



SOUTH CORRIDOR

Portland-Milwaukie Light Rail Project

Final Environmental Impact Statement

Volume 1 of 2

October 2010



U.S. Department
of Transportation
Federal Transit Administration

**PORTLAND-MILWAUKIE LIGHT RAIL PROJECT
CLACKAMAS AND MULTNOMAH COUNTIES, OREGON**

FINAL ENVIRONMENTAL IMPACT STATEMENT

Prepared pursuant to the National Environmental Policy Act

42 U.S.C. 4322(2)(c)

By the

FEDERAL TRANSIT ADMINISTRATION

and

METRO

and

TRI-COUNTY METROPOLITAN TRANSPORTATION DISTRICT OF OREGON

in cooperation with

U.S. COAST GUARD

U.S. ARMY CORPS OF ENGINEERS, PORTLAND DISTRICT

FEDERAL HIGHWAY ADMINISTRATION

3 October 2010
Date of Approval

Linda M. Genke
for R.F. Krochalis, Regional Administrator
For the Federal Transit Administration

9/30/2010
Date of Approval

Carlotta Collette
Carlotta Collette, Acting Metro President
For Metro

10/3/2010
Date of Approval

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

The following persons may be contacted for additional information regarding this document:

Ms. Linda Gehrke
Deputy Regional Administrator
or **Mr. James Saxton**, Transportation
Program Specialist

at:

Federal Transit Administration
Region 10
Jackson Federal Building, Suite 3142
915 Second Avenue
Seattle, WA 98174
(206) 220-7954

Ms. Bridget Wieghart, Project Manager
or **Mr. Mark Turpel**, FEIS Manager

Metro
600 NE Grand Avenue
Portland, OR 97232
(503) 797-1700

or

Mr. David Unsworth, Deputy Director

TriMet
710 NE Holladay
Portland, OR 97232
(503) 962-2150

Abstract:

TriMet proposes to construct and operate 7.3 miles of light rail transit and related facilities between downtown Portland, Oregon, the City of Milwaukie, and north Clackamas County. The Portland-Milwaukie Light Rail Project Final Environmental Impact Statement (FEIS) updates information contained in the Portland-Milwaukie Light Rail Project Supplemental Draft Environmental Impact Statement (SDEIS). It also considers findings from the South Corridor SDEIS published in December 2002, and the South/North Corridor Project Draft Environmental Impact Statement published in February 1998. This FEIS also examines a No-Build Alternative, which is compared to the project's Locally Preferred Alternative (LPA) and its related facilities and options, includes a new Willamette River bridge, a maintenance base expansion, bus and streetcar connections, up to 11 stations and two park-and-rides, modified roadway improvements, and an interim terminus. The LPA was identified in 2008 by the Metro Council after the publication of the South Corridor SDEIS, and its 45-day public review and comment period. The FEIS analysis and mitigation address long-term, short-term, and cumulative effects on transit service, ridership, accessibility, traffic, regional and local roadways, freight movements, acquisitions and displacements, land use, economics, neighborhoods, visual and aesthetic resources, ecosystems, water quality and hydrology, geology and seismology, air quality, hazardous materials, noise and vibration, energy, hazardous materials, parklands, safety and security, utilities, historic and cultural resources, and public services. The analysis also considers the financial feasibility of the LPA and its options.

Following the publication of this FEIS, the Federal Transit Administration (FTA) will issue a Record of Decision.

TABLE OF CONTENTS

S. EXECUTIVE SUMMARY

S.1 Portland-Milwaukie Corridor	S-3
S.2 Project History and Decision-Making Process.....	S-3
S.3 Purpose and Need	S-5
<i>S.3.1 Project Goals and Objectives</i>	S-6
S.4 Alternatives.....	S-6
<i>S.4.1 Locally Preferred Alternative (LPA) to Park Avenue</i>	S-6
<i>S.4.2 Minimum Operating Segment (MOS) to Lake Road</i>	S-12
<i>S.4.3 Related Facilities</i>	S-12
<i>S.4.4 Stations and Park-and-Rides</i>	S-13
<i>S.4.5 Willamette River Bridge</i>	S-15
<i>S.4.6 Light Rail Operations and Maintenance Facilities</i>	S-15
S.5 Transportation Impacts	S-16
<i>S.5.1 Transit Impacts</i>	S-16
<i>S.5.2 Traffic Impacts</i>	S-16
<i>S.5.3 Navigational Impacts</i>	S-17
S.6 Environmental Consequences.....	S-18
<i>S.6.1 Acquisitions and Displacements</i>	S-19
<i>S.6.2 Land Use and Economics</i>	S-19
<i>S.6.3 Communities</i>	S-20
<i>S.6.4 Visual Resources</i>	S-20
<i>S.6.5 Historical and Cultural Resources</i>	S-21
<i>S.6.6 Parks and Recreation</i>	S-21
<i>S.6.7 Geology and Soils</i>	S-21
<i>S.6.8 Ecosystems</i>	S-21
<i>S.6.9 Water Quality, Hydrology, and Floodplain</i>	S-22
<i>S.6.10 Noise and Vibration</i>	S-22
<i>S.6.11 Air Quality and Greenhouse Gas Emissions</i>	S-22
<i>S.6.12 Energy</i>	S-22
<i>S.6.13 Hazardous Materials</i>	S-23
<i>S.6.14 Utilities and Public Services</i>	S-23
<i>S.6.15 Construction Impacts</i>	S-23

