Chapter 6– Riparian and Wetland Habitat

Contents

List of Figures, Tables, and Maps

FIGURES

TABLES

Maps

Riparian and Wetland Habitat

Intercouncil Watershed Assessment Committee Questions/ Issues

1) **What is the current condition?**
   - What is the condition of the riparian corridor? Wetlands?
   - What is the extent of riparian vegetation in all creek basins?
   - Does creekside development have an impact on this? Do we need to restore former areas along the creek?
   - Do we have any riparian areas or wetlands? Where are they? Do they have any protection?
   - What is the percentage of canopy?

2) **How have riparian conditions changed over time?**
   - How have riparian zones and wetlands changed over time; specifically due to filling of wetlands and flood plains and removing riparian vegetation?
   - What changes have we seen in life forms in creeks? Species? Causes?

3) **What/where are the opportunities for restoration/ enhancement and how will they be implemented?**
   - What locations have the greatest potential for mitigation?
   - What areas are available for restoration?
   - Where are key existing wetlands in all creek basins?

4) **What is the ownership along streams? And what is the zoning?**
   - Public vs. Private
   - Are homeowners maintaining riparian areas and wetlands on their properties?

5) **What programs address identified problems and protect riparian areas?**

Introduction

This chapter summarizes riparian and wetland conditions and functions for the Pringle, Glenn-Gibson, Claggett, and Mill Creek watersheds. The purpose of the assessment was to evaluate how conditions have changed over time, how a riparian/ wetland area influences the fish, wildlife and water quality in the basin, and to identify opportunities available to restore and/or enhance impacted areas and protect intact wetland and riparian habitat.

Data sources

Aerial photographs obtained from the City of Salem, Marion County and the Marion County Soil and Water Conservation District were used as base maps to estimate shade. The criteria used to assess streamside shading were based on a shade index presented in OWAM (Watershed Professionals Network 1999).

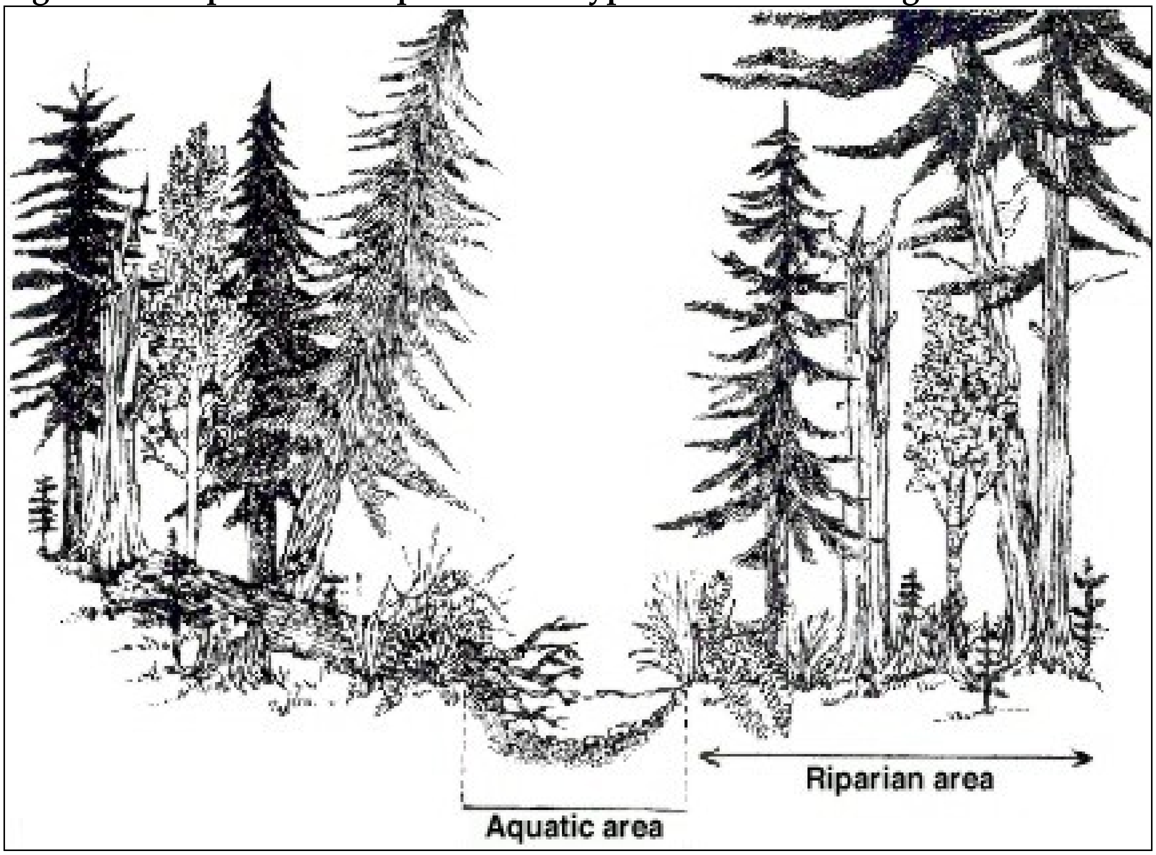
Other riparian measurements, such as riparian width and species composition, were not measured due to time constraints. Because three of the four watersheds studied in the assessment are urban, stand age was not measured. Stand age is typically measured for its potential to generate large woody debris. Flashy urban streams tend to move unattached woody debris downstream.

Riparian inventories conducted in Stayton (Fishman Environmental Services 1998) and Turner (Mid-Willamette Valley Council of Governments 2000) provided detailed information on riparian habitat conditions and functions. Information on Pringle Creek riparian habitat was provided by the City of Salem. Historical information on riparian vegetation was provided by Marion County Public Works (2000) and the Oregon Natural Heritage Program database (2000). Information on wetlands was obtained from National Wetland Inventory maps and from local wetland inventories of Salem-Keizer (Schott and Lorenz 1999), Turner (MWVCOG 2000) and Stayton (Fishman Environmental Services 2000).

What is a Riparian Area?

A riparian area, also referred to as "riparian zone", is a strip of land next to a body of water where vegetation and soils are influenced directly by the water. Its vegetation and microclimate are strongly influenced by annual and intermittent flow, a high water table, and wet (hydric) soils. Riparian zones contribute large wood, smaller organic material, shade, and insects to the stream and riparian area (Godwin 2000). A healthy riparian zone filters and purifies the water passing through it, reduces sediment loads, enhances soil stability, and contributes to ground water recharge and flow. Riparian vegetation differs around Oregon. **Figure 6-1** demonstrates a typical western Oregon riparian area dominated by conifers, deciduous (hardwood) trees, and some shrubs, native grasses (not lawns), sedges, and rushes.

Figure 6-1. Riparian and aquatic zones typical of western Oregon.



Source: Godwin (2000).

In the Willamette Valley today, hardwood trees dominate the riparian canopy. Depending on soil type and moisture availability, riparian areas in Marion County were historically dominated by Oregon ash, black cottonwood and willows in wetter areas, and bigleaf maple, Douglas fir, Ponderosa pine, and white oak in drier areas. Western red cedar, hemlock and grand fir could also be found in smaller quantities. The understory of these riparian areas contained smaller trees and shrubs such as red alder, vine maple, ninebark, hardhack, salmonberry, and native blackberries. A description of ecological communities in Marion County's valley region before Euro-American settlement can be found in the Natural Heritage Park Selection and Acquisition Plan (Marion County Public Works 2000).

The same woody species found historically in riparian areas of the mid-Willamette Valley can still be found today. However, invasive species such as Himalayan blackberry, Scotch broom, and reed canarygrass have become dominant understory species. In urban areas, English ivy, loosestrife, and other non-native plants used for landscaping have invaded riparian areas. These invasives are aggressive "pioneer" species that take advantage of soils recently disturbed by logging, grubbing, scraping, farming or development. They out-compete native species and can transform a diverse plant community into a monoculture, a community consisting of one plant species. Monocultures provide little or no habitat for many terrestrial animal species that live in or frequent riparian areas for food, water and shelter.

Ecological Benefits of Riparian Areas

Riparian areas provide many functions that influence both aquatic and terrestrial systems. Specifically, they act as a buffer zone between upland land uses and water resources, protect and enhance water quality, prevent erosion and moderate flood flows.

Water Quality

Healthy riparian areas produce multiple water quality benefits. Natural riparian vegetation settles out sediment, reduces streamside erosion, and lessens non-point source pollution from parking lots, golf courses, and lawns.

As a watershed urbanizes, impervious surface increases, and local water quality declines. Riparian areas and drainage patterns are changed by building construction, vegetation removal, bridge installation and expansion of local roads. Impervious surfaces increase the rate of stream flow, intensifying erosion and decreasing riparian areas' filtering capacity (ODSL 1998).

Increases in sediment load from poorly vegetated areas decreases local water quality. Higher sediment load also results from increased paving, and from floods. Heavy metals and organic nutrients, such as phosphates and nitrates, bind to soil particles and are carried to streams. Contaminated sediments modify stream chemistry, impact food chains and alter riparian habitat. Algal blooms in waterways may be triggered by excessive nutrient loading. When blooms decay, they consume dissolved oxygen required by other aquatic life (ODSL 1998).

Slope, riparian width and vegetative density contribute to sediment-trapping potential. Densely vegetated riparian areas with minimal slope, which allow sheet flow of runoff, are the most effective in reducing sediment entering waterways. Channelized streams carry sediment rather than allow it to settle out.

Potential riparian erosion varies with soil type, vegetative mix and density, slope and human modification. Erosion is reduced by actively growing plant root systems, complex forest cover and undisturbed soil.

Flood Management

Riparian areas, adjacent wetlands and local floodplains decrease flood volumes and rates of flow. Well-vegetated riparian areas may also store floodwaters, thereby reducing associated flood damage downstream. Forest vegetation is particularly effective in slowing and dissipating floodwaters (ODSL 1998).

