City of Sherwood Oregon

Home of the Tualatin River National Wildlife Refuge

RESOLUTION 2013-008

A RESOLUTION ACKNOWLEDGING THE ICE AGE TONQUIN TRAIL MASTER PLAN AS A REFERENCE DOCUMENT FOR DECISION MAKING PURPOSES

WHEREAS, Resolution 2006-070 authorized an Intergovernmental Agreement (IGA) with Metro to complete a Master Plan for the Tonquin Trail between the Willamette and Tualatin Rivers and passing through the cities of Wilsonville, Tualatin, Sherwood and Washington and Clackamas Counties;

WHEREAS, after extensive public outreach in the planning effort including local open houses and community events, surveys, mailers and updates in the local newspapers, the plan was completed in January 2013; and

WHEREAS, the City was represented on the Steering Committee by members of staff as well as a citizen representative, Brian Stecher, Parks and Recreation Advisory Board member; and

WHEREAS, on February 19, 2013, staff presented the contents of the Master Plan, attached as Exhibit A, at a City Council Work Session, and the completed plan was made available to each councilor; and

WHEREAS, the Master Plan serves as a detailed guide for implementation of the 22-mile Ice Age Tonquin Trail for all of the project partners; and

WHEREAS, the City has consistently determined that completion of the Cedar Creek Trail, a portion of the Ice Age Tonquin Trail, is a priority for the community and funding has been obtained for construction of a significant portion of the Cedar Creek Trail; and

WHEREAS, the City was a project partner on the Ice Age Tonquin Trail Master Plan and, along with the other partners, contributed funds and staff resources for the master planning effort; and

WHEREAS, the Regional Transportation Plan (RTP), the City's adopted Transportation System Plan, Parks Master Plan and Stella Olsen Park Master Plan, and Metro's Tonquin Trail Feasibility Study (2004) all identify a trail system within the Cedar Creek Corridor between Stella Olsen Park and the National Wildlife Refuge.

NOW, THEREFORE, THE CITY OF SHERWOOD RESOLVES AS FOLLOWS:

Section 1: The Sherwood City Council acknowledges the contents of the Tonquin Trail as published on January 2013 and acknowledges the study as a reference document for decision-making purposes.

Section 2: Staff is directed to utilize the Master Plan, attached as Exhibit A, as a guide for the development and design of the Cedar Creek Trail and other trail segments within Sherwood.

Section 3: Staff is authorized to document support for the other jurisdictions in their efforts to construct all portions of the Tonquin Trail.

Section 4: This Resolution shall be effective upon its approval and adoption.

Duly passed by the City Council this 19th day of February 2013.

Bill Middleton, Mayor

Attest:

Sylvia Murphy, CMC, City Recorder

Draft Master Plan

Ice Age Tonquin Trail

Connecting the cities of Wilsonville, Tualatin, and Sherwood in Oregon

February 2013

Project partners:
Metro, City of Wilsonville, City of Tualatin, City of Sherwood, Clackamas County, and Washington County

Acknowledgments

The Ice Age Tonquin Trail Master Plan project team appreciates the efforts of local partners, stakeholders, and residents who participated in the development of this plan. Their creativity, energy, and commitment to the future of the Ice Age Tonquin Trail were the driving force behind this master planning effort. In addition, the following project steering committee and project team members contributed regularly to the development of this plan.

Project Steering Committee

Hal Ballard – Washington County citizen bicycle advocate

Ronald Kroop – Oregon Department of Transportation

Connie Ledbetter – Tualatin resident

Al Levit – Wilsonville resident

Lori Mastrantonio – Clackamas County

Michelle Miller – City of Sherwood

Chris Neamtzu – City of Wilsonville

Jeff Owen – City of Wilsonville

Damon Reische* – Clean Water Services

Stephen Shane – Washington County

Brian Stecher – Sherwood resident

Carl Switzer – City of Tualatin

Aisha Willits – Washington County

**Technical advisor/non-voting member*

Project Team

Metro

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Anthony Butzek, Principal Transportation Engineer

Alta Planning + Design

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Rory Renfro, Associate

Elliot Akwai-Scott, Planner

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Anne Bothner-By, Graphic Designer

CH2M HILL

Kristin Hull, Project Manager

Howell Consulting

Leslie Howell

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Executive Summary

Located in the southwestern portion of the Portland metropolitan area, the Ice Age Tonquin Trail will provide a regional active transportation link between the Willamette and Tualatin Rivers, while enhancing local pedestrian and bicycle connectivity within and between the communities through which it passes.

The Ice Age Tonquin Trail Master Plan establishes a clearly defined roadmap for taking the trail from vision to reality. Building on work completed in the 2004 *Tonquin Trail Feasibility Study* and many other efforts, this Master Plan provides the information needed as local and regional partners embark on trail implementation efforts. Providing detailed alignment, design, and implementation guidance, this document represents the culmination of tremendous work efforts many stakeholders have undertaken over a multi-year period.

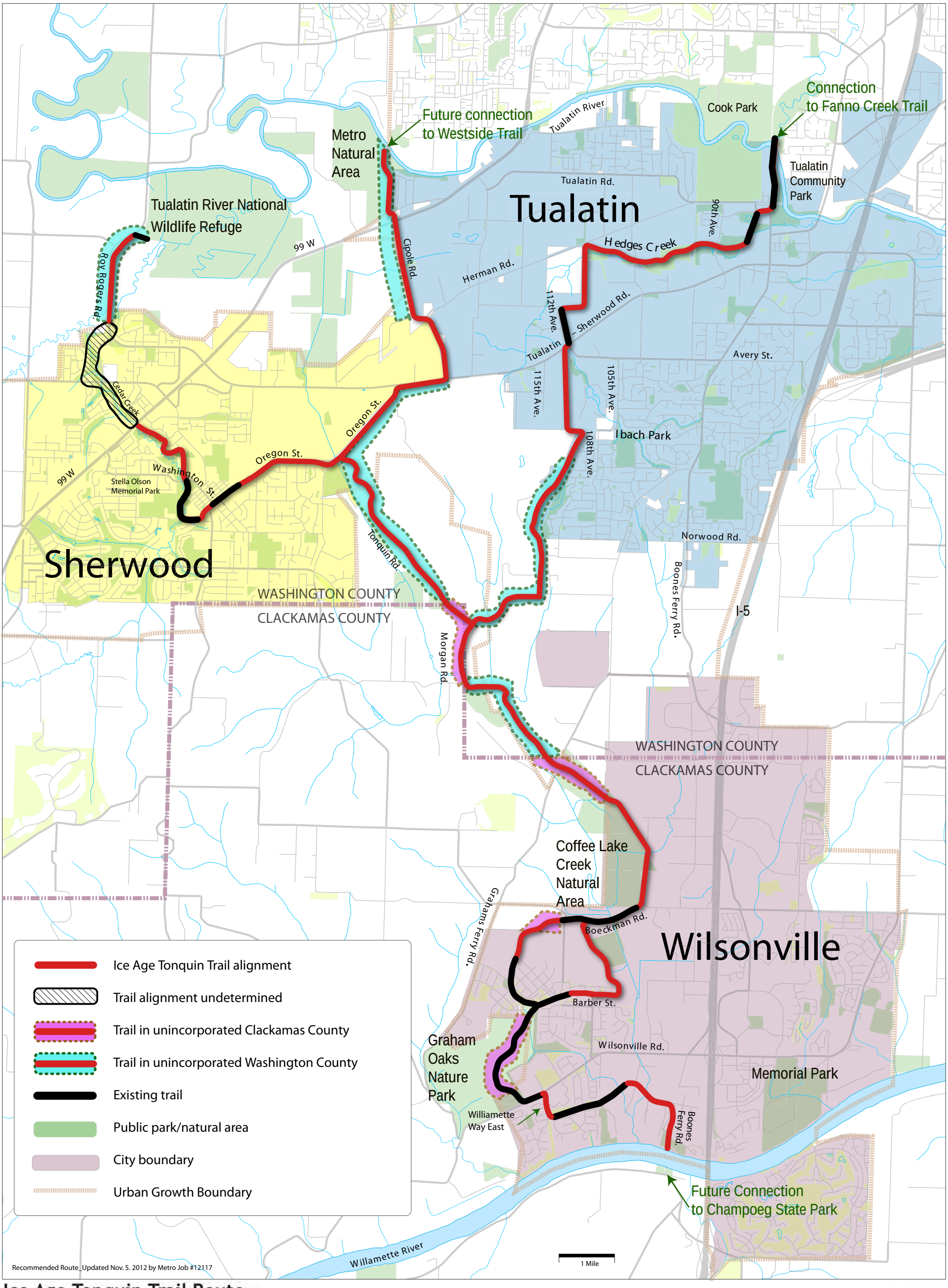
Spanning approximately 22 miles, the Ice Age Tonquin Trail will connect dozens of neighborhoods, businesses, schools, and parks as it travels through the communities of Wilsonville, Sherwood, and Tualatin (as shown on the Ice Age Tonquin Trail Route Map). The trail will provide a convenient, comfortable, and safe atmosphere for trail users of all ages and abilities.

The trail's name reinforces the primary theme to be interpreted throughout the corridor – the Glacial Lake Missoula Ice Age floods, a series of cataclysmic floods that formed the Columbia River Gorge and the Willamette Valley during the last Ice Age. Remains from the Ice Age floods that can be seen along the future trail include glacial erratics, scablands, kolk ponds, flood channels, and ripple marks. The trail's name also ties it to the National Park Service's Ice Age Floods National Geologic Trail, which increases the likelihood of trail funding opportunities and tourism in the cities the Ice Age Tonquin Trail will serve.

From its southern terminus at the Willamette River near Boones Ferry Park, the Ice Age Tonquin Trail may one day offer a connection south to Champoeg State Park via the proposed French Prairie Bridge. Heading north from the Willamette River, the trail will pass through several Wilsonville neighborhoods and Graham Oaks Nature Park before splitting into three segments. The western segment will traverse a bluff above Tonquin Road before descending into downtown Sherwood and Stella Olsen Park. This segment will follow Sherwood's majestic Cedar Creek corridor on its way to a Tualatin River National Wildlife Refuge trailhead near Roy Rogers Road. The central segment will follow Oregon Street and Cipole Road along the Sherwood/Tualatin boundary, access the Tualatin River at a Metro-owned natural area, and offer a connection to the future Westside Regional Trail. Making its way to Tualatin, the eastern segment will pass within close proximity of several historic and geologic features north of Tonquin Road. This segment will travel adjacent to Tualatin's Hedges Creek Greenway en route to Tualatin Community Park, and seamlessly link with the Fanno Creek Regional Trail via the existing Ki-a-Kuts Bridge traversing the Tualatin River.

The trail has garnered strong support from project partners (including the cities of Sherwood, Tualatin, and Wilsonville; Clackamas and Washington Counties; and Metro), who will work together to implement this Master Plan. Nearly 5 miles of the trail are built, but the majority of the Ice Age Tonquin Trail has not yet been completed. The trail will be constructed in phases by the jurisdictions (cities and counties) through which the trail passes, as funding becomes available. The trail partners will adopt the trail into their respective plans and policy documents (for example, comprehensive plans, zoning codes, and

transportation system plans). The three cities will be the primary jurisdictions responsible for operations and maintenance, while county maintenance will be less common and achieved through agreements with the cities. Any property acquired by Metro for the Ice Age Tonquin Trail will be acquired via a “willing seller” program.



Ice Age Tonquin Trail Route

Ice Age Tonquin Trail Master Plan

Source: Metro Data Resource Center

Chapter 1: Introduction

Trail Context

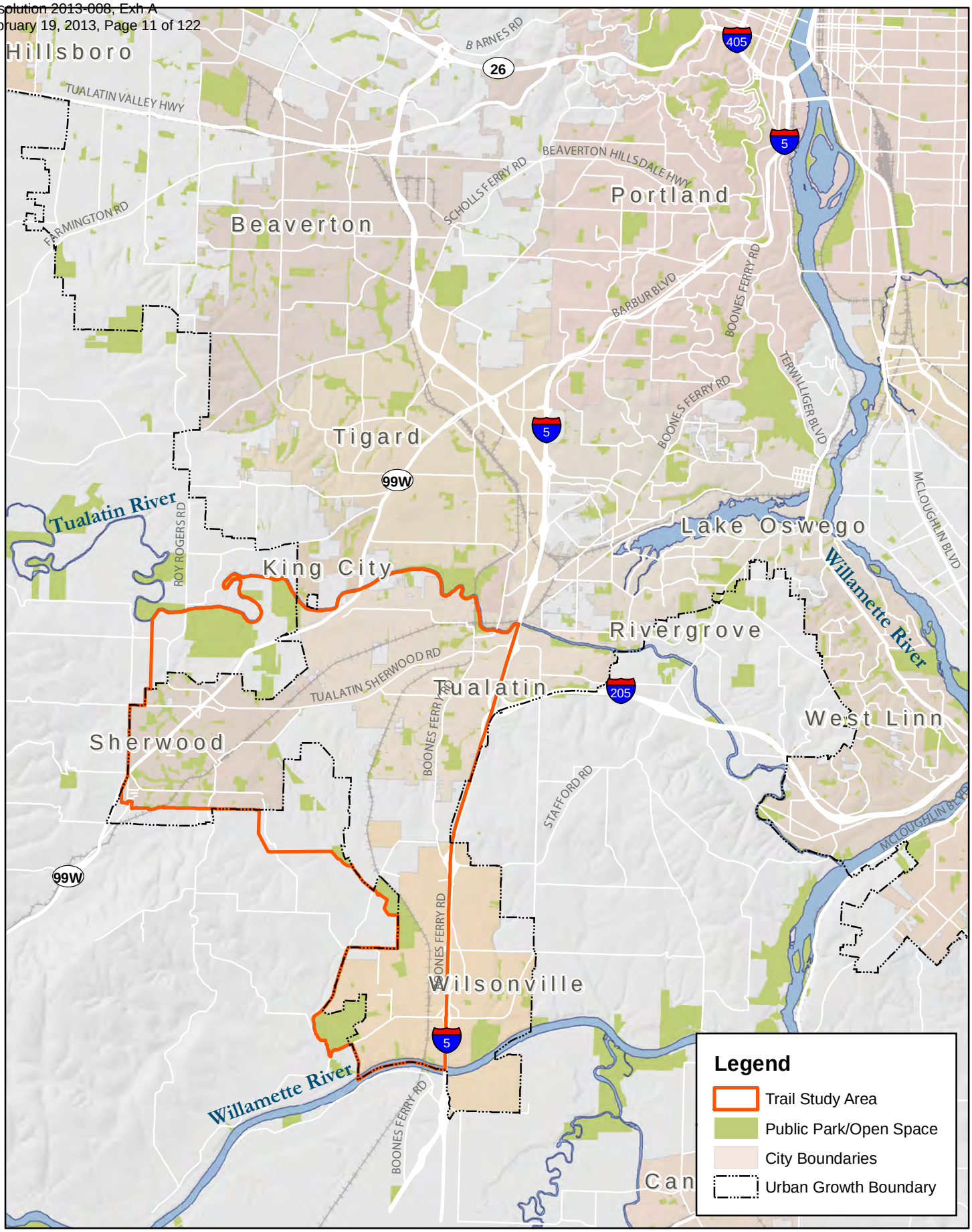
Location

Located in the southwestern portion of the Portland region, the Ice Age Tonquin Trail Master Plan study area encompasses portions of the cities of Sherwood, Tualatin, and Wilsonville, and Clackamas and Washington counties (see Map 1). Spanning urban and rural areas, the study area includes lands both inside and outside the regional urban growth boundary, including within and outside incorporated municipalities. As shown on Map 2, the area targeted for study is generally bounded by the Willamette River to the south, Tualatin River to the north, Interstate 5 to the east, and the regional urban growth boundary to the west. The Ice Age Tonquin Trail seeks to establish a regional active transportation link between the Willamette and Tualatin Rivers, while enhancing local pedestrian and bicycle connectivity within and between the communities through which it passes.

Regional Significance

The Ice Age Tonquin Trail is part of a larger interconnected network of regional trails and greenways that will connect the cities, parks, natural areas, and neighborhoods of the region with a special focus on waterways and views. This system of trails and greenways was originally conceived by the Olmsted Brothers 100 years ago as a 40-mile loop around Portland. Since then it has grown to an almost 140-mile system and has been endorsed or adopted by nearly 30 cities and 4 counties within the Portland/Vancouver metropolitan region. However, only 30 percent of the trail has been completed. Map 3 shows the Ice Age Tonquin Trail in the context of the regional trail system, and highlights eight trails identified in Metro's 2006 Parks and Natural Areas bond measure to be acquired (in no particular order of priority).

In 2011, a new bi-state organization (Oregon and Washington), known as the Intertwine Alliance, was formed consisting of a coalition of public, private, and nonprofit groups that are interested in working together to create a vibrant and healthy region, including completing the regional trail system. These leaders recognize the importance of building an interconnected network of parks, trails, and natural areas (the Intertwine), whether for economic development, public health or environmental conservation. Their work also involves developing a funding strategy to complete the remaining regional trail system. To learn more about the Intertwine go to http://theintertwine.org.



Map 1: Regional Vicinity Map

Ice Age Tonquin Trail Master Plan

Source: Metro Data Resource Center

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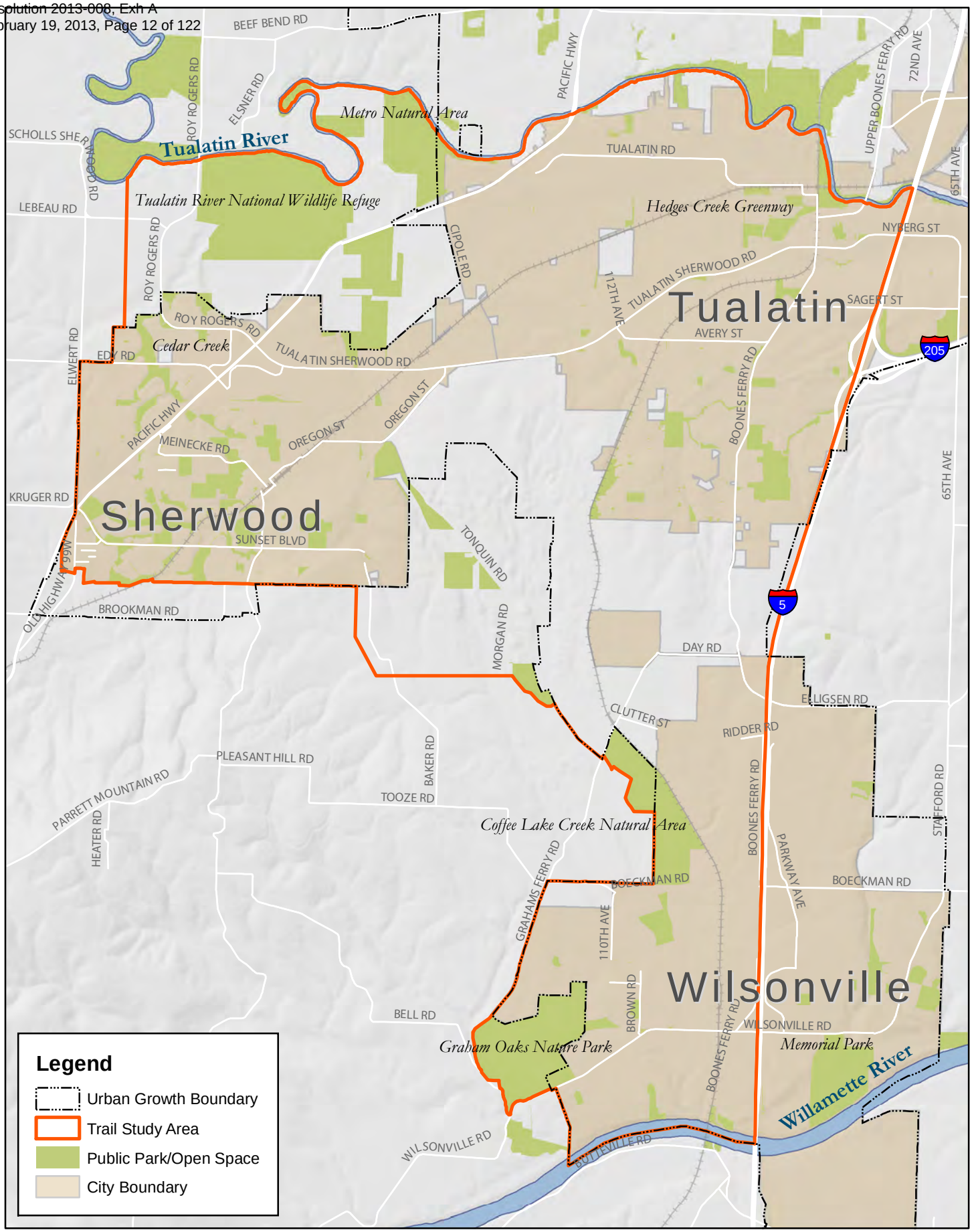

Map 2: Ice Age Tonquin Trail Study Area

Ice Age Tonquin Trail Master Plan

Source: Metro Data Resource Center

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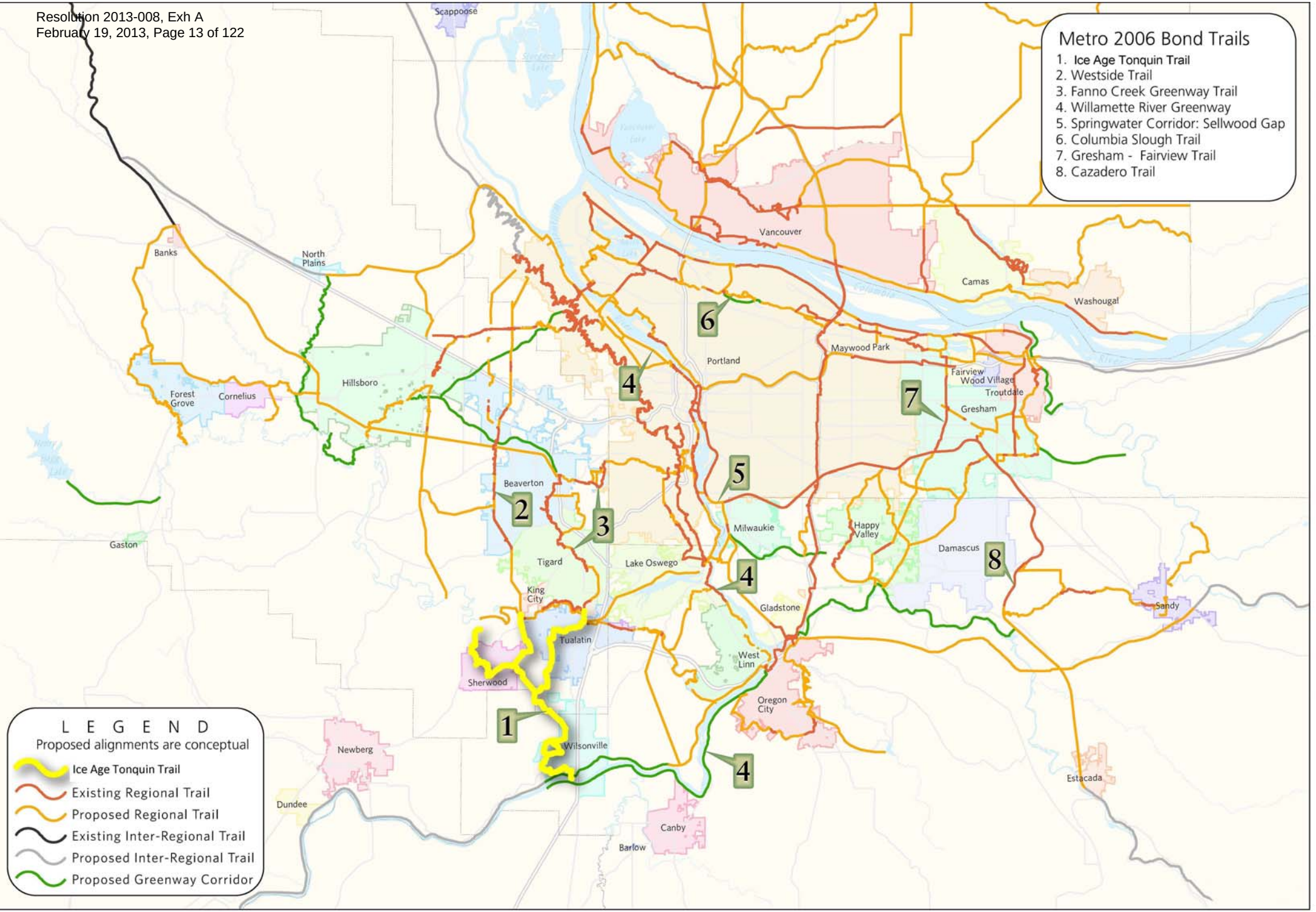


Map 3: Ice Age Tonquin Trail within the Regional System

Ice Age Tonquin Trail Master Plan

Source: Metro Data Resource Center

Geological and Cultural History

About 15,000 years ago, a glacial ice dam in western Montana gave way and released a torrential deluge of ice, rock, debris, and water across western Montana and Idaho, along the Columbia River Gorge, and through Washington and Oregon all the way to the Willamette Valley. This, along with other associated events known as the Glacial Lake Missoula (or Bretz) Floods, scoured the landscape, carrying large boulders and carving out new geological formations. The Tonquin Geologic Area south of Portland is one area transformed by this great flooding[1]. The Ice Age Tonquin Trail will traverse the Tonquin Geologic Area, where one can see unique features left from the Ice Age floods such as kolk ponds[2] and basalt outcroppings.

The great floods created a lake that filled the Willamette Valley, providing habitat for mastodons and other mammals that roamed its shores. The lake gradually receded and local Native Americans, the Kalapuya Indians, used the land for hunting and travel. The arrival of fur traders and explorers in the early 19th century caused a decline for the Kalapuya Indians, primarily due to the diseases carried by the traders and explorers. In 1846, Alphonso Boone, the grandson of Daniel Boone, settled at Boone's landing where he began a ferry service at the current location of Boones Ferry Park on the Willamette River in Wilsonville. Following the fur traders and explorers, farmers settled Sherwood as early as 1853. In 1886, the town of Tualatin emerged on the banks of the Tualatin River.

Path of the Glacial Lake Missoula floods, shown in gray (Photo source: http://nwcreation.net).

[1] Allen, John Eliot, Burns, Marjorie and Sargent, Sam C. 1986. *Cataclysms on the Columbia*, Portland, Oregon: Timber Press.

[2] Kolk ponds are pot-hole lakes carved out by large-scale floods.

Alphonso Boone initiated ferry service on the Willamette River at the current location of Boones Ferry Park in Wilsonville (Photo source: Oregon Coast Magazine).

Planning History

This unique landscape formed by the last Ice Age floods is what prompted the Columbia Region Association of Governments, the predecessor of Metro, to propose acquisition of these lands as early as 1971. Metro listed the area as unique open space to be protected under the *Metropolitan Greenspaces Master Plan* in 1992. Two subsequent Metro bond measures were approved by the region's voters in 1995 and 2006, and provided funds to acquire natural areas and trail right-of-way in the Tonquin Geologic Area. Approximately 500 acres of natural areas have been protected to date, and more is being acquired to meet conservation and trail goals in the target area. The 250-acre Graham Oaks Nature Park and 167-acre Coffee Lake Creek Natural Area make up a portion of these publicly owned natural areas. The *Tonquin Trail Feasibility Study* was completed in 2004 to confirm that feasible routes existed for the trail, and helped inform the analysis performed during this master planning process.

Purpose, Goals, and Process

Master Plan Purpose

The Ice Age Tonquin Trail Master Plan establishes a clearly defined roadmap for taking the trail from a feasible concept to reality. Building on work completed in the 2004 Tonquin Trail Feasibility Study and many other efforts, this Master Plan provides the information needed as local and regional partners embark on trail implementation efforts. Providing detailed alignment, design, and implementation guidance, this document represents the culmination of tremendous work undertaken by many stakeholders over a multi-year period.

The Master Plan is structured so that relevant items can be integrated into local comprehensive plans and transportation system plans, setting the stage for successful funding pursuits. Local jurisdictions responsible for implementing the Master Plan may need flexibility with some of the Master Plan's recommendations to meet local zoning code, regulatory, and other requirements.

Master Plan Goals

At the outset of the Metro-led master planning effort, Metro and the consultant team worked with the project steering committee to develop goals and criteria to clarify the Master Plan's intended purpose and outcome, and to establish a framework for evaluating trail alignment alternatives. The Ice Age Tonquin

Trail Master Plan includes 6 goals and 19 supporting criteria, as shown in Table 1. The project team also developed nearly 30 evaluation measures to provide an objective means for screening potential trail alignment options against the goals and criteria.