S.7 Evaluation of the Alternatives	S-24
<i>S.7.1 Financial Feasibility Analysis</i>	S-24
<i>S.7.2 Costs</i>	S-25
S.8 Social Equity Considerations.....	S-27
S.9 Project implementation.....	S-28
<i>S.9.1 Selection of a New Locally Preferred Alternative (LPA)</i>	S-28
<i>S.9.2 Publication of the Final Environmental Impact Statement</i>	S-28
<i>S.9.3 Implementation of the Finance Plan</i>	S-29
<i>S.9.4 Project Timeline</i>	S-29
1. PURPOSE AND NEED	
1.1 Statement of the Portland-Milwaukie Light Rail Project’s Purpose and Need	1-4
<i>1.1.1 Project Goals and Objectives</i>	1-5
1.2 High Capacity Transit and the Regional Strategy for Managing Growth	1-6
1.3 Description of the Portland-Milwaukie Corridor.....	1-8
<i>1.3.1 Description of the Portland-Milwaukie Corridor Transportation System</i>	1-8
1.4 Growth in the Region and the Project Corridor	1-11
<i>1.4.1 Future Growth in the Portland/Vancouver Metropolitan Area</i>	1-11
<i>1.4.2 Future Growth in the Portland-Milwaukie Project Corridor</i>	1-12
1.5 The Effect of Traffic Congestion and Vehicle Delay on the Portland-Milwaukie Project Corridor	1-16
1.6 State, Regional, and Local Planning and Policy Framework.....	1-18
2. ALTERNATIVES	
2.1 Definition Of Alternatives	2-2
<i>2.1.1 Portland-Milwaukie Light Rail Project Description</i>	2-5
<i>2.1.2 No-Build Alternative</i>	2-40
2.2 Cost Estimates.....	2-41
<i>2.2.1 Capital Cost Estimates</i>	2-41
<i>2.2.2 Operations and Maintenance Cost Estimates</i>	2-42
2.3 Background On Alternatives Considered	2-43
<i>2.3.1 The Portland-Milwaukie Refinement Study</i>	2-44
<i>2.3.2 The Portland-Milwaukie Light Rail Project SDEIS</i>	2-51
2.4 Next Steps	2-62
<i>2.4.1 Federal Record of Decision</i>	2-62
<i>2.4.2 Final Design and Full Funding Grant Agreement</i>	2-62
<i>2.4.3 Construction, Testing, and Operations</i>	2-63

