocks and Liberty Ship Memorial Park. The Pearl District contains many urban amenities, including retail and dining establishments that are particularly centered on the existing Portland streetcar line and surrounding Jamison Square. The Pearl District contains an above-average concentration of residents age 65 or older and renter-occupied housing units.

Old Town/Chinatown. The Old Town/Chinatown neighborhood contains a variety of retail stores, restaurants and bars, nightclubs, commercial office spaces and apartment buildings. It is bordered by Southwest Stark Street, Oak Street, Pine Street and West Burnside Street to the south, the Willamette River to the east and northeast, the Broadway Bridge to the northwest, and Southwest 1st Avenue, 2nd Avenue, 3rd Avenue and Broadway Street to the west. Old Town/ Chinatown is primarily zoned mixed-use commercial. It includes the New Chinatown/Japan Historic District. Community facilities in this neighborhood include the Portland Saturday Market, the Classical Chinese Gardens, Union Station, the Greyhound Bus Depot and the north part of Waterfront Park. Old Town/Chinatown is also home to many social service providers. Old Town/Chinatown contains many urban amenities, particularly along 3rd Avenue, 4th Avenue and Burnside Street. It is currently served by the MAX light rail and the Portland Mall, downtown's transit mall. Old Town/Chinatown contains an above-average concentration of residents age 65 or older, renter-occupied housing and low-income residents. The portion of residents who identify as "Black Alone" is higher in this neighborhood than in the region as a whole.

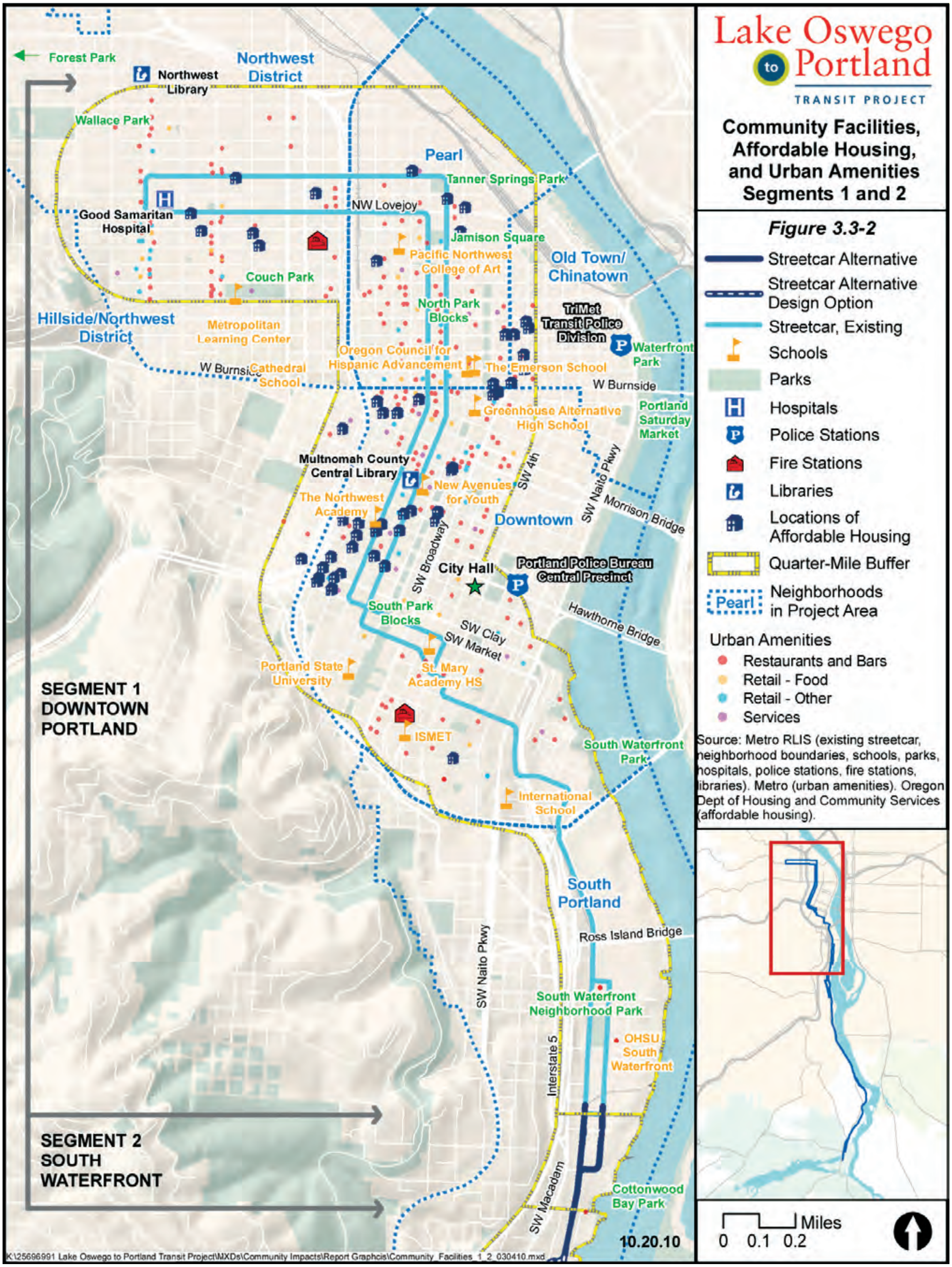
Downtown. The Portland Downtown neighborhood functions as Portland's central business district. It is bounded by Interstate 405 to the south and west, the Willamette River to the east, and West Burnside Street, Southwest 1st Avenue, 2nd Avenue and 3rd Avenue to the north. This neighborhood is primarily zoned central commercial and contains a high concentration of office uses, with areas towards the west of the neighborhood zoned high-density residential. Downtown Portland is served by the existing Portland streetcar and MAX light rail. It contains the Portland Mall, used by over one hundred bus lines that serve the greater Portland region. Community facilities in downtown Portland include the following parks: Pioneer Courthouse Square, Pettygrove Park, Chapman Square, Lovejoy Fountain Park, Portland Center Park, O'Bryant Square, Ira Keller Fountain, Waterfront Park and the South Park Blocks. The Downtown neighborhood also includes the following schools: Portland State University, St. Mary's Academy, the Islamic School of Muslim Educational Trust, the Northwest Academy, the International School, New Avenues for Youth, and the Greenhouse Alternative High School. The Multnomah County Central Library, Portland City Hall and Portland Fire and Rescue (511 SW College St.) are also community facilities located in this neighborhood. The Portland Downtown neighborhood contains hundreds of urban amenities, including many restaurants, bars, shopping districts, fitness centers, movie theaters and other services. The Portland Downtown neighborhood contains an above-average concentration of residents age 65 or older, renter-occupied housing and low-income residents.

South Portland. The South Portland Neighborhood is generally bounded by Interstate 405 to the north, the Willamette River to the east, Southwest 6th Avenue and Barbur Boulevard to the west and by the Sellwood Bridge to the south. The northern part of this neighborhood, South Waterfront, is served by the existing Portland streetcar. South Waterfront is one of Portland's newest neighborhoods and contains many mixed-use commercial and residential buildings. There are two restaurants in the South Waterfront that are within one-quarter mile of the existing streetcar alignment. South Waterfront is a high-density development area with many condominiums retail uses and offices, and it includes the eastern station of the Portland Aerial Tram as well as part of the Oregon Health Sciences University campus. The southern part of the neighborhood includes a commercial area surrounding Southwest Macadam Avenue; this contains many retail and dining uses that serve the community. This area also contains high-density residences along the Willamette River and a primarily single-family residential neighborhood west of Macadam Avenue. There are no libraries, fire stations, or civic buildings in this neighborhood. Community facilities include the Portland French School, Oregon Health Sciences University South Waterfront campus, Cottonwood Bay Park, Willamette Park and Willamette Moorage Park. The South Portland neighborhood contains an above-average concentration of renter-occupied housing units, low-income residents and residents of minority racial/ethnic status. The portion of residents who identify as "Black Alone," "Asian Alone," and "Two or More Races," is higher in this neighborhood than in the region as a whole.

Table 3.3-2 Racial and Ethnic Composition by Neighborhood in the City of Portland, Unincorporated Multnomah County and City of Lake Oswego (2000)

Jurisdiction/ Neighborhood	Persons	Black Alone	American Indian and Alaska Native alone	Asian alone	Two or More Races	Hispanic (any race)
City of Portland						
Northwest	10,309	1%	1%	2%	3%	4%
Pearl	1,702	2%	1%	2%	3%	3%
Old-Town/Chinatown	603	**6%**	1%	2%	2%	4%
Downtown	7,653	2%	1%	3%	3%	4%
South Portland	6,877	**4%**	1%	**9%**	**4%**	5%
South Burlingame	1,829	1%	0%	7%	2%	3%
Collins View	726	1%	0%	3%	2%	4%
Unincorporated Multnomah County						
Dunthorpe/Riverdale	1,078	1%	0%	3%	3%	4%
Unincorporated Clackamas County						
Birds Hill	213	1%	1%	4%	3%	2%
City of Lake Oswego						
Birds Hill	21	1%	1%	4%	3%	2%
First Addition	3,007	1%	0%	3%	3%	2%
Foothills	448	1%	0%	4%	3%	2%
Old Town	3,391	1%	1%	3%	2%	2%
Evergreen	829	0%	0%	4%	3%	4%
Lakewood	460	1%	0%	4%	3%	2%
Tri-County Region	*1,444,219*	*3%*	*1%*	*5%*	*3%*	*8%*

Source: U.S. Census Bureau. Census 2000, Summary File 3.
Note: **Bold** percentages indicate that that census tract had a minority population percentage greater than for the tri-county region for that minority group.



Lake Oswego to Portland
TRANSIT PROJECT
Community Facilities, Affordable Housing, and Urban Amenities
Segments 1 and 2
Figure 3.3-2
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar, Existing
Schools
Parks
Hospitals
Police Stations
Fire Stations
Libraries
Locations of Affordable Housing
Quarter-Mile Buffer
Pearl
Neighborhoods in Project Area
Urban Amenities
Restaurants and Bars
Retail - Food
Retail - Other
Services
Source: Metro RLIS (existing streetcar, neighborhood boundaries, schools, parks, hospitals, police stations, fire stations, libraries). Metro (urban amenities). Oregon Dept of Housing and Community Services (affordable housing).
Miles
0 0.1 0.2
Forest Park
Northwest Library
Northwest District
Wallace Park
Pearl
Tanner Springs Park
Good Samaritan Hospital
NW Lovejoy
Jamison Square
Pacific Northwest College of Art
Old Town/ Chinatown
Couch Park
North Park Blocks
Hillside/Northwest District
Metropolitan Learning Center
TriMet Transit Police Division
Waterfront Park
Oregon Council for Hispanic Advancement
The Emerson School
W Burnside
Cathedral School
Greenhouse Alternative High School
Portland Saturday Market
Multnomah County Central Library
New Avenues for Youth
SW 4th
SW Naito Pkwy
Morrison Bridge
The Northwest Academy
Downtown
SW Broadway
City Hall
Portland Police Bureau Central Precinct
South Park Blocks
Hawthorne Bridge
SW Clay
SW Market
Portland State University
St. Mary Academy HS
SEGMENT 1 DOWNTOWN PORTLAND
ISMET
South Waterfront Park
International School
South Portland
Ross Island Bridge
SW Naito Pkwy
South Waterfront Neighborhood Park
OHSU South Waterfront
Interstate 5
SEGMENT 2 SOUTH WATERFRONT
SW Macadam
Cottonwood Bay Park
10.20.10
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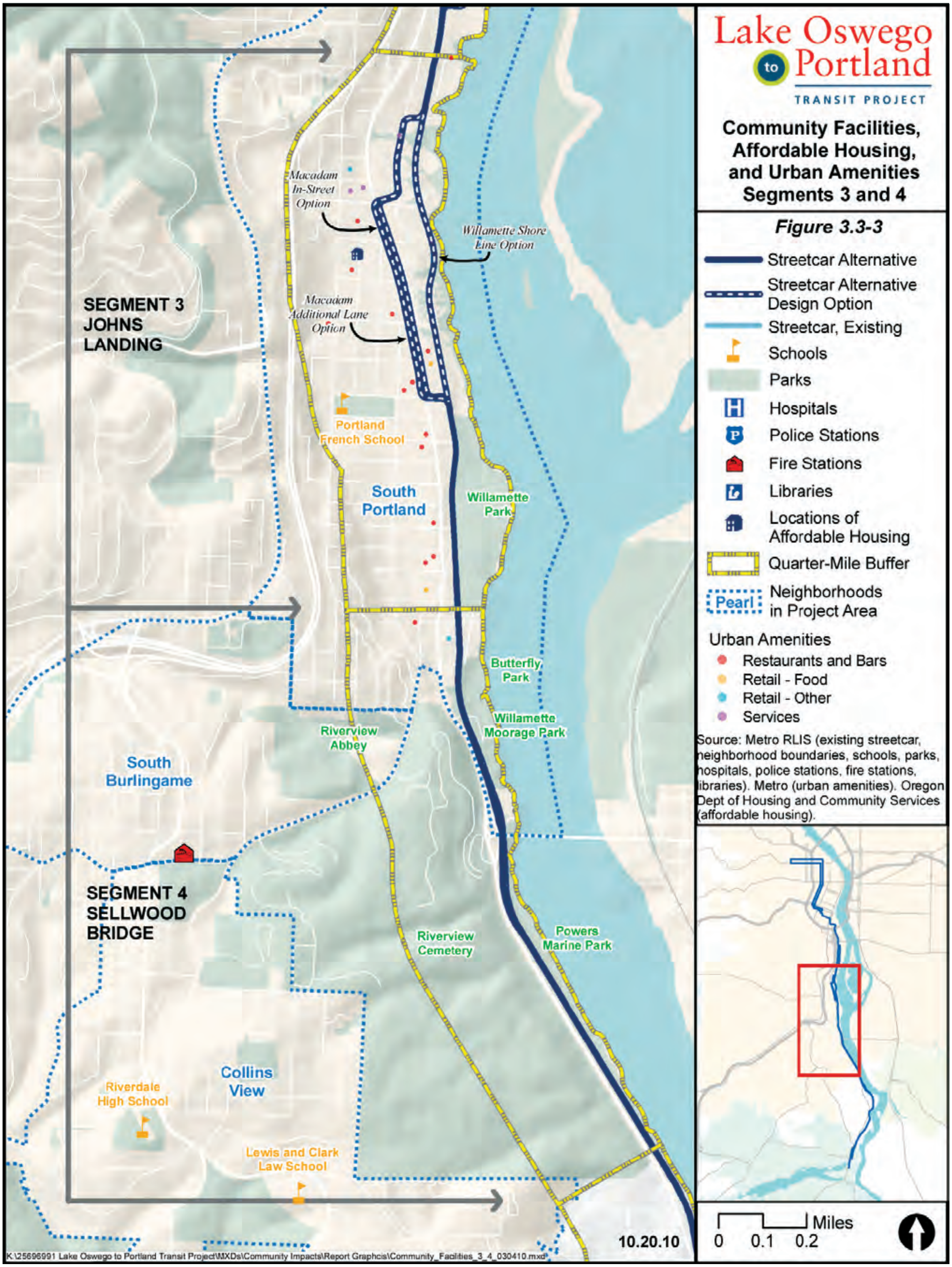
Lake Oswego to Portland
TRANSIT PROJECT
Community Facilities, Affordable Housing, and Urban Amenities Segments 3 and 4
Figure 3.3-3
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar, Existing
Schools
Parks
Hospitals
Police Stations
Fire Stations
Libraries
Locations of Affordable Housing
Quarter-Mile Buffer
Pearl
Neighborhoods in Project Area
Urban Amenities
Restaurants and Bars
Retail - Food
Retail - Other
Services
Source: Metro RLIS (existing streetcar, neighborhood boundaries, schools, parks, hospitals, police stations, fire stations, libraries). Metro (urban amenities). Oregon Dept of Housing and Community Services (affordable housing).
Miles
0 0.1 0.2
SEGMENT 3 JOHNS LANDING
SEGMENT 4 SELLWOOD BRIDGE
Macadam In-Street Option
Willamette Shore Line Option
Macadam Additional Lane Option
Portland French School
South Portland
Willamette Park
Butterfly Park
Willamette Moorage Park
Riverview Abbey
South Burlingame
Riverview Cemetery
Powers Marine Park
Collins View
Riverdale High School
Lewis and Clark Law School
10.20.10
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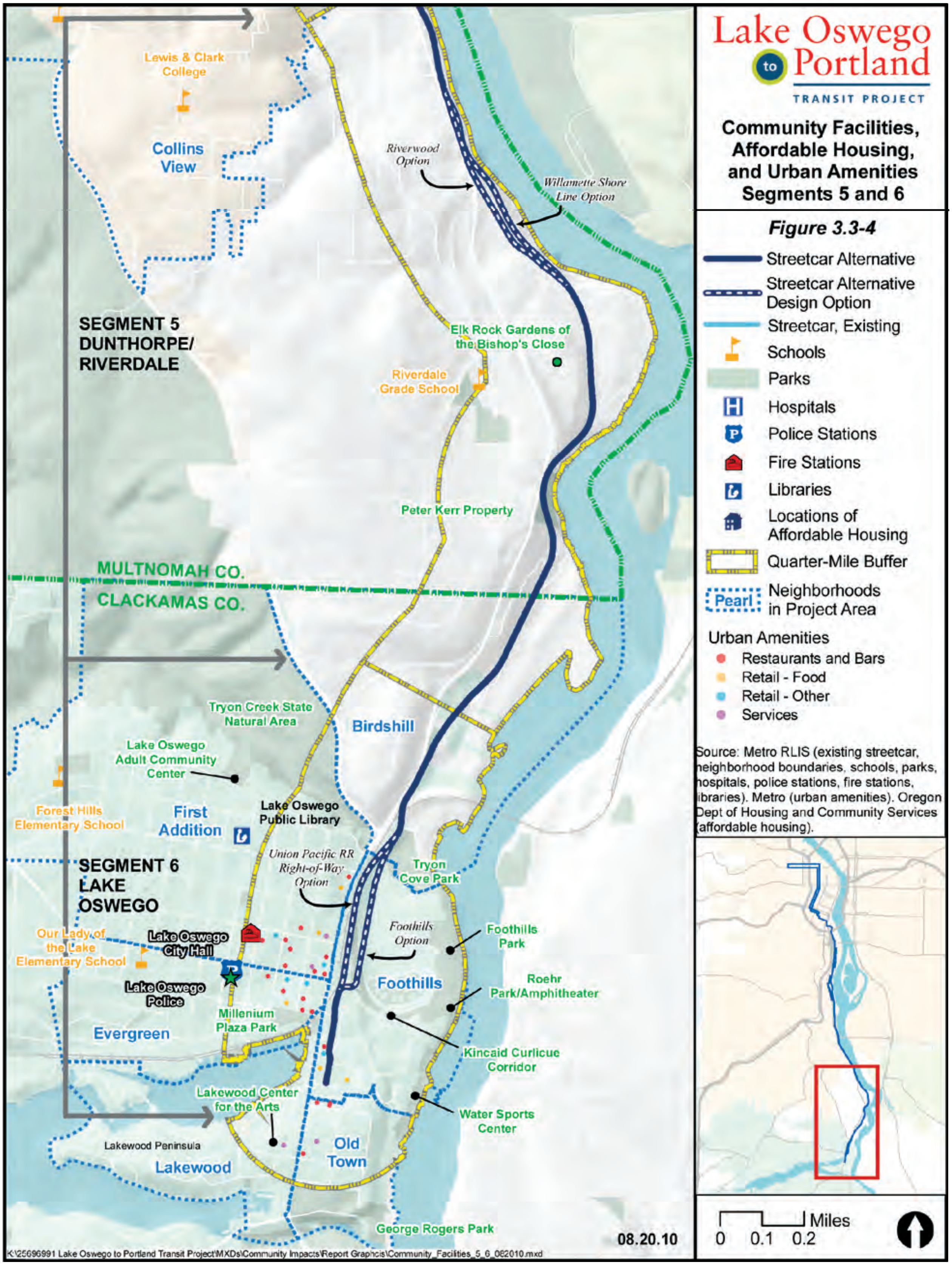

Lake Oswego to Portland
TRANSIT PROJECT
Community Facilities, Affordable Housing, and Urban Amenities Segments 5 and 6
Figure 3.3-4
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar, Existing
Schools
Parks
Hospitals
Police Stations
Fire Stations
Libraries
Locations of Affordable Housing
Quarter-Mile Buffer
Pearl
Neighborhoods in Project Area
Urban Amenities
Restaurants and Bars
Retail - Food
Retail - Other
Services
Source: Metro RLIS (existing streetcar, neighborhood boundaries, schools, parks, hospitals, police stations, fire stations, libraries). Metro (urban amenities). Oregon Dept of Housing and Community Services (affordable housing).
Miles
0 0.1 0.2
Lewis & Clark College
Collins View
Riverwood Option
Willamette Shore Line Option
SEGMENT 5 DUNTHORPE/ RIVERDALE
Elk Rock Gardens of the Bishop's Close
Riverdale Grade School
Peter Kerr Property
MULTNOMAH CO.
CLACKAMAS CO.
Tryon Creek State Natural Area
Birdshill
Lake Oswego Adult Community Center
Forest Hills Elementary School
First Addition
Lake Oswego Public Library
SEGMENT 6 LAKE OSWEGO
Union Pacific RR Right-of-Way Option
Tryon Cove Park
Foothills Option
Foothills Park
Our Lady of the Lake Elementary School
Lake Oswego City Hall
Lake Oswego Police
Foothills
Roehr Park/Amphitheater
Millenium Plaza Park
Evergreen
Kincaid Curlicue Corridor
Lakewood Center for the Arts
Water Sports Center
Lakewood Peninsula
Lakewood
Old Town
George Rogers Park
08.20.10
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South Burlingame. The South Burlingame neighborhood is bordered by Southwest Barbur Boulevard to the north, Intestate 5 to the west, and Taylors Ferry Road to the south and east. Interstate 5 cuts through the northern part of the neighborhood, separating the Fulton Park area from the rest of South Burlingame. This neighborhood is largely low-density residential with commercial uses along Barbur Boulevard. Community facilities in this neighborhood include the Riverview Cemetery (used as open space) and Portland Fire and Rescue at 451 SW Taylors Ferry Road. South Burlingame contains an above-average concentration of residents age 65 or older, renter-occupied housing and low-income residents.

Collins View. The Collins View neighborhood lies directly to the south of South Burlingame. It is composed primarily of single-family residential developments with a small commercial center at Southwest Taylors Ferry Road and Terwilliger Boulevard. Collins View is characterized by hilly terrain and a largely rural feel. This neighborhood is adjacent to portions of Tryon Creek State Park. Collins View is bordered by Taylors Ferry Road to the north, 8th Avenue and Boones Ferry Road to the west, Lewis and Clark College to the south and the Riverview Cemetery to the east. Lewis and Clark College is the community facility in this neighborhood. Collins View contains an above-average concentration of low-income residents and renter-occupied housing.

Dunthorpe/Riverdale. Though it is not an officially designated neighborhood, the portion of unincorporated Multnomah County that is south of the Powers Marine Park and Riverview Cemetery, and north of the county boundary, is commonly referred to as Dunthorpe or Riverdale. The development called Dunthorpe was platted in the 1910s and developed by William S. Ladd, who developed many notable areas in Portland. Riverdale is the name of the school district in this area, which is administered separately from the Lake Oswego and Portland Public School districts. Dunthorpe/Riverdale contains low-density residential development and has no commercial or industrial areas. It is one of the oldest bedroom communities of Portland. Community facilities in this area include the Riverdale Grade School, the Peter Kerr Property and the Elk Rock Gardens of the Bishop's Close. This area contains an above-average concentration of residents age 65 or older.

Birdshill. The Birdshill neighborhood lies to the south of Dunthorpe/Riverdale. It is bounded by the county boundary to the north, the Willamette River to the east, Southwest Terwilliger Boulevard to the west and the northern portion of Foothills Park to the south. The neighborhood boundary extends slightly south of the Clackamas County boundary into the City of Lake Oswego city limits. This area includes low-density residential communities. The Tryon Cove Park is the community facility in this area. This neighborhood contains an above-average concentration of residents age 65 or older.

First Addition. First Addition contains several blocks of historic and newer homes that are within walking distance of Lake Oswego's commercial core. The development pattern is a traditional urban grid with alleys in between houses. First Addition is bounded by State Street to the east, A Avenue to the south, the Clackamas County boundary to the north, and the edge of Tryon Creek State Park and Iron Mountain Boulevard to the west. There are several urban amenities in First Addition within one-quarter mile of the project alignment, including restaurants, dry cleaners, sporting goods stores and other services along State Street and A Avenue. The northern portion of this neighborhood includes portions of Tryon Creek State Park. First Addition includes a vibrant commercial area in the blocks surrounding A, B and C avenues between State Street and 6th Street. Community facilities in this neighborhood include the Lake Oswego Adult Community Center, the Lake Oswego City Hall, the Lake Oswego Public Library, Lake Oswego Fire and Rescue and Life Safety at 300 B Ave., portions of the Tryon Creek State Natural Area, Rossman Park and Forest Hills Elementary School.

Foothills. The Foothills neighborhood lies to the east of First Addition. It is bounded by State Street to the west, the Willamette River to the east, Green Street to the south and the edge of the Foothills development cul-de-sacs to the north. This neighborhood contains industrial uses adjacent to Foothills Park and multi-family housing and commercial uses along State Street. Community facilities in this neighborhood include Foothills Park and the Kincaid Curlicue Corridor. The Foothills neighborhood contains some urban amenities along State Street. This neighborhood contains an above-average concentration of residents age 65 or older.

Old Town. The Old Town neighborhood is the oldest settlement in the Lake Oswego area and contains homes that date to the 1860s. It is a small area immediately to the south of the Foothills neighborhood. Community facilities in Old Town include George Rogers Park. There are several urban amenities in Old Town within one-quarter mile of the project alignment, including fitness centers, restaurants and clothing stores. This neighborhood contains an above-average concentration of residents age 65 or older.

Evergreen. The Evergreen neighborhood is generally bordered by A Avenue to the north, Lakewood Bay to the south, State Street to the east and Berwick Road to the west. The neighborhood is primarily single-family residential, with a few multi-family residential parcels fronting Lakewood Bay and commercial uses along A Avenue. The Evergreen neighborhood contains several urban amenities within one-quarter mile of the project alignment, including grocery stores, restaurants and clothing stores. Community facilities in this neighborhood include Millennium Park and Our Lady of the Lake School. The Evergreen neighborhood contains an above-average concentration of low-income residents.

Lakewood. The Lakewood neighborhood is located west of State Street and south of Lakewood Bay. It is immediately to the west of the Old Town neighborhood. This neighborhood contains single-family residential development with commercial uses along State Street. Lakewood Center is the community facility in this neighborhood. This neighborhood contains an above-average concentration of residents age 65 or older.

3.3.2 Environmental Consequences

This section summarizes the effects that the project's alternatives and options would have on communities and neighborhoods. The effects of a project to communities and neighborhoods are defined as changes in neighborhood cohesion, quality of life and mobility; potential property acquisitions; and resulting potential displacements and relocations.

- **Neighborhood cohesion** is the amount to which a neighborhood is identifiable as a distinct place, separate from other neighborhoods and composed of a given geographic area. Cohesive neighborhoods have clear boundaries and landmarks and include community gathering spots, such as schools or parks, that help to give the neighborhood its identity. Cohesiveness within a neighborhood is also influenced by the neighborhood's mix of land uses and visual environment. Neighborhoods can be considered cohesive from the point of view of the residents and businesses within them, or from the point of view of an outsider.

- **Neighborhood quality of life** is a subjective assessment of the living conditions of a neighborhood, based on noise conditions, air quality conditions and open space within the neighborhood. Impacts to community facilities, affordable housing units and urban amenities can influence neighborhood quality of life.
- **Neighborhood mobility** is the degree to which residents and businesses in the neighborhood are able to move freely throughout the neighborhood and to other neighborhoods in the region. It is measured by the quantity and quality of pedestrian, bicycle, transit and vehicular transportation infrastructure. A neighborhood with a high level of mobility will typically have extensive sidewalks and bike lanes, good access to transit and a well-functioning street system for auto travel.

- Potential **property acquisitions** are privately-owned properties that have been identified through the conceptual design of the build alternatives as needing to be partially or fully purchased in order to build the alternative.

- Potential **displacements** occur when an activity that has been occurring on a parcel of land can no longer occur there due to a property acquisition. A full acquisition does not result in a displacement when there are no buildings or other activities that would be interrupted by the acquisition.

- **Relocations** would be offered to displaced activities through TriMet's Acquisition and Relocation program, which is consistent with USDOT guidelines.

3.3.2.1 Direct, Indirect and Cumulative Impacts

Following is a summary of the anticipated direct and indirect effects of the No-Build, Enhanced Bus and Streetcar alternatives on neighborhood cohesion, quality of life, mobility, and potential property acquisitions and displacements/relocations. Because all of the following analysis is based on the region's adopted land use and development plans and policies and on the transportation projects included in the financially-constrained list of the current Regional Transportation Plan (see Chapter 2), there would be no cumulative impacts to communities and neighborhoods beyond than those described within this section.

No-Build Alternative

There would be no direct or indirect effects from the No-Build Alternative to the cohesion or quality of life within the neighborhoods in the project area. There would be no property acquisitions or displacements/relocations from the No-Build Alternative. Neighborhood mobility would decrease as a result of the No-Build Alternative due to greater congestion in the area compared to the Enhanced Bus and Streetcar alternatives.

Enhanced Bus Alternative

The primary effect that the Enhanced Bus Alternative would have on the corridor's neighborhoods, compared to the No-Build Alternative, would be the result of changes to the operation of bus service on Highway 43, between downtown Lake Oswego and downtown Portland, as described in Chapter 2. Effects to neighborhood cohesion, quality of life, mobility, and potential property acquisitions and displacements/relocations are described below and summarized in Table 3.3-4.

- **Neighborhood Cohesion.** The Enhanced Bus Alternative would have limited effect on neighborhood cohesion in the project area. There would be low but no moderate to high visual impacts.

- **Neighborhood Quality of Life**. The Enhanced Bus Alternative would have no effect on neighborhood quality of life in the project area.

- **Neighborhood Mobility**. The Enhanced Bus Alternative would result in the removal of 13 of 26 bus stops served by Line 35 on Highway 43, between downtown Lake Oswego and Southwest Bancroft Street, leading to reduced travel times between the remaining 13 bus stops (see Figure 2.2-2 for an illustration of the remaining bus stops). Further, the frequency of Line 35 would increase to a bus every six minutes, compared to a bus every 15 minutes under the No-Build Alternative. In general, for areas of the corridor's neighborhoods that would have access to the remaining 13 bus stops, transit travel times would be improved through reduced transit travel and wait times. However, some areas of the corridor's neighborhoods within Segments 3 and 5 would experience longer walk distances and times to transit or the elimination of access to transit due to the removal of one or more of the bus stops. Within the Portland central city, Line 35 would be rerouted from the Portland Mall to 10th and 11th avenues, generally between Southwest Market and Clay streets and Northwest Lovejoy Street/Union Station, resulting in improved transit access along 10th and 11th avenues, with reduced transit access along the Portland Mall. In general, connections between Line 35 and other transit lines operating within downtown Portland would remain; some of them would occur at different and/or fewer locations. The Enhanced Bus Alternative would also create improved bicycle and pedestrian facilities near the park-and-ride lot in Segment 6. The Enhanced Bus Alternative would result in a slight increase in traffic volumes in Segment 6, within the Old Town neighborhood, due to the park-and-ride facility. However, this would not result in a major change in traffic congestion levels in the area.

- **Potential Property Acquisitions and Displacements.** The Enhanced Bus Alternative would result in the purchase of property for the construction of a 300-space structured park-and-ride lot at the Oswego Village Shopping Center on Highway 43 in downtown Lake Oswego. Eight parcels would potentially be partially or fully acquired by the project. There would be no displacements/relocations with the Enhanced Bus Alternative.

Streetcar Alternative

The effect that the Streetcar Alternative would have on the corridor's neighborhoods, compared to the No-Build Alternative, would primarily be the result of: 1) construction and operation of an extension of the existing Portland streetcar line from Southwest Bancroft Street to downtown Lake Oswego; 2) the elimination of Line 35 bus service, generally on Highway 43, between Lake Oswego and downtown Portland; and 3) localized changes to traffic, bicycle and pedestrian facilities. Following is a description of how the Streetcar Alternative would affect the cohesion, quality and mobility of the corridor's neighborhoods, and the potential property acquisitions and displacements/relocations. Note that there are two or three design options under study within three of the six segments of the Streetcar Alternative alignment, which result in ranges or variations in some of the effects that the Streetcar Alternative would have on the corridor's neighborhoods. This section concludes with a summary of the differences in effects that the different design options in those three segments would have effect on the corridor's neighborhoods.

- **Neighborhood Cohesion.** The Streetcar Alternative would not alter established community landmarks or neighborhood boundaries or result in any effects to community facilities, urban amenities or affordable housing units. However, both the potential for land use changes and the changes in the visual environment could affect community cohesion in neighborhoods throughout the project area. The Streetcar Alternative could contribute to redevelopment occurring more quickly in the South Portland and Foothills neighborhoods. Because any redevelopment would be in line with community-adopted plans, this change in community cohesion would not need to be mitigated. The Streetcar Alternative is expected to result in a moderate visual impact in Segments 3 and 6, and a moderate or moderate-high visual impact in Segment 5. Mitigation measures for visual impacts are discussed in Section 3.4. Final decisions on the appropriate mitigation measures for visual impacts would be coordinated with the community in order to ensure that the visual environment remains appropriate for the community as a whole.

- **Neighborhood Quality of Life.** The Streetcar Alternative would not result in any air quality impacts or major impacts to parks. However, it would result in moderate noise impacts in Segments 3 and 4, and moderate to severe noise impacts to Segment 5. The severe noise impacts in Segment 5 could be mitigated, using noise walls, to at least the moderate level. These impacts have the potential to negatively impact the quality of life for the South Portland neighborhood and the Dunthorpe/Riverdale area of Multnomah County.

- **Neighborhood Mobility.** The Streetcar Alternative would improve neighborhood mobility in all segments of the project area. It would do so by decreasing transit travel times, providing new bicycle and pedestrian facilities in Segments 4, 5 and 6, and improving traffic operations throughout the project area. However, it would result in a decrease in access to transit in the South Portland neighborhood within Segment 3; it would provide a total of six stations for the neighborhood, which is currently served by nine northbound and southbound bus stops. It would reduce access to transit in the Dunthorpe/Riverdale area and Birdshill neighborhood in Segment 5 by limiting the neighborhood to two stations, compared to the seven northbound and eight southbound that currently serve the area. It would also reduce access to transit in the First Addition and Evergreen neighborhoods of Segment 6 through the removal of the transit center at A Avenue and 4th Street. This would require residents of First Addition and Evergreen who live west of 4th Street to either walk further or take a short bus ride to the streetcar station at B Avenue in order to reach downtown Portland. The Streetcar Alternative would result in increased congestion at two intersections in Segment 6 as a result of traffic generated from the park-and-ride lot. These intersections are on the border of the Foothills, Old Town and Lakewood neighborhoods. Chapter 4 of this DEIS addresses potential mitigation for the impact to traffic of the park-and-ride facilities.

- **Potential Property Acquisition and Displacements.** The Streetcar Alternative would potentially result in the full or partial acquisition of 28 to 60 parcels, potentially resulting in zero to seven displacements. Details on potential property acquisitions by project segment are listed in Table 3.3-3.

  The potential commercial displacement in Segment 3 is a commercial fueling station located at 6140 SW Macadam Ave. The potential residential displacement in Segment 5 is located at 10808 SW Riverwood Road. The industrial displacements/relocations in Segment 6 are at the following locations: 801 N State St., currently in use as Public Storage-Self Storage; account number

182046 (no address available), currently part of the Public Storage-Self Storage complex; account number 182108 (no address available), currently part of the Public Storage-Self Storage complex; 99 Foothills Road, currently in use as All Purpose Design; 113 Foothills Road, currently in use as Skyline Northwest auto dealership; 101 Foothills Road, currently in use as Jeepers It's Erickson's auto dealership; and 100 Foothills Road, currently in use as Lakeshore Concrete.

Table 3.3-3 Streetcar Alternative Property Acquisitions and Displacements* by Type, Segment and Design Option

Segment/ Option	Residential	Commercial	Public Institution	Industrial	Total
	Acquisitions *(Displacements)*	Acquisitions *(Displacements)*	Acquisitions *(Displacements)*	Acquisitions *(Displacements)*	Acquisitions *(Displacements)*
3 - Johns Landing					
Willamette Shore Line	1	6			7
Macadam In Street	3	14			17
Macadam Add Lane	6	19 *(1)*			25 *(1)*
5 - Dunthorpe					
Willamette Shore Line					
Riverwood	8 *(1)*				8 *(1)*
6 - Lake Oswego					
UPRR	2	9	9	1	21
Foothills	2	9	9	7 *(5)*	27 *(5)*
Minimum Total (assuming selection of Willamette Shore Line in Segment 3, Willamette Shore Line in Segment 5 and UPRR in Segment 6)	**3 *(0)***	**15 *(0)***	**9 *(0)***	**1 *(0)***	**28 *(0)***
Maximum Total (assuming selection of Macadam Additional Lane in Segment 3, Riverwood in Segment 5 and Foothills in Segment 6)	**16 *(1)***	**28 *(1)***	**9 *(0)***	**7 *(5)***	**60 *(7)***

Note: Table does not include 1 property owned by ODOT and two properties owned by UPRR. Use of these properties for the Streetcar Alternative is not expected to require acquisition of the properties. ODOT may allow use of its property without acquisition and use of the UPRR property may be by permit.
*Displacements occur when an activity that has been occurring on a parcel of land can no longer occur there. A full acquisition does not result in a displacement when there are no buildings or other activities that would be interrupted by the acquisition.

Streetcar Design Options

Following is a description of the differences in effects that the Streetcar Alternative would have on neighborhoods based on the design options currently under study. Two or three design options are under study in three segments: Segment 3 – Johns Landing, Segment 5 – Dunthorpe/Riverdale, Segment 6 – Lake Oswego.

Segment 3 – Johns Landing

- **Willamette Shore Line Option.** The Willamette Shore Line design option would result in noise impacts to adjacent residences; the Macadam Avenue options would not result in noise impacts. The Willamette Shore Line design option would also result in a moderate visual impact to the South Portland neighborhood. The Macadam Avenue options would have no major effect on the visual environment.

- **Macadam In-Street Option.** The Macadam In-Street and Macadam Additional Lane design options would result in the greater likelihood for unauthorized parking[42] in the South Portland neighborhood, which would be a decrease in neighborhood mobility. Both the Macadam In-Street option and the Macadam Additional Lane design option would have a substantially higher potential for creating redevelopment in the South Portland neighborhood than the Willamette Shore Line design option would. The Macadam In-Street and Macadam Additional Lane options would require installation of a signal at Southwest Macadam Avenue and Carolina Street; this would lead to traffic congestion that exceeds ODOT standards at that intersection. This would be an impact to neighborhood mobility in the South Portland neighborhood.

- **Macadam Additional Lane Option.** The Macadam Additional Lane design option would result in one commercial displacement. The Macadam In-Street and Willamette Shore Line options would not result in any displacements. The Macadam Additional Lane option would result in a moderate visual impact; the Macadam In-Street option would not result in a visual impact.

Segment 5 – Dunthorpe/Riverdale

- **Willamette Shore Line Option.** The Willamette Shore Line design option would not provide additional bicycle and pedestrian facilities.

- **Riverwood Option.** The Riverwood design option would provide a bicycle lane and sidewalks along Riverwood Drive. The Riverwood design option would result in up to eight residential acquisitions. One of these acquisitions would result in a displacement.

Segment 6 – Lake Oswego

- **Union Pacific Railroad Right of Way Option.** The Union Pacific Railroad design option would result in fewer acquisitions and displacements/relocations than the Foothills design option. The Union Pacific Railroad design option would result in a total of 21 acquisitions.

- **Foothills Option.** The Foothills design option would result in up to 27 acquisitions. This would include five industrial displacements.

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[42] Unauthorized parking is what occurs when users of a transit system park on neighborhood streets adjacent to stations, due to lack of available parking spots at the station itself.

Table 3.3-4 Summary of Effects on Neighborhoods by Alternative

Effect on Neighborhoods	No-Build Alternative	Enhanced Bus Alternative	Streetcar Alternative
Cohesion			
Change to established community boundaries or landmarks	No Effects	No Effects	No Effects
Impacts to community facilities or urban amenities	No Effects	No Effects	No Effects
Change in land use	No Effects	No Effects	- Increased potential for redevelopment in Segment 2 (both options) - Increased potential for redevelopment in Segment 3 (Macadam options only) - Increased potential for redevelopment in the northern end of Segment 4 - Increased potential for redevelopment in Segment 6
Change in visual environment	No Effects	- No moderate or high visual impacts	- Moderate visual impact in Segment 3 (all options) - Moderate visual impact in Segment 5 (WSL option) - Moderate-high degree of visual impact in Segment 5 (Riverwood option) - Moderate visual impact in Segment 6 (both options)
Quality of Life			
Noise or air quality impacts	No Effects	No Effects	- Moderate noise impacts in Segment 3 (WSL option only) - Moderate noise impacts in Segment 4 - One potential severe noise impact to a residential property in Segment 5 (both options) however, this could be mitigated with sound walls to at least a moderate level - Moderate noise impacts to 14-15 residences in Segment 5 (WSL option) or 11-12 residences in Segment 5 (Riverwood option)
Impacts to parks and recreational facilities	No Effects	- Improved transit access to parks	- Improved transit access to parks
Impacts to affordable housing units	No Effects	No Effects	No Effects
Mobility			
Traffic	- Increased VMT - Increased congestion at several intersections	- Slight increase in traffic volumes in Segment 6 due to the park and ride, but this would not result in substantial additional congestion	- Overall improvement to traffic operations in Segments 2-5 - The installation of a traffic signal at SW Macadam Avenue and SW Carolina Street in Segment 3, under the Macadam options, would lead to congestion in that area - Potential for unauthorized parking in Segment 3 (Macadam options only) - Congestion in Segment 6 (both options)
Transit Travel Times	No Effects	- Decrease in transit travel times	- Decrease in transit travel times in all segments
Access to Transit	No Effects	- Decrease in access to transit in Segment 3 - Decrease in access to transit in Segment 5 - Decrease in access to transit in Segment 6	- Small decrease in access to transit in Segments 3 and 4 - Large decrease in access to transit in Segment 5 - Moderate decrease in access to transit in Segment 6
Change in bicycle and pedestrian facilities	No Effects	- Improved facilities associated with the park and ride facility	- New bicycle/pedestrian overcrossing in Segment 4 - Improvements to sidewalks and bicycle lanes in Segment 5 (Riverwood In-Street Option only) - New bicycle and pedestrian connections under UPRR rail line and over Tryon Creek in Segment 6 (both options)
Property Acquisition/ Displacement			
Residential (Partial/Full)	None	- 1 residential acquisition in Segment 6	- Maximum 16 acquisitions (assuming Macadam Add-Lane and Riverwood options are chosen) - 1 residential displacement in Segment 5, if Riverwood option is chosen
Commercial (Partial/Full)	None	- 7 commercial acquisitions in Segment 6	- Maximum 28 acquisitions (assuming Macadam Add-Lane is chosen) - 1 commercial displacement in Segment 3 under Macadam Add-Lane
Public/Institution (Partial/Full)	None	None	- Maximum 9 acquisitions
Industrial	None	None	- Maximum 7 acquisitions, assuming Foothills option is chosen - 5 displacements in Segment 6 under the Foothills option

3.3.3 Potential Neighborhood Mitigation Measures

The development of mitigation measures for the community impacts discussed above would be based on continued public involvement within all of the communities in the LOPT project area. The most prominent impact to communities and neighborhoods is an improvement in neighborhood mobility. This is generally considered a beneficial impact and does not require mitigation. Mitigation for visual impacts and noise impacts are discussed within the sections of this DEIS that are specific to those disciplines (Section 3.4 Visual Quality and Aesthetics and Section 3.10 Noise and Vibration). Each of these mitigation strategies should be discussed with the community throughout the public involvement process in order to ensure that they incorporate concerns of residences and businesses in the project area.

Mitigation of displacements to residences could be achieved in the following ways:

- Further refinement of the project design to avoid or minimize these displacements;
- Compensation to property owners based on fair market value of the property and a comprehensive relocation program that is consistent with USDOT guidelines.

The following mitigation measures would lessen adverse impacts to businesses and residences during construction of the project:

- Inform and update police, fire and emergency service providers of the construction activities that could affect emergency vehicles;
- Provide clear signage and warnings for temporary closures during construction;
- Coordinate with other nearby construction projects so that delays and intense equipment usage periods do not overlap;
- Maintain a route for emergency vehicles at all times; and
- Spray water to control dust in work areas.

3.4. Visual Quality and Aesthetics

This section summarizes information on the existing visual environment in the study corridor and the expected visual impacts of the project alternatives. For additional information on the visual analysis see the *Lake Oswego to Portland Transit Project: Visual Quality and Aesthetics Technical Report* (DEA/URS and TriMet/Metro, November 2010).

3.4.1 Introduction, Approach and Methodology

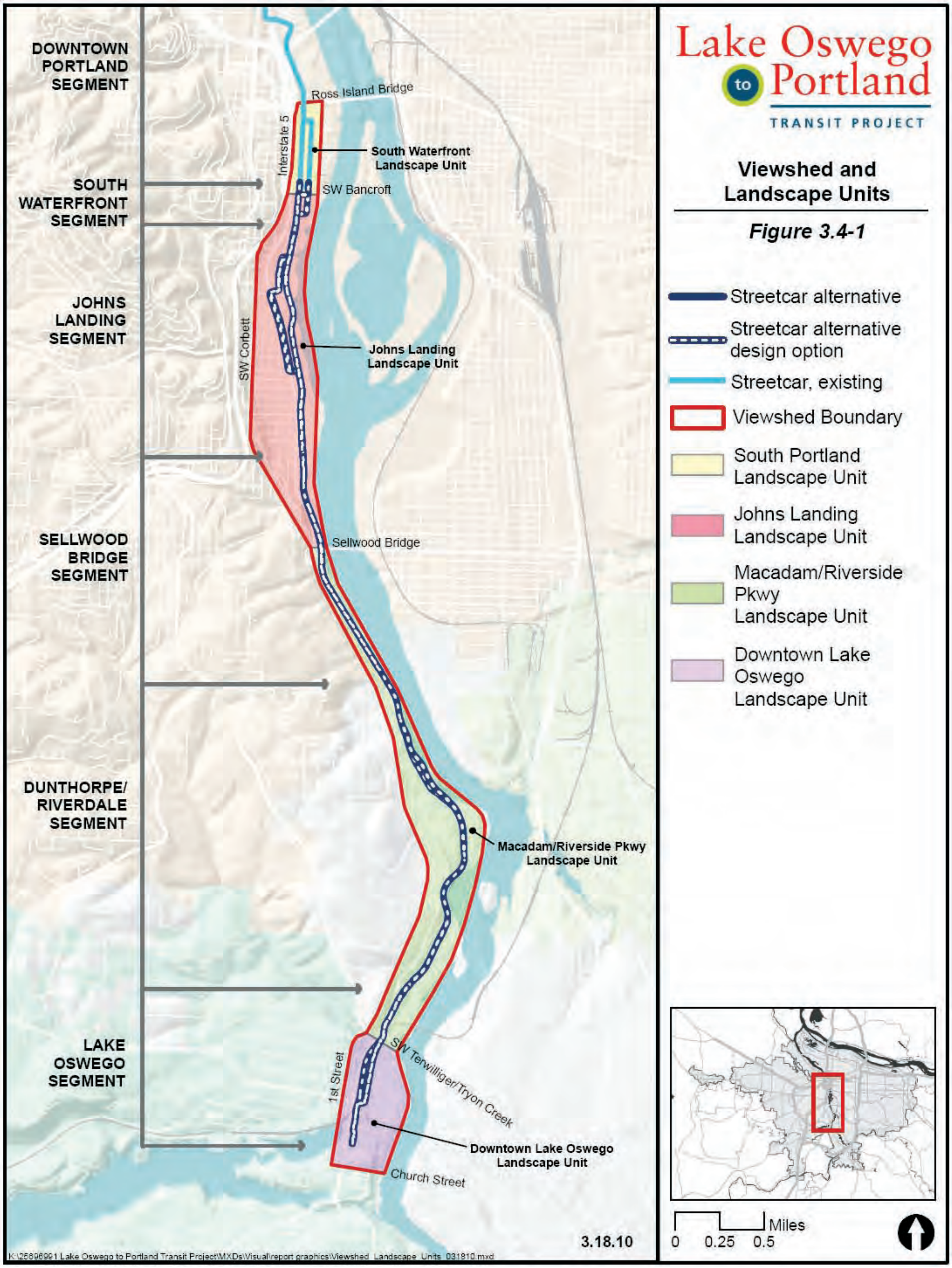
The analysis followed the Federal Highway Administration's (FHWA's) visual quality and aesthetics assessment methodology (FHWA, 1989). Identification of visual elements and determinations of potential effects were made through a series of field visits, analysis of the concept design plans and evaluation of elements of the current transit system. The visual quality and aesthetics analysis considers potential changes to the quality of the visual environment, including regional landscape patterns and local visual resources. This analysis describes:

- Existing visual character and patterns in the corridor;
- Current dominant and recognized visual features, including those identified through adopted; neighborhood plans and previous planning efforts as important neighborhood features, or formally designated in local or state planning documents;
- Landscape units and associated project segments have been identified within the project area, including a discussion of the general types of viewers, and their exposure and sensitivity;
- Changes to visual conditions that would result from construction and operation of the alternatives; and
- Potential mitigation measures.

New transit facilities can become highly visible public resources and can affect the visual character of the surrounding landscapes and the perception of visual resources. They can also be designed to fit sensitively into the existing visual environment, improving the visual environment, particularly when the existing visual environment lacks unity and cohesion. Significant transit improvements frequently serve as a catalyst for other improvements in an area through separate efforts such as urban renewal or local improvement districts. This assessment examines the possible effects of the study alternatives and design options on existing views and visual resources.

Section 3.4.2 Affected Environment describes existing visual resources in the corridor, and their context, in order to evaluate effects of the study alternatives and design options in Section 3.4.3 Environmental Consequences. The affected environment describes the overall existing landscape character of the area and identifies important views, landscapes or landmarks that serve as character-defining elements of the study area. The visual resources identified include major public views as well as dominant and recognized visual features (based on accepted practice in the field of visual analysis). Locations with notable views have also been identified through public feedback. The analysis also considers features or views identified in local plans or ordinances. Figure 3.4-1 shows a map of the project area, the landscape units and the project segments.

In addition, visual simulations have been prepared to illustrate what the changes associated with the Streetcar Alternative could look like. The simulations include a photograph of an existing view within the corridor compared with the same location in a simulation of how the proposed project improvements could change the view. The simulations are illustrative of the conceptual level of design that has been developed so far. No simulations were prepared for the Enhanced Bus



Lake Oswego to Portland
TRANSIT PROJECT
Viewshed and Landscape Units
Figure 3.4-1
Streetcar alternative
Streetcar alternative design option
Streetcar, existing
Viewshed Boundary
South Portland Landscape Unit
Johns Landing Landscape Unit
Macadam/Riverside Pkwy Landscape Unit
Downtown Lake Oswego Landscape Unit
DOWNTOWN PORTLAND SEGMENT
SOUTH WATERFRONT SEGMENT
JOHNS LANDING SEGMENT
SELLWOOD BRIDGE SEGMENT
DUNTHORPE/ RIVERDALE SEGMENT
LAKE OSWEGO SEGMENT
Ross Island Bridge
Interstate 5
South Waterfront Landscape Unit
SW Bancroft
SW Corbett
Johns Landing Landscape Unit
Sellwood Bridge
Macadam/Riverside Pkwy Landscape Unit
1st Street
SW Terwilliger/Tryon Creek
Downtown Lake Oswego Landscape Unit
Church Street
3.18.10
Miles
0 0.25 0.5

Alternative, because the changes would not be significant compared to existing bus service in the area.

3.4.2 Affected Visual Environment

The study area is in the urbanized northern portion of the Willamette River Valley. The Cascade Mountains including Mount Hood provide a distant backdrop in the east; the Tualatin Mountains, also known as the West Hills, frame the western edge of the viewshed. The study corridor generally runs along the west bank of the Willamette River between downtown Portland and downtown Lake Oswego.

Urban development of the Portland region began in the mid-1800s. Early development was tied to a dense network of streetcars and interurban rail lines. A railroad built in 1886 connected Portland to Lake Oswego in the study corridor. From 1914 to 1929 interurban trains ran on the line from Portland to Lake Oswego and extended south as far as Corvallis. These trains stimulated residential development in the 1920s and 1930s. After passenger service was terminated in the corridor, freight service continued on the railroad tracks until the 1980s. During the same time, the line was purchased by a consortium of government agencies to preserve the right of way for future transit use. Beginning in1987 the Willamette Shore Trolley began excursion type operation between Lake Oswego and Portland; the service operates primarily in the summer.

3.4.2.1 Landscape Units and Project Segments

This project describes the existing visual environment in terms of landscape units. To describe the existing visual environment and understand the level of visual changes that would occur with the project alternatives and design options; five “landscape units” have been identified. The landscape units and project segments are illustrated on Figure 3.4-1 and defined in more detail below. Each landscape unit is a subset of the project area that has a distinctive visual character and a specific geographic location. For each landscape unit the applicable project segments are noted. The five landscape units include Downtown Portland, South Waterfront, Johns Landing, Macadam/Riverside Parkway, and Downtown Lake Oswego.

This project describes the visual effects by project segment. The project segments do not match the landscape units however in most cases the landscape units and project segments have similar north south boundaries. Project segments are based on project functional or operational factors. Visual impacts are described by project segment to provide consistency with the other sections of the Environmental Impact Statement. Figure 3.4-1 illustrates the boundaries of the landscape units and the segments.

A. Downtown Portland. The downtown Portland landscape unit extends north from the Ross Island Bridge and includes parts of downtown Portland along the existing streetcar alignment. It is located entirely in Segment 1. It is an urban environment with medium- to large-scale buildings and a small-grid street system. There is a mix of older buildings, modern high rise buildings, urban parks and plazas, and well established ornamental landscaping. Much of the street system is a standard 200-foot block pattern, except where it is disrupted by topographical changes and major transportation features such as Interstate 5, Interstate 405 and the Willamette River.

Dominant visual features within the downtown Portland landscape unit include streetscape and architectural views, the skyline of downtown Portland, and views of the Willamette River and downtown bridges. Throughout the unit, the West Hills form the western edge of the viewshed and Mount Hood and the Cascades can be seen to the east. Buildings, street signs, street trees and the miscellaneous furnishings typical of an urban core are in the foreground and middle ground of most views. The City of Portland's *Scenic Views, Sites, and Corridors* (1991) formally identifies numerous view corridors and view points throughout the landscape unit.

B. South Waterfront. The South Waterfront landscape unit lies between the Ross Island Bridge and Southwest Bancroft Street. This landscape unit is located mostly in Segment 1, with one block in Segment 2. On the east is the Willamette River, and Macadam Avenue and Interstate 5 form the western boundary. The forested canopy of the West Hills and structures associated with Oregon Health Sciences University (OHSU) are visible to the west above Interstate 5. Ross Island, Willamette River riparian vegetation, distant foothills and the Cascade Range are visible in the middle and background views to the east. The Ross Island and Marquam bridges and associated on/off ramps are visible to the north primarily along public streets. The Portland Aerial Tram is also visible to the north. Most visual features to the south are blocked by existing structures. It is a dynamic, urban environment on the edge of the downtown core.

The visual character of this unit is an emerging urban area with a combination of modern high rise buildings and older industrial uses. Surface parking lots and undeveloped sites are interspersed with formal landscaping, urban parks, and urban street furnishings. Currently, the area has a limited but growing street network. Moody and Bond streets accommodate the existing Portland streetcar service.

The City of Portland's *Central City 2035 Subdistrict Profiles* (2010) designates minor viewpoints in the South Waterfront landscape unit along the Willamette River at Gaines Street, Gibbs Street and approximately midway between the Marquam and Ross Island bridges in alignment with the City of Portland's proposed street network. Several view corridors are also designated along Gaines Street, Gibbs Street and approximately Meade Street from Interstate 5 toward the Willamette River. *Scenic Views, Sites, and Corridors* identifies public viewpoints along Terwilliger Boulevard, but vegetation and trees in the green space below Terwilliger Boulevard obscure most views of the South Waterfront landscape unit.

C. Johns Landing. The Johns Landing landscape unit is defined by Southwest Bancroft Street on the north, the Willamette River on the east, the Sellwood Bridge on the south, and Interstate 5 and Corbett Avenue on the west. This landscape unit includes a small portion of Segment 2, all of Segment 3 and about half of Segment 4.

The visual character of this landscape unit is dominated by Southwest Macadam Avenue/Highway 43, a four-lane state highway with a boulevard type streetscape that divides the area. In the northern half of the segment, it has auto-oriented commercial, office and industrial uses on both sides mixed with medium- and low-density housing along with segments of mature landscaping. Macadam Avenue is a busy street that serves as a barrier between the western and eastern parts of the landscape unit. On the west behind the commercial uses is an older, predominately single-family neighborhood with a grid street system and smaller block sizes. The commercial and retail uses on the west side of Macadam Avenue are generally smaller parcels and more pedestrian oriented than the buildings and landscaping east of Macadam Avenue.

On the east side of Macadam Avenue, the parcels are larger and the streets are irregular, and both relate more to the Willamette River. The Willamette River Greenway Trail, a significant public feature, and the Willamette Shore Line run parallel to the river. Large parcel sizes create visual similarity with structures that are primarily three- to four-story office buildings, residential condominiums, industrial and/or river related sites, and public open space. The existing railroad tracks run north and south through this area between Macadam Avenue and the Willamette River. Many buildings on the east side of Macadam Avenue are oriented toward the river, but many commercial buildings along Macadam are oriented toward Macadam Avenue. Many buildings between the existing railroad tracks and Macadam Avenue include surface parking lots adjacent to the buildings.

The southern half of this landscape unit includes a small residential neighborhood and several parks on the east side of Macadam Avenue along with the existing Willamette Shore Line railroad tracks and the Willamette River Greenway trail, both running north and south, parallel to Macadam Avenue.

Visual features within the Johns Landing landscape unit include views of the Willamette River and associated bridges, boats, marinas and houseboats; Willamette Park; Ross Island; the Willamette Greenway Trail; the Willamette Shore Line railroad right of way; distant foothills; and the Cascade Range to the east. Downtown Portland, the Lloyd District and South Waterfront skylines, including the Portland Aerial Tram, are visible in background views to the north. The tree-covered West Hills, the Willamette River and the Sellwood Bridge are visible to the south and west.

The City of Portland Macadam Plan District identifies view corridors along Richardson, Pendleton, Carolina, Nebraska, Vermont, California, Nevada and Miles streets. View points are identified along the Willamette River at locations north of Boundary Street and at Florida Street. A minor viewpoint is identified between Bancroft and Hamilton streets. Scenic resources are protected by the Willamette Greenway Overlay Zones and the Design Overlay Zones which apply to many properties in the area. *Scenic Views, Sites, and Corridors* identifies two scenic viewpoints on the west side of the Willamette River near the Sellwood Bridge.

D. Macadam Avenue/Riverside Parkway. The Macadam Avenue/Riverside Parkway landscape unit is defined on the north by the Sellwood Bridge, on the east by the Willamette River, on the west by the natural bluff above Southwest Macadam Avenue/Highway 43, and on the south by Terwilliger Boulevard and the Tryon Creek. This landscape unit includes almost half of Segment 4, all of Segment 5 and a portion of Segment 6.

This landscape unit is predominantly a forested transportation corridor along Macadam Avenue with the parallel Willamette Shore Line right of way between the highway and Willamette River. The railroad corridor predates development in the area and often defines parcel boundaries. The area has natural vegetation along the Willamette River, creeks and tributaries running west to east, and large lot residential neighborhoods interspersed with some parks and open space. Mixed deciduous and conifer tree canopy, significant grade changes dropping off toward the river and curvatures in the roadway limit views in all directions along Macadam Avenue and Riverside Drive. Occasional openings in the trees provide views to the Willamette River and further east. The existing railroad corridor is generally below the highway. In the vicinity of Powers Marine Park, the existing railroad right of way runs between the river and Macadam Avenue. The Dunthorpe/Riverdale neighborhood are large lot single family areas with narrow rural roads and mature vegetation. Many houses have views oriented to the Willamette River.

Visual resources in the Macadam Avenue/Riverside Parkway landscape unit include the Macadam/ Terwilliger scenic corridor and the Willamette River corridor as identified in *Scenic Views, Sites, and Corridors*. The Macadam/Terwilliger scenic corridor runs along Macadam Avenue from Terwilliger Boulevard to the Portland city limits. This area is protected by the Scenic Overlay Zone. The Willamette River corridor runs the length of the Willamette River in Portland and unincorporated Multnomah County and is protected through the Environmental Overlay Zones and Willamette River Greenway Overlay Zones. South of Portland in unincorporated Multnomah County, the Riverside Drive corridor and areas extending east to the Willamette River are identified as “Scenic Corridor Resource Site 117A” in the *Inventory of Natural, Scenic, and Open Space Resources for Multnomah County Unincorporated Areas* (2001). Additionally, the Elk Rock Gardens is located in the Dunthorpe/Riverdale area and designed as a scenic site in the same inventory.

E. Downtown Lake Oswego. The downtown Lake Oswego landscape unit is defined on the north by Terwilliger Boulevard and Tryon Creek, on the west by the Willamette River, on the south by Church Street, and on the west by 1st Street. This landscape unit is entirely within Segment 6.

The visual character of this unit is that of a small well established downtown city center with an evolving industrial area, office park and open space to the east. State Street/Highway 43 divides the downtown and clearly differentiates the east and west areas both visually and physically. West of State Street the area is mixed-use, with a grid street system and strong pedestrian environment. The streetscape, furnishings, high quality materials and landscaping provide visual continuity.

East of State Street the grade drops toward the Willamette River where access is limited. A narrow row of storefront buildings front onto State Street. They limit views from downtown toward the river and provide a visual edge. The area is physically defined on the north by Tryon Creek and the structures associated with the railroad tracks to the east of the highway. City of Lake Oswego owned and undeveloped open space borders the Willamette River to the east and is different in visual character from the adjacent industrial uses. In the north, the area has large lots with industrial uses. To the southeast are an office campus, residential community and auto-oriented retail uses. This area lacks the visual continuity present west of State Street.

Visual resources in downtown Lake Oswego include view corridors along A, B and D avenues and unobstructed view sites at intersections of A, B, C and D avenues and State Street as identified in the *Foothills District Refinement Plan Alternatives Evaluation and Refinement Report* (OTAK 2005). The City of Lake Oswego’s Willamette Greenway Overlay extends 150 feet shoreward from the ordinary low waterline of the Willamette River and includes provisions protecting and enhancing significant natural and scenic areas, viewpoints and vistas.

3.4.3 Environmental Consequences

Project related effects to the visual and aesthetic environment include changes that would be brought about by construction and operation of the study alternatives and design options. These changes may detract from or enhance the visual environment.

Assessment of visual impacts relies on subjective criteria. This assessment focuses on changes to the visual environment measured as high, moderate, or low degrees of change. Table 3.4-1 describes some typical thresholds for high, moderate or low levels of change. For project related changes the analysis also considers viewer sensitivity to these changes. "Viewer sensitivity" is a measure of potential preferences, values and opinions of different groups of viewers, including considerations of the length of time for which the project could be seen, the distance of the viewer from the project improvements and the type of viewer (e.g., neighborhood resident, traveler on a highway).

Table 3.4-1 Characteristics of High, Moderate, and Low Levels of Visual Change[1]

High Level of Visual Change[1]	Moderate Level of Visual Change[1]	Low Level of Visual Change[1]
Significant new elevated structure	Moderate new grade separation	At-grade/below-grade
Significant displacement of structures	Moderate displacement of structures	Low displacement of structures
Significant new parking	Moderate new parking	Limited new parking
Significant view disruption	Moderate view disruption	Low view disruption
Removal of existing screening to residential uses	Partial removal of existing screening to residential uses	Minor removal of existing screening to residential uses
Significant visual change to public parkland	Moderate visual change to public parkland	Minor visual change to public parkland
Blocks significant scenic feature	Disrupts significant scenic feature	Limited change to significant scenic feature
Significant removal of vegetation	Removal of some vegetation	Limited removal of vegetation
Significant changes to streetscape character	Moderate changes to streetscape character	Limited changes to streetscape character
Significant changes to NRHP eligible historic structure	Significant or moderate changes to NRHP eligible historic site	Limited changes to a NRHP eligible site
Significant new night lighting and associated glare	Moderate new night lighting and associated glare	Low new night lighting and associated glare

[1] Some changes associated with transportation projects, such as screening, landscaping, lighting, sound walls, pedestrian and bike improvements, etc., can be a positive improvement compared to existing conditions.

3.4.3.1 Direct Visual Effects

The assessment considers a variety of factors, including the level of visual change anticipated, the context and scale of the surrounding area, effects on major public views, the sensitivity of viewers and the potential benefit of the project related changes in the area. As noted above, the ratings for the sensitivity of viewers can be more subjective than the other factors, but they consider the expectations of a viewer, the length of exposure he or she would have to the changed view and the viewpoint, including proximity. For example, residential viewers would be considered more highly sensitive to major changes of view and setting nearby because they would encounter the change on a daily basis. People at an established viewpoint, such as a public park, would also be more sensitive to change. Viewers in workplaces, particularly industrial areas, are expected to be less sensitive to changes in views than residential viewers. Motorists traveling through a corridor would be less sensitive to localized changes, but they would still notice major changes in views.

No-Build Alternative. The No-Build Alternative would include transportation improvements as defined in the Regional Transportation Plan financially constrained network. Other projects and additional development or redevelopment changes within the project area would have an effect on existing visual resources but would likely tend to be gradual and localized and not affect the length of the project area. The No-Build Alternative would not include new transit project related changes that would significantly alter the visual environment in the corridor.

Enhanced Bus Alternative. In addition to changes as noted with the No-Build Alternatives, visual changes with the Enhanced Bus Alternative would be limited. In the Lake Oswego project segment construction of a new 300-space park-and-ride structure and new two-lane roadway to connect the park and ride with Foothills Road would result in moderate visual changes to the existing environment; however, they would generally be compatible with the existing urban nature the area. Overall visual impacts with the Enhanced Bus Alternative would be low.

Streetcar Alternative. Implementation of the Streetcar Alternative would result in the addition of a variety of streetcar related elements that would cause visual changes in the corridor. Improvements would include extension of the streetcar system for approximately 5.9 miles from South Portland to downtown Lake Oswego, generally within the existing Willamette Shore Line railroad right of way, except as described for various design options. Related streetcar improvements would include trackway upgrades, generally replacing existing single tracks with double tracks (including some new retaining walls below and above the trackway), addition of 10 passenger stations between Southwest Bancroft Street and Lake Oswego, addition of overhead catenary lines to power the streetcars and associated features such as crossings, signals and lighting.

Potential long-term impacts resulting from the Streetcar Alternative improvements to the existing visual and aesthetic environment are discussed below. Table 3.4-2 summarizes the visual effects of all of the study alternatives. Table 3.4-3 provides detail on viewer sensitivity, degree of change, and overall visual impacts by project segment and design option. Table 3.4-4 summarizes the impacts of the Streetcar Alternative by segment, landscape unit and design option. A narrative description including some visual simulations that are intended to assist the reader in understanding the types of changes that could occur with various design options follows Table 3.4-3.

Table 3.4-2 Summary of Visual Impacts by No-Build, Enhanced Bus and Streetcar Alternatives

Project Segment	No-Build Alternative	Enhanced Bus Alternative	Streetcar Alternative[1]
1 - Downtown Portland	NA	L	L
2 - South Waterfront	NA	L	L
3 - Johns Landing	NA	NA	M
4 - Sellwood Bridge	NA	NA	L-M
5 - Dunthorpe/Riverdale	NA	NA	M-H
6 - Lake Oswego	NA	L	M

Source: Lake Oswego to Portland Transit Project: Visual and Aesthetics Technical Report, DEA August 2010.
Notes: H = High; M = Moderate; L = Low.
NA - Improvements not within the landscape unit or not applicable.
[1]Ranges are the result of various combinations of design options under study. See Table 3.4-3 for details on visual impacts for design options.

Table 3.4-3 Viewer Sensitivity, Degree of Change, and Overall Visual Impact Score for the Streetcar Alternative By Segment and Design Option

Segment/ Design Option	Visual Impacts: Viewer Sensitivity	Visual Impacts: Degree of Change	Visual Impacts: Overall Score[1]	Changing Features (in addition to new trackway and centenary system)
1 – Downtown Portland	L	L	L	New turnaround at Portland State University.
2 – South Waterfront [2]	L	L	L	New stations, relocate existing trolley station, intersection improvements, and new public access from SW Macadam Ave. to station. (Building removal, retaining walls, and new roadway connections done by others as part of South Portland Circulation Project).[3]
3 – Johns Landing				
Willamette Shore Line	L-H	M	M	New stations, retaining walls, regrading, and potential fencing. SW Boundary St. widening and improvements. Modifications to existing carport and parking lot. Removal of Jones Trestle. Potential vegetation removal in various locations including in Willamette Park. New pedestrian improvements and crossings.
Macadam In-Street	M	M	M	New stations and retaining walls. SW Landing Drive widening. Modifications to parking lots. SW Boundary St. reconfiguration, intersection improvements, widening of SW Macadam at SW Carolina, and SW Carolina reconfiguration. Potential vegetation removal in various locations including in Willamette Park. New pedestrian improvements and crossings.
Macadam Additional Lane	M	M-H	M	New stations and retaining walls. SW Landing Drive widening. Modifications to parking lots. SW Boundary St. reconfiguration, widening of SW Macadam from SW Boundary to SW Carolina, and SW Carolina reconfiguration. Building removal. Potential vegetation removal in various locations including in Willamette Park and along SW Macadam. New pedestrian improvements and crossings.
4 – Sellwood Bridge [3]	L-M	L-M	L-M	New stations and retaining walls. Potential vegetation removal and regrading. (Bridge, associated interchange and driveway relocation are part of the Sellwood Bridge Project)
5 – Dunthorpe/Riverdale				
Willamette Shore Line	L-H	L-H	M	New retaining walls, fences, stations, and SW Briarwood overcrossing. Driveway reconfiguration, intersection improvements, and replaced trestles. Potential vegetation removal.
Riverwood In-Street	L-H	L-H	M-H	New retaining walls, fences, station and SW Briarwood overcrossing. Replace 2 trestles with one long trestle. Close intersection of SW Riverwood Road and SW Riverside Drive. Widen SW Riverwood Road. Significant regrading. Building and potential vegetation removal.
6 – Lake Oswego				
UPRR	L-M	M	M	New retaining walls, pedestrian and bike connection from SW Fielding Road, freight under crossing, trestle over Tryon Creek, stations, and stairway connection from SW B Ave. New surface parking lots and parking structure. Roadway widening and reconfiguration, Stampher Road at-grade crossing, UPRR track shifted 15' west, intersection improvements, parking and driveway relocation, and regrading. Potential vegetation removal.
Foothills	L-M	M-H	M	New retaining walls, pedestrian and bike connection from SW Fielding Road, freight under crossing, trestle over Tryon Creek, stations, and stairway connection from SW B Ave. New surface parking lots and parking structure. Stampher Road reconfiguration and extension, SW Foothills road realignment and reconfiguration, intersection improvements, parking and driveway relocation, and regrading. Building (up to 11 structures) and potential vegetation removal.

Source: Source: Lake Oswego to Portland Transit Project: Visual and Aesthetics Technical Report, DEA August 2010.
Note: H = High; M = Moderate; L = Low. MOS = minimum operable segment.
[1] Overall score is the degree of change plus viewer sensitivity.
[2] The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and Moody/Bond Couplet are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.
[3] The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and New Interchange are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

Table 3.4-4 Summary of Overall Visual Impacts for the Streetcar Alternative By Segment and Design Option

Segment/Design Option	Landscape Unit	Overall Visual Impact[1]
1 – Downtown Portland	Downtown Portland (Downtown Portland to the Ross Island Bridge)	L
2 – South Waterfront[2]	South Waterfront (Ross Island Bridge to SW Bancroft)	L
3 – Johns Landing	Johns Landing (SW Bancroft to the Sellwood Bridge)	
Willamette Shore Line		M
Macadam In-Street		M
Macadam Additional Lane		M
4 – Sellwood Bridge[2]	Johns Landing (SW Bancroft to the Sellwood Bridge) Macadam/Riverside Parkway (Sellwood Bridge to SW Terwilliger)	L-M
5 – Dunthorpe/Riverdale	Macadam/Riverside Parkway (Sellwood Bridge to SW Terwilliger)	
Willamette Shore Line		M
Riverwood		M-H
6 – Lake Oswego	Downtown Lake Oswego (SW Terwilliger to Church Street)	
UPRR		M
Foothills		M

Source: Lake Oswego to Portland Transit Project: Visual and Aesthetics Technical Report, DEA August 2010.
[1] Visual impacts include the addition of tracks and catenary system and are rated as: L = Low, M = Moderate, or H = High. Overall score is the degree of change plus viewer sensitivity.
For more details see Table 3.4-3 Ranges represent the variety of change within the full segment.
[2] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

Segment 1 – Downtown Portland

Visual changes in this segment would be insignificant (only include a streetcar turnaround at Portland State University within the existing street right of way). The overall visual impacts within this segment would be low.

Segment 2 – South Waterfront

Viewers in the South Waterfront segment include motorists, streetcar riders, pedestrians, bicyclists, tourists, OHSU patients and students, employees/business people, industrial workers, construction workers, residents and recreationists. It is a dynamic, urban environment on the edge of the downtown core. Most viewers anticipate changes to the visual environment east of Southwest Naito Parkway where land has been rapidly developing. Viewers from residential units in the area anticipate changes to the evolving environment. Businesses adjacent to the existing railroad tracks would have foreground and middleground filtered and short duration views due to building orientation. Their sensitivity would be low to moderate. Commuters would have low sensitivity to the visual changes due to the speed at which they would be traveling, grade differentiation and the short duration they would be exposed to it. The overall viewer sensitivity would be low.

Visual changes in the area would include new stations, intersection improvements, and new public access from Macadam Avenue to the stations. These features would be added in existing road or railroad right of way. Due to topography, building orientation and regional transportation corridors, these features would not block existing views to the Willamette River or other scenic resources. New features and associated development would assist in visually uniting and enhancing intactness as the area evolves into an urban setting. The overall degree of change would be low.

Other visual changes, associated with the Moody/Bond Couplet, include building removal, retaining walls and new roadway connections. These visual changes would occur due to the South Portland Circulation Project and would be evaluated as part of that project.

The overall visual impacts within this segment would be low.

Segment 3 – Johns Landing

Willamette Shore Line Design Option. Viewers in the Johns Landing segment in near the Willamette Shore Line design option would include pedestrians, bicyclists, boaters, tourists, employees/business people and residents. Neighborhood residents would have foreground and middle ground views of the project and moderate to high sensitivity depending on proximity to the project area. Adjacent business people would have foreground and middle ground views and low to moderate sensitivity. Recreational users at Willamette Park would have moderate to high sensitivity depending on their proximity to the project area. The overall viewer sensitivity would range from low to high depending on proximity to the project area.

Visual changes in the area would include new stations, retaining walls varying in height, regrading, and potential fencing. Southwest Boundary Street would be widened and improved to include sidewalks. The Jones Trestle would be removed and the trackway would be lowered. Some vegetation would be removed in various locations including adjacent to Willamette Park. Visual changes would be higher in some locations where the project would be constructed between residential structures and the Willamette River as shown in Figure 3.4-2. Significant views could be partially disrupted by potential fencing and other project components, including catenary wires and support structures, formal landscaping would be removed, and lighting near stations and pedestrian crossings would alter the current visual environment. As shown in Figure 3.4-3, visual changes near Willamette Park would occur adjacent to the western boundary. In most areas the visual changes would be obscured by existing vegetation and would not detract from existing views toward the Willamette River. The visual changes could also improve the visual continuity of the western edge of the park by replacing the view of the back sides of industrial structures and building service areas (garbage, recycling, loading areas) with more active visually intact views. The overall degree of change for the segment as a whole would be moderate.

Overall visual impacts with this design option would be moderate. Mitigation could include screening where appropriate, selecting lighting components that shielding station and reduce impacts from glare, and designing the facilities to complement or blend with the surrounding landscapes and communities.

Macadam In-Street Design Option. Viewers in proximity to the Macadam In-Street design option would include motorists, transit riders, pedestrians, bicyclists, employees/business people, shoppers, industrial workers and residents. Neighborhood residents would have foreground and middle ground views of the project and moderate sensitivity depending on proximity to the project area. Business people and employees adjacent to Southwest Landing Drive and Macadam Avenue would have foreground and middle ground views and low to moderate sensitivity. Commuters would have low to moderate sensitivity to the visual changes due to the speed at which they would be traveling and the short duration they would be exposed to it. The overall viewer sensitivity would be moderate.

As shown in Figures 3.4-4 and 3.4-5, visual changes include new stations and retaining walls varying in height. Landing Drive would be widened and improved with sidewalks, street lighting and vegetation. Portions of existing surface parking lots would be converted to street improvements. Boundary Street would be reconfigured. Macadam Avenue would be widened at Carolina Street. Some vegetation would be removed in various locations, potentially including areas within Willamette Park. Many of visual changes associated with this design option would occur within existing road right of way. Although improvements to Landing Drive are in close proximity to residential structures, the new features do not block or obscure views toward the Willamette River. Many of the residential structures are oriented away from Landing Drive to capitalize on the scenic views toward the river. The adjacent uses along the west side of Landing Drive are primarily surface parking lots. Converting surface parking lots to streetcar and roadway infrastructure is not a significant visual change. Visual change along Macadam Avenue would be low due to the existing nature of Macadam Avenue as a transportation corridor. Landscape screening would be maintained between the adjacent businesses and the roadway. The streetcar could add an additional visual buffer between the pedestrians and the fast moving vehicles along Macadam Avenue. The overall degree of change would be moderate.

Overall visual impacts with this design option would be moderate. Mitigation could include screening where appropriate, minimizing project width where appropriate, selecting lighting components that shielding station and reduce impacts from glare, and designing the facilities to complement or blend with the surrounding landscapes and communities.

Macadam Additional Lane Design Option. Viewers in proximity to the Macadam Additional Lane design option are the same as the Macadam In-Street design option. The overall viewer sensitivity would be moderate. However, the viewer sensitivity may be higher where the residential development is adjacent to the proposed additional lane, because this option would eliminate the existing screening between the residences and the street.

As shown in Figures 3.4-4 and 3.4-6, visual changes would be similar to the Macadam In-Street design option but would also include widening of Southwest Macadam Avenue between Boundary and Carolina streets, removing existing vegetation, potentially including areas within Willamette Park, and reconfiguring adjacent parking areas. Removing the mature vegetation on the east side of the roadway would reduce visual screening between adjacent businesses and residential structures and Macadam Avenue. A small building would be removed at the corner of Macadam Avenue and Carolina Street, widening the transportation corridor slightly. Because this design option would construct the streetcar additional lane in an area that is currently parking and vegetation as well as a buffer between residents and the roadway, the overall degree of change would be moderate to high.

Overall visual impacts with this design option would be moderate. Mitigation could include screening where feasible, minimizing project width where appropriate; and designing the facilities to complement or blend with the surrounding landscapes and communities to the degree possible.

Segment 4 – Sellwood Bridge

Viewers in the Sellwood Bridge segment would include motorists, transit riders, park users, recreationalists, residents and employees of adjacent businesses. Motorists would have short duration and filtered views of the project because much of the project associated with this design option would either occur below view from Macadam Avenue or would be blocked by existing buildings. The project would run behind a number of residences on Miles Place. Residents would have moderate to high sensitivity due to the proximity and duration of visual changes, but the project could improve the visual unity and intactness by enhancing screening. Users of Butterfly, Willamette

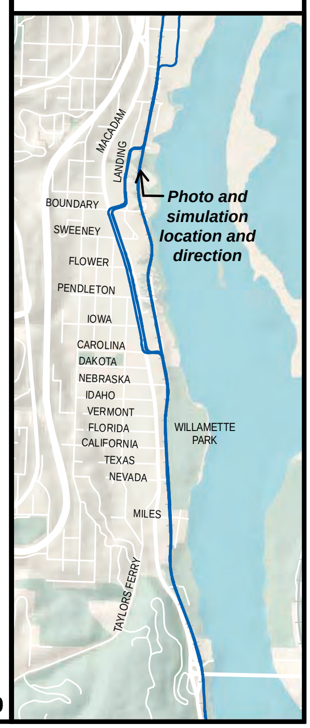
Lake Oswego to Portland TRANSIT PROJECT

Existing View and Visual Simulation from Heron Pointe Condominiums

Figure 3.4-2

A - Existing view looking north from near SW Richardson Street.

B - Future view looking north from near SW Richardson Street with Streetcar Alternative (Willamette Shore Line design option).



2.23.10

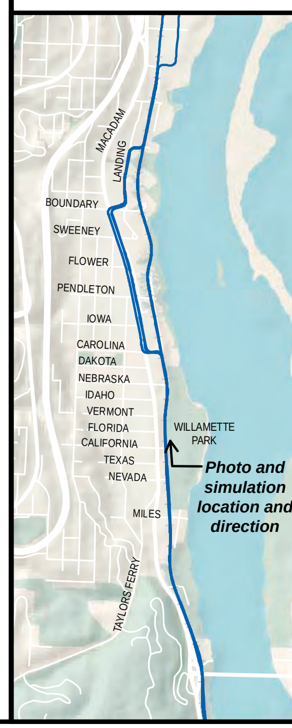
Lake Oswego to Portland TRANSIT PROJECT

Existing View and Visual Simulation from Willamette Park

Figure 3.4-3

A - Existing view looking north from Willamette Park.

B - Future view looking north from Willamette Park with Streetcar Alternative (all design options).



5.6.10

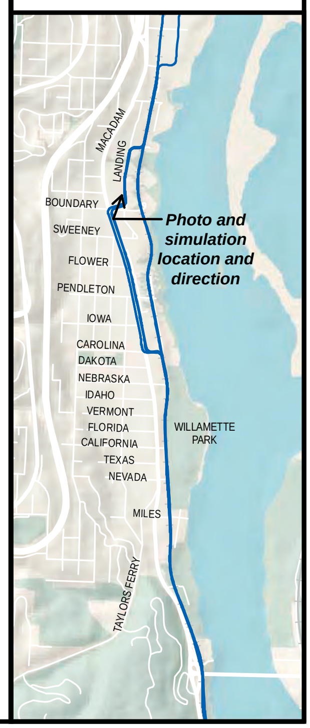
Lake Oswego to Portland
TRANSIT PROJECT

Existing View and Visual Simulation along SW Landing Drive

Figure 3.4-4

A - Existing view looking north from SW Boundary Street.

B - Future view looking north from SW Boundary Street with Streetcar Alternative (Macadam In-Street or Macadam Additional Lane design option).



5.6.10

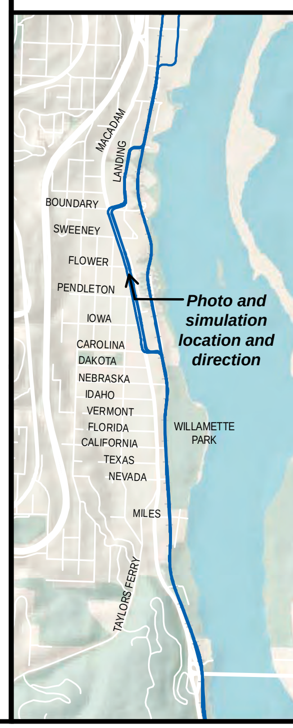
Lake Oswego to Portland
TRANSIT PROJECT

Existing View and Visual Simulation along SW Macadam Avenue

Figure 3.4-5

A - Existing view looking north from south of SW Flower Street.

B - Future view looking north from south of SW Flower Street with Streetcar Alternative (Macadam In-Street design option).



5.6.10

Lake Oswego to Portland TRANSIT PROJECT

Existing View and Visual Simulation along SW Macadam Avenue

Figure 3.4-6

A - Existing view looking north from south of SW Flower Street.

B - Future view looking north from south of SW Flower Street with Streetcar Alternative (Macadam Additional Lane design option).

5.6.10

Moorage and Powers Marine parks would have moderate sensitivity due to the location of the project in relation to the parks. The project would occur on the western boundaries of the parks and would not block park users' views to the Willamette River or interfere with park functions. Businesses in the area would have low to moderate sensitivity depending on proximity. The overall viewer sensitivity would be low to moderate.

Visual changes would include new stations, retaining walls varying in height, a new structure over Stephens Creek, fencing and a pedestrian overpass to Powers Marine Park. Existing vegetation would be removed in multiple locations. These visual changes would occur due to the Sellwood Bridge project, and have been evaluated as part of that project. The overall degree of change associated with this design option would be low to moderate.

Overall visual impacts with this design option would be low to moderate.

Segment 5 – Dunthorpe/Riverdale

Willamette Shore Line Design Option. Viewers in the Dunthorpe/Riverdale segment in proximity to the Willamette Shore Line design option include residents, visitors and motorists. Neighborhood residents would have foreground and middleground views of the project and moderate to high sensitivity depending on their proximity to the project area. Motorists would have low sensitivity to the visual impacts due to elevation differences, the speed at which they would be traveling and the short duration they would be exposed to it. The overall viewer sensitivity would range from low to high depending on the viewers proximity to the project area.

Visual changes would include trackway improvements, new stations, retaining walls varying in height, fences, lighting around the stations, reconstruction of existing trestles and a reconstructed Southwest Briarwood Road overcrossing. Intersection improvements would occur and existing trestles would be replaced. Some existing vegetation and landscaping would be removed in various locations. The area is predominately a residential neighborhood, and while topography reduces the visual impacts for properties on the west side of the project, the project could potentially disrupt views toward the Willamette River. The removal of vegetation could reduce the visual buffering between the existing railroad corridor and the adjacent residences. Introducing streetcar stations and related infrastructure would be somewhat of a departure from the existing visual character of the neighborhood. The overall degree of change would range from low to high.

Overall visual impacts with this design option would be moderate. Mitigation in areas with higher visual impacts could include enhanced screening and use of vegetation to soften visual impacts of retaining walls, shielding station lighting to reduce impacts from glare, minimizing project width where appropriate, and designing the facilities to complement or blend with the surrounding landscapes and communities.

Riverwood Design Option. Viewers in proximity to the Riverwood design option would be the same as the Willamette Shore Line design option. The overall viewer sensitivity would range from low to high depending on the viewers proximity to the project area.

Visual changes in the area include trackway improvements, a new trestle, new stations, retaining walls varying in height, fences, lighting around the stations and a new Southwest Briarwood Road overcrossing. The intersection of Riverwood Road and Riverside Drive/Highway 43 would be closed. Riverwood Road would be widened and regraded. One house would be removed. Some existing vegetation and landscaping would be removed in various locations. Visual changes would occur primarily in and adjacent to the existing road right of way, but the changes would alter the visual character of the street. Retaining walls would be built on the downhill side of SW Riverwood Road, potentially removing mature vegetation and screening between the roadway and the adjacent residences. The visual character of the road would change from a meandering unimproved residential street to a more urban roadway with sidewalks, curbs and bike lanes. Introducing streetcar stations and related infrastructure could be a departure from the visual character of the neighborhood. The overall degree of change would range from low to high.

Overall visual impacts with this design option would be moderate to high. Mitigation could include enhanced screening and use of vegetation to soften visual impacts of retaining walls, shielding station lighting to reduce impacts from glare, minimizing project width and street standards where appropriate, and designing the facilities to complement or blend with the surrounding landscapes and communities.

Segment 6 – Lake Oswego

Union Pacific Railroad Right of Way Design Option. Viewers in the Lake Oswego segment in proximity to the Union Pacific Railroad design option include motorists, residence, pedestrians, bicyclists, employees/business people, industrial workers and shoppers. Neighborhood residents would have foreground and middleground views of the project and moderate sensitivity depending on proximity to the project area. Adjacent business people, industrial workers and shoppers would have foreground and middleground views and low to moderate sensitivity. Commuters would have low sensitivity. Recreation users would have moderate sensitivity. The overall viewer sensitivity would be low to moderate.

Visual changes in the area would include new retaining walls height, a pedestrian and bike connection from Southwest Fielding Road, transit undercrossing of the freight rail line, a trestle over Tryon Creek, new stations, a stairway connection from B Avenue, new surface parking lots and a new parking structure. The roadway would be widened and reconfigured. The Union Pacific Railroad track would shift 15 feet to the west. Existing vegetation would be removed. The visual impacts from the project would occur primarily in the existing railroad corridor adjacent to industrial uses. Much of the project would be lower in elevation from State Street/Highway 43 and behind existing buildings maintaining the existing visual character of downtown Lake Oswego. Visual changes associated with the project could help unify the east and west sides of State Street and promote stronger visual and physical connections to the Willamette River. The moderate to high degree of change near the parking structure would be mitigated through design development with the City of Lake Oswego. Given the visual benefit the project could have on the area, the overall degree of change would be moderate.

Overall visual impacts with this design option would be moderate. Mitigation could include enhanced screening and terracing to soften visual impacts of retaining walls and designing the facilities to complement the aesthetics of downtown Lake Oswego.

Foothills Design Option. Viewers in proximity to the Foothills design option would be the same as the Union Pacific Railroad design option. The overall viewer sensitivity would be low to moderate.

Visual changes in the area would include new retaining walls varying in height, a pedestrian and bike connection from Southwest Fielding Road, streetcar crossing below the existing freight rail line, a trestle over Tryon Creek, new stations, a new stairway connection from B Avenue, new surface parking lots and a new parking structure. Stampher Road would be reconfigured and extended. Foothills Road would be realigned and reconfigured. Intersection improvements would be made. Seven buildings would be removed, in addition to existing vegetation. The visual changes from the project would occur primarily in an industrial part of the city. Many of the buildings removed would be below view from State Street. The new road connection would provide continuity in the future as redevelopment occurs. Visual changes associated with the project would help unify the east and west sides of State Street and promote stronger visual and physical connections to the Willamette River. The moderate to high degree of change near the parking structure would be mitigated through design development with the City of Lake Oswego. Given the visual benefit the project would have on the area, the overall degree of change would be moderate to high.

Overall visual impacts with this design option would be moderate. Mitigation could include enhanced screening and terracing to soften visual impacts of retaining walls and designing the facilities to complement the aesthetics of downtown Lake Oswego.

3.4.3.2 Indirect Visual Effects

Indirect visual effects could include visual effects of development that may choose to locate close to the Streetcar Alternative for better access to transit at both ends of the corridor. Assuming that new development complies with local jurisdiction design review requirements, there would be no resulting indirect adverse visual effects. Indirect effects of the No-Build Alternative and Enhanced Bus Alternative could result in lower levels of visual change but could include visual changes associated with increased congestion, and roadway and public works projects. With the Streetcar Alternative and design options, indirect effects could include redevelopment activities around the proposed stations, north and south ends only, as well as through redevelopment of surplus land cleared during the construction of the project.

3.4.3.3 Cumulative Visual Effects

Cumulative visual effects could include the effects of the various alternatives and design options along with other reasonably foreseeable activities in the corridor that could affect the visual environment. Relative to cumulative effects, it is assumed that there will be slow to moderate new development and some redevelopment in the Portland central city, in the South Waterfront District, in the Johns Landing area and in the Lake Oswego town center. In the Lake Oswego town center area, the Foothills District is likely to progress with a new street plan and some new development.

No-Build Alternative. Selection of the No-Build Alternative would not result in any direct cumulative effects, and therefore it would not increase cumulative visual changes. Cumulative visual effects would include effects from further development of the area including increasing densities. However, with the No-Build Alternative, there also would be no project related improvements to the visual environment from features such as improved pedestrian facilities, and landscaping from project facilities.

Enhanced Bus Alternative and Streetcar Alternative. For both the Enhanced Bus and Streetcar alternatives, the cumulative effects could be similar. Redevelopment in downtown Portland, South Waterfront District and Lake Oswego would continue, regardless of if new transit improvements were made. However, the cumulative effect from the Streetcar Alternative could be greater because the station areas within the South Waterfront, Johns Landing, and Foothills could attract infill development or redevelopment of existing uses to take advantage of the streetcar station than what would occur under the Enhanced Bus Alternative. With this development, there would be more potential for both negative and positive cumulative visual effects. Other projects, such as the South Portland Circulation Study Project, the Sellwood Bridge Project and the Foothills Redevelopment Plan would still be developed within the corridor and would alter the visual environment, with or without the transit project improvements.

3.4.4 Potential Mitigation Measures

This mitigation section identifies a range of potential mitigation measures that could be incorporated. Actual mitigation would be identified if a build alternative is selected as the Locally Preferred Alternative and during Preliminary Engineering and the Final Environmental Impact Statement phase. High-quality design and construction of the proposed transit facilities could help to ensure that the project improvements contribute to the visual environment of the corridor rather than detract from it.

The following techniques could be employed for any of the alternatives to improve the visual effects of the project improvements, depending on which option is selected as the locally preferred alternative and more specific impacts associated with that alternative.

- Planting vegetation, street trees and landscaping in and around the project where appropriate;
- Consideration of the design of alternatives in the vicinity of public parks, open spaces and historic sites;
- Shielding station and roadway lighting to reduce off site glare;
- Minimizing project width where appropriate; and
- Designing the facilities to complement or blend with the surrounding landscapes and communities.

3.5 Historic, Archaeological and Cultural Resources

This section presents an inventory of identified historic and cultural resources and a preliminary assessment of the proposed project's potential effects on those resources. More detailed information about the methodology, the historic resources evaluated, and the history of individual historic resources can be found in the *Lake Oswego to Portland Transit Project: Historic Resources Technical Report* (URS and TriMet/Metro, November 2010). Detailed information about the archaeological resources can be found in the *Lake Oswego to Portland Transit Project: Archaeology Technical Report* (URS and TriMet/Metro, November 2010).

3.5.1 Introduction, Applicable Regulations, Analysis Methods, Consultation

A. Applicable Regulations

This section addresses the requirements of Section 106 of the National Historic Preservation Act of 1966 as it relates to the project. Section 106 requires that federally funded or federally licensed projects include a consideration of project effects on districts, sites, structures objects or archaeological sites listed in or determined eligible for inclusion in the National Register of Historic Places (NRHP). Procedures for meeting Section 106 requirements are defined in *36 CFR Part 800 – Protection of Historic Properties*. Federal agencies must consult with the applicable State Historic Preservation Officer (SHPO) before undertaking projects that would adversely affect historic or cultural resources.

3.5.1.2 Analysis Methods

Area of potential effects (APE). The project team conducted an inventory of existing resources in the area of potential effect, which has been defined by FTA and Oregon SHPO as one-half block in each direction from the alternatives' alignments within the Portland and Lake Oswego downtown areas or areas with a similarly defined grid street pattern. In areas outside a defined grid street pattern, approximately one block or 150 feet in each direction from the study alternatives was used.

Historic resources. For above ground historic resources, all buildings and structures that will be at least 50 years old at the year of the anticipated transit improvement (2015) and located adjacent to the any of the proposed alternatives where construction would occur were evaluated and documented with a Reconnaissance Level Survey. This work included a pedestrian survey of the corridor and general research on the history and development of the area. Documentation included a brief description of the physical characteristics of the building or structure, photographs, and a description of alterations to the building or structure.

Archeological resources. Efforts toward identification of archaeological resources in the APE have been limited to the gathering of existing information. Records on file at the Oregon State Historic Preservation Office, Salem, were reviewed. Oregon SHPO maintains a statewide database of previously-recorded cultural resource sites and completed inventories, which are managed as restricted-access information. Historic General Land Office, Sanborn Fire Insurance and Metsker maps were consulted for information regarding potential historic use of the project area and thus the probability of encountering related resources. Ethnographic data and cultural resources reports were also reviewed to ascertain the past use of the project area and likelihood of encountering archaeological or other cultural resources.

3.5.1.3 Consultation

Project related consultation related to historic, archeological and cultural resources is being conducted as defined in the *Lake Oswego to Portland Transit Project: 6002 Coordination Plan* (August 2009) and as further described in Chapter 7 Public Involvement, Agency Coordination and Permits. Appendix A Agency Coordination and Correspondence includes copies of letters related to the consultation. Additional consultation between FTA, Oregon SHPO and interested tribes is expected to occur between issuance of this DEIS and the Final Environmental Impact Statement (FEIS).

The analysis and discussion of potential effects to historic, archaeological, and cultural resources in this DEIS is considered preliminary. FTA sent a letter in October 2009 to the Oregon SHPO requesting concurrence with the APE. FTA will consult with Oregon SHPO regarding concurrence on the list of properties that have been determined eligible for inclusion in the NRHP. FTA will also provide Oregon SHPO with the preliminary evaluation of the potential effects of all of the project alternatives. Following selection of the LPA and development of minimization or mitigation measures for the LPA, impacts to each historic resource will be re-evaluated and documented. If it is not possible to eliminate or significantly reduce adverse effects that would result from the LPA on historic and cultural resources, a Memorandum of Agreement (MOA) will be developed and executed between FTA, Oregon SHPO, TriMet, Metro and other affected parties to document the impacts of the LPA and the agreed upon mitigation.

3.5.2 Affected Environment

The following section describes the historic, archaeological, and cultural resources in and adjacent to the proposed project. The area of potential effect (APE) within which the historic, archaeological and cultural historical resources have been inventoried and evaluated for project effects has been defined above. For the archaeological resource investigation, the vertical APE may vary according to construction practice and depth of excavation, depending on the geomorphology of the landform where the project element occurs.

3.5.2.1 Historic Resources

There are 89 properties within the study area found to be at least 45 years old (50 years old in 2015). Table 3.5-1 lists all 89 properties and the preliminary evaluation of whether they are considered historic. Of those 89 properties, one (1) residence is individually listed on the NRHP (there are no historic districts in the study area); three (3) properties, including the rail line itself, had been determined eligible for listing on the NRHP by other recent projects; and twenty (20) properties were determined eligible for listing on the NRHP by this project. The remaining sixty-five (65) properties were determined to be not eligible for listing on the NRHP; most of those had been significantly altered and no longer retained sufficient historic integrity to be considered historic. As a result, there are twenty-four (24) historic resources in the study area. Those resources are shown on Figure 3.5-1.

The rail line itself was determined eligible for listing on the NRHP during the recent environmental analysis for the Sellwood Bridge Project. The determination of eligibility defined the Southern Pacific Railroad Red Electric Eastside Line (aka Jefferson Street Line) portion of the Red Electric lines as beginning at the intersection of Southwest Bancroft Street and Moody Avenue in southwest Portland and heading south 6 miles to 0.5 mile north of the intersection of North State Street/Highway 43. It is not clear why the southern terminus was defined in this way, as the Red

Electric Eastside Line's tracks continue west along the north side of Lakewood Bay and Oswego Lake, past Lake Grove.

The resource was considered eligible for its historic use as part of an interurban passenger rail network that connected Portland and larger communities with smaller Willamette Valley towns and strongly influenced growth and development of the outer suburbs south and west of Portland. The Elk Rock Tunnel and the Riverwood trestles (the long and short trestles in the vicinity of Riverwood Road) were described as important contributing elements. The determination of eligibility does not define the extent of the historic resource of the Red Electric any further, so for the purposes of this project, the eligibility has been assumed to include the rail-related features (tracks, ties, signs, signals, trestles and stations) associated with this segment of the Red Electric line. For the purposes of this DEIS, this historic resource is referred to as the "Red Electric Eastside Line."

The segment of rail line between Portland and Lake Oswego (site of the Streetcar Alternative) was completed in 1887 and provided both freight and passenger service. In 1914, Southern Pacific electrified the line and it became part of the Red Electric interurban rail network. The full line consisted of a loop from Portland to McMinnville, passing through Lake Oswego, Sherwood, Newberg, McMinnville, Carlton, Forest Grove and Hillsboro.[43] The Section 106 Determination of Eligibility stated that the railroad's period of significance is 1914 to 1929, the period during which the Red Electric interurban trains were operated on the line.

The Red Electric provided fast and convenient access to Lake Oswego (or Oswego, as the city was called at the time) and played an important role in the development of Lake Oswego and the Dunthorpe/Riverdale area. Between Portland and Lake Oswego, there were 13 stations along the route and the trains reached a maximum speed of 60 mph (remnants of the Riverwood Station near 11445 SW Riverwood Road still exist; traces of the other stations are no longer visible). Although some of these stations were little more than a set of stairs connecting the street to the rail line, they provided convenient access for daily commuters; by 1920, 64 cars ran daily between Portland and Lake Oswego. Importantly, nearly all[44] of the historic resources located along the rail corridor were built after the rail line was in place, and almost half were built during the period when the rail line was used for passenger service. As automobiles became increasingly popular and roads were built and paved, usage of the Red Electric declined. Southern Pacific ceased passenger service on the line in 1929 and removed the electric lines and poles around 1930. Segments of the western leg of the loop were dismantled; the eastern leg, the portion that would be used by the Streetcar Alternative, was retained for exclusively freight service. (Freight service had never entirely ceased on the line, but because the frequent passenger trains were given priority, freight often used alternate routes.) Freight trains used the line until 1983.

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[43] Dill, Tom & Walter. Grande, The Red Electrics, 1994.
[44] Riverview Cemetery is the only historic resource that pre-dates the rail line. It was established in 1882, just five years before the rail line was built.

Table 3.5-1 National Register Status of Resources in the Area of Potential Effect

Resource Address	Resource Type	National Register Status[1]
3910-3930 SW Macadam Ave	Warehouse	not eligible
4000 SW Macadam Ave	Warehouse	eligible
4110 SW Macadam Ave	Warehouse	not eligible
4550-4600 SW Macadam Ave	Offices	not eligible
5200 SW Macadam Ave	Commercial	not eligible
5331 SW Macadam Ave	Offices	not eligible
6140 SW Macadam Ave	Commercial	not eligible
6328 SW Macadam Ave	Commercial	not eligible
6342 SW Macadam Ave	Commercial	not eligible
6626 SW Macadam Ave	Commercial	not eligible
6720 SW Macadam Ave	Commercial	not eligible
6840 SW Macadam Ave	Commercial	not eligible
6932 SW Macadam Ave	Commercial	not eligible
7330 SW Macadam Ave	Commercial	not eligible
7400 SW Macadam Ave	Commercial	not eligible
7520 SW Macadam Ave	Commercial	not eligible
7524 SW Macadam Ave	Commercial	not eligible
8240 SW Macadam Ave	Commercial	not eligible
8421 SW Macadam Ave	Riverview Cemetery	DOE
5511 SW Hood Ave	Commercial	not eligible
0753 SW Miles St	House	not eligible
0755 SW Miles St	House	not eligible
7505 SW Miles Pl	House	not eligible
7423 SW Miles Pl	House	not eligible
Willamette River Mile 16.5	Sellwood Bridge	DOE
10110 SW Riverside Dr	House	eligible
10150 SW Riverside Dr	House	not eligible
10224 SW Riverside Dr	House	not eligible
10234 SW Riverside Dr	House	eligible
10268 SW Riverside Dr	House	eligible
10400 SW Riverside Dr	House	not eligible
10609 SW Riverside Dr	House	eligible[45]
11124 SW Riverside Dr	House	eligible
11930 SW Riverside Dr	House	not eligible
12020 SW Riverside Dr	House	eligible
12410 SW Riverside Dr	House	not eligible
13150 SW Riverside Dr	House	eligible
13100 SW Riverside Dr	House	NRHP
13180 SW Riverside Dr	House	not eligible
13200 SW Riverside Dr	House	not eligible
10808 SW Riverwood Rd	House	not eligible
10925 SW Riverwood Rd	House	not eligible
11075 SW Riverwood Rd	House	not eligible
11100 SW Riverwood Rd	House	eligible
11175 SW Riverwood Rd	House	eligible
11235 SW Riverwood Rd	House	eligible

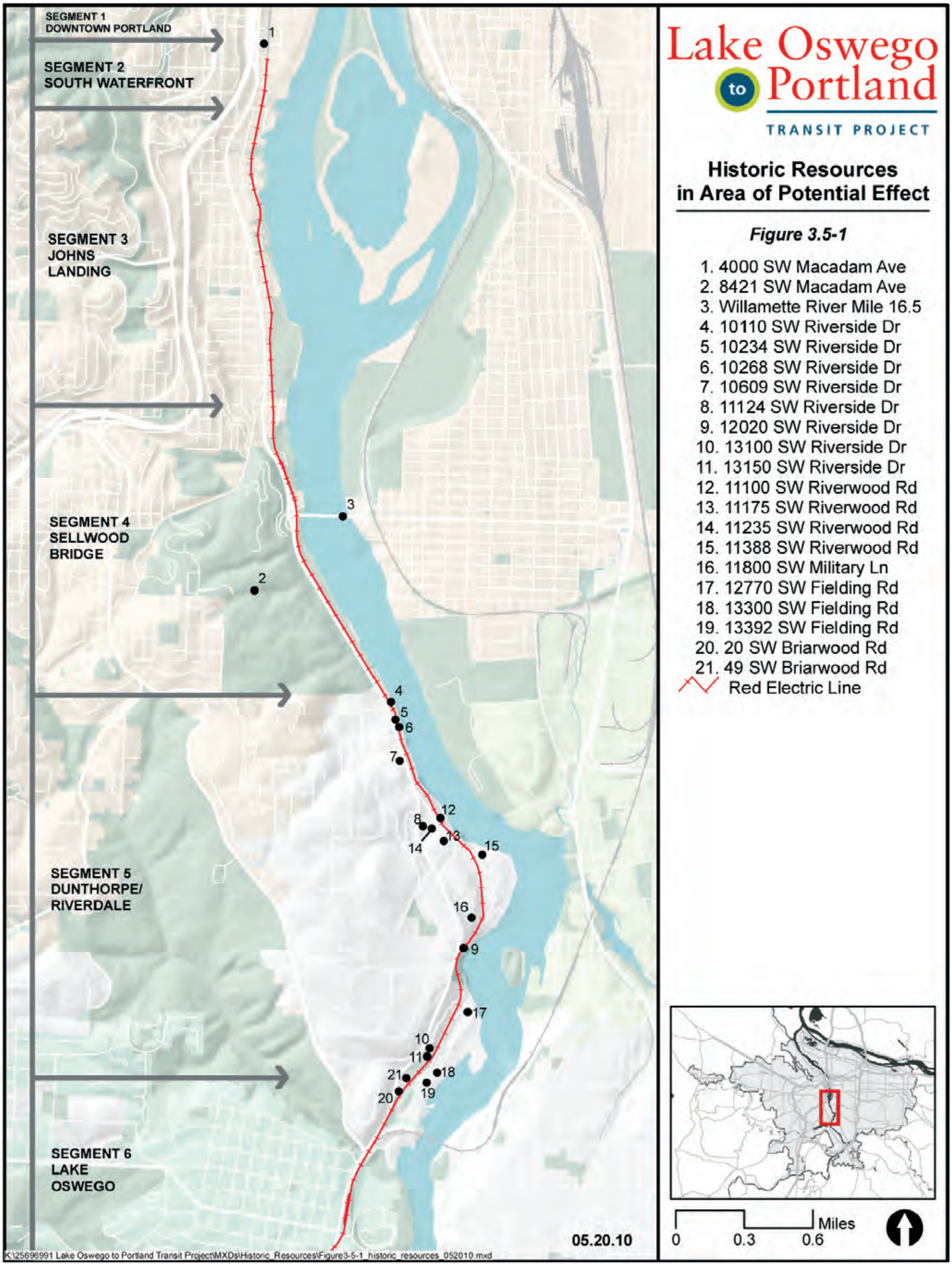
[45] The house at 10609 SW Riverside Drive is located on the west side of Riverside Drive (OR 43), but the property extends east across the road to the Willamette River. The boundary of the historic resource is limited to the portion of the tax lot on which the house is located (i.e. the area on the west side of Riverside Drive); the remnant portions of the tax lot that are located on the east side of Riverside Drive are not part of the historic resource.

Table 3.5-1 National Register Status of Resources in the Area of Potential Effect

Resource Address	Resource Type	National Register Status[1]
11312 SW Riverwood Rd	House	not eligible
11322 SW Riverwood Rd	House	not eligible
11350 SW Riverwood Rd	House	not eligible
11385 SW Riverwood Rd	House	eligible
11388 SW Riverwood Rd	House	eligible
11445 SW Riverwood Rd	House	not eligible
11639 SW Riverwood Rd	House	not eligible
11701 SW Riverwood Rd	House	not eligible
11721 SW Riverwood Rd	House	not eligible
11745 SW Riverwood Rd	House	not eligible
11801 SW Riverwood Rd	House	not eligible
11821 SW Riverwood Rd	House	not eligible
11829 SW Riverwood Rd	House	not eligible
02473 SW Military Rd	House	eligible
02484 SW Military Rd	House	not eligible
11800 SW Military Ln	Office[46]	eligible
12950 SW Elk Rock Rd	House	not eligible
12870 SW Elk Rock Rd	House	not eligible
13060 SW Elk Rock Rd	House	not eligible
12770 SW Fielding Rd	House	eligible
13000 SW Fielding Rd	House	not eligible
13060 SW Fielding Rd	House	not eligible
13070 SW Fielding Rd	House	not eligible
13150 SW Fielding Rd	House	not eligible
13200 SW Fielding Rd	House	not eligible
13250 SW Fielding Rd	House	not eligible
13300 SW Fielding Rd	House	eligible
13348 SW Fielding Rd	House	not eligible
13382 SW Fielding Rd	House	not eligible
13392 SW Fielding Rd	House	eligible
13581 SW Fielding Rd	House	not eligible
13641 SW Fielding Rd	House	not eligible
13711 SW Fielding Rd	House	not eligible
20 SW Briarwood Rd	House	eligible
49 Briarwood Rd	House	eligible
50 Briarwood Rd	House	not eligible
51 Briarwood Rd	House	not eligible
311 N State St	Railroad Building	not eligible
141 N State St	Commercial	not eligible
117 N State St	Commercial	not eligible
47 N State St	Commercial	not eligible
27 S State St	Commercial	not eligible
Red Electric Eastside Line	Railroad	DOE

Source: Historic, Archaeological and Cultural Impacts Results Report, (TriMet and URS, February 2010)
[1] **NRHP** = Currently listed on the National Register of Historic Places;
DOE = Determination of Eligibility: Resource previously determined eligible for listing on the NRHP;
eligible = Resource that has been identified as potentially eligible for the NRHP (formal determinations have not yet been made by the SHPO);
not eligible = Resource that has been identified as not eligible for the NRHP and is therefore not considered historic for the purposes of this project (formal determinations have not yet been made by the SHPO).

[46] This structure was originally a house, but is now the Diocese Headquarters.



Lake Oswego
to
Portland
TRANSIT PROJECT
Historic Resources
in Area of Potential Effect
Figure 3.5-1
1. 4000 SW Macadam Ave
2. 8421 SW Macadam Ave
3. Willamette River Mile 16.5
4. 10110 SW Riverside Dr
5. 10234 SW Riverside Dr
6. 10268 SW Riverside Dr
7. 10609 SW Riverside Dr
8. 11124 SW Riverside Dr
9. 12020 SW Riverside Dr
10. 13100 SW Riverside Dr
11. 13150 SW Riverside Dr
12. 11100 SW Riverwood Rd
13. 11175 SW Riverwood Rd
14. 11235 SW Riverwood Rd
15. 11388 SW Riverwood Rd
16. 11800 SW Military Ln
17. 12770 SW Fielding Rd
18. 13300 SW Fielding Rd
19. 13392 SW Fielding Rd
20. 20 SW Briarwood Rd
21. 49 SW Briarwood Rd
Red Electric Line
SEGMENT 1
DOWNTOWN PORTLAND
SEGMENT 2
SOUTH WATERFRONT
SEGMENT 3
JOHNS
LANDING
SEGMENT 4
SELLWOOD
BRIDGE
SEGMENT 5
DUNTHORPE/
RIVERDALE
SEGMENT 6
LAKE
OSWEGO
05.20.10
0
0.3
0.6
Miles
K:\25696991 Lake Oswego to Portland Transit Project\MXDs\Historic_Resources\Figure3-5-1_historic_resources_052010.mxd

In 1988 a consortium of governments, the Willamette Shore Line Consortium, purchased the Portland to Lake Oswego section for the purpose of preserving the rail right of way for future public rail mass transit use. Currently, the city of Lake Oswego leases the line from the consortium and it contracts with the Oregon Electric Railway Historical Society to operate interim trolley operation that has operated on a seasonal excursion schedule. The right of way and rail facilities are maintained by the Willamette Shore Line Consortium. As outlined in the Maintenance Plan, the Willamette Shore Line Consortium performs routine maintenance and ongoing modifications to the rail corridor in order to provide for active rail operation. The line was out of service for much of 2009 and 2010 due to maintenance activities, which included repairs to tracks, ties and trestles. During the period of significance, passenger rail service was provided using "Red Electric" interurban trains over the line from Portland to Corvallis. Today, trolley service is provided using the Portland Traction "Broadway Car" Brill Master Unit #813 built in 1932. Due to weight limitations on the existing trestles, there are only certain types of trolley cars that can operate on the existing right of way without major improvements to the structures.

3.5.2.2 Archaeological Resources

For archaeological resources, this study reviewed existing records on file at the Oregon State Historic Preservation Office, as well as archival data and historic maps. Based on records available at the Oregon SHPO, there are no known archaeological sites within the APE, and no prior archaeological survey coverage has occurred within the APE. Six archaeological sites have been recorded within a one-mile radius of the project APE within a similar urban setting, including three prehistoric-period resources and three historic-period resources.

Much of the APE can be considered to have a general sensitivity for archaeological resources based on:

- Proximity to the Willamette River shoreline, which increases probability for pre-contact and historic period sites;
- Historic maps review, which indicates the presence of early historic settlement throughout much of the proposed corridor;
- Association with the historic rail corridor, which could have archaeological sites related to construction and operation of the original rail line;
- Known presence of pre-contact and historic archaeological sites in the broader vicinity that are found within similarly developed, urban settings;
- Literature review, which indicates potential for ethnohistoric use of the project area; and
- The presence of old town neighborhoods and urban centers of historic importance, such as Chinatown, the Pearl District, the Fulton and Dunthorpe/Riverdale neighborhoods, and Old Town Lake Oswego, for example, which indicates sensitivity for a variety of historic-period archaeological site types.

While there is the potential for archaeological resources, the extent of past impacts associated with modern urban development in the APE may have caused disturbances to, obscured, or obliterated evidence for such potential resources.

A field reconnaissance or pedestrian archaeological inventory has not been conducted for this project to date. Each of the alternatives has the general potential for as yet-undocumented archaeological sites. Because much of the proposed corridor falls within urban developed areas, a pedestrian inventory may be of limited value in terms of site reconnaissance in many areas. Appropriate and practicable methods of archaeological site reconnaissance will be considered once Locally Preferred Alternative is selected and could include, but are not limited to, pedestrian survey, exploratory probing and/or monitoring of construction-related ground disturbing activities.

3.5.3 Environmental Consequences to Historic and Archaeological Resources

The assessment of effects contained in this DEIS is considered preliminary. It is based on evaluating a set of alternatives and design options that were initially defined before researching and evaluating in detail the location of potential historic, archaeological and cultural resources in the corridor. The assessment of effects has been done based on the initial design of the study alternatives. After the DEIS is published, the study partners are expected to select a Locally Preferred Alternative based on the DEIS results, including findings on historic and archaeological resources in the corridor. After the Locally Preferred Alternative is selected, the design of the alternative is expected to be refined based on knowledge of possible impacts to historic and archaeological resources, including first avoiding impacts to these resources and then minimizing effects if avoidance is not possible. Finally, the project team will work to define mitigation, if necessary, for effects that cannot be avoided or minimized.

The following section addresses the direct, indirect and cumulative effects of the study alternatives to historic, archaeological and cultural resources. Direct impacts would result from changes in right of way and access. Indirect effects include impacts to setting, including changes in noise and visual conditions. Short-term effects are those that would result from construction, and are addressed separately in Section 3.16 Construction Approach and Effects. Cumulative effects consider project impacts in the context of related past, present and future projects.

3.5.3.1 Direct Effects

Direct effects are those effects that would occur to historic, archaeological or cultural resources as a result of ground disturbing activities. For historic resources, direct effects would include direct changes to identified historic resources in the corridor resulting from construction of project related facilities. Table 3.5-2 summarizes the potential effects of the No-Build, Enhanced Bus and Streetcar Alternatives on the historic resources. Relative to archaeological resources, because no known sites have been previously recorded within the APE, direct effects would include the potential to affect as yet unidentified archaeological resources. Direct effects on traditional cultural properties or other sensitive or sacred resources that might be of concern cannot be determined until consultation with the tribes is concluded. This consultation is not expected to be completed until after the DEIS is issued.

Table 3.5-2 Summary of Effects of No-Build, Enhanced Bus and Streetcar on the Red Electric Line Historic Resource

Design Alternative	Red Electric Line Historic Resource Affected[1]	Red Electric Line Historic Resource Adversely Affected
No-Build	1	1
Enhanced Bus	1	1
Streetcar	1	0-1[2]

Source: Lake Oswego to Portland Transit Project Streetcar Plan Set, November 9, 2009.
[1] The Red Electric Rail Line runs the length of the corridor. Its impacts are detailed in each section of 3.5.3.1.
[2] Based on the project's current conceptual engineering (approximately 8 percent design), the Streetcar Alternative could result in an effect or an adverse effect on the Red Electric Eastside Rail Line, depending on further design work, analysis and coordination to be completed during Preliminary Engineering.

No Build Alternative. Except for the Red Electric Eastside Line, there would be no direct long-term impacts to historic properties resulting from the No-Build Alternative. The No-Build Alternative would likely result in adverse effects to the Red Electric Eastside Line, because the consortium purchased and maintains the Willamette Shore Line right of way to preserve it for future passenger rail service and could decide to relinquish ownership if its membership determines that passenger rail service in the corridor is not feasible or viable. Alternately, the consortium could decide to continue ownership and maintenance of the right of way indefinitely pending changes in conditions that would lead to conversion of the line to urban rail service in the future. However, the increasing decline of the condition of the existing track, ties and trestles and escalating maintenance costs would make it difficult for the consortium to continue ownership and maintenance of the line indefinitely. If passenger rail service is not reintroduced or maintained, the consortium would consider legal transfer or sale of the right of way. If the line were to be sold by the consortium, the interval excursion trolley service could be discontinued and ownership of at least portions of the Red Electric Eastside Line could revert to adjacent property owners. Further, contributing elements of the line (e.g., track, ties, ballast, trestles) could fall into disrepair and/or could be removed. If private individuals or other groups attained ownership of portions of the line, they would not be required to comply with Section 106 requirements for those portions of the line.

There would be no direct long-term impacts to archaeological sites with the No-Build Alternative. There is the potential for indirect effects to unidentified historic or archaeological resources due to development of other transportation projects that would still occur even if this transit project were not developed. These potential indirect effects cannot be quantified.

Enhanced Bus Alternative. The Enhanced Bus Alternative would result in the same risk of adversely affecting the Red Electric Eastside Line as would the No-Build Alternative, described above.

The construction of transit facilities (i.e., park-and-ride lot in downtown Lake Oswego and removal of approximately half of the existing bus stops between downtown Lake Oswego and downtown Portland) would not adversely affect any historic resources in the corridor.

For archaeological resources, the footprint for construction-related ground disturbance under the Enhanced Bus Alternative would be limited to the construction of a park-and-ride facility in Lake Oswego that would be constructed within an existing parking lot. Because construction of the park-and-ride lot would be confined to already-developed and disturbed property, the potential for the project to cause adverse impacts to historic resources or undiscovered, significant archaeological sites would be limited. However, additional evaluation would be necessary for those areas subject to ground disturbing construction if it were selected as the project's locally preferred alternative, because the Enhanced Bus Alternative could result in construction-related impacts to yet undiscovered pre-contact and historic-period archaeological resources within the APE. Long-term effects could include the impacts of disturbances to buried archaeological sites encountered during construction and the permanent loss of the archaeological deposits from destruction or removal. However, there would also be the potential for some compensatory benefits if resources are identified because they can be inventoried and recorded, and other preservation actions can be identified.

Streetcar Alternative. Effects of the Streetcar Alternative to historic resources are described below as precisely as possible, but the nature and extent of some impacts are not fully known at this point because of the current level of design. Once the Locally Preferred Alternative is selected, the project design is refined, and mitigation strategies are developed, impacts will be described and evaluated on a resource by resource basis and included in the project's FEIS. The preliminary finding is that there would be no historic properties adversely affected by the Streetcar Alternative, except for the potential for impacts to the Red Electric Rail Line. This information is summarized in Table 3.5-3 and described in further detail by segment below. Impacts to the Red Electric Eastside Rail Line are treated separately in the paragraph following the table.

Table 3.5-3 Effects of Streetcar Alternative and Design Options on Historic Resources

Segment	Design Option	Number of Historic Resources[1]	Number of Historic Resources Affected	Number of Historic Resources Adversely Affected*
1 – Downtown Portland	None	1	0	0
2 – South Waterfront[2]	None	0	0	0
3 – Johns Landing	Willamette Shore Line	0	0	0
	Macadam In-Street	0	0	0
	Macadam Additional Lane	0	0	0
4 – Sellwood Bridge[2]	None	1	0	0
5 – Dunthorpe/Riverdale	Willamette Shore Line	16	0	0
	Riverwood In-Street	19	0	0
6 – Lake Oswego	UPRR	1	0	0
	Foothills	1	0	0
All segments	**Red Electric Line[1]**	1	1	TBD[3]
Total (range)		22-24		0

Source: Lake Oswego to Portland Transit Project Streetcar Plan Set, November 9, 2009.
[1] The Red Electric Rail Line runs the length of the corridor through segments 2 through 6. [2] The Riverwood In-Street design option would use a non-historic portion of the tax parcel associated with 10609 SW Riverside Drive, but would not use any of the historic portion of that tax parcel.
[2] The South Waterfront and Sellwood Bridge Segmentscontain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.
[3] To Be Determined (TBD). Based on the project's current conceptual engineering (approximately 8 percent design), the Streetcar Alternative could result in an effect or an adverse effect on the Red Electric Eastside Rail Line.

Impacts to the Red Electric Eastside Rail Line

The Streetcar Alternative would use the Willamette Shore Line right of way, which is historically known as the Red Electric Eastside Rail Line. The Streetcar Alternative would result in the restoration of interurban electric rail service between downtown Portland and downtown Lake Oswego, a type of service that operated between 1914 and 1929. The existing railroad right of way and facilities generally between Southwest Lowell Road and downtown Lake Oswego would be restored, rehabilitated and replaced as needed to allow for the safe and efficient operations of interurban passenger electric rail service, meeting current design standards and permitting requirements. Based on the project's current conceptual engineering (approximately 8 percent design), the Streetcar Alternative could result in an effect or an adverse effect on the Red Electric Eastside Rail Line. Future design work during the Preliminary Engineering phase would further inform the determination of effect. In order to restore regular passenger service in the right of way, the whole line would be re-electrified. Safety improvements would be added to crossings, and stations would be reintroduced at various locations along the line. Streetcar improvements would likely include the replacement and reconstruction of the existing railroad ties and rails. Elk Rock

Tunnel, the one tunnel on the corridor, would be reinforced. The six rail trestles on the corridor will be analyzed for potential rehabilitation, restoration, or reconstruction. If the Streetcar Alternative is selected as the Locally Preferred Alternative, all future design work contributing the restoration of the interurban electric rail service would be completed in compliance will applicable elements of the Federal Section 106 regulations and guidelines, such as 36 CFR Part 800 (Protection of Historic Properties) and 36 CFR Part 68 (Secretary's Standards for the Treatment of Historic Properties).

TriMet, Metro and the City of Portland would conduct further design work during the project's Preliminary Engineering phase, prior to publication of the project's FEIS and final Section 106 and Section 4(f) report. That design work would be conducted in consultation with FTA and the Oregon SHPO with the intent to avoid any adverse effect on the Red Electric Eastside Rail Line, while providing for the safe and efficient operations of urban electric rail service, meeting current design standards and permitting requirements. If the design effort for the Streetcar Alternative were to result in an adverse effect on the Red Electric Eastside Rail Line, the project would need to demonstrate, consistent with Section 4(f) requirements), that there is no prudent or feasible alternative to that adverse effect and that all possible planning to minimize harm was done. That determination would be made, if warranted, prior to publication of the FEIS and final Section 106 and Section 4(f) report.

Effects to the Red Electric Eastside Rail Line would vary by design option. Option-specific effects are described in the following section. Some segments of the corridor include streetcar design options that would not use portions of the Red Electric Eastside Rail Line. In Segment 6, the current Willamette Shore Line right of way is not in the same location as the historic Red Electric Eastside Rail Line. For the most part, the project would extend the streetcar from its current locations at SW Lowell Street in South Waterfront with the necessary improvements to provide for safe and efficient passage between Lake Oswego and Portland. With the corridor there are design and phasing options that would not use the Red Electric Rail Line. A more detailed description of the streetcar design options follows.

Segment 1 – Downtown Portland (Northwest Portland to Southwest Lowell Street)
One historic resource, the Milwaukie Machinery Co. warehouse at 4000 SW Macadam Ave., is located in the APE of Segment 1. The preliminary finding is that there would be no historic properties adversely affected in this segment.[47]

Segment 2 – South Waterfront (Lowell Street to Hamilton Court)
Aside from the Red Electric Line, there are no historic properties in this segment; therefore the preliminary finding is that there would be no historic properties affected in this segment.

The streetcar could be built in the interim on the Red Electric line. In the future the streetcar would be integrated into the Moody and Bond avenues street network expansion as part of the South Portal project. The future street network would use the Red Electric right of way and private property to extend the street network to the south, as planned to accommodate the existing and planned growth in the South Waterfront.

[47] Potential impacts to the Red Electric Eastside Rail Line are described in the "Impacts to the Red Electric Eastside Line" section and are not included in the segment-by-segment analysis.

Segment 3 – Johns Landing (Hamilton Court to Miles Street)
Aside from the Red Electric Line, there are no historic properties in this segment; therefore the preliminary finding is that there would be no historic properties adversely affected by any of the three design options in this segment.

The design options would include use of the Red Electric Rail Line for future streetcar use or move the streetcar operations on to local private/public streets for a short distance. If the streetcar were to not use the Red Electric Rail Line in this section, there is a strong desire to construct a multi-use trail in this area

Segment 4 – Sellwood Bridge (Miles Street to south end of Powers Marine Park)
In addition to the Red Electric Rail Line, the Riverview Cemetery and the Sellwood Bridge are the only historic resources in this segment. The preliminary finding is that there would be no historic properties adversely affected by the project related improvement with any of the design options in this segment.

The existing Red Electric Rail Line would be displaced and moved as part of the Sellwood Bridge project. The Sellwood Bridge project has been designed to accommodate future potential streetcar tracks and concluded through the Sellwood Bridge Final Environmental Impact Statement that there would be no adverse effect on the Red Electric Rail Line.

Segment 5 – Dunthorpe/Riverdale (south end of Powers Marine Park to Briarwood Road)
Willamette Shore Line Design Option. In addition to the Red Electric Rail Line, there are sixteen (16) historic resources shown in Map 3.5-1 and listed in Table 3.5-1 in the APE for this design option, all of which are single-family houses except for 11800 SW Military Lane, a former residence that contains offices for the Episcopal Diocese of Oregon. The preliminary finding is that there would be no historic properties adversely affected by the re-introduction of the streetcar on the existing rail corridor.

Many of the historic resources are homes located close to the railroad; the rail corridor either bisects tax lots or is adjacent to properties on Riverside Drive and Riverwood Road. The rail corridor is located on a berm adjacent to Fielding Road, and is located beside properties on Briarwood Road. In Segment 5, all of the historic resources were built after the rail line, and two-thirds were built during the period when the Red Electric line was running frequent passenger service. Even after passenger service was discontinued, the rail line remained in continuous use for freight until 1983. The rail line is currently an active rail corridor. As a result, the reintroduction of an electric streetcar to the historic Red Electric Eastside Line would not, in itself, constitute an adverse effect.

One historic property located at 11100 SW Riverwood Road is bisected by the existing rail line. The house and attached garage were built in 1957 on the east side of the rail line (during a period when the rail line was in active use for freight). The driveway and a pedestrian walkway both cross the rail line. A second historic property located at 10268 SW Riverside Drive, built in 1941, is similarly situated; the driveway and pedestrian access both cross the tracks. A crossing gate or other safety mechanism is likely to be installed for these residences, although the design and nature of the crossings have not yet been developed. If the design is compatible with the site and does not substantially alter the historic integrity of the house or grounds, there would be no historic properties adversely affected by the installation of crossing equipment.

Three (3) historic properties lie above the Elk Rock Tunnel, which passes underneath on an easement. No effects are anticipated for the three properties above it.

The streetcar would use the Red Electric Rail Line for the entire length of this segment with the Willamette Shore Line design option.

Riverwood Design Option. In addition to the Red Electric Rail Line, there are nineteen (19) historic properties in the APE for this design option, all of which are single-family houses. The preliminary finding is that there would be no historic properties adversely affected by the re-introduction of the streetcar on the existing rail corridor.[48]

Potential impacts to historic properties are the same as for the Willamette Shore Line design option described above. In addition to those impacts, this design option would require the use of a non-historic portion of the tax parcel associated with the house at 10609 SW Riverside Drive. This house is located on the west side of Riverside Drive (OR 43), but the tax parcel extends east across the road to the Willamette River. The boundary of the historic resource is the portion of the tax parcel on which the house is located (i.e. the portion on the west side of SW Riverside Drive); the remnant pieces on the east side of SW Riverside Drive are not part of the historic resource. Because this design option would not use any of the historic resource itself, nor would it have any adverse effects on the historic resource, the preliminary evaluation is that there would be no historic properties adversely affected.

In the block where the new streetcar line would be added, the existing pavement is relatively narrow and there are wide unpaved shoulders on both sides. The rock walls that line many front yards along Riverwood Road are all located far enough from the roadway that they would not be displaced by this design option. Although the addition of a streetcar on Riverwood Road would be a change from the current conditions, it would not be significant enough to constitute an adverse effect.

The streetcar would be relocated to SW Riverwood Road for a portion of the alignment with the Riverwood Road design option. If the streetcar were to operate in SW Riverwood Road, the Red Electric Rail Line could be sold or abandoned.

Segment 6 – Lake Oswego (SW Briarwood Road to Lake Oswego Terminus)
In addition to the Red Electric Rail Line, there is one (1) historic resource in Segment 6. Potential impacts to this resource are similar to those described in Segment 5 for houses located adjacent to the rail line. This house was built during the period when the railroad was in use as the Red Electric line. The preliminary finding is that there would be no historic properties adversely affected by either of the design options in this segment.

Both of the design options in this segment would be located east of the existing tracks and terminate at Albertsons. The current location of the Willamette Shore Line right of way in this segment is not the historic location. The original alignment was modified as the district developed.

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[48] The Riverwood design option would displace the house at 10808 SW Riverwood Road. This house, built in 1961, was evaluated but determined to be not eligible for the National Register of Historic Places because of its loss of historic integrity and lack of historic significance. Therefore it is not considered a historic resource.

Impacts to Archaeology Resources
Effects of the Streetcar Alternative to **archaeology resources** could result from construction-related impacts where yet to be discovered resources exist. The Streetcar Alternative would require construction of approximately six miles of new street car tracks, 10 new stations, and two new park-and-ride facilities. However, most of the proposed project would be confined to the already developed and disturbed existing right of way . The potential for the project to cause adverse impacts to undiscovered, significant, archaeological sites is probably limited but would need to be considered in more detail for those areas subject to ground disturbing construction upon selection of a preferred alternative. Effects of the Streetcar Alternative to archaeology resources could result from construction-related impacts to areas with the general potential for pre-contact and historic-period archaeological resources within the APE. The locations of archaeological resources may not be determined prior to selection of the preferred alternative. After selection of a locally preferred alternative, the project would conduct additional investigations, possibly including subsurface explorations in undeveloped areas and other methods in paved areas as appropriate, to help further define the potential presence of resources. Still, some resources could be undetected and may not be avoided prior to construction. Long-term effects could include the impacts of disturbances to buried archaeological sites encountered during construction and the permanent loss of the archaeological deposits from destruction or removal. However, there is also the potential for some compensatory benefits if resources are identified because they can be inventoried and recorded, and other preservation actions can be identified.

3.5.3.2 Indirect and Cumulative Effects

Indirect and cumulative effects to historic and/or traditional cultural properties or other sensitive or sacred resources that might be of concern cannot be fully determined at this time. FTA will notify the appropriate tribal governments in order to commence government-to-government consultation and request their review of this project from a cultural resources perspective.

Relative to indirect and cumulative effects, it is assumed that there will be slow to moderate new development and some redevelopment in the Portland Central City, in the South Waterfront area, in the Johns Landing/North Macadam area, and in the Lake Oswego Town Center. In the Lake Oswego Town Center area, the foothills area is likely to progress with a new street plan and some new development.

No-Build Alternative. Selection of the No-Build Alternative would not result in any direct impacts, and therefore it would not increase indirect or cumulative impacts to historic or archaeological sites. Indirect and cumulative effects would include the further development of the area, increasing densities and pressure for changes to historic resources.

However, with the No-Build Alternative, there also would be less potential for discovery of, identification and documentation of archeological resources. While archaeological sites are protected by state and federal law, currently unidentified sites could be inadvertently disturbed by other development actions and may not be subject to the level of protection as a federally-funded project such as the Portland to Lake Oswego Transit Project. Archaeological sites could also be adversely affected by the actions of others, which could range from modification, to loss of association, to demolition.

Enhanced Bus Alternative. Selection of the Enhanced Bus Alternative would result in continued redevelopment of the area, risking changes to historic structures. Other projects would still be developed in areas that may contain pre-contact or historic-period archaeological sites, with or without the transit project. Cumulative impacts would derive from changes to historic resources that would decrease their historic integrity and the increased loss to the archaeological record of significant archaeological resources caused by new construction.

Streetcar Alternative. Selection of the Streetcar Alternative would also result in continued redevelopment of the area and the associated risks described under the Enhanced Bus Alternative. However, the Streetcar Alternative would enhance the economic development potential of the area more than the Enhanced Bus Alternative, so there may be slightly greater pressure for redevelopment or in-fill development. Increased development and redevelopment could result in an increased loss of archaeological resources. Because most of the historic resources are located in neighborhoods with relatively little potential for additional development, indirect and cumulative impacts to historic resources would not be substantially different from those associated with the Enhanced Bus Alternative.

3.5.4 Potential Mitigation

Mitigation could avoid adverse impacts to historic resources with the Streetcar Alternative. Following are potential mitigation measures. The potential mitigation measures are preliminary; Oregon SHPO may require additional or different measures as the project plans develop. Ongoing coordination, as described in Section 3.5.5 below, will be necessary to ensure that the project results in no historic properties adversely affected. Final mitigation will be determined during the FEIS and consultation under the Section 106 process.

- The Streetcar Alternative would replace the rails, railroad ties, and most trestles associated with the Red Electric Eastside Line. These resources could be documented and, in the case of the dated nails embedded in the railroad ties, retrieved and preserved. Documentation could include measured drawings, large-format photographs, and a detailed written narrative.
- Improvements to the Red Electric Rail Line could include elements to enhance and maintain the historic appearance, scale, materials or architectural elements of the rail line.

Unidentified archaeological resources could be affected by construction of the Enhanced Bus Alternative and Streetcar Alternative. Unlike historic buildings, archaeological resources are typically concealed beneath sidewalks, buildings, parking lots and streets. The probability of encountering archaeological resources is based upon presence of sensitive landforms or previous discoveries in the project vicinity; however, it is usually not possible to locate archaeological resources prior to construction, because they typically are hidden under sidewalks and streets. Because archaeological resources in urban settings are often identified only during project related construction, avoidance by selecting the alternative that would have the least impacts is not possible. The potential types of archaeological resources differ, but the treatment for potential mitigation would be similar.

Subsurface testing, shovel probing and exploratory excavations for buried archaeological sites during Preliminary Engineering, Final Design and in early construction could reduce potential impacts and minimize delays during general construction. Prior to such investigation, an inadvertent discovery plan would need to be prepared and approved by Oregon SHPO. This plan would establish procedures to deal with unanticipated discovery of cultural resources before and during construction. The plan would require immediate work stoppage and appropriate notification in the event of discovery of previously unknown cultural materials. The plan would also specify protocols for the treatment of human remains that fulfill the requirements of the Native American Graves Protection and Repatriation Act in the event that human remains and/or funerary items are encountered during construction or operation of the project. Monitoring protocol would be addressed in consultation with the federal agencies, Oregon SHPO, Metro, TriMet and appropriate interested Tribes.

The Advisory Council on Historic Preservation (ACHP) has issued guidance for the recovery of information from archaeological sites (ACHP, 1999 and 2008). Mitigation measures could include, but are not limited to, avoidance or preservation in place, recovery of archaeological data, public interpretive display or other options. Data recovery as mitigation for adverse effects is acceptable only when specific conditions are met and a data recovery plan has been prepared. Mitigation of adverse effects to archaeological resources will need to be defined in consultation with Oregon SHPO and other designated consulting parties.

For resources identified during construction that cannot be avoided, mitigation would focus on documentation, data recovery and analysis, as determined through consultation with Oregon SHPO and interested Tribes. The final analysis of impacts would be documented in the Portland to Lake Oswego Transit Project FEIS. If there are significant effects from the selected alternative that could not be avoided, a Memorandum of Agreement (MOA) would be developed through consultation among the agencies, FTA, Oregon SHPO, interested Tribes (if applicable) and other affected parties. The MOA would document mitigation commitments. The MOA would be completed prior to publication of and be included within the FEIS

After selection of a preferred alternative, the project would conduct more focused additional archaeological investigations, possibly including subsurface explorations in undeveloped areas and other methods in paved areas as appropriate, to help further define the potential presence of resources. Still, some resources could be undetected and may not be avoided prior to construction.

3.5.5 Next Steps and Completion of the Section 106 Process

Ongoing coordination with Oregon SHPO and federally recognized tribes, as retained by tribal treaty rights, will be necessary to ensure that there no historic properties or archaeological resources would be adversely affected by the proposed project improvements.

During the DEIS phase of the project, Determinations of Eligibility have been submitted to Oregon SHPO along with preliminary Level of Effect assessments and identification of potential mitigation measures. In the DEIS phase, it is expected that Oregon SHPO consultation and concurrence with the Determinations of Eligibility will be completed.

The preliminary Level of Effect evaluations that have been documented in this DEIS and potential mitigation measures will serve as the initial recommendations for incorporating into future design refinements. The assessment is expected to be refined through the selection of the Locally Preferred Alternative and project related design refinements in the Preliminary Engineering/FEIS phase. Oregon SHPO may recommend additional or different mitigation measures. Further coordination with SHPO and the results of the consultation would be incorporated into the project design, and documented in the FEIS and the ROD. The project’s goal would be to refine the design to the extent that there are no historic properties adversely affected. If necessary a Memorandum of Agreement between Oregon SHPO, FTA, TriMet and federally recognized tribes, if they so choose, would be prepared to document mitigation strategies that are mutually agreed upon and design refinements that are necessary.

3.6 Parks and Recreational Resources

This section addresses park and recreation resources in the study corridor. It summarizes the applicable regulations, provides an inventory of park and recreation resources in the corridor (including categorizing them as Section 4(f) and/or Section 6(f) resources), provides an assessment of effects from the study alternatives and design options on the identified resources and identifies potential measures to minimize the adverse effects to park and recreation resources. Appendix E Preliminary Section 4(f) Assessment contains an inventory of Section 4(f) resources and a preliminary assessment of effects of the alternatives and design options on the identified resources in the corridor. The Section 4(f) analysis is preliminary and focuses on comparing the alternatives and design options. Depending on which alternative is selected, additional Section 4(f) analysis would be prepared in conjunction with the FEIS. Short-term effects of construction on parks and recreation resources are discussed in Section 3.16.

More detailed information about the analysis methods, the identified resources, the evaluation of the study alternatives effects on park and recreation resources and the preliminary Section 4(f) analysis can be found in the *Lake Oswego to Portland Transit Project Park and Recreation Technical Report and Preliminary Section 4(f) Analysis* (DEA/URS and TriMet/Metro, November 2010).

3.6.1 Applicable Regulations and Coordination

This section describes applicable regulations that affect parks and recreation areas, and it describes the project's coordination efforts to date with the owners of parks and recreation areas within the project corridor.