Table 1 - Ice Age Tonquin Trail Master Plan Goals and Criteria

Goal	Criteria
Develop a trail that addresses crime prevention through design to provide safety for trail users and security for adjacent property owners.	• Segment provides for safe, sensible, multi-modal roadway crossings • Segment provides a safe experience for trail users • Segment provides safety and security for adjacent property owners
Develop a trail that avoids or minimizes impacts to natural and cultural resources.	• Segment avoids or minimizes impacts to natural resources • Segment avoids or minimizes impacts to cultural resources • Segment provides an opportunity for resource enhancement
Develop a trail that is convenient, pleasant, and accessible to a range of users regardless of ability or mode.	• Segment provides a positive user experience with respect to views, scenic quality, wildlife viewing, noise, and grades • Segment can be used by a variety of users of different abilities (for example, bicyclists, joggers, walkers, in-line skaters, and motorized and non-motorized wheelchair users) • Segment provides opportunities for interpretive and environmental education and access to unique natural features • Segment provides for a direct route between Wilsonville and Tualatin and between Wilsonville and Sherwood • Segment meets regional trail standards • Segment minimizes trail user conflicts
Develop a trail that can be implemented.	• Segment is consistent with local plans • Segment can be developed with a reasonable cost and minimizes expensive elements • Segment reduces private property impacts by (1) minimizing land acquisition needs, and (2) working with willing sellers where acquisition is needed • Segment can meet regulatory requirements
Develop a trail that encourages and enhances bicycle and pedestrian connectivity throughout the region.	• Segment provides linkages to other trails, parks, and natural areas • Segment provides seamless connections among residential areas, schools, employment areas, shopping, and transit facilities, and other designated bikeways and walkways (for example, trails, bike lanes, bicycle boulevards, and so forth.)
Develop a trail that is supported by the community and local jurisdictions and is informed by input from the public, elected officials and jurisdictional staff.	Criteria were not developed for this goal since the ultimate measure could only be applied after Master Plan completion and local government approvals.

Stakeholder and Community Engagement

The Ice Age Tonquin Trail Master Plan was supported by a robust public involvement program including outreach to affected public and private landowners, potential trail users, jurisdictional partners, and other interested members of the community. The following public involvement goals were adopted through the Ice Age Tonquin Trail public involvement plan, created at the beginning of the planning process in 2009:

- Provide opportunities for meaningful and constructive public input to develop a community-supported master plan for the Ice Age Tonquin Trail
- Provide for early and proactive outreach to property owners, both private and institutional, adjacent to potential trail alignments
- Receive agreements, as needed, from willing partners and property owners to ensure that the Ice Age Tonquin Trail Master Plan will be implemented and will meet the needs of the intended users

The project steering committee and the project team agreed that success would be measured by public support for the trail, and willingness of project partners and adjacent property owners to engage in discussions and enter into agreements regarding the trail's siting, design, construction, and long-term management.

Project Steering Committee

The Ice Age Tonquin Trail project steering committee was formed to help guide the master planning effort. The project steering committee included staff from Washington and Clackamas Counties; the cities of Wilsonville, Sherwood, and Tualatin; and the Oregon Department of Transportation (ODOT). The project steering committee also included community representatives such as citizen-appointees from Sherwood, Tualatin, and Wilsonville; and a countywide cycling advocate. Although not a "voting" member, a Clean Water Services staff person also participated as a technical adviser.

Beginning in September 2009, the project steering committee convened ten times at major project milestones over the three-year master planning effort. The committee was charged with the following tasks:

- Reviewing technical deliverables and providing input
- Representing jurisdictional viewpoints and reaching consensus on key project recommendations such as trail alignment, design, funding, and phasing
- Serving as liaisons to jurisdictions on project issues
- Providing information and participating in research and fieldwork, as needed

The project steering committee reached consensus-based recommendations at key decision milestones including the Public Involvement Plan; evaluation criteria and measures; preferred trail alignment; trail design recommendations; and implementation. The project steering committee endorses this Master Plan. The next step in the approval process will be its adoption by local jurisdictions and the Metro Council.

In addition to the work of the project steering committee, representatives of the counties and cities met twice to discuss trail implementation agreements. The outcome of those meetings is discussed in the implementation chapter of this Master Plan.

Community Outreach

The project team conducted extensive outreach in a variety of formats to solicit public input and feedback throughout the master planning effort. Three series of community events were hosted at major project

milestones. In addition to publications in local newsletters; feature articles in local and regional newspapers; Metro GreenScene; and use of Metro's social media channels to advertise events; postcards were mailed to approximately 15,000 households in advance of each event. The community event series included the following:

- Open houses in Sherwood, Tualatin, and Wilsonville in December 2009 (with approximately 100 total attendees)
- Project booths set up at summer events in 2011 (for example, Tualatin Crawfish Festival, Sherwood Concert in the Park, and Wilsonville Fun in the Park), which attracted several hundred visitors
- Open house in May 2012, with approximately 70 participants

Metro hosted a project website over the course of the master planning effort, providing opportunities for interested parties to participate at their convenience. Website materials included online surveys and "virtual open houses."

The project team also participated in other concurrent planning efforts in the study area, including concept planning and local transportation system planning. Presentations were given to community organizations upon request.

Appendix A provides a more detailed summary of the public involvement efforts conducted for this Master Plan.

A project booth was set up at Wilsonville's "Fun in the Park" event in June 2010.

Visitors at the trail booth in Sherwood's Stella Olsen Park during a "Music on the Green" concert in August 2010.

Stakeholder Outreach

Supplementing the broader community engagement, the project team met with individual stakeholders throughout the planning process, ranging from jurisdictions to individual property owners. These specific engagement activities included on-site stakeholder interviews with landowners (both institutional and private) and work sessions with jurisdictional partners (for example, City of Sherwood to discuss issues specific to the Cedar Creek corridor and City of Tualatin to discuss Hedges Creek Greenway issues). The

project team also coordinated extensively with numerous agencies including TriMet, Portland & Western Railroad, Clean Water Services, Tualatin Valley Water District, Bonneville Power Administration, ODOT, Tualatin River National Wildlife Refuge, and The Wetlands Conservancy. Presentations were also made to elected officials in the five jurisdictions through which the Ice Age Tonquin Trail passes.

The project team hosted several open houses, including this final one in May of 2012.

Chapter 2: Existing Conditions

Land Use and Transportation Connections

Land Use

Several types of land uses make up the expansive Ice Age Tonquin Trail Master Plan study area. Beginning at the trail corridor's southern end in Wilsonville, land uses are predominantly residential, industrial, and commercial in character (including redeveloping commercial areas along Boones Ferry Road). These areas are interspersed with attractive open spaces, including Morey's Landing Open Space and Graham Oaks Nature Park. Land uses transition to a rural setting in northern Wilsonville and southern Tualatin, with wetlands and vibrant water and wildlife habitat present near the Portland & Western Railroad. Rural land uses, including a portion of the Tualatin River National Wildlife Refuge along Tonquin Road, give way to residential and commercial uses as the trail corridor proceeds toward downtown Sherwood. Sherwood's downtown core benefits from a compact layout and land use mix appealing to residents and visitors alike. In the study area's far northwestern area, wildlife thrives in the Cedar Creek corridor, while residential and rural land uses comprise the area leading to the Tualatin River National Wildlife Refuge near Roy Rogers Road.

Encompassing portions of Tualatin, Sherwood, and unincorporated Clackamas and Washington Counties, the study area's central portion contains a mix of employment, light industrial, manufacturing, and commercial uses. North of Oregon 99W, the setting quickly transitions to residential and rural uses, offering future trail users a pleasant transition while making their way to the Tualatin River. The northeastern portion of the study area also offers a mix of settings including industrial uses in western Tualatin, an urban natural area environment along Hedges Creek Greenway, and a developed urban recreation area in Tualatin Community Park.

View of the Willamette River from the trail's southern terminus near Boones Ferry Park in Wilsonville.

Completed section of trail in Wilsonville's Morey's Landing neighborhood.

A wide promenade in Old Town Sherwood accommodates cyclists and pedestrians.

View of Coffee Lake Creek Natural Area from the Portland & Western Railroad.

The western-most trail segment terminates at the Tualatin River National Wildlife Refuge in Sherwood; a haven for bald eagles, herons, and many other wildlife species.

A future bicycle/pedestrian bridge over the Tualatin River will link the Ice Age Tonquin Trail to the Westside Trail.

Active Transportation Connections

Active transportation is about seamlessly connecting bicycling and walking trips from beginning to end. Active transportation projects like the Ice Age Tonquin Trail integrate walking; bicycling; transit; bike parking; signalization and wayfinding elements; and educational and interpretive signage. Increasing active transportation benefits the region by reducing greenhouse gas emissions and congestion, providing inexpensive travel options; improving our health and reducing health care costs; and fostering dynamic communities.

The Ice Age Tonquin Trail will link the Willamette River and Graham Oaks Nature Park in Wilsonville with the Tualatin River in Tualatin and the Tualatin River National Wildlife Refuge in Sherwood. The trail will connect with other regional trails and destinations including the Fanno Creek Greenway Trail, the Westside Trail, and (if the French Prairie Bridge is built) Champoeg and Willamette Mission State Parks. The Ice Age Tonquin Trail will link homes with schools; jobs; recreation; Westside Express Service (WES) commuter rail stations; industrial centers; local and regional TriMet and South Metro Area Rapid Transit bus routes; town centers; and public parks and natural areas.

Each of the three cities through which the Ice Age Tonquin Trail passes has achieved progress toward making these active transportation connections a reality. A completed trail segment passing through Graham Oaks Nature Park connects two schools with other existing segments in Wilsonville's Villebois community (and eventually to Wilsonville's commuter rail station). A built portion of Sherwood's Cedar Creek Trail links downtown Sherwood with Stella Olsen Park, and functions as a completed portion of the Ice Age Tonquin Trail. Sherwood plans to continue this momentum by completing additional segments made possible by Metro Regional Flexible Funds allocation program. To the east, completion of the Ki-a-Kuts Bridge linking Tualatin Community Park with Tigard's Cook Park has filled a major gap in the regional active transportation network by connecting the Tonquin and Fanno Creek regional trails. Beyond these significant achievements, several other on- and off-street Ice Age Tonquin Trail segments exist throughout the study area.

Completion in 2010 of the Ice Age Tonquin Trail in Graham Oaks Nature Park has significantly enhanced active transportation connections in Wilsonville.

Built section of the Ice Age Tonquin Trail in Wilsonville's Villebois neighborhood.

The Ki-a-Kuts bicycle/pedestrian bridge over the Tualatin River links a built section of the Ice Age Tonquin Trail and the Fanno Creek Trail.

Related Planning Efforts

Numerous planning efforts were conducted in the study area during the trail master planning process. The project team and project steering committee members coordinated extensively with those efforts to be sure the Ice Age Tonquin Trail Master Plan recommendations were incorporated when there was overlap in project goals. Map 4 graphically depicts the planning areas, and a description of the most important planning efforts and coordination follows.

Transportation System Planning

Each of the three cities and two counties in the study area began updating their transportation system plans during the trail master planning work. These long range plans (required by the State of Oregon and Metro) prioritize multi-modal transportation investments that will be made in their respective jurisdictions through the year 2035. The trail master planning work was closely coordinated with the transportation system planning and continued coordination will ensure successful trail implementation.

Concept Planning

Jurisdictions in the study area were also conducting concept planning (required by Metro) to identify where future development will occur in unincorporated areas that will eventually be annexed by Wilsonville, Tualatin, and Sherwood. The trail master planning recommendations were incorporated into each of the following Concept Planning processes:

- Tonquin Employment Concept Plan (Sherwood)
- Southwest Concept Plan (Tualatin)
- Basalt Creek and West Railroad Concept Plans, ongoing (Wilsonville, Tualatin)

Continued coordination as the concept plans move forward is vital to successful trail implementation.

Other Land Use and Transportation Planning

Additional ongoing and upcoming planning efforts (for example, 124th Avenue Extension between Tualatin-Sherwood Road and Tonquin Road, and the Southwest Corridor Plan) will set the groundwork for enhancing active transportation connections from those projects to the Ice Age Tonquin Trail. This Master Plan also considered key elements of many other local plans including park master plans, neighborhood plans, natural resource plans and trail feasibility studies.

Ice Age Floods National Geological Trail Planning

The National Park Service is currently planning the Ice Age Floods National Geologic Trail, which will be a network of driving routes, with spurs for walking and biking, that will begin in Montana and travel west to Oregon, ending at the Pacific Ocean. The trail will follow the path of the cataclysmic floods that occurred 12,000 to 17,000 years ago, linking many of the spectacular geological features left behind, such as the Columbia River Gorge and the Willamette Valley. Because the Ice Age Tonquin Trail travels through a landscape and unique geological features formed by these Ice Age floods, there may be funding opportunities to tie the regional trail to the national trail through interpretive signage, events, and other facilities and activities.

The Ice Age Tonquin Trail (formerly the Tonquin Trail) was renamed during the master planning process to tie it to the national trail. By linking the two trails, future funding opportunities will be expanded and increased tourism is expected in the cities the Ice Age Tonquin Trail will serve. A National Park Service

publication about the national trail, with a map showing the proposed routes can be found in Appendix E. Background information about the process to rename the trail can be found in Appendix A.

Map 4: Relevant Planning Efforts Occurring in the Ice Age Tonquin Trail Study Area

Ice Age Tonquin Trail Master Plan

Source: Metro Data Resource Center

Natural Environment

Despite a broad mix of developed land uses, the Ice Age Tonquin Trail study area offers a diversity of natural and cultural features potentially unmatched in the Portland region. Several rare species and habitats generally associated with these features can be found in the study area. For example, upland prairie fragments, oak and madrone woodlands, and rare wildflowers are found near basalt hummocks (scablands); and rare reptiles (pond turtles) and amphibians (northern red-legged frogs) live in the kolk ponds. Discussed earlier, remnants of geologic activities thousands of years in the making are on clear display, including kolk ponds and scablands dating to the Glacier Lake Missoula Floods over 15,000 years ago. Local and regional efforts have successfully preserved these and other key natural resources, offering a unique user experience once the Ice Age Tonquin Trail is completed.

The study area is also home to at least three sensitive natural areas including the Coffee Lake Creek Natural Area in Wilsonville, the Cedar Creek corridor in Sherwood, and Hedges Creek Greenway in Tualatin. Each area includes features contributing to their role as an environmental and community asset, thereby reinforcing the need to give careful consideration as trail or other development occurs. The Ice Age Tonquin Trail's proximity to these prominent natural areas provides opportunities to enhance these elements based on best practices while expanding environmental education and interpretive opportunities.

The publicly owned Coffee Lake Creek Natural Area in Wilsonville.

Tualatin's Hedges Creek Greenway is one of several sensitive natural areas in the Ice Age Tonquin Trail study area.

Chapter 3: Trail Segment Options Analysis and Preferred Trail Alignment

Segment Options Analysis

Working with the project steering committee, stakeholders, and local agency staff, the project team undertook an extensive process to identify and evaluate trail segment options. This process included the following key steps:

- An initial set of trail study segments were identified in late 2009, based on a review of background information, a "fatal flaw" analysis of segments proposed in the 2004 Tonquin Trail Feasibility Study, property research, and extensive input from stakeholders and the public.
- Additional study segments were added in 2010 in response to other concurrent planning efforts (for example, future 124th Avenue Extension between Tualatin-Sherwood Road and Tonquin Road) and additional public input.
- Adjustments to some study segments were made in 2011 as follow-up property research, additional discussions with stakeholders, and input from local agency staff and elected officials became available.

The evaluation was primarily based on an Evaluation Framework (including 6 goals, 19 criteria, and over 30 evaluative measures) jointly developed by the project team and project steering committee at the outset of the planning process. The project team performed a detailed evaluation of nearly 20 segment options based on each measure within the Evaluation Framework. This approach provided an objective means to compare the segments against one another. The project team then vetted the findings of the preliminary analysis with stakeholders, local decision makers, and the public, and made refinements, as needed, to develop the preferred Ice Age Tonquin Trail alignment.

Appendix B contains the Evaluation Framework memorandum and other technical background information related to the development and evaluation process.

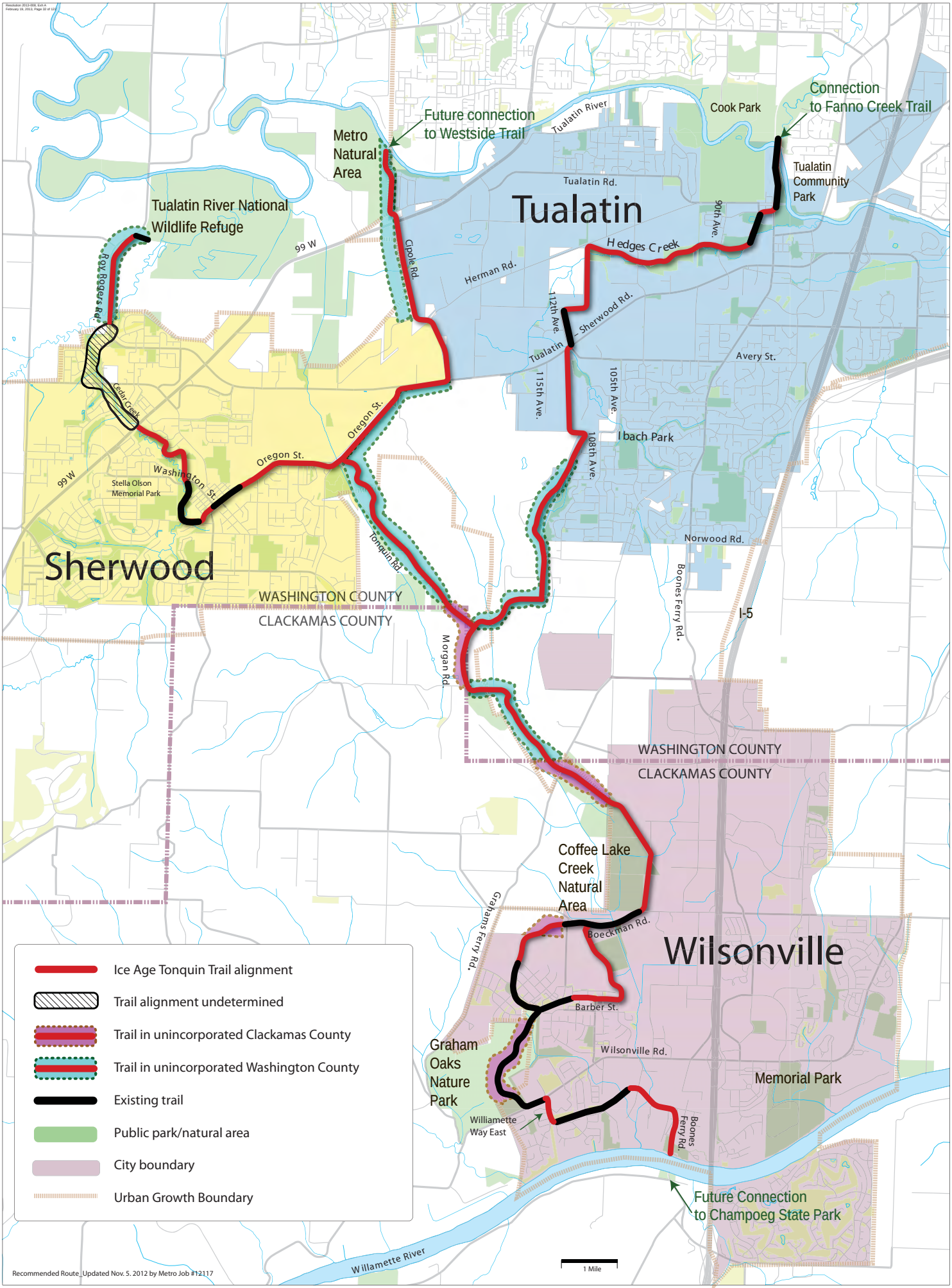
Preferred Trail Alignment

Overview

Spanning approximately 22 miles, the preferred Ice Age Tonquin Trail alignment will provide a seamless active transportation link between the Willamette and Tualatin Rivers while connecting the communities of Wilsonville, Sherwood, and Tualatin. The preferred alignment will provide a convenient, comfortable, and safe atmosphere for trail users of all ages and abilities; provide access (but limit impacts) to natural and cultural resources; and enhance non-motorized connectivity in the Portland region. Equally important, the alignment is implementable and has garnered support from the communities though which it passes.

From its southern terminus at the Willamette River, the preferred Ice Age Tonquin Trail alignment will pass through several Wilsonville neighborhoods and Graham Oaks Nature Park before splitting into three

segments, as depicted on Map 5. The western segment will traverse a bluff above Tonquin Road before descending into downtown Sherwood and Stella Olsen Park. This segment will follow Sherwood's majestic Cedar Creek corridor on its way to a Tualatin River National Wildlife Refuge trailhead near Roy Rogers Road. The central segment will follow Oregon Street and Cipole Road along the Sherwood/Tualatin boundary, access the Tualatin River at a Metro-owned natural area, and offer a connection to the future Westside Regional Trail. Making its way to Tualatin, the eastern segment will pass within close proximity of several historic and geologic features north of Tonquin Road. This segment will travel adjacent to Tualatin's Hedges Creek Greenway en route to Tualatin Community Park, and seamlessly link with the Fanno Creek Regional Trail via an existing bicycle/pedestrian bridge traversing the Tualatin River.



Map 5: Ice Age Tonquin Trail Route

Ice Age Tonquin Trail Master Plan

Source: Metro Data Resource Center

Recommended Trail Alignment

Tables 2 through 20 and the accompanying Maps 6 through 25 illustrate the preferred Ice Age Tonquin Trail alignment in greater detail, and describe specific recommended improvements. Beginning at the Willamette River in Wilsonville, the maps progress north first toward Sherwood, and conclude in Tualatin. The maps illustrate site-specific improvements that include the following:

- Recommended trail type (for example, shared use path, boardwalk)
- Proposed at-grade and grade-separated trail crossings
- Proposed trailhead locations
- Art, educational, and interpretive opportunities
- Potential wayfinding signage locations
- Potential trail spurs
- Locations where property easements or acquisitions will be needed to accommodate the trail
- Other features including wetlands, parks, natural areas, schools, and major destinations

The accompanying tables provide additional information where necessary to augment the features shown on each map.

Due to the diverse physical landscapes and settings through which the preferred alignment travels in its 22-mile course, the specific trail facility type will vary by location. The facility types are grouped into four main categories:

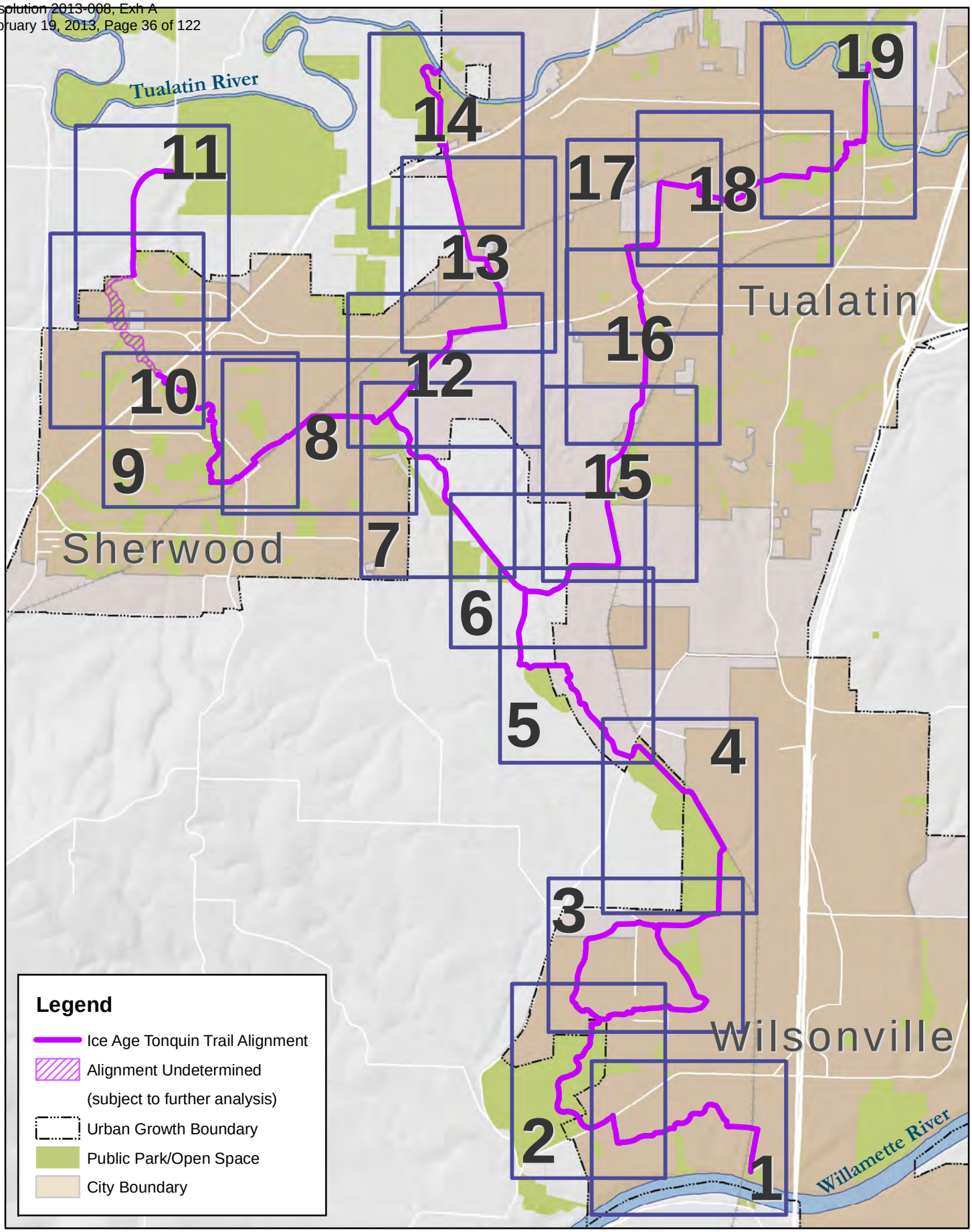
- Shared Use Path. A facility physically separated from motor vehicle traffic, dedicated for the exclusive use of bicyclists, pedestrians, joggers, in-line skaters, and other non-motorized users.

- Boardwalk. Similar to a shared use path and used in and near environmentally sensitive areas such as wetlands and sensitive wildlife habitat.

- Bike Lanes/Sidewalks. Where physical or other constraints (primarily in urban settings) preclude development of a shared use path, bicyclists would be accommodated with striped bike lanes while sidewalks would accommodate pedestrians.

- Shared Roadway. Where physical or other constraints along lower-volume and/or lower-speed streets preclude development of a shared use path, bicyclists and motorists would share the road (possibly augmented by shared lane markings), while sidewalks would accommodate pedestrians. Where vehicle volumes and speeds are very low, pedestrians, cyclists, and motorists would potentially use the same space.

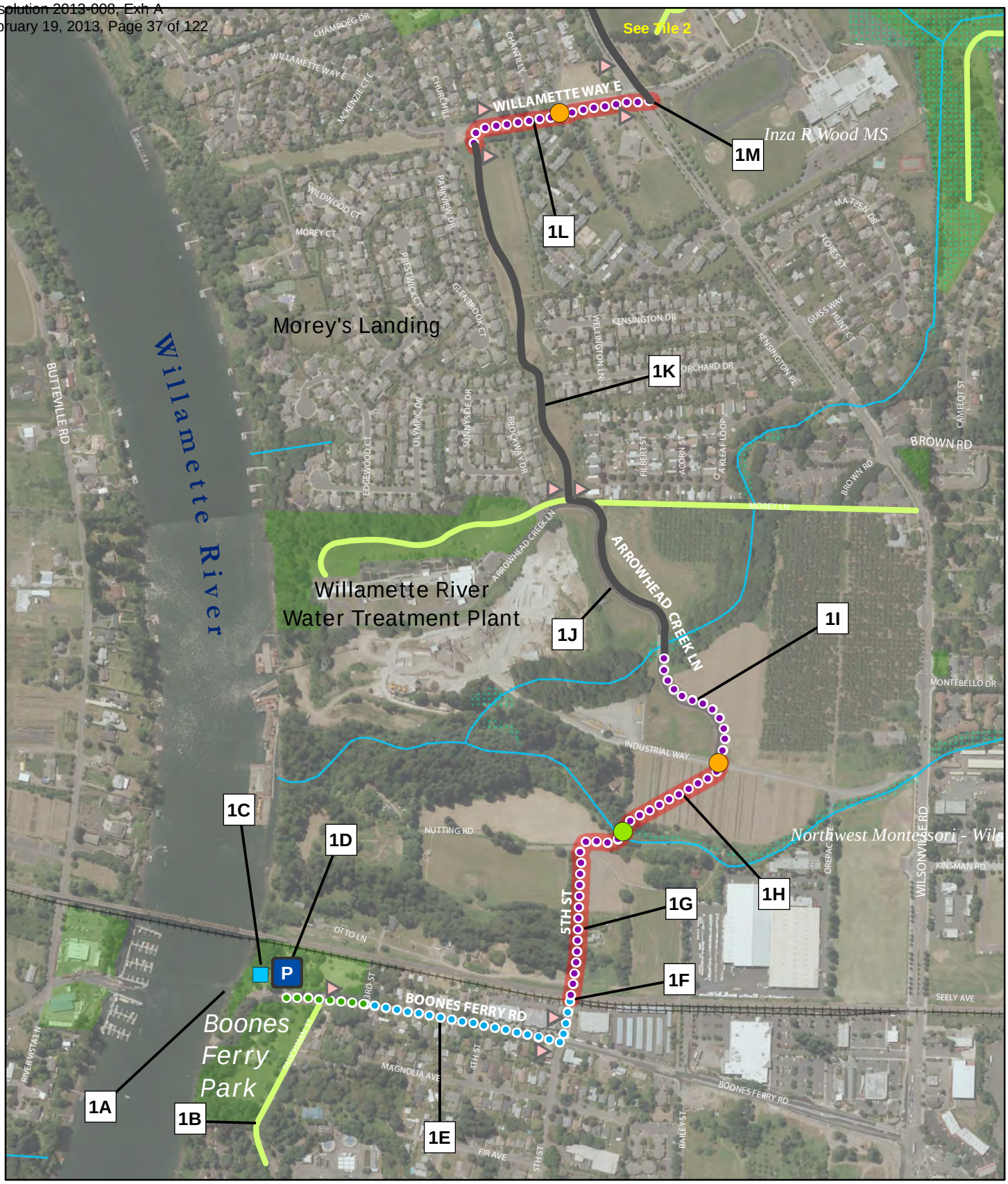
While this section depicts locations of site-specific improvements, the Ice Age Tonquin Trail Design Guidelines in Chapter 4 provide more detailed design guidance for the facility types listed above. It should be noted, however, that appropriate design treatments will vary on a case-by-case basis depending on location and further analysis at the time the Master Plan is implemented.