3. ENVIRONMENTAL ANALYSIS AND CONSEQUENCES

3.1 Acquisitions and Displacements 3-2

 3.1.1 *Affected Environment*..... 3-2

 3.1.2 *Environmental Impacts* 3-3

 3.1.3 *Mitigation*..... 3-9

3.2 Land Use and Economy 3-10

 3.2.1 *Affected Environment*..... 3-11

 3.2.2 *Environmental Consequences for Land Use*..... 3-21

 3.2.3 *Land Use Mitigation Measures*..... 3-38

 3.2.4 *Economic Affected Environment*..... 3-38

 3.2.5 *Economic Impacts* 3-40

 3.2.6 *Mitigation Measures for Economic Impacts*..... 3-49

3.3 Community Impact Assessment 3-50

 3.3.1 *Affected Environment*..... 3-50

 3.3.2 *Environmental Consequences* 3-57

 3.3.3 *Mitigation Measures* 3-68

 3.3.4 *Environmental Justice Compliance* 3-69

3.4 Visual Quality and Aesthetics..... 3-75

 3.4.1 *Affected Environment*..... 3-75

 3.4.2 *Environmental Impacts* 3-79

 3.4.3 *Mitigation*..... 3-99

3.5 Historic, Archaeological, and Cultural Resources 3-100

 3.5.1 *Affected Environment*..... 3-101

 3.5.2 *Environmental Impacts* 3-110

 3.5.3 *Short-Term Impacts (Construction)*..... 3-115

 3.5.4 *Indirect and Cumulative Impacts*..... 3-116

 3.5.5 *Mitigation Measures* 3-117

3.6 Parks and Recreational Resources 3-119

 3.6.1 *Affected Environment*..... 3-120

 3.6.2 *Environmental Impacts* 3-123

 3.6.3 *Mitigation*..... 3-129

 3.6.4 *Section 4(f) Resources*..... 3-129

 3.6.5 *Section 6(f) Resources*..... 3-130

3.7 Geology, Soils, and Groundwater 3-131

 3.7.1 *Affected Environment*..... 3-131

 3.7.2 *Environmental Impacts* 3-135

 3.7.3 *Mitigation*..... 3-139

3.8 Ecosystems.....	3-140
3.8.1 <i>Affected Environment</i>	3-142
3.8.2 <i>Environmental Consequences</i>	3-155
3.8.3 <i>Mitigation</i>	3-173
3.9 Water Quality and Hydrology.....	3-178
3.9.1 <i>Affected Environment</i>	3-178
3.9.2 <i>Environmental Impacts</i>	3-183
3.9.3 <i>Mitigation Measures</i>	3-196
3.10 Noise and Vibration.....	3-198
3.10.1 <i>Introduction to Noise</i>	3-198
3.10.2 <i>Introduction to Vibration</i>	3-199
3.10.3 <i>Impact Criteria and Methods for Noise and Vibration</i>	3-199
3.10.4 <i>Affected Environment</i>	3-207
3.10.5 <i>Environmental Consequences</i>	3-212
3.10.6 <i>Short-Term Impacts (Construction)</i>	3-229
3.10.7 <i>Project Noise Abatement and Mitigation Measures</i>	3-231
3.10.8 <i>Light Rail Vibration Mitigation</i>	3-238
3.10.9 <i>Fixed Noise Sources and Ancillary Facilities</i>	3-240
3.11 Air Quality.....	3-241
3.11.1 <i>Affected Environment</i>	3-241
3.11.2 <i>Environmental Consequences</i>	3-244
3.11.3 <i>Mitigation</i>	3-248
3.12 Energy Analysis.....	3-249
3.12.1 <i>Affected Environment</i>	3-250
3.12.2 <i>Environmental Consequences</i>	3-250
3.12.3 <i>Mitigation</i>	3-253
3.13 Hazardous Materials.....	3-253
3.13.1 <i>Affected Environment</i>	3-254
3.13.2 <i>Environmental Impacts</i>	3-263
3.13.3 <i>Mitigation</i>	3-270
3.14 Utilities.....	3-272
3.14.1 <i>Affected Environment</i>	3-272
3.14.2 <i>Environmental Impacts</i>	3-272
3.14.3 <i>Mitigation</i>	3-280
3.15 Public Services.....	3-280
3.15.1 <i>Affected Environment</i>	3-281
3.15.2 <i>Environmental Impacts</i>	3-285
3.15.3 <i>Mitigation</i>	3-290

3.16 Safety and Security	3-290
3.16.1 Affected Environment	3-290
3.16.2 Impact Assessment	3-294
3.16.3 Mitigation Measures	3-298
3.17 Section 4(F).....	3-300
3.17.1 Applicable Regulations	3-300
3.17.2 Section 4(f) Resources.....	3-301
3.17.3 Conclusion	3-303
4. TRANSPORTATION	
4.1 Affected Environment.....	4-1
4.1.1 Public Transportation.....	4-1
4.1.2 Travel Behavior	4-3
4.1.3 Roadways	4-3
4.1.4 Bicycle Activity.....	4-9
4.1.5 Pedestrian Activity.....	4-10
4.1.6 Parking.....	4-11
4.1.7 Streetcar.....	4-12
4.1.8 Freight Facilities	4-13
4.1.9 Navigable Waterways	4-14
4.2 Transportation Impacts	4-14
4.2.1 Service Characteristics	4-14
4.3 Highway And Street Impacts	4-29
4.3.1 System-wide Impacts	4-29
4.3.2 Local Impacts, Mitigation, and Project Improvements	4-30
4.3.3 Freight Impacts	4-60
4.3.4 Navigation Impacts	4-63
4.4 Short-Term Construction Impacts.....	4-64
4.4.1 Station Area Impacts.....	4-65
4.4.2 Corridor/Street Impacts	4-65
4.4.3 Intersection Area Impacts	4-65
4.4.4 Navigation.....	4-65
4.4.5 Mitigation for Short-Term Construction Impacts	4-66

