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Natural Resources Inventory

Southwest Corridor Existing Conditions
Technical Report

December 2011

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INTRODUCTION AND HISTORIC CONDITIONS

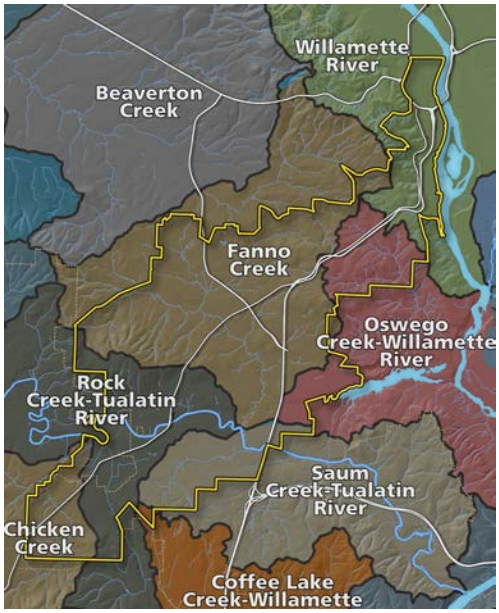
The Southwest Corridor Plan area has changed from a lush, forested landscape into a heavily urbanized one. Only remnants of the area's historic habitats remain to serve as a reminder of the abundant natural resources that once existed in this portion of the Lower Willamette Valley. The good news is that, even with a potential doubling of the valley's human population by 2050, more landscape change – and therefore more ecological effects – are estimated to have occurred from 1850 to 1990 than are considered likely from 1990 to 2050. What might be re-created through a collaborative regional effort to preserve, restore and enhance the elements needed for a healthy, functioning ecosystem within this corridor? This document seeks to identify those relatively ecologically intact natural resources needing continued or enhanced protection, portions of the landscape where restoration should be prioritized, and opportunities to adopt 'grey to green' redevelopment strategies that reintroduce improved ecological function into this heavily urbanized area.

The Southwest Corridor planning area is relatively large, encompassing portions of multiple watersheds and a variety of landscape types. This initial inventory of natural resources is broad and not intended to be all-inclusive. The purpose is to characterize the relative ecological health and functions within the planning area as a way of identifying potential opportunities, problems and constraints to address in the Southwest Corridor Plan. Once more specific transit alternatives or routes are identified, more detailed information and analysis of the natural resources will be needed.

For the purposes of this inventory, we are organizing 'natural resources' into five major topic areas: watersheds, streams and riparian areas, fish and wildlife habitat and connectivity, stormwater management and urban forestry. The following inventory of existing natural resources and natural resource needs in the Southwest Corridor area is based on GIS spatial analysis and information gathered from number of plans and reports including ODOT's Baseline Environmental Assessment, Metro, State of Oregon, the cities of Portland, Tigard, Tualatin, and Sherwood, special districts such as Clean Water Services and the West Multnomah Soil and Water Conservation District and other agencies, organizations and land owners associated with the planning area.

WATERSHED CONTEXT

Although the Southwest Corridor Plan area is largely developed, it is still ecologically dynamic, and includes important and diverse natural resources. Portions of numerous watersheds are included within the planning area, each with their own ecological characteristics.



Southwest Corridor planning area watersheds:

- Lower Willamette Drainage Basin
- Tryon Creek
- Tualatin River Drainage and Sub-Basins
- Fanno Creek
- Cedar Creek
- Rock Creek

Lower Willamette

The northern and easternmost portion of the planning area is included in the Willamette River drainage. There is no single drainage basin but many small drainages with waterways that can be characterized as mostly very small, high gradient headwaters and intermittent streams that drain the east-facing and heavily forested slopes of Portland's West Hills. These small waterways convey run-off that is mostly rainfall-generated, although some of the drainages are fed by perennial springs, from the top of Council Crest to outfall into the Willamette River. The terrain is too steep to accommodate extensive areas of wetlands, but there are likely individual "pocket" wetlands formed in areas where the drainages have a lower gradient, or side slope wetlands created by seeps. Many of these streams have culverts in their lower reaches and may or may not outfall into the Willamette River.

Tryon Creek

Tryon Creek is the largest of the perennial waterways that drains from the project area into the Willamette River and is an important urban waterway that is expected to be restored enough in future years to support runs of anadromous fish from the Willamette River. A number of native fish species can currently be found in this stream including resident and anadromous rainbow trout, coastal cutthroat trout, and coho salmon (Hudson et al. 2007; Tryon Creek Watershed Council 2008). It is thought that Pacific lamprey and other salmon species als**o** utilized this stream historically. However, a Highway 43 culvert outside our study area likely inhibits salmon and blocks lamprey passage.

Tualatin River Basin – including Fanno Creek

The majority of the project area drains into the Tualatin River through an extensive network of low-gradient perennial creeks and streams fed by wetlands and urban run-off. The lower Tualatin River

watershed is drained by the mainstem Tualatin River and two major tributaries, Fanno and Chicken Creeks. Fanno Creek drains the Portland Hills (Tualatin Mountains) and the urbanized northern portion of the watershed, while Chicken Creek drains the Chehalem Mountains and Parrett Mountain in the southwestern portion of the watershed.

Early trapper reports note that most lowland portions of the lower Tualatin sub-basin were wet and swampy. Physical factors played the greatest role in creating these wetlands including flat topography, low soil permeability and locally high water tables. Large beaver populations also contributed to the wetland area. The ponds and marshes they created by blocking streams slowed water flow and caused extensive flooding. These shallow wetland areas improved water quality, recharged groundwater and provided habitats suitable for many amphibian, aquatic and botanical species – many of which are no longer found within the Southwest Corridor planning area.

The Tualatin River National Wildlife Refuge represents the wetland habitat and landscape that once typified the lowlands of the Southwest Corridor.

Streams and Riparian Areas

The Southwest Corridor planning area includes 98 miles of streams – more than 10 percent of the region's waterways. These streams are ecological lifelines – the veins of the landscape. The region's biodiversity, water quality, and hydrological integrity are largely dependent on them. The health of these streams and their riparian areas are critical for aquatic and terrestrial wildlife. Metro's State of the Watersheds report explains that although trees and vegetation within 50 feet of streams and wetlands are necessary for stream health, a riparian area of this width alone is not sufficient for fully functioning waterways. This is particularly true in urban areas where storm water carrying high levels of pollutants and sediments enter our creeks and streams.

In the Southwest Corridor planning area, many of the creeks and their tributaries are still in tact but they do not currently maintain the continuous, ecologically viable streamside corridor necessary. Restoration activities by public agencies and private landowners are improving the condition of many of the streams and their associated riparian areas in the corridor planning area, enhancing conditions for wildlife and benefiting water quality. However, the lack of these healthy, connected corridors will continue to be the greatest challenge for the streams in the area. All of the streams within the planning area are 303(d) listed for water quality by the Oregon DEQ. Water quality issues include high temperatures, excessive nutrients and pollutants. Water quantity is also a challenge as impervious surfaces throughout the planning area cause excessive runoff into these creeks and streams during even small storm events, scouring and downcutting stream banks and causing flooding and erosion. Continued efforts to capture, slow and clean the stormwater runoff entering the area's waterways are planned and underway in the planning area. It is possible that

this project could increase attention on these efforts, speeding the work of restoration and water quality improvements for the waterways in the planning area and beyond.