3.6.1.1 Applicable Regulations

Federal regulations known as "Section 4(f)" refer to a portion of the U.S. Department of Transportation (USDOT) Act of 1966 that address the use of "public park and recreation lands, wildlife and waterfowl refuges and historic sites" by transportation projects. In 1983, Section 4(f) of the DOT Act was amended and codified in Title 49 USC Section 303. In 2005, the DOT ACT was again amended by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFTEA-LU). The amended regulations are still referred to as "Section 4(f)" and state, in part, "It is the policy of the United States Government that special effort is made to preserve the natural beauty of the countryside and public park and recreation lands…and historic sites." This regulation requires that the US DOT avoid "use" of Section 4(f) properties unless there is no feasible and prudent alternative to using the land or unless the impact will be *de minimis*. A *de minimis* impact is defined as an impact that would not adversely affect the features, attributes or activities qualifying the property for protection under Section 4(f).

This section also addresses Section 6(f) requirements. State and local governments often obtain grants through the Federal Land and Water Conservation Fund (LWCF) Act of 1965 to acquire or make improvements to parks and recreation areas. Section 6(f) of the LWCF Act prohibits the conversion of property acquired or developed with these funds to a non-recreational purpose without the approval of the U.S. Department of Interior (DOI) National Park Service (NPS).

Section 3.5 Historic, Archeological and Cultural Resources address the project's evaluation of historic resources. Sections 106 of the National Historic Preservation Act of 1966 requirements are defined in 36 CFR Part 800 Protection of Historic Properties. Federal agencies must consult with the applicable State Historic Preservation Officer (SHPO) before undertaking projects that would adversely affect historic or cultural resources. Historic sites can also qualify for protection under Section 4(f) and those potentially qualifying historic resources that could be affected or adversely affected by this project's alternatives are also addressed in Appendix E Preliminary Section 4(f) Assessment.

3.6.1.2 Coordination

Parks and recreation resources in the project area are managed by multiple public entities, including Portland Parks and Recreation, Lake Oswego's Department of Parks and Recreation, Metro and the State of Oregon. In addition, Multnomah County, Clackamas County, the cities of Portland and Lake Oswego maintain general park and recreational goals and policies within their comprehensive plans.

The statewide inventory of Section 6(f) resources is kept by the State of Oregon Parks and Recreation Department (OPRD). Information about the Land and Water Conservation Funds use on the parks in the corridor has been obtained from OPRD.

Section E-2 of Appendix E Preliminary Section 4(f) Evaluation and the *Park and Recreation Technical Report and Preliminary Section 4(f) Analysis* provide additional detail on agency coordination to date for Section 4(f)-related resources.

3.6.2 Affected Environment

The Lake Oswego to Portland Transit Project corridor is rich in public parklands, recreation areas and historic sites. There are no wildlife or waterfowl refuges within the corridor. Parks and recreation resources are identified below.

Table 3.6-1 lists the identified park and recreation resources in the study corridor, listing them from north to south. The table summarizes the location, ownership and types of use at each park. Figure 3.6-1 shows the location of these park and recreation resources in the corridor.

Fifteen of the identified resources are publicly owned. Of these, thirteen qualify as Section 4(f) resources. The other two along with the Peter Kerr Property and the six publicly-owned tax lots were analyzed for their potential status as Section 4(f) resources and were determined not to qualify as Section 4(f) resources. The reasoning for this conclusion follows.

The Peter Kerr property is a natural area located on a steep bluff west of Elk Rock Island. It is owned by the City of Portland and listed in their inventory of natural places. It is not considered a Section 4(f) resource because it is not publically accessible.

Table 3.6-1 Park and Recreation Resources and Natural Areas in the Project Vicinity and their Section 4(f) and 6(f) Status

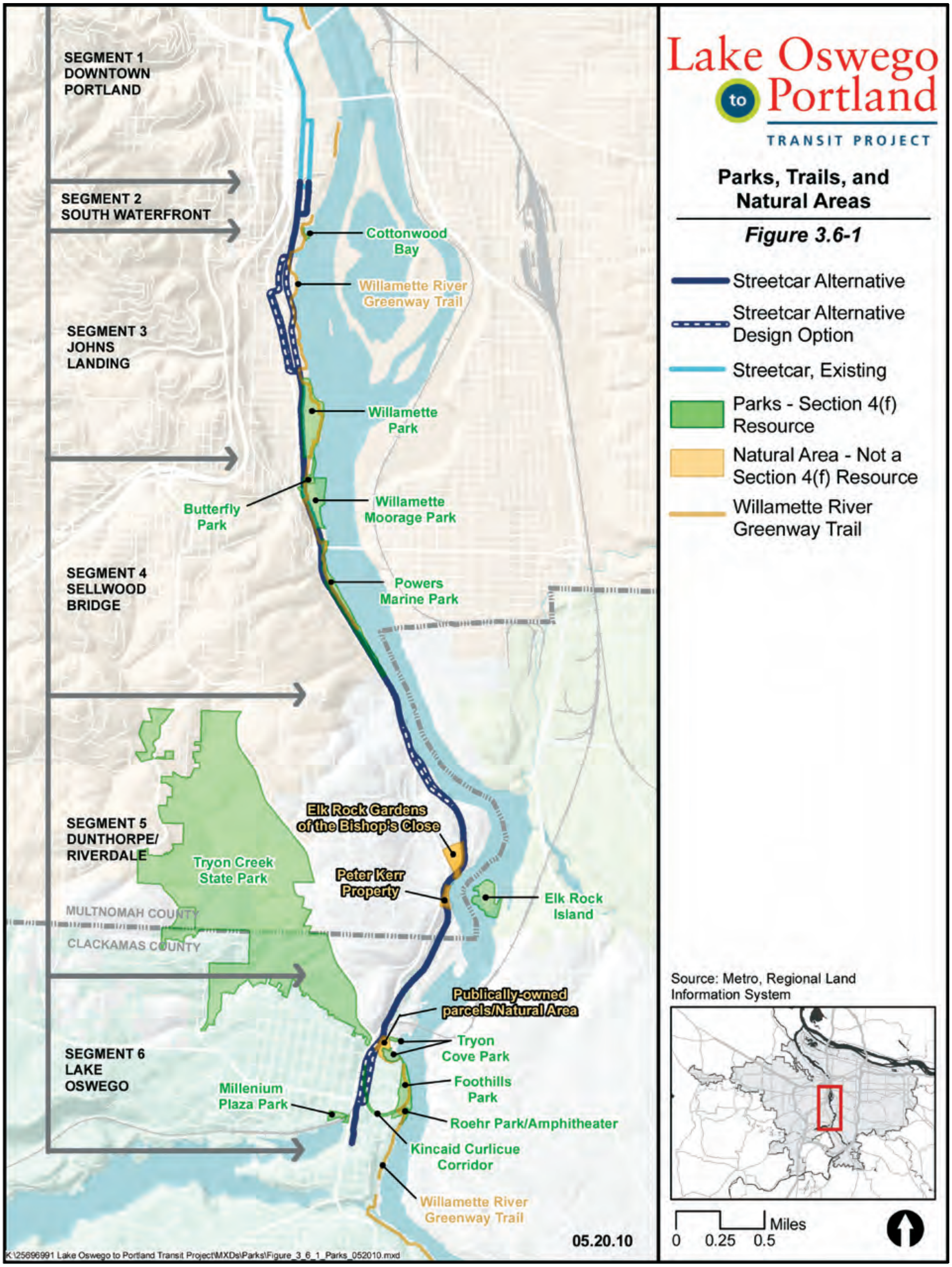
Name of Park or Recreation Area	Location	Adjacent to Project?	Owner(s)/ Custodian(s)	Size / Type of Recreational Uses	4(f) Resource?	6(f) Resource?
Willamette River Greenway Trail	Trail along portions of the west side of the Willamette River	Yes	City of Portland, City of Lake Oswego, private property	Trail along parts of the west bank of Willamette River	Yes	No
Lake Oswego to Portland Trail[1]	Planned alignment connecting Lake Oswego and Portland	Yes	To be determined	Planned trail	No[1]	No
Cottonwood Bay	Near SW Hamilton Court and Willamette River	No	City of Portland	0.67 acres / Natural area	Yes	No
Willamette Park	North of the Sellwood Bridge near SW Nevada Avenue	Yes	City of Portland	26.85 acres / Boat ramp, picnic area, soccer field, tennis courts, paved and unpaved paths	Yes	Yes[2]
Butterfly Park	7720 SW Macadam Ave	No	City of Portland	1.07 acres / Natural area, paths	Yes	No
Willamette Moorage Park	South of Willamette Park	Yes	City of Portland	10.3 acres / Natural area, path	Yes	No
Powers Marine Park	Sellwood Bridge area south	Yes	City of Portland	13 acres / Natural areas, picnic areas, unpaved trails	Yes	No
Elk Rock Gardens of the Bishop's Close	Adjacent to Elk Rock	No	Episcopal Diocese of Oregon	13 acres / Gardens open to public daily	No	No
Peter Kerr Property	Adjacent to Elk Rock	Yes	City of Portland	3.3 acres / City owned parcel, open space, no public access	No	No
Elk Rock Island	East side of Willamette River	No	City of Portland	13.24 acres / Natural area, hiking trails	Yes	No
Tryon Creek State Natural Area	At boundary between Portland and Lake Oswego, west of Highway 43	No	State of Oregon	645 acres / Nature center, hiking and horse trails, bicycle path	Yes	Yes
Tryon Cove Park Annex	Near Stampher Rd. on river	Yes	City of Lake Oswego	0.5 acres / Picnic tables, boat ramp constructed	Yes	No
Tryon Cove Park	At mouth of Tryon Creek	Yes	City of Lake Oswego	Natural area with access to Willamette River	Yes	No
Six tax lots adjacent to or near Tryon Cove Park [3]	Adjacent to or near Tryon Cove Park	Yes	City of Lake Oswego, Metro, City of Portland	4 acres / Open space, riparian habitat	No	No
Foothills Park	South of Tryon Cove Park, on Willamette River	No	City of Lake Oswego	9 acres / Trails, picnic area, grass amphitheater	Yes	No
Roehr Park	South of Foothills Park	No	City of Lake Oswego	7.5 acres / Amphitheater, paths, benches	Yes	No
Kincaid Curlicue Corridor	Trail linking existing trolley station and Foothills Park	Yes	City of Lake Oswego	3.6 acres / Walking and biking path	Yes	No
Millennium Plaza Park	200 First Street, Lake Oswego	No	City of Lake Oswego	Open space, fireplace, fountain	Yes	No

Source: LOPT Parks and Recreation Resources Results Report (Metro, January 2010). See Figure 3.6-1 for an illustration of these resources.

[1] This trail has been previously referred to as "Willamette Shoreline Trail." It is not a resource that would be protected by Section 4(f) because even though it is planned to be a public tr ail, no property is currently publicly owned for this purpose.

[2] Section 6(f) funds were used for development of the boat ramp in Willamette Park.

[3] Tax lot numbers are: 21E02CB02200, 21E02CB02300 (Lake Oswego), 21E02CB02400 (Metro) and 21E02CB02700, 21E02CB00900, and 21E02CB02800 (Portland). These are listed in summary tables as three resources, reflecting ownership.



SEGMENT 1
DOWNTOWN
PORTLAND
SEGMENT 2
SOUTH WATERFRONT
SEGMENT 3
JOHNS
LANDING
SEGMENT 4
SELLWOOD
BRIDGE
SEGMENT 5
DUNTHORPE/
RIVERDALE
SEGMENT 6
LAKE
OSWEGO
Cottonwood Bay
Willamette River Greenway Trail
Willamette Park
Butterfly Park
Willamette Moorage Park
Powers Marine Park
Elk Rock Gardens of the Bishop's Close
Tryon Creek State Park
Peter Kerr Property
Elk Rock Island
MULTNOMAH COUNTY
CLACKAMAS COUNTY
Publically-owned parcels/Natural Area
Tryon Cove Park
Foothills Park
Millenium Plaza Park
Roehr Park/Amphitheater
Kincaid Curlicue Corridor
Willamette River Greenway Trail
05.20.10
K:\25696991 Lake Oswego to Portland Transit Project\MXDs\Parks\Figure_3_6_1_Parks_052010.mxd
Lake Oswego to Portland
TRANSIT PROJECT
Parks, Trails, and Natural Areas
Figure 3.6-1
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar, Existing
Parks - Section 4(f) Resource
Natural Area - Not a Section 4(f) Resource
Willamette River Greenway Trail
Source: Metro, Regional Land Information System
0 0.25 0.5 Miles

The project researched six publicly-owned parcels that are located adjacent to or near Tryon Cove Park to determine if they were qualified as park or recreational facilities under Section 4(f). The six tax lots, located in Lake Oswego, are owned by the City of Portland, the City of Lake Oswego or Metro. These parcels are not Section 4(f) resources for the following reasons.

- The adopted Foothills District Refinement Plan does not list these parcels as part of Tryon Cove Park. A parks map published in April 2010 as the City of Lake Oswego shows five of the seven parcels as part of Tryon Cove Park; however, this map is not part of an adopted plan. To date, no master plan has been adopted for these parcels.

- The City of Portland owns three tax lots adjacent to Tryon Creek. These parcels are managed by the City of Portland's Bureau of Environmental Services and are used for riparian restoration, provision of riparian habitat and restoration for natural resources. The City of Portland has a wastewater treatment facility on the south side of Tryon Creek, adjacent to the subject properties. An above ground sewage pipe and sewage easement runs across these properties. Based on the current intergovernmental agreement (2003) regarding these parcels, the City of Portland is responsible for the management, operations and maintenance. Two of these properties are shown on the April 2010 City of Lake Oswego Parks Map as part of Tryon Cove Park.

- Metro purchased one tax lot in this area using public bonds for open spaces. There are currently no trails, signage, public facilities or adopted plan for this parcel. Based on a 2003 intergovernmental agreement regarding this parcel, it is intended as open space, and the City of Lake Oswego may build a trail through the property, but formal use shall not begin until a resource management plan has been adopted. No resource management plan for the parcel has been adopted to date.

- The City of Lake Oswego owns two parcels adjacent to Southwest Stampher Road and north of the other public properties. There are no trails, public facilities or signage for these properties. The City of Lake Oswego has not made formal plans for these parcels. Based on the current intergovernmental agreement (2003) regarding these parcels, these parcels were identified as surplus properties, subject to future development or sale by the City of Lake Oswego.

In summary, there are 14 publicly owned parks and recreation resources in the corridor that could qualify for protection under Section 4(f). Two of these resources, Willamette Park and Tryon Creek State Natural Area, have had improvements made with Section 6(f) or Land and Water Conservation funds. Appendix E Preliminary Section 4(f) Evaluation includes additional information about Section 4(f) properties.

3.6.3 Environmental Consequences

This section describes the direct, indirect and cumulative effects to park and recreation resources from the study alternatives and design options. Direct impacts would result from changes in right-of-way and/or access. Indirect effects could include impacts to setting, including changes in noise and visual conditions. Cumulative effects consider impacts in the context of related past, present and future projects. Short-term effects are those that would result from project related construction, and are addressed separately in Section 3.16 Construction Effects.

3.6.3.1 Long Term Impacts

The potential effects of the study alternatives on park and recreation resources and historic sites have been evaluated. The evaluation has considered the qualities of the resources and assessed the extent of impairment that would likely occur to the protected resources. The number of resources that would be affected by each of the study alternatives is shown in Table 3.6-2 and described in more detail in the following sections.

Table 3.6-2 Number of Park and Recreation Resources and Natural Areas that Would Be Used, by Alternative

Measure	No-Build Alternative	Enhanced Bus Alternative	Streetcar Alternative
Section 4(f) Eligible Parks and Recreation Areas	0	0	1[1]
Natural Areas (not Section 4(f) Resources)	0	0	3[2]
Section 6(f) Resources[3]	0	0	0

Source: Lake Oswego to Portland Transit Project Streetcar Plan Set, November 9, 2009 and *Lake Oswego to Portland Transit Project: Park and Recreation Technical Report* and Preliminary Section 4(f) Analysis, DEA/URS and TriMet/Metro, August 2010. See Table 3.6-3 for additional detail.

1 Preliminarily determined to be a *de minimis* impact to the Kincaid Curlicue Corridor – see Appendix E for additional detail.

2 Includes six tax lots in Lake Oswego owned by Metro, the City of Portland and the City of Lake Oswego. These are counted as three resources to reflect ownership by three separate entities).

3 See Table 3.6-1 for a list of qualifying Section 6(f) resources.

No-Build Alternative

The No-Build Alternative would not have direct impacts on park or recreational resources in the project area. This alternative would not include new significant transit improvements in the corridor; transportation improvements in the corridor would include those planned for in the 2035 financially constrained list of highway and transit projects in the Regional Transportation Plan (RTP). No impacts to the parks and recreation areas inventoried are anticipated with the No-Build Alternative.

Enhanced Bus Alternative

The Enhanced Bus Alternative would generally use established roadway and not require additional right of way, except for a new park-and-ride facility in downtown Lake Oswego and transportation improvements as defined in the 2035 financially constrained list of highway and transit project in the RTP. There would be no direct effects to park or recreational resources associated with the enhanced bus alternative.

Streetcar Alternative

The effects of the Streetcar Alternative on parks are described below. There would be one Section 4(f) park or recreation resource that would be used by the Streetcar Alternative, the Kincaid Curlicue Corridor. The use would vary based on design options. Table 3.6-3 summarizes the Streetcar Alternative use of Section 4(f) resources that would occur under the Streetcar Alternative, by segment and design option. Table 3.6-4 describes how other non-Section 4(f) natural area resources would be affected by the Streetcar Alternative. Following is a discussion of the Streetcar Alternative effects on Section 4(f) resources and non-Section natural area resources, by segments and design options.

Table 3.6-3 Public Parklands and Recreation Resources (Section 4(f) Resources) Used and/or Directly Impacted by the Streetcar Alternative, by Segment and Design Option

Segment/Design Option	Acres of Section 4(f) Resource Used	Summary Description of Direct Impacts by Resource
1 – Downtown Portland[1]	N/A	No direct impacts to Section 4(f) resources in this segment.
2 – South Waterfront	0.00	No direct impacts. Formally designated areas of the ***Willamette River Greenway Trail*** would be unaffected. There would be changes to temporary connections, including rerouting of the connector trail between SW Bancroft and Hamilton Streets (see temporary impacts).
3 – Johns Landing		
Willamette Shore Line	0.00	No direct impacts. Streetcar stations would be placed near the north and south ends of ***Willamette Park***.
Macadam In-Street	0.00	No direct impacts. A streetcar station would be placed near the south end of ***Willamette Park***.
Macadam Additional Lane	0.00	No direct impacts. A streetcar station would be placed near the south end of ***Willamette Park***.
4 – Sellwood Bridge[2]	0.00	No direct impacts. The project would add a pedestrian overpass over the Willamette Shore Line right-of-way to provide continued access to ***Powers Marine Park***.
5 – Dunthorpe/Riverdale		
Willamette Shore Line	N/A	No direct impacts to Section 4(f) resources in this segment.
Riverwood	N/A	No direct impacts to Section 4(f) resources in this segment.
6 – Lake Oswego		
UPRR	0.7[3]	The project would require the use of 0.7 acre of parkland from the ***Kincaid Curlicue Corridor***. The existing path in the corridor would be relocated to retain the trail function and improved with new connections.
Foothills	1.0[3]	This design option would result in use of 1.0 acre of parkland from the ***Kincaid Curlicue Corridor***. The existing path in the corridor would be relocated to retain the trail function and improved with new connections.

Source: *Lake Oswego to Portland Transit Project Streetcar Plan Set*, November 9, 2009 and *Lake Oswego to Portland Transit Project: Park and Recreation Technical Report and Preliminary Section 4(f) Analysis*, DEA/URS and TriMet/Metro, August 2010. See Figure 3.6-1 for an illustration of the location of these resources.

[1] The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

[2] The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

[3] Preliminarily determined to be a *de minimis* impact – see Appendix E for additional detail.

Table 3.6-4 Other Natural Areas (Non-Section 4(f) Resources) Directly Impacted the Streetcar Alternative, by Segment and Design Option

Segment/Design Option	Acres of Natural Areas Impacted	Summary Description of Impacts by Natural Area Resource
1 – Downtown Portland[1]	0	None
2 – South Waterfront	0	None
3 – Johns Landing		
Willamette Shore Line	0	None
Macadam In-Street	0	None
Macadam Additional Lane	0	None
4 – Sellwood Bridge[2]	0	None
5 – Dunthorpe/Riverdale		
Willamette Shore Line	0	None
Riverwood	0	None
6 – Lake Oswego		
UPRR	0.33	• The UPRR design option would require the use of approximately 0.33 acre of undeveloped land adjacent to or near Tryon Cove Park (publicly-owned land but not protected by Section 4(f)); • A bicycle and pedestrian crossing of Tryon Creek would be added as part of the streetcar project.
Foothills	0.5	• The Foothills Realignment design option would require the use of approximately 0.5 acre of undeveloped land adjacent to or near Tryon Cove Park (publicly-owned land but not protected by Section 4(f)); • A bicycle and pedestrian crossing of Tryon Creek would be added as part of the streetcar project.

Source: *Lake Oswego to Portland Transit Project Streetcar Plan Set*, November 9, 2009 and *Lake Oswego to Portland Transit Project: Park and Recreation Technical Report and Preliminary Section 4(f) Analysis*, DEA/URS and TriMet/Metro, August 2010. See Figure E-2 for an illustration of the location of these resources.

[1] The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

[2] The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

Segment 1 – Downtown Portland. No parks or recreational resources would be used directly impacted by the Streetcar Alternative or design options within the Downtown Portland Segment.

Segment 2 – South Waterfront. The Streetcar Alternative would extend the existing Streetcar within the couplet two blocks further south past the current couplet end at Southwest Bancroft Street. The temporary existing bicycle path used to access the Willamette River Greenway Trail would be changed. It could be incorporated into the street couplet extension, or it could be extended along the Willamette River. The existing temporary trail connection south of Bancroft Street is within the Willamette Shore Line right of way and would be replaced. The ultimate configuration of the Willamette River Greenway Trail alignment through this area is being planned by the City of Portland in conjunction with its South Portal planning efforts.

Segment 3 – Johns Landing. Within the Johns Landing Segment, both the Willamette Shore Line and the Macadam Avenue design options would change the existing temporary connection to the Willamette River Greenway Trail near the Boundary Street station. The trail connects Macadam Avenue with the Willamette River Greenway and crosses through private property. The streetcar alignment would cross the trail, either in the railroad right of way (Willamette Shore Line design option) or on the existing Landing Square Drive (Macadam Avenue design options). The Willamette Shore Line design option crossing would be altered from its current configuration to provide safety features for trail users (Z-crossings are planned). The Macadam Avenue design option would also cross this trail at an existing private road crossing (Landing Drive).

Willamette Park is generally separated from the existing railroad right of way and Streetcar Alternative alignment by a row of mature trees and a roadway within the park that runs parallel to the rail alignment behind the row of trees. The streetcar project would be constructed fully within the public or Willamette Shore Line right of way. Some of the trees in Willamette Park have been designated by the City of Portland as “trees of merit” which recognizes the tree(s) as noteworthy trees in the city that have been nominated for Heritage Tree status but, for a variety of reasons, were not given the status. The designation of “trees of merit” does not afford special protection. Figure 3.4-6 shows a visual simulation of the streetcar alignment adjacent to Willamette Park. One of the mature trees may be within the existing right of way of the streetcar and its proximity to the proposed streetcar alignment may require it to be removed during construction of the project. The project would develop and consider potential mitigation measures that could avoid the removal of the tree, while maintaining safe streetcar operations, if the Streetcar Alternative is selected as the Locally Preferred Alternative. Those mitigation measures would be developed and evaluated in consultation with the City of Portland. The current plans suggest that no additional mature trees within or directly adjacent to Willamette Park would need to be removed to construct or operate the Streetcar Alternative.

As potential mitigation for park impacts for any of the design options, sidewalks could be added at the Nevada Street station to bring the sidewalk into compliance with the Americans for Disability Act. The City of Portland would likely retain responsibility for maintenance of the sidewalk entering the park and there would be no change to the key characteristics and function of the sidewalk.

The project would coordinate with the City of Portland regarding minimizing vegetation removal and mitigation for impacts to Willamette Park, if the Streetcar Alternative is selected as the Locally Preferred Alternative.

Segment 4 – Sellwood Bridge. right of wayright of wayThe Streetcar Alternative would travel adjacent to Powers Marine Park within the Willamette Shore Line right of way. The construction of a new pedestrian overpass to continue to provide access to the park is planned to be included with all of the Streetcar Alternative design options and would result in a long-term change in the park, but no property would be transferred to the project as part of this action. The location of the proposed pedestrian overpass is in the area of a likely historic easement crossing the tracks.

Segment 5 – Dunthorpe/Riverdale. There would be no park or recreation impacts from the Streetcar Alternative or design options in the Dunthorpe/Riverdale Segment

Segment 6 – Lake Oswego. Impacts to the Kincaid Curlicue Corridor would vary by design option. The Union Pacific Railroad Right of Way design option would be aligned along the western edge of the property, and would require use of approximately 0.7 acre of the parcel. The Foothills design option would cross the parcel, requiring approximately 1.0 acre. Both of the design options would place a park-and-ride facility over the existing trail. The primary feature of the park, a multi-use trail, would be relocated. Additionally, the project would include the placement of a stairway between State Street/Highway 43 and the Foothills area, enhancing connectivity in this area (see Figure E-7 in Appendix E). Initial coordination with the City of Lake Oswego suggests that the trail could be satisfactorily modified in response to the design of the project through this area. See

Appendix E, 4(f) for additional information about coordination and mitigation for the Kincaid Curlicue Corridor.

In addition, the project examined six publicly-owned parcels that are located adjacent to or near Tryon Cove Park. The project looked at those parcels to determine if they were qualified as park or recreational facilities under Section 4(f), as noted above in Section 3.6.2. Both the Union Pacific Railroad Right of Way and Foothills design options would extend the proposed streetcar alignment through five of the six publicly-owned tax lots. These publicly-owned tax lots are 21E02CB02200 and 21E02CB02300, owned by the City of Lake Oswego; 21E02CB02400, owned by Metro; and 21E02CB00900, 21E02CB02800, and 21E02CB02700, owned by the City of Portland. The Union Pacific Railroad design option would use approximately 0.33 acres of the publicly-owned land. The Foothills design option would use 0.5 acres. Either alignment will create a new bridge over Tryon Creek, which is a priority creek for habitat restoration and enhancement for multiple jurisdictions, including Metro, the City Lake Oswego and the City of Portland. The bridge will include a 14-foot bicycle and pedestrian path to provide connectivity across Tryon Creek. Project-related planning in coordination with the property owners in conjunction with Foothills District planning could ensure that future design work for the project is coordinated with the plans for future development of these properties, if the Streetcar Alternative is selected as the Locally Preferred Alternative.

3.6.3.2 Indirect Impacts

Indirect effects would typically include effects from project improvements that could cause changes to the parks, but would be less direct than those described above as direct impacts. Indirect impacts could include project related changes, such as from noise or visual conditions.

No-Build Alternative

There would be no indirect impacts to park or recreational resources from project improvements with the No-Build Alternative. The No-Build Alternative would not include new project related transit improvements in the corridor. There would be however be transportation improvements related to other projects included in the 2035 RTP financially constrained list that could result in indirect impacts to parklands in the corridor, such as changes to the visual environment or noise environment in corridor parks.

Enhanced Bus Alternatives

The Enhanced Bus Alternative would result in park access improvements similar to those defined below for the Streetcar Alternative. There would be slightly longer walking distances between the new transit stops and several corridor parks, since the bus stops would be located along Southwest Macadam Avenue. The Enhanced Bus Alternative would not have visual, noise, or other indirect effects to park or recreational resources in the project area. Indirect impacts as described for the No-Build Alternative from other transportation projects in the area would also apply for the Enhanced Bus Alternative.

Streetcar Alternatives

Minor indirect effects could occur at some park and recreational resources with the Streetcar Alternative and would vary depending on the design option. In general, indirect impacts could include changes in visual conditions, changes in transit and traffic patterns, changes in access and changes in noise levels. The Streetcar Alternative could result in visual changes adjacent to Willamette Park, Butterfly Park, Willamette Moorage Park, Powers Marine Park, Tryon Cove Park and the Kincaid Curlicue Connector. None of the visual changes would be considered significant adverse visual impacts to the parks. A moderate noise impact is anticipated at Powers Marine Park. No severe noise impacts are anticipated at any of the park or recreational resources in the corridor. Based on current designs, transportation impacts and access changes would be minimal.

In general, the Streetcar Alternatives would improve access from transit to most of the publicly-accessible parks and recreational resources in the corridor. The exceptions are Elk Rock Island, which is accessed from the east side of the Willamette River, and Tryon Creek State Natural Area, which has entrances over 1.5 miles from the closest streetcar stop and can be more easily accessed by existing bus routes. The longest distance between a proposed station and a park would be 800 feet, which is the distance between Butterfly Park and the Sellwood Bridge station. It is possible that service frequency would decline for users of Powers Marine Park if bus service along Macadam Avenue is cut back as a result of the project.

In Willamette Park and Powers Marine Park, some users currently access the parks across the streetcar tracks at several locations, and some of these may be modified or relocated as a result of the project. In Willamette Park, there are four formal access points supported with easements (at Beaver, Nevada, Nebraska and Miles streets). These access points would be maintained with the streetcar project. There are at least three additional access points that are used by the public, which are generally located on private property. These crossing points will likely be consolidated or relocated by the project. The project team will work with the City of Portland regarding access to Willamette Park. Other than the crossings at roadways, which are marked with stop signs, the existing track crossings are not controlled with supplemental safety measures.

In Powers Marine Park, there are two park access points identified with easements across the existing tracks (at the north end of the park and near the proposed pedestrian bridge). There are two formal entrance points with associated parking areas and approximately five other parking areas located along the park on the shoulders of Macadam Avenue/Highway 43. These additional access points that are being used to enter the park may be modified due to safety restrictions with the operation of the streetcar. With the introduction of the streetcar project, people currently entering the park on foot from the south would need to walk along the roadway for approximately one-half mile to access the planned pedestrian bridge over the streetcar tracks. The project team would work with the City of Portland and the Oregon Department of Transportation (ODOT) regarding design and mitigation for access to Powers Marine Park during the project's preparation of its FEIS, if the Streetcar Alternative is selected as the Locally Preferred Alternative. The project would increase train traffic through Powers Marine Park, which could impede wildlife access patterns between the Willamette River and the hills to the west. However, Macadam Avenue provides a significant barrier to wildlife crossings between the river and the western hills.

Visual changes at Willamette Park, at Powers Marine Park and, to a lesser extent, at Tryon Cove Park and Kincaid Curlicue Corridor would occur due to construction of the streetcar alignment adjacent to these resources. In Willamette Park, visual changes related to construction of the streetcar at the west side of the park adjacent to the western boundary would be partially obscured by existing vegetation, and would not detract from existing views toward the Willamette River. (See Figure 3.4-6 for a visual simulation in Willamette Park.) Similarly, the streetcar would be located on the western edge of Powers Marine Park, allowing park users uninterrupted views of the Willamette River. Table 3.6-5 summarizes the anticipated indirect visual, noise and transportation impacts.

Table 3.6-5 Summary of Indirect Impacts to Park and Recreation Resources from the Streetcar Alternative

Segment/Design Option[1]	Access Modifications	Visual, Noise and Other Affects
1 – Downtown Portland	No impacts to resources in this segment	
2 – South Waterfront[2]		
No design options	• New streetcar route improves access to the ***Willamette River Greenway Trail*** at multiple points along its alignment • Access modifications to connector trail between Macadam and Willamette River Greenway Trail to enhance safety (no right-of-way changes) within Willamette Shore Line right of way (Willamette Shore Line Design Option) or SW Landing Drive (Macadam design options) • improved access to ***Cottonwood Bay***; Hamilton Station would be within 200 feet	• Delays associated with 7.5-minute peak-hour headways for connection trail near the Boundary Station • No impacts anticipated for Cottonwood Bay
3 – Johns Landing		
Willamette Shore Line	• Improved access for transit to ***Willamette Park*** (Nebraska and Nevada stations would be adjacent to park) • Change and potential consolidation of informal access across and along tracks	• Visual changes partially obscured by vegetation
Macadam In-Street and Macadam Additional Lane	• Improved access for transit to ***Willamette Park*** (Carolina and Nevada stations would be adjacent to park) • Change and potential consolidation of informal access across and along tracks	• Visual changes partially obscured by vegetation
4 – Sellwood Bridge[3]		
No design options	• Improved access with Sellwood Bridge station for ***Butterfly Park*** and ***Willamette Moorage Park*** • Sellwood Bridge station would be adjacent *to* ***Powers Marine Park*** • Change and consolidation of informal access across and along tracks at **Powers Marine Park**	• Visual changes for park users due to adjacent streetcar route • One moderate noise impact at **Powers Marine Park**
5 – Dunthorpe/Riverdale		
Willamette Shore Line and Riverwood	• Riverwood station would be approximately 500 feet from ***Elk Rock Gardens of the Bishops Close***; No changes to ***Peter Kerr Property*** or ***Elk Rock Island***	• None
6 – Lake Oswego		
UPRR and Foothills	• Improved access via B Avenue station for ***Tryon Cove Park, Tryon Cove Annex*** and ***six tax lots adjacent to or near Tryon Cove*** park, which would include a new multi-use bridge over Tryon Creek • Improved access to ***Foothills Park***, ***Roehr Park, Kincaid Curlicue Corridor***, and ***Millennium Plaza Park,*** which would include a new pedestrian crossing from State Street	• Visual changes for park users due to adjacent streetcar route for Tryon Cove Park, Tryon Cove Park Annex, six tax lots in the vicinity of Tryon Cove Park and the Kincaid Curlicue Corridor • No impacts on Foothills, Roehr or Millennium Plaza parks

Source: *Lake Oswego to Portland Transit Project Streetcar Plan Set*, November 9, 2009 and *Lake Oswego to Portland Transit Project: Park and Recreation Technical Report and Preliminary Section 4(f) Analysis*, DEA/URS and TriMet/Metro, August 2010. See Figure 3.6-1 for an illustration of the location of these resources.

[1] Except as noted in the Johns Landing Segment, the indirect impacts associated with the Streetcar Alternative would not vary by design option.

[2] The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and Moody/Bond Couplet are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options. [3] The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and New Interchange are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

3.6.3.4 Cumulative Effects

Cumulative effects include project-related impacts in the context of related past, present and future projects. Cumulative effects to park and recreational resources from the Enhanced Bus or Streetcar alternatives would generally be positive based on improved transit access. Considered in context of the benefits of the project to park users and considering past, present and reasonably foreseeable future projects in the project area, the cumulative effects on park and recreational resources in the project area would be positive.

3.6.4 Section 4(f) and Section 6(f) Resources

Section 4(f) resources include publicly owned parks, recreation areas, wildlife and waterfowl refuges, and historic sites. Section 6(f) resources are those public parks that received grants from the federal Land and Water Conservation Fund. Table 3.6-1 identifies Section 4(f) and Section 6(f) resources. The analysis of these resources helps determine if there would be any "use" or taking of Section 4(f) lands or if there would be impacts that would substantially impair the qualities, characteristic and attributes that make them Section 4(f) resources. The preliminary assessment is that the Enhanced Bus Alternative would have no impacts to parks in the project area, and impacts to parks in the project area by the Streetcar Alternative would either be temporary, minimal or positive. Further detail can be found in Appendix E, the preliminary Section 4(f) evaluation and in the documentation of the consultation under the Section 106 process.

A grant in the amount of $48,000 was made in 1980 to improve the boat ramps in Willamette Park by the Land and Water Conservation Funds, and grants were expended to acquire large portions of Tryon Creek State Natural Area and to develop the visitor center and trails there. No right of way would be required from either Willamette Park or Tryon Creek State Natural Area for any of the project's alternatives or design options. Thus, no further analysis regarding Section 6(f) requirements is required.

3.6.5 Potential Mitigation Measures

The design of Streetcar Alternative would be coordinated with park owners to minimize the effects of the project on park and recreational resources. The project will continue to coordinate with the City of Portland and the City of Lake Oswego to define appropriate measures for reducing impacts to identified resources. Many of the anticipated impacts to park and recreation resources could be reduced or eliminated through further project design efforts. The initial design for the project incorporates measures designed to minimize impacts and to provide opportunities for benefits (e.g., minimizing cutting of trees, planting vegetation in areas of impact and improving access opportunities for the public). Where the use of park property would be required, the project would work with the park owner to determine appropriate compensation or other agreements to allow use of the land for the project's improvements. After selection of the Locally Preferred Alternative and during future design efforts, the design team would explore other mitigation measures for the Locally Preferred Alternative. Potential mitigation measures could include new or replaced landscaping, park amenities or modified project design.

Mitigation is anticipated related to Section 4(f) requirements and would be developed in consultation with the park owners prior to the release of the FEIS if the Streetcar Alternative is selected as the Locally Preferred Alternative. No mitigation would be needed if the Enhanced Bus Alternative is selected as the Locally Preferred Alternative. See Appendix E Preliminary Section 4(f) Evaluation for more information.

3.7 Geology, Soils and Seismic Hazards

This section addresses geology, soils, hydrogeology and geologic hazards for Lake Oswego to Portland Transit Project. Detailed analyses of the geology, hydrogeology and geologic hazards within the project study area are presented in the *Lake Oswego to Portland Transit Project Geology, Soils and Seismic Hazards Technical Report* (URS and TriMet/Metro, November 2010). This section presents the following information:

- Methodology used for data collection and analyses and applicable regulations;
- Existing geology, hydrogeology and geo-hazards present within the affected environment;
- Summary of direct and indirect long-term effect and cumulative effects expected for each project alternative and option; and
- Potential mitigation measures.

3.7.1 Methodology and Applicable Regulations

The following documents were reviewed by project staff: local and regional soil surveys; water well and geotechnical boring logs; geologic maps; existing Oregon Department of Transportation (ODOT) subsurface information; and light distance and ranging based topography. In addition, a site reconnaissance was performed in the vicinity of the proposed transit alternatives to observe geologic and geotechnical features. The literature review included the final inspection report of the Elk Rock Tunnel, which is located approximately 1.5 miles north of the Lake Oswego terminus on the existing Willamette Shore Line right of way.

Laws or regulations pertaining specifically to geology that are applicable to the project area are addressed through industry practices established by ODOT's *Environmental Procedures Manual* (2002). [49]

3.7.2 Affected Environment

This section provides a description of the primary geologic and groundwater conditions and geologic hazards within the project's study area.

3.7.2.1 Geologic and Groundwater Conditions

The project is located in the northern Willamette Valley, positioned along the western side of the Portland Hills. Throughout the study area the near surface flood deposits, alluvium and artificial fill are generally underlain by completely weathered to fresh, basaltic volcanic rocks. The basaltic rocks are generally deeply weathered to depths of 30 feet or more, except where streams, rivers, glacial outburst flooding and human activity have removed the weathered rock. The 90-year old Elk Rock Tunnel is located within less-weathered basalt. The rock within the tunnel is unsupported and is coated with a very thin layer of unreinforced gunite.

The most prominent structural feature associate with the western edge of the Portland Basin is the Portland Hills Fault, which includes a series of northwest-trending subsurface faults that extend for a distance of about 25 miles along the eastern side of the Portland Hills. The main trace of the fault is inferred to cross the Willamette River from northwest to southeast between the west end of the Ross Island Bridge and the Oaks Bottom area. The mapped trace of the Oatfield Fault crosses the Lake

[49] Oregon Department of Transportation, 2002; *Environmental Procedures Manual, Volumes 1 and 2.*

Oswego to Portland transit corridor near Southwest Briarwood Road. The geology of the study area, as excerpted from Beeson et al. (1989),[50] is shown on Figure 3.7-1.

The United States Department of Agriculture Natural Resources Conservation Service (NRCS)[51] has mapped and described 10 soil map units within the project study area. A large percentage of the corridor is mapped by the NRCS as *Urban Land*, indicating considerable human modification of the near-surface soils. The soils identified on the NRCS maps consist predominantly of loams with varying sand, silt, clay and gravel contents. Predominant soils in the project area are within hydrologic class C or D and, therefore, have low rates of infiltration. All of the project's proposed capital improvements would generally be located within existing rail or roadway rights of way or developed parcels and within urbanized areas.

Groundwater levels within the study area are influenced by the Willamette River and groundwater flow from upland sources to the west of the proposed improvements. Groundwater data from existing wells in the project vicinity indicate depths to groundwater vary seasonally and spatially from within a few inches of the surface (near the Willamette River, especially north of the Sellwood Bridge) to tens of feet below the surface.

3.7.2.2 Geologic Hazards

Active or potentially-active crustal faults occur in the project vicinity. The mapped trace of the Portland Hills fault crosses the existing Portland Streetcar alignment in the vicinity of the Ross Island Bridge. The Oregon Department of Geology and Mineral Industries *Relative Earthquake Hazard Maps* (Mabey, et al, 1995[52], 1997[53]) for the Portland metropolitan area show the relative seismic hazards throughout the area based on a combination of liquefaction potential, earthquake-induced slope instability and amplification of ground motion during an earthquake. The rating system is divided into four categories or zones ranging from the greatest relative hazard (Zone A) to the least relative hazard (Zone D). The project study area is primarily located within Zone A to the north of the Sellwood Bridge and Zone B to the south of the bridge. The relative earthquake hazards of the study area as excerpted from Mabey, et al, (1995) are shown on Figure 3.7-2.

Volcanic ash fall from Mount Hood, Mount Saint Helens, or other volcanoes in the Cascade Range could occur within the project area.

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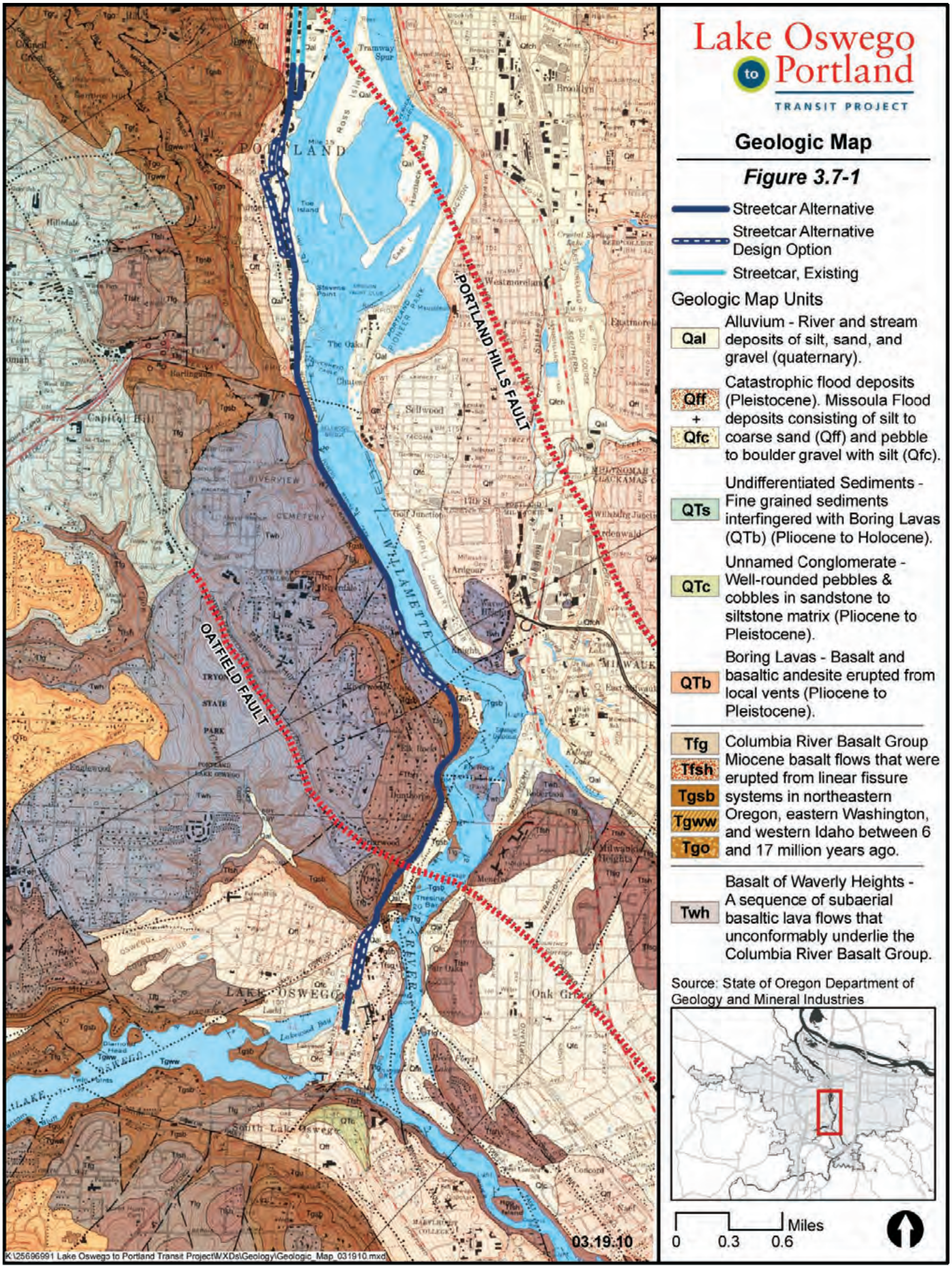
[50] Beeson, M. H., Tolan, T. L., Madin, I. P. 1989; *Geologic Map of the Lake Oswego Quadrangle, Clackamas, Multnomah and Washington Counties, Oregon.* Oregon Department of Geology and Mineral Industries, Geological Map Series 59.
[51] Natural Resources Conservation Service (NRCS), 2009. *Online Web Soil Survey, Custom Soil Resources Report. http://websoilsurvey.nrcs.usda.gov*. Accessed January 7, 2010.
[52] Mabey, M. A., Madin, I. P., Meier, D. B., 1995;*Relative Earthquake Hazard Map of the Lake Oswego Quadrangle, Clackamas, Multnomah, and Washington Counties, Oregon.* Oregon Department of Geology and Mineral Industries, Geological Map Series 91.
[53] Mabey, M. A., Black, G. L., Madin, I. P., Meier, D. B., Youd, T. L., Jones, C. F., Rice, J. B., 1997; *Relative Earthquake Hazard Map of the Portland Metro Region, Clackamas, Multnomah, and Washington Counties, Oregon.*


Lake Oswego to Portland
TRANSIT PROJECT
Geologic Map
Figure 3.7-1
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar, Existing
Geologic Map Units
Qal Alluvium - River and stream deposits of silt, sand, and gravel (quaternary).
Qff + Qfc Catastrophic flood deposits (Pleistocene). Missoula Flood deposits consisting of silt to coarse sand (Qff) and pebble to boulder gravel with silt (Qfc).
QTs Undifferentiated Sediments - Fine grained sediments interfingered with Boring Lavas (QTb) (Pliocene to Holocene).
QTc Unnamed Conglomerate - Well-rounded pebbles & cobbles in sandstone to siltstone matrix (Pliocene to Pleistocene).
QTb Boring Lavas - Basalt and basaltic andesite erupted from local vents (Pliocene to Pleistocene).
Tfg Tfsh Tgsb Tgww Tgo Columbia River Basalt Group Miocene basalt flows that were erupted from linear fissure systems in northeastern Oregon, eastern Washington, and western Idaho between 6 and 17 million years ago.
Twh Basalt of Waverly Heights - A sequence of subaerial basaltic lava flows that unconformably underlie the Columbia River Basalt Group.
Source: State of Oregon Department of Geology and Mineral Industries
0 0.3 0.6 Miles
PORTLAND HILLS FAULT
OATFIELD FAULT
WILLAMETTE
LAKE OSWEGO
03.19.10
K:\25696991 Lake Oswego to Portland Transit Project\WXDs\Geology\Geologic_Map_031910.mxd

Landslide hazards were assessed as part of the public document review, aerial photograph investigation, field reconnaissance and Light Distance and Ranging image analysis. All of these studies indicate that the primary areas of concern with regards to slope instability are located adjacent to and south of the Sellwood Bridge. The elevated slope stability hazard near the bridge is due to an existing ancient landslide, referred to as the Sellwood Landslide (CH2MHILL, 2009).[54] Movement of the Sellwood Landslide has damaged the western abutment of the existing bridge and construction of the replacement Sellwood Bridge will require stabilization of the Sellwood Landslide.

South of the Sellwood Landslide, the project area traverses relatively steep terrain, which is also susceptible to slope instability. LiDAR imagery reveals a large, arcuate-shaped topographic low located west (upslope) of the alignment between Riverwood Road and Radcliffe Road. This feature may represent a large, dormant, ancient landslide or may be an erosional feature related to differential erosion of weaker rock. This feature has been identified as a landslide on DOGAMI's Statewide Landslide Information Database for Oregon (SLIDO).

Existing near-vertical rock slopes in the vicinity of the Elk Rock Tunnel portals appear to be stable, however there may be an elevated rock fall hazard where the cuts are not supported by retaining structures.

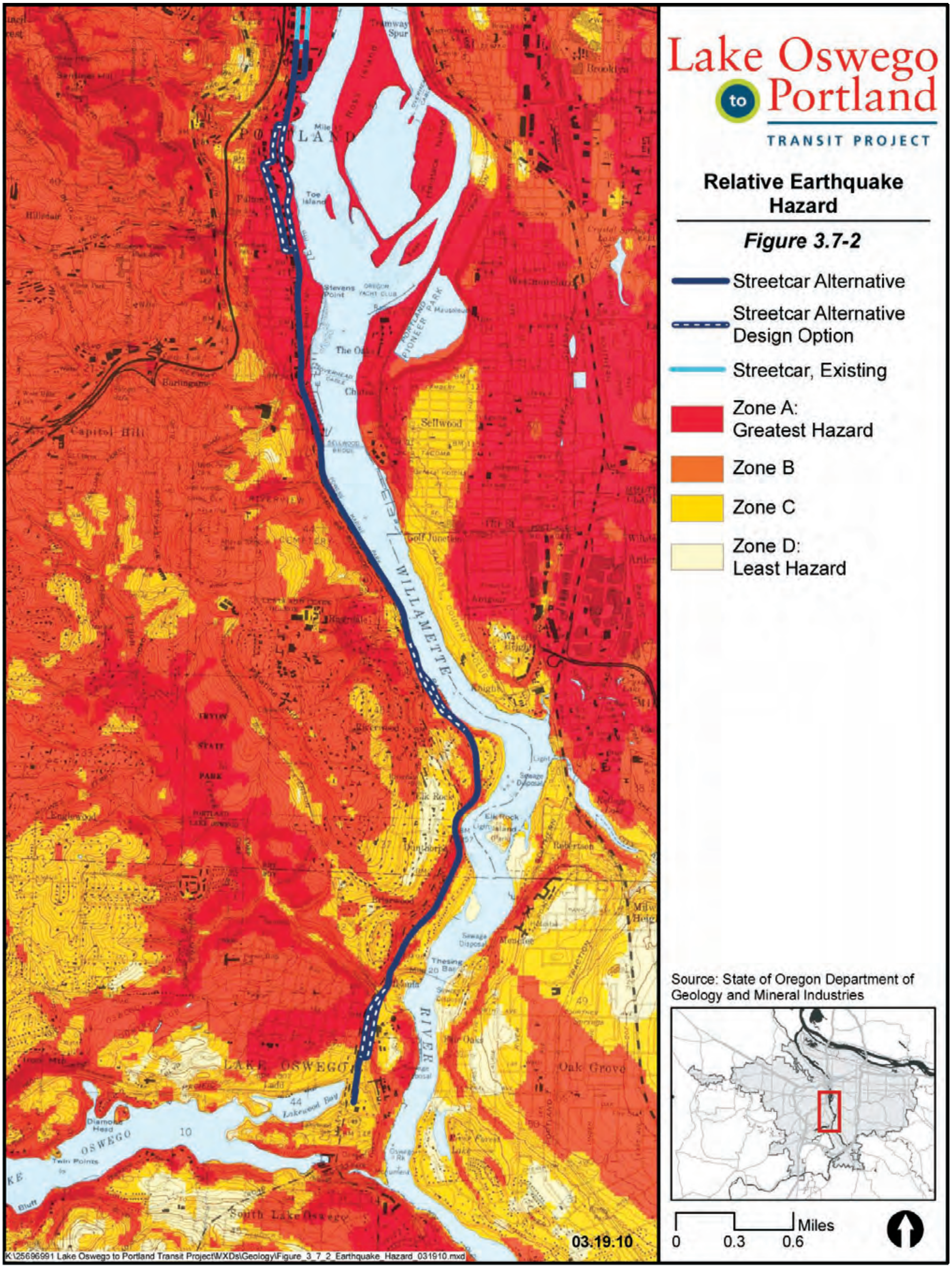
Steep slopes are defined as having an inclination greater than 20 degrees (37 percent). The proposed alignment of the Streetcar Alternative would traverse several steep slopes, some in excess of 30 degrees (60 percent). Hazards associated with steep slopes include higher susceptibility to landslides and rock fall and erosion.

3.7.3 Environmental Consequences

This section summarizes the long-term direct, indirect and cumulative affects on geology and soils that would occur due to the No-Build, Enhanced Bus and Streetcar alternatives, focusing on estimates of required cut and fill material and length of new retaining wall and on the potential of the alternatives to increase the risk of geologic and soils hazards. In geologic and soil science terms, the design options are not substantially different and are not individually assessed. Rather, the geologic and soil characteristics of the alternatives – No-Build, Enhanced Bus and Streetcar are analyzed in this document.

There would be no additional cumulative impacts due to the project alternatives beyond the described direct and indirect impacts, because the project's analysis is based on adopted state, regional and local land use plans and transportation project lists, which are the reasonably-foreseeable activities within the project vicinity that could also affect geology and soils. There are no prime or unique farmlands and soils within the project corridor as defined under the Farmlands Protection Policy Act.

[54] CH2MHILL, 2009; *2009 Geotechnical Data Report, Sellwood Bridge Project;* Prepared for Multnomah County, Oregon


Lake Oswego to Portland
TRANSIT PROJECT
Relative Earthquake Hazard
Figure 3.7-2
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar, Existing
Zone A: Greatest Hazard
Zone B
Zone C
Zone D: Least Hazard
Source: State of Oregon Department of Geology and Mineral Industries
0 0.3 0.6 Miles
03.19.10
K:\25696991 Lake Oswego to Portland Transit Project\WXDs\Geology\Figure_3_7_2_Earthquake_Hazard_031910.mxd
WILLAMETTE
RIVER
LAKE OSWEGO
Sellwood
Oak Grove

No-Build Alternative

There would be no direct effects related to geology, hydrogeology and seismic hazards associated with the No-Build Alternative. Indirectly, without any planned construction activities within the existing Willamette Shore Line right of way, the No-Build Alternative would generally allow the continuing degradation of soils and stability within existing right of way. On-going regional development would use existing groundwater and rock resources.

Enhanced Bus Alternative

Long term direct and indirect effects of the Enhanced Bus Alternative would be similar to those resulting from the No-Build Alternative. Design of the 300-space structured park-and-ride lot at the Lake Oswego Village Shopping Center under the Enhanced Bus Alternative would comply with applicable earthquake design standards for the site. There would be no cut and fill of soil under the Enhanced Bus Alternative.

Streetcar Alternative

The proposed Streetcar Alternative would require the construction of cut slopes and placement of engineered fill to accommodate the track and associated structures. Table 3.7-1 shows total estimated cut and fill volumes and estimated volume of export (excess cut material) for the various Streetcar Alternative options. In summary, the Streetcar Alternative would result in the excavation of approximately 76,350 to 95,100 cubic yards of material (depending on the design options). Approximately 11,820 to 45,850 cubic yards of the excavated material would be used as fill within the project's alignment, while approximately 64,180 to 76,200 cubic yards of excavated material would be removed from the project site, which would require locating and filling an off-site disposal area and/or identifying and contracting with other projects that could use the excess excavated material.

The majority of the engineered cuts and fills under the Streetcar Alternative would be supported by retaining walls. The Streetcar Alternative would result in approximately 22,050 to 27,450 linear feet of new retaining wall, generally along the proposed streetcar alignment, depending on the design options. Through the use of appropriate design standards, the Streetcar Alternative would avoid increasing geologic hazards, which would include the following: areas of undocumented fill and/or shrink-swell soils may be encountered, which could require additional excavation and replacement with suitable fill material; and potential rehabilitation of the Elk Rock Tunnel and associated portal structures, which would provide improved stability of the rock within the tunnel and the rock slopes in the vicinity of the portals.

Engineered bridges and structures included in the Streetcar Alternative would be designed to withstand a major seismic event by using current applicable design standards based on site specific geologic and seismic criteria. The Streetcar Alternative would not increase the likelihood or severity of geologic or soils hazards in the project vicinity. However, through the addition of improvements along the existing Willamette Shore Line right of way, the Streetcar Alternative would lead to increased soil stability and reduce soil erosion due to the introduction of new improvements, such as new retaining walls, the replacement of unstable soils with stable soils and improved stormwater drainage.

Compared to the No-Build Alternative, the Streetcar Alternative could use additional rock resources for fill if the project's cut material is not acceptable fill for the project. In contrast, the excess excavated material could be used for fill for other projects, which could reduce the demand for rock generally equivalent to the amount of excess cut from the project that could be used.

Table 3.7-1 Estimated Cubic Feet of Cut and Fill and Linear Feet of Retaining Wall for the Streetcar Alternative By Segment and Design Option

Segment/Design Option	Cubic Yards of Cut	Cubic Yards of Fill	Cubic Yards of Excess Cut[1]	Linear Feet of Retaining Wall
1 - Downtown Portland	0	0	0	0
2 - South Waterfront	4,000	8,000	(4,000)	1,200
3 - Johns Landing				
Willamette Shore Line	16,350	90	16,260	5,150
Macadam In-Street	6,400	30	6,370	3,250
Macadam Additional Lane	4,600	10	4,590	2,000
4 - Sellwood Bridge	24,000	110	23,890	6,450
5 - Dunthorpe/Riverdale				
Willamette Shore Line	24,400	250	24,150	8,100
Riverwood	27,750	3,950	23,800	8,850
6 - Lake Oswego				
UPRR	19,350	3,450	15,900	4,300
Foothills	23,000	33,700	(10,700)	5,800
Total (range)	**76,350 – 95,100**	**11,820 – 45,850**	**64,180 – 76,200**	**22,050 – 27,450**

[1] Excess cut material would be exported from the project site.
Source: *Lake Oswego to Portland Transit Project Streetcar Plan Set*, November 9, 2009.

Following is a summary of the approximate volume of cut and fill material and approximate length of new retaining wall would differ by Streetcar design option, by segment.

Segment 3 – Johns Landing. In Segment 3, Johns Landing, the Willamette Shore Line design option would result in the greatest volume of cut and excess cut material (16,350 and 16,260 cubic yards, respectively) and the greatest length of new retaining wall (5,150 linear feet). There would be 6,370 and 4,590 yards of excess cut material under the Macadam In-Street and Macadam Additional Lane design options, respectively. The Macadam In-Street and Macadam Additional Lane design options would also result in 3,250 and 2,000 feet of new retaining wall, respectively.

Segment 5 – Dunthorpe/Riverdale. In Segment 5, Dunthorpe/Riverdale, the Riverwood design option would result in the greater volume of cut material (27,750 cubic yards), but the lower volume of excess cut material (23,800 cubic yards), because it would require the greater volume of fill (3,950 cubic yards), which could be supplied from the cut material. In comparison, the Willamette Shore Line design option would result in 24,400 and 24,150 cubic yards of cut and excess cut material, respectively. The Riverwood design option would result in the greater length of new retaining wall (8,850 linear feet).

Segment 6 – Lake Oswego. In Segment 6, Lake Oswego, the Foothills design option would result in the greater volume of cut material (23,000 cubic yards), but the lower volume of excess cut material (a deficit of 10,700 cubic yards), because it would require the greater volume of fill (33,700 cubic yards), which could be supplied from the cut material in this and one or more segments. In comparison, the union Pacific Railroad design option would result in 19,350 and 15,900 cubic yards of cut and excess cut material, respectively. The Foothills design option would result in the greater length of new retaining wall (5,800 linear feet).

3.7.4 Potential Mitigation Measures

Long-term mitigation of effects related to geology, hydrogeology and seismic hazards would be based on the results of site specific geotechnical investigations, which would be performed in support of final design of the Locally Preferred Alternative, if the No-Build Alternative is not selected. Where hazards are identified, mitigation should be designed based on best practice geotechnical engineering in compliance with appropriate state and federal geotechnical and seismic design standards. Following is a summary of potential mitigation measures that the project could undertake to reduce risks related to geology, soils and seismic hazards.

3.7.4.1 Seismic Hazards

The primary seismic hazards that could affect the project include: liquefaction-related phenomena such as lateral spread and settlement; seismically-induced slope instability; strong ground motion; and surface fault rupture. Mitigation of these potential hazards could be achieved with one or more of the following techniques, depending upon the situation:

- Avoidance of the susceptible area(s);
- Densification of the subsurface soils through in-situ treatment including compaction or cement/chemical grout treatment;
- Removal of the liquefiable material and replacement with select backfill;
- Placement of retaining walls and/or rock-fall catchment zones or structures; and
- Improvement of rock slopes using mechanical reinforcement.

3.7.4.2 Landslides

Should landslides be identified through site-specific geotechnical investigations during subsequent phases of the project, stability analyses would be performed. Mitigation of landslide hazard could be accomplished using one or more of the following techniques:

- Mechanical retaining structures such as cantilevered walls, tied back walls, soil nail walls;
- Construction of shear keys and/or placement of earth buttresses at the landslide toe;
- Removal of driving forces in the upper portion of the landslide; and
- Installation of enhanced drainage facilities to redirect surface water and/or remove groundwater

3.7.4.3 Steep Slopes

Mitigation options for steep slope areas could include:

- Construction of retaining walls in areas of cuts (below ascending slopes) or fills (above descending slopes);
- Improvement of rock slopes using mechanical reinforcement such as rock bolts, steel mesh, shotcrete and drainage;
- If blasting is necessary to excavate rock slopes, controlled, pre-split blasting techniques should be employed to minimize damage to the finished rock cut face

3.7.4.4 Shrink/Swell and Hydric Soils

Hydric soils in areas of shallow groundwater may be encountered. Mitigation techniques for these soil types generally involve removal and replacement with engineered fill having properties that will provide a stable foundation for the Lake Oswego to Portland transit facilities. Additional mitigation related to wetlands impacts may be necessary in areas where soft soils are encountered and treated (see Section 3.9 for additional information on wetlands and hydrology). If zones are encountered that involve very large volumes of unsuitable soils, it may not be economical to remove and replace all of the unsuitable base material. Other mitigation options include:

- Partial removal and replacement with a combination of geogrid or geofabric and specified rock to bridge soft and/or wet zones;
- soil treatment using amendments to improve the soil structure; and
- Permanent drainage facilities to lower the groundwater.

3.8 Ecosystems

This section describes the analysis and anticipated effects of the study alternatives to wetlands, vegetation, wildlife, fisheries and threatened, endangered and sensitive (TES) species in the corridor. This section addresses long-term direct, indirect and cumulative effects of the study alternatives. Short-term or construction effects are also discussed in Section 3.16 Construction Activities. Additional detail on the ecosystems regulations, technical analysis methods, agency consultation, expected effects of the study alternatives and potential mitigation measures can be found in the *Lake Oswego to Portland Transit Project Ecosystems Technical Report* (URS/DEA and TriMet/Metro, November 2010).

3.8.1 Applicable Regulations

The project will be subject to federal, state and local regulations concerning potential impacts to biological resources. The principle natural resource regulations, ordinances and permits that would apply to a project in this corridor are summarized in Table 3.8-1. In addition, a list of expected permits and approvals is included in Section 7.3 Project Permits and Approvals. While Table 3.8-1 lists the array of applicable regulatory compliance requirements, particular attention is generally focused on regulations governing wetland protection (Clean Water Act Section 404), as administered by the U.S. Army Corps of Engineers (USACE), impacts to navigable waterways under Section 10 of the Rivers and Harbors Act by the USACE, and regulations protecting federal TES species under the federal Endangered Species Act (ESA). Should the Enhanced Bus Alternative or the Streetcar Alternative be selected as the Locally Preferred Alternative, the Federal Transit Administration would consult with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Services (NMFS) in compliance with Section 7 of the ESA. Following selection of the Locally Preferred Alternative, pre-consultation with USFWS and NMFS will be initiated and the appropriate compliance documentation prepared. Current expectation is that a Biological Assessment would be required for the Streetcar Alternative, but may not be required for the Enhanced Bus Alternative.[55]

Additionally, Executive Order 11990 – Protection of Wetlands, requires federal agencies to take action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Agencies must avoid undertaking or providing assistance for new construction located in wetlands unless the agency finds that there is no practicable alternative to such construction and that the proposed action includes all practicable measures to minimize harm to wetlands, which may result from such use. In making this finding, the head of the agency may take into account economic, environmental and other pertinent factors. Executive Order 11988 – Floodplain Management provides similar protection for floodplains.

3.8.2 Affected Environment

A transit project in this corridor has the potential to affect existing biological resources including wetlands, vegetation, wildlife, fisheries, and TES species. Assessment of the affected environment, focused primarily on resources within a study area extending 125 feet from the center line of the

[55] A Biological Assessment is a document prepared in compliance with the Endangered Species Act (ESA) to determine whether a proposed major construction activity under the authority of a Federal action agency is likely to adversely affect listed species, proposed species, or designated critical habitat.

Table 3.8-1 Summary of Natural Resource Regulations and Possible Permit Requirements

Regulation/ Permit	Responsible Agency	Resource Studies	Regulated Resources
Federal			
National Environmental Policy Act (NEPA)	Federal Transit Administration (FTA)	NEPA EIS addressing natural resource conditions, impacts, and mitigation	All
Clean Water Act (CWA) Section 404	U.S. Army Corps of Engineers (USACE)	Alternatives analysis; wetland delineation study; wetland functional assessment and impact analysis; and mitigation plan	Waters of the U.S., including wetlands
Rivers and Harbors Act (RHA) Section 10	USACE	Assessment of potential project impacts to navigable waters	Navigable waters
Endangered Species Act (ESA)	National Marine Fisheries Service (NMFS); U.S. Fish and Wildlife Service (USFWS)	Section 7 Consultation addressing project impacts to listed species, species proposed for listing, and candidate species, and their habitats. May require a Biological Assessment.	Vegetation, wildlife, fisheries, and habitats
Fish and Wildlife Coordination Act	USFWS; NMFS; Oregon Department of Fish, and Wildlife (ODFW)	Agency consultation; identify impacts to fish and wildlife resources; recommend mitigation if necessary	Vegetation, wildlife, fisheries, and habitat
Magnuson-Stevens Fishery Conservation Management Act	NMFS	Identify potential impacts to Essential Fish Habitat (EFH) (To be included in Biological Assessment)	Habitat for commercially significant fish: Chinook and coho salmon
Migratory Bird Treaty Act (MBTA)	USFWS	Identify impacts to migratory birds	Wildlife
State			
Oregon Removal-Fill Permit	OR Department of State Lands (DSL)	Alternatives analysis; wetland delineation study; wetland functional assessment and impact analysis; mitigation plan	Waters of the state, including wetlands
Oregon State ESA	ODFW; OR Department of Agriculture (ODA)	Identify project impact to state listed and candidate species	Vegetation, wildlife, fisheries
CWA Section 401 Water Quality Certification	OR Department of Environmental Quality (DEQ); U.S. Environmental Protection Agency (EPA)	Assess project compliance with state water quality standards; implement mitigation measures; stormwater management plan	Rivers, streams, other bodies of water
Oregon Fish Passage Statute	ODFW	Identify stream crossing and impacts to ability for fish to pass upstream and downstream	Native fish, streams, and culverts
Statewide Planning Goal 15 – Willamette River Greenway	City of Portland; City of Lake Oswego, Multnomah and Clackamas Counties	Project design alternatives relative to Greenway overlay and setback requirements	Willamette River shoreline within Greenway overlay
Local			
Portland Greenway Permit	City of Portland	Evaluation of impacts to native vegetation; mitigation, or preservation of native vegetation	Greenway setback, vegetation, wildlife, and fisheries
Environmental Zone Overlay	City of Portland	Identification of adverse impacts; mitigation plan	Streams, wetlands, and wildlife habitat
Environmental Zone Overlay Districts	City of Lake Oswego	Identification and evaluation of impacts to wetlands or waters, including associated buffers identified in a zoning overlay district	Vegetation, wildlife, waters, wetlands, and fisheries; may include buffers
Metro Urban Growth Management Functional Plan – Title 3	Metro (though administered by local governments)	Evaluation of impacts on water quality, flood management, and fish and wildlife	Wildlife and fisheries
Metro Urban Growth Management Functional Plan – Title 13	Metro (though administered by local governments)	Document Habitat Conservation Areas and local government compliance	Wildlife and fisheries
Setback Requirements	Clackamas County	Protection of river and stream corridors	Rivers and streams

Source: URS, January 2010

study alternatives and design options (creating a minimum 250-foot wide study corridor, though wider in areas of parallel design options). Where appropriate, potential effects to upstream and downstream aquatic resources were evaluated. The analysis is based on information collected during field investigations and from local, state, and federal agencies to help characterize ecosystem resources.

3.8.2.1 Wetlands

Four small wetlands sites have been identified within the project study area. The wetlands have been identified as Wetland A, B, C and D, as shown in Figure 3.8-1 and summarized in Table 3.8-2. Wetlands found within the study area are supported where drainage is intercepted by the railroad berm, which acts as a hydrologic impoundment and results in seasonally saturated or inundated soil conditions. The source of drainage is either stormwater discharge from upslope impervious areas, natural drainage features or a combination of the two. The majority of water entering the rail corridor comes from culverts that outfall above the tracks. This drainage flows down gradient through ditches at the base of the railroad embankment until it reaches a culvert inlet, which allows conveyance to the east, towards the Willamette River. Wetland conditions develop where culverts are placed too high, too far away from the incoming drainage, or where the gradient is nearly flat.

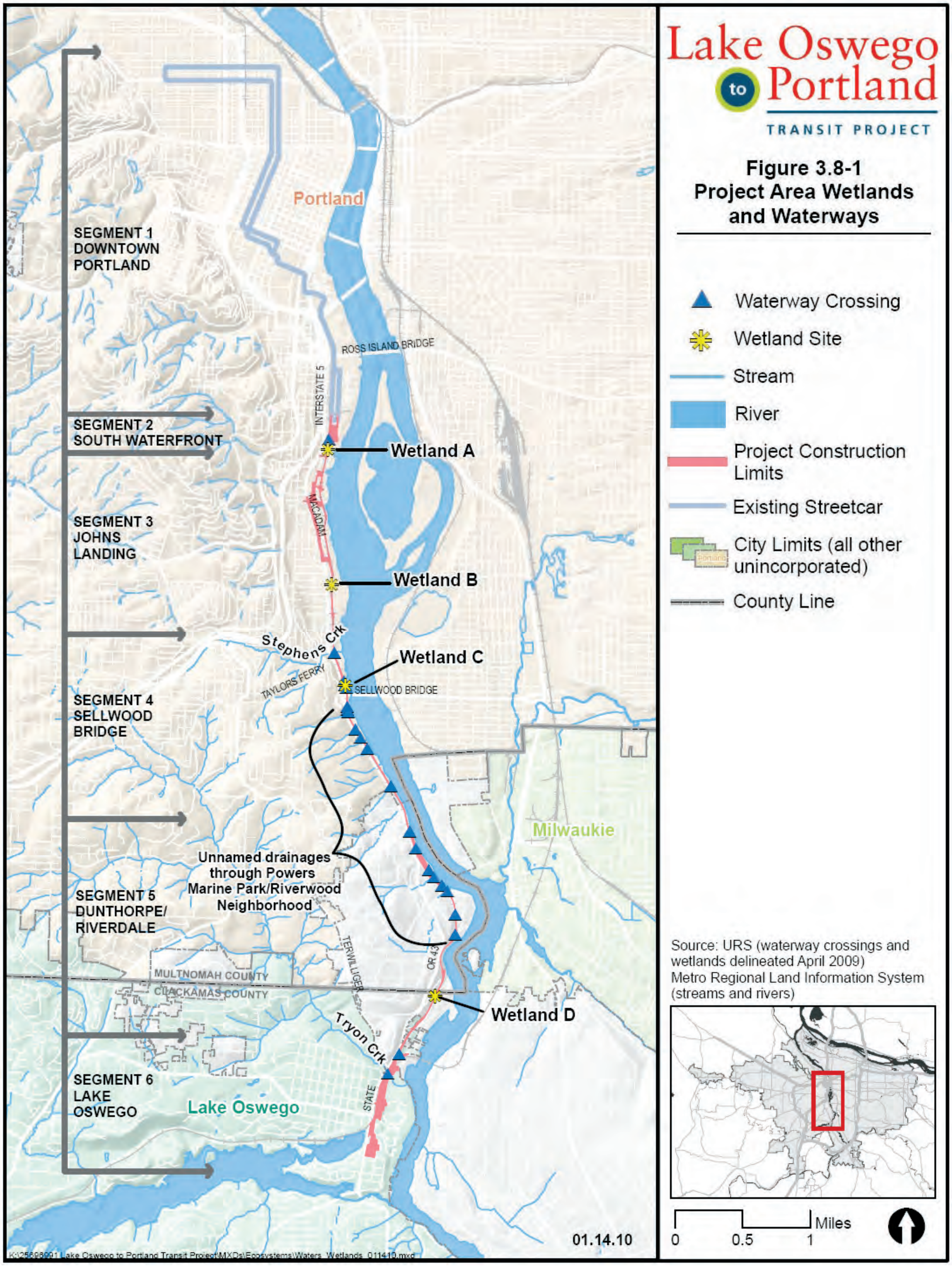
Table 3.8-2 Summary Description of Wetlands within the Study Corridor

Site/ Wetland	Cowardin Class[1]	HGM Class[2]	Size AC/Sq Ft[3]	Comments
Wetland A	PSSC	RFT	0.07/3,049	Stormwater ditch with scrub/shrub habitat. Outflows via rock –lined ditch with no ordinary high water (OHW) line to a grated inlet.[4] Unknown offsite path.
Wetland B	PEMB	DEP	0.01/435	Isolated wetland with emergent habitat, stormwater collection point. Overflows via culvert to an infiltration area on the east side of the tracks.
Wetland C	PEMC	RFT	0.03/1,307	Ditch and stream-fed outfall collection with emergent habitat. Continues to the Willamette River in an unnamed waterway identified as ditch [2].
Wetland D	PEMC	DEP	0.01/435	Depressional area that collects groundwater discharge at toe of slope in emergent habitat. General low point that outflows via culvert to ponds to the east.
		SUM	**0.12/5,226**	

Source: Wetland Delineation conducted by URS, April and November 2009 in compliance with the USACE 1987 Wetlands Delineation Manual and the Western Mountains, Valleys, and Coast Regional Supplement (2010); GIS impact analysis conducted by David Evans and Associates, Jan. 2010.
[1] Cowardin Class based on Cowardin 1979: PSSC = Palustrine Scrub-shrub seasonally flooded; PEMB = Palustrine Emergent Saturated; PEMC = Palustrine Emergent Seasonally Flooded
[2] Hydrogeomorphic (HGM) Class based on Adamus 2001: RFT = Riverine Flow-Through; DEP = Depressional.
[3] The USACE and DSL have not verified the wetland delineation report prior to submittal of this document.
[4] The Ordinary High Water (OHW) line is the mark left on stream banks by regular high water flow at the 2-year return interval.

3.8.2.2 Waterways

The study area contains 23 observed waterways, including Stephens Creek, Tryon Creek, Terwilliger Creek and other unnamed waterways identified as Streams 1 through 13 and Ditches 1 through 6. The majority of these waters currently receive runoff from roadways and other surfaces, which is not treated to current design standards for quality or quantity. All of these linear drainage channels eventually discharge to the Willamette River. Floodplains associated with the stream crossings are minimal as the majority of waterways have been culverted and channelized prior to being routed under the existing rail infrastructure. No study alternatives would cross the Willamette River; therefore, impacts to the river would be limited to indirect / cumulative impacts. Figure 3.8-1 shows the rivers and streams in the analysis area. Table 3.8-3 provides summary data on the area waterways.



Lake Oswego to Portland
TRANSIT PROJECT
Figure 3.8-1
Project Area Wetlands and Waterways
Waterway Crossing
Wetland Site
Stream
River
Project Construction Limits
Existing Streetcar
City Limits (all other unincorporated)
County Line
Source: URS (waterway crossings and wetlands delineated April 2009)
Metro Regional Land Information System (streams and rivers)
Miles
0
0.5
1
SEGMENT 1
DOWNTOWN PORTLAND
SEGMENT 2
SOUTH WATERFRONT
SEGMENT 3
JOHNS LANDING
SEGMENT 4
SELLWOOD BRIDGE
SEGMENT 5
DUNTHORPE/ RIVERDALE
SEGMENT 6
LAKE OSWEGO
Portland
ROSS ISLAND BRIDGE
INTERSTATE 5
MACADAM
Wetland A
Wetland B
Wetland C
Wetland D
Stephens Crk
TAYLORS FERRY
SELLWOOD BRIDGE
Unnamed drainages through Powers Marine Park/Riverwood Neighborhood
Milwaukie
TERWILLIGER
OR 43
MULTNOMAH COUNTY
CLACKAMAS COUNTY
Tryon Crk
STATE
Lake Oswego
01.14.10

Table 3.8-3 Summary of Project Area Streams

Waterbody Name	Corridor Segment	Supports TES Aquatic Species[1]	Channel Width (OHWL) in Feet[2]	Waterbody Flow Regime	Water Quality Limited Waterbodies for Following Parameters[3,4]	TMDL(s) Approved for Following Parameters[3,5]
Willamette River	None	Yes	1,200 (approximate/ varies)	P[6]	aldrin, biological criteria, DDT, DDE, dieldrin, E. coli, fecal coliform, iron, manganese, mercury, PCBs, PAHs, pentachlorophenol	Dioxin; temperature; bacteria
Ditch 1	2	No	0.5	E[6]	N/A	N/A
Stephens Creek	4	Yes	4	P	bacteria, mercury, temperature	temperature; bacteria
Ditch 2	4	No	1	E	N/A	N/A
Stream 1	4	No	0.5	I[6]	N/A	N/A
Stream 2	4	No	2	I	N/A	N/A
Ditch 3	4	No	0.5	E	N/A	N/A
Ditch 4	4	No	2	E	N/A	N/A
Stream 3	4	No	3	I	N/A	N/A
Stream 4	4	No	3	I	N/A	N/A
Ditch 5	4	No	1	E	N/A	N/A
Stream 5	4	No	1	I	N/A	N/A
Stream 6	4	No	5	I	N/A	N/A
Stream 7	4	No	2	I	N/A	N/A
Stream 8	5	No	3	I	N/A	N/A
Stream 9	5	No	3	I	N/A	N/A
Irrigation	5	No	2	I	N/A	N/A
Stream 10	5	No	4	I	N/A	N/A
Seep A	5	No	2	E	N/A	N/A
Stream 11	5	No	2	I	N/A	N/A
Stream 12	5	No	2	I	N/A	N/A
Stream 13	5	No	3	I	N/A	N/A
Ditch 6	6	No	0.5	E	N/A	N/A
Tryon Creek	6	Yes	10	P	temperature, bacteria, nutrients	temperature; bacteria

[1] Sources: PNW Ecosystem Research Consortium (2002); StreamNet (2007a); City of Portland (2007).[2] Source: URS field observations
[3] Source: DEQ 2007.
[4] The 303(d) list is a list of waterbodies (or segments of waterbodies) that do not meet their designated water quality standards as defined by Section 303(d) of the Federal Clean Water Act. These "impaired" waterbodies are reported to EPA every two years on the 303(d) list, which is maintained by DEQ.
[5] A Total Maximum Daily Load (TMDL) is a quantitative analysis of a waterbody that includes two components: (a) a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and (b) an allocation of that total amount amongst the pollutant's sources (both point and nonpoint).
[6] Flow Regime is defined as: P = Perennial, E = Ephemeral, I = Intermittent

3.8.2.3 Vegetation

The study area contains large sections of medium- and high-density commercial and residential development mixed with natural areas. Areas of commercial development include commercial buildings, roads, sidewalks and other infrastructure with limited landscaped vegetation and patches of invasive vegetation species. Residential developments include some high-density neighborhoods with limited landscaped vegetation and low-density residential areas characterized by mature landscaped vegetation and open lawns. Natural areas include the banks of the Willamette River, areas that traverse the riparian areas of Stephens Creek and Tryon Creek corridors, park land associated with Cottonwood Bay, Willamette Park, Butterfly Park, Powers Marine Park, and a few undeveloped lots. The entire project area is broadly classified as developed or composed of westside coniferous/deciduous forest. Vegetated areas consist of woodland/herbaceous plant communities composed of landscaped vegetation or a mix of landscaped and natural vegetation.

Of note are individual Oregon white oak (*Quercus garryana*) trees located in Willamette Park in proximity to the rail alignment. Oregon white oaks are rare in the region and there is concern over potential impacts to these trees. Current design shows the Streetcar Alternative potentially impacting several white oaks by encroaching within the drip line. At this level of design, specific avoidance and minimization measures have not been evaluated, but which will be developed and employed to the extent practicable.

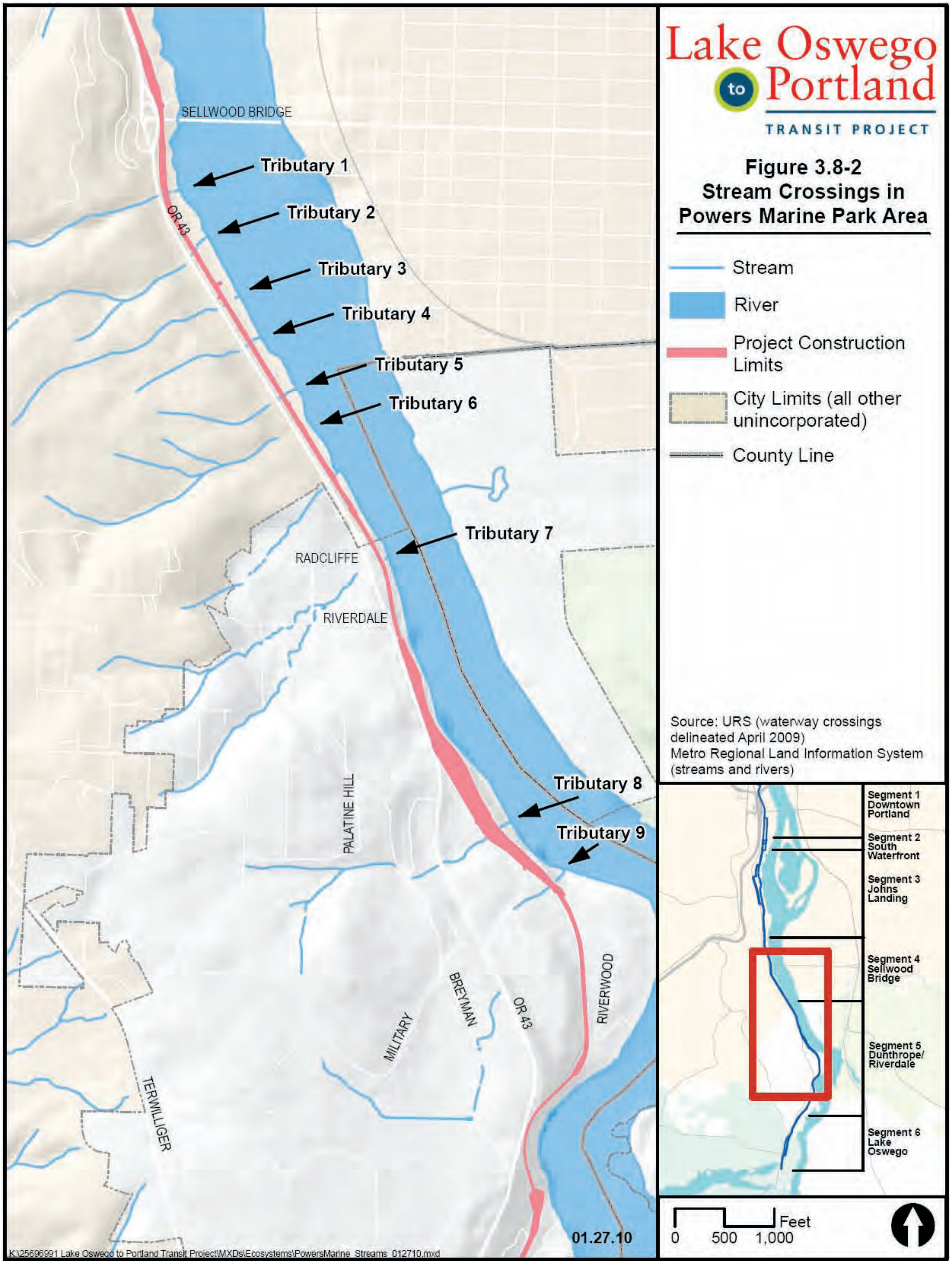
3.8.2.4 Wildlife

Wildlife species that occur within the study area include small mammals, reptiles, amphibians and birds. Many of these species are commonly found in urban habitats and use available habitats for foraging, nesting, cover and movement (habitat connectivity) purposes. They are generally adapted to life in urbanized areas, often occurring in edge habitats that exist along the boundaries of different habitat types. Bird species are the largest group of animals that occur in urban areas, including the study corridor. Raptor species, such as peregrine falcons and bald eagles, use some of the study area for nesting, foraging and migration activities.

Mammals in urban areas are usually found near larger undisturbed habitats. Mammals expected to occur in the project vicinity include: Virginia opossum, Eastern cottontail, raccoon, coyote, fox squirrel, vole, bat species, house mice and Norway rat. Black-tailed deer utilize habitat adjacent to the Willamette River and its tributaries as well as forested habitat areas. Urban areas are usually characterized by fragmented noncontiguous habitats and generally limit movements of ambulatory species. The study area is primarily located along existing streets and railways which may create a barrier to wildlife movement.

3.8.2.5 Fisheries

Fisheries resources in the study area include perennial, intermittent and ephemeral streams with the potential to provide habitat for fish. Waterbodies in the study area originate in the hills west of the corridor (the southern extent of Portland’s West Hills) and discharge into the Lower Willamette River Subbasin. Tryon Creek, Stephens Creek and Terwilliger Creek comprise the named drainages crossed by the Willamette Shore Line right of way. Smaller unnamed drainages are found within the Johns Landing, Sellwood Bridge and Dunthorpe/Riverdale segments of the corridor, with the majority in the Powers Marine Park area (See Figure 3.8-2 and Table 3.8-4).



Lake Oswego to Portland
TRANSIT PROJECT
Figure 3.8-2
Stream Crossings in Powers Marine Park Area
Stream
River
Project Construction Limits
City Limits (all other unincorporated)
County Line
Source: URS (waterway crossings delineated April 2009)
Metro Regional Land Information System (streams and rivers)
SELLWOOD BRIDGE
Tributary 1
Tributary 2
Tributary 3
Tributary 4
Tributary 5
Tributary 6
Tributary 7
Tributary 8
Tributary 9
OR 43
RADCLIFFE
RIVERDALE
PALATINE HILL
BREYMAN
MILITARY
RIVERWOOD
TERWILLIGER
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
Feet
0 500 1,000
01.27.10
K:\25696991 Lake Oswego to Portland Transit Project\MXDs\Ecosystems\PowersMarine_Streams_012710.mxd

Table 3.8-4 Stream Crossings within the Project Corridor

Stream Name (or Identifier)	Segment	Station[1] (Approx.)	Culvert ID Number	Description/Notes
Terwilliger Creek	3 - Johns Landing	Varies	N/A	Creek is piped under much of Johns Landing and does not daylight within the project corridor. Creek alignment has been altered such that it flows south, under Macadam Avenue, until it turns east at SW Carolina Street and continues in its pipe out to the Willamette River.
Unnamed Tributary to Terwilliger Creek #1	3 - Johns Landing	Varies	N/A	Creek is piped under much of Johns Landing and does not daylight within the project corridor. Creek is intercepted by the piped section of Terwilliger Creek and conveyed in the same pipe to the Willamette River.
Unnamed Tributary to Terwilliger Creek #2	3 - Johns Landing	Varies	N/A	Creek is piped under much of Johns Landing and does not daylight within the project corridor. Creek is intercepted by the piped section of Terwilliger Creek and conveyed in the same pipe to the Willamette River.
Unnamed Tributary to Willamette River #1	3 - Johns Landing	Unknown	N/A	Creek is piped under much of Johns Landing and does not daylight within the project corridor.
Stephens Creek	4 - Sellwood	1093+43	46	Twin 48-inch pipe culverts convey Stephens Creek under the rail grade, which is downstream from the Highway 43 culverts, which are identified fish passage barriers.
Unnamed Tributary to Willamette River #2	4 - Sellwood	2009+46	40	Single 24-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #3	4 - Sellwood	2016+78	39	Single 24-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #4	4 - Sellwood	2025+86	36	Single 48-inch wood box culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #5	4 - Sellwood	2026+04	34	Single 18-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #6	4 - Sellwood	2033+39	31	Single 12-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #7	4 - Sellwood	2037+35	29	Single 24-inch CMP culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #8	4 - Sellwood	2042+90	27	Culvert conveys tributary into Powers Marine Park. Culvert under Highway 43 constitutes a complete passage barrier.
Unnamed Tributary to Willamette River #9	5 - Dunthorpe/ Riverdale	2053+64	25	Culvert conveys tributary down steep hillslope to Willamette River. Gradient of downstream reach prevents upstream passage of fish.
Unnamed Tributary to Willamette River #10	5 - Dunthorpe/ Riverdale	Approx.206 3+60	N/A	Trestle Crossing over tributary.
Unnamed Tributary to Willamette River #11	5 - Dunthorpe/ Riverdale	Approx. 2067-2074	N/A	Trestle Crossing over tributary.
Tryon Creek	6 - Lake Oswego	3017+00	1	An eight foot concrete box culvert conveys Tryon Creek under combined rail crossing and Highway 43 crossing. Total culvert length is 400 feet. Culvert is believed to be fish passage barrier for certain species under certain flow conditions.

Source: Information based on URS field survey of project corridor, Fall 2009. DEA Impact Analysis of URS GIS data, Fall 2009.
[1]*Lake Oswego to Portland Streetcar Plan Set*, URS, 2009.

Stream habitat quality varies within the study area, with all streams demonstrating some degree of impairment from urban development. Current impacts include invasive species, encroachment, deforestation, stream channelization/piping, channel incision, floodplain filling, storm water runoff, and alterations disconnecting stream flows from historic channels and flood prone areas. Intensity of existing impacts is typically dependent on adjacent land uses and existing barriers to fish passage and upstream habitat access. Aquatic resources are described in the following paragraphs.

The **Lower Willamette River Subbasin** is the basin into which all streams within the study area discharge. While the study alternatives would not cross the Willamette River, there are portions of the study area that fall within the Willamette River's 100-year floodplain. The Lower Willamette Subbasin supports numerous native and non-native species, including Lower Columbia River chinook salmon and Upper Willamette River chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River coho salmon (*O. kisutch*), resident and coastal (Columbia River) cutthroat trout (*O. clarki*), Lower Columbia River steelhead and Upper Willamette steelhead (*O. mykiss*), green sturgeon (*Acipenser medirostris*), Pacific lamprey (*Lampetra tridentatus*) and Western brook lamprey (*L. richardsoni*).[56] Although bull trout (*Salvelinus confluentus*) typically are found in cold, clear streams at relatively high elevations, they may use portions of the Columbia River, and perhaps the Willamette River, seasonally. Consequently, although their presence in the study area is unlikely and is not documented, they could occur in the area during winter and spring months.

Tryon Creek is the largest tributary watershed within the study area (4,200 acres). Approximately 640 acres surrounding the main stem of Tryon Creek is protected in the Tryon Creek State Natural Area Park. Fish and amphibian passage is limited by a 400-foot culverted section located under the existing rail alignment and Highway 43. Tryon Creek maintains habitat for resident and coastal (Columbia River) cutthroat trout and Lower Columbia River steelhead trout in its lower, middle and upper watershed, while providing habitat for Pacific lamprey, Western brook lamprey, Lower Columbia River chinook salmon and Lower Columbia River coho salmon in stream reaches below the Highway 43 culvert.[57,58]

In 2008 the Oregon Department of Transportation completed the initial phase of a stream enhancement project upstream and downstream of the Highway 43 culvert and modified the culvert to improve fish passage. The City of Portland's Bureau of Environmental Services is conducting the second phase of the project that will enhance riparian conditions from the confluence with the Willamette River upstream to the work completed in the initial phase.[59]

Three **unnamed tributaries in the Dunthorpe/ Riverdale segment** are a mix of perennial and intermittent tributaries to the Willamette River. These creeks originate on the steep slopes of Palatine Hill, passing under Highway 43 in culverts and frequently flowing into manmade, ornamental water features before cascading down to the Willamette River. The gradient of these streams in their lower watersheds likely precludes habitat access by fish resources, though no studies have been conducted to confirm this assumption.

The **unnamed tributaries in the Powers Marine Park area** are a mix of perennial and intermittent tributaries to the Willamette River. The Bureau of Environmental Services is currently evaluating

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[56] Tinus, E. S., J. A. Koloszar, and D. L. Ward. 2003. Abundance and distribution of fish in City of Portland streams, Volume 1 & 2. Final report to the City of Portland, Portland, Oregon.
[57] Henderson Land Services. 2007. Tryon Creek @ Hwy 43 Culvert Alternates Analysis. June 2007.
[58] Graham, J. C., and D. L. Ward. 2002. Distribution of fish in Portland tributary streams. Final Report by the Oregon Department of Fish and Wildlife to the City of Portland Endangered Species Act Program, Portland, Oregon.
[59] Tryon Creek Confluence Habitat Enhancement Project. City of Portland on-line webpage. Accessed on 7/15/2010 at: http://www.portlandonline.com/bes/index.cfm?a=225319&c=46964

these drainages for suitable fish habitat and fish use. These creeks originate on the steep slopes of Palatine Hill, passing under Highway 43 through culverts that create complete barriers to upstream fish. Culvert crossings under the existing rail alignment may present upstream passage barriers for fish, as well.[60]

Stephens Creek watershed comprises approximately 760 acres with land use dominated by residential development and the Riverview Cemetery. Upstream fish passage is blocked by the culvert under Highway 43, but Pacific and Western brook lamprey, Lower Columbia River chinook and Lower Columbia coho salmon, resident and coastal cutthroat trout, and steelhead are all present downstream of the barrier culvert (Graham and Ward 2002).[61] The City of Portland has completed a stream restoration project to enhance fish habitat at the confluence of Stephens Creek with the Willamette River.[62]

Terwilliger Creek and three unnamed tributaries are a mix of perennial and intermittent streams that drain the hills west of Johns Landing. The Terwilliger Creek watershed is approximately 345 acres in area, the lower portion of which has been piped under the developed portion of Johns Landing, including the project corridor. The unnamed tributaries are similarly piped under Johns Landing and the project corridor. No fish or amphibian passage is expected in any of these drainages.

The Oregon Department of Fish and Wildlife (ODFW) has conducted fish presence, distribution and density studies within Tryon and Stephens creeks. Sampling results indicate that both native and non-native species can be found in these streams, including TES species.[63] Studies on these two creeks indicate that the culverts that convey these streams through the project corridor constitute a partial passage barrier for Tryon Creek[64] and a complete passage barrier in the case of Stephens Creek.[65] The Tryon Creek culvert is ranked as the City's highest fish passage priority by the Bureau of Environmental Services.[66] Additional features of streams crossed by the existing rail alignment are detailed in Table 3.8-4.

3.8.2.6 Threatened, Endangered and Sensitive Species

Threatened and endangered species include those species listed as threatened or endangered, proposed for listing or candidates for listing under the federal ESA[67,68] and the Oregon ESA.[69] Sensitive species are categorized as Species of Concern (SOC) by federal agencies and by ODFW

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[60] Bushman, M. 2010. Personal Communication with Mary Bushman, Bureau of Environmental Services. January 2010.
[61] Graham, J. C., and D. L. Ward. 2002. Distribution of fish in Portland tributary streams. Final Report by the Oregon Department of Fish and Wildlife to the City of Portland Endangered Species Act Program, Portland, Oregon.
[62] Communication from Nancy Gronowski, Park Planner with Portland Parks and Recreation. May 5, 2010.
[63] Gronowski. 2010.
[64] Henderson Land Services 2007
[65] Tinus et al. 2003
[66] Communication from Kaitlin Lovell, Biologist with Bureau of Environmental Services, May 5, 2010.
[67] US Fish and Wildlife Service (USFWS) 2009a. Federally Listed, Proposed, Candidate species and species of concern under the Jurisdiction of the Fish and Wildlife Service which may occur in Clackamas County, Oregon. Accessed on December 11, 2009 at www.fws.gov/oregonfwo/Species/Lists/Documents/County/CLACKAMAS %20COUNTY.pdf
[68] USFWS 2009b. Federally Listed, Proposed, Candidate species and species of concern under the Jurisdiction of the Fish and Wildlife Service which may occur in Multnomah County, Oregon. Accessed on December 11, 2009 at www.fws.gov/oregonfwo/Species/Lists/Documents/County/MULTNOMAH %20COUNTY.pdf
[69] Oregon Department of Fish and Wildlife (ODFW) 2009. Threatened and Endangered Species List. Accessed on December 11, 2009 at: http://www.dfw.state.or.us/wildlife/diversity/species/threatened_endangered_species.asp

through the Oregon Sensitive Species lists.[70] In addition, other entities may denote the special status of species including the City of Portland and the Oregon Natural Heritage Information Center (ORNHIC).[71] Threatened, endangered and sensitive species (collectively TES species) are addressed in this evaluation if there is a presumption or evidence of their presence. TES species are identified in Table 3.8-5, with state and federal threatened and endangered species presented first, followed by sensitive species.

Of the species identified in Table 3.8-5, only a subset are evaluated in this assessment. Exclusion of species from assessment is due to the absence of the species from the project vicinity, lack of suitable habitat conditions within the project area, or the presumed extinction of a species locally or regionally. Species excluded from evaluation are discussed fully in the *Lake Oswego to Portland Transit Project Ecosystems Technical Report* and indicated in Table 3.8-5 as not occurring in the project study area. Table 3.8-6 summarizes the status of TES species that occur in the study.

ORNHIC, NMFS, and USFWS identify ten native TES fish species comprising thirteen Evolutionarily Significant Units (ESU)[72] /Distinct Population Segments (DPS)[73] that could potentially occur in study area streams. Of these, four species, comprising six ESU/DPS occur in the study area and are listed as threatened under the Federal ESA. Three species are identified as SOC and occur in the study area. As listed in Table 3.8-5, waterbodies within the study area that support some or all of these species include the Willamette River, Tryon Creek, and Stephens Creek.[74,75] It is possible that the unnamed tributaries that drain to the Powers Marine Park area provide limited off-channel habitat for species in the Willamette River during periods of high water; however, such habitat is limited to stream reaches downstream of passage barriers under the existing rail line and Highway 43.

[70] ODFW 2009. 2008 Sensitive Species List. Accesses on December 11, 2009 at: http://www.dfw.state.or.us/wildlife/diversity/species/sensitive_species.asp

[71] Oregon Natural Heritage Information Center (ORNHIC). December 9, 2009. Data system search for threatened and endangered plant and animal records for the Lake Oswego to Portland Transit Project.

[72] An ESU is a distinct local population within a species that has very different behavioral and phenological traits and thus harbors enough genetic uniqueness to warrant its own management and conservation agenda. NMFS uses the ESU as the smallest management unit warranting listing under the Endangered Species Act for anadromous salmonids, excluding steelhead, which employs the DPS terminology.

[73] A DPS is the smallest management unit warranting listing under the Endangered Species Act. Species, as defined in the ESA for listing purposes, is a taxonomic species or subspecies of plant or animal, or in the case of vertebrate species, a distinct population segment (DPS).

[74] Streamnet. On-line query of fish distribution in project area streams. Accessed on 01/15/10 at: http://www.streamnet.org/

[75] Graham and Ward 2002.

Table 3.8-5 Species with Federal and/or State Status Potentially Occurring in the Project Vicinity

Common Name	Scientific Name	Federal Status	State Status	Tryon Creek	Stephens Creek	Willamette River	Occurs in Project Study Area	Critical Habitat in Study Area
Threatened and Endangered								
Mammals								
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	LE	SV	-	-	-	No	NA
Steller sea lion (Eastern Stock)	*(Eumetopias jubatus)*	LT	-	-	-	-	No	No
Avians								
Bald eagle	*Haliaeetus leucocephalus*	DL	LT	-	-	X	Yes	NA
Northern spotted owl	*Strix occidentalis caurina*	LT	-	-	-	-	No	No
Streaked horned lark	*Eremophila alpestris strigata*	C	SC	-	-	-	No	NA
Fish								
Lower Columbia River Coho Salmon ESU[1]	*Oncorhynchus kisutch*	LT	LE	X	X	X	Yes	No
Lower Columbia River Steelhead DPS	*O. mykiss*	LT	SC	X	X	X	Yes	Yes
Upper Willamette River Steelhead DPS	*O. mykiss*	LT	SV			X	Yes	Yes
Lower Columbia River Chinook Salmon ESU[1]	*O. tshawytscha*	LT	SC	X	X	X	Yes	Yes
Upper Willamette River Chinook Salmon ESU[1]	*O. tshawytscha*	LT	-	-	-	X	Yes	Yes
Bull trout	*Salvelinus confluentus*	LT	SC	-	-	X	No	No
Green sturgeon (southern DPS)	*Acipenser medirostris*	LT	-	-	-	X	Yes	No
Oregon chub	*Oregonichthys crameri*	LE	SC	-	-	-	No	No
Pacific eulachon/smelt (southern DPS)	*Thleichthys pacificus)*	LT	-	-	-	-	No	No
Plants								
Bradshaw's desert parsley	*Lomatium bradshawii*	LE	-	-	-	-	No	No
Nelson's checker-mallow	*Sidalcea nelsoniana*	LT	-	-	-	-	No	No
Water howellia	*Howellia aquatilis*	LT	-	-	-	-	No	No
White rock larkspur	*Delphenium leucophaeum*	SOC	LE	-	-	X	No	No
White-topped aster	*Sericocarpus rigidus*	SOC	LT	-	-	-	No	NA
Willamette daisy	*Erigeron decumbens var. decumbens*	LE	-	-	-	-	No	No
Northern wormwood	*Artemisia campestris var. wormskioldii*	C	-	-	-	-	No	NA
Oregon sullivantia	*Sullivantia oregano*	SOC	C	-	-	-	No	NA
Tall bugbane	*Cimicifuga elata var. elata*	-	C	-	-	-	No	NA
Sensitive Species								
Mammals								
California wolverine	*Gulo gulo luteus*	SOC	-	-	-	-	No	NA
Camas pocket gopher	*Thomomys bulbivorus*	SOC	-	-	-	-	No	NA
Fringed myotis bat	*Myotis thysanodes*	SOC	SV	-	-	-	No	NA
Long-eared myotis bat	*M. evotis*	SOC		-	-	-	No	NA
Long-legged myotis bat	*M. volans*	SOC	SV	-	-	-	No	NA
Pallid bat	*Antrozous pallidus pacificus*	SOC	SV	-	-	-	No	NA

Table 3.8-5 Species with Federal and/or State Status Potentially Occurring in the Project Vicinity

Common Name	Scientific Name	Federal Status	State Status	Tryon Creek	Stephens Creek	Willamette River	Occurs in Project Study Area	Critical Habitat in Study Area
Red tree vole	*Arborimus longicaudus*	SOC	SV	-	-	-	No	NA
Silver-haired bat	*Lasionycteris noctivagans*	SOC	SV	-	-	-	No	NA
Townsend's western big-eared bat	*Corynorhinus townsendii townsendii*	SOC	SC	-	-	-	No	NA
Yuma myotis bat	*M. yumanensis*	SOC	-	-	-	-	No	NA
Avians								
Acorn woodpecker	*Melanerpes formicivorus*	SOC	-	-	-	-	No	NA
Band-tailed pigeon	*Patagioenas fasciata*	SOC	-	-	-	X	Yes	NA
Harlequin duck	*Histrionicus histrionicus*	SOC	-	-	-	-	No	NA
Lewis' woodpecker	*Melanerpes lewis*	SOC	SC	-	-	-	No	NA
Mountain quail	*Oreortyx pictus*	SOC	SV	-	-	-	No	NA
Northern goshawk	*Accipiter gentilis*	SOC	SV	-	-	-	No	NA
Olive-sided flycatcher	*Contopus cooperi*	SOC	SV	-	X	-	Yes	NA
Oregon vesper sparrow	*Pooecetes gramineus affinis*	SOC	SC	-	-	-	No	NA
Peregrine falcon	*Falco peregrinus anatum*	DL	SV	-	-	X	Yes	NA
Purple martin	*Progne subis*	SOC	SC	-	-	-	No	NA
Tricolored blackbird	*Agelaius tricolor*	SOC	-	-	-	-	No	NA
Western burrowing owl	*Athene cunicularia hypugaea*	SOC	SC	-	-	-	No	NA
Yellow-breasted chat	*Icteria virens gramineus affinis*	SOC	SC	-	-	-	No	NA
Amphibians & Reptiles								
Cascades frog	*Rana cascadae*	SOC	SV	-	-	-	No	NA
Coastal tailed frog	*Ascaphus truei*	SOC	SV	-	-	-	No	NA
Larch Mountain salamander	*Plethodon larselli*	SOC	SV	-	-	-	No	NA
Northern red-legged frog	*R. aurora aurora*	SOC	SV	-	-	-	No	NA
Northern Pacific pond turtle	*Actinemys marmorata marmorata*	SOC	SC	-	-	-	No	NA
Oregon slender salamander	*Batrachoceps writorum*	SOC	SV	-	-	-	No	NA
Oregon spotted frog	*R. pretiosa*	SOC	SC				No	NA
Western painted turtle	*Chrysemys picta bellii*	SOC	SC	-	-	-	Yes	NA
Fish								
Resident and coastal cutthroat trout (Columbia River ESU)	*O. clarki*	SOC	SV	X	X	X	Yes	NA
Green sturgeon (northern DPS)	*A. medirostris*	SOC	-	-	-	X	Yes	NA
Pacific lamprey	*Lampetra tridentatus*	SOC	SV	X	X	X	Yes	NA
Western brook lamprey	*L. richardsoni*	SOC	SV	X	X	X	Yes	NA
Plants								
Barrett's penstemon	*Penstemon barrettiae*	SOC	-	-	-	-	No	NA
Cliff paintbrush	*Castilleja rupicola*	SOC	-	-	-	-	No	NA
Cold-water corydalis	*Corydalis aquae-gelidae*	SOC	-	-	-	-	No	NA
Henderson's checker-mallow	*S. hendersonii*	SOC	-	-	-	-	No	NA

Table 3.8-5 Species with Federal and/or State Status Potentially Occurring in the Project Vicinity

Common Name	Scientific Name	Federal Status	State Status	Tryon Creek	Stephens Creek	Willamette River	Occurs in Project Study Area	Critical Habitat in Study Area
Howell's bentgrass	*Agrostis howellii*	SOC	-	-	-	-	No	NA
Howell's daisy	*E. howellii*	SOC	-	-	-	-	No	NA
Oregon fleabane	*E. oreganus*	SOC	-	-	-	-	No	NA
Pale blue-eyed grass	*Sisyrinchium sarmentosum*	SOC	-	-	-	-	No	NA
Peacock larkspur	*D. pavonaceum*	SOC	-	-	-	-	No	NA
Snake River goldenweed	*Pyrrocoma radiata*	SOC	-	-	-	-	No	NA
Thin leaved peavine	*Lathyrus holochlorus*	SOC	-	-	-	-	No	NA
Willamette Valley larkspur	*D. oreganum*	SOC	-	-	-	-	No	NA

Table Key: DPS = Distinct Population Segment, ESU = Evolutionarily Significant Unit, SOC = Species of Concern, LT = Listed Threatened, LE = Listed Endangered, C = Candidate, SC = Sensitive Critical, SV = Sensitive Vulnerable, DL = De-listed.
Sources: USFWS (2009a); USFWS (2009b); PNW Ecosystem Research Consortium (2002); StreamNet (2010); City of Portland (2007); ODFW (2002); NMFS (2007). Streamnet (2010).
[1] Essential Fish Habitat, as designated under the Magnuson-Stevens Fishery Conservation Management Act, exists for these species in the project area.

The USFWS identified three federal TES plants species that may occur within Multnomah County[76] and five federal TES plant species that may occur within Clackamas County.[77] The ORNHIC database identified five state and federal TES botanical species within the two-mile search area. The majority of recorded occurrences are outside of the 250-foot wide study corridor. Of those species potentially occurring within the 250-foot study corridor, several are historic records and represent species that are not likely still within the project area. Field investigations did not observe any TES plant species within the study area. Additional literature search and contact with state resource agencies identified botanical TES and terrestrial species that may occur in the study corridor, but were ruled-out upon further investigation. Species ruled-out are discussed fully in the *Lake Oswego to Portland Transit Project Ecosystems Technical Report* and indicated in Table 3.8-5 as not occurring in the project study area.

[76] U.S. Fish and Wildlife Service (USFWS). 2009. Federally Listed, Proposed, Candidate Species and Species of Concern Under the Jurisdiction of the Fish and Wildlife Service which may occur in Multnomah County, Oregon. Northwest Habitat Field Office. Portland, Oregon. Last updated May 16, 2009.
[77] USFWS. 2009. Federally Listed, Proposed, Candidate Species and Species of Concern Under the Jurisdiction of the Fish and Wildlife Service which may occur in Clackamas County, Oregon. Northwest Habitat Field Office. Portland, Oregon. Last updated May 16, 2009.

The USFWS, ORNHIC and ODFW identify five TES wildlife species that may occur within the project vicinity. Of these, four are avian species and one is a turtle. For purposes of this assessment, the Western painted turtle is assumed to be impacted by those project activities that affect either aquatic or terrestrial, riparian habitats. Analysis of aquatic and terrestrial habitats presumes the potential to impact the painted turtle, unless specifically excluded. Of the avian species identified, both peregrine falcon and bald eagle have nested in the project vicinity, though documented nests occur outside the quarter-mile threshold for noise disturbance resulting in take.[78,79,80] Consequently, project activities may affect forage and perch habitat, but are unlikely to directly result in impacts to nesting habitats. It is possible that both band-tailed pigeons and olive-sided flycatchers utilize habitat in the project study area for nesting, foraging and cover/movement.

The list of TES species considered as likely to occur in the study area or potentially impacted by project construction and/or operation, include those identified in Table 3.8-6, below.

Table 3.8-6 TES Species Likely Occurring in the Project Vicinity

Common Name	Federal Status	State Status
Lower Columbia River Coho Salmon ESU	LT	LE
Lower Columbia River Steelhead DPS	LT	SC
Upper Willamette River Steelhead DPS	LT	SV
Lower Columbia River Chinook Salmon ESU	LT	SC
Upper Willamette River Chinook Salmon ESU	LT	-
Green Sturgeon (southern DPS)	LT	-
Bald eagle	DL	LT
Band-tailed pigeon	SOC	-
Olive-sided flycatcher	SOC	SV
Peregrine falcon	DL	SV
Western painted turtle	SOC	SC
Columbia River cutthroat trout ESU	SOC	SV
Green Sturgeon (northern DPS)	SOC	-
Pacific lamprey	SOC	SV
Western brook lamprey	SOC	SV

Table Key: DPS = Distinct Population Segment, ESU = Evolutionarily Significant Unit, SOC = Species of Concern, LT = Listed Threatened, LE = Listed Endangered, SC = Sensitive Critical, SV = Sensitive Vulnerable, DL = De-listed.
Sources: USFWS (2009a); USFWS (2009b); PNW Ecosystem Research Consortium (2002); StreamNet (2010); City of Portland (2007); ODFW (2002); NMFS (2007). Streamnet (2010).

[78] ORNHIC. December 9, 2009. Data system search for threatened and endangered plant and animal records for the Lake Oswego to Portland Transit Project.
[79] Oregon Department of Transportation (ODOT). 2008. Endangered Species Act Guidance Manual. ODOT Geo-Environmental Section. Salem OR. June 2008.
[80] Isaacs and Anthony. 2009. Bald eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1971 through 2008. Oregon Cooperative Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University. Corvallis, Oregon.

3.8.3 Environmental Impacts to Ecosystems

This section provides the analyses of potential environmental consequences to ecosystem resources from the study alternatives as described in Chapter 2. The effects could include long-term (during operations), short-term (during construction) and cumulative effects to ecosystem resources. Construction effects are discussed separately in Section 3.16 of this DEIS. Further analysis of specific effects, such as precise volumes of removal/fill activities, precise areas of vegetation removal, and hydraulic effects on streams, will be further evaluated during the preliminary engineering phase and during the natural resource permitting processes.

3.8.3.1 No Build Alternative

Long-Term Direct Effects

The No-Build Alternative would not include new transit construction and, therefore, would have no direct impacts to wetlands, vegetation, wildlife, fisheries or TES species or habitats.

Long-Term Indirect Effects

Potential indirect effects associated with the No-Build Alternative could include increased pollutant loading associated with increasing traffic and congestion on roadways throughout the project area. Increased congestion accelerates brake pad wear and, because brake pads contain metals such as copper and zinc, increased wear results in increased deposition of metals on roadways and parking lots. These pollutants subsequently are transported to project-area streams and wetlands by stormwater runoff. The same rationale applies to other motor vehicle pollutants such as oil and grease, whose deposition on impervious areas and concentrations in stormwater runoff also increase with increasing traffic and congestion. While traffic and congestion would increase over time with all project alternatives, the No-Build Alternative would be associated with worse congestion than the Enhanced Bus or Streetcar alternatives.

Furthermore, most of the area’s transportation facilities and adjacent developments were built prior to current stormwater management practices. Therefore, pollutant loading in stormwater runoff from impervious surfaces would continue to flow untreated or undertreated to project area streams and wetlands until redevelopment occurs (See Section 3.9.3.4 for further discussion of potential effects to water quality/water quantity).

It is possible for the No-Build Alterative to result in long-term degradation of aquatic resources as a result of incremental habitat impacts associated with the existing conditions. Should the No-Build Alternative become the Locally Preferred Alternative, no measures retarding long-term indirect impacts associated with increasing peak hour vehicle trips would be implemented. Consequently, fish habitat would be incrementally impaired as a result of continuing stormwater pollutant loading. Untreated and undertreated stormwater runoff would have long-term negative impacts on fishes and fish habitats. Furthermore, culverts passing under the rail alignment may constitute a barrier to upstream fish passage, particularly in the Sellwood Bridge Segment. The No-Build Alternative would not provide this opportunity to replace these culverts with structures designed to allow for fish passage.

The No-Build Alterative could result in impacts to aquatic TES species’ habitats as a result of incremental habitat impacts associated with the existing conditions. Should the No-Build Alternative become the Locally Preferred Alternative, no measures regarding long-term indirect impacts associated with increasing peak hour vehicle trips would be implemented. Consequently, TES aquatic habitat would be incrementally impaired as a result of continuing stormwater pollutant loading. Untreated and undertreated stormwater runoff would have long-term negative impacts on TES fishes and turtles, including critical habitats (where designated). Furthermore, culverts passing under the rail alignment may constitute a barrier to upstream fish and turtle passage, particularly in the Sellwood Bridge Segment. The No-Build Alternative would not provide the opportunity to replace these culverts with structures designed to allow for fish or small animal passage. The No-Build Alternative would have no effect on avian TES species or their habitat.

While no Section 7 ESA consultation would occur under the No-Build Alternative, it is anticipated that it could affect, and is likely to adversely affect, TES fish and turtle species within the study area and connected aquatic habitats. It would not destroy or adversely modify designated critical habitat; however, it is likely to adversely affect essential fish habitat (EFH), primarily because the existing conditions incrementally degrade, over time, the aquatic habitats used by Magnuson-Stevens Fisheries Conservation Act (MSA)-regulated species.

Cumulative Effects

It is projected that there will be slow to moderate new development and some redevelopment in the Portland central city, South Waterfront area, Johns Landing/North Macadam area and in the Lake Oswego town center. The Foothills District located within the Lake Oswego town center is also expected to redevelop in the future. Future plans include mixed-use development with associated urban infrastructure such as new roadway network. Additionally, bicycle and pedestrian facilities associated with the proposed construction of the Portland to Lake Oswego Trail Project, may provide non-motorized vehicular facilities within the study area. Planned projects include street improvements and a new bridge over Tryon Creek. However, use of such a trail system for peak hour travel is expected to have only minimal effects on overall traffic patterns and congestion. It is unlikely that these actions would result in large amounts of vegetation removal.

In addition, the metropolitan area will likely continue to develop pursuant to existing land use and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources. Cumulative effects of the No-Build Alternative may occur as a result of any or all of the past, present and reasonably foreseeable future infrastructure and development projects. Over time, these factors have reduced the extent and diversity of the region’s ecosystems. The No-Build Alternative could exacerbate the decline of ecosystem health by failing to slow the increase in personal automobile usage in the region and encouraging growth in a manner that is inconsistent with regional density goals. As previously discussed, increased motor traffic on Highway 43 may lead to a degradation of wetlands and streams within the project due to increased pollutant loading. The No-Build Alternative would not create these opportunities to treat additional runoff prior to discharge to area waterbodies.

3.8.3.2 Enhanced Bus Alternative

Long-Term Direct Effects

The Enhanced Bus Alternative would not result in long-term direct effects to wetlands, vegetation, or wildlife, fisheries or TES species or habitats. It would change the existing bus service by eliminating some stops and increasing frequency without major modification to existing roadway infrastructure. An additional two-way road between the proposed 300-space park-and-ride lot and Foothills Road would accommodate some commuter traffic. The park-and-ride facility would be located within the existing Lake Oswego Village shopping center parking area, where no significant ecosystem resources exist.

Long-Term Indirect Effects

Long-term indirect effects of the Enhanced Bus Alternative could increase transit ridership and could reduce the projected increase in peak hour vehicle use by commuters as the population and development increases. The Enhanced Bus Alternative would utilize existing infrastructure (roadway, bus stops) to improve transit. With the exception of a new park and ride facility, no additional impervious surface would be added. However, the buses would operate within a congested corridor, thus contributing to increased adverse effects of traffic and congestion on roadways in the study area. Increased congestion could result in increased deposition of pollutants such as metals, oil and grease on roadways and these pollutants would subsequently be transported to area streams and wetlands by stormwater runoff. Compared with the No-Build Alternative, this alternative may result in a long-term benefit to water quality by reducing the number of peak hour vehicle trips and reducing overall traffic and congestion within the project corridor. With a reduction in vehicles and congestion on Highway 43, fewer pollutants would be added to roadway runoff, compared with the No-Build Alternative (See Section 3.9.3.4 for further discussion of potential effects to water quality/water quantity). Similar to the No-Build Alternative, the Enhanced Bus Alternative would not provide the opportunity to replace culverts passing under the rail alignment in the Sellwood Bridge Segment with structures designed to allow for fish and turtle passage compared to the Streetcar Alternative. The Enhanced Bus Alternative would have no effect on avian TES species or their habitat.

Section 7 ESA consultation may not be required under the Enhanced Bus Alternative; however, based on preliminary information, it is anticipated that the Enhanced Bus Alternative may affect, and is likely to adversely affect, aquatic TES species within the project corridor and connected aquatic habitats as a result of incremental degradation of water quality from stormwater pollutants. It would not destroy or adversely modify designated critical habitat; however, it is likely to adversely EFH, primarily because the existing conditions incrementally degrade, over time, the aquatic habitats used by MSA-regulated species.

Cumulative Effects

As discussed above for the No-Build Alternative it is expected that there will be slow to moderate new development and some redevelopment in the Portland central city, South Waterfront area, Johns Landing/North Macadam area and in the Lake Oswego town center, including redevelopment of the Foothills District. Cumulative impacts from the Enhanced Bus Alternative may produce positive effects by reducing overall daily, peak hour vehicle trips, thereby reducing additional stormwater pollutants to local wetlands or waterways. This consequence is regarded as a positive effect of the Enhanced Bus Alternative. Additionally, bicycle and pedestrian facilities associated with the proposed construction of the Portland to Lake Oswego Trail project, may provide non-motorized vehicular transportation alternatives within the project corridor. However, use of such a trail system for peak hour transit is expected to have minimal effects on overall traffic patterns and congestion.

Potential cumulative impacts to vegetation include additive impacts from proposed projects that have been, or will be, constructed in the area. These impacts include the temporary and permanent removal of vegetation, as a result of other projects within the corridor. Indirect cumulative impacts also include modification of soils, hydrology, or other existing growing conditions, and an increase in noxious weeds due to disturbance. Past projects altered the area from a natural habitat to its current condition. Planned projects include street improvements and development of a pedestrian and bike trail connecting Lake Oswego and Portland including a new bridge over Tryon Creek. It is unlikely that these actions would result in large amounts of vegetation removal. In addition, the metropolitan area will likely continue to develop pursuant to land and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources.

3.8.3.3 Streetcar Alternative

3.8.3.3.1 Wetlands

Direct impacts to wetlands and jurisdictional waters would be avoided and minimized to the extent practicable in accordance with relevant state and federal regulations and Executive Order 11990. Estimated direct long- and short-term impacts to wetlands and waterways are in Table 3.8-7. Construction effects are discussed separately in Section 3.16. Wetland locations are shown in Figure 3.8-1. Long-term impacts to wetlands would be minor, totaling 0.11acres (approximately 4,792 square feet). Impacted wetlands would result in minimal loss of water quality functions and loss of low-quality habitat for amphibians and insects.

The indirect impacts of the Streetcar Alternative to wetlands would be negligible due to the existing impervious development upslope of the proposed streetcar. By improving ridership, the Streetcar Alternative would reduce the number of additional peak hour vehicle trips by commuters as population and development increases. Additional impervious surfaces would have a minor affect on groundwater storage and associated base flow support to creeks that cross the alignment.

Cumulative impacts to wetlands from implementation of the Streetcar Alternative may result in a positive effect on waters compared to the No-Build Alternative. The streetcar would likely result in fewer peak hour vehicle trips than the No-Build Alternative. Increased use of mass transit would result in a reduction in loading of stormwater pollutants to local waterways and wetlands from adjacent roadways due to less traffic and congestion (See Section 3.9.3.4 for further discussion of potential effects to water quality/water quantity). Areas of new construction or redevelopment would require construction of stormwater treatment systems to meet current standards for water quality prior to discharge. Local wetland inventories map few wetlands within the vicinity of the Streetcar Alternative that would be impacted by reasonably foreseeable future development.

Table 3.8-7 Wetland and Waterway Impacts by Segment and Design Option[1]

Segment	Design Option	Wetland Affected	Acres of Temporary Wetlands Impacts	Acres of Permanent Wetlands Loss
Potential Wetland Impacts				
1 - Downtown Portland	None	NA	0.00	0.00
2 - South Waterfront[2]	None	Wetland "A"	0.07	0.07
3 - Johns Landing	Willamette Shore Line	Wetland "B"	0.01	0.01
	Macadam In-Street	Wetland "B"	0.01	0.01
	Macadam Add'l Lane	Wetland "B"	0.01	0.00
4 - Sellwood Bridge[3]	None	Wetland "C"	0.03	0.02
5 - Dunthorpe/Riverdale	Willamette Shore Line	Wetland "D"	0.01	0.01
	Riverwood In-Street	Wetland "D"	0.01	0.01
6 - Lake Oswego	UPRR	none	0.00	0.00
	Foothills	none	0.00	0.00
	Maximum Possible Impacts		0.12	0.11
Potential Waterway Impacts				
Segment	**Design Option**	**Acres of Temporary Jurisdictional Open Waters Impacts**	**Acres of Permanent Jurisdictional Open Waters Impacts**	**Acres of Temporary Jurisdictional Culverted Waters Impacts**
1 - Downtown Portland	None	NA	NA	NA
2 - South Waterfront[2]	None	0.01	0.01	0.00
3 - Johns Landing	Willamette Shore Line	0.00	0.00	0.00
	Macadam In-Street	0.00	0.00	0.00
	Macadam Add'l Lane	0.00	0.00	0.00
4 - Sellwood Bridge[3]	None	0.03	NA	0.01
5 - Dunthorpe/Riverdale	Willamette Shore Line	0.05	NA	0.01
	Riverwood In-Street	0.05	NA	0.01
6 - Lake Oswego	UPRR	0.10	NA	0.01
	Foothills	0.10	NA	0.00
	Maximum Possible Impacts	0.19	0.01	0.03

Source: DEA Impact Analysis of URS GIS data, Fall 2009.

[1] All acreages based on field delineation conducted by URS.No jurisdictional determination has been made on the wetlands and waterways delineated by URS; some of the impacts may be to non-jurisdictional waters. All impacts calculated using GIS. Temporary impact footprint = construction limits. Permanent impact footprint = conservative estimate of all new development.

[2] The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and Moody/Bond Couplet are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

[3] The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. The Willamette Shore Line and New Interchange are considered phasing options rather than design options. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

3.8.3.3.2 Vegetation

Long-term *direct impacts* to vegetation would primarily result from track realignment and adding a second rail track. It is assumed that impacts to vegetation in high/medium density development would be limited to incidental removal of ornamental trees. In low-density residential and park settings, tree removal may be more extensive, including contiguous vegetation patches with high habitat values, depending on the vegetation density within right of way. The majority of the impacts would occur between the Sellwood Bridge and Tryon Creek, where the alignment passes through the mature native and landscaped vegetation of Powers Marine Park and the residential community of Dunthorpe/Riverdale. Where the alignment traverses residential and commercial areas, impacts to vegetation would occur in isolated instances and would not result in the loss of substantial amounts of vegetation. Total vegetation impacts exclude areas of open water (i.e., Willamette River tributaries).

Expansion of the rail ballast in proximity to Willamette Park could result in loss of vegetation, including mature Oregon white oak trees located in Willamette Park. Current estimates of impacts are based on the extent of right of way, which appears to impact the root zone of several white oaks in the park. Pending revised design engineering, species specific impacts will be quantified and avoidance and minimization measures will be developed to limit impacts to these sensitive species and habitats to the degree practicable.

Long-term *indirect impacts* to project area vegetation could result from changes in hydrological/ drainage patterns and in the inability to restore the impacted area to natural conditions. Soil compaction could cause changes in hydrology and the ability of the soil to support new vegetation growth. Vegetation removal would cause loss of habitat, thermoregulation and filtration functions.

Potential *cumulative impacts* to vegetation include additive impacts from proposed projects that have been, or will be, constructed in or near the study area. Direct cumulative impacts include the removal of vegetation as a result of other projects within the study area. Indirect cumulative impacts include temporary vegetation removal, modification of soils, hydrology, or other existing growing conditions, and an increase in noxious weeds due to disturbance.

Past projects have altered the area from a natural habitat to its current condition. Planned projects include street improvements, development of a proposed pedestrian and bike trail connecting Lake Oswego and Portland, including a new bridge over Tryon Creek and the construction of the proposed Fulton Pump Station at Willamette Park. These actions, in conjunction with the proposed streetcar, if selected as the Locally Preferred Alternative, could result in loss of vegetation, including mature Oregon white oak located in Willamette Park. Pending revised design engineering, species specific impacts will be quantified and avoidance and minimization measures will be developed to limit impacts to sensitive species and habitats to the degree practicable. In addition, the metropolitan area will likely continue to develop pursuant to land and zoning regulations, including requirements to protect and mitigate for sensitive environmental resources.

3.8.3.3.3 Wildlife

Long-term *direct impacts* of the Streetcar Alternative would result from realigning and widening the rail line and would include permanent loss of a small amount of habitat, including mature westside coniferous/deciduous forest located in Powers Marine Park and in the residential area of Dunthorpe. This may include areas important to wildlife for breeding, shelter or foraging and may cause some direct mortality to birds, small mammals, invertebrates or other terrestrial organisms. Long-term impacts to wildlife could also occur as a result of proposed retaining walls and fencing along the right of way in Segments 4 and 5. The height of the retaining walls varies from less than one foot to 15 feet in height, not including the fence to be located atop the wall. Figure 3.8-3, depicts a generalized example of changes to the existing conditions as a result of the Streetcar Alternative. The presence of retaining walls could result in animals falling into the rail alignment, resulting in injury or mortality, or becoming trapped within the alignment, possibly resulting in mortality from streetcar activity.

Long-term *indirect impacts* to project area wildlife from the Streetcar Alternative could include disturbance to existing nesting/denning and movement from upland areas near Powers Marine Park, Dunthorpe and Tryon Creek to the Willamette River. The height of the retaining walls and fencing could preclude species movement from adjacent habitats, resulting in an increase in habitat fragmentation and loss of connectivity. This is particularly relevant for species that transit between upland and riparian habitats.

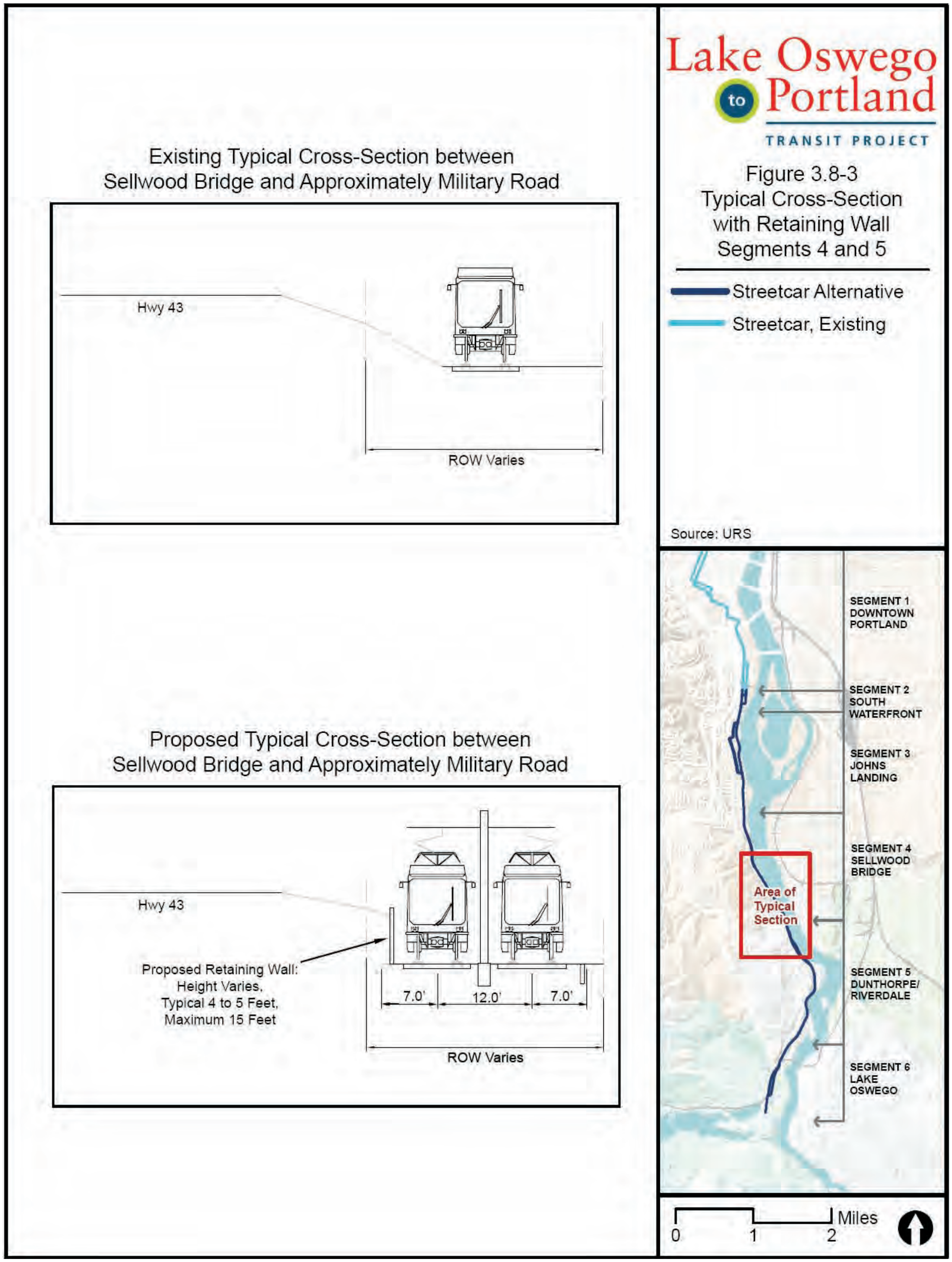
Direct *cumulative impacts* of the Streetcar Alternative could include increased transportation-related disturbance, increased habitat fragmentation, increased incidence of wildlife mortality and permanent vegetation removal to accommodate facilities or other structures. Indirect cumulative impacts include temporary vegetation removal due to construction and modification of soils, hydrology, or other existing growing conditions from other projects. Past projects have developed the area from natural habitats to its current condition. Expected future development would include projects in the financially constrained Regional Transportation Plan and low to moderate levels of residential and commercial development and redevelopment in compliance with adopted plans.

3.8.3.3.4 Fisheries

The Streetcar Alternative may potentially adversely impact fish and fish habitats. Impacts to fish resources include temporary construction impacts within active stream channels to replace culverts; a new crossing structure within the 100-year floodplain of Tryon Creek; and permanent removal of riparian vegetation within the 100-year floodplain of the Willamette River, Tryon Creek, Stephens Creek and several unnamed tributaries to the Willamette River. Specific discussion of direct, indirect and cumulative impacts to fisheries is below.

The Streetcar Alternative has the potential to *directly affect* fisheries resources through stream channel alteration, in-stream work associated with culvert replacement/modification, permanent loss of riparian vegetation to accommodate new structures, changes in rail width and minor decreases in available aquatic habitats. Such impacts are primarily within Segments 3 through 6 - Johns Landing, Sellwood Bridge, Dunthorpe/Riverdale and Lake Oswego. Table 3.8-8 summarizes anticipated impacts of the Streetcar Alternative based on segments and design option.

Stream Channel Modification, In-Stream Work and Reduction of Available Aquatic Habitats. The Streetcar Alternative would involve expanding the existing rail alignment to accommodate an additional parallel rail track through much of the corridor. In most areas, the widening could be accommodated within the existing right of way. In areas where the tracks would be installed in existing streets or other impervious surfaces, primarily Segment 2 (Johns Landing), no direct impacts to existing stream channels are anticipated, as stream channels in this segment are piped underground and would not be disturbed for construction or operations of the Streetcar Alternative. However, in areas where the existing rail alignment would be constructed on rock ballast, the addition of an additional parallel track would require expansion of the rock ballast by approximately 14 feet (on average) through the southern portion of Segment 3 (Johns Landing), all of Segments 4 and 5 (Sellwood Bridge and Dunthorpe/Riverdale) and the majority of Segment 6 (Lake Oswego). In these areas, existing culverts and ditches within the right of way would be replaced to accommodate the expanded ballast width. Expansion of the rock ballast within Segments 3 and 4 may encroach within the 100-year floodplain of the Willamette River and Stephens Creek. Development located within the



Source: Field Surveys and Plan and Profile drawings, URS Biologists and Engineers, January 2010

Table 3.8-8 Summary of Potential Temporary and Permanent Direct Effects to Fisheries-Related Resources by Segment and Design Option

Segment	Design Option	Permanent Stream Channel Alteration	Loss of Aquatic Habitats	Temporary In-Stream Construction Impacts	Permanent Loss of Riparian Habitat
1 - Downtown Portland	None	No	No	No	No
2 - South Waterfront[1]	None	No	No	No	No
3 - Johns Landing	Willamette Shore Line	No	No	No	No
	Macadam In-Street	No	No	No	No
	Macadam Additional Lane	No	No	No	No
4 - Sellwood Bridge[1]	None	Yes	Yes	Yes	Yes
5 - Dunthorpe/Riverdale	Willamette Shore Line	Yes	Yes	Yes	Yes
	Riverwood	Yes	Yes	Yes	Yes
6 - Lake Oswego	UPRR	Yes	Yes	Yes	Yes
	Foothills	Yes	Yes	Yes	Yes

Source: DEA Impact Analysis of URS GIS data, Fall 2009.
[1] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

100-year floodplain can change erosion and deposition patterns, changes in conveyance capacity and reduce the amount of available refuge habitat for species during high water events.

Field investigations identified 56 culvert crossings under the existing rail alignment. These culverts include conveyances for Tryon Creek, Stephens Creek, unnamed tributaries that discharge to the Powers Marine Park (Segments 4 and 5; see Figure 3.8-2), and numerous ephemeral drainage culverts and stormwater conveyance culverts. Sheet CS-040 in the Streetcar Plan Set[81] details all drainage features discovered in the field. Of these culverts, 41 would be replaced or modified as a result of rail construction, including the culverts conveying all eight unnamed tributaries in the Powers Marine Park. Replacement of the Powers Marin Park culverts would require in-stream construction and may require fish exclusion/fish salvage to minimize impacts to aquatic biota during construction. In general, culverts would be replaced in their existing locations, but will be sized appropriately for anticipated conveyance requirements and for fish passage, where appropriate. In most cases, replaced and modified culverts would be longer than the extent culverts, to accommodate the wider ballast footprint.

In the Powers Marine Park area (Segment 4), the culvert replacements of identified tributaries could result in the loss of aquatic habitat due to the longer length of the replacement structures. Analysis of conceptual level design estimates permanent stream habitat losses downstream of culverts to be between zero and 20 linear feet, depending on specific culvert conditions, and total approximately 110 linear feet of stream within the entire segment. As discussed previously, this stream habitat is largely used as off-channel refugia from the Willamette River, during periods of high water. The loss of the upper extent of these streams may not impair or prevent such habitat use, but the loss constitutes a decrease in the total off-channel habitat potentially available to aquatic species.

[81] URS. 2009. *Lake Oswego to Portland Transit Project Streetcar Plan Set*. November 9, 2009. Portland, Oregon.

The proposed design would not alter passage barriers that are associated with Highway 43, but may facilitate passage up to and under the rail alignment. While this will not allow access to any additional habitat, it could allow for future access to upstream habitat should the Highway 43 culverts be modified to allow passage for fish, amphibians and small mammals at a future opportunity. As proposed, culverts would be continuously piped from under Highway 43 under the new rail right of way and discharge to the Willamette River. This proposed alteration would eliminate existing daylighted sections of the streams between Highway 43 and the rail alignment. While this does not effectively eliminate existing fish habitat, it would change the existing conditions. Figure 3.8-4 depicts the anticipated change from existing conditions.

Unlike the No-Build and Enhanced Bus alternatives, the Streetcar Alternative would involve permanent alteration of existing stream habitat and loss of seasonally available fish habitats. Additionally, temporary construction would require in-stream work and may necessitate fish salvage/fish exclusion. Where the No-Build and Enhanced Bus alternatives would result in no changes to existing fish passage barriers, the Streetcar Alternative would allow for the removal of fish passage barriers associated with the rail alignment, allowing for potential future habitat access.

Permanent Riparian Vegetation Loss. Unlike the No-Build and Enhanced Bus alternatives, the Streetcar Alternative would involve permanent loss of riparian vegetation. For the Streetcar Alternative, the expanded ballast needed to support two sets of tracks throughout much of the corridor, the proposed new bridge crossing over Tryon Creek, and new piers for replaced trestle structures would result in the permanent loss of riparian vegetation. The current level of design leaves uncertainty as to the potential permanent loss of riparian vegetation. The anticipated permanent losses (for operations) are expected to be less than the temporary losses (for construction) but cannot be effectively calculated currently. Table 3.8-9 details anticipated temporary losses to riparian habitat resulting from the Streetcar Alternative. The Willamette Shore Line right of way may be relocated and a bridge over Stephens Creek may be required due to the Sellwood Bridge Project. This may impact riparian vegetation, but is outside the scope of this project.