5.	FINANCIAL ANALYSIS AND EVALUATION OF ALTERNATIVES	
5.1	Financial Analysis.....	5-1
5.1.1	<i>Costs</i>	5-3
5.1.2	<i>Available Resources</i>	5-6
5.1.3	<i>Existing Revenue Shortfalls</i>	5-13
5.1.4	<i>Opportunities for Additional Revenues</i>	5-14
5.1.5	<i>Conclusions</i>	5-16
5.2	Evaluation of the project.....	5-19
5.2.1	<i>Effectiveness in Meeting Corridor Objectives</i>	5-19
5.2.2	<i>Significant Trade-offs</i>	5-30
5.3	New Starts Evaluation Process	5-31
5.3.1	<i>Project Justification: Medium-High</i>	5-32
5.3.2	<i>Local Financial Commitment: Medium</i>	5-34
6.	COMMUNITY PARTICIPATION, AGENCY COORDINATION, AND REQUIRED PERMITS.....	6-1
6.1	Goals of the Community Participation Program	6-1
6.1.1	<i>Citizens Advisory Committee</i>	6-2
6.1.2	<i>Stakeholder Meetings</i>	6-4
6.1.3	<i>Other Community Meetings</i>	6-6
6.1.4	<i>Mitigation Related Outreach</i>	6-15
6.1.5	<i>Community Outreach Tools</i>	6-15
6.1.6	<i>Media Outreach and Advertising</i>	6-16
6.1.7	<i>Documentation</i>	6-16
6.1.8	<i>Notification</i>	6-17
6.1.9	<i>Environmental Justice Outreach and Compliance</i>	6-17
6.1.10	<i>Complying with Federal and State Regulations</i>	6-17
6.2	Public Participation Efforts in Previous Project Phases	6-17
6.2.1	<i>South/North Corridor DEIS</i>	6-17
6.2.2	<i>South Corridor Project</i>	6-18
6.2.3	<i>Portland-Milwaukie Light Rail Project SDEIS</i>	6-18
6.3	Agency Coordination.....	6-20
6.4	Tribal Coordination.....	6-23
6.5	Project Permits and Approvals.....	6-23
6.6	Federal Permits and Approvals.....	6-23
6.7	State of Oregon Permits and Approvals.....	6-24
6.8	Local Jurisdiction Permits and Approvals	6-25

7. PUBLIC COMMENT SUMMARY

7.1 SDEIS Public Comment Period 7-1

7.2 Comments Received 7-1

 7.2.1 Comments Supportive of the Project..... 7-2

 7.2.2 Comments Expressing Major Concerns or Opposition to the Project..... 7-3

 7.2.3 Summary of Other Public Concerns 7-3

 7.2.4 Comments Relating to Project Scope..... 7-9

 7.2.5 Comments Relating to Breadth and Depth of SDEIS..... 7-9

7.3 Common Comments and Responses..... 7-10

7.4 South Corridor Comments 7-12

APPENDICES

Attached with the FEIS

- Appendix A. Agency Coordination and Correspondence
- Appendix B. Environmental Justice Compliance
- Appendix C. Supporting Documents
- Appendix D. Visual Simulation Locations
- Appendix E. List of Preparers
- Appendix F. List of Recipients
- Appendix G. Properties Affected by Acquisitions
- Appendix H. Conceptual Design Information
- Appendix I. Index
- Appendix J. Acronyms and Abbreviations
- Appendix K. Final Section 4(f) Evaluation
- Appendix L. Background on Alternatives Development
- Appendix M. Mitigation
- Appendix N. Memorandum of Agreement and Programmatic Agreement for Historic and Archaeological Resources
- Appendix O. Navigation and Climate Change Summary
- Appendix P. Public Comments and Responses
- Appendix Q. Biological Opinion

Technical Results Reports

- Air Quality Analysis Results Report
- Biological Assessment for the Portland-Milwaukie Light Rail Project
- Navigation Results Report
- Noise and Vibration Results Report
- Section 106/Historic and Archaeological Resources Results Report
- Transportation Results Report