Map 6: Key to Tile Maps

Ice Age Tonquin Trail Master Plan
Preferred Alignment
Source: Metro Data Resource Center

0 0.5 1 2 Miles



Map 7: Tile 1 - Willamette River to Morey's Landing

Ice Age Tonquin Trail Master Plan
Preferred Alignment

Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path

- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch

- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location

- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 2 - Tile 1: Willamette River to Morey's Landing

Reference # (see Tile 1 map)	Recommended Improvements and Opportunities
1A	Connection to potential future French Prairie Bicycle/Pedestrian/Emergency Access Bridge
1B	Connection to Memorial Park
1C	Potential Willamette River art, educational or interpretive opportunity
1D	Use existing trailhead at Boones Ferry Park (includes parking, restrooms, a picnic shelter, and a boat launch)
1E	Coordinate trail development with Boones Ferry Road improvements; consider re-striping roadway to position bike lane on east (northbound) side to accommodate uphill cyclists, and shared lane markings in southbound direction
1F	Use existing at-grade railroad/roadway crossing; upgrade crossing treatments in tandem with future roadway and/or trail extension
1G	Trail design to occur in tandem with potential future roadway design in this area; trail will parallel 5th Street or Bailey Street
1H	Trail to either follow an independent corridor, or follow parallel to a potential future roadway such as Brown Road Extension (as a physically separated trail)
1I	Use existing graded trail alignment along Arrowhead Creek Lane (paving of trail corridor necessary) and existing creek crossing
1J	Use existing trail on north side of Arrowhead Creek Lane in this area
1K	Use existing trail in Morey's Landing
1L	Use power line corridor on east side of Willamette Way East; potential need for fence relocation immediately north of Chantilly
1M	Use existing signalized intersection of Wilsonville Road and Willamette Way East

Map 8: Tile 2 - Morey's Landing to Villebois

Ice Age Tonquin Trail Master Plan
Preferred Alignment

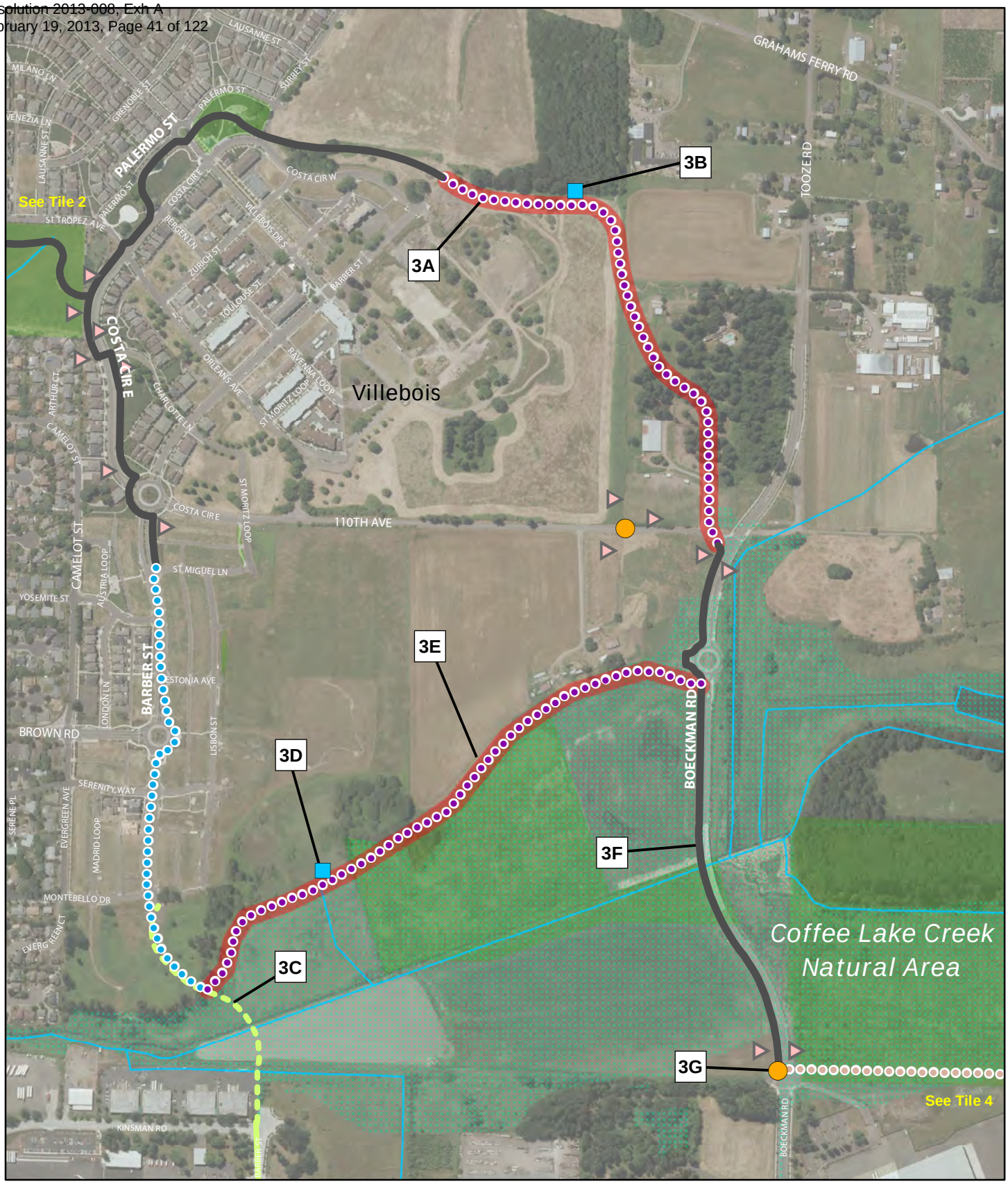
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 3 - Tile 2: Morey's Landing to Villebois

Reference # (see Tile 2 map)	Recommended Improvements and Opportunities
2A	Use existing trailhead at Graham Oaks Natural Area (includes parking, restrooms, a picnic shelter, and wayfinding/interpretive signage)
2B	Use built section of Ice Age Tonquin Trail through Graham Oaks Natural Area
2C	Existing connection between Merryfield Park and Ice Age Tonquin Trail
2D	Use existing trail in Villebois
2E	Use existing trail in Villebois



Map 9: Tile 3 - Villebois to Boeckman Road

Ice Age Tonquin Trail Master Plan
Preferred Alignment

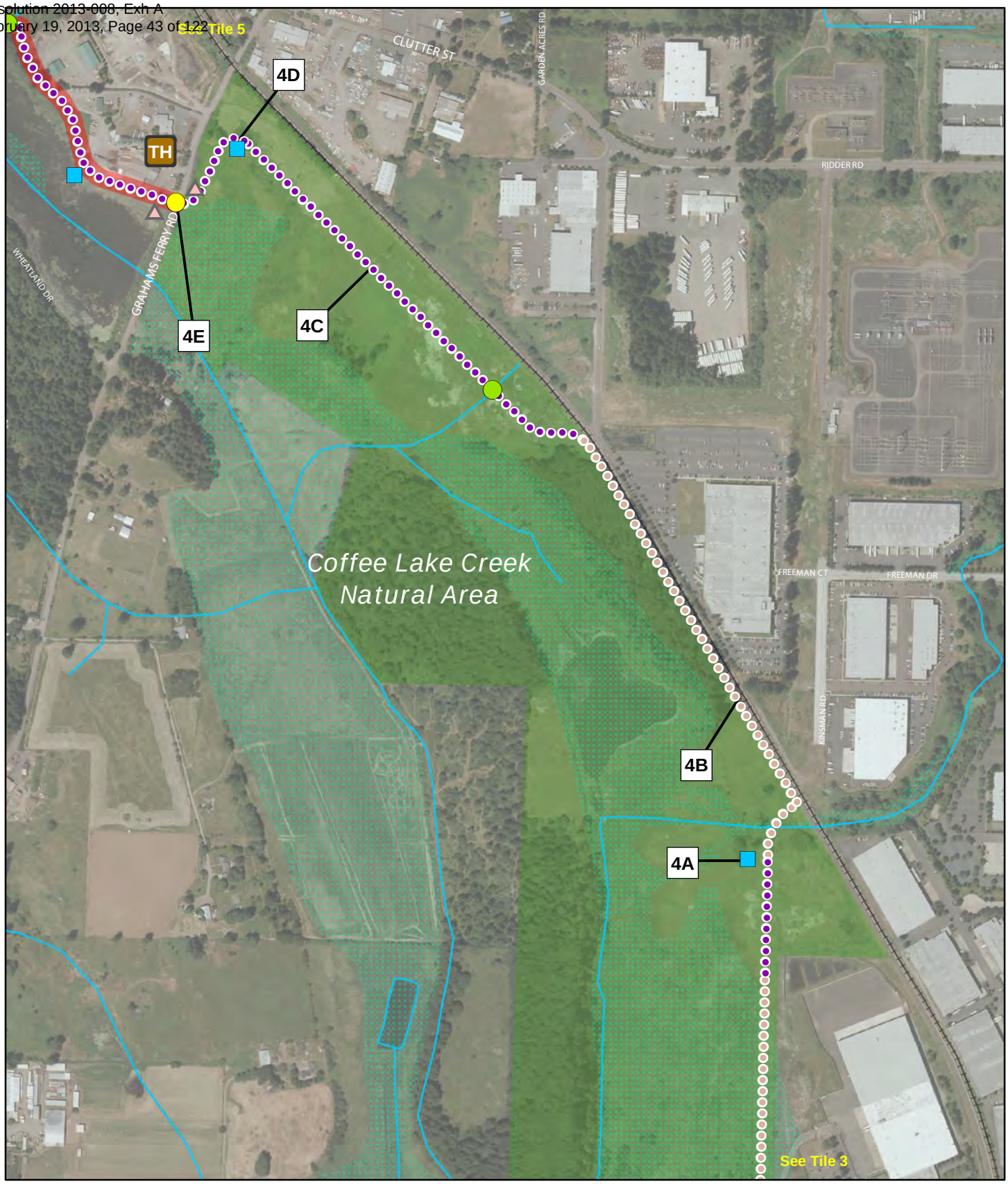
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 4 - Tile 3: Villebois to Boeckman Road

Reference # (see Tile 3 map)	Recommended Improvements and Opportunities
3A	Specific trail alignment, improvements, and necessary property easements/acquisitions dependent on Villebois Master Plan implementation
3B	Potential art, educational or interpretive opportunity associated with “neighborhood commons” area proposed in Villebois Master Plan
3C	Planned connection between Ice Age Tonquin Trail and Westside Express Service (WES) commuter rail station
3D	Potential Coffee Lake Creek Natural Area art, educational or interpretive opportunity
3E	Specific trail alignment, improvements, and necessary property easements/acquisitions dependent on Villebois Master Plan implementation
3F	Use existing trail on Boeckman Road’s south side
3G	Install high-visibility crosswalk on intersection’s west leg to align with trail corridor; install pedestrian push buttons on intersection’s northwest (NW) and southwest (SW) corners and coordinate with existing overhead flashing warning lights; provide wayfinding signage for nearby WES commuter rail station



Map 10: Tile 4 - Boeckman Road to Grahams Ferry Road

Ice Age Tonquin Trail Master Plan
Preferred Alignment

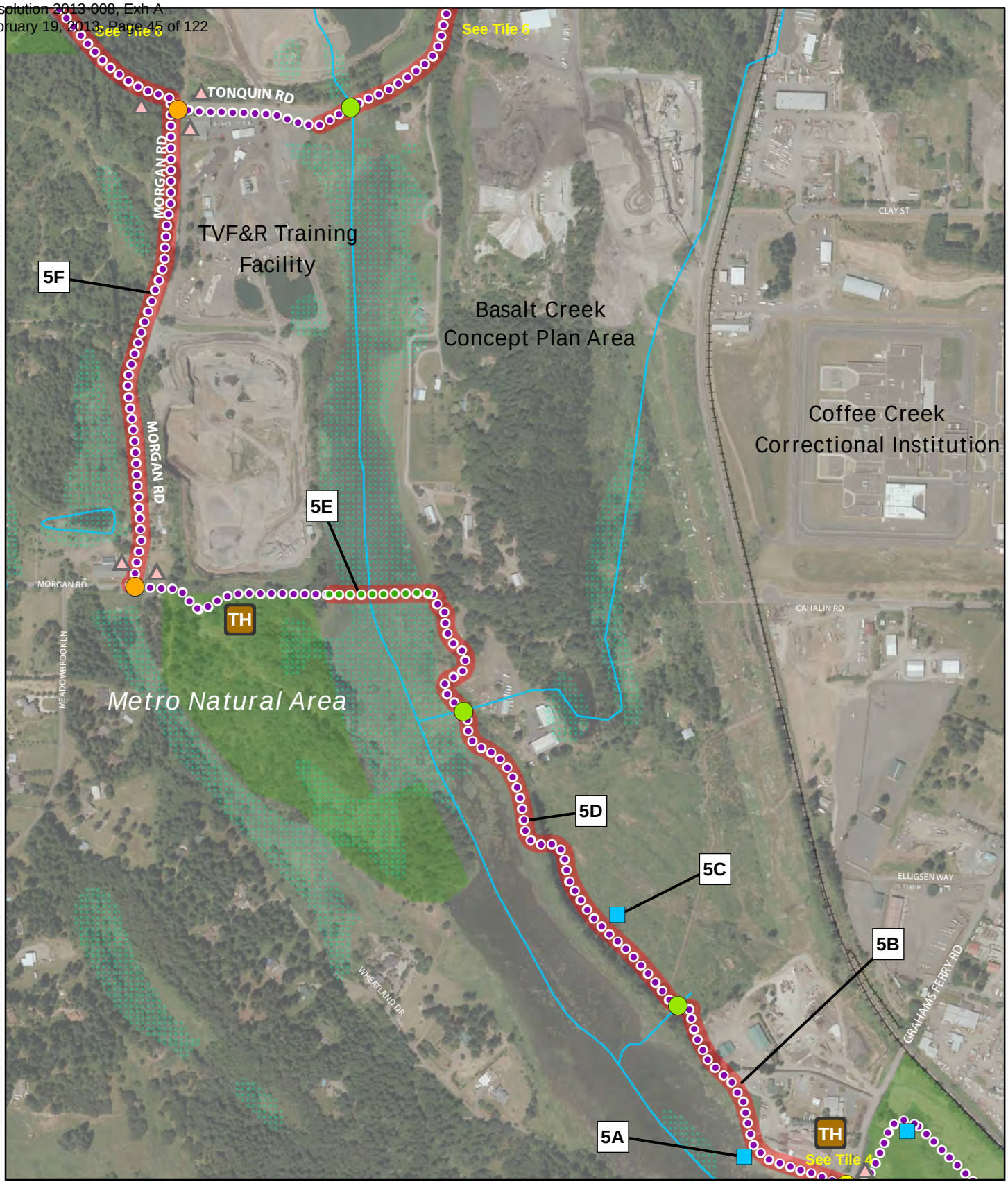
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 5 - Tile 4: Boeckman Road to Grahams Ferry Road

Reference # (see Tile 4 map)	Recommended Improvements and Opportunities
4A	Potential Coffee Lake Creek Natural Area art, educational or interpretive opportunity
4B	Trail alignment to follow eastern edge of Metro's Coffee Lake Creek Natural Area (to minimize wetland impacts); potential to include trail spurs to provide wetland views
4C	Specific trail alignment in this area to be determined during trail design
4D	Potential Coffee Lake Creek Natural Area art, educational or interpretive opportunity
4E	Install signal at crossing of Grahams Ferry Road and include advanced warning signage for motorists; further analysis may be needed to determine the most appropriate crossing type (for example, at-grade versus grade-separated crossing)



Map 11: Tile 5 - Grahams Ferry Road to Morgan Road/Tonquin Road

Ice Age Tonquin Trail Master Plan Preferred Alignment

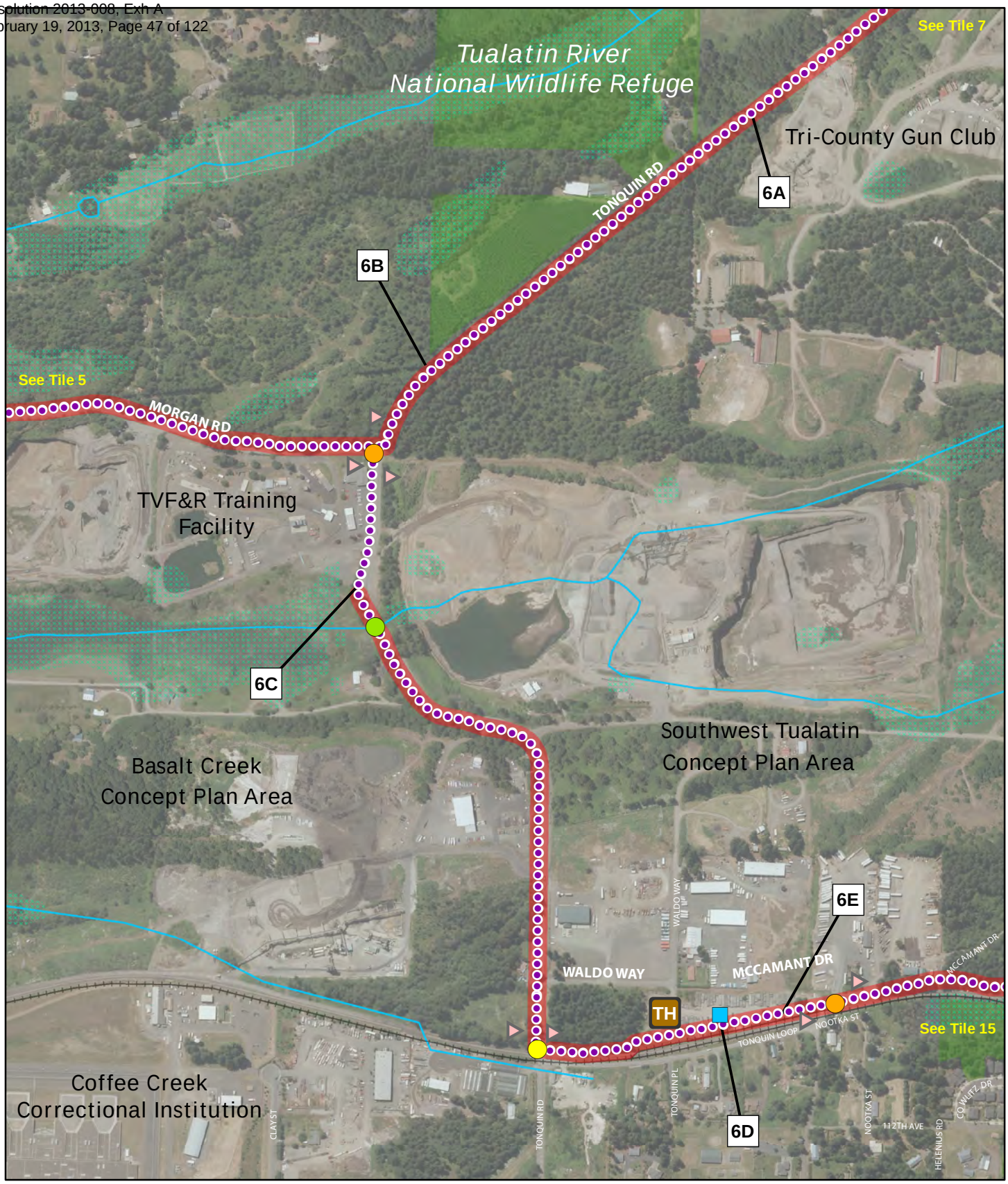
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 6 - Tile 5: Grahams Ferry Road to Tonquin Road/Morgan Road

Reference # (see Tile 5 map)	Recommended Improvements and Opportunities
5A	Potential Coffee Lake Creek Natural Area art, educational or interpretive opportunity
5B	Specific trail alignment immediately north of Grahams Ferry Road to be determined during trail design
5C	Potential Coffee Lake Creek Natural Area art, educational or interpretive opportunity
5D	Trail alignment to follow top of hill above wetlands area
5E	Potential need for fencing on both sides of causeway
5F	Specific trail alignment between Metro Natural Area and Tonquin Road to be determined in coordination with the following land use and transportation processes—Poole Quarry, Basalt Creek Concept Plan, 124th Avenue Extension project, and Southwest Tualatin Concept Plan



Map 12: Tile 6 - Tonquin Road/Morgan Road and Vicinity

Ice Age Tonquin Trail Master Plan Preferred Alignment

Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path

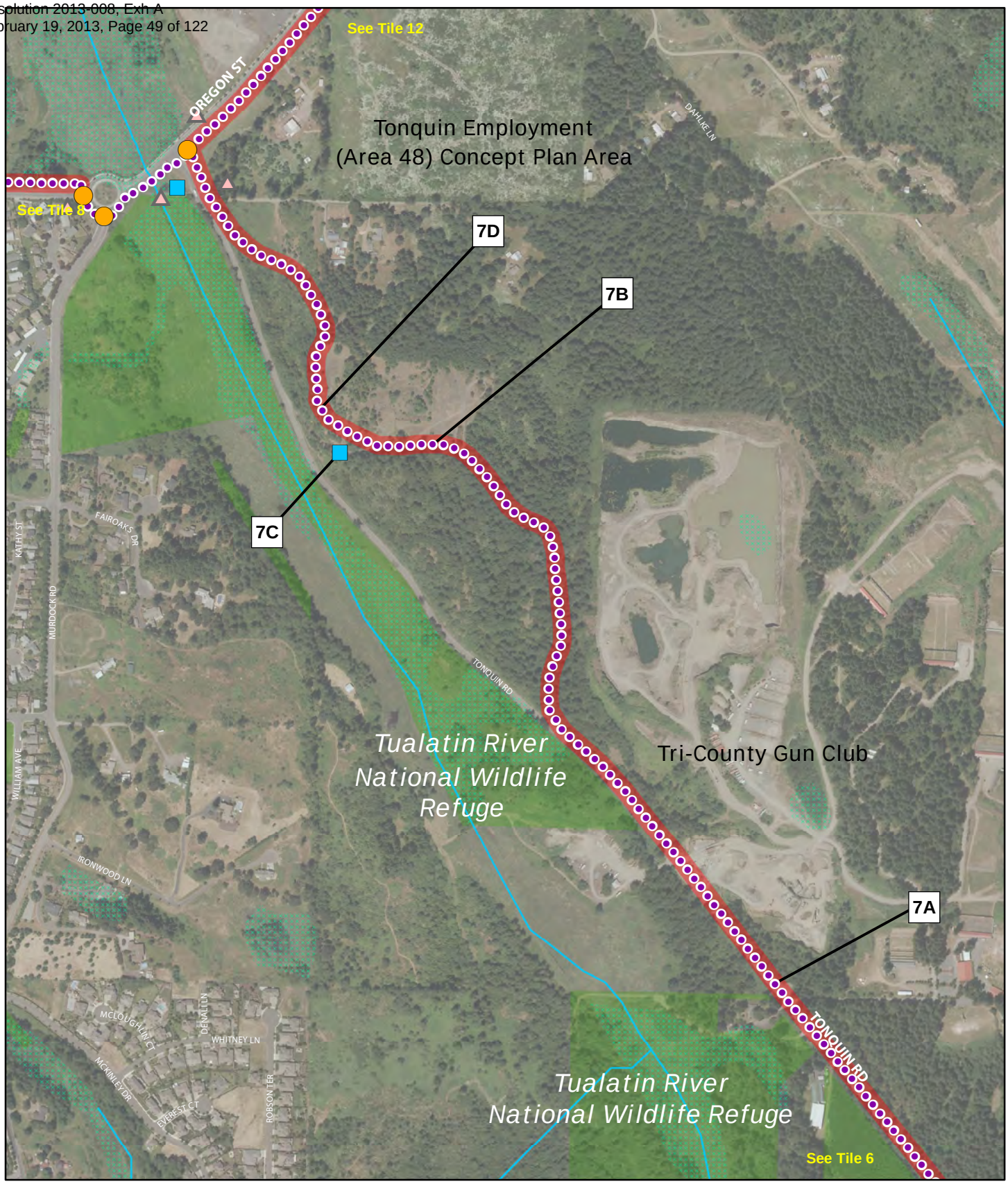
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch

- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location

- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 7 - Tile 6: Tonquin Road/Morgan Road and Vicinity

Reference # (see Tile 6 map)	Recommended Improvements and Opportunities
6A	Trail alignment proposed to follow east side of Tonquin Road (west of Morgan Road intersection); potential need for retaining walls between Tri-County Gun Club entrance and quarry entrance to the northwest; potential need for utility pole and/or guywire relocation in some locations north of Morgan Road; some vegetation removal necessary between Morgan Road and Tri County Gun Club entrance.
6B	Washington County's *Transportation System Plan* (TSP) recommends widening Tonquin Road; this could potentially enable the trail to be constructed on the roadway's west side within the existing right-of-way; continue to monitor Washington County's plans for Tonquin Road improvements, but pursue acquisition for the trail on east side of the road.
6C	The recommended alignment shown along Tonquin Road between Morgan Road and Tonquin Loop Road (including the intersection of Morgan and Tonquin Roads) was determined before the Basalt Creek Concept Planning process began and in the early stages of the 124th Avenue Extension project. The alignment shown here will be finalized during the design for the east-west corridor in the Basalt Creek Concept Plan, 124th Avenue Extension, and improvements to Tonquin Road. For purposes of the Master Plan documentation, details regarding the alignment that is shown include the following—trail to follow south side of Tonquin Road (east of Morgan Road intersection); existing right-of-way encroachment along several adjacent properties (would necessitate relocation of existing fencing and mailboxes); potential need for utility pole and/or guywire relocation in some locations; and vegetation removal necessary.
6D	Potential historic railway art, educational or interpretive opportunity
6E	The goal of the Ice Age Tonquin Trail in the Southwest Tualatin Concept Plan area is to have a north/south orientation through and adjacent to the areas of highest desirability for interpretation of the Ice Age floods and the associated natural and geologic features. The exact alignment and proposed trailhead location have yet to be determined and will be developed in the future in consultation with the industrial land owners in this area, adjacent property owners, the general public and other stakeholders, no later than the time of annexation. Any property acquired by Metro for the trail will be acquired via a willing seller program.