Table 3.8-9 Potential Temporary Riparian Vegetation Loss by Segment and Design Option

Segment	Design Option	Acres of Temporary Riparian Vegetation Impacted
1 - Downtown Portland	None	0
2 - South Waterfront[1]	None	0.02
3 - Johns Landing	Willamette Shore Line	4.06
	Macadam In-Street	3.29
	Macadam Additional Lane	3.29
4 - Sellwood Bridge[1]	None	5.74
5 - Dunthorpe/Riverdale	Willamette Shore Line	0.9
	Riverwood	0.9
6 - Lake Oswego	UPRR	2.16
	Foothills	1.86

Source: All impacts calculated by DEA (2010) using GIS. Permanent impact footprint = proposed right of way within the 100-year floodplain.
[1] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

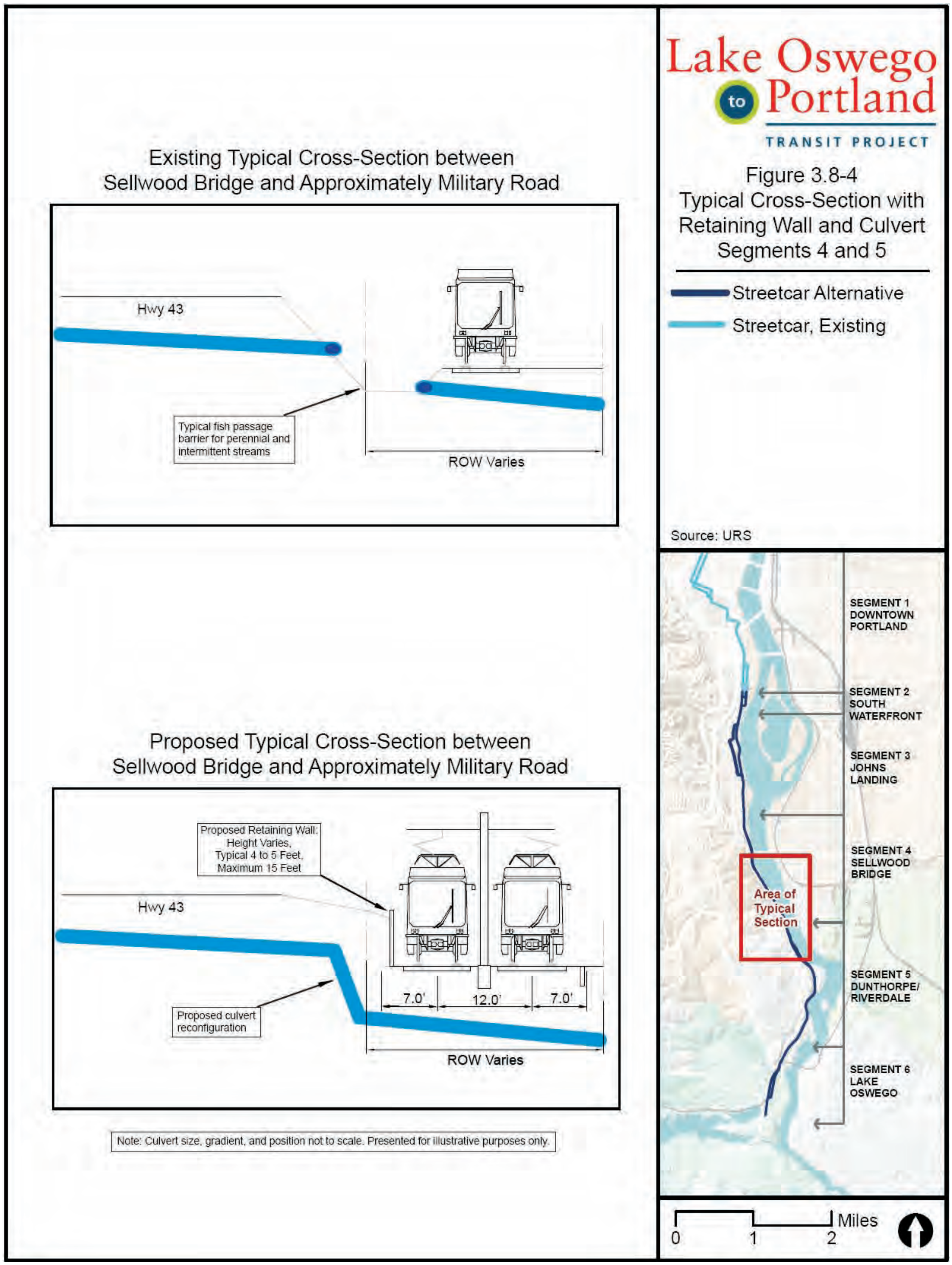


Figure 3.8-4
Typical Cross-Section with Retaining Wall and Culvert
Segments 4 and 5

Source: Field Surveys and Plan and Profile drawings, URS Biologists and Engineers, January 2010

Indirect impacts associated with the Streetcar Alternative that could affect fisheries resources include the creation or modification to stormwater generating surfaces, potential water quality impairment from construction-related erosion and temporary riparian vegetation loss associated with construction activities. Such impacts apply to nearly all segments. Table 3.8-10 summarizes anticipated impacts by segment and design option.

Table 3.8-10 Summary of Potential Temporary and Permanent Direct Effects to Fisheries-Related Resources by Segment and Design Option

Segment	Design Option	New Impervious Surface Area Created	Redevelopment of Existing Impervious Surface Areas	Construction-related Water Quality Impairment	Temporary Loss of Riparian Habitat
1 - Downtown Portland	None	No	Yes	Yes	No
2 - South Waterfront[1]	None	No	Yes	Yes	No
3 - Johns Landing	Willamette Shore Line	Yes	Yes	Yes	No
	Macadam In-Street	Yes	Yes	Yes	No
	Macadam Additional Lane	Yes	Yes	Yes	No
4 - Sellwood Bridge[1]	None	Yes	Yes	Yes	Yes
5 - Dunthorpe/Riverdale	Willamette Shore Line	Yes	Yes	Yes	Yes
	Riverwood	Yes	Yes	Yes	Yes
6 - Lake Oswego	UPRR	Yes	Yes	Yes	Yes
	Foothills	Yes	Yes	Yes	Yes

Source: URS Analysis of Metro GIS data, Fall 2009.

[1] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

Stormwater Management and Impervious Surface Area. The Streetcar Alternative would require the creation of new impervious surface area and redevelopment of existing impervious surface areas within the corridor. For areas of new and redeveloped impervious surface area, stormwater capture and treatment is proposed in compliance with state and local regulations. Redeveloped impervious surface area may result in improvements to receiving waters, as existing impervious surface area that is untreated or undertreated would be brought into compliance with current regulations. Section 3.9, Hydrology and Water Quality discusses new and redeveloped impervious surface area, treatment standards and evaluation by drainages. Table 3.8-11 summarizes the anticipated area of new and redeveloped impervious surface area by segment and design option.

With the Streetcar Alternative, stormwater generated from new and redeveloped impervious surface areas would be treated in compliance with current stormwater guidance. Consequently, the Streetcar Alternative may result in a long-term benefit to water quality, when compared to the No-Build and Enhanced Bus Alternatives, by increasing treatment of redeveloped impervious surface area, reducing the number of peak hour vehicle trips and reducing overall traffic and congestion within the corridor.

Table 3.8-11 New and Redeveloped Impervious Surface Area by Segment and Design Option

Segment	Design Option	Acres of New Impervious Surface Area	Acres of Redeveloped Impervious Surface Area
1 - Downtown Portland	None	--	--
2 - South Waterfront[1]	None	3.54	1.54
3 - Johns Landing	Willamette Shore Line	0.69	0.29
	Macadam In-Street	6.15	0.58
	Macadam Additional Lane	7.20	1.51
4 - Sellwood Bridge[1]	None	0. 00	0.05
5 - Dunthorpe/Riverdale	Willamette Shore Line	0.37	0.22
	Riverwood	2.46	1.58
6 - Lake Oswego	UPRR	2.75	1.75
	Foothills	5.02	2.88
	Maximum Possible Impacts	**18.22**	**7.56**

Source: URS analysis of Metro GIS data, Fall 2009.
[1] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

Cumulative Effects of the Streetcar Alternative. Slow to moderate new development and redevelopment in the Portland central city, South Waterfront, Johns Landing/North Macadam and in the Lake Oswego Town Center is projected to occur throughout the planning horizon of this analysis. Consequently, traffic and congestion are expected to increase within the project corridor as a result of population growth, particularly in regards to peak hour vehicle trips. The Streetcar Alternative would produce positive affects by reducing overall daily peak hour vehicle trips, thereby reducing additional pollutants to local aquatic habitats. Mitigation measures required for impacts to waters / wetlands would further address water quality through upgraded and redesigned crossings, allowing for capture of sediment and pollutants through treatment wetlands adjacent to the tracks or in other appropriate areas (See Section 3.9.3.4 for further discussion of potential effects to water quality/water quantity). Runoff from these reconstructed waterways and wetland areas is anticipated to be cleaner than the existing flow into the Willamette River. This consequence is regarded as a positive effect of this alternative.

3.8.3.3.5 TES Species and Habitats

TES species likely to occur within the project study area that may be impacted by the alternatives considered include fish and turtle species and their aquatic and riparian habitats as well as avian species and their (primarily) forested habitats. For this reason, much of the information presented in this section relative to TES aquatic species is effectively identical to the effects discussed in the Fisheries discussion (Section 3.8.3.3.4). To reduce redundancy, the entire discussion relative to impacts to fishes and aquatic habitats are not repeated here, but summarized. Impacts to avian TES species are addressed in the following section.

Although designs for the Streetcar Alternative are currently conceptual and Section 7 ESA consultation is expected to occur in 2011, it is anticipated that the Streetcar Alternative may affect, and is likely to adversely affect, TES fish species and their habitats. Impacts to aquatic resources include: temporary construction within active stream channels; a new crossing structure within the 100-year floodplain of Tryon Creek; and removal of riparian vegetation within the 100-year floodplain of the Willamette River, Tryon Creek, Stephens Creek and several unnamed tributaries to the Willamette River. This alternative is not likely to destroy or adversely modify designated critical habitat; however, the extent of existing aquatic habitats will be reduced, primarily through culvert extensions and changes in existing surface drainage patterns. This alternative is likely to adversely affect EFH. Project design, construction and conservation measures will be part of the Section 7 ESA consultation with NMFS and USFWS as project planning continues. Discussion of direct, indirect and cumulative impacts on aquatic habitats is presented in Section 3.8.3.3.4, above, and summarized for all TES species below.

Direct impacts associated with the Streetcar Alternative include the potential to directly affect TES aquatic species and their habitats include stream channel alteration, in-stream work associated with culvert replacement/modification, and permanent loss of riparian vegetation to accommodate new structures/rail width. Such impacts are largely contained in Segments 3 through 6 - Johns Landing, Sellwood Bridge, Dunthorpe/Riverdale and Lake Oswego. Table 3.8-12 summarizes anticipated impacts by segment and design option.

Table 3.8-12 Summary of Potential Temporary and Permanent Direct Effects to TES Fish Species and Aquatic Habitats by Segment and Design Option

Segment	Design Option	Permanent Stream Channel Alteration	Loss of Aquatic Habitats	Temporary In-Stream Construction Impacts	Permanent Loss of Riparian Habitat
1 - Downtown Portland	None	No	No	No	No
2 - South Waterfront[1]	None	No	No	No	No
3 - Johns Landing	Willamette Shore Line	No	No	No	No
	Macadam In-Street	No	No	No	No
	Macadam Additional Lane	No	No	No	No
4 - Sellwood Bridge[1]	None	Yes	Yes	Yes	Yes
5 - Dunthorpe/Riverdale	Willamette Shore Line	Yes	Yes	Yes	Yes
	Riverwood	Yes	Yes	Yes	Yes
6 - Lake Oswego	UPRR	Yes	Yes	Yes	Yes
	Foothills	Yes	Yes	Yes	Yes

Source: Impact Analysis of URS GIS data, Fall 2009.

[1] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

With respect to avian TES species, removal of coniferous forested habitat could impact band-tailed pigeon and olive-sided flycatcher habitat, particularly because both species favor edge habitats which are present along the existing rail alignment. Coordination with USFWS will be required to avoid or minimize take of these and other migratory birds during construction. Neither the bald eagle nor the peregrine falcon is documented as nesting within the area proposed for tree removal. However, both species may use the project area for foraging, perching and cover/shelter. Long-term, the impact on avian TES species and their habitat is highly speculative, as project construction could create suitable habitat conditions in portions of the alignment just as easily as rendering existing suitable habitat less suitable. Such impacts may occur in the coniferous and mixed coniferous forested areas found in the Sellwood Bridge, Dunthorpe/Riverdale and Lake Oswego segments.

Unlike the No-Build and Enhanced Bus alternatives, the Streetcar Alternative involves permanent alteration of existing TES aquatic habitats and permanent removal of riparian vegetation. Additionally, temporary construction would require in-stream work and may necessitate fish salvage/fish exclusion. Where the No-Build and Enhanced Bus alternatives would result in no changes to existing fish passage barriers, the Streetcar Alternative would allow for the removal of fish passage barriers associated with the rail alignment, allowing for potential future habitat access.

With the Streetcar Alternative, stormwater generated from new and redeveloped impervious surface areas would be treated in compliance with current stormwater guidance. Consequently, when compared to the No-Build and Enhanced Bus alternatives, the Streetcar Alternative may result in a long-term benefit to water quality by increasing treatment of redeveloped impervious surface area, reducing the number of peak hour vehicle trips and reducing overall traffic and congestion within the corridor. The Streetcar Alternative involves ground disturbing construction, increasing the potential for temporary water quality impairment from turbidity and sedimentation. Unlike the No-Build and Enhanced Bus alternatives, the Streetcar Alternative involves the temporary loss of riparian vegetation.

Indirect impacts associated with the Streetcar Alternative that could affect TES aquatic resources include the creation or modification to stormwater generating surfaces, potential water quality impairment from construction-related erosion, and temporary riparian vegetation loss associated with construction activities. Such impacts apply to nearly all segments. Table 3.8-10 summarizes anticipated aquatic resources impacts by segment and design option.

Indirect impacts on avian TES habitats from the Streetcar Alternative may include modification of adjacent habitats rendering them less suitable/unsuitable for TES species' forage resources, predation avoidance, or disturbing other necessary life cycle activities. Such impacts may occur in the coniferous and mixed coniferous forested areas found in the Sellwood Bridge, Dunthorpe/Riverdale and Lake Oswego segments.

Cumulative effects include slow to moderate new development and redevelopment in the Portland Central City, South Waterfront, Johns Landing/North Macadam and in the Lake Oswego Town Center is projected to occur throughout the planning horizon of this analysis. Consequently, traffic and congestion are expected to increase within the project corridor as a result of population growth, particularly with regard to peak hour vehicle trips. The Streetcar Alternative will produce positive affects by reducing overall daily peak hour vehicle trips, thereby reducing additional pollutants to local TES habitats. Mitigation measures required for impacts to waters and wetlands would further address water quality through upgraded and redesigned crossings, allowing for capture of sediment and pollutants through treatment wetlands adjacent to the tracks or in other appropriate areas (See Section 3.9.3.4 for further discussion of potential effects to water quality/water quantity). Runoff from these reconstructed waterways and wetland areas is anticipated to be cleaner than the existing flow into the Willamette River. This consequence is regarded as a positive effect of this alternative. Improvement in this regard does not constitute a cessation of incremental degradation of aquatic ecosystems used by TES aquatic species.

Cumulative effects on avian TES species are limited to the direct impacts of habitat loss and fragmentation resulting from increased urbanization in the project corridor. Indirect impacts are identical to those associated with habitat loss and fragmentation; i.e. modification of adjacent habitats rendering them less suitable/unsuitable for TES species' forage resources, predation avoidance, or disturbing other necessary life cycle activities. Such impacts are anticipated to be limited due to the level of development already extent in the project corridor and would be restricted to the coniferous and mixed coniferous forested areas found in the Sellwood Bridge, Dunthorpe/Riverdale and Lake Oswego segments.

3.8.4 Potential Mitigation Measures

Mitigation for the project would include attempts to first avoid, then minimize and finally to compensate for all unavoidable impacts. Impact avoidance and minimization would largely be addressed through further project design. Some Streetcar Alternative design options have been modified to reduce impacts to resources. These avoidance and minimization efforts would be continued (with ongoing agency input) through preliminary engineering, final design and construction.

The Enhanced Bus and Streetcar alternatives would mitigate their potential impacts through full compliance with all applicable regulations, as summarized in Table 3.8.1. It should be noted that further refinement of mitigation designs, including determination of the size and location of mitigation features, would occur after the alternative, alignment and/or design options are selected as the Locally Preferred Alternative. Discussions with federal, state and local agencies to determine appropriate mitigation measures will be initiated and will continue during the preliminary engineering stage, including those that may arise from the Section 7 ESA consultation and drafting of the FEIS, and through other permitting processes during final design. Consequently, mitigation measures presented in this section are preliminary and are described in conceptual terms.

The project has identified areas where there is a potential for greater environmental impacts such as stream crossings. In an effort to design a project that first avoids and then minimizes and, where appropriate, mitigates unavoidable impacts, the project team will evaluate different options that meet all local, state and federal requirements. Avoidance and minimization efforts will be developed in on-going coordination with local, state and federal agencies and incorporate the requirements for local, state and federal regulations and permit conditions. Examples include bridges versus culverts, constructability and sequencing.

Where impacts cannot be avoided, mitigation will be developed in coordination with local, state and federal agencies. The project will mitigate detrimental effects to vegetation, waterways and fisheries, including impacts to both habitat quality and quantity, through compliance with federal, state and local regulations and permitting requirements, including conservation recommendations and terms and conditions stipulated in a Biological Opinion and requirements placed as conditions for the sale of land or easements to the project by jurisdictional property owners.

3.8.4.1 Wetlands and Waterways

Due of the limited scale of anticipated wetlands and waterways impacts, wetland and waterway functions would not be difficult to replace in-kind. However, depending on design options selected, in-kind mitigation may require the use of areas beyond the existing right of way. Opportunities for onsite waterway mitigation exist within the Powers Marine Park area (expanding existing waters or enhancement of degraded waters). Other onsite opportunities for mitigating wetland or waterway impacts exist around Stephens and Tryon Creeks. Portions of these creeks could be enhanced by reestablishing a native riparian corridor, creating wetland floodplain, providing in-stream habitat features or improving fish and wildlife access. Similar riparian enhancement of Stephen’s Creek at its confluence with the Willamette River was completed by the City of Portland recently. Enhancement of these on-site waters could occur in concert with fisheries mitigation.

If onsite mitigation is not feasible, off-site mitigation for wetland impacts would likely be required. The corridor is not located within a mitigation bank service area. Therefore, offsite mitigation opportunities are limited to applicant-provided, offsite wetland mitigation or monetary contribution to the Oregon Department of State Land's (DSL's) In-Lieu Fee Program. Project sponsored offsite mitigation could include wetland restoration, creation or enhancement within the Lower Willamette River Subbasin. However, due to the high cost and limited availability of urban land where offsite mitigation could take place, contribution to the DSL's In-Lieu Fee Program account could be the preferred off-site mitigation option. This option is acceptable to the DSL and may be acceptable to the USACE due to the small area of impact.

3.8.4.2 Vegetation

Vegetation impacted by the project would be replaced with native vegetation where appropriate and will be coordinated with regulatory agencies. Potential vegetation mitigation opportunities exist in areas adjacent to and nearby the streetcar alignment. Such opportunities occur in similar locations as described for wetland mitigation above. Coordination with the City of Portland and City of Lake Oswego and other stakeholders in the areas adjacent to the Willamette River and Tryon Creek would also occur to ensure planned restoration and enhancement activities at these sites are supported for the Streetcar Alternative. Additionally, vegetation mitigation could include removal of invasive non-native species and replacement with desirable native species. The City of Portland also requires preservation or replacement of trees over six inches in diameter with similar sized trees.

3.8.4.3 Wildlife and Avian TES Species

The following mitigation measures could be implemented to avoid or reduce potentially adverse impacts to wildlife within the corridor:

- Avoid removal of native vegetation;
- Where native vegetation removal is unavoidable, remove potential bird nest trees outside of nesting season and leave cut trees and large shrubs onsite to provide cover for small mammals, ground-nesting birds and herpetofauna;
- Retain snags and downed woody material;
- Provide for nesting and roosting habitats where practicable for native birds and bats;
- Provide culverts and concrete box structures for small mammal and amphibian passage in order to reduce habitat fragmentation and facilitate movement of small mammals under retaining walls/fences;
- Manage vegetation at culverts targeted for smaller mammal species to encourage the effectiveness of the crossing; and
- Provide terrestrial connectivity between the river and upland habitat communities by incorporating design elements that promote passage by terrestrial and aquatic species.

3.8.4.4 Fisheries Resources and TES Species

Impacts to aquatic TES species, fish species, and aquatic and riparian habitats are likely to occur, but avoidance or minimization of impacts to riparian areas, waterways and native, treed habitats could reduce negative effects. Additional mitigation measures would likely be developed in coordination with regulatory agencies and project sponsors during Section 7 EPA consultation. Through the consultation process, the project team could mitigate impacts by:

- Developing alignment refinements and designs that avoid and minimize impacts to TES species;
- Identifying elements of the project that could enhance habitat and fish production to compensate for unavoidable impacts, such as:
  - Restoring shallow-water habitat in the lower Willamette River,
  - Upgrading culverts and other passage constraints on smaller streams so that they are fish passable,
  - Removing invasive vegetation and replacement with native species,
  - Planting of large, native trees in riparian areas for shading and large woody debris recruitment,
  - Replacing or restoring off-channel riparian and floodplain habitat,
  - Integrating of pervious pavement where practical,
  - Designing infrastructure elements within floodplains to reduce stranding of fish during flood events, and
  - Implementing enhanced treatment for stormwater;
- Reviewing listed species recovery plans to determine if conservation measures could be implemented to support management recommendations and recovery efforts;
- Coordinating planned restoration and enhancement efforts and locations with the plans and proposals of other parties active in the watershed;
- Removing existing abandoned piles in water;
- Developing construction practices that minimize unavoidable impacts, such as in-water work timing, isolation of in-water work areas when practical and erosion and sediment control; and
- Implementing fish exclusion and fish salvage actions, as required to preclude TES species from active in-stream work areas.

3.9 Hydrology and Water Quality

This section describes the analysis and anticipated effects of the Lake Oswego to Portland Transit Project's alternatives on hydrology, water quality and floodplains. Water bodies within the vicinity of the project include the Willamette River, Tryon Creek and Stephens Creek. Tryon Creek and Stephens Creek are both tributaries of the Willamette River. Terwilliger Creek also passes through the project study area, but the lower portion has been piped under the developed portion of Johns Landing. Because of this, Terwilliger Creek has not been evaluated for project-related effects.

This section summarizes the *Lake Oswego to Portland Transit Project Hydrology and Water Quality Technical Report* (URS/DEA and TriMet/Metro, November 2010). Additional information on the hydrology and water quality technical analysis methods, agency consultation, expected effects of the study alternatives and potential mitigation measures can be found in the technical report.

3.9.1 Introduction, Approach and Methodology and Applicable Regulations

Project-related changes to water quality, hydrology and floodplains are primarily a function of changes to impervious surface area, stormwater runoff characteristics and fill in floodplains or water bodies resulting from study alternatives and design options.

3.9.1.1 Approach and Methodology

The technical analysis methods for the water quality evaluation are based primarily on FHWA procedures, as identified in *Pollutant Loadings and Impacts from Highway Storm Water Runoff* (FHWA-RD-88-006, April 1990).

The study has evaluated possible effects in the Lower Willamette Subbasin including areas that either discharge to the Lower Willamette River directly or via small, unnamed tributaries. Areas within the Stephens Creek and Tyron Creek subbasins are also evaluated and effects are documented. Effects related to water quality, hydrology and floodplains have been estimated based on evaluation of the alternatives as defined in Chapter 2 of this DEIS, regulatory guidance and best professional judgment. Direct, indirect and cumulative effects have been assessed and documented in the following section. Short-term or temporary effects related to construction have been evaluated and are documented in Section 3.16 Construction Effects. For purposes of this analysis, the project area was assumed to extend 125 feet out from the proposed project alignment centerline (creating a 250-foot wide study corridor). For the Streetcar Alternative, the analysis documents the expected effects as a range in projected water quality effects (high and low) as associated with the various design options. Any combination of the design options would result in water quality effects between the two extremes. The No-Build and Enhanced Bus alternatives do not have design options.

Water quality is a function of the deposition of pollutants on surface areas that allow for the conveyance and discharge of such pollutants (i.e., impervious surfaces). Consequently increases in impervious surfaces could result in changes to water quality. The analysis of water quality effects estimated the projected increase in annual loading and pollutant concentrations from the additional impervious area that would be added by the project alternatives. The analysis provides information related to predicted in-stream pollutant concentrations and increases in pollutant concentrations resulting from runoff from the project alternatives.

Impervious surfaces can prevent the direct infiltration of stormwater runoff, resulting in changes in **hydrology**. The addition of impervious surface area could result in increased runoff volume and peak flows discharging to public stormwater conveyance systems and waterways.

Effects to **floodplains** could include encroachment on 100-year floodplains of affected watersheds. For this analysis, the 100-year floodplain was defined as the boundaries established by Metro in response to the 1996 flood event in the Portland metropolitan area. Project improvements within floodplain areas can result in a loss of flood storage area, which can exacerbate flooding during high-flow events. The effect to the 100-year floodplain has been estimated by examining the area of expected project improvements within the floodplain for each alternative and design option.

3.9.1.2 Applicable Regulations

Water resources in the project area are protected by federal, state and local regulations addressing stormwater quality and quantity and restrictions on modifying floodplains. In general, regulations governing stormwater quality and quantity have been developed and implemented primarily at the local and state level, while floodplain regulations (e.g., Executive Order 11988 – Floodplain Management) are developed at the federal level and implemented at the local level. The State of Oregon does not have specific stormwater quantity control or floodplain development guidelines; however, under authority of the U.S. Environmental Protection Agency (EPA), it implements federal water quality regulations. The City of Portland, City of Lake Oswego, Multnomah County and Clackamas County regulate water quantity and quality through standards for new development and redevelopment.

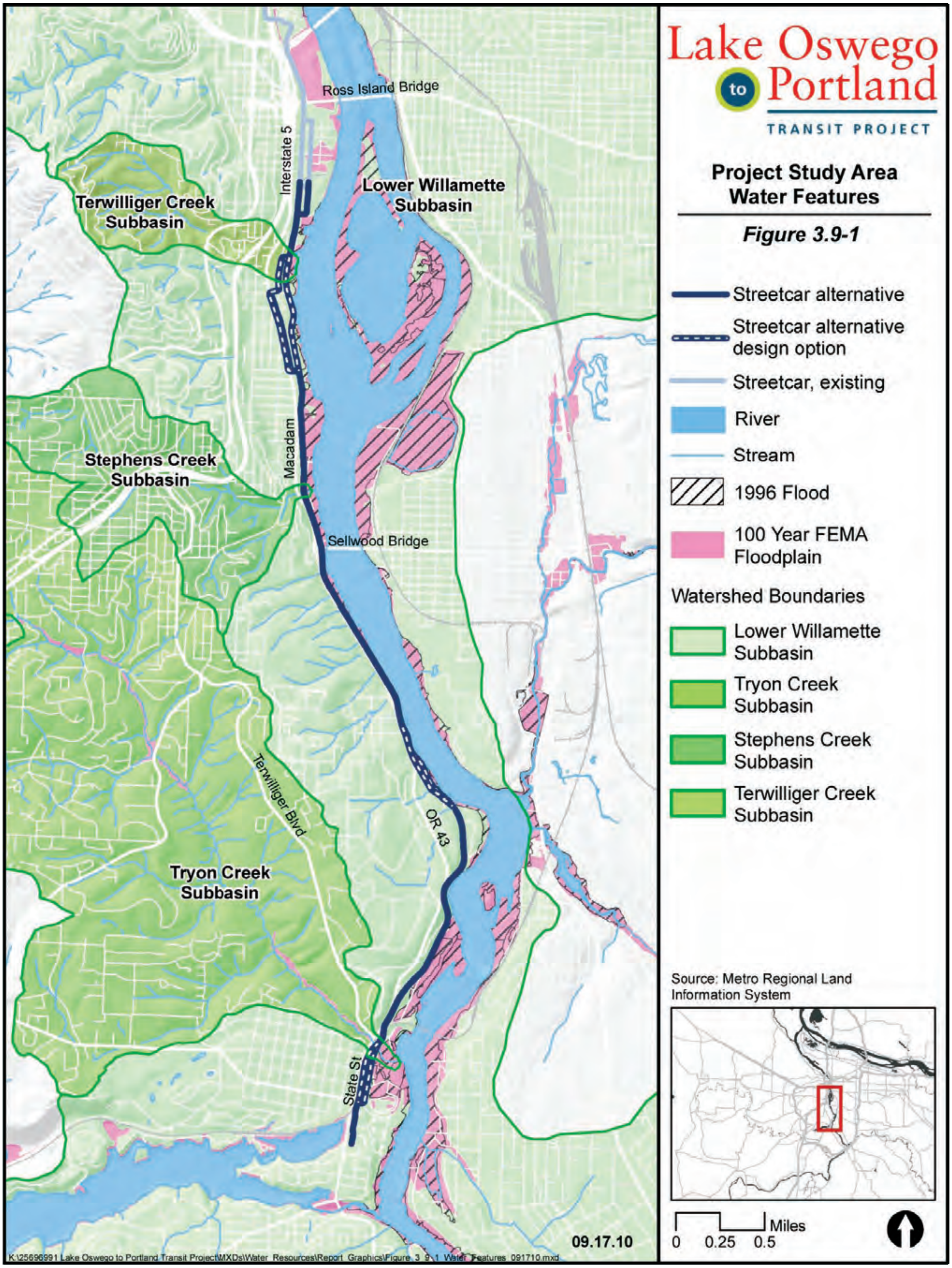
Generally, the regulations and standards intend to accomplish the following:

- Maintain predevelopment flow rates and timing (known as the hydrograph);
- Prevent flooding conditions from worsening;
- Protect new facilities constructed in the floodplain from damage; and
- Protect water quality.

3.9.2 Affected Environment

The study corridor is located in the Lower Willamette River Subbasin (refer to Figure 3.9-1). Existing land use in the vicinity of the project area is primarily urban. Current land use includes single-family residential with pockets of other urban land use types (e.g., multifamily residential, mixed-use commercial and industrial). Additionally, the study corridor crosses through several parks and open spaces.

Much of the study area in and adjacent to the project improvements is developed with significant impervious surface coverage, such as streets, roofs and parking areas. Impervious surfaces affect the hydrology of a basin and the water quality within its receiving streams because they provide a medium for collecting pollutants and a conveyance mechanism for efficiently transporting these pollutants to local streams. Consequently, a primary indicator of a potential project's effect on hydrology and water quality is the amount of impervious surface area that could be added or converted to a higher intensity use.



Lake Oswego to Portland
TRANSIT PROJECT
Project Study Area
Water Features
Figure 3.9-1
Streetcar alternative
Streetcar alternative design option
Streetcar, existing
River
Stream
1996 Flood
100 Year FEMA Floodplain
Watershed Boundaries
Lower Willamette Subbasin
Tryon Creek Subbasin
Stephens Creek Subbasin
Terwilliger Creek Subbasin
Source: Metro Regional Land Information System
Miles
0 0.25 0.5
Ross Island Bridge
Interstate 5
Lower Willamette Subbasin
Terwilliger Creek Subbasin
Macadam
Stephens Creek Subbasin
Sellwood Bridge
Terwilliger Blvd
OR 43
Tryon Creek Subbasin
State St
09.17.10

3.9.2.1 Hydrology

The study corridor is within the Lower Willamette River Subbasin and includes Tryon Creek and Stephens Creek, which are tributaries to the Willamette River, as well as several additional unnamed tributaries to the Willamette River and within the Lower Willamette River Subbasin. These features are shown on Figure 3.9-1. Three basins are discussed in this analysis: the Lower Willamette Subbasin, the Tryon Creek Subbasin and the Stephens Creek Subbasin. As mentioned above, Terwilliger Creek passes through the project study area, but has not been evaluated for project-related effects because it has been piped under the developed portion of Johns Landing.

Topography within the project area slopes from west to east, and runoff from Highway 43 and other upstream areas is directed downslope towards the existing railroad tracks via storm drains or overland flow, where it is frequently collected in trackside ditches and culverts. Fifty-four existing culverts that convey runoff underneath the existing tracks were identified during field reconnaissance. The majority of these culverts are buried, blocked or damaged such that they do not provide adequate conveyance. These culverts either discharge to the top of slope on the east side of the tracks prior to discharging to the Willamette River via overland flow or discharge to the Willamette River directly. Predominant soils in the project area are within hydrologic class C or D and do not have favorable infiltration potential.[82]

Willamette River. The Lower Willamette River Subbasin covers approximately 261,120 acres and is highly urbanized with residential, commercial, industrial and recreational land use.[83] Portions of the lower Willamette River have been channelized, with much of its banks either constrained by riprap or the Portland seawall. Most of the river's original off-channel and floodplain habitat has been eliminated or is highly degraded, and its channel largely lacks topographic and habitat diversity. The river is regulated by 11 multipurpose flood control/recreation/hydropower reservoirs, all located upstream of the project area and operated by the U.S. Army Corps of Engineers (USACE). These facilities have substantially altered the hydraulics of the River compared to its original state.[84] Table 3.9-1 summarizes average flow and flood flows in cubic feet per second (cfs) in the Willamette River in the vicinity of the project area.

Table 3.9-1 Estimated Average Flows for Project Area Streams

Water body	Average Flow (cubic feet per second)
Willamette River[1]	32,000
Tryon Creek[2]	8.5
Stephens Creek[3]	1.5

Notes: cfs = cubic feet per second.
[1] USGS, 2002, as reported by Metro.
[2] 2008; USGS, 2007.
[3] BES, 2010. This flow represents the average of a range of average flows provided on the BES website for Stephens Creek

[82] Natural Resources Conservation Service (NRCS), 2009. Online Web Soil Survey, Soil Water Features Report. http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm. Accessed November 30, 2009.
[83] Department of Environmental Quality (DEQ), 2006. Willamette Basin TMDL: Chapter 5 Lower Willamette Basin TMDL. September 2006.
[84] South Corridor Portland-Milwaukie Light Rail Project, Water Quality and Hydrology Results Report, Metro: May 2008.

Tryon Creek. The Tryon Creek Subbasin covers an area of approximately 4,200 acres. The Tryon Creek main stem is about seven miles long and flows southeast from its headwaters near Multnomah Village (just north of Interstate 5 and Highway 99W) to its confluence with the Willamette River in the City of Lake Oswego at the Highway 43 crossing. Development in the Tryon Creek Subbasin is concentrated in the upper portion of the watershed and therefore affects the hydrology of the entire main stem of Tryon Creek. The project corridor crosses Tryon Creek near its confluence with the Willamette River, and the creek passes underneath the existing rail tracks via an 8-foot by 8-foot concrete box culvert. The hydrology of the Tryon Creek watershed has been modified by the effects of development and urbanization. The most significant modifications include the loss of native vegetation, including mature forest cover; the increase in impervious surfaces, including travel corridors; and the construction of closed-conveyance drainage systems, including piped storm sewer systems and culverts.

Stephens Creek. The Stephens Creek Subbasin covers an area of approximately 760 acres and runs in a northwest to southeast direction through Southwest Portland. Several areas of the creek have been culverted as it flows through urban areas of Southwest Portland. Land use in the subbasin is dominated by residential, parks and vacant areas, and some commercial land uses. The project corridor crosses Stephens Creek, very near its confluence with the Willamette River, where the creek passes underneath the existing rail tracks via two parallel concrete culverts. The riparian area through this segment of the stream is wooded, with some rocks. Woody debris has been placed in the area as part of a City of Portland habitat restoration project in completed in 2008. The project was intended to improve in-stream, stream bank and floodplain wetland habitat.

3.9.2.2 Floodplains

Portions of the project area are within the regulatory 100-year floodplain for the Willamette River (as shown on Figure 3.9-1). A major flood event occurred in the Portland metropolitan area in February 1996. Flooding during the February 1996 event within downtown Portland was, in many areas, more extensive than the 100-year floodplain area shown on the Flood Insurance Rate Map (FIRM) as shown on Figure 3.9-1. The South Waterfront area floodplain is defined by the extents of the FEMA 100-year floodplain and the February 1996 flood inundation area combined.[85] The South Waterfront area, which includes portions of the project study area, is exempt from Metro Title 3 regulations, which include requirements for balanced cut and fill.

Although the February 1996 flood event caused severe landslide, streambank and streambed damage to Tryon Creek and its tributaries, it did not cause any significant flooding or property damage in the watershed. The effects of flooding will likely remain the same in the future. Changing hydrologic conditions may continue to cause damage to the stream system in the watershed but may not result in any significant flooding of properties.[86]

3.9.2.3 Water Quality

A Total Maximum Daily Load (TMDL) was approved by the Environmental Protection Agency (EPA) in 2006 for the entire Willamette Basin for temperature, bacteria and mercury. This TMDL includes Tryon Creek, specifically, and Stephens Creek as a tributary to the Willamette River. The

[85] South Corridor Portland-Milwaukie Light Rail Project, Water Quality and Hydrology Results Report, Metro: May 2008.
[86] Bureau of Environmental Services (BES). 2005. Fanno and Tryon Creeks Watershed Management Plan.

Willamette River and Tryon Creek are listed on the Department of Environmental Quality's (DEQ's) 2004/2006 list of impaired waterbodies (Section 303(d) of the Federal Clean Water Act) (DEQ, 2009c) Table 3.9-2 presents the 303(d) parameters within the project area.

Table 3.9-2 303(d) 2004/2006 Listed Reaches[1] within Project Area

Water Body	Listed Reaches (RM)[2]	Parameter	Season
Tryon Creek	0 to 5	Temperature	Summer
Willamette River	0 to 186.4	E. Coli	Fall/Winter/Spring
Willamette River	0 to 24.8	Aldrin	Year-round
Willamette River	0 to 24.8	Biological Criteria	Undefined
Willamette River	0 to 24.8	DDT	Year-round
Willamette River	0 to 24.8	Dieldrin	Year-round
Willamette River	0 to 24.8	Fecal Coliform	Fall/Winter/Spring
Willamette River	0 to 24.8	Iron	Year-round
Willamette River	0 to 24.8	Manganese	Year-round
Willamette River	0 to 24.8	Mercury	Year-round
Willamette River	0 to 24.8	PCB	Year-round
Willamette River	0 to 24.8	Pentachlorophenol	Undefined
Willamette River	0 to 24.8	PAH	Year-round
Willamette River	0 to 50.6	Temperature	Year-round

Source: DEQ, 2009c.
[1] Listed reaches are those reaches or portions of reaches listed in the 303(d) 2004/2006 Integrated Report Database, which reports on streams or lakes identified as impaired for one or more pollutants and do not meet one or more water quality standards.
[2] RM = River Mile.

Willamette River. General water quality issues in the portion of the Willamette River located in the project area include aquatic ecosystem degradation, soil erosion from construction, and elevated concentrations of nutrients, synthetic compounds and trace elements (e.g., heavy metals). The Willamette River TMDL was approved by EPA in 2006 for mercury, bacteria and temperature within the Willamette River maintstem (Lower Willamette Subbasin). Additionally, the Willamette River is on DEQ's 303(d) list of water quality limited waterbodies for the following parameters: dieldrin, DDT, DDE, PAHs, aldrin, PCBs, manganese, iron and pentachlorophenol.[87]

Tryon Creek. Water quality issues in the Tryon Creek watershed include elevated temperatures, elevated instream bacteria concentrations and elevated levels of nutrients (phosphorous and nitrogen), especially during storm events.[88] Elevated temperatures are likely the result of low streamflows during the summer months, warmer air temperature resulting from urban heat island effects, reduced riparian vegetation (and consequent lack of stream shading), and stormwater runoff from impervious surfaces exposed to sunlight. The Willamette River TMDL approved by EPA in 2006 also established TMDLs for Tryon Creek for temperature and bacteria.

Stephens Creek. Portions of Stephens Creek run through urbanized areas, and it is subject to stormwater pollutants typical of urbanized areas such as sediments, pesticides, oil and grease, and metals. Stephens Creek is not specifically listed as water quality limited by DEQ; however, as a tributary to the Willamette River it is incorporated into the Lower Willamette Subbasin TMDL for bacteria, mercury and temperature.

[87] DEQ 2009c. 2004/2006 Integrated Report Database. Accessed on November 4, 2009 at http://www.deq.state.or.us/wq/assessment/rpt0406.htm.
[88] Bureau of Environmental Services (BES). 2005. Fanno and Tryon Creeks Watershed Management Plan.

3.9.3 Environmental Consequences

Project-related effects to water resources, specifically hydrology, floodplains and water quality, are discussed below. Long-term effects include direct, indirect and cumulative effects, which are likely to affect the area for the operational life of the project and are discussed below. Short-term effects are those associated with construction and are discussed in Section 3.16 Construction Effects.

The increase in impervious surface is the main indicator used to classify water quality and hydrology effects. Floodplain effects and impacts are primarily determined by estimating the amount of project work and fill that may occur within the floodplain. An increase in impervious surface can have an adverse effect on hydrology and water quality because it collects pollutants and prevents stormwater from entering the ground, therefore increasing runoff volumes and providing a means of conveyance for accumulated pollutants to waterbodies within the project area. Table 3.9-3 provides a summary of the increase in new impervious surface, by alternative and subbasin, which was used to analyze potential effects as discussed in the following sections. Due to the various design options associated with the Streetcar Alternative, the increase in impervious surface is presented as a range.

Table 3.9-3 Percent Increase in Impervious Surface Area, by Basin and Alternative

Basin	Existing Impervious Area in the Basin (No-Build Alternative)	Enhanced Bus Alternative	Streetcar Alternative	
			Minimum	Maximum
Willamette River	27,517[1]	0.002%	0.012%	0.031%
Tryon Creek	1,121[2]	0%	0.010%	0.017%
Stephens Creek	207[2]	0%	0.020%	0.020%

[1] Source: Metro, 2008
[2] Source: Metro, 2009; Clackamas County, 2008

3.9.3.1 Direct Effects to Hydrology

Direct Effects to Hydrology typical of linear development projects include the following:

- Alterations to the stormwater hydrograph (increased volume, altered timing);
- Changes in drainage flow paths, routing and discharge locations;
- Reductions in infiltration capacity; and
- Modifications to channel conveyance capacity.

Most of these effects are directly related to the increase in impervious surface associated with construction of stations, park and ride lots, maintenance facilities and segments of non-ballasted track. These direct hydrologic effects are also related to the encroachment of development on the stream channels as well as changes in drainage patterns. Potential hydrologic effects based on these three indicators were determined for the No-Build, Enhanced Bus and Streetcar alternatives. The new impervious surface area created by the various alternatives is summarized in Table 3.9-3.

No-Build Alternative. The No-Build Alternative represents existing conditions in the project area. The No-Build Alternative would not include new streetcar or bus facilities in the area and associated new impervious surface and, therefore, would not induce project-related effects. There would also be no effect to drainage patterns or channel conveyance capacity. However, in association with hydrologic effects, existing culverts along the existing tracks would not be improved and likely continue to degrade, becoming further blocked.

Enhanced Bus Alternative. The Enhanced Bus Alternative would result in approximately 3.6 acres of new and redeveloped impervious surface. The majority (approximately 80 percent) is redeveloped impervious surface, consisting of a park-and-ride facility and associated access road. Stormwater runoff generated from the new and redeveloped impervious surfaces would likely be intercepted by the existing storm drainage system that currently serves that area and drains to the Willamette River. As part of the design and construction process, the downstream capacity of the existing storm drainage system would be assessed and redesigned as necessary to maintain flow. Therefore, changes to site drainage patterns are expected to be minimal. No new waterbody crossings would be constructed as part of the Enhanced Bus Alternative. All new impervious surface added as a result of the Enhanced Bus Alternative would occur within the Lower Willamette Subbasin.

The amount of new impervious surface that would be added as a result of the Enhanced Bus Alternative (0.8 acres) is negligible compared to the overall size of the basin. This construction would occur within the City of Lake Oswego and per the city's design standards, sufficient storm water detention shall be provided to maintain runoff rates at their natural undeveloped levels (City of Lake Oswego, 2002).

Direct effects associated with hydrology are expected to be negligible due to the small increase in impervious surface associated with the alternative, in adherence to City of Lake Oswego design standards, and the lack of modifications to site drainage patterns and stream encroachments.

Streetcar Alternative. Depending on the design option selected, the Streetcar Alternative would result in between 11.2and 25.8acres of new and redeveloped impervious surface. These impervious areas consist of stations, park-and-ride lots, maintenance facilities and segments of track embedded in concrete pavement. Note that tie and ballast track is considered pervious surface and therefore is not factored into the impervious area estimates. As previously noted, the only Streetcar Alternative design options summarized in this DEIS are those that would result in the minimum and the maximum increases in impervious surface. The range of the percent increase in impervious surface area for each river basin that would be created by the Streetcar Alternative is shown in Table 3.9-3. Table 3.8-11 in Section 3.8 Ecosystems shows the increase in acres of new and redeveloped impervious surface area for each design option.

Rearranging of existing culverts or re-grading to alter existing drainage patterns is not anticipated with the construction of the Streetcar Alternative. However, it is assumed that culverts in disrepair would be replaced or maintained to improve conveyance capacity and provide for fish passage if necessary, and conveyance ditches along the existing tracks would be improved for better conveyance to culverts. (See Section 3.8 for more detail on fish passage issues) This could increase the amount of runoff directed to the culverts; however, the majority of the runoff currently received is from upland areas and thus a noticeable increase in flow associated with construction of the project would not be expected. In several locations along the western boundary of the track alignment, retaining walls are proposed. In these areas, a new drainage ditch on the upslope area of the retaining wall would be constructed, which would intercept runoff from Highway 43 that currently flows into the existing drainage ditches and would convey it to the existing (or replaced) culverts running underneath the track. This is also not anticipated to noticeably increase flows or velocities to the culverts, and hydrologic effects are expected to be minimal. The crossings at Stephens Creek and Tryon Creek are not anticipated to involve construction below the ordinary high water mark (OHWM) (OBEC, 2009); therefore, no hydraulic effects to those creeks are anticipated.

Hydrologic effects associated with the Streetcar Alternative resulting from an increase in impervious surface and projected changes in drainage patterns are expected to be minor, because the Streetcar Alternative would adhere to all applicable stormwater quantity regulations, including providing sufficient storm water detention to maintain runoff rates at their natural undeveloped levels, and the amount of new impervious surface added is very low compared to the overall size of the basins in which it is located.

3.9.3.2 Direct Effects to Floodplains

No Build Alternative. No direct effects related to floodplains would be associated with the No-Build Alternative.

Enhanced Bus Alternative. The Enhanced Bus Alternative would encroach upon approximately 1.3 acres of the FEMA-designated floodplains of the Willamette River. Effects to 100-year floodplains would be analyzed in accordance with local regulations and Executive Order 11988 – Floodplain Management. As required by these regulations, all lost storage would be mitigated by creating additional volume elsewhere in the floodplain.

Streetcar Alternative. Depending on the design option, the Streetcar Alternative would encroach on between 6.4 and 10.1 acres of the FEMA-designated floodplains of the Willamette River, as summarized in Table 3.9-4. Based on these numbers, the Willamette Shore Line design option would have the largest effect on floodplains in each segment where it is a design option. Additional effects to floodplains could potentially occur due to new stream crossings at Tryon Creek and Stephens Creek.

Effects to 100-year floodplains would be analyzed in accordance with local regulations and Executive Order 11988, Floodplain Management. As required by these regulations and not otherwise exempted by Metro regulations, lost storage would be mitigated by creating additional storage elsewhere in the floodplain. Furthermore, where appropriate, culverts would be placed under the proposed track to allow water to flow under the elevated track and to provide access to adjacent floodplain storage areas and preserve their functionality. These two mitigation measures would combine to substantially minimize, and perhaps eliminate, any potential rise in flood elevation.

Table 3.9-4 Floodplain Effects in Acres

Alternative / Segment	Design Option	Area (acres)
Enhanced Bus	None	1.3
Streetcar		
1 - Downtown Portland	None	0.0
2 - South Waterfront[1]	None	0.1
3 - Johns Landing	Willamette Shore Line	2.5
	Macadam In-Street	1.6
	Macadam Additional Lane	1.6
4 - Sellwood Bridge[2]	None	4.4
5 - Dunthorpe/Riverdale	Willamette Shore Line	2.7
	Riverwood	0.0
6 - Lake Oswego	UPRR	0.4
	Foothills	0.4

Source: Metro RLIS GIS Database (Accessed in 2009). Originally published in 1996/2004.
[1] The South Waterfront Segment contains potential construction phasing options associated with the streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.
[2] The Sellwood Bridge Segment contains potential construction phasing options associated with the streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

3.9.3.3 Direct Effects to Water Quality

Water quality effects associated with linear projects typically are a result of:

- Reduced infiltration potential and increase in volume of runoff (and pollutants) conveyed to waterbodies through the increase in impervious surface;
- Increased in-stream water temperatures as a result of riparian vegetation removal;
- Export of pollutants from motor vehicles using park-and-ride lots and other associated infrastructure; and
- Export of small amounts of oil and grease, sediment and metals from streetcar under the Streetcar Alternative.

The water quality impacts for the study alternatives are based on the increase in impervious area, as shown in Table 3.9-3.

No-Build. The No-Build Alternative would not result in increases in impervious surface area associated with the Lake Oswego to Portland Transit Project. Despite this, background development and other projects would still occur, causing an increase in impervious surface area and its related effects associated with water quality. Potential adverse effects associated with the No-Build Alternative could include:

- Stormwater runoff from currently untreated impervious surfaces would continue to flow untreated to project area streams and generally would not be improved unless there is redevelopment that adheres to current standards.
- Over time, an increase in traffic and congestion is likely, which will result in a likely increase in pollutant loading, including increases in sediment, heavy metals, and oil and grease concentrations from roadways and parking lots. These pollutants subsequently are transported to project area waterbodies by stormwater runoff. It is assumed that the Streetcar

and Enhanced Bus alternatives would reduce vehicle congestion in their service areas; while the No-Build Alternative would either result in no change or potentially an eventual increase in traffic congestion. Therefore, pollutant transport is expected to be higher with No-Build Alternative.

Enhanced Bus Alternative. The new and replaced impervious surface associated with the Enhanced Bus Alternative represents a small overall increase in total impervious surface area in the Lower Willamette Subbasin, and results in no impervious area increase in the Stephens Creek and Tryon Creek basins (see Table 3.9-3). Approximately 80 percent of the Enhanced Bus Alternative's total impervious area is replaced impervious surface area. Most of these areas were initially developed prior to current stormwater controls and therefore have little, if any, stormwater treatment. Because current regulations require that stormwater from redeveloped areas be treated, water quality conditions could improve as a result of the Enhanced Bus Alternative by managing runoff from replaced impervious surfaces and adhering to current regulations.

Streetcar Alternative. The new and replaced impervious surfaces related to the Streetcar Alternative represent a small overall increase in total impervious surface area specific to each basin (see Table 3.9-3). Therefore, similar to the Enhanced Bus Alternative, water quality conditions could improve as a result of the Streetcar Alternative by managing runoff from replaced impervious surfaces and adhering to current regulations.

Additionally, although operation of streetcar facilities has the capacity to release small amounts of pollutants (primarily sediment, oil and grease, and metals), pollutant generation typically is very low and, as stated above, the Lake Oswego to Portland Transit Project would adhere to all applicable stormwater regulations. Consequently, adverse water quality effects associated with impervious surfaces are not anticipated for the Streetcar Alternative.

3.9.3.4 Indirect and Cumulative Effects

Indirect effects are not anticipated from this project. If the project enables future development or redevelopment to occur, water quantity and quality mitigation would likely be required in addition to the proposed water quality mitigation for this project. Development upstream and within the drainage basins intersected by this project will also be subject to the regulatory requirements for mitigation of stormwater quality and quantity controls.

Past and future development within the watershed cumulatively affects the health of the watershed by removing natural cover, creating impervious surfaces, channelizing streams, altering flow regimes and discharging contaminants into water bodies. With or without the implementation of the Enhanced Bus or Streetcar alternatives, continued development and redevelopment activities are expected along the project corridor and throughout the Portland metropolitan area. Although the build alternatives will contribute to additional pollutant loadings and concentrations, by adhering to current water quality and quantity regulations, it is not expected that the proposed build alternatives would worsen conditions in the project corridor's receiving water bodies.

The region's land use plans envision that most of the future growth in population and employment will be focused on established regional and urban centers connected by high quality multimodal transportation systems. The No-Build Alternative would not include one of the major transportation investments assumed in regional growth management plans. One possible indirect effect of the No-Build Alternative would be increased pressure to develop in areas with lower congestion, which tend to be on the outskirts of the region. These areas would experience an increase in impervious surfaces as they are further developed.

In contrast the Streetcar Alternative, and Enhanced Bus Alternative to a lesser extent due to its impermanent nature, would help facilitate future development that reduces dependence on vehicular travel and is consistent with regional growth plans and density goals. Much of this development would occur in previously disturbed, existing impervious areas. Additionally, by focusing development in underutilized urban areas, development pressure in outlying rural areas could be lessened, which could potentially limit sprawl and help to protect forests and farmland in headwater reaches.

3.9.4 Potential Mitigation Measures

The project would be required to meet local, state and federal design guidelines, which require stormwater treatment and volume (flow control) via permanent structural best management practices (BMPs) and may include Low Impact Development (LID) alternatives. Improvements to water quality would occur when pollutants are removed from stormwater runoff; filtered through the use of separators, screens, filter media or soils; and/or taken up by plants. Hydrologic and water quality benefits would occur when stormwater is infiltrated onsite (retained) or discharged to the receiving waterbody at flow rates and durations consistent with pre-developed conditions.

Additional tools available to minimize water quality effects are nonstructural BMPs, which are source control activities related to maintenance, pollution prevention or other housekeeping activities that help prevent stormwater from coming in contact with pollutants. They could include activities such as street sweeping, properly maintaining vehicles and routine litter removal.

Potential mitigation measures for construction-related activities for control of accidental spills and leaks (to prevent water quality problems) could include diapering dump trucks, routine inspection and cleaning of heavy equipment and mandatory presence of spill control kits. Mitigation measures to protect riparian vegetation could include protecting large trees and other components of vegetative buffers, limiting construction footprints and replanting after construction is complete.

Water quality and hydrologic mitigation measures implemented as part of the Enhanced Bus and Streetcar alternatives would include minimizing impervious surface area (especially new impervious surfaces) and implementation of structural and nonstructural BMPs (especially onsite infiltration facilities), which could include the use of LID alternatives.

The Streetcar and Enhanced Bus alternatives could mitigate channel/floodplain effects through full compliance with applicable regulations and implementation of other project design features to help maximize benefits to water resources. Local jurisdictions require balanced cut and fill for fill placed in the 100-year floodplain unless technical analysis shows that the development would not result in an increase in the base flood elevation or exempt, as is the case in the South Waterfront area. Removal of existing structures in the floodplain also may be used to partially or fully account for mitigation of floodplain effects. In addition to including the same volume of fill, floodplain mitigation should occur at the same land surface elevation as the effect. Wherever possible it would be beneficial for floodplain cuts to be incorporated with projects that improve water quality, such as revegetating riparian areas that are currently in a degraded state.

3.10 Noise and Vibration

This section summarizes the assessment of the potential noise and vibration effects that would result from the project's alternatives and design options. This section addresses the affected environment, the potential environmental consequences, and possible mitigation related to the noise and vibration analysis. For more detail, see the *Lake Oswego to Portland Transit Project Noise Technical Report* (ENVIRON/URS and TriMet/Metro, November 2010).

3.10.1 Terminology and Standards

This section provides a summary of the terms and FTA impact criteria used for the project's noise and vibration analysis. See the *Noise and Vibration Technical Report* for additional detail and for a description of FTA, FHWA and ODOT noise criteria as well as a summary of local ordinances related to noise and vibration.

3.10.1.1 Noise

Within this analysis, the terms *noise* and *sound* are used interchangeably. The decibel (dB) scale used to describe sound is a logarithmic rating system capable of assessing large differences in audible sound intensities. This scale accounts for the human perception of a doubling of loudness as an increase of 10 dB. For example, a 70-dB sound level would sound about twice as loud as a 60-dB sound level. People generally cannot detect sound level differences (increases or decreases) of 1 dB in a given noise source. Differences of 2 dB or 3 dB can be detected by humans under ideal laboratory situations, although they are often difficult to discern in an active, outdoor noise environment. However, a 5-dB change in a given noise source or environment would likely be perceived by most people under normal listening conditions.

When assessing potential effects of noise on people, it is necessary to consider the range of frequencies that the human ear perceives the best. Sound-measuring instruments are designed to weight sounds based on the way people hear. The frequency weighting most often used to evaluate environmental noise is known as A-weighting (dBA) and this scale is used exclusively in this evaluation for noise. Sound levels associated with a range of common noise sources are listed in Figure 3.10-1.

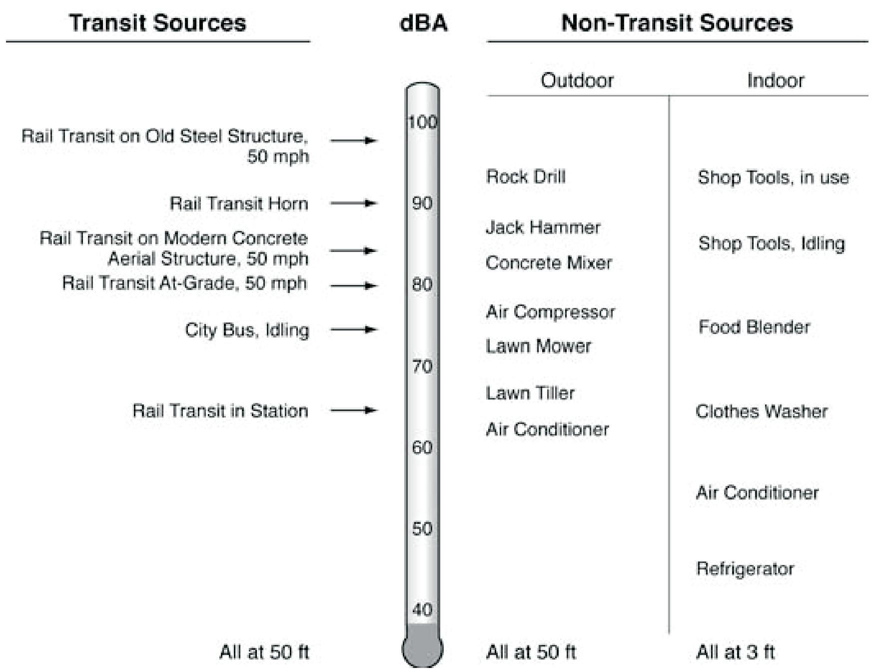
Factors affecting the sound transmission from a given source, which in turn affects the potential for noise impacts, include distance from the source, frequency of the sound, absorbency and roughness of the intervening ground surface, the presence or absence of obstructions and their absorbency or reflectivity, and the duration of the sound. The degree of impact on humans also depends on existing sound levels at the receiving location and who is listening, and the perception of impact also may depend on any preconceived attitudes regarding the noise source.

Two metrics used to quantify sound are used throughout the project's noise analysis. Each is described below.

- **The equivalent sound level (L_{eq}).** L_{eq} considers sound levels over time and accounts for the number, levels and durations of noise events during a specific time interval. In general, the L_{eq} noise metric is highly correlated to community response to noise, and this metric is used within the noise impact criteria developed by the FTA. FTA's criteria that apply at locations primarily involving daytime use (e.g., parks, schools, libraries, churches) are based on the hourly L_{eq} in an average weekday when the most transit vehicles would be operating.

- **Day-night sound level (L_{dn})**. L_{dn} is derived from the hourly L_{eqs} across an entire day and is similar to 24-hour L_{eq}, except that the calculation of this metric includes adding 10 dBA to sound levels between 10:00 p.m. and 7:00 a.m. In this way, the L_{dn} reflects the greater noise sensitivity of most people during the nighttime hours when typical background noise is lower and most people are sleeping. FTA uses L_{dn} to assess potential noise impacts to residential and other properties used for sleeping, such as residences, hospitals and hotels.

Figure 3.10-1 Sound Levels Produced by Common Noise Sources

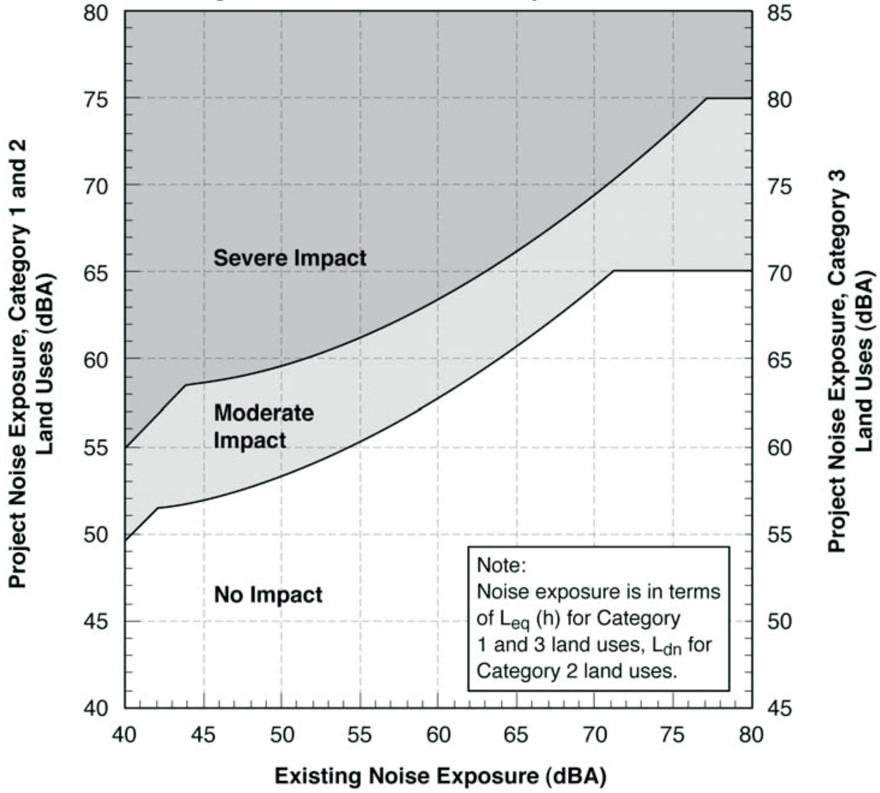


Source: FTA 2006.
Note: The rail transit sound level indicated on this figure likely represents Commuter Rail Transit, not LRT or Streetcar. Because Commuter Rail is a diesel powered vehicle, the sound profile would typically be much higher than LRT or Streetcar, which are electrically powered.

FTA noise impact criteria are based on comparing expected project-related noise to existing sound levels (see Figure 3.10-2). Under these criteria, receiving locations with low existing sound levels can be exposed to greater increases in overall noise due to the addition of project noise before an impact would occur; conversely, locations with higher existing sound levels can be exposed to smaller increases in overall noise before an impact would occur. The FTA noise impact analysis is based on a three-step process: 1) screening using standard distances, 2) a general noise assessment using a simple noise model produced by FTA and 3) a detailed noise analysis. Most of the streetcar components of this project were considered in a detailed analysis using noise modeling.

The majority of the Lake Oswego to Portland Transit Project alternatives and design options would be subject only to FTA noise impact criteria. Only the Macadam Additional Lane design option of the Streetcar Alternative would result in a change to the geometry of Highway 43, an ODOT roadway facility, which would make it subject to FHWA/ODOT noise impact criteria. However, this design option would not add a through lane of traffic, construct a new roadway on a new alignment, result in an acoustically significant shift in the roadway alignment, or bring about a new traffic noise impact. Therefore, in accordance with the provisions of 23 CFR 772(h), an ODOT traffic noise study is not required by this project (*ODOT Noise Manual*, March 2009, pg 2).

Figure 3.10-2 FTA Noise Impact Criteria



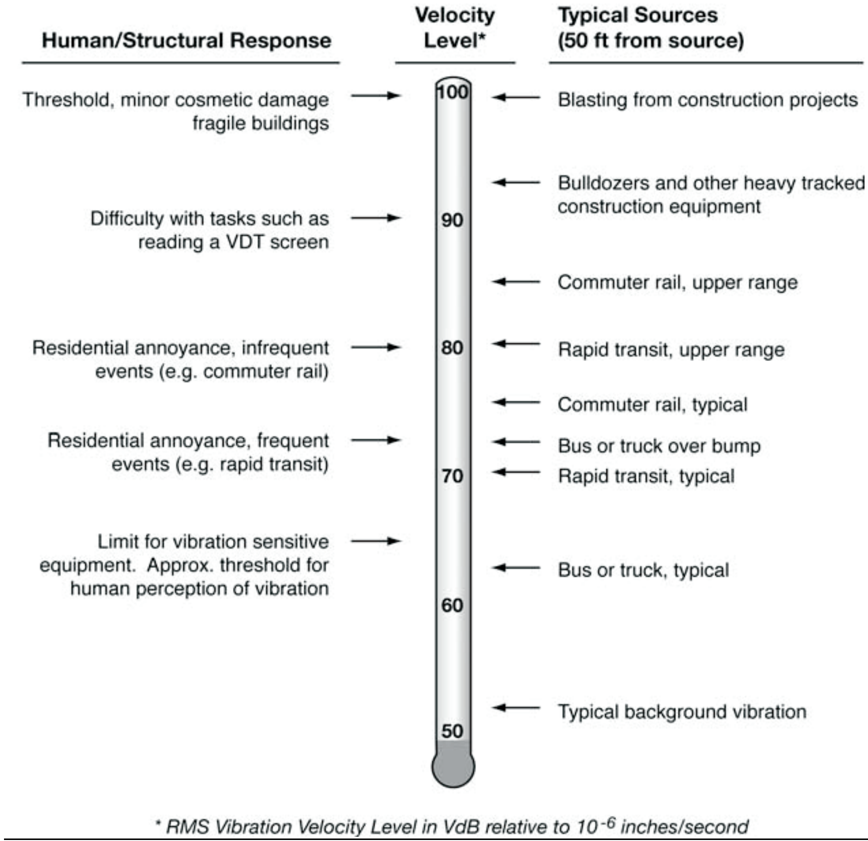
Source: FTA; 2006.
Note: Land Use Category 1 corresponds to tracts of land where quiet is an essential element in the intended purpose (e.g., an outdoor amphitheater). Land Use Category 2 denotes residences and buildings where people normally sleep. Land Use Category 3 represents institutional land uses (e.g., schools, churches) with primarily daytime and evening use where it is important to avoid interference with speech. See Section 3.10-1(A) for a description of the noise measurements.

3.10.1.2 Vibration

For this analysis, *ground-borne vibration* is assessed as the motion of building surfaces such as rattling of windows, items on shelves or pictures hanging on walls, or as a low-frequency rumbling noise, which is referred to as *ground-borne noise*. Some common levels of ground-borne vibration are shown in Figure 3.10-3. FTA's guidance calls for vibration to be reported as vibration decibel levels (VdB).

FTA characterizes impacts from ground-borne vibration and ground-borne noise based on three categories of land uses: 1) buildings where vibration would interfere with sensitive interior operations, 2) residences and buildings where people normally sleep and 3) buildings that are primarily used during the daytime. FTA's approach for screening potential vibration impacts for vehicles like streetcars is based on distances of 200, 100 and 50 feet for the three categories of land uses, respectively. FTA has established thresholds of impact for three categories of noise event frequency for both ground-borne vibration and ground-borne noise: frequent, occasional and infrequent events (see the *Noise and Vibration Technical Report* for the specific threshold criteria per land use and type of event).

Figure 3.10-3 Typical Levels of Ground-Borne Vibration



Source: FTA 2006.
Note: The "rapid transit typical" would be the most likely to correlate to LRT and Streetcars that would be lower because they are lighter vehicles.

3.10.2 Affected Environment

Existing noise levels at representative locations throughout the project area were documented using a series of long-term (about 24-hours) and short-term (about one hour) sound level measurements. Existing vibration conditions in the project study area were determined through a survey of existing homes and other buildings and a determination of their distance from the proposed transit improvements and construction areas under the alternatives and Streetcar Alternative design options. The sound level measurements and vibration receiver survey were conducted during three separate site visits to the project study area. Based on the FTA vibration screening criteria described in Section 3.10.1, the survey found that there are 103 buildings within the project area, which were then evaluated for potential ground-borne vibration impacts. Ground-borne noise was not specifically assessed because such noise is typically more of a concern for trains in long tunnels or in underground transit systems such as subways where little to no airborne noise reaches the receivers. Ground-borne noise is associated with and related to levels of ground-borne vibration and, according to FTA guidance, can be estimated by reducing projected levels of ground-borne vibration by amounts that vary depending on the frequency spectrum of the source. Based on this relationship, ground-borne noise related to operation of the streetcar was reviewed and dismissed as a potential source of impacts due to the project. The *Noise and Vibration Technical Report* documents in detail the results of the existing noise and vibration surveys and further discusses the review of ground-borne noise.

3.10.3 Environmental Consequences

This section summarizes the noise and vibration impacts that would result from the project's alternatives (see Tables 3.10-1 and 3.10-2). The noise assessment included sounds from the streetcar line, the associated park-and-ride lot, and streetcar bells at gated crossings and stations.

In summary, the No-Build and Enhanced Bus alternatives would not result in any moderate or severe noise impacts or ground-borne vibration impacts based on FTA's impact criteria.

Without potential mitigation measures in place, operation of the Streetcar Alternative would result in severe noise impacts to one residential property in the Dunthorpe/Riverdale Segment with either the Willamette Shore Line or Riverwood design options. Without potential mitigation measures, the Streetcar Alternative would also result in moderate noise impacts to 13 to 24 residences in the Johns Landing, Sellwood Bridge and Dunthorpe/Riverdale segments. Figure 3.10-4 depicts the noise receptor locations considered in the analysis and the range of potential noise impacts. See the *Noise and Vibration Technical Report* for a list and illustration of specific locations and how the moderate impacts would vary by design option.

The survey of the potentially affected area revealed 103 buildings within the screening distances defined by FTA as being subject to operational vibration impacts based on the varying uses of these buildings. The screening distances are 200 feet for particularly sensitive uses (e.g., research facilities with vibration-sensitive equipment), 100 feet for residences, and 50 feet for institutional uses such as banks and offices. After considering the specific anticipated streetcar travel speeds, the uses of the buildings within screening distance of the tracks, and the actual distances of the buildings from the tracks, it was determined that 23 to 28 buildings remained as potentially impacted. See Figure 3.10-5 for a depiction of the vibration receiver locations considered and areas subject to potential operational vibration impacts. With the use of ballast mats for the rail line near these potentially affected locations, all of these possible operational vibration impacts could be mitigated to the level of no impact under FTA criteria. Refer to Section 3.10.4 for additional information regarding where such mitigation measures would be implemented.

Table 3.10-1 Severe Operational Noise Impacts and Operational Vibration Impacts without and with Potential Mitigation by Alternative

Type of Impact	No-Build	Enhanced Bus	Streetcar
Severe Noise Impact			
Without Potential Mitigation	0	0	1[1]
With Potential Mitigation	0	0	0
Ground-Borne Vibration Impact			
Without Potential Mitigation	0	0	23-28[2]
With Potential Mitigation	0	0	0

Source: ENVIRON International Corporation 2010
Note: All data are based on operations during an average weekday, 2031. Determination of a severe noise impact is based on existing noise conditions and on FTA impact criteria and methods described in sections 3.10-1 and 3.10-2 of this DEIS.

1 The severe noise impact would be at an outdoor use area associated with a residence and would occur within the Dunthorpe/Riverdale Segment. The projected impact would occur under both the Willamette Shore Line and Riverwood design options (see Figure 3.10-6). Without the potential mitigation measures, the Streetcar Alternative would also result in moderate noise impacts to 13 to 24 residences in the Johns Landing, Sellwood Bridge, and Dunthorpe/Riverdale segments (see the *Noise and Vibration Technical Report* for a list and illustration of specific locations and how the moderate impacts would vary by design option). No assessment was made of how many of the projected moderate impacts could be lowered to *no impact* based on potential mitigation measures and on the FTA impact criteria.

2 The range reflects the potential number of buildings (i.e., not total residences) impacted by vibrations with the varying alternatives.

Table 3.10-2 Noise and Vibration Impacts without and with Potential Mitigation Measures By Segment Design Options (2035)

Segment/Design Option	Moderate Noise Impacts[1]		Severe Noise Impacts[1]		Vibration Impacts	
	Without Mitigation	With Potential Mitigation	Without Mitigation	With Potential Mitigation	Without Mitigation	With Potential Mitigation
1 – Downtown Portland[2]	-	-	-	-	-	-
2 – South Waterfront[3]	0	0	0	0	0	0
3 – Johns Landing						
Willamette Shore Line	8	8	0	0	3	0
Macadam In-Street	0	0	0	0	5	0
Macadam Additional Lane	0	0	0	0	5	0
4 – Sellwood Bridge[3]	2	2	0	0	4	0
5 – Dunthorpe/Riverdale						
Willamette Shore Line	14	15	1	0	19	0
Riverwood	11	12	1	0	16	0
6 – Lake Oswego						
UPRR	0	0	0	0	0	0
Foothills	0	0	0	0	0	0

Source: ENVIRON International Corporation.

Note: All data are based on operations during an average weekday, 2031. Determination of a severe noise impact is based on existing noise conditions and on FTA's impact criteria and methods described in sections 3.10-1 and 3.10-2 of this DEIS.

1 Impacts are those that are categorized as *moderate* or *severe* using FTA noise criteria. Mitigation measures are potential and have not been incorporated into the project design. Impacts are those generated by operation of rail transit vehicles. The increase in the number of moderate impacts with mitigation is due to the severe noise impact being reduced to a moderate impact. No assessment was made of how many moderate impacts could be lowered to no impact based on potential mitigation measures and on the FTA impact criteria.

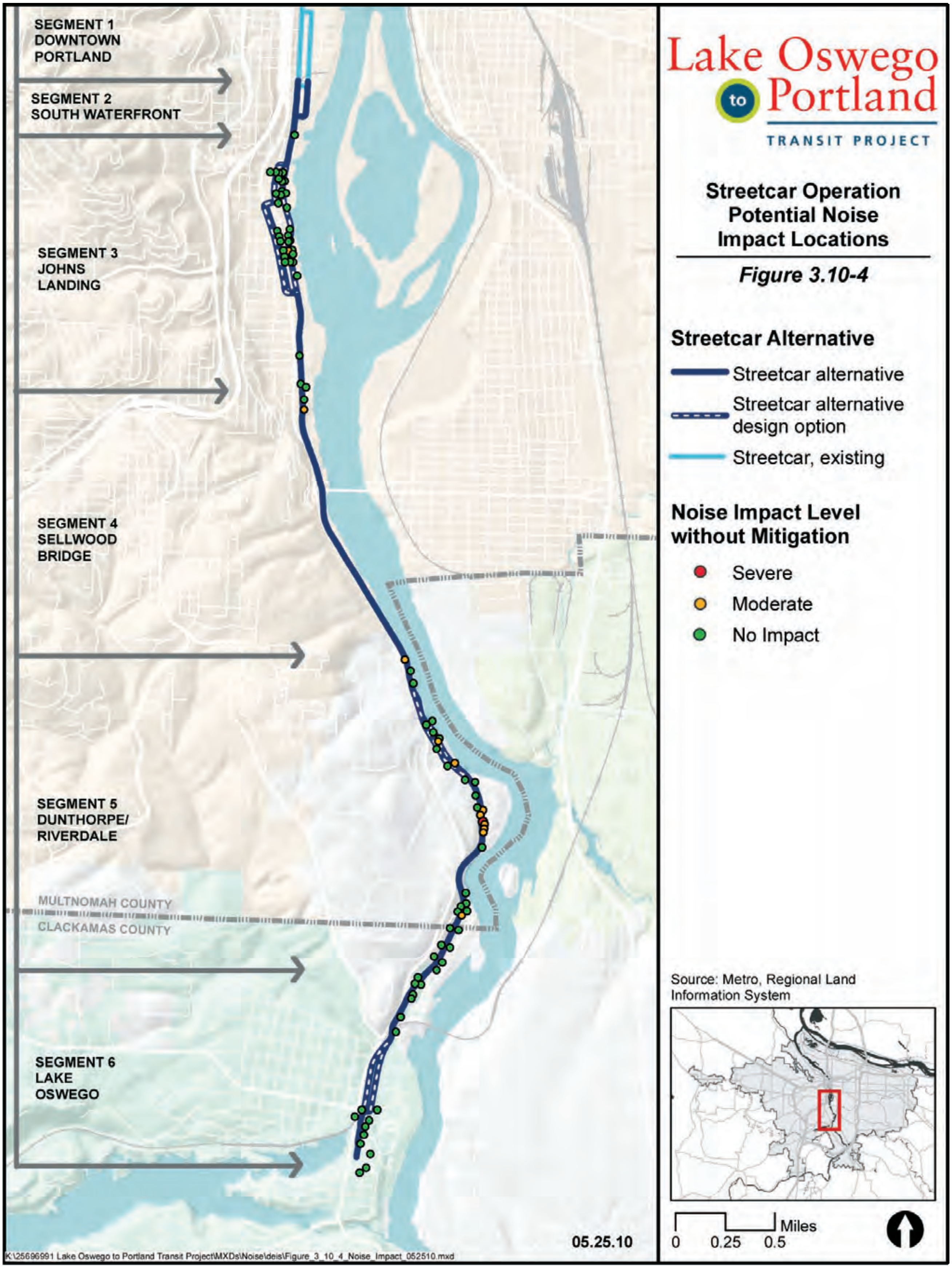
2 Noise and vibration impacts were not assessed in the Downtown segment 1 because no new facilities would be constructed in this area.

3 The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

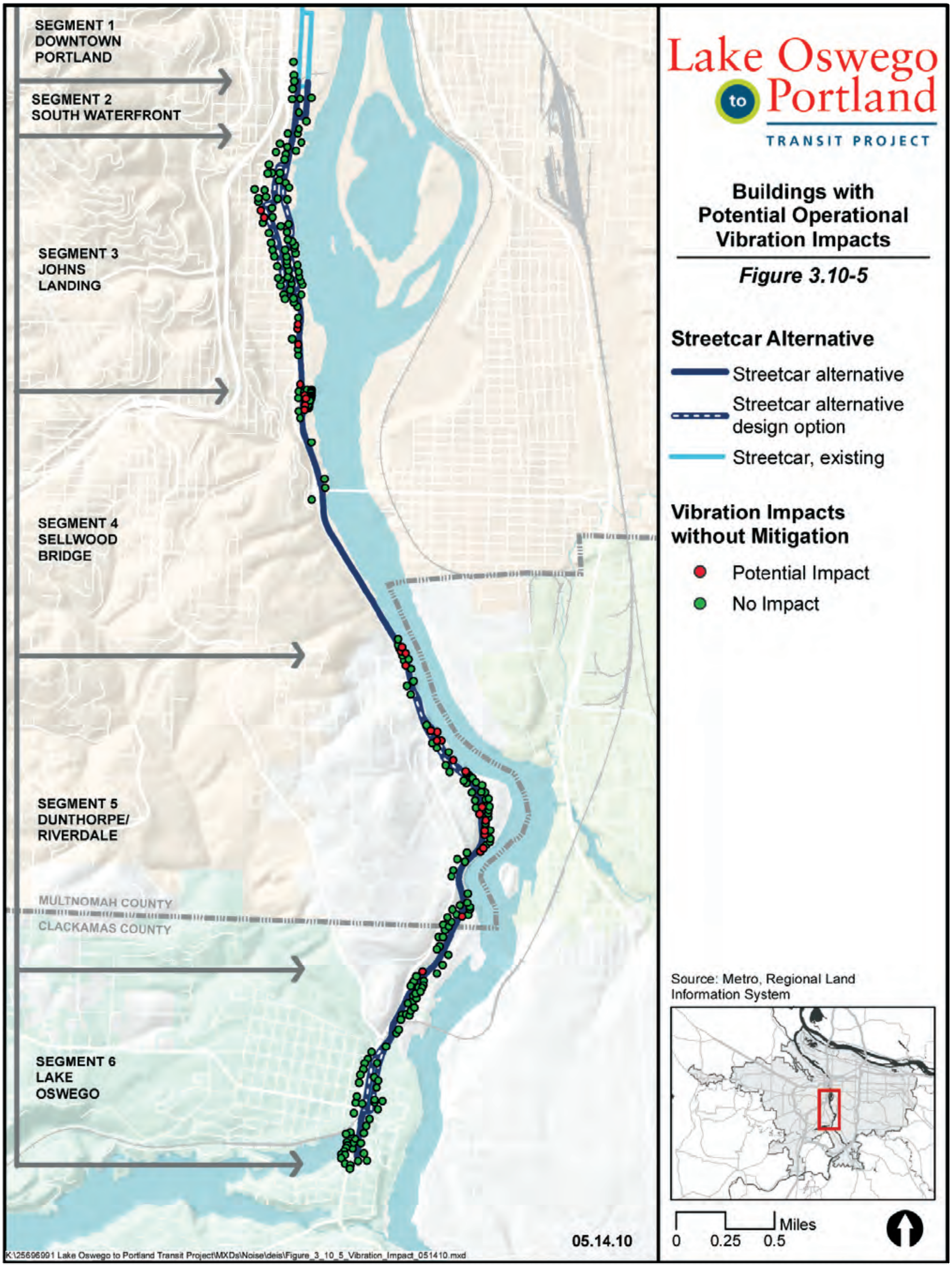
3.10.4 Potential Mitigation

As required by the FTA, noise and vibration impacts associated with the project will be considered for possible mitigation. FTA guidance says, "If it is not practical to avoid severe impacts by changing the location of the project, mitigation measures must be considered… Projected noise levels in the moderate impact range will also require consideration and adoption of mitigation measures when it is considered reasonable" (FTA, 2006, page 3-11). Thus, the potential noise impacts associated with the proposed project were considered in a preliminary analysis of potential mitigation measures. This section describes the potential noise and vibration mitigation measures that could be implemented to resolve project related impacts, including discussion of an initial review conducted for one location.

A preliminary review indicated the severe noise impact to one residence in the Dunthorpe/Riverdale Segment that would result from the Streetcar Alternative could be mitigated with a noise wall located between the residence and the streetcar tracks, generally within what would be the streetcar right of way. The noise wall approximately 3 feet tall and 200 feet long east of the tracks could reduce the *severe* noise impact to a *moderate* impact. The noise wall is illustrated in Figure 3.10-6.



SEGMENT 1
DOWNTOWN
PORTLAND
SEGMENT 2
SOUTH WATERFRONT
SEGMENT 3
JOHNS
LANDING
SEGMENT 4
SELLWOOD
BRIDGE
SEGMENT 5
DUNTHORPE/
RIVERDALE
MULTNOMAH COUNTY
CLACKAMAS COUNTY
SEGMENT 6
LAKE
OSWEGO
05.25.10
K:\25696991 Lake Oswego to Portland Transit Project\MXDs\Noise\deis\Figure_3_10_4_Noise_Impact_052510.mxd
Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Operation
Potential Noise
Impact Locations
Figure 3.10-4
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
Streetcar, existing
Noise Impact Level without Mitigation
Severe
Moderate
No Impact
Source: Metro, Regional Land Information System
Miles
0
0.25
0.5


SEGMENT 1
DOWNTOWN
PORTLAND
SEGMENT 2
SOUTH WATERFRONT
SEGMENT 3
JOHNS
LANDING
SEGMENT 4
SELLWOOD
BRIDGE
SEGMENT 5
DUNTHORPE/
RIVERDALE
MULTNOMAH COUNTY
CLACKAMAS COUNTY
SEGMENT 6
LAKE
OSWEGO
05.14.10
K:\25696991 Lake Oswego to Portland Transit Project\MXDs\Noise\deis\Figure_3_10_5_Vibration_Impact_051410.mxd
Lake Oswego to Portland
TRANSIT PROJECT
Buildings with
Potential Operational
Vibration Impacts
Figure 3.10-5
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
Streetcar, existing
Vibration Impacts without Mitigation
Potential Impact
No Impact
Source: Metro, Regional Land Information System
0
0.25
0.5
Miles

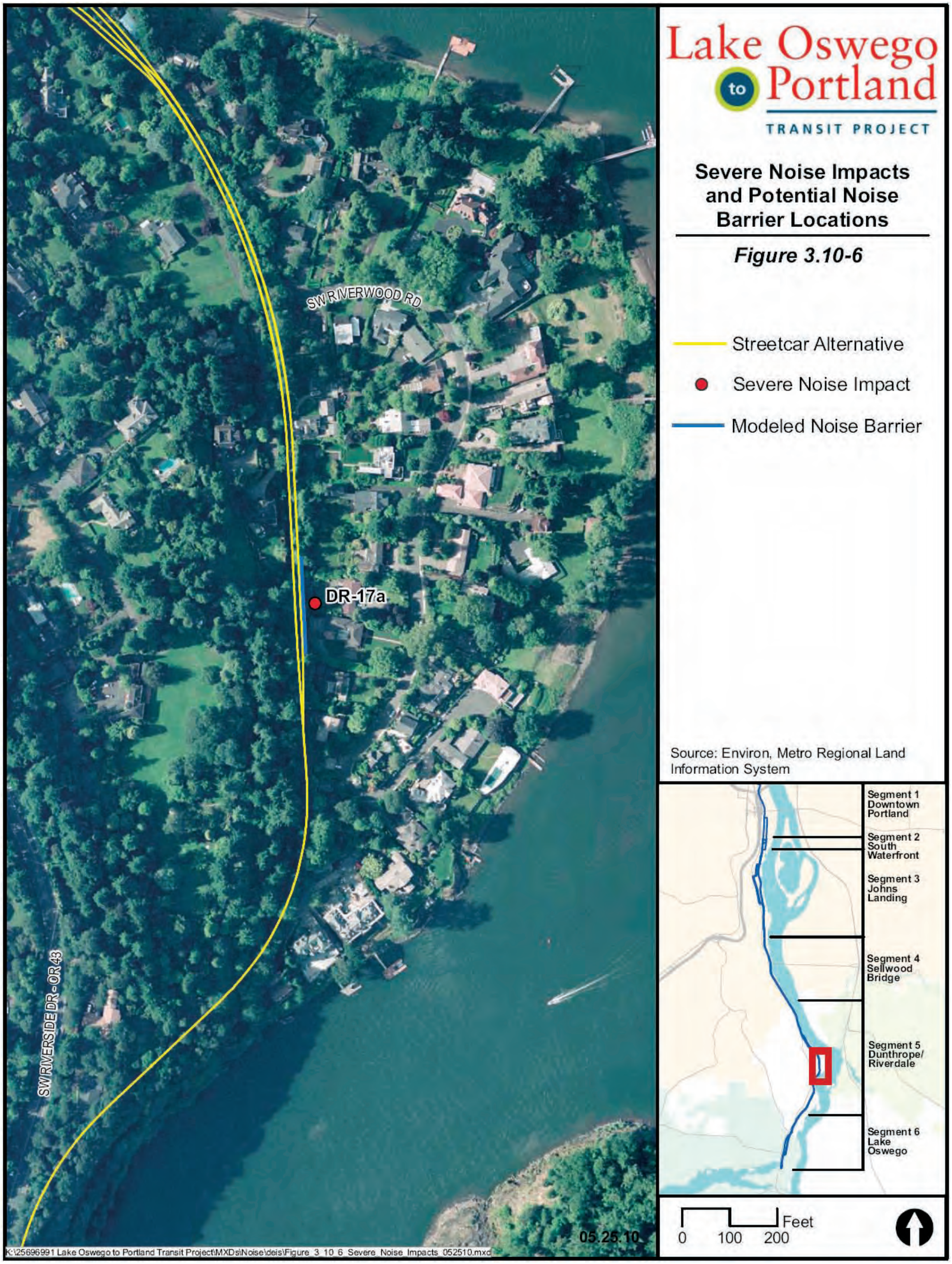
The preliminary review of mitigation measures suggests that at least some of the *moderate* noise impacts that would occur in three of the six project segments also could potentially be mitigated using noise walls between buildings and the streetcar tracks. The effectiveness of the potential mitigation measures on *moderate* impacts has not yet been fully examined, and noise walls may not be feasible and/or cost-effective in all locations (e.g., where gaps in the walls would be required to retain vehicular and/or pedestrian access and in any locations where there is insufficient room to accommodate such barriers). These issues would be more completely considered after the selection of the Locally Preferred Alternative.

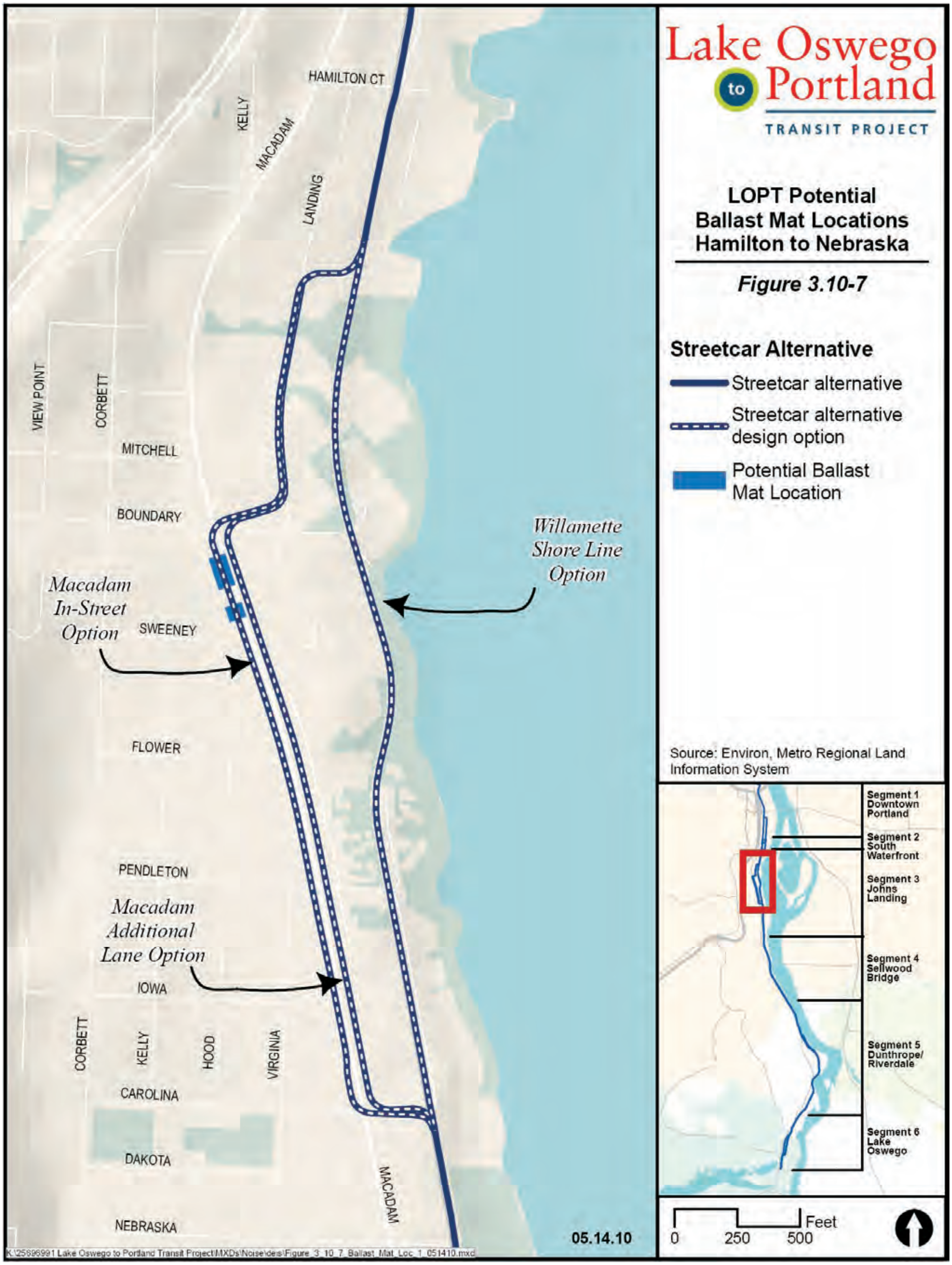
In the event the Streetcar Alternative is selected as the Locally Preferred Alternative, the size, design and location of noise walls and/or other mitigation measures that would be constructed with the project would be determined during the project's Preliminary Engineering phase and before publication of the project's Final EIS. Those decisions would be based on several factors, such as FTA criteria for mitigation measures, costs compared to effectiveness and any secondary impacts associated with the potential mitigation measures (e.g., visual or access impacts that could result from noise walls). The following factors are typically considered in evaluating mitigation measures:

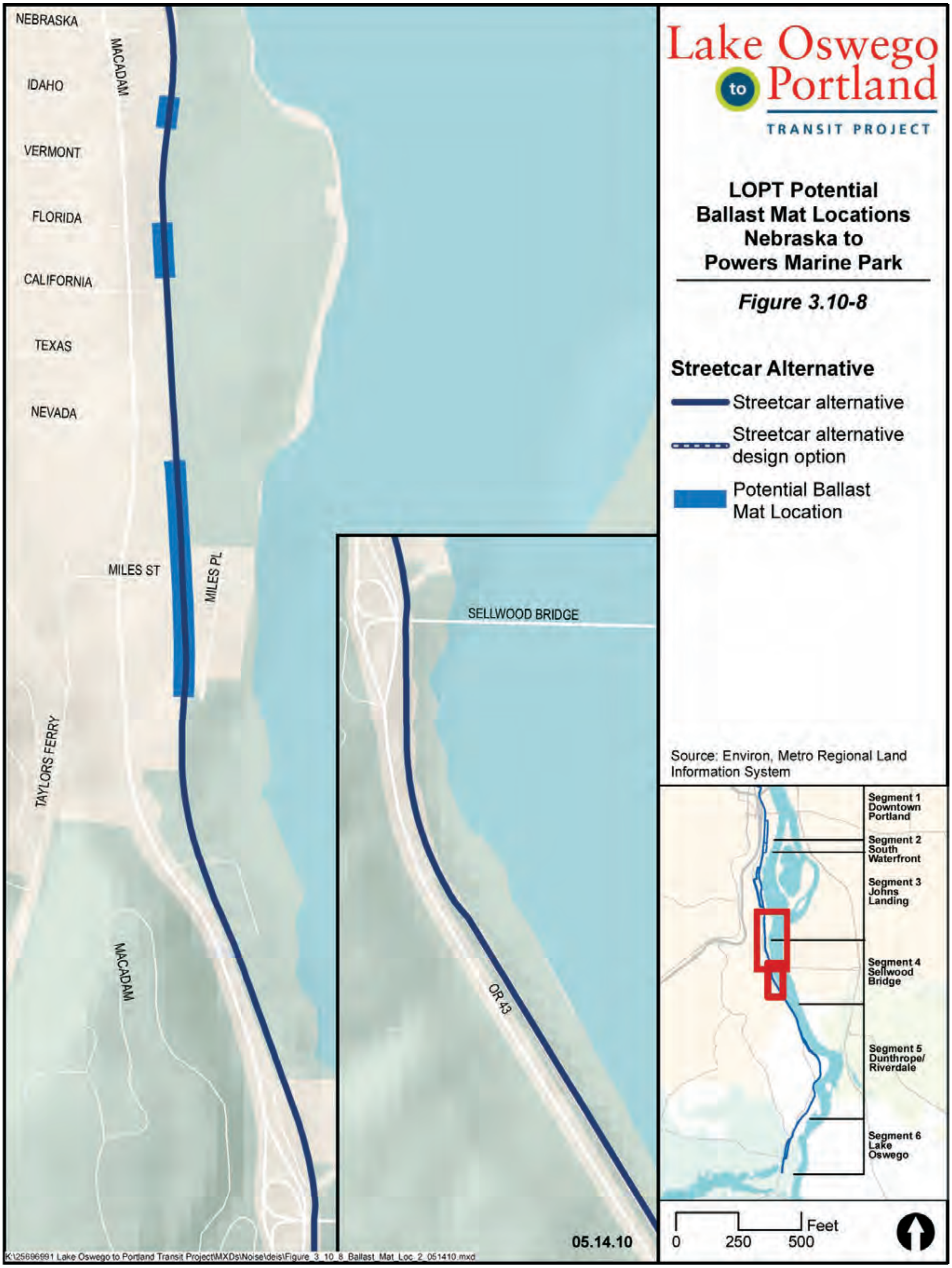
- The number of noise-sensitive sites affected at a particular noise level;
- The increase over existing noise levels and the "location" of the estimated noise level in relation to the moderate and severe ranges depicted in Figure 3.10-2;
- The noise sensitivity of the property;
- The effectiveness of the potential mitigation measures in terms of the magnitude of the noise reduction that can be achieved and the number of receptors that would benefit; and
- Cost versus potential noise-reduction benefit will be a critical factor during deliberations regarding whether and where to implement mitigation for this project.

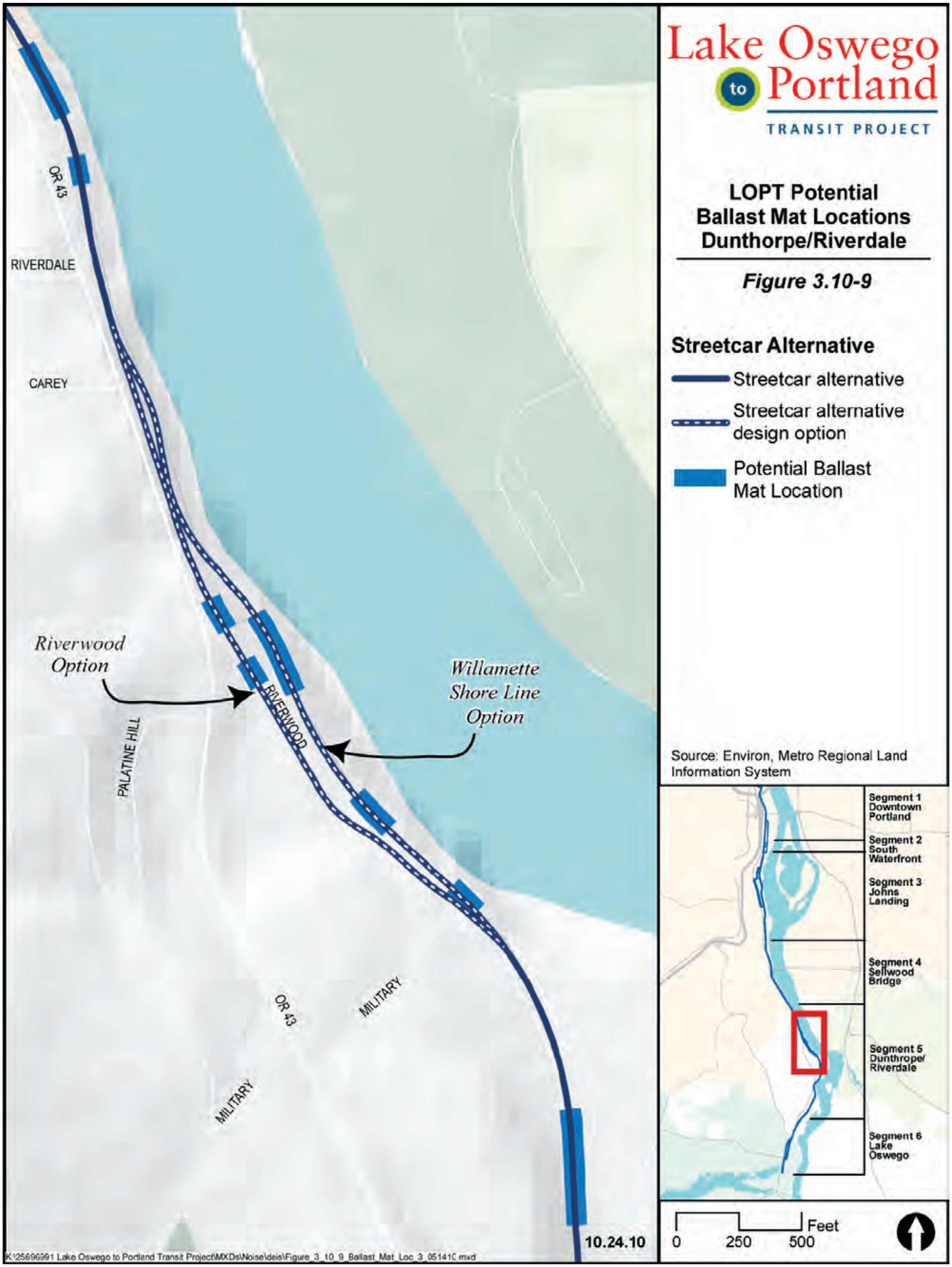
Thus, project-related operational severe and moderate noise impacts will be considered in additional detail after selection of a preferred alternative. Mitigation determined to be both feasible and reasonable will be considered for implementation on a case-by-case basis. Decisions would be reached and commitments to any selected mitigation measures would be made prior to publication of the Final EIS, and these decisions and any related commitments to implement mitigation measures would be included in this document.

The only mitigation measure necessary to avoid operational vibration impacts associated with operation of the Streetcar Alternative would be in the form of ballast mats under the rail line. With the use of ballast mats or similarly effective vibration-reducing technology in locations where the rail would be very near one or more potentially affected buildings, all the potential operational vibration impacts could be avoided. Figures 3.10-7 through 3.10-10 depict the locations where ballast mats would be needed to avoid vibration impacts from operation of the streetcar alternative and design options. Refer to the *Noise and Vibration Technical Report* for additional information in this regard.

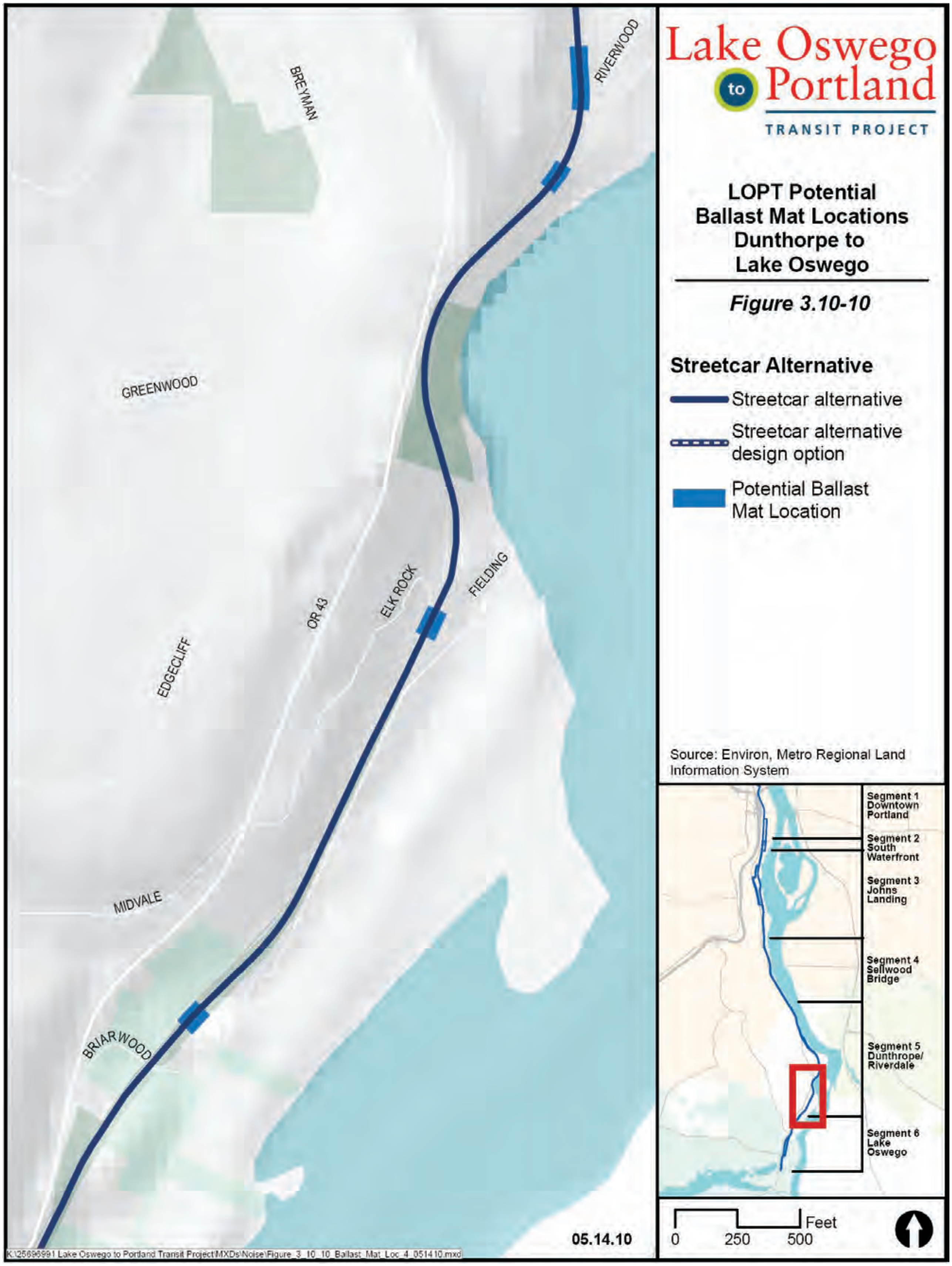

Lake Oswego to Portland
TRANSIT PROJECT
Severe Noise Impacts and Potential Noise Barrier Locations
Figure 3.10-6
Streetcar Alternative
Severe Noise Impact
Modeled Noise Barrier
Source: Environ, Metro Regional Land Information System
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
Feet
0 100 200
SW RIVERWOOD RD
DR-17a
SW RIVERSIDE DR - OR 43
05.25.10
K:\25696991 Lake Oswego to Portland Transit Project\MXDs\Noise\deis\Figure_3_10_6_Severe_Noise_Impacts_052510.mxd


Lake Oswego to Portland
TRANSIT PROJECT
LOPT Potential Ballast Mat Locations Hamilton to Nebraska
Figure 3.10-7
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
Potential Ballast Mat Location
Source: Environ, Metro Regional Land Information System
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
Feet
0
250
500
HAMILTON CT
KELLY
MACADAM
LANDING
VIEW POINT
CORBETT
MITCHELL
BOUNDARY
Willamette Shore Line Option
Macadam In-Street Option
SWEENEY
FLOWER
PENDLETON
Macadam Additional Lane Option
IOWA
CORBETT
KELLY
HOOD
VIRGINIA
CAROLINA
DAKOTA
MACADAM
NEBRASKA
05.14.10


NEBRASKA
IDAHO
VERMONT
FLORIDA
CALIFORNIA
TEXAS
NEVADA
MACADAM
MILES ST
MILES PL
TAYLORS FERRY
MACADAM
SELLWOOD BRIDGE
OR 43
05.14.10
K:\25696991 Lake Oswego to Portland Transit Project\MXDs\Noise\deis\Figure_3_10_8_Ballast_Mat_Loc_2_051410.mxd
Lake Oswego to Portland
TRANSIT PROJECT
LOPT Potential Ballast Mat Locations Nebraska to Powers Marine Park
Figure 3.10-8
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
Potential Ballast Mat Location
Source: Environ, Metro Regional Land Information System
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
0
250
500
Feet



Lake Oswego to Portland
TRANSIT PROJECT
LOPT Potential
Ballast Mat Locations
Dunthorpe/Riverdale
Figure 3.10-9
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
Potential Ballast Mat Location
Source: Environ, Metro Regional Land Information System
OR 43
RIVERDALE
CAREY
Riverwood Option
Willamette Shore Line Option
PALATINE HILL
RIVERWOOD
MILITARY
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
Feet
0
250
500
10.24.10


Lake Oswego
to Portland
TRANSIT PROJECT
LOPT Potential
Ballast Mat Locations
Dunthorpe to
Lake Oswego
Figure 3.10-10
Streetcar Alternative
Streetcar alternative
Streetcar alternative
design option
Potential Ballast
Mat Location
Source: Environ, Metro Regional Land
Information System
Segment 1
Downtown
Portland
Segment 2
South
Waterfront
Segment 3
Johns
Landing
Segment 4
Sellwood
Bridge
Segment 5
Dunthrope/
Riverdale
Segment 6
Lake
Oswego
Feet
0
250
500
BREYMAN
RIVERWOOD
GREENWOOD
OR 43
ELK ROCK
FIELDING
EDGECLIFF
MIDVALE
BRIARWOOD
05.14.10

3.11 Air Quality

This section discusses the air quality analysis and conformity determination for the Lake Oswego to Portland Transit Project alternatives. It includes a summary of the applicable regulations, methods used, affected environment and anticipated environmental consequences. Potential mitigation measures and a discussion on climate change are also included. For additional detail, see the *Lake Oswego to Portland Transit Project Air Quality Technical Report* (URS, TriMet/Metro, November 2010). There are two potential sources of air pollution associated with the project: 1) changes to vehicular traffic as a result of transit operation and 2) project construction. This section focuses on transit changes that affect vehicular-caused air pollution; see Section 3.16 for a discussion of construction activities and their affect on air quality.

3.11.1 Introduction, Applicable Regulations, Analysis Methods and Coordination

Proposed surface transportation projects seeking federal funding must meet the Clean Air Act standards and its related rules on a regional level and on a localized (project) level. To meet conformity at a regional level, a project must be included in the approved Metro financially constrained Regional Transportation Plan (RTP) and demonstrated to meet air quality standards. This air quality conformity is a condition to securing federal funds for surface transportation projects. The RTP and the Metropolitan Transportation Improvement Program (MTIP) include a set of regional projects, all of which are analyzed for regional air quality conformity to ensure that the entire package of projects help the region meet federal and state air quality guidelines.

There are two potential sources of air pollution associated with the project: construction and vehicular traffic (operation). Construction impacts are associated with the build alternatives only. They are temporary and expected to be minimal. Most construction emissions (and impacts) are usually generated during earth moving activities. Air pollution associated with operational activities (vehicular traffic) will most likely be reduced due to implementation of the build alternatives, but modifications in traffic patterns can potentially create localized areas of elevated pollution, or “hot-spots,” which are assessed below.

3.11.1.1 Applicable Regulations

Air quality in the project area is regulated by the U.S. Environmental Protection Agency (EPA) and the Oregon Department of Environmental Quality (ODEQ). Under the Clean Air Act, EPA has established the National Ambient Air Quality Standards (NAAQS), which specify maximum concentrations for carbon monoxide (CO), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), ozone (O_3), sulfur oxides (SO_x), lead (Pb), and nitrogen dioxide (NO_2). Federal and state standards for the five pollutants relevant to vehicular emissions (CO, PM_{10}, $PM_{2.5}$, O_3 and NO_2) are listed below in Table 3.11-1.

Nonattainment areas are geographical regions where air pollutant concentrations exceed the NAAQS for a pollutant. Air quality maintenance areas are regions that have historically been in nonattainment for air quality standards but have achieved compliance through improved planning and control measures. The project area lies within the Portland Air Quality Maintenance Area (AQMA) which extends from Portland, south to Wilsonville, east to Gresham and west past Hillsboro. Air quality emissions in the Portland metro region are currently being managed under the provisions of the State Implementation Plan, which has adopted the Portland Area Carbon Monoxide Maintenance Plan (ODEQ, Air Quality Division, December 10, 2004) and the Portland-Vancouver Air Quality Maintenance Area (Oregon Portion) and Salem-Keizer Area Ozone Maintenance Plan

(ODEQ, Adopted by the Environmental Quality Commission February 22, 2007). Any regionally significant transportation project in the Portland AQMA must conform to the maintenance plans. Generally, conformity is demonstrated by showing that the project would not cause or contribute to any new violation of any NAAQS, would not increase the frequency or severity of any existing violation of any NAAQS, or would not delay timely attainment of the NAAQS. For the Portland metro region, conformity must be demonstrated for carbon monoxide only, being in attainment or not having to demonstrate conformity for any other air pollutant for surface transportation projects.

Table 3.11-1 Ambient Air Quality Standards (AAQS)

Pollutant	Averaging Time	Federal Standard (NAAQS)	State Standard
Carbon Monoxide (CO)	1-hour	35 ppm	35 ppm
	8-hour	9 ppm	9 ppm
Ozone (O_3)	8-hour	0.075 ppm	0.08 ppm
Particulate Matter < 2.5 µm ($PM_{2.5}$)	24-hour	35 µg/m3	--
	Annual	15 µg/m3	--
Particulate Matter < 10 µm (PM_{10})	24-hour	150 µg/m3	150 µg/m3
	Annual	N/A	50 µg/m3
Nitrogen Dioxide (NO_2)	1-hour	0.100ppm	--
	Annual	0.053 ppm	0.053 ppm

Source: EPA Office of Air Quality Planning (http://www.epa.gov/air/criteria.html) and Oregon Administrative Rule (OAR) 340-202-0050 through -0130. [Note: EPA is in the process of revising the ozone standard to between 0.06 and 0.07 ppm. Further, EPA is revising the 1-hour nitrogen dioxide standard at 0.100 ppm, effective April 12, 2010. Oregon is in the process of updating rules to incorporate new lead and $PM_{2.5}$ standards.]
Notes:
µm = microns (for particulate diameter)
µg/m^3 = micrograms of pollutant per cubic meter of air
ppm = parts per million

3.11.1.2 Analysis Methods for Conformity

Regional Analysis

As part of the adoption of the 2035 RTP, a list of surface transportation projects planned and expected to be built in the future was included in the regional level air quality analysis. To assess the expected CO emissions, this analysis used the resulting road and transit networks planned for the year 2035, the forecast jobs and housing for several intervening years, and the EPA and DEQ approved MOBILE6.2 air quality model. These emissions were compared against the EPA and DEQ approved "motor vehicle emission budgets," or maximum emissions allowed from surface transportation sources. The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), after consulting with EPA, approved this regionwide air quality conformity on February 29, 2008 (Air Quality Conformity Determination, 2035 RTP and 2008-2011 MTIP, February 2008, Metro). The RTP analysis included the Lake Oswego to Portland Transit Project (Metro Project Number 10912).

For the purposes of this DEIS, a comparison of emissions for the alternatives was made using mileage data from Metro along with emission factor data, also provided by Metro and described further below. This methodology follows that performed for the Air Quality Conformity Determination (AQCD). The emission comparison is shown in Table 3.11-2.

Table 3.11-2 Estimated Regional Average Weekday Pollutant Emissions for Motor Vehicles (lbs/day)

Alternative	Daily Vehicle Miles Traveled (VMT)[1]	Carbon Monoxide (CO) (lbs/day)[2]
Existing Conditions (Year 2005)[3]	41,611,800	1,476,394
Project Alternatives (Year 2035)		
No-Build	63,090,900	1,423,436
Enhanced Bus	63,049,900	1,422,511
Streetcar with In-Street/Additional Lane Design Options	63,025,500	1,421,961
Streetcar with Willamette Shore Line Design Option	63,022,900	1,421,902

Notes:
[1] Source: Metro, 2010.
[2] Based on MOBILE6.2 data from Metro (2010): emission factors for winter conditions with average speed of 35 mph (Year 2007 - 16.108 gram/mile; Year 2035 - 10.243 gram/mile).
[3] Existing regional VMT data only available for 2005.

Hot Spot (Localized) Analysis

To determine whether a proposed project meets localized, "hot spot" level conformity, traffic levels at local intersections must be examined. A hot-spot analysis includes air quality modeling to determine whether a project conforms to the NAAQS.

The analysis used traffic data for the No-Build, Enhanced Bus and Streetcar alternatives for existing year, 2009 (No-Build Alternative only), and future year 2035.[89] A complete description of this data is provided in the *Lake Oswego to Portland Transit Project Transportation Analysis Technical Report* (DEA, URS, TriMet and Metro, November 2010). The intersections along the project route were evaluated by level of service (LOS) and volumes to assess the need for hot spot analyses. The project itself appears to have minimal effect on intersection traffic, causing slightly decreased volumes (vehicles per hour) and volume to capacity ratios compared to the No-Build Alternative for most intersections. However, 18 of the intersections showed LOS worse than C for at least one scenario and analysis year; 12 of the intersection showed LOS F. Therefore, a hot spot analysis was performed to demonstrate local conformity.

Predictions of existing and future localized CO concentrations in the project vicinity were made using the MOBILE 6.2 emission factors and the CAL3QHC line-source dispersion model following ODOT methodology (*ODOT Air Quality Manual*, September 26, 2008; *MOBILE 6.2.03*, EPA, September 24, 2003; *CAL3QHC: Line Source Dispersion Model – Version 2.0*, EPA, August 9, 1995).[90] Emission factors and idle emission rates are based on average vehicle speeds, regional vehicle registration mixes and annual mileage accumulation rates, the effects of vehicle inspection and maintenance programs, and regional ambient conditions. Emission factors were calculated for the existing year (2009) and future year (2035).[91] To be conservative, CO emission factors are based on winter temperatures.

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[89] David Evans and Associates, Inc. ,Lake Oswego to Portland Transit Project Traffic Data (Synchro Model Runs and Operations Figures; based on data from Metro), e-mails from Scott Harmon (DEA) to Christy Schmitt (URS), February 3, 2010).
[90] The MOBILE 6.2 factors were provided by Metro personnel (*MOBILE 6.2 Emission Factors*, Email from Bill Stein (Metro) to Christy Schmitt (URS), February 11, 2010.
[91] Note: Metro had data for 2007, not 2009. Because vehicle emission factors *decrease* with time (due to vehicle emissions reduction programs), the 2007 emission factors were used as a conservative surrogate for 2009 analyses.

A local CO hot spot analysis is used to identify when traffic patterns, idle times, queue lengths and vehicle CO emission rates might lead to elevated CO levels near congested intersections, possibly exceeding the NAAQS. Signalized intersections for the CO analysis were selected using traffic data from the project's traffic analysis, following ODOT and EPA guidance.[92] The guidance recommends ranking intersections based on LOS and vehicles per hour to select the intersections where CO impacts are most likely to occur. Signalized intersections expected to operate at LOS D, E or F must be included in the ranking analysis. Following this methodology, the following three intersections were selected as the worst case modeling scenario based upon both the No-Build Alternative and build alternatives' traffic conditions:

- A Avenue and Highway 43
- Foothills Road and Highway 43
- North Shore Road and Highway 43

It is expected that the CO impacts at these intersections will be higher than those at all other intersections; therefore, a demonstration of compliance for the modeled intersections will show compliance for all other intersections. Since the geometry and traffic patterns for each of these intersections are slightly different, all three were analyzed for hot spots. The full analysis methodology is presented in the *Air Quality Technical Report*.

3.11.1.3 Coordination

Metro is the local Metropolitan Planning Organization responsible for coordinating the regional transportation planning processes, including performing regional conformity assessments. Metro has provided the regional CO emission factors for use in the local conformity assessment. Traffic data was provided in the *Transportation Analysis Technical Report.*

3.11.2 Affected Environment

As discussed above, the project area lies within the Portland AQMA. Portland is currently in compliance for all regulated air pollutants (CO, PM_{10}, $PM_{2.5}$, O_3, NO_2, SO_2, and Pb). [Note: although Portland is in compliance for all regulated air pollutants, it has not yet been redesignated as attainment status for CO.] As shown in Table 3.11-3 below, the calculated worst-case CO concentrations for existing conditions (2009) do not exceed the one-hour or eight-hour average NAAQS for CO at any of the three modeled intersection locations (eight-hour concentrations are between 5.4 and 6.2 parts per million (ppm), well below the standard of 9 ppm).

3.11.3 Environmental Consequences

3.11.3.1 Regional Analysis

As noted above, when Metro modeled regional air quality, it included the Lake Oswego to Portland Transit Project. Regional pollutant emissions, including the effects of the project, were demonstrated to be within regionally-allowable amounts.

[92] *Air Quality Manual*, ODOT, September 26, 2008, and *Guideline for Modeling Carbon Monoxide from Roadway Intersections.* EPA-454/R—92-005, Office of Air Quality Planning and Standards, Technical Support Division. November, 1992.

For comparative purposes, estimates of *regional* motor vehicle CO emissions are shown in Table 3.11-2 for each of the project alternatives. Because the air quality differences between the design and phasing options are beyond the ability of current analysis methods sensitivity, only the alternatives – No-Build, Enhanced Bus and Streetcar are analyzed and compared. The table shows a slight decrease in regional vehicular traffic for each of the two build alternatives over the No-Build Alternative. The decreases range from 0.06 to 0.11 percent (for the Enhanced Bus Alternative and the Streetcar Alternative Willamette Shore Line design option, respectively). For regional examination, CO emissions are directly related to vehicle miles traveled (VMT), so CO emissions also show a slight decrease due to either of the build alternatives over the No-Build Alternative, with the Streetcar Alternative Willamette Shore Line design option having the greatest reduction (1,534 lbs/day reduction over the No-Build Alternative). Emissions of other pollutants are also expected to follow this same trend for Year 2035 (comparison of Alternatives), as emissions are directly related to VMT.

3.11.3.2 Local Hot Spot Analysis

The results of the air quality hot spot analysis are summarized in Table 3.11-3. As shown, the maximum predicted eight-hour CO concentrations for the No-Build Alternative and two build alternatives were found to be within the air quality standard of 9 ppm. Because the project would not cause or contribute to any violation of the NAAQS for CO, it would not cause any adverse localized CO Impacts.

With the No-Build Alternative, operations would not change from the existing transit scenario, however, overall traffic volumes (regardless of the project) are expected to increase in future years. As mentioned above, the project itself appears to have minimal effect on intersection traffic, causing slightly decreased volumes and volume to capacity ratios as compared to the No-Build Alternative for most intersections. Compared to the No-Build Alternative, operations for the Streetcar Alternative and Enhanced Bus Alternative are not expected to have significantly different local air quality effects through the design and future analysis years. Because the hot spot analysis only looks at the worst-case intersections, some segments of the project are not specifically included in the analysis. For example, the Johns Landing area, which does show some design option variations for the Streetcar Alternative, does not include any of the analyzed intersections (based on LOS and volume, as shown in Section 3.11.1.2). However, by the ranking methodology, the Johns Landing intersections are assumed to have better air quality than the three analyzed intersections and are therefore assumed to be in compliance with air quality standards for each of the alternatives and design options.

By intersections, A Avenue and Highway 43 is predicted to have the highest eight-hour CO impact (6.2 ppm for each alternative and year). Northshore Road and Highway 43 has a predicted impact of 5.4 ppm for year 2009 and 5.5 ppm for each alternative in year 2035. Foothills Road and Highway 43 has predicted impacts of 5.6 ppm for 2009 existing and 2035 No-Build Alternative scenarios, and 5.5 ppm for each build alternative in 2035. As noted above, the differences in predicted impacts between the alternatives are minimal. The alternatives do not cause any major changes to these worst-case intersections (besides the slight decreases in volumes and volume to capacity ratios); there are no physical lane modifications at any of these intersections. In addition, the similarities between predicted impacts for the alternatives follows along with the regional analysis which showed overall daily VMT to be very similar, especially between the build alternatives.

Table 3.11-3 Air Quality Hot Spot Analysis[1] – Predicted 8-Hour CO Concentrations (ppm)[2]

Existing Conditions	2009
Avenue A and Highway 43	6.2
North Shore and Highway 43	5.4
Foothills and Highway 43	5.6
Alternative	**2035**
No-Build Alternative	
Avenue A and Highway 43	6.2
North Shore and Highway 43	5.5
Foothills and Highway 43	5.6
Enhanced Bus Alternative	
Avenue A and Highway 43	6.2
North Shore and Highway 43	5.5
Foothills and Highway 43	5.5
Streetcar Alternative (in Segment 3 Johns Landing)	
In-Street/Additional Lane Design Options	
Avenue A and Highway 43	6.2
North Shore and Highway 43	5.5
Foothills and Highway 43	5.5
Willamette Shore Line Design Option	
Avenue A and Highway 43	6.2
North Shore and Highway 43	5.5
Foothills and Highway 43	5.5

Source: URS, March 2010.
Notes:
1 For the following intersections: Avenue A and Highway 43; North Shore and Highway 43; Foothills and Highway 43.
2 8-Hour concentration = 1-Hour concentration times persistence factor of 0.76; 1-Hour concentration equals 1-Hour modeled impact plus background concentration of 2 ppm.

3.11.3.3 Mobile Source Air Toxics

In addition to the regional effects on criteria pollutants, Mobile Source Air Toxics (MSATs) are also expected to be minimally impacted by project. Regionally, MSAT emissions are proportional to vehicle miles traveled (VMT); however, MSAT emission rates are expected to be greatly reduced by technological improvements over the next several years. As shown above in Table 3.11-2, the differences in regional VMT between the alternatives is minimal, with each of the build alternatives having lower predicted VMT than the No-Build Alternative. The Streetcar Alternative In-Street/Additional Lane design option has the lowest expected VMT, and therefore, would be expected to have the lowest MSAT emissions.

3.11.3.4 Climate Change

Climate change is a global problem caused by emissions of greenhouse gases (GHG) from every conceivable source in every nation of the world. Transit projects, in general, can both add (e.g., operations of buses) and reduce GHG (e.g., the overall reduction of vehicle trips). A study by the American Public Transportation Association, *Public Transportation's Contribution to Greenhouse Gas Reduction* by Todd Davis and Monica Hale of Science Applications International Corporation, September 2007, suggests that investments in transit generally lead to long-term reduction in the growth of GHG emissions. Further, because transit projects vary, it is difficult to provide an overall statement of transit projects' effects on GHG. However, very generally speaking, the (adverse) impact of any one transit project on GHG emissions, even in a cumulative effects evaluation, is miniscule within the global context of the problem. Thus, the increased use of transit locally in the Portland metro region, and across the United States, may have a measurable (positive) impact on the environment from the overall reduction in GHG emissions but, as a general proposition, the overall increase or decrease in global GHG emissions resulting from an individual transit project is so small that it is not necessarily possible to predict the impact of that project on the global climate. Because of this, climate change historically has not been considered useful in choosing a preference from among the alternatives considered during the National Environmental Policy Act (NEPA) review of a single proposed transit project.

Recent guidance from the Council on Environmental Quality (*Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*, CEQ Memorandum, February 18, 2010) states:

> 25,000 metric tons may provide a useful, presumptive, threshold for discussion and disclosure of GHG emissions because it has been used an proposed in rule-makings under the Clean Air Act (e.g., EPA's Mandatory Reporting of Greenhouse Gases Final Rule, 74 FR 56260, October 30, 2009). This threshold is used in Clean Air Act rulemakings because it provides comprehensive coverage of emissions with a reasonable number of reporters, thereby creating an important data set useful in quantitative analyses of GHG policies, programs and regulations (see 74 FR 56272). This rationale is pertinent to the presentation of NEPA analysis as well.

For the purpose of this DEIS, GHG emissions were calculated to compare the differences for each of the alternatives (2035 only). Table 3.11-4 shows effects of the various build alternatives as compared to the No-Build Alternative on emissions of carbon dioxide (CO_2), evaluated as a surrogate for all GHGs as it is a major component (approximately 95 percent) of transportation-related GHGs. The build alternatives are considered to have a slightly beneficial impact on CO_2 emissions, up to an approximate 42-ton per day reduction due to the Willamette Shore Line design option. Over a one year period, this equates to a reduction of approximately 15,375 tons, which is below the CEQ proposed level of 25,000 metric tons (27,560 tons) of CO_2 'equivalents' (includes prorated amounts of other GHG's based on their potency) to require further evaluation for NEPA analysis.

Apart from the overall reduction in GHG due to the build alternatives, public transportation also produces significantly lower GHG emissions per passenger mile than private vehicles. On a national average, CO_2 emissions per passenger mile are approximately 62 percent lower with light rail as they are for average single occupancy vehicles (SOV), and 23 percent lower for large bus systems as compared to SOVs (*Public Transportation's Role in Responding to Climate Change*, FTA, Updated January 2010).

Table 3.11-4 Estimated Average Daily Difference in Carbon Dioxide (CO_2) Emissions Between Project Alternatives (tons/day)

Project Alternative (2035)	Difference between No-Build and Build Alternative Daily Vehicle Miles Traveled (VMT)[1]	Difference between No-Build and Build Alternative Carbon Dioxide (CO_2) (tons/day)[2]
No-Build	--	--
Enhanced Bus	-41,000	-25.40
Streetcar with In-Street/Additional Lane Design Options	-65,400	-40.51
Streetcar with Willamette Shore Line Design Options	-68,000	-42.12

Notes:

[1] VMT from Metro, 2010 (see data provided in Table 3.11-2).

[2] Based on MOBILE6.2 data from Metro (2010): emission factor for winter conditions with average speed of 35 mph (562.489 gram/mile). [Example calculation for Enhanced Bus Scenario: -41,000 (miles/day) * 562.489 (grams/mile)/908000 (grams/ton) = -25.40 (tons/day)]

3.11.3.5 Cumulative and Indirect Impacts

The project alternatives are not expected to have significant effect upon energy supply or consumption at the regional level. Therefore cumulative effect of this project with other projects and ongoing demand for energy are expected to be limited.

The forecast traffic volumes used to analyze the air quality impacts of the project alternatives include traffic from other sources and are based on the future expected land use and employment information for the project area (which include expected traffic from development in the region and project area). Background concentrations representing the cumulative emissions of other sources in the area are added into the predicted local concentrations for CO at intersections. Because of these inclusive analysis methodologies, the impacts are representative of cumulative and indirect sources, and no further analyses are conducted.

3.11.4 Conformity Determination

In summary, the Lake Oswego to Portland Transit Project is included in the 2035 RTP, which will be implemented through the 2008-11 MTIP. Metro has performed an AQCD for the 2035 RTP and 2008-2011 MTIP. As shown in the project’s air quality analysis, none of the project alternatives would cause or contribute to any violation of the NAAQS for CO. Therefore, the project would not cause any significant adverse air quality impacts.

3.11.5 Potential Mitigation Measures

The Lake Oswego to Portland Transit Project would meet air quality conformity criteria, as discussed above; therefore, no operational air quality mitigation is required. Construction impacts and mitigation are addressed in Section 3.16 Construction Activities and Consequences.

3.12 Energy

This section describes the analysis and anticipated effects of the project alternatives on energy consumption from operation and construction. This section addresses long-term direct, indirect and cumulative effects of the study alternatives. Short-term or construction energy use is also discussed below and in Section 3.16 Construction Activities. Additional detail on the energy analysis, including applicable regulations, consultations, comprehensive technical analysis methods, expected effects of the study alternatives and potential mitigation measures can be found in the *Lake Oswego to Portland Transit Project Energy Technical Report* (URS and TriMet/Metro, August 2010).

3.12.1 Introduction and Analysis Methods

Introduction

The purpose of performing an energy analysis is to compare, in general, the amount of energy that each alternative would require to construct and operate. Energy use, supply sources, rates of energy use and demand forecasts in the greater Portland/Vancouver metropolitan area are characterized for petroleum, electricity and natural gas.

The energy consumption of the study alternatives is evaluated using regional roadway data and corridor data from Metro for the base year (2005) and the planning horizon year (2035) for each alternative. The alternatives for the project are the No-Build Alternative, the Enhanced Bus Alternative and the Streetcar Alternative. For the Streetcar Alternative, there are various design options in various segments as described in Chapter 2. Only one segment has design options with significant enough differences to evaluate the differences in energy consumption. The Johns Landing Segment includes three streetcar design options: the Willamette Shore Line, Macadam In-Street and the Macadam Additional Lane. The analysis considers the differences in operation energy consumption between the Willamette Shore Line design option and the two Macadam Avenue design options. The differences between the Macadam In-Street and the Macadam Additional Lane design options are minimal; therefore, no separate analysis was performed.

Analysis Methods

The procedures and analysis is conducted in accordance with guidance provided by the Federal Transit Administration (FTA) and uses FTA approved transportation energy analysis methods created by Caltrans.

Energy analysis addresses two components: long-term use (operational energy consumption) and short-term use (construction energy consumption). Long-term energy impacts refer to the fuel consumed by the operations of project alternatives, such as cars, buses and streetcar vehicles. Short-term energy impacts refer to the energy associated with the construction of the Enhanced Bus Alternative or the Streetcar Alternative. Both long-term and short-term energy consumption is measured in British thermal units (Btu). One Btu is the quantity of energy necessary to raise one pound of water one degree of Fahrenheit at one atmosphere of pressure.

3.12.2 Affected Energy Environment

Existing Energy Consumption Overview. Energy generated from gasoline and diesel fuels generally account for over 95 percent of the total energy demand for the surface transportation sector.

Existing Transportation Energy Consumption in the Portland Metropolitan Area. Existing energy consumption includes energy used for motor vehicles, the TriMet light rail system, the Portland Streetcar system, TriMet buses, transit vehicle maintenance and the operation of maintenance facilities, and park-and-ride lots. Table 3.12-1 summarizes the daily energy consumption for these activities. Year 2005 total daily transportation energy consumption in the Portland metropolitan area was estimated at 354 billion Btu per day, which was equivalent to 2,827,800 gallons of gasoline per day.

Table 3.12-1 Transportation Operations Energy Consumption in Portland Metropolitan Area, Base Year (2005)

Vehicle and Facility Operations	Daily VMT[1]	Daily Fuel Consumption[2] (Gallons)	Daily Energy Consumption (Billions of Btu*)
Motor Vehicle Operations Totals	41,611,800	2,528,800	322
Motor Vehicle Maintenance[3]		278,300	29
Total Motor Vehicle Energy Usage		2,807,100	351
Transit Bus Vehicles	85,900	13,600	1.891
Non-Fuel Source Transit System[4]	13,100		0.367
LRT Maintenance Facility Operation[5]			0.029
Bus Vehicle Maintenance[5]		7,100	0.147
Bus Maintenance Facility Operation[5]			0.147
Park and Ride Operation[5]			0.008
Total Transit Energy Usage		20,700	2.600
Combined Energy Usage		2,827,800	354

Source: South Corridor Portland to Milwaukie Light Rail Project SDEIS - Energy Results Report (Metro and DEA, 2008).
Note: * Btu = British Thermal Unit, Btu/gallon of gasoline = 125,000 (gross), Btu/gallon of diesel = 138,700 (gross)
[1] Vehicle Miles Traveled, Metro 2002
[2] Methodology derived from Caltrans 1997
[3] Methodology derived from Caltrans 1983
[4] Includes MAX, Portland Streetcar, and Tram; energy calculated as (8.2 kWH/car mile) x (13,127 car miles) x (3,412 Btu/kWH)
[5] TriMet 2007

3.12.3 Environmental Consequences

This section evaluates and assesses the effects of the project alternatives on the transportation-related energy consumption in the study corridor. The energy analysis focuses on the following components:

- Energy consumed during operation (direct, long-term impacts) and construction (direct, short-term) of the project alternatives;
- Indirect impacts and cumulative energy impacts; and
- Projected long-term and short-term energy savings for the transportation system with the operation and construction of the project alternative.

Variations associated with the Streetcar Alternative design and phasing options would result in only minor differences in energy use (less than 1 percent) on a systemwide level.

3.12.3.1 Direct Impacts

3.12.3.1.1 Long-Term Energy Impacts

Long-term, direct energy impacts refer to the fuel and electricity consumed by motor vehicles and transit for operations and maintenance of the project alternatives.

Summary of Daily Corridor Energy Impacts

Year 2035 total daily transportation energy consumption in the corridor for the No-Build Alternative is estimated at 1.817 billion Btu per day, which is equivalent to 14,533 gallons of gasoline per day. The Enhanced Bus Alternative is estimated at 1.825 billion Btu per day, which is equivalent to 14,593 gallons of gasoline per day. The Streetcar Alternative Willamette Shore Line design option is estimated at 1.772 billion Btu per day, which is equivalent to 14,176 gallons of gasoline per day. The Streetcar Alternative Macadam In-Street or the Macadam Additional Lane design option is estimated at 1.775 billion Btu per day, which is equivalent to 14,200 gallons of gasoline per day.

The daily corridor transportation operations fuel consumption for motor vehicle use and transit energy use in 2035 is summarized in Table 3.12-2.

Table 3.12-2 Summary of Daily Corridor Transportation Operations Energy Consumption, Future Year 2035, Lake Oswego to Portland Transit Project Alternatives

			Streetcar Alternative[3] (Billions of Btu)	
Vehicle and Facility Operations[1]	No-Build Alternative (Billions of Btu[2])	Enhanced Bus Alternative (Billions of Btu)	with Willamette Shore Line Design Option	with Macadam In-Street/ Macadam Additional Lane Design Options
Motor Vehicle Operations Totals	1.36200	1.35700	1.34300	1.34600
Motor Vehicle Maintenance	0.16100	0.16100	0.15900	0.15900
Total Motor Vehicle Energy Usage	1.52300	1.51800	1.50200	1.50500
Transit Bus Vehicles	0.07100	0.08400	0.05100	0.05100
Non-Fuel Source Transit System	0.00000	0.00000	0.00012	0.00012
Total Transit Energy Usage	0.07100	0.08400	0.05112	0.05112
Bus Vehicle Maintenance	0.00600	0.00700	0.00400	0.00400
Bus Maintenance Facility Operation	0.05500	0.05500	0.05500	0.05500
LRT Maintenance Facility Operation	0.00100	0.00100	0.00100	0.00100
Total Transit Maintenance Energy Usage	0.06200	0.06300	0.06000	0.06000
Heavy Duty Vehicle Maintenance	0.08800	0.08750	0.08670	0.08690
Light Duty Vehicle Maintenance	0.07290	0.07270	0.07200	0.07220
Total Vehicle Maintenance Energy Use	0.16090	0.16020	0.15870	0.15910
Combined Energy Usage (Billions of Btu per day)	1.817	1.825	1.772	1.775
Combined Energy Usage (Gallons of Gasoline per day)	14,533	14,593	14,176	14,200

Sources: URS Corporation 2010, Metro 2010, TriMet 2010, Caltrans 1983

[1] There are no energy contributions from operations of commuter rail vehicles, commuter rail maintenance and park-and-ride operations.

[2] Btu = British Thermal Unit, Btu/gallon of gasoline = 125,000 (gross), Btu/gallon of diesel = 138,700 (gross)

[3] The Streetcar Alternative is for the full length project form South Portland to Lake Oswego. Most design options would not have significant energy consumption differences, but the ones in the Johns Landing Segment would, and are shown in this table.

Comparison of Alternatives

The energy analysis and comparison of alternatives are conducted for the differences among the project alternatives, as compared to the No-Build Alternative. The operations energy consumption for the Enhanced Bus Alternative would increase 0.008 billion Btu per day, as compared to the No-Build Alternative. This is equivalent to a daily increase in expenditure of 60 gallons of gasoline and would require approximately 0.42 percent more operations energy than the No-Build Alternative.

With the Streetcar Alternative, the operations energy consumption for the Willamette Shore Line design option would decrease 0.045 billion Btu per day, as compared to the No-Build Alternative. This is equivalent to a daily decrease in expenditure of 360 gallons of gasoline and would require approximately 2.46 percent less operations energy than the No-Build Alternative.

The operations energy consumption for the Macadam In-Street or the Macadam Additional Lane design options would decrease 0.042 billion Btu per day, as compared to the No-Build Alternative. This is equivalent to a daily decrease in expenditure of 335 gallons of gasoline and would require approximately 2.29 percent less operations energy than the No-Build Alternative.

Besides the Willamette Shore Line design option and the Macadam In-Street or the Macadam Additional Lane design options, there are no length differences between the Streetcar Alternative design options, therefore, no operational energy consumption difference. The energy differences between the design options are negligible; therefore, no separate comparison analysis of energy consumption between the design options was conducted.

Table 3.12-3 compares the daily and annual corridor energy operations consumption for the corridor by alternatives and design options, with respect to the No-Build Alternative for future year 2035.

Power Consumption for the Streetcar Alternative

Portland General Electric (PGE) would supply the energy that powers the streetcar. PGE's power supply mix consists of hydro (approximately 36 percent), coal (approximately 39 percent), natural gas (approximately 23 percent) and others such as nuclear, biomass and waste (approximately 2 percent).

Streetcars typically operate as a single car, requiring a peak current of 800 amps during acceleration. Streetcars operate at relatively low speeds, typically the speed of traffic on central city roadways. The low power requirements of streetcars allow the system to be fed at the supply utility's secondary voltage (between 120 volts and 480 volts).

Traction Power Substations (TPS) supply direct current (dc) electric power for operation of the streetcar ystem. The traction power system, with transformer substations placed at approximately half-mile intervals, is able to maintain operational voltage levels while eliminating the need for adding underground conduits for a parallel feed cable. Streetcar substations do not require a dedicated utility feed at the primary distribution voltage and sometimes can be fed from existing transformers as additional load.

The existing Portland streetcar system uses 750 volts of direct current (Vdc) traction power system. In the past, the Portland streetcar has used substations supplied by the electrical utility at 400 volts of alternating current (Vac). Streetcars have regenerating capability to minimize the power demand. This voltage is commonly available and it is assumed this voltage will be used to supply the substations for the Streetcar Alternatives extension (*Traction Electrification System Report*, February 2010).