LIST OF FIGURES

Figure S-1. Regional Setting.....	S-2
Figure S-2. Regional Setting with Regional Rail System.....	S-4
Figure S-3. Locally Preferred Alternative and Minimum Operable Segment.....	S-7
Figure S-4. Willamette River Bridge Area and Related Transportation Facilities.....	S-8
Figure 1.1-1. Regional Setting.....	1-2
Figure 1.1-2. Regional Setting with Regional Rail System.....	1-3
Figure 1.2-1. 2040 Growth Concept [Region].....	1-7
Figure 1.3-1. Existing Transportation System.....	1-10
Figure 1.4-1. Percent Change in Forecasted Household, 2005-2030.....	1-14
Figure 1.4-2. Percent Change in Forecasted Employment, 2005-2030.....	1-15
Figure 1.5-1. Vehicle Miles Traveled (VMT) Projected Change, 2005-2030.....	1-17
Figure 1.5-2. Two-Hour P.M. Peak Conditions in the Corridor, 2005-2030.....	1-19
Figure 2.1-1. Locally Preferred Alternative and Minimum Operable Segment.....	2-4
Figure 2.1-2. Downtown Portland Transit Mall to Willamette River Bridge.....	2-8
Figure 2.1-3. Willamette River Bridge.....	2-9
Figure 2.1-4. Willamette River Bridge Design.....	2-10
Figure 2.1-5. OMSI to SE Tacoma Street.....	2-12
Figure 2.1-6. SE Tacoma Street to SE Lake Road.....	2-16
Figure 2.1-7. SE Lake to SE Park Avenue.....	2-18
Figure 2.1-8. Ruby Junction Maintenance Facility Location.....	2-24
Figure 2.1-9. Willamette River Bridge Area Related Transportation Facilities.....	2-25
Figure 2.3-1. South/North Corridor and Portland Streetcar Loop Development Processes.....	2-46
Figure 2.3-2. Refinement Study.....	2-47
Figure 2.3-3. Willamette River Crossing: SDEIS Study Options and 2008 LPA.....	2-48
Figure 2.3-4. Bridge Type Narrowing and Selection.....	2-54
Figure 2.3-5. SDEIS Study Options: Tacoma to Project Terminus.....	2-55
Figure 3.1-1 Properties Potentially Affected by Acquisitions, All Alternatives.....	3-5

Figure 3.2-1 2040 Growth Concept	3-13
Figure 3.2-2 2040 Growth Concept – Focus on SE Portland and Clackamas County	3-14
Figure 3.2-3 Jurisdictions and Boundaries.....	3-20
Figure 3.2-4 Comprehensive Plans.....	3-22
Figure 3.2-5 Zoning	3-23
Figure 3.3-1 Neighborhood and Boundaries.....	3-51
Figure 3.3-2 Poverty Level by Census Tract	3-54
Figure 3.3-3 Minority Residents by Census Tract.....	3-55
Figure 3.4-1 Visual Analysis Units and Neighborhoods	3-77
Figure 3.5-1 Identified Historic Resources.....	3-108
Figure 3.6-1 Parkland Resources	3-122
Figure 3.7-1 Relative Earthquake Hazard.....	3-134
Figure 3.8-1 Wetland/Waterway Sites and Locations	3-145
Figure 3.8-2 Vegetative Cover in Project Study Area	3-148
Figure 3.8-3 Stream Crossing Locations and Threatened, Endangered, and Sensitive Fish Species	3-160
Figure 3.9-1 River, Stream, and Floodplain Crossings.....	3-180
Figure 3.10-1 Typical Ldn Noise Levels and Compatible Land Uses.....	3-199
Figure 3.10-2 Typical Vibration Levels.....	3-200
Figure 3.10-3 FTA Noise Impact Criteria for Category 1 or 2 Land Uses.....	3-201
Figure 3.10-4 Noise and Vibration Monitoring Sites	3-208
Figure 3.10-5 Freight Train Pass-By Test at the Portland Waldorf School.....	3-212
Figure 3.10-6 Light Rail and Shared Transitway Noise and Vibration Impacts	3-217
Figure 3.10-7 Traffic Noise Impacts.....	3-224
Figure 3.13-1 Identified Hazardous Materials Site Locations	3-257
Figure 3.13-2 Willamette River Area – Sites of Concern.....	3-258
Figure 3.15-1 Public Services Locations in Project Area	3-282
Figure 4.1-1. Transportation Affected Environment	4-6
Figure 4.2-1. 2030 No-Build Transit Network	4-15
Figure 4.2-2. 2030 Light Rail Alternative Transit Network	4-16
Figure 4.2-3. Average Weekday Corridor and System Transit Trips1: Change from No-Build Alternative, Year 2030, with and without Streetcar	4-22
Figure 4.2-4. Change in Transit Trip Productions	4-25