The capacity of a riparian area to contain floods increases when depressions or swales are present. Excess floodwaters are slowed in these areas, soak into the ground, and release at a later date (ODSL 1998). The natural capacity of a watershed to manage flood events is reduced when channelization occurs, impervious surfaces increase and wetlands are filled in.

Thermal Regulation

Water temperature variations outside of normal ranges may impact the stream's ability to support native aquatic life. Streamside shade, especially forest cover, is important in maintaining steady temperatures in riparian areas.

Stream temperatures are important for native cold-water species such as salmonids. Summer water temperatures are the most critical for survival. (Please refer to the Fish and Water Quality chapters for more detailed information). High water temperatures disturb stream ecology by increasing plant growth and decreasing the water's capacity to retain oxygen (ODSL 1998).

Stream orientation is an important factor in correlating riparian vegetation to streamside shade. In the Willamette Valley, vegetation on the south edge of an east/west-oriented stream has the best opportunity to provide shade during the critical summer months, since in Oregon the sun is always south of vertical. Riparian vegetation overhanging the north side of an east/west stream provides limited shade. Overhanging vegetation on either bank of the stream creates cooler microclimates which benefit cold-water species such as salmon and their prey (ODSL 1998).

Larger plants and trees provide more shade when mature. Placement on southern slopes enhances shade potential. Grasses and shrubs provide limited shade on small streams (ODSL 1998).

Wildlife Habitat

Both aquatic and terrestrial wildlife species benefit from healthy riparian areas. The best wildlife habitat has a wide variety of plant species, regular water flow and minimal human disturbance. Riparian corridors serve as important migration routes for species traveling between aquatic and upland environments. Corridors facilitate mingling of individuals, thus helping preserve genetic diversity (ODSL 1998). Riparian disruptions, such as lights, bridges and roads, discourage movement, as do artificial lawns along streams. Wildlife may be harmed while crossing human places, or by the pesticides and fertilizers used to maintain lawns.

Many native Oregon species, including amphibians and reptiles, use riparian or wetland areas during their lives. Wildlife is dependent on a range of plants for food sources, cover from predators and habitat for raising young. A complex vertical canopy contains more niches for birds and mammals than a low canopy, and is less likely to be invaded by humans or domesticated animals (ODSL 1998).

Large woody debris (LWD) in riparian zones create additional aquatic and terrestrial habitat for many species of insects, birds, fish, mammals and reptiles. LWD and associated shade create microhabitats in riparian areas. Large woody debris may be deposited from adjacent riparian vegetation, fall into streams as a result of erosion or floods, or be placed during restoration activities (ODSL 1998).

In stream channels LWD modifies flows and enhances complexity. Complex stream channels provide refuges for fish during high water events, hiding areas from predators, and rearing areas (Watershed Professionals Network 1999).

Adequacy of Riparian Vegetation for Shade

Shade provided by riparian vegetation affects stream temperature by reducing the inputs of solar radiation to the water surface (Watershed Professionals Network 1999). A shade index provided by OWAM (Watershed Professionals Network 1999) (**Table 6-1**) and aerial photographs were used to roughly estimate stream shading in local streams**.** Three sources of aerial photographs were used to develop the streamside shading maps. Marion County aerial photos taken in 1998 were used in the riparian shade assessment for rural portions of the Mill Creek watershed. In addition, a series of Marion County aerial photos taken in 1992-1993 were used for areas outside of the Salem-Keizer UGB. Inside the UGB, aerial photos taken from 1994-1999 were analyzed using the OWAM criteria mentioned above. When shade cover was not discernable from aerial photographs, site visits were made for field verification. Stream segments were categorized at a minimum length of 500 feet. Shade levels were assessed along approximately 250 miles of stream located in all four watersheds. Approximately 86 miles of stream remained unclassified for the assessment, primarily due to low-resolution photos or time constraints. Each side of a stream was evaluated separately for shade.

Open water features such as ponds or lakes were classified as having low shade cover even if trees occured along the banks. These water bodies, most of which are shallow in depth, typically act as heat sinks since most of the water is exposed to the sun regardless of the presence of riparian vegetation. Exceptions to open bodies of water that may not act as heat sinks include gravel pits and Clear Lake, both which are deep.

Table 6-1. Indicators of Stream Shading Used in the Riparian Conditions Assessment

Indicator	Shade	Category
Stream surface not visible, slightly visible, or visible in patches	>70%	High
Stream surface visible but banks are not visible	40-70%	Medium
Stream surface visible; banks visible or visible at times	<40%	Low

Source: Watershed Professionals Network (1999)

Watershed Summaries

Table 6-2 shows total miles of open/closed stream miles and the percent of stream miles, within each watershed, categorized as having high, medium or low shade cover. Stream miles that were not categorized due to time constraints or low resolution photographs are also given.

Table 6-2. Percent of Stream Miles Categorized into Low, Medium and High Shade Cover and the Total Number of Open Stream Miles in Each Watershed

	High (%)	Medium (%)	Low (%)	Unclassified (%)	Stream miles classified	Total open stream miles
Pringle	28	16	52	4	27	28
Glenn-Gibson	55	10	25	10	28	31
Claggett	25	13	43	19	21	26
Mill	28	11	16	45	174	316

Note: Please refer to **Map 6-1** through **Map 6-5** for a visual representation of the shade categories.

Pringle Creek

Approximately 27 stream miles were classified in the Pringle Creek watershed. There are 164.16 miles of piped waterways. Only 4% of Pringle Creek was not classified into a shade category (**Table 6-2**). Over 50% of Pringle Creek and its tributaries have low, or less than 40%, shade cover.

Map 6-1 shows that the location of stream reaches with low shade cover are located on the main stem of Pringle Creek, East Fork Pringle Creek and in the upper extent of all tributaries. In the southeastern portion of the watershed, almost the entire length of Tanglewood Brook and a substantial section along the West Middle Fork of Pringle Creek have little shade cover. Other poorly shaded stream areas are found intermittently throughout the watershed. In general, stream sections classified as low shade are located in areas designated for industrial, commercial and residential uses.

An agricultural area just outside Salem's southeastern urban growth boundary also has low shade.

Stream reaches with high shade cover are scattered throughout the Pringle Creek system in downtown Salem and adjacent to Bush's Pasture Park and Deepwood. Sections along the West Fork of Pringle Creek, West Middle Fork of Pringle Creek and the upper reaches of the Middle Fork of Pringle Creek all appear to have some high shade cover. Land uses in these areas are primarily residential and public.

Glenn-Gibson Creeks

Approximately 28 stream miles were classified using the OWAM shade index, with 10% of the waterways reported as unclassified in the Glenn-Gibson system (**Table 6-2**). The 10% not classified includes Turnage Brook. A total of 40.42 miles of stream is piped.

Overall, the Glenn-Gibson streams and tributaries appear to have relatively good shade cover. Approximately 55% of the creeks in the watershed were categorized as having greater than 70% shade. Creeks in the Glenn-Gibson watershed have the highest percentage of creek miles with high shade cover relative to all other local streams studied.

An estimated 25% of Glenn-Gibson stream surfaces and banks have low shade cover. These low shade areas are located near the headwaters of Gibson Creek, the North Gibson Swale, and the upper extent of Farmer's Brook, Eagle Crest, Winslow Creek, Dahlia Swale, and Archer Brook (**Map 6-2**). Low shaded areas were also identified on Glenn Creek at and near the Salemtowne pond and in the southern portion of the watershed near Ptarmigan Street. Small sections of Gibson Creek exhibit medium to low shaded reaches. Single family residential, public, and some industrial areas border these waterways.

Most stream reaches with medium shade cover are within the City of Salem's urban growth boundary (UGB). Areas with high shade cover are found both inside and outside the UGB. Because relatively small stretches of creek classified as having low or medium shade cover are scattered throughout the basin (**Map 6-2**), several relatively small stream enhancements could lead to continuous shade cover for the entire length of a stream.

Claggett Creek

In the Claggett Creek system, about 21 stream miles were classified into the following shade categories: 25% high, 13% medium, and 43% low shade cover (**Table 6-2**). Approximately 19% of the waterways remained unclassified and 76.37 miles of stream are enclosed in pipes. Most of the unclassified waterway is a small tributary to Labish Ditch in the north part of the watershed. A quick review of this area shows that this tributary apparently has low shade cover along most of its length.

Map 6-3 illustrates that the shade indexes vary throughout the Claggett Creek watershed. Claggett Creek has low shade cover in the upper reaches of the watershed where land use is mostly commercial and residential. As the stream flows from east Salem into Keizer, reaches of the stream alternate between high and low shade cover. A large section of creek with low shade cover stretches from approximately Lawless Avenue to Chemawa Loop. Claggett Creek receives more shade as it flows north of Staats Lake and into Clear Lake. While Clear Lake does have trees along its banks, we categorized the lake as having low shade cover because its surface waters are totally exposed. As the stream flows from Clear Lake, it alternates between low and high shade cover. It is interesting to note that the creek in this area has a wide meander channel that is dominated by grasses, though the banks of the channel do contain mature trees. Frequent flooding and an actively moving channel may impede the growth of trees. This part of the stream is visible from a bridge on Windsor Island Road.

Some areas with high shade cover are found in the upper portion of the basin, adjacent to agricultural, single-family residential and public land. From **Map 6-3**, it appears that two areas designated as public land support highly shaded sections of stream. One area is located west of Hyacinth Street near the Salem Parkway and the other is located on the Chemawa Indian School site, south of Hazelgreen Road. The area between Portland Road and Interstate 5 supports a continuous section of stream classified as high shade.

Labish Ditch and its tributaries are predominately classified as having low shade cover. Labish Ditch is used for drainage and the land surrounding the ditch is typically farmed to the top of the bank.