Portland Area

The northern portion of the plan area within City of Portland jurisdiction intersects with the watersheds of the Willamette River, Tryon and Fanno creeks. Within the city's boundary, management of these watersheds is conducted by Portland's Bureau of Environmental Services (BES). The Portland Watershed Management Plan (2005) provides an ecological characterization of these watersheds, largely describing the degradation of these waterways and their associated riparian areas. Although the Southwest Corridor is heavily developed, each of these watersheds still contain many important natural resources. Critical ecological functions prevail in even the most urbanized Portland landscapes.

Willamette River

The segment of the Willamette River adjacent to the northern extent of the plan area (downtown Portland moving south) has limited riparian area and relatively poor water quality. The overall ecological quality of this section of the river is largely impaired. Nonetheless, fish, including salmon and steelhead, still use the Willamette for rearing and migration. Birds and other wildlife use the Willamette River corridor and adjacent uplands as stopover spots and connections to other habitat areas. The west side of the Willamette River from Willamette Park to Powers Marine Park is one of the few remaining intact natural areas along the river within Portland, and presents opportunities for strategic, integrated planning and implementation of water quality, habitat connectivity, and stormwater improvements. In close proximity to Ross Island and the Oaks Bottom Wildlife Refuge across the river, the area has been identified as an important rearing and refuge complex for juvenile salmonids. The area includes the Stephens Creek confluence, where Portland Bureau of Environmental Services (BES) completed a significant habitat enhancement project for native fish in 2008. Although Stephens Creek has been affected by urbanization, its confluence with the Willamette River just north of the Sellwood Bridge provides important off-channel habitat.

Tryon Creek

For this planning area, Tryon Creek is located mostly within Portland's boundary. Tryon Creek exhibits many of the typical impairments of an urban stream, however, the watershed maintains some ecological strongholds. Lower Tryon Creek, which includes the Tryon Creek State Natural Area, retains more intact streamside vegetation and complex, winding stream channel than other parts of the creek and provides important habitat for salmon as well as other fish and wildlife. Trees and shrubs in this area provide good sources of large woody debris to the creek and help maintain appropriate stream temperatures and dissolved oxygen levels. The section of Tryon Creek just above Boones Ferry Road has intact vegetation and relatively good stream bank conditions. Water quality in Arnold Creek, an important tributary, provides benefits for itself and the main stem. In 2010, a habitat enhancement project at the confluence of Tryon Creek and the Willamette River was completed. This significant restoration project includes stream enhancement to improve spawning and rearing habitat for salmon and other native fish, several acres of invasive species removal, revegetation with native plants and work to reconnect the stream's natural floodplain.

Hundreds of landowners in this area have been engaged through the Friends of Tryon Creek and the West Multnomah Soil and Water Conservation District in improving habitat and water quality on private lands.

Tigard, Tualatin, Sherwood and unincorporated Washington County

Riparian area health and in-stream ecological integrity within the vicinity of Tigard, Tualatin, and Sherwood falls under the jurisdiction of Clean Water Services, the regional water resources management utility for urban Washington County. Through their **Healthy Streams Plan**, CWS identifies policy and program refinements, as well as surface water and stormwater projects to be funded through the capital improvement program to improve water quality, water quantity management, and aquatic species habitat.

The City of Tigard, with help from a number of regional partners, purchased the 43-acre Summer Creek property in 2011 to create the city's second largest park and protect water quality. It is located at the confluence of Summer and Fanno creeks.

Watershed character within this section of the planning area generally exhibits the ecological impairments typical of urbanized areas.

Fanno Creek

Fanno Creek responded to 19th and 20th century land conversion and intensive development by downcutting and losing touch with much of its floodplain. The 21st century is already presenting new challenges, with new invasive species and threats from climate changes among them. Despite its dense residential and commercial development, the Fanno Creek watershed supports many native plant communities and at least 100 native birds as well as black-tail deer, coyote, river otter, beaver, spotted skunk, Douglas squirrel, Townsend's chipmunk, and other mammals. The splash of startled red-legged frogs isn't an uncommon sound along some tributaries. Both painted and Western pond turtles can be found where conditions allow. Cutthroat trout remain in breeding populations and very small numbers of steelhead and coho have been found during fish surveys along with redside shiners, sculpins, dace, lamprey and crayfish. This diversity of native species, however, is burdened by reed canary grass, Japanese knotweed, nutria, snapping turtles, bullfrogs, bass and many other invasive introductions.

In spite of its many challenges, the watershed has been the focus of nearly two decades of enhancement projects and successful riparian plantings. Numerous parks, creek crossings and the Fanno Creek Greenway Trail offer many opportunities for visitors to and residents within the planning corridor to experience and enjoy these improvements. With continued efforts to plant native trees and shrubs, improve storm water management and greater stewardship from landowners and residents within the area, Fanno Creek could become one of the Metro area's most healthy, accessible and beloved urban streams and a wonderfully rich community asset.

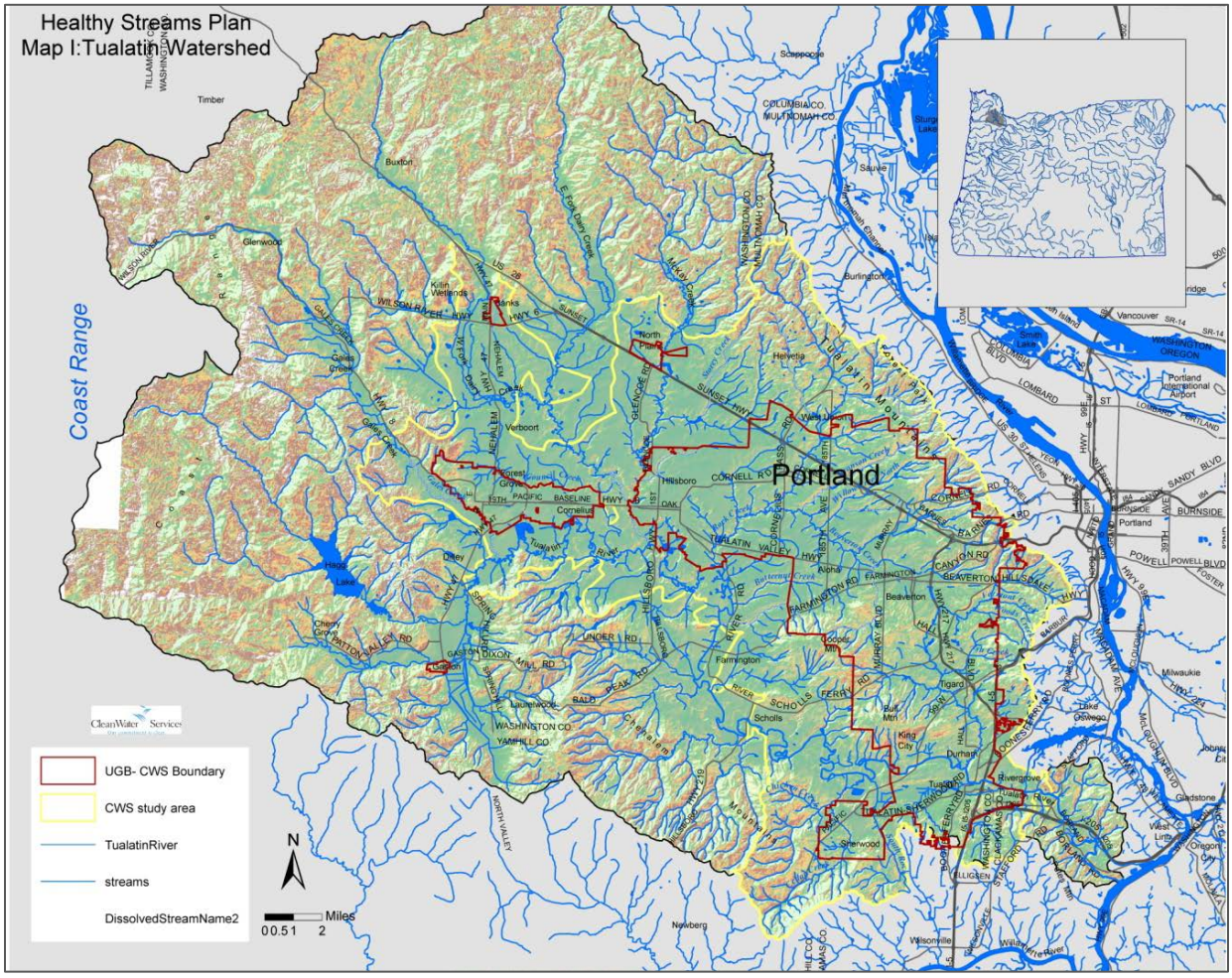
In the Natural Resource Inventory conducted for the Tigard High Capacity Transit Land Use Plan (part of the Southwest Corridor Plan) the importance of riparian corridors within the City of Tigard is called out. The riparian corridors of the Tualatin River and Fanno Creek support the majority of the nearly 300 acres of wetlands within the boundaries of the city. Additionally, it notes that many species of fish and wildlife, including winter-run steelhead that are federally listed as threatened, are found in these waterways along with numerous native plant communities.