LIST OF TABLES

Table S-1 Summary of Transit and Roadway Improvements/Modifications	S-14
Table S-2 Summary of Environmental Impacts	S-18
Table S-3 Capital Costs of Portland-Milwaukie Light Rail Project In Millions of 2010 and Year-of-Expenditure (YOE) Dollars	S-25
Table S-4 Capital Funding Plan for Portland-Milwaukie Light Rail project by Funding Scenario In Millions of Year-of-Expenditure Dollars	S-26
Table 1.4-1 Historical and Future Growth in Population and Employment within the Four- County Portland/Vancouver Standard Metropolitan Statistical Area1	1-12
Table 1.5-1 Historic Growth in Portland-Milwaukie Project Corridor Traffic Volumes	1-16
Table 2.1-1 Summary of Transit and Roadway Improvements/Modifications	2-5
Table 2.1-2 Travel Times.....	2-29
Table 2.1-3 Number of Willamette River Bridge Crossings per Hour in Peak Direction in 2030	2-31
Table 2.2-1 Light Rail Project Capital Cost Estimates (in millions of 2010 dollars).....	2-43
Table 2.2-2 Annual Operating and Maintenance Cost Estimates for Year 2030 Service Levels In Millions of (2010) Dollars	2-44
Table 2.4-1. Portland-Milwaukie Light Rail Project Timeline.....	2-63
Table 3.1-1 Summary of Full and Partial Acquisitions and Breakdown of Displaced Uses	3-6
Table 3.2-1 Current Zoning and Potential Transit-Oriented Development Opportunities	3-31
Table 3.2-2 Assessments of Redevelopment Potential Within 1/4 Mile of Selected Stations ..	3-36
Table 3.2-3 Population and Employment within One-Half Mile of Station, 2008 to 2030.....	3-39
Table 3.2-4 Estimated Businesses and Jobs Affected by Displacements	3-42
Table 3.2-6 Short-Term Construction Effects: Direct, Indirect, and Induced Effects	3-46
Table 3.3-1 Historical Growth in Population and Employment within the Four-County Portland-Vancouver Standard Metropolitan Statistical Area1	3-52
Table 3.3-2 Summary of Socioeconomic Data by Neighborhood.....	3-53
Table 3.3-3 Percentages of Homes with Limited English-Speaking Ability (2000)	3-56
Table 3.3-4 Comparison of EJ Population Ratios.....	3-70
Table 3.3-5 Characteristics of Potential Rider Populations	3-72
Table 3.3-6 Rockwood Neighborhood Minority and Low-Income Populations	3-73
Table 3.4-1 Characteristics of High, Moderate, and Low Levels of Visual Change.....	3-80
Table 3.4-2 Summary of Potential Visual Quality and Aesthetic Impacts of the Portland- Milwaukie Light Rail Project	3-94
Table 3.5-1 Historic Resources and Effects.....	3-103
Table 3.5-2 Summary of Adverse Effects.....	3-111
Table 3.6-1 Summary of Potential Parkland and Recreational Resources Evaluated	3-120

Table 3.6-2 Summary of Direct Impacts to Parks and Recreational Resources from the LPA to Park Avenue and the MOS to Lake Road	3-124
Table 3.6-3 Potential Secondary Impacts to Parks and Recreational Resources from the LPA to Park Avenue and the MOS to Lake Road	3-124
Table 3.8-1 Summary of Potential Natural Resource Permit Requirements	3-140
Table 3.8-2 Summary of Wetlands and Waterways within the Project Study Area.....	3-143
Table 3.8-3 Project Area Streams	3-144
Table 3.8-4 Summary of Existing Conditions in Project Area Streams	3-146
Table 3.8-5 Vegetation Cover Types/Plant Communities within the Project Study Area.....	3-149
Table 3.8-6 Threatened, Endangered, and Sensitive Wildlife and Plant Species with Recorded Presence Near the Project.....	3-153
Table 3.8-7 Fish Species with Federal Status Likely to be Present near the Project.....	3-155
Table 3.8-8 Potential Wetland Impacts (Acres).....	3-157
Table 3.8-9 Permanent Footprint of Project Area Stream Crossings.....	3-159
Table 3.8-10 Total New Impervious Surface Area (acres) by Watershed.....	3-163
Table 3.8-11 Potential Vegetation Cover Impacts.....	3-165
Table 3.8-12 Determinations of Effect for Listed Species and Designated Critical Habitat...	3-171
Table 3.9-1 Summary of Existing Conditions in Project Area Streams	3-181
Table 3.9-2 Estimated Average and Flood Flows in the Willamette River	3-182
Table 3.9-3 Project Area Streams with Crossings	3-184
Table 3.9-4 Total New Impervious Surface Area (acres) by Watershed.....	3-186
Table 3.9-5 Combined Acreage of Facilities in Mapped Project-Area Floodplains.....	3-187
Table 3.9-6 Ordinal Scale of Impacts	3-189
Table 3.9-7 Summary of Long-Term Impacts	3-190
Table 3.9-8 Summary of Short-Term Impacts.....	3-194
Table 3.10-1 FTA Vibration Impact Criteria for Frequent Events.....	3-202
Table 3.10-2 FHWA Traffic Noise Abatement Criteria	3-203
Table 3.10-3 Existing Conditions Noise Levels	3-210
Table 3.10-4 Light Rail and Fixed Guideway Noise Impacts without Mitigation Measures..	3-218
Table 3.10-5 Traffic Noise Impacts Before Mitigation	3-222
Table 3.10-6 Light Rail Vibration Levels without Mitigation.....	3-227
Table 3.10-7 Summary and Comparison of Transit Noise and Vibration Impacts without/with Mitigation	3-232
Table 3.10-8 Summary of Noise Mitigation Measures for Light Rail, Bus, Streetcar, Warning Bell, and Traffic Noise.....	3-236
Table 3.10-9 Light Rail Vibration Mitigation Measures	3-239
Table 3.11-1 Federal and State Ambient Air Quality Standards	3-242