Mill Creek

Approximately 174 stream miles (55% of the waterways) of the Mill Creek watershed were categorized into shade categories. Approximately 45% of Mill Creek and its tributaries remain unclassified (**Table 6-2**). About 28% of Mill Creek and its tributaries were classified as having high shade cover with another 11% as having medium and 16% as having low shade cover. There are 141.72 miles of stream enclosed in pipes.

Many of the smaller Mill Creek tributaries were not mapped due to time constraints, which contributed to the 45% of unclassified waterways. Most of these tributaries lie within the southern portion of the watershed where they have been ditched and are now primarily used for irrigation and drainage (**Map 6-4**). A cursory review of the area shows that most of the creek miles have low shade cover.

Overall, the main stem of Mill Creek has high shade cover along its entire length (**Map 6-4** and **Map 6-5**). Exceptions to this include a stretch of the creek north of Stayton along Highway 22, the reach between Mill Creek's confluence with Beaver Creek west of the City of Turner, and another reach that stretches from the Salem UGB to approximately Kuebler Road. The large stretch of creek with low and medium shade cover near Kuebler Blvd. is state-owned property. Another smaller stretch of Mill

Creek with low shade cover can be seen near the Oregon State Penitentiary along State Street in Salem.

With the exception of its headwaters, the majority of Beaver Creek appears to offer little shade cover (**Map 6-4**). This creek has been channelized and is used for drainage.

Many reaches of Battle Creek and its associated tributaries have high shade cover. Areas of low shade cover include the confluence of Battle, Waln and other tributaries just west of Commercial Street (**Map 6-5**), the lower reach of Waln Creek (**Map 6-5**), and the lower reach of Battle Creek before it flows into Mill Creek at the City of Turner (**Map 6-4**).

Other Riparian Studies

Pringle Creek

In the spring of 2000, a local riparian area survey assessed riparian functions (water quality, flood management, thermal regulation, wildlife habitat) along a 550-foot long reach of Pringle Creek between Mission and Winter Streets (City of Salem 2000). The survey was conducted by City of Salem staff and a member of the Pringle Creek Watershed Council. The survey stated:

> ….this reach is 18 to 24 feet wide with a stream bank oversteepened at a 1:1 slope and steeper, exceeds 25% impervious surface, exceeds 75% development and human disturbance, has numerous stormwater outfalls and substantial evidence of mass wasting along the bank, is constricted by man-made features such as bank armoring with riprap and concrete slabs, has less than 10% of its water resource edge bordered by a vegetated riparian area at least 30 feet wide and less than 25% of that edge has woody vegetation overhanging the water edge. Wildlife habitat and plant health are poor. Water quality, flood management, and thermal regulation (functions) are medium (City of Salem 2000).

The survey also noted invasive species and the overall health of native trees and shrubs. English ivy and Himalayan blackberries were running "rampant" on the site, with ivy overtaking the native trees and blackberries out-competing the native shrubs (City of Salem 2000).

There were a substantial number of dead and dying trees along the stretch of Pringle Creek between Mission and Winter Streets. Soil conditions may be responsible for the poor health of the native trees and shrubs. A good portion of the stream banks consisted of concrete/rock/rubble. The soil was characterized as having low fertility, a lack of tilth and very little organic matter (City of Salem 2000).

Although a riparian characterization and functional assessment has not been completed for other creeks in the Salem-Keizer UGB, the description of this reach of Pringle Creek is probably typical of many urban streams in the Salem-Keizer area.

Mill Creek

City of Turner

In spring 2000, the *Local Wetlands and Riparian Area Inventory* was completed for the City of Turner (MWVCOG 2000). The study area covered about 14.8 miles of riparian area located within the City of Turner's urban growth boundary. The project area included the Perrin Lateral Canal and Mill Creek.

The report found that most of the riparian area in Turner has been disturbed by building, landscaping, farming, or roadways. In undisturbed areas, typical riparian vegetation was forest over a shrub layer with sparse groundcover. Riparian forest canopies were dominated by Oregon ash, red alder, Pacific willow, black cottonwood, and Oregon white oak. Shrubs included Pacific ninebark, cascara, red-osier dogwood, snowberry, clustered rose and Nootka rose. Himalayan blackberry was common on disturbed sites.

Riparian area functions (water quality, flood management, thermal regulation and wildlife habitat) were evaluated and summarized in the report. Overall, water quality and flood management functions were reported as functioning at medium to high levels. Depending on the reach of stream, thermal regulation and wildlife habitat varied from high to low.

City of Stayton

In 1998, the *City of Stayton Local Wetlands and Riparian Inventory* was conducted for the City of Stayton (Fishman Environmental Services 1998). Four streams/ditches were included in the riparian corridor study: North Santiam River, Mill Creek, Salem Ditch, and the Stayton Water Ditch. Both ditches were created in the 1800s for industrial purposes. Riparian habitat has developed along both ditches over the last century and the canals have become more "naturalized."

Within the Stayton UGB, only Mill Creek and the Salem Ditch are located within the Mill Creek watershed. Mill Creek was divided into three reaches, each reach assessed separately for four functions (water quality, flood management, thermal regulation and wildlife habitat). Salem Ditch was divided into four reaches. The characterizations of these reaches follows. The codes refer to specific stretches of the ditches.

Upper Mill Creek: Stream banks are vertical mud banks about 10 feet deep. This part of the creek was most likely ditched historically for agricultural purposes. The stream is about 75% shaded east of 1st Ave. and approximately 25% shaded west of 1st Ave.

Canopy is dominated by Pacific ninebark, willow and Oregon ash. This stretch of the creek rated high for water quality and medium for flood management, thermal regulation, and wildlife habitat.

Middle Mill Creek: This stretch of the creek is well shaded. The riparian corridor is broad to the northeast, grading into a Douglas fir/big leaf maple upland forest. Reed canarygrass dominates the understory. Large woody debris is common. The stream bottom has rock to cobble substrate. This reach of Mill Creek rated high for the functions of water quality, thermal regulation, and wildlife habitat. It ranked medium for flood management.

Lower Mill Creek: This reach of Mill Creek has been channelized through the golf course. The understory has been mowed, often to the top of bank, and tree cover is limited. This reach rated medium for water quality, flood management, and thermal regulation. It ranked low for functioning wildlife habitat.

Salem Water Ditch (RSD-1): From the west end of Wilderness Park to 4th Avenue, this reach supports a well-developed riparian community. Big leaf maple, red alder and Douglas fir dominate the canopy and provide approximately 95% cover to the stream. Dominant understory species include red elderberry, snowberry, Himalayan blackberry, and sword fern. The riparian corridor is typically flat and more than 75 feet wide. Riparian functions ranked high for water quality, thermal regulation, and wildlife habitat. Flood management ranked medium.

Salem Water Ditch (RSD-2): The most urban reach of the Salem Water Ditch is located between 1st and 4th Avenue. Canopy vegetation is generally lacking and the channel is more often shaded by buildings located adjacent to the top of the banks. Vegetation is often mowed and disturbed and impervious surfaces dominate the riparian corridor. The channel is concrete lined. All riparian functions ranked low in this reach of the Salem Ditch.

Salem Water Ditch (RSD-3): Between 1st Avenue and Wilco Road, the riparian corridor is forested with a narrow band of trees and is approximately 60 feet wide. Vegetation is dominated by big leaf maple, red alder and Douglas Fir; Oregon white oak and cherry are also present. The understory includes Himalayan blackberry, snowberry, Oregon grape, English ivy, sword fern, soft rush, reed canarygrass and other grasses. Riparian functions ranked high for water quality, thermal regulation, wildlife habitat and fish habitat. Flood management ranked low.

Salem Water Ditch (RSD-3): From Wilco Road to the northwest corner of the UGB, trees are scattered and limited to a narrow band where present. This reach ranked low in flood management, thermal regulation and wildlife habitat functions. Water quality functions ranked medium.

Canopy Cover Study

The City of Salem participated in a regional study that analyzed the forest canopy from Eugene, Oregon to Longview, Washington. Classified as a "Regional Ecosystem Analysis," Salem received regional, as well as localized, data documenting tree canopy changes over the past three decades, and air quality and stormwater benefits associated with the City's existing forest canopy cover. This information was generated from satellite images, remote sensing techniques, Geographical Information Systems (GIS) technology, and field surveys. The City expanded the ecosystem analysis to show canopy cover changes along each riparian corridor in Salem within the city's 12 watersheds. The tree canopy analysis is now available to the public.

The City of Salem's Parks Operations Division has produced "Sensitive Area Management Handbook," to be used by Parks staff to help them limit impacts of park use and necessary park management practices on sensitive environmental areas within and adjacent to City parks. The handbook is the result of an ongoing study of sensitive areas in City parks. The study came about in response to Endangered Species Act listings, Clean Water Act regulation of wetlands, and an increasing awareness of the need to use techniques such as Integrative Pest Management (City of Salem Parks Operations Division 2002).

Effects of Urbanization on Riparian Areas

The cumulative effects of land-use practices including agricultural and urbanization have contributed significantly to the decline of local aquatic life forms throughout the Pacific Northwest. Over the past century salmon have disappeared from about 40% of their historical range and many of the remaining populations (especially in urbanizing areas) are severely depressed (Nehlsen et al. 1991).

The effects of watershed urbanization on streams are well documented and include extensive changes in basin hydrologic regime, channel morphology, and water quality (see May et al. 2000). Over time, these alterations have changed the instream habitat structure required by local salmonid populations. Several studies performed on Pacific Northwest urban streams reveal how development pressure has a negative impact on riparian forests. Fragmentation of the riparian corridor and an increase in impervious cover are often associated with urbanization. Urban development is also accompanied by such practices as land clearing, soil compaction, riparian corridor encroachment, and modifications to the surface water drainage network. A major finding in the report *Effects of Urbanization on Small Streams in the Puget Sound Ecoregion* is that wide, continuous, and mature-forested riparian corridors appear to be effective in mitigating at least some of the cumulative effects of adjacent basin development (May et al. 2000).