Cedar Creek

A Tualatin River tributary, Cedar Creek is both an important wildlife corridor and a large habitat area located in the Sherwood area. Floodplains and wetlands lie along the stream, much of it protected within the city's boundaries. Floodplains and vegetation are wide north of Highway 99W and connect to large upland, riparian and Tualatin River National Wildlife Refuge habitats via Chicken Creek. Further north, Edy Road disrupts wildlife passage. A large culvert at Highway 99W blocks essentially all wildlife from crossing, and wildlife road kills are common in the area though fish likely pass through the culvert.

Both the Sherwood Community Plan (2005) and Washington County's Rural/Natural Resources Plan (2006) identify significant wetlands and wildlife habitat along the Cedar Creek corridor.

Clean Water Service's Healthy Streams Plan vicinity map



See also: ODOT Baseline Report p. 32-33, Portland memo, etc.

Opportunities for improving stream conditions

Redevelopment and new development offers an opportunity for significantly improving stream conditions within the Southwest Corridor planning area. All jurisdictions within Clean Water Service's boundary must adopt the CWS Vegetated Corridor Design and Construction Standards. This standard requires a protected buffer around streams and wetlands and additionally requires that this buffer be enhanced with native plans (and removal of non-native invasive species) if it is not currently in "Good Condition" (as defined in the standard). Similarly, any redevelopment within Portland is required to incorporate designs that improve water quality and riverbank conditions.

Clean Water Services' Healthy Streams Plan specifies various completed and planned stream enhancement (riparian and in-stream) projects within the Southwest Corridor area:

- Fanno Creek, which crosses Highway 99-W, is a priority for enhancement through Tigard
- Saum Creek is a priority for enhancement in Tualatin to the west of its connection with the Tualatin River

- Cedar Creek, which crosses Highway 99-W, is a priority for enhancement at a reach just east of the crossing point in Sherwood.
- Numerous smaller tributaries near these identified enhancement projects in Tigard, Tualatin, and Sherwood were also identified as 'high priority streams' in CWS' Healthy Streams Plan.

Habitat restoration on private land

Initiatives by private land owners to restore and improve stream health or wildlife habitat have gained momentum over the past decade in the Southwest Corridor planning area. Supported with funding from service and special districts, local governments, parks districts, state agencies and non-profits, these programs include Audubon and Columbia River Land Conservancy's Backyard Habitat Certification, Willamette Partners and Clean Water Services' Tree For All among others.

Backyard Habitat Certification

The Backyard Habitat Certification Program started as a pilot in the southwest hills of Portland in 2006. In 2009, Columbia Land Trust and Audubon Society of Portland began collaborating on the citywide program serving the entire Portland area in 2010 and 2011 the program expanded to serve areas of Eastern Multnomah County and Lake Oswego. The program provides technical assistance to small lot (less than 1-acre) private property owners to restore native wildlife habitat and manage stormwater in their backyards. It has received a tremendous response from private homeowners, municipalities and non-profit organizations throughout the metro region and within the Southwest Corridor planning area.

Tree for All

Clean Water Services' Healthy Streams Plan (2005) suggests that local streams need more riparian area trees for shade and large woody debris to improve water quality (particularly temperature) and aquatic habitats.

As part of Clean Water Services Healthy Streams program, cities within CWS' service district have planted more than one million trees and completed dozens of enhancement projects throughout the Tualatin River basin.

West Multnomah Soil and Water Conservation District

Within its boundaries, the district works with land owners of sites larger than one acre to improve wildlife habitat, water quality and soil conditions.

Raindrops to Refuge

The City of Sherwood's "Raindrops to Refuge" initiative has helped landowners make the connection between protecting water quality in their neighborhood in order to protect and the

unique and precious habitat found within the Refuge. Residents in Sherwood take pride in their reputation as a park-rich, green community (think Sherwood Forest) and must continue to invest in the stewardship of these resources as their community grows.

Friends of Trees

Friends of Trees works with local governments, natural resource land managers and private landowners to plant trees in urban areas and natural areas throughout the corridor planning area.

FISH AND WILDLIFE, HABITAT AND CONNECTIVITY

Like people, fish and wildlife need food, shelter and places to raise their young. Different species have different needs, so a variety of habitats such as streamside, wetland, hardwood and conifer forest supports more species. In general large habitat areas are more important than small patches, although small patches are more important where there isn't much habitat left, and they also provide "stepping stones" between larger habitats. Animals need ways to move among habitat areas (connectivity), often through fairly linear wildlife corridors such as stream corridors or powerlines. Isolated habitat patches tend to lose fish and wildlife species over time and, without connectivity, these species cannot repopulate an area. Improving connectivity will help maintain the region's biodiversity by allowing species to move as needed to fulfill their life history requirements.

With some important exceptions, the Southwest Corridor planning area is characterized by smaller habitat patches and interrupted wildlife corridors, but it supports a surprisingly rich fish and wildlife community and connects to some much larger habitats nearby. The western and middle parts of the study area tend to be fairly flat with the Tualatin River and some long, meandering tributaries with associated floodplains and wetlands. Significantly, this area includes the Tualatin River Wildlife Refuge and hundreds of acres of wetlands and natural areas protected by Metro and other local jurisdictions.

The northeastern portion of the study area includes some Douglas fir/maple mixed forests connecting to some of the region's largest habitats, such as Forest Park and Tryon Creek State Natural Area; many headwater streams are present. Various fish and wildlife, habitat and water quality surveys paint a picture of conditions in the area and some of the highlights of those are included in this report.

Native fish and fish passage

Within the study area, many native fish and lamprey inhabit streams and some wetlands. Fall steelhead and coho salmon traverse the lengths of Fanno and Rock creeks, and the downstream portion of Hedges Creek[1]. These fish are listed under the federal Endangered Species Act (provide state and federal listings here) and are priority considerations for aquatic species in the study area. Fish-blocking culverts contribute to the decline of these species and may need replacement or, less costly retrofitting. Whenever a fish barrier is addressed, wildlife passage should be simultaneously considered if possible because fish barriers often block wildlife, too. In some cases, barriers well outside the study area influence what species can pass through.