Table 3.11-2 Estimated Regional Average Weekday Pollutant Emissions for Motor Vehicles (tons/day)	3-245
Table 3.11-3 Estimated Regional MSAT Pollutant Emissions (pounds/day).....	3-246
Table 3.11-4 Highest Projected 8-Hour and 1-Hour Carbon Monoxide Concentrations Near Intersections (ppm)	3-247
Table 3.12-1 Transportation Operations Energy Consumption in Base Year of 2005 (Billions of Btu) Portland Metropolitan Area.....	3-250
Table 3.12-2 Summary of Daily Corridor Transportation Operations Energy Consumption in 2030 (Billions of Btu) Portland-Milwaukie Light Rail Project.....	3-252
Table 3.12-3 Summary of Construction Energy Consumption (Billions of Btu) Portland-Milwaukie Light Rail Project Alternatives.....	3-252
Table 3.12-4 Summary of Annual Energy Consumption by Alternatives (Billions of Btu) ...	3-253
Table 3.13-1 Summary of Sites with Complex Contamination Issues that Would Potentially Be Acquired by the Portland-Milwaukie Light Rail Project	3-263
Table 3.15-1 Portland Public Schools within the Portland-Milwaukie Light Rail Project Area	3-284
Table 3.15-2 North Clackamas Public Schools within the Portland-Milwaukie Light Rail Project Area	3-285
Table 3.17-1 Portland-Milwaukie Light Rail Project - Summary of Park and Recreational Resource Use	3-301
Table 3.17-2 Portland-Milwaukie Light Rail Project - Section 4(f) Historic Sites Used	3-302
Table 4.1-1 TriMet Fixed-Route Service Summary	4-2
Table 4.1-2 Existing Portland-Milwaukie Light Rail Project Station Area On-Street Parking Spaces and Use	4-12
Table 4.2-1 Average Weekday Corridor1 Transit Service Characteristics, Year 2030.....	4-17
Table 4.2-2 Transit and Auto Average Weekday PM Peak Hour Travel Times to Selected Locations from Selected Downtown Portland Locations, Year 2030	4-19
Table 4.2-3 Measures of Transit Reliability in the Corridor	4-20
Table 4.2-4 Average Weekday Light Rail, Streetcar, and Commuter Rail Ridership, Year 2030.....	4-21
Table 4.2-5 Average Weekday Total System-wide and Portland-Milwaukie Corridor Transit Trips,1 Year 2030	4-22
Table 4.2-6 Average Weekday Ridership Across the Willamette River Bridge1 by Transit Mode, Year 2030	4-23
Table 4.2-7 Average Weekday Work and Nonwork Corridor Transit Trips and Transit Mode Share to Downtown Portland, Year 2030	4-24
Table 4.3-1 Average Weekday Regional Roadway Data, Year 2030.....	4-30
Table 4.3-2 Average Weekday PM Peak Vehicle Volumes at Select Corridor Screenlines, Year 2030.....	4-30
Table 4.3-3 Pedestrian Facilities Provided by the Project by Transit Station	4-31