Map 13: Tile 7 - Tonquin Road/Morgan Road and Vicinity to Oregon Street

Ice Age Tonquin Trail Master Plan Preferred Alignment

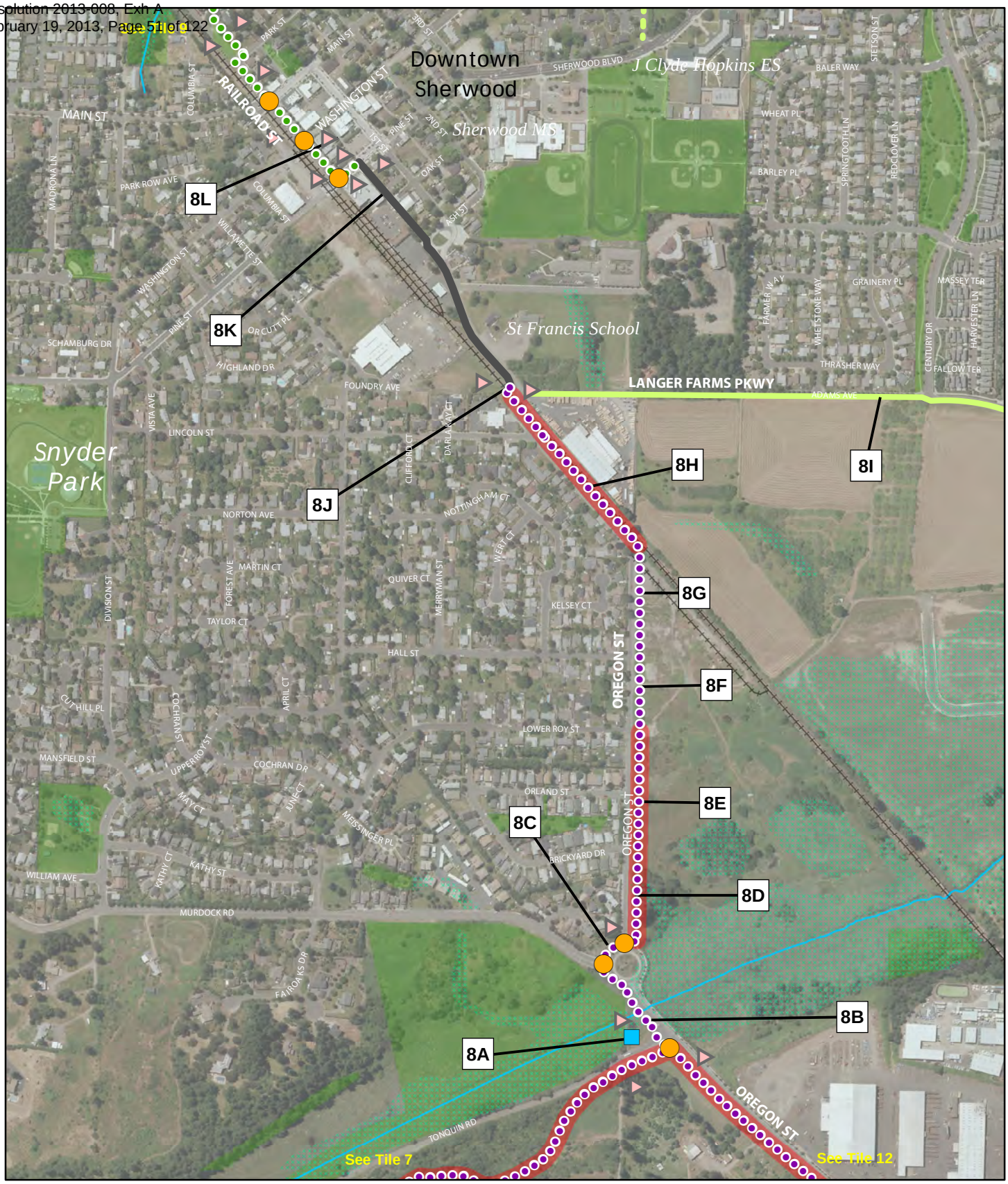
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 8 - Tile 7: Tonquin Road/Morgan Road and Vicinity to Oregon Street

Reference # (see Tile 7 map)	Recommended Improvements and Opportunities
7A	Barrier separation needed between trail and Tonquin Road
7B	Trail alignment to follow bluff above Tonquin Road
7C	Potential Tualatin River National Wildlife Refuge art, educational or interpretive opportunity
7D	Trail alignment could follow existing unimproved roadway; final alignment to be determined in coordination with Sherwood's Tonquin Employment Area Concept Plan (which includes a future east-west road in this area)



Map 14: Tile 8 - Tonquin Road/Oregon Street to Downtown Sherwood

Ice Age Tonquin Trail Master Plan Preferred Alignment

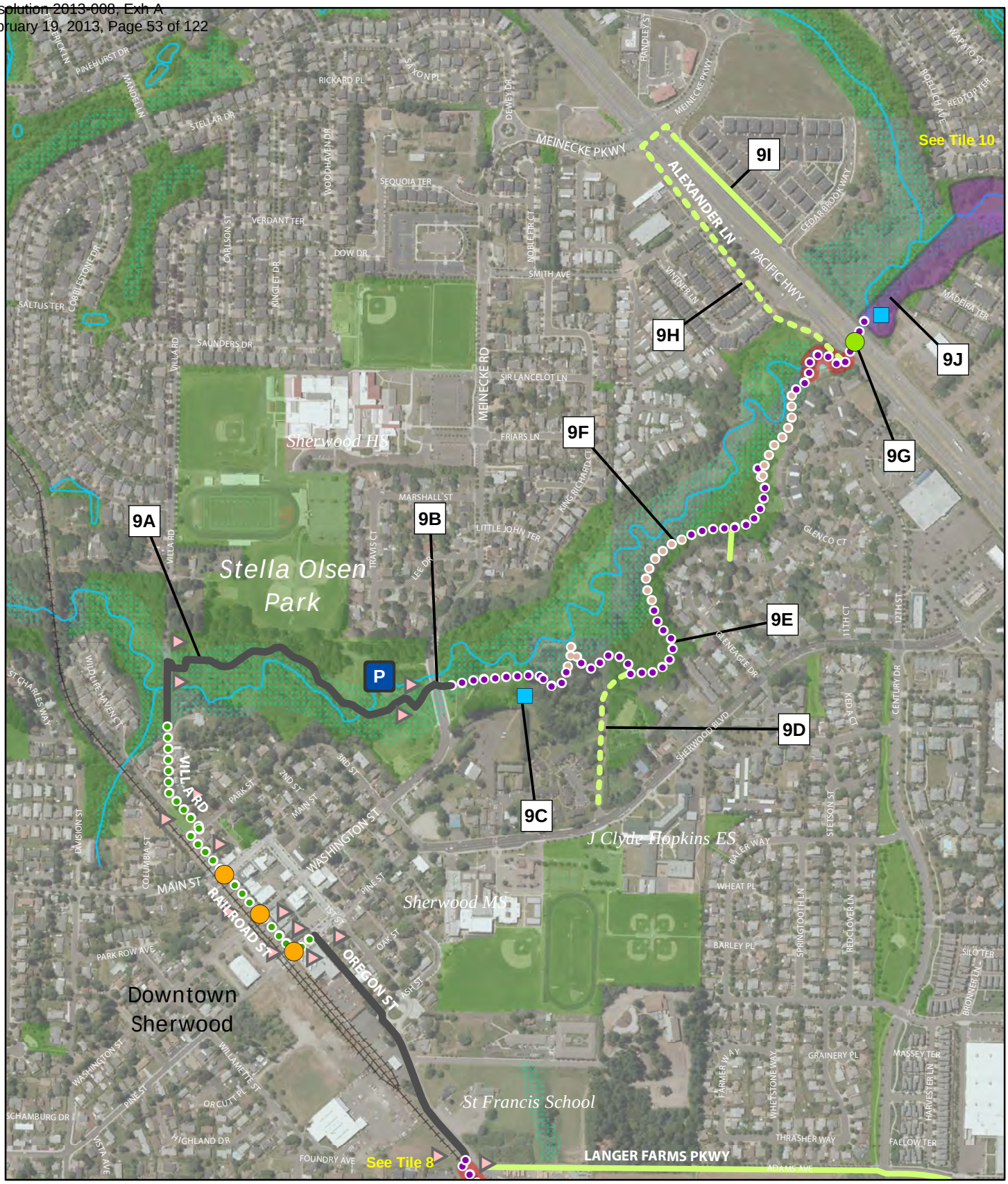
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 9 - Tile 8: Tonquin Road/Oregon Street to Downtown Sherwood

Reference # (see Tile 8 map)	Recommended Improvements and Opportunities
8A	Potential Tualatin River National Wildlife Refuge art, educational or interpretive opportunity
8B	Widen sidewalk on Oregon Street's south side between Tonquin Road and Murdock Road to accommodate trail
8C	Widen sidewalk on SW and southeast (SE) sides of roundabout to accommodate trail
8D	Potential need for vegetation removal and retaining wall (or bank stabilization) to accommodate trail
8E	Relocate existing fence on Oregon Street's north side
8G	Trail alignment to follow Oregon Street's north side between Murdock Road and Langer Farms Parkway
8G	Potential need for utility pole relocation and vegetation removal
8H	Trail alignment to be situated beneath power line corridor between railroad and Oregon Street; install fencing between trail and railroad; potential need for utility pole relocation
8I	Existing local connection on Langer Farms Parkway (including a 12-foot-wide sidewalk on roadway's east side, and a 6-foot wide sidewalk and a 5-foot wide planter strip on roadway's west side)
8J	Existing at-grade railroad/roadway crossing
8K	Use existing trail on Oregon Street's south side and existing trail in downtown Sherwood
8L	City of Sherwood to coordinate shared roadway treatments on Railroad Street (including wayfinding)



Map 15: Tile 9 - Cedar Creek Corridor (Southern Portion)

Ice Age Tonquin Trail Master Plan
Preferred Alignment

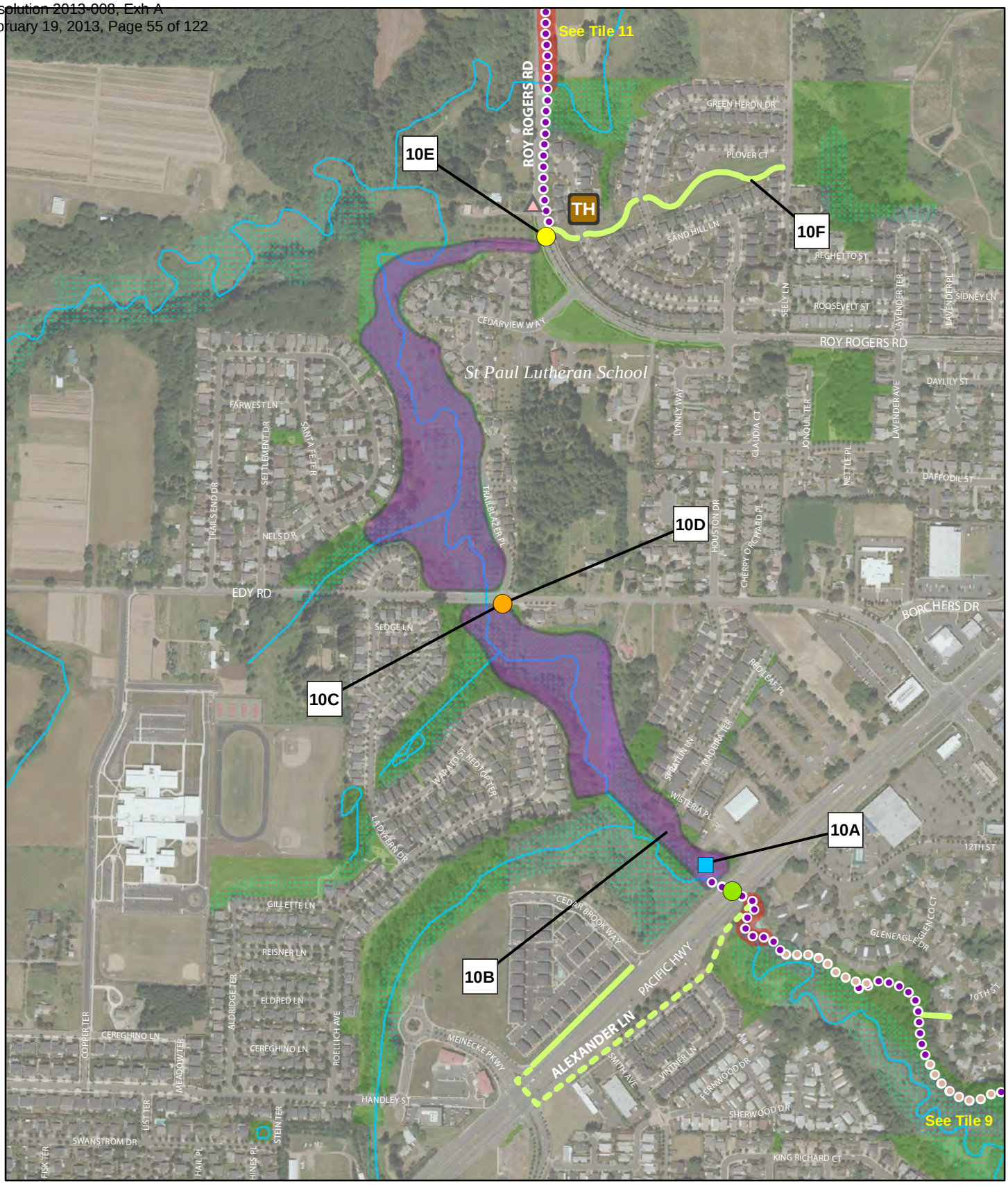
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 10 - Tile 9: Cedar Creek Corridor (Southern Portion)

Reference # (see Tile 9 map)	Recommended Improvements and Opportunities
9A	Use existing Cedar Creek Trail
9B	Use existing grade-separated crossing at Washington Street; use existing trailhead immediately south of Washington Street (parking available north of Washington Street)
9C	Potential Cedar Creek art, educational or interpretive opportunity
9D	Planned trail access for nearby senior center and elementary school
9E	City of Sherwood to conduct further analysis to determine specific trail alignment in this area; trail design to be based on guidance provided in the Ice Age Tonquin Trail Master Plan specific to the Cedar Creek corridor
9F	Vegetation removal and mitigation necessary to accommodate trail throughout most portions of the Cedar Creek corridor
9G	Proposed trail/wildlife undercrossing of Pacific Highway/Oregon 99W (subject to ODOT approval)
9H	Planned neighborhood connection and crossing enhancements at intersection of Pacific Highway/Oregon 99W and Meinecke Road
9I	Existing neighborhood connection (sidewalk)
9J	City of Sherwood to conduct further analysis to determine specific trail alignment in this area; trail design to be based on guidance provided in the Ice Age Tonquin Trail Master Plan specific to the Cedar Creek corridor



Map 16: Tile 10 - Cedar Creek Corridor (Northern Portion)

Ice Age Tonquin Trail Master Plan
Preferred Alignment

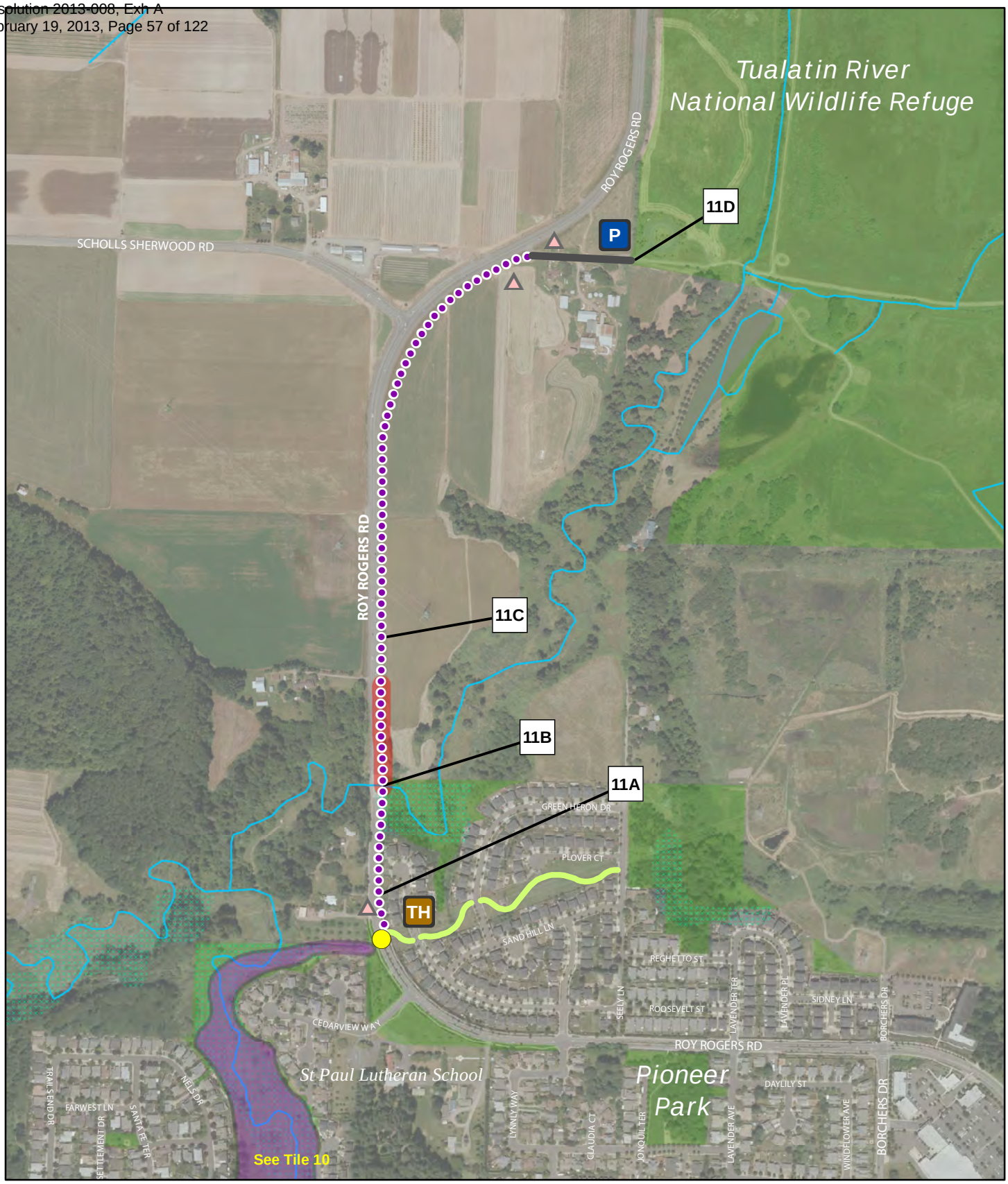
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 11 - Tile 10: Cedar Creek Corridor (Northern Portion)

Reference # (see Tile 10 map)	Recommended Improvements and Opportunities
10A	Potential Cedar Creek art, educational or interpretive opportunity
10B	City of Sherwood to conduct further analysis to determine specific trail alignment in this area; trail design to be based on guidance provided in the Ice Age Tonquin Trail Master Plan specific to the Cedar Creek corridor
10C	Use existing Edy Road bridge to cross over Cedar Creek
10D	Potential to create future trail/wildlife undercrossing of Edy Road
10E	Potential motorist sight distance issues on horizontal curve of Roy Rogers Road; signalization proposed to provide protected bicyclist/pedestrian crossings
10F	Existing neighborhood connection



Map 17: Tile 11 - Roy Rogers Road to Tualatin River National Wildlife Refuge

Ice Age Tonquin Trail Master Plan
Preferred Alignment

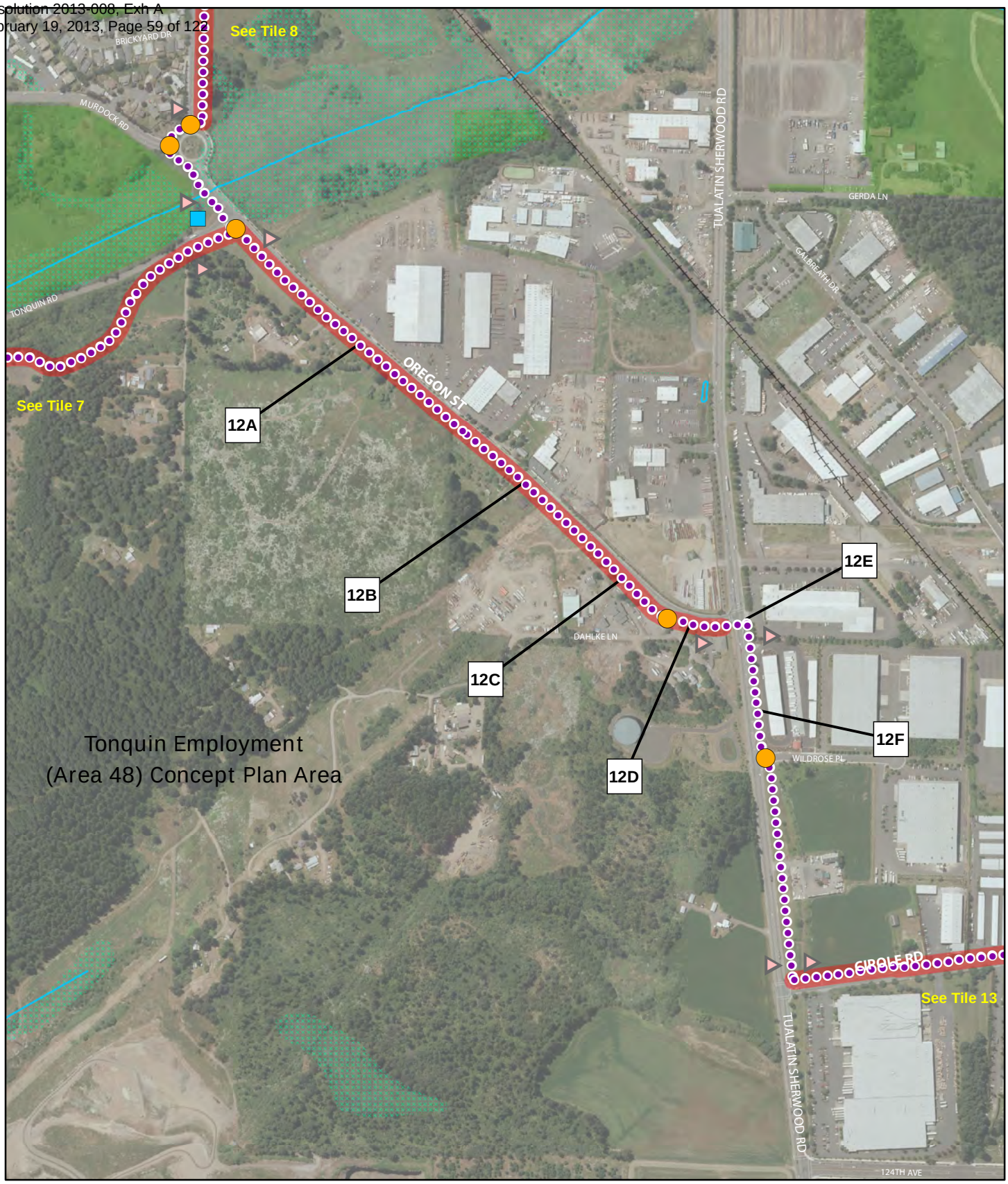
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 12 - Tile 11: Roy Rogers Road to Tualatin River National Wildlife Refuge

Reference # (see Tile 11 map)	Recommended Improvements and Opportunities
11A	Widen existing sidewalk on east side of Roy Rogers Road to accommodate trail (vegetation removal necessary)
11B	Widen existing bridge over Chicken Creek to accommodate trail, or construct cantilevered bridge or independent structure immediately east of Roy Rogers Road; retaining walls/bank stabilization necessary immediately north and south of creek crossing
11C	Trail alignment to follow east side of Roy Rogers Road (located within Sherwood's urban growth boundary)
11D	Trail will share access road to existing trailhead at Tualatin River National Wildlife Refuge



Map 18: Tile 12 - Tonquin Road/Oregon Road to Tualatin-Sherwood Road

Ice Age Tonquin Trail Master Plan Preferred Alignment

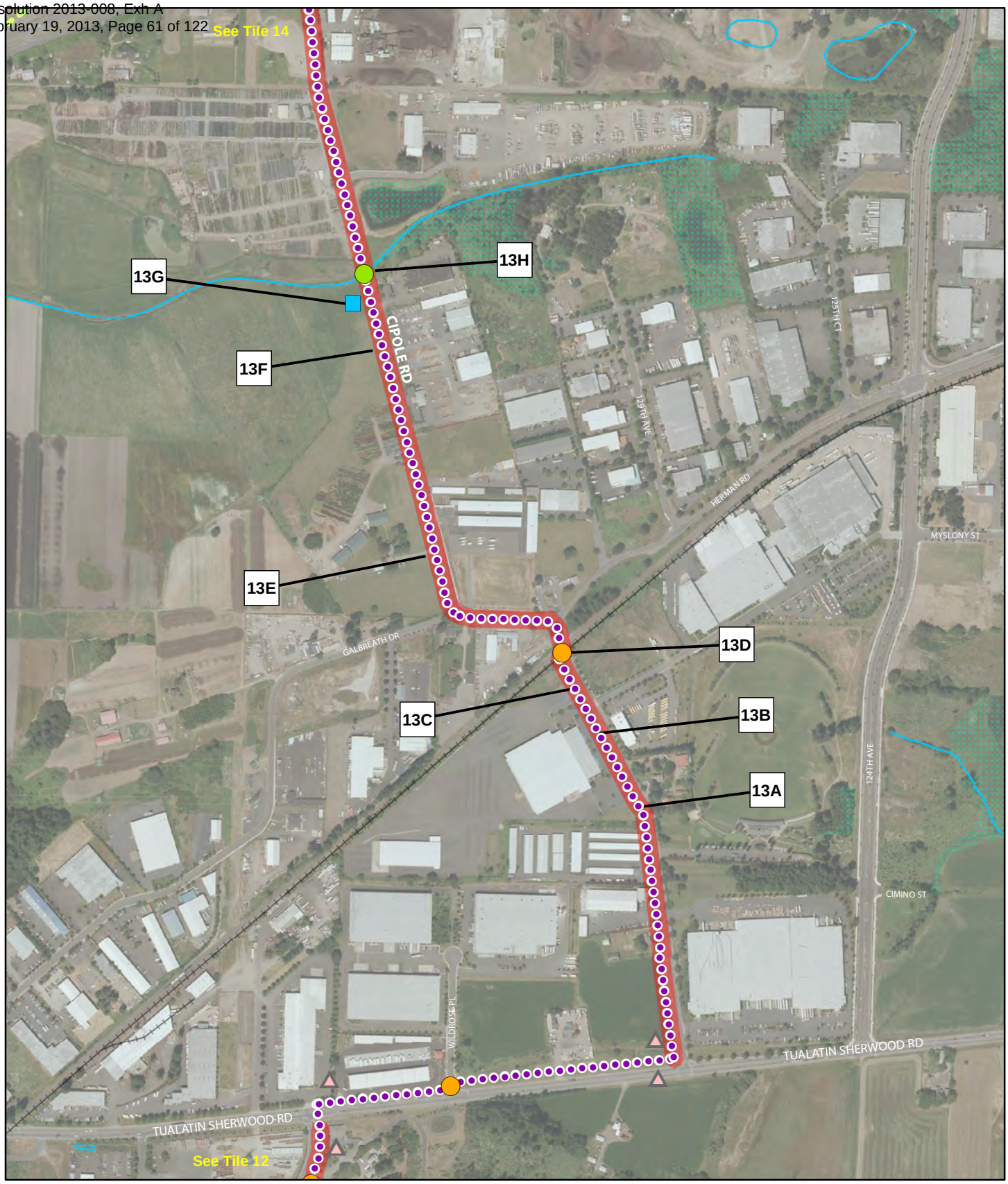
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 13 - Tile 12: Tonquin Road/Oregon Street to Tualatin-Sherwood Road

Reference # (see Tile 12 map)	Recommended Improvements and Opportunities
12A	Trail alignment to follow Oregon Street's east side between Tonquin Road and Tualatin-Sherwood Road; alignment to be sited immediately east of power line corridor (vegetation removal necessary in several locations); property easements/acquisitions could occur as part of Tonquin Employment Area Concept Plan implementation
12B	Trail alignment to be sited on top of bank immediately east of Oregon Street
12C	Relocate existing fence and retaining wall south of Dahlke Lane
12D	Retaining wall/bank stabilization necessary between Dahlke Lane and Tualatin-Sherwood Road
12E	Use existing signalized intersection of Tualatin-Sherwood Road and Oregon Street; potential need to relocate existing signal poles and utility boxes on intersection's SE and northeast (NE) corners to accommodate trail
12F	Trail alignment to follow north side of Tualatin-Sherwood Road; vegetation removal potentially necessary between Oregon Street and Wildrose Place



Map 19: Tile 13 - Cipole Road (Southern Portion)