Table 3.12-3 Total and Comparison of Operations Energy Consumption for the Lake Oswego to Portland Corridor, Future Year 2035

	Daily			Annual[2]		
Project Alternatives and Design Options (DOs)	**Vehicle Miles Traveled (Daily VMT)**	**Energy Consumption[1] (Billions of Btu/day)**	**Fuel Consumption (gal/day)**	**Vehicle Miles Traveled (Annual VMT)**	**Energy Consumption[1] (Billions of Btu/year)**	**Fuel Consumption (gal/year)**
No-Build Alternative	220,100	1.817	14,500	79,151,600	595	4,747,700
Enhanced Bus Alternative	219,600	1.825	14,600	78,756,600	595	4,734,200
Streetcar Alternative[3]						
Willamette Shore Line design option	215,900	1.772	14,200	77,979,600	585	4,681,400
Macadam In-Street design option	216,400	1.775	14,200	78,144,100	590	4,689,800
Macadam Additional Lane design option	216,400	1.775	14,200	78,144,100	590	4,689,800
Percent Change in Energy Consumption as Compared to the No-Build Alternative[4]						
Enhanced Bus Alternative	-0.23%	0.42%	0.42%	-0.50%	-0.28%	-0.28%
Streetcar Alternative[3]						
Willamette Shore Line design option	-1.88%	-2.46%	-2.46%	-1.48%	-1.40%	-1.40%
Macadam In-Street design option	-1.67%	-2.29%	-2.29%	-1.27%	-1.22%	-1.22%
Macadam Additional Lane design option	-1.67%	-2.29%	-2.29%	-1.27%	-1.22%	-1.22%
Net Difference In 2035 Energy Consumption as Compared to the No-Build Alternative[5]						
Enhanced Bus Alternative	-500	0.008	60	-395,000	-2	-13,500
Streetcar Alternative[3]						
Willamette Shore Line design option	-4,200	-0.045	-360	-1,172,000	-8	-66,400
Macadam In-Street design option	-3,700	-0.042	-335	-1,007,600	-7	-58,000
Macadam Additional Lane design option	-3,700	-0.042	-335	-1,007,600	-7	-59,000

Sources: URS Corporation 2010, Metro 2010, DEA, Inc. 2010
Lake Oswego to Portland Transit Project Transportation Technical Report (DEA Inc. and Metro/TriMet, March 2010)
Btu = British Thermal Unit
VMT = Vehicle Miles Traveled
These figures do not include maintenance and maintenance facility energy use
[1] Energy Consumption, Auto: Btu/gallon of gasoline = 125,000, Trucks: Btu/gallon of diesel = 139,000
[2] Annual energy consumptions are estimates only and do not accurately account for variations in seasonal energy use
[3] Streetcar Alternative calculations reflect the whole alignment with the design options in the Johns Landing segment.
[3] Percentages computed from unrounded numbers.
[4] Differences computed from unrounded numbers and rounded.

3.12.3.2 Indirect Impacts and Cumulative Energy Impacts

Cumulative effects related to energy use are integrated into the long-term effects analysis since energy estimates are based on travel demand forecasts and their associated operational efficiency. Compared to the No-Build Alternative, operation of the Enhanced Bus Alternative and the Streetcar Alternatives would cumulatively add to the availability of energy by reducing overall VMT and associated energy consumption in the Portland metropolitan area. Construction and operation of any project alternative are not expected to affect local or regional fuel availability or require the development of new energy sources.

No notable indirect energy impacts are expected to result from the project alternatives. None of the project alternatives is expected to have a significant cumulative effect on energy supply or consumption at a regional level. Construction and operations of any of the project build alternatives are not expected to affect local or regional fuel availability or require development of new energy sources.

3.12.4 Potential Energy Mitigation Measures and Projected Energy Savings

One of the goals of the Lake Oswego to Portland Transit Project is to reduce demand for energy. Operation of the Streetcar Alternative would reduce operating energy consumption for the total transit system, as compared to the No-Build Alternative and the Enhanced Bus Alternative; therefore, no energy mitigation measures are necessary for the Streetcar Alternative. The operating energy consumption for the Enhanced Bus Alternative is minimally higher than the No-Build Alternative and would not require mitigation.

Although no energy mitigation is required, innovative approaches such as new technologies, energy conservation methods, employment of sustainable design and techniques during construction, and maintenance programs could reduce the amount of energy the project would require during construction. Efforts to incorporate energy savings objectives may result in a reduction of overall construction energy use. The following examples of energy-efficient construction practices could help to minimize energy use:

- Minimizing the number of hauling trips by using full trucks to and from the site;
- Using recycled materials when possible, so that energy is not used to create new products;
- Using regional products whenever possible to reduce the distance materials travel;
- Using bio-diesel or other non-petroleum fuels;
- Limiting vehicle idling;
- Locating staging areas near work sites;
- Reusing construction signage, barriers, lighting, and other common materials to reduce energy in the production of materials; and
- Ensuring that all diesel-powered medium and heavy duty vehicles and off-road construction equipment have advanced emissions exhaust controls to reduce diesel particulate matter and nitrogen oxides.

In addition to reducing energy use during construction, consideration should be given to reducing the energy required to operate and maintain the project longer term, such as lighting, water collection and treatment, roadway materials, landscape maintenance and structural maintenance.

3.13 Hazardous Materials

This section identifies potential hazardous material sites in the area of potential effect (APE) for the Lake Oswego to Portland Transit Project. A hazardous materials site is a location or facility that has reportedly contained a hazardous substance or has released a hazardous substance into the environment. Results are based on review of the regulatory databases. For more information, see the *Lake Oswego to Portland Transit Project Hazardous Materials Technical Report* (TriMet/Metro, November 2010). Short-term hazardous materials impacts are summarized in Section 3.16 Construction Activities and Consequences.

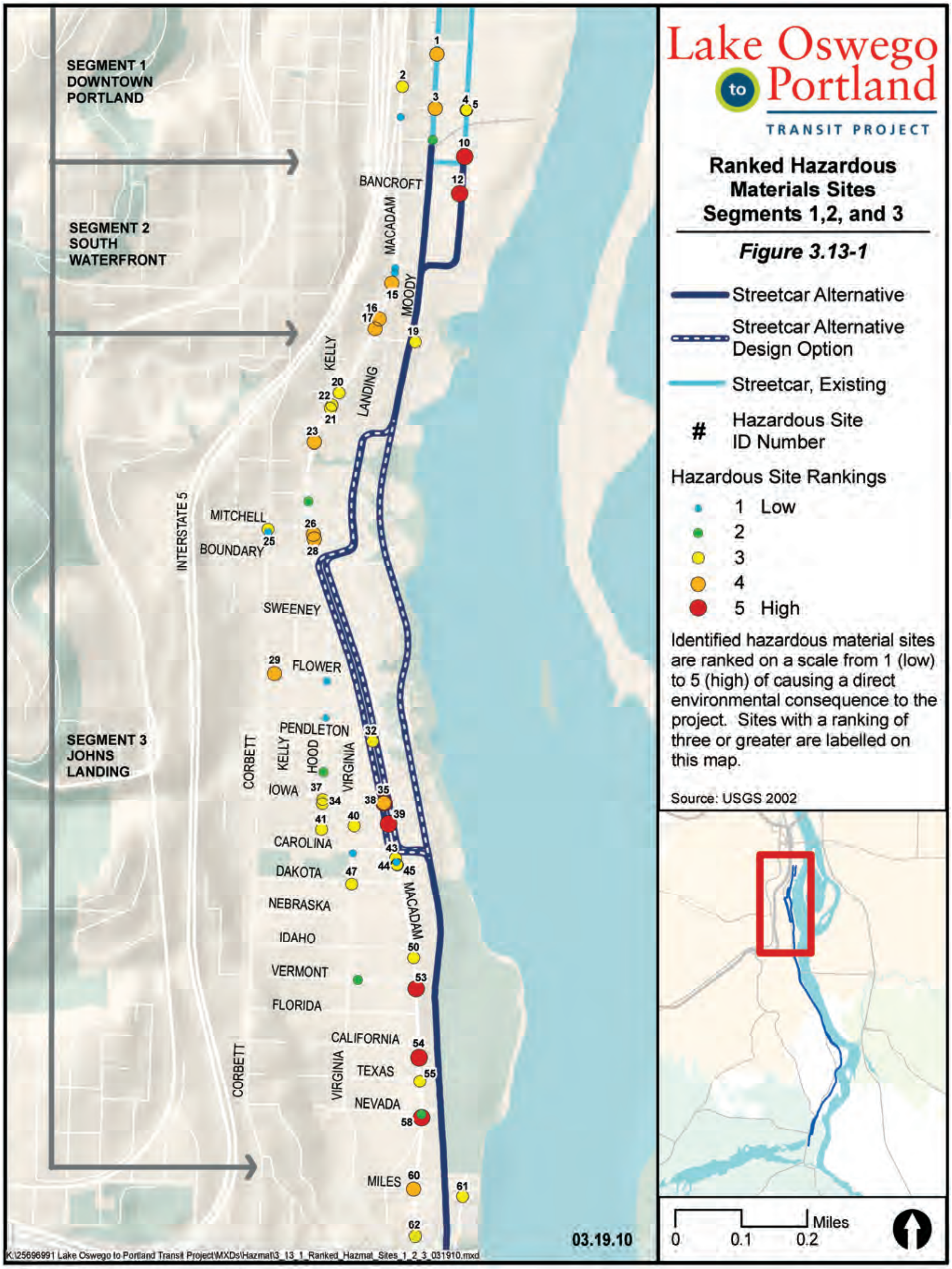
3.13.1 Affected Environment

The hazardous material APE is defined as a 500-foot buffer zone located laterally on each side of the project with the northern terminus at Southwest Bancroft Street and Moody Avenue, and the southern terminus at North State Street and Northshore Road. The affected environment within the APE was assessed by reviewing readily-available government database records from federal and state sources. Information for the database review is based, in part, on the Environmental Data Report that compiled database records through November 2, 2009. Based on this review, 119 sites were identified as potential hazardous material sites within the project's APE.

The project team assessed each of the potential sites and ranked them based on their potential impact to the project. Sites were ranked one to five, with five having the greatest potential to impact the project. Sites that were ranked three, four or five were given a unique site identification number by the project team, generally in ascending order from north to south. Sites ranked four or five were used for the assessment of environmental consequences for comparing the alternatives and options (see Section 3.12.2). Sites identified with a one to two include sites that were too far from the alignment and/or contained hazardous issues that could not affect the corridor. These sites included sites that were confirmed clean or were reported as not affecting the soil or groundwater. Sites identified as three to five are sites that have the greatest potential to affect the corridor site. Sites with the number three to four affected the soil and groundwater, have open files with the State of Oregon DEQ, or not enough information was available to determine their affect on the corridor alignment, but are not directly on the alignment. Sites listed as a "five" are impacted sites that have the greatest potential to directly affect the corridor due to minimal or no environmental actions currently being performed. Sites ranked "four" and "five" have a direct affect on the corridor and are in need of further investigation. Figures 3.13-1 to 3.13-3 illustrate the approximate location of the identified sites.

3.13.2 Environmental Consequences

This section summarizes the long-term direct and indirect impacts and cumulative impacts to hazardous materials sites that would result from the project alternatives and design options. Table 3.13-3 summarizes by alternative the number of known hazardous material sites that are located within 500 feet of proposed ground disturbing construction activities that would occur under the No-Build, Enhanced Bus, and Streetcar alternatives. Data for the Streetcar Alternative is reported as a range, reflecting differences due various Streetcar Alternative design options under study. Table 3.13-2 summarizes the differences in hazardous materials sites that would be within 500 feet of the proposed streetcar alignment under the design options, by segment.


Lake Oswego to Portland
TRANSIT PROJECT
Ranked Hazardous Materials Sites Segments 1,2, and 3
Figure 3.13-1
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar, Existing
Hazardous Site ID Number
Hazardous Site Rankings
1 Low
2
3
4
5 High
Identified hazardous material sites are ranked on a scale from 1 (low) to 5 (high) of causing a direct environmental consequence to the project. Sites with a ranking of three or greater are labelled on this map.
Source: USGS 2002
Miles
0
0.1
0.2
SEGMENT 1
DOWNTOWN
PORTLAND
SEGMENT 2
SOUTH
WATERFRONT
SEGMENT 3
JOHNS
LANDING
BANCROFT
MACADAM
MOODY
KELLY
LANDING
INTERSTATE 5
MITCHELL
BOUNDARY
SWEENEY
FLOWER
PENDLETON
CORBETT
KELLY
HOOD
VIRGINIA
IOWA
CAROLINA
DAKOTA
NEBRASKA
IDAHO
VERMONT
FLORIDA
CALIFORNIA
TEXAS
NEVADA
MILES
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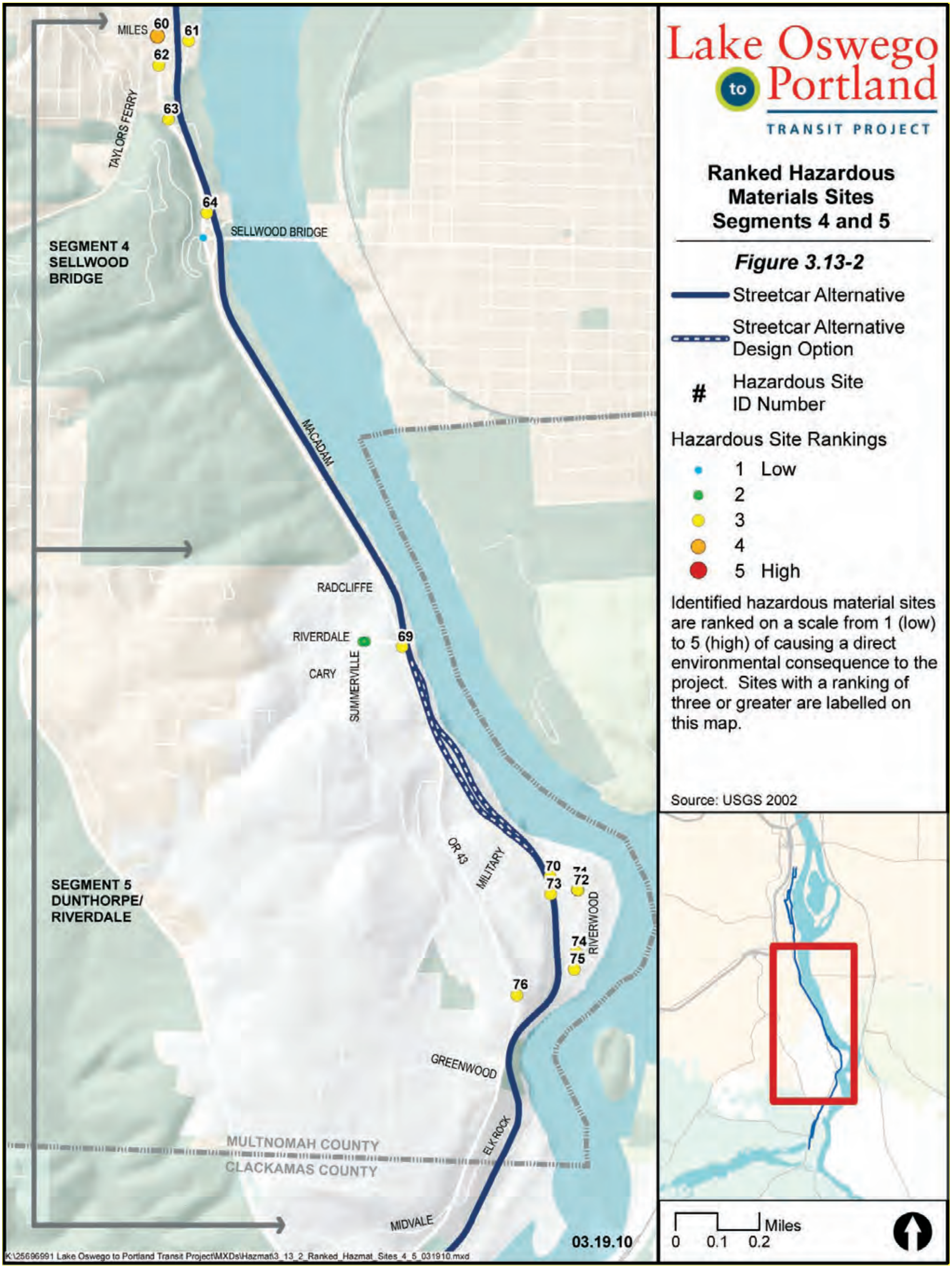

Lake Oswego to Portland
TRANSIT PROJECT
Ranked Hazardous Materials Sites Segments 4 and 5
Figure 3.13-2
Streetcar Alternative
Streetcar Alternative Design Option
Hazardous Site ID Number
Hazardous Site Rankings
1 Low
2
3
4
5 High
Identified hazardous material sites are ranked on a scale from 1 (low) to 5 (high) of causing a direct environmental consequence to the project. Sites with a ranking of three or greater are labelled on this map.
Source: USGS 2002
0 0.1 0.2 Miles
MILES
60
61
62
63
TAYLORS FERRY
64
SELLWOOD BRIDGE
SEGMENT 4
SELLWOOD
BRIDGE
MACADAM
RADCLIFFE
RIVERDALE
69
CARY
SUMMERVILLE
OR 43
MILITARY
70
71
72
73
RIVERWOOD
74
75
76
SEGMENT 5
DUNTHORPE/
RIVERDALE
GREENWOOD
ELK ROCK
MULTNOMAH COUNTY
CLACKAMAS COUNTY
MIDVALE
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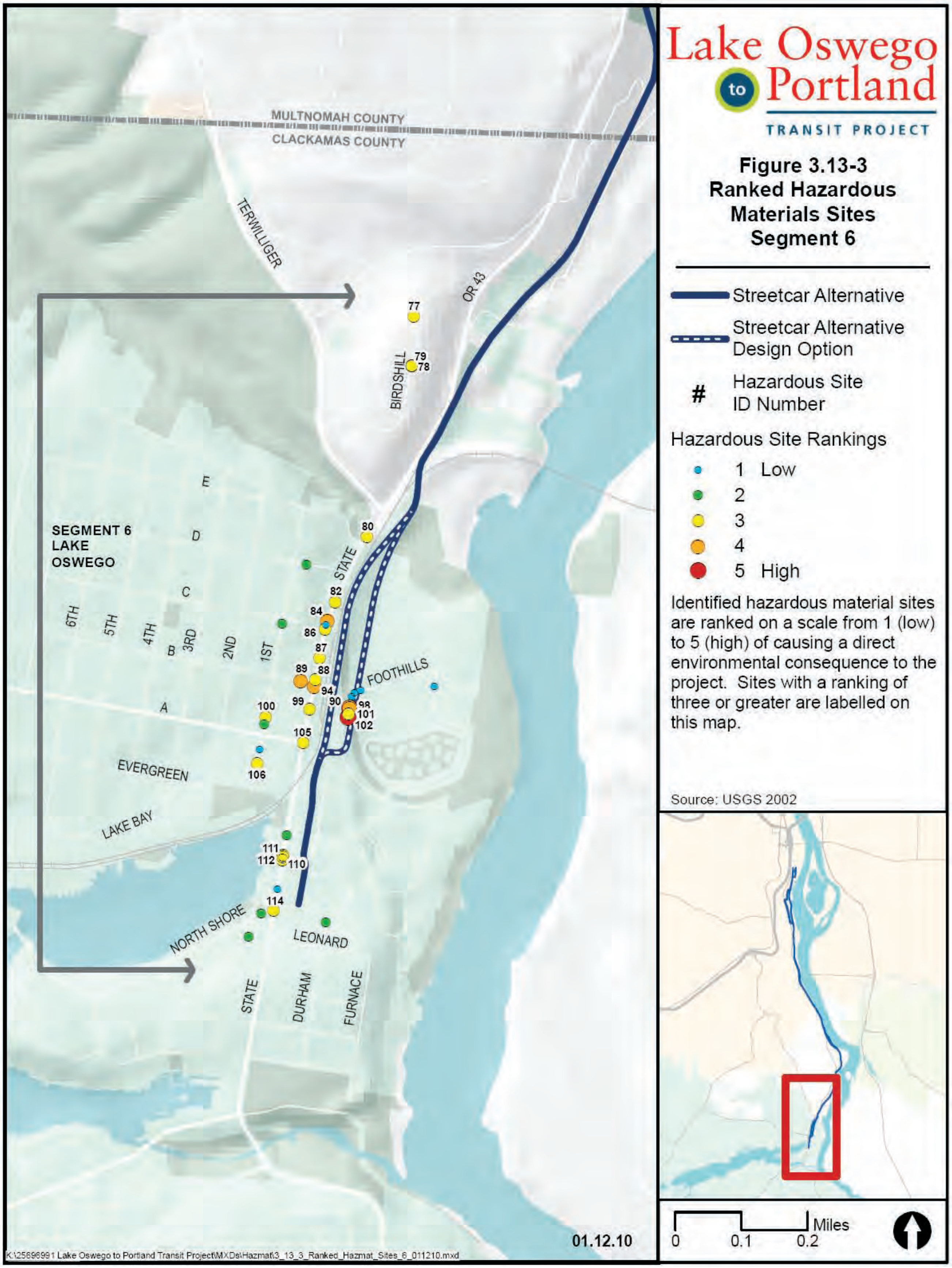
Lake Oswego to Portland
TRANSIT PROJECT
Figure 3.13-3
Ranked Hazardous Materials Sites
Segment 6
Streetcar Alternative
Streetcar Alternative Design Option
#
Hazardous Site ID Number
Hazardous Site Rankings
1 Low
2
3
4
5 High
Identified hazardous material sites are ranked on a scale from 1 (low) to 5 (high) of causing a direct environmental consequence to the project. Sites with a ranking of three or greater are labelled on this map.
Source: USGS 2002
Miles
0
0.1
0.2
MULTNOMAH COUNTY
CLACKAMAS COUNTY
TERWILLIGER
OR 43
BIRDSHILL
SEGMENT 6
LAKE
OSWEGO
E
D
C
B
A
6TH
5TH
4TH
3RD
2ND
1ST
STATE
FOOTHILLS
EVERGREEN
LAKE BAY
NORTH SHORE
LEONARD
STATE
DURHAM
FURNACE
77
79
78
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The following table summarizes the total number of sites potentially impact by proposed alternative:

Table 3.13-1 Hazardous Materials Sites within 500-Feet of Ground-Disturbing Construction, by Alternative

Measure	No-Build Alternative	Enhanced Bus Alternative	Streetcar Alternative
Hazardous Materials Sites[1]	0	10	31

[1] Number of known hazardous materials sites within 500-feet of ground-disturbing construction.
Source: URS – January 2010.

3.13.2.1 No-Build Alternative

Under the No-Build Alternative, ground disturbances associated with the project would not occur. The lack of these disturbances would create both potentially adverse as well as beneficial long-term effects associated with the No-Build Alternative. Adverse long-term effects include hazardous materials sites that would not be investigated or subsequently remediated. Such sites would likely continue to pose long-term environmental risk. In addition, adverse effects may be associated with the No-Build Alternative due to increased traffic demands in the corridor. These effects would include but would not be limited to bridge, roadway and transit upkeep, incidental spills or releases from vehicles or transit, and stormwater management and treatment. Beneficial long-term effects of the No-Build Alternative would include limiting the potential for exacerbating contamination in soil or groundwater because identified and unidentified hazardous material sites would not be aggravated. As a result, the long-term hazardous materials impacts would generally tend to be greater from the No-Build Alternative compared to the Enhanced Bus and Streetcar alternatives.

3.13.2.2 Enhanced Bus Alternative

Except for the effects associated with the proposed 300-space structured park-and-ride lot at the Lake Oswego Village shopping center, the effect of the Enhanced Bus Alternative would be similar to those under the No-Build Alternative. Long-term impacts to hazardous material sites from the Enhanced Bus Alternative at the park-and-ride lot site may include adverse effects on remedial actions proceeding at hazardous material sites. Remedial actions could include active cleanup, long-term monitoring and maintenance, enforcement, institutional controls (i.e., deed restrictions, restrictive covenants) and/or engineering controls (i.e., soil cap, groundwater pump and treat). Long-term operation of these remedial actions could conflict with transit operations under the Enhanced Bus Alternative. Risk of these conflicts would be minor.

Ten known hazardous material sites rated four or five are within the APE of the proposed Lake Oswego park-and-ride facility (see Figure 3.13-1). Long-term impacts associated with remedial actions at these sites would be minor. Long-term impacts to hazardous materials sites under the Enhanced Bus Alternative would also include direct and indirect exposure or mobilization of contaminated materials as a result of roadway and transit operation and maintenance. In general, operation and maintenance associated with the Enhanced Bus Alternative would not cause an appreciable increase in incidental spills or releases of hazardous materials from vehicles or transit.

3.13.2.3 Streetcar Alternative

There are 31 known hazardous materials sites that are rated four or five that would be located within 500 feet of ground-disturbing construction locations under the Streetcar Alternative (see figures 3.13-1 to 3.13-3), including the ten sites that were identified for the Enhanced Bus Alternative. As illustrated in Table 3.13-2, there are no differences between the streetcar design options in the number of known hazardous material sites that would be within 500 feet of ground-disturbing construction.

Long-term impacts associated with remedial actions at the 31 known sites would be minor. Long-term impacts to hazardous materials sites under the Streetcar Alternative would also include direct and indirect exposure or mobilization of contaminated materials as a result of roadway and transit operation and maintenance. In general, operation and maintenance associated with the Streetcar Alternative would not cause an appreciable change in incidental spills or releases of hazardous materials from vehicles or transit.

The Streetcar Alternative would not add to the number of hazardous materials sites along the corridor, so there would be no increase in the cumulative hazardous materials sites as a result of the project. Existing sites as well as currently unidentified sites, if any, would otherwise be subject to further measures for clean up activities or contain contaminated sites.

Table 3.13-2 Hazardous Materials Sites within 500-Feet of Ground-Disturbing Construction Under the Streetcar Alternative, by Segment and Design Option[1]

Segment	Design Option	Hazardous Materials Sites[1]
1 – Downtown Portland	None	4
2 – South Waterfront[2]	None	5
3 – Johns Landing	Willamette Shore Line	11
	Macadam In-Street	11
	Macadam Additional Lane	11
4 – Sellwood Bridge[3]	None	1
5 – Dunthorpe/Riverdale	Willamette Shore Line	0
	Riverwood In-Street	0
6 – Lake Oswego	UPRR	10
	Foothills	10

Source: URS – January 2010.
Note: UPRR = Union Pacific Railroad.
[1] Number of known hazardous materials sites within 500-feet of ground-disturbing construction.
[2] The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.
[3] The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

3.13.5 Mitigation

Project improvements would be constructed to current state and federal standards and, as a result, would tend to reduce long-term effects of contaminant migration from shallow soil to groundwater and/or surface water, relative to existing conditions. Potential releases of hazardous substances and petroleum products on roadways and located adjacent to or within the roadway or project right of way would be mitigated by the applicable federal, state or local response agency. Responses by the Oregon State Fire Marshal would be under *Hazardous Waste Operations and Emergency Response: Responding to Hazardous Substance Releases* (i.e., directive A-206, issued April 15, 1994 and revised September 14, 2000).Mitigation for short-term hazardous materials impacts are summarized in Section 3.16 – Construction Activities and Consequences.

3.14 Safety and Security

This section describes the safety and security conditions in the project area and evaluates potential effects of the Lake Oswego to Portland Transit Project. This DEIS has a related section on Neighborhoods, Displacements and Relocations (Section 3.3), which contains discussion about public services, such as fire, police, emergency medical services and hospitals. This section focuses on public safety considerations for the communities to be served by the transit project and discusses safety and security factors for the transit facilities.

Safety and security issues related to construction are addressed in Section 3.16 Construction Activities and Consequences. For more details on safety and security issues and effects of the study alternatives and design options, refer to the *Lake Oswego to Portland Transit Project Safety and Security Technical Report* (Alta/URS and TriMet/Metro, November 2010).

3.14.1 Affected Environment

Figures 3.3-2, 3.3-3 and 3.3-4 in section 3.3 Neighborhoods, Displacements and Relocations, show the location of fire, emergency services, law enforcement and other public service providers found in the study area.

3.14.1.1 Law Enforcement, Fire and Emergency Medical Services

Oregon State Police (OSP) Patrol Services Division provides a uniformed presence and law enforcement services throughout the state, with a primary responsibility for crash reduction, crime reduction, and other transportation safety issues; as well as to respond to emergency calls-for-service on Oregon's state and interstate highways. The study area is located in the Willamette Patrol Area headquartered in Milwaukie. One trooper is assigned to the patrol area which includes Highway 99E and Interstate 205 in western and southern Clackamas County. Within the study area OSP has primary responsibility for a short segment (one-half mile) of Highway 43 in the area between Lake Oswego and the Multnomah County line. City agencies assume primary enforcement responsibilities for Highway 43 within their jurisdictions, with backup and other cooperation from OSP.

The City of Portland Police Bureau (PPB) is the largest city law enforcement agency in Oregon. The Bureau has approximately 1,000 full-time officers, up to 100 reserves, 50 cadets, and 300 civilian positions. The PPB provides law enforcement services in three precincts: Central, North, and East. A portion of the Lake Oswego to Portland Transit Project will be located within the Central Precinct which covers 32.4 square miles with an estimated residential population of 99,174 as of 2000.

City of Portland Fire and Rescue (PF&R) is Oregon's largest fire and emergency provider. PF&R has 30 stations, two of which serve areas adjacent to the proposed light rail alignment: Station 4 (Portland State University) serves downtown Portland and the South Portland (formerly Corbett-Terwilliger-Lair Hill) and Homestead neighborhoods; and Station 10 (Burlingame) on Southwest Taylors Ferry Road serves the South Burlingame, Collins View, Arnold Creek and Johns Landing neighborhoods. While each station is responsible for specific parts of the city, stations support one another to provide 24-hour emergency operational readiness.

Multnomah County Sheriff's Office (MCSO) provides patrol, incarceration, civil process, and search and rescue services for over 17,000 residents in 291 square miles within Multnomah County. The MCSO employs 28 patrol officers and up to 75 law enforcement personnel. In addition to enforcing state statutes and county ordinances, patrol deputies provide direct assistance to city residents as well as routine and emergency backup for city police officers and specialized units. One patrol car is normally assigned to the 65 square mile Westside Patrol District which includes the Riverdale and Dunthorpe neighborhoods, an area in the middle of the project area bounded to the north by Portland's southern city boundary, to the south by the northern boundary of Clackamas County, and to the east by the Willamette River. Patrol deputies may be dispatched out of the sheriff's office at Northeast 122nd Avenue and Glisan Street.

Clackamas County Sheriff's Office provides patrol, incarceration, civil process, and search and rescue services for approximately 1,893 square miles within Clackamas County with approximately 90 patrol officers. In addition to enforcing state statutes and county ordinances, patrol deputies provide direct assistance to county residents as well as routine and emergency backup for city police officers and specialized units. The Wilsonville patrol district covers the Birdshill neighborhood, a small triangular area in the southern end of the project area bounded to the north by the Clackamas County boundary, to the southwest by Lake Oswego's northern city boundary and to the east by the Willamette River. Patrol deputies may be dispatched out of the Wilsonville, South Station in Oregon City and Oak Lodge substation. The Lake Oswego Police Department provides police services for a small portion of this area.[93]

City of Lake Oswego Police Department (LOPD) provides law enforcement within the jurisdiction of Lake Oswego, back-up to the Clackamas County Sheriff's Office, response to major crimes in Clackamas County, and direct support to the City of Portland. In addition to areas within the city, the Lake Oswego Police Department responds to calls in the Birdshill[94] neighborhood north of the city. Lake Oswego's Police Station is in City Hall at 380 A Avenue, on the corner of 4th Street and A Avenue, approximately one-third mile west of the project corridor. The LOPD has 43 officers including 29 patrol officers and serves an area of 11.5 square miles with a population of approximately 36,700 (2009). As part of their commitment to addressing local criminal issues quickly and fully, the City of Lake Oswego also has a municipal court which handles local jury trials on Monday mornings and all other cases on Wednesdays.

Lake Oswego Fire Department provides fire, rescue and emergency medical response to approximately 37,000 citizens within the City of Lake Oswego and three adjoining contract districts, including Riverdale/Dunthorpe Fire District within the project corridor. The department has 51 fire fighters serving 15 square miles. Fire Station 214, Lake Oswego's main fire station is at 300 B Avenue in Lake Oswego, about one-third mile west of the project corridor. Fire Station 212 serving the southern tip of the corridor is at 1880 South Shore Boulevard.

Riverdale Dunthorpe Patrol, Inc. is a private security patrol company serving individual families and homeowners in Dunthorpe and surrounding neighborhoods. It has no responsibility to a homeowners association or neighborhood organization. Response to enforcement or emergency situations is exactly like a citizen reporting an incident.

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[93] Some parcels in the Birdshill neighborhood are within the Lake Oswego city limits. The unincorporated areas are in Clackamas County.
[94] See note above.

3.14.1.2 Safety and Security Statistics by Neighborhood

City of Portland, Multnomah County, Clackamas County and City of Lake Oswego crime statistics for the project area are shown in Table 3.14-1.

Table 3.14-1 Number of Crimes in Portland, Multnomah County, Clackamas County and Lake Oswego January 2009 through December 2009

	Part I Crimes	Part II-A Crimes	Part II-B Crimes	Total
Portland				
South Portland (formerly Corbett-Terwilliger- Lair Hill)	228	125	81	434
Multnomah County				
Dunthorpe-Riverdale	12	7	5	24
Clackamas County				
Birdshill	2	14	0	16
Lake Oswego				
Birdshill	1	0	12	13
Foothills	30	44	162	236

Source: Portland Police Bureau, 2010. Multnomah County Sherriff's Office, 2010. Lake Oswego Police Department, 2010. Clackamas County Sherriff's Office, 2010.

The area patrolled by the Portland Police Bureau falls entirely within the South Portland neighborhood in the Central Precinct. The population of the neighborhood was 6,877 (2000 Census). Part I Crimes[95] account for 53 percent of the reported crimes in the neighborhood.

The area patrolled by the Multnomah County falls entirely within the Dunthorpe/Riverdale Neighborhood in the Westside Patrol District. The population of the neighborhood was 1,025 (2000 Census). Part I Crimes account for 50 percent of the reported crimes in the neighborhood.

The area patrolled by Clackamas County includes the unincorporated portion of the Birdshill Neighborhood (population 215). Part I Crimes account for 13 percent of the reported crimes in the neighborhood.

The area patrolled by the Lake Oswego Police department includes a portion of the Birdshill (population 215), and Foothills (population 413) neighborhoods. Part I Crimes account for 12 percent of the reported crimes in the neighborhoods.

3.14.1.3 Transit Safety and Security Statistics

TriMet's service district covers 575 square miles in the urban portions of the tri-county area. TriMet's 52-mile light rail system and 81 bus routes provide about 322,900 rides each weekday. Streetcars operated by Portland Streetcar Inc., run on an 8.0-mile continuous loop (4.0-mile in each direction) from Northwest 23rd Avenue, through the Pearl District, downtown past Portland State

[95] Each agency labels crimes differently, this analysis classifies Part I Crimes as: aggravated assault, arson, burglary, homicide, larceny, rape, robbery, theft from vehicle and vehicle theft. Part II Crimes include: drugs, embezzlement, forgery, fraud, prostitution, sex crime, simple assault, stolen property vandalism and weapon. Part III Crimes include Curfew, DUI, trespass, disorderly conduct, gambling, kidnapping, liquor laws, offense against family, runaway, and other less serious crimes such as traffic or fish and game violations.

University, to the South Waterfront District at Southwest Lowell Street and Bond Avenue, and back. The streetcar system provides approximately 10,000 rides each day. On average about three incidents are reported per day for the entire transit system. Generally, these are non-weapon and non-violent incidents.

3.14.1.4 Transit Safety and Security

The Department of Homeland Security provides guidance on safety and security that apply to TriMet and Portland Streetcar Inc., and both agencies collaborate with state and local agencies to coordinate fire and life safety policies. TriMet and Portland Streetcar Inc. take the following steps to implement safety and security measures for major new capital facilities:

- Prepare a Safety and Security Management Plan. This plan would define the safety and security activities and methods for identifying, evaluating and resolving potential safety issues and security vulnerabilities, and would establish responsibility and accountability for safety and security during each project phase – Preliminary Engineering through startup. A Safety and Security Certification Program, also a required element, would verify that identified safety-critical items have been designed and constructed into the system. These plans are reviewed by the FTA Project Management Oversight Committee and FTA staff.

- Meet regularly with a Fire, Life and Safety Committee comprised of police, fire and safety personnel along with transit operations staff to ensure safe project operations.

- Review procedures, staffing levels, and safety and security measures with the Fire, Life and Safety Committee during on-going operations. This allows transit agencies and their partners to identify and respond to localized security concerns that may occur over time.

TriMet and Portland Streetcar Inc. consider safety and security management as an integral part of their mission to develop and operate an effective transit system. Safety and security are key factors in the planning and design of transit stations and other facilities. The agencies use a combination of design, public education, and operations measures to lower the potential for crime and to minimize potential conflicts among trains, buses, people, and other vehicles.

While safety and security are terms that are often used interchangeably, they have distinct meaning and each needs to be addressed with a unique approach. Safety can be described as freedom from unintentional danger, whereas security represents freedom from intentional danger.

From a transit system perspective, safety focuses on elements of the system such as vehicle operations, station area function, pedestrian movements, crossings and emergency response. Safety measures aim to reduce potential conflicts related to interactions among transit, autos, bicyclists and people. Transit agencies prepare an annual systemwide safety plan that reinforces safety as a core value and defines safety requirements, lines of authority, accountability and documentation.

Transit system security starts with facility design and is achieved by establishing appropriate policies and procedures and optimizing the use of human resources, technology and equipment, and by establishing strong partnerships among the community, transit operators and law enforcement. Transit agencies prepare an annual security plan that establishes systemwide security goals aimed at enhancing facility design, increasing employee and public awareness, reducing unlawful behavior and facilitating emergency preparedness.

Security improvements are affected by system design and maintenance, technology, community outreach, and enforcement. While enforcement is critical, a design that deters misconduct and promotes safety is of utmost importance. In planning the proposed enhanced bus and streetcar alternatives, the project team proposes facility designs to be responsive to the neighborhood context and to maximize community benefits.

To allow crime prevention principles to be fully incorporated into a project, safety and security considerations are evaluated when making choices about station siting, layout, platform design, and park-and-ride facilities, beginning with the project's earliest planning stages. TriMet and Portland Streetcar Inc. consider best practices related to security when designing transit facilities and especially stations.[96] The best practices are derived from Crime Prevention Through Environmental Design[97] (CPTED) concepts, which provide guidelines to deter unlawful activity in a number of areas, described as follows:

- **Design and Maintenance.** Station security starts with good design and upkeep. Generally, well-kept and well-lit neighborhoods, office and industrial parks, good building stock, and few vacant spaces correlate with fewer security issues. Good maintenance and timely response to repairs also demonstrates capable guardianship of transit property, deterring adverse behavior.

- **Natural Surveillance**. The activity levels on surrounding streets or neighborhoods, the presence of passersby, transit personnel, and other riders waiting at a station or parking area all contribute to the number of "eyes on the street," helping to reduce the potential for security concerns. Strategies include good platform visibility, street-level windows, adequate lighting, and pedestrian friendly designs.

- **Territorial Reinforcement.** A sense of ownership among users translates into a deterrent to intruders. Features that define property lines and distinguish public from private spaces through the use of plantings, landscaping design, pavement materials, and fencing are common tools to create ownership. Features that suggest community ownership or pride in place such as neighborhood specific art or interpretive elements, message centers or furnishings, can also create this feeling.

- **Natural Access Control**. Guiding people to safe access routes and denying access to potential targets creates a sense of risk in potential offenders. This is achieved by clearly delineating public routes through landscaping and design, and preventing access to private property through physical barriers.

- **Target Hardening**. Managing entry and access means including features that make it more difficult to vandalize improvements, things like graffiti-resistant surfaces. It could also include emergency call-boxes and/or closed circuit television (CCTV).

According to these CPTED principles, station areas should be easily accessible to law enforcement personnel and should maximize opportunities for natural surveillance. The design of the station and its surroundings should promote personal safety and security by providing good sight-lines and

[96] TriMet Report to the Legislature, Light Rail Safety & Security, February 7, 2008.
[97] International CPTED Association.

avoiding conditions such as tall landscaping or other features that could obscure the presence of individuals on transit property. Well-lit, bright environments with high degrees of visibility from nearby streets or public areas also help deter vandalism and increase the perception of security. Though the lights from stations should be shielded from adjacent neighborhoods, the safety of pedestrians walking to those neighborhoods must be considered in design. Bright designated station areas and walkways with appropriate landscaping, free of entrapment areas, deter unlawful behavior. Stations should be kept clean, and signs of vandalism should be removed immediately to send the message that the community is in control.

Based on TriMet and Portland Streetcar Inc. experience with their existing systems and on national information, crime levels along rail transit project corridors are typically closely related to the existing conditions that prevail in the surrounding community.[98] A study of' the Los Angeles Green Line light rail revealed that inner city stations showed a decrease in crime that generally followed a decrease throughout Los Angeles County and crime in the higher income western suburbs did not increase after the Green Line was built.[99] In 2006, the Denver Regional Transportation District (RTD), which administers the FASTRACKS light rail system, conducted a review of one Denver light rail station and revealed that crime rates at the station directly correlated to issues occurring in the surrounding neighborhood.[100]

3.14.2 Impact Assessment

TriMet and Portland Streetcar Inc. develop and operate transit projects to provide a transportation benefit to the community, to support long-range land use plans and economic development goals, and to minimize other environmental impacts.

Public safety and security planning are major considerations in the development of transit projects such as the Lake Oswego to Portland Transit Project. Public involvement efforts for transit projects have also highlighted a number of questions and issues from the community about how transit projects are implemented, including:

Safety
- The need for lighting at transit stations and park-and-ride lots
- Interaction at vehicular, pedestrian and bike crossings of the transit alignment
- Interaction between children and transit vehicles and the transit right of way

Security
- Passenger security on transit vehicles
- Incidence of misconduct along the transit corridor
- Nuisance behavior aboard transit vehicles
- Streetcar station placement and access, especially in less active areas or near schools

[98] Numerous reports have been written and studies conducted across the U.S. and Europe regarding general crime patterns and criminal behavior. A study of transit security by the U.S. Department of Transportation noted that transit stations with high crime rates are generally located in neighborhoods with high crime rates (USDOT: Transit Security: A Description of Problems and Countermeasures Mauri, Ronald et al October 1984, reprint May 1985).
[99] Liggett, R, Loukaitou-Sideris, A, and Isek, H, Journeys to Crime: Assessing the Effects of a Light Rail Line on Crime in the Neighborhoods, 2002.
[100] Denver Regional Transportation District, Technical Memorandum: Neighborhood vs. Station Crime Myths and Facts November 16, 2006.

- The public's perception of security near parks, trails, and the Willamette River within vicinity of proposed stations
- Car and bike prowls, theft or graffiti near transit station locations
- Neighborhood visibility from the transit line

3.14.2.1 Long-Term Impacts

No-Build Alternative
With future growth in households and employment at the north and south ends of the corridor, demand for emergency services and law enforcement services would increase over time. As the population grows, there would be a corresponding demand for public safety and security services. Increased traffic would be a byproduct of growth and would be likely to increase congestion on roadways, which has the potential to slow emergency response times, as discussed in more detail in Chapter 4, Transportation, and Section 3.3, Neighborhoods, Displacements and Relocations of this DEIS. Because no new streetcar stations or bus facilities would be built along the corridor with the No-Build Alternative, local opportunities to improve safety conditions through transit-related improvements to streets, intersections, sidewalks, and lighting would not occur. Improved security through overall higher activity levels would also not occur.

Enhanced Bus Alternative
Household and employment growth is forecast to be the same under all of the alternatives. As with the No-Build Alternative, regionally and locally there will be increased demand for public safety and security services to meet the demands of growth. Increased traffic would also occur at levels similar to the No-Build Alternative, which would be likely to increase congestion on roadways and slow emergency response times, as discussed in more detail in Chapter 4 Transportation and Section 3.3 Neighborhoods, Displacements and Relocations.

Safety. Considering operational safety, the Enhanced Bus Alternative transit stops would all be street-oriented stations and transit centers. The lighting and amenities at the Lake Oswego park-and-ride lot located near Albertsons east of State Street in downtown Lake Oswego, taken with the higher activity levels that would accompany Enhanced Bus operation, would be an improvement over existing transit stops. Remaining bus stops would not be altered.

Buses accessing the park-and-ride location could increase the potential for transit/pedestrian and transit/auto conflicts.

Security. Considering system security, the facilities proposed in the Enhanced Bus Alternative are at locations with existing TriMet bus stops where TriMet's Transit Police Division already provides security, as they do throughout the transit system. Maintaining security and providing for emergency responses at all of the transit stops would be handled through TriMet's Transit Police Division and established fire, life and safety programs, which feature cooperative and ongoing planning between TriMet and local jurisdictions. This allows TriMet and its local partners to identify and address security concerns and response needs at all phases of systems development and operation.

The Lake Oswego park-and-ride lot would be in an area with a relatively low incidence of crime. State Street/Highway 43 is an active roadway. The station and park-and-ride lot would also benefit from the 6:00 a.m. to midnight activity at the grocery store because retail patrons may observe a more irregular schedule than park and ride patrons, providing passive surveillance of the area at times when the parking area may otherwise be unoccupied. The principles of passive surveillance suggest illegal activities are less likely to be carried out when they might be observed by others. As with other facilities in the transit system, the stations and park-and-ride would be designed to maximize visibility, provide for safe and convenient access for patrons, and reduce potential property loss or damage to parked vehicles. Other potential measures could include access controls, emergency call boxes, the use of CCTV, and security patrols.

Streetcar Alternative

As with the No-Build Alternative, there will be increased regional and local demand for public safety and security services to meet the demands of growth. Increased traffic would also occur at levels similar to the No-Build Alternative, which is likely to increase congestion on roadways and slow emergency response times, as discussed in more detail in Chapter 4 Transportation and Section 3.3 Neighborhoods, Displacements and Relocations.

Safety. Streetcar safety is related to function and operation. The stations and crossings for the streetcar would incorporate a combination of design, education and operating measures to minimize potential safety concerns to anyone who may access the streetcar or cross the corridor. Outreach and education programs would be targeted directly to community members and nearby schools to help them better understand streetcar operation and safety issues.

Station access would be oriented to streets and sidewalks and all crossings would be clearly designated. The station and the streetcar alignment would feature physical barriers to discourage people from walking directly across the tracks from the station or onto private properties.

The streetcar alternative and design options include segments running in the street as well as within separated right of way. These variables and the transitions between them present safety challenges that are addressed through audible warnings, signing, striping, signalization, enforcement and education. Signals would be the primary method for accommodating transitions between in-street and separated segments, offering a protected signal phase for the streetcar to enter and leave the roadway. Within the roadway, the streetcar vehicles would operate similar to buses.

Thirty-five public and private roadway, railroad and pedestrian track crossings have been identified in the proposed alignment. Proposed crossing treatments include closure or relocation, grade separation, stop signs, gates, traffic signals and pedestrian Z-crossings. Treatment selection criteria include sightlines, traffic volumes and speeds, transit vehicle speed, proximity and suitability of alternative routes, and convenience for pedestrians and transit patrons.

Security. Streetcar security is focused at stations. Except for the stations at SW Nebraska Street and SW Nevada Street, all the proposed stations in Johns Landing for all design options would be street-oriented in areas that currently have mixed-use environments, with residential and commercial uses nearby and high levels of activity.

The proposed stations adjacent to Willamette Park at Southwest Nebraska Street and Nevada Street are within sight of Macadam Avenue and would be located next to a large, heavily programmed regional park and nearby office buildings that provide natural surveillance. Collaboration with City of Portland Parks and Recreation on streetcar station design elements, including lighting and amenities at the stations, with the higher activity levels that accompany streetcar operation, would create an improvement over existing conditions.

The proposed Sellwood Bridge station would be located on currently active transit Lines 35 and 36 adjacent to Highway 43 at the west end of the Sellwood Bridge. The lighting and amenities at the station, with the higher activity levels that accompany streetcar operation, would be an improvement over existing conditions. With the expected replacement of the Sellwood Bridge, possibly open in 2016, bus transfers will occur at this station, further increasing station activity.

The proposed Riverwood and Briarwood stations are surrounded by single-family neighborhoods that are not anticipated to change character or redevelop as a result of transit improvements. These station sites are close to neighborhood roadways, which provide opportunities for natural surveillance from surrounding uses. The Riverwood station would be more visible to travelers on Riverwood Road, compared to the Briarwood station which is above Briarwood Road. The Riverwood and Briarwood stations are located in a neighborhood with very low incidence of crime. Design and operating measures are available for either station to provide patrons with well-lit and visible station areas and accessways. Note that lighting will be limited to the station area and access routes from the nearest roadway and surrounding homes will be shielded from glare.

The B Avenue station and park-and-ride lot would be located in an area that currently includes industrial uses, although commercial areas are located nearby and the area is anticipated to redevelop with a mix of land uses. While State Street/Highway 43 and Foothills Road are active roadways, activity levels in the area surrounding the B Avenue station and park-and-ride lot are currently relatively low outside of daytime hours. Design and operating measures are available to provide well-lit and visible station areas and accessways. With redevelopment, activity levels are expected to increase, providing more “eyes on the station.”

The Lake Oswego terminus station and park-and-ride lot would be located adjacent to a commercial shopping center with a high level of activity. As with other facilities in the transit system, the station and park-and-ride facility would be designed to maximize visibility, provide for safe and convenient access for patrons, and reduce potential property loss or damage to parked vehicles. Other potential measures could include access controls, emergency call boxes, the use of CCTV, and security patrols.

Streetcar Design Options (Safety). Streetcar operations and safety issues would be addressed, somewhat differently based on design option.

- *Johns Landing Design Option, Willamette Shore Line*. The Wi1lamette Shore Line Design Option would operate on the existing Willamette Shore Line right of way through Johns Landing. This alignment would operate in an exclusive transit alignment through commercial and residential areas. The residential areas include condominiums that have lawn and other landscaping surrounding the existing rail right of way. The streetcar would operate at a relatively low speed through these residential areas that would allow the driver sufficient time to react to any right of way encroachments. Pedestrian crossing treatments would include signage and Z-crossings.

- *Johns Landing Design Options, Macadam Avenue*. Both the Macadam In-Street and the Macadam Additional Lane design options would veer southwest off of the Willamette Shore Line and operate in mixed traffic on SW Landing Drive, SW Boundary Street, SW Macadam Avenue and SW Carolina Street. For in-street operations, special traffic signals, improved pedestrian crossings and signage would be used to facilitate safe movements among auto, bicycles, pedestrians and transit. Stations at SW Boundary Street and SW Carolina Street would increase pedestrian activity on adjacent sidewalks, on neighborhood streets and on SW Macadam Avenue.

- *Dunthorpe/Riverwood Design Option, Willamette Shore Line.* The Willamette Shore Line design option would operate on the existing Willamette Shore Line right of way through this segment. Approximately five private crossings would be included with this design option, most typically a driveway or access road crossing where the right of way is between SW Riverwood Road and garages and homes on the east side of the Willamette Shore Line. Appropriate private crossing treatments would be developed in conjunction with individual property owners.

- *Dunthorpe/Riverwood Design Option, Riverwood.* The Riverwood design option would operate in mixed traffic on SW Riverwood Road. The streetcar would not exceed the existing speed limit of 25 mph. This design option would close the access for Riverwood Road to Highway 43 which would reduce the amount of traffic on Riverwood Road in this vicinity. The Riverwood Road streetscape would include sidewalks and bike lanes, increasing potential for "eyes on the street".

- *Lake Oswego Design Options.* Both the Foothills and UPRR design options would operate in a similar manner through this segment and have similar safety and security treatments.

In summary, the Streetcar Alternative is not anticipated to create unique concerns.

3.14.2.2 Indirect and Cumulative Impacts

Secondary impacts are reasonably foreseeable effects that occur as a result of an action or not doing an action, but which are removed from the direct impacts of a project in place or time. Cumulative impacts are the sum of effects from past, current and other expected improvements or public actions. Safety and security issues related to construction are addressed in Section 3.16 Construction Activities and Consequences.

Streetcar projects typically encourage nearby development. Current streetcar alignments have contributed to public and private redevelopment investments occurring, for instance, in the developments in South Waterfront, including projects underway (see Section 3.1 Land Use). According to existing plans and policies, development or redevelopment in this corridor would be focused in Johns Landing and Lake Oswego and is not anticipated in the Dunthorpe/Riverdale or Birdshill areas.

In station areas that do experience redevelopment, the uses would typically be denser and involve higher levels of activity, greater design attention to personal security and renewed levels of maintenance. All of these elements contribute to more "eyes on the street," improvements in defensible space and a better sense of personal security, according to above CPTED principles for safety and security.

3.14.3 Safety and Security Mitigation Measures

There are different approaches to provide transit safety and security mitigation. The current Portland Streetcar Inc. model uses the Portland Police Bureau in downtown Portland. TriMet uses a dedicated transit police force and support personnel. A hybrid approach that fits the context of each segment of this corridor is likely to mix elements from Portland Streetcar Inc. and TriMet approaches to address safety and security needs throughout the transit system and in the Lake Oswego to Portland corridor. The approaches will respond to public issues and questions regarding safety and security related to specific conditions affecting the Lake Oswego to Portland Transit Project.

The public involvement programs for similar projects in the region have generated constructive feedback on:

- Use of CPTED principles throughout the design process;
- Incorporating design principles to enhance safety and security at station areas;
- Including a multidisciplinary review of safety and security design and operations practices prior to final design and construction;
- Evaluating station locations, overall alignment issues and operations as they relate to safety and security;
- Location of ticket machines away from platforms, so anyone on the platform will already have purchased a ticket;
- Clear delineation of platform area and communication that riders must have a fare in the platform areas, if station access is not restricted;
- Way-finding at platforms to help pedestrians find bus connections and other destinations;
- Work with freight railroads to adopt industry standards for safe operations in shared corridors;
- Safety and security outreach and education upon construction and operation of the system; and
- Consideration of emergency call boxes and CCTV cameras at stations.

3.14.3.1 Safety Measures

TriMet and Portland Streetcar Inc. are committed to making continued improvements to help maintain a safe transit system. Potential measures to address safety issues along the Lake Oswego to Portland Transit Project are shaped by comments and suggestions from the project team, local jurisdictions and the public and could include the following:

- To address streetcar safety for school children, new users, especially children, would be educated on how to be safe around the transit system, particularly before opening a new streetcar extension. By collaborating with teachers and parents, extensive safety outreach programs would reach schools located close to the new transit service.

- To address safe roadway crossings, the public would be alerted to the fact that streetcars pass through crossings with a brief signal cycle. The system would operate with computer controls and operator procedures that minimize the potential for conflicts.

- To address safe pedestrian crossings, the pedestrian and bicycle network along the proposed transit alignment would be evaluated and Z-crossings or other crossing treatments added where needed. After station platforms have been sited, the pedestrian network may be re-evaluated and the pedestrian crossings refined. Z-crossings control movements of pedestrians by turning pedestrians toward the direction of approaching trains before they cross each track. Z-crossings may be used at locations where pedestrians are likely to cross the tracks, such as at isolated, midblock or pedestrian-only crossings. Other crossing treatments are being considered and may be evaluated to address other crossing needs in the corridor.

- For streetcar operations within Macadam Avenue/Highway 43, safety and security measures would include traffic signals, signage, station design, pedestrian crossings and other features that contribute to a safe and pedestrian-oriented streetscape.

3.14.3.2 Security Measures

Security measures would be addressed by applying established policies, procedures and responsibilities appropriate to the Lake Oswego to Portland corridor. The following describes the TriMet and Portland Streetcar Inc. approach to system security.

TriMet's Transit Police Division (**TPD**) is a special unit within the Portland Police Bureau with cooperating agreements with the police agencies in the region including Multnomah and Clackamas County Sheriff's Offices. To provide more focused deployment and presence, four precincts have been established with offices in Hillsboro, Gresham, Clackamas Town Center, and downtown Portland. The TPD currently (2010) consists of 58 sworn officers. Transit security efforts are supplemented by contract security personnel, 30 fare inspectors and 46 field supervisors as well as operators, customer service staff and maintenance workers. TriMet's Director of Safety and Security and the TPD commander meet regularly with various community members, law enforcement agencies and security partners to evaluate issues and collaborate on solutions. TriMet also has an established transit rider security program that combines enforcement with public safety resources from community organizations.

Portland Streetcar Inc. Safety and Security Plans are reviewed at least annually. The transit system organizational structure includes safety committees to evaluate the effectiveness of the system safety and security programs and activities. Throughout the design process, the project team conducts safety and hazard analysis of the alignment, including identification of traffic conflicts and development of mitigation strategies, analysis of pedestrian and bicycle safety, and design of a safe interface between streetcars and other transit. Portland Streetcar certifies that new extensions are operationally ready before entering service. Managers of transit operations and safety coordinate with local governments, Department of Homeland Security, and other agencies to ensure emergency responders are familiar with transit equipment and property and that personnel are trained to perform satisfactorily in emergency situations. Portland Streetcar Inc. relies on the City of Portland Police Bureau to respond to safety and security issues and questions.

Based on transit system experience, specific security measures include the following:

- To address vandalism and graffiti, quick clean-up response times will be maintained. Murals, etched glass and other techniques may be used at station platforms to deter vandalism.

- To address passenger safety on streetcars at night, riders would be encouraged to implement personal safety strategies such as choosing to sit near the driver in the front of the train.

- TriMet employs more than 2,600 staff members and Portland Streetcar Inc. employs 40 staff who receive system safety and security training. Most of the employees work in the community, serving as "eyes and ears" and visible deterrents to crime.

If the Enhanced Bus Alternative or No-Build Alternative is chosen as the Locally Preferred Alternative, TriMet would continue with its existing safety and security policies and practices while working with the local jurisdictions and communities. If the Streetcar Alternative is selected as the preferred alternative, TriMet and Portland Streetcar Inc. would continue to develop and refine specific safety and security measures in consultation with the local communities and jurisdictions through preliminary engineering, the Final EIS and Final Design.

3.15 Utilities

This section identifies the utilities in the project area and evaluates the project alternatives' potential effects on them. This section first briefly describes the existing utilities within the Lake Oswego to Portland Transit Corridor, followed by an assessment of the potential effects on utilities that the project's alternatives and options would have on utilities, concluding with a summary of potential mitigation measures.

3.15.1 Affected Environment

The Lake Oswego to Portland Corridor currently has both underground and aerial utilities. Underground utilities include water, sanitary sewer facilities, storm sewer facilities and natural gas lines. Electrical service facilities are sometimes located underground. Underground utilities in the LOPT Corridor include City of Portland water, storm and sanitary sewers, City of Lake Oswego water, storm and sanitary sewers. Natural gas is provided by Northwest Natural.

Aerial utilities typically include communication facilities that are attached to electric distribution poles or on their own special-purpose structures, such as high-tension power lines or wireless communication towers. Electric service providers within the Lake Oswego to Portland Transit Corridor include Portland General Electric and PacificCorp. Communications providers in the corridor area include Qwest, Sprint, T-Mobile, Verizon and Comcast.

3.15.2 Environmental Consequences

This section summarizes how the project alternatives and options would affect utilities in the corridor. The conceptual engineering efforts for the LOPT Project included initial reviews of major utilities to identify locations where the Enhanced Bus Alternative, Streetcar Alternative and Streetcar design options could be in conflict with major utilities. Because the project's analysis of potential utility impacts is based on the state, region and local jurisdiction's adopted land use plans and lists of transportation projects, there would be no cumulative long-term impacts other than those summarized in this section, except for upgrades to utilities that typically occur when project construction is in the area of existing utilities.

3.15.2.1 No-Build Alternative

The No-Build Alternative would have no direct or indirect effect on utilities within the corridor. Although other transportation and development projects are programmed or planned within the corridor, utility conflicts would be addressed through the individual projects' design and construction measures and long-term effects would not be anticipated.

3.15.2.2 Enhanced Bus Alternative

The primary capital improvement that would occur under the Enhanced Bus Alternative would be the construction of the proposed 300-space structured park-and-ride lot at the Oswego Village Shopping Center. The park-and-ride lot would not adversely affect existing aerial or underground utilities, because the design of the lot would accommodate existing utilities. Utilities located on the park-and-ride site, where the structure would be located, would likely be relocated. Other transportation and development projects that are programmed or planned within the corridor would address utility conflicts through design. Construction measures and other long-term effects resulting from the Enhanced Bus Alternative are not anticipated.

3.15.2.3 Streetcar Alternative

In general, the Streetcar Alternative would be designed to allow utilities to cross under or over the proposed streetcar alignment and it would generally allow ongoing utility maintenance or improvements to occur without affecting transit operations. The required relocation of specific utilities would be identified during Preliminary Engineering and final design phases of the project, after a preferred alternative has been identified and in close coordination with the utility companies and agencies. This design process for utilities would be used because a higher level of detailed engineering information is required to verify site-specific conditions, such as depth of excavation for construction, or how the drainage system would be constructed. Therefore, the utility facilities and infrastructure impacts identified for this DEIS generally represent typical conditions, as well as any major conflicts that have been identified in available conceptual engineering documents.

The general types of impacts to utilities due to the Streetcar Alternative would be categorized as longitudinal or crossing. A potential longitudinal impact would occur where the utility is located in close proximity and parallel to the proposed transit alignment and the utility would need to be relocated to either side, out from under or over the proposed streetcar alignment. A potential crossing impact would occur where the proposed streetcar alignment would intersect the existing utility facility and the utility may need to be either lowered further underground or elevated to a greater height. In general, the longitudinal impacts would require relocation of a greater number of linear feet of utilities than required by crossing impacts. There is a relative increased potential for longitudinal impacts on major roadways such as Highway 43 and along the Willamette Shore Line right of way, because these are typically major utility corridors. In general, underground utilities that are located under the proposed transit trackway would be relocated to either side of the trackway to facilitate future utility maintenance without disruption to the transit service. New drainage or stormwater features for the project could also affect the need to relocate existing utilities.

Typically, private utilities located within public rights-of-way or in the Willamette Shore Line right of way would pay for their own relocation costs as part of their agreements that allow them to use of the right of way, although some franchise agreements could provide for exceptions. In contrast, private utilities are typically allowed on private property through easements. Private utilities on private property often have the right to be reimbursed for the costs of relocations or changes. Public utility relocation costs are normally paid for by the project, but, in general, upgrades to the facilities would not be. The Streetcar Alternative would be designed to minimize the corrosive effect that potential stray electrical current could have on underground utilities.

The electric energy demands for the streetcar operations could require upgrades to electrical transmission systems along the corridor, which could include increasing the capacity of transmission lines, replacing poles or towers and improving electrical substations. Necessary improvements would be determined through consultation with the electrical utility providers during the Preliminary Engineering and Final Design phases of the project. Improvements to the electrical transmission system as a result of the project would likely involve upgrading existing transmission facilities, rather than creating new facilities. Section 3.12 Energy, provides additional information on the expected energy effects of the project alternatives.

Indirect impacts resulting from the relocation of utilities could include the need to reconstruct or widen existing public right of way, which could result in effects on adjacent properties, and in limited cases could require acquisition of additional property, or temporary or permanent easements for the utilities. The extent of indirect impacts due to utility relocations will be determined in greater detail during the Preliminary Engineering and Final Design phases of the project.

Following is a summary by segment of the differences in effects on utilities that would result from the different Streetcar design options under study.

A. South Waterfront Segment

In the South Waterfront Segment it is anticipated that all the existing utilities in the affected area will be adjusted to the revised grades of the Moody/Bond Couplet extension. In addition, new utilities could be designed in the public right of way to address existing sewer and water needs for the area. Design for this area will be coordinated with the City of Portland Moody/Bond Extension project.

B. Johns Landing Segment

All Design Options. A 60-foot water main is located at Southwest Nevada Street. Utilities scheduled for installation by 2012 include two additional water lines up to 36 inches in diameter each. In addition, in the vicinity of the Nevada Station, existing Oregon Public Broadcasting (OPB) fiber optic lines may be affected. The water main would be protected by extension of the existing casing pipe and additional corrosion measures determined as part of the design process. Project improvements would be designed to avoid the OPB fiber optic lines.

Macadam In-Street and Additional-Lane Design Options. Existing sewer lines would be directly in conflict with the proposed track location for both the Macadam In-Street and the Macadam Additional Lane design options. These sewer lines run on the outside lanes of Macadam Avenue where the tracks would be located. Approximately 2,500 feet of sewer line would be relocated, generally between Southwest Boundary and Carolina streets.

Willamette Shore Line Design Option. The streetcar alignment under the Willamette Shore Line Design Option would be located within the existing railroad right of way, except at stations. This would minimize the need to relocate existing utilities. A field verification and review of the existing utility maps show no significant utilities exist within the right of way, except for the 60-foot water main located at Nevada Street referenced above.

C. Sellwood Bridge Segment

A field verification and review of the existing utility maps show no significant utilities exist within the Willamette Shore Line right of way in this segment, except for a 30-foot water main located at Southwest Sellwood Ferry Road, which would be sleeved to protect it from the corrosive effect of stray current. There are few overhead lines that cross the tracks that may be affected by the proposed alignment, including a high-capacity power transmission line located just north of the Macadam Bay driveway. Because that power line is generally 30-feet high, it would not need to be relocated horizontally or vertically.

Because utilities will be addressed by Multnomah County and others when the design of the proposed new interchange and Sellwood Bridge is finalized, there would likely be no conflicts between utilities and the proposed Streetcar alignment. Project staff would coordinate with the Sellwood Bridge designers to ensure that utility relocations would not result in additional impacts to utilities.

D. Dunthorpe/Riverdale Segment

Riverwood Design Option. There are approximately 2,500 feet of underground utilities along Southwest Riverwood Road, between Highway 43 and the at-grade crossing of the Willamette Shore Line right of way that would need to be relocated as a result of the Riverwood Design Option. These utilities include sewer lines and water mains that service approximately 15 houses. Private utilities along Riverwood Road may also need to be relocated under this design option.

Willamette Shore Line Design Option. This design option would locate the Streetcar alignment within the existing Willamette Shore Line right of way, thereby minimizing the number of utilities that would need to be relocated. A field verification and review of the existing utility maps show no significant utilities exist within the right of way, except for a parallel pressurized sewer line, which is incased in concrete for the full length of the Elk Rock Tunnel (approximately 1,500 feet). It is unlikely that the sewer line would need to be relocated under this design option, but it would be protected from stray current.

E. Lake Oswego Segment

UPRR Design Option. There are three sanitary sewer lines that cross the UPRR right of way that serve the Tryon Creek Sewage Facility. The three pipes cross beneath the existing freight tracks south of Tryon Creek and they would remain there under the UPRR Design Option. Private utilities include an overhead power transmission lines that may need to be relocated. There are existing sewer lines and a water main within the Foothills Road right of way that would need to be relocated under this design option. The realignment of Foothills Road would also lead to the relocation of an existing transmission line that crosses Foothills Road and connects to an adjacent power substation.

Foothills Road Design Option. This design option would locate the proposed Streetcar alignment within a proposed redesigned Foothills Road. Most of the utilities within the existing right of way of Foothills Road likely need to be relocated under this design option. This design option would not, however, require the relocation of the three sewer lines that connect to the Tryon Creek Sewage Facility. The existing Foothills Road portion of the roadway will have similar affect as described for the UPRR design option.

3.15.3 Mitigation

This section provides a summary of potential mitigation of effects on utilities if the Streetcar Alternative is selected as the Locally Preferred Alternative.

During the future design phases of the project development process, including Preliminary Engineering, Final Design and construction, the project team would contact all utility providers and would work with them to coordinate and develop plans to either protect or relocate utility facilities. The project sponsors would work with the affected utility owners to minimize effects to existing utilities and to minimize the amount of utility relocation for the project. The relocation of utilities can involve impacts of their own, including the need to reconstruct or widen existing public right of way, which could result in effects on adjacent properties, and in limited cases could require acquisition of additional property, or temporary or permanent easements for the utilities. During the Preliminary Engineering phase the design team would work with the utility owners to more carefully locate and map all potentially affected utilities in the area where the project would have direct impacts. During the Final Design phase, the design team would develop plans in consultation with the utility owners to specifically define where and when utilities would need to be relocated and/or upgraded, and how they would be relocated and/or upgraded. During construction utility work typically precedes the project related civil construction work.

Proper coordination and the use of standard construction procedures and techniques would ensure minimal disturbance to system users and avoid damage or impacts to existing facilities that would not require relocation or upgrades. Typically, new facilities such as poles or ducts are installed and then service is switched over to the new facilities, thereby minimizing any disruption of service to the utility users.

3.16 Construction Activities and Consequences

This section addresses construction of the Lake Oswego to Portland Transit Project and the expected temporary effects of construction with respect to the natural environment and social topic areas that have been discussed previously in the earlier sections of Chapter 3 of this DEIS. Additional information on the short-term effects of construction can be found in the more detailed technical reports listed in Appendix B Supporting Documents.

Construction related impacts can be direct or indirect, are short-term in duration and generally end with the completion of project related construction. Construction impacts can also be more disruptive than the longer-term impacts of project operations.

The No-Build Alternative would not cause construction related impacts related to the Project. Other projects that are listed in the RTP financially constrained network that would be included in the No-Build Alternative would individually have construction impacts, but it is not possible to measure or document them at this time because most of the projects have not yet been designed or evaluated for specific impacts.

3.16.1 Approach to Construction of Project Improvements

This section describes the construction activities that would result from the Enhanced Bus and Streetcar alternatives.

3.16.1.1 Enhanced Bus Alternative

With the Enhanced Bus Alternative project related construction would consist mainly of a new 300-space park-and-ride structure and related bus facilities in downtown Lake Oswego. Construction of the park-and-ride structure would include demolition of the existing facilities on the site (consisting of existing impervious surface associated with parking areas for the Lake Oswego Village shopping center), excavation for utility and foundation work, construction of the parking structure and surrounding road and bus streets, and finishing work such as landscaping and signage for the structure and related bus facilities. Rerouting of buses would require changes to bus stops in the corridor including downtown Portland areas.

3.16.1.2 Streetcar Alternative

In general, construction of the Streetcar Alternative would be similar to previous streetcar projects in the region. Construction of the streetcar would mostly occur within the existing Willamette Shore Line right of way, within existing streets, or in areas where future streets are planned and include two park-and-ride facilities in downtown Lake Oswego: one 300-space structure and one smaller surface lot. The final construction approach for the Streetcar Alternative would be defined in detail, including methods, staging and sequencing, would be determined in coordination with the project's yet-to-be determined construction contractor.

Before construction activities would commence, some public and private utility companies, under direction of the project and local jurisdiction engineers would need to relocate some utility infrastructure that is in conflict with the proposed streetcar facilities. This could include limited relocation of utility duct banks, reconstruction of utility vaults to provide an access outside of the streetcar operating envelope, or the relocation or adjustment of power service lines.

Construction of the Lake Oswego to Portland Transit Project Streetcar Alternative is projected to take approximately 24 to 30 months. Major construction activities would be done within 24 months and finishing and testing would take the remaining time. The project construction is expected to be between 2014 and 2016. All construction would be performed in full coordination with TriMet and Portland Streetcar Inc., and would comply with all applicable safety requirements.

It is expected that construction of the tracks and the supporting structures would commence in stages. The contractor could segment the alignment into four or five "reaches" allowing the different construction teams to work in sequence. The work could be done from inside of the Willamette Shore Line right of way using existing access to move equipment in and out of the right of way. The plans have identified potential staging areas, which are typically in parking or vacant lots adjacent to commercial sites. It is anticipated that a temporary rail yard operation would be established at one end of the project. The rail yard would be used for flash butt welding operations to produce lengths of ribbon rails used in continuously welded rail.

The initial stage of the construction would involve preparation of the right of way, including clearing and grubbing of the work zone. This would remove any trees or other vegetation identified for removal, establish barriers and protection zones and secure staging areas. The contractor could use the existing the Willamette Shore Line tracks for access and haul by using hi-rail vehicles or track maintenance vehicles, or they could remove the existing tracks and trackbed and expose the subgrade for prep work.

The next phase of construction would be advanced utility work for the in-street segments, installation of any subgrade conduits, culvert upgrades and replacement work. A number of culverts have been identified for replacement and would require upgrades. In some cases there may be a need to install manholes and additional piping (such as in the area of Powers Marine Park) as a few exiting culverts would require upgrades.

Following the subsurface and drainage work, the contractor would begin grading and construction of the retaining walls. The type of retaining walls has not been defined so construction methods are not established. Likely scenarios would include gravity walls for low walls (5 feet and under) and concrete masonry units which are precast and stacked or cast in place walls for higher walls. It is expected that the majority of work on the walls would be from within the right of way with some areas requiring a work zone outside the right of way. At the same time work on the trestles, as recommended in the structural report, would begin. Structures and tunnel work would be advancing in preparation for the track installation.

Once the grades are established and the subgrade is compacted, the installation of foundations for the overhead catenary poles, station foundations and other structure foundations would begin. Ballast mats or vibration attenuators would be placed and the subballast, ballast, ties and rails sections would be placed. Insulated joints and field welds would be next. Once the initial track is set, a tamper would run the length of the alignment and finished the final grades for the track. The stations would be constructed and the traction electrification system installed along with signals, gates and other communication systems.

The last phase of the construction would be the testing of the system along with final grading, landscaping and right of way improvements as necessary to finish the work.

3.16.2 Impacts Related to Construction

As noted above, there would be no construction related impacts associated with the No-Build Alternative. Following is a description of the short-term effects that would result from construction activities for the Enhanced Bus and Streetcar alternatives.

3.16.2.1 Enhanced Bus Alternative Construction Impacts

In the vicinity of the park-and-ride lot in downtown Lake Oswego, temporary traffic impacts would occur on local streets and occasional daytime lane closure north bound on Highway 43 could occur during construction. Pedestrian and auto access to area businesses would be disrupted, but access would be maintained at all times. Local businesses and nearby residents could experience short-term noise and vibration, air quality and visual effects. Also, the project would be required to prepare a hazardous materials work plan, including a containment plan for any contaminants encountered during construction.

The Enhanced Bus Alternative park-and-ride structure and an associated access road would be within the Lower Willamette Subbasin, and could result in approximately 7 acres of ground disturbance due to construction. Potential construction-related effects to hydrology would be minor. However, a 1200-C construction permit would be required which would require an erosion and sediment control plan and best management practices, which could include temporary detention and flow controls. With the implementation of these requirements, construction effects to hydrology would be minimized and considered negligible.

The Enhanced Bus Alternative would encroach upon approximately 1.3 acres of the FEMA-designated 100-year floodplain for the Willamette River. Construction within the floodplain could result in a temporary decrease in floodplain storage. No construction at stream crossings is proposed with this alternative. In addition, there would be 1.14 acres of riparian vegetation temporarily impacted with the Enhanced Bus Alternative along with relatively limited ground disturbing construction in Segment 6 (Lake Oswego) associated with the park-and-ride facility.

Construction effects to water quality associated with the Enhanced Bus Alternative include increased rates and volumes of sediment-laden runoff during construction activities, risk of accidental spills and leaks from construction vehicles and equipment, and removal of riparian vegetation. A construction storm water plan would be required that would implement erosion and sediment best management practices.

The Enhanced Bus Alternative would require approximately 20.3 billion Btu or 1.63 million of gallons of gasoline for construction of the project.

3.16.2.2 Streetcar Alternative Construction Impacts

Following is a summary, by discipline area, of the construction activity consequences for the Streetcar Alternative with various design options.

Transportation

Transit. During daytime hours, project construction could result in some transit service delays with the Macadam In-Street and Macadam Additional Lane design options in the Johns Landing area. Temporary closure or relocation of bus transit stops would occur along Macadam Avenue/Highway

43 in construction zones. The seasonal Willamette Shore Line trolley would permanently close with the commencement of construction.

Traffic. Construction traffic effects during weekday daytime hours would occur in the corridor in various locations where construction activities would interface with Highway 43, local roadways and private access, such as:

- In the South Waterfront Segment where both design options would interface with, or cross local streets.

- In the Johns Landing Segment with the In-Street and Additional Lane design options where the alignment would be constructed within Highway 43 right of way. There would be no construction traffic effects on Highway 43 with the Willamette Shore Line design option in this segment.

- In the Sellwood Bridge Segment with both design options where the alignment would be constructed crossing existing public and private streets and access points.

- In the Dunthorpe/Riverdale Segment with both design options where the alignment would be constructed crossing existing public and private streets and access points, and where the Riverwood In-Street design option would affect local access and circulation.

- In the Lake Oswego Segment where both design options would interface with local streets in the area where the alignment would connect to the new park-and-ride structure and the new streetcar station.

Public and private parking in the vicinity of project construction would be disrupted during construction primarily in the South Waterfront, Johns Landing and Lake Oswego segments.

Freight Rail. With both the design options in the Lake Oswego Segment, construction of the Streetcar Alternative alignment would have effects on the existing freight rail line, either the streetcar would cross under the existing rail line with the Foothills design option, or running adjacent to it with the Union Pacific Railroad Right of way design option. Either option would require negotiations with the railroad and agreements about how construction would interface with the railroad.

Land Use and Economics

Construction of the project is unlikely to result in changes to land use in the corridor during the construction period. Streetcar Alternative related construction would result in between 1,430 and 1,530 short-term jobs, depending on the design options chosen. Construction can be disruptive or supportive of businesses in the vicinity of the construction activity. Where construction activity occurs in streets near businesses, access for customers can be disrupted. Construction activity can also be good for businesses, such as when construction workers patronize local businesses and when construction related activities utilize local contractors or utilize local suppliers.

Streetcar construction could result in reduced access to properties adjacent to the construction zone for short periods, often less than one month, but access would not be eliminated during this time. The project would employ typical construction management practices to avoid or minimize adverse economic consequence to adjacent resident and businesses such as avoiding full access closures, providing temporary alternative access, signage indicating that businesses are open and timely communications with business owners.

Neighborhoods, Displacements and Relocations Construction activities from the Streetcar Alternative and design options would likely affect the adjacent residents and neighborhoods by temporarily increasing noise and dust, establishing construction zones and signage, altering or reducing access and establishing detours, and temporarily disrupting utilities as they are reinforced or relocated. The project would undertake standard types of construction practices to avoid or minimize these effects on neighborhoods and adjacent uses, as described for each of the discipline areas in this section. Relocations would be offered to displaced activities through TriMet's Acquisition and Relocation program, which is consistent with USDOT guidelines.

Visual Quality and Aesthetics
Construction of the Streetcar Alternative would cause temporary visual impacts relating to the presence of construction equipment, the storage of materials, the disruption of the existing railroad corridor and streetscape where applicable to the various design options. The location of the construction zones would tend to move as the construction begins and ends in the corridor. Due to the temporary nature and the fact that construction is a common visual element in the region and corridor, construction visual impacts would be classified as low to moderate.

Construction in the project corridor would occur in stages over a period of approximately two years, although any one location would likely experience construction activities that would be shorter. Construction is conducted in stages but begins with utilities relocation, clearing and grading, and reconstruction. These actions could remove existing visual features and create visual clutter. Construction equipment, trailers, workers' parking, construction materials, debris, lighting, and signage also change visual conditions in a corridor under construction. The areas affected can be larger than the permanent facility to allow construction equipment and materials to be brought to alignment.

The Streetcar Alternative would have higher level of construction visual effects than the Enhanced Bus Alternative. The differences are more closely related to where construction would be occurring, and the extent of the construction activities.

Historic, Archaeological and Cultural Resources
Construction of the Streetcar Alternative could affect known historic, archaeological or cultural resources. Minor temporary changes in the vicinity of known resources could include: nearby clearing and grading; dust, exhaust and other airborne matter; and reduced vehicular and pedestrian access. The Streetcar Alternative would be constructed in the historic Red Electric Railroad right of way, and construction could affect contributing features of the historic corridor such as trestles, railroad ties and other features.

Currently unknown archaeological or cultural resources encountered during construction would be protected from any adverse effects by taking some or all of the following actions, in compliance with federal and state regulations: notification to and consultations with regulatory agencies and/or tribes, temporary work stoppage at the site, additional surveying and/or documentation, removal and preservation, and other actions as appropriate. See the discussion of this in Section 3.5.4.

Parklands and Recreation Areas
Short-term effects of construction of the Streetcar Alternative could include temporary disruption adjacent to or within some parks in the corridor. Short-term impacts could result from noise and dust generated during construction, from temporary disruptions in access, or due to construction easements onto park property.

In the South Waterfront Segment, the temporary bicycle path used to connect to the Willamette River Greenway Trail would be temporarily disrupted during construction. The construction of the streetcar project would also temporarily disrupt the connector trail between Southwest Macadam Avenue and the Willamette River Greenway near the proposed Boundary Street station. Trail use would be interrupted during construction with temporary closures. Interim routes would be provided.

The project could result in short-term construction impacts adjacent to and possibly within Willamette Park. Construction activities could extend into the park area near the Nebraska Street station at a small area east of the tracks and west of Beaver Avenue. The other potential area within the park that could be affected by construction is near the Nevada Street station, south of the tennis courts.

There would be a small area of construction impact within the Willamette Moorage Park north of the Sellwood Bridge Station. Also, project construction could impact property within Powers Marine Park from construction of a pedestrian overpass of the rail alignment, and from improvement of culverts that pass under the existing tracks. Of the eight anticipated culvert replacements, two are expected to have temporary impacts in the park, based on right of way location.

In the Lake Oswego Segment, there would be a new bridge constructed over Tryon Creek. The properties to the north of the creek are owned by public entities and planned for future park land. Construction staging areas have not been determined in the area around Tryon Cove Park, but it is possible that the publicly-owned land adjacent to the bridge may be used for staging. Further planning between the project and the owners of the parcels in question could avoid a Section 4(f) impact in this area.

The Foothills design option alignment would result in temporary construction impacts to the Kincaid Curlicue Corridor path. Both design options would result in construction impacts to path in this area. An alternate pathway would be made available during construction, probably along the existing road.

Geology, Soils and Seismic Hazards
The Streetcar Alternative would require the construction of several cut slopes and placement of engineered fill to accommodate the track and associated ancillary structures. Locally, cut excavations may be temporarily unsupported during construction, and fill slopes may be exposed to erosion prior to establishment of permanent vegetative cover. Most of the proposed cut slopes on the project will be permanently supported by retaining structures (walls). Construction of park and ride facilities may temporarily expose native and human-placed soil and/or rock to potential erosion, especially if constructed during wet weather conditions.

Ecosystems

Construction of the Streetcar Alternative would cause some effects to wetlands, vegetation, wildlife and/or fisheries. Effects would be short-term, localized and of limited consequence, which could include: increased dust and emissions, increased noise, inadvertent small-scale soil contamination and vegetation removal. Expected effects would include:

- Temporary disturbance to vegetation would occur as a result of direct removal of vegetation and potential soil compaction. Work access, the expanded ballast needed to support two rail tracks throughout much of the corridor, the proposed new bridge crossing over Tryon Creek, and new piers for replaced trestle structures would result in the temporary loss of riparian vegetation. Coordination with the proposed Sellwood Bridge Project may necessitate a new bridge crossing structure over Stephens Creek. Table 3.16-1 details anticipated temporary losses to riparian habitat resulting from construction of the Streetcar Alternative.

Table 3.16-1 Temporary Riparian Vegetation Loss from the Streetcar Alternative by Segment and Design Option

Segment	Design Option	Acres of Temporary Riparian Vegetation Impacted
1 - Downtown Portland	None	0
2 - South Waterfront	None	0.02
3 - Johns Landing	Willamette Shore Line	4.06
	Macadam In-Street	3.29
	Macadam Additional Lane	3.29
4 - Sellwood Bridge[1]	None	5.74
5 - Dunthorpe/Riverdale	Willamette Shore Line	0.9
	Riverwood	0.9
6 - Lake Oswego	UPRR	2.16
	Foothills	1.86
Total Range for Design Options (low to high)		11.81 – 12.88

Note: All impacts calculated by DEA (2010) using GIS. Temporary impact footprint = construction limits within the 100-year floodplain.

- Temporary construction impacts to wetlands, including grader and dozer work and material storage, may result in soil compaction, vegetation removal and minor sedimentation from upgradient erosion areas. Soil compaction could cause changes in hydrology and the ability of the soil to support new vegetation growth. Vegetation removal in these areas would cause loss of habitat, thermoregulation and filtration functions.

- Temporary impacts to wildlife may include visual and auditory disturbance and temporary removal of vegetation during construction, including noise from operating machinery. Potential construction noise impacts could cause birds, including species of breeding birds, to abandon nest sites prematurely.

- Temporary ground disturbing construction-derived erosion would be likely, increasing the potential for water quality impairment from turbidity and sedimentation. Construction involving ground disturbance has potential for fugitive sediment transport as a result of erosion. Erosion can result in sediment-laden runoff entering streams, resulting in water column turbidity and sedimentation of substrates, particularly spawning gravels. Table 3.16-2 identifies the acreage of anticipated temporary ground disturbing construction activities by segment and design option.

Table 3.16-2 Construction-Related Temporary Impacts from Ground Disturbing Activities for the Streetcar Alternative by Segment and Design Option

Segment	Design Option	Acres of Temporary Ground Disturbance
1 - Downtown Portland	None	--
2 - South Waterfront	None	8.79
3 -Johns Landing	Willamette Shore Line	9.68
	Macadam In-Street	17.34
	Macadam Additional Lane	18.71
4 -Sellwood Bridge[1]	None	8.81
5. Dunthorpe/Riverdale	Willamette Shore Line	11.82
	Riverwood	11.82
6. Lake Oswego	UPRR	22.43
	Foothills	23.27
Total Range for Design Options (low to high)		**61.53 to 71.4**

Note: All impacts calculated by DEA (2010) using GIS. Temporary impact footprint = construction limits

Construction could indirectly affect threatened and endangered species and habitats including creation/modification to stormwater generating surfaces, potential water quality impairment from construction-related erosion, and temporary riparian vegetation loss associated with construction activities. Such impacts would apply to nearly all segments. Table 3.16-3 summarizes anticipated impacts by segment and design option. There would be no in-water work with the Streetcar Alternative.

Table 3.16-3 Summary of Temporary Indirect Effects to Fisheries Resources of the Streetcar Alternative by Segment and Design Option

Segment	Design Option	New Impervious Surface Area Created	Redevelopment of Existing Impervious Surface Areas	Construction-related Water Quality Impairment	Temporary Loss of Riparian Habitat
1 - Downtown Portland	None	No	Yes	Yes	No
2 - South Waterfront	None	Yes	Yes	Yes	No
3 - Johns Landing	Willamette Shore Line	Yes	Yes	Yes	No
	Macadam In-Street	Yes	Yes	Yes	No
	Macadam Additional Lane	Yes	Yes	Yes	No
4 - Sellwood Bridge	None	Yes	Yes	Yes	Yes
5 - Dunthorpe/Riverdale	Willamette Shore Line	Yes	Yes	Yes	Yes
	Riverwood	Yes	Yes	Yes	Yes
6 - Lake Oswego	UPRR	Yes	Yes	Yes	Yes
	Foothills	Yes	Yes	Yes	Yes

Source: URS
Note: All impacts calculated by DEA (2010) using GIS

Hydrology and Water Quality
Although a new stream crossing at Tryon Creek and a potential new crossing at Stephens Creek would be constructed, preliminary design information suggests the structures will be above the ordinary high water mark (OHWM), thus not requiring in-water construction permits. In the event that in-water construction cannot be avoided, all in-water work would be conducted during agency-coordinated and approved in-water work windows. Details regarding construction equipment, methods, timing and sequencing would be developed in conjunction with the appropriate regulatory agencies at a later date, if this alternative was selected as the Locally Preferred Alternative.

Typical construction effects for the Streetcar Alternative related to hydrology would include the replacement, removal, addition or extension of existing stormwater drainage features (culverts, crossings, and conveyance ditches) or facilities which could temporarily affect flow patterns and result in minor, short-term effects to the instream flow conditions in the immediate proximity of construction. Temporary stormwater conveyance structures may need to be installed during construction, which would result in modification to existing drainage patterns. Additionally, compaction of soils and removal of vegetation associated with construction activities could result in reduced infiltration capacity and temporarily increase flows.

Construction associated with the Streetcar Alternative would result in between approximately 56 to 71 acres of overall construction disturbance, depending on the design options chosen. Potential construction related effects would include the replacement, removal, addition or extension of existing stormwater drainage features (culverts, crossings, and conveyance ditches) or facilities which could temporarily affect flow patterns and result in minor, short term effects to the instream flow conditions in the immediate proximity of construction.

The Streetcar Alternative would encroach upon the FEMA designated 100-year floodplain for the Willamette River. The encroachment could potentially result in temporary decreases in floodplain storage. Additionally, effects to floodplains from construction of the Streetcar Alternative could occur at stream crossings, particularly Tryon Creek and Stephens Creek.

Noise and Vibration
During construction there would be temporary increases in sound levels near the active areas of construction and near any materials staging areas due to the use of heavy equipment. In some areas construction activities would occur within close proximity to buildings, some immediately adjacent to the Willamette Shore Line right of way, including residences and numerous commercial structures along Highway 43. Construction noise and vibration received at both commercial and residential uses adjacent to the alignment could be perceived as intrusive. However, construction in any one area is expected to be of limited duration and any such intrusive noise or vibration would be temporary in duration. The project would be required to comply with the City of Portland Noise Ordinance which defines the hours for construction related noise. In general, the project's construction activities would occur during weekday daytime hours (i.e. 7:00 a.m. to 7:00 p.m.) and construction activities outside of daytime hours would require obtaining a noise variance from the City of Portland.

Construction of the streetcar line would involve some noise sources similar to those used during recent repairs of some of the Willamette Shore Line corridor trestles. Thus, resulting noise levels would be similar, but in most locations periods of construction would be of shorter duration than occurred during repair of the area trestles.

Air Quality

Construction activities from the Streetcar Alternative, primarily earth moving, would temporarily create dust and would result in emissions from construction equipment. Construction effects to air quality could include generation of PM_{10} and small amounts of CO and other criteria pollutants from construction machinery exhaust. The sources of particulates would be “fugitive dust” from demolition (removal of existing trackway and rail ties) and earth moving excavation and diesel exhaust. Fugitive dust includes fine particles raised by construction activities and is common in dry windy weather. Its dispersion depends on dryness of the soil, the soil texture and the general weather conditions such as presence or absence of participation and wind velocity. It is most common in dry windy weather. Larger particles would settle near the source, while fine particles could be dispersed over greater distances.

Energy

Construction energy effects involve a one-time, non-recoverable energy cost associated with construction of roadways, structures, etc. The analysis was conducted using the Input-Output Approach for Urban Conventional Highway Construction developed by CalTrans (1983). This method assigns an energy-to-dollar ratio to various roadway construction activities, which converts construction dollars into energy consumption.

The No-Build Alternative would require minimal consumption of energy associated with construction. The construction energy would be in a form of indirect energy consumption due to maintenance cost per mile.

The Enhanced Bus Alternative would require approximately 139 billion Btu or 1.12 million gallons of gasoline for construction of the project. The Streetcar Alternative would require approximately 1,400 billion Btu or 11.2 million gallons of gasoline for construction of the project. In addition, the maintenance facility storage yard, which includes building and equipment, would require approximately 17.4 billion Btu or 140,000 gallons of gasoline for construction. Table 3.16-4 provides the results of the construction energy expenditures with respect to construction using gasoline fuel. Section 3.16 Construction Impacts also addresses short-term construction energy effects

Table 3.16-4 Summary of Construction Energy Consumption, (Billions of Btu[1])

Alternative	Energy Consumption (Billions of Btu[1])	Fuel Consumption (Million Gallons of Gasoline)
No-Build Alternative	Negligible	Negligible
Enhanced Bus Alternative	139	1.12
Streetcar Alternative	1,400	11.2
Maintenance Facility	17.4	0.14

Sources: URS Corporation 2010, Metro 2010, TriMet 2010
[1] Btu = British Thermal Unit. One gallon of gasoline = 125,000 Btu.

Hazardous Materials

The Streetcar Alternative would not result in exposure to known hazardous materials sites, and the use of Phase I (and potentially Phase II) environmental site assessments for all property acquisitions should identify any unknown sites within the portions of parcels to be acquired for the project. Soil would be monitored during construction and any contaminated soil encountered would be managed appropriately. If contaminated soil is uncovered, remedial actions could include the excavation and proper disposal of affected soils by properly trained and equipped technicians before construction begins or proceeds. Adverse impacts to construction workers from contamination would be avoided or minimized through the development and implementation of a hazardous materials work plan that would be designed for the project and that would include actions to be implemented if construction activities encounter contaminated soil. Construction impacts related to hazardous materials for the Streetcar Alternative are not considered significant.

Public Safety and Security

Safety and security issues during construction typically include access to the construction site areas, safety of construction workers (particularly when working near moving vehicles). Short-term construction safety and security issues would be addressed by TriMet's Safety Engineer and Risk Manager, using construction, contractor and safety management plans prepared for the project. Fences and barriers will be used as necessary to secure construction areas from public access and signage will redirect vehicles, bicycles and pedestrians as needed.

Utilities

The construction of streetcar tracks and associated facilities would result in physical conflicts with existing and planned utilities, including street lighting, electrical, sewer, water and gas services along with communication cables. These conflicts would likely be greatest where the streetcar alignment and other facilities would be within existing street right of way. Streetcar electrification could lead to stray electrical current that could accelerate corrosion of metal pipes and, as a result, some water or gas pipes under the trackway may need to be relocated. During Preliminary Engineering, TriMet would coordinate with utility providers and would identify specific conflicts and define strategies for managing cost and construction scheduling. The relocation of utilities would be carefully managed and scheduled during Final Design to avoid construction delays and additional project costs. Also, TriMet would coordinate with local utilities to assure adequacy of services necessary to operation the project related facilities, including enough power along the corridor for streetcar operations.

Environmental Justice, Elderly, and Disabled Populations

Construction activities from the Streetcar Alternative would result in temporary detours and nuisances to businesses and residences located near construction areas, which could include protected populations, but these would not be disproportionately high adverse impacts. These impacts include: noise and dust from construction equipment and machinery, temporary loss of on-street (and possibly some off-street) parking, traffic delays and temporary changes in routings to businesses or residences. These impacts would not differ from those experienced by other populations in the project area.

3.16.3 Mitigation of Construction Impacts

Mitigation measures for project related construction impacts would begin following selection of the Locally Preferred Alternative. The FEIS will describe the project commitments for mitigation, depending on the selection of the locally preferred alternative. The potential mitigation measures described below are measures that could be implemented by the project to reduce the construction related impacts, generally identified above. Mitigation of construction impacts will be further defined in the Preliminary Engineering and Final Design phases of the project development process.

Transportation (transit, traffic, bikes, pedestrians and freight)

Following is a list of potential transportation construction mitigation measures. This list represents a range of measures that could be implemented:

- During construction affected transit stops could be temporarily relocated to the nearest possible location on the same route.

- During construction, temporary sidewalks and/or pathways could be provided to replace any sidewalks or paths that are affected by construction.

- To minimize the amount of construction related traffic to and from the construction sites, efforts should be made to recycle or reuse as much of the excavated earth from the project sites as possible.

- Construction truck trips could be monitored on a regular basis to minimize effects on traffic operations on nearby roadways, such as Highway 43.

- Implement a comprehensive public outreach program to inform local resident and businesses of construction related issues that could result in potential delays and impacts to the local street network due to construction.

- To help minimize on-street parking impacts, temporary parking could be identified to mitigate the temporary loss of parking due to construction.

- Preparation and implementation of a traffic management plan for the construction period.

Land Use and Economics
Because there would not be adverse land use impacts, no land use mitigation measures would be necessary during construction. Mitigation of economic impacts would include working with local businesses during construction to minimize the impact of nearby construction activities to local businesses. If access to a business would be temporarily affected, an alternative, safe and temporary access would be provided.

Communities and Neighborhoods
Mitigation for temporary impacts to neighborhoods during construction could include the public information and coordination efforts that would focus on affected businesses and residents and on implementing measures to help minimize the effects of construction and to address ongoing concerns. Mitigation for specific issues such as noise and air quality is specifically addressed in other section below.

Visual Quality and Aesthetics
There would not be significant visual impacts during construction of the Streetcar Alternative; therefore, no visual mitigation is required during construction.

Historic, Archaeological and Cultural Resources
Because the railroad right of way is considered historic and construction would alter features that are considered contributing to the historic resource, documentation of the historic features of the corridor that would be altered would be implemented prior to initiation of construction as defined in a (future) Memorandum of Agreement between the Oregon SHPO, FTA and the project proponents. Also, and inadvertent discovery plan would be developed to address the possibility of discovery of undocumented historic or cultural resources during construction.

Parklands and Recreation Areas
Depending on the type of resource and the type of project-related impacts, short-term mitigation measures can include a wide range of options, including those defined within individual topic areas such as noise, visual and transportation. Where direct or proximity impacts are expected, the project will coordinate with park owners to maintain access to park resources where possible and, when restrictions to access or the use of park or recreational resources are unavoidable, the project would work to minimize the duration.

Geology, Soils and Seismic Hazards
Mitigation of construction effects related to geology, hydrogeology and seismic hazards should be based on the results of site specific geotechnical investigations, which will be performed in support of final design of the Locally Preferred Alternative and associated options.

The primary approach to mitigation of construction issues is avoidance of geologic hazards, where possible. Because the majority of the project alignment is already determined, especially for the Lake Oswego terminus option of the Streetcar Alternative, this approach has limitations. Erosion of exposed cut and fill slopes can be mitigated using erosion control best management practices during construction and until permanent erosion control measures are established. Areas of shallow groundwater, unsuitable fill material and shrink-swell soils should be identified, to the extent possible, through the geotechnical investigations and mitigation strategies established prior to construction.

Areas of potential slope instability, such as suspected ancient landslides or steep slopes should be identified and delineated during site specific geotechnical investigations and slope stability analyses should be conducted as part of the design. The design should consider temporary factors of safety for slopes during construction, as well as permanent slope stability.
Close attention should be paid to proposed bridge abutment areas during the site specific geotechnical investigations to provide the necessary detail to design stable temporary construction access.

Ecosystems
Temporary impacts to vegetation would be minimized by limiting construction staging and access corridors to the minimum size practicable and siting such areas in already disturbed areas where possible. All temporarily disturbed areas would be re-vegetated with native plant species and restored to pre-project conditions or better. Silt fencing and other erosion control methods would be utilized to minimize the potential short-term impacts to adjacent vegetation.

Hydrology and Water Quality
The project would comply with all applicable water quality regulations in all areas of construction, including the implementation of erosion control best management practices that prevent offsite sediment transport. Some of the erosion control best management practices required by state and local jurisdictions include the following:

- Using straw, plastic, or other coverings for exposed ground;
- Protecting large trees and other components of vegetative buffers;
- Restricting vegetation clearing activities and site grading to dry weather periods;
- Installing natural or synthetic geomembranes to prevent soil from eroding; and

- Using barrier berms (such as hay bales or check dams), silt fencing, and/or temporary sediment detention basins to help control sediment transport.

A 1200-C construction permit would be required which would require an erosion and sediment control plan and construction best management practices, which could include temporary detention and flow controls. With the implementation of these requirements, construction effects to hydrology would be minimized and considered negligible.

Noise

Noise from construction of any elements of the Streetcar Alternative or the various options would be unlikely to result in significant noise impacts. Such noise may nonetheless be intrusive at nearby locations and especially at homes. However, there are means through which such intrusive noise can be minimized.

Practices that can reduce the extent to which people are affected by construction noise and could include elements such as using properly sized and maintained mufflers, engine intake silencers, engine enclosures and turning off idle equipment. Construction contracts could specify that equipment mufflers be in good working order and that engine enclosures be used on equipment when the engine is the dominant source of noise.

Stationary equipment could be placed as far away from sensitive receiving locations as possible. Where this is infeasible, or where noise levels are nonetheless still loud at nearby receivers, temporary, portable noise barriers could be placed around the equipment with the opening directed away from the sensitive receiving property. These measures are especially effective for engines used in pumps, compressors, welding machines and similar equipment that operate continuously and contribute to high, steady background noise levels. Such measures can typically provide about a 10-dBA reduction in equivalent sound levels from shielded equipment.

Construction staging areas expected to be in use for more than a few weeks should be located, and to the extent practicable laid out, to situate the most frequent or loud activities as far as possible from sensitive receivers, particularly residences. Likewise, in areas where construction would occur within about 200 feet of existing uses (such as residences and noise-sensitive businesses), effective noise control measures (possibly outlined in a construction noise management plan) should be employed to minimize the potential for noise impacts. In addition to placing noise-producing equipment as far as possible from homes and businesses, such control could include using quiet equipment and temporary noise barriers to shield sensitive uses and orienting the work areas to minimize noise transmission to sensitive off-site locations. Although the overall construction sound levels will vary with the type of equipment used, common sense placement to maximize distance attenuation should be applied. Additionally, effort could be made to plan the construction schedule to the extent feasible with nearby sensitive receivers to avoid the loudest activities during the most sensitive time periods.

Vibration

The potential for impacts from ground borne vibration related to construction equipment and activities could be most effectively controlled by avoiding use of problematic equipment within defined critical distances for such equipment. Where avoidance is impractical or impossible, using equipment that generates less ground borne vibration instead of more standard equipment also would reduce the potential for impacts. If neither option is applicable, potentially affected buildings should be examined for preconstruction conditions and possibly monitored during nearby construction activities to reduce the potential for ground borne vibration impacts.

Air Quality

The project has potential for temporary and localized air quality affects from construction activities. The temporary effects would result from activities such as demolition, grading, paving and the use of heavy equipment. The construction contractors would be required to comply with relevant federal, state and local air quality regulations. With the implementation of best management practices for the duration of the project construction, effects on air quality are not anticipated to be significant.

During construction, measures would be implemented to minimize construction effects in the project vicinity. Measures to minimize construction effects to air quality during construction would include best management practices, including the following:

- Use of water spray as necessary to prevent dust emissions;
- Prompt cleanup of any spills of transported material on public roads by frequent use of a street sweeper machine or other appropriate methods; and
- Require contractors to maintain all construction machinery engines in good mechanical condition to minimize exhaust emissions.

Hazardous Materials

Lands containing hazardous materials could incur risk for the project. To reduce risks, the data compiled in this DEIS should be reviewed and evaluated to identify possible locations where hazardous materials are known to exist or may be present. Sites that are currently owned by project sponsors or would be acquired for the project that may contain hazardous materials should be evaluated in more depth during Preliminary Engineering. This could include file reviews, reviewing permits, conducting geophysical surveys and/or conducting subsurface assessments. Coordination with appropriate regulatory agencies would occur, so that appropriate steps can be taken to decrease the project's risk.

Prepare a health and safety plan for construction, incorporating a work plan for handling any identified hazardous materials on the site, and specifically addressing any identified hazardous materials sites.

Public Safety and Security

Short-term construction impacts related to the Streetcar Alternative would be addressed by TriMet and Portland Streetcar Inc. Safety engineers and risk managers using construction, contractor and safety management plans written specifically for this project. Fences and barriers will secure construction areas from public access and signage will redirect vehicles, bicycles and pedestrians as needed. Persons with disabilities will be provided for as well.

3.16.4 Cumulative Construction Impacts

The construction impacts of the Streetcar Alternative described above could combine with impacts from the construction of other planned projects, if their construction periods overlap. Construction of the Sellwood Bridge Project is expected to begin in late 2012. When the Streetcar Alternative would be constructed, if selected as the Locally Preferred Alternative, has not been determined. For this reason, how the construction impacts of both projects would combine is too uncertain to be described. Other projects that could be constructed at the same time as the Streetcar Alternative are the South Portal project in Segment 2 and the extension of Foothills Road in Segment 6. When these projects would be constructed is uncertain. Were construction of the Streetcar Alternative to overlap with construction of any of these other projects, project sponsors would coordinate with each other to minimize the combined impacts.

3.17 Phasing Effects

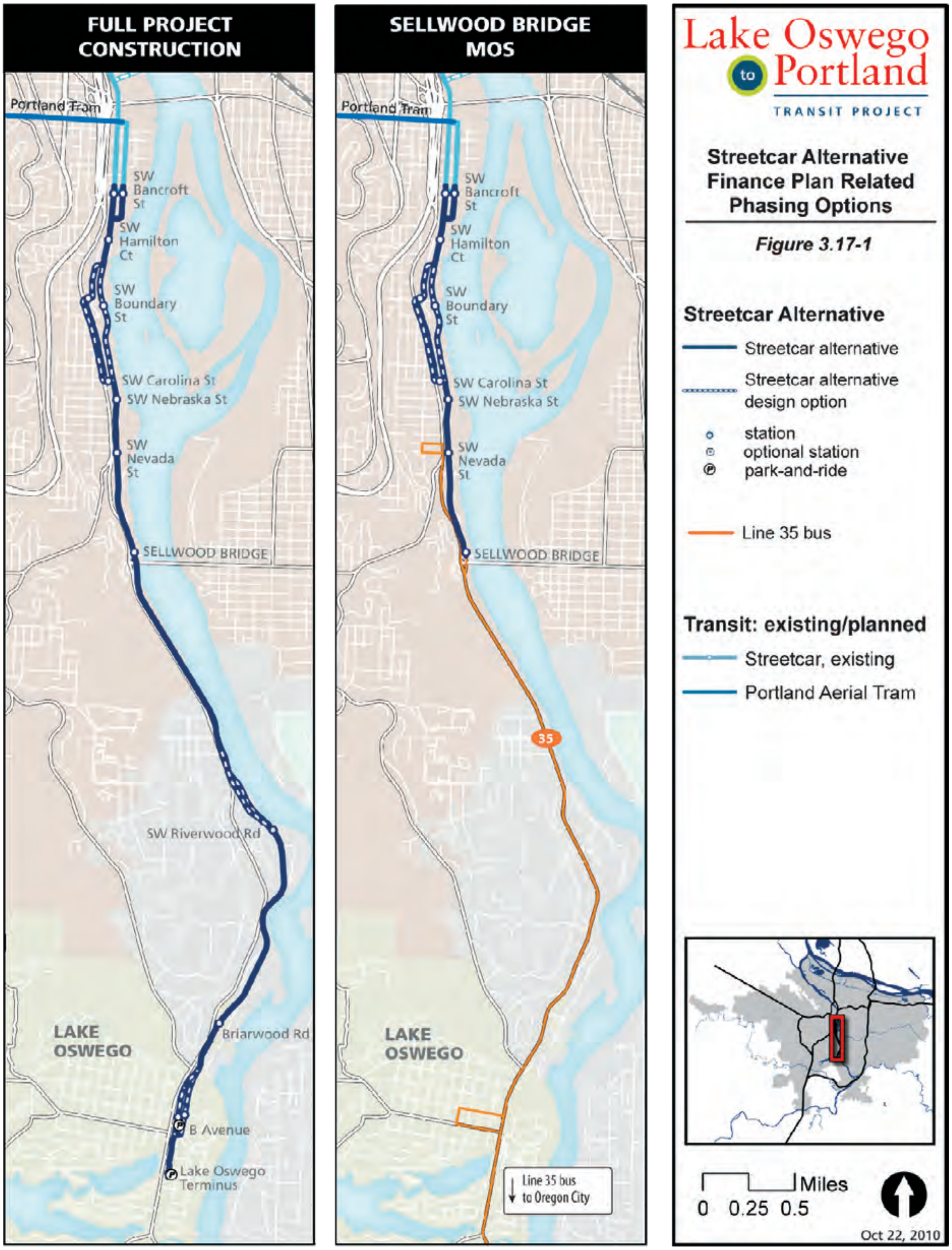
This section summarizes how the environmental effects of the Streetcar Alternative would vary based on construction phasing options currently under consideration – neither the No-Build Alternative nor the Enhanced Bus Alternative include construction phasing options. The project's construction phasing options for the Streetcar Alternative are described in Section 2.2.3.3, summarized in Table 3.17-1 and illustrated in Figures 3.17-1 and 3.17-2. In summary, there are two types of phasing options: 1) those related to the project's finance plan (i.e., Full Project Construction and the Sellwood Bridge MOS Construction); and 2) those related to coordination between this project and other capital projects in three of the project segments (i.e., South Waterfront, Sellwood Bridge and Lake Oswego segments). The Streetcar Alternative evaluated under this DEIS is as Full-Project Construction. Should the Streetcar Alternative with phasing be selected as the Locally Preferred Alternative, during preliminary engineering (PE) additional analysis of environmental impacts resulting from the interim project alignment (as opposed to Full-Project Construction) will be conducted and additional opportunity for public review and comment may be required.

3.17.1 Finance Plan Related Phasing Options

There are currently two phasing options for how the Streetcar Alternative might be initially implemented: 1) Full Project Construction; and 2) the Sellwood Bridge MOS Construction as shown in Figure 3.17-1. These two phasing options would constitute the project's capital improvements and transit operating plan for the initial opening of the Streetcar Alternative. Currently, the Metro and TriMet estimate that the project would initially open during 2017. Note that the Full Project Construction phasing option also represents the proposed Streetcar Alternative for the project's forecast year (i.e., 2035), as documented throughout this DEIS. The two finance plan related construction phasing options under consideration would lead to full implementation of the Streetcar Alternative by the project's forecast year and, therefore, the long-term impacts associated with the Streetcar Alternative would not be affected by these two construction phasing options. The project's current conceptual finance plan is summarized in Chapter 5 of this DEIS and it is based on the Full Project Construction phasing option.

Full Project Construction Phasing Option. Under the Full Project Construction phasing option, the Streetcar Alternative would be constructed and begin initial operations as a full project to Lake Oswego with capital improvements between Southwest Bancroft Street and downtown Lake Oswego. All project elements described in Chapter 2 of this DEIS for the Streetcar Alternative would be completed prior to the project's initial opening for revenue service. Under the Streetcar Alternative and this phasing option, no additional capital improvements would occur between the project's initial opening of revenue service and 2035. The project's initial operating plan (i.e., frequency of transit lines) would generally be scaled to meet ridership demand during the project's opening year through to 2035. The project's initial purchase of streetcars could be sized to meet anticipated streetcar ridership during the project's opening year of service or up to projected ridership for 2035, depending on the project's final finance plan.

Sellwood Bridge MOS Construction Phasing Option. The Sellwood Bridge MOS Construction phasing option could be used as a component of the project's finance plan to address issues, such as, but not limited to, projected cash flow or reducing finance costs. Under the Sellwood Bridge MOS Construction phasing option, the proposed Streetcar Alternative alignment and associated improvements proposed for the area generally between Southwest Bancroft Street and the Sellwood



FULL PROJECT CONSTRUCTION
SELLWOOD BRIDGE MOS
Portland Tram
SW Bancroft St
SW Hamilton Ct
SW Boundary St
SW Carolina St
SW Nebraska St
SW Nevada St
SELLWOOD BRIDGE
SW Riverwood Rd
Briarwood Rd
B Avenue
Lake Oswego Terminus
LAKE OSWEGO
35
Line 35 bus to Oregon City
Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative Finance Plan Related Phasing Options
Figure 3.17-1
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
station
optional station
park-and-ride
Line 35 bus
Transit: existing/planned
Streetcar, existing
Portland Aerial Tram
Miles
0 0.25 0.5
Oct 22, 2010

Table 3.17-1 Summary of Finance Plan Related Phasing Option and External Project Coordination Related Phasing Options

Type / Segment	Phasing Option	Notes
Finance Plan Related Phasing Options		
	✓Full Project Construction	• Base alignment for funding plan
	Sellwood Bridge MOS Construction	• Would address potential cash flow issues • Would result in a phased opening of the project
External Project Coordination Related Phasing Options		
1 – Downtown Portland	None	
2 – South Waterfront	✓South Portal Alignment	• Base alignment • Streetcar would be constructed concurrently with or subsequent to the roadway improvements associated with the South Portal project.
	South Portal Alignment – Streetcar Only	• Streetcar would be constructed in the same location as under the base alignment • Roadway improvements associated with the South Portal project would occur after the streetcar alignment is constructed
	Willamette Shore Line	• Streetcar would initially be constructed in the existing Willamette Shore Line alignment • Roadway improvements as a part of the South Portal project would occur after the streetcar alignment is constructed • The South Portal project would move the streetcar track to the South Portal alignment when the roadway improvements are made
3 – Johns Landing	None	
4 – Sellwood Bridge	✓New Interchange	• Base alignment • Streetcar would be constructed concurrently with or subsequent to the roadway improvements of the Sellwood Bridge project's replacement interchange • Impacts from the New Interchange alignment (compared to the Willamette Shore Line alignment) are addressed in the Sellwood Bridge FEIS
	Willamette Shore Line	• Streetcar project would occur prior to the construction of the new Sellwood Bridge interchange • Streetcar project would use the existing Willamette Shore Line right of way and there would be no streetcar improvements outside of the right of way • Sellwood Bridge project would move the streetcar tracks to the New Interchange alignment when the new interchange is constructed
5 – Riverdale/Dunthorpe	None	
6 – Lake Oswego	✓Foothills Design Option	• Base alignment • Streetcar would be constructed concurrently with or subsequent to the roadway improvements associated with the Foothills development project
	Foothills Design Option – Streetcar Only	• Roadway improvements as a part of the Foothills development project would occur after the streetcar alignment is constructed • Streetcar would be located in the same location as it would be under the base alignment

✓ = base alignment

Bridge would be implemented as a first construction phase. The remaining Streetcar Alternative alignment and related improvements south of the Sellwood Bridge would be made at a later time, but prior to 2035. Under the Sellwood Bridge MOS Construction phasing option there would be 2.2 miles of new streetcar track (4.3 miles of new one-way streetcar track miles) and six new streetcar stations, and there would be 10 Line 35 bus stops on Highway 43 between Lake Oswego and the Nevada Street Station As currently defined for this interim phasing option, Line 35 would operate on Highway 43 between Oregon City and the Nevada Street station, where through passengers would transfer to and from the proposed streetcar line. Other operating plans for the Sellwood Bridge MOS may also be considered if this phasing option becomes a component of the project's final finance plan.

Table 3.17-2 summarizes the facility improvements and transit operating characteristics that would occur under the Streetcar Alternative's finance plan related construction phasing options. Table 3.17-3 summarizes the differences in interim environmental effect on the two finance plan related design options. Ranges in the tables account for design and other phasing options under consideration. Under the Sellwood Bridge MOS, these characteristics and effects would be in place between the date of initial revenue service and the date when the remainder of the Streetcar Alternative would be constructed and opened for revenue service, before 2035. Under the Full Project Construction phasing option, there would be no change in the long-term effects of the project between the initial date of revenue service and 2035, except for those related to the frequency of streetcar service, which would generally be scaled to meet anticipate ridership between the initial revenue service and 2035. The long-term (2035) facilities, transit operating characteristics and environmental effects of the Streetcar Alternative (Full-Project Construction) would be unchanged by either finance plan related phasing option (see chapters 2, 3 and 4 of this DEIS). Should the Streetcar Alternative, with the Sellwood Bridge MOS construction phasing option, be selected as the Locally Preferred Alternative, during PE additional analysis would identify and document the duration of time for the phased construction. Depending on the length of time between phases, additional environmental analysis on the short- and long-term effects associated with shorter alignment and additional opportunity for public review and comment on the analysis may be required. Additional detail on the effects of the two finance plan related phasing options can be found in the discipline-related supporting technical memoranda listed in Appendix B of this DEIS.

Table 3.17-2 Summary Capital and Operating Characteristics of the Streetcar Alternative's Finance Plan Related Construction Phasing Options[1]

Attribute	Full Project Construction	Sellwood Bridge MOS Construction
New Streetcar Track Miles	6	2.2
New Streetcar Stations	10	6
Line 35 Bus Stops North of Lake Oswego	0	10
Corridor Park-and-Ride Lots / Spaces	5 / 476	3 / 76

Source: Metro, TriMet; January 2010.

1 This table summarizes the transit facility improvements and transit operating characteristics under the Streetcar Alternative's finance plan related construction phasing options as a result of the project's initial construction phase. The long-term (2035) transit facilities and transit operating characteristics of the Streetcar Alternative (see Chapters 2of this DEIS) would be unchanged by either finance plan related phasing option.

2 Operating costs for the opening year of the alternatives have not been calculated, because opening year travel demand forecasts have not been prepared (see footnote 3 in Table 3.17-2). Operating costs for opening year will be prepared for the Streetcar Alternative, if it is selected as the LPA. Those opening year forecasts and operating costs, which would be documented in the project's FEIS, would be based on the finance plan related phasing option included in the project's final finance plan.

In general, the initial interim effects of the Sellwood Bridge MOS Construction phasing option would be less than those of the Full Project Construction phasing option. For those not related to travel demand, the effects would generally be reduced in the Dunthorpe/Riverdale and Lake Oswego segments compared to the full project construction, as those segments would be delayed until the full project would be complete. For the effects that would be related to travel demand, the general direction of the effect (e.g., increased, decreased) has been estimated based on an assessment

Table 3.17- 3 Summary Environmental Effects of the Streetcar Alternative's Finance Plan Related Construction Phasing Options[1]

Attribute	Full Project Construction	Sellwood Bridge MOS Construction
Households/Jobs within New Fixed-Guideway Station Areas	12,080 / 24,920	8,329/19,180
P.M. In-Vehicle Transit Travel Time PSU to Lake Oswego	33 or 30	Increased[2]
Annual Systemwide Transit Ridership	Greater than MOS[3]	Less than Full Project[3]
Regional Vehicle Hours of Delay	Greater than MOS[3]	Less than Full Project[3]
New Congested Intersections(compared to No-Build)	2 or 4	0 or 2
Parking Spaces Removed	0 to 175	0 to 175
Construction Jobs Created	1,430 to 1,530	570 to 580
Available Floor Area in New Station Areas (x 1,000 square feet)	42,760 or 42,830	42,760 or 42,830
Potential Displacements	0 to 7	0 to 1
Severe Noise Impacts (without / with potential mitigation)	1 / 0	0/0
Vibration Impacts (without / with potential mitigation)	23 to 28 / 0	23 to 28 / 0
Tons of CO_2 Released by Vehicles	TBD	TBD
Visual	Same as for 2035[4]	Less than Full Project[4]
Historic Resources Adversely Affected	TBD	TBD
Acres of Parkland Used	0.7 or 1.0	0.0
Acres of Wetland Filled	0.09 to 0.11	0.09 to 0.11[5]
Acres of Fill in Floodplain	6.4 to 11.0	3.6 to 8.2
Acres of Net New Impervious Surfaces	3.6 to 8.8	0.4 to 3.1

Source: Metro, TriMet; January 2010. Note: TBD = to be determined.

1 The long-term (2035) environmental effects of the Streetcar Alternative (see chapters 2, 3 and 4 of this DEIS) would be unchanged by either finance plan related phasing option.

2 P.M. peak-period in-vehicle transit travel time from PSU to Lake Oswego would increase under the Sellwood Bridge MOS, compared to the Full Construction Project, due to a slower bus travel time (compared to the streetcar) from the Nevada Street Station to the Lake Oswego Transit Center and due to the transfer from the streetcar to the bus at the Nevada Street Station. Actual travel times would be dependent upon the level of congestion on Highway 43 between the Nevada Street Station and downtown Lake Oswego, which would be used by Line 35, and the level of congestion would be dependent upon the time period that the MOS would be in place.

3 Opening year travel demand forecasts for the project's alternatives have not been prepared. Based on FTA's guidance, opening year forecasts for the LPA would be prepared for the project's finance plan, during Preliminary Engineering. The estimated relative scale of transit ridership and regional vehicle miles of delay is based on an assessment of the travel demand forecasts for the No-Build and Streetcar alternatives for 2035. Systemwide transit ridership compared to the No-Build Alternative would be reduced under the Sellwood Bridge MOS, compared to the Full Construction Project because of decreased fixed-guideway household and employment coverage and generally longer transit travel times in the corridor.

4 Under the Full Project Construction phasing option, visual effects would be the same as described for the Streetcar Alternative in Section 3.4 of this DEIS; under the Sellwood Bridge MOS Construction phasing option, the visual effects of the Streetcar Alternative described in Section 3.4 of this DEIS for the Streetcar Alternative in the Dunthorpe/Riverdale and Lake Oswego segments would be temporarily avoided.

5 There would be a reduction of approximately 0.0025 acres of wetland filled (in the Dunthorpe/Riverdale Segment) under the Sellwood Bridge MOS Construction, which is not reflected in the total due to rounding.

of the 2035 travel demand forecasts for the No-Build and Streetcar alternatives (see Table 3.17-2). Opening year travel demand forecasts for the Streetcar Alternative have not been prepared for this DEIS, but they would be prepared for the project's final finance plan and Final EIS, which would be prepared during Preliminary Engineering, if the Streetcar Alternative is selected as the Locally Preferred Alternative. Because there would be no additional park-and-ride lot spaces in the corridor under the Sellwood Bridge MOS Construction phasing option, there could be more potential transit patrons parking vehicles in the Sellwood Bridge and Johns Landing segments generally near streetcar stations than under the Full Project Construction phasing option, which may warrant the consideration and implementation of one or more interim parking management programs to avoid or minimize and mitigate potential effects. The project's Final EIS would address this issue in more detail, including consideration of mitigation measures, if appropriate, if the Streetcar Alternative is selected as the Locally Preferred Alternative and if the Sellwood Bridge MOS Construction phasing option is included in the project's final finance plan.

3.17.2 External Project Coordination Related Phasing Options

This section addresses phasing options related to the coordination of the Streetcar Alternative (see Figure 3.17-2), if it is selected as the Locally Preferred Alternative, and other external projects. These phasing options represent interim steps in the construction process that would be taken to implement the Streetcar Alternative, in response to external projects as further explained below.

Following is a summary of how the direct impacts of the Streetcar Alternative would be temporarily affected by external project coordination related phasing options in the South Waterfront, Sellwood Bridge and Lake Oswego segments. The project's technical memoranda for the various environmental disciplines listed in Appendix B of this DEIS provide more detail on the changes to the direct environmental effects of the Streetcar Alternative due to the phasing options in the South Waterfront and Sellwood Bridge Segments. Chapters 3, 4, 5 and 6 of this DEIS summarize the changes to the changes to the direct environmental effects of the Streetcar Alternative due to the design options in the Lake Oswego segments.

3.17.2.1 South Waterfront Segment

This section addresses construction phasing options for the South Waterfront Segment, which would be affected by the status of the City of Portland's planned and programmed South Portal roadway improvements (see Section 2.2.1.1). These phasing options represent potential scenarios of how the project would be constructed dependent on how external conditions transpire with South Portal roadway improvement project. As such, the phasing options for the South Waterfront Segment do not constitute choices that would be made by the project, as much as response to external circumstances.

If the South Portal roadway improvements were made before, or concurrently with, construction of the Streetcar Alternative, the streetcar would operate on the Southwest Moody and Bond avenues couplet. If the South Portal roadway improvements are not in place or would not be constructed concurrently with the Streetcar Alternative, there would be two interim phasing options, as shown in Figure 3.17-2 for proceeding with construction of the streetcar alignment in the South Waterfront Segment: 1) the streetcar alignment and its required infrastructure improvements would be constructed, consistent with the alignment under the Full Project Construction phasing option (Moody/Bond couplet), but other non-project roadway improvements would be constructed at a later date by others; or 2) a different streetcar alignment using the Willamette Shore Line right of way would be initially constructed, until the South Portal improvements are constructed. If the Willamette Shore Line right of way were to be used, then when the South Portal roadway improvements were made, the streetcar alignment would be reconstructed consistent with the alignment described in Section 2.2.2 (i.e., within the right of way of the new Southwest Bond and Moody avenues, between Bancroft and Bond streets). The transit operating characteristics of the Streetcar Alternative would not be affected by the South Portal phasing options. Either phasing scenario or option could be implemented as Streetcar Alternative's initial construction phase described in Section 3.17.1.

During the interim period under the first phasing option, the Streetcar Alternative would be located in the Willamette Shore Line right of way and there would be a temporary change in some of the direct environmental effects of the Streetcar Alternative, until the South Portal roadway improvements were completed. The streetcar alignment would be changed at a later date to be consistent with the design of the Full Project Construction phasing option, concurrent with construction of the South Portal roadway project.

As shown in Table 3.17-4, phasing options in the South Waterfront Segment would not change the basic characteristics of the Streetcar Alternative (Moody/Bond Couplet); for example, the number of new streetcar stations and one-way track miles would remain unchanged, compared to the Full Project Construction option. Further, the direct effects of the Streetcar Alternative would remain unchanged under phasing options (compared to the Full Project Construction phasing option), except that there would be a 0.3-acre increase in fill within the 100-year floodplain.

Table 3.17-4 Summary Characteristics of the South Portal Construction Phasing Options for the Streetcar Alternative

	Moody/Bond Couplet[1]	Willamette Shore Line	Interim Moody/Bond Couplet[2]
New Streetcar Alignment Length (miles)	5.9 to 6.0	5.9 to 6.0	5.9 to 6.0
New One-Way Track Miles	10.5 to 11.3	10.5 to 11.3	10.5 to 11.3
New Streetcar Stations	10	10	10
Line 35 Bus Stops North of Lake Oswego	0	0	0
Corridor Park-and-Ride Lots / Spaces	5 / 476	5 / 476	5 / 476
P.M. In-Vehicle Transit Travel Time PSU to Lake Oswego	33 or 30	33 or 30	33 or 30
Transit Ridership (compared to No-Build)	6,700 or 7,000	6,700 or 7,000	6,700 or 7,000
New Congested Intersections(compared to No-Build)	2 or 4	2 or 4	2 or 4
Net Parking Spaces Removed	0 to 175	0 to 175	0 to 175
Potential Displacements	0 to 7	0 to 7	1 to 8
Severe Noise Impacts (without / with potential mitigation)	5/0	5/0	5/0
Vibration Impacts (without / with potential mitigation)	39 to 46 / 0	39 to 46 / 0	39 to 46 / 0
Visual[3]	low to moderate	low to moderate	low to moderate
Historic Resources Adversely Affected	TBD[4]	TBD[4]	TBD[4]
Acres of Parkland Used	0.7 to 1.0	0.7 to 1.0	0.7 to 1.0
Acres of Wetland Filled	0.10 to 0.12	0..10 to 0.12	0.10 to 0.12
Acres of Fill in Floodplain	6.4 to 10.1	6.7 to 10.4	6.4 to 10.1
Acres of New Impervious Surfaces	7.35 to 18.27	4.92 to 15.84	7.35 to 18.27

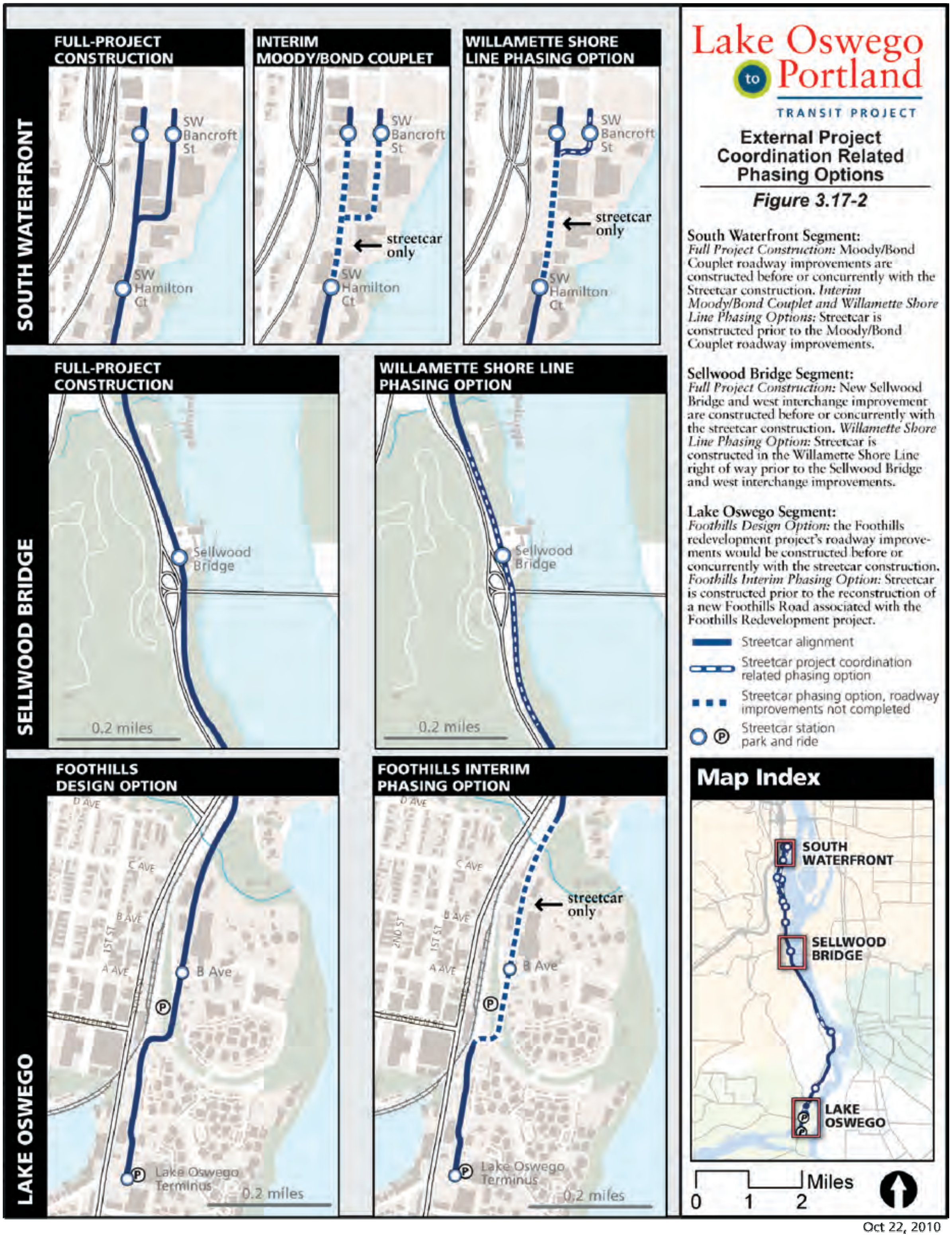
Source: Metro, TriMet; January 2010.

1 Based on the Moody/Bond Couplet alignment in the South Waterfront Segment as described for the Streetcar Alternative throughout this DEIS.

2 The streetcar alignment and stations would be in the same location in the South Waterfront Segment under the Interim Moody/Bond Couplet as under the Moody/Bond Couplet phasing option, except that the roadway improvements that would be associated with the South Portal roadway project would not be in place and would be constructed by others at a later date.

3 The initial interim effects of the Streetcar Alternative's in the South Waterfront Segment would vary by phasing options. Under the Moody/Bond Couplet phasing option, the alternative's visual effects would be those described for the South Waterfront Segment in Section 3.4 of this DEIS. Under the Willamette Shore Line interim phasing option, the visual effects that would occur on SW Moody and Bond streets due to the introduction of Streetcar facilities would occur within the vicinity of the Willamette Shore Line Right-of-Way. The Streetcar facilities and resulting visual effects under the Interim Moody/Bond Couplet phasing option would be the same as under the Moody/Bound Couplet phasing option, but initially there would be no roadway improvements.

4 To Be Determined (TBD). Based on the project's current conceptual engineering (approximately 8 percent design), the Streetcar Alternative could result in an effect or an adverse effect on the Red Electric Rail Line.


Lake Oswego to Portland
TRANSIT PROJECT
External Project Coordination Related Phasing Options
Figure 3.17-2
South Waterfront Segment:
Full Project Construction: Moody/Bond Couplet roadway improvements are constructed before or concurrently with the Streetcar construction. Interim Moody/Bond Couplet and Willamette Shore Line Phasing Options: Streetcar is constructed prior to the Moody/Bond Couplet roadway improvements.
Sellwood Bridge Segment:
Full Project Construction: New Sellwood Bridge and west interchange improvement are constructed before or concurrently with the streetcar construction. Willamette Shore Line Phasing Option: Streetcar is constructed in the Willamette Shore Line right of way prior to the Sellwood Bridge and west interchange improvements.
Lake Oswego Segment:
Foothills Design Option: the Foothills redevelopment project's roadway improvements would be constructed before or concurrently with the streetcar construction. Foothills Interim Phasing Option: Streetcar is constructed prior to the reconstruction of a new Foothills Road associated with the Foothills Redevelopment project.
Streetcar alignment
Streetcar project coordination related phasing option
Streetcar phasing option, roadway improvements not completed
Streetcar station
park and ride
Map Index
SOUTH WATERFRONT
SELLWOOD BRIDGE
LAKE OSWEGO
0 1 2 Miles
Oct 22, 2010
SOUTH WATERFRONT
FULL-PROJECT CONSTRUCTION
INTERIM MOODY/BOND COUPLET
WILLAMETTE SHORE LINE PHASING OPTION
SW Bancroft St
SW Hamilton Ct
streetcar only
SELLWOOD BRIDGE
FULL-PROJECT CONSTRUCTION
WILLAMETTE SHORE LINE PHASING OPTION
Sellwood Bridge
0.2 miles
LAKE OSWEGO
FOOTHILLS DESIGN OPTION
FOOTHILLS INTERIM PHASING OPTION
D AVE
C AVE
B AVE
A AVE
1ST ST
2ND ST
B Ave
Lake Oswego Terminus
streetcar only
0.2 miles

3.17.2.1 Sellwood Bridge Segment

The Sellwood Bridge Segment includes two potential phasing options for the Streetcar Alternative (see Figure 3.17-2). The phasing options reflect two scenarios for construction of the project in relationship to the construction of a proposed new interchange for the Sellwood Bridge replacement project. Because the two phasing options in this segment are dependent upon how construction of the Sellwood Bridge replacement project progresses, they do not constitute a choice of alignments for the Lake Oswego to Portland Transit Project; instead, they represent two construction phasing scenarios, dependent upon how external conditions transpire. In effect, the Sellwood Bridge replacement project would displace the Willamette Shore Line right of way and the effects of that displacement are addressed within the Sellwood Bridge replacement project's environmental documentation (see the Sellwood Bridge Final Environmental Impact Statement (FEIS), at www.sellwoodbridge.org). Following is a summary of the two phasing options for the Streetcar Alternative in the Sellwood Bridge Segment.

New Interchange Phasing Option. If the new interchange is constructed prior to or concurrently with the Streetcar Alternative, the initial and long-term streetcar alignment (considered the Full Construction Project) would be based on the Sellwood Bridge new west interchange as described in Chapters 2, 3, 4, 5 and 6 of this DEIS. The streetcar alignment under New Interchange phasing option could not be constructed prior to the Sellwood Bridge replacement project's reconstruction of the interchange, because of existing roadway facilities within that alignment that need to be maintained until the interchange is replaced.

Willamette Shore Line Phasing Option. If the proposed Sellwood Bridge's western interchange is constructed after the Streetcar Alternative, then the initial streetcar alignment to be constructed would be on the Willamette Shore Line. Under the Willamette Shore Line phasing option for the Sellwood Bridge Segment, when the proposed interchange is constructed, the Sellwood Bridge replacement project would relocate the streetcar alignment to the New Interchange alignment. Therefore, the long-term streetcar alignment would be the New Interchange phasing option, and the Willamette Shore Line phasing option would only be implemented as an interim alignment. Streetcar service under the Willamette Shore Line phasing option could be disrupted for an undetermined period of time while the streetcar alignment is moved from the Willamette Shore Line right of way to the new streetcar right of way, depending on the Sellwood Bridge replacement project's construction plan and final design of the new west interchange.

Neither of the phasing options would change the long-term effects of the Streetcar Alternative in the Sellwood Bridge Segment; those long-term effects of the Streetcar Alternative are represented by the New Interchange alignment. The two phasing options would only change the initial interim environmental effects of the Streetcar Alternative in the Sellwood Bridge Segment: 1) if the New Interchange phasing option unfolds, then the interim and long-term environmental effects of the Streetcar Alternative would be the same in this segment; and 2) if the Willamette Shore Line phasing option unfolds, then the effects associated with Willamette Shore Line phasing option would occur between the initial opening of the streetcar project and the time the Sellwood Bridge replacement project constructs the new roadway interchange and moves the Streetcar alignment from the Willamette Shore Line right of way to the New Interchange alignment.

As shown in Table 3.17-5, phasing in the Sellwood Bridge Segment would not change the basic characteristics of the Streetcar Alternative – for example, the number of new streetcar stations and one-way track miles would remain unchanged, compared to the Full Project Construction option.

Further, the direct effects of the Streetcar Alternative would remain unchanged under the phasing to accommodate the Sellwood Bridge reconstruction (compared to the Full Project Construction phasing option), except 0.01 acres increase in wetland fill, 0.1 decrease in fill in the floodplain and 0.05 increase in new impervious surfaces.

Table 3.17-5 Summary Characteristics of the Sellwood Bridge Construction Phasing Options for the Streetcar Alternative

Attribute	New Interchange[1]	Willamette Shore Line
New Streetcar Alignment Length (miles)	5.9 to 6.0	5.9 to 6.0
New One-Way Track Miles	10.5 to 11.3	10.5 to 11.3
New Streetcar Stations	10	10
Line 35 Bus Stops North of Lake Oswego	0	0
Corridor Park-and-Ride Lots / Spaces	5 / 476	5 / 476
P.M. In-Vehicle Transit Travel Time PSU to Lake Oswego	33 or 30	33 or 30
Transit Ridership (compared to No-Build)	6,700 or 7,000	6,700 or 7,000
New Congested Intersections(compared to No-Build)	2 or 4	2 or 4
Net Parking Spaces Removed	0 to 175	0 to 175
Potential Displacements	0 to 7	0 to 7
Severe Noise Impacts (without / with potential mitigation)	5/0	5/0
Vibration Impacts (without / with potential mitigation)	39 to 46 / 0	39 to 46 / 0
Visual[2]	Low to Moderate	Low to Moderate
Historic Resources Adversely Affected	TBD[3]	TBD[3]
Acres of Parkland Used[4]	0.7 to 1.0	0.7 to 1.0
Acres of Wetland Filled[5]	0.10 to 0.11	0.11 to 0.12
Acres of Fill in Floodplain[6]	6.5 to 10.1	6.4 to 10
Acres of New Impervious Surfaces[7]	4.92 to 18.22	4.97 to 18.27

Source: Metro, TriMet; January 2010.

1 Based on the New Interchange alignment in the Sellwood Bridge Segment as described for the Streetcar Alternative throughout this DEIS.

2 The initial interim effects of the Streetcar Alternative's in the Sellwood Bridge Segment would not vary by phasing options. Under the New Interchange and Willamette Shore Line phasing options, the alternative's visual effects would be those described for the Sellwood Bridge Segment in Section 3.4 of this DEIS. Under the Willamette Shore Line interim phasing option, the visual effects that would occur within the vicinity of the Willamette Shore Line right of way without roadway improvements associated with the Sellwood Bridge project.

3 To Be Determined (TBD). Based on the project's current conceptual engineering (approximately 8 percent design), the Streetcar Alternative could result in an effect or an adverse effect on the Red Electric Rail Line.

4 In order for the Sellwood Bridge replacement project's interchange to be constructed, the streetcar alignment could not use the current Willamette Shore Line right of way. Because the Sellwood Bridge project would, in effect, displace the streetcar alignment from the Willamette Shore Line right of way, the impacts associated with a change in the streetcar alignment are addressed within the Sellwood Bridge replacement project's EIS. The design of the streetcar alignment is being coordinated with the Sellwood Bridge replacement project. The Sellwood Bridge Project also discloses impacts to Powers Marine Park and the Willamette Moorage Park. The LOPT project would not add to those impacts. See Sellwood Bridge DEIS, at http://www.sellwoodbridge.org.

5 There is a difference in wetland impacts associate with the two Sellwood Bridge phasing options. The New Interchange phasing option would include 0.02 acre of wetland impacts, while the Willamette Shore Line would include 0.03 acres of wetland impacts

6 There is a difference in acres of fill in the floodplain with the two Sellwood Bridge phasing options. The new interchange phasing option would include 4.4 acres of fill in the floodplain and the Willamette Shore Line would include 4.3 acres of fill in the floodplain.

7 There is a difference in acres of new impervious surfaces with the two Sellwood Bridge phasing options. The new interchange phasing option would 0.00 acres of new impervious surfaces and the Willamette Shore Line would include 0.05 acres of new impervious surface.

3.17.2.3 Lake Oswego Segment

The Lake Oswego Segment has two design options Streetcar Alternative that represent choices for the project, as well as two potential phasing options for one of those design options.

The two Streetcar Alternative design options in the Lake Oswego Segment are: 1) the Foothills design option; and 2) the Union Pacific Railroad Right of Way design option. The effects of the

Foothills and Union Pacific Railroad design options are summarized in Chapters 2, 3, 4 and 5 of this DEIS; see Figure 2.2-5 for an illustration of the streetcar alignment under both design options.

There are no construction phasing options for the Streetcar Alternative in the Lake Oswego Segment under the Union Pacific Railroad design option. The Foothills design option includes two potential construction scenarios that are dependent upon the Foothills redevelopment project. How the Foothills design option would be constructed would be dependent upon the construction schedule for Foothills redevelopment project, which is currently not certain. The Foothills redevelopment project includes proposed property development/redevelopment and infrastructure improvements, which includes proposed new and redesigned roadways. Some of the planned roadway improvements would be designed and constructed in coordination with the Lake Oswego to Portland Transit Project, if the Streetcar Alternative is selected as the Locally Preferred Alternative.