[1] Information about the Oregon Fish Passage Barrier Data Standard (OFPBDS) can be found online at http://www.oregon.gov/DAS/EISPD/GEO/docs/bioscience/OregonFishPassageBarrierDataStandardv1dot1.pdf.

Steelhead domain has been identified in the following plan area waterways: Cedar Creek, Chicken Creek, Fanno Creek, Hedges Creek, Rock Creek, Tualatin River, and an unnamed tributary of the Tualatin River located north of Chicken Creek and south of Tualatin River (ODOT, 2011). Insert Coho domain here.

Portland Area

See City of Portland Bureau of Environmental Services memo for fish information in the planning area.

Outside of Portland

Clean Water Service's Healthy Streams Plan identified issues and guiding principles for culvert retrofit or replacement based on a number of values and opportunities including deficiencies in fish passage, fish species present, miles of stream the improvement would open for habitat, associated transportation plans, priority watershed areas, and proposed stream enhancement projects. In many cases retrofit of fish passage, rather than replacement, can be done at far less cost. Update list of key projects identified in Healthy Streams Plan and Washington County's culvert replacement program within the Southwest Corridor.

Other important natural resources in the Southwest Corridor planning area add to the ecological framework. The area includes numerous wetlands (see ODOT Baseline Report), floodplains and upland habitat patches of varying sizes and ecological value. Many of these are public parks and natural areas, while others are in private ownership. Floodplains, wetlands and some portions of riparian areas along streams, are fully or partially protected from development. Upland natural areas and remnant habitat patches, older and larger tree stands and other important natural resources still found in the corridor area are typically afforded fewer protections. Similarly, transportation rights of way (also often identified as important natural corridors) typically receive limited resource protection.

Native wildlife

The Southwest Corridor planning area includes a wide range of native wildlife including mammals, amphibians and birds including several state or federally listed species (see table below) Many parts of the study area supports mammals such as deer, coyote, raccoon, striped skunk, shrews, bats (primarily *Myotis* species) and other small rodents. The study area may even host bobcat, the occasional cougar or black bear. In the lower areas where streams have greater amounts of adjacent habitat one can find river otter, beaver and muskrat. Significantly, both Pacific (Western) pond and breeding Western Painted turtles are found in the study area along with various amphibians such as red-legged and tree frogs, rough-skinned newt, western red-backed salamander, long-toed salamander and, potentially, Dunn's and clouded salamanders.

There is more survey data for birds, and an excellent assortment live in or pass through the study area. For example, Fanno Creek supports breeding populations of migratory species like willow flycatcher, black-headed grosbeak, common yellowthroat, orange-crowned and Wilson's warbler,

and violet-green swallow, as well as more resident species such as great blue and green heron, goldfinch, song sparrow, chickadee, Bewick's wren, bushtit and red-winged blackbird. Larger patches along Fanno Creek also support Western wood-peewee and Swainson's thrush. Cedar Creek's large habitats in Sherwood support breeding populations of winter wren, olive-sided flycatcher, warbling vireo and Steller's jay, plus Western tanager in the uplands. Annual bird Christmas Counts show that stream and wetland areas support an abundance of wintering waterfowl and other birds. In the eastern portion of the study area, large upland/headwater areas are home to species such as brown creeper, band-tailed pigeon, Pacific-slope and Hammond's flycatcher, Western tanager, chestnut and black-capped chickadees and dark-eyed juncos.

Wildlife species of concern known to use the study area include:

Species	**Federal status**	**State status**
Northern Red-legged Frog *Rana aurora aurora*	Species of Concern	Sensitive - Vulnerable
Western Painted Turtle *Chrysemys picta bellii*	Species of Concern	Sensitive - Critical
Pacific (Western) Pond Turtle *Actinemys (=Clemmys) marmorata*	Species of Concern	Sensitive - Critical
Bald Eagle *Haliaeetus leucocephalus*	Federally de-listed; Species of Concern	Listed – Threatened
American Peregrine Falcon *Falco peregrinus anatum*	Federally de-listed; Species of Concern	Sensitive - Vulnerable
Band-tailed Pigeon *Patagioenas fasciata*	Species of Concern	None (Oregon state Strategy species per ODFW)
Pileated Woodpecker *Dryocopus pileatus*	None	Sensitive – Vulnerable
Olive-sided Flycatcher *Contopus cooperi*	Species of Concern	Sensitive – Vulnerable
Little Willow Flycatcher *Empidonax traillii brewsteri*	None	Sensitive – Vulnerable
Purple Martin *Progne subis*	Species of Concern	Sensitive – Critical
Slender-billed (White-breasted) Nuthatch *Sitta carolinensis aculeate*	Species of Concern	Sensitive – Vulnerable

Bat species are not well documented, but likely includes several state or federally listed species.

Wildlife Habitat

Climate adaptation strategies being developed in the State of Oregon and regionally point to the importance of healthy, connected wildlife corridors for the long term health of wildlife in the Portland area including the Southwest Corridor planning area. Wider riparian areas provide more of the functions necessary to support the life cycle of our native wildlife species. When these areas include healthy trees, shrubs and other native vegetation, these areas also provide significant water quality benefits. Many studies and agency recommendations suggest that a width of about 150 feet on each side of streams and wetlands is necessary in order to provide the full range of riparian

functions, and this range also accommodates passage and habitat for many wildlife species. (Metro, State of the Watersheds Report).

Identifying those sections of streams where existing riparian areas can be enhanced or restored – or where narrow riparian areas can be widened – presents opportunities for significantly improving water quality and wildlife health. In the Southwest Corridor, these opportunities will be limited due to historical development patterns, current regulations and zoning. Even with a wider vegetated riparian area, storm and surface water run off from the significant amount of impervious surface within the planning area will continue to severely degrade the streams in the area due to the high volume of water entering these waterways during storm events. Strategic stream corridor enhancements, sustainable stormwater management strategies and greater urban tree canopy can help restore water quality and hydrologic function in these streams while also offering native wildlife the room they need to thrive in the Southwest Corridor. This has benefits for people too who consistently voice their desire to protect and preserve nature in their neighborhoods.

STORMWATER MANAGEMENT AND LID'S

Stormwater management is an important part of this natural resource inventory because of its significant impact on stream water quality and the quantity and velocity of stormwater entering the waterways in the Southwest Corridor planning area. Stormwater runoff from roads and parking lots can carry numerous pollutants, including dissolved and particulate heavy metals; oil, grease, and other petroleum products; sediments; and polycyclic aromatic hydrocarbons (PAHs). Small quantities of these pollutants can negatively impact salmonids and other aquatic species. Stormwater treatment is aimed at reducing these pollutants in runoff from roads. Transportation facilities and other types of urbanization can also significantly impact the hydrologic cycle, particularly a watershed's response to storm events. The amount of stormwater that occurs as runoff is greatly increased as the watershed becomes developed and covered with impervious surfaces. The loss of vegetation that accompanies development means that less water is intercepted or evapotranspired by vegetation. The smooth grading and compaction of soils adjacent to roadways also results in less infiltration or storage capacity on the unpaved surfaces. Hydrologic impacts of roads stem primarily from increased impervious surface, which results in larger peak flow magnitudes and greater runoff volumes for a specific frequency rainfall event.