Ice Age Tonquin Trail Master Plan
Preferred Alignment

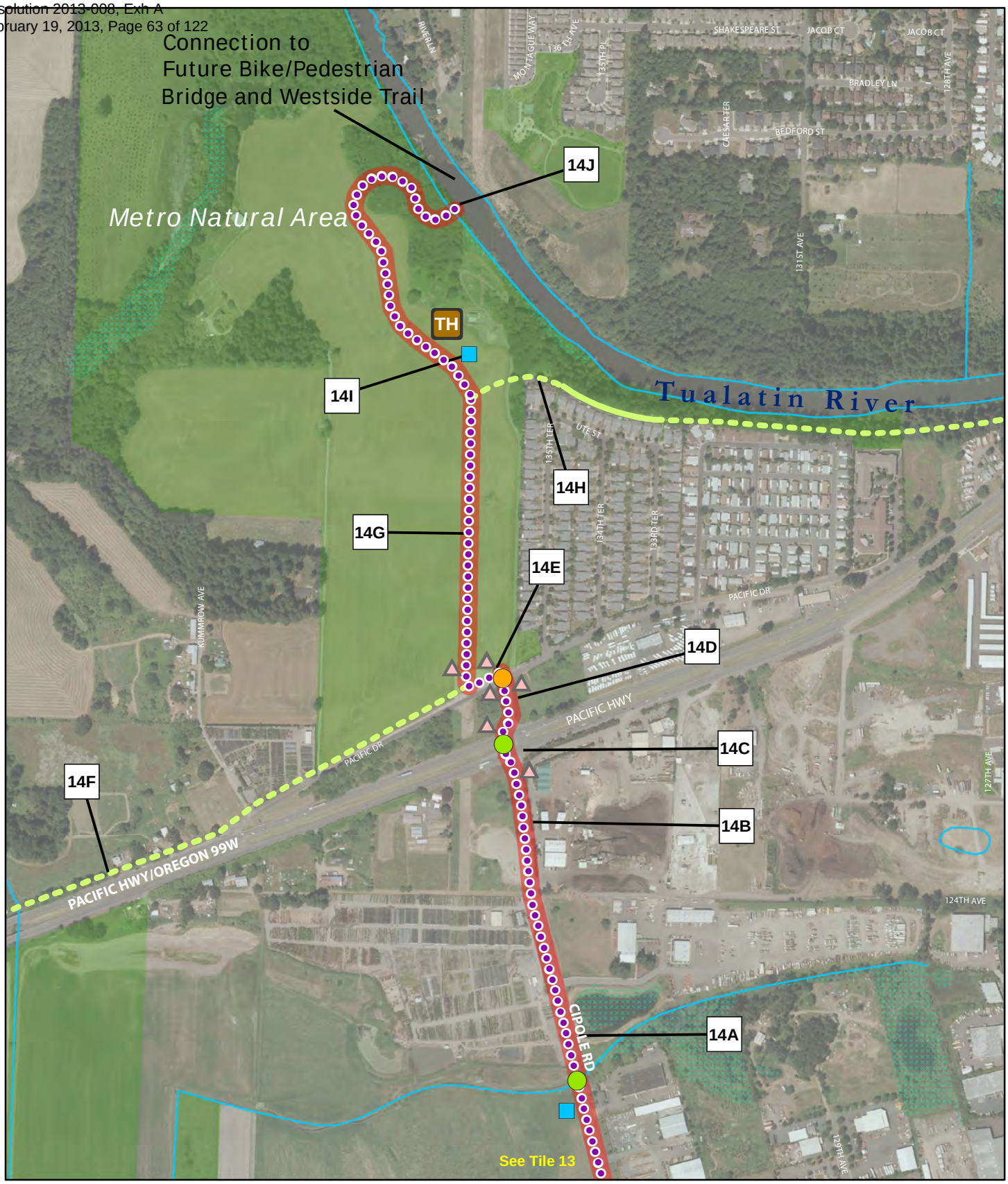
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 14 - Tile 13: Cipole Road (Southern Portion)

Reference # (see Tile 13 map)	Recommended Improvements and Opportunities
13A	Tualatin's *Transportation System Plan* proposes widening Cipole Road to three vehicle travel lanes, plus bike lanes and sidewalks; trail alignment to follow Cipole Road's west side between Tualatin-Sherwood Road and Pacific Highway/Oregon 99W; trail should be constructed in lieu of a sidewalk on the roadway's west side
13B	Vegetation removal and utility pole/mailbox relocation necessary in several locations to accommodate future Cipole Road widening and trail development between Tualatin-Sherwood Road and Herman Road
13C	Fence relocation necessary on Cipole Road's west side (immediately north and south of railroad) to accommodate future road widening and trail development
13D	Use existing at-grade railroad/roadway crossing; upgrade crossing treatments on roadway's west side (in tandem with future roadway widening) to accommodate trail
13E	Utility pole and fence relocation necessary immediately west/north of Cipole Road/Herman Road intersection to accommodate future road widening and trail development
13F	Vegetation removal necessary in several locations on Cipole Road's west side to accommodate future road widening and trail development between Herman Road and Pacific Highway/Oregon 99W
13G	Potential creekside art, educational, or interpretive opportunity
13H	Retaining wall potentially necessary in vicinity of creek crossing to accommodate future road widening and trail development



Map 20: Tile 14 - Cipole Road (Northern Portion) to Tualatin River

Ice Age Tonquin Trail Master Plan Preferred Alignment

Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path

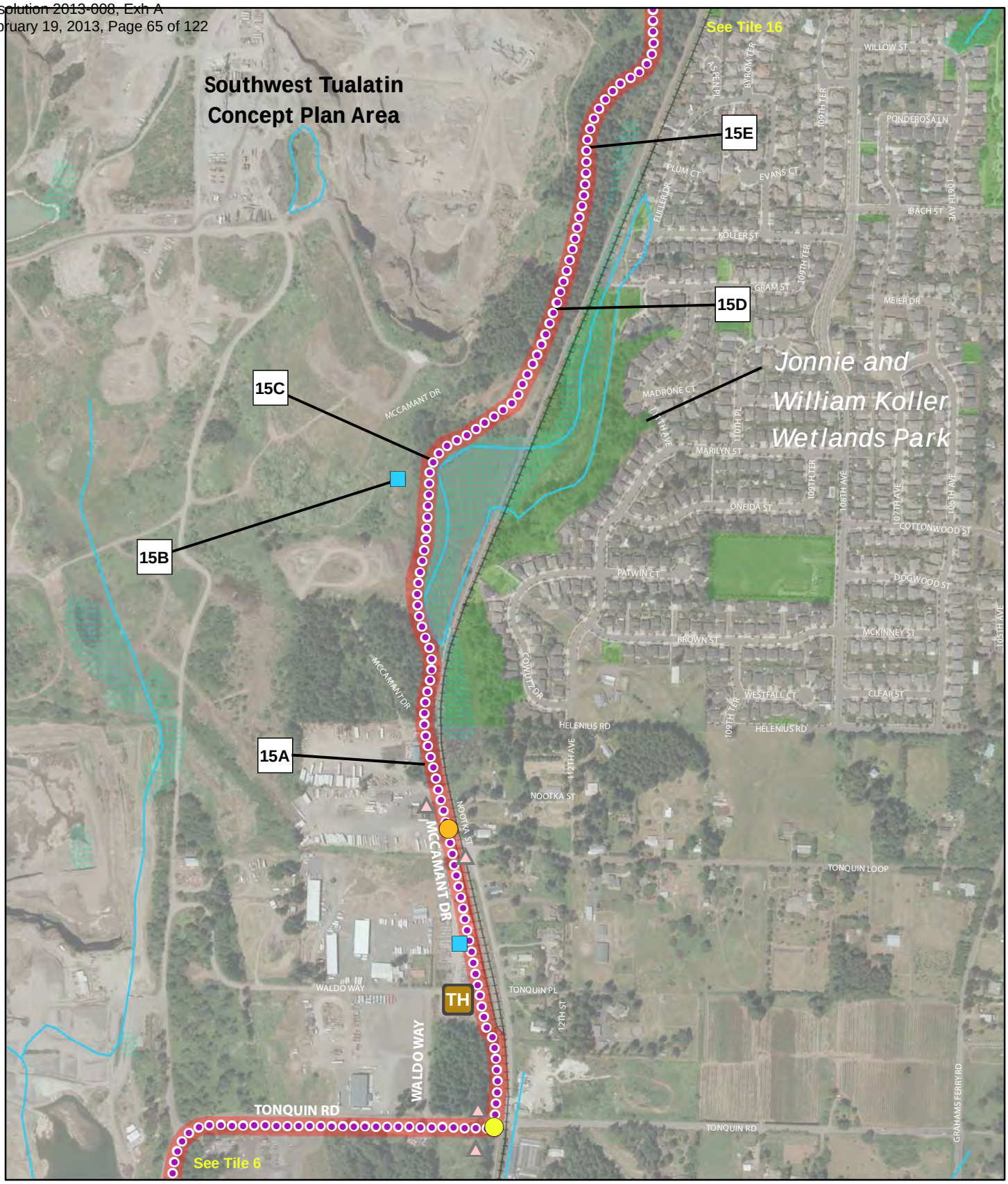
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch

- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location

- Art, Educational or Interpretive Opportunity
- TH — Proposed Trailhead
- P — Existing Parking or Trailhead

Table 15 - Tile 14: Cipole Road (Northern Portion) to Tualatin River

Reference # (see Tile 14 map)	Recommended Improvements and Opportunities
14A	Tualatin's *Transportation System Plan* proposes widening Cipole Road to three vehicle travel lanes, plus bike lanes and sidewalks; trail alignment to follow Cipole Road's west side between Tualatin-Sherwood Road and Pacific Highway/Oregon 99W; trail should be constructed in lieu of a sidewalk on the roadway's west side
14B	Vegetation removal and mailbox relocation necessary in several locations to accommodate future Cipole Road widening and trail development
14C	Construct overcrossing of Pacific Highway/Oregon 99W; alternative/interim treatments may include using existing signalized intersection (including pedestrian-activated push buttons) and crosswalk on intersection's west leg
14D	Vegetation removal necessary to accommodate future Cipole Road widening and trail development
14E	Trail alignment to follow north side of Pacific Drive
14F	Potential future connection to Tualatin River National Wildlife Refuge Visitors Center
14G	Final trail alignment to be determined when future site planning occurs; trail may follow power line corridor through Metro Natural Area; new trailhead planned
14H	Potential future connection to Tualatin River Greenway Trail
14I	Potential Tualatin River art, educational or interpretive opportunity
14J	Connection to future bicycle/pedestrian bridge and Westside Regional Trail



Map 21: Tile 15 - SW Tualatin Concept Plan Area (Southern Portion)

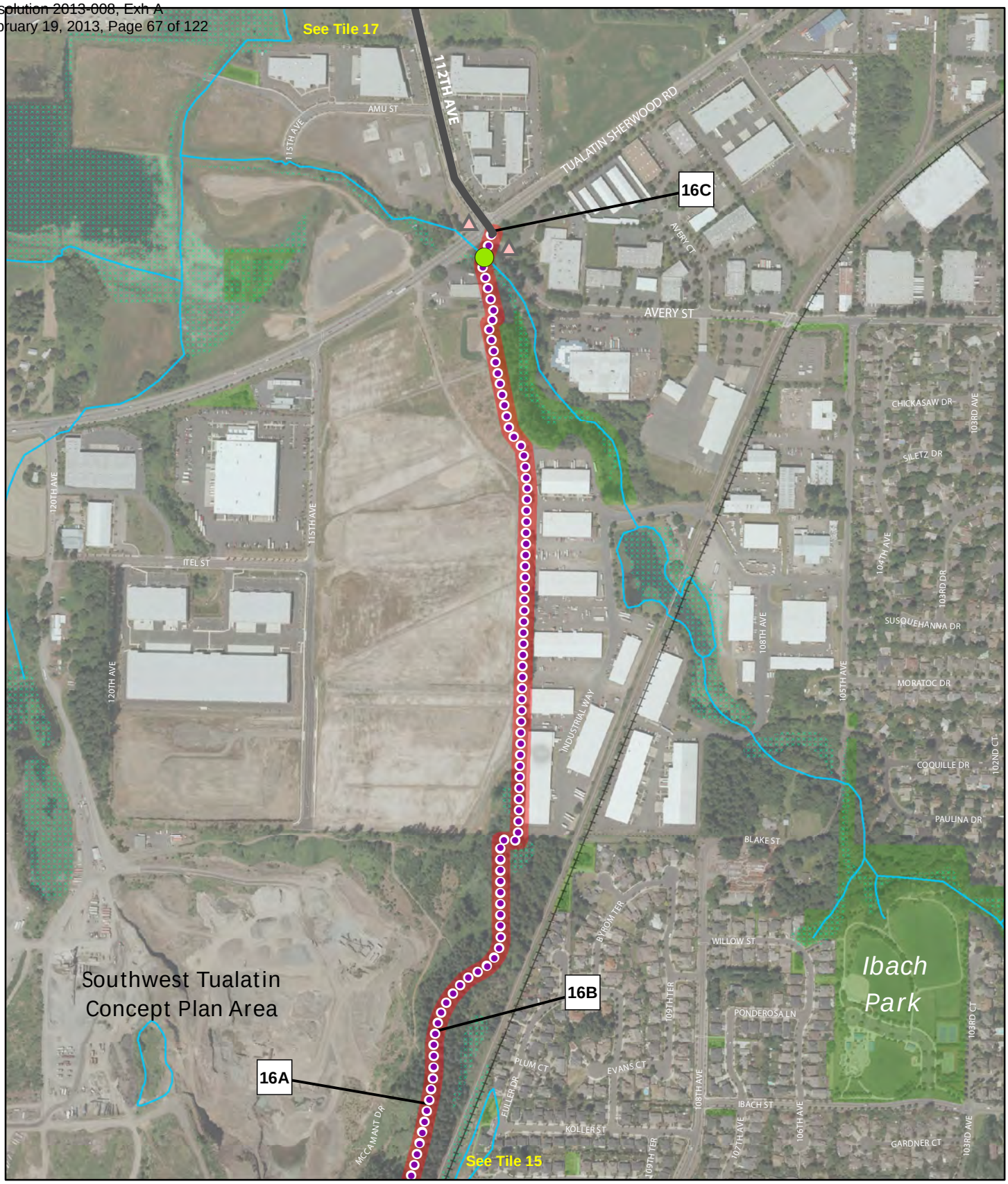
Ice Age Tonquin Trail Master Plan
Preferred Alignment
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 16 - Tile 15: Southwest Tualatin Concept Plan Area (Southern Portion)

Reference # (see Tile 15 map)	Recommended Improvements and Opportunities
15A	The goal of the Ice Age Tonquin Trail in the Southwest Tualatin Concept Plan area is to have a north/south orientation through and adjacent to the areas of highest desirability for interpretation of the Ice Age floods and the associated natural and geologic features. The exact alignment and proposed trailhead location have yet to be determined and will be developed in the future in consultation with the industrial land owners in this area, adjacent property owners, the general public and other stakeholders, no later than the time of annexation. Any property acquired by Metro for the trail will be acquired via a willing seller program.
15B	Potential kolk ponds art, educational or interpretive opportunity
15C	The Ice Age Tonquin Trail will follow an alignment shown in the Southwest Tualatin Concept Plan in this area; trail alignment to avoid steep slopes to the greatest extent possible.
15D	Vegetation removal and mitigation necessary to accommodate trail throughout the Southwest Tualatin Concept Plan area
15E	Trail alignment to follow ridge between quarry and railroad through Southwest Tualatin Concept Plan area



Map 22: Tile 16 - SW Tualatin Concept Plan Area (Northern Portion)

Ice Age Tonquin Trail Master Plan Preferred Alignment

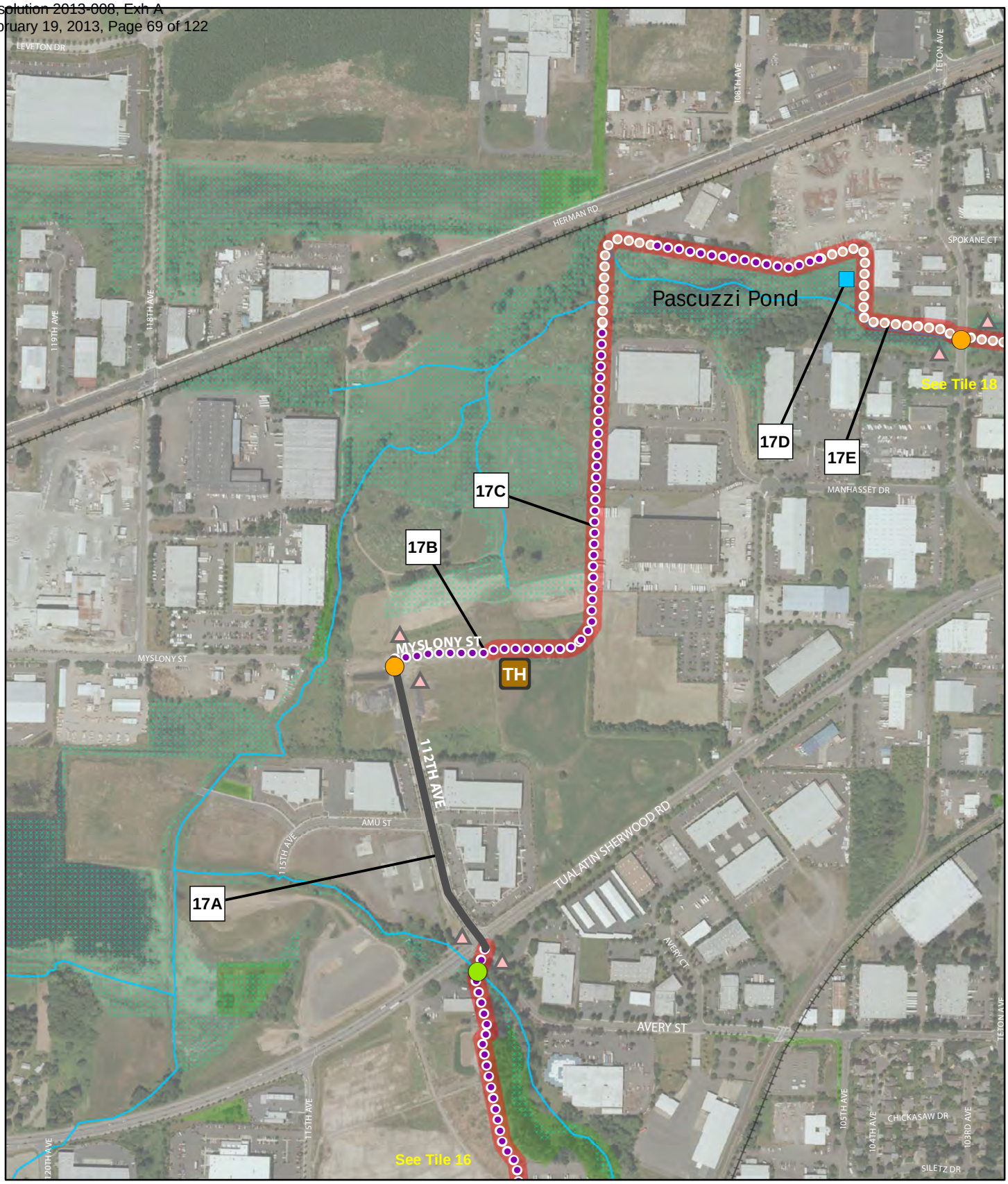
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 17 - Tile 16: Southwest Tualatin Concept Plan Area (Northern Portion)

Reference # (see Tile 16 map)	Recommended Improvements and Opportunities
16A	Ice Age Tonquin Trail is identified in Southwest Tualatin Concept Plan; trail alignment to follow ridge between quarry and railroad through Southwest Tualatin Concept Plan area
16B	Vegetation removal and mitigation necessary to accommodate trail throughout the Southwest Tualatin Concept Plan area
16C	Use existing signalized intersection of Tualatin-Sherwood Road and 112th Avenue/Avery Street; install bicycle detection on southbound approach



Map 23: Tile 17 - Hedges Creek Greenway (Western Portion)

Ice Age Tonquin Trail Master Plan
Preferred Alignment

Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 18 - Tile 17: Hedges Creek Greenway (Western Portion)

Reference # (see Tile 17 map)	Recommended Improvements and Opportunities
17A	Use existing 112th Avenue bike lanes and sidewalks
17B	Trail alignment to follow north side of Myslony Street; new trailhead in this area
17C	Partial reconfiguration of truck storage area necessary to accommodate trail
17D	Potential Hedges Creek Greenway art, educational or interpretive opportunity
17E	Trail alignment to be sited on top of buried trunk sewer line easement through Hedges Creek Greenway to the greatest extent possible; trail to be constructed of boardwalk, as needed, in wet areas

Map 24: Tile 18 - Hedges Creek Greenway (Central Portion)

Ice Age Tonquin Trail Master Plan
Preferred Alignment

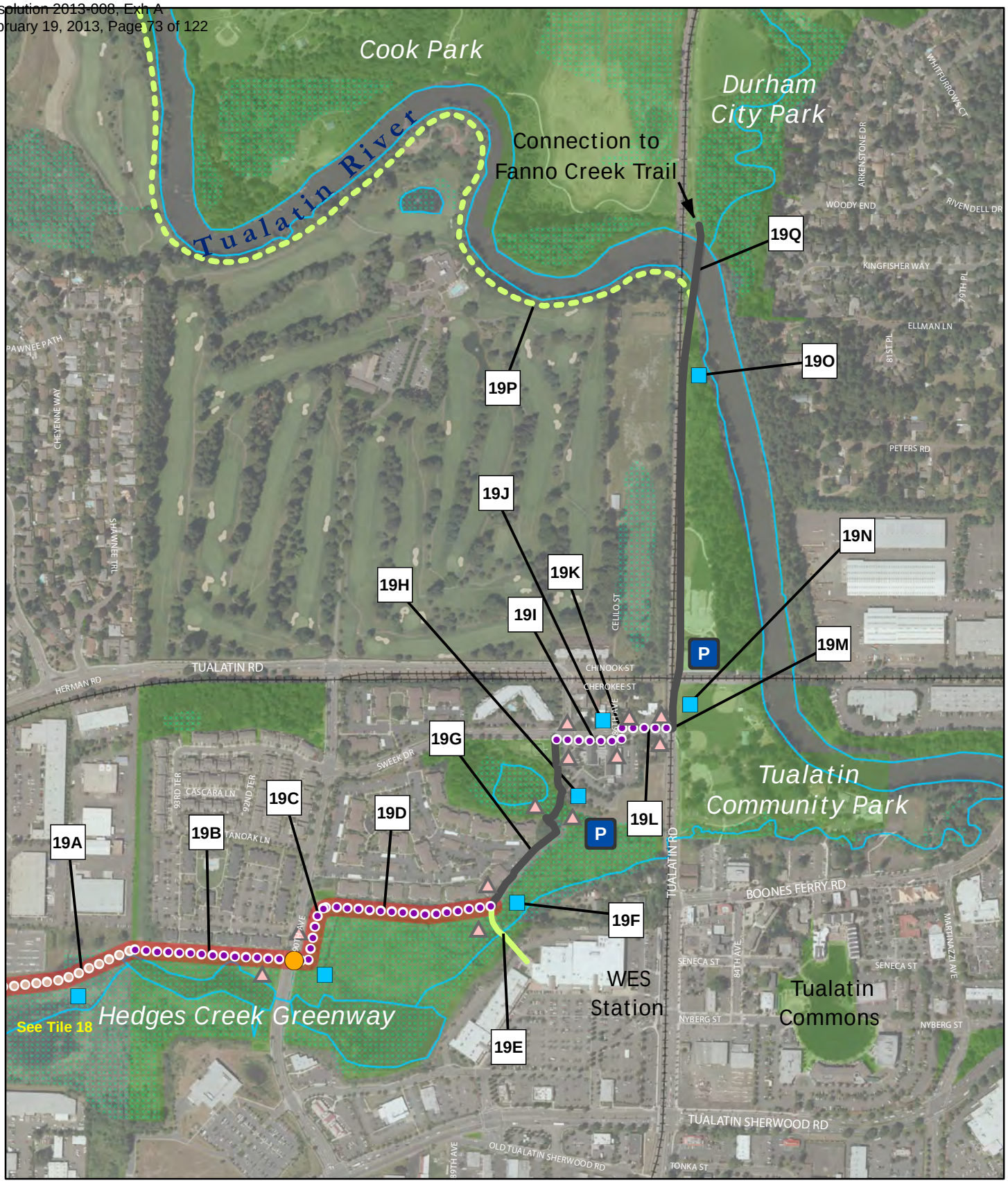
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 19 - Tile 18: Hedges Creek Greenway (Central Portion)

Reference # (see Tile 18 map)	Recommended Improvements and Opportunities
18A	Opportunity to replace existing culvert beneath Teton Avenue to enhance wildlife crossing; potential pedestrian crossing enhancements include a marked crosswalk, warning signs, and pedestrian-activated flashing warning lights
18B	Trail alignment to be sited on top of buried trunk sewer line easement through Hedges Creek Greenway to the greatest extent possible; trail to be constructed of boardwalk, as needed, in wet areas
18C	Potential Hedges Creek Greenway art, educational or interpretive opportunity
18D	Potential pedestrian crossing enhancements include a refuge island, marked crosswalk, warning signs, and pedestrian-activated flashing warning lights
18E	Potential Hedges Creek Greenway art, educational or interpretive opportunity



Map 25: Tile 19 - Hedges Creek Greenway (Eastern Portion)

Ice Age Tonquin Trail Master Plan
Preferred Alignment
Source: Metro Data Resource Center

0 500 1,000 2,000 Feet

Ice Age Tonquin Trail
- Existing Trail
- Proposed Bike Lanes/Sidewalks
- Proposed Boardwalk
- Proposed Shared Roadway
- Proposed Shared Use Path
- Alignment Undetermined
- Potential Easement or Acquisition Needed
- Existing Neighborhood Connection
- Potential Future Connection
- Wetland
- Park or Natural Area
- River/Stream/Drainage Ditch
- Proposed Grade-Separated Crossing
- Proposed At-Grade Crossing (Signalized)
- Proposed At-Grade Crossing (Unsignalized)
- Potential Wayfinding Sign Location
- Art, Educational or Interpretive Opportunity
- TH Proposed Trailhead
- P Existing Parking or Trailhead

Table 20 - Tile 19: Hedges Creek Greenway (Eastern Portion)

Reference # (see Tile 19 map)	Recommended Improvements and Opportunities
19A	Vegetation and wetland mitigation necessary to accommodate trail along Hedges Creek Greenway
19B	Trail alignment to be located atop berm above Hedges Creek Greenway
19C	Trail alignment to be located on 90th Avenue's east side
19D	Trail alignment to be located at toe of slope; potential to incorporate themes of the "Tree Top Trail" as described in the Hedges Creek Greenway Wetlands Master Plan
19E	Existing bicycle/pedestrian bridge (providing access to nearby commercial center)
19F	Potential Hedges Creek Greenway art, educational or interpretive opportunity
19G	Use existing trail between Hedges Creek Greenway and Tualatin Road
19H	Potential civic art, educational or interpretive opportunity
19I	Widen existing sidewalk on Tualatin Road's south side to accommodate trail
19J	Potential civic art, educational or interpretive opportunity
19K	Use existing mid-block crossing
19L	Widen existing sidewalk on Tualatin Road's north side to accommodate trail (either acquire easement from adjacent properties or use adjacent bike lane for sidewalk widening)
19M	Use existing at-grade railroad/roadway crossing; widen short sidewalk segment immediately east of railroad crossing to accommodate trail
19N	Potential Tualatin Community Park art, educational or interpretive opportunity
190	Potential Tualatin River art, educational or interpretive opportunity
19P	Potential future connection to Tualatin River Greenway Trail
19Q	Use existing trail in Tualatin Community Park, Ki-a-Kuts Bridge, and connection to Fanno Creek Regional Trail

Chapter 4: Trail Design Guidelines

Overview

Ice Age Tonquin Trail Design Guidelines

This section presents recommended design guidelines for the Ice Age Tonquin Trail. The guidelines are meant to cover a broad range of agency standards for shared use paths; bicycle lanes; shared lane markings; trail-roadway intersections; trail related facilities; signage and wayfinding; special design requirements; and environmentally sensitive trail design, including bridges and boardwalks. Trail design guidelines refer to the characteristics of a trail that provide varying levels of access, enhance the trail user experience, and provide environmental protection and/or restoration. To select the appropriate trail guidelines, a number of factors such as the following should be considered.

Built section of the Ice Age Tonquin Trail in Graham Oaks Nature Park in Wilsonville.

- Corridor location and environmentally sensitive areas
- Anticipated trail traffic volumes and seasonal demands
- Trail user types
- Drainage needs
- Preservation of as many existing trees as possible
- Maintenance needs
- Maintenance costs and schedules

Site-specific treatments are shown and described in the maps and tables in Chapter 3.

While these guidelines provide recommendations for design of the Ice Age Tonquin Trail, it should be noted that each jurisdiction that the Ice Age Tonquin Trail passes through has different design standards that will need to be met. In addition, survey and preliminary engineering have not yet been completed for the trail. Therefore, grading, drainage, and retaining-wall design will be required at the time of Master Plan implementation.