The riparian inventory conducted on a small reach of Pringle Creek is a local example of the effects of urbanization on streams.

Riparian Protection

The impact of development activities on riparian corridors can vary widely and must be addressed at the state and local levels. Until recently, regional development regulations did not address riparian buffer requirements. Sensitive area ordinances, now in effect in most local municipalities in the Pacific Northwest, typically require riparian buffers 100 to 150 feet in width (May et al. 2000). A recent report concluded that the actual size of a riparian buffer needed to protect the ecological integrity of the stream system is difficult to establish (Schueler 2000). In general, the more fragmented and asymmetrical the buffer, the wider it needs to be to perform the desired functions (Barton et al. 1985).

The state of Oregon has a set of 19 statewide planning goals. These statewide goals are achieved through local comprehensive planning. The local comprehensive plans guide a community's land use, conservation of natural resources, economic development, and public services. The purpose of Goal 5 is "to conserve open space and protect natural and scenic resources," including riparian areas. The process of achieving Goal 5 includes completing an inventory of all riparian areas, analyzing their functions, determining their "significance," and adopting local ordinances to protect significant areas. To date, Turner and Stayton are the only cities in the four watersheds that have conducted a riparian inventory and functional assessment (MWVCOG 2000; Fishman Environmental Services 1998).

Although no riparian inventory has been completed, the City of Salem does provide some protection for riparian areas. As of June 20, 2000, the City of Salem's Tree Ordinance pertains to all trees, including trees and vegetation in riparian corridors. The ordinance:

1. Prohibits removing trees within 50 feet of non fish-bearing streams.

2. Prohibits removing trees and intact riparian corridor vegetation within 50 feet of fish-bearing streams and within 75 feet of the Willamette River.

In the ordinance, "trees" are defined as 8 inches or greater diameter as measured four feet from the base. "Intact riparian corridor vegetation" is defined as a diverse, multi-layered collection of native trees and vigorous, dense understory of native plants. Finally, the width of the riparian corridor boundary is measured 50 feet horizontally from the top of the bank on each side of a stream with the exception of the Willamette River, which measures 75 feet horizontally from the top of the bank on each side. Exceptions to the tree ordinance can be granted by the City of Salem (City of Salem 2001).

Potential Sites for Riparian Restoration and Enhancement

The City of Salem's Tree Ordinance may help protect what little remaining riparian habitat is present along Salem's streams, but to improve their degraded condition, restoration and enhancement of riparian areas will be necessary. Riparian restoration and enhancement activities should focus on improving water quality, flood management, thermal regulation, and wildlife habitat associated with streams. Maintaining healthy riparian functions improves habitat for aquatic species, wildlife, and humans.

Riparian areas adjust in species, width, and complexity as streams change over time. A well-established riparian area with vegetation of various species, sizes, and ages adapts to change better than a simplified, narrow riparian area (Godwin 2000). Although there are no absolute or single solutions for riparian restoration, one common resource goal should be to integrate the needs of both aquatic wildlife and local vegetation. In general, riparian enhancement in western Oregon often focuses on the long-term goal of establishing diverse patches of tree species, sizes, and age classes (Godwin 2000). For instance, large conifers that fall into a stream last much longer than hardwoods. They provide the long-term building blocks for fish habitat. By holding organic material they provide food for stream insects, which subsequently becomes food for fish.

In urban areas, the recruitment of large wood into streams is problematic due to limited space and the increased risk of flooding. However, this does not diminish the need to manage urban riparian habitat for diverse plant communities. Terrestrial and aquatic animal communities depend on the vegetation cover and plant diversity of riparian areas to provide adequate food, water and shelter, especially in urban environments, where streamsides provide the only natural areas within a "concrete jungle" of roads and impervious surfaces.

For the most part, identification of site-specific restoration projects is beyond the scope of this document. A few early-action items will be apparent from the analysis and will be identified in the Recommendations section. Identifying sites for restoration and enhancement should be a goal of the "action plan." General areas in need of riparian restoration can be initially determined by referring to the low shade (red) areas indicated on **Maps 6-1** through **6-5**. Initial target areas for restoration or enhancement should include public land and areas zoned as vacant residential, vacant industrial, and vacant commercial. Riparian areas found in Urban Renewal areas may provide another source of potential projects. Riparian areas in these areas have usually been highly impacted by urbanization and are in desperate need of restoration or enhancement. The process of urban renewal gives the community an opportunity to improve the condition of the neighborhood economically and aesthetically, including incorporating open space. Urban Renewal areas also offer funds to help achieve their goals. These funds could potentially be tapped for riparian restoration projects.

As a result of on-the-ground (field-checked) riparian inventories, potential sites for riparian restoration and enhancement are given below:

Pringle Creek – An inventory and assessment of a small stretch of Pringle Creek between Mission and Winter Streets in Salem resulted in the following suggestions for riparian enhancement:

> This section of Pringle Creek which is bounded by Salem Cardiology Associates, the Salem Hospital, and their attendant parking lots was identified as a critical reach because of its urban connection with a fish-bearing stream in downtown Salem. The left bank offers the opportunity to plant substantial trees and shrubs for shading the creek. Removing invasive plant species and planting additional native trees, shrubs and groundcover can improve riparian functions. Trees and other tall, woody vegetation should be emphasized on the south side of the creek (City of Salem 2000).

City of Turner – The assessment results for the Local Wetlands and Riparian Area Inventory for the City of Turner (MWVCOG 2000), indicated how different riparian functions in Turner could be improved. Increasing the percentage of tall woody vegetation in the riparian area and flood-prone areas would improve all riparian functions. Water quality, thermal regulation and wildlife habitat could improve by increasing the percentage of trees and shrubs along the top of the bank to provide overhanging vegetation along watercourses. Removing riprap, berms, and channelization from watercourses in undeveloped areas could improve the flood management function. Increasing tall woody vegetation (by providing more layers and structural diversity), increasing large woody debris in the riparian area, preserving existing wetlands, and minimizing human disturbances could all potentially improve wildlife habitat. Encouraging building locations and road alignments outside of the riparian area, establishing native vegetation corridors in developed and undeveloped areas, and minimizing road crossings would all help.

City of Stayton –The *Local Wetlands and Riparian Inventory for the City of Stayton* offers recommendations based on inventory results. Overall, sites without adjacent trees would have higher values if vegetation were enhanced with a variety of native trees and shrubs. Also, protecting riparian corridors from ornamental landscaping, mowing, and other impacts would improve their value (Fishman Environmental Services 1998).

What are wetlands?

More commonly known as marshes, swamps, and bogs, wetlands are a transitional zone between terrestrial and aquatic ecosystems where the water table is usually at or near the surface or the land is covered by shallow water. In wetlands saturation with water is the dominant factor determining soil development and the types of plants and animal communities living in the soil and on its surface (Cowardin et al. 1979). According to Cowardin et al. (1979), wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes (wetland plants); 2) the substrate is predominantly undrained hydric soil; 3) the substrate is non-soil (e.g., rock) and is saturated with water or covered by shallow water at some time during the growing season of each year.

Both the Oregon Division of State Lands (ODSL) and the U.S. Army Corps of Engineers (ACOE) regulate the filling of wetlands. According to Oregon's Removal-Fill Law (ORS 196.800) and Section 404 of the Clean Water Act, " wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil." To identify wetlands out in the field, ODSL and ACOE use three criteria: hydrology, soils and vegetation. In general, an area is identified as a wetland if it can be proven to have surface water or saturated soil during some period of the growing season, contains hydric soils, and has a predominance of hydrophytes.

The Ecological Benefits of Wetlands

The many functions that wetlands provide are critical to watershed health. The main functions of wetlands include the following (ODSL 1999a):

Flood Storage and Water Supply--Many floodplain and stream-associated wetlands absorb and store stormwater flows, which reduces flood velocities and stream bank erosion. Preserving these wetlands reduces flood damage and the need for expensive flood control devices such as levees. When the storms are over, many wetlands augment summer stream flows when the water is needed, by slowly releasing the stored water back to the stream system.

Food Chain Support--Because of their high productivity, wetlands provide essential food chain support. The green pond scum that coats cattail stems and the ankles of wetland visitors provides food for an abundance of tiny organisms that, in turn, feed fish, wildlife, and humans.

Wildlife and Fish Habitat--Wetlands provide essential water, food, cover, and reproductive areas for many wildlife species. For example, nearly two-thirds of the commercially important fish and shellfish species are dependent upon estuarine wetland habitats for food, spawning, and/or nursery areas. Similarly, millions of waterfowl, shorebirds, and other birds depend on wetlands. In semi-arid eastern Oregon, riparian (stream-associated) wetlands and springs are crucial to the survival of many birds, amphibians and mammals. In the Willamette Valley, wetlands provide important feeding and resting areas for migrating shorebirds and waterfowl. A series of wetlands strung together as bird sanctuaries in the Valley serves as a major stopover for migratory birds on the Pacific flyway. In addition, they provide important wintering habitat for Canada geese and other waterfowl.

Habitat for Rare and Endangered Species--Nationally, nearly 35% of all rare and endangered animal species depend on wetlands, even though wetlands comprise only about 5% of the land area.

Water Quality Improvement--Wetlands are highly effective at removing nitrogen, phosphorous, some chemicals, heavy metals, and other pollutants from water. For this reason, artificial wetlands are often constructed for cleaning stormwater runoff and for tertiary treatment (polishing) of wastewater. Wetlands bordering streams and rivers and those that intercept runoff from fields and roads provide this valuable service free of charge.

Aesthetics, Recreation and Education--Depending on their type and location, wetlands provide opportunities for fishing, hunting, plant identification, and wildlife observation. They are also visually pleasing, interesting elements in the landscape, often providing some of the last open space in urbanized areas. Wetlands are wonderful outdoor classrooms and laboratories.