Every jurisdiction within the planning area requires onsite stormwater quality treatment for runoff from impervious surfaces associated with development permits. This requirement is primarily based on Clean Water Act compliance. Jurisdictions have municipal stormwater permits from the Oregon Department of Environmental Quality and post-construction stormwater quality controls are required. The threshold for stormwater quality standards application varies between jurisdictions with this corridor, from 500 to 5,000 square feet of new or re-developed impervious area.

Portland area

Portland's dense urbanization results in high volumes of stormwater runoff draining directly into the city's combined sewer system (stormwater runoff and sewage managed through the same pipe). During heavy rainfall, this combined sewer system can reach maximum capacity and overflow through outfalls (combined sewer overflows) into the Willamette River, impacting both water quality and waterway hydrology.

Urban portions of the upper Tryon Creek Watershed and the Interstate 5, Barbur Boulevard, and Terwilliger Boulevard transportation corridors are the largest sources of ongoing stormwater-related health problems for this watershed. Portland streets contribute 66% of the City's total stormwater runoff discharge and 77% of the pollutants in the discharge. Portland is building "green street" projects throughout the city to reduce the impacts of stormwater runoff. Green streets divert stormwater from the sewer system to reduce combined sewer overflows and increase stormwater infiltration, which reduces stormwater pollution in rivers and streams. Low-growing native and ornamental plants make green streets attractive neighborhood amenities.

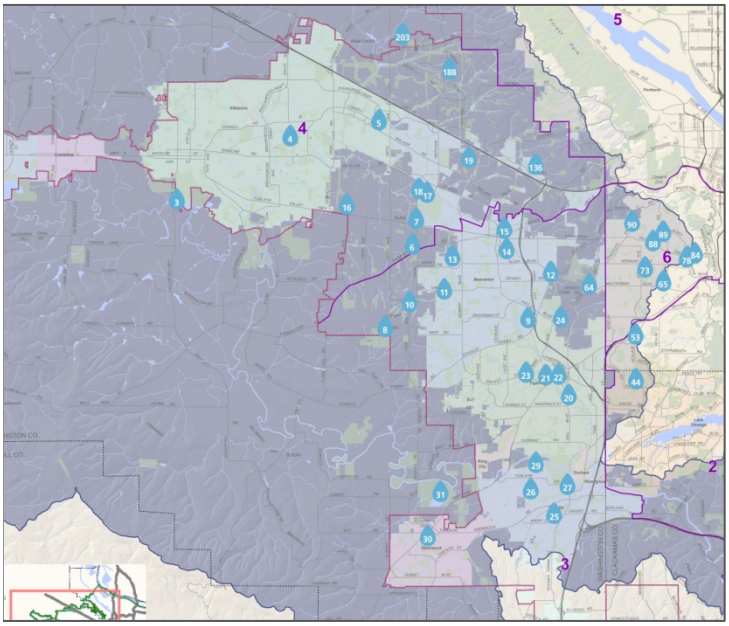
Outside Portland

While Portland's stormwater conveyance system is part of a combined sewer system, stormwater runoff in Tigard, Tualatin, and Sherwood is typically released without treatment directly into Tualatin Basin streams through numerous stormwater outfalls developed prior to 1991. Similarly, this direct release of stormwater causes problems for both water quantity and quality.

Clean Water Services' Healthy Streams Plan data suggests that local streams (in the vicinity of Tigard, Tualatin, and Sherwood) need more flow in the summer and less scouring stormwater in the rainy season to improve water quality and aquatic habitats. A general conclusion of the Healthy Streams Plan is that streams need watersheds that mimic natural hydrologic regimes, even in urban areas, in order to reduce scouring stormwater runoff. The Healthy Streams Plan also identifies a number of stormwater outfalls within the Southwest Corridor with high pollutant loading potential that have been prioritized for retrofit or enhanced stormwater management in their respective drainage areas.

Projects affecting waters classified as impaired under the federal Clean Water Act and listed on the state (303)d list, or with a total maximum daily load (TMDL) approved by the U.S. Environmental Protection Agency, may be subject to higher expectations for treatment of stormwater for those pollutants. The proposed stormwater management plan (SWMP) for any transportation project that results from the Southwest Corridor Plan would need to establish that stormwater is being treated for those pollutants for which the stream is listed, to the maximum extent practicable. ODOT's Environmental Reconnaissance Report for the Southwest Corridor Plan provides TMDL status and (303)d listing for each of the plan area waterways. Fanno Creek and the Tualatin River are the two waterways that are (303)d listed and have TMDLs that have not been met.

In Clean Water Service's area, onsite stormwater treatments may or may not take the form of LID facilities (which include vegetated infiltration and filtration planters and swales, rain gardens, green roofs and porous pavements). For example, underground filter vaults and stormwater treatment/detention basins may also be used and are not considered LID under Metro's definition.



Metro's Connect the Drops map shows that there are a few low impact development projects within the planning area located in the Tualatin Basin.

For details visit: Connect the Drops

Research conducted by the University of Washington and the Center for Watershed Protection indicates that the biological productivity of streams declines significantly once effective impervious area reaches 10-20% in a subwatershed (Importance of Imperviousness, Appendix 2). In conducting watershed hydrologic models for each watershed in the Healthy Streams Plan study area, the level of effective impervious surface (EIA) was determined (Map 1). There were few subwatersheds inside the urban growth boundary with less than 20% EIA. However, there are still many in the 30-40% EIA range that have the potential for retrofit that could bring the amount of EIA down. In urban fringe areas, preventing high levels of EIA could reduce potential stream impacts. While typical stormwater pretreatment and detention facility designs have helped to improve stormwater quality and reduce large storm flooding, they have not been specifically designed to manage small storm flow impacts. A combined approach of reducing effective impervious area, reforestation of uplands, protection of riparian corridors, and strategically placed "facilities" could result in greater improvements to stream health, than any one or two strategies alone. (From CWS Effective Impervious Area Taskforce 2002).

Low Impact Development

In early 2011, Metro commissioned GreenWorks to review the status, success and issues related to implementation of low impact development practices (LIDs) by local jurisdictions. The main study objectives were to discover how widely LIDs are being used in the region; determine barriers, issues and needs that still exist related to the use of LIDs; and to identify opportunities for removing those barriers.

The most consistently heard concerns from local government staff were about costs: costs of design and construction, cost of maintenance, replacement costs, and cost of inspection and enforcement. There is a common feeling shared and heard (from developers and others doing development) by local government staff that LID measures are more expensive overall than conventional construction practices. Local jurisdiction staff also express concerns about how to effectively and efficiently ensure the proper long-term maintenance of public and private vegetated stormwater facilities, porous paving and planted/protected trees and vegetation. Concerns range from how to track and inspect these measures spread across the landscape, how and whether to train public works staff to perform vegetation maintenance, how to ensure that private property LIDs are properly cared for and, how to pay for it all.

The Clean Water Act and its municipal stormwater permit requirements are the main driver for the use of stormwater treatment related LIDs (e.g. rain gardens, porous paving, green roofs). There is little attention paid to the other benefits of the habitat-friendly development practices encouraged under Metro's Title 13 Ordinance such as natural resource protection and wildlife habitat preservation or enhancement.

Local government staff identified that federal, regional or local programs or mandates seem to work against the use of habitat-friendly development practices such as regional transportation planning or urban center goals that set street sizes, density and pedestrian accessibility goals. There is also a perception that Metro's Title 13 Model Ordinance only applies directly to development sites that include a Habitat Conservation Area. As a result, some jurisdictions have

included the use of LIDs only in those designated areas rather than integrating some or all LIDs into development and zoning codes and public works standards across the board for all or most new development or redevelopment.