With the Foothills design/phasing option, the Foothills redevelopment project's roadway improvements would be constructed before or concurrently with the Foothills design option. If so, then the interim effects of the Streetcar Alternative (i.e., from the project's opening year) and long-term environmental effects of the Streetcar Alternative would be identical. Alternately, if the Foothills redevelopment project's roadway improvements are not constructed prior to or concurrently with construction of the streetcar alignment, then the Lake Oswego to Portland Transit Project would construct the streetcar alignment and required infrastructure improvements using the same alignment as under the Foothills design option (see Figure 2.2-5), but the roadway improvements would be added at a later date by others. In the interim, when the Streetcar Alternative would be initially constructed and open for service, there would be no environmental effects of the Foothills redevelopment project's proposed roadway improvements. The environmental effects of the subsequent roadway improvements would occur only when the roadway improvements are made by others. There would be no change in the long-term effects of the Streetcar Alternative and the Foothills design option whether the roadway improvements are made before, concurrently with or after construction of the streetcar improvements. The long-term environmental effects of the Foothills design option are summarized in chapters 2, 3, 4 and 5 of this DEIS.

3.18 Environmental Justice, Elderly and Disabled Populations

This section summarizes the potential effects of the proposed alternatives and options on minority, low-income, elderly and/or disabled populations. These populations are protected through regulations to ensure that issues of concern to these populations are considered in the project development process and that disproportionately high impacts to minority and low-income populations do not occur. Outreach efforts specifically target these groups to facilitate involvement of protected populations. Additional information on the assessment of impacts to environmental justice, elderly and disabled populations is included in the *Lake Oswego to Portland Transit Project Community Impact Assessment Technical Report* (URS and TriMet/Metro, November 2010).

3.18.1 Affected Environment

3.18.1.1 Minority and Low-Income Populations

Executive Order 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations forms the basis for environmental justice policies in the United States. It requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies and activities on minority[101] and low-income[102] populations. USDOT Order 5610.2 (*Order to Address Environmental Justice in Minority Populations and Low-Income Populations*) implements the Executive Order for federally-funded transportation projects.

The Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) work with their state and local transportation partners to ensure that the principles of environmental justice are integrated into their transportation projects. These principles are to:

- Ensure the full and fair participation by all potential affected communities in the transportation decision-making process;
- Avoid, mitigate, or minimize disproportionally high and adverse human health and environmental impacts, including social and economic impacts, on minority and low-income populations; and
- Prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

The analysis units for this project's environmental justice evaluation are the neighborhoods that are located fully or predominantly within the project corridor and the unincorporated areas of Clackamas and Multnomah counties that are located between Portland and Lake Oswego in the project area (which encompasses the suburban communities known as Dunthorpe or Riverdale). These neighborhoods and unincorporated areas are illustrated in Figure 3.3-1 in Section 3.3 Neighborhoods, Displacements and Relocations.

The data in Table 3.18-1 show that minority and low-income populations exist within neighborhoods in the project area. This table identifies which U.S. Census Bureau tracts (according to Census 2000)

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[101] A person is considered minority if he or she is Hispanic, Latino, black or African American, American Indian, Alaska Native, Asian, Native Hawaiian/Pacific Islander, or of mixed-race.
[102] Low income is defined as populations that are at or below the federal poverty level.

had a higher percentage of minority and/or low-income populations than the tri-county region[103] for that demographic characteristic.

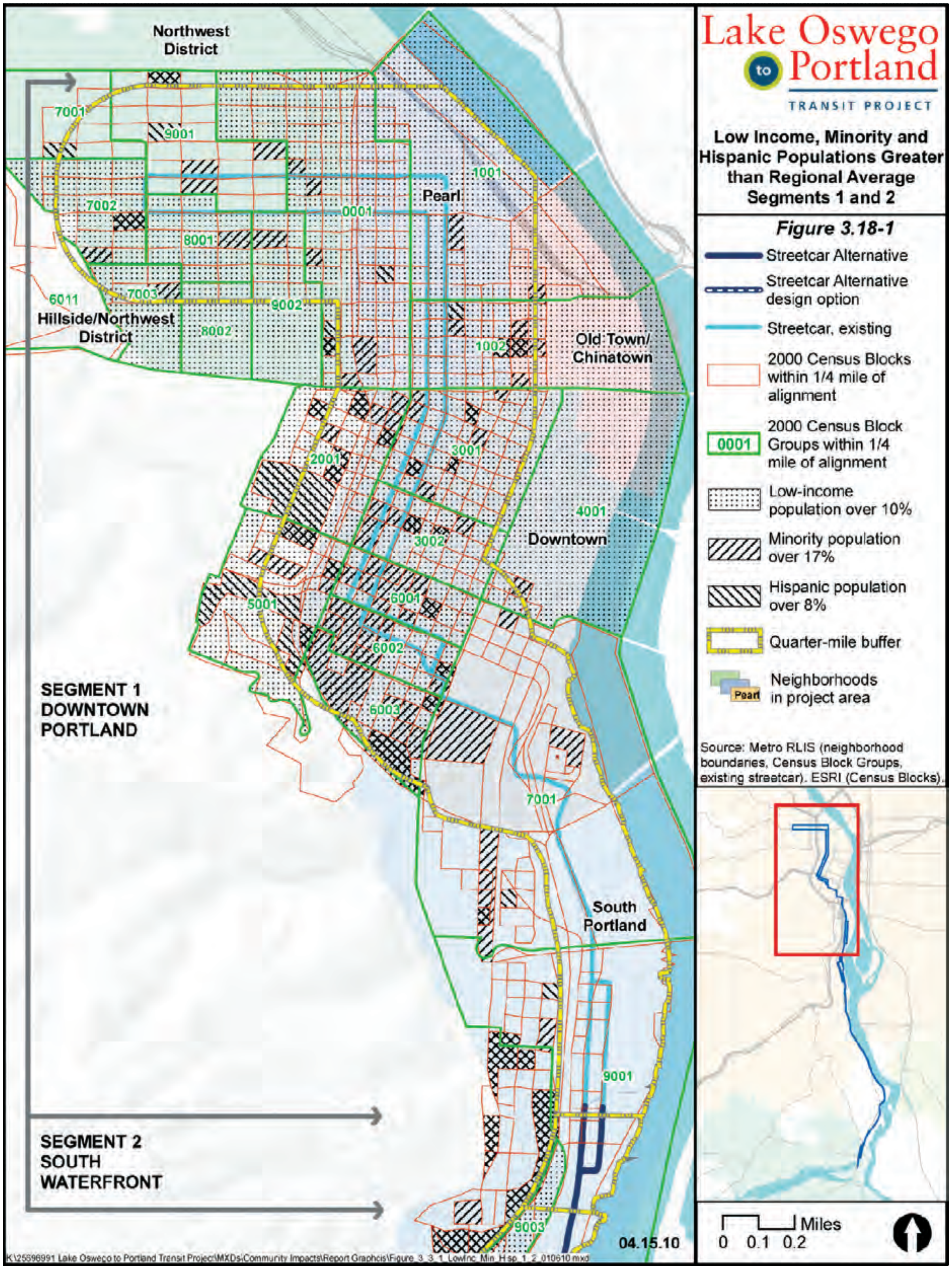
Table 3.18-1 Demographic Characteristics in the Project Area (2000)[1]

Jurisdiction Neighborhood[2]	Persons	Households	Residents over 65	Renter Occupied	Disabled	Below Poverty	Minority[3]
City of Portland							
Northwest District	10,309	4,388	**13%**	37%	12%	10%	10%
Pearl District	1,702	858	**33%**	**56%**	9%	9%	9%
Old-Town/Chinatown	603	284	**12%**	**41%**	9%	**12%**	14%
Downtown	7,653	4,987	**11%**	**80%**	12%	**16%**	13%
South Portland	6,877	4,390	10%	**88%**	13%	**31%**	**22%**
South Burlingame	1,829	1,065	**12%**	**62%**	12%	**17%**	14%
Collins View	726	407	9%	**49%**	10%	**11%**	11%
Unincorporated Multnomah County							
Dunthorpe/Riverdale	1,025	592	**11%**	11%	11%	8%	10%
Unincorporated Clackamas County							
Birdshill[4]	213	97	**11%**	13%	14%	2%	11%
City of Lake Oswego							
Birdshill	21	9	**11%**	13%	14%	2%	11%
First Addition	2,879	1,004	10%	21%	9%	6%	11%
Foothills	413	171	**11%**	11%	10%	4%	9%
Old Town	186	76	**11%**	10%	10%	4%	9%
Evergreen	795	357	7%	24%	8%	**11%**	11%
Lakewood	424	174	**11%**	10%	10%	4%	9%
Tri-County Region[5]	*1,444,219*	*569,461*	*10%*	*39%*	*17%*	*10%*	*17%*

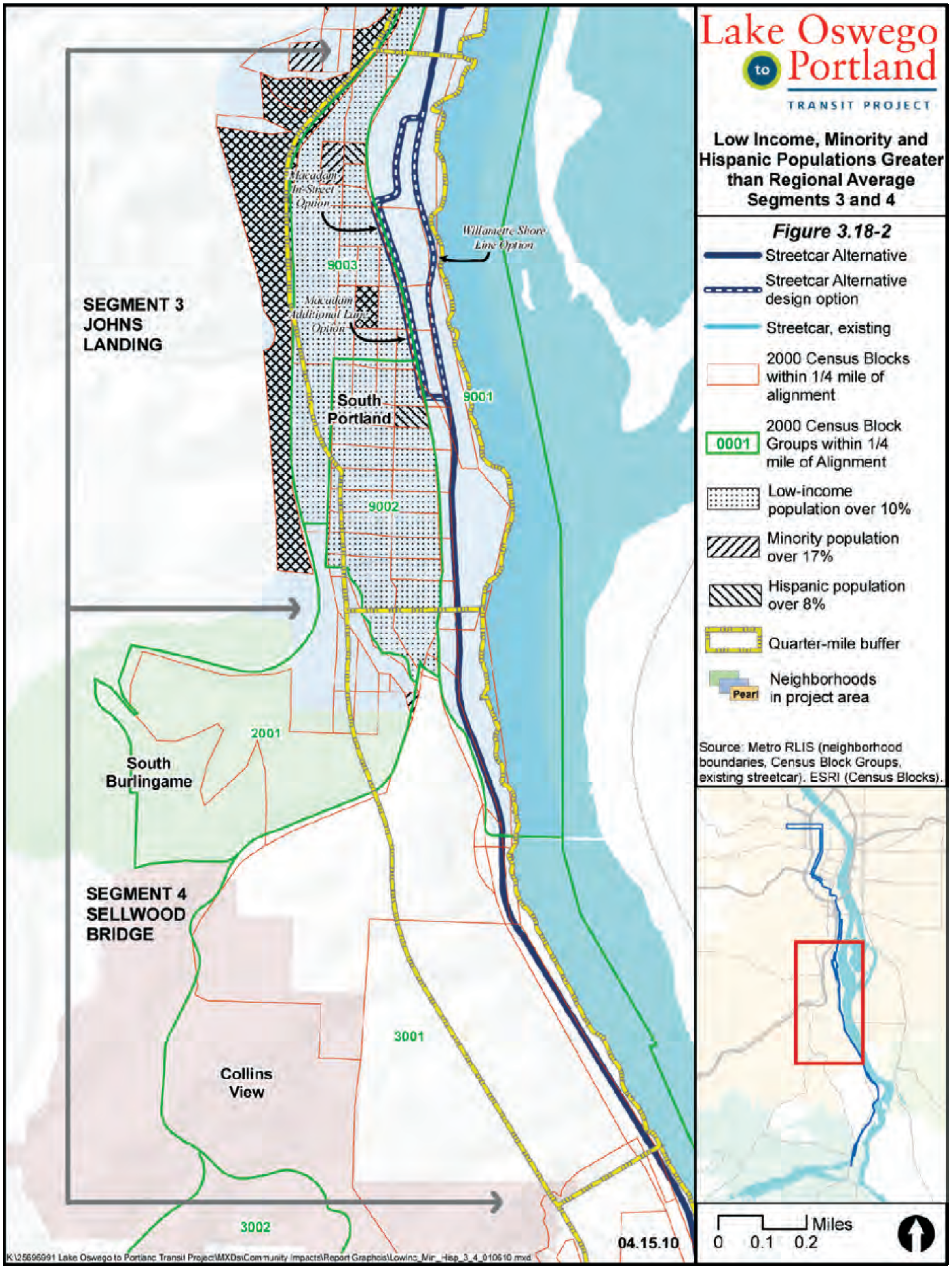
Source: U.S. Census Bureau. *Census 2000*, Summary File 1 and Summary File 3.
[1] **Bold** percentages indicate that that Census tract had a percentage greater than the Tri-County Region for that demographic characteristic.
[2] See the *Community Impacts Technical Report* for a description of the method used to define the neighborhood boundaries relative to Census block group boundaries for this analysis.
[3] See Table 3.3-2 for additional detail by minority group. The total of minority groups shown in Table 3.3-2 does not equal the minority data in this table because individuals may be members of two or more minority groups.
[4] The Birdshill neighborhood encompasses portions of the City of Lake Oswego and portions of unincorporated Clackamas County.
[5] The Tri-County Region includes all of Multnomah, Clackamas, and Washington counties.

According to Census 2000, a higher than average percentage of low-income persons resides in the Old Town/Chinatown, downtown Portland, South Portland, South Burlingame, Collins View and Evergreen neighborhoods. The highest percent of low-income persons reside in the South Portland neighborhood. Higher percentages of minorities reside in the South Portland neighborhood. Figures 3.18-1, 3.18-2 and 3.18-3 depict locations of higher percentages of environmental justice populations in the Lake Oswego to Portland Transit Project area for the census blocks and block groups within one-quarter mile of the project alignment.

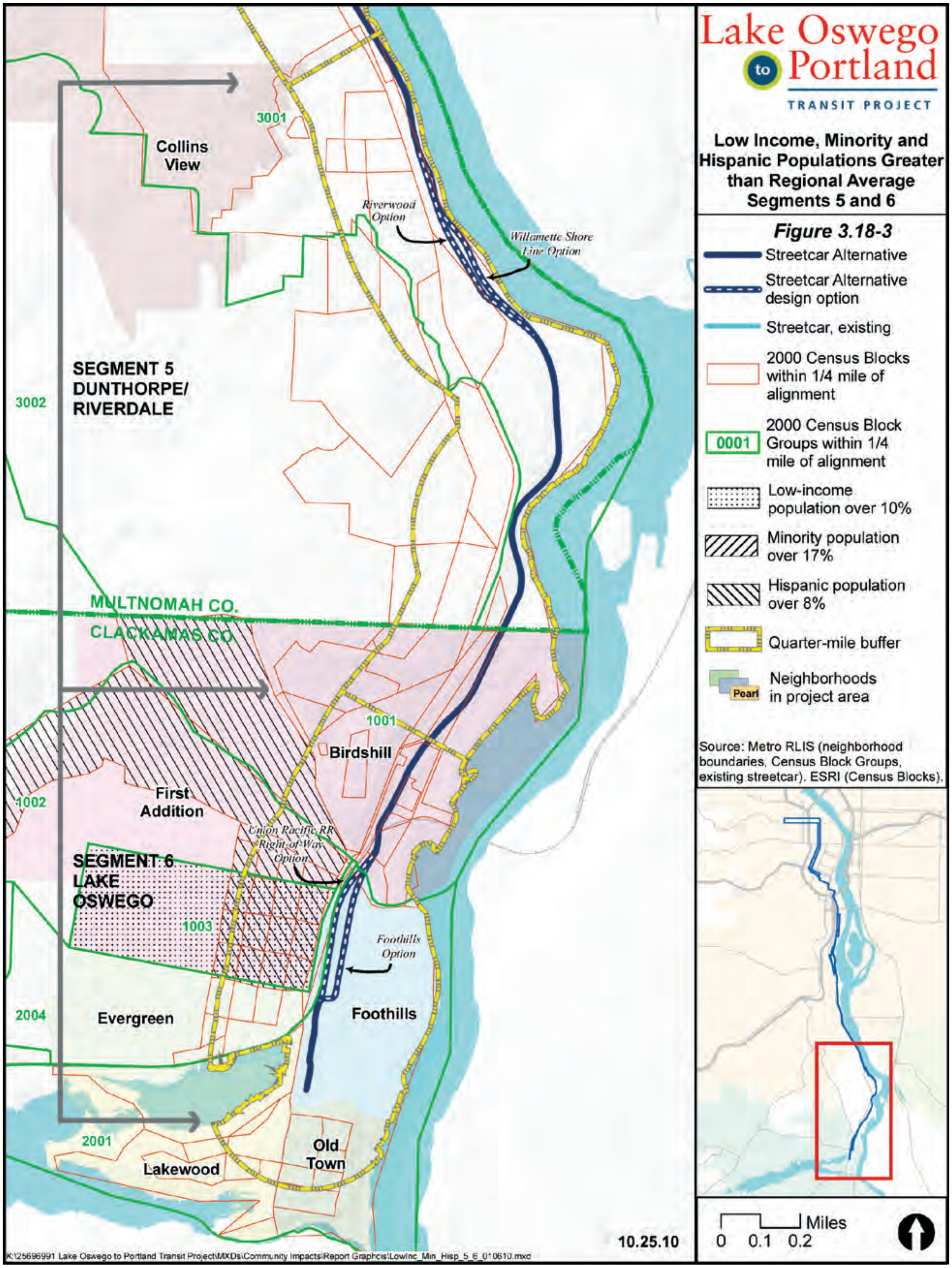
[103] The tri-county region includes Multnomah, Clackamas and Washington counties.



Lake Oswego to Portland
TRANSIT PROJECT
Low Income, Minority and Hispanic Populations Greater than Regional Average Segments 1 and 2
Figure 3.18-1
Streetcar Alternative
Streetcar Alternative design option
Streetcar, existing
2000 Census Blocks within 1/4 mile of alignment
2000 Census Block Groups within 1/4 mile of alignment
Low-income population over 10%
Minority population over 17%
Hispanic population over 8%
Quarter-mile buffer
Neighborhoods in project area
Source: Metro RLIS (neighborhood boundaries, Census Block Groups, existing streetcar). ESRI (Census Blocks).
Northwest District
Pearl
Hillside/Northwest District
Old Town/ Chinatown
Downtown
South Portland
SEGMENT 1 DOWNTOWN PORTLAND
SEGMENT 2 SOUTH WATERFRONT
Miles
0 0.1 0.2
04.15.10



Lake Oswego to Portland
TRANSIT PROJECT
Low Income, Minority and Hispanic Populations Greater than Regional Average Segments 3 and 4
Figure 3.18-2
Streetcar Alternative
Streetcar Alternative design option
Streetcar, existing
2000 Census Blocks within 1/4 mile of alignment
0001
2000 Census Block Groups within 1/4 mile of Alignment
Low-income population over 10%
Minority population over 17%
Hispanic population over 8%
Quarter-mile buffer
Neighborhoods in project area
Pearl
Source: Metro RLIS (neighborhood boundaries, Census Block Groups, existing streetcar). ESRI (Census Blocks).
Miles
0 0.1 0.2
SEGMENT 3 JOHNS LANDING
SEGMENT 4 SELLWOOD BRIDGE
South Portland
South Burlingame
Collins View
Macadam In-Street Option
Macadam Additional Lane Option
Willamette Shore Line Option
9003
9001
9002
2001
3001
3002
04.15.10


Lake Oswego to Portland
TRANSIT PROJECT
Low Income, Minority and Hispanic Populations Greater than Regional Average Segments 5 and 6
Figure 3.18-3
Streetcar Alternative
Streetcar Alternative design option
Streetcar, existing
2000 Census Blocks within 1/4 mile of alignment
0001
2000 Census Block Groups within 1/4 mile of alignment
Low-income population over 10%
Minority population over 17%
Hispanic population over 8%
Quarter-mile buffer
Pearl
Neighborhoods in project area
Source: Metro RLIS (neighborhood boundaries, Census Block Groups, existing streetcar). ESRI (Census Blocks).
Miles
0 0.1 0.2
Collins View
3001
Riverwood Option
Willamette Shore Line Option
SEGMENT 5
DUNTHORPE/
RIVERDALE
3002
MULTNOMAH CO.
CLACKAMAS CO.
1001
Birdshill
First Addition
1002
Union Pacific RR Right-of-Way Option
SEGMENT 6
LAKE
OSWEGO
1003
Foothills Option
Foothills
2004
Evergreen
2001
Lakewood
Old Town
10.25.10

3.18.3.1 Elderly and/or Disabled Populations

Although federal regulations do not provide for separate consideration of elderly and disabled populations, these populations are protected by Title VI of the Civil Rights Act of 1964 and related nondiscrimination statutes. The Americans with Disabilities Act (ADA) requires that transportation facilities accommodate the disabled, including those with mobility or vision impairments. A larger elderly and/or disabled population can indicate a population with special transportation needs. Many may not be able to walk as well or as far as younger people, and many no longer drive; therefore, they can often be more dependent on transit. A larger elderly population can also signify a lower-income community because many retirees are on fixed, lower incomes.

A higher than average percentage of persons over 65 reside in the majority of neighborhoods within this corridor, including Northwest District, Pearl District, Old Town/Chinatown, downtown Portland, South Burlingame, Dunthorpe/Riverdale, Birdshill, Foothills, Old Town and Lakewood. None of the neighborhoods in the project area contain a higher than average percentage of disabled persons.

3.18.2 Public Outreach to Low Income and Minority Populations

The project team has conducted targeted public outreach activities to protected populations in the project area in order to help identify and address their issues of concern. Outreach specific to these populations included:

- Direct mailing to residents in the corridor area that would specifically reach low-income persons;
- Holding all public meetings and events in ADA-accessible buildings and areas;
- Including a representative of persons over 65 on the project's Community Advisory Committee (there are nine persons representing this age group on the committee).

Outreach efforts will continue to ensure that development of this project is sensitive to the needs of minority, low-income, elderly and disabled populations. Continued outreach activities may include the following:

- Project team attendance at regularly scheduled neighborhood association meetings, particularly in the Old Town/Chinatown, downtown Portland, South Portland, South Burlingame, Collins View, and Evergreen neighborhoods;
- Door-to-door canvassing;
- Tabling at grocery stores and community events;
- Radio interviews on Spanish-speaking and English-speaking radio stations;
- Provision of information in newsletters targeted to people over the age of 65, such as the Lake Oswego Adult Community Center and Elders in Action newsletters; and
- Meetings at the Lake Oswego Adult Community Center to share information about how to participate in the DEIS process.

3.18.3 Environmental Consequences

Section 3.3.2 addresses the environmental consequences that the project's alternatives and design options would have on communities and neighborhoods. These effects are addressed below as they apply to environmental justice, elderly and disabled populations.

3.18.3.1 Direct Impacts to Environmental Justice Populations

No-Build Alternative. There would be no changes to existing conditions; there are therefore no direct disproportionate impacts to minority and low-income populations from the No-Build Alternative.

Enhanced Bus Alternative. The following summarizes the impacts to environmental justice populations anticipated with the Enhanced Bus Alternative.

- *Neighborhood Cohesion.* The Enhanced Bus Alternative is not expected to result in a major change to neighborhood cohesion, except for a moderate visual change in Segment 6 due to the construction of the new park-and-ride lot. This visual change would affect one small area and would not disproportionately impact minority and/or low-income populations.

- *Neighborhood Quality of Life.* The Enhanced Bus Alternative would not negatively affect the quality of life in neighborhoods in the project corridor. Therefore, the Enhanced Bus Alternative would not result in a disproportionate burden to minority or low-income populations.

- *Neighborhood Mobility.* The Enhanced Bus Alternative would improve transit travel times to most of the project area. This impact would provide a benefit to minority and low-income populations as well as other demographics throughout the area. However, the Enhanced Bus Alternative would reduce access to transit in Segments 3, 5 and 6. Because the stops would still be located within one-quarter mile of each other, access to transit would still be considered good. In addition, while this impact would affect low-income and minority residents, the impact would be no greater than for other populations. Thus, this alternative would not result in a disproportionate impact to environmental justice populations.

- *Property Acquisitions and Displacements.* The Enhanced Bus Alternative would result in eight property acquisitions of commercial and multifamily residential properties in Segment 6. However, these properties are located in an area where there is not a significant concentration of minority or low-income populations. Therefore, the Enhanced Bus Alternative would not result in a disproportionate impact to environmental justice populations.

Streetcar Alternative. The following summarizes the impacts to environmental justice populations anticipated with the Streetcar Alternative.

- *Neighborhood Cohesion.* The Streetcar Alternative could have an effect on neighborhood cohesion in Segments 3, 5 and 6. Consistent with adopted land use plans in the study area, existing land uses in Segment 3 would be expected to change. These changes could impact all demographics but not necessarily cause a disproportionate adverse impact to minority or low-income residents. The change to neighborhood cohesion in Segment 6 resulting from visual changes in the corridor. Changes to neighborhood cohesion in Segments 5 and 6 could occur from moderate to high visual changes associated with the Streetcar Alternative (e.g., the addition of streetcar tracks, electrical lines, and park-and-ride lots). The visual changes are not likely to disproportionately result in adverse effects to minority and low-income populations in the

Evergreen neighborhood (Segment 6), because although that population exists within the neighborhood, it is not immediately adjacent to the proposed improvements.[104]

- *Neighborhood Quality of Life.* The Streetcar Alternative would result in effects to neighborhood quality of life based on anticipated moderate noise impacts in Segments 3, 4 and 5. The noise impacts in Segment 3 have the potential to affect low-income persons in the South Portland neighborhood (Segment 3) because of the high percentage of low-income population in that area. However, it is anticipated that this would not constitute a disproportionate impact because the precise locations of low-income and minority populations are unknown within the census block group. Therefore, the presence of protected populations on the census block level does not necessarily indicate a concentration of highly impacted protected populations. Low-income persons in the South Burlingame and Collins View neighborhood (Segments 4 and 5), while they are within the neighborhood boundaries, do not reside immediately adjacent to the project.

- *Neighborhood Mobility.* The Streetcar Alternative would provide a benefit to minority and low-income populations throughout the area by decreasing transit travel times and by providing an overall improvement in traffic operations. The installation of a traffic signal and resulting traffic congestion at Southwest Macadam Avenue and Carolina Street in either of the Segment 3 Macadam Avenue design options could impact the adjacent low-income population. The small decrease in access to transit from the Streetcar Alternative in Segments 3 and 4 is not substantial enough to be considered a disproportionate impact to environmental justice populations.

- *Property Acquisitions and Displacements.* For the Streetcar Alternative, Segments 3, 5 and 6 have potential acquisitions and/or displacements.

  In Segment 3, the Streetcar Alternative would result in the acquisition of right of way from seven to 25 properties, depending on the design option selected. However, all except one of these properties are along the east side of Southwest Macadam Avenue. The high percentage low-income population in South Portland is only along the west side of Macadam Avenue, so the vast majority of these acquisitions would not likely impact that population and would not, therefore, represent a disproportionate burden to low-income and minority residents.

  In Segment 5, the Streetcar Alternative Riverwood In-Street option, would result in right of way acquisition from eight properties. One of these acquisitions would result in displacement of a residential building. Because this is a singular displacement, it would not constitute a disproportionate impact to potential minority and/or low-income residents in the Dunthorpe/Riverdale area. The remaining seven acquisitions are small and would not impact the use of those properties.

  In Segment 6, the Streetcar Alternative would result in 21 to 27 property acquisitions, depending on the design option chosen. Five of the 27 acquisitions in the Foothills option are considered displacements. These displacements are to industrial properties that are not specifically identified as under minority or low-income ownership and are considered unlikely to result in disproportionate adverse impacts to environmental justice populations.

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[104] For more details on the specific population groups adjacent to the project, see the *Lake Owego to Portland Community Impacts Technical Report.*

3.18.3.2 Direct Impacts to Elderly and/or Disabled Populations

No-Build Alternative. There would be no changes to existing conditions and therefore no direct impacts to elderly and/or disabled populations with the No-Build Alternative.

Enhanced Bus Alternative. The impacts associated with the Enhanced Bus Alternative are anticipated to be very similar to those associated with minority and/or low-income populations. The additional potential impacts are identified below. Regulations do not require evaluation of disproportionate adverse impacts related to the elderly and/or disabled.

- *Neighborhood Mobility.* The Enhanced Bus Alternative would improve transit travel times to most of the project area, thus providing a benefit to elderly and/or disabled populations as well as other demographics throughout the area. However, the Enhanced Bus Alternative would reduce access to transit in Segments 3, 5 and 6. Although transit travel times would still be considered good, the reduced number of stops would require additional distance for the elderly and/or disabled to travel. This would increase the time and difficulty required to reach bus stops for these populations, who may have restricted mobility.

- *Property Acquisitions and Displacements.* The property acquisitions associated with this alternative are to properties that are not specifically used by persons over 65 more than persons of other ages; these are not businesses that target persons over 65.

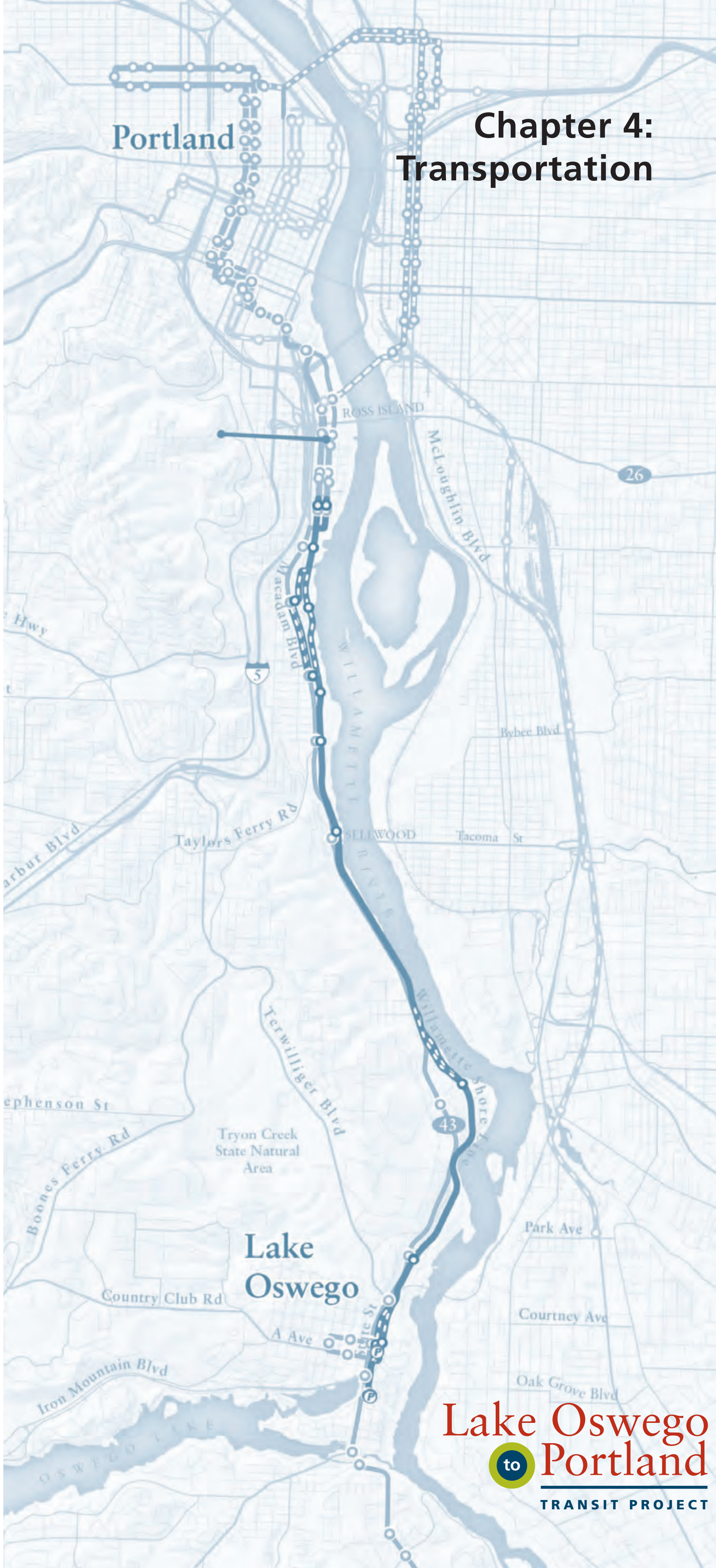
Streetcar Alternative. The impacts to persons over 65 and/or the disabled that would be associated with the Streetcar Alternative are similar to those identified above for minority and/or low-income populations.

3.18.3.3 Indirect Impacts to Environmental Justice Populations, the Elderly and/or Disabled

No-Build Alternative. No potential indirect impacts to minority, low-income, the elderly, and/or disabled are anticipated with the No-Build Alternative that would differ from impacts to other populations.

Enhanced Bus and Streetcar Alternatives. Properties in Segment 3, portions of Segment 5, and Segment 6 could experience development pressure which could be attributable to the project, and which could ultimately result in the displacement of protected populations. It is not known at this time whether any of these potential displacements would be disproportionate when compared to other populations. It is also not known whether the impacts would be considered negative since this will vary from property to property and individual to individual.

Chapter 4: Transportation



CHAPTER 4

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4. TRANSPORTATION

This chapter describes the effects that the No-Build, Enhanced Bus and Streetcar alternatives would have on transit operations and ridership, traffic operations and movement, freight movement, bicycle movement, pedestrian facilities and parking. Where there are differences between the effects of the Streetcar Alternative's design options, the sections describe those differences. Where appropriate, this chapter includes a summary of the relevant regulations and analysis methods. Short-term effects (effects related to construction activities) are addressed in section 4.3. More detailed information on the effects of the alternatives on the regional and local transportation system may be found in the *Lake Oswego to Portland Transit Project: Transportation Impacts Technical Report* (TriMet/Metro, November, 2010).

4.1 Affected Environment

This section summarizes characteristics of the existing transportation system and travel behavior within the region and corridor.

4.1.1 Public Transportation

Transit service in the corridor is primarily provided by TriMet's fixed-route, fixed-schedule buses operating in mixed traffic on Highway 43 and other arterial and collector roadways. The corridor includes one transit center, which is an on-street facility located in downtown Lake Oswego. The transit center is served by four bus routes, including: two that provide a feeder function with suburb-to-suburb connections (Line 37 and Line 78); one that provides peak-only service to downtown Portland and provides suburb-to-suburb connections in the midday (Line 36); and one that provides all day trunk route service from Oregon City to downtown Portland via the Lake Oswego Transit Center (Line 35).

In the northern portion of the corridor, public transit service also includes Line 43 Taylors Ferry which operates on Southwest Corbett Avenue and Macadam Avenue, streetcar service on Moody Avenue, connecting Northwest and downtown Portland to Lowell Street and aerial tram service between Gibbs Street at Moody Avenue and the Oregon Health and Sciences University (OHSU). The corridor also includes an excursion trolley operating on the existing Willamette Shore Line railroad.

4.1.1.1 Public Transportation Providers

There are three fixed-route transit providers in the Lake Oswego to Portland corridor. The Tri-County Metropolitan Transportation District of Oregon (TriMet) is the mass transit operating agency in the Portland metropolitan area. TriMet is the largest transit district in Oregon and the fifth largest on the West Coast. Under Oregon law (ORS 267), TriMet is a non-profit, municipal corporation operating in the urbanized portion of three Oregon counties: Multnomah, Clackamas and Washington. Its operating area covers 575 square miles and serves a population of approximately 1.3 million.

Portland Streetcar operates between South Waterfront and Northwest Portland through downtown Portland. Portland Streetcar is managed by the Portland Bureau of Transportation, under the direction of the Commissioner-in-Charge of Transportation. The City of Portland contracts with Portland Streetcar, Inc. (PSI) to construct and operate the Streetcar system. PSI is a private non-profit corporation. PSI contracts with TriMet to operate the streetcars. OHSU, through an intergovernmental agreement with the City of Portland, operates the Portland Aerial Tram, while the City is responsible for maintenance.

The Oregon Electric Railway Historical Society (a non-profit Oregon Corporation) has operated weekend and special event excursion service on the Willamette Shore Trolley since 1987 through an agreement with the City of Lake Oswego and TriMet. TriMet, representing a consortium of seven local, regional and state agencies, is responsible for maintenance of the trackway.

4.1.1.2 Transit Lines, Operations and Facilities

TriMet's current fleet of 652 buses serves 81 bus lines and seasonal shuttles with 7,155 bus stops and 1,040 bus shelters. There are 164 miles of frequent service bus lines on 12 routes that provide 15-minute or better service throughout the day, 7 days a week. The 84-station Metropolitan Area Express (MAX) light rail system is 52 miles long and also operates at least every 15 minutes. The 14.7-mile Westside Express Service (WES) Commuter Rail service provides eight peak period trips in each direction during weekdays, serving five stations. In addition to fixed-route bus and MAX service, TriMet operates 254 LIFT vehicles and 15 sedans, providing door-to-door service for people with special needs.

Table 4.1-1 summarizes TriMet's existing fixed-route service. Overall, 90 percent of people in the TriMet district live within one-half mile of TriMet service.

Table 4.1-1 Number and Length of Existing TriMet Fixed Route Transit Lines

	Streetcar[1]	MAX LRT	Frequent Bus	Total Bus
Routes	1	4	12	81
Length (miles)	8	52	164	792

Source: TriMet and Portland Streetcar Inc.; February 2010.
[1] Includes 2010 operations between NW 23rd Avenue and SW Lowell Street. The Eastside Loop Streetcar Project is currently under construction and is scheduled to open in 2012.

The Portland Streetcar operates four miles between the intersection of Northwest 23rd Avenue and Northrup Street and Southwest Moody Avenue and Lowell Street. Streetcars operate approximately every 13 minutes during most of the day and less frequently in the evening and weekends. An extension of Portland Streetcar from Northwest Northrup Street to the OMSI district is currently under construction and scheduled to open in 2012 and will provide approximately 12-minute frequency between those two locations.

The Portland Aerial Tram generally operates daily between South Waterfront and the OHSU campus on SW Sam Jackson Park Road on Marquam Hill, with Sunday operations only in the summer. The Marquam Hill area also includes the Shriners Hospital for Children and the Veterans Affairs Medical Center.

4.1.1.3 Current Ridership, Operating Revenue, and Operating Expenses

For fiscal year (FY) 2009, TriMet weekday system boarding rides (bus and light rail) averaged approximately 322,900 boarding rides with 215,300 on bus and 107,600 on light rail. Total weekend ridership (bus and light rail) averaged 351,800 trips. In addition, weekday boarding rides on streetcar averaged 12,100 during the same period.

Between FY 1999 and FY 2009, TriMet's annual systemwide farebox revenues increased from $40.6 million to $88.7 million. Costs for operations and maintenance during this period increased from $141.5 million to $261.1 million. Fare revenue as a percentage of the cost of operation and maintenance improved from 28.7 percent to 34 percent and the average operations cost per boarding ride for the entire fixed-route system increased from $1.85 to $2.57, reflecting inflation and service expansion to lower ridership areas and times. Cost per boarding ride for light rail, at $1.92, is lower than that for buses, at $2.88 (FY 2009). Cost per boarding ride for the Portland Streetcar is $1.30 (FY 2009).

4.1.2 Travel Behavior

The basic unit of measurement used in describing travel behavior is the "person trip," which is a trip made by one person from a point of origin to a destination, via any travel mode. Several trip variables, including the origin, destination, mode and purpose of the trip, further describe travel behavior.

For 2005, the transportation facilities in the Lake Oswego-Portland corridor carried approximately 27,200 person trips from the corridor to the Portland Central Business District (CBD) on an average weekday. Of these, approximately 2,100 (8 percent) were on the transit system. Of the 3,700 daily work trips from the corridor to the CBD, 700 (18 percent) were on transit.

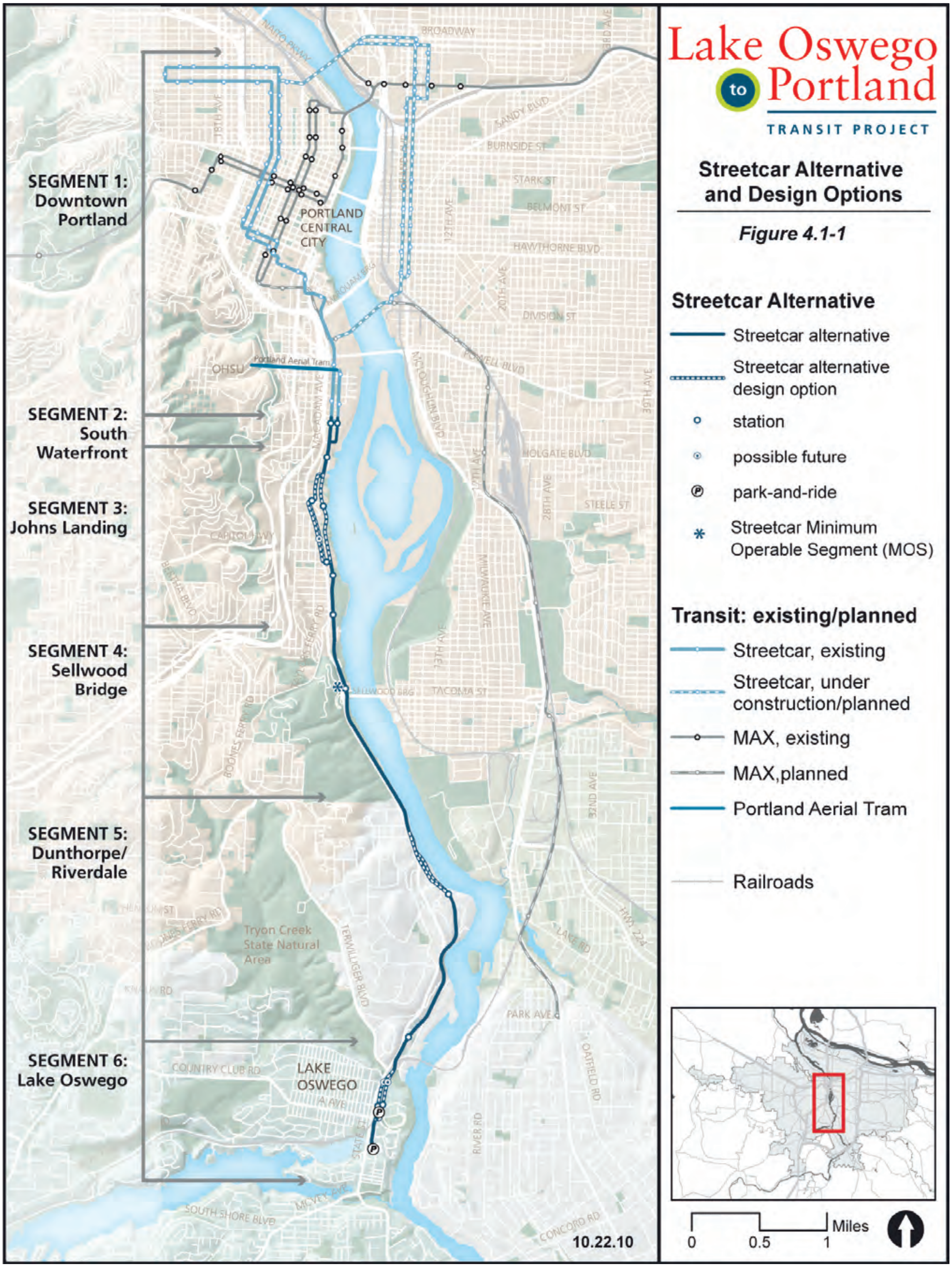
4.1.3 Roadways

The Lake Oswego to Portland corridor is served by a network of roads under the jurisdiction of the Oregon Department of Transportation (ODOT), Clackamas and Multnomah counties, the City of Lake Oswego, and the City of Portland. Congestion currently occurs on the corridor's highways, arterials and local streets.

4.1.3.1 Roadway Network

Although the transportation analysis focuses on system performance within the corridor, many of the region's freeways and highways are also affected by travel choices within the study corridor. The regional facilities related to the corridor include: Interstate 5 (I-5), Interstate 405 (I-405), Southeast McLoughlin Boulevard, Southwest Macadam Avenue/ Riverside Drive/ State Street (Highway 43), and Southwest Barbur Boulevard (OR 99W). When facilities such as I-5, Barbur Boulevard and McLoughlin Boulevard experience severe congestion, some overflow traffic is diverted to Highway 43 (Macadam Avenue/ Riverside Drive/State Street).

The roadway performance evaluation focuses on a study area that includes arterial and local streets within the corridor, principally, Highway 43 (Macadam Avenue/ Riverside Drive/State Street) and the streets that intersect this arterial route from Lake Oswego to Portland.


Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative and Design Options
Figure 4.1-1
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
station
possible future
park-and-ride
Streetcar Minimum Operable Segment (MOS)
Transit: existing/planned
Streetcar, existing
Streetcar, under construction/planned
MAX, existing
MAX,planned
Portland Aerial Tram
Railroads
SEGMENT 1: Downtown Portland
SEGMENT 2: South Waterfront
SEGMENT 3: Johns Landing
SEGMENT 4: Sellwood Bridge
SEGMENT 5: Dunthorpe/ Riverdale
SEGMENT 6: Lake Oswego
PORTLAND CENTRAL CITY
OHSU
Portland Aerial Tram
Tryon Creek State Natural Area
LAKE OSWEGO
BROADWAY
BURNSIDE ST
STARK ST
BELMONT ST
HAWTHORNE BLVD
DIVISION ST
POWELL BLVD
HOLGATE BLVD
STEELE ST
TACOMA ST
SELLWOOD BRG
MILWAUKIE AVE
TERWILLIGER BLVD
COUNTRY CLUB RD
A AVE
SOUTH SHORE BLVD
MCVEY AVE
PARK AVE
RIVER RD
OATFIELD RD
CONCORD RD
10.22.10
0
0.5
1
Miles

The study area is divided into six segments, as illustrated in Figure 4.1-1. The segments and a brief description of the roadway network to be analyzed are provided below.

Segment 1 – Downtown Portland: (Northwest Portland to Southwest Lowell Street) does not include any roadway network operations analysis. With the Streetcar Alternative the number of streetcars operating on the existing alignment through downtown would increase from 5 to 6 trains per hour during the peak hours. Because there are no changes to the street network, streetcar operates in mixed traffic and does not include any signal priority or preemption in downtown Portland, no intersection analysis was included in this segment.

Segment 2 – South Waterfront: (Southwest Lowell Street to Hamilton Court) includes nine intersections in the roadway network analysis, either on Macadam Avenue (Highway 43) or on other roadways which could be impacted by one of the alternatives.

Segment 3 – Johns Landing: (Southwest Hamilton Court to Miles Street) includes 22 intersections in the roadway network analysis, primarily along Macadam Avenue (Highway 43).

Segment 4 – Sellwood Bridge: (Southwest Miles Street to south end of Powers Marine Park) includes four intersections in the roadway network analysis, all on Macadam Avenue/ Riverside Drive (Highway 43) clustered around the Sellwood Bridge.

Segment 5 – Dunthorpe/Riverdale: (south end of Powers Marine Park to Southwest Briarwood Road) includes ten intersections in the roadway network analysis, primarily along Riverside Drive (Highway 43).

Segment 6 – Lake Oswego: (Southwest Briarwood Road to Lake Oswego Terminus) includes 14 intersections in the roadway network analysis, primarily along State Street (Highway 43).

4.1.3.2 Motor Vehicle Operations

Motor vehicle performance is assessed using a number of different operational measures including volume-to-capacity (V/C) ratio, level of service (LOS) and queuing. The V/C represents a comparison of vehicular demand to available throughput or capacity of an intersection and is the basic performance measure used by ODOT. Delay is used to define the LOS at intersection, which is a measure of operational conditions and how those conditions are perceived by motorists; the City of Portland and City of Lake Oswego use LOS in their performance standards. Queuing occurs as vehicles line up at either a traffic signal while waiting for the light to turn green or a stop or yield sign while waiting for a gap in the traffic flow on the major street. While none of the agencies use queuing as a performance standard, when queues build up between intersections or when they overflow out of a turn lane into the adjacent through lane, they can affect the performance of the surrounding roadway network. Table 4.3-5 displays the V/C ratio or LOS for intersections that would exceed standards in the forecast year. A more detailed explanation of these performance measures can be found in the *Lake Oswego to Portland Transit Project: Transportation Impacts Technical Report*.

The assessment of existing traffic conditions is based primarily on analysis of operations using traffic volumes collected in August 2009. The 2009 traffic volume counts were adjusted in some locations using 2006 traffic counts to account for seasonal fluctuations and a reduction in regional traffic volumes due to the economic recession during 2009. Year 2009 traffic volumes were calculated at 59 study area intersections. Operational analysis was completed for all intersections in p.m. peak period. The a.m. peak period traffic operations analysis was completed for intersections in Segments 2 (South Waterfront) and 3 (Johns Landing). This DEIS provides a summary of the analysis, more detailed information is available in the *Lake Oswego to Portland Transit Project: Transportation Impacts Technical Report*.

The 59 study area intersections were evaluated to determine V/C and LOS for the p.m. peak hour and 31 intersections were evaluated for the a.m. peak hour[1]. Based on the 2009 data, all of the study area intersections analyzed currently meet ODOT and local jurisdictional standards, with the exception of the unsignalized intersection at the Highway 43 southbound approach to Sellwood Bridge in the p.m. peak hour.

Queuing at the study area intersections was evaluated in segments 2 through 6 to determine: where existing queues build up or spill back from one signalized intersection to another, or where queues overflow out of a turn lane into the adjacent through lane[2]. Locations where queue spillback or overflow would occur are listed in Table 4.1-2.

[1] Traffic operations were evaluated using Synchro, which is based on the *2000 Highway Capacity Manual* methodologies.

[2] Queuing was evaluated using VISSIM peak hour simulation for Segment 2, 3 and 6. Synchro was used for Segment 4 and 5.

Table 4.1-2 Summary of Existing Queue Spillback or Overflow Locations

Intersection Location (Traffic Control)	Queue Spillback or Overflow[1] A.M. Peak Hour Direction[2]	P.M. Peak Hour Direction[2]
Segment 2		
SW Moody Ave/SW Bancroft St		SB Left Turn
SW Macadam Ave (Highway 43)/SW Bancroft St.	WB Left Turn	WB Left Turn
SW Macadam Ave (Highway 43)/SW Hamilton Ct.		WB Left Turn, WB Right Turn
Segment 3		
SW Macadam Ave (Highway 43)/SW Boundary St.		EB Left Turn, WB Left Turn
SW Macadam Ave (Highway 43)/SW Nevada St.	NA	EB Right Turn, WB Approach
SW Macadam Ave (Highway 43)/SW Taylors Ferry Rd.	NA	NB Left Turn
Segment 4		
SW Macadam Ave (Highway 43)/Sellwood Bridge	NA	SB back to Pendleton
Segment 5		
None	NA	NA
Segment 6		
N State St (Highway 43)/A Ave.	NA	EB Left Turn, NB Left Turn
N State St (Highway 43)/Foothills Rd.	NA	WB Approach
S State St (Highway 43)/McVey Ave.	NA	EB Left Turn

Notes:
[1] Queue spillback refers to traffic queues spilling back from one signalized intersection to another. Overflow refers to traffic queues exceeding the capacity of a turn lane and overflowing into the adjacent lane.
[2] Refers to the direction of travel approaching the intersection: NB = northbound, SB = southbound, EB = eastbound, WB = westbound. NA = not analyzed
Source: David Evans and Associates, Inc, 2010.

4.1.4 Freight Facilities and Activities

Highway 43 is not designated as a truck or freight route in the 1999 Oregon Highway Plan and is not approved as a continuous route for oversized freight by the ODOT Permit Unit. Despite its lack of official designation, Highway 43 carries truck traffic. Some carriers use Highway 43 as a route for oversized freight in order to bypass sections of I-5. Truck activity on Highway 43 is generally highest during the midday period, when total traffic levels are lower, but the analysis included in this DEIS is based on the p.m. peak hour which is the most congested period of the day. Truck traffic characteristics by segment are summarized below.

Segment 1 – Downtown Portland: does not include any freight analysis. With the Streetcar Alternative the number of streetcars operating on the existing alignment through downtown would increase from 5 to 6 trains per hour during the peak hours. This change is considered insignificant with regards to freight activities.

Segment 2 – South Waterfront: Truck traffic accounts for 2 to 3 percent of the total daily traffic and 1 to 1.5 percent of the p.m. peak hour traffic along Southwest Macadam Avenue (Highway 43) in this segment. Truck volumes on the other streets within the South Waterfront segment are less than 2 percent of the total traffic volume. Over-dimensional loads typically use Bancroft Street to access the South Waterfront neighborhood.

Segment 3 – Johns Landing: Truck traffic accounts for 2 to 3 percent of the total daily traffic and 1 to 2 percent of the p.m. peak hour traffic along Macadam Avenue (Highway 43) in this segment. Truck volumes on the other streets within the Johns Landing segment are less than 2 percent of the total traffic volume.

Segment 4 – Sellwood Bridge: North of the Sellwood Bridge, truck traffic accounts for 2 to 3 percent of the total daily traffic and 1 to 2 percent of the p.m. peak hour traffic along Macadam Avenue (Highway 43). South of the Sellwood Bridge, truck percentages are similar to those found north of the bridge.

Segment 5 – Dunthorpe/Riverdale: Truck traffic accounts for 1 to 2 percent of the total daily traffic and 1 to 2 percent of the p.m. peak hour traffic along Riverside Drive (Highway 43) in this segment. Truck volumes on the other streets within this segment are less than 2 percent of the total traffic volume.

Segment 6 – Lake Oswego: Truck traffic accounts for 2 to 3.5 percent of the total daily traffic along State Street (Highway 43). During the p.m. peak hour, trucks account for 1 to 3 percent of total traffic. Cross streets with the highest truck volumes in this segment include A Avenue and Foothills Road.

4.1.5 Bicycle Facilities and Activities

Existing bicycle facilities in the Lake Oswego to Portland corridor include designated bike lanes, the Willamette Greenway Trail and the Tryon Creek State Park Trail. There is currently a gap in north-south bicycle facilities between the Sellwood Bridge and Southwest Terwilliger Boulevard in Lake Oswego. Macadam Avenue/ Riverside Drive (Highway 43) provides the only through north-south route serving the corridor. South of the Sellwood Bridge, Highway 43 includes sections with no shoulders, high traffic volumes and high speeds.

In the northern portion of the corridor Segment 1 – Downtown Portland has traffic signals set for 12 miles per hour which allows bicycles to travel relatively flat sections in the travel lanes with auto traffic. Certain uphill sections (e.g. SW Broadway and SW Jefferson Street) include bicycle facilities. Segment 2 - South Waterfront and Segment 3 - Johns Landing, include several existing bicycle facilities; however, gaps or deficiencies are associated with them. These existing facilities include on-street bike lanes along Moody and Bond avenues and an existing portion of the incomplete Willamette Greenway Trail that meanders near the Willamette River shore line.

Bicycle counts taken at several intersections found fewer than 5 peak hour bicycle trips being taken directly on Highway 43 in Segment 3 - Johns Landing, Segment 4 – Sellwood Bridge and Segment 5 – Dunthorpe/Riverdale. This relatively light usage could be due to safety concerns related to the narrow right of way and high traffic speeds on Highway 43. Bicycle planners have estimated latent demand for commuter and recreational bicycle travel exists in the corridor and suggested improvements to address existing safety concerns[3]. Bicycle counts taken on the Willamette Greenway Trail south of Willamette Park found daily bicycle volumes of 275 in 2009[4].

4.1.6 Pedestrian Facilities

The existing pedestrian facilities in the Lake Oswego to Portland corridor vary considerably among the study segments. The segment pedestrian environments are summarized below.

Segment 1 - Downtown Portland: includes sidewalks and traffic signals with pedestrian crossings at most intersections. This segment does not include any pedestrian analysis. With the Streetcar Alternative the number of streetcars operating on the existing alignment through downtown would increase from 5 to 6 trains per hour during the peak hours. This change is considered insignificant with regards to pedestrian activities.

Segment 2 – South Waterfront: This segment includes areas that are currently converting from industrial uses to residential uses. North of Southwest Bancroft Street most block faces include existing or new sidewalks. Portions of the Willamette Greenway Trail are being implemented as development occurs, resulting in a discontinuous exclusive trail at this time.

Segment 3 – Johns Landing: West of Macadam Avenue the Johns Landing area is a traditional grid system with sidewalks on all block faces. East of Macadam Avenue, the development pattern is marked by office and condominium developments with private walkways and some public easements. Public pedestrian facilities are the sidewalk on the east side of Macadam Avenue and the Willamette Greenway Trail.

Segment 4 – Sellwood Bridge: Pedestrian facilities in this segment include the Willamette Greenway Trail and a 5-foot sidewalk adjacent to Highway 43 just north of the Sellwood Bridge. South of the bridge is an informal dirt path in Powers Marine Park.

Segment 5 – Dunthorpe/Riverdale: Neighborhood streets in this segment have occasional sidewalks, although many streets have low traffic volumes and low speeds.

Segment 6 – Lake Oswego: Central Lake Oswego west of State Street is a traditional grid pattern with sidewalks. East of State Street pedestrian facilities are limited but would be included in any planned Foothills area redevelopment. The Kincaid Curlicue Trail also provides pedestrian access east of State Street.

4.1.7 Parking

The number of on-street and off-street parking facilities and spaces were assessed for the Segments 2 through 6. Segment characteristics are summarized below.

Segment 1 - Downtown Portland: does not include parking analysis. With the Streetcar Alternative the number of streetcars operating on the existing alignment through downtown would increase from 5 to 6 trains per hour during the peak hours. This change is considered insignificant with regards to parking.

[3] *Lake Oswego to Portland Transit and Trail Study, Evaluation Summary Public Review Draft, July 12, 2007.*
[4] City of Portland Bicycle Counts, 2009.

Segment 2 – South Waterfront: The majority of the parking in this segment is in private, off-street lots serving adjacent development. This segment has some on-street parking along the streetcar alignment and on the adjacent streets. Most on-street parking in this segment is metered with both short-term and long-term spaces.

Segment 3 – Johns Landing: Although there is no on-street parking directly on Southwest Macadam Avenue (Highway 43), many of the side streets in the Johns Landing neighborhood west of Macadam Avenue permit on-street parking. The area is also served by private, off-street parking lots serving adjacent development. There is one large pay public parking lot within Willamette Park used by boaters and other park users.

Segment 4 – Sellwood Bridge: In this segment there are public parking spaces at the Macadam Bay Club and a limited number of private lots associated with adjacent businesses. On the east side of Southwest Riverside Drive (Highway 43) adjacent to Powers Marine Park there are two wide gravel areas that are used as informal parking for park visitors.

Segment 5 – Dunthorpe/Riverdale: On-street parking is available in limited portions of Riverside Drive (Highway 43) where adequate shoulder is available. There are no public or private parking lots immediately adjacent to Riverside Drive (Highway 43) in this segment.

Segment 6 – Lake Oswego: There is no on-street parking along Riverside Drive or State Street (Highway 43) in this segment. On-street parking is permitted along most streets in downtown Lake Oswego with many areas signed with time restrictions. South of D Avenue, numerous private, off-street parking lots serve adjacent development and public parking is available in the development adjacent to Millennium Park, on the corner of North State Street and A Avenue. East of State Street, there is public parking associated with a public riverfront park and private parking associated with individual businesses and residential properties.

4.2 Transit Impacts

This section presents the effects that project alternatives and options would have on the transit system in the corridor. For more detailed information on transportation impacts see the *Lake Oswego to Portland: Transportation Technical Report*.

The No-Build Alternative represents the service characteristics of the 2035 financially constrained transit network associated with the 2035 Regional Transportation Plan (Metro) (see Figure 4.2-1) without the proposed transit investment in the corridor. The corridor's bus network would vary by alternative, but would not be affected by the Streetcar design options under consideration. See Figures 4.2-2 and 4.2-3 for the Enhanced Bus and Streetcar alternatives transit networks. The transit analysis includes a distinction in Segment 3 Johns Landing between the Willamette Shore Line design option and the two design options that would operate in Southwest Macadam Avenue (Macadam Additional Lane and Macadam In-Street design options). The Macadam In-Street design option would include the streetcar operating in mixed traffic in the existing outside lanes of Macadam Avenue between Carolina Street and Boundary Street. The Macadam Additional Lane design option would include a third northbound lane between Carolina Street and Boundary Street with streetcar operating in mixed traffic. See Chapter 2, Section 2.1 for a detailed description of the alternatives and design options.

4.2.1 Amount of Service

The amount of transit service provided is measured by daily transit vehicle hours traveled (VHT) in revenue service, daily transit vehicle miles traveled (VMT) in revenue service, and daily place-miles of service. Daily VHT are the cumulative time that transit vehicles are in service and daily VMT are the distance they travel, independent of the size of the vehicle. Daily is defined as an average weekday in the year 2035. Place-miles refers to the total carrying capacity (seated and standing) of each bus or train type and is calculated by multiplying the vehicle capacity of each bus or light rail vehicle type by the daily VMT for each vehicle type. Place-miles highlight differences between alternatives caused by a different mix of vehicle types and levels of service. Table 4.2-1 summarizes these transit service characteristics.

Table 4.2-1 Average Weekday Corridor[1] Transit Service Characteristics, Year 2035

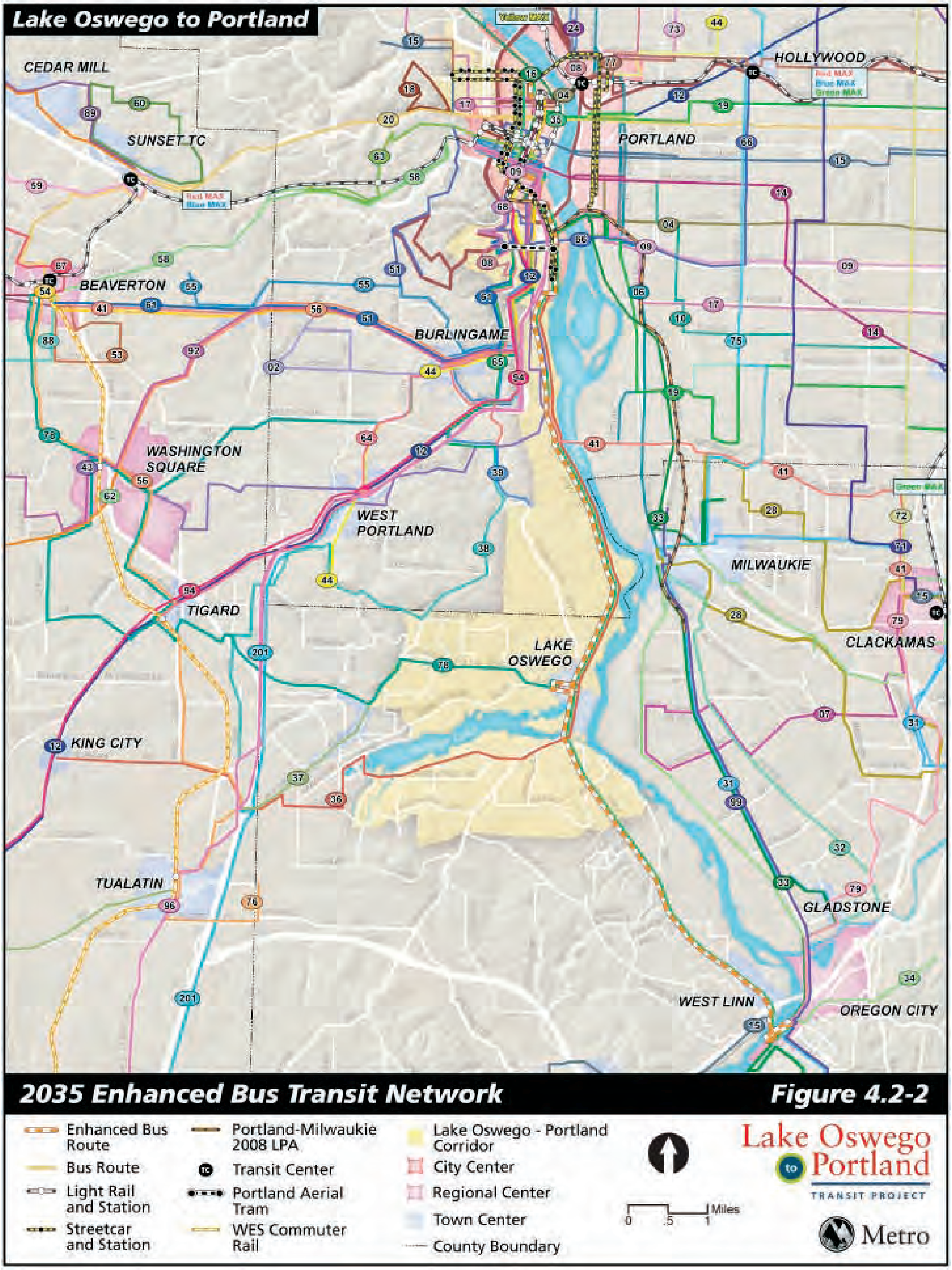
			Streetcar[2]	
	No-Build	**Enhanced Bus**	**Willamette Shore Line**	**Macadam Avenue design options**
Transit VMT				
Bus	3,160	3,780	2,400	2,400
Streetcar[2]	320	320	1,300	1,330
Total	3,480	4,100	3,700	3,730
Percent Change	N/A	18%	6%	7%
Transit VHT				
Bus	200	240	140	140
Streetcar[2]	30	30	80	90
Total	230	270	220	230
Percent Change	N/A	17%	-4%	0%
Place Miles				
Bus	161,160	192,780	122,400	122,400
Streetcar[2]	29,440	29,440	119,600	122,360
Total	190,600	222,220	242,000	244,760
Percent Change	N/A	17%	27%	28%

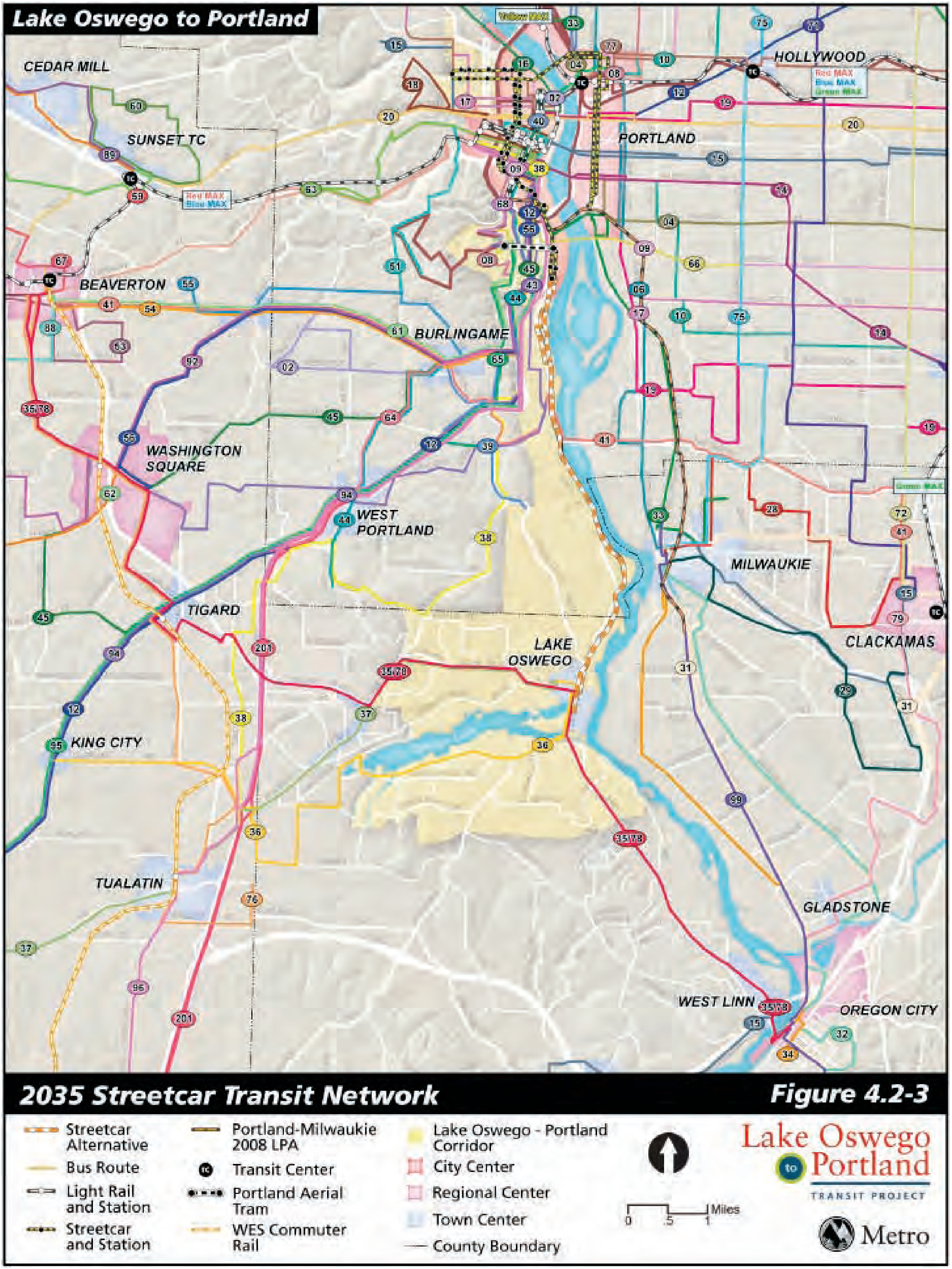
Source: Metro, 2010.
Note: VMT = vehicle miles traveled; VHT = vehicle hours traveled; N/A = not applicable.
[1] Excludes downtown Portland and NW Portland.
[2] Streetcar data is from the RiverPlace Station south to Lake Oswego. In the 2005 base year the streetcar did not travel south of the RiverPlace Station. There would be differences in transit service characteristics for the Streetcar Alternative design options in Segment 3 Johns Landing. No other design options include differences in transit service characteristics.

The Enhanced Bus Alternative would increase the corridor transit VMT by 18 percent, the corridor transit VHT by 17 percent and the corridor place miles by 17 percent compared with the No-Build Alternative. The Streetcar Alternative would increase the corridor transit VMT by 37 percent (Macadam Avenue design options) and 46 percent (Willamette Shore Line design option). Although the Streetcar Alternative (with all design options) would provide more frequent service in the corridor than the No-Build Alternative bus (lines 35 and 36), it would result in less transit VHT than the No-Build Alternative because the new streetcar would connect to existing streetcar at Lowell Street, replacing the No-Build Alternative bus lines that extend through downtown to Union Station. Conversely, the transit VHT for the Enhanced Bus Alternative would increase over the No-Build Alternative because it would provide more frequent service but would also be routed to Union Station. The Streetcar Alternative would include the largest increase in place miles, with a 27 percent (Willamette Shore Line design option) to 28 percent (Macadam Avenue design options) increase over the No-Build Alternative.

2035 No-Build Transit Network

Figure 4.2-1


Lake Oswego to Portland
CEDAR MILL
SUNSET TC
BEAVERTON
HOLLYWOOD
PORTLAND
BURLINGAME
WASHINGTON SQUARE
WEST PORTLAND
TIGARD
MILWAUKIE
CLACKAMAS
LAKE OSWEGO
KING CITY
TUALATIN
GLADSTONE
WEST LINN
OREGON CITY
Yellow MAX
Red MAX
Blue MAX
Green MAX
2035 Enhanced Bus Transit Network
Figure 4.2-2
Enhanced Bus Route
Bus Route
Light Rail and Station
Streetcar and Station
Portland-Milwaukie 2008 LPA
Transit Center
Portland Aerial Tram
WES Commuter Rail
Lake Oswego - Portland Corridor
City Center
Regional Center
Town Center
County Boundary
0
.5
1
Miles
Lake Oswego to Portland
TRANSIT PROJECT
Metro



2035 Streetcar Transit Network

Figure 4.2-3

4.2.2 Service Growth

Service growth under the No-Build Alternative would be constrained by available revenue sources, consistent with the Financially Constrained transit network in the 2035 RTP. With the No-Build Alternative, weekday corridor transit VMT and VHT would increase compared to existing levels by 41 and 53 percent, respectively. The greater percentage increase in VHT compared to VMT indicates that transit speeds in the corridor would slow relative to existing conditions due to increasingly congested and slowing traffic on highways, arterials and local streets. The build alternatives would result in increased transit capacity in the corridor and a level of service similar to the No-Build Alternative outside of the corridor.

The Enhanced Bus Alternative would operate between the Oregon City Transit Center and downtown Portland. South of Lake Oswego, service would be similar to the existing Line 35 Macadam. Modifications to existing service would occur north of Lake Oswego, including limited stop service to improve travel times in the corridor. A new park-and-ride lot at the Lake Oswego Terminus would be constructed under the Streetcar Alternative and the Enhanced Bus Alternative. A second, smaller park and ride location would be constructed at the B Avenue station under the Streetcar Alternative only.

The Streetcar Alternative would result in an approximately 5.9 to 6.0 mile extension of the existing Portland Streetcar line from Southwest Lowell Street in South Waterfront to downtown Lake Oswego. Streetcars would operate every 7.5 minutes along the extension in the peak direction to meet projected demand during the peak period. The bus feeder network would be reconfigured to provide connectivity with streetcar stations and transit centers. Bus service that would be parallel to and duplicative of the proposed Streetcar alignment would be eliminated[5] (see Section 2.2.3.2 for details).

4.2.3 Travel Time

Transit travel times are assessed using in-vehicle time and total travel time, as shown in Table 4.2-2. This table summarizes the change in p.m. peak hour in-vehicle and total travel time between the No-Build, Enhanced Bus and Streetcar alternatives. Transit in-vehicle travel times would be reduced under the Enhanced Bus Alternative by three minutes between Southwest Lowell Street and downtown Lake Oswego, compared to the No-Build Alternative; and transit in-vehicle travel times would be reduced by 9 to 14 minutes under the Streetcar Alternative, compared to the No-Build Alternative. Under the Streetcar Alternative, the Willamette Shore Line design option in Segment 3 – Johns Landing would reduce transit travel times between corridor destinations by approximately four minutes, compared to the two Macadam Avenue design options.

4.2.4 Reliability

Table 4.2-3 summarizes three measures of transit reliability in the corridor: miles of separated right of way, the number of passenger miles that would occur on that separated right of way, and the percentage of corridor passenger miles that would occur in separated right of way. In the TriMet system, transit lines, which use reserved or separated right of way, exhibit a greater proportion of on-time arrivals than lines operating in mixed traffic. Transit service that would utilize little or no reserved right of way would be subject to traffic congestion and delay which would typically result

[5] During project implementation, TriMet would determine the final bus operations plan to support streetcar service in the corridor.

in worse on-time performance. Neither the No-Build Alternative nor the Enhanced Bus Alternative includes portions of exclusive guideway, queue jumps or signal priority. These strategies were considered during the Alternatives Analysis phase and were not included in the Enhanced Bus Alternative due to the length of queues and resulting right of way impacts in the most congested portions of Highway 43.

Table 4.2-2 Transit and Auto Average Weekday P.M. Peak Hour Travel Times to Lake Oswego from Selected Locations (in minutes, year 2035)

					Streetcar[1]			
	No-Build		Enhanced Bus		Willamette Shore Line		Macadam Avenue Design Options	
Origin/Destination	**Auto**	**Transit**	**Auto**	**Transit**	**Auto**	**Transit**	**Auto**	**Transit**
In-Vehicle Travel Time[2]								
To Lake Oswego from:								
Portland State University	28	42	28	39	27	29	27	33
SW Lowell Street	22	32	22	29	22	18	22	22
Total Travel Time[3]								
To Lake Oswego from:								
Portland State University	33	53	33	48	32	38	32	42
SW Lowell Street	27	43	27	37	27	27	27	31

Source: Metro, 2010.
[1] Except in Segment 3 – Johns Landing, there would be no difference in transit travel times for the Streetcar Alternative by design option. This table presents the differences in Segment 3 due to either of the two Macadam Avenue design options (i.e. Macadam Additional Lane and Macadam In-Street) and the Willamette Shore Line Design Option.
[2] In minutes; in-vehicle time is the time that a passenger would spend within a public transit vehicle or an automobile.
[3] In minutes; total travel time includes walk access times at the start and end of a trip, in-vehicle time and wait time, if any.

Table 4.2-3 Measures of Transit Reliability in the Corridor, Year 2035[1, 2]

			Streetcar[3]	
Rail Right of way Measure	**No-Build**	**Enhanced Bus**	**Willamette Shore Line**	**Macadam Avenue design options**
Miles of Separated or Exclusive ROW[4]	0	0	4.8	4.0
Average Weekday Passenger Miles in Exclusive ROW[5]	0	0	39,700	32,500
Percent of Total Corridor Passenger Miles	0%	0%	71%	60%

Source: Metro, 2010.
Note: ROW = right of way.
[1] Some streetcar sections would provide an exclusive grade and/or barrier-separated transit right of way.
[2] Excludes Portland CBD and NW Portland districts to isolate transit lines that primarily serve the corridor.
[3] Except in Segment 3 – Johns Landing, there would be no difference in transit reliability measures for the Streetcar Alternative by design option. This table presents the differences in Segment 3 due to either of the two Macadam Avenue design options (i.e. Macadam In-Street and Macadam Additional Lane) and the Willamette Shore Line Design Option.
[4] Miles of Separated or Exclusive ROW based on Streetcar Alternative as modeled. The model assumed either Macadam or Willamette Shore Line design options in Segment 3, Willamette Shore Line in Segments 4 and 5 and Foothills Design Option in Segment 6.
[5] Rail right of way in the corridor would also be provided by the Milwaukie Light Rail Project for all alternatives. This measure considers only additional rail in exclusive right of way provided by the Lake Oswego to Portland Transit Project.

The Enhanced Bus Alternative would result in no additional passenger miles in separated right of way in the corridor compared to the No-Build Alternative. The Streetcar Alternative includes 4 miles of separated right of way and 32,500 separated right of way passenger miles for the Macadam In-Street/Macadam Additional Lane design options and 4.8 miles of separated right of way or 39,700 separated right of way passenger miles for the Willamette Shore Line design option. Of the average weekday streetcar passenger miles in the corridor in 2035 (excluding passenger miles on the Milwaukie light rail), approximately 60 and 71 percent of transit passenger miles would be in separated or exclusive right of way with the Streetcar Alternative for the Macadam In-Street and Macadam Additional Lane design options or the Willamette Shore Line design option, respectively.

4.2.5 Transit Ridership

This section summarizes transit ridership data including: line boardings and peak load points for specific lines, corridor and total transit system ridership, work and non-work transit trips, transit mode share and Lake Oswego to Portland Streetcar and Enhanced Bus station boardings.

The transit ridership forecasts for the No-Build, Enhanced Bus and Streetcar alternatives summarized in this section were prepared using Metro's regional travel demand model for average weekdays in 2035. In Segment 3 – Johns Landing, the streetcar travel times and station locations would be similar with the Macadam In-Street and Macadam Additional Lane design options. The streetcar travel times and station locations with the Willamette Shore Line design option would be substantially different than the Macadam design options and would result in differences in overall streetcar ridership. The design options in all other segments would have similar streetcar travel times and station locations and there would be no difference in overall streetcar ridership due to those design options. Differences in transit ridership due to the design options in Segment 3 for the Streetcar Alternative are presented within this section.

- **Lake Oswego to Portland Line Ridership.** Table 4.2-4 summarizes average weekday boardings for corridor streetcar and bus lines in each alternative (bus lines 35, 36, 43 and 78), including the corridor boardings between Lake Oswego and Southwest Bancroft Street. In summary, the Enhanced Bus Alternative would produce a total of 19,980 daily boardings among these transit lines. In comparison, the Streetcar Alternative would result in 23,600 streetcar and bus boardings with the Willamette Shore Line design option and 23,110 streetcar and bus boardings with the Macadam Avenue design option. With the No-Build Alternative, the frequency of service assumed for the Line 35 Macadam would not be adequate to accommodate the forecast boardings. The corridor transit service assumed in each of the three build alternatives, however, was sized to accommodate the forecast demand.
- **Corridor and Total System-wide Ridership.** Table 4.2-5 and Figure 4.2-4 show that the total average daily transit ridership in the corridor would increase over the No-Build Alternative by 1,800 with the Enhanced Bus Alternative and by 3,100to 3,400 with the Streetcar Alternative. Total transit ridership in the system would increase over the No-Build Alternative by 2,400 with the Enhanced Bus Alternative and by 3,600 to 3,900 with the Streetcar Alternative. The increase in ridership outside the corridor with the Streetcar Alternative is due to the ability to through-route the southern portion of Line 35 with Line 78, thus providing a through transit connection between Oregon City Transit Center and Beaverton Transit Center.
- **Transit Trip Productions.** Transit trip productions refers to the number of transit trips that would be generated or "produced" under the various alternatives, both within the corridor and in the region. Increases in the number of transit trips produced would primarily be due to reductions in transit travel time and improved transit accessibility with the proposed streetcar line and bus line modifications. Reductions in transit trip productions would occur in areas where bus line modifications would result in loss of access to transit or access to less frequent transit. In summary, the Enhanced Bus Alternative would result in an increase of approximately 2,020 transit trips produced in the corridor and an additional 360 transit trips produced outside of the corridor. The Streetcar Alternative (Willamette Shore Line design option) would result in an increase of approximately 3,130 transit trips produced in the corridor and an additional 750 transit

trips produced outside of the corridor, compared to the No-Build Alternative. The Streetcar Alternative with the Macadam In-Street and Macadam Additional Lane design options would result in increases of 2,970 trips generated within the corridor and 620 generated outside of the corridor.

Table 4.2-4 Average Weekday Boarding Rides and Peak Loads for Corridor Transit Routes[1,2], Year 2035

Segment	No-Build	Enhanced Bus	Streetcar: Willamette Shore Line	Streetcar: Macadam Avenue design options
Streetcar				
Lake Oswego to Portland Streetcar (SW Bancroft St to Lake Oswego)	N/A	N/A	**11,930**	**11,170**
Bus				
35 Macadam (SW Bancroft St to Lake Oswego)	**8,590**	N/A	N/A	N/A
35 Enhanced Bus (SW Bancroft St to Lake Oswego)	N/A	**9,810**	N/A	N/A
36 King City to Lake Oswego	600	1,070	1,230	1,200
36 King City to Portland	1,310	N/A	N/A	N/A
3578 Beaverton to Oregon City	N/A	N/A	8,110	8,060
43 Washington Square to Portland	2,590	2,550	2,330	2,680
78 Beaverton to Lake Oswego	6,500	6,550	N/A	N/A
Bus Total	**19,590**	**19,980**	**11,670**	**11,940**
Total Boardings	**19,590**	**19,980**	**23,600**	**23,110**
P.M. Peak Hour, Peak-Direction, Peak Load Point[2]				
Portland Streetcar	554	652	N/A	N/A
Lake Oswego to Portland Streetcar	N/A	N/A	974	932
35 Macadam (LO to Union Station)	460	N/A	N/A	N/A
35 Enhanced Bus (LO to Union Station)	N/A	724	N/A	N/A

Source: Metro, 2010

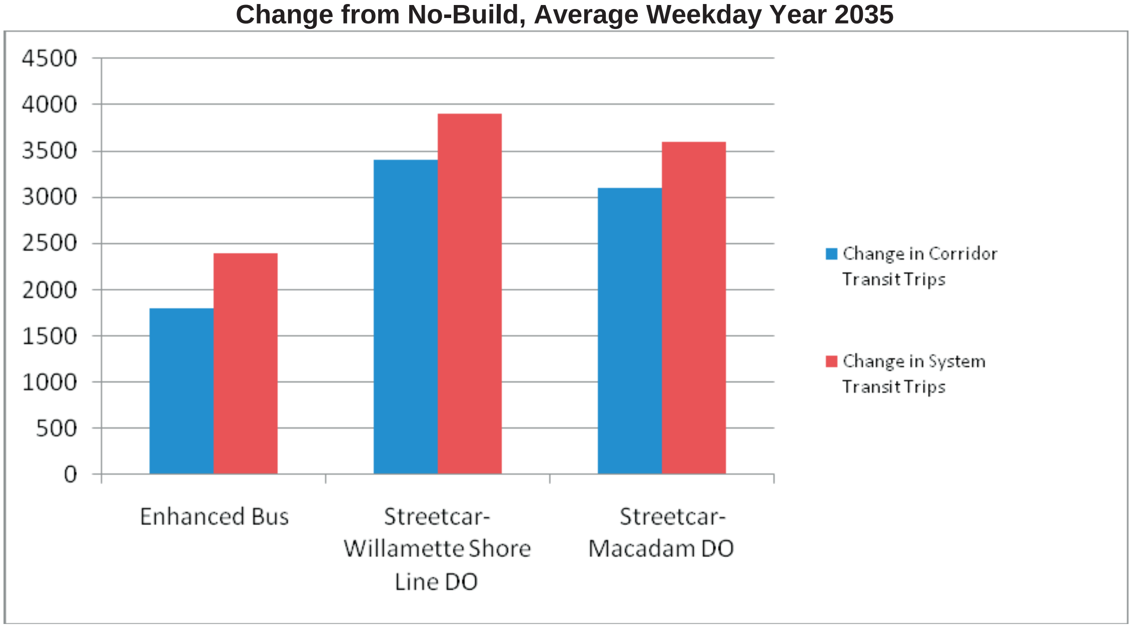
[1] Corridor boarding rides are per line. Linked trips include two boardings if the passenger transfers from one transit line to another line.
[2] Boardings for No-Build and Enhanced Bus 35, and LO to Portland Streetcar are restricted to the segment between Lake Oswego and SW Bancroft Street for comparative purposes.
[3] The peak-load points for each line would be in the following locations: Portland Streetcar -- north of W Burnside St.; Lake Oswego to Portland Streetcar -- north of Lowell St.; Streetcar Loop -- south of NE Holladay St.; 35 Macadam -- north of Lowell St.; 35 Enhanced Bus -- north of Lowell St.

Table 4.2-5 Average Weekday Total Systemwide and Corridor Transit Ridership[1], Year 2035

Ridership area	Existing (2005)	No-Build	Enhanced Bus	Streetcar[2] Willamette Shore Line	Streetcar[2] Macadam Avenue design options
Total Corridor Transit Trips	103,600	231,900	233,700	235, 300	235,000
Change from Existing	N/A	128,300	130,100	131,700	131,400
Change from No-Build	N/A	N/A	1,800	3,400	3,200
Total Systemwide Transit Trips[2]	**267,300**	**583,800**	**586,200**	**587,700**	**587,400**

Source: Metro, 2010.
Note: N/A = not applicable
[1] Ridership is measured in person trips, which are also termed originating rides (i.e. one-way linked trips from an origin (e.g., home) to a destination (e.g., place of work or school), independent of whether the trip requires a transfer. A person traveling from home to work and back counts as two trips. Total corridor transit trips include all streetcar, bus, and light rail trips produced in or attracted to the Lake Oswego-Portland corridor. Excludes intra-Portland CBD and intra-NW Portland trips and trips between the Portland CBD and Northwest Portland (districts 1 and 2; see Figure 1.2-1).
[2] The design options in Segment 3 – Johns Landing would be the only design options that would result in a difference in Streetcar Alternative total corridor transit trips and total systemwide transit trips. This table presents the differences in Segment 3 due to either of the two Macadam design options (i.e. Macadam Additional Lane and Macadam In-Street) and the Willamette Shore Line design option.

Figure 4.2-4
Enhanced Bus and Streetcar Alternative Corridor and System Transit Trips[1]
Change from No-Build, Average Weekday Year 2035



[1] Transit trips are one-way linked trips from an origin (e.g., home) to a destination (e.g., place of work or school), independent of whether the trip requires a transfer. A person traveling from home to work and back counts as two trips. Total corridor transit trips include all light rail, bus and streetcar trips produced in or attracted to the corridor. Intra-CBD trips are not included.
[2] Except in Segment 3 – Johns Landing, there would be no difference in transit ridership for the Streetcar Alternative by design option. This table presents the differences in Segment 3 due to either of the two Macadam design options (i.e. Macadam Additional Lane and Macadam In-Street) and the Willamette Shore Line Design Option.
Source: Metro, 2010 – see Table 4.2-5 for the illustrated data.

- **Work and Non-Work Transit Trips and Mode Share.** Table 4.2-6 shows projected transit trips and transit mode share for trips produced in the corridor that would be destined to Portland's central business district (CBD) for work and non-work purposes. The CBD is projected to have 147,830 jobs in 2035, accounting for 63 percent of the jobs in the Corridor. The build alternatives would induce higher transit mode shares for home-based work trips between the corridor and Portland CBD, compared to the No-Build Alternative.

- **Station Usage.** Table 4.2-7 summarizes individual station use for the Enhanced Bus and the Streetcar alternatives with the Macadam In-Street and Macadam Additional Lane and the Willamette Shore Line design options. With the Enhanced Bus alternative, the highest level of on/off activity would be at Albertsons, accounting for 16 percent of boardings and alightings between Lake Oswego and Southwest Lowell Street. With the Streetcar Alternative (under all design options), the most heavily used station along the streetcar extension would be the B Avenue station in downtown Lake Oswego. The B Avenue station would account for 29 percent of the streetcar boardings and alightings with all streetcar options.

Table 4.2-6 Average Weekday Work and Non-Work Transit Trips and Transit Mode Share Between the Corridor and Portland CBD, Year 2035

				Streetcar	
Trip Purpose	**Existing (2005)**	**No-Build**	**Enhanced Bus**	**Willamette Shore Line**	**Macadam Avenue design options**
Home-Based Work[1]					
Transit	940	5,860	6,380	6,920	6,860
Transit Mode Share	20%	43%	45%	49%	49%
Non-Work[2]					
Transit	1,760	9,500	9,890	9,880	9,880
Transit Mode Share	6%	14%	14%	14%	14%
Total					
Transit	2,700	15,360	16,270	16,740	16,800
Transit Mode Share	8%	19%	19%	20%	20%

Source: Metro, 2010.
Note: LRT = Light Rail Transit; N/A = not applicable.
[1] Home-based work trips are defined as trips taken directly from one's home to one's place of work.
[2] Non-work trips are defined as all trips that are not home-based work trips.

Table 4.2-7 Average Weekday Station Usage (Ons and Offs), Year 2035

			Streetcar			
	Enhanced Bus		Willamette Shore Line		Macadam Avenue design options	
Station	**Station Ons/Offs**	**% of Total Ons/Offs**	**Station Ons/Offs**	**% of Total Ons/Offs**	**Station Ons/Offs**	**% of Total Ons/Offs**
Hamilton Ct	275	3%	622	5%	583	5%
Boundary / Macadam	2,118	22%	0	0%	2,281	18%
Boundary (Shoreline)	0	0%	2,429	18%	0	0%
Carolina / Macadam	1,938	20%	0	0%	2,049	16%
Nebraska (Shoreline)	0	0%	2,178	16%	0	0%
Nevada	734	8%	755	6%	707	6%
Sellwood Bridge	116	1%	407	3%	365	3%
Riverwood Rd	136	1%	201	1%	197	2%
Briarwood Rd	62	1%	92	1%	86	1%
B Avenue	1,229	13%	3,868	29%	3,684	29%
Other Downtown LO stops (Enhanced Bus)	1,559	16%	0	0%	0	0%
Albertson's Station / P&R	1,578	16%	3,003	22%	2,832	22%
Total Station Ons/Offs	**9,745**		**13,555**		**12,784**	

Source: Metro, 2010.

4.3 Effects on the Regional, Corridor and Local Roadways

This section presents the impacts to the regional and corridor highway and street network that would result from the project’s alternatives and design options.

4.3.1 System-Wide Effects

This section addresses how the project’s alternatives would affect overall transportation system demand and performance using three measures: 1) vehicle miles traveled (VMT); 2) vehicle hours traveled (VHT); and 3) vehicle hours of delay (VHD) (see Table 4.3-1). In summary, the Streetcar Alternative would reduce average weekday VMT, VHT and VHD by 68,000 miles, 5,700 hours and 400 hours, respectively, compared to the No-Build Alternative, while the Enhance Bus Alternative would reduce average weekday VMT, VHT and VHD by 41,000 miles, 3,300 hours and 200 hours, respectively, compared to the No-Build Alternative.

Average weekday peak period, peak direction vehicle volumes across three corridor screen lines in 2035 are summarized in Table 4.3-2 for the No-Build, Enhanced Bus and Streetcar alternatives. In summary, the Streetcar Alternative would reduce screen line volumes by approximately 100 vehicles in the peak direction during the two-hour peak period, compared to the No-Build Alternative, while the Enhanced Bus Alternative would not decrease screen line volumes.

Table 4.3-1 Average Weekday Regional VMT, VHT and VHD, Year 2035

System-Wide Measure	No-Build	Enhanced Bus	Streetcar[1]
VMT[2]	63,076,000	63,035,000	63,008,000
VMT Change from No-Build	N/A	-41,000	-68,000
VHT[2]	2,371,800	2,368,500	2,366,100
VHT Change from No-Build	N/A	-3,300	-5,700
VHD[3]	49,400	49,200	49,000
VHD Change from No-Build	N/A	-200	-400

Source: Metro, 2010.
Note: VMT = vehicle miles traveled; VHT = vehicle hours traveled; VHD = vehicle hours of delay.
[1] Based on Willamette Shore Line Design Option. With the Macadam In-Street and Macadam Additional Lane design options VMT would be 63,010,600, VHT would be 2,366,400, VHD would be 49,000.
[2] Based on average weekday conditions in 2035 on freeways, arterials and collector streets.
[3] Based on average weekday p.m. peak hour conditions in 2035 on freeways, arterials, and collector streets.

Table 4.3-2 Average Weekday Two Hour PM Peak Period, Peak Direction Corridor Screen Line Volumes, Year 2035

Screen line Location	No-Build	Enhanced Bus	Streetcar
SW Macadam Ave (Highway 43) and Parallel Streets in Johns Landing[1]	5,600	5,600	5,500
Change from No-Build	N/A	0	-100
N State St (Highway 43) north of Lake Oswego	6,200	6,200	6,100
Change from No-Build	N/A	0	-100
S State St (Highway 43) south of Lake Oswego	7,100	7,100	7,100
Change from No-Build	N/A	0	0

Source: Metro, 2010.[1] Screen line includes SW Macadam Avenue and SW Corbett Avenue at SW Pendleton Street.

4.3.2 Corridor and Local Roadways

This section addresses the long-term direct effects that the project's alternatives would have in 2035 on corridor and local roadways. In addition to standard intersection operations (LOS and V/C ratio), this section also addresses queuing and signal warrants. This section is organized by the corridor segments; note that traffic in Segment 1 – Downtown Portland was not analyzed for this study because there would be no changes to roadway facilities or operation within that segment under any alternative. A more detailed analysis of motor vehicle operations can be found in the *Lake Oswego to Portland Transit Project: Transportation Technical Report*.

Standards for Considering Mitigation

Potential mitigation measures are identified in this section when specific criteria would be met. Mitigation criteria are based on level of service (LOS), volume to capacity (V/C) ratio, queuing, signal warrants and turn lane criteria. The need for turn lanes or traffic signals is based on turn lane criteria and traffic signal warrants in the ODOT Analysis Procedures Manual. Criteria for mitigation of intersection operations on Highway 43 that are below standards would follow the ODOT Transportation Planning Rule and Oregon Highway Plan guidelines, and are dependent on whether the No-Build Alternative would meet applicable V/C ratio standards. If the No-Build Alternative would meet operational standards, then the Enhanced Bus and Streetcar alternatives must meet the same operational standards or potential mitigation measures are identified. If the No-Build Alternative would not meet operational standards, then the Enhanced Bus and Streetcar alternatives must not cause the intersection to perform worse than the with the No-Build Alternative or potential mitigation measures are identified. For the cities of Portland and Lake Oswego, the compliance standard is measured by overall intersection LOS. However, all but one intersection impact would occur at intersections with Highway 43 where the ODOT standards would apply.

Mitigation for queuing is identified for locations where traffic queues from one intersection would back up through another signalized intersection under the Enhanced Bus or Streetcar alternatives, while under the No-Build Alternative queues at that intersection would not backup to another intersection. Warrants for proposed signals and for left and right turn lanes were evaluated for all alternatives.

Impacts and Potential Mitigation

Table 4.3-3 identifies locations on an average weekday in 2035 along Highway 43 where queue spillback or overflow would occur under the No-Build Alternative. Queue spillback refers to traffic queues spilling back from one signalized intersection to another. Overflow refers to traffic queues exceeding the capacity of a turn lane and overflowing into the adjacent lane. Table 4.3-4 identifies locations where queues with the build alternatives would exceed those in the No-Build Alternative. In summary, queue spillback and overflow would occur from 31 corridor intersections under the No-Build Alternative, compared to 10 corridor intersections under existing conditions (see Table 4.1-2). Compared to the No-Build Alternative, the project's alternatives and design options would generally not result in an increase in queue spillback at corridor intersections, except potentially in Segment 6, which is discussed below.

Table 4.3-5 summarizes average weekday levels of congestion (i.e., V/C ratio or LOS with average delay) in 2035 at signalized intersections in the corridor under the No-Build, Enhanced Bus and Streetcar alternatives, in relationship to the applicable ODOT standard for the intersections (except for Southwest Landing Drive and Hamilton Court, which is under the jurisdiction of the City of Portland). The intersections included in the table are only those that would operate at congested levels under the No-Build Alternative, based on the jurisdictional standard. In summary, all of the intersections would see the same level or slightly reduced congestion under the Enhanced Bus and Streetcar alternatives (compared to the No-Build Alternative) in segments 2, 4 and 5. In no instances would the reduction in congestion result in an intersection meeting the jurisdictional standard. In segments 3 and 6, congestion levels at most of the intersections would also remain unchanged or become slightly reduced under the Enhanced Bus and Streetcar alternatives (compared to the No-Build Alternative) except for five intersections, which are discussed below. The primary cause of the slight reduction in congestion at most of the corridor intersections would be the reduction of vehicle volumes on Highway 43 as a result of some automobile users shifting to transit, responding to improved transit travel times and access under the Enhanced Bus and Streetcar alternatives, compared to the No-Build Alternative.

In Segment 3, the intersection at Southwest Macadam Avenue and Carolina Street would require the installation of a traffic signal with the Macadam In-Street and Macadam Additional Lane design options of the Streetcar Alternative (which would not be required under the Willamette Shore Line design option or the Enhanced Bus Alternative). With a new traffic signal, the intersection of Macadam Avenue and Carolina Street would have operations exceeding the jurisdictional standard in 2035 (1.26 V/C during the AM peak hour, compared to the standard of 0.99 V/C). However, this level of congestion would be similar to or better than at other intersections in the surrounding street network. The signal at the intersection at Macadam Avenue and Boundary Street would require modification to accommodate the In-Street and Additional Lane Alternatives. The modified signal

Table 4.3-3 Summary of Corridor No-Build Alternative Queue Spillback or Overflow Average Weekday, 2035

Segment/Intersection	Queue Spillback or Overflow[1] AM Peak Hour Direction[2]	Queue Spillback or Overflow[1] PM Peak Hour Direction[2]
Segment 2		
Highway 43/SW Hamilton St	SB Left Turn	WB Left Turn
Highway 43/SW Hamilton Ct	NB, WB Left Turn	NB, SB, WB Left Turn
SW Moody Ave/SW Hamilton St		EB
SW Landing Drive/SW Hamilton Ct		NB
Segment 3		
Highway 43/SW Richardson Ct	EB	EB
Highway 43/SW Mitchell St		EB
Highway 43/SW Boundary St	NB, NB Left Turn, EB Left Turn	SB past Bancroft, NB, NB Left Turn, EB Left Turn, WB Left Turn
Highway 43/SW Sweeney St		EB
Highway 43/SW Flower St		EB
Highway 43/SW Pendleton St	NB	NB
Highway 43/SW Iowa St	EB, WB	EB, WB
Highway 43/SW Carolina St	EB, WB	
Highway 43/SW Nebraska St	NB, SB	SB
Highway 43/SW Idaho St		EB
Highway 43/SW Vermont St		EB, WB
Highway 43/SW California St		EB
Highway 43/SW Nevada St		SB
Highway 43/SW Taylors Ferry Rd		SB, NB Left turn, EB Right Turn
Segment 4		
Highway 43/Sellwood Bridge	NA	SB Left Turn past Pendleton
Highway 43/Riverview Cemetery	NA	SB on Highway 43 and from Sellwood Bridge
Segment 5		
Highway 43 and SW Radcliff Road	NA	EB
Highway 43 and SW Riverdale Road	NA	NB
Highway 43 and SW Riverwood Road	NA	WB
Highway 43 and SW Military Road	NA	NB
Highway 43 and SW Greenwood Road	NA	SB
Highway 43 and SW Midvale Road	NA	SB
Highway 43 and SW Brianwood Road	NA	SB
Segment 6		
B AveLeftHighway 43/A Ave	NA	SB, EB Left Turn
Highway 43/Foothills Rd	NA	SB, SB Left Turn, WB Left Turn
Highway 43/North Shore Rd	NA	NB Left Turn, NB, SB, EB, WB, WB Left Turn
Highway 43/McVey Ave	NA	SB, NB, EB Left Turn

Note: NB = northbound; SB = southbound; EB = eastbound; WB = westbound; NA = not analyzed.
[1] Queue spillback refers to traffic queues spilling back from one signalized intersection to another. Overflow refers to traffic queues exceeding the capacity of a turn lane and overflowing into the adjacent lane.
[2] Refers to the through movement direction of travel approaching the intersection, unless otherwise noted.
Source: David Evans and Associates, Inc, 2010. Queuing was evaluated using Synchro for all segments

Table 4.3-4 Queue Spillback or Overflow for the Enhanced Bus and Streetcar Alternatives, Average Weekday, 2035

Segment/Time Period[1]/Intersection	No-Build	Project Queuing Impact[2]		
			Streetcar	
		Enhanced Bus	Willamette Shore Line	Macadam Avenue Design Options[3]
Segment 3 - *PM Peak Hour*				
SW Macadam Ave/SW Boundary St	SB past Bancroft, NB, NB Left Turn, EB Left Turn, WB Left Turn	**EB Left Turn**	**NB Left Turn, EB Left Turn**	**EB Left Turn, WB, WB Left Turn**
SW Macadam Ave/SW Carolina St			No Impact	**NB, SB**
Segment 3 - *AM Peak Hour*				
SW Macadam Ave/SW Boundary St	NB, NB Left Turn, EB Left Turn	No Impact	**EB Left Turn**	**EB Left Turn**
SW Macadam Ave/SW Carolina St	EB, WB	No Impact	No Impact	**NB**
Segment 6 - *PM Peak Hour*				
N/S State St/North Shore Rd	NB Left Turn, NB, SB, EB, WB	**NB Left Turn, NB, EB**	**NB Left Turn, NB, WB**	**NB Left Turn, NB, WB**
S State St/Middlecrest Rd/Wilbur St	SB	**SB**	**SB**	**SB**
S State St/McVey Ave/Green St	SB, NB, EB Left Turn	**SB, NB**	**SB, NB**	**SB, NB**

Note: Bolded values indicate a project impact as defined by the mitigation criteria. NB = northbound; SB = southbound; EB = eastbound; WB = westbound; NA = not analyzed. The direction refers to the through movement direction of travel approaching the intersection, unless otherwise noted.

[1] Unless noted, all intersections were analyzed for PM peak period conditions.

[2] Queuing Impact indicates increased queue spillback and/or overflow compared to the No-Build Alternative. Queue spillback refers to traffic queues spilling back from one signalized intersection to another. Overflow refers to traffic queues exceeding the capacity of a turn lane and overflowing into the adjacent lane. Generally a through movement refers to queue spillback and turn movements refer overflow.

[3] Queuing findings apply to both the Macadam In-Street and Macadam Additional Lane design options.

As noted previously, there would be no increase in congestion levels in Segment 4 due to the Enhanced Bus or Streetcar alternatives, compared to the No-Build Alternative. In Segment 5 the Riverwood In-Street design option of the Streetcar Alternative would close the existing intersection of Riverside Drive (Highway 43) and Riverwood Road to all vehicular traffic, which would require all vehicles to access the neighborhood east of Riverside Drive via Military Road. This closure would redirect vehicles to Military Road, however the additional vehicles would not change the overall intersection V/C ratio or LOS. The additional left-turning vehicles would increase southbound queuing at Military Road. The traffic volume increase would not result in queue spillback to upstream intersections or queues spilling out of a turn lane because there is no southbound left-turn lane on Highway 43 at Military Road. The slight increased frequency of left-turning vehicles on Highway 43 at Military Road could result in an increased potential for rear-end accidents. Although it would not meet specific mitigation criteria, consideration should be given to adding an exclusive southbound left turn pocket at Military Road with this design option.

In Segment 6, the 300-space structured park-and-ride lot at the Lake Oswego Village Shopping would generate additional traffic during the average weekday p.m. peak period in 2035 under the Enhanced Bus and the Streetcar alternatives, which would result in a slight increase in V/C ratios and the potential for increased queuing spillback and overflow at three intersections along State Street. There would also be some increased queuing on Foothills Road due to streetcar operations.

Table 4.3-5 Corridor Intersection V/C and LOS for the No-Build, Enhanced Bus and Streetcar Alternatives, Average Weekday, 2035

Segment/Time Period[1]/Intersection	Standard[2]	Alternative			Project Impact
		No-Build	Enhanced Bus	Streetcar[3]	
Segment 2					
PM Peak Hour					
SW Macadam Ave/SW Hamilton Ct	0.99	1.10	1.08	1.07	
SW Landing Dr/SW Hamilton Ct[2]	LOS E	LOS F (103 sec)	LOS F (100 sec)	LOS F (95 sec)	
AM Peak Hour					
SW Macadam Ave/SW Hamilton Ct	0.99	1.21	1.21	1.20	
Segment 3					
PM Peak Hour					
SW Macadam Ave/SW Boundary St	0.99	1.45	1.45	1.45 / 1.32 / 1.32[4]	
SW Macadam Ave/SW Pendleton St	0.99	1.06	1.05	1.04 / 1.05 / 1.05[4]	
SW Macadam Ave/SW Carolina St	0.99	1.99[5]	1.81[5]	1.58[5] / **1.11** / **1.11**[4]	**Yes**
SW Macadam Ave/SW Nevada St	0.99	1.00	0.99	0.98 / 0.98 / 0.98[4]	
SW Macadam Ave/SW Taylors Ferry Rd/SW Miles St	0.99	1.29	1.28	1.27	
AM Peak Hour					
SW Macadam Ave/SW Boundary St	0.99	1.32	1.31	1.30 / 1.26 / 1.27[4]	
SW Macadam Ave/SW Pendleton St	0.99	1.09	1.08	1.06	
SW Macadam Ave/SW Carolina St	0.99	>2.00[5]	>2.00[5]	>2.00[5]/ **1.26** / **1.26**[4]	**Yes**
SW Macadam Ave/SW Nebraska St	0.99	1.35	1.32	1.32	
Segment 4					
Existing Intersection Configuration					
SW Riverside Dr/Sellwood Bridge[5]	0.99	1.59	1.59	1.59	
SW Riverside Dr/Riverview Cemetery	0.99	1.54	1.52	1.50	
Future Interchange Configuration					
SW Riverside Dr/Sellwood Bridge[5]	0.99	1.20	1.20	1.19	
Segment 5					
SW Riverside Dr/SW Military Rd	0.99	1.20	1.17	1.13	
SW Riverside Dr/SW Greenwood Rd/ SW Breyman Ave	0.99	1.35	1.34	1.31	
SW Riverside Dr/SW Midvale Rd/SW Elk Rock Rd	0.99	1.34	1.32	1.31	
SW Riverside Dr/Briarwood Rd	0.99	1.40	1.38	1.36	
Segment 6					
N State St/ B Ave	1.10	1.32	1.31	1.30	
N State St/A Ave	1.10	1.95	1.94	1.92	
N State St/Foothills Rd	1.10	1.30	1.29	1.27	
N/S State St/North Shore Rd	1.10	1.91	**1.96**	1.89	**Yes**
S State St/Middlecrest Rd/Wilbur St	1.10	1.30	**1.32**	**1.32**	**Yes**
S State St/McVey Ave/Green St	1.10	1.15	**1.17**	**1.17**	**Yes**

Note: **Bolded values indicate a project impact as defined by the mitigation criteria** (any worsening of V/C ratio when intersection performance does not meet operational standards of ODOT intersections). LOS = level of service; V/C = volume-to-capacity.

1 Unless noted, all intersections were analyzed for p.m. peak period conditions.

2 Except for the intersection at SW Landing Drive and SW Hamilton Court, the applicable standard for the intersection is based on V/C ratio because those intersections are under the jurisdiction of ODOT; for the intersection at SW Landing Drive and SW Hamilton Court, the City of Portland's LOS standard applies (including the length of time in seconds of delay, which is noted).

3 Unless noted, the V/C or LOS/delay applies to all Streetcar Alternative design options in the segment for that intersection.

4 V/Cs are for the Willamette Shore Line, Macadam In-Street and Macadam Additional Lane design options, respectively.

5 Unsignalized intersection highest stop controlled approach V/C ratio (Westbound approach in a.m. Eastbound in p.m.)

Source: David Evans and Associates, Inc, 2010.

The three intersections with increased V/C ratios and potential for queuing on Highway 43 are at North Shore Road, Middlecrest Road/Wilbur Street and McVey Avenue/Green Street. At Highway 43 and North Shore Road, the V/C ratio would increase from 1.91 under the No-Build Alternative to 1.96 under the Enhanced Bus Alternative (and declining to 1.89 under both Streetcar design options). Potential mitigation at Highway 43 and North Shore Road would be the addition of an eastbound left-turn lane, which would reduce the intersection's V/C ratio to 1.83.

At Highway 43 and Middlecrest Road/Wilbur Street and at Highway 43 and McVey Avenue/Green Street, the No-Build Alternative V/C ratios of 1.30 and 1.15, respectively, would increase to 1.32 and 1.17 under the Enhanced Bus Alternative and both Streetcar design options, respectively. A potential mitigation measure at Highway 43 and Middlecrest Road/Wilbur Street is changing the signal phasing to provide permitted/protected northbound and southbound left-turn phases which reduces the intersection's V/C ratio to 1.25. At Highway 43 and McVey Avenue/Green Street, a potential mitigation measure of closing the intersection's westbound approach (with alternate access provided via Ladd and Wilbur streets) reduces the intersection's V/C ratio to 0.99.

4.4 Effects on Freight Movement

The Enhanced Bus and Streetcar alternatives would have little effect on freight operations, except at those locations within the study area where there would be effects to motor vehicle operations, as discussed in Section 4.2.3. No restrictions to truck movements would occur with the Enhanced Bus Alternative. No restrictions to truck movements would occur with the Streetcar Alternative. However, the Macadam design options could require raising the catenary wires to their maximum height of 20.5 feet where the wires cross Macadam Avenue at Boundary and Carolina streets in order to accommodate oversized loads that sometimes utilize Macadam Avenue to bypass I-5.

4.5 Effects on Bicycle and Pedestrian Facilities

This section provides a summary of the effects that the project's alternatives and options would have on bicycle and pedestrian facilities and behavior. More detailed information may be found in the *Lake Oswego to Portland Transit Project: Transportation Impacts Technical Report*.

Because the No-Build Alternative would not construct any transit capital improvement projects in the corridor, it would result in no direct impacts to bicycle or pedestrian infrastructure. Compared to the No-Build Alternative, there would be no changes to corridor's bicycle and pedestrian infrastructure under the Enhanced Bus Alternative, except for new bike facilities and sidewalks associated with the 300-space structured park-and-ride lot in the vicinity of Albertsons.

Table 4.5-1 summarizes the effects that the Streetcar Alternative would have on existing or funded bicycle facilities within the corridor. Along certain streets where existing or planned bike lanes would parallel the tracks, this alternative would intentionally avoid the bike facilities by running in the far left-hand lane (Southwest Bond Avenue south of Lowell Street). The majority of the remaining bicycle facilities would cross the tracks in a generally perpendicular and safe manner.

Following is a brief description, by segment, of the changes to bicycle and pedestrian facilities that would result from the Streetcar Alternative. In addition to the changes associated with existing or funded bicycle and pedestrian facilities, the Streetcar Alternative, with the Macadam In-Street and Macadam Additional Lane design options in Segment 3 – Johns Landing, could limit the ability to implement a future bike improvement on Macadam Avenue as identified in the Portland Bicycle

Table 4.5-1 Summary of Impacts of Streetcar Alternative on Existing or Funded Bicycle/Pedestrian Facilities, By Segment and Design Option

Location	Facility Type	Direction	Extent of Facility in Proximity to Project	Design Considerations
Segment 1 – Downtown Portland				
None				
Segment 2 – South Waterfront[1]				
SW Moody	On-Street Bike Lane	SB	SW Lowell - SW Bancroft	Parallel; separation at station; perpendicular crossing; box left turn
SW Bond	On-Street Bike Lane	NB	SW Bancroft - SW Lowell	Bike lane on right side of street opposite streetcar tracks
SW Bond (new street)	New connection to existing Greenway Trail	EB/WB	Willamette Shore Line - Willamette Greenway Trail	Interim connection; near perpendicular crossing
Willamette Greenway Trail	Existing bike path	NB/SB	SW Bancroft - SW Moody	Extend and formalize multi-use path
Segment 3 – Johns Landing: Willamette Shore Line Design Option				
Willamette Greenway Trail	Existing/funded bike/ pedestrian path	NB/SB	SW Hamilton Ct - SW Miles Ct	Crossing improvements
Segment 3 – Johns Landing: Macadam Additional Lane Design Option				
Willamette Greenway Trail	Existing/funded bike/ pedestrian path	NB/SB	SW Hamilton Ct - SW Miles Pl	Parallel facilities; WSL right of way could potentially be used for future bike path
Segment 3 – Johns Landing: Macadam In-Street Design Option				
Willamette Greenway Trail	Existing/funded bike/pedestrian path	NB/SB	SW Hamilton Ct - SW Miles Pl	Parallel facilities; WSL right of way could potentially be used for future bike path
Segment 4 – Sellwood Bridge[1]				
Sellwood Bridge Replacement Project	Funded bike/ pedestrian facilities	EB/WB	Highway 43 - SE Grand Av	Connection with new bridge bike/pedestrian facilities
Powers Marine Park	New overcrossing connection to Powers Marine Park	EB/WB	Highway 43 - Powers Marine Park	New connection; grade-separated
Segments 5 and 6				
Kincaid Curlicue Corridor	Local Trail/Pathway	EB/WB	Foothills Road – Roehr Park	New connection

Source: City of Portland, City of Lake Oswego URS: March 2010

Notes: EB = eastbound, WB = westbound, NB = northbound, SB = southbound. Additional details of the crossings of the Willamette Shore Line right of way are noted in the track crossings table on page CS-020 of the *LOPT Transit Project Streetcar Plan Set*, November 9, 2009. Sidewalks are provided on many streets and bicycle travel is allowed on all streets in the study area.

[1] The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

Plan for 2030 (adopted in February 2010). Bicycle parking facilities would be provided at the new streetcar stations.

Similarly, in the Lake Oswego to Portland corridor, Metro and the cities of Lake Oswego and Portland show a potential regional bike or trail facility along Macadam Avenue, Highway 43 and the Willamette Shore Line right of way. Though the Streetcar Alternative may operate along portions of Macadam Avenue and/or the Willamette Shore Line right of way, the Streetcar Alternative would not preclude the implementation of a future regional bike/trail facility in the corridor.

Segment 1 – Downtown Portland: There would be no changes to existing or planned bicycle or pedestrian facilities in Segment 1. While a new rail connection between the existing tracks would be installed along Southwest 10th Avenue and Market Street, the connection would not interfere with any existing or planned bike routes or facilities.

Segment 2 – South Waterfront: In Segment 2, the Streetcar Alternative would extend the existing streetcar/bike facility pattern and design strategies already established in the district by the streetcar and other transportation projects. For example, as shown in the Figure 4.5-1, the new southbound streetcar station at Bancroft would position the on-street bike lane between the station platform and the sidewalk and be graded-separated from the platform. Along Bond Avenue, the alternative would position the northbound streetcar tracks in the left-hand lane to avoid the right-hand side bicycle lane. The existing bicycle/pedestrian path along the Willamette Shore Line right of way would be maintained or improved in this segment and access to the existing portion of the Willamette Greenway Trail would be maintained.

Figure 4.5-1
Bike lane at the SW Moody – Gaines station.

Segment 3 – Johns Landing: In Segment 3, the Willamette Shore Line Design Option would change two existing bicycle and pedestrian crossings of the trackway. First, a bike/pedestrian "z-crossing" would be installed where an existing asphalt concrete pathway currently provides a direct crossing of the trackway near Richardson Street. Second, the current grade-separated bike/pedestrian crossing below the Jones Trestle between Sweeney and Flower streets would be replaced with an at-grade crossing in roughly the same location.

With the Macadam In-Street and the Macadam Additional Lane design options, no additional bicycle or pedestrian facilities are currently proposed. However, the Willamette Shore Line right of way between Boundary and Carolina could be improved by others and establish part of a regional bike facility that would parallel the existing, more meandering Willamette Greenway Trail to the east.

With either of the two Macadam design options, relocation of curbs associated with the reconstruction of Macadam Avenue would trigger the need to comply with the Oregon Highway Plan, the Oregon Bicycle and Pedestrian Plan (ODOT, June 1995) and the provisions of Oregon

Revised Statute (ORS) 366.514, also known as the "Bike Bill." [6] Where the project realigns the position of roadway curbs, the project would need to provide bike facilities, provide appropriate width for future bike facilities or provide a suitable, alternate parallel bike facility. In the Macadam In-Street design option, the curb realignment is limited to the intersection of Macadam Avenue and Carolina. With the Macadam Additional Lane design option, the curb realignment is limited to the intersection of Macadam Avenue and Carolina and the eastern curb of Macadam Avenue from SW Carolina to SW Boundary (associated with the new northbound streetcar lane). See the *Lake Oswego to Portland Transit Project Land Use and Planning Technical Report* for a discussion of these policies.

Segment 4 – Sellwood Bridge:Segment 4 would include the addition of a second track at several existing bike/pedestrian crossings and a new bicycle and pedestrian overcrossing of the Willamette Shore Line right of way, which would be located near the south end of the City of Portland's Powers Marine Park, connecting the now informal trails of the park to Highway 43. Other trail improvement projects could lead to new bicycle and pedestrian trails in this segment, which could be facilitated through coordination of design efforts for the streetcar and trail projects. For example, Multnomah County's Sellwood Bridge Replacement Project includes proposed changes to bicycle and pedestrian access to local streets and Metro's Lake Oswego to Portland Trail Project is examining options for trails within this segment.

Segment 5 – Dunthorpe/Riverdale: In Segment 5, the Streetcar Alternative would affect local bicycle and pedestrian access by changing the frequency of rail vehicle use of the existing rail right of way at street crossings and access ways to private residences and to a privately-owned boating facility. Figure 4.5-2 illustrates an example of an existing pedestrian crossing and the Streetcar Alternative Plan Set provides a list of the location of all existing private pedestrian crossings in this segment and how they would be changed under the Streetcar Alternatives' design options. In summary, the number of private accesses crossing the existing rail right of way would decrease if the Riverwood In-Street design option were selected in this segment. Additionally, new sidewalks and bicycle facilities would be included in the design of the new Riverwood Road. However, the new Riverwood Road would no longer have direct access to Riverside Drive (Highway 43); access to the highway would be provided via Military Road.

Figure 4.5-2
Existing Private Residence Pedestrian Crossing of Willamette Shore Line right of way in Segment 5

Segment 6 – Lake Oswego: In Segment 6, the Streetcar Alternative would provide a new bicycle and pedestrian connection under the existing Union Pacific Railroad (UPRR) freight tracks north and east of Terwilliger Boulevard. This new crossing, which would occur under both design options for

[6] http://www.oregon.gov/ODOT/HWY/BIKEPED/bike_bill.shtml

this segment, would connect Fielding Road and Stampher Road, which is not possible under existing conditions. In addition, both design options would create new sidewalks and bike facilities along the new or re-aligned roadways that are part of each option within the segment south from the crossing of the freight rail line to the Lake Oswego terminus. Other changes for pedestrians would include new or enlarged sidewalks near streetcar station platforms that would facilitate access to the stations.

In the Foothills design option, the Streetcar Alternative would intersect a local bicycle/ pedestrian pathway known as the Kincaid Curlicue Corridor along the realigned Foothills Road. This design option would provide a new connection between this pathway and new bike and pedestrian facilities along Foothills Road.

Additionally, both design options would create new sidewalks and bike facilities along the new or re-aligned roadways that are part of each option within the segment south from the crossing of the freight rail line to the Lake Oswego terminus. Other changes for pedestrians would include new or enlarged sidewalks near streetcar station platforms that would facilitate access to the stations.

4.6 Parking

This section discusses potential impacts that the project's alternatives and options would have on on-street and off-street parking. A more detailed description can be found in the *Lake Oswego to Portland Transit Project Transportation Technical Report*.

Neither the No-Build Alternative nor the Enhanced Bus Alternative would affect the supply of on or off-street parking in the corridor (except that the Enhanced Bus Alternative would result in the construction of the 300-space structured park-and-ride lot at the Lake Oswego Village Shopping Center).

Under the Streetcar Alternative, Segment 3 is the only segment that would have a loss of parking spaces (in Segment 6, the Streetcar Alternative would result in the construction of a 100-space surface park-and-ride lot and a 300-space structured park-and-ride lot). Table 4.6-1 shows the potential loss of off-street and gain in on-street parking spaces in Segment 3 that would result from the various Streetcar Alternative design options. In summary, several privately-owned parking lots along Southwest Landing Drive would lose parking spaces under the Macadam In-Street and Macadam Additional Lane design options, due to property acquisitions to provide additional project right of way. There would be a loss of 166 and 193 spaces under the Macadam In-Street and Macadam Additional Lane design options, respectively. Both of these design options would include the addition of 18 on-street parking spaces along Landing Drive. Potential mitigation to offset some of the off-street parking loss could include reconfiguring affected parking lots to maximize the use of the remaining parking spaces. The Willamette Shore Line design option would not result in any loss of off-street parking spaces or gain in on-street parking spaces in Segment 3.

Table 4.6-1 Potential Change in Parking Spaces for Segment 3 – Johns Landing By Alternative and Streetcar Design Option

Parking Type	No-Build	Enhanced Bus	Streetcar: Macadam In-Street	Streetcar: Macadam Additional Lane	Streetcar: Willamette Shore Line
Off-Street Parking	0	0	-166	-193	0
On-Street Parking	0	0	18	18	0
Net Parking Loss	**0**	**0**	**148**	**175**	**0**

Source: David Evans and Associates, Inc (2010).

Another potential affect that the Streetcar Alternative would have on parking in Segment 3 would occur at the Willamette Sailing Club. Although there will be no loss of parking at the club, sailboats are often rigged in the parking lots west of the existing Willamette Shore Line right of way and then brought across the tracks to be launched from the sailing club property. Under all three Streetcar Alternative design options, sailboats would need to be rigged on the Willamette Sailing Club property east of the rail line because the clearance under the catenary would be approximately 18 feet which is too low to move even the smallest rigged sailboats.

Unauthorized parking (parking within a neighborhood or a downtown area when not destined to that area) as a result of the introduction of streetcar stations would not be an issue along the majority of the alignment. However, in the Johns Landing area there could be increased potential for unauthorized parking for automobile users seeking to access the proposed streetcar station. If this type of activity is identified as a problem by the adjacent neighborhoods, TriMet would work with the local jurisdictions and neighborhood residents to assist in the evaluation of the problem and the development of potential feasible solutions.

4.7 Cumulative and Indirect Impacts

The cumulative impacts associated with the Enhanced Bus or Streetcar alternatives are taken into account through the use of regional travel forecasting models. The regional models use population and employment growth forecasts and include planned and funded transportation projects throughout the region. The models encompass the entire Portland metropolitan area, including Washington, Clackamas and Multnomah counties in Oregon and Clark County, Washington. The models account for the cumulative effect that the planned projects would have within the study corridor and the models found that there were only very minor changes in traffic volumes and transit ridership in areas outside of the study corridor.

In certain instances the potential population and employment growth and redevelopment in the corridor could be considered to be an indirect impact of the planned transit improvements. However, the regional growth forecast used in the travel models already includes aggressive assumptions regarding the potential for redevelopment in the corridor. The growth forecast includes an assumption of transit-supportive, mixed use development in the north portion of Segment 3 – Johns Landing and in the Foothills portion of Segment 6 – Lake Oswego. The traffic and transit ridership consequences of this growth is captured in the travel demand models and is included in this chapter under the discussion of direct effects of the project alternatives.

The transit networks developed for modeling the Enhanced Bus and Streetcar alternatives make assumptions regarding modifications to the supporting bus system. As with previous rail transit projects in the region, the final decisions on bus system modifications occur later in the project planning phase and are developed in conjunction with the local community and the TriMet Board. A possible indirect impact of the Enhanced Bus and Streetcar alternatives could be other bus route modifications that could include changes in routing and bus stop locations.

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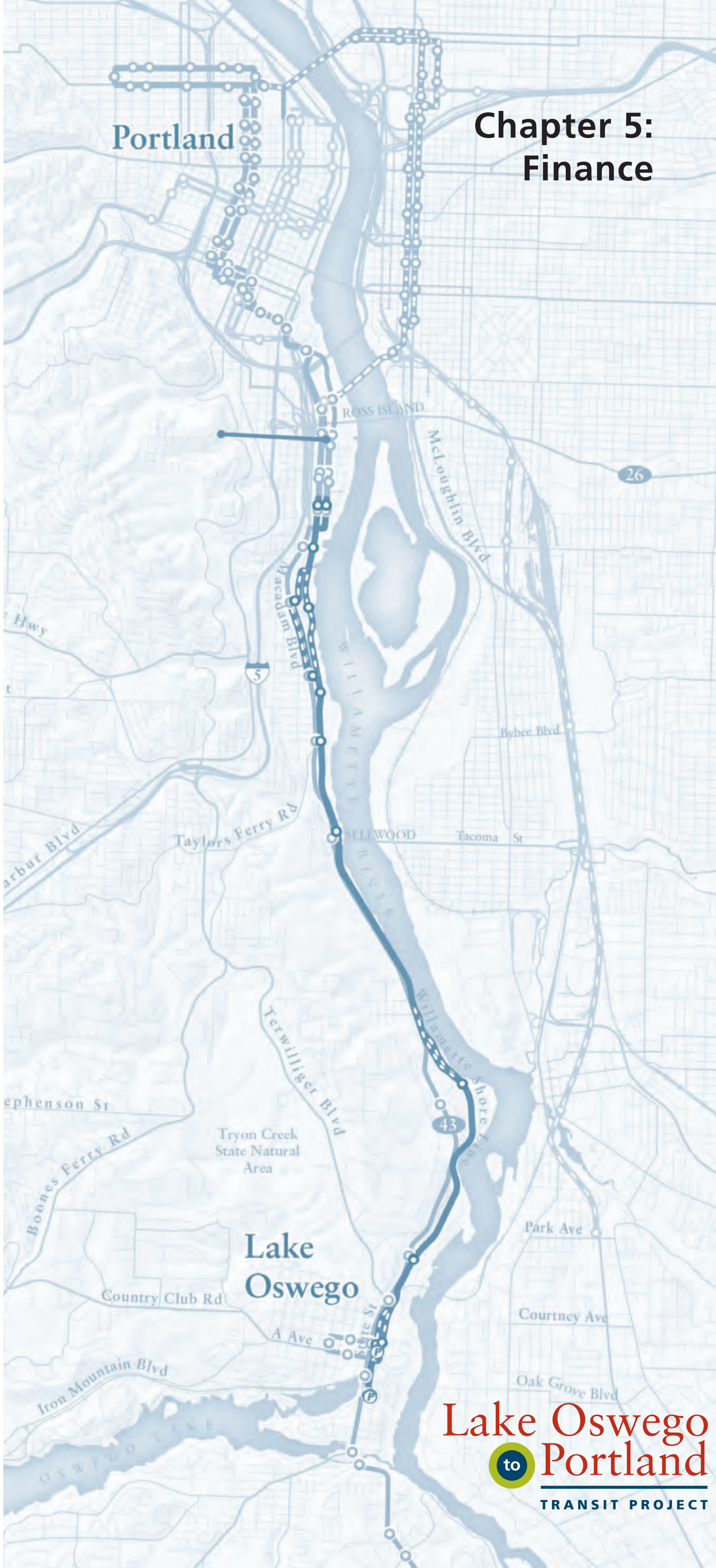
Chapter 5: Finance



Lake Oswego to Portland TRANSIT PROJECT

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5. FINANCIAL ANALYSIS

This chapter presents the financial analysis of the Lake Oswego to Portland Transit Project's alternatives and design options. The analysis is conducted in two parts (i.e., a project capital funding analysis and a system funding analysis) to differentiate between one-time-only project capital cost requirements and ongoing system fiscal costs. Following is a description of the two elements of the financial analysis and the key factors underlying those analyses.

A. Project Capital Funding Analysis

The project's capital funding analysis focuses on the capital resources required to construct the Lake Oswego to Portland Transit Project alternatives. The capital costs addressed in this portion of the analysis are only those costs associated with constructing the project; other capital expenditures of TriMet are addressed in the system funding analysis.

The project's capital funding analysis is based on the following key factors:

- **Construction Schedule.** The estimates of capital costs are provided in 2010 dollars and year-of-expenditure (YOE) dollars. The YOE estimate is based on a project development schedule under which civil construction, vehicle and systems procurement, and right of way acquisition would occur between 2015 and 2017. Based on this schedule, revenue service would start in September 2017.

- **Construction Cost Inflation.** Construction costs are projected to inflate between 2010 (the date of the capital cost estimate in current year dollars) and September 2017, when project construction would be complete and revenue operations would begin. The inflation rate used in this analysis over the construction period is 4 percent per year.

B. System Funding Analysis

The system funding analysis focuses on whether there would be adequate resources to operate and maintain the entire transit system, including operations of the Lake Oswego to Portland Transit Project alternatives, over the 25-year planning period. System costs include all transit operating and maintenance costs and all transit capital expenditures through fiscal year (FY) 2035, except for Lake Oswego to Portland Transit Project alternative's capital costs. The system funding analysis is based on the following key factors:

- **Annual Transit Service Increase.** Bus service levels in FY 2010 and FY 2011 reflect the service cutbacks undertaken by TriMet in response to the recent economic slowdown. Bus service expansion (measured in revenue hours) is projected to resume in FY 2014, growing at an annual rate of 0.25 percent between FY 2014 and FY 2016 and 1.5 percent between FY 2017 and FY 2035. Beginning in FY 2018, five additional buses, on average, would be purchased every two years to support these bus service increases.

  Based on this analysis, existing light rail and commuter rail operations would expand on an ongoing basis in response to increasing demand. Specifically, rail vehicle hours would grow 1.2 percent per year and rail miles will grow 1.8 percent per year beginning in FY 2013, as the economy recovers from the recession. In addition, there would be a continuation of TriMet's payment of about one-half of the Portland Streetcar operations costs to Southwest Lowell Street and an additional $1.3 million (inflated) for Portland Streetcar operations on the east side beginning in 2012. In addition, the transit network would include the planned light rail extension between Expo Center and Clark College in Vancouver, Washington, that is part of the locally preferred alternative for the Columbia River Crossing Project and the Portland to Milwaukie LRT Project. Furthermore, the transit network would include the specific streetcar and bus service increases associated with the applicable Lake Oswego to Portland Transit Project alternative.

- **Operations Cost Inflation.** The forecast assumes that management wages are flat in FY 2010 and FY 2011 and increase 4 percent per year thereafter, consistent with historic trends. Increases in union wage rates, which are tied to the Consumer Price Index with a 5 percent ceiling, are projected to increase 3 percent per year throughout the forecast period. Health benefit costs are projected to escalate in FY 2011 at 19 percent for union employees and 5 percent for management. Thereafter, all health benefits are anticipated to grow at 8.5 percent per year, with revisions to health benefits that produce continuous annual saving of $2 million beginning in FY 2011, an additional $7 million beginning in FY 2012, and an additional $1 million beginning in FY 2013.

  The financial analysis uses the Energy Information Agency forecast of diesel fuel cost. The annual escalation in fuel cost differs between FY 2011 and FY 2015, ranging between 4.8 percent and 10 percent. From FY 2016 and thereafter, fuel costs are anticipated to increase by 5 percent per year. Electricity costs are anticipated to escalate at 5 percent per year, and other materials and service costs are projected to escalate at 3 percent per year throughout the forecast period.

- **System Capital Cost Inflation.** Transit capital costs other than for the Lake Oswego to Portland Transit Project alternatives would inflate at 3 percent per year, with the exception of FY 2011 when a one-time-only reduction of $4 million is forecast.

- **Tax Revenue Increases.** The key factors underlying forecasts of payroll tax revenues, self-employment tax revenues and state in-lieu tax revenues are documented in Section 5.2.2.

- **Fares.** TriMet first implemented a policy of increasing fares with inflation in 1990. The forecast assumes a continuation of this policy, with a 3 percent inflation-adjusted fare increase each year between FY 2011 and FY 2035. TriMet has planned for a $0.05 fare increase in FY 2010.

Section 5.1 summarizes the project capital and system costs of the alternatives, followed by Section 5.2, which summarizes the available project resources that could fund the alternatives. Section 5.3 identifies existing revenue shortfalls and opportunities for additional revenues to cover those shortfalls are summarized in Section 5.4. Section 5.5 provides conclusions from the project's financial analysis.

5.1 Costs

This section examines both project capital costs and systems costs. Costs are shown in 2010 dollars and YOE dollars. YOE dollars were calculated by inflating 2010 dollar costs by the appropriate inflation index for that cost component.

5.1.1 Lake Oswego to Portland Transit Project Costs

This section addresses the capital costs and the operations and maintenance (O&M) costs of the Lake Oswego to Portland Transit Project.

A. Lake Oswego to Portland Transit Project Capital Costs

Table 5.1-1 shows the capital costs for the Enhanced Bus and Streetcar alternatives. A range reflecting the high and low cost alignment options is provided for the Streetcar Alternative. The capital costs include all facility and system improvements, right of way costs (including the value of the contributed Willamette Shore Line right of way), and vehicle purchases required by the project alternative in excess of the already-committed capital costs associated with the No-Build Alternative.

Table 5.1-1 Capital Costs for Lake Oswego to Portland Transit Project In Millions of 2010 and Year-of-Expenditure Dollars

Line Item	Enhanced Bus	Streetcar Low[3]	Streetcar High[3]
2010 Dollar Costs			
Guideway & Track Elements	$0.0	$48.7	$53.2
Stations, Stops, Terminals	$9.9	$14.4	$14.8
Support Facilities: Yards, Shops	$3.5	$6.0	$6.0
Sitework & Special Conditions	$2.1	$36.8	$41.7
Systems	$0.1	$19.0	$21.5
ROW, Land	$2.2	$76.4	$107.7
Vehicles[1]	$9.6	$48.4	$48.4
Professional Services	$8.6	$29.0	$41.2
Unallocated Contingency	$1.8	$10.2	$12.9
Total	***$37.8***	***$288.9***	***$347.4***
Year-of-Expenditure Dollar Costs			
Escalation to Year-of-Expenditure	$11.0	$81.6	$98.6
Finance Charges[2]	$2.3	$9.0	$12.4
Total	***$51.1***	***$379.6***	***$458.3***

Source for 2010 Cost Estimate: URS, 2010; numbers may not add due to rounding.

1 Includes all eleven vehicles required to serve 2035 ridership.

2 Includes interest payments for interim borrowing and net finance costs during the construction period on bonds issued to provide local match.

3 The Streetcar Alternative "Low Cost" assumes the following options by segment: South Waterfront – Willamette Shore Line; Johns Landing – Willamette Shore Line; Sellwood Bridge – New Interchange; Dunthorpe/Riverdale – Riverwood In-Street; Lake Oswego – UPRR ROW. The Streetcar Alternative "High Cost" assumes the following options by segment: South Waterfront – South Portal; Johns Landing – Macadam In-Street; Sellwood Bridge – Willamette Shore Line; Dunthorpe/Riverdale – Willamette Shore Line; Lake Oswego – Foothills Realignment.

As shown in Table 5.1-1, Streetcar Alternative is estimated to cost between $379.6 to $458.3 million in YOE dollars, including finance costs and the value of the contributed Willamette Shore Line right of way, depending on the alignment options. The total cost of the Enhanced Bus Alternative is estimated to be about $51.1 million in YOE dollars.

B. Lake Oswego to Portland Transit Project O&M Costs

Table 5.1-2 shows year 2035 transit O&M costs in 2010 dollars for the No-Build Alternative, Enhanced Bus and Streetcar alternatives. These O&M costs include the cost of operating and maintaining the streetcar line between Lowell Street and Lake Oswego, where applicable, and the buses in the Lake Oswego to Portland transit corridor.

As shown, the year 2035 corridor O&M costs for the Streetcar Alternative would be $1.25 million (2010 dollars) higher than the No-Build Alternative, due to the increased service levels. The corridor O&M costs for the Enhanced Bus Alternative would be about $1.54 million (2010 dollars) higher than those for the Streetcar Alternative.

Table 5.1-2 Lake Oswego to Portland Transit Project Operating Costs for Year 2035 Service Levels In millions of 2010 dollars

	No-Build	Enhanced Bus	Streetcar
Corridor Streetcar O&M Costs[1]			$3.78
Corridor Bus O&M Costs[2]	$28.41	$31.20	$25.88
Total Corridor O&M Costs	$28.41	$31.20	$29.66
Difference from No-Build Alternative	NA	$2.79	$1.25

Source: TriMet and Metro 2010. Differences may not sum due to rounding.

[1] Streetcar O&M costs reflect service between Lowell Street in Portland (the current streetcar terminus) and Lake Oswego as well as increased service on the existing alignment to support greater passenger loads resulting from the extension to Lake Oswego.

[2] Corridor Bus O&M costs include all buses operating within a geographic travel shed between Portland and Lake Oswego, both in a north-south orientation and an east-west orientation.

5.1.2 System Costs

System costs include all capital and O&M expenditures by TriMet over the 25-year planning period, except the capital costs for building the Lake Oswego to Portland Transit Project. Total system cost is the aggregate of system operating costs and system capital costs. System operating costs are the annual O&M costs of the TriMet system including the Lake Oswego to Portland Transit Project. Total system costs includes: the cost of operating and maintaining the existing transit and demand responsive system; anticipated increases in transit service required to maintain headways and capacity; expanded demand-responsive service; expanded bus service; and operations of the planned light rail extensions to Clark College in Vancouver, Washington, as part of the Columbia River Crossing Project, and the Portland-to-Milwaukie LRT Project. System costs also include TriMet's contribution toward annual Portland Streetcar operating costs.

Table 5.1-3 shows the cumulative system operating costs for the light rail project alternatives compared to the No-Build Alternative, covering the period between FY 2010 and FY 2035. Table 5.1-3 also shows the cumulative system capital costs of the light rail project over the 25-year planning period in YOE dollars. System capital costs include all currently committed capital projects except the Lake Oswego to Portland Transit Project, a regular schedule of vehicle replacement purchases, and the purchase of additional vehicles required by anticipated service increases.

Table 5.1-3 Summary of Transit System Costs: Cumulative Total from FY 2010 to FY 2035 In Millions of Year-of-Expenditure Dollars

	No-Build	Enhanced Bus	Streetcar
System Operating Costs [1]	$20,047	$20,132	$20,093
System Capital Costs [2]	$1,781	$1,825	$1,805
Total	**$21,828**	**$21,957**	**$21,898**

Source: TriMet, 2010.
[1] All operating and maintenance costs between FY 2010 and FY 2035, including the Lake Oswego to Portland Transit Project.
[2] All capital replacement and improvement costs between FY 2010 and FY 2035, excluding planned New Starts projects.

The total system cost of an alternative is the sum of system capital costs and system operating costs. Table 5.1-3 shows that the total system costs for the No-Build Alternative in YOE dollars (over the period FY 2010 through FY 2035) would be about $70 million less than the total system costs for the Streetcar Alternative. The total system cost for the Enhanced Bus Alternative would be about $59 million more than the Streetcar Alternative.

5.2 Available Resources

Two categories of available revenue resources are examined within this section: revenue resources for Lake Oswego to Portland Transit Project capital costs; and revenue resources for its transit system costs.

5.2.1 Available Project Capital Revenues

Up to $97 million (year-of-expenditure dollars) of local matching funds is available to pay the capital costs of the Lake Oswego to Portland Transit Project, depending on the alternative, from in-kind contribution of right of way. Portions of the Willamette Shore Line right of way, owned by the Willamette Shore Line Consortium, would be used for project improvements and mitigation. This right of way would be donated to the project and its value would be used as in-kind matching funds. The value of the in-kind match would depend on the alignment options selected for the locally preferred alternative.