Types of Wetlands in Local Watersheds

Wetlands and deepwater habitats are typically classified using the Cowardin system of classification (Cowardin et al. 1979). The structure of the classification is hierarchical, progressing from systems and subsystems, at the most general levels, to classes, subclasses, and dominance types. There are five wetland systems that are further broken down into specific wetland types. Those systems are marine, estuarine, palustrine, riverine, and lacustrine (lakes):

Palustrine —These are freshwater wetlands commonly referred to as marshes, bogs, and swamps. Included are wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and some non-vegetated wetlands that do not meet the criteria for Lacustrine (lake) wetlands.

Riverine – These are river, creek and stream habitats contained within a channel, where water is usually, but not always flowing. Riverine systems are usually unvegetated but may include nonpersistent emergent vegetation; palustrine (persistent vegetation) wetlands are often adjacent to riverine systems or contained within them as islands.

Lacustrine—This system includes permanently flooded lakes and reservoirs, intermittent lakes (e.g., playa lakes), and tidal lakes with ocean-derived salinities. Typically, there are extensive areas of deep water and there is considerable wave action.

According to the National Wetland Inventory (NWI) and several local wetland inventories (LWI), two wetland systems are found in local watersheds, palustrine and riverine. The palustrine system can be further classified into eight classes: Rock Bottom, Moss-Lichen Wetland, Aquatic Bed, Unconsolidated Shore, Unconsolidated Bottom, Emergent Wetland (includes wet meadow), Scrub-Shrub wetland, and Forested Wetland. Wetlands that fall into the last four Classes are the most abundant in the four watersheds. Descriptions of the four classes follow.

Unconsolidated Bottom—Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7cm) and a vegetative cover less than 30%.

Emergent Wetlands—These wetlands have rooted herbaceous vegetation standing above the water or ground surface. Includes wetlands such as cattail marshes and wet meadows.

Scrub-Shrub Wetlands—Wetlands dominated by shrubs and tree saplings that are less than 20 feet high.

Forested Wetlands—Wetlands dominated by trees that are greater than 20 feet high.

The riverine system can be furthered classified into four subsystems, which include: Tidal, Lower Perennial, Upper Perennial, and Intermittent. According to the NWI and the LWI, examples of the last three subsystems are present in local watersheds. Descriptions of the three subsystems follows.

Lower Perennial—The gradient is low and water velocity is slow. There is no tidal influence, and some water flows throughout the year. The substrate consists mainly of sand and mud.

Upper Perennial—The gradient is high and velocity of the water fast. There is no tidal influence and some water flows throughout the year. The substrate consists of rock, cobbles, or gravel with occasional patches of sand.

Intermittent—The channel contains flowing water for only part of the year. When the water is not flowing, it may remain in isolated pools or surface water may be present.

Because lacustrine systems, although present, are not abundant in the four watersheds, no description of subsystems or classes is given here.

Wetland modifications influence the character of such habitats, special modifying terms have been developed to explain these types of wetlands. There are six types of modified wetlands: excavated, impounded, diked, partly drained, artificial, and farmed. According to the NWI, all six of these modified wetland types can be found in the four watersheds.

Two modified wetland types are of special interest in the local area: farmed wetlands and excavated wetlands. Farmed wetlands are good potential sites of wetland restoration or enhancement projects. As for excavated wetlands, most of the Palustrine Unconsolidated Bottom Wetlands (PUB) wetlands in the Salem-Keizer UGB and in the Mill Creek watershed are the result of excavation for sand and gravel. PUB wetlands are the most abundant wetland type in the Salem-Keizer urban growth boundary (**Table 6-3**). Descriptions of the two most common modified wetland types follows.

Farmed Wetlands --Wetlands in which the soil surface has been mechanically or physically altered for production of crops, but hydrophytes will become established if farming is discontinued.

Excavated—Habitat lies within a basin or channel excavated by man.

Location of Wetlands

Two separate inventories were used to determine the location of wetlands in the four watersheds.

National Wetland Inventory (NWI)—This inventory was developed by the U.S. Fish and Wildlife Service and covers the entire country. While the NWI is extremely useful for many resource management and planning purposes, its small scale, accuracy limitations, and absence of property boundaries make it unsuitable for parcel-based decision making.

Local Wetlands Inventories (LWI)—To augment the NWI in areas where more detailed inventory information is needed, the Oregon Division of State Lands developed guidelines and rules for the Local Wetland Inventory. A LWI aims to map all wetlands 0.5 acres or larger at an accuracy of approximately 25 feet on a parcel-based map. Local wetland inventories are typically completed by municipalities when updating local comprehensive plans. For this reason, the extent of a local wetland inventory is usually within a city's urban growth boundary.

Salem-Keizer Local Wetland Inventory

According to the Salem-Keizer LWI (Schott and Lorenz 1999), there are a total of 1,482 acres of wetland within the urban growth boundary of Salem and Keizer. **Table 6-3** shows the distribution of wetlands types within the entire study area and indicates that the most extensive type of wetlands are natural ponds and inundated gravel pits (PUB), followed by emergent wetlands (PEM) and forested wetlands (PFO).

Table 6-3. Distribution of Wetland Area By Cowardin Classification Within Salem-Keizer UGB

Cowardin Class	Area (acres)
Ponds and Gravel Pits (PUB)	743
Wet Meadow Wetlands (PEM)	296
Forested Wetlands (PFO)	264
Farmed Wetlands (FW)	65
Scrub-Shrub Wetlands (PSS)	59
Total	**1427[1]**

[1]This total does not include 34 acres of wetland mitigation and 21 acres of riverine wetland included in Table 2. Riverine wetlands identified in the LWI were not classified using the Cowardin Classification, thus they are not included in the above table.
Data Source: Schott and Lorenz (1999)

According to the Salem-Keizer LWI, only 21 acres of riverine habitat are present within the urban growth boundary. All of those acres are located in the West Willamette Slough along the Willamette River. Streams and creeks are also identified in the LWI. The Salem-Keizer LWI did not attempt to identify all stream reaches (i.e. intermittent creeks, drainages or swales).

Table 6-4 shows the distribution of wetland types by watershed within the urban growth boundary. Schott and Lorenz (1999) provide a general description of the wetland types and their distribution in each of the four watersheds in the following text.

Table 6-4. Summary of Wetland Types (Cowardin Classes) By Watershed

Subwatershed	Wet Meadow (PEM)	Scrub-Shrub (PSS)	Forest (PFO)	Unconsolidated Bottom (PUB)	Farmed Wetland (FW)	Mitigation Wetland	Total
Battlecreek (BC)	4.73 acres 7 units	0.51 acres 2 units	1.34 acres 3 units	10.56 acres 16 units	0 acres 0 units	0 acres 0 units	17.14 acres 28 units
Croison Creek (CC)	0.97 acres 1 unit	0 acres 0 units	5.42 acres 1 unit	3.04 acres 4 units	0 acres 0 units	0 acres 0 units	9.43 acres 6 units
Claggett Creek Lower (CL)	89.29 acres 16 units	7.3 acres 5 units	18.32 acres 6 units	62.89 acres 6 units	0 acres 0 units	0 acres 0 units	177.8 acres 30 units
Claggett Creek Upper (CU)	34.59 acres 14 units	2.22 acres 1 unit	1.64 acres 2 units	15.22 acres 1 unit	0.39 acres 1 unit	0 acres 0 units	54.06 acres 19 units
East Bank (EB)	7.19 acres 13 units	2.02 acres 2 units	19.62 acres 6 units	65.21 acres 16 units	8.83 acres 1 unit	0 acres 0 units	102.87 acres 38 units
Glenn-Gibson Creeks (GG)	0.08 acres 1 unit	1.49 acres 3 units	1.59 acres 1 unit	4.77 acres 4 units	0 acres 0 units	0 acres 0 units	7.93 acres 9 units
Mill Creek (MC)	37.62 acres 24 units	7.99 acres 7 units	24.64 acres 10 units	281.55 acres 15 units	13.87 acres 5 units	0 acres 0 units	365.67 acres 61 units
Pringle Creek (PC)	11.67 acres 15 units	5.14 acres 3 units	12.2 acres 7 units	66.18 acres 13 units	0.62 acres 1 unit	28.13 acres 5 units	123.94 acres 44 units
Pettijohn-Laurel Creek (PJ)	0 acres 0 units	0 acres 0 units	0 acres 0 units	0.68 acres 2 units	0 acres 0 units	0 acres 0 units	0.68 acres 2 units
Little Pudding River (PU)	31.62 acres 35 units	2.49 acres 3 units	24.61 acres 16 units	2.08 acres 5 units	2.59 acres 5 units	5.47 acres 4 units	68.86 acres 68 units
Willamette Slough East (WS)	77.23 acres 14 units	22.85 acres 5 units	139.32 acres 15 units	228.62 acres 32 units	38.09 acres 10 units	0 acres 0 units	506.11 acres 76 units
Willamette Slough West (WW)[1]	0.93 acres 1 unit	7.46 acres 3 units	15.3 acres 3 units	2.30 acres 1 unit	0.47 acres 1 unit	0 acres 0 units	48.72 acres[1] 17 units
Total	**296 acres**	**59 acres**	**264 acres**	**743 acres**	**65 acres**	**34 acres**	**1482 acres**

1. Total wetland acreage and units for the Willamette Slough West includes 8, R2 wetland units subtotaling 21.48 acres

Source: Schott and Lorenz (1999)

Watershed Summaries of Wetland Locations

Because all four watersheds lie either entirely or partly within the Salem-Keizer urban growth boundary, the Salem-Keizer LWI was used to determine the types of wetlands present and their locations in these watersheds. Because the upper portion of the Glenn-Gibson watershed and the lower portion of the Claggett Creek watershed lie outside the UGB, the NWI was used to identify and locate wetlands outside the UGB. The Mill Creek watershed crosses several jurisdictional boundaries. The identification and location of wetlands in this watershed was determined using the NWI and the local wetland inventories of Salem-Keizer (Schott and Lorenz 1999), Turner (MWVCOG 2000), and Stayton (Fishman Environmental Services 1998).