In several jurisdictions, HFDP's are not specifically listed or mentioned in local codes or standards though most jurisdictions allow for submittal of alternate designs. However, because there often is not a standard to follow, this typically requires a more substantial design review and permitting process, which can be an obstacle for developers to use these facilities or designs.

Some jurisdictions have at least some incentives for LIDs in place, and some are moving to increase these or add more. Typical incentives related to protection in HCA's are reductions of required set-backs or the amount of required site landscaping, allowing the HCA area NOT to be included in calculations of required site development density, and density transfers. Some jurisdictions go further, allowing building floor area, height or density increases, parking reductions, lot size adjustments, open space requirement reductions, and/or allowing stormwater facilities to be located in HCA's. Other incentives include credits for other onsite measures such as tree retention (may count toward required landscaping or reduce the amount of impervious area that must have stormwater treatment), green roofs or porous paving (reduced landscaping requirements or sizing of stormwater facilities). For example, the City of Portland provides incentives for using a green roof, including a floor area ratio bonus and, in many cases, funding up to $5 per square foot of green roof area. Additional incentives within all areas of the Southwest Corridor could greatly increase the use of these practices.

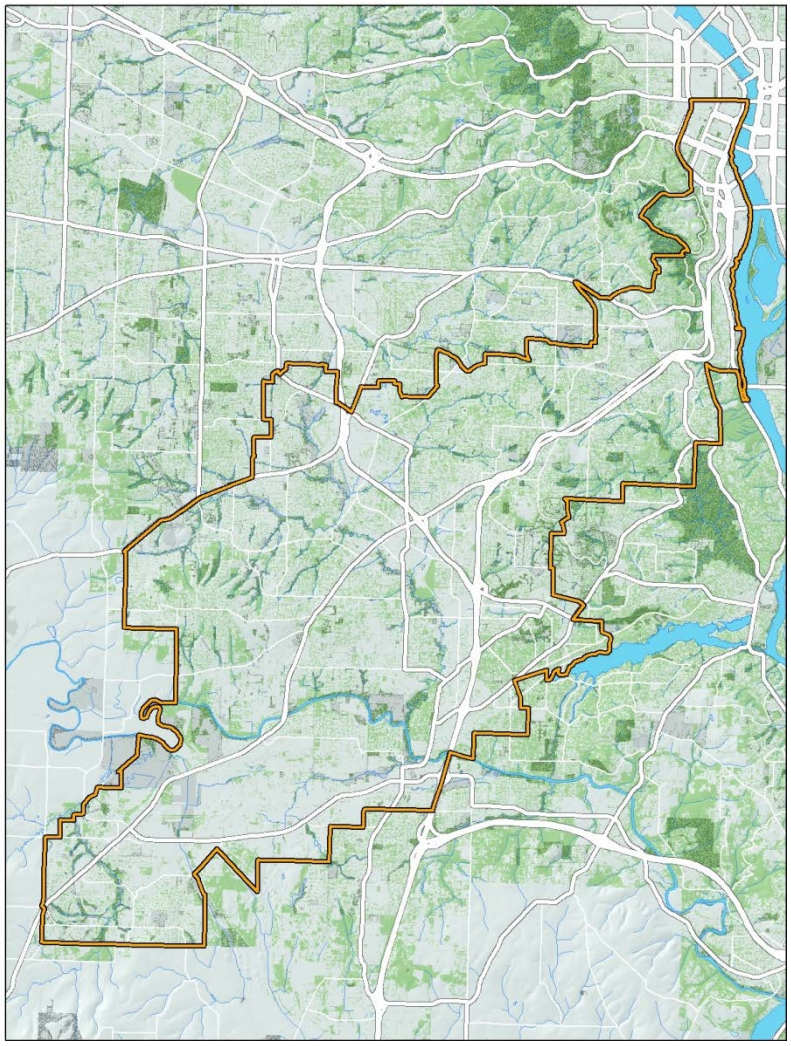
Stormwater fees

All of these jurisdictions have a stormwater utility and collect user fees as well as stormwater SDC's. Monthly user fees are based on site impervious area, with single family residential charges based on the typical or average impervious area for one residential lot. Monthly residential charges in the region vary from $4.75 to $9.60 with Portland the outlier at $21.75 per month. Although a few jurisdictions offer fee discount incentives, most don't think they can offer a large enough discount to truly incentivize significant onsite runoff reduction measures. Portland's relatively larger fee and the subsequent discount can be a substantial incentive. Portland's Clean River Rewards program allows for the onsite portion of the monthly fee to be discounted if stormwater is managed onsite by such measures as disconnected downspouts, soakage trenches and large trees (the onsite portion of the fee is 35% of the total monthly stormwater fee). In the City of Troutdale, by comparison, a full 100 percent discount of the monthly stormwater fee and the upfront SDC is discounted if 10 percent of the sites stormwater is handled onsite. They report that this is enough of an incentive to encourage developers of commercial sites with parking lots to consider the use of porous pavement.

URBAN FOREST CANOPY – TREES

Urban forests provide a host of environmental, social and economic benefits, yet they also pose costs and in some cases present constraints to development. Street trees, in particular, provide important stormwater management functions, as well as providing shade, habitat, clean air, enhancing our neighborhoods and increasing property values.

Tree canopy cover in the Southwest Corridor planning area.



Recent research suggests that trees may also improve driving safety. One study found a 46 percent decrease in crash rates across urban arterial and highway sites after landscape improvements were installed. Another study found that placing trees and planters in urban arterial roadsides reduced mid-block crashes by 5 percent to 20 percent. Enhanced tree protection and ambitious tree planting goals could become an important aspect providing a multitude of benefits to any redevelopment scenario within the Southwest Corridor.

An American Forests study conducted in the Willamette/Lower Columbia Region found that average tree canopy cover had been reduced nearly in half, from 46 percent in 1972 to 24 percent in 2000. In the study's "urban areas", canopy was reduced from 21 to only 12 percent coverage. Metro's Nature In Neighborhoods 2007 study of tree canopy coverage for the metro region shows that the existing percent tree canopy in jurisdictions within the Metro area range from a high of 54.3 percent in Durham to a low of 13.5 percent in King City. Within the Southwest Corridor planning area the tree canopy is relatively high - estimated at 29 percent overall. Commercial and industrial zoned lands have a much lower percentage (13-14 percent) of canopy. There are opportunities for increasing the urban forest canopy in targeted areas within the planning area for multiple benefits .

Tree Canopy in Southwest Corridor planning area – by city and county

Incorporated city/urban area	Year incorporated or founded	Acres	Estimated population (2008)	Estimated median income (1999)	Acres of tree canopy cover (2007)	Percent tree canopy cover (2007)
Portland	1851	95260	575,930	40,146	27,231	29.4%
Sherwood	1924	2644	16,420	62,518	541	19.8%
Tigard	1961	7416	47,150	51,581	1,920	25.4%
Tualatin	1913	5088	26,040	55,762	1,028	19.8%
Urban Washington County*	1849	20404	185,786	Not avail.	8,512	41.7%

* Unincorporated land inside Metro UBG (2007)

Metro commissioned a report on Urban Forestry Practices among jurisdictions in 2007 with some of the information updated in 2010. The report concluded that there is considerable variation in local urban forestry policies and programs in the region. Policies and programs vary with respect to the applicability, strength and enforcement of regulatory elements, the level of public investment, the extent of incentive/voluntary programs for tree preservation and planning and the levels of citizen involvement and public/private partnerships. There is greater consistency between jurisdictions and generally higher level of protection afforded in policies related to street trees relative to those regulating trees on private land. Only a handful of jurisdictions have urban forestry management plans in place or have an inventory of existing urban forest canopy or target goals for percent forest cover.