Design with Active Transportation in Mind

One of the goals of the Intertwine Alliance is to increase opportunities for active transportation within the region. Active transportation as it applies to the Ice Age Tonquin Trail includes the following items:

- Expanding the regional trail network by connecting the Ice Age Tonquin Trail to nearby regional trails.
- Safely accommodating a mix of uses and trail users of all abilities.
- Providing access from neighborhoods to local destinations and venues.
- Providing high quality connections for all users to the goods and services needed for daily life.
- Increasing the number of bicycle and pedestrian trips, reducing the number of auto trips.
- Providing informational and wayfinding signs that help people reach their destination.

Trail Theme

A trail theme creates a cohesive and memorable trail, while establishing a distinct identity or "sense of place." The theme brands a trail system with unifying materials, elements, images, and colors. These features define the system as a unique place and provide a reason for people to experience it. A unifying theme serves to inform subsequent design elements from site furnishings to interpretive information. The Ice Age Tonquin Trail should be a celebration of the Glacial Lake Missoula Ice Age flood events. As such, the design should tie together the natural features along the route that are evidence of the flood events. Material selections should be native, including rock, wood, and plant material. Placement of glacial erratics as mileage markers is a good example of celebrating the Ice Age Tonquin Trail. Consistency in the look and feel of the trail amenities will help to provide a seamless aesthetic experience for trail users. Examples include, but are not limited to, signage, site furnishings, and a planting palette.

Off-Street Facilities

Figure 1 – Typical cross-section for a shared use path

Shared Use Paths

The Ice Age Tonquin Trail will primarily be a shared use path where possible. Shared use paths are completely separated from motorized vehicular traffic and are constructed in their own corridor, often within an open-space area. The following list of trail design recommendations are also illustrated in Figure 1:

- Permeable asphalt is the recommended surface treatment, though concrete, asphalt, and permeable concrete may be acceptable.
- The typical cross section is 12 feet wide with 2-foot-wide compacted crushed stone shoulders.
- The constrained cross section is 10 feet wide with 2-foot-wide shoulders.
- The running slope (for example, the grade at which the trail travels) should be less than 5 percent.

Shared use paths are typically constructed in their own corridor, and are physically separated from motor vehicle traffic.

- The cross slope (for example, slope running perpendicular to the trail) should be 2 percent maximum.
- Use centerline and fog line striping in constrained areas or on sharp or blind curves.

Shared Use Paths Adjacent to Roadways

Shared use paths located within the roadway corridor right-of-way or adjacent to roads provide a comfortable walking space for pedestrians and enable children and recreational bicyclists to ride without the discomfort of riding in a busy street.

This configuration works best along roadways with limited driveway crossings and with services primarily located on one side of the roadway, or along a riverfront or other natural feature (see Figure 2). *Not recommended in areas with frequent driveways or cross streets.*

One cyclist passing another on shared use path.

- A minimum 10-foot width is necessary for bicyclists to pass one another safely (12 feet for areas expecting high use).
- A 5-foot-wide minimum vegetated buffer should be provided between the edge of the path and the edge of the roadway.
- Vegetated buffer can be used as a low impact water quality swale.
- The Ice Age Tonquin Trail shared use paths adjacent to the roadway will be within areas of future road right-of-way acquisition.
- Seek opportunities to close/decommission unused or wider than necessary driveways.

Figure 2 – Shared use path adjacent to roadway

On-Street Facilities

Bicycle Lanes

Sections of the trail will require on-street bicycle facilities such bicycle lanes (see Figure 3). A bicycle lane is a portion of the roadway that has been designated by striping, signing, and pavement markings for the preferential and exclusive use of bicyclists. Bicycle lanes are located on both sides of the road, except on most one-way streets, and carry bicyclists in the same direction as adjacent motor vehicle traffic. Recommended bicycle lane design features include the following:

- Without parking, 6 feet from curb face or edge of pavement
- With parking, 14.5 feet from curb face to edge of bike lane
- White 8-inch barrier line between bike lane and traffic lane
- Bike friendly catch basin grates shall be used for on-street segments
- Should be used on roadways with average daily traffic (ADT) counts of 3,000 or more
- Not suitable where there are a high number of commercial driveways
- Suitable for 2-lane or 3-lane facilities and 4-lane divided facilities

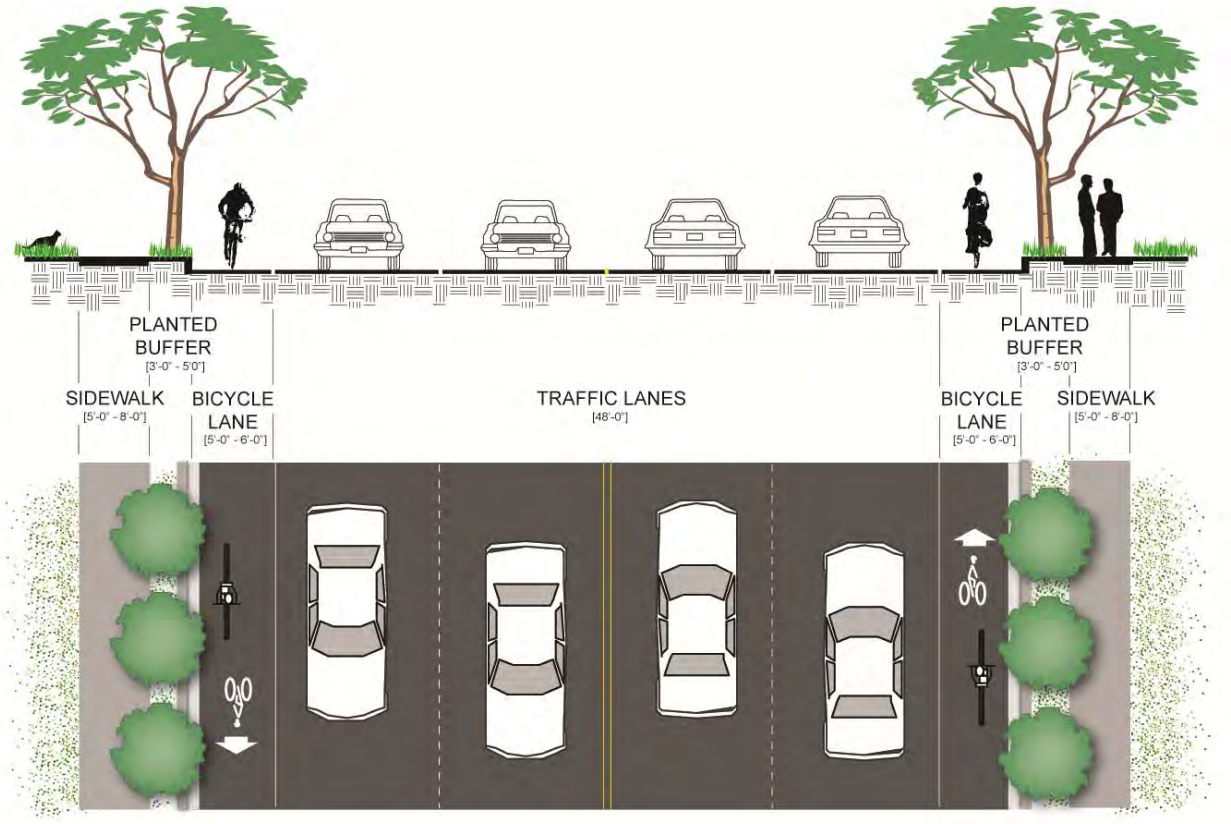


Figure 3 – On-street trail design includes bike lanes and sidewalks

Shared Lane Markings

Shared lane markings (or "sharrow") can serve a number of purposes, such as making motorists aware of bicycles occupying the travel lane, showing bicyclists the appropriate direction of travel, and, with proper placement, reminding bicyclists to bike further from parked cars to prevent "dooring" collisions. As shown in Figure 4, shared lane markings are typically used in the following situations:

- Where lanes are too narrow for striping bike lanes
- Where the posted speed limit does not exceed 35 miles per hour
- With or without on-street parking (with on-street parking, the center of the shared lane marking should be placed a minimum of 11 feet from the curb face; without on-street parking, the center of the marking should be placed a minimum of 4 feet from the curb face or edge of pavement)

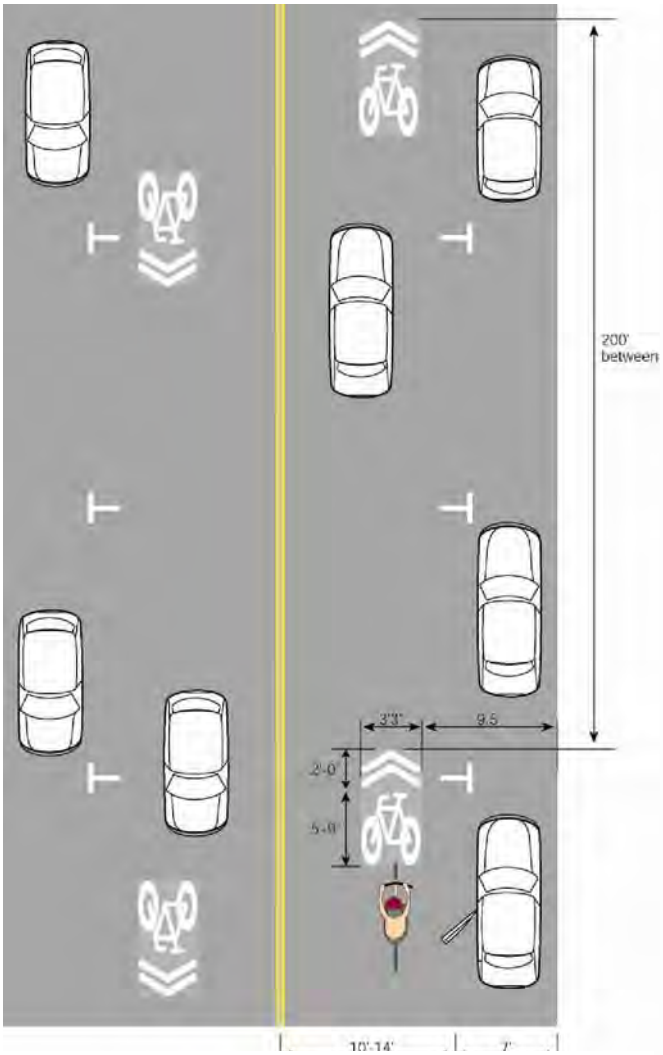


Figure 4 – Shared lane markings

Cities throughout the United States have effectively used this treatment for many years; it is now officially part of the Federal Highway Administration's (FHWA's) 2009 *Manual on Uniform Traffic Control Devices* (MUTCD). Additional guidance is also available in the 2012 American Association of State Highway and Transportation Officials' (AASHTO's) *Guide for the Development of Bicycle Facilities*.

Trail-Roadway Intersections

The following sections provide design guidance for trail/roadway intersections. The guidelines presented in this chapter represent conceptual recommendations. Specific trail/roadway intersection treatments should be determined on a case-by-case basis based on further engineering analysis conducted by each respective local agency.

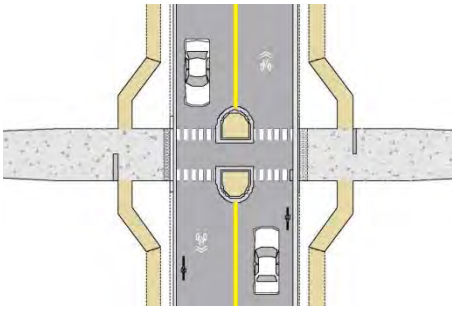


Figure 5 - Median refuge and shared use path with sidewalks

Non-Signalized Intersections

- Site the crossing area at a logical and visible location. The crossing should be a safe enough distance (based on travel speeds and sight lines) from neighboring intersections to not interfere (or be interfered) with traffic flow. Crossing at a roadway with flat topography is desirable to increase motorist visibility of the path crossing. The crossing should occur as close to perpendicular (90 degrees) to the roadway as possible.

- Warn motorists of the upcoming trail crossing and trail users of the upcoming intersections. Motorists and trail users can be warned with signage (including trail stop signs), changes in pavement texture, flashing beacons, raised crossings, striping, and so forth.

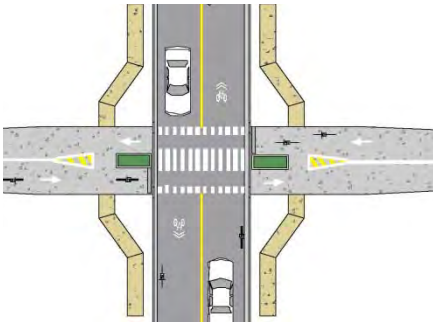


Figure 6 - Mid-block crossing and shared use path with sidewalks and medians

- Maintain visibility between trail users and motorists by clearing or trimming vegetation that obstructs the view between them.

- Intersection approaches should be made at relatively flat grades so that cyclists are not riding downhill into intersections.

Bicyclist approaching a trail/roadway crossing.

- If the intersection is more than 75 feet from curb to curb, it is preferable to provide a center median refuge area (see Figures 5 and 6). A refuge is needed in conditions exhibiting high volumes/speeds and where the primary user group crossing the roadway requires additional time, such as schoolchildren and the elderly. Where possible, the refuge island should be angled so that crossing pedestrians are visually oriented to the leg of roadway in which they intend to cross.

- If possible, it may be desirable to bring the path crossing up to a nearby signalized crossing in situations with high speeds/average daily traffic and design and/or physical constraints.

Sample signage and pavement marking treatments at a trail/roadway crossing.

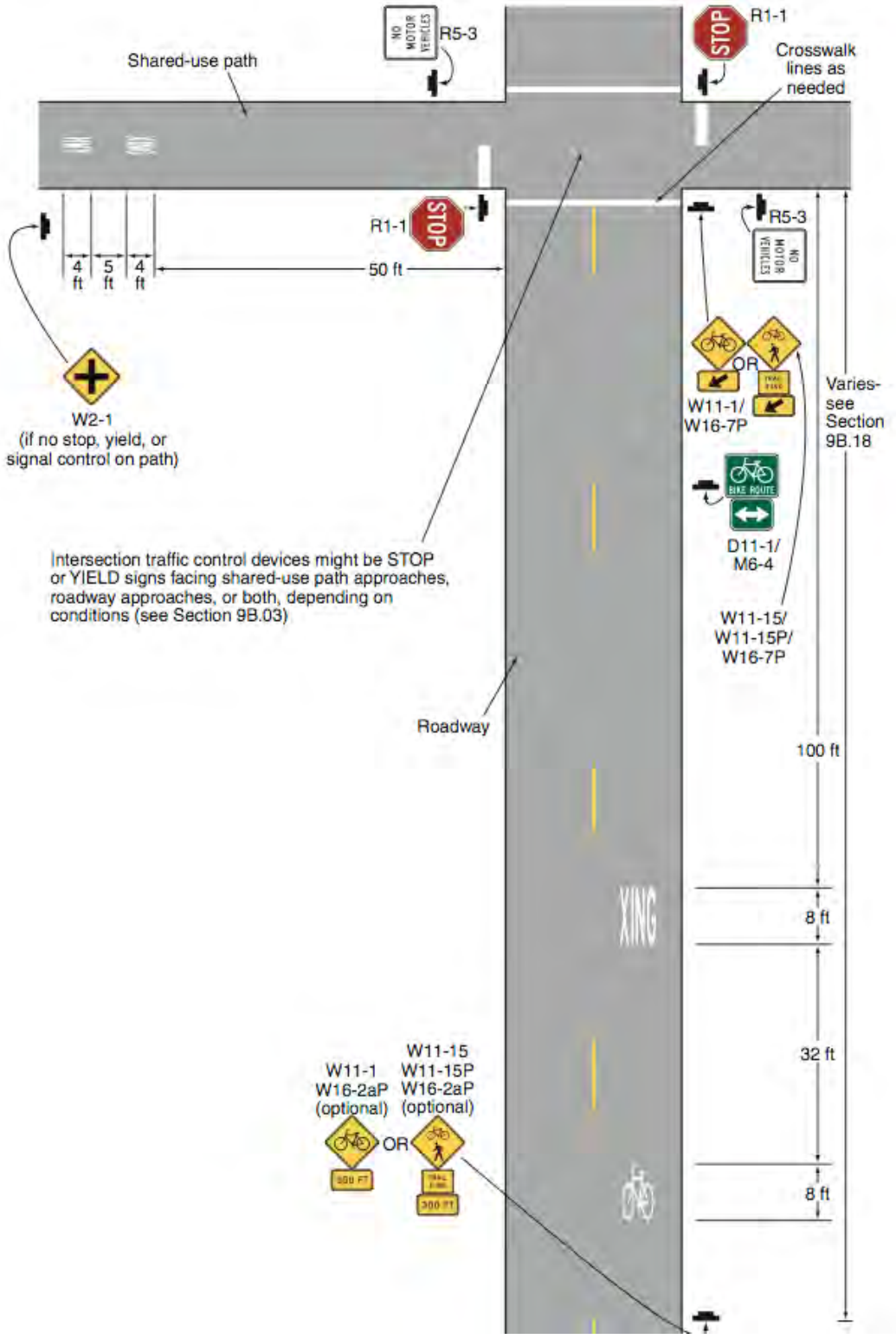


Figure 7 - Trail/roadway crossing design guidance
(Source: FHWA's 2009 Manual on Uniform Traffic Control Devices)

Signalized Intersections

- Signalized crossings may be necessary on high-volume trail segments that intersect with high-volume roadways, but the 2009 MUTCD warrants must be met for the installation of a signalized crossing. Consult the MUTCD or ODOT for signal, sign, and light placement.

- The FHWA issued an interim approval for the optional use of rectangular rapid flashing beacons as warning beacons supplementing pedestrian crossing or school-crossing warning signs at crossings across uncontrolled approaches. An analysis by the Center for Education and Research in Safety found them to have much higher levels of effectiveness in making drivers yield at crosswalks than the standard over-head and side-mount round flashing beacons.

Rectangular rapid flashing beacons at a trail/roadway crossing.

- Pedestrian Hybrid Beacons (also known as HAWK signals) help alert motorists to stop for non-motorized users that are crossing mid-block, without the assistance of traffic signals or stop signs. When not activated, the signal is blanked out. The HAWK signal is typically activated by a pedestrian push button. The overhead signal begins flashing yellow, followed by solid yellow, advising motorists to prepare to stop. The signal then displays a solid red and shows the bicyclists/pedestrian a "Walk" indication. Finally, an alternating flashing red signal indicates that motorists may proceed when safe, after coming to a full stop. The bicyclist/pedestrian is shown a flashing "Don't Walk" with a countdown indicating the time left to cross.

- Bicycle detection is recommended at signalized intersections, either in the form of loop, video or microwave detection.

Grade-Separated Crossings

Grade-separated crossings can represent one of the most important elements of a community's non-motorized transportation network, and can overcome major barriers hindering direct travel. Grade-separated crossings can address real or perceived safety and convenience issues by providing a formalized means for traversing these "problem areas."

Grade-separated crossings work best when the trail user can pass over or under the barrier without changing speed, grade, or direction; in other words, make a seamless transition. In many cases, however, grade-separated crossings need to rise above or travel beneath the natural ground line to cross major barriers, thus requiring stairways, access ramps or other provisions. In these situations, it is important to provide crossing choices. Bicyclists, for instance, may choose to carry their bikes up stairways even if a ramp is provided.

Grade-separated crossings should include the components necessary to enhance user comfort, safety, and security. Wider structures not only facilitate easier travel by minimizing user conflicts, they could also minimize the perception of isolation (especially for tunnels or bridges with fully enclosed fencing). These crossings should also provide sufficient vertical clearances to accommodate various users including maintenance and emergency vehicles, as needed. Access ramps should be designed with appropriate grades, landings, railings, fences, and lighting to promote user safety and comfort.

Grade-separated crossings should also include provisions for mobility-impaired users (for example, elevators or ramps with level landings). Wider stairways and access ramps with broader turns (for example, avoiding switchbacks) facilitate easier maneuverability for all users, and can minimize potential conflicts between users traveling at varying speeds.

Special Design Requirements

Bonneville Power Administration (BPA) Design Requirements for Trails within Power Line Corridors

- Trail alignment
    - Preferably as close to the edge of power line corridor as possible, and away from power pole bases (recommended 50-foot clear zone from steel transmission towers; 25-foot clear zone from wood poles)
    - Trail crossings of power lines should be minimized; provide the shortest crossing distance as possible where crossings are needed (minimum 60-degree angle)
    - Should not inhibit maintenance vehicle access to power poles
- Trail surfacing. Must support Highway Standard 20-ton vehicle loading (BPA will use trail to access power poles)
- Lighting. Fixtures should be placed at least 25 feet away from conductors
- Structures. Prohibited within power line corridors
- Vegetation. Prohibited within power line corridors
- Future detailed trail design should involve BPA to expedite approval process

Westside Express Service (WES) Commuter Rail

A chain link fence (4 feet high minimum, 6 feet high maximum) and/or other separation techniques should be a part of the trail design in the area adjacent to the railroad tracks.

Maximize the setback between the trail and the railroad track used by WES. The setback distance between a track centerline and the closest edge of the trail should correlate to the type, speed, and frequency of train operations, as well as the topographic conditions and separation techniques.

The maximum setback is subject to railroad, regional, state, and federal guidelines and to the advice of engineering and safety experts. Exceptions to the recommended setbacks may include the following:

- Constrained areas (bridges, cut-and-fill areas)
- Low speed and low frequency train operations

In these cases, the minimum recommended setback is 8.5 feet from the track centerline or 9.5 feet on curves.

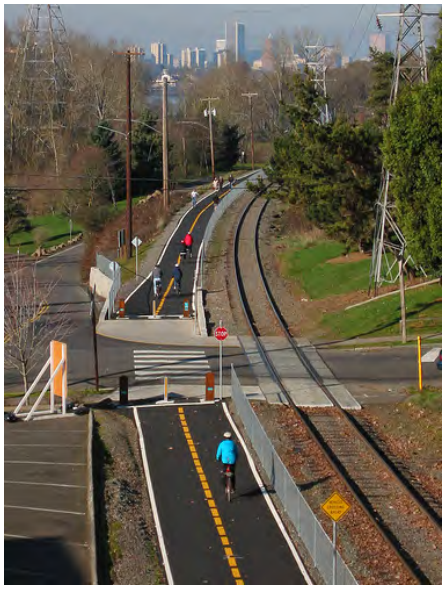


Photo of chain link fence used along a rail-with-trail within a constrained corridor (Springwater Trail).

Trail-Related Facilities

Fences

Fences, where needed, are important features along trails. They define the public space and protect trail users in areas where there may be a cliff or steep slope or hazardous adjacent land use or physical feature. Fencing may be necessary in some areas along the trail (such as adjacent to active rail lines and industrial areas).

Wildlife friendly fence with 6-inch vertical gap at the bottom for small animal passage (Springwater Trail).

- At a minimum, fences should consist of a horizontal top and bottom rail.
- Picket style fencing should be avoided because it presents a safety hazard for bicyclists.
- Maximum fence height should be 4 feet unless a taller fence is required for safety or privacy.
- Wildlife friendly fences should be used in sensitive natural resource areas to separate users from protected habitat and breeding areas.
- In rural areas, 4-foot-high split-rail style fencing should be used.
- Use a chain link fence to separate the trail users from active rail lines. The chain link fence may include vinyl coating if required by a local agency.

Trail Lighting

Pedestrian-scaled, low level lighting improves safety, enables the trail to be used year-round and can improve the aesthetic of the trail. Good pedestrian-scaled lighting provides high quality lighting without the glare and light pollution that is produced by typical cobra-type street fixtures. Each jurisdiction will determine trail lighting standards for their segment. Minimal or no lighting should be used in sensitive natural resource areas as it can have negative effects on wildlife. If lighting is required in these areas, full-cutoff fixtures should be used to minimize light pollution.

Bollards

Minimize the use of bollards to avoid creating obstacles for bicyclists. Bollards, particularly solid bollards, have caused serious injury to bicyclists. Instead, design the path entry and use signage to alert drivers that motor vehicles are prohibited. In cases where bollards must be used, a single post placed in the center of the path entry is preferred, and bollards should be installed to be removed or be flexible to allow passage of maintenance or emergency vehicles. They should also include reflective paint or tape so that they are visible in times of low light. Solid bollards that are secured to the base with a lock should use combination locks.

Public Art on Trails

Efforts should be made to include public art within the overall design of the trail system. Local artists may be commissioned to provide art for the trail system, making it uniquely distinct and memorable. Many trail art installations are functional as well as aesthetic, as they may provide places to sit and play on. According to American Trails,

"Art is one of the best ways to strengthen the connection between people and trails. Across America and elsewhere, artists are employing a remarkably wide range of creative strategies to support all phases of trail activities, from design and development to stewardship and interpretation. In particular, art can be an effective tool for telling a trail's story compellingly and memorably."

Examples of art programs for trails can be found at www.americantrails.org/resources/art/ArtfulWays.html.

Example of public art on trails.

Trailheads

Major access points should be established near commercial developments and transportation nodes, making them highly accessible to the surrounding communities. Minor trailheads should be simple pedestrian and bicycle entrances at locally known spots, such as parks and residential developments.

A minor trailhead could include facilities such as parking, drinking fountains, benches, a bicycle rack, trash receptacles, pet waste bag dispensers, and an information kiosk and/or signage. Major trailheads could include all of these facilities plus additional amenities, such as rest rooms, shelters, picnic areas, wayfinding, interpretive signs, a secure bike parking area, a bike maintenance station, a fitness course, an emergency telephone, and a larger parking area.

Partnerships could also be sought with owners of existing parking lots near trails. Benefits are threefold—businesses benefit from trail-user patronage; trail owners benefit from not having to buy more land to construct a parking facility; and the environment benefits from less development in the watershed.

Trailhead development will likely be opportunity driven. Site-specific amenities will be determined during the design process.

A major trailhead featuring concessions and bicycle, canoe, and kayak rentals.

A major trailhead with bike racks, air compressor (for bicycle tires), water fountain, restrooms, phone, and benches.

Trail Signage

A comprehensive system of signage provides information to trail users to ensure that they can travel safely, find their way easily, and have opportunities to learn about the trail's unique natural and cultural setting.

Intertwine signage on the Fanno Creek Trail.

Signage is divided into the following categories:

- Identity/logo signs
- Directional/wayfinding signs
- Regulatory and warning signs
- Educational/interpretive signs

The *Intertwine Regional Trail Signage Guidelines* (see Appendix C) are recommended for new and retrofitted directional, wayfinding, and regulatory and warning signage throughout the Ice Age Tonquin Trail corridor. Using the Intertwine signage guidelines will create a consistent look and feel as the Ice Age Tonquin Trail travels through multiple jurisdictions. The Ice Age Tonquin Trail signage will also be consistent with the Intertwine signage used on other regional trails with which it connects. The Intertwine signage guidelines embrace local trail providers' existing branding and provide flexibility for jurisdictions that already have trail sign standards.

Metro's *Signage Manual* is recommended for new and retrofitted educational and interpretive signage. Using Metro's signage guidelines for these types of signs will create a consistent look throughout the trail corridor. Examples of existing educational and interpretive signage that currently follow these guidelines exist on the Ice Age Tonquin Trail at Graham Oaks Nature Park. The chapter on educational and interpretive signage from Metro's *Signage Manual* is included in Appendix C.

Ice Age Tonquin Trail Identity/Logo Signs

The Ice Age Tonquin Trail logo should be used to aid in reinforcing the trail's identity. Identity signs with the logo reflecting the trail's overall theme should be placed at each major and secondary entry point to the trail system. An identity sign is the first step in the trail visitor's way-finding experience. Images and text on the identity sign should be clear and legible from a roadway when oriented towards those arriving via motorized vehicle. Smaller scaled signs, legible from the pedestrian perspective, are recommended for neighborhood gateway points.

- Identity signs should be simple, direct, and easy to identify.
- A skilled professional graphic designer should be consulted when generating the design for the trail logo.
- Be consistent with the logo throughout the trail by using it as a stand-alone sign, on other signage, or incorporating it into trail furnishings, such as benches or waste receptacles.

- The Ice Age Tonquin Trail logo will be designed as a separate effort following Master Plan completion.

Directional/Wayfinding Signs

The purpose of a directional sign is to direct trail users and motorists to the location of trailheads and other nearby destinations, provide incremental distances along the trail, and illustrate overall maps of the regional trail system to help orient visitors.

- Kiosks are a great facility for directional signage by providing a wealth of information at once, including other trail opportunities, regional maps, or local/seasonal events occurring along the trail.
- Locate trail access signs with overall trail maps at trail access points to help users entering the trail determine their next destination.
- Locate "you are here" signs at intervals along the trail to help users identify their destination or orient their position.
- The trail should be signed seamlessly with information on how to connect to other alternative transportation routes, such as bicycle routes to neighboring jurisdictions, other trails, historic and/or cultural walking tours, and where ever possible, local transit systems.
- Locate mile markers 3 feet from the edge of the paved trail surface and at one-mile intervals beginning at the northern and southern ends of the trail network to help users determine their location and the distance to their destination.