Pringle Creek

Pringle Creek, a perennial creek, drains the area north of Kuebler Blvd., west of the Salem airport, and east of the hills at Belcrest Memorial Park and Cemetery. In the lower reaches, Pringle Creek flows through Bush's Pasture Park, the south downtown area and into the Willamette Slough near Boise Cascade's downtown plant. The several branches of Pringle Creek are best described as stormwater drainages in an urbanized environment. There are isolated wetlands at the south end of the Salem airport and in the Fairview Industrial Park area. Ponded areas created by past gravel mining are located north and south of McGilchrist Street. There are a total of 123.94 acres of inventoried wetlands in this sub-basin (**Table 6-4**). **Map 6-6** shows the location of wetlands in the Pringle Creek Watershed.

Glenn-Gibson Creeks

Glenn and Gibson Creeks originate in the hills of West Salem. The upper reaches of Glenn Creek currently flow through undeveloped property. There may be opportunities for stormwater detention in this upper reach. Small constructed ponds are located within the drainages at several locations. The largest native wetland complex is located south of Brush College Road in the northern portion of West Salem. A ponded area on the northern boundary of the West Salem study area, east of Wallace Rd., appears to have been constructed to hold water for irrigating agricultural fields. There are 7.93 acres of inventoried wetlands in the Glenn-Gibson watershed (**Table 6-4**). **Map 6-7** shows the location of wetlands in the Glenn-Gibson watershed. The wetlands highlighted in blue are taken from the Salem-Keizer Local Wetland Inventory. The wetlands highlighted in green or with a green border are from the National Wetland Inventory.

Lower Claggett Creek

Most of the wetland area in this watershed is along the riparian floodplain of Claggett Creek. The floodplain is in an undeveloped greenway. Both indigenous wetland plants such as sedges, rushes, and Oregon ash, as well as the introduced reed canarygrass grow in the wetlands. There appear to be opportunities for enhancement and mitigation along the lower portion of Claggett Creek. This area appears to be in relatively good ecological condition with high ratings for wildlife habitat, hydrologic control, and aesthetics.

Staats Lake and ponds on McNary Golf course are constructed features, created for aggregate mining or landscaping. Inventoried wetlands in this sub-basin total 177.80 acres (**Table 6-4). Map 6-8** shows the location of wetlands within the UGB in the Claggett Creek watershed. The wetlands highlighted in blue are taken from the Salem-Keizer Local Wetland Inventory. The wetlands highlighted in green or with a green border are from the National Wetland Inventory.

Labish Ditch enters Claggett Creek from the east. It is channelized with portions flowing through culverts. This ditch drains an area known as Lake Labish, a historic swamp that had once been the main channel of the Willamette River. This area, approximately 2000 acres in size, is now drained and intensively farmed. The soils of Lake Labish are peat or muck, decayed organic matter typically found in swamps. The Labish Ditch drains Lake Labish in two different directions. The west portion of the historic lake bed drains west into the Claggett Creek watershed while the majority of the area drains east into the Pudding River.

Upper Claggett Creek

Existing wetlands in the Upper Claggett watershed tend to be either small or isolated due to extensive development. Historic swales with hydric soils have been filled. Drainages tend to follow old swales with portions now in underground pipes. There are isolated depressions in fields used for parking lots at the north and south ends of the State Fairgrounds that meet jurisdictional wetland criteria. There is a relatively large emergent wetland and gravel pit complex at the lower end of the basin, just north of the Salem Industrial Park. The wetland appears to have been disturbed in the past and has enhancement potential. At the end of 2002, the City was poised to acquire 37 acres for a large urban park adjacent to the Northgate Extension Project. The additional 29 acres will be developed as light industrial and office space. The entire 66 acres is within the Northgate Urban Renewal Area. As part of the agreement, the City will file a conservation easement to cover Claggett Creek, its riparian area and nearby wetlands. There are a total of 54.06 acres of inventoried wetlands in the Upper Claggett Creek sub-basin (**Table 6-4**). **Map 6-8** shows the location of wetlands within the UGB in the Claggett Creek watershed. The wetlands highlighted in blue are taken from the Salem-Keizer Local Wetland Inventory. The wetlands highlighted in green or with a green border are from the National Wetland Inventory.

Mill Creek

The Mill Creek basin is approximately 110 square miles in area and originates in the foothills of the Cascades north of Stayton. Mill Creek is a perennial creek. The creek's water supply is supplemented from the North Santiam River during Oregon's growing season (March 1-October 1). Historically, before North Santiam water was supplied to Mill Creek, it is believed the creek had periods of very low to no flows in late summer. Major tributaries of Mill Creek include Beaver Creek and Battle Creek.

According to the NWI, large natural wetlands still remain intact in several areas throughout the watershed. **Map 6-9** shows the location of wetlands throughout the Mill Creek watershed. Wetlands are abundant near the confluences of creeks. Palustrine wetlands are located along Beaver Creek just before it flows into Mill Creek at Turner. Where Shaw Creek enters Beaver Creek, a large emergent and forested wetland dominated by Oregon ash and reed canarygrass, can be seen just north of Highway 22 across from the Aumsville wastewater treatment lagoons. Emergent and forested wetlands can also be found along the flat terrain of Beaver Creek, east of Turner, and along Simpson Creek north and west of Aumsville.

Mill Creek enters the southeast portion of the study area on State Penitentiary farm property. There are no riparian wetlands along this reach. Several isolated farmed wetlands are located on the southeast portion of the farm property. Between Kuebler Blvd. and Highway 22, including Cascades Gateway Park, there are several ponds created by gravel mining. Some of the best examples, in terms of diversity of native plant species, of wet prairie and forested wetlands are found in wetlands near the banks of Mill Creek between Highway 22 and the Southern Pacific Railroad. Several small and isolated emergent wetlands are located on the penitentiary property north of the railroad.

West of the State Penitentiary property Mill Creek divides into three branches including the constructed Mill Race and Shelton Ditch. These channels, passing through Salem's downtown areas have been channelized with riprap banks in many locations or in the case of the Mill Race, flow through a concrete-lined sluice. Currently, there are no native wetlands in the downtown Salem area. However, there are historical accounts of wetlands in this area, as noted in the Historical Conditions and Hydrology chapters. Inventoried wetlands in the Mill Creek sub-basin total 365.67 acres (**Table 6-4**). **Map 6-10** shows the locations of wetlands in the portion of the Mill Creek watershed that lies within the Salem-Keizer urban growth boundary. The wetlands highlighted in blue are taken from the Salem-Keizer Local Wetland Inventory. The wetlands highlighted in green or with a green border are from the National Wetland Inventory.

Wetlands Quality Assessment

Local wetland inventories gather information about the location, type and size of wetland resources. Information about the quality of wetland resources is determined by applying the Oregon Freshwater Assessment Methodology (OFWAM) (Roth et al.

1996) to the inventory information. Wetland quality assessments, combined with the inventory data, complete the information required to determine resource "significance." Local jurisdictions can then proceed with long-range planning to conserve significant natural resources, required by Oregon Land Use Planning Goal 5 (MWVCOG 2000). Once a wetland is determined to be "significant," the local jurisdiction can take steps to protect it by using a combination of methods such as land acquisition, conservation easements, local ordinances and education.

OFWAM gathers information about the watershed and the individual wetlands from background reports, maps, and fieldwork. The methodology indicates which functions are performed by wetlands in the planning area. OFWAM evaluates four ecological functions (wildlife habitat, fish habitat, hydrologic control, and water quality); three social functions (education use, recreational use, and aesthetic appeal), and two wetland conditions (sensitivity to impact and enhancement potential). If a wetland ranks "high" in any of the four ecological functions, it is considered a "locally significant wetland." However, a wetland can be deemed significant based on a combination of factors.

In 2002 the City of Salem complied a list of wetlands that meet the State's criteria for "locally significant wetlands." Currently, the City of Salem is in the process of completing the analysis for a list of significant wetlands as part of the City's effort to comply with the state planning goals. Development of the local significant wetlands list is a directive of Goal 5. The process for developing this list is outlined in the City's new wetlands ordinance Chapter 126. Once the list is developed, those wetlands within riparian corridors will have limited protection through SRC Chapter 68, Preservation of Trees and Vegetation. Further protection, such as for those wetlands outside riparian corridors, will be evaluated as the City's efforts progress. The cities of Turner and Stayton have already determined significant wetlands within their urban growth boundaries.

Potential Sites for Wetland Enhancement

Because wetlands provide many functions that are critical to watershed health, enhancement and restoration of wetlands should be a critical component in any watershed plan. In this section, information obtained from the Salem LWI, Stayton LWI and Turner LWI, was used to compile a list of degraded wetland sites whose functions (i.e. water quality improvement, fish habitat, wildlife habitat and hydrologic control) could be enhanced through efforts of the watershed councils or other interested parties.

The local wetland inventories reviewed in this assessment used the Oregon Freshwater Assessment Methodology (OFWAM) to determine a wetland's potential for enhancement. In some cases, the methodology outlined by OFWAM did not accurately rate a wetland's potential for enhancement. In these cases, notes made by the authors of the wetland inventories were used to more accurately rate enhancement potential. In other words, the ratings shown below are the result of OFWAM and best professional judgments. Information regarding the enhancement potential of wetlands outside of urban growth boundaries, but within the watershed boundaries, does not exist for the four watersheds.

Some wetlands listed are not rated for enhancement potential. Ratings were not available for wetlands in which information was lacking in local wetland inventories. Wetlands were also not rated if the wetlands were active gravel mines, permitted to be filled for development, mapped as mitigation sites, or current uses were not conducive to enhancement (e.g., wetlands on State Fairgrounds that are mowed and used for parking).