State or regional law requires jurisdictions to limit tree removal adjacent to streams and wetlands to protect water quality, fish and wildlife habitat, or public health and safety. Four jurisdictions in the region – Portland, Wilsonville, Lake Oswego and Hillsboro – have Goal 5 (or Title 13) programs that preserve upland forests inside the 2002 UGB, and Beaverton and Washington County require mitigation when development displaces upland forests. Other jurisdictions, like Gresham and Tigard, regulate tree removal associated with hillside development.

Similarly, there is a wide range of staffing, funding and programming levels relating to urban forestry among local governments in the region. While most jurisdictions have some local funding sources for urban forestry-related activities, the Metro study documented that the levels and sources of funding vary considerably. Notably, three of the seven jurisdictions that have adopted urban forestry management plans in the region are part of the Southwest Corridor: Portland, Tualatin, and Tigard. Half of all local governments have an established urban tree committee, board or urban forestry commission (required for "Tree City U.S.A. designation). Five jurisdictions have an inventory of urban forestry canopy (including Portland, Tigard and Tualatin) and two have established targets for urban forest cover (in the planning area, only Portland has done this). Ten jurisdictions have a certified arborist on staff. Eight jurisdictions have a dedicated tree fund that pools in lieu planting or penalty funds. Eleven local governments have heritage tree programs at protect trees at landowner's request.

Several local governments have particularly strong or comprehensive urban street tree programs. The City of Portland's Neighborhood Tree Liaison Program provides an exceptional level of training and education to local citizens. Portland has also invested heavily in street tree stocking inventories and funded extensive street tree planting.

City of Portland

Currently, trees cover about 26 percent of Portland's land area—roughly half on private property and half on public property. North Portland and the city's higher density residential, commercial and industrial areas have the sparsest tree canopy – this is consistent with the analysis of tree cover in the Southwest Corridor planning area.

The City of Portland is just beginning to put an economic value on its urban forest. A 2007 report estimates that it would cost nearly $500 million to replace Portland's street trees and $1.8 billion to replace trees in parks and natural areas. The replacement value of the entire urban canopy (including private property) is estimated at $5 billion. These figures do not include the value of the ecosystem services the trees provide, such as cooling the air and retaining stormwater. In Portland, street and park trees are thought to provide $27 million worth of environmental and aesthetic benefits each year.

Although overall tree canopy cover in Portland has increased slightly over the last 30 years, the City is not meeting its goals for tree canopy cover:

Land Use	Current Canopy	Target Canopy
Residential	30%	35-40%
Commercial/industrial	7%	15%
Parks and open spaces	28%	30%
Rights-of-way	17%	35%
Citywide	26%	33%

Urban forest canopy growth in Portland's existing east side neighborhoods is estimated in the low single digits. This growth, at least in part, is attributed to the "Friends of Trees Effect." Friends of Trees is a non-profit that assists neighborhoods in planning for and planting street trees and has been very active in Portland. Although significant canopy loss has occurred over time, Portland's increase shows that restoration of the urban forest canopy can be achieved even in dense urban settings.

City of Sherwood

Sherwood has had urban tree regulations in place for more than 20 years, located within their Zoning and Community Development Code and implemented new tree regulations in 2007 (16.142). The city has had Tree City USA designation for eight years and has an established urban tree board or committee. The main goal of the city's tree preservation standards is to minimize the removal of trees and woodlands within the city. Sherwood does not have an adopted urban forestry plan.

The code regulates the size of regulated trees depending on species differently for tree removal and protection requirements within the development process and outside of it. For planned unit developments, site review and subdivision, the code protects Douglas fir, ponderosa pine, red cedar, white oak, big leaf maple and American chestnuts that are ten inches or greater, while all other species are regulated if they are five inches or greater. The code only allows tree removal

during development within areas that are needed to build utilities and infrastructure, streets and grading necessary for development in PUD and subdivisions.

Outside of the development process, regulated deciduous trees are those that are 10" or greater and coniferous trees that are 20" or greater. Landowners are allowed to remove five trees per year, not exceeding 100" dbh total. However, there is no permit system in place. Instead, the landowner must report to the planning department at least 48 hours before tree removal. If landowners wish to remove more than the maximum allowance then they must apply for a site plan review at a cost of $200.

Sherwood's natural resource overlay zones define minimum disturbance standards for resource protection, but do not have any regulations that target tree conservation specifically and regulated areas are exceeded by Clean Water Service's vegetated corridor standards. Sherwood does not regulate any heritage or historic trees.

City of Tigard

Tigard has had Tree City USA designation since 2000 and an established tree board for the past ten years. Tigard implemented it first tree ordinances and regulations almost 30 years ago. Those tree regulations governed the removal of all trees on undeveloped land, developed commercial and industrial land, and public land. However, changes to the tree ordinance in 1997 now allow the removal of any tree as long as its removal is mitigated. Currently, tree removal permits are processed by means of a Type I procedure.

Tigard regulates trees on both public and private property. Regulated trees during development are defined as any tree ≥ 6 inches dbh. Trees that require a removal permit include street trees, trees on city property, trees that were planted as a condition of development approval, trees in sensitive lands areas, trees on developing properties, trees that are restricted on the deed of a property, and heritage trees. Removal is defined as the cutting or removing of 50 percent or more of a crown, trunk or root system of a tree (Section 9.06.020).

In fiscal year 2007/2008, Tigard spent approximately $200,000 on urban forestry-related activities. Funding comes from general fund allocations (mostly property taxes), development fees and grants. Additional funding comes for urban forestry-related activities come from Clean Water Services stormwater service fees. Through a partnership with Clean Water Services, the City of Tigard is conducting stream restoration and enhancement projects that will result in the planting of approximately 100,000 native trees from 2001 to 2011. Also, the city's public works department annually plants approximately 250 new or replacement trees on public lands, distributes street trees each year to private property owners through the Street Tree Program, and plants 25 trees in celebration of Arbor Day.

Tigard adopted an Urban Forestry Master Plan in 2009, which included recommendations for revisions to Tigard's tree and landscaping ordinances and the development of a tree grove protection program. Tigard has been working on revising its code consistent with these recommendations and adoption is scheduled for April of 2012. The draft code proposal is a shift from mitigation of tree removal to increasing tree canopy citywide.

City of Tualatin

Tualatin has had Tree City USA status since 1987 and has had a tree preservation ordinance and urban tree committee in place since 1979. The city council adopted the existing ordinance in 2001 with an urban forestry management plan that focuses on street trees. Tualatin has won several awards for its urban forestry activities over the last 25 years.

Tualatin regulates removal of trees greater than eight inches in diameter during development review and outside the development process. However, various exemptions allow removal of trees greater than eight inches outside these permit processes. The city of Tualatin does not require mitigation when regulated trees are removed unless those trees were designated for preservation and were lost or damaged during construction. Tualatin is working on developing new regulations that would require mitigation. Some tree preservation and tree protection apply in Tualatin's natural resource protection overlay but these areas are mostly covered by Clean Water Service's vegetated corridor standards.

Tualatin regulates street trees and requires the planting as a condition of approving development. The city also pays for some street tree planting. Additional tree planting requirements are applied in parking lots and as part of landscaping requirements.