Various examples of wayfinding/directional signs for the trail include kiosks, regional maps, or mile markers.

Regulatory and Warning Signs

Regulatory and warning trail signs should conform to FHWA's 2009 MUTCD and AASHTO's *Guide for the Development of Bicycle Facilities*. Trail signage should also be coordinated with county as well as citywide networks. These signs typically address safety-related elements such as tight turns, intersection approaches and railroad crossings.

Educational Signs/Interpretive Elements

Educational and Interpretive signage provides trail users with information about the trail; native flora and fauna; history and culture; and significance of elements along the trail.

- There is a wide variety of interpretive signage styles and the amount/type of information they provide.
- Tie signage themes to the Ice Age Floods National Geologic Trail themes (see Appendix E).
- Consider the character of the trail and surrounding elements when designing educational signage.

Educational signage provides opportunities for gathering and learning about local environment.

- A skilled graphic designer should be used for sign design.
- The edge of the interpretive elements should maintain 3 feet clear from trail edge.

Possible interpretive sign themes for the Ice Age Tonquin Trail could include the following:

- Geology, natural history
- Wildlife, habitat
- Native plants, ecology
- Cultural History
- Glacial Lake Missoula Ice Age floods

Wayfinding signage along Tualatin's Hedges Creek Greenway.

Quick Response Codes

Quick Response (QR) Codes (images that Smartphone users can scan with free downloadable applications) can be added to any trail sign. QR codes typically send scanners to websites for more information including GPS coordinates, regional maps, agency websites, videos, additional interpretive information, and so forth.

An advantage of using the QR codes is that the information can easily be updated without replacing a sign, and more information can fit onto a website than your typical sign for those seeking a greater depth of knowledge.

Example of a QR Code

Environmentally Sensitive Trail Design

An overarching goal of the Ice Age Tonquin Trail design in natural resource areas is to site, design, build, and maintain the trail in a manner that minimizes, or if possible, avoids impacts to sensitive natural resource areas. Align the trail to avoid or minimize impacts to sensitive resources to the greatest extent practicable. When impacts are unavoidable, trail construction should leave the areas in better shape than the original condition. Low impact trail design standards include the following:

- Installing locally occurring native plant species between the trail and existing riparian vegetation. Plantings should consist of native species to increase the diversity and width of the riparian corridor, and may include species that discourage human access into the riparian area.
- Installing plant species that support local bird and wildlife habitat.
- Using permeable asphalt trail 10 feet wide with 2-foot shoulders in vegetated buffer areas to minimize stormwater runoff into nearby creeks.
- Minimizing creek crossings and improvement of existing barriers to wildlife passage.
- Including signs indicating the sensitive nature of all creek habitats and restricting entrance into the areas posted along the corridor fencing and on boardwalks.
- Avoiding cutting mature trees; replacing trees at a 1:1 ratio.
- Using vegetated buffers as a low impact water quality swale.
- Removing invasive plant species within the project limits.
- Seeking opportunities to align trails through degraded areas to minimize impact to higher quality areas and provide restoration.

Wetland, Stream and Creek Crossings (Typical)

Where the trail will be located near natural resource areas, including streams, wetlands, and sensitive wildlife habitat, special structures may need to be included in the design.

Different animals have different needs. Some species avoid edges and narrow corridors and prefer a landscape buffer for cover. Some species will cross bridges and boardwalks if planting is provided up to the edges of the structure. Other species are more reclusive and will prefer to use the stream or wetland to travel under the structure. It is important to provide connectivity by design through these areas.

Bridge design allows for wildlife to pass beneath it.

Trail Bridges

Shared use path bridges (also “bicycle/pedestrian bridges” or “footbridges”) are most often used to provide trail access over natural features such as streams and rivers, where a culvert is not an option. The type and size of bridges can vary widely depending on the trail type and specific site requirements (see Figure 8). Some bridges often used for shared use paths include suspension bridges, prefabricated span bridges and simple log bridges. When determining a bridge design for a shared use path, it is important to consider emergency and maintenance vehicle access.

- If a corridor already contains a bridge such as an abandoned rail bridge, an engineer should be consulted to assess the structural integrity before deciding to remove or reuse it.
- One advantage of bridges is that they typically span the floodway thereby not causing impacts to local flood levels.
- A trail bridge should support 6.25 tons; Information about the load-bearing capacity of bridges can be found in AASHTO’s *Standard Specifications for Highway Bridges*.
- There are many options in terms of high quality, prefabricated pedestrian bridges available. Prefabricated bridges are recommended because of their relative low cost, minimal disturbance to the project site, and usually, simple installation.
- All abutment design should be approved by a qualified structural engineer and all relevant permits should be filed.
- The bridge and path should be connected to the greatest extent possible to avoid creating a gap when settling of the ground occurs.

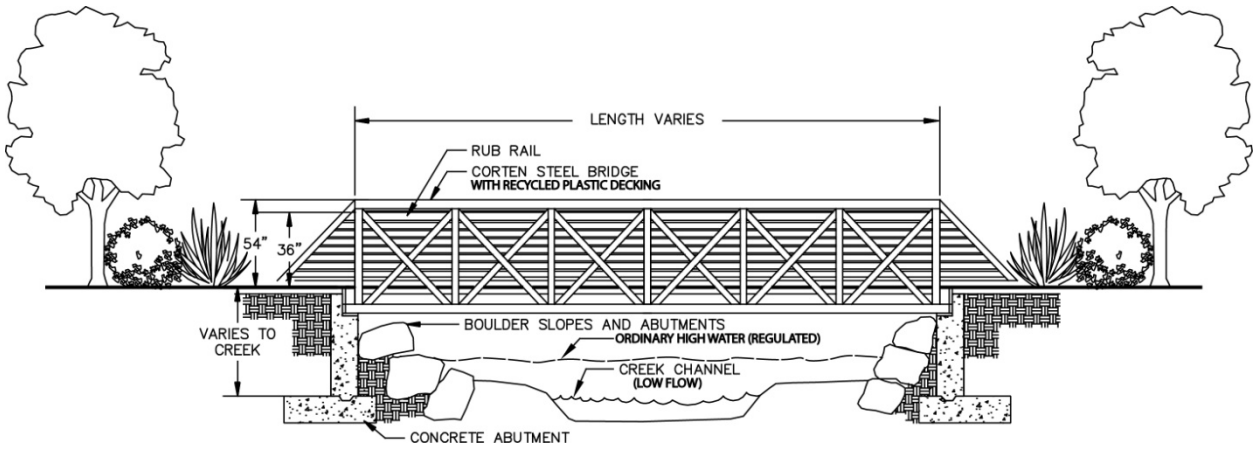


Figure 8 – Environmentally-friendly trail bridge design

Boardwalks

A boardwalk is typically required when crossing wetlands, other poorly drained areas or wildlife habitat. They are constructed of wood planks, recycled plastic material planks or steel grates (which offer light penetration below) that form the top layer of the boardwalk (see Figure 9). The recycled plastic material is preferred to wood because it lasts much longer, especially in wet conditions, although initial investment is greater. A variety of low-impact boardwalk support systems are also available that reduce the disturbance within wetland areas to the greatest extent possible.

Boardwalks are an appropriate trail design treatment in wetlands or sensitive wildlife habitat areas.

- The boardwalk should be 2 feet wider than the trail approaching it and have at minimum a 6-inch-high wheel rail at the edge.
- If a boardwalk is needed in an environmentally sensitive area, the clear width of the boardwalk may be reduced to 10 feet.
- If the height of the boardwalk exceeds 30 inches above the finish grade, railings will be required.
- A pedestrian railing should be 42 inches above the surface.
- A bicyclist railing should be 54 inches above the surface.

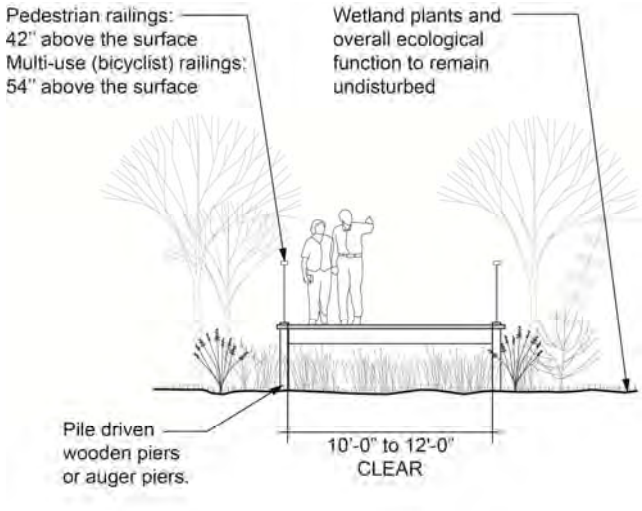


Figure 9 – Boardwalk design guidance

- The middle railing functions as a “rub rail” for bicyclists and should be located 33 inches and 36 inches above the surface.
- Provide a smooth transition between trail and boardwalk and flare the approach to minimize collision potential.

Culvert Improvements

There are some existing culverts in the trail corridor serving as partial or complete barriers to wildlife passage. Where trail crossings intersect with existing culverts at Edy Road, Roy Rogers Road, and Teton Avenue, culvert improvements will improve the function of the Cedar Creek and Hedges Creek Greenway corridors for wildlife passage.

In addition, a grade-separated crossing where the trail meets Oregon 99W is recommended. The existing culvert near the trail corridor at Oregon 99W contains Cedar Creek and is not adequate for a trail and creek. Replacement of the culvert would provide safety for trail users and improve the wildlife corridor function throughout that trail segment.

Cedar Creek Trail Segment – Trail Siting Guidelines

The Ice Age Tonquin Trail follows the same route as the Cedar Creek Trail in Sherwood. Design and construction for this trail segment will begin in the spring of 2013, and construction will be complete in 2015. The following are general goals regarding design of this segment:

- Consolidate and formalize the existing footpaths.
- Preserve the corridor’s width as much as possible.
- Preserve as many existing trees as possible.
- Minimize the amount of trail that is within the floodplain (except at pinch points, as necessary).
- Develop a trail on the floodplain’s edge to the greatest extent possible.
- Where crossing wetlands is unavoidable, use boardwalks.
- Mitigate and enhance the natural resource area that trail occupies as required by regulatory agencies.
- Design roads to accommodate trail users over creek crossings (for example, Edy Road and Roy Rogers Road).
- Maintain and, where possible, create wide uninterrupted “bands” of wildlife corridor.
- Consider on-street alignments that allow for efficient travel in areas with major constraints.
- Develop a trail that addresses the primary concerns of nearby property owners.
- Identify critical east/west and north/south connections to the trail and consolidate creek crossings where feasible.

- Provide environmental education and interpretation opportunities.

Hedges Creek Greenway Trail Segment – Trail Siting Guidelines

Another area that will require special attention as the project progresses further into design is the segment adjacent to Hedges Creek Greenway. The Hedges Creek Greenway Trail segment will require the following considerations during design:

- Increase the vegetated buffer and provide habitat areas through property acquisition from willing sellers.
- If possible, avoid locating the trail or boardwalk in the wetland and vegetated buffer.
- Purchase trail easement on the industrial properties north of The Wetlands Conservancy (TWC) where sellers are willing and when funding is available.
- To the extent possible, place the trail within the same easement as the buried sewer line through Hedges Creek Greenway; ensure trail design does not conflict with sewer maintenance.
- Improve degraded habitat and restore newly acquired habitat when funding is available.
- Preserve as many existing trees as possible.
- Improve wildlife crossings.
- Replace the culvert at Teton Road with a wildlife friendly crossing, when funding is available.
- Locate the trail to one side of the Greenway, unless unavoidable.
- Minimize impacts to the natural resource area as much as possible.
- Mitigate and enhance the natural resource area that trail occupies as required by regulatory agencies.
- Limit paved trails to the upland areas as much as possible and do not place them in wetland areas.
- Coordinate closely with landowners, regulatory agencies, and other stakeholders when designing the trail.
- Provide environmental education and interpretation opportunities.

Domesticated Animals on the Trail

Dogs

Local jurisdictions will decide whether to allow dogs on the trail, especially near natural areas. The Ice Age Tonquin Trail travels within close proximity to natural areas throughout its length, including the Graham Oaks Nature Park and Coffee Lake Creek wetlands in Wilsonville, Cedar Creek in Sherwood, and the Hedges Creek Greenway in Tualatin. Where dogs are permitted, it is recommended that they be on leash, as is the policy for the existing section of the Ice Age Tonquin Trail near Graham Oaks Nature Park.

Horses

The project team determined that horses were not a compatible use on the Ice Age Tonquin Trail based on feedback from the Oregon Equestrian Trails group. They indicated that riders desired more rural settings with longer stretches of trail uninterrupted by road crossings. In addition, Wilsonville and Tualatin do not have designated equestrian areas, and the trail in Sherwood will travel close to major roads (for example, Tonquin Road, Oregon Street) or along Cedar Creek, where steep slopes are prone to erosion. Census data also indicate a low number of households with horses in the study area.

Chapter 5: Implementation

Introduction

Given that the trail passes through multiple jurisdictions, the Ice Age Tonquin Trail partners (including the cities of Sherwood, Tualatin, and Wilsonville; Clackamas and Washington Counties; and Metro) will need to work together to implement this Master Plan. While built sections exist, the majority of the Ice Age Tonquin Trail has not yet been completed. Of the 22-mile long Ice Age Tonquin Trail, nearly 5 miles are complete, while approximately 17 miles remain to be built. The trail will be constructed in phases by the jurisdictions (cities and counties) through which the trail passes, as funding becomes available. Jurisdictions will adopt the trail into their respective plans and policy documents (for example, concept plans, transportation system plans, comprehensive plans, and zoning codes). The three cities will be the primary jurisdictions responsible for operations and maintenance, while county maintenance will be less prominent and achieved through agreements with the cities. Property for the Ice Age Tonquin Trail will be acquired by Metro and local jurisdictions.

The following sections describe the jurisdictions' responsibilities; actions needed to implement the trail; land use and regulatory requirements; potential funding sources; funding strategies and phasing; and cost estimates.

Responsibilities and Partnerships

Implementation Actions

Table 21 presents a summary of actions needed to implement the Ice Age Tonquin Trail. The table is organized based on the segments illustrated on Map 26. In a few instances, a segment is listed more than once in the table to explain different areas of that particular segment. Specific information includes the lead implementing jurisdiction for each trail segment (including construction, operations, and maintenance); the current funding and completion status; and a summary of known issues. Later sections of this Master Plan discuss cost, maintenance, and operations in greater detail.

Cooperation

Most of the implementation actions described in Table 21 require one or more partners to work together, thereby making ongoing coordination critical for success. One potential method to ensure this coordination, which has proven successful elsewhere in the region, consists of partners entering into a Declaration of Cooperation agreement. Appendix F provides a sample Declaration of Cooperation agreement.

This agreement would represent a means for focusing the partners' shared goals and call for their voluntary efforts to seek opportunities to leverage funding and other resources to implement the Master Plan. One of the most important tasks will be to ensure that the trail alignment is incorporated into key local planning efforts such as concept plans and transportation system plans.

Table 21 - Ice Age Tonquin Trail Implementation

	Segment description	Who will construct?	What stages are funded?	Who will operate/maintain?	Unresolved issues and why?	Needed action	Who is responsible for actions?
1	Willamette River to immediately south of Wilsonville Road	Wilsonville	None	Morey's Landing Home Owners Association will maintain the portion of the trail in that area. The city of Wilsonville will maintain the rest of the trail.	Trail design uncertain along Boones Ferry Rd. and other future roads in this segment. Need to determine whether trail will connect from Boones Ferry Road to 5th St. or Bailey St. Trail easements or right-of-way needed.	Coordinate trail design/development with future improvements to Boones Ferry Rd. and other potential new roads in this segment. Fund and construct improvements.	Wilsonville
2	Immediately south of Wilsonville Road to immediately south of Costa Circle	Constructed	Constructed	Metro	None	None	None
3	Intersection of trail at north end of Graham Oaks Nature Park with south side of Costa Circle to immediately north of Boeckman Road (includes both trail segments in Villebois)	Wilsonville	Private developers will fund.	Wilsonville	Trail right-of-way needed as parks develop.	Implement Villebois Master Plan with private development partners.	Wilsonville
4	Immediately north of Boeckman Road to immediately north of Grahams Ferry Road	Undetermined – Metro owns this segment; the northern portion of segment is located in unincorporated Clackamas County.	None	Undetermined – Metro owns this segment; the northern portion of segment is located in unincorporated Clackamas County.	No trail provider in unincorporated county.	Include trail in Clackamas County's Transportation System Plan (TSP) update and amend Clackamas County Bike/Pedestrian plan to include trail. Update trail description in Metro's 2035 Regional Transportation Plan (RTP) including the Financially Constrained list. Clackamas County, Wilsonville and Metro identify strategy for trail development and operation/maintenance.	Clackamas County, Wilsonville and Metro
5	Immediately north of Grahams Ferry Road to southern terminus of Morgan Road at Metro Natural Area	Undetermined – Small area immediately north of Grahams Ferry Rd. located in unincorporated Clackamas County, and remainder located in unincorporated Washington County. Metro owns northern portion of this segment.	None	Undetermined – Small area immediately north of Grahams Ferry Rd. located in unincorporated Clackamas County, and remainder located in unincorporated Washington County. Metro owns northern portion of this segment, but not sure who will maintain.	No trail provider in unincorporated county. Basalt Creek and West Railroad concept planning will determine how this area will be annexed. After annexations, jurisdiction can be identified to develop/maintain trail. Need to acquire land for trail from 3 land owners in this area.	Include trail in Clackamas and Washington County TSP updates. Update trail description in Metro's 2035 RTP, including the Financially Constrained list. Incorporate trail as component of Basalt Creek and West Railroad concept plans. Wilsonville, Clackamas County, Metro, Washington County identify strategy for trail development and operation/maintenance. Prioritize Metro bond funds for trail acquisition.	Wilsonville, Clackamas County, Metro, Washington County

Table 21 - Ice Age Tonquin Trail Implementation, cont'd

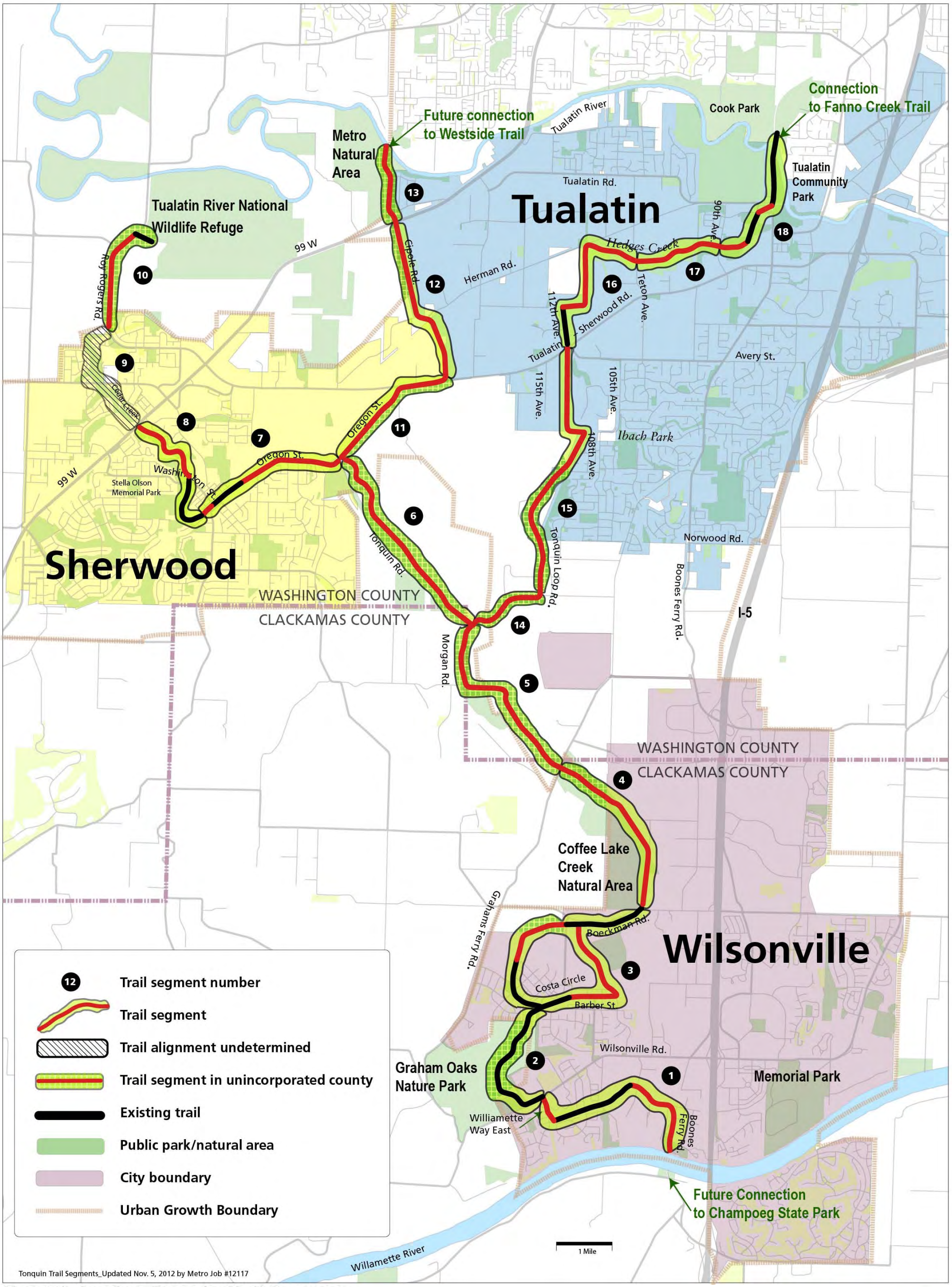
	Segment description	Who will construct?	What stages are funded?	Who will operate/maintain?	Unresolved issues and why?	Needed action	Who is responsible for actions?
5	Southern terminus of Morgan Road at Metro Natural Area to immediately north of Morgan Rd./Tounquin Rd. intersection	Undetermined – outside urban growth boundary in unincorporated Clackamas County.	None	Undetermined – outside urban growth boundary in unincorporated Clackamas County.	No trail provider in unincorporated county. Basalt Creek concept planning will determine future annexations and then jurisdiction can be identified to develop and maintain trail. Quarry property in appeal process. If appeal holds, condition requiring trail will no longer apply. Need to acquire land from 2-3 land owners.	Include trail in Clackamas County TSP update, and amend Clackamas County Bike/Pedestrian plan to include trail. Incorporate trail as component of Basalt Creek and West Railroad concept plans. Wilsonville, Clackamas County, Metro, Washington County identify strategy for trail development and operation/maintenance. Prioritize Metro bond funds for trail acquisition.	Wilsonville, Tualatin, Clackamas County, Washington County, Metro
6	Immediately west of Tonquin Road/Morgan Road intersection to intersection of Tonquin Road and Oregon Street (including Tonquin Rd./Oregon St. intersection)	Undetermined (segment located in unincorporated Washington County)	None	Undetermined (segment located in unincorporated Washington County).	Need to acquire land for trail from 5-6 land owners on east side of Tonquin Road. Washington County TSP recommends widening Tonquin Road in this area. If county moves forward with this plan, there may be room to construct trail within right-of-way on west side of Tonquin Rd. Sherwood's approved Tonquin Employment Area concept plan overlaps with northern portion of this segment; plan implementation needs to address the trail.	Prioritize Metro bond funds for trail acquisition. Trail partners should coordinate with Washington County on county's plans to improve Tonquin Rd. but move forward with acquisition of land on east side of Tonquin Road. Trail partners need to coordinate with Sherwood to implement trail in Tonquin Employment Area. Update trail description in Metro's 2035 RTP, including the Financially Constrained list.	Metro, Sherwood, Washington County, Tualatin, Wilsonville, Clackamas County
7	Immediately west of Tonquin Road/Oregon Street intersection to immediately north of Park Street (downtown Sherwood)	Sherwood	To be determined in coordination with Metro and ODOT.	Sherwood	Sherwood will work with Metro and ODOT to determine if 2014-15 Regional Flex Funds award for Cedar Creek trail will include design and construction of this segment. Need to acquire easement/land for trail from 2 land owners.	Refine cost estimates for Cedar Creek trail project to see if the award amount will cover proposed improvements. Sherwood and Metro to determine acquisition strategy.	Sherwood, Metro, ODOT
8	Immediately north of Park Street to immediately south of Hwy 99	Sherwood	Design and construct.	Sherwood	None	Sherwood will design and construct this segment by 2016.	Sherwood with involvement of Metro and partners as needed.
9	Immediately south of Highway 99 to Roy Rogers Road, including Roy Rogers intersection)	Sherwood	To be determined in coordination with Metro and ODOT.	Sherwood	Sherwood to work with Metro and ODOT to determine scope of work for this segment pursuant to 2014-15 Regional Flex Funds award for Cedar Creek trail. Hwy 99 undercrossing not included in 2014-15 Regional Flex Funds award.	Public involvement needed to determine alignment in this area. Sherwood may need to acquire land for trail. Sherwood will apply in 2012 for ODOT/ STIP Enhance funds to design/construct Hwy 99 undercrossing.	Sherwood Sherwood, ODOT Sherwood, ODOT with support of Metro and partners.
10	Roy Rogers Road north to Tualatin River National Wildlife Refuge trailhead	Sherwood or Washington County	None	Sherwood may consider role in owning/building/operating and maintaining once the Cedar Creek portion of the trail is built.	Segment is in unincorporated Washington County, no obvious trail provider. Need to acquire land from one land owner.	Sherwood and Washington County determine ownership and O&M agreements.	Sherwood, Washington County
11	Immediately east of Tonquin Road/Oregon	Sherwood	None	Sherwood	Funding not identified for design/construction	Sherwood to identify funding strategy.	City of Sherwood

Table 21 - Ice Age Tonquin Trail Implementation, cont'd

	Segment description	Who will construct?	What stages are funded?	Who will operate/maintain?	Unresolved issues and why?	Needed action	Who is responsible for actions?
	Street intersection to immediately north of Tualatin-Sherwood Road.				Need to acquire land from 8 land owners between Tonquin Rd. and Oregon St.	Include trail in Sherwood's TSP update. Update trail description in Metro's 2035 RTP, including the Financially Constrained list. Sherwood to acquire trail.	
11	Immediately north of Tualatin Sherwood Road to immediately west of Cipole Road	Sherwood	None	Sherwood	Trail is recommended on north side of road in Right of Way. Funding not identified for design/construction	Include trail in Sherwood and Washington County TSP updates. Update trail description in Metro's 2035 RTP, including the Financially Constrained list. Sherwood to identify funding strategy	Sherwood, Tualatin, Washington County, Metro
12	Immediately west of Cipole Road to immediately north of Highway 99	Undetermined. Trail route is in Sherwood up to railroad; north of the railroad portions of the trail are outside urban growth boundary in unincorporated Washington County. Construction likely to occur by special agreement between Sherwood and Tualatin.	None	Operation and maintenance likely to occur by special agreement between Sherwood and Tualatin.	Part of segment is in Sherwood, part is outside the urban growth boundary in unincorporated Washington County. Need to work identify who will acquire/develop/operate/maintain. Need to acquire land from 5 land owners on west side of road.	Include trail in Tualatin and Sherwood TSP updates. Update trail description in Metro's 2035 RTP, including the Financially Constrained list. Sherwood, Tualatin and Washington County need to develop strategy for trail acquisition/development.	Sherwood, Tualatin, Washington County, Metro
13	Immediately north of Highway 99 to south side of Tualatin River.	Trail crosses Metro land north of Pacific Drive to Tualatin River. Tualatin may develop trail in this area. Tualatin and King City likely partners to develop bridge over Tualatin River at this location.	None	Metro owns portion north of Pacific Drive; Tualatin may operate/maintain trail in this area.	Need to identify who will build / maintain trail and bridge.	Westside Trail master planning process (ongoing) will determine responsible party to build/maintain trail and bridge.	Tualatin, Metro, King City
14	Immediately east of Tonquin Road/Morgan Road intersection to intersection of Tonquin Road and Tonquin Loop (including Tonquin Road/Tonquin Loop intersection)	Tualatin or Wilsonville. Future annexations in this area will determine which jurisdiction will construct.	None	Tualatin or Wilsonville. Future annexations in this area will determine who will operate / maintain trail.	Basalt Creek concept planning efforts are underway. Trail alignment in this area subject to change based on that work. Easements or right-of-way will be needed for the trail.	Trail partners to coordinate with Washington County during development of Basalt Creek Concept Plan to determine whether to integrate the trail in to the east-west arterial planned just south of Tonquin Rd., and/or as improvements are made along Tonquin Rd. in this area, including how trail relates to intersection of 124th Ave. extension and Tonquin Road. Acquire land for trail right-of-way when land acquired for east-west arterial between Morgan Road and Tonquin Rd./Tonquin Loop Rd. intersection.	Tualatin, Metro, Washington County, Wilsonville, Clackamas County, Sherwood
15	Immediately north of Tonquin Road/Tonquin Loop intersection to immediately south of Tualatin-Sherwood Road	Tualatin (once it is annexed into the city).	None	Tualatin (once it is annexed into the City).	S.W. concept plan area may not develop for years, delaying trail in this area. Every effort should be made to avoid developing disconnected segments of trail. Need to acquire land for trail from 9 landowners in this segment.	Include trail in Tualatin TSP update. Update trail description in Metro's 2035 RTP, including the Financially Constrained list. Tualatin and Metro to develop strategy for trail in this area. Include trail in Basalt Creek Concept Plan recommendations. Prioritize Metro bond funds for trail acquisition.	Tualatin, Metro, Washington County

Table 21 - Ice Age Tonquin Trail Implementation, cont'd

	Segment description	Who will construct?	What stages are funded?	Who will operate/maintain?	Unresolved issues and why?	Needed action	Who is responsible for actions?
16	Immediately south of Tualatin-Sherwood Road to immediately east of Teton Avenue	Tualatin	None	Tualatin	Need funding to design and construct trail. Need to acquire land for trail from 8 land owners.	Include trail in Tualatin TSP update. Update trail description in Metro's 2035 RTP, including the Financially Constrained list. Tualatin to identify funding strategy. Prioritize Metro bond funds for trail acquisition.	Tualatin, Washington County , Metro
17	Immediately east of Teton Avenue to immediately east of 90th Avenue	Tualatin	None	Tualatin	Need funding to design and construct trail. Need to acquire land for trail from 3 land owners.	Tualatin to identify funding strategy. Include in Tualatin TSP update. Update trail description in Metro's 2035 RTP, including the Financially Constrained list. Prioritize Metro bond funds for trail acquisition.	Tualatin, Metro
18	Immediately east of 90th Avenue to Tualatin River	Tualatin Northern section in Tualatin Community Park is complete.	None	Tualatin Northern section in Tualatin Community Park is complete.	May need to acquire land for trail from 2 owners.	Prioritize Metro bond funds for trail acquisition. Include in Tualatin TSP update. Update trail description in Metro's 2035 RTP, including the Financially Constrained list.	Tualatin, Metro



Map 26: Ice Age Tonquin Trail Segments

Ice Age Tonquin Trail Master Plan

Source: Metro Data Resource Center

Land Use Approvals and Regulatory Requirements

Though the Master Plan has not identified any regulatory fatal flaws, a detailed analysis of required permits will need to be developed by jurisdictions as the trail is implemented. Local jurisdictions will need to obtain required permits and regulatory approvals. Table 22 provides an overview of permits that may be required. Additional permits and approvals may be identified during the design phase.