Some wetlands were rated "low" for enhancement potential because they were already of high quality. The authors of this document noted a couple of wetlands that perhaps should be preserved because of special characteristics identified in either the local wetland inventories or via personal communication with watershed council members.

Many times the terms "wetland restoration" and "wetland enhancement" are used interchangeably. "Wetland creation" is also term used frequently when talking about wetland mitigation. The Oregon Division of State Lands (ODSL) provides detailed definitions of these three terms (ODSL 1999b):

Wetland restoration— the re-establishing of wetland vegetation and hydrology to a site that was historically wetland but has been dried out by diking, draining, or filling.

Wetland enhancement -- improving an existing but badly degraded wetland by correcting the conditions that cause it to be degraded.

Wetland creation— constructing a wetland in an area that never supported wetlands historically.

Because local wetland inventories only identify existing wetlands, potential sites for wetland enhancement are emphasized in the following tables adapted from local wetland inventories.

Watershed Summaries for Wetland Enhancement

Wetlands are identified by a letter code in the following tables. The letter codes identify wetlands on local wetland inventory maps. Because of space limitations, local wetland inventory maps displaying wetland codes for all identified wetlands were not printed. Wetland maps provided show the extent of current wetlands and identify only the wetlands with high enhancement potential. For more detailed information, the reader must refer to the actual local wetland inventories: Salem LWI, Stayton LWI and Turner LWI. These documents are available for public review at the Oregon Division of State Lands.

Pringle Creek

Table 6-5 lists and identifies wetlands with high enhancement potential in the Pringle Creek watershed. Four wetlands have high enhancement potential according to the Salem LWI (Schott and Lorenz 1999). Three of the wetlands are actually abandoned gravel pits: Walling Sand and Gravel Pits (PC-E), Webb Lake (PC-F), and Berger Lake (PC-O). The fourth wetland is a cattail marsh (PC-DD) located west of 36th Avenue near the intersection of 36th and Kashmir Way. A forested wetland (PC-X) near the headwaters of the East Fork of Pringle Creek is the largest natural wetland still in existence in the watershed and may be a candidate for preservation. The wetland is dominated by Oregon ash and soft rush.

Table 6-5. Enhancement Potential of Wetlands in the Pringle Creek Watershed[1]

Wetland Identifier	Area (acres)	Enhancement Potential
PC-A	0.14	LOW
PC-AA	0.36	-
PC-BB	0.61	-
PC-DD	3.32	HIGH
PC-E	11.52	HIGH
PC-F	43.69	HIGH
PC-G	4.85	-
PC-I	0.62	-
PC-J	7.16	MODERATE
PC-K	1.68	MODERATE
PC-L	0.23	-
PC-M	0.58	MODERATE
PC-O	5.96	HIGH
PC-P	0.79	MODERATE
PC-S	0.39	-
PC-T	28.16	-
PC-U	0.46	-
PC-V	0.79	MODERATE
PC-W	0.12	-
PC-X	10.99	LOW-PRESERVE
PC-Y	1.52	LOW
Watershed Total	**123.94**	

[1] Source: Schott and Lorenz (1999).

Glenn-Gibson Creek

Table 6-6 lists and identifies wetlands with high enhancement potential in the Glenn-Gibson Creeks watershed. Two wetlands have high enhancement potential according to the Salem LWI. The first wetland (GG-E) is found along a tributary to Glenn Creek just east of the intersection of Linwood Street and Goldcrest Avenue. The tributary contains a palustine scrub-shrub wetland. The second wetland (GG-M) is the pond at Salemtowne. The pond was created by placing a weir across Gibson Creek. Woody vegetation is lacking around the pond. The lack of shade causes water temperatures to soar in summer months creating a thermal barrier to migrating salmonids in the Glenn-Gibson watershed (see Water Quality Chapter).

A palustrine forested wetland on Glenn Creek may be a candidate for protection. The Salem LWI notes the wetland, GG-G, has good riparian vegetation cover. This wetland is also the largest natural wetland within the portion of the Glenn-Gibson watershed that lies within Salem's UGB.

The Glenn-Gibson Watershed Council also represents the Turnage Brook watershed. Turnage Brook is mapped as a small intermittent stream in the Salem LWI and by the NWI. The stream drains directly into the Willamette River. Although not identified in the Salem LWI, a wetland is adjacent to Turnage Brook between Lower La Vista Court NW and Eola Drive. The site is protected by a wetland conservation easement and has been designated as a "Wetland Conservation Area".

Table 6-6. Enhancement Potential of Wetlands in the Glenn-Gibson Watershed Within Salem's City Limits[1]

Wetland Identifier	Area (acres)	Enhancement Potential
GG-A	3.55	LOW
GG-E	0.89	HIGH
GG-G	1.59	LOW-PRESERVE
GG-M	1.34	HIGH
GG-N	0.22	LOW
GG-O	0.34	-
Watershed Total	**7.93**	

[1] Source: Schott and Lorenz (1999).. The study area for the Salem-Keizer LWI was limited to the city limits in Polk County.

Outside city limits in West Salem, wetlands in the Glenn-Gibson watershed are mainly limited to ponds that have been created by impounding Glenn or Gibson Creeks and their tributaries. Enhancement potential for these created wetlands is unknown. The ponds probably provide stormwater detention. However, the weirs or dams associated with the ponds can be fish barriers (see Fish and Fish Habitat Chapter).

According to the NWI, one natural palustrine emergent wetland does occur along a small tributary of Glenn Creek just East of Mogul Street and north of Hoodoo Court.

Claggett Creek

Table 6-7 lists and identifies wetlands with high enhancement potential in the Claggett Creek watershed. Six wetlands have high enhancement potential according to the Salem LWI (Schott and Lorenz 1999). Four of the wetlands are contiguous and form a corridor along Claggett Creek from just north of Promenade Way to the Salem Parkway (CL-F, CL-G, CL-H, CL-I). Evidence of diking and channelization can be seen throughout this stretch of the creek. Amount of vegetative cover along the creek varies from mowed grass to a well-established canopy of Oregon ash trees. Reed canarygrass can be found dominating the plant community in some areas. The fifth wetland, CL-M, is located at the Chemawa Indian School, west of Portland Road and just south of Chemawa Road. This wetland is part of the old Lake Labish. It is currently dominated by a very dense stand of reed canarygrass. The final wetland, CU-J, is located at McKay Park between Hollywood Drive and Phipps Lane. This degraded palustrine emergent wetland lies along the upper reaches of Claggett Creek. It is currently dominated by reed canary grass and soft rush.

Table 6-7. Enhancement Potential of Wetlands in the Claggett Creek Watershed Within Salem-Keizer's Urban Growth Boundary[1]

Wetland Identifier[2]	Area (acres)	Enhancement Potential
CL-A	1.35	MODERATE
CL-C	56.17	LOW
CL-D	0.2	MODERATE
CL-F	11.64	HIGH
CL-G	26.59	HIGH
CL-H	5.96	HIGH
CL-I	31.32	HIGH
CL-J	6.41	LOW
CL-K	2.15	LOW
CL-L	2.92	MODERATE
CL-M	30.92	HIGH
CL-N	2.17	LOW
CU-B	31.33	MODERATE
CU-C	15.22	LOW
CU-D	1.22	-
CU-E	0.5	LOW
CU-F	0.93	LOW
CU-G	0.57	-
CU-H	0.46	-
CU-I	1.14	LOW
CU-J	0.61	HIGH
CU-K	0.76	-
CU-L	0.81	LOW
CU-M	0.51	MODERATE
Watershed Total	**231.86**	

[1] Source: Schott and Lorenz (1999). [2] CL=Lower Claggett Creek; CU=Upper Claggett Creek

Outside of the Salem-Keizer UGB, the NWI shows extensive wetlands in the north part of the watershed surrounding Clear Lake and the lower portion of Claggett Creek before it drains into a backwater slough of the Willamette River. Many of the wetlands classified as palustrine forested or palustrine emergent appear to be old meander scars or oxbows of the Willamette River. Small isolated wetlands, including gravel pits, are also found in this area.

Mill Creek

City of Salem

Table 6-8 lists and identifies wetlands with high enhancement potential within the Mill Creek watershed. This list contains wetlands located within the Salem UGB only. Four wetlands have high enhancement potential according to the Salem LWI. The first wetland (MC-Q) is an old gravel pit, Wirth Lake, adjacent to Mill Creek in Cascades Gateway Park. The west side of the lake is the best location for future wetland enhancement or creation. The second and third wetlands, MC-V and MC-X, are farmed wetlands located on prison property just east of Kuebler Boulevard. If the state stops farming this land, these wetlands could be enhanced. Wetland MC-L is a possible candidate for preservation. Located just south of the State of Oregon motor pool and east of Airport Road, this wetland is considered one of the best examples of wet meadow in the Salem-Keizer UGB.

According to the Salem LWI, only one wetland in the Battle Creek sub-watershed has high enhancement potential. Wetland BC-B is a constructed pond that was not field verified by the authors of the Salem LWI. It is believed that the pond may have potential fish habitat. The wetland is located on the northeast corner of Holder Lane and Liberty Street.