Over the years, urban forestry activities in Tualatin have been funded with a combination of property taxes, development fees, general fund allocations, grants and the city's road fund. In the 2007-2008 fiscal year, Tualatin spent $215,465 on urban forestry-related activities.

Tualatin officials are currently considering a number of potential changes to the city's tree codes including reducing exemptions that allow tree removal outside the permit process, the size of regulated trees, and requiring some mitigation of tree removal. There is also discussion of raising additional funds for urban forestry activities by establishing a tree bank fund for in-lieu mitigation and/or raising funds through a street utility fee.

Washington County, urban unincorporated

Washington County limited policies and regulations relating to tree preservation or mitigation outside "Significant Natural Resources Areas" mapped and regulated as part of the county's acknowledged Goal 5 program or floodplain and natural drainage hazard areas. Policy 10.h for "Biological Resources and Natural Areas" of the comprehensive plan circumscribes tree regulations to significant natural areas by committing the county to "Develop tree conservation standards to regulate the removal of or damage to trees and vegetation in identified Significant Natural Areas within the unincorporated urban area, in order to retain the wooded character and habitat of urban forested lands." Section 421 references the retention of "large trees" in flood areas. Section 422 governs tree removal associated with Significant Natural Resource Areas. These regulations have been in place since 1983. In addition, Section 407 for Landscape Design of the Community Development Code has standards for tree removal but not for tree preservation. Section 407 also contains planting standards associated with development, including street trees. Some community plans have additional tree protections for specific sites; however, all but community plan

subordinates tree retention to "development of the site at the planned density." Section 404 has specific tree-related standards for planned developments. No mitigation of tree removal is required.

No permit is required to cut trees outside the development review process unless the site is identified as a Goal 5 resource on the applicable community plan**.** Washington County has no official sanctioned tree committee, board, or commission. The county does not have an urban forestry management plan. Discussions with planning staff and citizens in Washington County reveal that tree removal is often deemed unavoidable because of zoned densities. This widespread view may limit more innovative designs. Section 207-5.1 of the CDC specifies that conditions on approved development "shall not restrict densities to less than that authorized by the development standards of this Code." This provision is often invoked as the reason for not preserving more trees. However, there is also some disagreement as to whether staff can or does use its full discretion to preserve trees through clustering or design modification. The widespread view that tree preservation is impractical or unachievable at planned densities may dissuade staff from using their discretionary authority to preserve trees. In sum, both a lack of specific standards for tree preservation and the presumption that trees cannot be accommodated at zoned densities result in little tree preservation in urban unincorporated Washington County.

A Joint-CPO Tree Code Group formed in the summer of 2007 to explore policy and code changes and stem the accelerated loss of trees in urban unincorporated Washington County. CPO representatives and interested citizens worked together to research what policies and development codes other counties and cities have implemented to address tree preservation and increase urban forest canopy. In 2009 the Joint-CPO Tree Code Group produced an executive summary and research report and submitted it to the Washington County Board of Commissioners. The group requested that development of urban forestry policies be included on the county's 2009 work program as a Tier 1 (priority) item. The county commissioners did not include the request in the 2009 work program (or again in 2010 or 2011) but indicated they will consider it for future work plans. For more information on the Joint-CPO Tree Code Group see: http://www.washcotreegroup.org.

The Willamette Basin Alternative Futures Analysis provides a plausible window into the future for ecological conditions in the Southwest Corridor. One future could see substantial success in revegetating stream corridors, active management of second- or third-growth conifer forests in public parks and natural areas, stronger protections for the last remaining groves of privately-owned trees and vigorous tree planting and green street initiatives. By combining these efforts, tree canopy could increase and additional losses of native wildlife species may be minimal. Water quality and quantity issues will continue to be the greatest challenge of this corridor planning area. Fortunately, we have the skills and ability to reverse some of these impacts to our water resources using habitat friendly development techniques – and the benefits are well documented. There is the potential that visitors to the Southwest Corridor fifty years from now could find a much more lush, green and healthy environment than what we find here today.

KEY FINDINGS

Water Quality and Quantity The Southwest Corridor planning area includes 98 miles of streams – more than 10 percent of the region's waterways. All of the streams within the planning area are 303(d) listed for water quality by the Oregon DEQ. Water quality issues include high temperatures, excessive nutrients and pollutants. Water quantity is also a challenge as impervious surfaces throughout the planning area cause excessive runoff into these creeks and streams during even small storm events, scouring and downcutting stream banks and causing flooding and erosion. Long term, water quantity issues – both too much and too little – will likely be an even greater issue for these urban streams. Projections for the Willamette Basin show that the length of time that streams are expected to go dry in even a moderately dry summer will double causing even greater impacts to water quality, stream health, fish and wildlife over time.

Streams and Riparian Areas Identifying those sections of streams where wider corridors can be enhanced or restored – and where narrow riparian areas can be widened – presents the best opportunity for significantly improving water quality and wildlife health. Ecologists and wildlife biologists agree that wildlife corridors are becoming increasingly important to the long term health of our native species in the face of the impacts of climate change. Improving riparian areas is an important climate adaptation strategy that could be incorporated in the Southwest Corridor.

Wildlife Habitat Because it is so intensely developed, there are few remaining opportunities for protecting significant habitat in the corridor planning area. However, enhancement and restoration of fish and wildlife habitats is happening throughout the planning area supported by public agencies, non-profits, neighborhood groups and private land owners. Habitat enhancement and the re-creation of habitat and habitat functions that have been lost is important to the health of wildlife within the planning area and could be a strategy in the corridor plan. A few significant habitat patches and special habitats do still remain (primarily remnant oak woodlands, hardwood floodplain forests and turtle habitats) that should be given special consideration in conservation and protection strategies within the corridor area.

Wildlife Crossings There are three major stream crossings and several smaller/minor stream crossings impacted by Highway 99W. Typically, these stream crossings also serve as connectivity corridors for wildlife. Next to improving water quality and quantity issues, improving the stream crossings and allowing fish and wildlife passage represent the best opportunities to support wildlife health within the planning area. Improvements of crossings for wildlife could be paired with improved pedestrian crossings to create safer and more reliable transportation alternatives and opportunities for increased access to nature for people living, working and traveling within the area.

LID(A)s In Washington County, generally, low-impact development approaches (LIDAs) are not as widespread as in the City of Portland. LIDAs are often perceived as more expensive due to the low infiltration rates caused, in part, by the area's tight soils. Often there is a concern that these facilities take up too much space – creating direct conflicts with the region's density goals. Additionally, some LIDA practices are difficult to permit and finance.

Urban Tree Canopy Overall the tree canopy in the Southwest Corridor planning area is high (estimated at 29 percent) and many of the residential areas in the corridor feel quite lush and beautifully forested. However, most areas directly adjacent to major roadways, industrial and commercial areas have a much lower percentage (commercial – 14%, industrial – 13%) tree canopy and offer opportunities for increasing the urban forest for multiple benefits . Tree canopy can help beautify the area, clean the air, cool water in streams and slow and clean urban stormwater runoff. Tigard and the City of Portland have updated their urban forestry policies and adopted aggressive tree canopy goals for all land use types. Plans for the Southwest Corridor could include more ambitious goals for expanding tree canopy in areas where canopy is lacking. Actions could include tree planting programs for public lands (including public ROW's), identifying new funding sources for tree planting and tree maintenance, improving enforcement of existing tree protection and implementing best management practices during construction, development and redevelopment.