5.2.2 Available Transit System Revenues

Available transit system revenues are derived from a variety of sources. The major sources of available transit system revenues and the key factors used to forecast these revenues follow.

A. Payroll Tax Revenues

Payroll taxes are TriMet's largest source of operating revenue, accounting for approximately 48 percent (about $200 million) of FY 2009 operating revenues. As of January 2010, the payroll tax is currently levied at 0.6818 percent ($6.818 per $1,000) on the gross payrolls of private businesses and municipalities within the district. In August 2004, the TriMet Board authorized a one-hundredth of one percent per year increase in the payroll tax rate, which will ultimately reach 0.7218 percent on January 1, 2014.

In its 2009 session, the Oregon Legislature (Senate Bill 34) granted the TriMet Board the authority to further increase the payroll tax rate to 0.8218 percent. The legislation specifies that the tax rate increase cannot be implemented until the TriMet Board determines that the economy in the district has sufficiently recovered to warrant the increase; that it must be phased in over ten years; and that no annual increase can exceed 0.02 percent. The forecast anticipates that TriMet would begin to implement Senate Bill 34 on January 1, 2013, increasing the rate an additional one-one hundredth of a percent for ten years and resulting in a payroll tax rate of 0.8218 percent beginning January 1, 2022.

In addition to the increases in the tax rate, payroll tax collections are forecast to grow as the number of jobs in the district and wages grow. This analysis is based on a 5.5 percent decline in underlying payroll tax receipts for FY 2010 (excluding any increase in the tax rate), a 3 percent increase in FY 2011 and a 5.7 percent per year increase in FY 2012 and subsequent years.

B. Self-Employment Tax Revenues
In addition to the payroll tax, TriMet currently levies a 0.6818 percent tax on the net income earned within its district by self-employed individuals. The self-employment tax rate will increase at the same rate as the payroll tax rate. The annual fluctuations for proceeds received from the self-employment tax are wider than for the payroll tax. After growth of 4 percent in FY 2004 and 5.0 percent in FY 2005, self-employment tax receipts increased 19.8 percent in FY 2006 and 21.3 percent in FY 2007. Because of the recent economic turndown, self-employment tax revenues decreased 2.7 percent in FY 2008 and 7.7 percent in FY 2009. The forecasts are based on a 10 percent decline in underlying self-employment tax receipts in FY 2010 (excluding any tax rate increase), a 3 percent increase in FY 2011 and a 4.5 percent increase in FY 2012 and annually thereafter.

C. State Payroll "In-Lieu" Revenues
State of Oregon government offices located within TriMet's district boundaries are not subject to the municipal payroll tax. Instead, they make "in lieu of" tax payments to TriMet based on 0.6218 percent of their gross payrolls within the TriMet district. State "in-lieu" revenues are forecast to decline 2 percent in FY 2010, grow 4 percent in FY 2011 and 5 percent in FY 2012 and annually thereafter, consistent with historic trends since OHSU was converted from a state agency to a private employer paying TriMet's payroll tax.

D. Grants and Capital Reimbursement
Currently TriMet receives about $45 million annually in federal transit formula funds, which are used for operations. In addition, TriMet receives about $11 million dollars annually in federal transportation funds from the Surface Transportation Program (STP) and Congestion Mitigation Air Quality (CMAQ) programs, which are used for the regional rail program, passenger amenity improvements and the Regional Transportation Options program. Federal funds in total constitute about 15 percent of TriMet's operating revenues.

Section 5307 Urbanized Area Formula Funds are TriMet's primary federal formula grant funds. The forecast is based on the expectation that Section 5307 Urbanized Area Formula Funds would remain flat in FY 2010 and FY 2011 and would grow 3 percent per year in subsequent years during the project's planning period.

Fixed Guideway Modernization Funds ("Rail Mod Funds") represent TriMet's second largest source of federal formula funds. TriMet's share of Rail Mod Funds is based, in part, on the number of light rail and streetcar vehicle miles operated within its district for at least seven years. TriMet's allocation of Rail Mod Funds is forecast to grow 6.5 percent in FY 2010, stay flat in FY 2011 and grow 3 percent per year between FY 2012 and FY 2016. In FY 2017, when Westside Express Service (WES) Commuter Rail enters its eighth year of operation, Rail Mod Funds are anticipated to increase 14 percent. A 14 percent increase is anticipated in FY 2018, when the Green Line enters its eighth year of operation; and a 10 percent increase is projected for FY 2023, when the Portland-Milwaukie light rail line would enter its eighth year of operation.

In addition, the amounts of STP funds currently approved by Metro's Joint Policy Advisory Committee on Transportation (JPACT) and Metro for TriMet's preventive maintenance program are assumed to continue throughout the forecast period. The forecast also assumes the continuation of the regional allocation of the federal CMAQ funds for the Travel Demand Management Program.

E. Passenger Revenues

Revenues from passenger fares (from LIFT Paratransit Program, MAX Light Rail, WES Commuter Rail, demand-responsive transit and bus services) are TriMet's second largest revenue source, contributing about $90 million (over 21 percent) of operating revenue in FY 2009. In 1990, TriMet implemented a policy of regular fare increases, and the passenger revenue forecast is based on a continuation of this policy. The passenger revenue forecast assumes a 3 percent per year increase in fares.

Passenger revenue forecasts also reflect the forecast of bus and rail ridership. Due to year-over-year declines in gas prices and job losses in the region, bus ridership is projected to decline 8 percent in FY 2010. Bus ridership is projected to remain flat in FY 2011 due to service reductions on low-ridership bus lines planned for FY 2011, which are expected to offset anticipated bus ridership gains from an anticipated gradual increase in employment. Thereafter, bus ridership on existing services is forecast to grow 2 percent per year. With the newly opened Green Line, MAX (the aggregation of the Blue, Red, Yellow and Green lines) ridership is estimated to grow by 7.5 percent in FY 2010. Ridership on these lines is projected to grow 1.5 percent in FY 2011 and 3 percent each year thereafter, consistent with the underlying historic trend.

Table 5.1-4 shows, based on the factors described above, that existing available transit system O&M revenue sources are projected to provide between $20.50billion and $20.55 billion (YOE dollars) through FY 2035, depending on the alternative. The range primarily reflects differences in passenger revenues and interest earnings between the alternatives.

Table 5.1-4 Summary of Transit System Revenues: Cumulative Total from FY 2010 to FY 2035
In Millions of Year-of-Expenditure Dollars

	No Build	Enhanced Bus	Streetcar	
			WSL	Macadam
System O&M Revenues				
Passenger Revenue	$5,332	$5,342	$5,355	$5,358
Other Operating Revenue	$516	$516	$516	$516
Employer/Municipal Payroll Tax [1]	$10,825	$10,825	$10,825	$10,825
Self Employed Tax	$491	$491	$491	$491
State in Lieu	$125	$125	$125	$125
Grants and Capital Reimbursement	$2,128	$2,128	$2,128	$2,128
Interest	$168	$146	$177	$178
Accessible Transportation Revenues	$129	$129	$129	$129
One Time Only and DMAP Reimbursement	$799	$799	$799	$799
Total	**$20,513**	**$20,501**	**$20,545**	**$20,548**
System Capital Revenues [2]				
Grants: State or Federal	$141	$141	$141	$141
Bond Proceeds	$1,165	$1,165	$1,165	$1,165
Transfer from General Fund	$475	$519	$499	$499
Total	**$1,781**	**$1,825**	**$1,805**	**$1,805**

Source: TriMet, 2010.
[1] Includes implementation of payroll tax rate increase authorized by HB 3183 (2009 Legislative Session) beginning January 2013.
[2] System capital revenues exclude capital revenues for New Starts projects.

5.3 Existing Revenue Shortfalls

This section discusses the additional project and system revenues needed to make the project fiscally feasible. The project is fiscally feasible if:

- Project capital revenues are sufficient to meet the capital costs; and
- Ongoing revenues would be sufficient to meet ongoing total system costs, including the operations of the Lake Oswego to Portland Transit Project, plus maintain an ongoing beginning-year cash and cash equivalent (beginning cash) reserve of at least 12 percent of annual system operating costs.

5.3.1 Existing Project Capital Revenue Shortfalls

Table 5.1-5 summarizes the capital funding shortfalls (project capital cost minus currently available capital revenues) for the project alternatives in YOE dollars. Additional capital revenues are required to make the capital project fiscally feasible. Opportunities for eliminating the shortfall are discussed in Section 5.4.

Table 5.1-5 Summary of Capital Revenue Shortfalls In Millions of Year-of-Expenditure Dollars

		Streetcar[1]	
	Enhanced Bus	Low	High
Capital Cost	$51.1	$379.6	$458.3
Available Revenues	$0.0	$75.2	$77.1
Capital Revenue Shortfall	$51.1	$304.4	$381.2

Source: TriMet – May 2010.
[1]Low and high costs for the Streetcar Alternative are the result of variations in design options (see tables on the previous page). Operating costs are change from the No-Build Alternative.

5.3.2 Existing System Revenue Shortfalls

System costs and revenues were projected for each year of the 25-year planning period based on the financial assumptions described in previous sections. Table 5.1-6 shows for each alternative and each year the beginning-of-the-year unrestricted cash reserve expressed in YOE dollars and in percent of annual operations cost. As mentioned previously, the fiscal condition of transit system operations is considered adequate if the beginning cash reserve is maintained at 12 percent of annual operations costs each year.

As shown in Table 5.1-6, with the imposition of the payroll tax increase authorized by HB 3183 (2009 Legislative Session), the beginning year unrestricted cash reserve for all alternatives exceeds the 12 percent threshold in all years except for the Enhanced Bus alternative in FY 2023 and FY 2024. However, the deficit in the beginning cash reserve for the Enhanced Bus alternative in those years would be small and could be addressed by TriMet with standard management measures. Thus given the assumptions described above and the imposition of the payroll tax increase authorized by HB 3183 (2009 Legislative Session), all of the project alternatives are fiscally feasible from a total systems costs perspective.

5.4 Opportunities for Additional Revenues

This section discusses opportunities for additional revenues that TriMet may seek in order to eliminate revenue shortfalls.

5.4.1 Project Capital Revenue Options

All of the alternatives for the Lake Oswego to Portland Transit Project require additional capital revenues to cover the shortfalls shown in Table 5.1-5. A detailed plan to secure these additional capital revenues will be developed during Preliminary Engineering and reported in the Final Environmental Impact Statement. Currently, potential sources to eliminate these revenue shortfalls have been identified for further analysis. Following is a summary description of those potential sources of revenue to cover the capital shortfalls.

Table 5.1-6 System Fiscal Feasibility Analysis: Beginning Working Capital 2010-2035 In Millions of Year-of-Expenditure Dollars

	No Build		Enhanced Bus		Streetcar			
					WSL		Macadam	
Fiscal Year	Beginning Working Capital[1]	% Annual Operating Cost[2]	Beginning Working Capital[1]	% Annual Operating Cost[2]	Beginning Working Capital[1]	% Annual Operating Cost[2]	Beginning Working Capital[1]	% Annual Operating Cost[2]
2010	$57	16%	$57	16%	$57	16%	$57	16%
2011	$94	25%	$94	25%	$94	25%	$94	25%
2012	$80	22%	$80	22%	$80	22%	$80	22%
2013	$80	20%	$80	20%	$80	20%	$80	20%
2014	$74	18%	$74	18%	$74	18%	$74	18%
2015	$72	17%	$72	17%	$72	17%	$72	17%
2016	$71	15%	$71	15%	$71	15%	$71	15%
2017	$69	14%	$69	14%	$69	14%	$69	14%
2018	$72	14%	$72	14%	$72	14%	$72	14%
2019	$79	15%	$79	14%	$79	14%	$79	14%
2020	$83	14%	$80	14%	$82	14%	$82	14%
2021	$85	14%	$78	13%	$83	14%	$83	14%
2022	$84	13%	$74	12%	$82	13%	$82	13%
2023	$86	13%	$75	11%	$82	12%	$82	12%
2024	$90	13%	$79	11%	$86	12%	$85	12%
2025	$98	13%	$87	12%	$93	13%	$92	13%
2026	$110	14%	$94	12%	$103	14%	$102	13%
2027	$121	15%	$100	12%	$113	14%	$112	14%
2028	$145	17%	$118	14%	$135	16%	$134	16%
2029	$163	19%	$130	15%	$152	17%	$151	17%
2030	$190	21%	$150	16%	$177	19%	$175	19%
2031	$222	23%	$174	18%	$207	22%	$205	21%
2032	$262	26%	$206	21%	$245	24%	$243	24%
2033	$309	30%	$245	23%	$290	28%	$288	27%
2034	$363	33%	$289	26%	$341	31%	$339	31%
2035	$424	37%	$339	29%	$400	35%	$397	34%

A. Section 5309 New Starts Funds

FTA Section 5309 New Starts funds are discretionary federal grants available for new fixed-guideway transit systems and extensions to existing fixed-guideway systems that meet certain requirements. Congress establishes the year-to-year availability and amount of New Starts funds in each federal transportation authorization act. FTA disburses New Start funds through a Full Funding Grant Agreement (FFGA), which establishes the maximum funding available to the project and the terms and conditions of receiving the funds.

FTA also administers a rating system established by federal law to determine eligibility of the project for a New Starts grant. Among other factors, a project's overall rating is affected by its project justification and financial plan ratings. The feasibility of obtaining a New Starts grant will not be settled until the rating is complete and FTA determines the rating to be sufficient.

The amount of funds available to the Lake Oswego to Portland Transit Project depends on many factors beyond the project itself, including the overall amount authorized and appropriated by Congress and competing projects nationwide. While Federal statutes allow up to 80 percent of project costs to be paid by New Starts funds, the FTA financial rating system prioritizes projects that propose a New Starts share of 60 percent or less of project costs. The proposed funding plan for the Lake Oswego to Portland Transit Project alternatives is based on a 60 percent New Starts share. FTA has not yet rated the financial plan for this project and has not agreed to the Section 5309 New Starts share proposed in this FEIS. Projects with a New Starts share of less than 50 percent receive higher ratings for the non-New Starts share ratings factor, and New Starts shares less than 35 percent receive the highest rating for this factor. In deciding an acceptable New Starts share, FTA would also consider the demand for New Starts funding by other projects in the metropolitan area and elsewhere. FTA will review the financial plans and rate this project when it is requested that the locally preferred alternative be advanced into preliminary engineering.

Table 5.1-7 illustrates the potential amounts of Section 5309 New Starts funds that would be requested. As shown in Table 5.1-7, the Streetcar Alternative would require $197.0 to $244.3 million more in Section 5309 funds than the Enhanced Bus Alternative.

Table 5.1-7 Proposed Amounts of Section 5309 Small Starts/New Starts Funds In Millions of Year-of-Expenditure Dollars [1]

		Streetcar[2]	
	Enhanced Bus	Low	High
Section 5309 Small Start Funds	$30.7		
Section 5309 New Start Funds		$227.7	$275.0

Source: TriMet/Metro – May 2010.
[1]FTA has not yet rated the financial plan for this project and has not agreed to the Section 5309 New Starts share proposed in this Table 5.1-7. Projects with a New Starts share of less than 50 percent receive higher ratings for the non-New Starts share rating factor, and New Starts shares less than 35 percent receive the highest rating for this factor. In deciding an acceptable New Starts share, FTA would also consider the demand for New Starts funding by other projects in the metropolitan area and elsewhere. FTA will review the financial plans and rate this project when TriMet requests that its preferred alternative be advanced into preliminary engineering.
[2]Low and high costs for the Streetcar Alternative are the result of variations in design options (see tables on the previous page). Operating costs are change from the No-Build Alternative.

B. State Lottery Bond Proceeds

State lottery bond proceeds have been used to fund several high capacity transit projects in the Portland region. These include $125 million for the Westside LRT Project, about $35 million for the Wilsonville-to-Beaverton Commuter Rail Project, $25 million for Eastside Streetcar, and $250 million for the Portland to Milwaukie LRT Project. Legislative approval of the lottery bonds is required to secure lottery bonds for a project. In addition, TriMet and the Oregon Department of Transportation (ODOT) would need to execute an intergovernmental agreement setting forth the detailed terms and conditions for the use of such funds.

C. GARVEE Bonds Secured by MTIP Funds
A Grant Anticipation Revenue Vehicle (GARVEE) bond is a debt-financing instrument that pledges future federal funds to repay bondholders.[1] The Portland region has a long history of using GARVEE bonds secured by a stream of Metropolitan Transportation Improvement Program (MTIP) funds to help fund high capacity transit projects. GARVEE bonds have been used to provide about $24.0 million for the Interstate LRT Project, $23.5 million for the Wilsonville-to-Beaverton Commuter Rail Project, $48.5 million for the South Corridor (I-205/Mall) LRT Project, and $72.5 million for the Portland to Milwaukie LRT Project.

MTIP funds include federal Surface Transportation Program (STP) funds and Congestion Management Air Quality (CMAQ) Program funds, which are funds allocated to Metro as the Portland Metropolitan Planning Organization (MPO). Approval of STP and/or CMAQ funds by the Joint Policy Advisory Committee for Transportation (JPACT) and the Metro Council through the MTIP process would be required to make such funds available for the Lake Oswego to Portland Transit Project. In addition, TriMet and Metro would need to execute an intergovernmental agreement setting forth the detailed terms and conditions for the use of such funds. TriMet would likely be responsible for implementing the borrowing program that would provide funds to the Lake Oswego to Portland Transit Project and would structure debt service so that principal and interest could be paid with the flow of MTIP funds.

D. Local, Regional and State Agency Funds
The regional and local governmental entities participating in the project, including TriMet, the City of Lake Oswego, City of Portland, ODOT and Clackamas County could provide local matching funds for the project. The amounts to be provided by these governmental entities and the specific funding sources to be used to provide funding will be determined during Preliminary Engineering. Potential sources may include system development charge proceeds, local improvement districts, urban renewal funds, dedicated transportation funds, payroll tax revenues, formula federal funds and other funding sources. Approval of such funding would be required by the governing bodies of the local and regional governmental entities providing local matching funds. TriMet would enter into intergovernmental agreements with the contributing governmental entities wherein the local matching funds would be committed to the project.

E. Revenues Used to Pay Construction-Period Finance Costs on Bonds Used for Local Match
Under Federal Transit Administration (FTA) policy, the financing costs paid during the project development period on bonds issued to provide local match for a project, net of any interest earnings on the bond proceeds, constitute project costs The revenues used to pay such net finance costs constitute project revenues. The project development period begins when preliminary engineering is authorized and ends at the later of: 1) the start of revenue operations; or 2) receipt of the final federal funds committed to the project in the FFGA. The capital cost estimates shown in Table 5.1-1 assume that one-half of the local match contribution from local and regional governmental entities would be derived from bond proceeds, and that the project development period would be five years. The state and local revenues used to pay the net finance costs on these bonds would be project revenues.

[1] 23 USC 122(a) and (b).

5.4.2 System Revenue Options

As shown in Table 5.1-6 and discussed in Section 5.3.2, TriMet will have sufficient system revenues to operate the Lake Oswego to Portland Transit Project and maintain adequate beginning cash with implementation of the payroll tax increase authorized by HB 3183 enacted during the 2009 Legislative Session.

5.5 Conclusions

A 25-year cash flow analysis was prepared for each alternative, in which transit revenues (by source expenditures, transit expenditures and line item) were projected by year using key elements of the fiscal analysis described in previous sections. The following paragraphs summarize the analysis.

5.5.1 Project Capital Funding Conclusions

Table 5.1-8 illustrates the proposed capital funding plans for the Enhanced Bus and Streetcar alternatives. As shown, the Streetcar Alternative would require $33.8 to $59.9 million more in contributions from state, regional and local governments than the Enhanced Bus Alternative.

Table 5.1-8 Capital Funding Plan for Lake Oswego to Portland Transit Project In Millions of Year-of-Expenditure Dollars [1]

			Streetcar	
Source	**Availability[2]**	**Enhanced Bus**	**Low**	**High**
Capital Cost in Year-of-Expenditure Dollars		$51.1	$379.6	$458.3
Capital Revenues				
Section 5309 Small Start Funds	U	$30.7		
Section 5309 New Start Funds	U		$227.7	$275.0
Donated Right of Way: In-Kind Match	A		$94.5	$97.0
State, Regional and Local Funds	U	$18.4	$52.2	$78.3
Local Funds used for Construction-Period Finance Costs	U	$2.0	$5.1	$8.0
Total Revenues (Year-of-Expenditure Dollars)		***$51.1***	***$379.6***	***$458.3***

Source: TriMet – May 2010.

1 FTA has not yet rated the financial plan for this project and has not agreed to the Section 5309 New Starts share proposed in this Table 5.1-7. Projects with a New Starts share of less than 50 percent receive higher ratings for the non-New Starts share rating factor, and New Starts shares less than 35 percent receive the highest rating for this factor. In deciding an acceptable New Starts share, FTA would also consider the demand for New Starts funding by other projects in the metropolitan area and elsewhere. FTA will review the financial plans and rate this project when TriMet requests that its preferred alternative be advanced into preliminary engineering

2 U = Unavailable Currently (subject to future approvals); A = Available.

Even with a FFGA, a project must have New Starts funds appropriated to it by Congress on an annual basis to actually receive such funds. The appropriation is subject to budget limits, the demand for appropriations from other projects, and other congressional dynamics. The amount of New Starts funds appropriated to a project in a given year may be less than the Lake Oswego to Portland Transit Project requires that year.

In years when fewer New Starts funds are appropriated for the project than are needed by the project, the finance plan must use interim borrowing to maintain its optimum construction schedule. Interim-borrowed funds would be repaid with later-appropriated New Starts funds, but the Lake Oswego to Portland Transit Project would incur interest costs during that interim. The cost estimates shown in Table 5.1-1 include the finance costs associated with the interim-borrowing program.

5.5.2 System Fiscal Feasibility Conclusions

As explained in Section 5.3.2, the transit system cash flow analysis for the light rail project found that there were sufficient beginning cash amounts to meet transit system needs when the payroll tax increase authorized by HB 3183 (2009 Legislative Session) is levied (which is expected to occur in 2015).

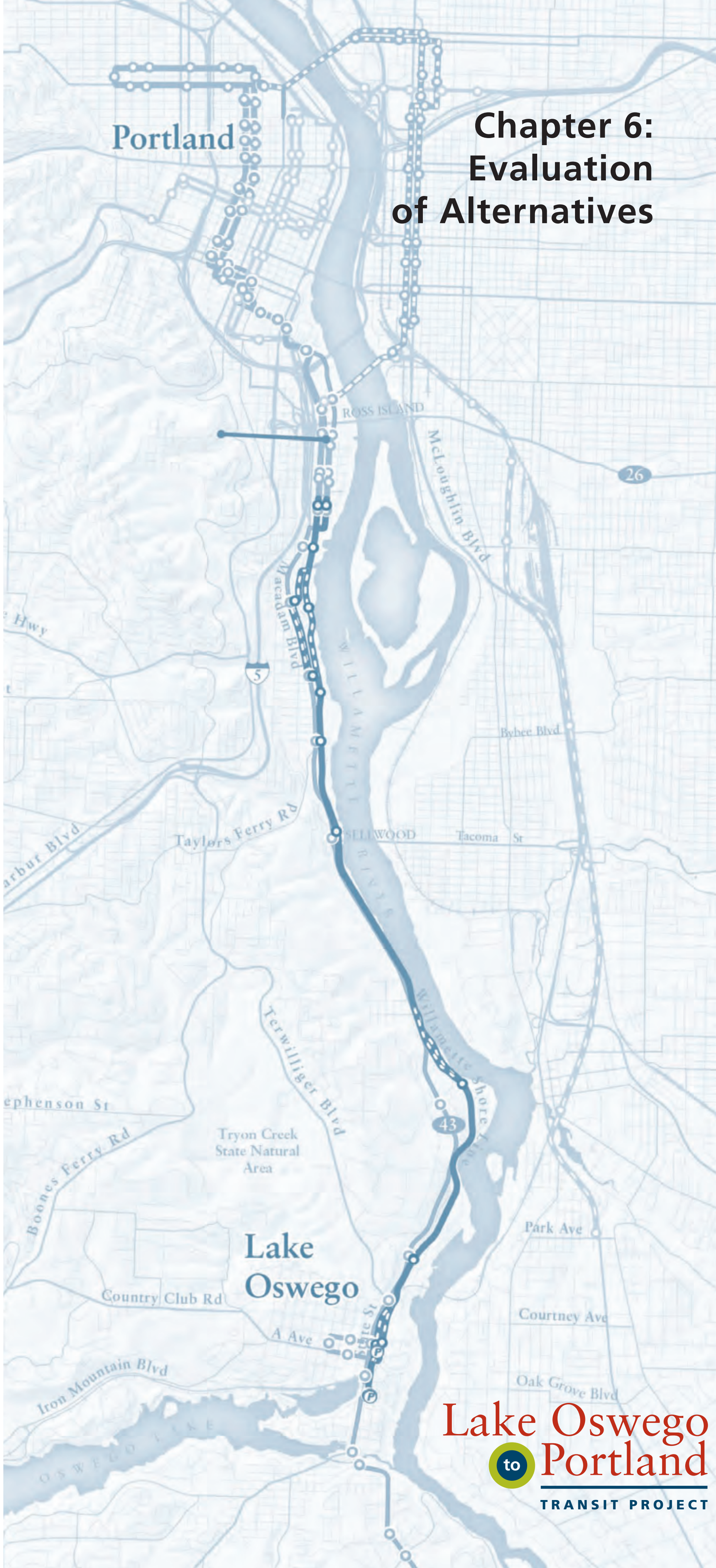
5.6 Implementation of the Finance Plan

Implementation of the finance plan depends on successfully obtaining:

- Selection of the Locally Preferred Alternative;
- Completion of the Final Environmental Impact Statement;
- Issuance of the Record of Decision by FTA;
- Formal commitments of the remaining donations of right of way and construction staging areas, to be used as in-kind local match;
- Secure commitments of required local match from contributing public and private entities;
- A sufficient New Starts rating to be eligible for New Starts funding;
- FTA approval to begin Final Design; and
- FTA approval of an FFGA that provides Section 5309 New Starts funds in the amount required by the finance plan.

CHAPTER 6

Chapter 6: Evaluation of Alternatives



Lake Oswego to Portland

TRANSIT PROJECT

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6. EVALUATION OF ALTERNATIVES

This chapter summarizes the evaluation of the No-Build, Enhanced Bus and Streetcar alternatives and the Streetcar design options, followed by a summary of the tradeoffs between the alternatives and options and by an assessment of social and equity issues. This chapter concludes with a brief description of the evaluation process and measures used within the Federal New Starts and Small Start Section 5309 capital grant program.

The evaluation of alternatives and options for the LOTP Project is based on the project's Purpose and Need Statement (see Section 1.1). The project's Goal is a restatement of the Purpose statement and the project's Objectives correspond to the primary elements of the Purpose Statement. Together, these form the project's evaluation framework that will be used to select a Locally Preferred Alternative (LPA) (see Section 1.1). The element of the Purpose statement that relates to garnering public support is not addressed in this section. Instead, the project will conduct a public comment period following publication of this DEIS, including a public hearing, during which comment will be invited, received and documented. All comments received during the comment period will be forwarded to the decision-making bodies that will adopt the project's LPA. Further, various jurisdictions and committees are scheduled to adopt recommendations on the LPA following the public comment period and those recommendations will be documented for, and considered by, the decision-making bodies that will adopt the LPA. All comments received by the project's lead agencies during the public comment period will be documented and responded to in the project's Final EIS.

6.1 Effectiveness of the Alternatives and Design Options

This section assesses the effectiveness of the project's alternatives and design options, based on the project's goals (which are the primary elements of the projects Purpose statement) and criteria, using the various evaluation measures listed in Table 6.1-1. Each objective is defined by two or more criteria and each criterion is defined by one or more measures. The goals, criteria and measures are not listed or assessed in any order of priority or weighting. The measures used within the evaluation framework were obtained or calculated from the environmental and fiscal analysis included within this DEIS. Unless noted, all measures are for average weekday conditions in 2035 and all costs are in current year (2010) dollars. The measures reported in this section are also used to assess the trade-offs between alternatives and design options within Section 6.2.

All of the measures in Table 6.1-1 are used to evaluate the project's alternatives, while a subset of the measures is used to evaluate the Streetcar design options, as noted in the table. In three of the corridor's six segments there are either two or three design options under study for the Streetcar Alternative (in segments 3, 5 and 6 – see Section 2.2.3 for a description of and maps illustrating the Streetcar design options). This section notes how one or more sets of design options would affect the performance of the Streetcar Alternative relative to the various evaluation measures.

6.1.1 Maximize Transit's Ability to Accommodate Growth in Travel Demand

The objective to maximize the transit system's ability to accommodate growth in travel demand in the corridor is evaluated using growth accommodated on transit and future expansion capability.

Table 6.1-1 Evaluation Objectives[1], Criteria and Measures

Objective/Criteria[1]	Measure
Maximize the transit system's ability to accommodate growth in travel demand in the corridor	
Growth Accommodated on Transit:	• Corridor transit place miles[2]
Future Expansion Capability:	• Corridor transit network expansion capability
Minimize the adverse effect of increased roadway congestion	
Highway System Use:	• Vehicle miles and hours traveled[2] • Vehicle hours of delay • Number of parking spaces removed[2]
Traffic Infiltration/Congestion:	• P.M. peak traffic volumes at select corridor cutlines • P.M. peak transit ridership volumes at select corridor cutlines[2] • Congestion levels at signalized intersections on Highway 43[2]
Increase the quality, efficiency and effectiveness of transit	
Fixed-Guideway Coverage:	• Increase in employment and households within fixed-guideway station areas[2] • Number of bus stops and streetcar stations on Highway 43[2] • Increase in effective transit coverage[2]
Transit Reliability:	• Change in miles of exclusive transit right of way[2]
Transit Travel Times:	• Peak transit travel times between select corridor activity centers[2]
Efficiency:	• New transit rides per change in transit revenue hours[2]
Ridership:	• New transit rides[2]
Provide for a fiscally stable and financially efficient transit system	
Financial Feasibility:	• Capital costs[2] • Change in operating costs • Local Match Requirement[2]
Cost Effectiveness:	• Change in operating cost per new transit ride[2]
Comply with and support regional and local land use and transportation policies, plans, goals and objectives	
Support Activity Centers:	• Ability to provide high-quality transit connections between key corridor activity centers[2]
Support of Land Use Policies:	• Compatibility with state, regional and local land use plans and policies
Economic Development:	• Ability to facilitate local development and redevelopment[2] • Change in short-term and long-term employment • Available floor area within new fixed-guideway transit station areas[2]
Markets served	• Change in transit ridership and mode split for project's primary transit markets
Optimize the environmental sensitivity and engineering design of the project	
Bicycle/Pedestrian Facilities:	• Improvements to bicycle and pedestrian facilities[2]
Displacements:	• Number of residential units, businesses and public facilities displaced[2]
Noise and Vibration:	• Number of receptors exposed to significant noise impacts without and with mitigation[2] • Number of receptors exposed to significant vibration impacts without and with mitigation[2]
Wetlands and Hydrology:	• Acres of filled wetland[2] • Acres of fill in the 100-year floodplain[2] • Temporary impacts to culverted waterways • Acres of new impervious surfaces[2]
Air Quality	• Tons of CO_2 Released by Vehicles
Parks and Cultural:	• Number and acres of parks used[2] • Number of sensitive archaeological sites potentially disturbed[2]
Historic:	• Number of historic resources adversely affected
Design Considerations:	• Major engineering considerations[2]

[1] The project's Objectives are the primary elements of the project's Purpose Statement (see Section 1.1). The introductory paragraphs to Chapter 6 provide a description of the linkage between the project's Purpose Statement and Objectives. Section 6.1 provides a more detailed description of the measures listed in this table and the methods used to calculate the measures.
[2] These measures are used to evaluate both alternatives and Streetcar design options; all other measures are used to evaluate only alternatives.
Source: Metro/TriMet; January 2010.

A. Growth Accommodated on Transit

The ability of the alternatives to accommodate growth is assessed using the change in transit place miles. Table 6.1-2 summarizes the increase in transit place miles that would occur under the project's alternatives, compared to the No-Build Alternative. A transit place mile, similar to a seat mile in the airline industry, is a measure of the overall passenger-carrying capacity of a transit system, referring to the total carrying capacity (seated and standing) of each bus or train type. Place miles are calculated by multiplying the vehicle capacity of each bus or rail vehicle type by the daily vehicle miles traveled for each vehicle type. The Streetcar Alternative would result in up to 54,160 more transit place miles (average weekday, 2035) than the No-Build Alternative and up to 22,540 more transit place miles than the Enhanced Bus Alternative. In general, a greater number of transit place miles indicates that an alternative would be better able to respond to future growth in demand.

Table 6.1-2 Measures Assessing Transit's Accommodation of Growth and Minimizing Congestion By Alternative (2035)

			Streetcar[1]	
Criteria/Measures	**No-Build**	**Enhanced Bus**	**Willamette Shore Line**	**Macadam Design Options**
Growth Accommodated on Transit				
Corridor Transit Place Miles[2]	190,600	222,220	242,000	244,760
Highway System Use				
Vehicle Miles Traveled	63,076,000	63,035,000	63,008,000	63,010,600
Vehicle Hours Traveled	2,371,800	2,368,500	2,366,100	2,366,400
Vehicle Hours of Delay[3]	49,400	49,200	49,000	49,000
Net Parking Spaces Removed[4]	0	0	0	148 /175
Traffic Infiltration/Congestion[5]				
Traffic Volumes on Highway 43				
Johns Landing	5,600	5,600	5,500	5,500
South of Lake Oswego	7,100	7,100	7,100	7,100
Transit Volumes on Highway 43				
Johns Landing	900	1,170	1,470	1,270
South of Lake Oswego	390	360	430	400
Congested Intersections[6]	N/A	3	2	2

Source: Metro/TriMet – January 2010.
Note: unless noted, all data are average weekday.
1 The other Streetcar design options in other segments would not affect the data within this table.
2 Place-miles refers to the total carrying capacity (seated and standing) of each bus or train type and is calculated by multiplying the vehicle capacity of each bus or light rail vehicle type by the daily VMT for each vehicle type.
3 Based on average weekday p.m. peak hour conditions in 2035 on freeways, arterials and collector streets.
4 Net number of parking spaces removed. Includes public on-street and private off-street parking spaces. Under the Streetcar Alternative's Macadam Design Options, the number of displaced parking spaces represents the Macadam In-Street and the Macadam Additional Lane design options, respectively.
5 Peak-period, peak-direction vehicle and transit passenger volumes (average weekday, 2035) across screen line on Highway 43, SW Corbett Avenue, and Willamette Shore Line in Johns Landing; on Highway 43 south of Lake Oswego.
6 Intersections that would be congested under the No-Build Alternative (based on the applicable operational standard) and that would experience an increase in volume-to-capacity ratios or level of service and queuing delays, compared to conditions under the No-Build Alternative. In addition, the new signalized intersection under the Macadam design options in the Johns Landing Segment that would be located at Highway 43 and SW Carolina Street would not meet ODOT's operating standards.

For the Streetcar Alternative, the two Macadam design options would result in approximately 2,760 more transit place miles than the Willamette Shoreline Design Option (see Table 6.1-2). Other Streetcar design options under study would not affect transit place miles.

B. Future Expansion Capability

Future expansion capability is based on a qualitative assessment of the alternatives' transit network in the corridor to expand to meet demand. The Streetcar Alternative would have a greater capability for future transit service expansion than the No-Build or Enhanced Bus alternatives, because the Streetcar Alternative would result in a new transit right of way between Lake Oswego and the South Waterfront, with direct connections into downtown Portland and northwest Portland. Frequencies of transit vehicle on the proposed streetcar line would be below the practical limits of the line, so frequencies could be increased to respond to increasing demand over time. In addition, sections of single-track alignment, which tend to limit frequencies, could be changed in the future into two-track sections, thereby allowing even more frequent streetcar service. The Streetcar Alternative would not impair operations on the adjacent roadway and total transit capacity in the corridor could be increased with additional parallel bus lines, if needed. With the No-Build and Enhanced Bus alternatives, the corridor's trunk line bus routes would operate in mixed traffic on the congested Highway 43, thereby limiting alternatives' ability to expand to increasing demand.

6.1.2 Minimize the Adverse Effect of Increased Roadway Congestion

The objective to minimize the adverse effect of increased roadway congestion in the corridor is evaluated based on: highway system use and traffic infiltration.

A. Highway System Use

Highway system use under the project's alternatives is assessed using four measures (see Table 6.1-2): vehicle miles traveled; vehicle hours traveled; vehicle hours of delay; and the number of parking spaced removed. In general, the alternative and option that would lead to a greater reduction in vehicle miles traveled, vehicle hours traveled and vehicle hours of delay would perform the best in reducing congestion on roadways.

The Enhanced Bus Alternative would reduce vehicle miles traveled, vehicle hours traveled and vehicle hours of delay, compared to the No-Build Alternative (by 41,000 miles, 3,300 hours and 200 hours, respectively). The Streetcar Alternative with the Willamette Shore Line design option (in the Johns Landing segment) would reduce vehicle miles traveled by up to 68,000 miles, vehicle hours traveled by up to 5,700 hours and vehicle hours of delay by 400 hours compared to the No-Build Alternative.

For the Streetcar Alternative, the two Macadam design options would result in approximately 2,600 more vehicle miles traveled and 300 more vehicle hours traveled, compared to the Willamette Shore Line design option. Other Streetcar design options under study would not affect vehicle miles or hours traveled. Vehicle hours of delay would be the same under all Streetcar design options.

The No-Build and Enhanced Bus alternatives would not result in any parking displacements, compared to up to 175 net displaced parking spaces with the Streetcar Alternative.

Only the design options within the Johns Landing Segment would affect the number of net displaced parking spaces (see Table 6.1-2). The Willamette Shore Line design option would result in no displacement of parking spaces. There would be a loss of 166 and 193 off-street spaces under the Macadam In-Street and Macadam Additional Lane design options, respectively. Both of these design options would include the addition of 18 on-street parking spaces along Landing Drive. Thus, the Macadam In-Street design option would result in a net loss of 148 parking spaces and the Macadam Additional Lane design option would result in a net loss of 175 parking spaces.

B. Traffic Infiltration

The ability of the project's alternatives to reduce traffic infiltration onto neighborhood streets is assessed using three measures (see Table 6.1-2): p.m. peak-hour traffic volumes in the peak direction at select corridor cutlines; p.m. peak transit ridership volumes during the peak-hour in the peak direction at select corridor cutlines; and congestion levels at signalized intersections on Highway 43 (average weekday, 2035). In general, the alternative that would lead to the greatest reduction in vehicle volumes at a cutline would best help to avoid or reduce the likelihood of arterial street traffic infiltrating onto adjacent neighborhood streets, as some automobile users tend to seek out alternate paths for their travel when arterial roadways become congested.

The Enhanced Bus Alternative would increase p.m. peak-period, peak-direction traffic volumes on Highway 43 and parallel streets in Johns Landing by approximately 100 vehicles, compared to the No-Build Alternative. Under the Macadam design options, the Streetcar Alternative would also increase those volumes by 100 vehicles, compared to the No-Build Alternative. However, under the Willamette Shore Line design option vehicle volumes would be reduced by 100, compared to the No-Build Alternative. Vehicle volumes on State Street in Lake Oswego would remain unchanged under the Enhanced Bus and Streetcar alternatives.

Similarly, increases in transit line ridership on arterials in Johns Landing indicate potential for reduced traffic infiltration onto neighborhood streets, because automobile use in a corridor tends to decline as transit use increases. The Enhanced Bus Alternative would increase p.m. peak-period, peak-direction transit ridership volumes at the Johns Landing cut lines in 2035 by 270 passengers, compared to the No-Build Alternative. In contrast, the Streetcar Alternative would increase p.m. peak-period, peak-direction transit ridership volumes at the same location by up to 570 riders, compared to the No-Build Alternative.

Of the Streetcar design options under study, only those within the Johns Landing Segment would affect transit ridership at the corridor's two cut lines (see Table 6.1-2). Compared to the Willamette Shore Line design option, the two Macadam design options would result in 30 and 200 fewer transit riders in the weekday p.m. peak period in the peak direction on Highway 43 and adjacent parallel streets, south of Lake Oswego and in Johns Landing, respectively.

6.1.3 Increase the Quality, Efficiency and Effectiveness of Transit

The objective to increase the quality, efficiency and effectiveness of transit is evaluated based on: transit coverage; transit reliability; transit travel times; transit efficiency; and transit ridership.

A. Transit Coverage

Transit coverage under the project's alternatives and Streetcar design options is assessed using three measures and 6.1-5): 1) the increase in households and employment within fixed-guideway station areas (see Tables 6.1-3 and 6.1-4); 2) the number of Line 35 bus stops or new streetcar stations (see Table 6.1-5); and 3) the effective transit coverage of households and employment within Districts 3 through 6 of the corridor (see Table 6.1-3 and Figure 1.2-1).

Table 6.1-3 Measures Assessing the Quality, Efficiency and Effectiveness of Transit by Alternative

Criteria/Measures	No-Build	Enhanced Bus	Streetcar[1] Willamette Shore Line	Streetcar[1] Macadam Design Options
Coverage[2]				
New Station-Area Households	0	0	12,080[2]	12,080[2]
New Station-Area Employment	0	0	24,920[2]	24,920[2]
Line 35 Bus Stops / New Streetcar Stations[3]	26 / 0	13 / 0	0 / 10	0 / 10
Effective Transit Coverage of Households[4]	17,190	17,090	17,470	17,470
Effective Transit Coverage of Employment[4]	59,110	59,000	59,220	59,220
Travel Times[5] (minutes)				
In-Vehicle Transit Travel Times (minutes)				
PSU to Lake Oswego	42	39	29	33
SW Lowell St to Lake Oswego	32	29	18	22
In-Vehicle Auto Travel Times				
PSU to Lake Oswego	28	28	27	27
SW Lowell St to Lake Oswego	22	22	22	22
Efficiency				
Corridor Transit Miles per Transit Hour[6]	15.1	15.2	16.8	16.2
Transit Ridership[7]				
New Annual Transit Person Trips	N/A	730,550	1,277,900	1,180,650

Source: Metro/TriMet – January 2010.
Note: ROW = right of way; NA = not applicable. All data are average weekday, 2035, unless noted.

1 Unless noted, the other streetcar design options in other segments would not affect the data within this table. See footnote 2 of this table for a description of how differences in transit coverage for new station areas by design option are addressed.
2 The number of households and employment in 2035 that would be within one-half mile of a new fixed-guideway station. In locations where there are design options that would affect the location of a fixed-guideway (i.e., streetcar) station, the approximate mid-point between the station locations is used as the center point of the station area. Table 6.1-5 shows the differences in households and employment for station areas that would be affected by Streetcar design options.
3 Between downtown Lake Oswego and SW Bancroft. Inbound and outbound bus stop pairs are counted as one bus stop.
4 Effective transit coverage is defined as the number of households and jobs within a 0.20-mile radius of a bus stop and a 0.35-radius of a streetcar station within the following corridor districts: South Waterfront/OHSU; Johns Landing; Dunthorpe; and Lake Oswego (see Figure 1.2-1 for an illustration of the districts). The radii are based on the coverage factors used within Metro's regional travel demand forecasting model.
5 In minutes, peak period, peak direction; in-vehicle time is the time that a passenger would spend within a public transit vehicle or an automobile.
6 Average weekday in 2035.
7 New transit person trips are the change in annual system-wide transit person trips, compared to the No-Build Alternative.

- **Households/Employment within New Streetcar Station Areas.** The Streetcar Alternative would result in approximately 12,080 households and 24,920 jobs within a half-mile of a new streetcar station, providing them with access to faster and more reliable transit within the corridor, compared to either the No-Build or Enhanced Bus alternatives (see Table 6.1-3). In the Johns Landing Segment, the Willamette Shore Line design option would provide new transit station coverage to approximately 4,190 households and 11,950 jobs, compared to approximately 4,600 households and 12,490 jobs under the Macadam In-Street and Macadam Additional Lane design options (see Table 6.1-4). In the Lake Oswego Segment, there would be 40 more households and 50 more jobs within the new station areas under the UPRR Right of Way design option, than under the Foothills design option. No other design options would affect households or employment within new station areas.

- **Line 35 Bus Stops and New Streetcar Stations**. With the No-Build Alternative, there would be 26 bus stops between downtown Lake Oswego and Southwest Lowell Street served by Line 35 (see Table 6.1-3). Under the Enhanced Bus Alternative, half of those bus stops would be removed to provide quicker bus service between the corridor's primary activity centers. Under the Streetcar Alternative, all 26 of those bus stops would be removed and replaced by 10 new streetcar stations.

Table 6.1-4 Households and Employment in New Fixed-Guideway Station Areas[1] and Capital Cost (2010 dollars) by Corridor Segment and Design Option[2] (2035)

Segment/Design Option	Station-Area Households	Station-Area Employment	Capital Cost[3]
3 – Johns Landing			
Willamette Shore Line	4,190	11,950	$19.0
Macadam In-Street	4,600	12,490	$27.9
Macadam Additional Lane	4,600	12,490	$32.7
4 – Sellwood Bridge	830	1,330	$23.7
5 – Dunthorpe/Riverdale			
Willamette Shore Line	190	120	$52.6
Riverwood	190	120	$52.1
6 – Lake Oswego			
UPRR	3,630	4,970	$48.6
Foothills	3,590	4,920	$69.9

Source: Metro/TriMet – January 2010.
Note: ROW = right of way; UPRR = Union Pacific Railroad.
1 The number of households and employment in 2035 that would be within one-half mile of a new fixed-guideway station.
2 Only data for segments with design options are shown and only data for station areas that would change between the design options are shown. See Figure 2.2-5 for an illustration of the Streetcar design options, including station locations, by segment.
3 Costs are expressed in millions of 2010 dollars and are based on 2035 service levels.

Table 6.1-5 Miles of New Transit-Exclusive Right of Way by Alternative and Streetcar Design Option

Alternative/Segment	Design Option	Miles of New Transit-Exclusive Right of Way[1]
No-Build Alternative		0.0
Enhanced Bus		0.0
Streetcar		
1 – Downtown Portland	None	0.0
2 – South Portal	None	0.1
3 – Johns Landing	Willamette Shore Line	1.2
	Macadam In-Street	0.5
	Macadam Additional Lane	0.5
4 – Sellwood Bridge	None	1.4
5 – Dunthorpe/Riverdale	Willamette Shore Line	2.0
	Riverwood	1.7
6 – Lake Oswego	UPRR	0.7
	Foothills	0.2
	Streetcar Total - Low	**3.9**
	Streetcar Total - High	**5.4**

Source: Metro/TriMet – January 2010.
Note: ROW = right of way; UPRR = Union Pacific Railroad.
1 New one-way miles of protected transit-exclusive right of way over the No-Build Alternative.

- **Effective Transit Coverage.** The effective transit coverage measure addresses the number of households and jobs in 2035 that would have access to a bus stop or streetcar station under the three alternatives, reflecting different draw areas for bus stops and streetcar stations. Based on local survey data, there is generally a draw area of approximately 0.20 mile radius for a bus stop and 0.35-mile radius for a streetcar station. The size of these draw areas are consistent with transit coverage factors used within Metro's travel demand forecasting model. Compared to the No-Build Alternative, the Enhanced Bus Alternative would reduce effective transit coverage by 100 households and 110 jobs, reflecting the removal of 13 bus stops (see Table 6.1-3). In contrast, the Streetcar Alternative would increase effective transit coverage by 280 households and 110 jobs, reflecting the greater draw area provided by 10 streetcar stations, compared to the draw area of 26 bus stops. The effective transit coverage of the Streetcar Alternative would not be affected by design options under consideration.

B. Transit Reliability

Transit reliability under the project's alternatives and design options is assessed using the change in miles of exclusive transit right of way (see Table 6.1-5). In general, TriMet has found that transit vehicles operating in their own right of way, generally removed from automobile traffic congestion, tend to have more reliable on-time performance and on-time performance is a key factor in a transit line's ability to attract ridership. Therefore, increasing the miles of exclusive transit right of way in a corridor would tend to increase the reliability of transit in the corridor.

Neither the No-Build nor the Enhanced Bus alternatives would increase the miles of exclusive transit right of way within the corridor, so transit reliability in the corridor under those alternatives would be reduced compared to existing conditions, reflecting growth in congestion in the corridor over time. In contrast, the Streetcar Alternative would lead to up to 5.4 miles of additional exclusive transit right of way in the corridor.

Table 6.1-5 also summarizes the miles of transit-exclusive right of way within each segment of the Streetcar Alternative by segment and how the segment mileage would vary by each segment's design option. Compared to the Willamette Shore Line design option in the Johns Landing Segment, the two Macadam design options would reduce the miles of new exclusive transitway by 0.8 miles. In the Dunthorpe/Riverdale Segment, the Willamette Shore Line design option would provide 2.0 miles of exclusive transit right of way, compared to 1.7 miles under the Riverwood design option. In the Lake Oswego Segment, the UPRR Right of Way design option would provide 0.7 miles of exclusive transit right of way, compared to 0.2 miles under the Foothills design option.

C. Transit Travel Times

Transit travel times under the project's alternatives and Streetcar design options in the Johns Landing Segment are assessed using peak-period, p.m. peak-direction, in-vehicle transit travel times between select locations in the corridor (see Table 6.1-3), compared to automobile travel times. The Enhanced Bus Alternative would reduce transit travel times in the p.m. peak period and peak direction to Lake Oswego from PSU and Lowell Street by three minutes compared to the No-Build Alternative. In comparison, the Streetcar Alternative would reduce transit in-vehicle travel times by up to 13 and 14 minutes from PSU and Lowell Street to Lake Oswego, respectively, compared to the No-Build Alternative.

Of the Streetcar design options, only those within the Johns Landing Segment would affect transit travel times in the corridor. Under the two Macadam design options, transit travel times in the peak period and direction between the select locations would be approximately four minutes longer than under the Willamette Shore Line design option.

D. Efficiency
The efficiency of the project's alternatives is assessed through calculating the corridor transit vehicle miles traveled by corridor transit vehicle hours traveled in 2035 on an average weekday (see Table 4.2-1). Based on this measure, the No-Build Alternative would be the least efficient of the alternatives and the Streetcar Alternative would be the most efficient. Under the No-Build Alternative, there would be 15.1 transit vehicle miles of service for each hour of transit service. Under the Enhanced Bus Alternative, that would increase to 15.1. Under the Streetcar Alternative that would increase further to up to 16.8 transit vehicle miles of service for each hour of transit service.

The only design options that would affect the efficiency measure would be in the Johns Landing Segment, where the two Macadam design options would result in 16.2 transit vehicle miles of service for each hour of transit service, compared to 16.8 under the Willamette Shore Line design option, reflecting the faster streetcar operating speeds and shorter distance in that segment under the Willamette Shore Line design option.

E. Ridership
Transit ridership resulting from the project's alternatives and Streetcar design options in the Johns Landing Segment is assessed by using annual new systemwide transit person trips (see Table 6.1-3). New annual system wide transit trips are assessed by comparing total transit ridership on the Enhanced Bus and Streetcar Alternatives to the No-Build Alternative. The Enhanced Bus Alternative would result in approximately 730,550 new transit person trips, compared to up to approximately 1.28 million new transit riders under the Streetcar Alternative, a 175 percent difference. The only design options that would affect transit ridership are within the Johns Landing Segment, where there would be approximately 1.18 million annual new transit rides under the two Macadam design options and approximately 1.28 million under the Willamette Shore Line design option, an 8 percent difference.

6.1.4 Provide for a Fiscally Stable and Financially Efficient Transit System

The objective to provide for a fiscally stable and financially efficient transit system is evaluated based on: fiscal feasibility and cost-effectiveness.

A. Financial Feasibility
The financial feasibility of the project's alternatives is assessed using three measures (see tables 6.1-4 and 6.1-6): capital costs; the change in operating and maintenance costs (from the No-Build Alternative); and the local match requirement.

Capital Costs. The Enhanced Bus Alternative would result in capital costs of $37.8 million (2010 dollars), a majority of which would be due to the proposed park-and-ride lot in downtown Lake Oswego and the purchase of 13 additional buses. The capital cost of the Streetcar Alternative would range from $288.9 to $347.4 million. In the Johns Landing Segment, the Willamette Shore Line design option would cost $19.0 million, while the Macadam In-Street and Macadam Additional Lane design options would cost $27.9 and $32.7 million. The higher costs associated with the two Macadam design options reflect the longer alignment, more costly facility improvements (e.g., the additional lane on Southwest Macadam Avenue with the Macadam Additional Lane design option) and additional right of way purchases. There would be relatively little capital cost differences between the phasing options in Sellwood Bridge and design options in Dunthorpe/Riverdale segments (approximately 1 percent). In the Lake Oswego Segment, the UPRR Right of Way design option would cost $48.6 million to construct, compared to $69.9 for the Foothills design option, which generally reflects the greater amount of roadway improvements and right of way purchases that would be required under the Foothills design option.

Table 6.1-6 Financial Feasibility and Cost-Effectiveness by Alternative

Financial Measure	No-Build	Enhanced Bus	Streetcar	
			Low	High
Financial Feasibility[1]				
Capital Costs	$0.00	$37.8	$288.9	$347.4
Change in Operating Cost	N/A	$2.79	$1.25	$1.25
Local Match Requirement[2]	$0.00	$20.4	$57.3	$86.3
Cost-Effectiveness				
Operating Cost per New Transit Person Trip[3]	N/A	$3.82	$0.98	$1.06

Source: Metro/TriMet – January 2010.

[1] Capital and operating costs are expressed in millions of 2010 dollars and are based on 2035 service levels. The range of capital costs for the Streetcar alternative is the result of different combinations of design options in four of the project's six segments – see Table 6.1-4 for additional detail by design option.

[2] In millions of year-of-expenditure dollars based on operations in 2035. Based on the cost of the alternative in year-of-expenditure dollars, minus the proposed Section 5309 federal share and minus the value of the Willamette Shore Line right of way. Design options would affect local match requirements both through the differences in capital costs and in the amount of local share that could come from the value of the existing Willamette Shore Line right of way that would be used for each design option. In the Johns Landing Segment, approximately $8.9 million more of Willamette Shore Line right of way would be available for local match under the Willamette Shore Line Design Option than would be available under the two Macadam design options; in the Sellwood Bridge Segment approximately $4.8 million more of Willamette Shore Line right of way would be available for local match under the Willamette Shore Line Design Option than would be available under the New Interchange Design Option; in the Dunthorpe/Riverdale Segment approximately $10.2 million more of Willamette Shore Line right of way would be available for local match under the Willamette Shore Line Design Option than would be available under the Riverwood Design Option (there would be no difference in local match available under the Lake Oswego Segment design options).

[3] In 2010 dollars, based on operations in 2035. Operating cost per new transit trip is the change in annual systemwide O&M costs, divided by the change in annual system-wide transit person trips (see Table 6.1-3), compared to the No-Build Alternative. The Low operating cost per new transit person trip represents the Willamette Shore Line Design Option in the Johns Landing Segment and the High cost represents the two Macadam design options.

- **O&M Costs.** As presented in Table 6.1-6, the Enhanced Bus Alternative would cost $2.79 million more per year to operate in 2035, compared to the No-Build Alternative, primarily due to the increased frequency of service on Line 35 (2010 dollars). In comparison, the Streetcar Alternative would cost $1.25 million more per year to operate than the No-Build Alternative, reflecting a reduction in bus operating costs in the corridor and an increase in Streetcar operating costs. Operating costs would not vary by Streetcar Alternative design option.

- **Local Match Requirement.** Local match requirement is the amount of local funds that would be needed, based on the proposed capital finance plan for the alternative. The local match requirement is equal to the cost of the alternative in year-of-expenditure dollars, minus the proposed Section 5309 federal share and minus the value of the Willamette Shore Line right of way. For the Enhanced Bus Alternative, $20.4 million in local match would be required to fund the project, compared to $57.3 to $86.3 million in local match required for the Streetcar Alternative, depending on the design option.

  Design options would affect local match requirements both through the differences in capital costs and in the amount of local share that could come from the value of the existing Willamette Shore Line right of way that would be used for each design option. In the Johns Landing Segment, approximately $8.9 million more of Willamette Shore Line right of way would be available for local match under the Willamette Shore Line design option than would be available under the two Macadam design options. Finally, in the Dunthorpe/Riverdale Segment approximately $10.2 million more of Willamette Shore Line right of way would be available for local match under the Willamette Shore Line design option than would be available under the Riverwood design option. There would be no difference in local match available under the Sellwood Bridge Segment and Lake Oswego Segment design options.

B. Cost Effectiveness

The cost-effectiveness of the project's alternatives is assessed by calculating the annual operating cost difference from the No-Build Alternative and dividing that by the number of annual systemwide new transit person trips (see Table 6.1-6). For this calculation, operating costs and ridership are based on average weekday demand in 2035 and operating costs are expressed in 2010 dollars.

Based on this measure, the Streetcar Alternative would be more effective in its use of local operating revenues in generating new transit ridership than the Enhanced Bus Alternative, costing up to $1.06 per new systemwide transit person trip, compared to $3.82 per new transit trip under the Enhanced Bus Alternative. The results reflect both the Streetcar Alternative's lower annual operating costs (Table 6.1-6) and its greater systemwide transit ridership (Table 6.1-3), both expressed as increases compared to the No-Build Alternative.

The only Streetcar Alternative design options that would affect this cost-effectiveness measure are the three design options within the Johns Landing Segment – they would not affect annual operating costs, but they would differ in systemwide transit person trips (Table 6.1-4). As a result of its 5 percent greater annual transit ridership, the cost effectiveness of the Willamette Shore Line design option in the Johns Landing Segment would be $0.98 of operating cost per new transit trip (labeled Low in Table 6.1-6), compared to $1.06 per new transit trip under the two Macadam design options (labeled High in Table 6.1-6).

6.1.5 Comply with and Support Regional and Local Land Use and Transportation Policies, Plans, Goals and Objectives

The objective to comply with and support regional and local land use and transportation policies, plans, goals and objectives is evaluated based on: support of activity centers; compliance with land use policies; economic development; and markets served.

A. Support of Activity Centers

Support of activity centers by the project's alternatives is based on a qualitative assessment of the alternatives' ability to provide high-quality transit connections between key corridor activity centers. In the Lake Oswego to Portland Corridor, the key activity centers are: downtown Lake Oswego; Johns Landing; the South Waterfront District; and downtown and northwest Portland. The Enhanced Bus Alternative would better support activity centers in the corridor than the No-Build Alternative by reducing transit travel time between those centers and through construction of a 300-space structured park-and-ride lot in the Lake Oswego Segment. However, the Streetcar Alternative would provide additional support for those activity centers over the Enhanced Bus Alternative by:
1) providing additional transit travel time improvements between the activity centers; 2) improving the reliability of the connecting transit line through the addition of exclusive transit right of way; and 3) constructing visible streetcar stations integrated within the various activity centers.

The only design options that would vary in their support of activity centers within the corridor would be in the Johns Landing Segment. Streetcar stations located on Macadam Avenue under the Macadam design options would be more visible by more people that live in, work in and visit the Johns Landing area, compared to streetcar stations in the segment under the Willamette Shore Line design option, which would be located approximately one block east of Macadam Avenue. The streetcar stations under the Macadam design options would be easier for infrequent riders to find and would provide easier and quicker access from stations to the main street through the district. In general, stations on the Willamette Shore Line would not be visible from Macadam Avenue between Boundary and Nebraska streets. Access to the Willamette Shore Line station at Boundary would require pedestrian access easements across private property.

B. Compliance with Land Use Policies

The No-Build Alternative would not comply with the RTP because it would not encourage 2040 Growth Concept development types and intensities and would not provide rapid streetcar in the corridor, as the RTP calls for. While the Enhanced Bus Alternative would provide more frequent and faster transit service within the corridor, compared to the No-Build Alternative, it would not comply with the RTP because it would not encourage 2040 Growth Concept development types and intensities and would not provide rapid streetcar in the corridor, as the RTP calls for. The Streetcar Alternative would comply with the RTP because: 1) it is on the financially constrained project list; 2) would provide rapid streetcar in the corridor; and 3) would encourage the types and intensities of development the 2040 Growth Concept designations call for. See Section 3.1 for additional detail. The Streetcar Alternative design options would not differ regarding compliance with the RTP.

Neither the No-Build nor Enhanced Bus alternative would be consistent with the desire for “high capacity transit” on the Willamette Shore Line alignment implicit in Policy 6 and the “Recommended Action Measures” under Goal 8 of the Lake Oswego Comprehensive Plan. They would also be inconsistent with various City of Portland TSP policies, such as Policy 6.17, which states: “Implement the Comprehensive Plan Map and the 2040 Growth Concept through long-range transportation and land use planning and the development of efficient and effective transportation projects and programs.” In particular, the No Build Alternative would not encourage the types and intensities of development called for by the applicable Comprehensive Plan designation policy language or by the Town Center 2040 Growth Concept classification of downtown Lake Oswego. In each of these instances, the Streetcar Alternative would comply or would better comply with regional and local land use plans and policies through the construction of a streetcar line, generally using exclusive transit right of way, connecting the corridor’s key activity centers. See section 3.1.4.1 and 3.1.4.2 of this DEIS for additional plan compliance findings.

C. Economic Development

The potential facilitation of economic development by the project’s alternatives is assessed using three measures (see tables 6.1-7 and 6.1-8): ability to facilitate local development and redevelopment; the change in short-term and long-term employment; and unused allowable floor area in new fixed-guideway station areas.

Table 6.1-7 Measures Assessing Effects to the Economic, Built and Natural Environment By Alternative (2035)

Criteria/Measures	No-Build	Enhanced Bus	Streetcar[1]
Economic Development[2]			
Short-Term Employment	0	240	1,430 to 1,530
Long-Term Employment	0	28	13
Available Floor Area in New Station Areas[3]	0	0	42.830 or 44.492
Potential Displacements[4]			
Residential	0	0	0 or 1
Business	0	0	0 or 6
Public/Institutional	0	0	0
Noise and Vibration[5]			
Noise Impacts Without/With Mitigation	0 / 0	0 / 0	1/0
Vibration Impacts Without/With Mitigation	0 / 0	0 / 0	23 to 28 / 0
Wetlands/Hydrology[6]			
Acres of Filled Wetland	0	0	0.10 to 0.11
Acres Temporary- Culverted Waters Impacts	0	0	0.02 to 0.03
Acres of Fill in Floodplain	0	1.3	6.5 to 10.1
Acres of New Impervious Surface	0	0.8	7.35 to 18.22
Air Quality[7]			
Reduction in Tons of CO_2 Released by Vehicles	N/A	-25.40	-40.51 or -42.12
Parks and Cultural[8]			
Number/Acres of Parks Used	0	0	0.7 or 1.0
Archaeological Sites Disturbed	0	0	0
Historic			
Resources Adversely Affected	1	1	0 or 1

Source: Metro/TriMet/URS/DEA – January 2010.
Note: all data are average weekday, unless noted.

1 Where there are two numbers for a measure within this column they represent the range in the measure that would result from different Streetcar design options in four of the project's six segments. See Table 6.1-7 for an assessment of how those measures would change by Streetcar design option.

2 Short-term employment are those jobs that would be created during construction of the project alternative. For more detail, see section 3.2. Estimates of long-term employment are compared to the No-Build Alternative and are based on changes in annual transit operating costs in 2035. See Section 2.4 for the operating cost estimates by alternative. Streetcar design options under consideration would not affect long-term employment estimates.

3 As currently allowed and in millions of square feet. New station areas are as compared to the No-Build Alternative.

4 For more detail on displacements, see section 3.3.[5] Based on average weekday p.m. peak hour conditions in 2035. Impacts are those that are categorized as *severe* using FTA's noise and vibration standards. Mitigation measures are potential and have not been incorporated into the project design. Impacts are those generated by rail transit vehicles – there would be no severe roadway noise impacts under any alternative, based on FHWA's noise standards.

6 The floodplain is defined as the 100-year floodplain mapped by Metro.

7 Tons per average weekday in 2035, compared to the No-Build Alternative.

8 The data for this measure would vary by design option only within the Lake Oswego Segment: 0.7 acres under the UPRR Right of Way design option and 1.0 acres under the Foothills design option.

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Table 6.1-8 Available Floor Area in New Station Areas within New Station Areas and Potential Displacements By Streetcar Design Option[1] (2035)

Segment/Design Option	Available Floor Area in New Station Areas[2]	Potential Displacements[3]		
		Residential	Business	Institutional
3 – Johns Landing				
Willamette Shore Line	4.450	0	0	0
Macadam In-Street	6.120	0	0	0
Macadam Additional Lane	6.120	0	1	0
5 – Dunthorpe/Riverdale				
Willamette Shore Line	0	0	0	0
Riverwood	0	1	0	0
6 – Lake Oswego				
UPRR	25.550	0	0	0
Foothills	25.550	0	5	0

Source: Metro/TriMet – January 2010.
Note: ROW = right of way; UPRR = Union Pacific Railroad.
1 Only data for segments with design options are shown. See Figure 2.2-5 for an illustration of the Streetcar design options, including station locations, by segment.
2 As currently allowed; in millions of square feet. New station areas are as compared to the No-Build Alternative.
3 A displacement would occur when an activity that has been occurring on a parcel of land can no longer occur there. A full acquisition would not result in a displacement when there are no buildings or other activities that would be interrupted by the acquisition.

- **Ability to Facilitate Local Development and Redevelopment.** Neither the No-Build Alternative nor Enhanced Bus Alternative would facilitate development or redevelopment in the corridor over existing trends. Overall, the Streetcar Alternative would be more likely to facilitate development and redevelopment in the corridor, because of the major capital investment that would be made in the corridor's transportation infrastructure and because of improved transit travel times, reliability and visibility linking the corridor's major activity centers. This conclusion is consistent with the region's experience with its existing light rail and streetcar corridors.

  Under the Streetcar Alternative in the Johns Landing Segment, there would tend to be more redevelopment with the Macadam In-Street and Macadam Additional Lane design options than with the Willamette Shore Line design option, because: 1) more land with low improvement to land value ratios would be close to the Boundary Station under the Macadam In-Street and Macadam Additional Lane design options, compared to the Willamette Shore Line design option (51acres with a ratio under two, compared to 39 acres, respectively); 2) there would be nearly twice as much unused allowed floor area in the Boundary Station area under the Macadam Options as under the Willamette Shore Line design option; 3) 25 acres in the Carolina Station area have an improvement to land value ratio under two, compared with 14 acres in the Nebraska Station area; and 4) the location of the Boundary and Carolina Stations on or near Macadam Avenue under the Macadam In-Street and Macadam Additional Lane design options would strengthen the perception of Macadam Avenue being served by streetcar, helping to improve the visibility and marketability of commercial real estate along Macadam Avenue and thereby making redevelopment more likely.

  There would be no difference in the economic development potential within the Sellwood Bridge Segment by design option. In the Dunthorpe/Riverdale Segment, the Streetcar Alternative, under either design option, would not result in any economic development potential, because the area is already developed in compliance with its single-family residential zoning. In the Lake Oswego Segment, under both options, the Streetcar Alternatives would likely result in more land redevelopment, redevelopment to more intense uses and redevelopment sooner in the station areas than under the No-Build Alternative.

- **Change in Short-Term and Long-Term Employment.** Short-term employment is the number of local jobs that would be needed to the construct the alternative and long-term employment is the number of jobs that would be needed to operate the additional transit service as a result of the alternative. The No-Build Alternative would result in no new short-term or long-term employment. The Enhanced Bus Alternative would result in 240 short-term and 28 long-term jobs, compared to the Streetcar Alternative that would result in up to 1,530 short-term and 13 long-term jobs. The differences between the two alternatives reflect the greater construction cost of the Streetcar Alternative and the greater increase in operating costs for the Enhanced Bus Alternative. The Streetcar Alternative design options would not affect short-term employment and their affect on long-term employment would be generally proportional to their difference in capital costs (see Table 3.2-6).

- **Available Floor Area.** A measure of the economic development potential of an area is the square feet of available floor area that is allowed by the local jurisdiction – the greater the area of available floor area within a station area, the greater the potential for redevelopment within the station area. The No-Build and Enhanced Bus alternatives would not result in any new station areas. There would be up to approximately 44.50 million square feet of available floor area within the Streetcar Alternative's new station areas. The new station areas in the Johns Landing Segment under the Willamette Shore Line design option would have 4.45 million square feet of available floor area, compared to 6.12 million square feet under the two Macadam design options. There would be no other differences in available floor area in any other segment.

D. Markets Served

The markets served by the project's alternatives are measured by assessing the change in transit ridership and mode split for project's primary transit markets (see Table 6.1-9). The primary transit markets within the corridor are commute trips (i.e., work and college) that travel to and from the Portland CBD, South Waterfront/OHSU, Johns Landing and Lake Oswego districts (see Figure 1.2-1). Compared to the No-Build Alternative, the Enhanced Bus Alternative would increase transit mode shares for those markets by 1 to 5 percentage points, while the Streetcar Alternative would increase transit mode shares for those markets by 2 to 11 percentage-points (average weekday, 2035). The largest percent gain in transit ridership under the Streetcar Alternative would occur to and from the Lake Oswego market, with an increase of up to 90 percent, compared to the No-Build Alternative. The largest gain in new transit commute rides would occur to and from the Portland CBD market, with up to 1,060 additional transit person trips, compared to the No-Build Alternative. The Streetcar design options in the Johns Landing Segment would result in only slight differences in the transit ridership and no differences in mode split within the corridor's primary transit markets. The other Streetcar design options would result in no differences in transit ridership or mode split for the corridor's transit markets.

6.1.6 Optimize the Environmental Sensitivity and Engineering Design of the Project

The objective to optimize the environmental sensitivity and engineering design of the project is evaluated based on: bicycle and pedestrian facilities; displacements; noise and vibration; wetland and hydrology; air quality; parks and recreation areas; historical and cultural resources; and design considerations.

Table 6.1-9 Commute[1] and Non-Commute[1] Trips Between the Lake Oswego to Portland Transit Corridor[2] and Selected LocationsBy Alternative (2035)

					Streetcar			
	No-Build		Enhanced Bus		Willamette Shore Line		Macadam Design Options	
Trips Between the Corridor and:	**Commute**	**Non-Commute**	**Commute**	**Non-Commute**	**Commute**	**Non-Commute**	**Commute**	**Non-Commute**
Portland CBD								
Person Trips	13,780	68,960	14,110	69,880	14,050	69,740	14,050	69,740
Transit Trips	5,860	9,500	6,380	9,890	6,920	9,880	6,860	9,880
Transit Mode Share	43%	14%	45%	14%	49%	14%	49%	14%
South Waterfront/OHSU								
Person Trips	14,220	107,420	14,280	107,690	14,270	107,640	14,270	107,640
Transit Trips	5,140	11,250	5,250	11,340	5,490	11,370	5,470	11,360
Transit Mode Share	36%	10%	37%	11%	38%	11%	38%	11%
Johns Landing								
Person Trips	5,760	36,840	5,840	37,520	5,830	37,390	5,830	37,400
Transit Trips	1,820	3,210	1,940	3,540	2,120	3,500	2,110	3,510
Transit Mode Share	32%	9%	33%	9%	36%	9%	36%	9%
Lake Oswego								
Person Trips	11,700	11,380	11,950	12,770	11,900	12,620	11,900	12,620
Transit Trips	1,460	840	2,080	1,090	2,770	1,280	2,680	1,240
Transit Mode Share	12%	7%	17%	9%	23%	10%	23%	10%

Source: Metro, August 2010.
Note: OHSU = Oregon Health and Science University.
[1] Commute trips are work and college person trips; non-work trips are all other person trips.
[2] See Figure 1.2-1 for an illustration of the Lake Oswego to Portland Transit Corridor and the corridor districts.

A. Bicycle and Pedestrian Facilities

The effect of the project's alternatives on bicycle and pedestrian network in the corridor is measured by assessing the change in existing and planned bicycle and pedestrian facilities. There would be no changes to the region's existing and planned bicycle and pedestrian facilities under the No-Build Alternative and the Enhanced Bus Alternative would only result in new bicycle facilities and sidewalks associated with the new park-and-ride lot in Lake Oswego. Under the Streetcar Alternative, there would be various changes to the corridor's bicycle and pedestrian facilities, as documented in Section 4.5 of this DEIS. Along certain streets where existing or planned bike lanes would parallel the tracks, the streetcar alignment would avoid bike facilities by running in the far left-hand lane (Bond Avenue south of Lowell Street). The majority of the remaining bicycle facilities would cross the proposed streetcar tracks in a generally perpendicular and safe manner. The Streetcar Alternative, with the Macadam In-Street and Macadam Additional Lane design options in Segment 3 – Johns Landing, could constrain the implementation of a future bicycle improvement on Macadam Avenue, as identified in the *Portland Bicycle Plan* for 2030.

B. Displacements

The potential displacements that could result from the project's alternatives are measured by assessing the number of residential units, businesses and public facilities that could be displaced (see Table 6.1-7). The Enhanced Bus Alternative would result in no displaced business, compared to the Streetcar Alternative, which would potentially result in up to one residential displacement and up to six business displacements, depending on design options.

In the Johns Landing Segment, the Macadam Additional Lane design option would potentially result in one displaced business, compared to no displacements under the other two design options (see Table 6.1-8). In the Dunthorpe/Riverdale Segment, the Riverwood design option would potentially result in one residential displacement, compared to no displacements under the Willamette Shore Line design option. In the Lake Oswego Segment, the Foothills design option would potentially also result in five business displacements, compared to zero under the UPRR Right of Way design option.

C. Noise

Noise impacts resulting from the project's alternatives are assessed based on the number of sensitive receptors that would be exposed to significant noise impacts without and with potential mitigation measures (see Tables 6.1-7). There would be no severe noise or vibration impacts resulting from the No-Build or Enhanced Bus alternatives. The Streetcar Alternative would result in one severe noise impact without mitigation, but that severe impact would not occur with the implementation of potential mitigation measures. Up to 28 existing buildings would experience vibration impacts from the Streetcar Alternative. However, there would be no vibration impacts to buildings with implementation of potential vibration mitigation measures.

Design options in the Johns Landing and Dunthorpe/Riverdale segments would affect the number of buildings with vibration impacts without potential mitigation measures (see Table 6.1-10). In the Johns Landing Segment, there would be unmitigated vibration impacts to three existing buildings under the Willamette Shore Line design option, compared to five buildings under the two Macadam design options. In the Dunthorpe/Riverdale Segment, there would be unmitigated vibration impacts to 19 buildings under the Willamette Shore Line design option, compared to 16 buildings under the Riverwood design option. There would be no vibration impacts to buildings with implementation of potential vibration mitigation measures.

D. Wetlands and Hydrology

The effects on wetlands and hydrology resulting from the project's alternatives are assessed using four measures (see Table 6.1-7): acres of filled wetland; acres of temporary impacts to culverted jurisdictional waters, acres of fill in the 100-year floodplain; and acres of new impervious surface. The only effect that the No-Build or Enhanced Bus alternatives would have on the wetlands and hydrology measures would be that the Enhanced Bus Alternative would require 1.3 acres of fill in the 100-year floodplain and it would result in 0.8 acres of new impervious surface. In contrast, the Streetcar Alternative would lead to up to 0.11 acres of filled wetland, up to 0.03 acres of temporary impacts to culverted jurisdictional waters, up to 10.1 acres of fill in the 100-year floodplain and up to 18.22 acres of new impervious surface.

Differences in effects upon wetlands and hydrology by Streetcar segment and design option are presented in Table 6.1-11. In the Johns Landing Segment, differences would occur among the design options for only fill in the 100-year floodplain and acres of new impervious surface. In particular, the two Macadam design options would require 1.6 acres of fill in the 100-year floodplain, compared to 2.5 acres of fill under the Willamette Shore Line design option. Further, the Macadam Additional Lane design option would lead to the greatest area of new impervious surface (i.e., 7.2 acres) with the least new impervious surface under the Willamette Shore Line design option (i.e., 0.69 acres).

Table 6.1-10 Severe Noise Impacts and Vibration Impacts without and with Potential Mitigation Measures By Segment Design Options (2035)

Segment/Design Option	Severe Noise Impacts[1]		Vibration Impacts[1]	
	Without Mitigation	With Potential Mitigation	Without Mitigation	With Potential Mitigation
1 – Downtown Portland	0	0	0	0
2 – South Waterfront[2]	0	0	0	0
3 – Johns Landing				
Willamette Shore Line	0	0	3	0
Macadam In-Street	0	0	5	0
Macadam Additional Lane	0	0	5	0
4 – Sellwood Bridge[2]	0	0	4	0
5 – Dunthorpe/Riverdale				
Willamette Shore Line	4	0	19	0
Riverwood	4	0	16	0
6 – Lake Oswego				
UPRR	0	0	0	0
Foothills	0	0	0	0

Source: Metro/TriMet – January 2010.
Note: ROW = right of way; UPRR = Union Pacific Railroad.
1 Based on average weekday p.m. peak hour conditions in 2035. Impacts are those that are categorized as *severe* using FTA's noise and vibration standards. Mitigation measures are potential and have not been incorporated into the project design. Impacts are those generated by rail transit vehicles – there would be no severe roadway noise impacts under any alternative, based on FHWA's noise standards. There would be no severe noise impacts or vibration impacts in the South Portal Segment and noise and vibration analyses were not conducted for the Downtown Portland Segment.
2 The South Waterfront and Sellwood Bridge Segments contain potential construction phasing options associated with the Streetcar alignment. See Section 3.17 Phasing for more information regarding phasing options and the differences between those options.

Table 6.1-11 Effects on Wetlands and Hydrology By Segment Design Options (acres)

Segment/Design Option	Wetland Filled	Temporary Impacts to-Culverted Waters	Floodplain Filled[1]	New Impervious Surface
1 – Downtown Portland	0	0	0	0
2 – South Waterfront[2]	0.07	0	0.1	3.54
3 – Johns Landing				
Willamette Shore Line	0.01	0.0	2.5	0.69
Macadam In-Street	0.01	0.0	1.6	6.15
Macadam Additional Lane	0.0	0.0	1.6	7.20
4 – Sellwood Bridge	0.02	0.01	4.4	0.00
5 – Dunthorpe/Riverdale				
Willamette Shore Line	0.01	0.01	2.7	0.37
Riverwood	0.01	0.01	0.0	2.46
6 – Lake Oswego				
UPRR	0.00	0.01	0.4	2.75
Foothills	0.00	0.00	0.4	5.02

Source: Metro/TriMet – January 2010.
Note: U ROW = right of way; PRR = Union Pacific Railroad.
1 The floodplain is defined as the 100-year floodplain mapped by Metro.

In the Dunthorpe/Riverdale Segment, there would be no difference between the design options in the number of acres of wetland filled (i.e., 0.01 acres). The Willamette Shore Line design option would result in 2.7 acres of fill in the floodplain and 0.37 acres of new impervious surface, compared to 0.0 acres of floodplain fill and 2.46 acres of new impervious surface under the Riverwood design option. In the Lake Oswego Segment there would be no wetlands filled. The UPRR Right of Way design option would result in 0.01 acre of temporary impacts to culverted waters and 2.75 acres of new impervious surface, compared to no temporary impacts to culverted waters and 5.02 acres of new impervious surface under the Foothills design option.

E. Air Quality

Change in air quality is assessed by calculating the tons of regional carbon dioxide released by vehicles under each of the alternatives (average weekday, 2035). As shown in Table 6.1-7, the Enhanced Bus Alternative would result in a reduction of 0.46 tons of carbon dioxide and the Streetcar Alternative would result in a reduction of up to 0.77 tons of carbon dioxide.
Only design options in the Johns Landing Segment would affect the number of tons of carbon dioxide emissions. Under the Willamette Shore Line design option, the Streetcar Alternative would reduce carbon dioxide emissions by 42.12 tons per average weekday in 2035, compared to a reduction of 40.51 tons under the two Macadam design options (in relationship to the No-Build Alternative).

F. Parks

The effect of the project's alternatives on public parks and recreation areas in the corridor is measured by assessing the acres of public park and/or recreation areas that would be used by the project and potentially-sensitive archaeological sites that would be disturbed (see Table 6.1-7). None of the alternatives would result in the disturbance of any known potentially-sensitive archaeological sites. The No-Build and Enhanced Bus alternatives would not use any park or recreation land. The Streetcar Alternative could potentially require the use of up to 1.0 acres of park land, affecting one park in the Lake Oswego Segment. In the Lake Oswego Segment, the UPRR Right of Way design option would use 0.7 acres of parkland, compared to 1.0 acres under the Foothills Realignment design option. FHWA, Metro and TriMet have preliminary determined that the use of that park resource by the Streetcar Alternative would be a *de minimis* impact. The final section 4(f) analysis will be conducted as part of the FEIS.

G. Historic Resources

The effect on historic resources by the project's alternatives is measured by assessing the number of historic resources that would be adversely affected (see Table 6.1-7). The No-Build and Enhanced Bus alternative would likely result in an adverse indirect impact to one historic resource, the Red Electric Eastside Rail Line. The Streetcar Alternative could have either an effect, but no adverse effect, or an adverse effect on the Red Electric Eastside Line, depending on design refinement and mitigation decisions to be made within Preliminary Engineering, if the Streetcar Alternative is selected as the LPA. Final determination of the Streetcar Alternative's effect on the Red Electric Eastside Rail Line will be made by FTA, in consultation with the OSHPO, during Preliminary Engineering, if the Streetcar Alternative is selected as the LPA. No other historic resource would be adversely affected by any of the alternatives.

H. Design Consideration

Design considerations of the project's alternatives are assessed by describing the major engineering consideration. There would be no major engineering considerations for the No-Build or Enhanced Bus alternatives. For the Streetcar Alternative, the major engineering considerations would be:
1) coordination of the Streetcar design and construction with pending roadway improvement projects in the South Waterfront, Sellwood Bridge and Lake Oswego segments; 2) reconstruction of existing trestles to meet current design standards; 3) reconstruction of the existing tunnel to meeting current design standards; 4) coordination of design with future trail projects; and 5) design refinements and mitigation measures related to avoiding adverse effects to the Red Electric Eastside Line.

6.2 Tradeoffs between the Alternatives and Design Options

This section summarizes the tradeoffs in effectiveness between the project's alternatives and the streetcar alternative design options in the three of the six project segments.

6.2.1 Tradeoffs between the Alternatives

This section summarizes the tradeoffs in effectiveness between the project's alternatives, based on the evaluation measures in Section 6.1. There are three alternatives under study: the No-Build Alternative; the Enhanced Bus Alternative, and the Streetcar Alternative. All data within this section are for average weekdays in 2035, unless otherwise noted.

A. Enhanced Bus Alternative Compared to the No-Build Alternative

Compared to the No-Build Alternative, the **Enhanced Bus Alternative** would result in:

- 31,620 additional transit place miles
- 41,000 fewer vehicle miles traveled, 3,300 fewer vehicle hours traveled and 200 fewer vehicle hours of delay
- 270 more transit riders on Highway 43 and Southwest Corbett Avenue in the peak hour in the peak direction within Johns Landing
- A reduction three minutes in in-vehicle transit travel time from PSU and SW Lowell Street to downtown Lake Oswego during the peak period
- An increase of 0.1 corridor transit miles per hour
- 730,550 annual systemwide transit person trips
- 240 additional short-term construction jobs and 28 additional long-term jobs
- A reduction of 25.40 tons of CO_2 released by vehicles

While the **No-Build Alternative** would avoid:

- $37.8 million in capital costs (2010 dollars)
- $2.79 million additional annual operating costs (2010 dollars in 2035)
- Higher congestion levels at three congested intersections
- 1.3 acres of fill in the 100-year floodplain and 0.8 acres of new impervious surface

B. Streetcar Alternative Compared to the No-Build Alternative

Compared to the No-Build Alternative, the **Streetcar Alternative** would result in:

- Up to 54,160 additional transit place miles per weekday
- Up to 68,000 fewer vehicle miles traveled, up to 5,700 fewer vehicle hours traveled and 400 fewer vehicle hours of delay
- 200 fewer vehicles on Highway 43 during the peak hour in the peak direction in Johns Landing and in Lake Oswego (under the Willamette Shore Line design option)
- 370 or 570 more transit riders on Highway 43 in the peak hour in the peak direction within Johns Landing
- 12,080 households and 24,920 additional jobs within new streetcar station areas
- The addition of up to 4.8 miles of exclusive transit right of way and up to 39,700 additional passenger miles within exclusive transit right of way
- A reduction of up to 13 and 14 minutes in in-vehicle transit travel time from PSU and SW Lowell Street, respectively, to downtown Lake Oswego during the peak period and a reduction of one minute of in-vehicle automobile travel time from PSU to downtown Lake Oswego during the peak period

- An increase of up to 1.7 corridor transit miles per hour
- 1.18 or 1.28 million additional annual systemwide transit person trips
- Compliance with the RTP and local plans and policies related to the use of high-capacity transit links between major activity centers in the corridor
- The addition of up to 42,830 square feet of available floor area within new streetcar station areas
- Up to 1,530 additional short-term construction jobs and 27 additional long-term jobs
- A reduction of up to 42.12 tons per day of CO_2 released by vehicles

While the **No-Build Alternative** would avoid:
- Up to $347.4 million in capital costs (2010 dollars)
- $1.25 million additional annual operating costs (2010 dollars)
- Up to one potential residential and up to seven potential business displacements
- The potential displacement of up to 148 on-street and 175 off-street parking spaces
- Higher congestions levels at two congested intersections
- One severe noise impact without potential mitigation and up to 28 vibration impacts without mitigation (there would be no noise or vibration impacts with the potential mitigation measures)
- Up to 0.11 acres of filled wetland, 0.03 acres of temporary impacts to culverted waters, 10.1 acres of fill in the 100-year floodplain and 18.22 acres of new impervious surface
- Up to 1.0 acres of parkland used in one park

6.2.2 Tradeoff between the Streetcar Design Options

This section summarizes the tradeoffs in effectiveness between the Streetcar Alternative's design options in three of the project's six segments, based on the evaluation measures in Section 6.1. Those three segments are: Segment 3 – Johns Landing; Segment 5 – Dunthorpe/Riverdale; and Segment 6 – Lake Oswego. All data in this section are based on operations in 2035, 2010 dollar capital costs and 2010 dollar operating costs.

A. Segment 3 – Johns Landing

There are three design options under consideration within the Johns Landing Segment: 1) Willamette Shore Line; 2) Macadam In-Street; and 3) Macadam Additional Lane. Following is a summary of the primary advantages of each design option.

The **Willamette Shore Line Design Option** would result in:
- Avoiding the potential net loss of 148 to 175 parking spaces compared to the Macadam In-Street design options.
- 200 additional transit riders on Highway 43 in Johns Landing in the peak period and peak direction
- An additional 0.7 miles of exclusive transit right of way and an additional 7,200 passenger miles in exclusive transit right of way
- An additional four minutes of transit in-vehicle travel time savings from PSU and SW Lowell Street to Lake Oswego during the peak period
- The avoidance of up to $13.7 million in capital costs
- $8.9 million more local match available from the use of the existing Willamette Shore Line right of way
- Avoidance of two vibration impacts (all vibration impacts in this segment would be eliminated with the identified potential mitigation measures)

- The reduction of 1.61 tons of CO_2 emitted by vehicles
- 97,250 more annual transit person trips
- No displacements
- The avoidance of up to 6.5 acres of new impervious surface

The **Macadam In-Street Design Option** would result in:

- One more optional new streetcar station at SW Pendleton Street
- 2,760 more transit place miles[1]
- Greater visibility within the Johns Landing activity center, thus providing better support to the desired land use and economic development objectives for the activity centers[1]
- 1.67 million more square feet of Available Floor Area within new station areas[1]
- No displacements
- Approximately one acre less of new impervious surface[2]
- 0.9 fewer acres of floodplain filled[1]

The **Macadam Additional Lane Design Option** would result in:

- 2,760 more transit place miles[1]
- Greater visibility within the Johns Landing activity center, thus providing better support to the desired land use and economic development objectives for the activity centers [1]
- 1.67 million more square feet of available floor area within new station areas, thus providing for more development/redevelopment opportunities[1]
- One potential commercial displacement
- 0.9 fewer acres of floodplain filled[1]

B. Segment 5 – Dunthorpe/Riverdale

There are two design options under consideration within the Dunthorpe/Riverdale Segment: 1) Willamette Shore Line; and 2) Riverwood. Following is a summary of the primary advantages of each design option.

The **Willamette Shore Line Design Option** would result in:

- An additional 0.3 miles of exclusive transit right of way
- $10.2 million more local match available from the use of the existing Willamette Shore Line right of way
- No displacements in the segment, thus avoiding one potential residential displacement
- Avoidance of two acres of new impervious surface

The **Riverwood Design Option** would result in:

- A savings of $500,000 in capital costs
- Avoidance of three vibration impacts (all vibration impacts in this segment would be eliminated with the identified potential mitigation measures)
- Approximately one acre less of new impervious surface

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[1] Than the Willamette Shore Line Design Option.
[2] Than the Macadam Additional Lane Design Option – it would result in 0.29 additional acres of new impervious surface compared to the Willamette Shore Line Design Option.

- 2.7 fewer acres of floodplain filled (there would be no fill in the segment under the Riverwood design option)

C. Segment 6 – Lake Oswego

There are two design options under consideration within the Lake Oswego Segment: 1) UPRR Right of way; and 2) Foothills. Following is a summary of the primary advantages of each design option.

The **UPRR Right of Way design option** would result in:

- A savings of $21.3 million in capital costs
- Five fewer potential business displacements
- 2.3 fewer acres of new impervious surface
- 0.5 miles of additional transit-exclusive right of way
- 0.3 fewer acres of parkland used

The **Foothills design option** would result in:

- Avoidance of four noise impacts (all noise impacts in this segment would be eliminated with the identified potential mitigation measures)
- Avoidance of temporary impacts to culverted waters

6.3 Social Equity Considerations

The project's assessment of the alternatives' impacts to low-income and minority populations is summarized in Section 3.18 of this DEIS. This analysis concludes that there would be no disproportionate and high adverse impact to low-income or minority populations as a result of any of the No-Build, Enhanced Bus or Streetcar alternatives.

6.4 Section 5309 Evaluation

This section provides a brief summary of the Federal Section 5309 New Starts and Small Starts evaluation process and measures, based on FTA's *Reporting Instructions for the Section 5309 New Starts Criteria* (July 2009), and on the *Update Interim Guidance and Instruction: Small Starts Provision of the Section 5309 Capital Investment Grants Program* (July 20, 2007), respectively, which are used to guide local project sponsors of proposed New Starts and Small Starts projects in the submittal of data and supporting information addressing the Section 5309 New Starts criteria.

The Section 5309 New Starts program is the federal government's primary program for providing major capital support to locally planned, implemented and operated fixed-guideway transit projects. The New Starts evaluation process is used in conjunction with the evaluation process under NEPA for which this DEIS has been prepared. This section describes the how FTA evaluates projects for its New Starts funding recommendations. Each year FTA submits its *Annual Report on Funding Recommendations* to Congress as a companion document to the annual budget submitted by the President. The report provides recommendations for the allocation of New Starts funds under Section 5309 of Title 49 of the United States Code.

The current financial analysis for the project is based on varying levels of Small Starts funding for the Enhanced Bus Alternative and of News Starts funding for the Streetcar Alternative (see Chapter 5). Depending on the alternative selected as the LPA, the project would undertake the New Starts or Small Starts Section 5309 grant request process, which would address the New Starts or Small Starts evaluation measures, summarized as follows. Prior to authorizing the project's entry into either

Preliminary Engineering (under New Starts) or Project Development (under Small Starts), FTA would review the project's justification criteria, which would be submitted by the local project sponsor and grant recipient. FTA reviews the project's justification and local financial commitment criteria for each candidate project and assigns a rating for each criterion. For some of the project justification criteria, the proposed project is compared against a New Starts baseline alternative. The New Starts baseline alternative consists of improvements to the transit system that are relatively low in cost and represent the best that can be done to improve transit without major capital investment in new guideway infrastructure. As such, the New Starts baseline alternative is usually different from the No-Build Alternative, which is the NEPA baseline against which environmental impacts are measured in this DEIS.

A candidate project is given an overall rating of "High," "Medium-High," "Medium," "Medium-Low," or "Low," based on ratings assigned by FTA to each of the project justification and local financial commitment criteria described above. These ratings are important, because FTA considers them in its decision to recommend projects for New Starts funding. Specifically, FTA will not recommend funding for projects which are rated "Medium-Low" or "Low." Moreover, federal budget constraints mean that a "High," "Medium-High," or "Medium" rating does not automatically translate into a funding recommendation, although the potential for receiving New Starts funding is much greater with these ratings.

The New Starts evaluation of a project is an on-going process. FTA's evaluation and rating occurs annually in support of budget recommendations presented in the *Annual Report on Funding Recommendations* and intermittently when the project sponsor requests FTA approval to enter into Preliminary Engineering or final design (or project development for a Small Starts project). Consequently, as proposed New Starts projects proceed through the project development process, information concerning costs, benefits and impacts is refined and the ratings are updated to reflect new information.

6.4.1 New Starts Evaluation Measures

As required by the Safe Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), FTA uses project justification and financial commitment criteria to evaluate New Starts projects. In total, the criteria are intended to measure the overall merits of the project and the sponsor's ability to build and operate it.

6.4.1.1 Project Justification Criteria

The project justification under the New Starts program takes into account the following six factors:

A. Mobility Improvements
In its evaluation of the mobility improvements that would be realized by implementation of a proposed project, FTA evaluates four measures:

User Benefits essentially represent all the travel time savings to transit riders in the forecast year that result from the New Starts project as compared to the New Starts baseline alternative. The benefits include reductions in walk times, wait times, transfers, and, most importantly, in-vehicle times. In order to rate projects in comparison to other proposed New Starts, this measure is normalized by the annual passenger miles traveled on the New Starts project in the forecast year. The result is a measure of the intensity of the user benefits.

Number of Transit Dependent Individuals Using the Project and Transit Dependent User Benefits per Passenger Mile on the Project: These two measures represent the number of transit dependents affected by the project and the intensity of the benefits to those transit dependent users. The first is self-explanatory, while the second is defined the same as the measure of user benefits per passenger mile described above, but for transit dependent passengers.

Share of User Benefits Received by Transit Dependents Compared to Share of Transit Dependents in the Region: This measure represents the extent to which the project benefits transit dependents compared to their regional representation. For example, if 10 percent of the user benefits for the project accrued to transit dependents, but they represented 20 percent of the region's population, the measure would be 0.5, indicating that the project did not benefit transit dependents compared to their share of the region's population.

B. Environmental Benefits

In its evaluation of environmental benefits that would be realized through the implementation of a proposed project FTA considers the current air quality designation of the project area by the U.S. Environmental Protection Agency (EPA). This measure is defined for each of the transportation-related pollutants (ozone, CO, and PM_{10} and $PM_{2.5}$) as the current air quality designation by EPA for the metropolitan region in which the proposed project is located, indicating the severity of the metropolitan area's noncompliance with the health-based EPA standard (NAAQS) for the pollutant, or its compliance with that standard. FTA has found that the air quality information submitted to assess the environmental benefits does not significantly distinguish the competing New Starts projects. While FTA reports the information submitted by project sponsors on environmental benefits to Congress in the *Annual Report on Funding Recommendations*, it does not formally incorporate this measure in its evaluation of New Starts projects.

C. Operating Efficiencies

Based upon its prior experience in evaluating New Starts projects, FTA has previously determined that locally generated and reported information in support of the operating efficiencies criterion does not distinguish in any meaningful way differences between competing major transit capital investments. FTA further believes that the anticipated operating efficiencies of proposed New Starts projects are adequately captured under its measure for evaluating project cost-effectiveness.

D. Cost-Effectiveness

Significant among the project justification criteria is cost-effectiveness, which is the annualized capital and operating cost per hour of user benefits for the forecast year. It captures the additional costs of the New Starts project compared to the transportation benefits to transit riders. User benefits are defined identical to the measure used in the mobility improvements criterion. New Starts projects must be rated "Medium" for cost-effectiveness, in addition to receiving an overall "Medium" rating, in order to be considered by the FTA for New Starts funding.

E. Transit-Supportive Land Use

This criterion reflects the population and employment densities within 0.5 mile of each proposed station in the project.

F. Economic Development
This criterion addresses the extent that transit-oriented development is likely to occur in the New Starts project's corridor. FTA explicitly considers the following transit-supportive land use categories and factors:

1. Transit-Supportive Plans and Policies, including the following factors:
   - Growth management;
   - Transit-supportive corridor policies;
   - Supportive zoning regulations near transit stations; and
   - Tools to implement land use policies.

2. Performance and Impacts of Policies, including the following factors:
   - Performance of land use policies; and
   - Potential impact of transit project on regional land use.

6.4.1.2 Local Financial Commitment

Proposed New Starts projects must be supported by evidence of stable and dependable financial resources to construct, operate and maintain the existing and the new transit system. The measures FTA uses to evaluate local financial commitment are:

A. Local Share
FTA examines the proposed share of total project costs from sources other than Section 5309 New Starts, including federal formula and flexible funds, the local match required by federal law, and any additional capital funding.

B. Strength of Capital Financing Plan
FTA looks at the stability and reliability of the proposed capital financing plan, including the current capital condition of the project sponsor, the level of commitment of capital funds to the proposed project and to other projects, the financial capacity of the project sponsor to withstand cost overruns or funding shortfalls, and the reliability of the capital cost estimates and planning assumptions.

C. Strength of Operating Financing Plan
FTA looks at the ability of the sponsoring agency to fund operation and maintenance of the entire transit system (including existing service) as planned, once the guideway project is built. This analysis includes: an examination of the current operating condition of the project sponsor; the level of commitment of operating funds for the transit system; the financial capacity of the project sponsor to operate and maintain all proposed, existing, and planned transit services; and the reliability of the operating cost estimates and planning assumptions.

6.4.2 Small Starts Evaluation Measures

FTA Section 5309 New Starts evaluation measures to:

- Assign ratings to proposed Small Starts projects for the purpose of deciding whether the projects may advance into the Project Development phase, which includes Preliminary Engineering and Final Design;

- Assign ratings to proposed Small Starts projects for the *Annual Report on Funding Recommendations* in support of funding recommendations for the Administration's annual budget request; and

- Determine final ratings for New Starts projects at the time of the execution of a Project Construction Grant Agreement

Until the issuance of the final rule, the Small Starts evaluation framework and measures will be consistent with the framework established for evaluating New Starts, with the exception that fewer measures are required and their development is simplified.

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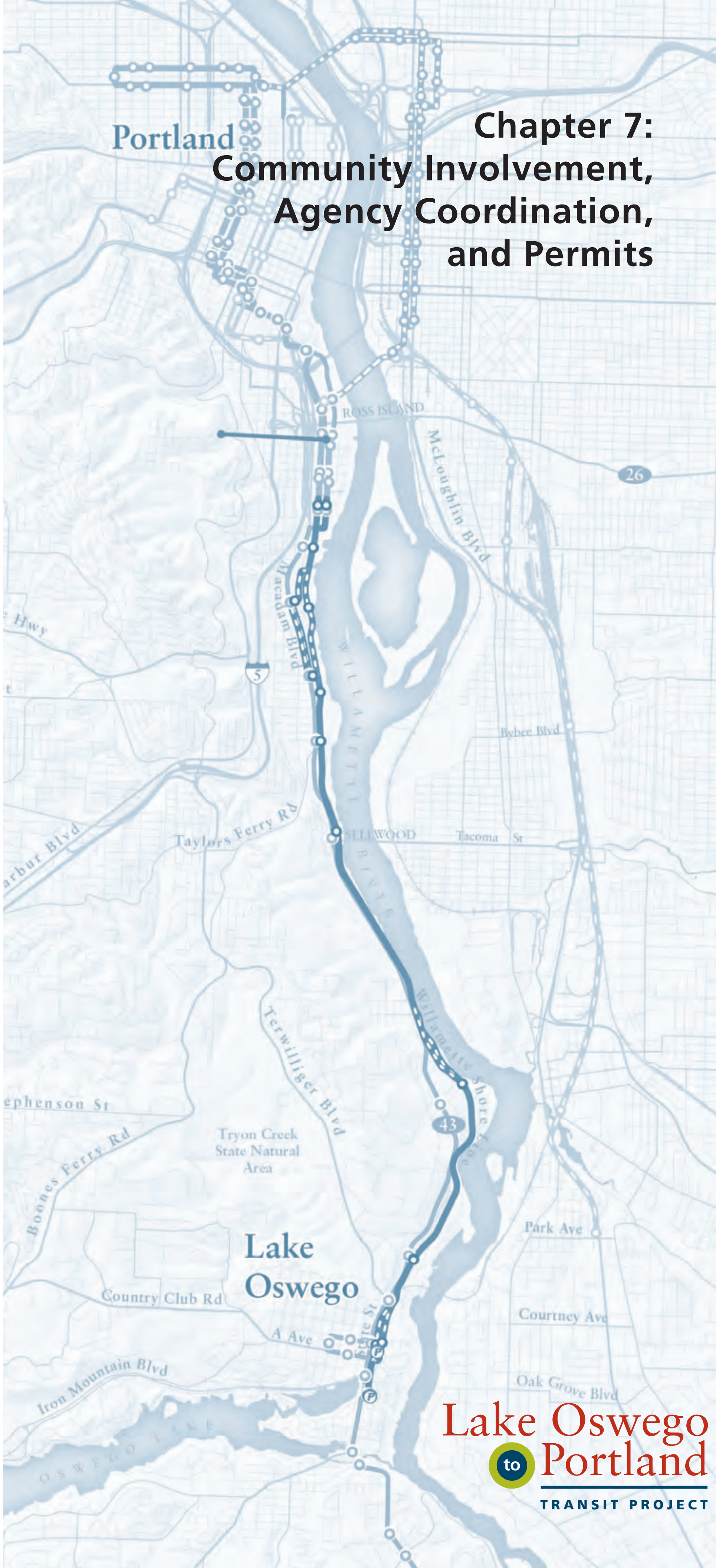
Chapter 7:
Community Involvement, Agency Coordination, and Permits

CHAPTER 7



Lake Oswego to Portland

TRANSIT PROJECT

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7. COMMUNITY PARTICIPATION, AGENCY COORDINATION AND PERMITS

This chapter summarizes the efforts of the Lake Oswego to Portland Transit Project (LOPT) staff to engage members of the public and federal, state and local agencies in project development activities through the publication of the project's Draft Environmental Impact Statement (DEIS) and selection of the project's locally preferred alternative (LPA). The project has evolved through several phases of planning and project development, each with a unique set of public and agency engagement objectives and efforts. The project staff will continue to engage the public and agencies after the DEIS publication through a variety of efforts specifically defined for each future phase of the project. For additional information about agency coordination and/or to review a copy of the project's Public Involvement Plan, refer to the *Lake Oswego to Portland Transit Project: Section 6002 Coordination Plan* (LSA/URS and TriMet/Metro, September, 2009).

7.1 Community Participation

This section summarizes the community participation process for the project, describing past activities and activities that are planned for the public comment period following publication of this DEIS and leading to the selection of an LPA for the corridor. Additional information on community participation activities can be found in Section 2.1, Screening and Selection Process and Alternatives and Options Previously Considered.

7.1.1 Goals of the Community Participation Program

The goal of project-related communication and public involvement is to engage, early and often, the community along the corridor, broader community interests and stakeholders, and those who use Highway 43 as transit riders or drivers, seeking to share project information and understand community concerns and preferences so they can inform the transit solutions considered for advancement.

In order to achieve this goal, Metro, TriMet, the cities of Lake Oswego and Portland, Clackamas and Multnomah counties, ODOT, and Portland Streetcar, Inc. have offered multiple opportunities for the public to obtain information about the project and provide feedback, including:

- **Early involvement**: A public scoping meeting was held on April 16, 2008 and followed by a 93-day comment period (through July 18, 2008), to allow for comments on the project Purpose and Need statement, alternatives to be considered, and any specific environmental or community issues that need to be addressed in this DEIS. Public comments on the project scope are documented in the *Lake Oswego to Portland Transit Project: Public Scoping Report* (August 2008).

- **Information sharing**: Project updates have been and will continue to be available on Metro's website and from links on project partner websites, as well as by project newsletters and fact sheets. Metro has held open houses and has provided information at area events, community meetings, local grocery stores, and farmers' markets to make information accessible to a wide range of local residents and corridor commuters. The project team has held targeted meetings to interact with stakeholders and property owners. At the time of its publication, this DEIS will be posted on the website and CDs and/or hard copies made available at TriMet, Metro, the cities of Portland and Lake Oswego, Clackamas and Multnomah counties, and area libraries. After its publication, and before a decision is made on the LPA, the project will hold additional open houses and a public hearing, and provide information through local organization and school newsletters, at additional area events, community meetings and local grocery stores and through canvassing in the corridor and e-mail, U.S. Mail and newspaper notifications.

- **Input from local experts**: The project's Community Advisory Committee (CAC) was appointed in late 2009. The CAC members were selected to represent a broad cross section of the community in the study corridor, and includes neighborhood, business, advocacy group and commuter, transit-dependent, elderly and disabled representatives who have been charged with advising the project Steering Committee on key tradeoffs, like which alignment and/or design options would best move people through the corridor while making it a great place to live, work, and play. Additional information on the CAC is below in Section 7.1.2.

- **Comments and preferences**: Prior to selection of a LPA, a 45-day public comment period will allow interested parties to submit comments on this DEIS document and express preferences related to the LPA. Comments received via the website, e-mail, and U.S. Mail or collected at open houses and the public hearing will be compiled, reviewed, and summarized by project staff and shared with decision-makers. The Final Environmental Impact Statement (FEIS) will provide a response to the comments.

Public involvement and participation have also been instrumental in previous phases of the project: an Alternatives Analysis conducted between July 2005 and December 2007 and a refinement phase which proceeded the DEIS. These earlier public involvement efforts included:

- Proactive public involvement and information sharing to provide comprehensive and understandable project related information;
- Public notice via e-mail, U.S. Mail and canvassing prior to public meetings about the project;
- Public access to and involvement in key actions and decisions, such as the selection of alternatives to advance to a DEIS at the conclusion of the Alternatives Analysis or when the Steering Committee was considering narrowing of study alternatives during the refinement phase;
- Outreach to segments of the community that typically do not become involved in transportation planning or project development activities, such as those with low incomes, minorities, elderly, disabled and those with limited English proficiency; and
- Support for early and continuous involvement of the public.

See 7.1.6 below and Appendix B for supporting documentation on public outreach.

7.1.2 General Elements of the Community Participation Program

This section summarizes the elements of the community participation and outreach program.

Community Advisory Committee (CAC) – Twenty-three members were appointed by the project Steering Committee in late 2009. An open recruitment process was used to identify potential resident, business, commuter, and advocacy group members. Phone interviews and a balance of interests and geographical representation were considered in selecting members. Members were asked to attend monthly CAC meetings and act as liaisons to their communities and other stakeholders or interest groups. Metro publicizes the CAC meetings and makes available all CAC meeting agendas and packets on the website and through e-mail notification to members and interested persons on the project e-mail list. Project information has been shared and discussed by members to consider tradeoffs of the DEIS alternatives and design options relative to community needs and concerns. Presentations on DEIS topics are made by project staff and technical experts. The CAC has provided ongoing input on issues addressed in this DEIS, the range of impacts identified, and potential types of mitigation that the community could support as the project proceeds to the FEIS and Preliminary Engineering. The CAC will make a recommendation to the Steering Committee and sponsoring agencies on potential station locations and other design refinements. With consideration for all CAC member perspectives, this will include points of consensus as well as minority opinions.

Metro website – Information has been regularly updated on the project website to provide readers with an understanding of the current status of work on the project, as well as background and next steps. Opportunities for public engagement are posted and updated on the website, which also includes materials presented to the CAC and Steering Committee. Materials from public open houses or events have been posted to the website along with an online comment form to solicit public input from a wider range of participants.

E-mail and new media – Outlets, such as Metro planning and Councilor newsfeeds and local government and community blogs, have been used to connect with the public and inform them of the project. A middle school class from the corridor learned about the project and how to create new media resources to reach out to the broader community about the project with project staff coordination. Project staff provided to the students project information and liaisons to interview so that the class might produce podcasts and timelines, which were published on the project website.

Newsletters and fact sheets – Periodic updates were provided to property owners and interested persons in the form of project newsletters and fact sheets, distributed via e-mail, regular U.S. Mail, the website, at meetings and through project partners.

Events, activities, and presentations – Staff from the cities of Portland and Lake Oswego, Multnomah and Clackamas counties, Metro, TriMet, Portland Streetcar, Inc., and ODOT and consultants participated in community events and activities and at neighborhood, community, business and property owner meetings to share and discuss project information. In addition, staff organized small group discussions with commuters to corridor colleges and universities, business owners, and employer and advocacy groups to discuss the alternatives and design options in the corridor, specifically focusing on how they would affect commuters. The Steering Committee co-chairs participated in a majority of these meetings and discussions.

Earned media – The project team coordinated with local news media and new media to describe the project, explain its timeline, highlight opportunities for involvement, discuss relevant issues, and frame possible outcomes.

Postcard notification – In order to ensure awareness of the project and project decision-making processes, Metro sent a postcard notice to all property owners near the proposed alignments and design options and to other interested parties. This notice announced the publication of this DEIS and described opportunities to participate in the formal public comment period prior to LPA selection. The postcard referred recipients to the website for more detailed information.

Promotion and advertising – In addition to sharing public participation opportunities via new media, like blogs and social networking sites, upon publication of this DEIS, Metro placed an advertisement in area newspapers to announce opportunities for public participation and to refer recipients to the website for more detailed information. The advertisements were placed in advance of the public comment period and prior to the project's public hearing.

Canvassing and property owner notices and meetings – All property owners potentially affected by the project were notified via U.S. Mail. Some property owners were individually contacted by project staff and consultants as part of the public engagement process. This took the form of canvassing areas along the alignment to ensure project awareness and invite participation. Targeted property owner meetings were held to discuss details of specific potential effects.

Visual renderings and simulations - Sketches and visual simulations of the current concept design for the project study alternatives and design options were used to increase public understanding and encourage meaningful input on design, environmental review, and selection of the LPA.

Public comment period – To meet federal requirements and provide ample time for comments on this DEIS, a 45-day comment period follows DEIS publication of this DEIS. Public comments received will inform the LPA decision-making process and be included and addressed in the project's FEIS.

Open houses/public events – After publication of this DEIS and prior to LPA selection, TriMet, Metro and local jurisdictions will hold at least two open houses to request where interested persons will have an opportunity to ask questions and offer comments on the DEIS analysis and which alternative and design options best meet the needs of the corridor. Staff may also use other community events to supplement public outreach during the DEIS comment period.

Public hearing – To meet federal requirements and provide an opportunity for the public to address decision-makers, a public hearing will be held at least 15 days after publication of the notice of availability of this DEIS in the *Federal Register*, during the public comment period, and prior to the LPA decision.

7.1.3 Environmental Justice Outreach and Compliance

This section summarizes the project's compliance with the federal environmental justice requirements for public outreach. Refer also to Section 3.18, Environmental Justice, Elderly and Disabled Populations for a summary of the project's compliance with environmental justice requirements.

Early in the DEIS, Metro staff evaluated the 2000 U.S. Census data for the corridor and reviewed other past documentation of the project area to identify potential concentrations of low-income, Hispanic, or minority residents. Low-income persons reside in the Old Town/Chinatown, Downtown Portland, South Portland, South Burlingame, Collins View and Evergreen neighborhoods. Persons of minority racial/ethnic status reside in the South Portland neighborhood. In addition, relative to other sensitive populations, a higher than average percentage of persons over 65 reside in the majority of the neighborhoods within the corridor. As part of the advertisement efforts described in 7.1.2, Metro included local ethnic-focused newspapers to ensure minority and Hispanic awareness of project related outreach activities. The 2000 U.S. Census data related to low-income, minority, and Hispanic populations is provided in Section 3.18, Environmental Justice, Elderly and Disabled Populations.

To respond to the presence of low-income and minority populations in the corridor, project information was provided at neighborhood farmers markets, grocery stores or by canvassing areas with low-income and minority populations and shared through school and community publications or websites in these areas. This served to raise awareness about the project and be sure people were prepared to participate in discussion about and selection of the locally preferred alternative. NOTE: Segment 1 will not see significant capital improvements or impacts as a result of the project but may see some additional and/or different bus and streetcar service depending on the alternative selected.

To address the presence of elderly populations throughout the corridor, the project provided presentations to numerous groups whose members are mainly over 65 (examples include the Lake Oswego Adult Community Center, the 50-Plus Advisory Board and the Lake Oswego Women's Coalition). Group members were also asked to network and share project information with elderly populations throughout the corridor. In addition, a Community Advisory Committee member was designated to represent the elderly population. This designee was selected from the existing CAC membership, as several members are over age 65. Around publication of the DEIS, when the public comment period is open and public events and a public hearing are occurring, information will be shared via the project website, written materials, community sites, events, and/or canvassing in specific areas. Additional electronic notification will be distributed to members of the groups mentioned above and featured on the on the Meals on Wheels website.

7.1.4 Compliance with Federal, State and Regional Regulations

Metro's *Public Involvement Planning Guide* ensures that the appropriate publics are involved in each project, that adequate notice of meetings and decision points are provided, and that a variety of appropriate public involvement strategies are employed for each project. FTA also provides guidance and review to ensure that the requirements of the National Environmental Policy Act (NEPA) and other applicable federal laws are met. The Oregon Statewide Planning program requires public engagement in planning activities through the Land Conservation and Development Commission's Goal 1: Citizen Involvement[1]. The public involvement effort for this DEIS also complies with Metro's *Public Involvement Policy for Transportation Planning*. Metro's policy exceeds federal and state requirements for public involvement and notification.

7.1.5 DEIS Public Comment Period and Adoption of the LPA

The publication of this DEIS in the *Federal Register* will initiate a public comment period. By federal requirement, the public comment period must be a minimum of 45 days and a maximum of 60 days. At the conclusion of the public comment period, the sponsoring agencies will begin a process to select the preferred alternative and, if applicable, design options. A concerted effort will be made during the public comment period to inform and engage community members, using the tools described above. The activities will include community group briefings, newsletters, website updates, online comment, open houses, a public hearing, and CAC meetings.

At the conclusion of the public comment period, public comments and concerns will be taken into account as the public agencies consider a preferred alternative and, if applicable, design options. After consideration of the public comments, the CAC will make a recommendation on a locally preferred alternative to the Steering Committee. Each involved agency and jurisdiction will review

[1] http://www.oregon.gov/LCD/docs/goals/goal1.pdf

and vote on the Steering Committee's LPA recommendation. Local jurisdictions will, at their discretion, provide a public comment opportunity prior to voting on the recommendation. The LPA recommendations from the Steering Committee and supporting agencies and jurisdictions will be reviewed by the Joint Policy Advisory Committee on Transportation (JPACT). JPACT will forward a final recommendation to the Metro Council for consideration and adoption. The Metro Council will hold a public hearing prior to adopting the LPA.

7.1.6 Public Participation Efforts in Previous Project Phases

Public involvement activities were undertaken by project staff within the previous major project phases, prior to initiating this DEIS phase. The key previous activities are summarized below. Section 2.1, Screening and Selection Process and Alternatives and Options Previously Considered, provides a project timeline and more detailed description of theses project phases.

A. Pre-Alternatives Analysis

In 1988, a seven-member consortium of local governments purchased the Willamette Shore Line (WSL) right of way from Southern Pacific Railroad to preserve it for a future transit improvement. The group of local agencies and jurisdictions (TriMet, Metro, ODOT, the cities of Portland and Lake Oswego, and Multnomah and Clackamas counties) formed the WSL Consortium during the right of way purchase process. The owner agencies worked through the WSL Consortium and with adjacent property owners for approximately the next 20 years, primarily for the purpose of preserving right of way from encroachments and to ensure its preservation for future transit use. Public engagement was most typically with adjacent property owners regarding issues related to preservation and maintenance of the right of way.

B. Alternatives Analysis

In July 2005, Metro initiated the project's Alternatives Analysis (AA) process that included a broad public outreach process in the corridor. The Lake Oswego to Portland Transit and Trail Project Advisory Committee (LOPAC) was formed and made recommendations on narrowing of alternatives in the corridor. The project Steering Committee held a public hearing and received comment on draft recommendations before making a formal recommendation to the Metro Council. The Metro Council adopted a resolution that selected the No-Build, Enhanced Bus and Streetcar alternatives for further study in this DEIS. Public comments on the AA phase are documented in the *Lake Oswego to Portland Transit and Trail Study: Alternatives Analysis Public Comment Report* (September 2007) and its addendum (December 2007).

C. Refinement Phase

In December 2008, Metro initiated the Lake Oswego to Portland Transit Project Refinement Study to narrow the streetcar alignments and design options in the Johns Landing area and terminus options in downtown Lake Oswego. Design and terminus options were evaluated and narrowed after extensive public engagement with stakeholders in Johns Landing and Lake Oswego, respectively. In both cases, a series of meetings were held to discuss options, receive feedback and understand narrowing preferences.

7.2 Agency Coordination

Agency Coordination has played a significant role throughout the Lake Oswego to Portland corridor project development process, including the past approximately 20-year period of Willamette Shore Line right of way ownership and corridor preservation, the AA and the NEPA processes. A broad set of local, state and federal agencies have a wide range of expertise and jurisdictional authority in the corridor. The corridor is located in two cities and two counties, and as noted earlier, the Willamette Shore Line right of way is owned by a consortium of local governments and agencies, (cities of Portland and Lake Oswego, Multnomah and Clackamas counties, TriMet, Metro, and ODOT). Implementation of transit project improvements in the corridor will require a variety of approvals from local, state and federal regulatory agencies, as described further in Section 7.3 below.

For the purpose of this chapter, “regulatory agency” refers to those federal, state and local agencies from which a permit is anticipated or approval is needed for a build alternative. The project team has, and will continue to, communicate with regulatory agencies throughout the project development and NEPA processes, including identifying and securing permits and approvals required for a transit project to be completed.

The project team works extensively with local jurisdictions and regulatory agencies, as described in more detail in the *Lake Oswego to Portland Transit Project: Section 6002 Coordination Plan.* Cooperating agencies are agencies invited to participate in development of this Environmental Impact Statement (EIS) and may use this document to help in their approval for permits or other decision making related to the project. Participating agencies include representatives from a variety of local and state agencies with an interest in the project.

7.2.1 Section 6002 Coordination Plan

In the fall of 2009, the project team prepared a Section 6002 Coordination Plan[2] to guide the various public and agency involvement activities for the Lake Oswego to Portland Transit Project (LOPT). The plan outlines activities covered during the project periods of NEPA scoping through final design and construction. The plan was designed to solicit early and continuous feedback from agency stakeholder groups as the project progresses through the Federal Transit Administration (FTA) project development process, and is intended to ensure that input received will be incorporated into the project’s decision-making processes.

A. Lead Agencies

The project’s federal lead agency is the FTA and the local lead agencies are Metro and TriMet.

B. Cooperating Agencies

Cooperating Agencies have an elevated status in the NEPA process, which includes an opportunity to contribute expertise in the development of technical analysis methods and the analysis of effects associated with project alternatives and options. In accordance with NEPA regulations, and upon

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[2] The plan complies with Section 6002 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) that states “The lead agency shall establish a plan for coordinating public and agency participation in and comment on the environmental review process for a project or category of projects” (23 USC Section) 139 (g)(i)(A).

request of a lead federal agency, any other federal or state agency which has jurisdiction or a special expertise with respect to any environmental issue may become a Cooperating Agency.

The Cooperating Agencies for the Lake Oswego to Portland Transit Project are:

- Federal Highway Administration (FHWA)
- US Army Corps of Engineers (Corps)

C. Participating Agencies

The Participating Agency role was established through the Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU) to create specific coordination opportunities for a broader array of public agencies and tribal governments. Invitation letters were broadly distributed to a list of local and tribal governments with potential interest in the project. The following agencies were invited to become Participating Agencies; **agencies in bold** accepted the invitation to be a Participating Agency:

- **U.S. Department of the Interior (USDOI)**
- **U.S. Environmental Protection Agency (USEPA)**
- **U.S. Fish and Wildlife Service (USFWS)**
- **National Marine Fisheries Service (NMFS)**
- **Federal Railroad Administration (FRA)**
- Oregon Parks and Recreation Department (OPRD)
- **Oregon Department of Environmental Quality (ODEQ)**
- **Oregon Department of Fish and Wildlife (ODFW)**
- Oregon Land Conservation and Development Department (OLCDD)
- **Oregon State Historic Preservation Office (OSHPO)**
- **Oregon Department of State Lands (ODSL)**
- **Oregon Department of Transportation (ODOT)**
- **Multnomah County**
- **West Multnomah Soil and Water Conservation District**
- **Clackamas County**
- North Clackamas Parks and Recreation District
- **City of Lake Oswego**
- **City of Portland**

C. Tribes

The project sponsors are committed to government-to-government consultation with tribes on projects that may affect tribal rights and resources. The project is encouraging early and continued feedback from and involvement by tribes potentially affected by the project to ensure that their input will be included in the decision-making process. Invitations for consultation were extended to the following tribes; **tribes in bold** accepted the invitation for consultation:

- **Confederated Tribes of the Grand Ronde**
- Confederated Tribes of Siletz Indians

- **Columbia River Inter-Tribal Fish Commission, on behalf of Confederated Tribes of Warm Springs**

D. Agency Coordination Activity Summary

Agency Coordination activities for this DEIS have been conducted by project staff and consultants as shown in Table 7.2-1. For more detail on these activities, refer to the Lake *Oswego to Portland Transit Project: Section 6002 Coordination Plan*.

Table 7.2-1 Agency Coordination Dates [1]

Agency	Invitation	6002 Coordination Plan	Purpose and Need	Alternatives to be Considered	List of DEIS Topics	Technical Analysis Methods	DEIS Sections
Federal Highway Administration	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
U.S. Army Corps of Engineers	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Department of the Interior	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
National Marine Fisheries Service	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
U.S. Environmental Protection Agency	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
U.S. Fish and Wildlife Service	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Federal Railroad Administration	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Oregon Department of Environmental Quality	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Oregon Department of Fish and Wildlife	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Oregon State Historic Preservation Office	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Oregon Department of State Lands	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Oregon Department of Transportation	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
City of Lake Oswego	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
City of Portland	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Clackamas County	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Multnomah County	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
West Multnomah Soil and Water Conservation District	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Confederated Tribes of Grand Ronde	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Confederated Tribes of Warm Springs	26-Aug-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10
Columbia River Inter-Tribal Fish Commission on behalf of Confederated Tribes of Warm Springs	14-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	17-Sep-09	20-Oct-09	28-May-10

Source: Metro 2010
[1] Dates that project related materials were provided to agencies for review.

7.3 Permits and Approvals

The Portland to Lake Oswego Transit Project will need a variety of federal, state and local permits and approvals. The project sponsors will seek intergovernmental agreements with the local government and agency partners to consolidate, simplify and contain costs of the local permitting process to the extent possible. A list of the major permits and approvals that may be needed includes, but is not limited to the following:

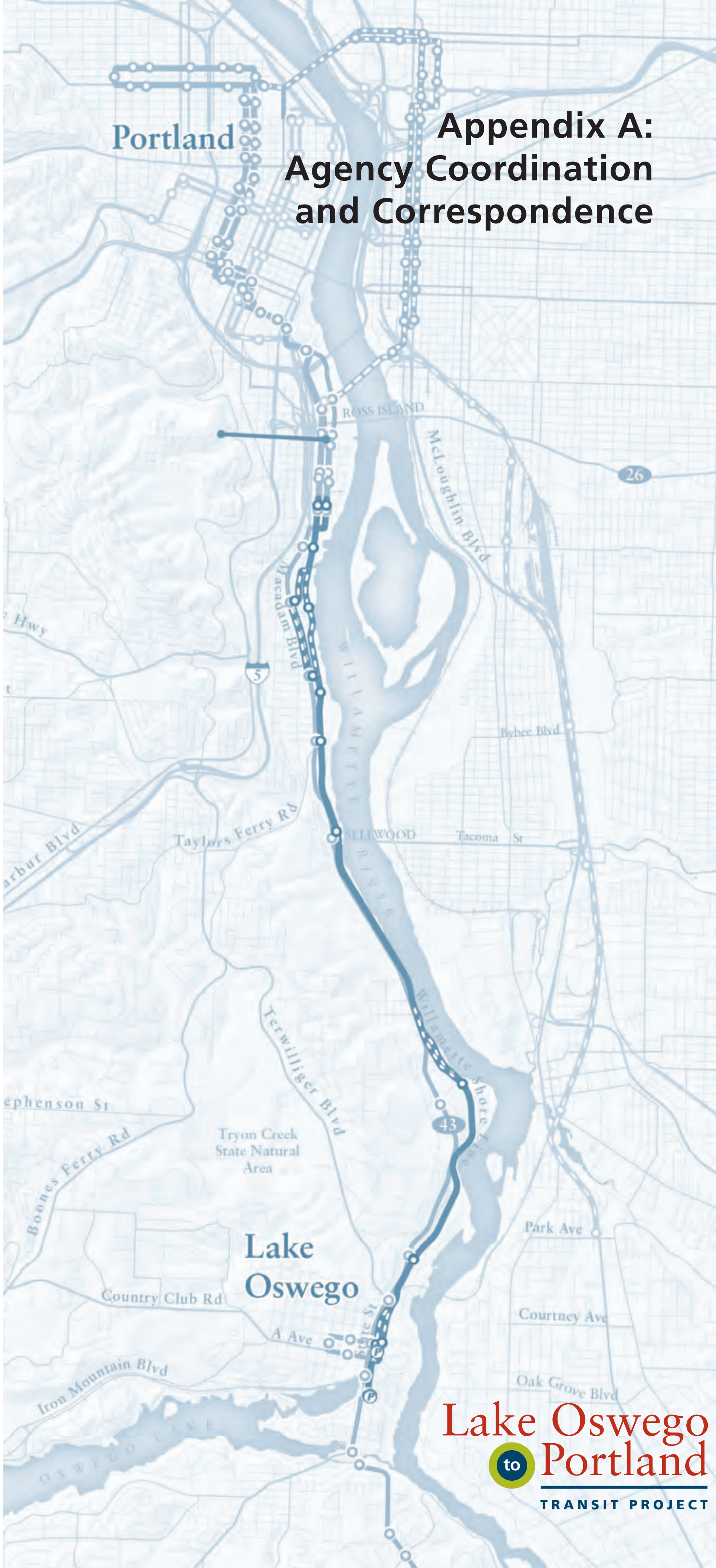
A. Federal and State Permits and Approvals

- Section 404 Permit (or nationwide permit) under the Clean Water Act (CWA) – U. S. Army Corps of Engineers
- Wetlands Removal and Fill Permit – Oregon Department of State Lands (ODSL)
- Section 401/Water Quality Certification – Oregon Department of Environmental Quality (ODEQ)
- Federal Endangered Species Act Review, Section 7 Consultation – National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)
- National Historic Preservation Act: Section 106 Evaluation – Oregon State Historic Preservation Officer (SHPO) and Federal Transit Administration (FTA)
- Section 4(f) Evaluation (and Section 6(f)) – U.S. Department of Transportation (USDOT) in consultation with the U.S. Department of the Interior
- Migratory Bird Treaty Act – U.S. Fish and Wildlife Service (USFWS)
- National Pollutant Discharge Elimination System (NPDES) Permit under the Clean Water Act (CWA) – Oregon Department of Environmental Quality (ODEQ)
- Magnuson-Stevens Act Clearance – National Marine Fisheries Service (NMFS)
- Farmland Protection Policy Act (FPPA) Compliance – Federal Transit Administration (FTA)
- Air Quality Conformity Determination – Federal Transit Administration (FTA)
- Oregon Endangered Species Act – Oregon Department of Fish and Wildlife (ODFW)
- Public Utilities Commission (PUC) Permits – Oregon PUC
- Right of way permits – ODOT and local jurisdictions

B. Local Permits and Approvals

- Land use, design review, conditional use, subdivision/lot line adjustment and environmental review permits – City of Portland, City of Lake Oswego, Multnomah County and Clackamas County
- Greenway Permits and Environmental Zone Review – City of Portland, City of Lake Oswego, Multnomah County and Clackamas County
- Building, demolition, grading, tree removal and erosion control permits – City of Portland, City of Lake Oswego, Multnomah County and Clackamas County
- Electrical, mechanical, plumbing permits – City of Portland, City of Lake Oswego, Multnomah County and Clackamas County
- Utility relocations – use and occupancy agreements from various public and private utility providers
- Right of way permits – City of Portland, City of Lake Oswego, Multnomah County and Clackamas County

Appendix A: Agency Coordination and Correspondence



Lake Oswego to Portland

TRANSIT PROJECT

APPENDIX A

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APPENDIX A
AGENCY COORDINATION AND CORESPONDENCE

This appendix lists agency coordination and correspondence from the current Lake Oswego to Portland Transit Project as part of the Section 6002 Coordination Plan. The Coordination Plan guides Metro, the Tri-County Metropolitan Transportation District (TriMet) and the Federal Transit Administration (FTA) through the various public and agency involvement activities for the project. The plan outlined activities covered during the project period of Scoping under National Environmental Policy Act (NEPA) through final design and construction. If needed and appropriate, an addendum to the plan may be issued at a later date to address specific activities during final design and construction.

August 20, 2009 – Letter of Invitation of Participation or Coordination Request

Federal Agencies Invited:
Federal Highway Administration
U.S. Army Corps of Engineers
U.S. Department of the Interior
National Marine Fisheries Service
U.S. Environmental Protection Agency
U.S Fish and Wildlife Service
Federal Railroad Administration

Tribes and Tribal Agencies Invited:
Confederated Tribes of Grand Ronde
Confederated Tribes of Siletz Indians of Oregon
Confederated Tribes of Warm Springs
Columbia River Inter Tribal Fish Commission

State, County and Local Agencies Invited:
Oregon Parks and Recreation Department
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Department of Land Conservation and Development
Oregon State Historic Preservation Office
Oregon Department of State Lands
Oregon Department of Transportation
City of Lake Oswego
City of Portland
Clackamas County
Multnomah County
North Clackamas Parks and Recreation
West Multnomah Soil and Water Conservation District

Letters were sent to the above agencies describing the project, inviting them to be a participating of cooperating agency as part of the environmental review process for the project, and inviting them to the participating and cooperating agency meeting on Sept. 17, 2009.

Federal Highway Administration and the U.S. Army Corps of Engineers have agreed to be cooperating agencies. Confederated Tribes of Grand Ronde and Columbia River Inter Tribal Fish Commission, as a representative of Confederated Tribes of Warm Springs, have agreed to be participating agencies. National Marine Fisheries Service, Oregon Department of State Lands, Oregon Department of Transportation, Oregon State Historic Preservation Office, Clackamas County, Multnomah County, City of Lake Oswego, City of Portland, and West Multnomah Soil and Water Conservation District have agreed to be participating agencies. Oregon Parks and Recreation Department declined as a participating agency, indicating that its role in the Section 106 review would suffice.

September 17, 2009 – Initiating the Draft Environmental Impact Statement Section 6002 Coordination

Agencies in Attendance: Federal Transit Administration, Metro, TriMet, National Marine Fisheries Service, Confederated Tribes of Grand Ronde, Oregon Department of State Lands, Oregon Department of Transportation, Oregon State Historic Preservation Office, Clackamas County, West Multnomah Soil and Water Conservation District

The DEIS lead agencies, Federal Transit Administration, Metro and TriMet, convened this meeting to initiate the DEIS agency coordination. Staff provided an overview of the project area, corridor constraints and opportunities, project history, alternatives to be considered draft Coordination Plan, and the topics to be covered in the DEIS. Staff reviewed the draft purpose and need statement for the project and the project schedule.

Comments and concerns that were presented at the meeting were: Oregon State Historic Preservation Office asked for a clarification of the term “cultural resources,” which was described as those relating to Native tribes; National Marine Fisheries Service asked if the project yet aware of the impacts to natural resources, to which staff stated that it was yet unclear, but the project area is near the environment of the Willamette River and at or near the flood plain; Oregon Department of State Lands asked about the process for defining the area of impact and advised that the footprint could overlap with City of Portland and state plans for the Willamette Greenway; and West Multnomah Soil and Water Conservation District expressed concern about affects to the Tryon Creek watershed, issues about fish passage, specifically in Stevens Creek, and water quality on the Willamette River.

September 17, 2009 – Follow up to the Section 6002 Coordination Meeting
To follow up on the September 17 meeting, all invited agencies were sent electronic copies of the draft Section 6002 Coordination Plan, draft Purpose and Need, and list of topics to be covered in the DEIS for review and further invitation to participate.

October 5, 2009 – Additional Initiating the Draft Environmental Impact Statement 6002 Coordination Meeting

Agency in Attendance: Metro, TriMet, U.S. Army Corps of Engineers

For agencies unable to attend the September 17 meeting, staff held an additional meeting to discuss the project and coordination plan. Staff provided an overview of the project area of impact, corridor constraints and opportunities, project history, alternatives to be considered draft Coordination Plan, and the topics to be covered in the DEIS. Staff reviewed the draft purpose and need statement for the project and the project schedule and advised that the Project Methods would be distributed for a cooperating and participating agency review in October.

October 20, 2009 – Distribution of Draft Technical Analysis Methods Report

Cooperating and participating agencies were sent, both electronically and via post, the agency review draft of the Technical Analysis Methods Report for review and comment. Comments were received on the analysis methods from Oregon Department of State Lands, Multnomah county and Clackamas County: Oregon Department of State Lands notified the project of differences in their process from the NEPA process, specifically regarding the ecosystems impacts analysis methods and compensatory mitigation; Multnomah County corrected the citing of a county agency; and Clackamas County corrected the citing of a county agency and pointed sections where the county's authority or contact information should be referenced.

October 20, 2009 – Additional Invitation to Unrepresented Tribe to Participate

Tribe Invited: Confederated Tribes of Siletz Indians of Oregon

As the one potentially affected tribe that did not respond to the invitation to participate, Confederated Tribes of Siletz Indians of Oregon was sent the agency review draft of the Technical Analysis Methods Report for review and comment and as further invitation to participate. No response was received.

March 30, 2010 – Agency Coordination Meeting/Distribution of Advance Draft DEIS

Agencies in Attendance: Metro, TriMet, City of Portland,

Staff presented a project overview, preliminary findings and a project timeline and solicited comments on the advance draft of the DEIS.

April 16, 2010 – Agency Coordination Meeting/Distribution of Advance Draft DEIS

Agencies in Attendance: Metro, TriMet, City of Lake Oswego

Staff presented a project overview, preliminary findings and a project timeline and solicited comments on the advance draft of the DEIS.

April 13, 2010 – Agency Coordination Meeting/Distribution and Tour of Advance Draft DEIS

Agencies in Attendance: Metro, TriMet, Oregon State Historic Preservation Office

Staff presented a project overview, preliminary findings and a project timeline and solicited comments on the advance draft of the DEIS.

May 6, 2010 – Distribution of Advance Draft DEIS

Cooperating and participating agencies were sent, both electronically and via post, the agency review draft of the DEIS for review and comment.

May 28, 2010 – Letter of Invitation to Participating and Cooperating Agency Meeting for Comments on Advance Draft of DEIS

Agencies Invited:
Federal Highway Administration
U.S. Army Corps of Engineers
Confederated Tribes of Grand Ronde
Columbia River Inter Tribal Fish Commission for Confederated Tribes of Warm Springs
National Marine Fisheries Service
Oregon Department of State Lands
Oregon Department of Transportation
Clackamas County
Multnomah County
City of Lake Oswego
City of Portland
West Multnomah Soil and Water Conservation District

A letter of invitation was sent with the advance draft DEIS, inviting agencies to a tour of the alignment and a meeting on June 21, 2010 to discuss their comments on the document.

June 21, 2010 – Agency Coordination Alignment Meeting and Tour/Comments on Advance Draft of DEIS

Agencies in Attendance: Federal Transit Administration, Federal Fish and Wildlife, US Army Corps of Engineers, National Marine Fisheries Service, Oregon Fish and Wildlife, Oregon Department of Transportation, Oregon Department of State Lands, Confederated Tribes of Grand Ronde, Confederated Tribes of Warm Springs, West Multnomah Soil and Water Conservation District and Metro.

Staff provided a tour of the alignment options and an overview of the results of the DEIS and solicited agency comments. Comments and concerns that were presented at the meeting were:

National Marine Fisheries Service asked for clarification on where the stream crossings were in the project, staff described the Tryon Creek and Stephens Creek crossings in addition to some smaller stream crossings in Powers Marine Park; Federal Fish and Wildlife asked for a description of the existing trolley car with the streetcar project, to which staff replied that the project will be mostly double-track with a few single-track areas because of right of way issues; West Multnomah Soil and Water Conservation District inquired about a bike and pedestrian trail as part of the footprint for the project and the water resources and fish habitat along the project, staff replied that there are separate process for both the streetcar and the trail projects, Powers Marine Park access and parking would remain, and regarding the water quality issues staff replied that the project is looking at the areas as fisheries habitat and the wildlife needs through the Powers Marine Park; National Marine Fisheries Service asked how the trail and the streetcar project are being looked at, staff replied that they being considered together but moved forward separately so a trail can be added later in the future; West Multnomah Soil and Water Conservation District and the Oregon Fish and Wildlife both asked about the mitigation and unavoidable impacts from the project, questions which were addressed by staff in detail; Oregon Department of State Lands inquired about the long-term indirect impacts, to which staff gave an overview with a reference to more detail in the DEIS; the Confederate Tribes of Grand Ronde asked to be involved in the development of the mitigation plan, in particularly about the vegetation; Oregon Department of State Lands expressed concern about the loss of the big trees that cannot be mitigated in our lifetime, also noting the areas along the alignment that can create better habitat connectivity; National Marine Fisheries Service asked if the any of the trees will be removed with the roots intact to be moved to other areas, advising that they can be used in restoration projects as part of mitigation; US Army Corps of Engineers suggested to look at the habitats in area around Jennings Marina to provide areas for restoration; Oregon Fish and Wildlife stated that the Oregon white oak needs to be preserved and root systems protected during construction.