Table 22 - Potential Permits, Approvals and Coordination Needed

Agency	Potential Permit, Approval or Coordination
Federal	
Federal Highway Administration	• National Environmental Policy Act (NEPA) Approval • Executive Order 11988 Floodplain Management Compliance • Executive Order 11990 Protection of Wetlands Compliance • Executive Order 12898 Environmental Justice Compliance
National Marine Fisheries	• Section 7 of the Endangered Species Act Consultation • Magnuson-Stevens Fishery Conservation and Management Act Consultation • Fish and Wildlife Coordination Act Coordination
United States Fish and Wildlife Service	• Section 7 of the Endangered Species Act Consultation • Migratory Bird Treaty Act Compliance • Fish and Wildlife Coordination Act Compliance
U.S. Army Corps of Engineers	• Section 404 Permit: Clean Water Act of 1977 Compliance
State	
Oregon State Historic Preservation Office	• Section 106 of the National Historic Preservation Act of 1966 Consultation
Oregon Department of Environmental Quality	• Clean Water Act Section 401: Water Quality Certification • Clean Water Act Section 404 Permit Review • National Pollutant Discharge Elimination System (NPDES) Program Construction Stormwater Discharge Permit
Oregon Department of State Lands	• Wetland Delineation Clearance • Removal-Fill Permit or General Authorization • Pre-Construction Assessment Permit for In-water Work
Oregon Department of Fish and Wildlife	• Oregon Fish Passage Law Compliance • Oregon Endangered Species Act Compliance
Oregon Department of Transportation	Permit to occupy or Perform Operations upon a state highway
Local	
Washington County, Clackamas County, Wilsonville, Tualatin, Sherwood	• Floodplain Development Permits • Land Use Permits (Conditional Use, Development, and/or Environmental Permits)
Clean Water Services	• Environmental Review, Development Review, Stormwater, and/or Erosion Control Permit

Cost Estimates, Phasing, and Funding

Cost Estimates

Table 23 summarizes cost estimates by trail segment and describes key general improvements for each segment, while Map 26 illustrates the corresponding trail segments. Specific improvements are shown on the tile maps (and described in Tables 2 through 20) in Chapter 3. The Ice Age Tonquin Trail Segments map and the tile maps do not share corresponding boundaries because the cost estimates needed to be divided at logical breaks along the trail corridor to aid in funding and implementation efforts.

The cost estimates represent planning-level construction and easement/acquisition estimates, and are intended to provide local jurisdictions an order-of-magnitude opinion, so that further steps can be taken (including soliciting funding; preliminary and final design; and so forth). A planning-level range of potential costs is appropriate given a level of uncertainty in the design at this point in the process. Many factors can affect final construction costs, including the following:

- Revisions to facility design as required by local, state, and federal agencies, and/or in response to public input
- More detailed understanding of constraints such as drainage and utilities
- Fluctuations in commodity and labor prices during the design and permitting phases
- Selected construction materials

As each trail segment progresses through preliminary, semi-final, and final design phases, these uncertainties will begin to diminish. With each round of refinement, the range of expected construction costs will become more accurately known. The following should be noted regarding cost estimates:

- The cost estimates were based on input from local and regional agency staff, and on recent experience in comparable communities
- A fully burdened cost estimate was developed for each trail segment by increasing the construction cost by multipliers to account for engineering, design, construction administration, and mobilization; the likelihood of receiving federal funding to develop the trail; and unexpected contingency costs.
- Cost estimates include the cost to acquire land and trail easements, as needed, at fair market value
- Costs are provided in 2012 dollars, inflation factors must be applied
- Cost estimates do not include information for built portions of the trail

Appendix D provides a more detailed breakdown of the cost estimates by trail segment.

Table 23 - Ice Age Tonquin Trail Estimated Costs

Segment #	Approx. Length (miles)	Segment Beginning and Endpoint Description	General Improvements	Property Easement or Acquisition Needed?	Estimated Cost
1	1.48	Willamette River to immediately south of Wilsonville Road	Bike lanes; sidewalks; new paved path; creek bridge; road crossings; fencing; signage	Yes	$2,440,000
2	1.13	Immediately south of Wilsonville Road to immediately south of Costa Circle	Signage	No	$2,000
3	2.83	Intersection of trail at north end of Graham Oaks Nature Park with south side of Costa Circle to immediately north of Boeckman Road (includes both trail segments in Villebois)	Widen existing sidewalks; new paved path; road crossings; signage	Yes	$2,700,000
4	1.36	Immediately north of Boeckman Road to immediately north of Grahams Ferry Road	Boardwalk; new paved path; road crossings; creek bridge; fencing; signage; wetland mitigation	No	$9,079,000
5	1.52	Immediately north of Grahams Ferry Road to intersection of Morgan Road and Tonquin Road (including Tonquin/Morgan intersection)	New paved path; creek bridge; road crossings; trailhead; handrail/retaining wall; fencing; signage	Yes	$7,483,000
6	1.49	Immediately west of Tonquin Road/Morgan Road intersection to intersection of Tonquin Road and Oregon Street (including Tonquin/Oregon intersection)	New paved path; road crossing; fencing; signage	Yes	$7,005,000
7	1.14	Immediately west of Tonquin Road/Oregon Street intersection to immediately north of Park Street (downtown Sherwood)	Widen existing sidewalks; new paved path; road crossings; fencing; signage	Yes	$1,770,000
8	1.20	Immediately north of Park Street (downtown Sherwood) to immediately south of Pacific Highway/Oregon 99W	Boardwalk; new paved path; retaining wall; signage; wetland mitigation	No	$4,677,000
9	1.05	Immediately south of Pacific Highway/Oregon 99W to Roy Rogers Road (including Roy Rogers intersection)	Boardwalk; Oregon 99W undercrossing; new paved path; road crossing; signalized road crossing; handrail/retaining wall; fencing; signage; wetland mitigation	Possibly	$25,400,000
10	0.81	Roy Rogers Road north to Tualatin River National Wildlife Refuge trailhead	Widen existing sidewalks; new paved path; creek bridge; trailhead; handrail/retaining wall; signage	Yes	$4,216,000

Segment #	Approx. Length (miles)	Segment Beginning and Endpoint Description	General Improvements	Property Easement or Acquisition Needed?	Estimated Cost
11	1.00	Immediately east of Tonquin Road/Oregon Street intersection to immediately west of Cipole Road	New paved path; road crossing; hand rail/retaining wall; fencing; signage	Yes	$2,738,000
12	1.27	Immediately west of Cipole Road to immediately north of Pacific Highway/Oregon 99W	Widen existing sidewalk; new paved path; creek bridge; road crossing; Oregon 99W overcrossing; fencing; signage	Yes	$11,697,000
13	0.67	Immediately north of Pacific Highway/Oregon 99W to south side of Tualatin River	New paved path; road crossing; trailhead; signage	Yes	$2,917,000
14	0.95	Immediately east of Tonquin Road/Morgan Road intersection to intersection of Tonquin Road and Tonquin Loop (including Tonquin Road/Tonquin Loop intersection)	New paved path; road crossing; signalized road crossing; handrail/retaining wall; fencing; signage	Yes	$4,501,000
15	1.53	Immediately north of Tonquin Road/Tonquin Loop intersection to immediately south of Tualatin-Sherwood Road	New paved path; road crossing; creek crossing; trailhead; signage	Yes	$5,702,000
16	1.26	Immediately south of Tualatin-Sherwood Road to immediately east of Teton Avenue	Boardwalk; paved path; road crossings; trailhead; signage; wetland mitigation	Yes	$7,060,000
17	0.66	Immediately east of Teton Avenue to immediately east of 90th Avenue	Boardwalk; paved path; road crossing; handrail/retaining wall; signage; wetland mitigation	Yes	$7,357,000
18	1.01	Immediately east of 90th Avenue to Tualatin River	Widen existing sidewalk; new sidewalk; new paved path; handrail/retaining wall; signage	Yes	$1,925,000
Subtotal (all segments combined)					*$108,669,000*
Property easements (all segments combined)					*$5,792,000*
Total estimated costs (all segments combined)					***$114,461,000***

Cost Qualifications:

- Trail/roadway crossings are at-grade and unsignalized unless otherwise noted.
- Shared use path surface consists of asphalt, permeable asphalt, or concrete depending on location.
- Shared use paths and boardwalks are assumed to measure 12 feet in width.
- Table does not include information for built portions of the trail.

Phasing

Regional trail projects can take years to grow from concept to reality. As with the Ice Age Tonquin Trail, such projects are often quite complex, involving many landowners and crossing multiple jurisdictions. The Ice Age Tonquin Trail will be completed in phases as funding becomes available for design and construction, and as trail easements are secured. It is important to avoid sections of the trail being built that do not connect to anything. This is a phenomenon that often results when developers are required to make public improvements as a condition of development approval (when development occurs incrementally over a long period of time). The following sections present a proposed phasing plan for implementing the trail. References to segment numbers in the following sections pertain to the segments shown on Map 26.

Phase 1 – Present to 2015

Cedar Creek Corridor (Portions of Segments 7 through 10)
The City of Sherwood secured funding for design and construction of approximately 1.5 miles of the Cedar Creek corridor section of the Ice Age Tonquin Trail. The City may need to purchase easements prior to design and construction. Construction is expected to be complete by 2015. The City, in partnership with Metro, will submit a funding application to ODOT in winter 2013 for design and construction of a pedestrian/bicycle/wildlife undercrossing of Oregon 99W. If awarded, the project will link Sherwood residents who live close to Cedar Creek to downtown Sherwood.

Purchase Trail Easements (Portions of Segments 1 through 5, and Portions of Segments 15 through 18)

- The city of Wilsonville has completed approximately 50 percent of the Ice Age Tonquin Trail passing through its jurisdiction; in a few remaining areas, easements are needed to complete the remaining trail segments.

- Secure land for the trail in the unincorporated area between Grahams Ferry Road and Morgan Road.

- Secure trail easements in the Hedges Creek Greenway area of Tualatin.

Metro and partner jurisdictions should develop an acquisition strategy for land to be acquired in this implementation phase. Metro follows “willing seller” guidelines, meaning that eminent domain, or property condemnation, is never used to acquire land. Metro’s 2006 Open Spaces, Parks and Trails bond measure provides acquisition guidance that must be followed when acquiring land for the trail.

On-Going Concept Planning, Transportation System Planning, and Other Land Use Planning (All Trail Segments)
The Ice Age Tonquin Trail needs to be incorporated into ongoing concept planning, updates to transportation system plans and other relevant transportation and land use planning processes and decisions. In particular, there are three projects being planned in a corridor between the Tonquin Road/Morgan Road intersection and the Tonquin Road/Tonquin Loop intersection that directly overlap with the recommended trail alignment. These projects, which are shown on Map 27, include the following:

- The design for how the 124th Avenue Extension will tie into Tonquin Road

- The design for the westernmost portion of the new east-west connector (that will extend the 124th Avenue Extension project east toward Interstate 5)

- Improvements to Tonquin Road

Project partners need to work closely with Washington County to be sure that trail design is a component of these projects and that trail right-of-way is preserved for future development in this area. In addition, Metro's *2035 Regional Transportation Plan* (especially the Financially Constrained project list in that plan) needs to be updated to include the Ice Age Tonquin Trail recommended alignment.

Partners Apply for Funding in Fall 2012/Winter 2013 (Portions of Segments 1 and 3, and Portions of Segments 16 through 18)
Three programs that provide funding for bicycle and pedestrian improvements are soliciting applications in fall 2012/winter 2013. It is highly recommended that project partners pursue these funding opportunities to implement trail segments that are within their respective jurisdictions. The Hedges Creek Greenway should be a high priority.

Phase 2 – 2015 to 2020

The concept planning and transportation system plan updates occurring in Phase 1 will inform the actions needed for trail development in Phase 2. Likely actions include securing funding; right-of-way acquisition; and trail design and construction in vicinity of the Coffee Lake Creek Natural Area, Morgan Road, Tonquin Road, Tonquin Loop, McCamant Road, and Oregon Street. Where necessary, agreements should be established between partner jurisdictions that will be involved in trail development. Other Phase 2 actions include the following:

- Implementing the trail in concept planning areas (portions of Segments 4, 5, 6, 14, 11, and 15)

- Acquiring easements along Roy Rogers Road (Segment 10), and subsequently constructing the trail

- Implementing trail segments along Cipole Road (Segments 12 and 13)

Phase 3 – 2020 to 2030

Phase 3 consists of acquiring easements, designing, and completing Ice Age Tonquin Trail gaps where needed.

Map 27: Trail alignment in relation to land use planning efforts

Source: Metro Data Resource Center

Potential Funding Sources

The Ice Age Tonquin Trail received special dedicated funding for property acquisition from Metro's 2006 Open Spaces, Parks and Trails bond measure. Metro's bond funds can only be used for lands that were prioritized in the 2007 Refinement Plan for the Tonquin Geologic Area. It is highly unlikely that the Metro funds will be adequate to purchase all land that is needed for the trail, and local jurisdictions will need to purchase some of those lands.

The National Park Service is responsible for preparing the management plan for the recently created Ice Age Floods National Geologic Trail (which may overlap with all or portions of the Ice Age Tonquin Trail). The act of Congress that created the trail in 2009 mentions a fund of $12 million for grants to implement the trail, but that funding has not yet been appropriated. The local chapter of the National Ice Age Floods Institute is an official partner with the National Park Service to implementation the project. Project partners should stay in close communication with the Institute to learn about future funding opportunities, especially for interpretive signage that includes themes related to the Ice Age Floods.

Table 24 provides a list of other potential funding sources that should be sought for Ice Age Tonquin Trail implementation.

Table 24 – Potential Funding Sources

Funding Source	Funding Cycle
Oregon Department of Transportation – Statewide Transportation Improvement Program – Enhance and Fix It	Annual cycle; applications for the 2015-2018 funding cycle due November 27, 2012
Oregon Department of Transportation – Flexible Funds	Annual cycle; applications due late fall
Oregon Department of Transportation – Discretionary Funds	Annual cycle
Oregon Department of Transportation – Gas tax funds for bike/ped improvements in the public right-of-way	Annual cycle
Oregon Department of Transportation – Transportation Enhancement/Oregon Bicycle and Pedestrian Projects	Application due December 13, 2012 (only for applicants who were invited to apply after submitting a successful Notice of Intent)
Oregon State Parks – Recreational Trails Grants	Annual cycle
Oregon State Parks – Land and Water Conservation Fund (LWCF)	Biannual funding cycle
Oregon State Parks – Measure 66 lottery funds for parks and trails	Biannual funding cycle
Oregon State Parks – County Opportunity Grant Program	Annual funding cycle
Governor's Watershed Enhancement Board	Annual cycle
Metro – Metropolitan Transportation Improvement Program – Regional Flexible Funds	Annual cycle; applications due February 2013

Chapter 6: Maintenance, Management, and Operations

Proposed Management Responsibilities

Trail segments traveling through incorporated areas of Wilsonville, Sherwood, and Tualatin will be managed and maintained by those jurisdictions, except where other arrangements exist (for example, Morey's Landing in Wilsonville). A critical next step in the trail implementation process is to clarify and formalize partner responsibilities for segments passing through unincorporated Clackamas and Washington Counties, which do not have an identified agency or jurisdiction to build, manage or maintain the trail. It is expected that these areas will eventually be annexed by the three city jurisdictions, but that may not happen before funding is identified to construct the trail. The solution for these segments may involve one of several approaches discussed in Table 21 in the Implementation chapter.

Trail Maintenance

Consistent management practices between multiple jurisdictions managing the trail will be critical to create a seamless and safe experience for the trail users. Among the factors determining maintenance requirements are the existing landscape character and the quality of capital improvements. The Ice Age Tonquin Trail travels through a diverse landscape including rural and urban settings, creek corridors, natural areas, on-street sections, and basalt substrate among others.

Maintenance activities typically include trail surface repair; landscape maintenance; trailhead and other amenities upkeep; sign replacement; mowing; litter removal; and painting. Successful maintenance programs involve a high level of citizen participation, and coordination of volunteer efforts will be important given the multiple jurisdictions through which the Ice Age Tonquin Trail passes. Routine maintenance on a year-round basis will not only improve trail safety, but will also prolong the life of the trail. The benefits of a good maintenance program are far-reaching. These benefits include the following items:

- A high standard of maintenance is an effective advertisement to promote the trail as a regional recreation resource.
- Good maintenance can be an effective deterrent to vandalism, litter, and encroachments.
- Good maintenance can make enforcement of regulations on the trail more efficient. Local clubs and interest groups will take pride in "their" trail and be more apt to assist in protection of the trail.
- A proactive maintenance policy will help improve safety along the trail.

On-going trail maintenance will likely include some, if not all, of the activities described in the following sections.

Vegetation

In general, visibility between plantings at trailside should be maintained to avoid creating the feeling of an enclosed space. This will give trail users good, clear views of their surroundings, thereby enhancing

the aesthetic experience. Understory vegetation near the trail should not be allowed to grow higher than 36 inches. Tree species selection and placement should minimize vegetative litter on the trail and root uplifting of pavement. Vertical clearance along the trail should be periodically checked, and any overhanging branches should be pruned to a minimum vertical clearance of 10 feet.

Trail corridors can act as highways to transport seeds of invasive plants brought in by trail users (for example, from shoes or bike tires) and the wind. Invasive plants along the corridor should be monitored and controlled on a regular basis to avoid the spread of invasive plants.

Surfacing

Permeable asphalt is the preferred trail surface material, though additional maintenance may be needed (for example, a deeper trail section, a fabric barrier to deter weed growth, removal of adjacent trees to avoid root damage to trail). Asphalt and concrete are also acceptable surfaces. A combination of all three of these trail surfaces will likely be used by the individual jurisdictions developing the trail.

Asphalt has a shorter life span than concrete and needs more maintenance over its lifetime. Cracks, ruts, and water damage to both surfaces will need periodic repair. The trail surface should be kept free of debris, especially broken glass and other sharp objects; loose gravel; leaves; and stray branches. Trail surfaces should be swept periodically. Soft shoulders should be well maintained to maximize their usability.

Where drainage problems exist along the trail, ditches and drainage structures should be kept clear of debris to prevent washouts along the trail and maintain positive drainage flow. Checks for erosion along the trail should be made during the wet season and immediately after any storm that brings flooding to the local area.

Pest and Vegetation Management

Some basic measures should be taken to protect the trail investment. This includes a bi-annual mowing along both sides of the trail to prevent invasion of plants into the gravel shoulders and pavement area. The recommended time of year for mowing is fall and spring. Vegetation management in boardwalk areas typically occurs bi-annually and after major flooding events.

Wherever possible, vegetation control should be accomplished by mechanical means or hand labor. Some species may require spot application of state-approved herbicide. Metro's *Integrated Pest Management Policies* (recently updated) should be followed when using herbicides. If local jurisdictions already have an approved Integrated Pest Management Plan, they can be used instead.

Litter and Illegal Dumping

Staff from responsible jurisdictions or volunteers should remove litter along the trail. Litter receptacles should be placed at access points such as trailheads by the managing agencies.

Illegal dumping should be controlled by vehicle barriers, regulatory signage, and enforcement to the greatest extent possible. When illegal dumping does occur, it should be removed immediately to discourage further dumping. Neighborhood volunteers, friends groups, alternative community service crews, and inmate labor should be considered in addition to maintenance staff.

Signage

It is recommended that Metro's Intertwine signage guidelines be used by all jurisdictions so that a consistent and uniform signage system is installed throughout the Ice Age Tonquin Trail corridor. The Intertwine signage materials are sturdy, vandal-proof, low maintenance, and relatively inexpensive to create and replace.

Since the Ice Age Tonquin Trail will be completed in phases, it should be stated clearly at all trail accesses and in any printed /electronic material that portions of the trail are not yet fully developed or open to the public, and that users must exercise the necessary caution when using the trail.

Flooding

Portions of the trail in the Cedar Creek and Hedges Creek Greenway areas are subject to flooding. Debris accumulated on the trail surface should be removed after each recession of water. Trail/creek crossings should also be inspected periodically, with debris removal from beneath waterway bridges occurring, as needed.

Table 25 summarizes maintenance recommendations for the Ice Age Tonquin Trail.

Table 25 – Trail Maintenance Recommendations

Item	Suggested Frequency
Sign inspection/repair	1-3 years
Trail logo/marking inspection/replacement if needed	1-3 years
Planted tree, shrub, trimming/fertilization	5 months-1 year
Pavement sealing/potholes	5-15 years
Clean drainage system, clean inlets, keep swales clear	Annually before winter rains
Remove debris from beneath bridges and boardwalks	Bi-annually and after flood events
Bridge inspection	1-2 years
Pavement sweeping	Monthly
Shoulder mowing*	Bi-annually (early summer and fall)
Trash disposal	As needed depending on trail section
Graffiti removal	As needed
Maintain benches, site amenities	Annually
Pruning to maintain vertical clearance	1-4 years
Remove fallen trees	As needed
Weed control	Monthly
Water Plants	As needed

*Additional maintenance may be required.

Typical maintenance vehicles for the trail will consist of light trucks and, occasionally, heavy dump trucks and tractors. A mechanical sweeper is recommended to keep the trail clear of loose gravel and other debris. Care should also be taken when operating heavier equipment on the trail to avoid damaging the trail surface (particularly the edges).

Hours of Operation

Regional trails are open 24 hours a day, 7 days a week. Because this will be their first regional trail, some jurisdictions may need to revise their policies and procedures to be sure that access to the trail is available 24 hours a day, 7 days a week, throughout its entire length.

Maintenance Costs

The total estimated annual maintenance cost for the off-street segments of the Tonquin Trail is approximately $147,000. This estimate is based on an industry standard of approximately $7,000 per mile of asphalt path annually, which is the approximate maintenance cost per mile on Portland's Springwater Corridor Trail. Maintenance costs generally include labor, supplies, and amortized equipment costs for trash removal; sweeping; resurfacing; repairs to crossings; cleaning drainage systems and clearing debris from beneath bridges; landscaping; and underbrush and weed abatement. Some of the off-street Ice Age Tonquin Trail segments will be constructed of concrete or plastic lumber where boardwalks are proposed, and these surfaces typically cost less to maintain.

Maintenance costs for on-street segments are not included, based on the assumption that maintenance of those segments would occur as part of each jurisdiction's routine street maintenance activities.

Friends Groups

Forming a *Friends of the Ice Age Tonquin Trail* group would be a great way to help the various jurisdictions maintain and operate the trail. It also taps into latent support for these community assets, and builds a sense of ownership and shared responsibility. Friends groups are often part of a city's Adopt-A-Trail program or they can be an independent non-profit organization. The purpose of a friends group is as varied as the citizens who take part in them. At its core, a well-run friends group will engage volunteer citizens in a variety of activities and events that build community pride for the trail, help defer trail maintenance and operation costs, and improve safety for trail users. Programs such as Trail Work, Trail Education Days, Trail Watch, Trail Patrol, Community Outreach and Resource Stewardship are often part of a friends group. They can also hold fun event days or even run community facilities along a trail (such as a coffee shop or event space). There are many good examples of existing successful friends groups in the region and nationally from which to draw on.

The cities of Wilsonville and Tualatin each have long-standing Adopt-A-Trail programs where interested citizens can participate in maintaining, cleaning, monitoring, or otherwise helping to keep the trail in good working order for the community's enjoyment. These existing programs could serve as the foundation for a *Friends of the Ice Age Tonquin Trail* group, potentially administered through a partnership consisting of the jurisdictions through which the trail passes. Alternately, a friends group could form on its own and create its own mission and identity. Often, these groups are very influential in building support for funding. Sometimes such a group just needs an "incubator" type kick-start from a jurisdiction (or group of jurisdictions) initially to become established.

Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADT	average daily traffic
BPA	Bonneville Power Administration
FHWA	Federal Highway Administration
HAWK signal	Pedestrian Hybrid Beacon
HOA	Home Owners Association
LWCF	Land and Water Conservation Fund
MUTCD	FHWA's 2009 *Manual on Uniform Traffic Control Devices*
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
ODOT	Oregon Department of Transportation
QR	Quick Response
RFF	Regional Flexible Funds
RTP	Regional Transportation Plan
STIP	Statewide Transportation Improvement Program
TSP	Transportation System Plan
TWC	The Wetlands Conservancy
WES	Westside Express Service

Terms

Concept Plan	A concept plan is the first step in planning for urban development in areas that have been brought into the urban growth boundary. Concept plans are followed by more detailed comprehensive planning by the cities before any new urban development can occur in those areas.
Intertwine Alliance	The Intertwine is an ever-growing network of integrated parks, trails and natural areas in the Portland metropolitan region. The Intertwine Alliance is a coalition of public, private and nonprofit groups that are interested in working together to create a vibrant and healthy region, including completing the regional trail system.
Metro 2035 Regional Transportation Plan	The RTP presents the overarching policies and goals, system concepts for all modes of travel, funding strategies and local implementation requirements. The plan recommends how to invest more than $20 billion in anticipated federal, state and local transportation funding in the Portland metropolitan area during the next 25 years.
ODOT STIP Enhance Funds	Oregon Department of Transportation Statewide Transportation Improvement Program funds allocated through a grant program for activities that enhance, expand or improve the region's transportation system, including bicycle and pedestrian improvements.
Project Team	Metro project staff and consultant team members that managed the master planning process.
Project Steering Committee	11-member advisory group made up of representatives from jurisdictions, citizens, trail advocates, and agencies that advised the project team.
Trail Partners	Local jurisdictions responsible for implementing the Master Plan.
Transportation System Plan	Long-range guide to transportation investments in a community. These plans are required by the State of Oregon and Metro and are implemented by cities, private developers, and regional, state and federal agencies.
Urban Growth Boundary	Under Oregon law, each city or metropolitan area in the state has an urban growth boundary that separates urban land from rural land. Metro is responsible for managing the Portland metropolitan region's urban growth boundary.

Metro | *Making a great place*

Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy, and sustainable transportation and living choices for people and businesses in the region. Voters have asked Metro to help with the challenges and opportunities that affect the 25 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to providing services, operating venues and making decisions about how the region grows. Metro works with communities to support a resilient economy, keep nature close by and respond to a changing climate. Together, we're making a great place, now and for generations to come.

Stay in touch with news, stories and things to do.

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