Table 4.3-4 Bicycle Facility Improvements Locations by Transit Station	4-33
Table 4.3-5 Off-Street Parking Reduction Impact Minimization Measures.....	4-35
Table 4.3-6 Sub-Area A - Portland State University to SE Powell Boulevard Potential Motor Vehicle Impacts in 2030 PM Peak Hour	4-37
Table 4.3-7 Sub-area A - Portland State University to SE Powell Boulevard 2030 PM Peak Hour Motor Vehicle Operations by Jurisdiction.....	4-39
Table 4.3-8 Sub-area A - Portland State University to SE Powell Boulevard Summary of 2030 Potential Motor Vehicle Operation Improvements.....	4-41
Table 4.3-9 Sub-area B: SE Powell Boulevard to SE Tacoma Street Motor Vehicle Impacts..	4-45
Table 4.3-10 Sub-area B - SE Powell Boulevard to SE Tacoma Street 2030 PM Peak Hour No-Build Alternative and Light Rail Project Intersection Operations	4-47
Table 4.3-11 Sub-area B - SE Powell Boulevard to SE Tacoma Street Summary of 2030 Potential Motor Vehicle Impact Minimization Measures.....	4-48
Table 4.3-12 Sub-area C - SE Powell Boulevard to SE Tacoma Street Potential Motor Vehicle Impacts	4-49
Table 4.3-14 Sub-area C - SE Tacoma Street to Highway 224 Summary of 2030 Potential Motor Vehicle Impact Minimization Measures.....	4-52
Table 4.3-15 Sub-area D - Highway 224 to SE Park Avenue Motor Vehicle Impact Locations	4-55
Table 4.3-16 Sub-Area D - Highway 224 to SE Park Avenue 2030 PM Peak Hour Average Delay and 95th Percentile Queuing at Light Rail At-Grade Crossings in Downtown Milwaukie	4-58
Table 4.3-17 Sub-Area D - Highway 224 to SE Park Avenue 2030 PM Peak Hour No-Build Alternative and Light Rail Project Intersection Operations.....	4-58
Table 4.3-18 Sub-Area D - Highway 224 to SE Park Avenue Summary of 2030 Potential Motor Vehicle Impact Minimization Measures.....	4-61
Table 5.1-1 Capital Costs for Portland-Milwaukie Light Rail Project In Millions of 2010 and Year-of-Expenditure (YOE) Dollars	5-4
Table 5.1-2 Portland-Milwaukie Light Rail Project Operating Costs for Year 2030 Service Levels In millions of 2010 dollars	5-5
Table 5.1-3 Summary of Transit System Costs: Cumulative Total from FY 2010 to FY 2030 In Millions of Year-of-Expenditure Dollars	5-6
Table 5.1-4 Required Local Matching Funds In Millions of Year-of-Expenditure (YOE) Dollars	5-7
Table 5.1-5 Summary of Transit System Revenues: Cumulative Total from FY 2010 to FY 2030 Millions of Year-of-Expenditure Dollars	5-12
Table 5.1-6 Summary of Capital Revenue Shortfalls In Millions of Year-of-Expenditure Dollars	5-13
Table 5.1-7 System Fiscal Feasibility Analysis: Beginning Cash Reserves by Fiscal Year In Millions of Year-of-Expenditure Dollars	5-14

Table 5.1-8 Capital Funding Plan for Portland-Milwaukie Light Rail Project In Millions of Year-of-Expenditure Dollars	5-16
Table 5.1-9 Summary of Detailed Cash Flow Analysis - LPA Phasing Option In Millions of Year-of-Expenditure Dollars	5-18
Table 5.2-1 Objectives, Criteria, and Measures of Effectiveness.....	5-19
Table 5.2-2 Households and Employment within One-Half Mile of Stations by 2030.....	5-21
Table 5.2-3 Transit and Auto Average Weekday PM Peak Hour Travel Times to Selected Locations from Selected Downtown Portland Locations, Year 2030	5-21
Table 5.2-4 Reliability: Miles of Light Rail Right-of-Way and Average Weekday Passenger Miles on Light Rail Right-of-Way in Corridor, Year 2030.....	5-22
Table 5.2-5 Average Weekday Total System-wide and Portland-Milwaukie Corridor Transit Trips, Year 2030	5-23
Table 5.2-6 Average Weekday Transit Mode Share to Downtown Portland, Year 2030	5-24
Table 5.2-7 Highway System Use: 2030 Average Weekday Two-hour PM Peak Vehicle Volumes at Select Corridor Screenlines	5-25
Table 5.2-8 Highway System Use: 2030 Region-wide VMT, VHT, and VHD compared to the No-Build	5-26
Table 5.2-9 Cost-Effectiveness: Corridor Cost Per Boarding Ride, Year 2030	5-28
Table 5.2-10 Summary of Environmental Impacts	5-29
Table 6.1-1 Stakeholder Meetings	6-4
Table 6.1-2 Project Briefings to Established Groups.....	6-7
Table 6.3-1 Federal, State, and Local Agency Coordination.....	6-20