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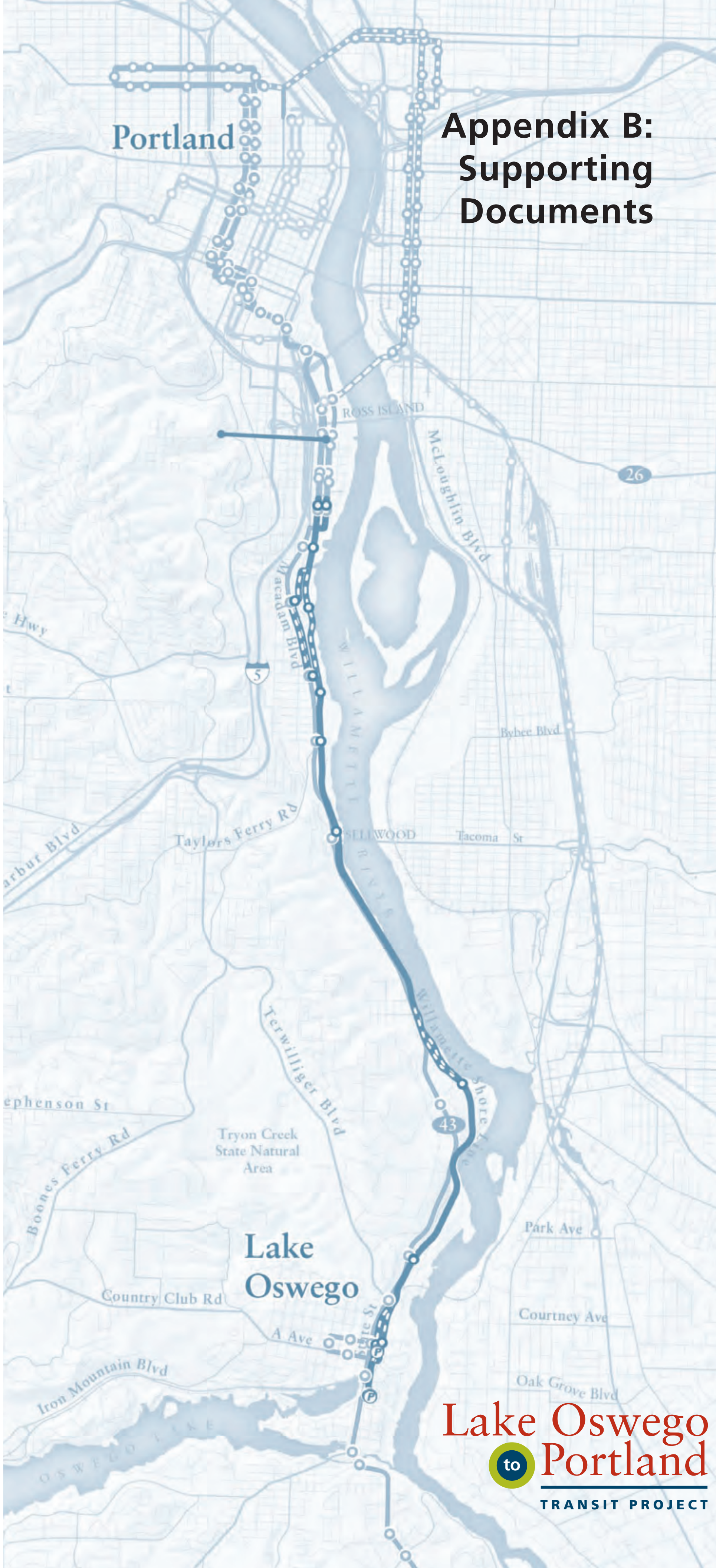
APPENDIX B

Appendix B: Supporting Documents



Lake Oswego to Portland

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APPENDIX B
SUPPORTING DOCUMENTS

The following Lake Oswego to Portland Project documents are available for review at Metro and FTA Offices:

A. Alternatives Analysis Reports:

Lake Oswego to Portland Transit and Trail Alternatives Analysis: ***Background Report*** (Metro: January 2006)

Lake Oswego to Portland Transit and Trail: ***Initiation of Alternatives Analysis Planning Study*** (Metro: September 2006)

Lake Oswego to Portland Transit and Trail Alternatives Analysis: ***Evaluation Summary*** *Public Review Draft* (Metro: July 12, 2007)

Lake Oswego to Portland Transit and Trail Alternative Analysis: ***Public Involvement Summary*** (Metro: September 2007)

Lake Oswego to Portland Transit and Trail Study: Alternatives Analysis ***Public Comment Report*** (Metro: September 2007)

Lake Oswego to Portland Transit and Trail Study: Alternatives Analysis ***Public Comment Report Addendum*** (Metro: December 2007)

Lake Oswego to Portland Transit and Trail Alternatives Analysis: ***Alternatives to be Advanced into a Draft Environmental Impact Statement and Work Program Considerations*** (Metro: December 13, 2007)

Lake Oswego to Portland Transit Project: ***Public Scoping Report*** (Metro: August 2008)

Lake Oswego to Portland Transit Project: ***Refinement Project Study Report*** (Metro: March 2010)

Memorandum dated August 25, 2009 from Metro to FTA – Re: Lake Oswego to Portland Transit Project Narrowing of Streetcar Alignments

B. NEPA Process Support Reports:

*Lake Oswego to Portland Transit Project**: Section 6002 Coordination Plan** for Development of the Draft Environmental Impact Statement* (LSA, URS, TriMet, Metro and FTA: January 2010)

*Lake Oswego to Portland Transit Project: **Technical Analysis Methods Report** for Development of the Draft Environmental Impact Statement* (URS et al and TriMet, Metro, FTA: January 2010)

*Lake Oswego to Portland Transit Project**: Detailed Definition of Alternatives Report** for Development of the Draft Environmental Impact Statement* (URS/ DEA and TriMet, Metro, FTA: January 2010)

*Lake Oswego to Portland Transit Project: **Streetcar Plan Set*** (URS and Metro/TriMet: November 9, 2009)

*Lake Oswego to Portland Transit Project: **Enhanced Bus Plan Set*** (URS and Metro/TriMet: November 9, 2009)

C. DEIS Technical Reports:

*Lake Oswego to Portland Transit Project: **Land Use and Planning Technical Report*** (URS and TriMet/Metro, November 2010)

*Lake Oswego to Portland Transit Project: **Economic Activity Technical Report*** (BGY/URS and TriMet/Metro, November 2010)

*Lake Oswego to Portland Transit Project: **Community Effects Technical Report*** (URS and TriMet/Metro, November 2010)

*Lake Oswego to Portland Transit Project: **Visual Quality and Aesthetics Technical Report*** (DEA/URS and TriMet/Metro, November 2010)

*Lake Oswego to Portland Transit Project: **Historic, Archaeological and Cultural Resources Technical Report*** (URS and TriMet/Metro, November 2010)

*Lake Oswego to Portland Transit Project: **Parklands and Recreation Areas and Wildlife and Waterfowl Refuges Technical Report*** (DEA/URS and TriMet/Metro, November 2010)

*Lake Oswego to Portland Transit Project: **Geology, Soils and Seismic Activity Technical Report*** (URS and TriMet/Metro, November 2010)

*Lake Oswego to Portland Transit Project: **Ecosystems Technical Report*** (URS and TriMet/Metro, November 2010)

Lake Oswego to Portland Transit Project: ***Hydrology and Water Quality Technical Report*** (URS and TriMet/Metro, November 2010)

Lake Oswego to Portland Transit Project: ***Noise and Vibration Technical Report*** (ENVIRON/URS and TriMet/Metro, November 2010)

Lake Oswego to Portland Transit Project: ***Air Quality Technical Report*** (URS and TriMet/Metro, November 2010)

Lake Oswego to Portland Transit Project: ***Energy Technical Report*** (URS and TriMet/Metro, November 2010)

Lake Oswego to Portland Transit Project: ***Hazardous Materials Technical Report*** (URS and TriMet/Metro, November 2010)

Lake Oswego to Portland Transit Project: ***Public Safety and Security Technical Report*** (URS and TriMet/Metro, November 2010)

Lake Oswego to Portland Transit Project: ***Transportation Analysis Technical Report*** (URS/DEA and TriMet/Metro, November 2010)

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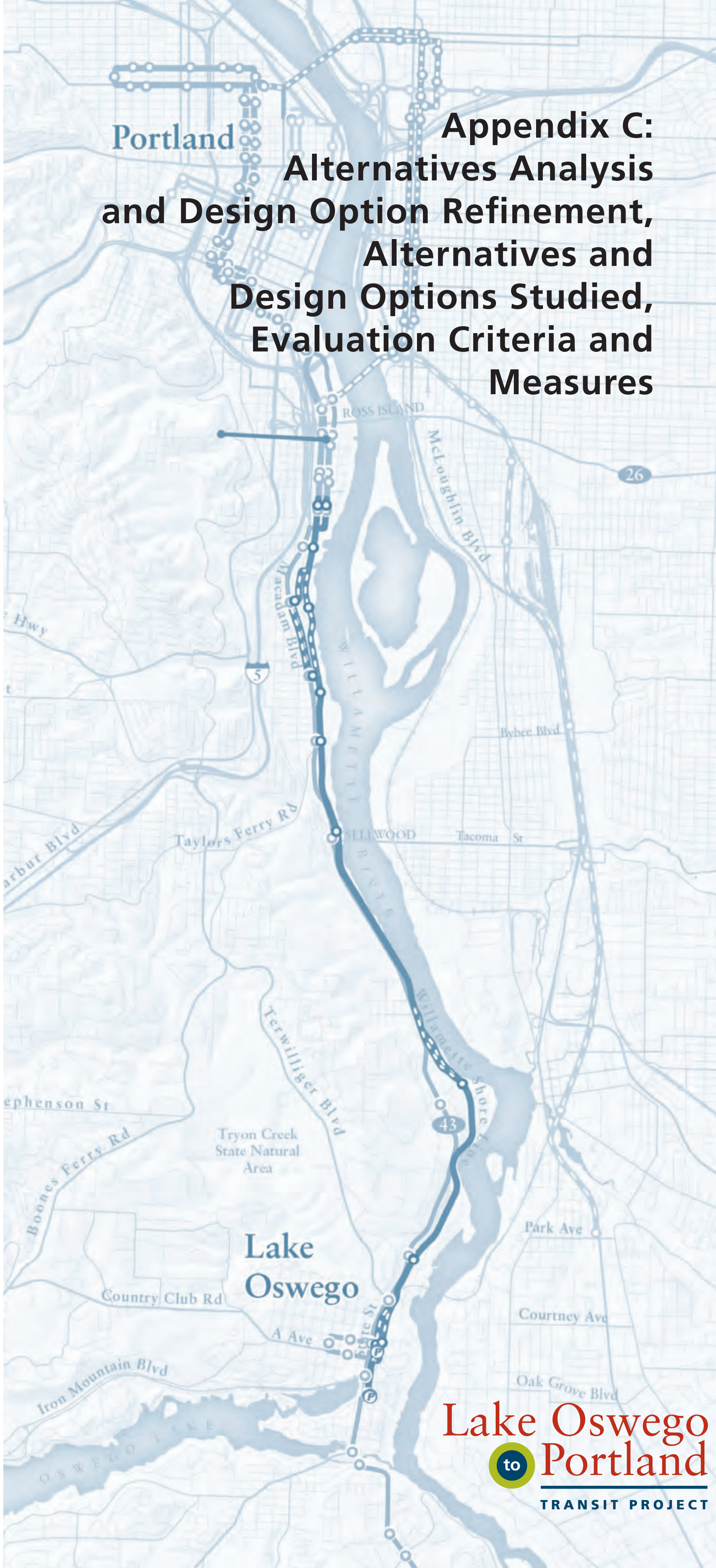
Appendix C: Alternatives Analysis and Design Option Refinement, Alternatives and Design Options Studied, Evaluation Criteria and Measures

APPENDIX C



Lake Oswego to Portland

TRANSIT PROJECT

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APPENDIX C
ALTERNATIVES ANALYSIS AND DEISGN OPTOIN REFINEMENT ALTERNATIVES AND DESIGN OPTIONS STUDIED AND EVALUATION CRITERIA AND MEASURS

This appendix provides maps and a summary of the evaluation criteria and measures of the alternatives and options that were proposed and analyzed in the following phases of the Lake Oswego to Portland Transit Project: 1) Alternatives Analysis – Early Screening of the Wide Range of Alternatives; 2) Alternatives Analysis – Narrowed Range of Alternatives; 3) Scoping/Project Refinement Study. Section 2.1.2 of the Lake Oswego to Portland Transit Project DEIS provides a summary of these three phases and the alternatives and options eliminated from and selected for further study. Following is an itemization of the figures and tables that make up this appendix, organized by study phase.

1) Alternatives Analysis – Early Screening of the Wide Range of Alternatives (source: *Lake Oswego to Portland Transit and Trail: Initiation of Alternatives Analysis Planning Study*, September 2006). Figures and Table:

- Figure C.1-1 – Bus Rapid Transit
- Figure C.1-2 – River Transit
- Figure C.1-3 – Rail Transit
- Table C.1-1 – Screening of Alignments through the Purpose and Need

2) Alternatives Analysis – Narrowed Range of Alternatives (source: *Lake Oswego to Portland Transit and Trail Alternatives Analysis: Evaluation Summary Public Review Draft*, July 12, 2007). Figures and Tables:

- Figure C.2-1 – Bus Rapid Transit
- Figure C.2-2 – Streetcar
- Table C.2-1 – Alternatives Analysis – Narrowed Range of Alternatives Evaluation Criteria and Measures for the BRT and Streetcar Alternatives
- Table C.2.2 – Alternatives Analysis – Narrowed Range of Alternatives Advantages and Disadvantages for the BRT and Streetcar Alternatives

3) Scoping/Design Refinement Study

a) Johns Landing Design Options (source: memorandum from Metro to FTA – Re: *Lake Oswego to Portland Transit Project Narrowing of Streetcar Alignments*; August 25, 2009). Figures and Table:

- Figure C.3-1 – Hybrid 1: Macadam
- Figure C.3-2 – Hybrid 2: East Side Exclusive
- Figure C.3-3 – Hybrid 3: Macadam with New North Bound Lane
- Figure C.3-4 – Willamette Shore Line
- Figure C.3-5 – Full Macadam In-Street
- Table C.3-1 – Comparison of Johns Landing Options

b) Terminus Options (source: memorandum from Metro to FTA – Re: *Lake Oswego to Portland Transit Project Narrowing of Streetcar Terminus Options*; October 19, 2009). Figures and Table:

- Figure C.3-6 – Albertsons Terminus
- Figure C.3-7 – Safeway Terminus Option
- Figure C.3-8 – Trolley Terminus Option
- Table C.3-2 – Comparison of Terminus Options

Figure C.1-1 Bus Rapid Transit Alternative
Alternatives Analysis – Early Screening of the Wide Range of Alternatives

BUS RAPID TRANSIT

Option 1: Portland to Lake Oswego via Highway 43

Option 2: Portland to Lake Oswego via Terwilliger and Barbur Boulevards

Option 3: Portland to Lake Oswego via Terwilliger/ Boones Ferry/Taylor's Ferry Roads

Figure C.1-2 River Transit Alternative
Alternatives Analysis – Early Screening of the Wide Range of Alternatives

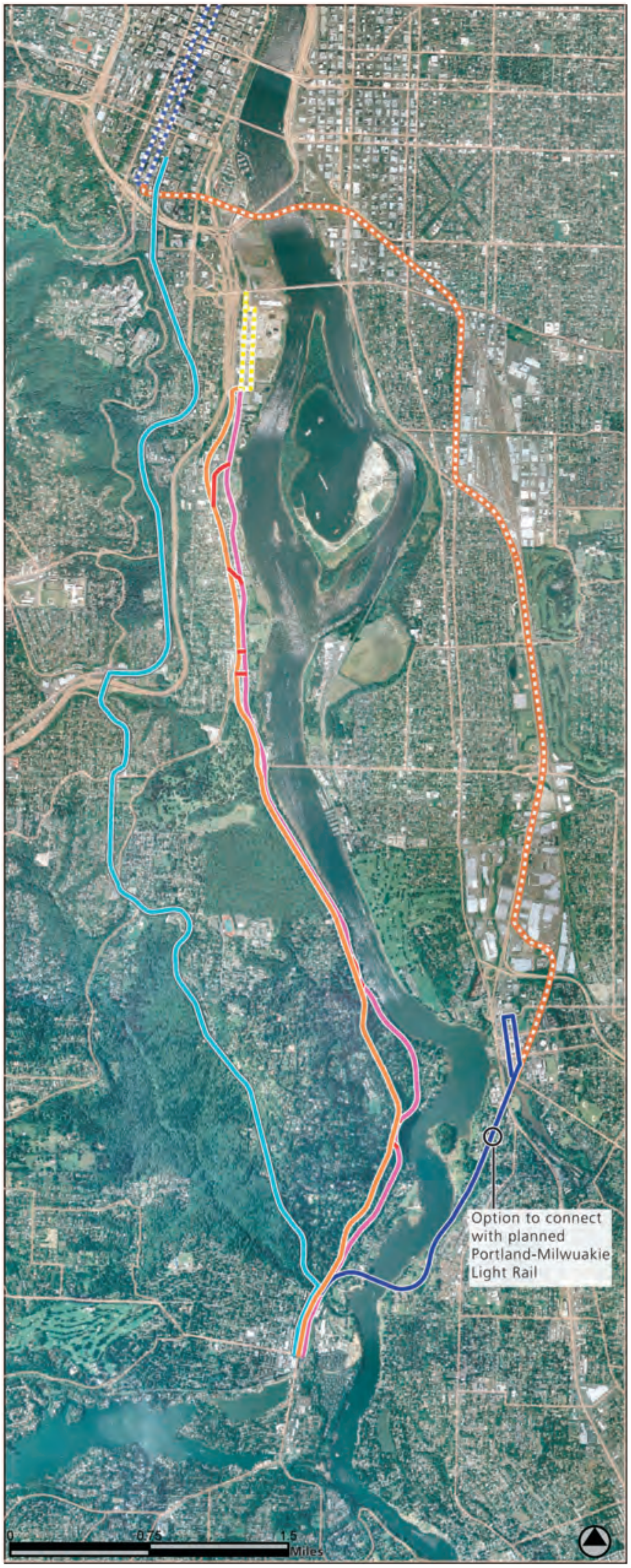
RIVER TRANSIT

Option 1: Portland to Lake Oswego

Option 2: Sellwood to Lake Oswego

Option 3: Portland to Oregon City

Figure C.1-3 Streetcar Alternative
Alternatives Analysis – Early Screening of the Wide Range of Alternatives



RAIL TRANSIT

Option 1: Portland to Lake Oswego via the Willamette Shoreline right of way

Option 2: Portland to Lake Oswego via Highway 43

Option 3: Portland to Lake Oswego via the Willamette Shoreline right of way/ Highway 43

Option 4: Portland to Lake Oswego via Terwilleger and Barbur Boulevards

Option 5: Portland to Lake Oswego via the Portland & Western (P&W) Railroad Bridge to Milwaukie

Existing and Planned Rail Transit

Existing Streetcar

Streetcar under construction

Existing Light Rail

Light Rail under construction

Portland-Milwaukie Light Rail Project

Table C.1-1

Screening of Alignments Through the Purpose and Need For River Transit, Bus, Rail and Trail TAC/PMG and LOPAC Recommendations

MODE	ALIGNMENT			GENERATED BY		PURPOSE AND NEED THRESHOLD			PROJECT GOALS						TAC/PMG RECOMMENDATIONS			LOPAC RECOMMENDATIONS		
River Transit 	Alignment (See River-North and River-South maps)	Start	End	LOPAC	Community Workshop	Is it in the Hwy 43 Corridor?	Does it Serve Travel Demand?	Does it Connect Corridor Destinations?	Does the alignment improve mobility & accessibility in the Corridor?	Does the alternative minimize traffic impacts in the corridor?	Does the alignment support local and regional land use & transportation goals?	Is the alignment part of an integrated system?	Does the alignment allow for future expansion?	Does it support and enhance the neighborhood character in an environmentally sensitive manner?	The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study	The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study
River 1	Willamette River	Portland	Lake Oswego	Yes	Yes	●	◒	◒	◒	○	◒	◒	◒	◒	✓	✗	✗	✓	✗	✗
River 2	Willamette River	Sellwood	Lake Oswego		Yes	◒	○	○							✗	✗	✗	✗	✗	✗
River 3	Willamette River	Portland	Oregon City	Yes	Yes	●	◒	◒	◒	○	◒	◒	◒	◒	✓	✗	✗	✓	✓	✓
Bus 	Alignment (See Bus-North and Bus-South maps)	Start	End	LOPAC	Community Workshop	Is it in the Hwy 43 Corridor?	Does it Serve Travel Demand?	Does it Connect Corridor Destinations?	Does the alignment improve mobility & accessibility in the Corridor?	Does the alternative minimize traffic impacts in the corridor?	Does the alignment support local and regional land use & transportation goals?	Is the alignment part of an integrated system?	Does the alignment allow for future expansion?	Does it support and enhance the neighborhood character in an environmentally sensitive manner?	The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study	The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study
Bus 1	Highway 43	Portland	Lake Oswego	Yes	Yes	●	●	●	●	◒	◒	●	●	◒	✓	✓	✓	✓	✓	✓
Bus 2	Terwilliger/Barbur/I-5	Portland	Lake Oswego	Yes	Yes	○	○	○							✗	✗	✗	✗	✗	✗
Bus 3	Terwilliger/Boones Ferry/Taylors Ferry/Macadam	Portland	Lake Oswego	Yes														✓	✓	✓
Rail 	Alignment (See Rail-North and Rail-South maps)	Start	End	LOPAC	Community Workshop	Is it in the Hwy 43 Corridor?	Does it Serve Travel Demand?	Does it Connect Corridor Destinations?	Does the alignment improve mobility & accessibility in the Corridor?	Does the alternative minimize traffic impacts in the corridor?	Does the alignment support local and regional land use & transportation goals?	Is the alignment part of an integrated system?	Does the alignment allow for future expansion?	Does it support and enhance the neighborhood character in an environmentally sensitive manner?	The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study	The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study
Rail 1	Willamette Shoreline right of way	Portland	Lake Oswego	Yes	Yes	●	●	●	●	●	●	●	●	◒	✓	✓	✓	✓	✓	✓
Rail 2	Highway 43	Portland	Lake Oswego		Yes	●	●	●	●	◒	●	●	●	◒	✓	✓	✓	✓	✓	✓
Rail 3	Combined Willamette Shoreline right of way/Hwy 43	Portland	Lake Oswego	Yes	Yes	●	●	●	●	◒	●	●	●	◒	✓	✓	✓	✓	✓	✓
Rail 4	Terwilliger/Barbur	Portland	Lake Oswego	Yes		○	○	○							✗	✗	✗	✗	✗	✗
Rail 5	P&W railroad bridge	Milwaukie Transit Center	Lake Oswego	Yes	Yes	○	○	○							✗	✗	✗	✗	✗	✗
Trail 	Alignment (See Trail-North and Trail-South maps)	Start	End	LOPAC	Community Workshop	Is it in the Hwy 43 Corridor?	Does it Serve Travel Demand?	Does it Connect Corridor Destinations?	[illegible]	[illegible]	[illegible]				The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study	The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study
Trail 1	Willamette Shoreline right of way	Portland	Lake Oswego	Yes	Yes	●	●	●	●	●	◒				✓	N/A	✓	✓	N/A	✓
Trail 2	Extend Greenway Trail with Willamette Shoreline right of way	Portland	Lake Oswego	Yes	Yes	●	●	●	●	●	◒				✓	N/A	✓	✓	N/A	✓
Trail 3	Extend Greenway Trail with Hwy 43 and local roadway connections (with multiple alignment opportunities shown on map)	Portland	Lake Oswego		Yes	●	●	●	◒	◒	◒				✓	N/A	✓	✓	N/A	✓
Trail 4	Terwilliger/Tryon Creek trail (this alignment is not mapped)	Portland	Lake Oswego		Yes	●	○	○							✗	N/A	✗	✗	N/A	✗
Trail 5	P&W railroad bridge	Springwater Trail	Lake Oswego	Yes	Yes	○	○	○							✗	N/A	✗	✗	N/A	✗
Trail 6	Terwilliger/Barbur	Portland	Lake Oswego	Yes		○	○	○							✗	N/A	✗	✗	N/A	✗
No-Build 						Basis for comparison									The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study	The alignment meets the Purpose & Need	The alignment is a good representative alignment	The alignment should move forward for further study
	Existing Transportation System plus projects identified in the 2004 Regional Transportation Plan (RTP) Financially Constrained Network														N/A	✓	✓	N/A	✓	✓

Version 3, July 12, 2006

Summary of scoring rationale and recommendations provided under separate cover (see Mode/Alignment Initial Screening Summary).

Figure C.2-1 Bus Rapid Transit Alternative
Alternatives Analysis – Early Narrowed Range of Alternatives

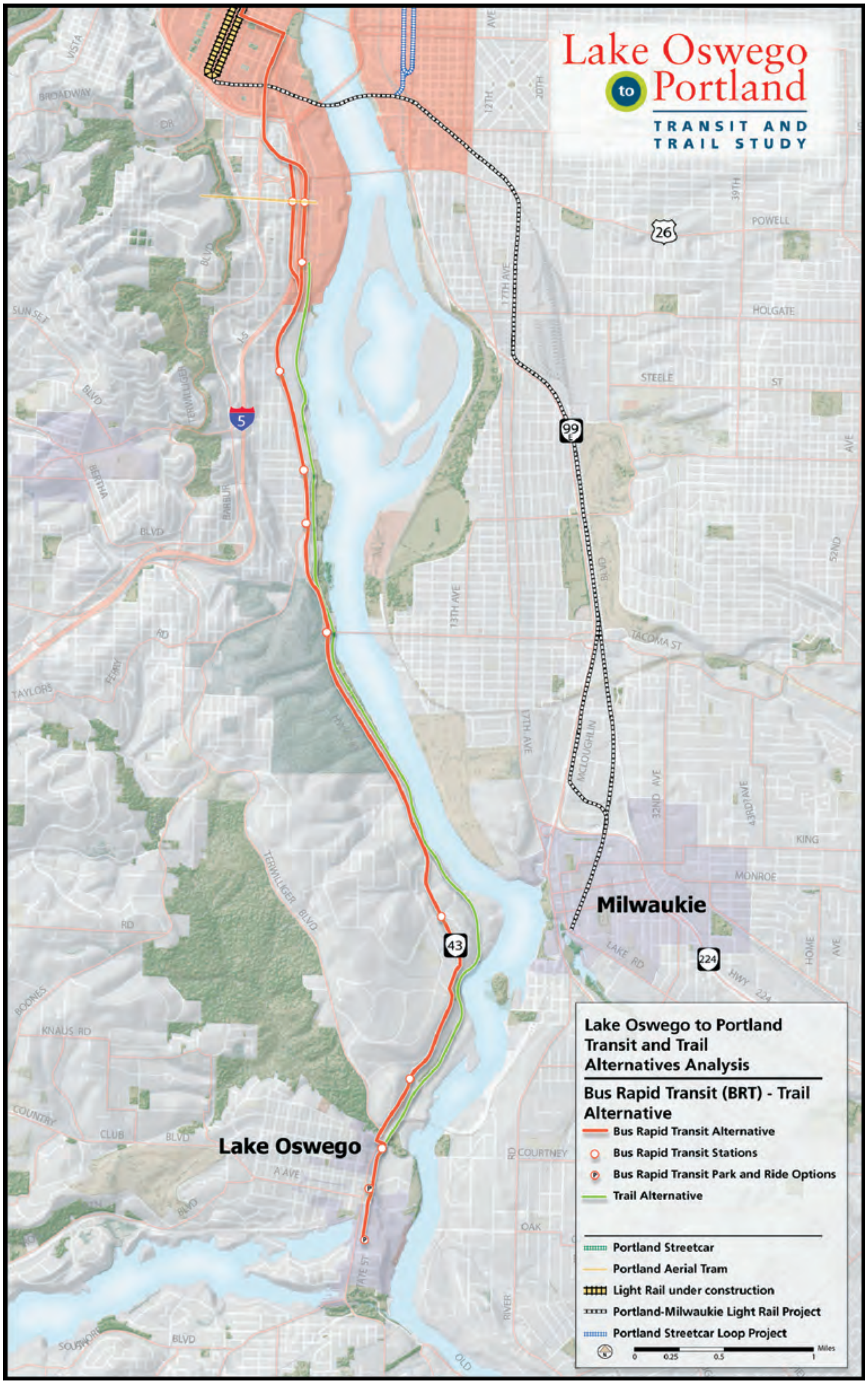


Figure C.2-2 Streetcar Alternative
Alternatives Analysis – Early Narrowed Range of Alternatives

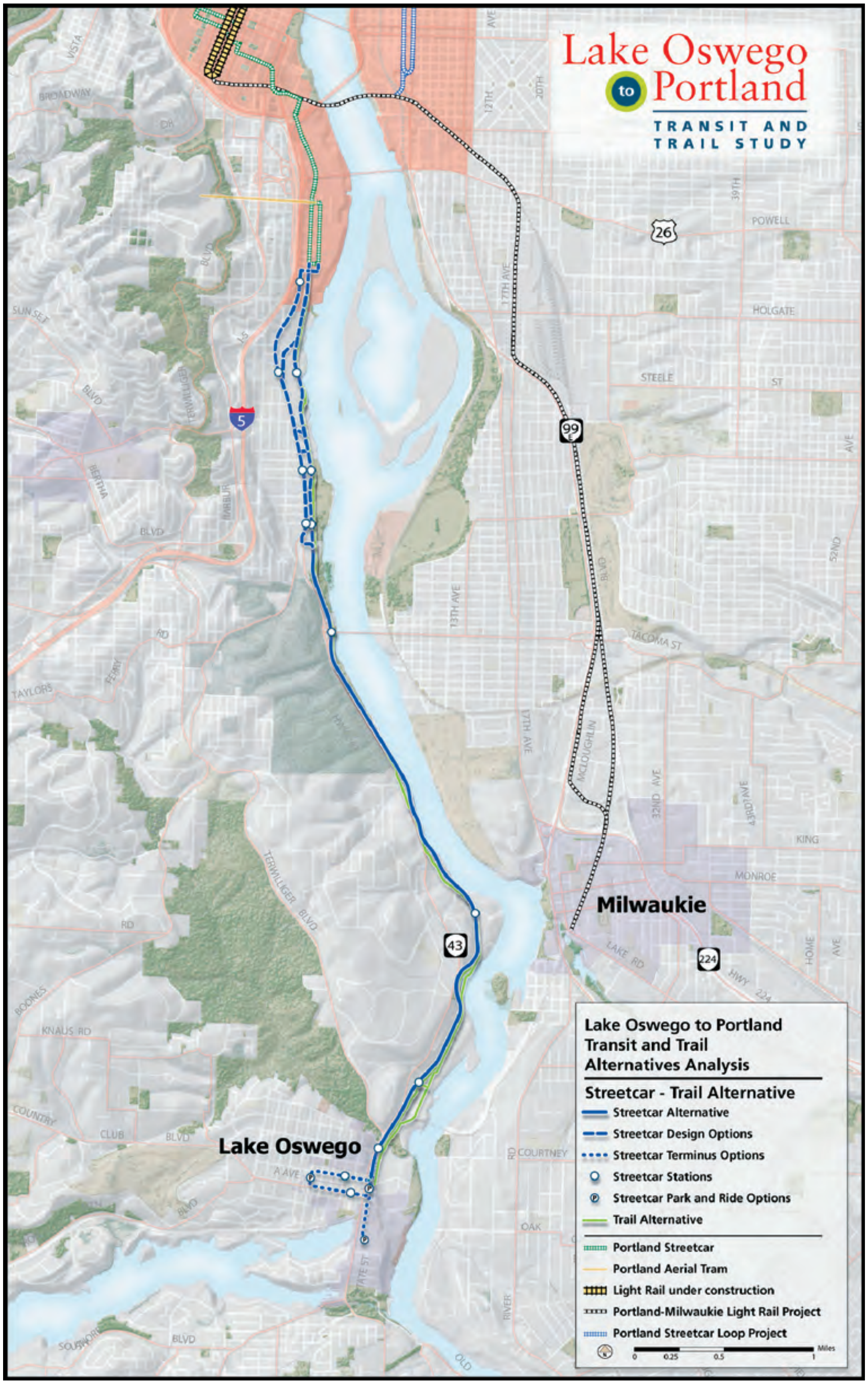


Table C.2-1
Alternatives Analysis – Narrowed Range of Alternatives
Evaluation Criteria and Measures for the BRT and Streetcar Alternatives

Criteria/Measures	BRT	Streetcar
Travel Time/Ridership		
Transit In-Vehicle Travel Time – PSU to Lake Oswego (minutes)[1]	33	24
Transit In-Vehicle Travel Time – PSU to West Linn (minutes)[1]	52	43
Weekday Line Boarding Rides[2]	8,700	10,900
Costs[3]		
Capital Costs (millions of 2007 dollars)	$50.0	$138.4 to $157.0[4]
O&M Costs (millions of 2007 dollars)	$2.3	$8.0
Net O&M Costs (millions of 2007 dollars)	$4.61	($1.17)
Farebox Recovery Rate[5]	32%	53%
Cumulative O&M Costs (millions 2007 to 2025)	$216	$87
Cost Effectiveness[3]		
O&M Cost/Boarding Ride (2007 dollars)	$2.67	$0.60
Annualized Capital/O&M Cost per Boarding Ride (2007 dollars)	$3.97	$3.44
Development Impacts[6]	None	Potential
Financial		
Willamette Shore Line Right-of-Way Contribution	$0.0	$50.0
Other Local Contribution (60% Federal – millions of 2007 dollars)	$62.8	$32.8

Source: Metro; July 2007.
Note: BRT = bus rapid transit; PSU = Portland State University; O&M = operating and maintenance.
[1] Average weekday in 2025, p.m. peak period.
[2] In 2025.
[3] Based on operations in 2025.
[4] Range reflects different terminus options.
[5] The farebox recovery rate is the percentage of operating costs that would be covered by collected fares – the remaining percentage of costs would be covered through other sources, primarily revenue from TriMet's payroll tax.
[6] See the *Lake Oswego to Portland Transit and Trail Study Evaluation Summary – Public Review Draft* (Metro: July 2007) for details on the analysis of potential development impacts.

Table C.2-2

Advantages and Disadvantages

	Advantages	Disadvantages	Issues
BUS RAPID TRANSIT	**Strong ridership** - 8,700 daily riders on BRT line	**Ridership may not be achievable with transit priority measures** assumed in the analysis - future congestion makes intersection queues longer	**Queue jump lanes may need to double in length to achieve ridership and travel times,** potentially doubling the capital cost and increasing property impacts
BUS RAPID TRANSIT	**Low initial capital cost of $50 million** (2007 dollars). Could be funded through federal Small Starts Program	**High ongoing local TriMet operating and maintenance costs** of $8.0 million per year for the BRT line	**Operating in mixed traffic reduces reliability of service** and adds cost over time, creating a cumulative operating cost impact on TriMet's budget
BUS RAPID TRANSIT	**Could allow Willamette Shoreline to be used as a trail** with minimal improvements for a cost of $7.3 million	**Value of Willamette Shoreline right-of-way could be lost as local match** to leverage federal funds for a transit project	**Willamette Shoreline right-of-way can be used for rail transit, but legal status of trail use either alone or with rail is less clear**
BUS RAPID TRANSIT	**Property impacts limited to eight intersections** where some travel time advantage could be gained through queue jumps and signal priority	**Highway 43 operating environment is too constrained to allow for an exclusive bus lane** that would maximize speed and reliability	**Property impacts and costs could increase** if queue jump lane lengths are doubled to bypass future congestion
BUS RAPID TRANSIT	**Operational flexibility** allows for future expansion and different operating scenarios to adapt to future conditions	**Future reliability** is a function of traffic congestion and the ability to maintain schedules	**Further development of this alternative will need to address the effects of congestion** on the capital facilities in the corridor
STREETCAR	**Strongest ridership**, with 11,000 rides on the Streetcar line	**Single track sections will limit number of trains** per hour in the long term	**Further study should look at vehicle type and operating plan** to maximize future capacity
STREETCAR	**Operation in exclusive right of way yields higher reliability and faster travel time**	**Proximity to residences** - John's Landing Condos, Dunthorpe, other parcels - creates vehicle speed concerns	**Need to make sure that operating speeds are attainable and that mitigation of residential impacts is considered in DEIS**
STREETCAR	**Lower ongoing TriMet operation and maintenance costs** - $2.25 million per year	**Higher capital cost,** up to $149 million	**Trade-off between one-time only federal funding (New Starts) and ongoing local TriMet operating costs**
STREETCAR	**Design work shows that a continuous trail can be created along with the Streetcar**	**Trail adds $69.2 to $83.3 million to cost of Streetcar**	**Very expensive to create continuous trail,** may need to consider alternatives like putting bikes on Streetcar through the pinch points
STREETCAR	**Value of Willamette Shoreline right-of-way has potential to reduce local cash contribution to project**	**Value of Willamette Shoreline right-of-way for local match** is partially lost if Macadam design option (or BRT) is chosen	**Finance Plan will address different funding scenarios** and local funding mechanisms
STREETCAR	**Potential for 3.3 million square feet of total new development** in John's Landing and Lake Oswego by 2025		
TRAIL	**Continuous trail is technically possible**	**Legal uncertainty exists** about using the Willamette Shoreline right of way for anything except rail	**Need to develop alternatives** for trail connections such as the Portland and Western railroad bridge connection to Milwaukie and downtown
TRAIL	**Could meet latent demand** of up to 4,000 trips per day	**Very costly to use Willamette Shoreline right of way for a trail** due to design issues and possible property impacts	**May need to develop short segments** rather than the entire trail to avoid high costs and potential property impacts
TRAIL	**Strong public support** expressed through project meetings	**Using the Willamette Shoreline right of way for a trail prevents its use as local match** against federal transit dollars	**No identified funding source or lead agency for the next phase** of planning and development
TRAIL	**Documented economic benefits** such as avoided auto and parking costs, health benefits, support for trail-related retail sales and tourism, increased property values		

Figure C.3-1 Hybrid 1: Macadam Avenue In-Street Design Option Scoping/Design Refinement Study

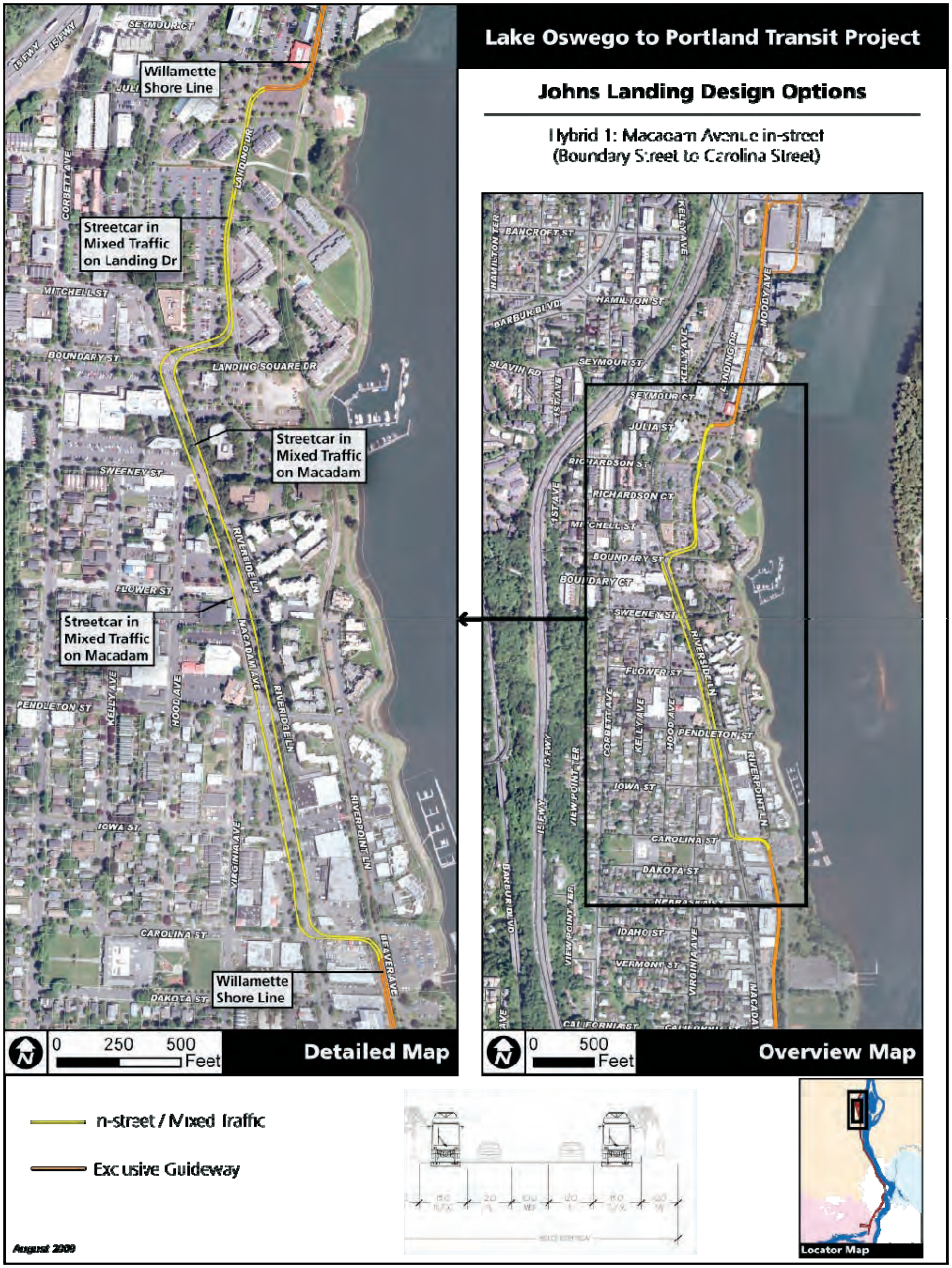


Figure C.3-2 Hybrid 2: Eastside Exclusive Design Option
Scoping/Design Refinement Study

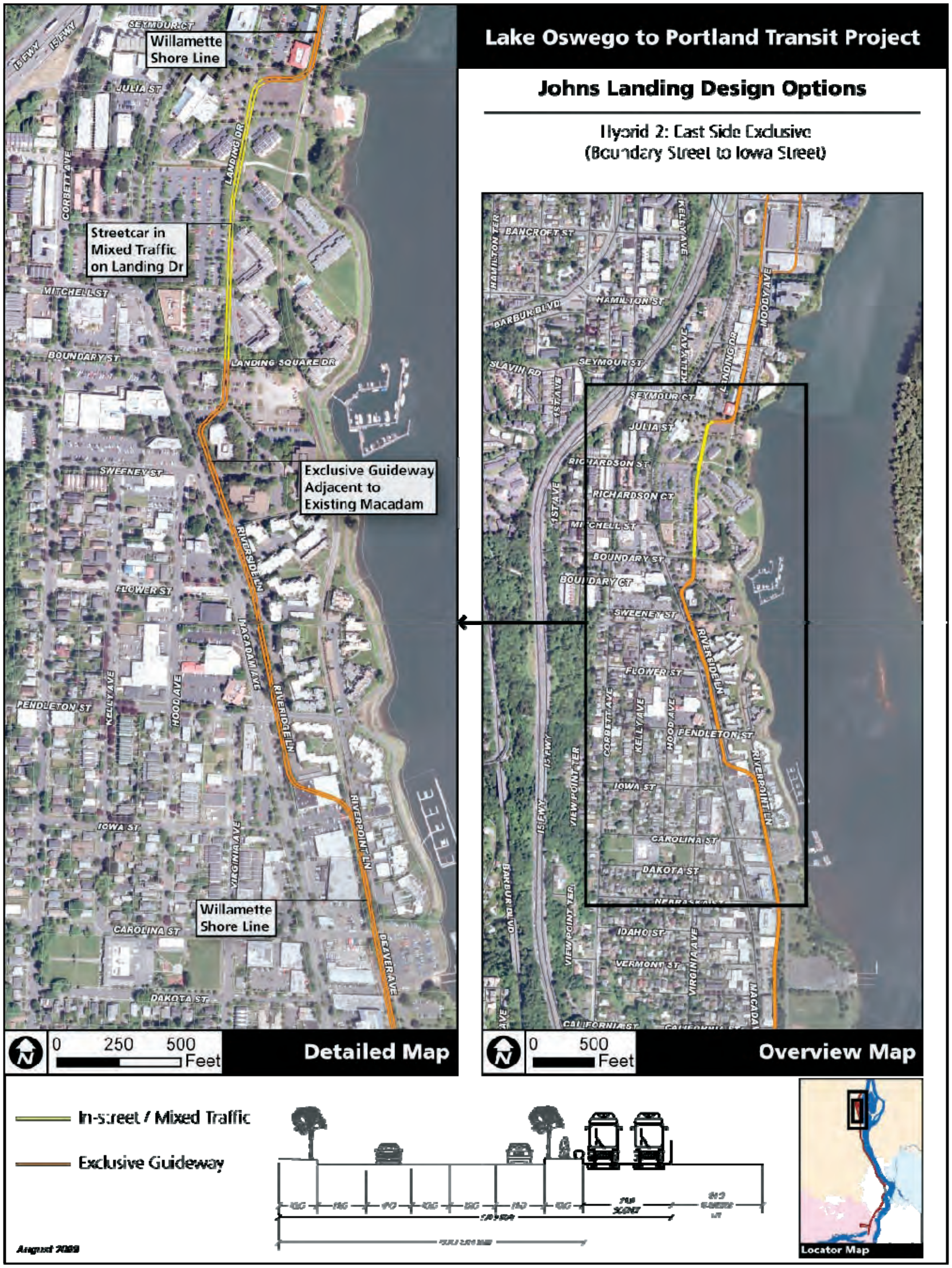


Figure C.3-3 Hybrid 3: Macadam Avenue with new Northbound Lane Design Option Scoping/Design Refinement Study

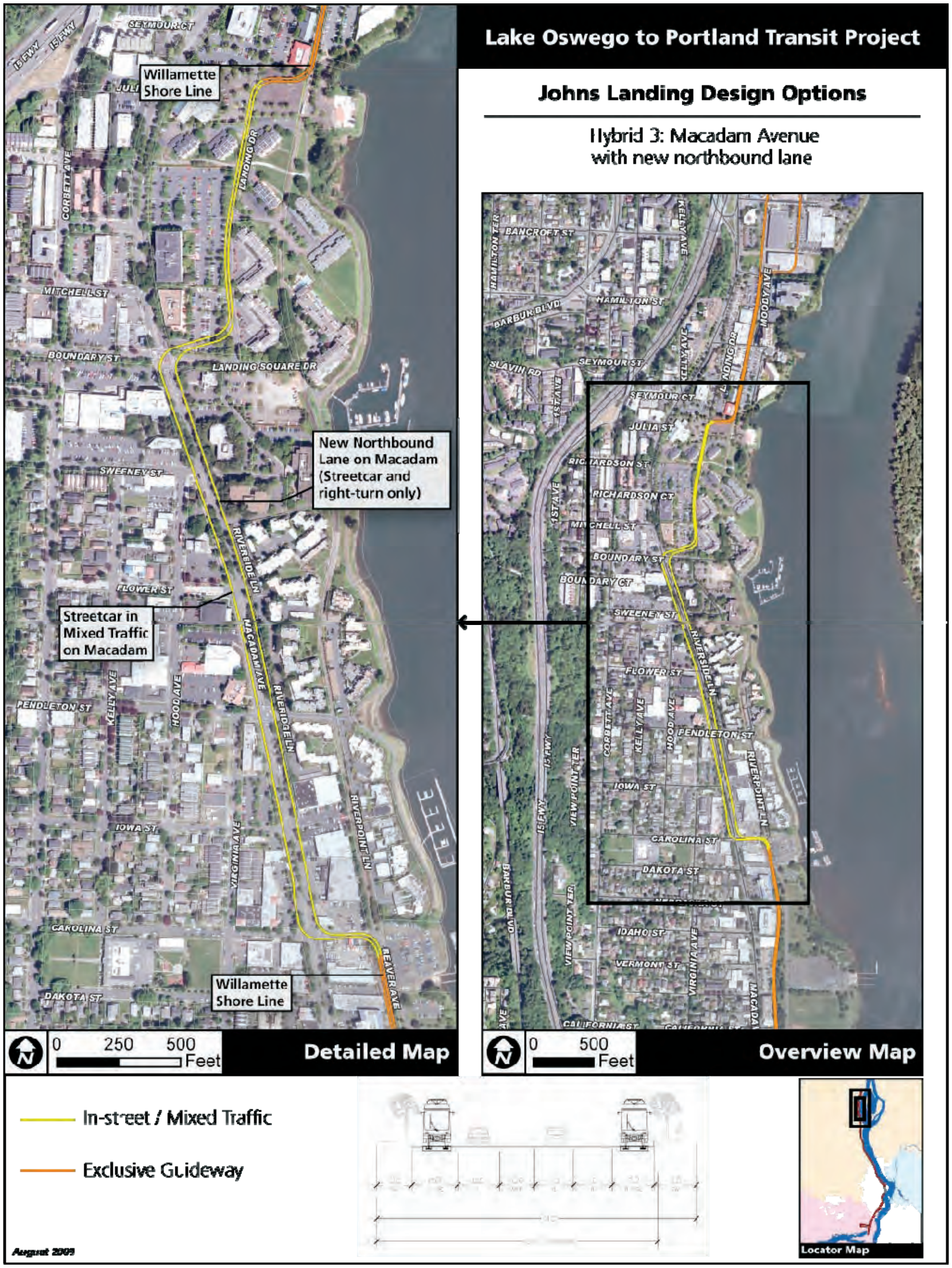


Figure C.3-4 Willamette Shore Line Design Option
Scoping/Design Refinement Study

Figure C.3-5 Full Macadam in-Street Design Option
Scoping/Design Refinement Study

Table C.3-1 Comparison of Johns Landing Design Options
Scoping/Design Refinement Study

	Hybrid 1: Macadam In-Street (Boundary to Carolina)	Hybrid 2: East Side Exclusive (Boundary to Iowa)	Hybrid 3: Macadam with New North Bound Lane (Boundary to Carolina)	Willamette Shore Line	Full Macadam In-Street
1. OPTIMIZE THE REGIONAL TRANSIT SYSTEM					
GOAL 1A. IMPROVE TRANSIT OPERATIONS					
Minimize travel time (minutes)	8.5 - 9.5	7.5 - 7.9	8.5 - 9.5	5.2 - 5.9	7.7 - 10.7
Maximize reliability of service	Less reliability, in mixed traffic for a portion of alignment	Most amount of exclusive transit guideway of the hybrid options	Provides some reliability in the NB direction	Most reliable transit service/exclusive guideway	Least reliable, in mixed traffic.
Maximize ability to expand service	Good; double track operations allow for expansion	Less ability to expand service if single track at Pendleton; good if double tracked adjacent to Macadam	Good; double track operations allow for expansion	Less ability to expand service if single track; good if double tracked	Good; double track operations allow for expansion
GOAL 1B. IMPROVE TRANSIT PERFORMANCE					
Maximize ridership	10,300 - 9,900	10,500 - 10,400	10,300 - 9,900	11,100 - 10,900	10,100 - 9,400
Estmated operating costs (millions $)	$2.28 - $2.33 M	$2.27 - $2.28 M	$2.28 - $2.33 M	$2.21 - $2.22 M	$2.31 - $2.38 M
Cost/ride	$0.64 - $0.67	$0.63 - $0.64	$0.64 - $0.67	$0.58 - $0.59	$0.67 - $0.74
2. THE PROJECT SHOULD BE FISCALLY RESPONSIVE AND MAXIMIZE REGIONAL RESOURCES					
GOAL 2A. FISCALLY RESPONSIVE					
Minimize capital cost (millions $)	$36.2 M	$41.3 M	$39.4 M	$28.8 M single track $21.7 M double track	$34.1 M
Maximize local match potential	$20,147,519	$20,147,519	$20,147,519	$29,003,666	$3,562,679
3. MAXIMIZE THE ECONOMIC DEVELOPMENT POTENTIAL					
GOAL 3A. MAXIMIZE THE ECONOMIC DEVELOPMENT POTENTIAL					
Maximize development potential	Add'l 1,827,000 sf development 740 housing units 2,170 jobs	Add'l 1,744,000 sf development 710 housing units 2,070 jobs	Add'l 1,827,000 sf development 740 housing units 2,170 jobs	Add'l 1,563,00 sf development 620 housing units 1,890 jobs	Add'l 1,957,00 sf development 840 housing units 2,230 jobs
GOAL 3B. MAXIMIZE THE ACCESSIBILITY TO PROMOTE REDEVELOPMENT					
Optimize bicycle and pedestrian access to stops and the Willamette Riverfront	Greater proximity and visibility to both sides of Macadam from Boundary to Carolina; no/minimal potnetial impact to access to riverfront	Good proximity and visibility from Macadam; increased crossing distance to and from west side of Macadam for pedestrians; no/minimal potential impact to access to riverfront	Greater proximity and visibility to both sides of Macadam from Boundary to Carolina; no/minimal impact to access to riverfront	Less visibility and greater distance from existing bicycle and pedestrian network; controlled access to riverfront	Greater proximity and visibility to both sides of Macadam; no/minimal impact to access to riverfront
Maximize access to commercial, residential & employment nodes	Good proximity to commercial nodes and residences on both sides of Macadam	Good proximity to commercial nodes and residences on both sides of Macadam	Good proximity to commercial nodes and residences on both sides of Macadam	Furthest from commercial nodes and residences on both sides of Macadam	Greater proximity to commercial nodes and residences on both sides of Macadam

This evaluation matrix is based on analysis completed during the Alternatives Analysis process conducted summer 2005 through December 2007 and some addition refinement work done in 2009. Alternatives selected to advance into the Draft Environmental Impact Statement will be analyzed further and in greater detail.

Legend:

1	2	3	4	5

Highest Rank <------------------------------> Lowest Rank

Table C.3-1 Comparison of Johns Landing Design Options Scoping/Design Refinement Study

Lake Oswego to Portland TRANSIT AND TRAIL STUDY

GOAL 4B. SUSTAIN EXISTING NEIGHBORHOODS			
Compatibility with Existing Development	Would not fit with the proposed foothills development but could support the existing Town Center	Would support the proposed Foothills development and the existing Town Center via a potential pedestrian connection at State St/B Ave	Would support the existing Town Center via a potential pedestrian connection at State St/B Ave; however would require a large park and ride in Foothills
Minimize ROW Impacts	Would have property impacts to businesses between the WSL and State St	Would have the most right of way acquisitions	Would utilize the existing right of way (unless configured to fit within the Foothills District
Minimize Off-Street Parking Impacts	Coordination with Safeway redevelopment/parking facility (smaller site)	Coordination with Albertsons redevelopment/parking facility (some neighborhood concerns)	No anticpated off-street parking impacts
Minimize Noise Impacts	Potential noise impacts with residential development in Town Center	Potential noise impact with residential area adjacent to the Albertsons site	No anticipated noise impacts
Minimize Visual Impacts	Potential visual impacts with elevated structure from Foothills area to State St	No anticipated visual impacts	No anticipated visual impacts
Minimize Bicycle & Pedestrian Conflicts	Potential Impacts to proposed Willamette Steps idea as part of the Foothills development plans	No anticipated bicycle & pedestrian conflicts. Could provide a new connection from Foothills to the Albertsons site.	No anticipated bicycle & pedestrian conflicts
Maximize Public Support	Would have the least public support	Would have the most public support and most consistent with the DTAAC recommendations	Would not have strong public support
5. BE SENSITIVE TO THE NATURAL ENVIRONMENT			
GOAL 5A. MINIMIZES IMPACTS TO THE NATURAL ENVIRONMENT			
Minimizes impacts to streams, wetlands and waterways	Would cross Tryon Creek	Would cross Tryon Creek	Would cross Tryon Creek
Minimize construction in or proximity to the FEMA 100-year floodplain	Potential floodplain concerns	Potential floodplain concerns	Potential floodplain concerns
Mimize impacts to Metro Title 3 lands (Water Quality, Flood Management and Fish and Wildlife Conservation)	Potential Title 3 land proximity concerns	Potential Title 3 land proximity concerns	Potential Title 3 land proximity concerns
Minimizes impacts to parklands, recreational areas and other Section 4(f)	Potential Tryon Creek State Park impacts	Potential Tryon Creek State Park impacts	Potential Tryon Creek State Park impacts

This evaluation matrix is based on analysis completed during the Alternatives Analysis process conducted summer 2005 through December 2007. Alternatives selected to advance into the Draft Environmental Impact

Legend:

1	2	3
Highest Rank	<----------->	**Lowest Rank**

Table C.3-1 Comparison of Johns Landing Design Options
Scoping/Design Refinement Study

Lake Oswego to Portland TRANSIT PROJECT

	Hybrid 1: Macadam In-Street (Boundary to Carolina)	Hybrid 2: East Side Exclusive (Boundary to Iowa)	Hybrid 3: Macadam with New North Bound Lane (Boundary to Carolina)	Willamette Shore Line	Full Macadam In-Street
5. BE SENSITIVE TO THE NATURAL ENVIRONMENT					
GOAL 5A. MINIMIZES IMPACTS TO THE NATURAL ENVIRONMENT					
Minimize impacts to streams, wetlands and waterways	Alignment is moved away from the Willamette River between SW Julia and SW Carolina Sts.	Alignment is moved away from the Willamette River between SW Julia and SW Iowa Sts.	Alignment is moved away from the Willamette River between SW Julia and SW Carolina Sts.	Close proximity to the Willamette River.	Alignment is moved away from the Willamette River between South Waterfront and SW Nevada St.
Minimize construction in or proximity to the FEMA 100-year floodplain	Similar to the WSL between South Waterfront and Julia St and from Carolina St south. Bypasses potential impacts to floodplain between SW Julia and SW Carolina Sts.	Similar to the WSL between South Waterfront and Julia St and from Iowa St south. Bypasses potential impacts to floodplain between SW Julia and SW Iowa Sts.	Similar to the WSL between South Waterfront and Julia St and from Carolina St south. Bypasses potential impacts to floodplain between SW Julia and SW Carolina Sts.	Greatest potential floodplain concerns due to proximity to the Willamette River and the FEMA 100-year floodplain	Least amount of potenail concerns regarding Willamette River and FEMA 100-year floodplain between South Waterfront and Nevada. Potential concerns south.
Mimize impacts to Metro Title 3 lands (Water Quality, Flood Management and Fish and Wildlife Conservation)	Similar to the WSL between South Waterfront and Julia St and from Carolina St south. Bypasses small segments of Title 3 lands between SW Julia and SW Carolina Sts.	Similar to the WSL between South Waterfront and Julia St and from Carolina St south. Bypasses small segments of Title 3 lands between SW Julia and SW Iowa Sts.	Similar to the WSL between South Waterfront and Julia St and from Carolina St south. Bypasses small segments of Title 3 lands between SW Julia and SW Carolina Sts.	WSL alignment through some segments of Title 3 lands including a large segment in Willamette Park.	Alignment is outside Title 3 lands from South Waterfront to SW Nevada.
Minimize impacts to parklands, recreational areas and other Section 4(f)	Utilizes right of way in/adjacent to Willamette Park and Butterfly Park	Utilizes right of way in/adjacent to Willamette Park and Butterfly Park	Utilizes right of way in/adjacent to Willamette Park and Butterfly Park	Utilizes right of way in/adjacent to Willamette Park and Butterfly Park	Minimizes the use of right of way in/adjacent to Willamette Park. Utilizes the right of way in Butterfly Park.

This evaluation matrix is based on analysis completed during the Alternatives Analysis process conducted summer 2005 through December 2007 and some addition refinement work done in 2009. Alternatives selected to advance into the Draft Environmental Impact Statement will be analyzed further and in greater detail.

Legend:

1	2	3	4	5

Highest Rank <------------------------------> Lowest Rank

Figure C.3-6 Albertsons Terminus Option
Scoping/Design Refinement Study

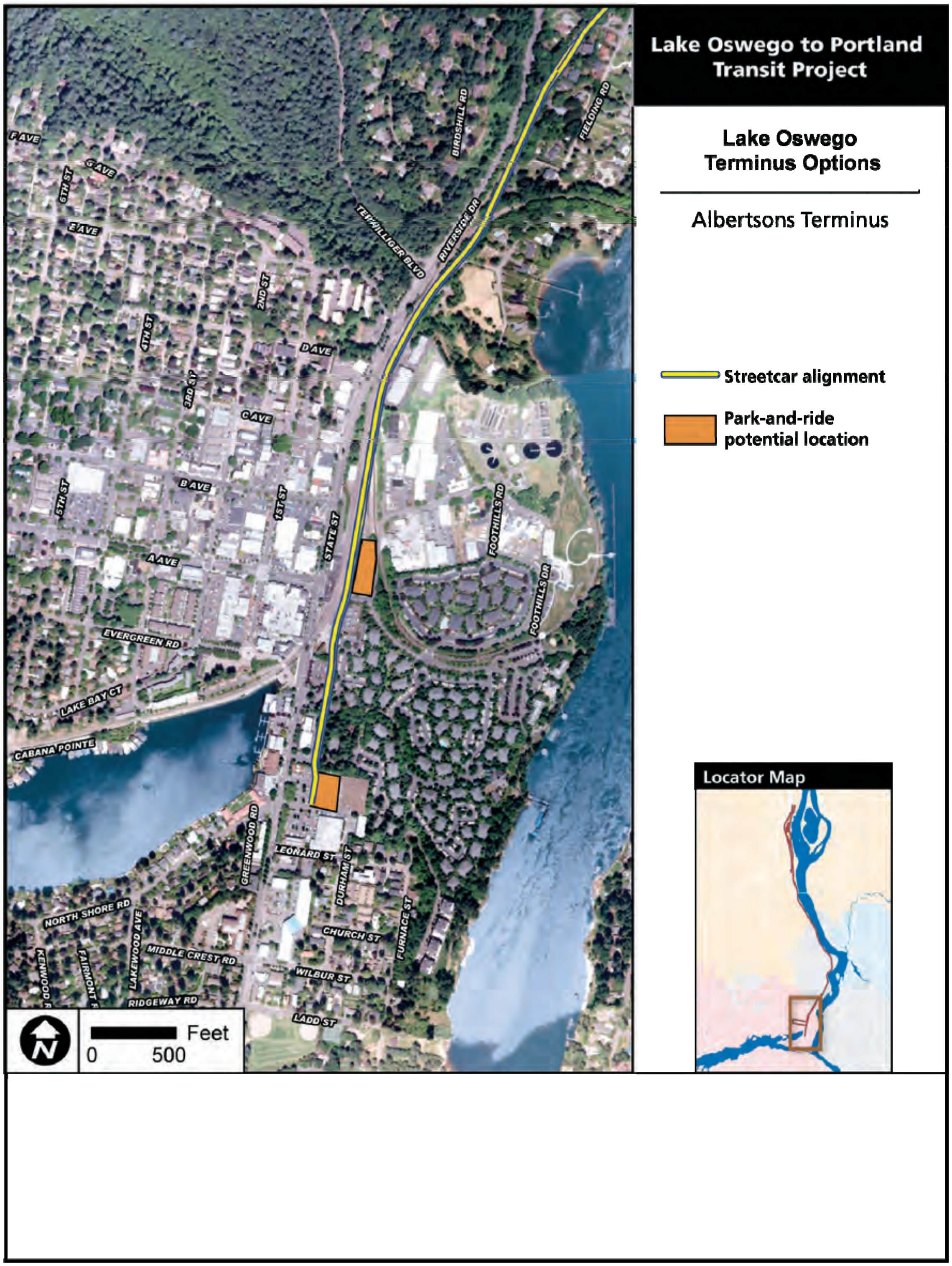


Figure C.3-7 SafewayTerminus Option
Scoping/Design Refinement Study

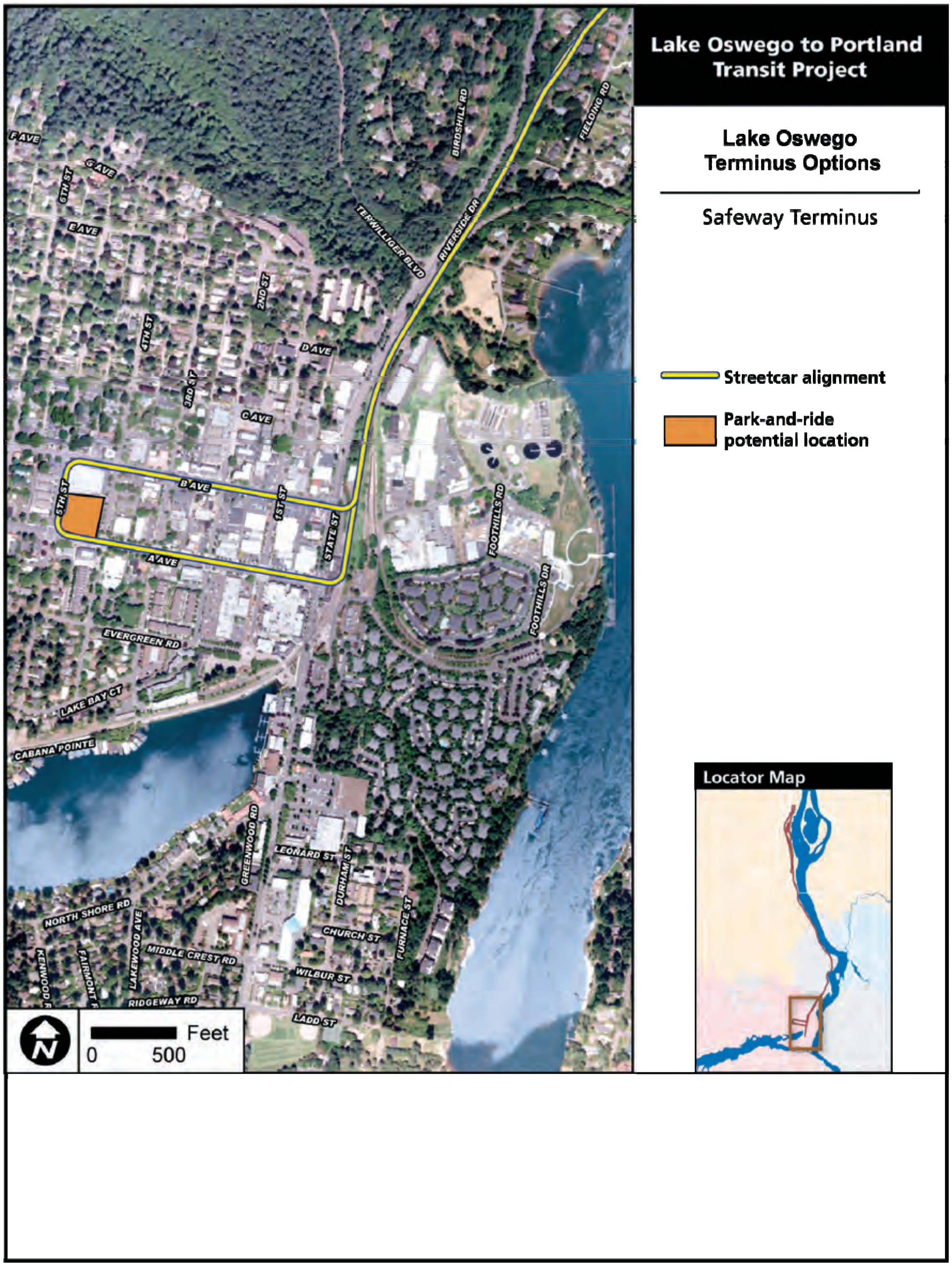


Figure C.3-8 Trolley Terminus Option
Scoping/Design Refinement Study

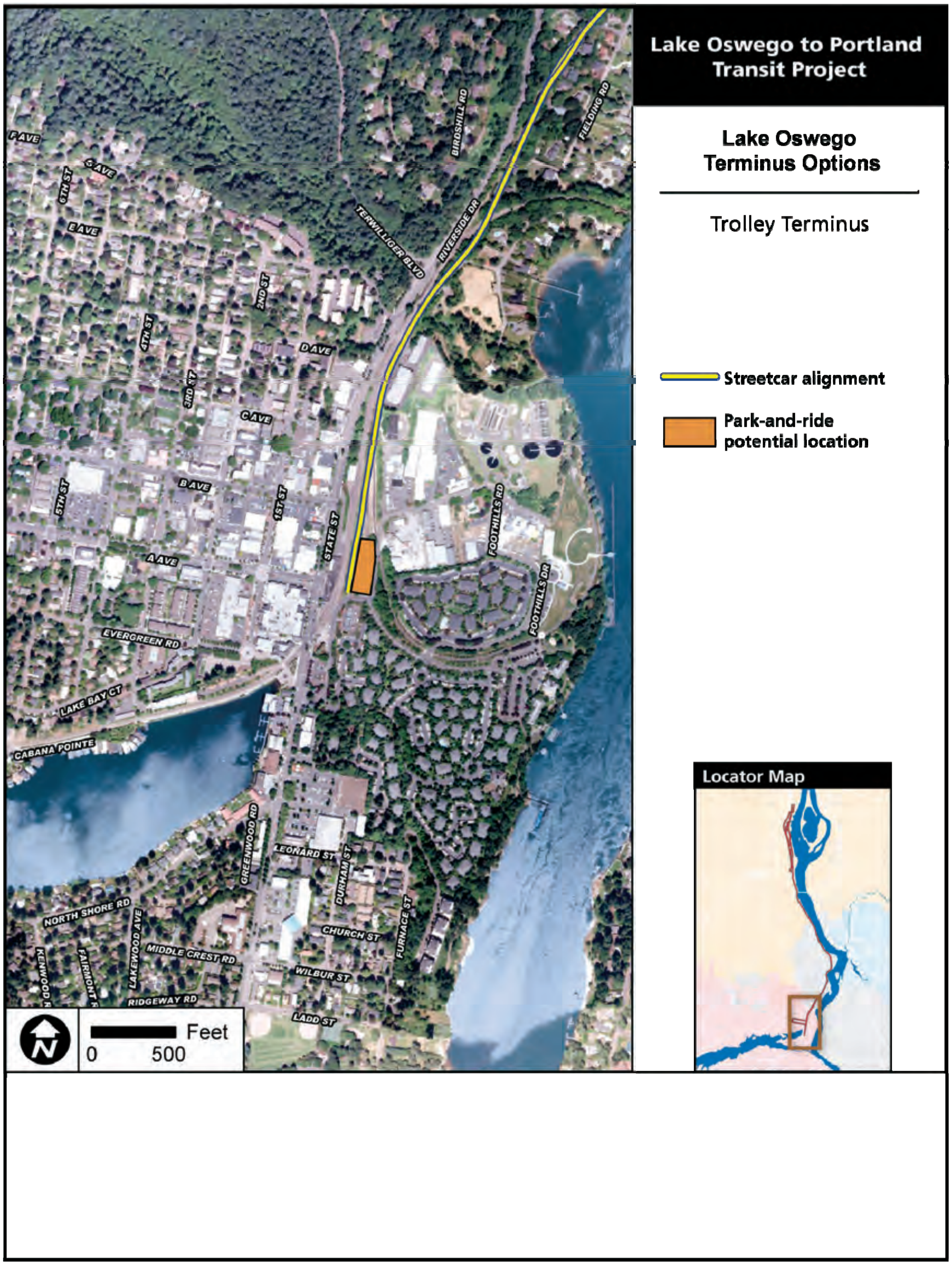


Table C.3-2 Comparison of Lake Oswego Terminus Options Scoping/Design Refinement Study

	Safeway Terminus	Albertsons Terminus	Trolley Terminus
1. OPTIMIZE THE REGIONAL TRANSIT SYSTEM			
GOAL 1A. IMPROVE TRANSIT OPERATIONS			
Minimize Travel Time (minutes)	23	21.6	20.7
Maximize Reliability of Service	Less reliability - dependent on congestion on State St and A/B Aves	Provides reliability with exclusive guideway/low volume streets	Provides reliability with exclusive guideway
Maximize Ability to Expand Service	Good if double track operations	Good if double track operations	Good if double track operations
GOAL 1B. IMPROVE TRANSIT PERFORMANCE			
Estimated Ridership	10,957	10,865	10,642
2. THE PROJECT SHOULD BE FISCALLY RESPONSIVE AND MAXIMIZE REGIONAL RESOURCES			
GOAL 2A. FISCALLY RESPONSIVE			
Minimize Capital Cost (millions $)	$42.6	$36.4	$30.8
Maximize Local Match Potential	Because the cost is highest, there would be a need for more local match.	Because the right of way is owned by UP, all alternatives would have to aquire the appropriate resources.	Because the cost is the lowest, there would be lesser local match required.
3. MAXIMIZE THE ECONOMIC DEVELOPMENT POTENTIAL			
GOAL 3A. MAXIMIZE THE ECONOMIC DEVELOPMENT POTENTIAL			
Maximize Development Potential	Add'l 1,080,000 sf development 630 housing units 900 jobs	Add'l 904,000 sf development 600 housing units 600 jobs	Add'l 667,000 sf development 450 housing units 440 jobs
GOAL 3B. MAXIMIZE THE ACCESSIBILITY TO PROMOTE REDEVELOPMENT			
Maximize Access to Commercial, Residential & Employment Nodes	Good connectivity to commercial activity in existing Town Center	Best connectivity to proposed Foothills District and South	Good connectivity to Foothills District
Maximize the Potential Future Expansion	Would allow for future expansion to the west; may be redundant to the proposed Clackamas/Washington Square HCT project	Would allow for future expansion to the south	Would not preclude future expansion
Supports Local and Regional Plans	Would not fit with the proposed foothills development but could support the existing Town Center	Would support the proposed Foothills development and the existing Town Center via a potential pedestrian connection at State St/B Ave	Would support the existing Town Center via a potential pedestrian connection at State St/B Ave; however would require a large park and ride in Foothills
4. BE SENSITIVE TO THE BUILT AND SOCIAL ENVIRONMENT.			
GOAL 4A. MINIMIZE TRAFFIC IMPACTS			
Maintain Traffic Progression	Potential change in the intersection operations at State St and A/B Avenues	No change to traffic progression on State St or A/B Avenues	No change to traffic progression on State St or A/B Avenues
Minimize Auto Travel Time	Potential travel time impacts through Town Center because of changes in intersection operations	No impact on auto travel time on State St or A/B Aves	No impact on auto travel time on State St or A/B Aves
Maintain Acceptable Intersection LOS	Potential impact to operations at State St/A Ave due to special streetcar phase	Potential impact to LOS at State St and Albertsons and Foothills - park and ride split between these 2 locations	Potential impct to LOS as State St/Foothills - all park and ride would be accessed via State/Foothills
Traffic Signal Modifications Required	Traffic signal modifications at State/A and State/B	No traffic signal modifications required	Minimal potential traffic signal modifications required (only if additional green time is needed to serve park & riders)
Work Zone/Construction Staging Impacts	Potential construction impacts on State and A/B Aves	Minimal potential construction impacts on existing traffic operations, longer line, more construction required than Trolley	Potential construction impacts
Safe Operations for Bicycles and Motorcycles	Streetcar track in roadway on A Avenue and B Avenue	Exclusive transit right of way reduces potential track conflicts with bicycles and motorcycles. Streetcar track in new shared roadway between Foothills Rd and Albertsons	Exclusive transit right of way reduces potential track conflicts

This evaluation matrix is based on analysis completed during the Alternatives Analysis process conducted summer 2005 through December 2007. Alternatives selected to advance into the Draft Environmental Impact

Legend:

1	2	3
Highest Rank	<----------->	Lowest Rank

Table C.3-2 Comparison of Lake Oswego Terminus Options Scoping/Design Refinement Study

Lake Oswego to Portland TRANSIT AND TRAIL STUDY

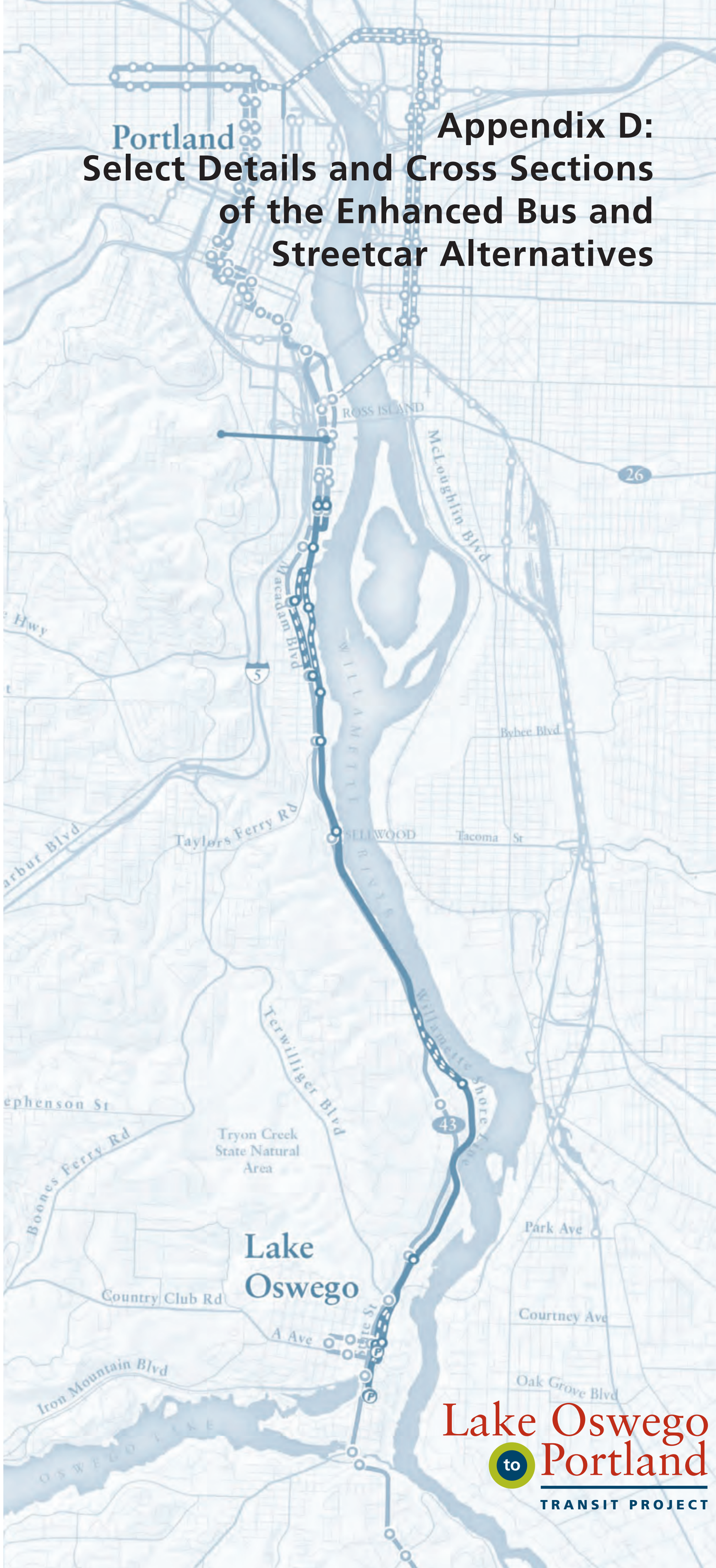
GOAL 4B. SUSTAIN EXISTING NEIGHBORHOODS			
Compatibility with Existing Development	Would not fit with the proposed foothills development but could support the existing Town Center	Would support the proposed Foothills development and the existing Town Center via a potential pedestrian connection at State St/B Ave	Would support the existing Town Center via a potential pedestrian connection at State St/B Ave; however would require a large park and ride in Foothills
Minimize ROW Impacts	Would have property impacts to businesses between the WSL and State St	Would have the most right of way acquisitions	Would utilize the existing right of way (unless configured to fit within the Foothills District
Minimize Off-Street Parking Impacts	Coordination with Safeway redevelopment/parking facility (smaller site)	Coordination with Albertsons redevelopment/parking facility (some neighborhood concerns)	No anticpated off-street parking impacts
Minimize Noise Impacts	Potential noise impacts with residential development in Town Center	Potential noise impact with residential area adjacent to the Albertsons site	No anticipated noise impacts
Minimize Visual Impacts	Potential visual impacts with elevated structure from Foothills area to State St	No anticipated visual impacts	No anticipated visual impacts
Minimize Bicycle & Pedestrian Conflicts	Potential Impacts to proposed Willamette Steps idea as part of the Foothills development plans	No anticipated bicycle & pedestrian conflicts. Could provide a new connection from Foothills to the Albertsons site.	No anticipated bicycle & pedestrian conflicts
Maximize Public Support	Would have the least public support	Would have the most public support and most consistent with the DTAAC recommendations	Would not have strong public support
5. BE SENSITIVE TO THE NATURAL ENVIRONMENT			
GOAL 5A. MINIMIZES IMPACTS TO THE NATURAL ENVIRONMENT			
Minimizes impacts to streams, wetlands and waterways	Would cross Tryon Creek	Would cross Tyron Creek	Would cross Tryon Creek
Minimize construction in or proximity to the FEMA 100-year floodplain	Potential floodplain concerns	Potential floodplain concerns	Potential floodplain concerns
Mimize impacts to Metro Title 3 lands (Water Quality, Flood Management and Fish and Wildlife Conservation)	Potential Title 3 land proximity concerns	Potential Title 3 land proximity concerns	Potential Title 3 land proximity concerns
Minimizes impacts to parklands, recreational areas and other Section 4(f)	Potential Tryon Creek State Park impacts	Potential Tryon Creek State Park impacts	Potential Tryon Creek State Park impacts

This evaluation matrix is based on analysis completed during the Alternatives Analysis process conducted summer 2005 through December 2007. Alternatives selected to advance into the Draft Environmental Impact

Legend:

1	2	3
Highest Rank	<----------->	Lowest Rank

Appendix D: Select Details and Cross Sections of the Enhanced Bus and Streetcar Alternatives



Lake Oswego to Portland
TRANSIT PROJECT

APPENDIX D

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APPENDIX D
SELECT DETAILS AND CROSS SECTIONS OF THE ENHANCED BUS AND STREETCAR ALTERNATIVES

Enhanced Bus Alternative:

D-1. Park-and-Ride at Southern Terminus

Streetcar Alternative:

D-2. Moody/Bond Couplet

D-3. Macadam In-Street and Macadam Additional Lane Design Options
Transition from Willamette Shore Line to SW Landing Drive

D-4. Macadam In-Street and Macadam Additional Lane Design Options
Typical Cross-Sections on SW Landing Drive

D-5. Macadam In-Street Design Option
Transition from Landing Drive to Macadam at Boundary

D-6. Macadam Additional Lane Design Option
Transition from Landing Drive to Macadam at Boundary

D-7. Willamette Shore Line Design Option at SW Boundary Street

D-8. Typical Cross-Sections near SW Pendleton Street

D-9. Macadam In-Street Design Option
Transition from Macadam to Willamette Shore Line at Carolina

D-10. Macadam Additional Lane Design Option
Transition from Macadam to Willamette Shore Line at Carolina

D-11. New Interchange Design Option at Sellwood Bridge

D-12. Willamette Shore Line Design Option at Sellwood Bridge

D-13. Riverwood In-Street Design Option at Riverwood Road

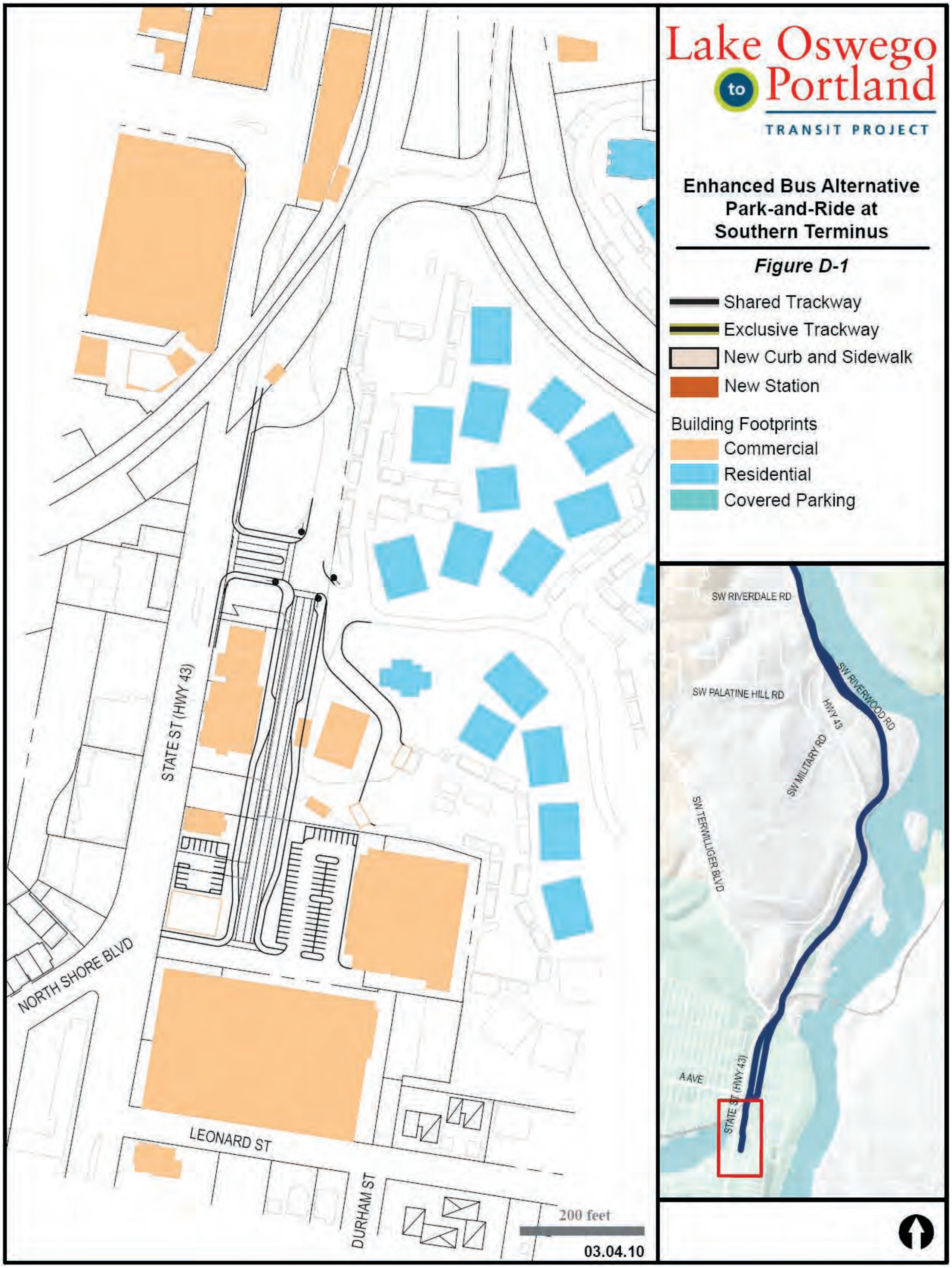
D-14. Willamette Shore Line Design Option at Riverwood Road

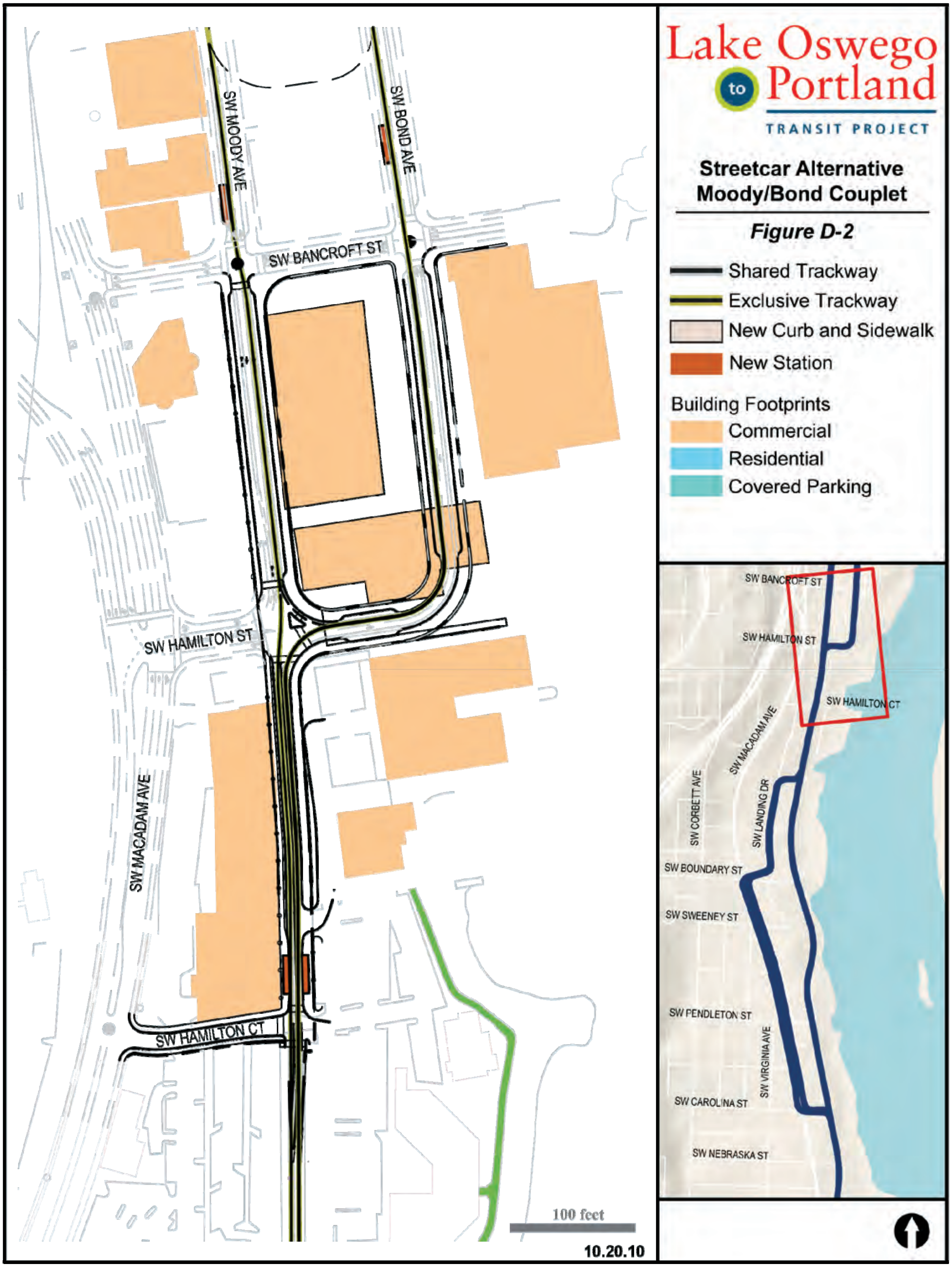
D-15. Riverwood In-Street Design Option and Willamette Shore Line Design Option
Typical Cross-Sections

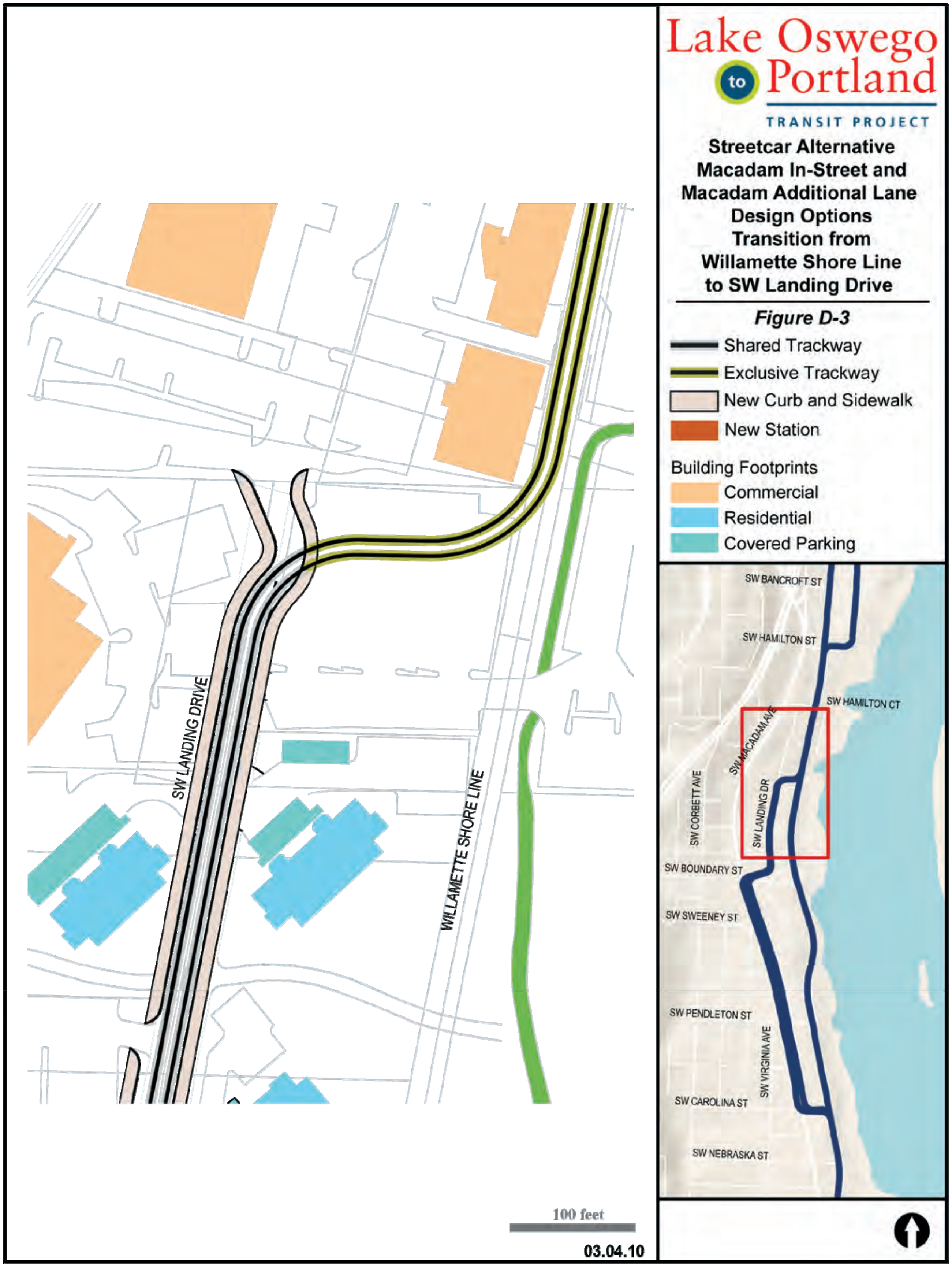
D-16. UPRR Design Option

D-17. Foothills Design Option

D-18. Park-and-Ride at Southern Terminus


Lake Oswego
to Portland
TRANSIT PROJECT
Enhanced Bus Alternative
Park-and-Ride at
Southern Terminus
Figure D-1
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
STATE ST (HWY 43)
NORTH SHORE BLVD
LEONARD ST
DURHAM ST
200 feet
03.04.10
SW RIVERDALE RD
SW PALATINE HILL RD
SW RIVERWOOD RD
HWY 43
SW MILITARY RD
SW TERWILLIGER BLVD
A AVE
STATE ST (HWY 43)


Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Moody/Bond Couplet
Figure D-2
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW MOODY AVE
SW BOND AVE
SW BANCROFT ST
SW HAMILTON ST
SW MACADAM AVE
SW HAMILTON CT
100 feet
10.20.10
SW BANCROFT ST
SW HAMILTON ST
SW HAMILTON CT
SW MACADAM AVE
SW CORBETT AVE
SW LANDING DR
SW BOUNDARY ST
SW SWEENEY ST
SW PENDLETON ST
SW VIRGINIA AVE
SW CAROLINA ST
SW NEBRASKA ST

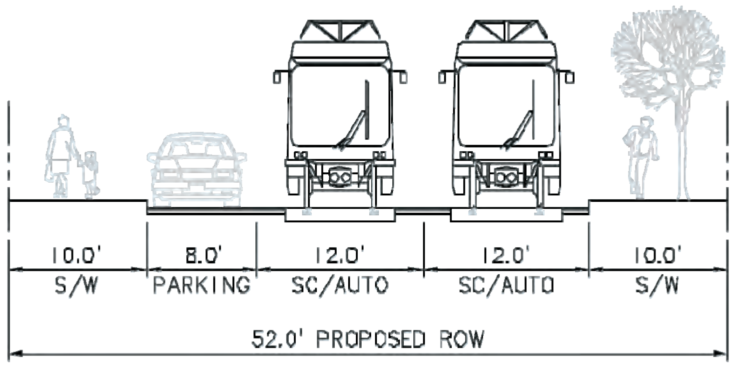


Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Macadam In-Street and
Macadam Additional Lane
Design Options
Transition from
Willamette Shore Line
to SW Landing Drive
Figure D-3
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW LANDING DRIVE
WILLAMETTE SHORE LINE
SW BANCROFT ST
SW HAMILTON ST
SW HAMILTON CT
SW MACADAM AVE
SW CORBETT AVE
SW LANDING DR
SW BOUNDARY ST
SW SWEENEY ST
SW PENDLETON ST
SW VIRGINIA AVE
SW CAROLINA ST
SW NEBRASKA ST
100 feet
03.04.10

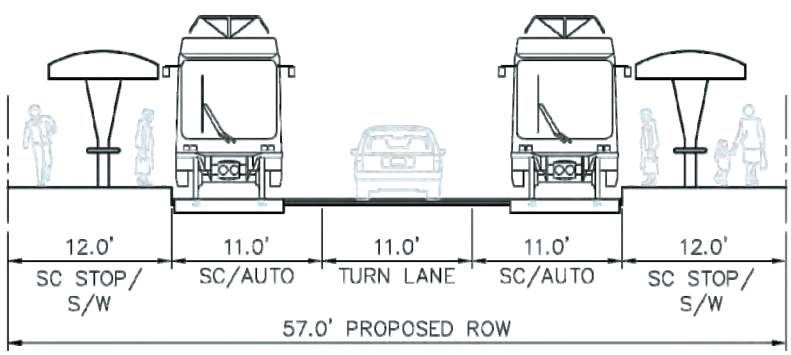
Lake Oswego to Portland
TRANSIT PROJECT

Streetcar Alternative Typical Cross-Sections on SW Landing Drive Macadam In-Street and Macadam Additional Lane Design Options

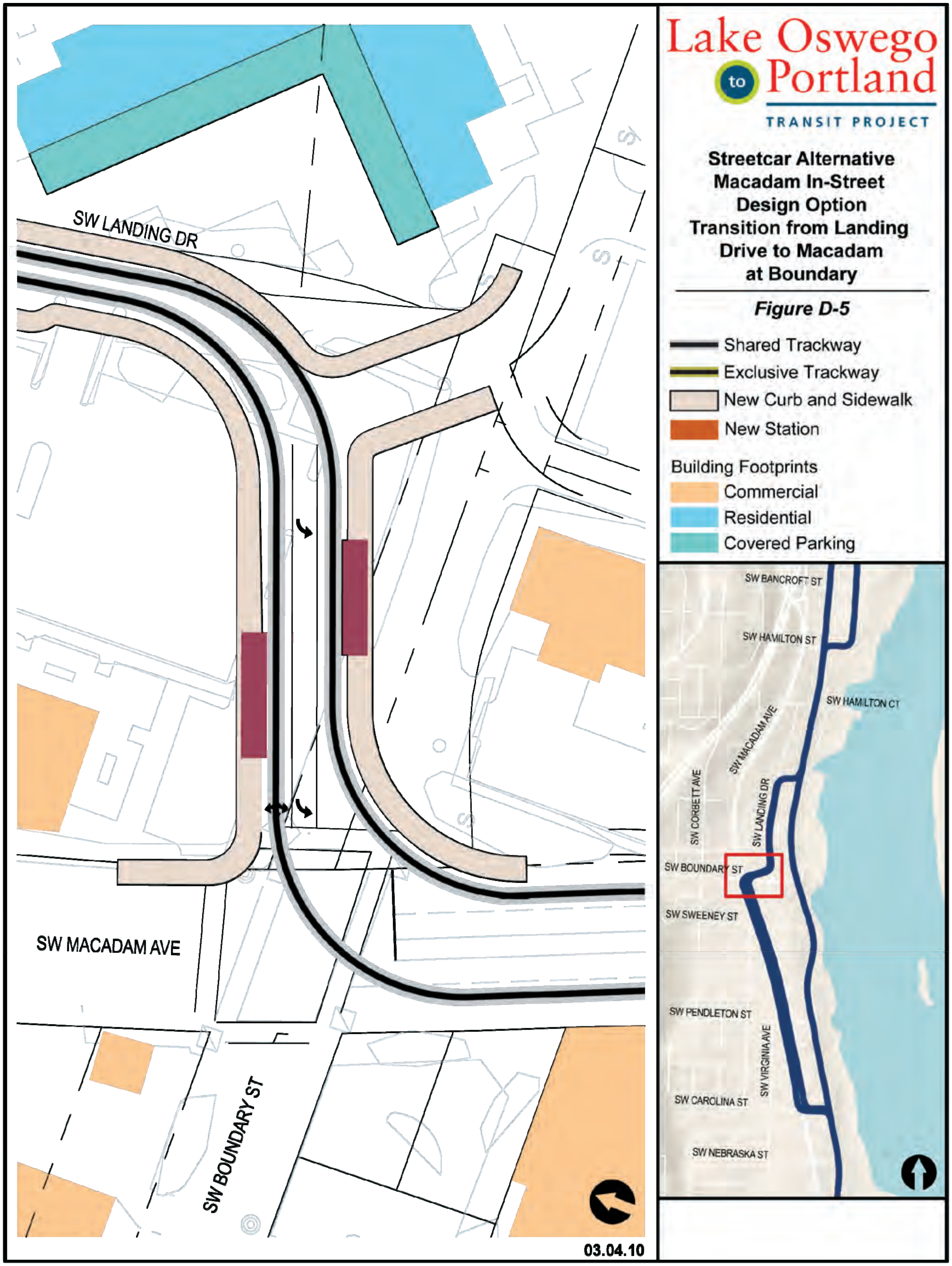
Figure D-4

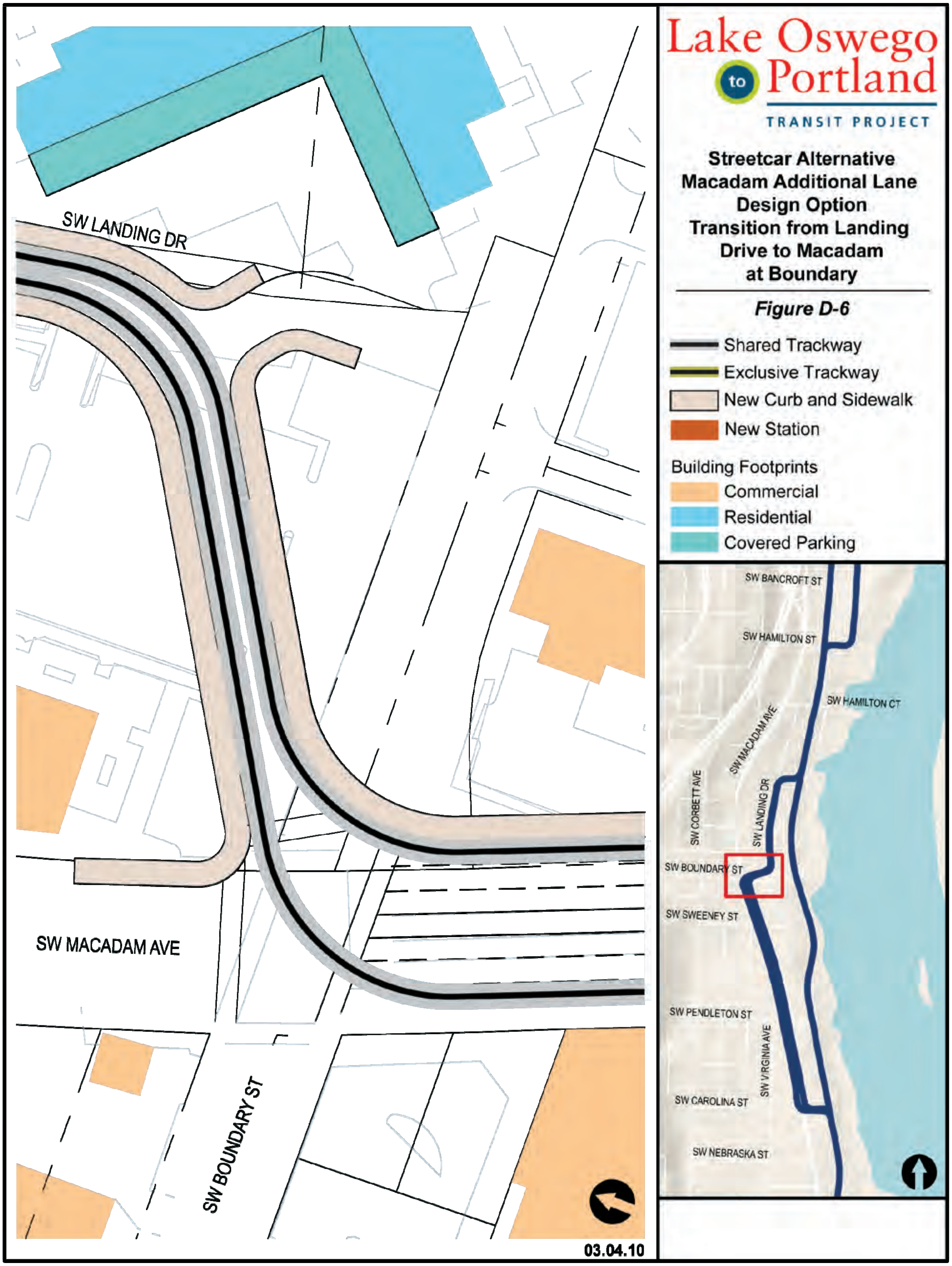


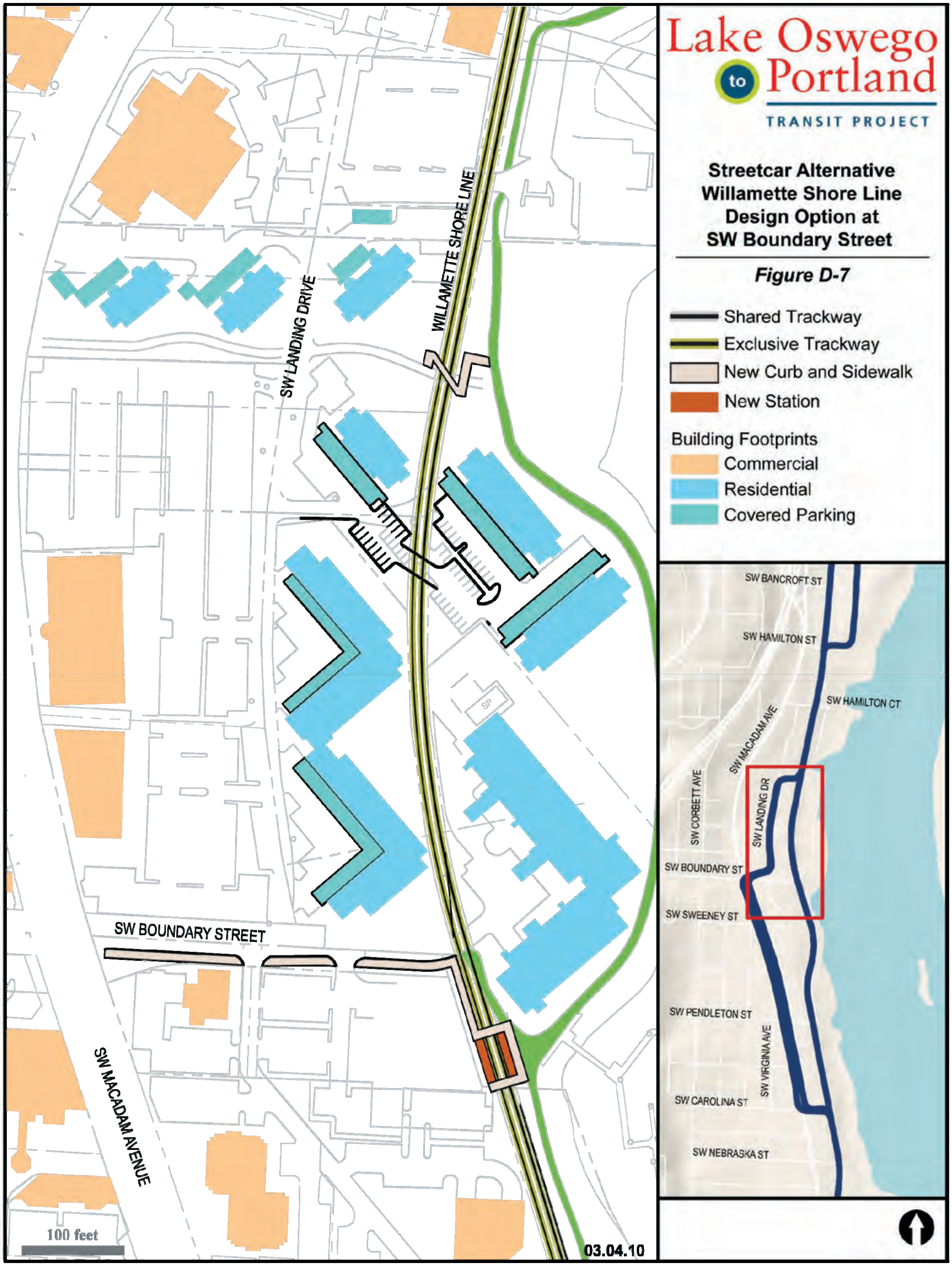
A: Streetcar Alternative
Macadam In-Street and Additional Lane Design Options
Typical Cross-Section on SW Landing Drive - Facing North



B: Streetcar Alternative
Macadam In-Street and Additional Lane Design Options
Cross-Section at SW Boundary Street Station - Facing West

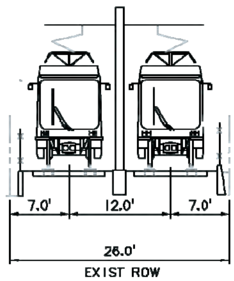

SW LANDING DR
SW MACADAM AVE
SW BOUNDARY ST
03.04.10
Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Macadam In-Street
Design Option
Transition from Landing
Drive to Macadam
at Boundary
Figure D-5
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW BANCROFT ST
SW HAMILTON ST
SW HAMILTON CT
SW MACADAM AVE
SW CORBETT AVE
SW LANDING DR
SW BOUNDARY ST
SW SWEENEY ST
SW PENDLETON ST
SW VIRGINIA AVE
SW CAROLINA ST
SW NEBRASKA ST


Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Macadam Additional Lane
Design Option
Transition from Landing
Drive to Macadam
at Boundary
Figure D-6
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW LANDING DR
SW MACADAM AVE
SW BOUNDARY ST
03.04.10
SW BANCROFT ST
SW HAMILTON ST
SW HAMILTON CT
SW MACADAM AVE
SW CORBETT AVE
SW LANDING DR
SW BOUNDARY ST
SW SWEENEY ST
SW PENDLETON ST
SW VIRGINIA AVE
SW CAROLINA ST
SW NEBRASKA ST

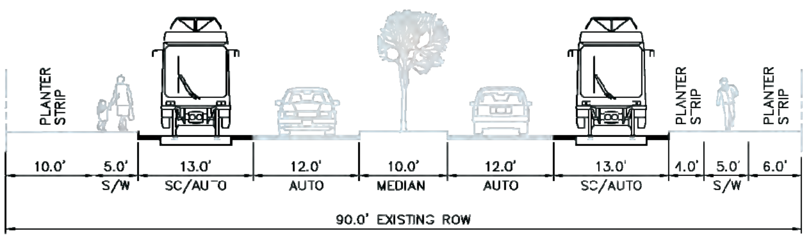

Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Willamette Shore Line
Design Option at
SW Boundary Street
Figure D-7
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
WILLAMETTE SHORE LINE
SW LANDING DRIVE
SW BOUNDARY STREET
SW MACADAM AVENUE
100 feet
03.04.10
SW BANCROFT ST
SW HAMILTON ST
SW HAMILTON CT
SW MACADAM AVE
SW CORBETT AVE
SW LANDING DR
SW BOUNDARY ST
SW SWEENEY ST
SW PENDLETON ST
SW VIRGINIA AVE
SW CAROLINA ST
SW NEBRASKA ST

Streetcar Alternative Typical Cross-Sections near SW Pendleton Street

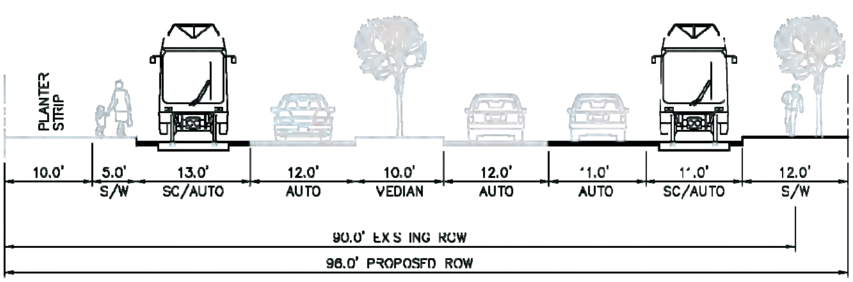
Figure D-8



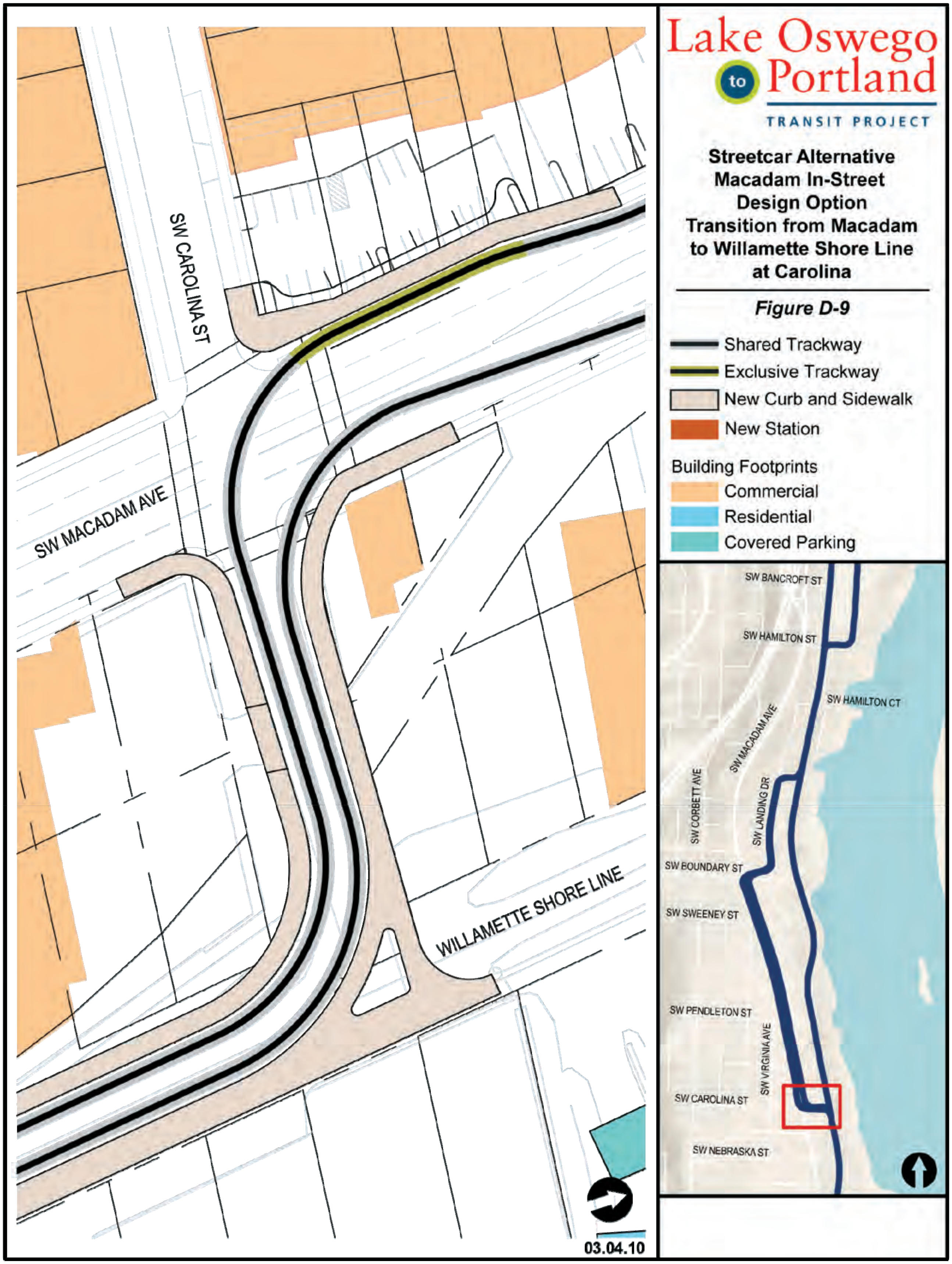
A: Streetcar Alternative Willamette Shore Line Design Option Cross-Section near SW Pendleton Street - Facing North



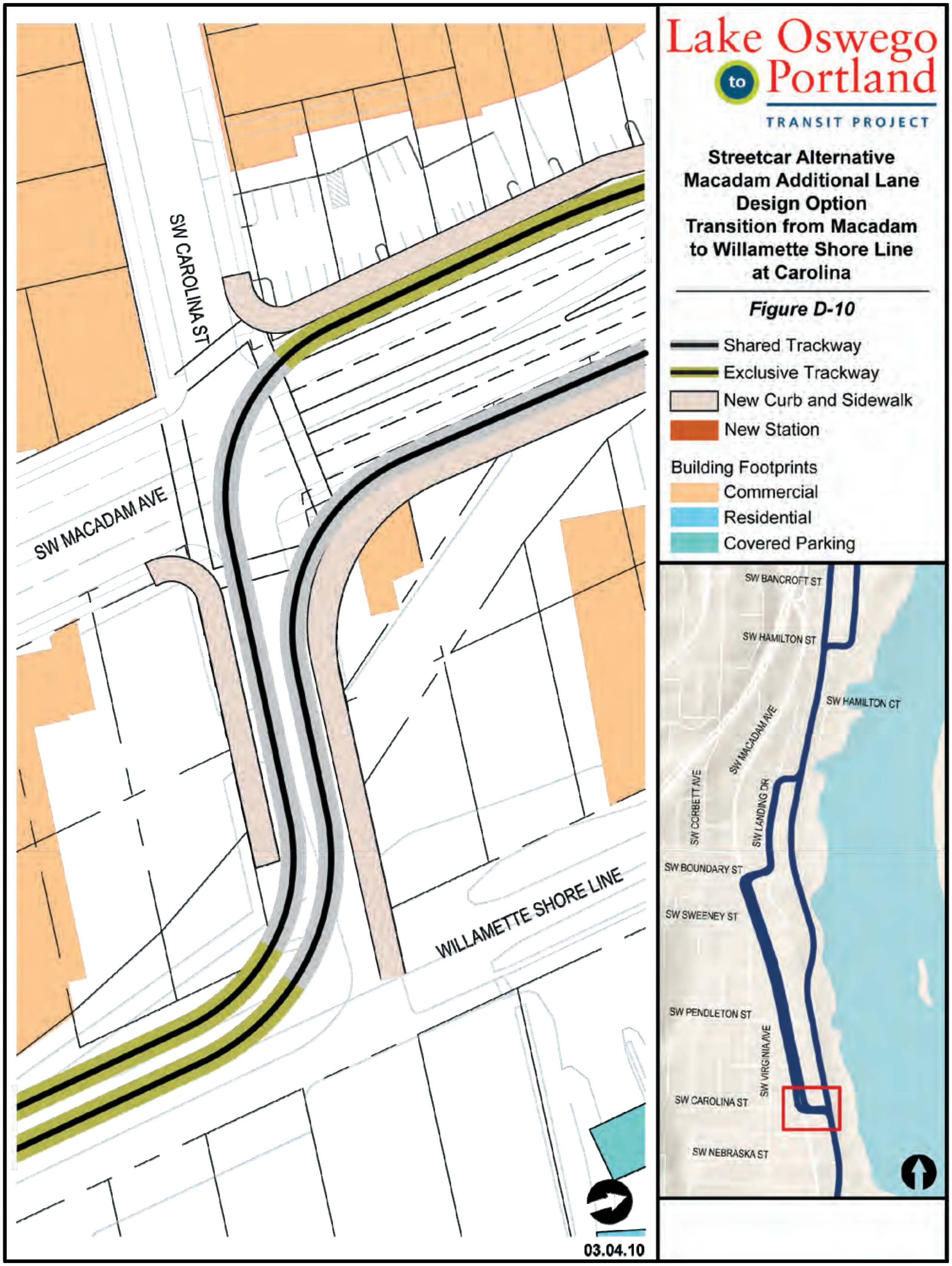
B: Streetcar Alternative Macadam In-Street Design Option Cross-Section near SW Pendleton Street - Facing North

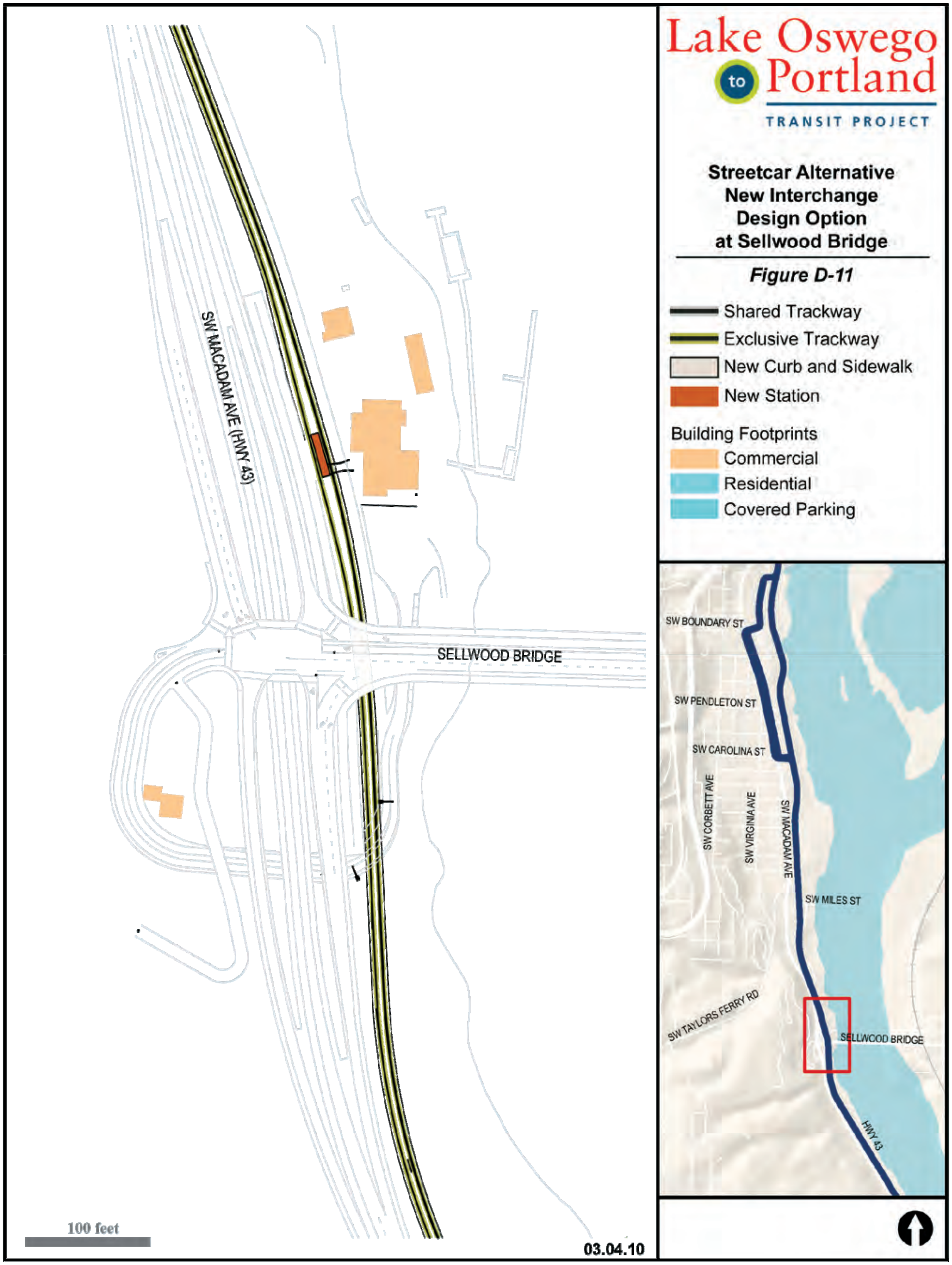


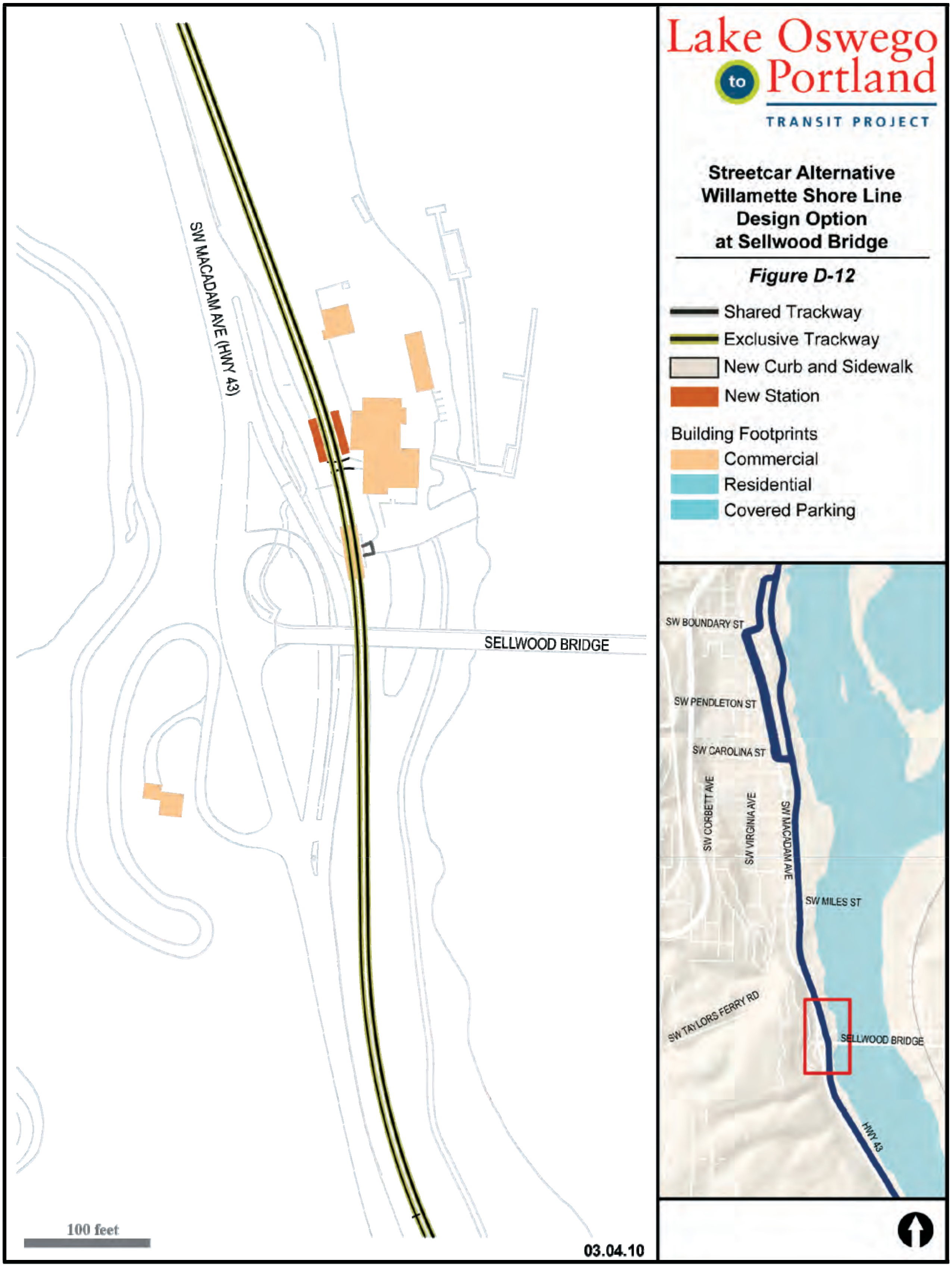
C: Streetcar Alternative Macadam Additional Lane Design Option Cross-Section near SW Pendleton Street - Facing North



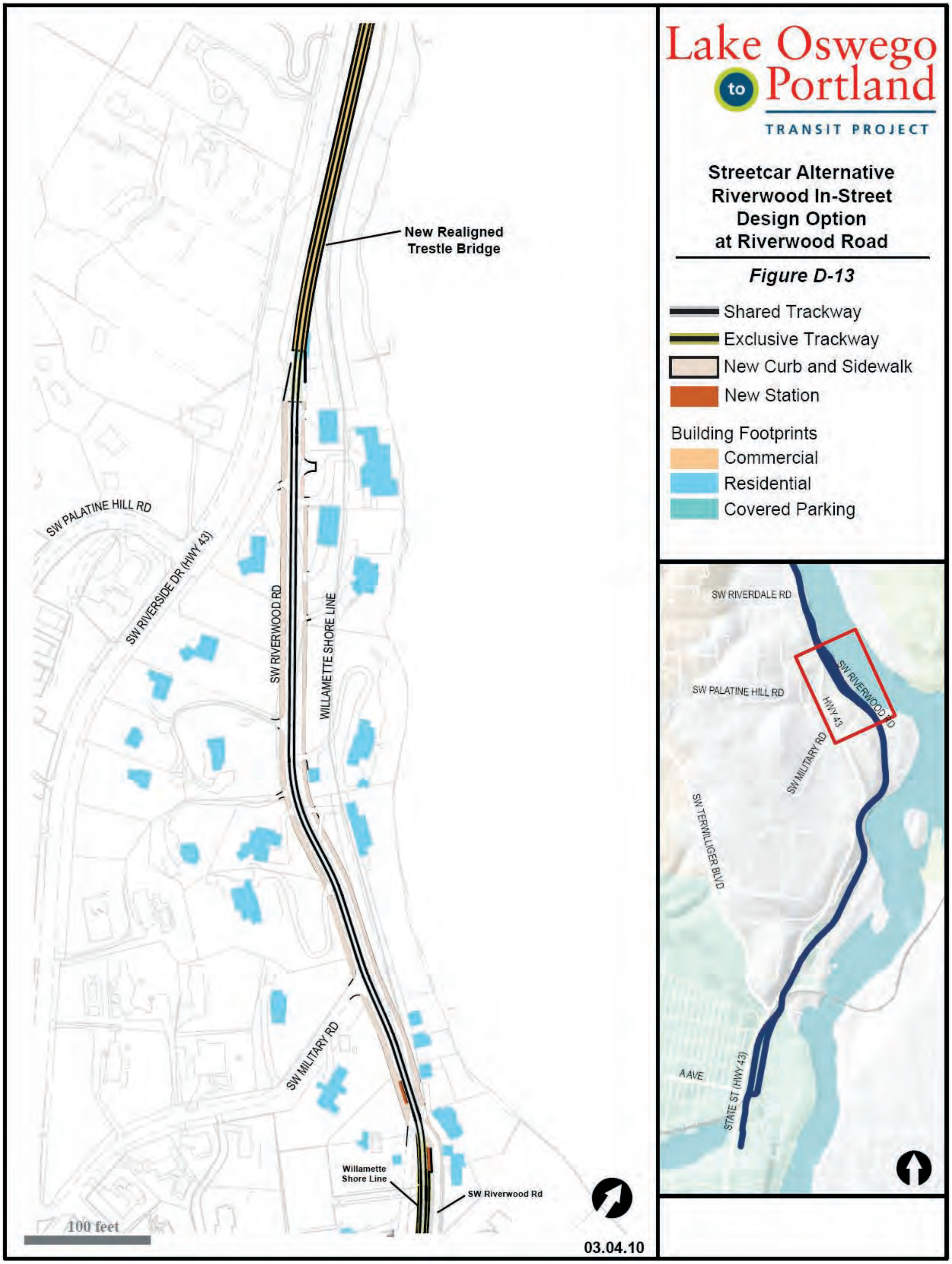
Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Macadam In-Street
Design Option
Transition from Macadam
to Willamette Shore Line
at Carolina
Figure D-9
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW CAROLINA ST
SW MACADAM AVE
WILLAMETTE SHORE LINE
03.04.10
SW BANCROFT ST
SW HAMILTON ST
SW HAMILTON CT
SW MACADAM AVE
SW CORBETT AVE
SW LANDING DR
SW BOUNDARY ST
SW SWEENEY ST
SW PENDLETON ST
SW VIRGINIA AVE
SW CAROLINA ST
SW NEBRASKA ST


Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Macadam Additional Lane
Design Option
Transition from Macadam
to Willamette Shore Line
at Carolina
Figure D-10
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW CAROLINA ST
SW MACADAM AVE
WILLAMETTE SHORE LINE
03.04.10
SW BANCROFT ST
SW HAMILTON ST
SW HAMILTON CT
SW MACADAM AVE
SW CORBETT AVE
SW LANDING DR
SW BOUNDARY ST
SW SWEENEY ST
SW PENDLETON ST
SW VIRGINIA AVE
SW CAROLINA ST
SW NEBRASKA ST


Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
New Interchange
Design Option
at Sellwood Bridge
Figure D-11
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW MACADAM AVE (HWY 43)
SELLWOOD BRIDGE
100 feet
03.04.10
SW BOUNDARY ST
SW PENDLETON ST
SW CAROLINA ST
SW CORBETT AVE
SW VIRGINIA AVE
SW MACADAM AVE
SW MILES ST
SW TAYLORS FERRY RD
SELLWOOD BRIDGE
HWY 43



Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Willamette Shore Line
Design Option
at Sellwood Bridge
Figure D-12
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW MACADAM AVE (HWY 43)
SELLWOOD BRIDGE
100 feet
03.04.10
SW BOUNDARY ST
SW PENDLETON ST
SW CAROLINA ST
SW CORBETT AVE
SW VIRGINIA AVE
SW MACADAM AVE
SW MILES ST
SW TAYLORS FERRY RD
SELLWOOD BRIDGE
HWY 43


Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Riverwood In-Street
Design Option
at Riverwood Road
Figure D-13
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
New Realigned
Trestle Bridge
SW PALATINE HILL RD
SW RIVERSIDE DR (HWY 43)
SW RIVERWOOD RD
WILLAMETTE SHORE LINE
SW MILITARY RD
Willamette
Shore Line
SW Riverwood Rd
100 feet
03.04.10
SW RIVERDALE RD
SW PALATINE HILL RD
SW RIVERWOOD RD
HWY 43
SW MILITARY RD
SW TERWILLIGER BLVD
A AVE
STATE ST (HWY 43)

Lake Oswego to Portland
TRANSIT PROJECT

Streetcar Alternative Willamette Shore Line Design Option at Riverwood Road

Figure D-14

Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station

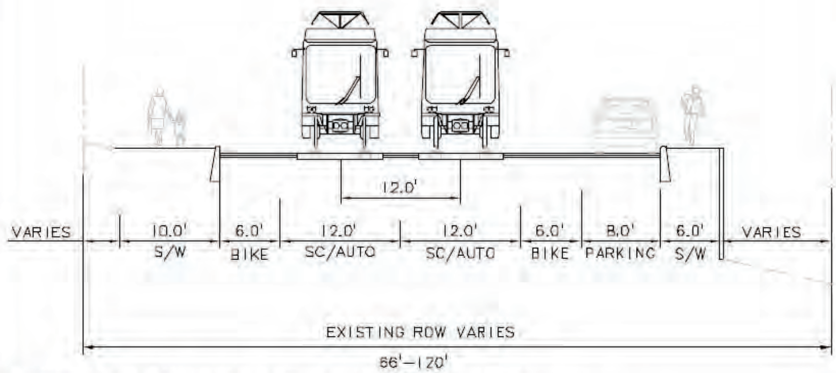
Building Footprints
Commercial
Residential
Covered Parking

Lake Oswego to Portland

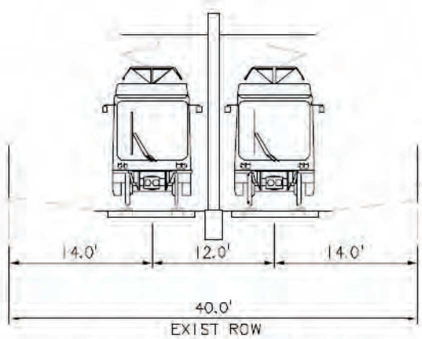
TRANSIT PROJECT

Streetcar Alternative Riverwood In-Street Design Option and Willamette Shore Line Design Option Typical Cross-Sections

Figure D-15

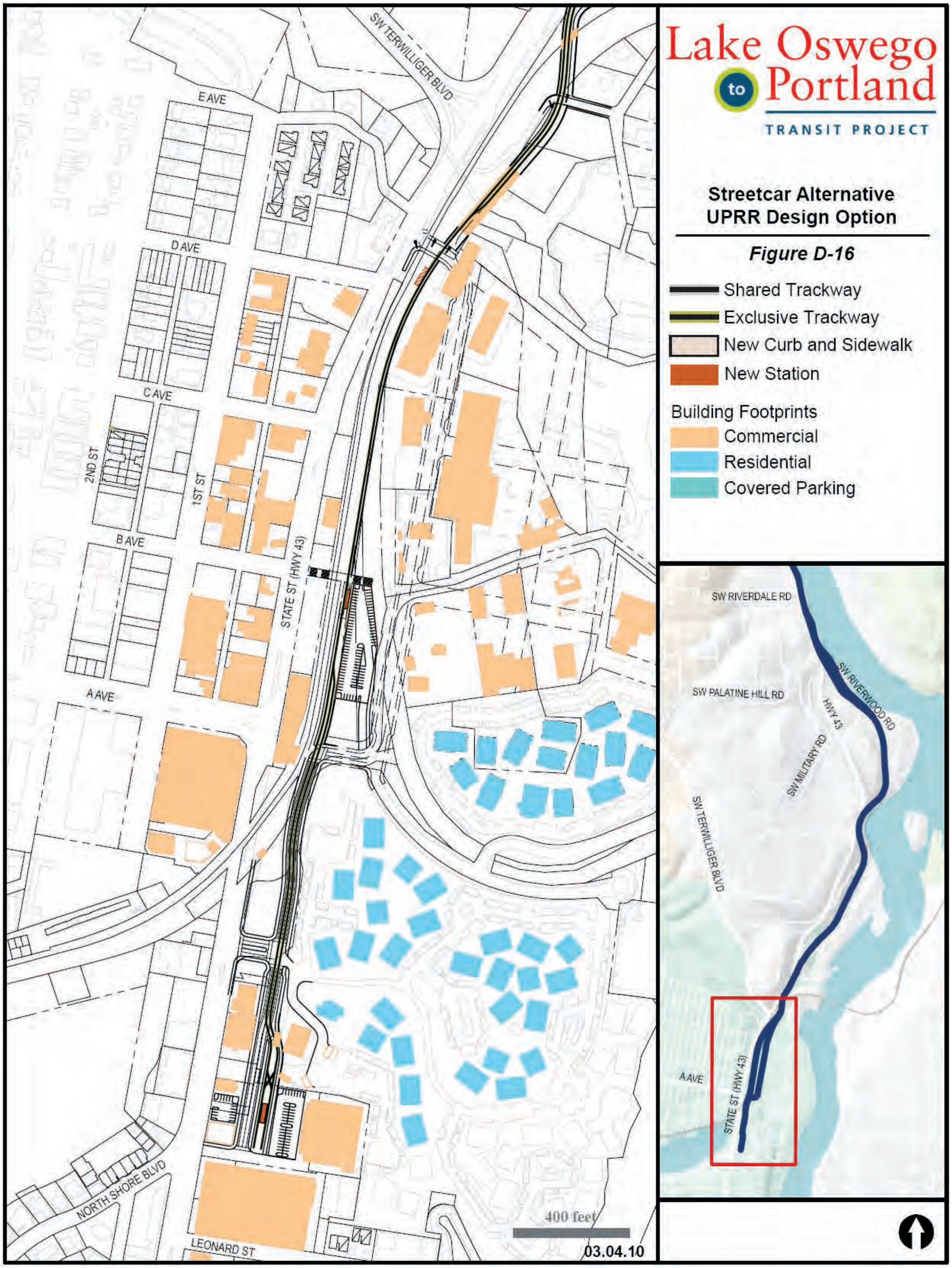


A: Streetcar Alternative Riverwood Design Option
Cross-Section North of SW Military Road - Facing North

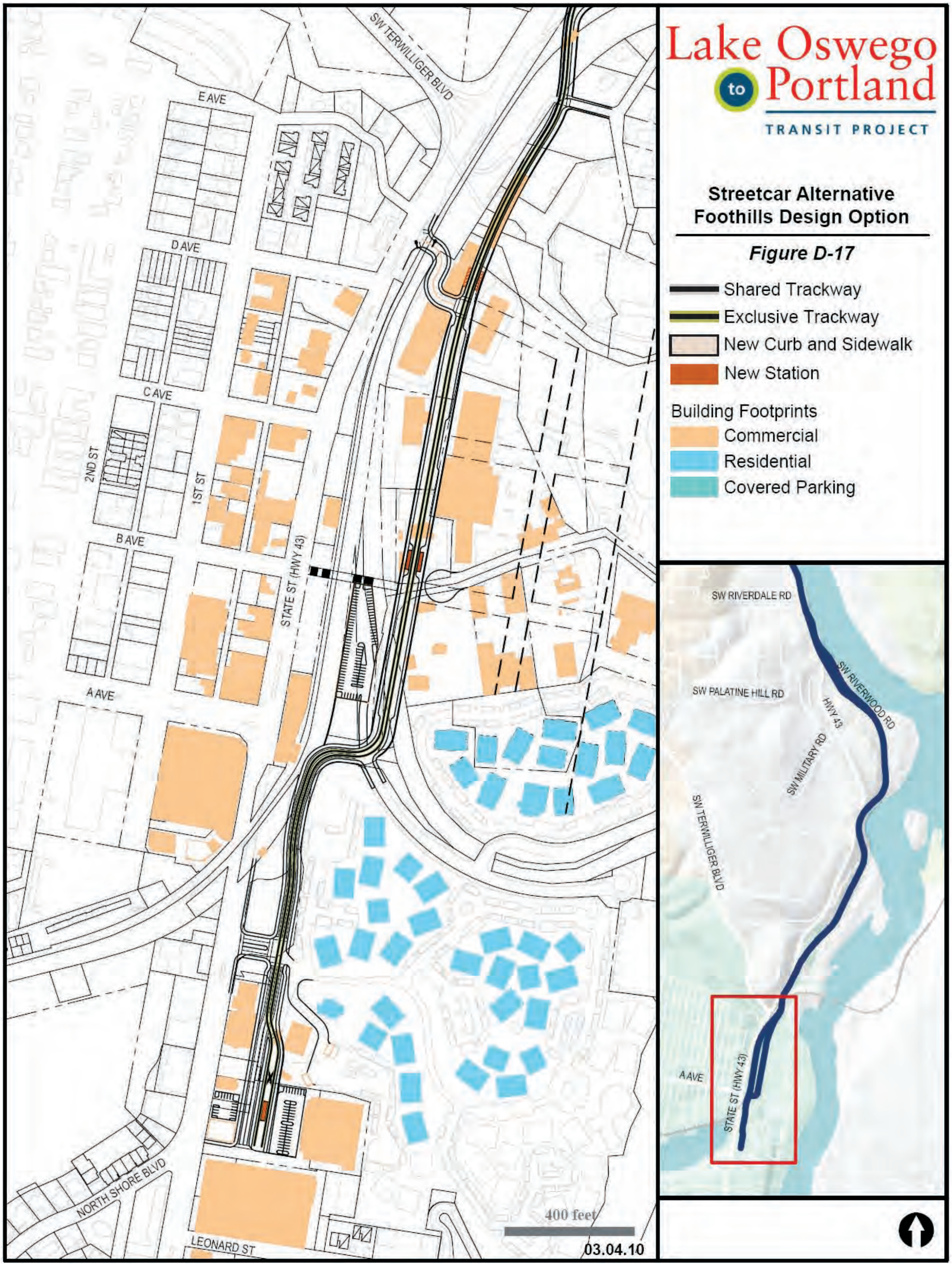


B: Streetcar Alternative Willamette Shore Line Design Option
Cross-Section North of SW Military Road - Facing North

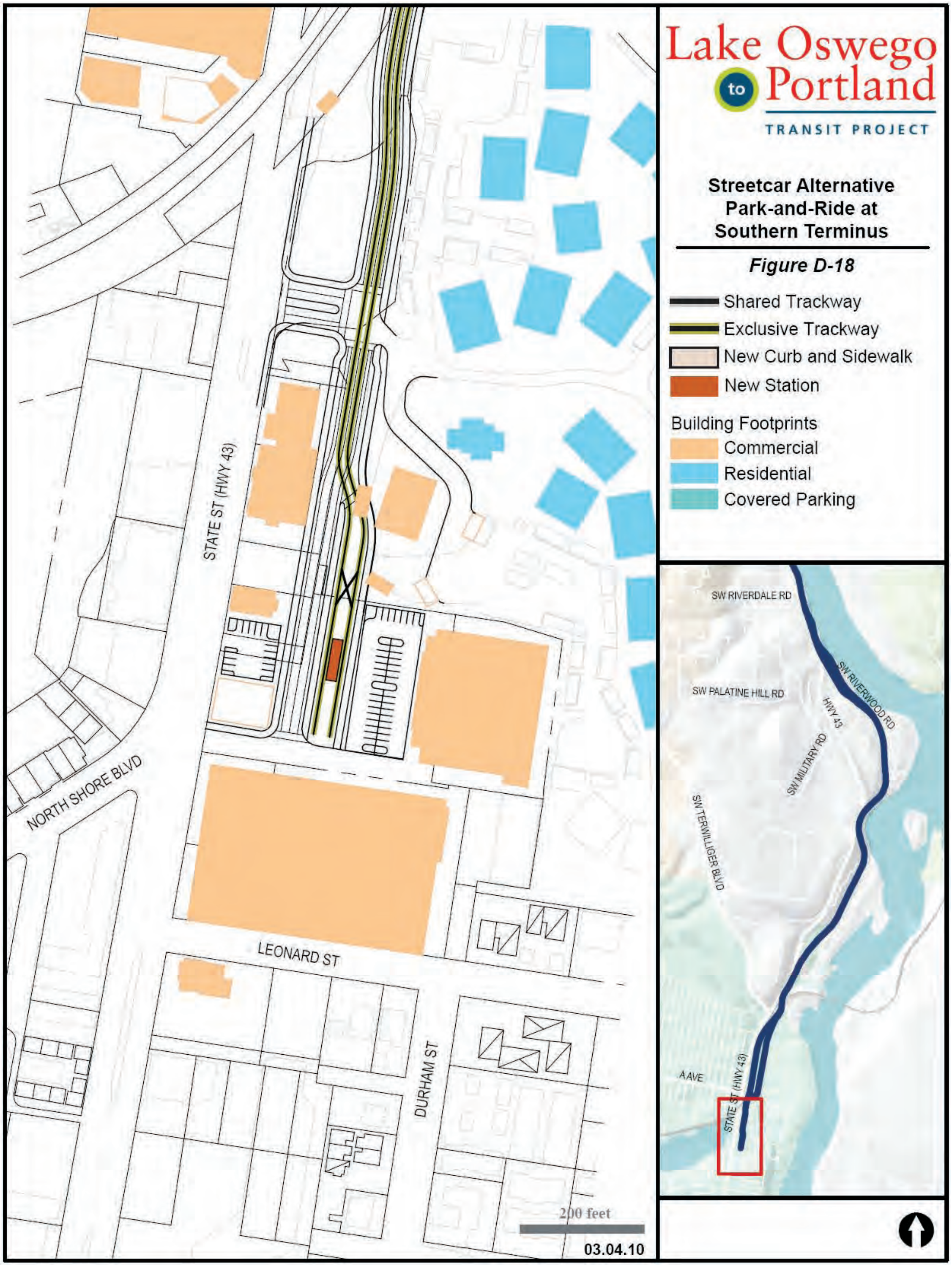
03.04.10



Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
UPRR Design Option
Figure D-16
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW TERWILLIGER BLVD
E AVE
D AVE
C AVE
B AVE
A AVE
2ND ST
1ST ST
STATE ST (HWY 43)
NORTH SHORE BLVD
LEONARD ST
400 feet
03.04.10
SW RIVERDALE RD
SW PALATINE HILL RD
SW RIVERWOOD RD
HWY 43
SW MILITARY RD
SW TERWILLIGER BLVD
A AVE
STATE ST (HWY 43)



Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative
Foothills Design Option
Figure D-17
Shared Trackway
Exclusive Trackway
New Curb and Sidewalk
New Station
Building Footprints
Commercial
Residential
Covered Parking
SW TERWILLIGER BLVD
E AVE
D AVE
C AVE
B AVE
A AVE
2ND ST
1ST ST
STATE ST (HWY 43)
NORTH SHORE BLVD
LEONARD ST
400 feet
03.04.10
SW RIVERDALE RD
SW PALATINE HILL RD
SW RIVERWOOD RD
HWY 43
SW MILITARY RD



Streetcar Alternative Park-and-Ride at Southern Terminus

Figure D-18

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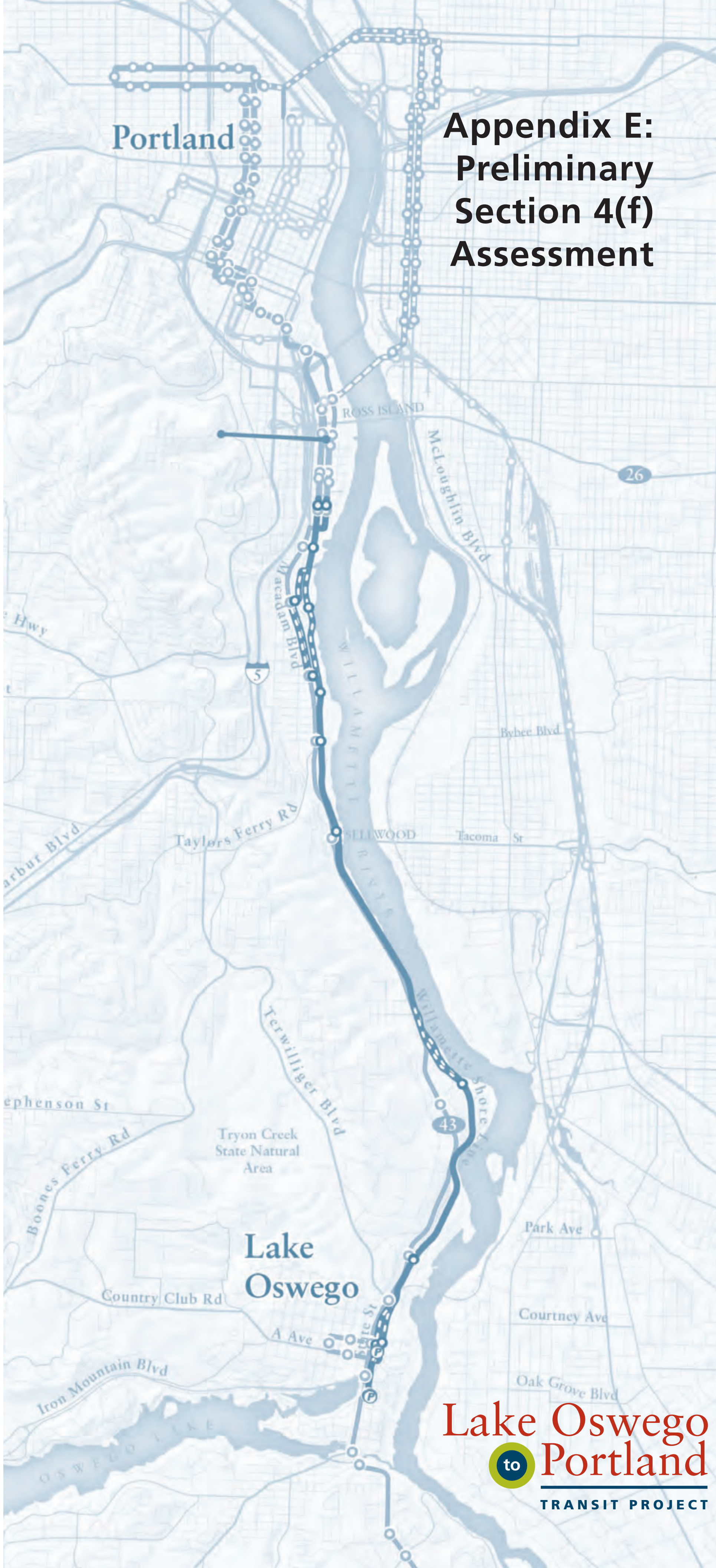
Appendix E: Preliminary Section 4(f) Assessment

APPENDIX E



Lake Oswego to Portland

TRANSIT PROJECT

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APPENDIX E
PRELIMINARY SECTION 4(F) ASSESSMENT

This document addresses how the Lake Oswego to Portland Transit Project is responding to a federal environmental law known as Section 4(f), which protects public parks and recreation areas, wildlife and waterfowl refuges and historic sites. The document describes Section 4(f) of the United States Department of Transportation Act and explains its role in the Federal Transit Administration's (FTA's) decision-making. It also summarizes several key terms, concepts and legal standards that are used here. This description is followed by the preliminary Section 4(f) assessment for the project.

E.1 Section 4(f) Guidelines and Regulations

Federal regulations known as "Section 4(f)" refer to a portion of the U.S. Department of Transportation (USDOT) Act address the use of "public park and recreation lands, wildlife and waterfowl refuges and historic sites" by transportation projects. "Section 4(f)" states in part that "it is the policy of the United States Government that special effort is made to preserve the natural beauty of the countryside and public park and recreation lands…and historic sites." This regulation requires that the United States Department of Transportation (USDOT) avoid "use" of Section 4(f) properties unless there is no feasible and prudent alternative to using the land, unless the impact would be *de minimis*. A *de minimis* impact is defined as an impact that would not adversely affect the features, attributes or activities qualifying the property for protection under Section 4(f).

The USDOT Act of 1966 (49 USC 303) includes regulations that prohibit the use of parks, recreation areas, historic sites or nature refuges for transportation projects except in very unusual circumstances. These regulations, known as Section 4(f), require that USDOT agencies (including the FTA):

> *… not approve the use of land from a significant publicly-owned park, recreation area or wildlife and waterfowl refuge or any significant historic site, unless there is no feasible and prudent alternative to the use of land from the property and the action includes all possible planning to minimize harm to the property resulting from the use.*

A use is generally defined as a transportation activity that permanently or temporarily acquires land from a Section 4(f) property. Section 6009(a) of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Pub. L. 109-59, amended existing Section 4(f) legislation at Section 138 of Title 23 and Section 303 of Title 49, United States Code. Section 6009 directed the USDOT to issue regulations that clarify the factors to be considered and the standards to be applied when determining whether feasible and prudent alternatives could avoid the use of a Section 4(f) property. On March 12, 2008, the Federal Highway Administration (FHWA) issued a Final Rule on Section 4(f), which moves the Section 4(f) regulation to 23 CFR 774 and provides updated direction for Section 4(f) evaluations. If there is no direct use of a property, 23 CFR 774.15(c) indicates that the project proponents are "not required to document each determination that a project would not result in a constructive use of a nearby Section 4(f) property." Further information about project noise, access, and visual impacts to recreational resources in the project corridor may be found in Chapter 3 of the DEIS.

Section 6009 of SAFETEA-LU also provided regulations simplifying the processing and approval of projects that have only *de minimis* impacts to lands protected by Section 4(f). This revision provides for minor uses that will not adversely affect Section 4(f) properties under certain conditions. If USDOT determines that a transportation use of Section 4(f) property (including any impact avoidance, minimization, and mitigation or enhancement measures) results in a *de minimis* impact on that property, an analysis of avoidance alternatives is not required and the Section 4(f) evaluation process is complete.

This preliminary 4(f) Assessment addresses the Lake Oswego to Portland Transit Project. It identifies potential uses of Section 4(f) properties as outlined in 23 CFR 774.

Section 4(f) properties may not be used for any transportation project receiving federal funds or approval from a USDOT agency, except where a use with *de minimis* impacts occurs, where there is a specific exception to a use in Section 4(f) regulations, or where no feasible or prudent alternative exists. Section 4(f) ensures that all possible planning has been done to minimize harm to those properties covered by the act.

The Area of Potential Effect (APE) for this preliminary assessment is based on the parks that are within the project corridor between the south waterfront area of Portland and downtown Lake Oswego. The evaluation of historic, cultural, and archaeological resources is based on the analysis and documentation provided in the Draft Environmental Impact Statement (DEIS) and its related documentation as required under Section 106 of the National Historic Preservation Act of 1966. The evaluation of potential impacts to parks and recreation resources incorporates findings from the DEIS parks and recreational resources section and other environmental analyses, particularly visual and aesthetic, traffic, transportation, and noise and vibration analyses. Other findings and information from the DEIS and its preceding environmental and planning documents are also used in this preliminary Section 4(f) Assessment to support conclusions regarding other avoidance and minimization alternatives.

Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 USC 303) establishes a national policy “to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites.” This act applies to three types of resources:

1. Significant publicly-owned parks and recreation areas that are open to the public;
2. Significant publicly-owned wildlife and waterfowl refuges, whether or not they are open to the public; and
3. Historic sites of national, state or local significance, whether or not these sites are publicly owned or open to the public. In most cases, only historic properties listed in or eligible for inclusion in the National Register of Historic Places are protected under Section 4(f).

Section 4(f) resources are presumed to be significant unless the official having jurisdiction over the site, or in the case of historic resources, the State Historic Preservation Officer (SHPO), concludes that the entire site is not significant.[1] Additionally, FTA must confirm that the official’s finding of significance or non-significance is reasonable.

[1] 23 CFR 774.

E.1.1 "Uses" of Section 4(f) Resources

Under Section 4(f), USDOT agencies cannot approve a transportation program or project that incorporates land or substantially affects the essential functions and features of a significant Section 4(f) resource, except under specific circumstances, as defined in the following section.[2] A use can be permanent, temporary, constructive, or one with *de minimis* impacts, as defined below.

Permanent use includes acquisition and incorporation of the resource into the transportation facility. It includes fee simple and permanent easements use, and involves the taking of any property within the established boundary of a Section 4(f) resource.

Temporary use occurs when a transportation project temporarily occupies any portion of the resource. In order for a temporary use of Section 4(f) land not to be considered adverse, it must meet the following conditions as summarized from 23 CFR 774.13:

- The duration of the occupancy must be less than the time needed for the construction of the project and there must not be a change in ownership.
- Both the nature and magnitude of the changes to Section 4(f) resources are minimal.
- There are no anticipated permanent adverse physical changes or interference with protected activities, features, or attributes of the resource, on a temporary or permanent basis.
- The land is restored to the same or better condition.
- There is a documented agreement of the appropriate federal, state or local officials having jurisdiction over the resource, and authority over use of the property, regarding the above condition.

Constructive, or *indirect*, use occurs when the proximity effects of the transportation project are so great that the use of the property is substantially impaired. Examples are provided in 23 CFR 774.15.

A use with *de minimis* impacts is allowed after the public has had an opportunity to comment on the proposed finding and the project proponent, in consultation with the resource owner or official with jurisdiction, determines that the use will not "adversely affect the activities, features, and attributes" that make the resource eligible for protection under Section 4(f).

E.1.2 Permitted Uses of Section 4(f) Resources

Approval of a transportation use of a Section 4(f) resource may occur if the project proponent demonstrates that:

- The use of the resource falls within the criteria allowing an exception to Section 4(f) as allowed in 23 CFR 774.13. Particular to this project, this regulation allows an exception for uses that are temporary.
- The use will have no more than a *de minimis* impact on the property; or
- There is no feasible and prudent avoidance alternative to using the property; and

[2] Section 4(f) "use" is defined and addressed in the FHWA/FTA Regulations at 23 CFR 774.

- The program or project includes all possible planning to minimize harm to the property resulting from the use.

De minimis impacts relate to publicly-owned parks, recreation areas and wildlife and waterfowl refuges. *De minimis* impacts do not “adversely affect the activities, features and attributes” of a Section 4(f) resource.[3] Once the USDOT determines that a transportation use of Section 4(f) property results in a *de minimis* impact, the project does not need to analyze avoidance alternatives, and the Section 4(f) evaluation process is complete.

When a project impact is greater than *de minimis*, the project proponent must determine whether there are feasible and prudent alternatives that would not result in an impact. An alternative is feasible if it is technically possible to design and build. An alternative is prudent if:

- It meets the project purpose and need and does not compromise the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need;
- It does not require extraordinary operational or safety problems;
- It carries no unique problems or truly unusual factors;
- It has no other unacceptable or severe adverse economic or environmental impacts;
- It would not cause extraordinary community disruption;
- It does not have construction costs of an extraordinary magnitude; or
- There are no other factors that collectively have adverse impacts that present unique problems or reach extraordinary magnitudes.

Once a project proponent demonstrates that an alternative is not feasible and prudent, that alternative may be removed from consideration within the Section 4(f) analysis. When there are no prudent and feasible alternatives that can avoid all Section 4(f) resources, then the Section 4(f) analysis must determine which alternative results in the least overall harm to Section 4(f) resources. Assessing least harm must consider the relative significance of the impacts on the Section 4(f) resources, mitigation incorporated into the proposed project, and impacts on other important resources that would occur from avoiding or minimizing the impact to a Section 4(f) resource.

The regulations list specific factors that FTA must consider when determining which alternative causes the “least overall harm.” See 23 USC 774.3(c)(1). These factors include:

i. The ability to mitigate adverse impacts to each Section 4(f) property (including mitigation measures that result in benefits to the property);

ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection;

iii. The relative significance of each Section 4(f) property;

iv. The views of the official(s) with jurisdiction over each Section 4(f) property;

[3] For historic and archaeological sites, a *de minimis* impact is defined as a “no adverse effect” or “no historic or archaeological properties affected” in compliance with Section 106 of the National Historic Preservation Act. Prior to making a determination of *de minimis* impact, USDOT should receive concurrence on the determination of effect to historic resources from the State Historic Preservation Officer (23 CFR 774.5).

iv. The degree to which each alternative meets the purpose and need for the project;

v. After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f); and

vi. Substantial differences in costs among the alternatives.

This Draft Section 4(f) Assessment describes the Section 4(f) resources, the uses of those resources by the Lake Oswego to Portland Project alternatives, coordination efforts to protect Section 4(f) resources, and a preliminary determination. These conclusions will be subject to public review and comment prior to making a final determination.

E.1.3 Section 106 Historic and Cultural Resources

Section 4(f) resources include those historic and cultural resources that qualify for protection under Section 106 of the National Historic Preservation Act. This Draft Section 4(f) Assessment incorporates the preliminary findings being developed through the project's Section 106 Consultation process.

Section 106 of the National Historic Preservation Act requires consideration of the impacts of federal transportation projects on historic properties and archaeological resources that are eligible for or listed in the National Register of Historic Places (NRHP). For this project, Section 106 compliance requires consultation between FTA, the SHPO, and federally recognized tribes, if they so choose. TriMet and Metro also coordinated with the SHPO and tribes during preparation of the Section 106 Consultation.

There are four ways, or criteria, through which an historic property or cultural resource can qualify for NRHP eligibility. These criteria are described below:

- Criterion A. The property is associated with events that have made a significant contribution to the broad patterns of our history.
- Criterion B. The property is associated with the lives of persons significant in our past.
- Criterion C. The property embodies distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D. The property has yielded, or may be likely to yield, information important in prehistory or history. This criterion is generally associated with archaeological resources.

In addition to defining Section 4(f) historic resources based on their eligibility for inclusion in the NRHP, the Section 4(f) evaluation considers the determination of effects from the Section 106 process in determining whether or not there is a use of a Section 4(f) resource.

If an alternative has a direct use of land from an historic site, but there is a written finding of "no adverse effect" in the Section 106 process, a Section 4(f) *de minimis* impact finding may result. If the use results in an "adverse effect" in the Section 106 process, a Section 4(f) *de minimis* impact finding cannot be made. If an alternative avoids a direct use of land from an historic site that is within the area of potential effects, but the alternative is determined to have "no adverse effect" through the Section 106 process, there would likely be no constructive use under the Section 4(f) evaluation. However, an adverse effect does not necessarily imply a constructive use – there must be a substantial impairment of the historic site for the proximity impact to rise to the constructive-use level.

The Section 106 process requires consultation to resolve any adverse effects. Commitments made in the Section 106 process and documented in the Memorandum of Agreement (MOA) established for the project may also satisfy the requirement under Section 4(f) to minimize harm resulting from the use of a historic property. These agreements have not yet been initiated but will be finalized prior to the publication of the FEIS.

E.1.4 Section 6(f) Resources

State and local governments often obtain grants through the Federal Land and Water Conservation Fund (LWCF) Act of 1965 to acquire or make improvements to parks and recreation areas. Section 6(f) of the LWCF Act prohibits the conversion of property acquired or developed with these funds to a non-recreational purpose without the approval of the U.S. Department of Interior (DOI) and the National Park Service (NPS). A Section 6(f) analysis was also conducted, and it was determined that while Willamette Park received 6(f) funds for the development of the boat ramp, the boat ramp would not be affected by the project and thus the project is not encumbered by the requirements of Section 6(f). The Tryon Creek State Natural Area received 6(f) funding but would not be affected by the project.

E.2 Agency Coordination

The project conducted coordination meetings and correspondence with park owners and managers and the SHPO to guide the preliminary conclusions made in this Draft Section 4(f) Assessment, as summarized below (see Sections 3.6 and 3.5, respectively, for additional detail).

Since initiating the DEIS in 2009, FTA, Metro and TriMet have coordinated with the City of Portland Parks and Recreation Department and the City Lake Oswego Parks and Recreation Department. The project team held preliminary meetings with the City of Portland and the City of Lake Oswego. In these meetings, the team obtained information about the features, activities, and attributes of the park and recreational resources found in the project corridor. These findings are detailed in Section E.3. The cities also participate in regular advisory committee meetings about the project. The cities also were provided the opportunity to review and comment on this appendix and on Sections 3.5 and 3.6 of this DEIS, prior to its publication, in compliance with the project's *Section 6002 Coordination Plan*. Edits were made to the appendix and section in response to those comments and follow-up meetings with the jurisdictions were held from May through September of 2010 to review the comments and revisions and to discuss additional potential mitigation measures that could be considered during preparation of the project's FEIS and potentially incorporated into the project's design and the final Section 4(f) analysis and findings.

FTA sent a letter in October 2009 to the Oregon SHPO requesting concurrence with the project's historic area of potential effect. Further, FTA provided Oregon SHPO with draft determination of eligibility documentation, which was reviewed during a site tour in April 2010, which included local project staff. The project received a letter of concurrence on eligibility of historic properties in July 2010 for all but three properties. In accordance with the FHWA/FTA *de minimis* guidance, FTA (or, through its agents, Metro and TriMet) must notify SHPO that it intends to make a *de minimis* finding based on the Section 106 finding of “no adverse effect.” As stated in the *Guidance for Determining de Minimis Impacts to Section 4(f) Resources* (FHWA 2005), SHPO must concur in writing with FTA, Metro and TriMet’s Section 106 “no adverse effect” finding for historic resources.

Upon publication of this DEIS and preliminary Section 4(f) analysis, FTA, Metro and TriMet will solicit comments on the project, including design options that could use or impact identified Section 4(f) resources. FTA, Metro and TriMet will conduct a public hearing and comment period for the DEIS that will serve as the opportunity for public review and comments for these impacts, in compliance with NEPA, Section 4(f) and Section 6(f) requirements. Agency and public comments made during the public comment period and hearing will be documented and responded to in the project’s DEIS, with edits reflected in the project’s FEIS and final Section 4(f) analysis, as appropriate.

E.3 Description of Project Alternatives

Chapter 2 of this DEIS includes a detailed description of the study area, alternatives and design options. The projects alternatives include the No-Build Alternative, the Enhanced Bus Alternative and the Streetcar Alternative. The Streetcar Alternative has various design options.

E.4 Affected Environment

This section provides a summary of the Section 4(f) and Section 6(f) resources in the corridor, including public parks and recreation areas, wildlife and waterfowl refuges and eligible historic resources.

Figure E-1 illustrates the location of public parks and recreation areas in the project area, differentiating between those that are and that are not Section 4(f) and Section 6(f) resources. Table E-1 provides a summary description of the parks and recreation areas that are in the project area and it notes which parks and recreation areas would be adjacent to an improvement under the Streetcar Alternative and which parks and recreation areas are publicly and privately owned. Note that there are no public parks or recreation areas that would be adjacent to improvements under the Enhanced Bus Alternative (see Section 3.6 of the DEIS for additional detail on the public park and recreation resources in the project area). In summary, there are 13 public parks and recreation areas in the vicinity of the project that qualify as section 4(f) resources and four resources that do not qualify as Section 4(f) resources.

The other resources listed in Table E-1 (i.e., the Peter Kerr Property and the six publicly-owned tax lots) were analyzed for their potential status as 4(f) resources and were determined not to qualify as Section 4(f) resources. The reasoning for this conclusion follows.

The Peter Kerr property is a natural area located on a steep bluff west of Elk Rock Island. It is owned by the City of Portland and listed in their inventory of natural places. It is not considered a Section 4(f) resource because it is not publically accessible.

The project researched six publicly-owned parcels that are located adjacent to or near Tryon Cove Park to determine if they were qualified as park or recreational facilities under Section 4(f). The six tax lots, located in Lake Oswego, are in ownership by the City of Portland, the City of Lake Oswego or Metro. These parcels are not Section 4(f) resources for the following reasons:

- The adopted Foothills District Refinement Plan does not list these parcels as part of Tryon Cove Park. A parks map published in April 2010 as the City of Lake Oswego shows five of the seven parcels as part of Tryon Cove Park, however, this map is not part of an adopted plan. To date, no Master Plan has been adopted for these parcels.

- The City of Portland owns three tax lots adjacent to Tryon Creek. These parcels are managed by the City's Bureau of Environmental Services and are used for riparian restoration, provision of riparian habitat and restoration for natural resources. The City of Portland has a wastewater treatment facility on the south side of Tryon Creek, adjacent to the subject properties. An above ground sewage pipe and sewage easement runs across these properties. Based on the current intergovernmental agreement (2003) regarding these parcels, the City of Portland is responsible for the management, operations and maintenance. Two of these properties are shown on the April 2010 City of Lake Oswego Parks Map as part of Tryon Cove Park.

- Metro purchased one tax lot in this area using public bonds for open spaces. There are currently no trails, signage, public access or adopted plan for this parcel. Based on the current intergovernmental agreement (2003) regarding this parcel, it is intended as open space, and the City of Lake Oswego may build a trail through the property, but formal use shall not begin until a Resource Management Plan has been adopted. No resource management plan for the parcel has been adopted to date.

- The City of Lake Oswego owns two parcels adjacent to Stampher Road and north of the other public properties. There are no trails, public facilities or signage for these properties. The City of Lake Oswego has not made formal plans for these parcels. Based on the current intergovernmental agreement (2003) regarding these parcels, these parcels were identified as surplus properties, subject to future development or sale by the city.

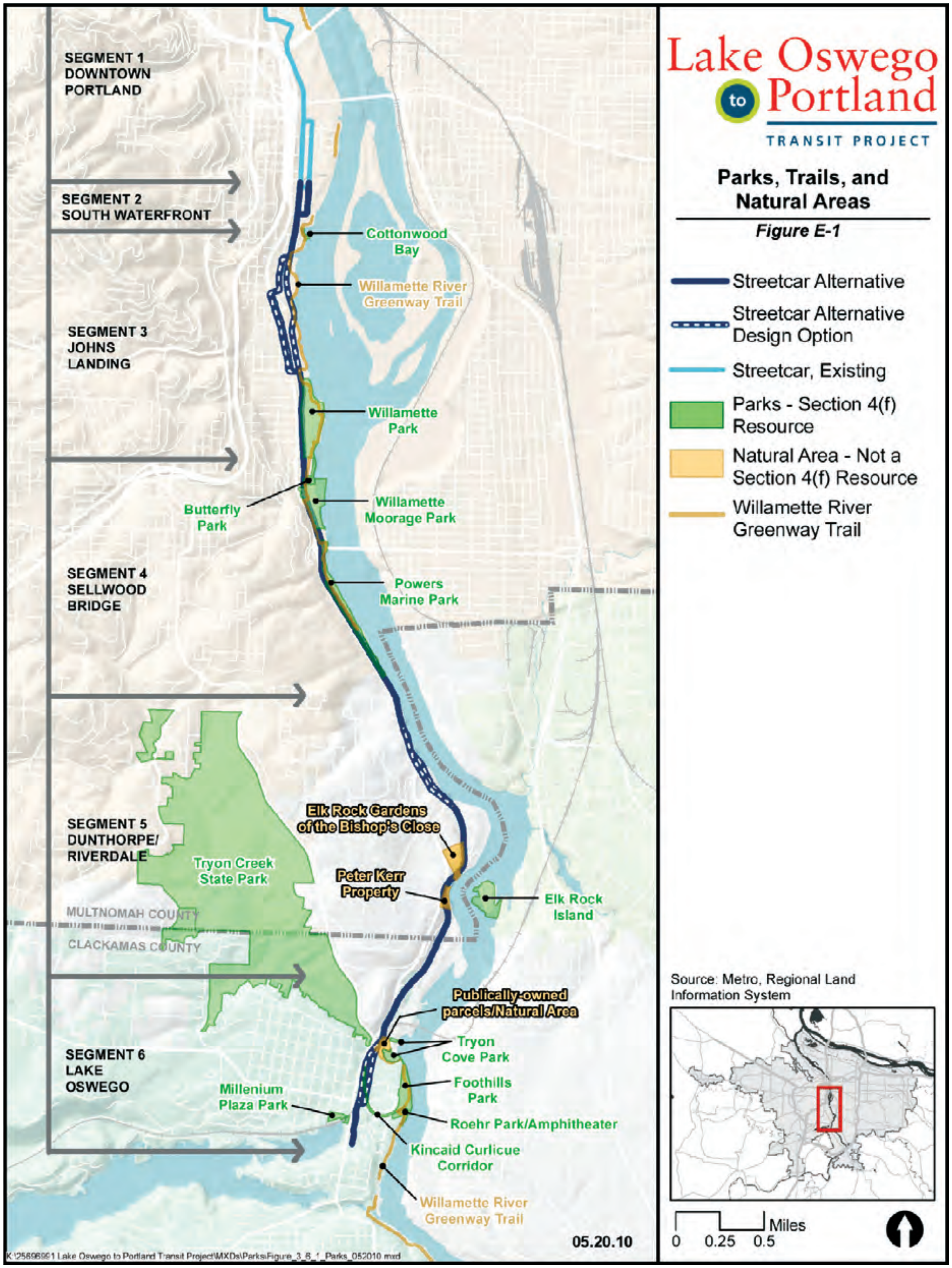
Two of the resources listed in Table E-1, Willamette Park and the Tryon Creek State Natural Area, had improvements made with Section 6(f) or Land and Water Conservation funds (see Figure E-1). There are no wildlife or waterfowl refuges and no known archeological sites in the project area.

Figure E-2 illustrates the location of 22 eligible historic resources in the project area (see Section 3.5 of the DEIS for additional detail on the analysis of historic resources).

Table E-1
Parks and Recreation Areas and Natural Areas in the Project Vicinity and their Section 4(f) and 6(f) Status

Name of Park or Recreation Area	Location	Adjacent to Project?[1]	Owner(s)/ Custodian(s)	Size / Type of Recreational Uses	4(f) Resource?	6(f) Resource?
Willamette River Greenway Trail	Trail along portions of the west side of the Willamette River	Yes	City of Portland, City of Lake Oswego, private property	Trail along parts of the west bank of Willamette River	Yes	No
Lake Oswego to Portland Trail	Planned alignment connecting Lake Oswego and Portland	Yes	To be determined	Planned trail	No[2]	No
Cottonwood Bay	Near SW Hamilton Court and Willamette River	No	City of Portland	0.67 acres / Natural area	Yes	No
Willamette Park	North of the Sellwood Bridge near SW Nevada Avenue	Yes	City of Portland	26.85 acres / Boat ramp, picnic area, soccer field, tennis courts, paved and unpaved paths	Yes	Yes[3]
Butterfly Park	7720 SW Macadam Avenue	No	City of Portland	1.07 acres / Natural area, paths	Yes	No
Willamette Moorage Park	South of Willamette Park	Yes	City of Portland	10.3 acres / Natural area, path	Yes	No
Powers Marine Park	Sellwood Bridge area south	Yes	City of Portland	13 acres / Natural areas, picnic areas, unpaved trails	Yes	No
Elk Rock Gardens of the Bishop's Close	Adjacent to Elk Rock	No	Episcopal Diocese of Oregon	13 acres / Gardens open to public daily	No	No
Peter Kerr Property	Adjacent to Elk Rock	Yes	City of Portland	3.3 acres / City owned parcel, open space, no public access	No	No
Elk Rock Island	East side of Willamette River	No	City of Portland	13.24 acres / Natural area, hiking trails	Yes	No
Tryon Creek State Natural Area	Boundary of Portland and Lake Oswego, west of Highway 43	No	State of Oregon	645 acres / Nature center, hiking and horse trails, bicycle path	Yes	Yes
Tryon Cove Park Annex	Near Stampher Road on river	Yes	City of Lake Oswego	0.5 acres / Picnic tables, boat ramp constructed	Yes	No
Tryon Cove Park	At mouth of Tryon Creek	Yes	City of Lake Oswego, Metro, City of Portland	Natural area with access to Willamette River	Yes	No
Six tax Lots north of Tryon Cove Park[4]	North of Tryon Cove Park	Yes	City of Lake Oswego, Metro, City of Portland	4 acres / Open space , riparian habitat	No	No
Foothills Park	South of Tryon Cove Park, on Willamette River	No	City of Lake Oswego	9 acres / Trails, picnic area, grass amphitheater	Yes	No
Roehr Park	South of Foothills Park	No	City of Lake Oswego	7.5 acres / Amphitheater, paths, benches	Yes	No
Kincaid Curlicue Corridor	Trail linking existing trolley station and Foothills Park	Yes	City of Lake Oswego	3.6 acres / Walking and biking path	Yes	No
Millennium Plaza Park	200 First Street, Lake Oswego	No	City of Lake Oswego	Open space, fireplace, fountain	Yes	No

Source: LOPT Parks and Recreation Resources Results Report (Metro, January 2010). See Figure E-1 for an illustration of these resources.
[1] All parks and recreation areas that would be located adjacent to an improvement would be adjacent to an improvement under the Streetcar Alternative – no park or recreation area would be adjacent to an improvement under the Enhanced Bus Alternative.
[2] The Lake Oswego to Portland Trail has been previously referred to as "Willamette Shoreline Trail." The proposed trail is not a resource that would be protected by Section 4(f) because even though it is planned to be a public trail, no property is currently publicly owned for this purpose.
[3] Section 6(f) funds were used for development of the boat ramp in Willamette Park.
[4] Tax lot numbers are: 21E02CB02200, 21E02CB02300 (Lake Oswego), 21E02CB02400 (Metro) and 21E02CB02700, 21E02CB00900, and 21E02CB02800 (Portland).


SEGMENT 1
DOWNTOWN
PORTLAND
SEGMENT 2
SOUTH WATERFRONT
SEGMENT 3
JOHNS
LANDING
SEGMENT 4
SELLWOOD
BRIDGE
SEGMENT 5
DUNTHORPE/
RIVERDALE
SEGMENT 6
LAKE
OSWEGO
Cottonwood Bay
Willamette River Greenway Trail
Willamette Park
Butterfly Park
Willamette Moorage Park
Powers Marine Park
Elk Rock Gardens of the Bishop's Close
Tryon Creek State Park
Peter Kerr Property
Elk Rock Island
MULTNOMAH COUNTY
CLACKAMAS COUNTY
Publically-owned parcels/Natural Area
Tryon Cove Park
Foothills Park
Millenium Plaza Park
Roehr Park/Amphitheater
Kincaid Curlicue Corridor
Willamette River Greenway Trail
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Lake Oswego to Portland
TRANSIT PROJECT
Parks, Trails, and Natural Areas
Figure E-1
Streetcar Alternative
Streetcar Alternative Design Option
Streetcar, Existing
Parks - Section 4(f) Resource
Natural Area - Not a Section 4(f) Resource
Willamette River Greenway Trail
Source: Metro, Regional Land Information System
Miles
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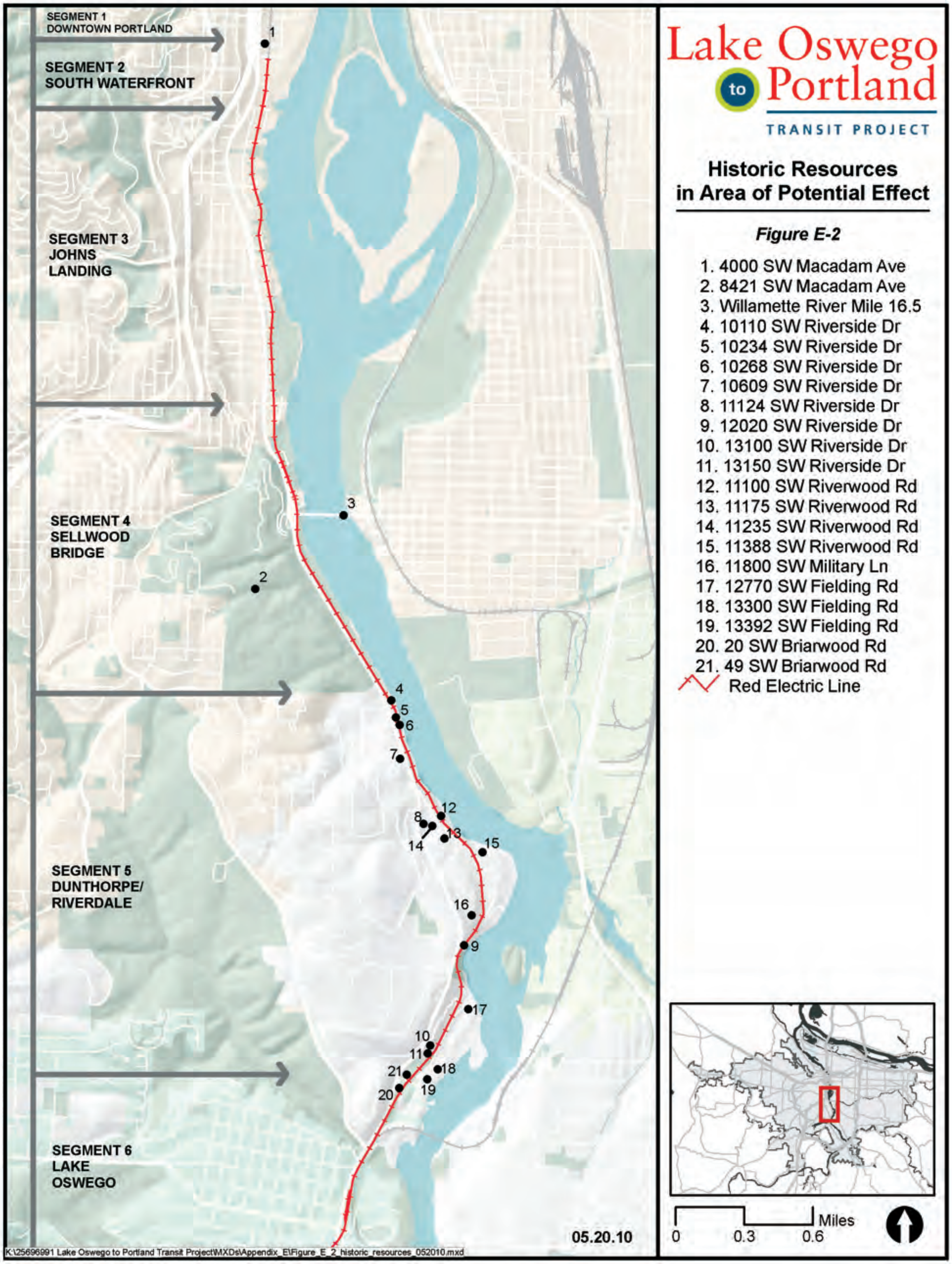
SEGMENT 1
DOWNTOWN PORTLAND
SEGMENT 2
SOUTH WATERFRONT
SEGMENT 3
JOHNS
LANDING
SEGMENT 4
SELLWOOD
BRIDGE
SEGMENT 5
DUNTHORPE/
RIVERDALE
SEGMENT 6
LAKE
OSWEGO
Lake Oswego to Portland
TRANSIT PROJECT
Historic Resources in Area of Potential Effect
Figure E-2
1. 4000 SW Macadam Ave
2. 8421 SW Macadam Ave
3. Willamette River Mile 16.5
4. 10110 SW Riverside Dr
5. 10234 SW Riverside Dr
6. 10268 SW Riverside Dr
7. 10609 SW Riverside Dr
8. 11124 SW Riverside Dr
9. 12020 SW Riverside Dr
10. 13100 SW Riverside Dr
11. 13150 SW Riverside Dr
12. 11100 SW Riverwood Rd
13. 11175 SW Riverwood Rd
14. 11235 SW Riverwood Rd
15. 11388 SW Riverwood Rd
16. 11800 SW Military Ln
17. 12770 SW Fielding Rd
18. 13300 SW Fielding Rd
19. 13392 SW Fielding Rd
20. 20 SW Briarwood Rd
21. 49 SW Briarwood Rd
Red Electric Line
0 0.3 0.6 Miles
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K:\25696991 Lake Oswego to Portland Transit Project\MXDs\Appendix_E\Figure_E_2_historic_resources_052010.mxd

E.5 Evaluation of Section 4(f) Resource by Alternative

This section provides an evaluation of the Section 4(f) resources identified in Section E.4 and how they would be affected by the alternatives and Streetcar Alternative design options. Table E-2 provides a summary of the preliminary Section 4(f) assessment by alternative.

Table E-2
Summary of Preliminary Assessment of Section 4(f) "Use" by Alternative

Measure	No-Build Alternative	Enhanced Bus Alternative	Streetcar Alternative
Public Parks and Recreation Areas	0	0	1[1]
Wildlife/Waterfowl Refuges	0	0	0
Historic Sites	1[2]	1[3]	0-1[4]
Archaeology Sites	0	0	0

Source: *Lake Oswego to Portland Transit Project Streetcar Plan Set*, November 9, 2009, *Lake Oswego to Portland Transit Project: Park and Recreation Technical Report and Preliminary Section 4(f) Analysis* DEA/URS and TriMet/Metro, August 2010, and *Lake Oswego to Portland Transit Project: Historic, Archaeological and Cultural Resources Technical Report*, URS and TriMet/Metro, September 2010.

1 Preliminarily determined to be a *de minimis* impact to the Kincaid Curlicue Corridor, dependent upon mitigation measures. Under both design options under consideration within the Lake Oswego Segment. See Section E.5.3 for additional detail.

2 Likely adverse indirect impact to the Red Electric Eastside Rail Line. See Section E.5.1 for additional detail.

3 Likely adverse indirect impact to the Red Electric Eastside Rail Line. See Section E.5.2 for additional detail.

4 A potential effect with no adverse effect (which would be a *de minimis* impact under Section 4(f)) or a potential adverse effect (which would be a use under Section 4(f)) to the Red Electric Eastside Rail Line, depending on further design work, analysis and coordination to be completed during Preliminary Engineering. Under all design options currently under consideration. See Section E.5-3 for additional detail.

E.5.1 No-Build Alternative

The No-Build Alternative would not require the use of any public park and recreation lands, wildlife and waterfowl refuges or archaeological sites.

The No-Build Alternative would result in a constructive use of the Willamette Shore Line right of way, which is historically known as the **Red Electric Eastside Rail Line**, an interurban electric rail service which operated between 1914 and 1929. The rail line was determined eligible for listing on the NRHP during the recent environmental analysis for the Sellwood Bridge Replacement Project. The determination of eligibility defined the Southern Pacific Railroad Red Electric Eastside Line (aka Jefferson Street Line) portion of the Red Electric lines as beginning at the intersection of SW Bancroft Street and SW Moody Avenue in southwest Portland and heading south 6 miles to 0.5 mile north of the intersection of N State Street. The segment of rail line between Portland and Lake Oswego was completed in 1887 and provided both freight and passenger service. In 1914, Southern Pacific electrified the line and it became part of the Red Electric interurban rail network. The full line consisted of a loop from Portland to McMinnville, passing through Lake Oswego, Sherwood, Newberg, McMinnville, Carlton, Forest Grove, and Hillsboro.[4] The resource was considered eligible for its historic use as part of an interurban passenger rail network that connected Portland and larger communities with smaller Willamette Valley towns and strongly influenced growth and development of the outer suburbs south and west of Portland.

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[4] Dill, Tom & Walter. Grande, The Red Electrics, 1994.

During the period of significance, passenger rail service was provided using "Red Electric" interurban trains over the line from Portland to Corvallis. In 1988 a consortium of governments, the Willamette Shore Line Consortium, purchased the Portland to Lake Oswego section for the purpose of preserving the rail right of way for future public rail mass transit use. Currently, the city of Lake Oswego leases the line from the Consortium and it contracts with the Oregon Electric Railway Historical Society to operate interim trolley operation that has operated on a seasonal excursion schedule. The right of way and remaining facilities are maintained by the Willamette Shore Line Consortium. As outlined in the Maintenance Plan, the Willamette Shore Line Consortium performs routine maintenance and ongoing modifications to the rail corridor in order to provide for active rail operation. The line was out of service for much of 2009 and 2010 due to maintenance activities, which included repairs to tracks, ties and trestles. Today, trolley service is provided using the Portland Traction "Broadway Car" Brill Master Unit #813 built in 1932. Due to weight limitations on the existing trestles, there are limited types of trolley cars that can operate on the existing right of way without major improvements to the structures.

The No-Build Alternative would likely result in indirect adverse effects to the Red Electric Eastside Line, because the Consortium purchased and maintains the Willamette Shore Line right of way to preserve it for future passenger rail service and the Consortium could decide to relinquish ownership if its membership determines that passenger rail service in the corridor is not feasible or viable. Alternately, the Consortium could decide to continue ownership and maintenance of the right of way indefinitely pending changes in conditions that would lead to conversion of the line to urban rail service in the future. However, the increasing decline of the condition of the existing track, ties and trestles and escalating maintenance costs would make it difficult for the Consortium to continue ownership and maintenance of the line indefinitely. If passenger rail service is not reintroduced or maintained, the Consortium would consider legal transfer or sale of the right of way. The interim excursion trolley service could be discontinued and ownership of at least portions of the Red Electric Eastside Line could be sold, transferred or abandoned. Alternative uses for the corridor could be considered, including a multi-use path if feasible. Further, contributing elements of the line (e.g., track, ties, ballast, trestles) could fall into disrepair and/or could be removed. If private individuals or other groups attained ownership of portions of the line, they would not be required to comply with Section 106 requirements for those portions of the line.

E.5.2 Enhanced Bus Alternative

The Enhanced Bus Alternative would not require the use of any public park and recreation lands, wildlife and waterfowl refuges, or archaeological sites.

The Enhanced Bus Alternative would likely result in indirect adverse effects to the Red Electric Eastside Line, for the same reasons as the described for the likely adverse effect of the No-Build Alternative to the Red Electric Eastside Line.

E.5.3 Streetcar Alternative and Design Options

The Streetcar Alternative would not require the use of any wildlife and waterfowl refuges nor would it adversely affect any known archaeological sites.

Table E-3
Public Park Resources Directly Affected by the Streetcar Alternative and Preliminary Section 4(f) Determination

Segment/Design Option	Acres of Resource Used	Summary Description of Direct Impacts by Resource	Preliminary Section 4(f) Determination[3]
1 – Downtown Portland	N/A	No Section 4(f) resources in this segment.	N/A
2 – South Waterfront[1]	0.00	No direct impacts. Formally designated areas of the ***Willamette River Greenway Trail*** would be unaffected. There would be changes to temporary connections, including rerouting of the connector trail between SW Bancroft and Hamilton Streets (see temporary impacts).	
3 – Johns Landing			
Willamette Shore Line	0.00	No direct impacts. Streetcar stations would be placed near the north and south ends of ***Willamette Park***. Construction impacts, including potential staging, associated with the stations could temporarily extend into Willamette Park.	*No Use/ Temporary occupancy as per 23 CFR 771.135(p)(7)*
Macadam In-Street	0.00	No direct impacts. A streetcar station would be placed near the south end of ***Willamette Park***. Construction impacts, including potential staging, associated with the stations could temporarily extend into Willamette Park.	*No Use/ Temporary occupancy as per 23 CFR 771.135(p)(7)*
Macadam Additional Lane	0.00	No direct impacts. A streetcar station would be placed near the south end of ***Willamette Park***. Construction impacts, including potential staging, associated with the stations could temporarily extend into Willamette Park.	*No Use/ Temporary occupancy as per 23 CFR 771.135(p)(7)*
4 – Sellwood Bridge[2]	0.00	No direct impacts. The project would add a pedestrian overpass over the Willamette Shore Line right of way to provide continued access to ***Powers Marine Park***. Up to 8 culverts would be replaced; 2 to 4 of these could result in temporary occupancy for limited construction activities within the park property (see Figure E-6).	*No Use. Temporary occupancy as per 23 CFR 771.135(p)(7)*
5 – Dunthorpe/Riverdale			
Willamette Shore Line	0.00	No direct impacts.	
Riverwood	0.00	No direct impacts.	
6 – Lake Oswego			
UPRR	0.7[3]	The project would require the use of 0.7 acre of the ***Kincaid Curlicue Corridor***. The corridor's existing path would be relocated to retain the trail function and improved with new connections.	*De minimis* impact with mitigation
Foothills Realignment	1.0[3]	This design option would result in use of 1.0 acre of the ***Kincaid Curlicue Corridor***. The corridor's existing path would be relocated to retain the trail function and improved with new connections.	*De minimis* impact with mitigation

Source: *Lake Oswego to Portland Transit Project Streetcar Plan Set*, November 9, 2009 (revised May 2010) and *Lake Oswego to Portland Transit Project: Park and Recreation Technical Report and Preliminary Section 4(f) Analysis*, DEA/URS and TriMet/Metro, August 2010. See Figure E-2 for an illustration of the location of these resources.

1 I The South Waterfront Segment contains potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

2 The Sellwood Bridge Segment contains potential construction phasing options associated with the Streetcar alignments. See Section 3.17 Phasing for more information regarding phasing options and differences between those options.

3 Preliminarily determines of *de minimis* impact are based on inclusion of potential mitigation measures to be determined. As per USDOT guidance, documentation of agreement by jurisdictional owners of the resources with determinations of *de Minimis* impacts and temporary occupancy will be obtained prior to publication of the final Section 4(f) Assessment.

Table E-3 summarizes the affects (use, direct, and indirect impacts) that the Streetcar Alternative and design options would have on parks. As currently designed, the Streetcar Alternative and design options would require the use of one park, the Kincaid Curlicue Corridor, and would have short-term and indirect impacts on two other parks: Willamette Park and Powers Marine Park (see Figure E-1).

As documented in Section 3.5 of the DEIS, the Streetcar Alternative would potentially use one historic resource: the Red Electric Eastside Rail Line (see Figure E-2 and Section E.5.2).

E.5.3.1 Streetcar Alternative Effects on Parks and Preliminary Finding of *De Minimis* Impact

The following is a description of the parks that would be used by or would have direct, indirect or temporary construction impacts from the Streetcar Alternative follow, in order from north to south: Willamette Park; Powers Marine Park; and the Kincaid Curlicue Corridor. This section provides: 1) a description of the resource; 2) a description of the potential use and/or impact; 3) any enhancements or mitigation that are being considered; and 4) Metro, TriMet's and FTA's preliminary determination of the status of any use and/or impact. The description also includes Metro, TriMet and FTA's rationale for the preliminary finding of *de minimis* impact for the Kincaid Curlicue Corridor. Each of these conclusions is pending further consultation regarding impacts and potential mitigation with the affected cities, which would occur following publication of this DEIS and preliminary Section 4(f) analysis, if the Streetcar Alternative is selected as the Locally Preferred Alternative (LPA). In addition, further design refinements, if the Enhanced Bus or Streetcar alternatives are selected as the LPA, would be considered by Metro, TriMet and FTA in making their final determinations under Section 4(f). Table E-2 provides a summary of the parks and the preliminary impact assessment.

A. Willamette Park

Willamette Park is located north of the Sellwood Bridge between the Willamette River and the existing streetcar right of way (Figures E-3 and E-4). It is a 26.85-acre park, acquired in 1929. Willamette Park amenities include a dock, boat ramp, disabled access picnic area, disabled access restroom, dog off-leash area, paved and unpaved paths, picnic sites, playground, soccer field and a lighted tennis court. The Willamette Park boat ramp had improvements funded by LWCF in 1980. The recreational features of the park are generally separated from the streetcar alignment by a row of mature oak trees and a roadway that runs parallel to the rail alignment behind the row of trees.

Under the Streetcar Alternative, the streetcar alignment would be adjacent to the park's western boundary along the park's entire length and would operate fully within the Willamette Shore Line right of way. The streetcar alignment, including a streetcar station at SW Nevada Street, would be identical in the Johns Landing Segment south of SW Nebraska Street. Pedestrian access to and from the park across the Willamette Shore Line right of way at SW Nevada Street would be maintained. Vehicle and pedestrian access to and from the park at SW Nebraska Street would be maintained under the Streetcar Alternative and design options. However, there would be a change to the rail crossing signage and controls at SW Nebraska Street. Configuration of those signage and control changes and final determination of the location of the Nebraska Station under the Willamette Shore Line design option would be determined in consultation with ODOT and the City of Portland during Preliminary Engineering and final design, if the Streetcar Alternative is selected as the LPA.


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Willamette Park:
Macadam In-Street and
Macadam Additional Lane
Design Options
Figure E-3
Streetcar alternative alignment
station
park-and-ride
Project footprint
Railroads
Park resource
Source: Metro Regional Land
Information System, URS
Feet
0
180
360
05.14.10
CAROLINA ST
Carolina
BEAVER AVE
DAKOTA ST
NEBRASKA ST
IDAHO ST
VERMONT ST
FLORIDA ST
MACADAM AVE
CALIFORNIA ST
TEXAS ST
NEVADA ST
Nevada
MILES CT
MILES PL
MILES ST
Willamette Park

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Willamette Park:
Willamette Shore Line
Design Option
Figure E-4
Streetcar alternative alignment
station
park-and-ride
Project footprint
Railroads
Park resource
Source: Metro Regional Land Information System, URS
Feet
0
180
360
05.14.10
CAROLINA ST
Carolina
BEAVER AVE
DAKOTA ST
NEBRASKA ST
Nebraska
IDAHO ST
VERMONT ST
MACADAM AVE
FLORIDA ST
Willamette Park
CALIFORNIA ST
TEXAS ST
NEVADA ST
Nevada
MILES CT
MILES PL
MILES ST

Streetcar improvements in relationship to the park, primarily the location of streetcar stations, would vary by design option north of SW Nebraska Street. Under the Willamette Shore Line design option, there would be a center platform streetcar station just north of SW Nebraska Street, which would be in the streetcar right of way and in close proximity to the park's primary vehicular entrance and exit (see Figure E-4). The station would not require use of park property.

Under the Macadam In-Street design option and the Macadam Additional Lane design option, there would be no station at SW Nebraska Street (see Figure E-3). Instead, transit access to the north end of the park would be provided approximately two blocks north at a streetcar station at SW Carolina Street, between SW Macadam and Beaver avenues. While the location of the streetcar station north of SW Nebraska Street would vary by design option, the streetcar alignment in the vicinity of the park, between SW Nebraska and Dakota streets, would not vary by design option.

Under the Streetcar Alternative, visual changes in Willamette Park would occur at the west side of the park adjacent to the western park boundary. In most areas these visual changes would be obscured by existing vegetation, and would not detract from existing views toward the Willamette River. Some of the trees in Willamette Park have been designated by the City of Portland as "trees of merit" which recognizes the tree(s) as noteworthy trees in the city that have been nominated for Heritage Tree status but, for a variety of reasons, were not given the status. The designation of "trees of merit" does not afford special protection. One of the mature oak trees may be within the existing right of way of the streetcar and its proximity to the proposed streetcar alignment may require it to be removed during construction of the project. Figure E-5 shows a visual simulation of the streetcar alignment adjacent to Willamette Park with the one mature tree removed (pending consideration of potential mitigation measures). Based on the current design, no additional mature oak trees within or directly adjacent to Willamette Park would need to be removed to construct or operate the Streetcar Alternative. The project would develop and consider potential mitigation measures that could avoid the removal of mature oak trees, while maintaining safe streetcar operations, if the Streetcar Alternative is selected as the LPA. Those mitigation measures would be developed and evaluated in consultation with the City of Portland. The project owner would coordinate with the City of Portland regarding minimizing vegetation removal and mitigation for impacts to Willamette Park. A final determination regarding the status of the trees along or in the Willamette Shore Line right of way would be made during Preliminary Engineering. Measures to avoid its removal would be considered as potential Section 4(f) mitigation in consultation with the City Arborist and the City Parks.

In Willamette Park, some users currently access the parks across the streetcar tracks at several locations, and some of these may be modified or relocated as a result of the project. In Willamette Park, there are four formal access points supported with easements (at SW Beaver, Nevada, Nebraska and Miles streets). These access points would be maintained with the Streetcar Alternative. There are at least three additional informal access points that are used by the public, which are generally located on private property. Safety measures installed for the streetcar alignment would likely relocate and/or consolidate these access points; park users would have to cross the tracks at designated locations. For any of the Streetcar Alternative's design options, the pedestrian crossing at SW Nevada Street could be improved as part of the project as mitigation for its effect on pedestrian access to/from the park. The sidewalk improvement would bring the park's sidewalk into compliance with the Americans for Disability Act and it would provide direct pedestrian access between the park and the proposed streetcar station. The City of Portland would likely retain responsibility for maintenance of the sidewalk entering the park and there would be no change to the key characteristics and function of the sidewalk.

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Existing View and Visual Simulation from Willamette Park

Figure E-5

A - Existing view looking north from Willamette Park.

B - Future view looking north from Willamette Park with Streetcar Alternative (all design options).

5.6.10

Construction impacts, including potential staging, associated with the stations could temporarily extend into Willamette Park. The duration of the construction would be less than the time needed for the construction of the project and there would not be a change in ownership associated with the construction or staging areas.

Based on preliminary project plans which include minimization of vegetation loss and planned improvements to pedestrian environment at park entrances, the indirect effects of the project would not substantially impair affect the features, activities or attributes of Willamette Park. Further, construction activities, such as reconstruction of the sidewalk within the park boundary, are preliminarily determined to be temporary in nature, as defined by 23 CFR 771.135(p)(7), and would likely not constitute a Section 4(f) use.

B. Powers Marine Park

Powers Marine Park is a 13-acre park located on the west side of the Willamette River, primarily south of the Sellwood Bridge that includes natural areas, picnic areas and unpaved trails (Figure E-6). It was acquired in 1926 and named after Ira Powers, owner of Powers Furniture Company, who lived in the area.

In the vicinity of the Powers Marine Park, the streetcar alignment would be located within the existing Willamette Shore Line right of way. The Streetcar Alternative would not use any portion of the Powers Marine Park and it would have no direct long-term impacts to the park. The Streetcar Alternative would have short-term construction-related impacts and indirect impacts (access) to the Powers Marine Park, described below.

The Streetcar Alternative would have short-term effects on park property related to the replacement of culverts that pass under the existing rail tracks used by the excursion trolley. Of the eight anticipated culvert replacements, two to four could have temporary impacts in the park, based on right of way location (see Figure E-6). The construction impacts from replacement of those culverts would likely require less time that the project's overall construction period and would not interfere with the activities or purpose of the park, thus their reconstruction would be preliminarily defined as temporary in nature as per 23 CFR 771.135(p)(7) and would likely not constitute a Section 4(f) use.

In Powers Marine Park, some users currently access the parks across the streetcar tracks away from formal park entry points. There are two park access points identified with easements across the existing tracks (at the north end of the park and near the proposed pedestrian bridge). There are two formal entrance points with associated parking areas, and at least five additional parking spots located along the park on the shoulders of the roadway (Highway 43, SW Macadam Avenue). These additional points that are being used to enter the park may be modified due to safety restrictions with the operation of the streetcar. With the introduction of the streetcar project, people currently entering the park on foot from the south will have to walk along the roadway for approximately 1/2-mile to access the planned pedestrian bridge over the streetcar tracks. If the Streetcar Alternative is selected as the LPA, the project team would continue to work with the City of Portland and the Oregon Department of Transportation (ODOT) regarding design and mitigation for access to Powers Marine Park from Highway 43. Additionally, if the Streetcar Alternative is selected as the LPA, the project would increase the frequency of passenger rail service adjacent to Powers Marine Park, which could impede wildlife access patterns between the Willamette River and the hills to the west. However,

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Powers Marine Park
Figure E-6
Sellwood
SPOKANE ST
SELLWOOD BRG
6TH AVE
UMATILLA ST
Powers Marine Park
Pedestrian overpass
Powers Marine Park
MACADAM AVE
RIVERSIDE DR
RADCLIFFE RD
10.24.10
Streetcar alternative alignment
station
park-and-ride
Pedestrian overpass
Culvert replacement location
Railroads
Park resource
Source: Metro Regional Land Information System, URS
0
320
640
Feet

SW Macadam Avenue provides a significant barrier to wildlife crossings between the river and the western hills.

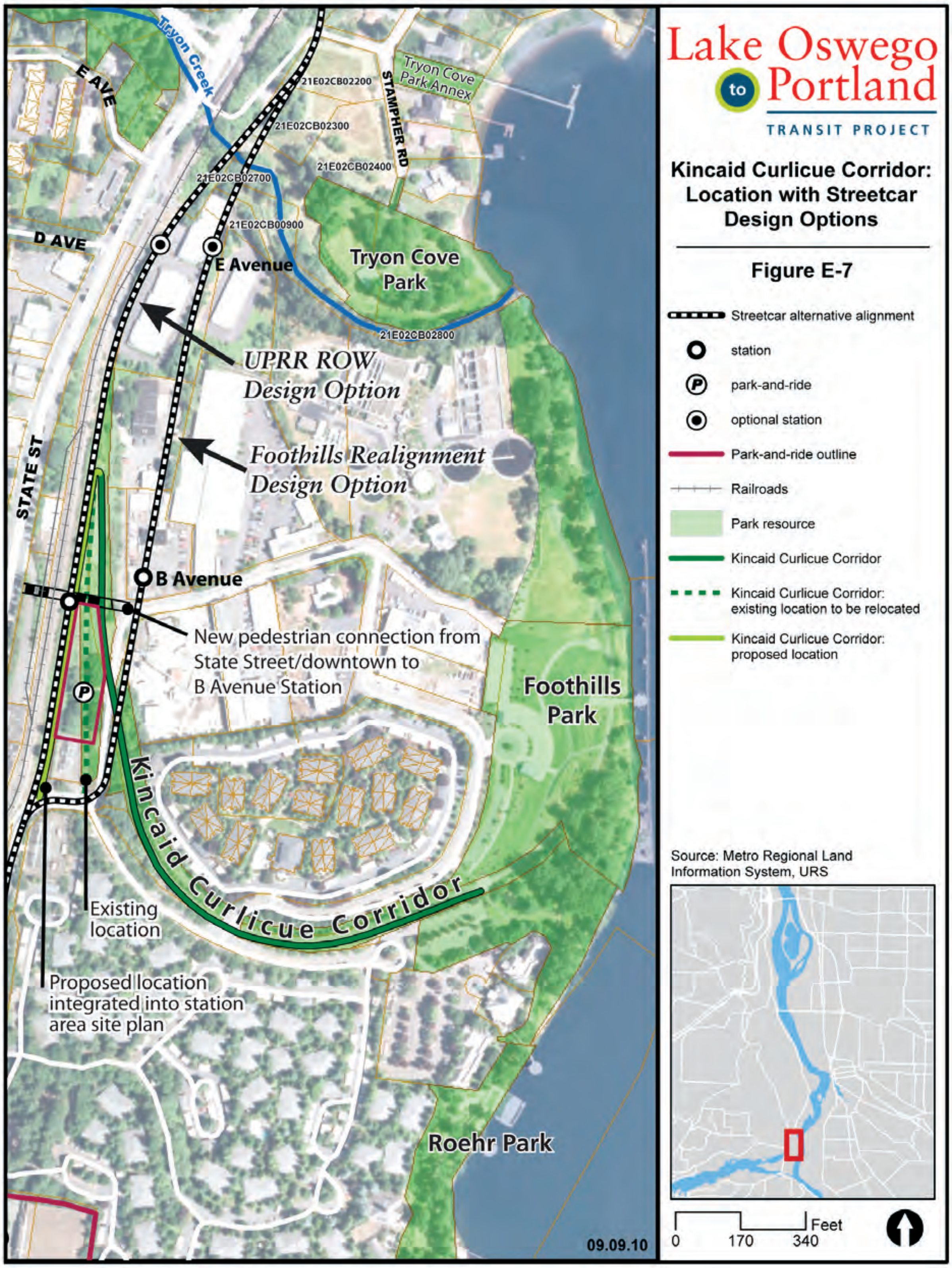
Staging locations in or near Powers Marine Park may be used for the construction of the project, particularly the construction of the pedestrian bridge over the streetcar tracks. The construction and staging for the pedestrian bridge would be minor, would likely require less time that the project's overall construction period and would not interfere with the activities or purpose of the park and would, therefore, preliminarily determined to be a temporary occupancy, as defined by 23 CFR 771.135(p)(7), and would likely not constitute a Section 4(f) use.

Based on preliminary project plans, which include the provision of safe access across the streetcar line between SW Macadam Avenue and Powers Marine Park, the indirect effects of the project would not substantially impair the features, activities or attributes of Powers Marine Park. Potential mitigation could include fencing for wildlife and safety structures or barriers for pedestrians to deter them from using the tracks or crossing at undesignated locations. Proposed mitigation measures would be discussed and confirmed with the City of Portland during the project's FEIS phase, if the Streetcar Alternative is selected as the LPA.

C. Kincaid Curlicue Corridor

The Kincaid Curlicue Corridor is a multi-use paved trail linking Foothills Road near the existing trolley station and Foothills Park. The main recreational feature of the resource is the multi-use trail, which is used for walking and bicycling. There are two portions of the trail: an upper level that includes a paved trail with a switchback; and a lower portion that connects to Foothills Park. Foothills Road bisects these two sections. The Kincaid Curlicue Corridor is located in an area that is planned to go through redevelopment. The area owned by the City of Lake Oswego for the Kincaid Curlicue Corridor totals 3.6 acres, spanning several parcels. See Figure E-7 for an illustration of the resource and an overlay of current plans for the parcel in conjunction with the project, including the proposed relocation of the existing trail under the Streetcar Alternative, which is described below.

The Streetcar Alternative's design options in this segment have been designed to be consistent with the City of Lake Oswego's plans for a trail linking to Foothills Park under their Foothills redevelopment proposal. The Streetcar Alternative's affect on the Kincaid Curlicue Corridor would be similar under the segment's two design options, but some specifics would vary by design option. Both design options would relocate an approximately 800-foot segment of the existing trail, because both options would construct a surface park-and-ride lot over portion of the existing trail. Under both design options, the relocated portion of the trail would be slightly west of its current location and immediately west of the proposed surface park-and-ride lot (see Figure E-7). Additionally, both design options of the Streetcar Alternative would include the construction of a stairway between State Street (downtown Lake Oswego) and the Foothills area, enhancing connectivity in this area and connecting to the Kincaid Curlicue Corridor trail at two locations. The configuration of the pedestrian facilities in relationship to the vehicular facilities has been designed to separate those activities and to consolidate pedestrian crossings at controlled locations. Overall, initial coordination with the City of Lake Oswego staff indicates that the trail could be satisfactorily modified in response to the design of the project through this area, retaining and even enhancing the path's function and use.



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Kincaid Curlicue Corridor: Location with Streetcar Design Options
Figure E-7
Streetcar alternative alignment
station
park-and-ride
optional station
Park-and-ride outline
Railroads
Park resource
Kincaid Curlicue Corridor
Kincaid Curlicue Corridor: existing location to be relocated
Kincaid Curlicue Corridor: proposed location
Source: Metro Regional Land Information System, URS
0 170 340 Feet
Tryon Creek
E AVE
D AVE
STATE ST
STAMPHER RD
Tryon Cove Park Annex
Tryon Cove Park
Foothills Park
Roehr Park
21E02CB02200
21E02CB02300
21E02CB02400
21E02CB02700
21E02CB00900
21E02CB02800
E Avenue
B Avenue
UPRR ROW Design Option
Foothills Realignment Design Option
New pedestrian connection from State Street/downtown to B Avenue Station
Kincaid Curlicue Corridor
Existing location
Proposed location integrated into station area site plan
09.09.10

The following is a description of how the segment's two design options would differ in relationship to the Kincaid Curlicue Corridor:

Under the Foothills Realignment design option, the streetcar alignment and B Avenue Station would be located about 200 feet east of the existing UPRR alignment, integrated into a redesigned Foothills development area. The streetcar alignment would cross the Kincaid Curlicue Corridor and path about 300 feet south of the proposed B Avenue Station. The Foothills Realignment design option would result in the likely use of approximately 1.0 acre of the Kincaid Curlicue Park.

Under the UPRR Right of Way design option, the proposed streetcar alignment would be located approximately 50 feet east of the existing UPRR alignment, immediately west of the realigned bike path and park-and-ride lot. The B Avenue Station would be located adjacent to the proposed stairway along the alignment and the realigned path would be designed to be nitrated within the B Avenue Station design. Under the UPRR Right of Way design option, the streetcar alignment would not cross the Kincaid Curlicue Corridor or path. As a result of the design of the UPRR right of way design option, the Streetcar Alternative would result in the likely use of 0.7 acre of the Kincaid Curlicue Corridor.

Under both design options, the primary feature of the corridor (i.e., a trail) and activity on the corridor (i.e., bicycle and pedestrian access between State Street and Foothills Park) would be maintained. The net direct and indirect effects of the project would not adversely affect the features, activities or attributes of the Kincaid Curlicue Corridor. Initial coordination with the city suggests that the trail could be satisfactorily modified in response to the design of the project through this area. Potential mitigation measures that would be considered during Preliminary Engineering, if the Streetcar Alternative is selected as the LPA, would include: design treatments for the relocated portions of the trail, integration of the trail into the project's pedestrian facility improvements and design treatments to address any potential conflicts between vehicular and pedestrian traffic. Based on the initial assessment of impacts, plans for mitigation and coordination with the City of Lake Oswego, FTA has preliminarily determined that with adequate mitigation the Streetcar Alternative would have a *de minimis* impact to the Kincaid Curlicue Corridor, because there would be no adverse affect to the features, activities or attributes of the resource. This preliminary determination requires concurrence with the City of Lake Oswego. The final determination of this finding would be made during the preparation of the FEIS, if the Streetcar Alternative is selected as the LPA.

E.5.3.2 Streetcar Alternative Effects on Historic Resources

Of the eligible historic resources in the corridor, the **Red Electric Eastside Rail Line** (generally the Willamette Shore Line right of way) would be effected by the Streetcar Alternative.

The Streetcar Alternative would use the Willamette Shore Line right of way, which is historically known as the Red Electric Eastside Rail Line. The Streetcar Alternative would result in the restoration of interurban electric rail service between downtown Portland and downtown Lake Oswego, which historically operated between 1914 and 1929. The existing railroad right of way and facilities would be restored, rehabilitated and replaced as needed to allow for the safe and efficient operations of interurban passenger electric rail service, meeting current design standards and permitting requirements.

Effects to the Red Electric Eastside Rail Line would vary by design option. Some segments of the corridor include streetcar design and phasing options that would not use portions of the Red Electric Eastside Rail Line. For the most part, the project would extend the streetcar from its current locations at SW Lowell Street in South Waterfront with the necessary improvements to provide for safe and efficient passage between Lake Oswego and Portland. A more detailed description of the streetcar design and phasing options is discussed in the paragraphs below. Figures E-8 and E-9 illustrate the Streetcar Alternative and design options.

In South Waterfront area, the streetcar could be built in the interim on the Red Electric (For more information, see Chapter 2, section 2.2.3). In the future the streetcar would be integrated into the SW Moody/SW Bond street network expansion as part of the South Portal project. The future street network would use the Red Electric right of way and private property to extend the street network to the south, as planned to accommodate the existing and planned growth in the South Waterfront.

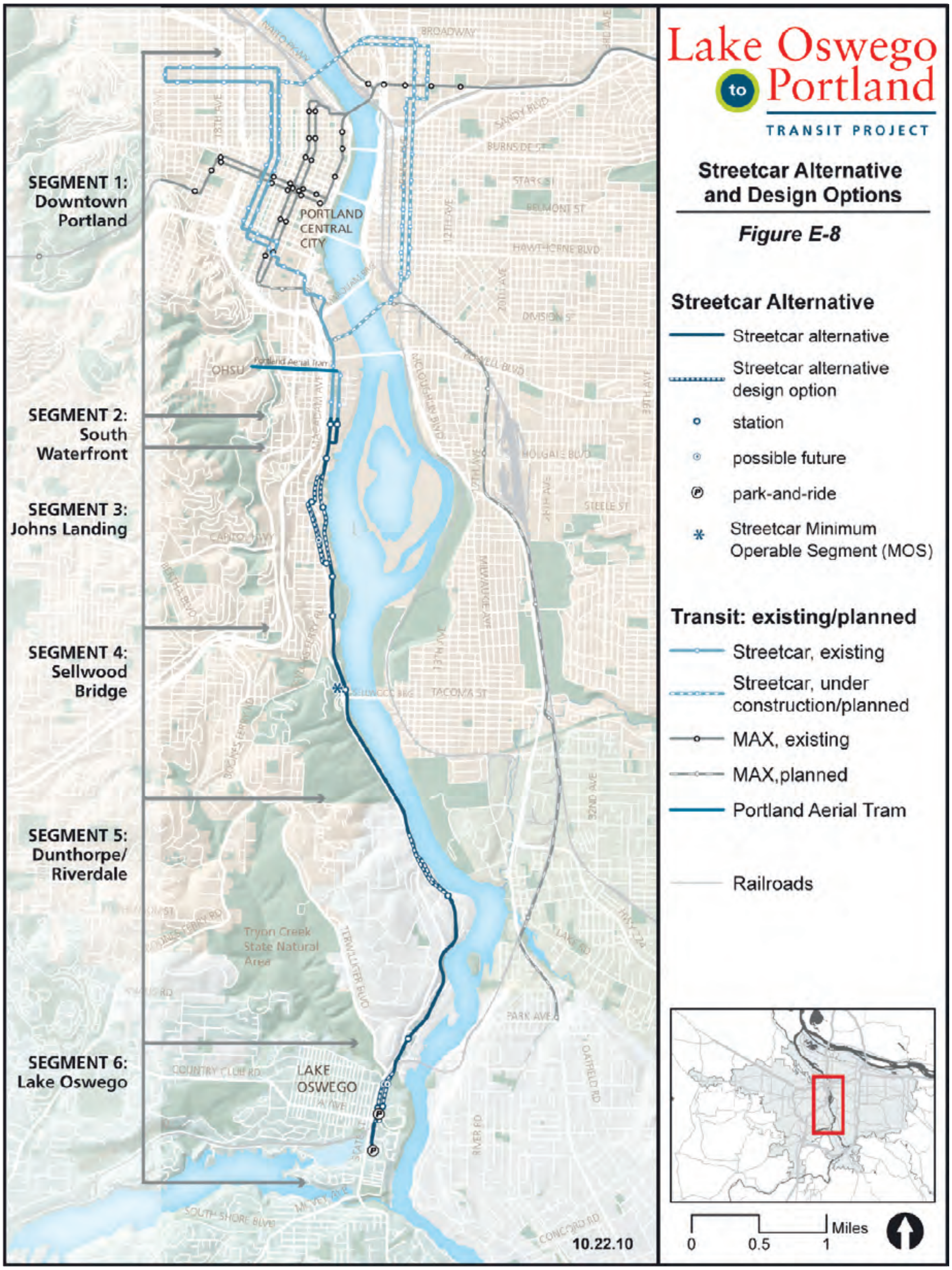
In Johns Landing, the design options would include use of the Red Electric Rail Line for future streetcar use or move the streetcar operations on to local private/public streets for a short distance (see Figure E-9). If the streetcar were to not use the Red Electric Rail Line in this section, there is a strong desire to construct a multi-use trail in this area.

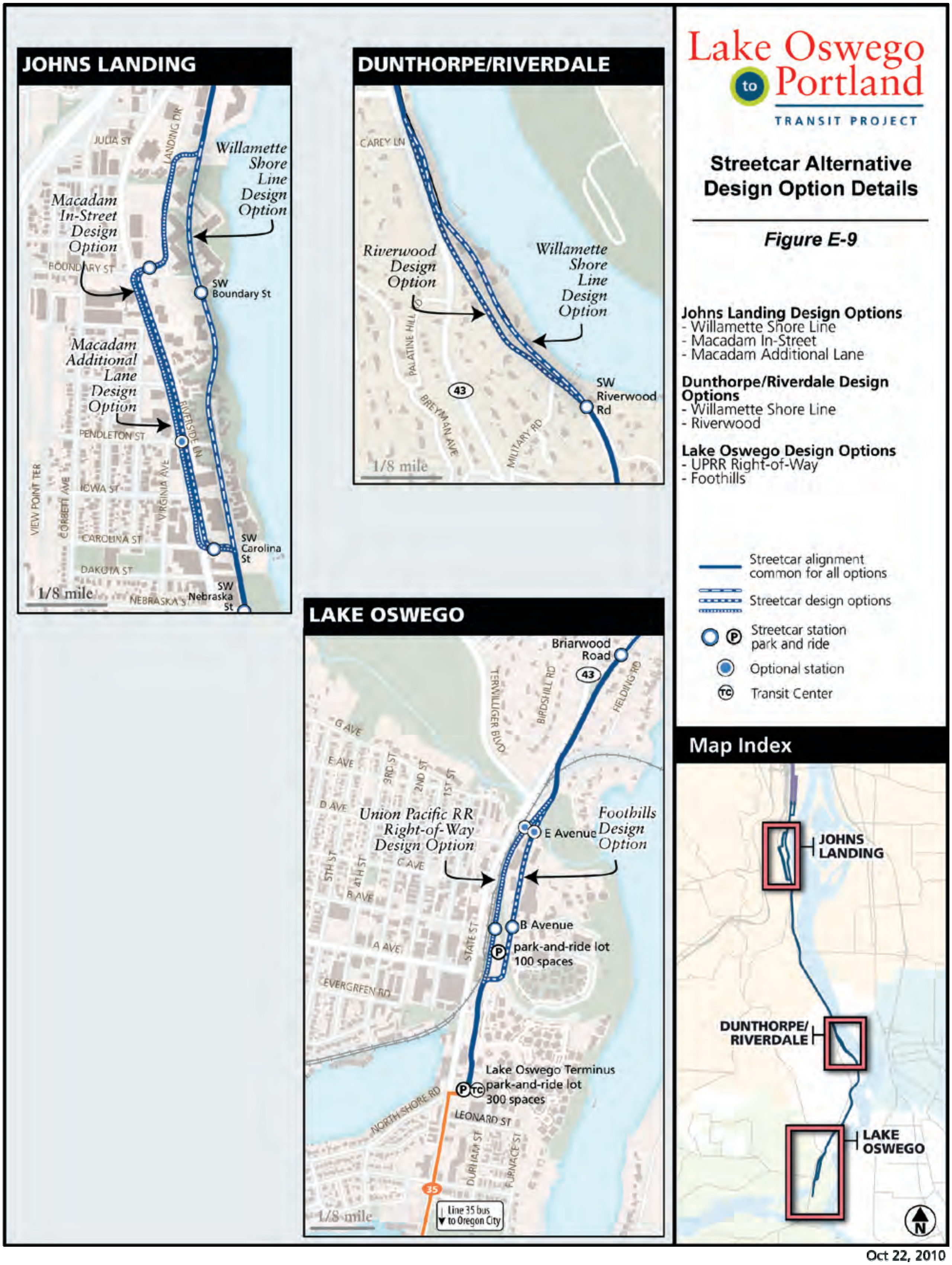
In the Sellwood Bridge area, the existing Red Electric Rail Line would be displaced and moved as part of the Sellwood Bridge project. The Sellwood Bridge project has been designed to accommodate future potential streetcar tracks and concluded through the Sellwood Bridge Final Environmental Impact Statement (FEIS) that there would be no adverse effect on the Red Electric Rail Line. In the interim, there is the option to construct the streetcar alignment in the existing right of way until funding for the west interchange is fully committed.

In the Dunthorpe/Riverdale area, the streetcar would use the Red Electric Rail Line for the entire length of this segment with the Willamette Shore Line design option or would be relocated to SW Riverwood Road for a portion of the alignment with the Riverwood Road design option (see Figure E-9). If the streetcar were to operate in SW Riverwood Road, the Red Electric Rail Line could be sold or abandoned.

In Lake Oswego, there are two design options the UPRR and Foothills design option (see Figure E-9). Both of these design options would be located east of the existing tracks with a terminus at Albertsons. The current location of the Willamette Shore Line right of way in this segment is not in the same location of the historic Red Electric Eastside Rail Line. The original alignment was modified as the district developed.

Based on the project's current conceptual engineering (approximately 8 percent design) of the Streetcar Alternative and design and phasing options, the Streetcar Alternative could result in an effect or an adverse effect on the Red Electric Eastside Rail Line. Future design work during the Preliminary Engineering phase of the selected LPA would further inform the determination of effect. In order to restore regular passenger service in the right of way, the whole line would be re-electrified. Safety improvements would be added to crossings, and stations would be reintroduced at various locations along the line. Streetcar improvements would likely include the replacement and reconstruction of the existing railroad ties and rails. Elk Rock Tunnel, the one tunnel on the corridor, would be reinforced. The six rail trestles on the corridor will be analyzed for potential rehabilitation, restoration or reconstruction. If the Streetcar Alternative is selected as the LPA, all future design

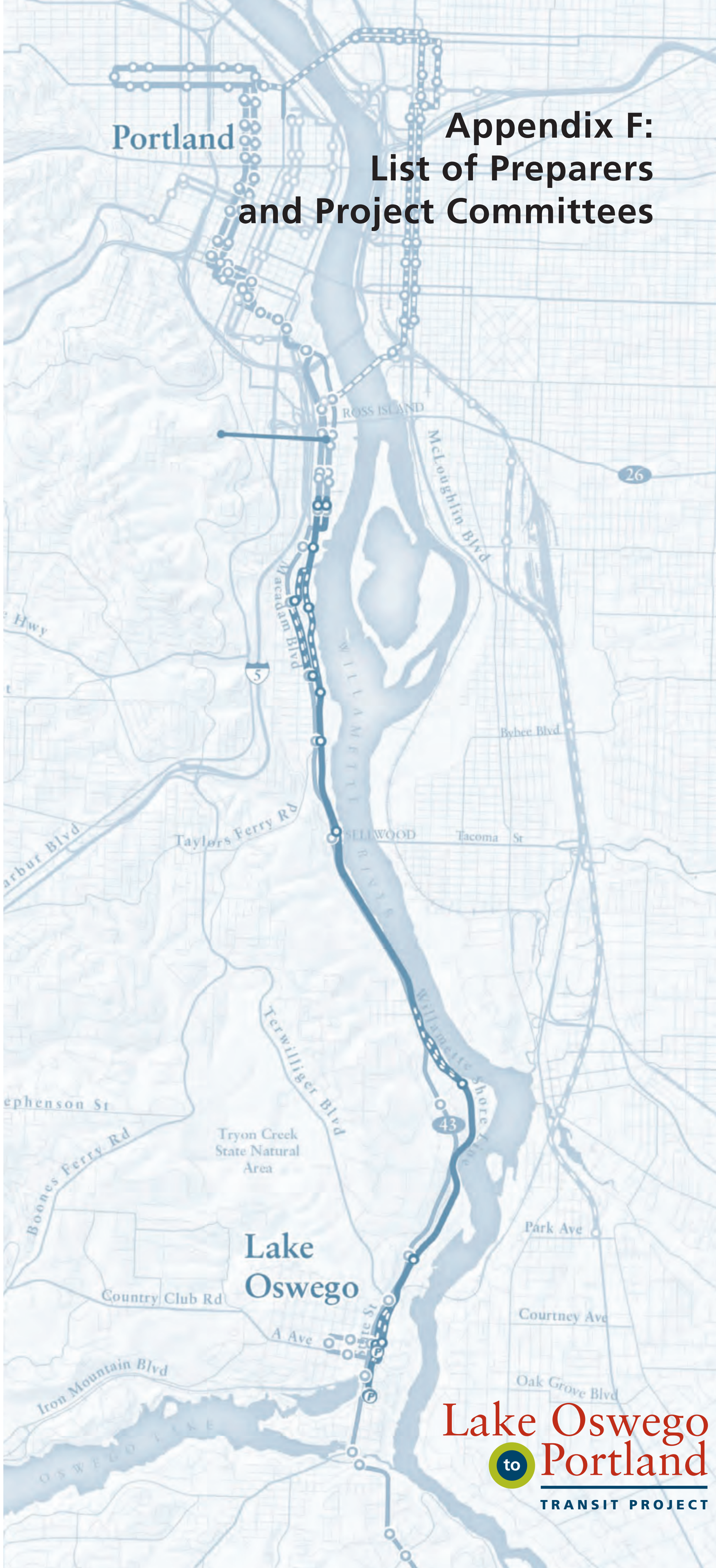

Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative and Design Options
Figure E-8
Streetcar Alternative
Streetcar alternative
Streetcar alternative design option
station
possible future
park-and-ride
Streetcar Minimum Operable Segment (MOS)
Transit: existing/planned
Streetcar, existing
Streetcar, under construction/planned
MAX, existing
MAX,planned
Portland Aerial Tram
Railroads
SEGMENT 1: Downtown Portland
SEGMENT 2: South Waterfront
SEGMENT 3: Johns Landing
SEGMENT 4: Sellwood Bridge
SEGMENT 5: Dunthorpe/ Riverdale
SEGMENT 6: Lake Oswego
PORTLAND CENTRAL CITY
OHSU
Tryon Creek State Natural Area
LAKE OSWEGO
0 0.5 1 Miles
10.22.10


Lake Oswego to Portland
TRANSIT PROJECT
Streetcar Alternative Design Option Details
Figure E-9
Johns Landing Design Options
- Willamette Shore Line
- Macadam In-Street
- Macadam Additional Lane
Dunthorpe/Riverdale Design Options
- Willamette Shore Line
- Riverwood
Lake Oswego Design Options
- UPRR Right-of-Way
- Foothills
Streetcar alignment common for all options
Streetcar design options
Streetcar station park and ride
Optional station
Transit Center
Map Index
JOHNS LANDING
DUNTHORPE/ RIVERDALE
LAKE OSWEGO
JOHNS LANDING
Willamette Shore Line Design Option
Macadam In-Street Design Option
SW Boundary St
Macadam Additional Lane Design Option
SW Carolina St
SW Nebraska St
1/8 mile
DUNTHORPE/RIVERDALE
Riverwood Design Option
Willamette Shore Line Design Option
SW Riverwood Rd
1/8 mile
LAKE OSWEGO
Briarwood Road
Union Pacific RR Right-of-Way Design Option
E Avenue
Foothills Design Option
B Avenue
park-and-ride lot 100 spaces
Lake Oswego Terminus park-and-ride lot 300 spaces
Line 35 bus to Oregon City
1/8 mile
Oct 22, 2010

work contributing the restoration of the interurban electric rail service would be completed in compliance will applicable elements of the Federal Section 106 regulations and guidelines, such as 36 CFR Part 800 (Protection of Historic Properties) and 36 CFR Part 68 (Secretary's Standards for the Treatment of Historic Properties).

TriMet, Metro and the City of Portland would conduct further design work during the project's Preliminary Engineering phase, prior to publication of the project's FEIS and final Section 106 and Section 4(f) report. That design work would be conducted in consultation with FTA and the Oregon SHPO with the intent to avoid any adverse effect on the Red Electric Eastside Rail Line, while providing for the safe and efficient operations of urban electric rail service, meeting current design standards and permitting requirements. If the design effort for the Streetcar Alternative were to result in an adverse effect on the Red Electric Eastside Rail Line, the project would need to demonstrate, consistent with Section 4(f) requirements that there is no prudent or feasible alternative to that adverse effect and that all possible planning to minimize harm was done. That determination would be made, if warranted, prior to publication of the project's FEIS and final Section 106 and Section 4(f) report.

Appendix F: List of Preparers and Project Committees



Lake Oswego to Portland

TRANSIT PROJECT

APPENDIX F

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APPENDIX F
LIST OF PREPARERS
AND PROJECT COMMITTEES

1. PUBLIC AGENCIES

Federal Transit Administration (FTA) Region 10, Seattle WA (Federal lead agency)

Linda Gehrke, Deputy Regional Administrator
Tricia Harr, Environmental Planner – Headquarters office in Washington D.C.
R.F. Krochalis, Regional Administrator
Joe Ossi, Environmental Planner – Headquarters office in Washington D.C.
Tom Radmilovich, Community Planner
Rebecca Reyes-Alecia – Director of Planning and Program Development
Theodore Uyeno, Legal Counsel
John Witmer, Community Planner
Elizabeth Zelasko, Environmental Planner – Headquarters office in Washington D.C.

Metro, Portland, OR - Portland area Metropolitan Planning Organization (local co-lead agency),

Matt Bihn, Transit Reviewer
Tim Collins, Traffic Reviewer
Joyce Felton, Hazardous Materials, Ecosystems and Endangered Species, Hydrology and Water Quality Reviewer
Gabriela Frask, GIS analysis
Crista Gardner, Land Use and Economic Development, Community Impact Assessment, Historic, Archeological and Cultural Resources Reviewer
Alan Gunn, GIS analysis
Kyle Hauger, Transportation Modeler
Cliff Higgins, Communications
Scott Higgins, Transportation Modeler
Tony Mendoza, Transit Project Analysis
Brian Monberg, Land Acquisition, Displacements and Relocation of Existing Uses, Parklands, Recreation Areas, Section 4(f) and Multi-Use Paths
Thaya Patton, Transportation Modeler
Bud Reiff, Transportation Modeler
Jamie Snook, NEPA Project Manager, Noise and Vibration, Visual Analysis and Conceptual Design Reviewer
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Mark Turpel, AICP, Air Quality, Energy, Geology, Soils and Earthquake Reviewer
Bridget Wieghart, Transit Program Manager, Finance Reviewer
Karen Withrow, Public Involvement Manager

Tri-County Metropolitan Transportation District of Oregon (TriMet), Portland, OR - Portland area transit provider (local co-lead agency)

John Baker, Manager of Real Property Acquisition
Janni Baugh, Real Property Acquisition

John Griffiths, Manager of Rail Operations Planning
Alan Lehto, Director of Project Planning
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Bonnie Gee Yosick, Economic Analysis

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Kristen Wallace, Noise and Vibration Analysis

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Leon Skiles, 6002 Coordination Plan, DEIS Preparation

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Donald Newlands, Visual Simulations

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Doug Obletz, Project Manager

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Steve Siegel, Financial Analysis

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Seth Gallant, Transportation Analysis and GIS/Graphics
Noah Herlocker, Wetland Analysis
Omar Jaff, Concept Design Lead
Terry Kearns, Consultant Team Project Manager
John Kelly, Built Environment Analysis Lead, Land Use and Planning Analysis
Sharon Kelly, NEPA Lead, DEIS Manager
Kate Lyman, Community Impacts Analysis
Dan Meier, Geotechnical Analysis
Nicki Newman, Terrestrial Analysis
Dautis Pearson, Natural Environment Analysis Lead
Brad Rawls, Aquatic Analysis
Martha Richards, Historic Analysis
Christy Schmitt, Air Quality Analysis
Michelle Stegner, Archaeology Analysis
Thuy Tu, Consultant Team Coordinator, Energy Analysis
Emily Whiteman, Hydrology and Water Quality Analysis
Shawn Williams, Hazardous Materials Analysis
David Zagel, Transportation Analysis

3. PROJECT COMMITTEES

Steering Committee:
Mayor Sam Adams, City of Portland
Metro Councilor Carlotta Collette, committee co−chair
Judie Hammerstad, Portland Streetcar Inc.
Fred Hanson/Neil McFarlane, TriMet
Mayor Jack Hoffman, City of Lake Oswego
Commissioner Deborah Kafoury, Multnomah County
Metro Councilor Robert Liberty, committee co−chair
Chair Lynn Anne Peterson, Clackamas County
Michael Powell, Portland Streetcar Inc.

Jason Tell, Oregon Department of Transportation

Citizens Advisory Committee:

Ed Abrahamson, Bicycle Transportation Alliance (BTA) representative, transit rider
John Betts, McVey South Shore neighborhood resident, accessible transit user
Bev Bookin, South Portland neighborhood resident (Bankside Condominiums), Johns Landing Owners Association representative, Willamette Shore Line adjacent property owner
Matt Brown, Foothills owner representative (Williams and Dame Development)
Heather Chrisman, Lakewood neighborhood resident, Lake Oswego retail business owner
Mary Beth Coffey, Foothills resident
Andrew Franklin, Riverdale neighborhood resident, OPB Board member
Paul Graham, downtown Lake Oswego retail business owner
Dave Jorling, First Addition neighborhood resident, transit rider
Beth Kieres, Willamette neighborhood resident (West Linn), commuter to OHSU
Bryce Linton, Birdshill Community Planning Organization chair
Lydia Lipman, Willamette Shore Line adjacent property owner, Birdshill neighborhood resident
Ken Love, South Portland neighborhood resident, elderly resident perspective
Ellie McPeak, chair, Old Town neighborhood resident
Tom Moisan, Johns Landing business owner
Eli Morgan, Riverdale neighborhood resident, Willamette Shore Line adjacent property owner
Pascal Pascuzzi, South Waterfront property owner, North Macadam Urban Renewal Advisory Committee member
Vern Rifer, South Portland neighborhood resident, Portland Streetcar Inc. Citizen Advisory Committee representative, Willamette Shore Line adjacent property owner
Bob Sack, Old Town neighborhood resident
Katherine Schultz, Willamette Shore Line adjacent property owner, commuter on Hwy 43
Mike Sisavic, South Portland neighborhood resident (Willamette Shores Condominiums), Willamette Shore Line adjacent property owner
Jeremy Solley, South Waterfront resident, South Portland Waterfront community relations coordinator, Neighborhood Association representative, South Portland Business Association member
Joy Strull, Evergreen neighborhood resident

Project Management Group:

Elissa Gertler, Clackamas County
Rick Gustafson, Portland Streetcar Inc.
Neil McFarlane/Alan Lehto, TriMet
Doug Obletz, Project Manager, SOJ
Ross Roberts, Metro
Paul Smith, City of Portland
Brant Williams, City of Lake Oswego
Rian Windsheimer, ODOT Region 1

Technical Advisory Committee:

Joseph Auth, ODOT
John Cullerton, URS
Ralph Drewfs, ODOT
Clifford Higgins, Metro
Omar Jaff, URS
Terry Kearns, URS
Sharon Kelly, URS
Mauricio Leclerc, City of Portland
Charles Maggio, Multnomah County
Tom Markgraf, Markgraf and Associates
Brian Monberg, Metro
Grant Morehead, City of Portland
Douglas Obletz, SOJ
Joe Recker, TriMet
Leon Skiles, LSA
Jamie Snook, Metro
Patrick Sweeney, City of Portland
Thuy Tu, URS
Bridget Wieghart, Metro
Brant Williams, City of Lake Oswego
Karen Withrow, Metro

Concept Design Team:

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John Gustafson, LTK, Systems Design
Gary Hartnett, IBI Group, Architectural
Mark Havekost, Jacobs and Associates, Elk Rock Tunnel
Omar Jaff, URS, Design Team Lead
John Kalvelage, OBEC Consulting Engineers, Trestles Project Manager
Brad Larsen, OBEC Consulting Engineers, Bridge Engineer
Tom McKerlick, URS, Cost Estimate
Ron Stewart, ZGF, Urban Design
Kris Westersund, DEA, Map and Survey
Lindsay Yazzolino, URS, Transit Design

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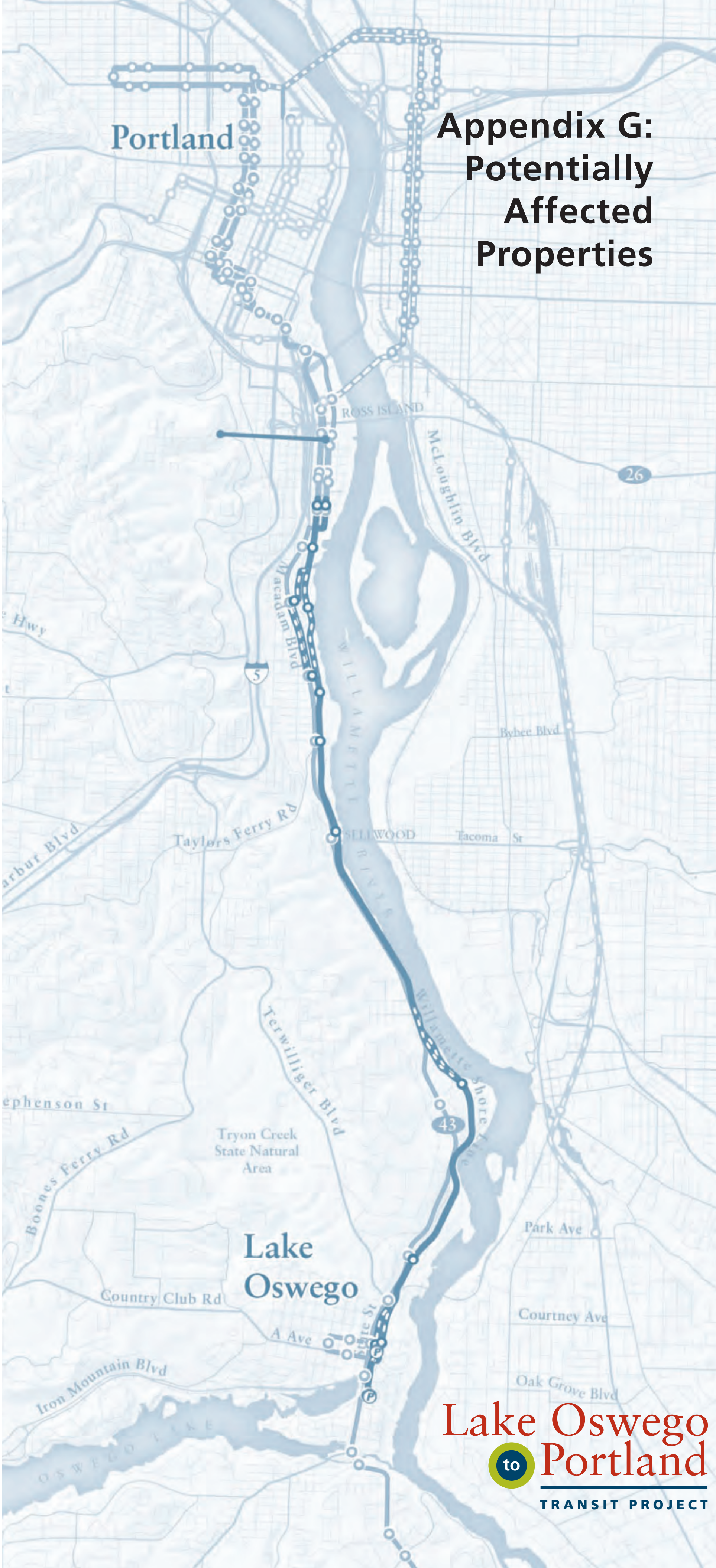
Appendix G: Potentially Affected Properties



Lake Oswego to Portland
TRANSIT PROJECT

APPENDIX G

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APPENDIX G
POTENTIALLY AFFECTED PROPERTIES

Building and operating the Lake Oswego to Portland Transit Project requires acquiring property for right of way and other facilities and presumes displacing and relocating some existing uses. This appendix presents the likely property acquisitions based on the current conceptual design. It is important to note that this list of potentially affected parcels should not be interpreted as the final determination regarding property acquisition and the list could be updated as the project design is further refined. Furthermore, the estimates described below reflect the various alternatives and design options that are being considered in the DEIS. Accordingly, the number and/or type of acquisitions and/or displacements could vary between what has been disclosed in this DEIS and what is actually required for the project but would reflect the alternative and design options chosen as the locally preferred alternative.

Two types of property acquisitions could occur:

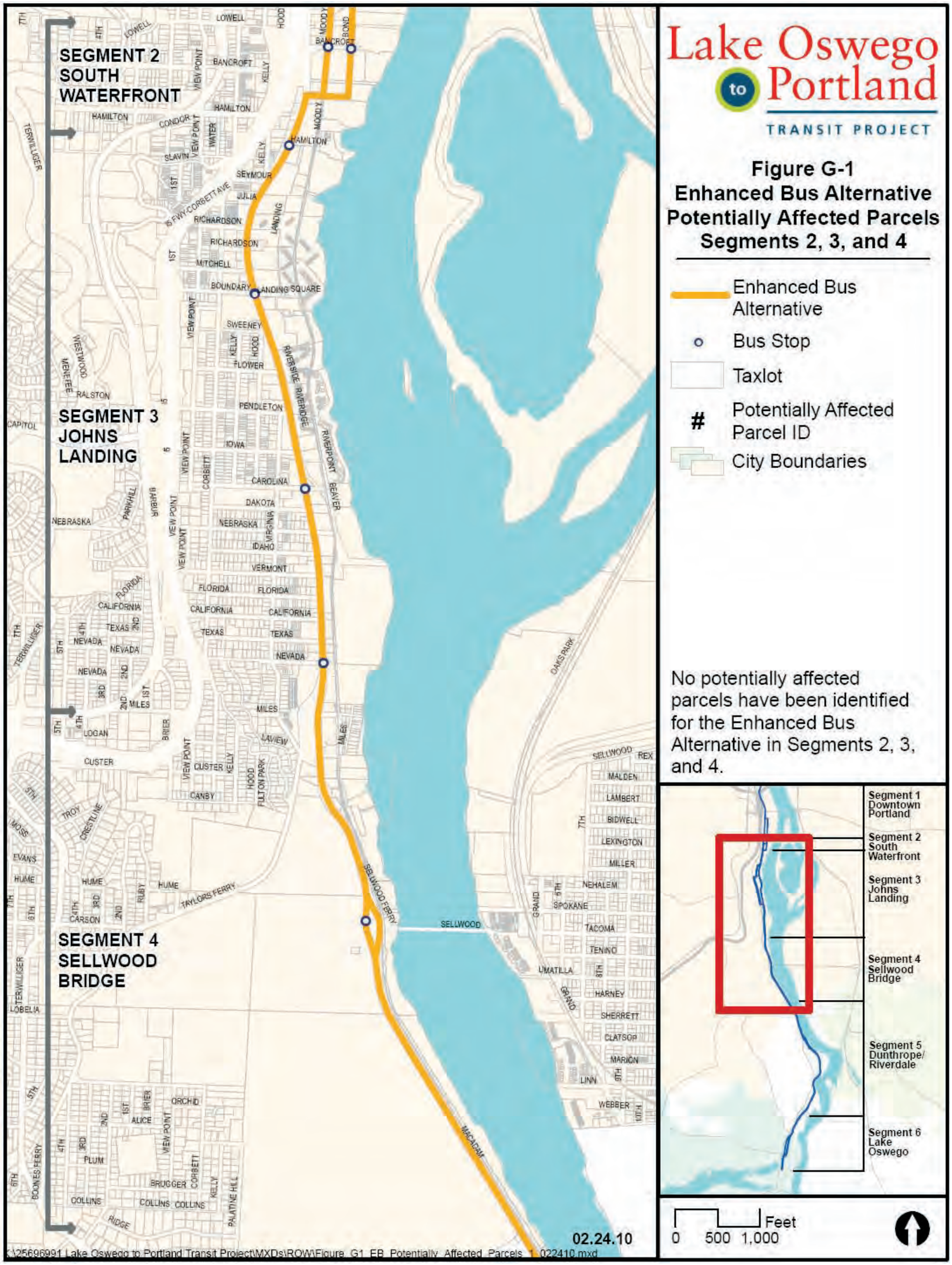
- A partial acquisition would acquire part of a parcel but would not dislocate the existing use.
- A full acquisition would acquire the full parcel and displace the current use. Full acquisitions include parcels that may not be fully acquired for the project but would be affected (due to loss of parking, access or other features) such that the existing use would be substantially impaired. This includes parcels that would be required for construction activities, although in some cases all or part of the parcels would be available for other use or redevelopment after construction is complete.

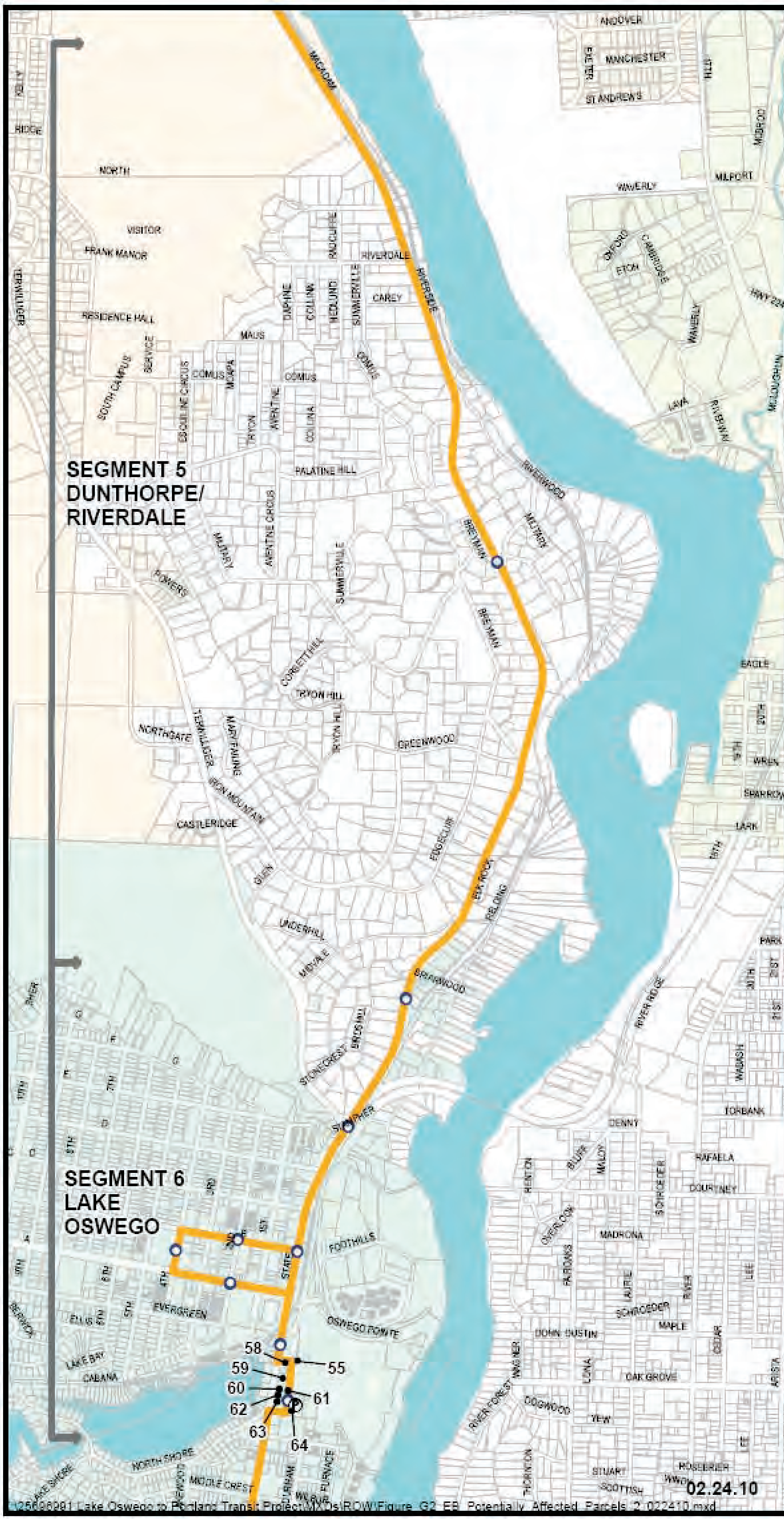
The following tables present information on the likely acquisitions. Tables G-1 though G-9 present a list of properties potentially affected with each alternative and design option. The tables list map identification numbers, parcel identification numbers, property owner's name and current use of the property, provided by the Multnomah and Clackamas County Tax Assessors. Figures G-1 through G-4 show the locations of the properties as identified by the map identification numbers.

Table G-1*
Enhanced Bus Alternative – Segment 6
(See Figure G-2)

Map ID No.	Taxlot ID Number	Account Number	Owner	Existing Use
55	21E11BB -00400	273288	Oswego Lender LLC	Multi-Family Residential
58	21E10AA -03600	253647	Pak Hasong J.	Commercial
59	21E10AA -03900	253674	Pak Hasong J.	Commercial
60	21E10AA -04000	253683	Pak Hasong J.	Commercial
61	21E10AA -03700	253656	Pak Hasong J.	Commercial
62	21E10AA -04001	253692	Headlee Properties LP	Commercial
63	21E10AA -04002	253709	City of Lake Oswego	Commercial
64	21E10AA -04100	253718	GMS Realty LLC	Commercial

*Note: No potentially affected parcels have been identified for the Enhanced Bus Alternative in Segments 1 through 5.


Lake Oswego to Portland
TRANSIT PROJECT
Figure G-1
Enhanced Bus Alternative
Potentially Affected Parcels
Segments 2, 3, and 4
Enhanced Bus Alternative
Bus Stop
Taxlot
Potentially Affected Parcel ID
City Boundaries
No potentially affected parcels have been identified for the Enhanced Bus Alternative in Segments 2, 3, and 4.
SEGMENT 2 SOUTH WATERFRONT
SEGMENT 3 JOHNS LANDING
SEGMENT 4 SELLWOOD BRIDGE
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
Feet
0 500 1,000
02.24.10

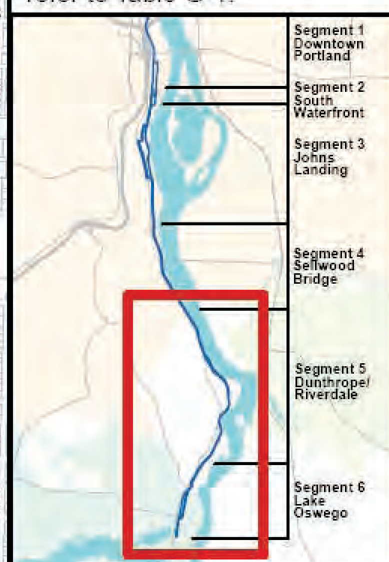


Lake Oswego to Portland
TRANSIT PROJECT

Figure G-2
Enhanced Bus Alternative
Potentially Affected Parcels
Segments 5 and 6

Enhanced Bus Alternative
Bus Stop
Park-and-Ride
Taxlot
Potentially Affected Parcel ID
City Boundaries

This map shows potentially affected parcels for the Enhanced Bus Alternative in Segments 5 and 6.
For specific parcel information, refer to Table G-1.



Feet
0 500 1,000

Table G-2
Streetcar Alternative – Segment 2
South Waterfront Phasing Options
(See Figure G-3)

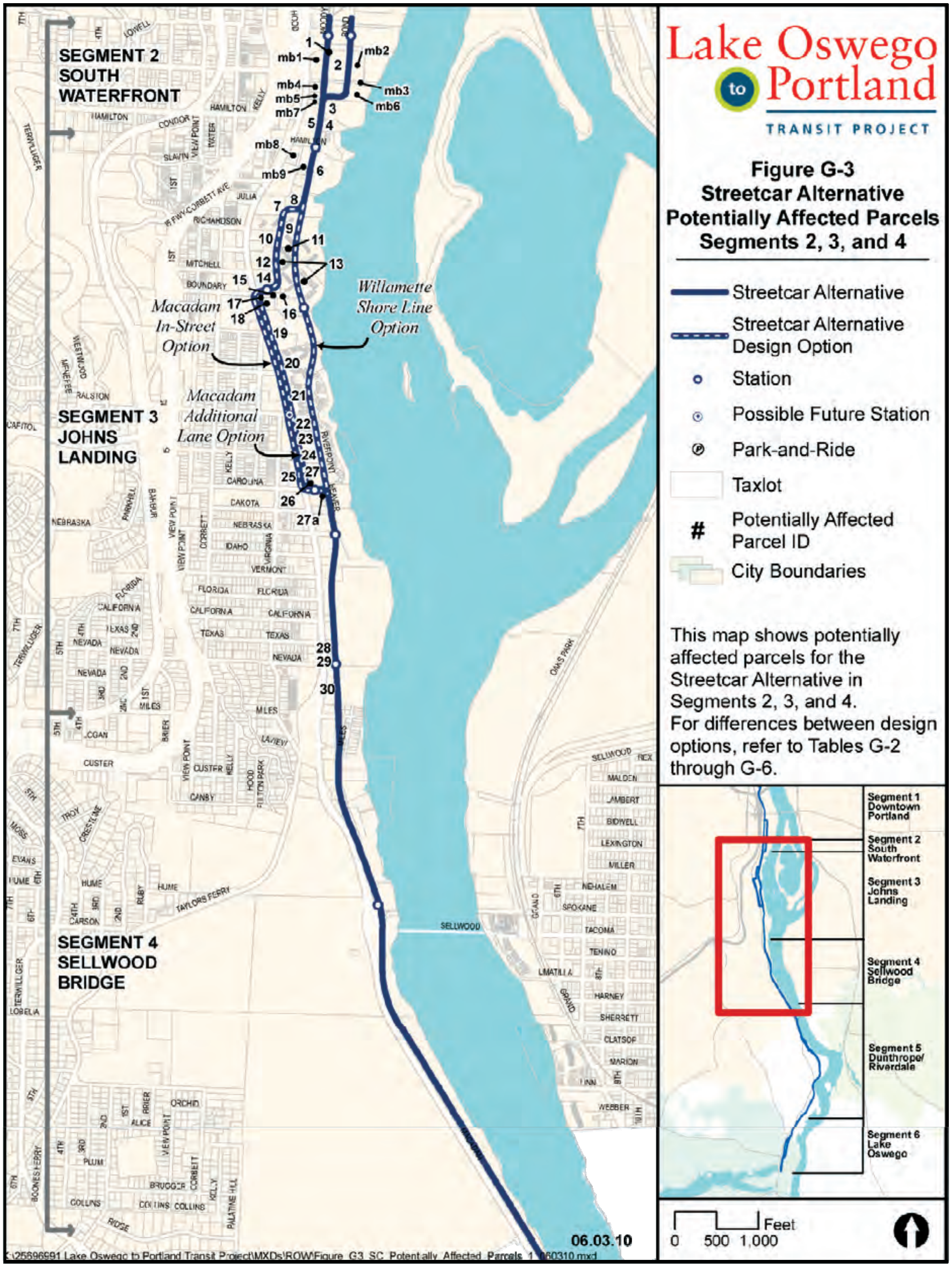
Willamette Shore Line Construction Phasing Option				
Map ID No.	**Taxlot ID Number**	**Account Number**	**Owner**	**Existing Use**
1	1S1E10DC -00200	R991100660	City of Portland	Vacant
2	1S1E10DC -00300	R991100740	South Riverblocks Investors LLC	Commercial
3	1S1E10DC -00800	R991100650	River Forum LLC	Commercial
4	1S1E10DC -00900	R991100890	River Forum LLC	Commercial
5	1S1E10CD -01300	R991100170	Gerding Robert K. et al	Commercial
Moody/Bond Couplet Construction Phasing Option*				
mb1	1S1E10CD -00500	R991100800	Lindquist Stuart H.	Commercial
mb2	1S1E10DC -00400	R991100730	T & E Investments	Commercial
mb3	1S1E10DC -00600	R991100840	State of Oregon	Transportation (non-right of way)
mb4	1S1E10CD -00900	R991100090	Lex Associates Inc.	Vacant
mb5	1S1E10CD -01100	R991100140	Gerding Robert K. et al	Commercial
mb6	1S1E10DC -00700	R991100920	Lex Associates Inc.	Industrial
mb7	1S1E10CD -01200	R991100150	Gerding Robert K. et al	Commercial

*Note: These additional parcels would be potentially affected with the Moody/Bond Couplet Phasing Option.

Table G-3
Streetcar Alternative – Segment 3
Willamette Shore Line Option
(See Figure G-3)

Map ID No.	**Taxlot ID Number**	**Account Number**	**Owner**	**Existing Use**
6	1S1E15BA -00300	R991150710	Cameron Oregon Properties LLC	Commercial
13	1S1E15BD -90000	R828550010	Association of Unit Owners of	Multi-Family Residential
15	1S1E15BD -00400	R991150130	Johns Landing Commercial Areas Association	Vacant
16	1S1E15BD -00403	R991151420	Johns Landing Commercial Areas Association	Vacant
28	1S1E22A -00700	R780200030	Oregon Public Broadcasting	Commercial
29	1S1E22A -00800	R780200010	Oregon Public Broadcasting	Vacant
30	1S1E22AC -00200	R991220380	Oregon Public Broadcasting	Commercial
mb8*	1S1E15BA -01100	R991150700	Breuer Charles F. & Bruun Kelly C.	Commercial
mb9*	1S1E15BA -00900	R991150870	PCC Johns Landing LLC	Commercial

*Note: These additional parcels would be potentially affected with the Moody/Bond Couplet Phasing Option.



Lake Oswego to Portland
TRANSIT PROJECT
Figure G-3
Streetcar Alternative
Potentially Affected Parcels
Segments 2, 3, and 4
Streetcar Alternative
Streetcar Alternative Design Option
Station
Possible Future Station
Park-and-Ride
Taxlot
Potentially Affected Parcel ID
City Boundaries
This map shows potentially affected parcels for the Streetcar Alternative in Segments 2, 3, and 4.
For differences between design options, refer to Tables G-2 through G-6.
SEGMENT 2
SOUTH
WATERFRONT
SEGMENT 3
JOHNS
LANDING
SEGMENT 4
SELLWOOD
BRIDGE
Macadam In-Street Option
Willamette Shore Line Option
Macadam Additional Lane Option
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
Feet
0 500 1,000
06.03.10

Table G-4
Streetcar Alternative – Segment 3
Macadam In-Street Option
(See Figure G-3)

Map ID No.	Taxlot ID Number	Account Number	Owner	Existing Use
6	1S1E15BA -00300	R991150710	Cameron Oregon Properties LLC	Commercial
7	1S1E15BA -00601	R649833050	Matin Realty Investors LLC	Commercial
8	1S1E15BA -00602	R649833060	BAM Waterfront LLC	Commercial
9	1S1E15BA -60000	R378870010	Heron Pointe at Johns Landing	Multi-Family Residential
10	1S1E15BA -01600	R991150400	SRI Eight Riverside LLC	Commercial
11	1S1E15 -90000	R378900010	Association of Unit Owners of Bowen Property Management Co.	Multi-Family Residential
12	1S1E15BD -00200	R991151100	SRI Eight Riverside LLC	Commercial
13	1S1E15BD -90000	R828550010	Association of Unit Owners of	Multi-Family Residential
14	1S1E15BD -00300	R991151110	Harbor Landing LLC	Commercial
15	1S1E15BD -00400	R991150130	Johns Landing Commercial Areas Association	Vacant
16	1S1E15BD -00403	R991151420	Johns Landing Commercial Areas Association	Vacant
17	1S1E15BD -00402	R991151410	Johns Landing Commercial Areas Association	Vacant
18	1S1E15BD -00500	R991151080	Willamette Waterfront Ltd	Commercial
25	1S1E15CD -00500	R781202520	Macadam LLC	Commercial
27a	1S1E15CD -19200	R780200630	Oregon Dept. of Transportation	Transportation (non-right of way)
28	1S1E22A -00700	R780200030	Oregon Public Broadcasting	Commercial
29	1S1E22A -00800	R780200010	Oregon Public Broadcasting	Vacant
30	1S1E22AC -00200	R991220380	Oregon Public Broadcasting	Commercial
mb8*	1S1E15BA -01100	R991150700	Breuer Charles F. & Bruun Kelly C.	Commercial
mb9*	1S1E15BA -00900	R991150870	PCC Johns Landing LLC	Commercial

*Note: These additional parcels would be potentially affected with the Moody/Bond Couplet Phasing Option.

Table G-5
Streetcar Alternative – Segment 3
Macadam Additional Lane Option
(See Figure G-3)

Map ID No.	Taxlot ID Number	Account Number	Owner	Existing Use
6	1S1E15BA -00300	R991150710	Cameron Oregon Properties LLC	Commercial
7	1S1E15BA -00601	R649833050	Matin Realty Investors LLC	Commercial
8	1S1E15BA -00602	R649833060	BAM Waterfront LLC	Commercial
9	1S1E15BA -60000	R378870010	Heron Pointe at Johns Landing	Multi-Family Residential
10	1S1E15BA -01600	R991150400	SRI Eight Riverside LLC	Commercial
11	1S1E15 -90000	R378900010	Association of Unit Owners of Bowen Property Management Co.	Multi-Family Residential
12	1S1E15BD -00200	R991151100	SRI Eight Riverside LLC	Commercial
13	1S1E15BD -90000	R828550010	Association of Unit Owners of	Multi-Family Residential
14	1S1E15BD -00300	R991151110	Harbor Landing LLC	Commercial
15	1S1E15BD -00400	R991150130	Johns Landing Commercial Areas Association	Vacant
16	1S1E15BD -00403	R991151420	Johns Landing Commercial Areas Association	Vacant
17	1S1E15BD -00402	R991151410	Johns Landing Commercial Areas Association	Vacant
18	1S1E15BD -00500	R991151080	Willamette Waterfront Ltd	Commercial
19	1S1E15BD -01300	R991151050	Harbor Landing LLC	Commercial
20	1S1E15CA -90000	R913900010	Association of Unit Owners of Bowen Property Management Co.	Multi-Family Residential
21	1S1E15CA -60000	R708980006	Association of Unit Owners of Riveridge (Phases 1&2)	Multi-Family Residential
22	1S1E15CA -50000	R711000010	Association of Unit Owners of	Multi-Family Residential
23	1S1E15CA -13000	R991150800	Abraham Patricia J. Tr et al	Commercial
24	1S1E15CA -13100	R991150790	Abraham Patricia J. Tr et al	Commercial
25	1S1E15CD -00500	R781202520	Macadam LLC	Commercial
26	1S1E15CD -00200	R780200690	Petrocard Systems Inc.	Commercial
27	1S1E15CD -00100	R780200680	Sunset Fuel Co.	Commercial
27a	1S1E15CD -19200	R780200630	Oregon Dept. of Transportation	Transportation (non-right of way)
28	1S1E22A -00700	R780200030	Oregon Public Broadcasting	Commercial
29	1S1E22A -00800	R780200010	Oregon Public Broadcasting	Vacant
30	1S1E22AC -00200	R991220380	Oregon Public Broadcasting	Commercial
mb8*	1S1E15BA -01100	R991150700	Breuer Charles F. & Bruun Kelly C.	Commercial
mb9*	1S1E15BA -00900	R991150870	PCC Johns Landing LLC	Commercial

*Note: These additional parcels would be potentially affected with the Moody/Bond Couplet Phasing Option.

Table G-6
Streetcar Alternative – Segment 4
(See Figure G-3)

Map ID No.	Taxlot ID Number	Account Number	Owner	Existing Use
No potentially affected parcels have been identified for the Streetcar Alternative in Segment 4 with either design option.				

Table G-7
Streetcar Alternative – Segment 5
Riverwood Option
(See Figure G-4)

Map ID No.	Taxlot ID Number	Account Number	Owner	Existing Use
31	1S1E26CC -00200	R708800510	Waverley Country Club	Single-Family Residential
32	1S1E26CC -00300	R708800590	Evans Carey R. Tr	Single-Family Residential
33	1S1E26CC -00400	R708800990	Evans Carey R. Tr	Single-Family Residential
34	1S1E26CC -00500	R638800180	KDH LLC	Single-Family Residential
35	1S1E26CC -00600	R638800140	Spada Charisse M.	Single-Family Residential
36	1S1E35BA -00100	R638800080	Lindquist Stuart H.	Single-Family Residential
37	1S1E35BA -01500	R711301830	Orloff Susan L.	Single-Family Residential
38	1S1E35BA -01400	R711301840	Howieson John Tr	Vacant

Note: No potentially affected parcels have been identified for the Streetcar Alternative in Segments 5 with the Willamette Shore Line option.

Table G-8
Streetcar Alternative – Segment 6
UPRR Right of Way Option
(See Figure G-4)

Map ID No.	Taxlot ID Number	Account Number	Owner	Existing Use
38a*	No Taxlot	NA	Union Pacific Railroad (UPRR)	Transportation
39	21E02BD -01700	181760	Voncolditz Rochelle Trustee	Single-Family Residential
40	21E02CB -02200	5021790	City of Lake Oswego	Public/Semi-Public
41	21E02CB -02300	5021791	City of Lake Oswego	Public/Semi-Public
42	21E02CB -02400	5021792	Metro	Public/Semi-Public
43	21E02CB -02700	5021795	City of Portland	Utility
44	21E02CB -00900	182037	City of Portland	Utility
46	21E02CB -01700	182117	Public Storage Inst Fund	Industrial
47a*	No Taxlot	NA	Union Pacific Railroad (UPRR)	Transportation
50a	21E03DD -06900	198547	City of Lake Oswego	Commercial
51	21E02CC -00700	182215	City of Lake Oswego	Public/Semi-Public
52	21E03DD -07000	198574	Portland General Electric Co.	Utility
53	21E02CC -00800	182224	City of Lake Oswego	Public/Semi-Public
55	21E11BB -00400	273288	Oswego Lender LLC	Multi-Family Residential
56	21E03DD -09300	5021201	City of Lake Oswego	Vacant
57	21E10AA -05800	5005604	City of Lake Oswego	Commercial
58	21E10AA -03600	253647	Pak Hasong J.	Commercial
59	21E10AA -03900	253674	Pak Hasong J.	Commercial
60	21E10AA -04000	253683	Pak Hasong J.	Commercial
61	21E10AA -03700	253656	Pak Hasong J.	Commercial
62	21E10AA -04001	253692	Headlee Properties LP	Commercial
63	21E10AA -04002	253709	City of Lake Oswego	Commercial
64	21E10AA -04100	253718	GMS Realty LLC	Commercial

*Note: Property owned by UPRR may be acquired or leased for the Lake Oswego to Portland Transit Project. Final disposition would be determined after negotiations with UPRR.

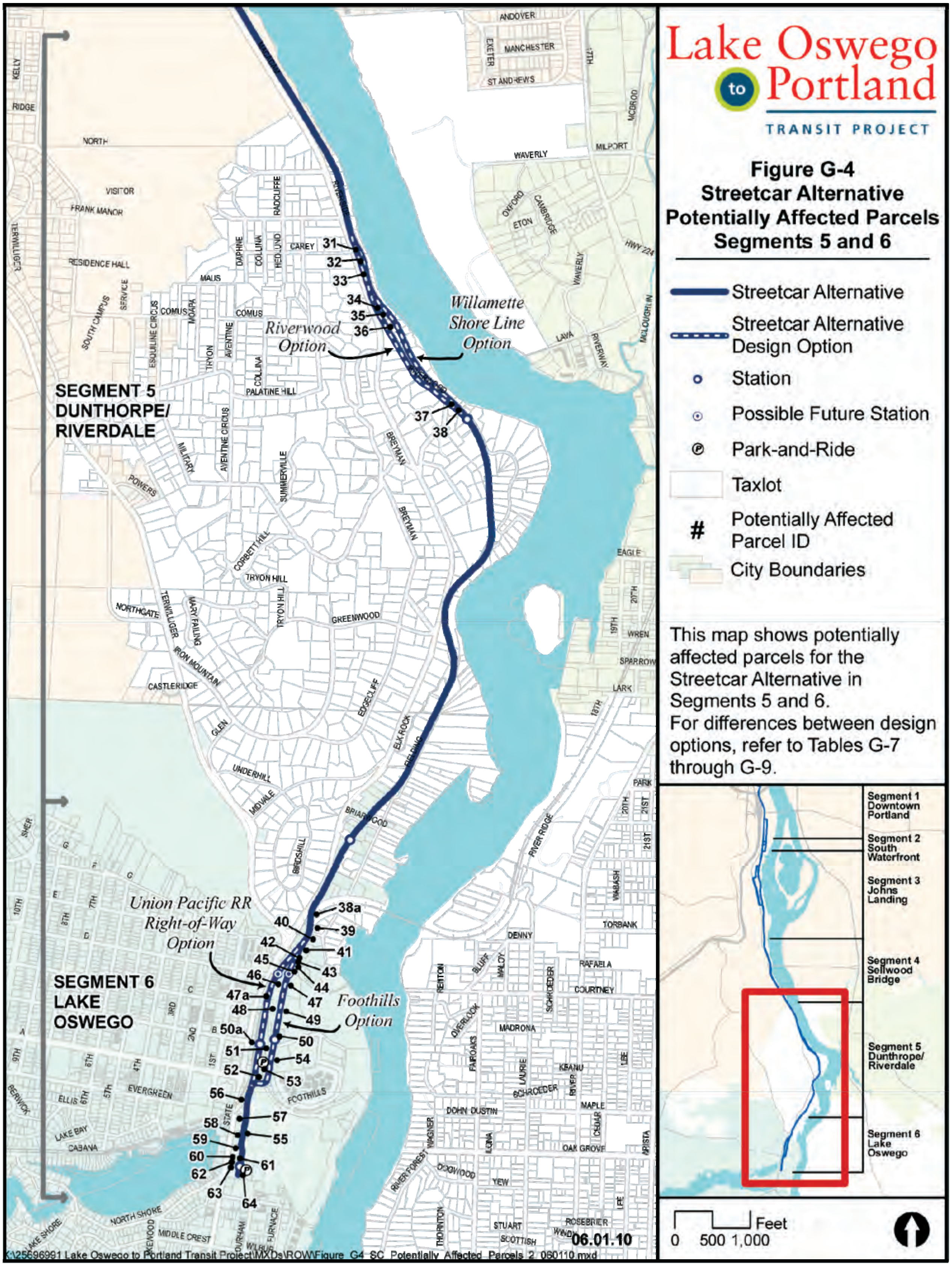
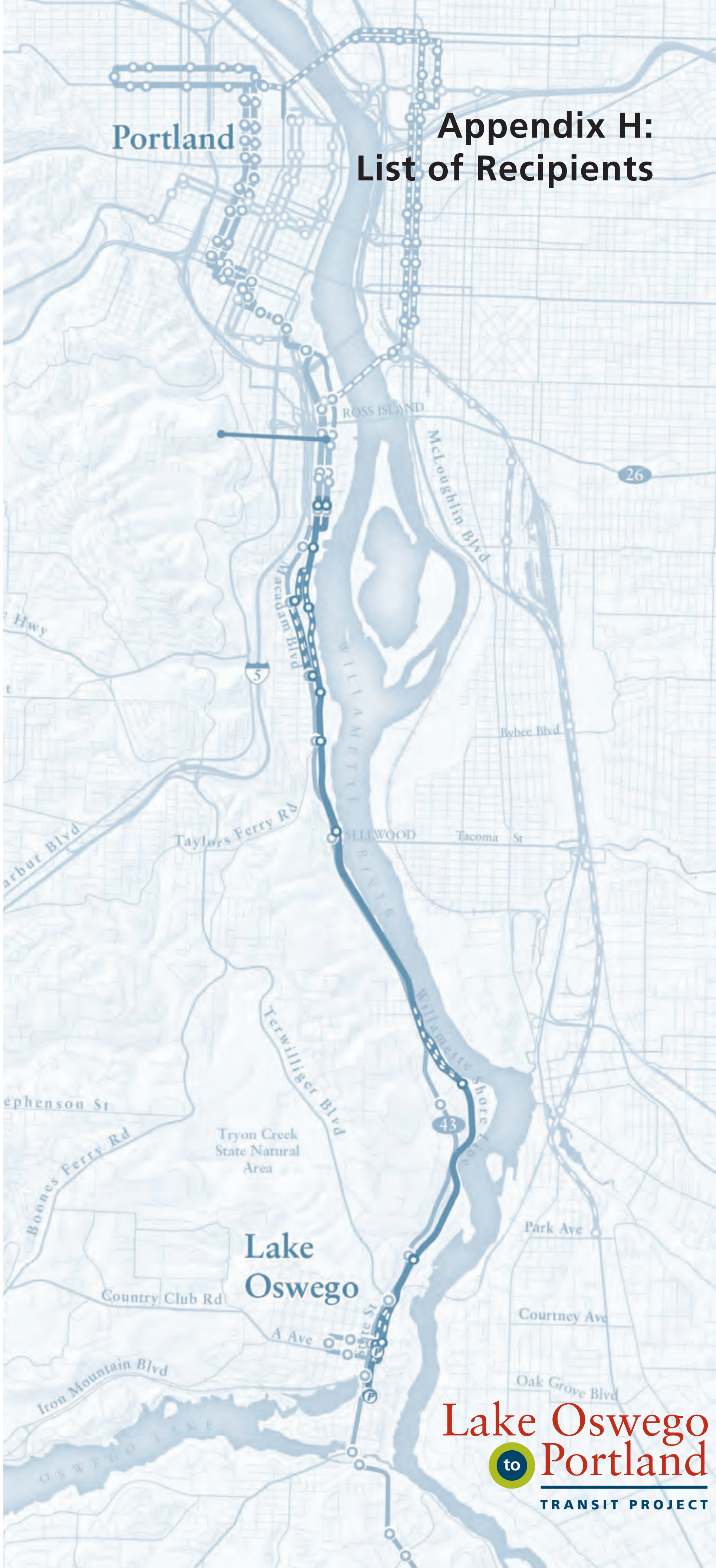

Lake Oswego to Portland
TRANSIT PROJECT
Figure G-4
Streetcar Alternative
Potentially Affected Parcels
Segments 5 and 6
Streetcar Alternative
Streetcar Alternative Design Option
Station
Possible Future Station
Park-and-Ride
Taxlot
Potentially Affected Parcel ID
City Boundaries
This map shows potentially affected parcels for the Streetcar Alternative in Segments 5 and 6.
For differences between design options, refer to Tables G-7 through G-9.
SEGMENT 5
DUNTHORPE/
RIVERDALE
SEGMENT 6
LAKE
OSWEGO
Riverwood Option
Willamette Shore Line Option
Union Pacific RR Right-of-Way Option
Foothills Option
Segment 1 Downtown Portland
Segment 2 South Waterfront
Segment 3 Johns Landing
Segment 4 Sellwood Bridge
Segment 5 Dunthrope/ Riverdale
Segment 6 Lake Oswego
Feet
0 500 1,000
06.01.10

Table G-9
Streetcar Alternative – Segment 6
Foothills Option
(See Figure G-4)

Map ID No.	Taxlot ID Number	Account Number	Owner	Existing Use
38a*	No Taxlot	NA	Union Pacific Railroad (UPRR)	Transportation
39	21E02BD -01700	181760	Voncolditz Rochelle Trustee	Single-Family Residential
40	21E02CB -02200	5021790	City of Lake Oswego	Public/Semi-Public
41	21E02CB -02300	5021791	City of Lake Oswego	Public/Semi-Public
42	21E02CB -02400	5021792	Metro	Public/Semi-Public
43	21E02CB -02700	5021795	City of Portland	Utility
44	21E02CB -00900	182037	City of Portland	Utility
45	21E02CB -01000	182046	Public Storage Inst Fund	Industrial
46	21E02CB -01700	182117	Public Storage Inst Fund	Industrial
47	21E02CB -01501	182108	Public Storage Inst Fund	Industrial
48	21E02CB -01800	182126	Stafford Investments Ltd.	Industrial
49	21E02CB -01500	182091	Mreen Family LLC	Industrial
50	21E02CB -02101	182144	Black-Warren-Mcphee LLC	Industrial
50a	21E03DD -06900	198547	City of Lake Oswego	Commercial
51	21E02CC -00700	182215	City of Lake Oswego	Public/Semi-Public
52	21E03DD -07000	198574	Portland General Electric Co.	Utility
53	21E02CC -00800	182224	City of Lake Oswego	Public/Semi-Public
54	21E02CC -00600	182206	L&S Investments	Industrial
55	21E11BB -00400	273288	Oswego Lender LLC	Multi-Family Residential
56	21E03DD -09300	5021201	City of Lake Oswego	Vacant
57	21E10AA -05800	5005604	City of Lake Oswego	Commercial
58	21E10AA -03600	253647	Pak Hasong J.	Commercial
59	21E10AA -03900	253674	Pak Hasong J.	Commercial
60	21E10AA -04000	253683	Pak Hasong J.	Commercial
61	21E10AA -03700	253656	Pak Hasong J.	Commercial
62	21E10AA -04001	253692	Headlee Properties LP	Commercial
63	21E10AA -04002	253709	City of Lake Oswego	Commercial
64	21E10AA -04100	253718	GMS Realty LLC	Commercial

*Note: Property owned by UPRR may be acquired or leased for the Lake Oswego to Portland Transit Project. Final disposition would be determined after negotiations with UPRR.

Appendix H: List of Recipients



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APPENDIX H

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APPENDIX H
LIST OF RECIPIENTS

H.1 Federal Agencies

Federal Emergency Management Administration
Federal Highway Administration
Federal Railroad Administration
Federal Transit Administration
Interstate Commerce Commission
National Marine Fisheries Service
U.S. Army Corps of Engineers
U.S. Department of the Interior
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

H.2 Native American Tribes and Agencies

Columbia River Inter Tribal Fish Commission
Confederated Tribes of Grand Ronde
Confederated Tribes of Siletz Indians
Confederated Tribes of Warm Springs

H.3 Oregon State Agencies

Office of the Governor
Department of Energy
Department of Environmental Quality
Department of Fish and Wildlife
Department of Geology and Mineral Industries
Department of Land Conservation and Development
Department of State Lands
Department of Transportation
Economic and Community Development Department
Parks and Recreation Department
Public Utilities Commission
State Historic Preservation Office

H.4 Regional, County and Local Agencies

Clackamas County
Multnomah County
City of Lake Oswego
City of Oregon City
City of Portland
City of West Linn
North Clackamas Parks and Recreation
West Multnomah Soil and Water Conservation District

H.5 Libraries
City of Lake Oswego Public Library
City of Oregon City Public Library
City of West Linn Public Library
Clackamas County Library
Multnomah County Library
Lewis and Clark College Library
Marylhurst University Library
Portland State University Library

H.6 Neighborhood Associations
Birdshill Neighborhood Association/Community Planning Organization
Collins View Neighborhood Association
Evergreen Neighborhood Association
First Addition Neighbors and Forest Hills Neighborhood Association
Lakewood Neighborhood Association
Old Town Neighborhood Association
Riverdale Neighborhood Association
South Burlingame Neighborhood Association
South Portland Neighborhood Association
South Waterfront Community Association

H.7 Miscellaneous
Alliance of Portland Neighborhoods
Clackamas County Historical Society
Clackamas Town Center
Lake Oswego Chamber of Commerce
Lake Oswego Neighborhood Action Coalition
North Clackamas Chamber of Commerce
North Macadam Urban Renewal Advisory Committee
Oregon Historical Society
Oregon League of Women Voters
Oregon Water Resource Council
Portland Business Alliance
Portland Development Commission
Portland Freight Committee
Portland Metropolitan Chamber of Commerce
South Portland Business Association

In addition to those listed above, notices to every person or group on the Lake Oswego to Portland Transit Project interested persons list were sent prior to the publication of this document.

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