Table 6-8. Enhancement Potential of Wetlands in the Mill Creek Watershed Within Salem's Urban Growth Boundary[1]

Wetland Identifier[2]	Area (acres)	Enhancement Potential
MC-AA	2.56	LOW
MC-C	0.51	LOW
MC-D	0.82	LOW
MC-E	2.57	LOW
MC-EE	0.77	MODERATE
MC-F	4.48	LOW
MC-G	7.4	MODERATE
MC-H	1.34	MODERATE
MC-I	0.42	-
MC-J	7.1	-
MC-K	5.38	-
MC-L	7.1	LOW-PRESERVE
MC-M	2.61	-
MC-N	22.24	-
MC-O	44.53	-
MC-P	0.27	MODERATE
MC-Q	20.4	HIGH
MC-R	0.33	-
MC-U	2.1	MODERATE
MC-V	10.73	HIGH
MC-W	216.8	-
MC-X	5.21	HIGH
BC-B	0.87	HIGH
BC-F	2.62	MODERATE
BC-G	0.64	MODERATE
BC-H	4.12	LOW
BC-I	2.83	LOW
BC-J	0.65	LOW
BC-K	3.83	LOW
BC-M	0.99	LOW
BC-N	0.59	LOW
Watershed Total	**382.81**	

[1] Source: Schott and Lorenz (1999).
[2] MC=Mill Creek; BC=Battle Creek

City of Turner

Approximately 137 acres of wetlands were located in the City of Turner. The local wetland inventory for the city identifies three wetlands with high enhancement potential (**Table 6-9**) (MWVCOG 2000). The first wetland, MCN-C, is located on the Mill Creek floodplain in northwest Turner. It is an old gravel pit and it is the future site of Lake Turner. Most of the mine will be reclaimed as 82 acres of open water. According to the wetland mitigation plan and mining reclamation plan developed prior to the mining operation, approximately 17.7 acres of wetlands will be enhanced, restored and created at the site. Wetland MCN-D is located on the east side of the future Lake Turner. This wetland is classified as a palustrine emergent and scrub-shrub wetland. An intermittent stream that has been ditched flows through the wetland. This wetland is also part of the mitigation plan for the gravel pit, the future site of Lake Turner. The final wetland, MCC-D, is a constructed pond located in the east central part of Turner. This wetland is fed by a spring and swale located north of the pond. Vegetation surrounding the pond is highly impacted by grazing.

Table 6-9. Enhancement Potential of Wetlands and the Identification of Locally Significant Wetlands in the Mill Creek Watershed Within City of Turner's Urban Growth Boundary[1]

Wetland Identifier[2]	Area (acres)	Enhancement Potential	Significance[3]
MCN-B	1.76	-	S
MCN-C	85.7	HIGH	S
MCN-D	3.91	HIGH	NS
MCN-E	0.2	-	S
MCC-B	0.93	-	S
MCC-C	14.66	-	NS
MCC-D	0.9	HIGH	NS
MCS-B	0.2	MODERATE	S
MCS-C	2.51	-	S
MCS-D	4.04	MODERATE	S
MCS-F	1.34	MODERATE	NS
PL-B	1.09	-	S
PL-C	0.54	-	S
PL-D	1.74	MODERATE	NS
PL-E	2.45	-	S
PL-F	15.68	-	S
Watershed Total	137		

[1] Source: MWVCOG (2000).
[2] Abbreviations represent the following sub-watersheds: MCN=Mill Creek North; MCC=Mill Creek Central; MCS=Mill Creek South; PL=Perrin Lateral Channel.
[3] Identifies which wetlands are considered Locally Significant Wetlands when using the methodology presented in the Oregon Freshwater Assessment Methodology (OFWAM).

Many of the wetlands identified within the City of Turner UGB did not have high enhancement potential because they were already operating at a high ecological level. In other words, the wetlands did not need enhancement to improve their ecological functions.

With the exclusion of the future Lake Turner, Wetland PL-F is the largest wetland located in the City of Turner. The wetland is centered along an intermittent drainage that was the former location of the Perrin Lateral Channel, which is now located east of this drainage. Using OFWAM, this wetland is rated high, having diverse wildlife habitat and intact water quality and hydrological functions. The land is currently designated for industrial use in the Turner Comprehensive Plan.

City of Stayton

Within the City of Stayton's UGB, approximately 115 acres of wetlands were identified in the Mill Creek watershed. An additional six acres are found along the Salem Ditch, a channel that diverts water from the North Santiam River into Mill Creek. According to the Stayton LWI (Fishman Environmental Services 1998), seven wetland units have high enhancement potential in the Mill Creek watershed, including the area surrounding the Salem Ditch (**Table 6-10**). Wetland W1 consists of a reach of Mill Creek that has been ditched (M1) and a large 10 acre wetland mitigation site (M2) owned by the Oregon Department of Transportation just south of Highway 22 on the east side of the Cascade Highway. The ditched creek is the portion of this wetland unit that could be enhanced. Wetland M3 is a large emergent wetland lying within the floodplain of Mill Creek on the west side of the Cascade Highway. Mill Creek has been channelized in this location and the vegetation has been impacted by agricultural practices. The third wetland unit, W8, is composed of two golf course ponds (M9) whose vegetation cover is limited to an emergent fringe. Wetland unit W9, or wetland MT1, is a large wetland in the Mill Creek floodplain located east of the Cascade Highway and south of Mill Creek. This wetland is currently being filled for development. Wetland mitigation is occurring on-site according to the Removal-Fill Permit (FP-11456) filed at ODSL. Wetland unit W10, or wetland MT-4, is a channelized tributary of Mill Creek that flows across the Santiam Golf Course in northwest Stayton. Vegetation along the creek is typically mowed.

Two wetlands have high enhancement potential along the Salem Ditch. Wetland SD1 is a small emergent wetland north of Locust Street on the east bank of the Salem Ditch. It provides water quality functions but has degraded fish habitat and hydrologic control. The second wetland, SD3, is a constructed pond located south of Shaff Road on the east side of the Salem Ditch. The open water attracts waterfowl, but wetland vegetation is lacking.

Table 6-10. Enhancement Potential of Wetlands and the Identification of Locally Significant Wetlands in the Mill Creek Watershed Within City of Stayton's Urban Growth Boundary[1]

Wetland Unit[3]	Wetland Identifier[2]	Area (acres)	Enhancement Potential	Significance
W1	M1, M2	11.5	HIGH	S
W2	M3	34.65	HIGH	S
W3	M4, MT2, MT3	20.15	-	S
W4	M5	6.4	LOW	S
W5	M6	9.8	MODERATE	S
W6	M7	4	LOW	NS
W7	M8, MT5	7.4	MODERATE	S
W8	M9	1	HIGH	NS
W9	MT1	19.2	HIGH	S
W10	MT4	1.3	HIGH	S
W19	SD1	0.6	HIGH	S
W20	SD2	2.9	LOW	NS
W21	SD3	2.2	HIGH	NS
Watershed Total		**121.1**		

1 Source: Fishman Environmental Services (1998).
2 Abbreviations represent the following sub-watersheds: M=Mill Creek; MT=Mill Creek tributary; SD= Salem Ditch.
3 Some wetlands were grouped together into "wetland units" in order to conduct the Oregon Freshwater Assessment Methodology assessment. The wetlands were grouped together due to their proximity, connectivity and/or for their similarities in type (e.g. farmed wetlands) or in function (e.g. provide diverse wildlife habitat).

Outside Urban Growth Boundaries

Many large wetlands still exist within the Mill Creek watershed in the rural landscape. Five large wetland complexes are worth noting. All five wetlands are classified as palustrine, each wetland containing a mix of emergent, scrub-shrub and forested wetland types. The first complex stretches for two miles along Battle Creek immediately before the creek's confluence with McKinney Creek south of the City of Turner. The second wetland complex is located on the north side of Beaver Creek, west of 75th Place SE and south of Olney Street. Shaw Creek, a tributary of Beaver Creek, contains extensive wetlands that can be seen north of Highway 22, across the highway from the Aumsville Ponds. The fourth wetland complex occurs along Simpson Creek. This creek flows south into Beaver Creek approximately 1.25 miles east of the Aumsville Ponds. According to the NWI maps, the wetland complex stretches along the creek for over a mile. The fifth and final wetland is found north of the City of Stayton. This large palustrine emergent wetland is located south of Highway 22 and immediately west of the Cascade Highway. Because all these wetlands are located in the Mill Creek watershed in mostly fertile soil, many of the wetlands are probably impacted by farming or grazing, in addition to other impacts associated with Highway 22 and the extensive road network in the lower portion of the watershed. Enhancement potential is unknown.

Potential Sites for Wetland Restoration

Wetland Restoration is the re-establishing of wetland vegetation and hydrology to a site that was historically a wetland but has been dried out by diking, draining, or filling. The number of potential wetland restoration sites will be limited by current land uses. Restoration may be impossible in areas that have current infrastructure or irreversible changes to hydrology sources. For example, wet meadows were more common in the Salem-Keizer area before development and before stream channels became incised due to an increase in stormwater runoff. Restoration of wet meadows where incised stream channels lower the neighboring water table will require both the restoration of vegetation and a change in the management of stormwater runoff.

The following maps and information provide a beginning to a process that will lead to a list of potential wetland restoration sites. An inventory, not unlike a local wetland inventory, will be needed to determine the availability and feasibility of restoring wetlands in areas that historically contained wetlands.

Watershed Summaries

Pringle

Pringle Creek is a perennial creek that drains the south Salem hills and a large flat area that extends from Kuebler Boulevard northwest through Fairview Industrial Park and the Salem Airport, crossing downtown Salem, and flowing into the Willamette Slough under Boise Cascade. Most of the hydric soils in the Pringle Creek watershed are mapped in the flat area that makes up the eastern portion of the watershed (**Map 6-6**).

Areas containing extensive hydric soils in the Pringle Creek watershed include the following:

1. A large belt of hydric soil is associated with Clark Creek. The belt extends from Gilmore Field, through the South Salem High School property and ends at Bush's Pasture Park. Land use in this area is mostly residential and public.
2. A large complex of hydric soils extends south of Mission Street and parallels the west side of Turner Road. Land use in this area is mostly industrial or commercial. The Salem Airport is zoned public. The Fairview Industrial Park sits on top of a large historic wetland. Wetland mitigation is occurring in this area to compensate for the loss of wetlands due to the development of the park. The mitigation has been met with limited success.

3. South and east of the Kuebler Boulevard and I-5 exit, land use is mainly industrial and residential. This area of the watershed is currently under development and vacant land is still in abundance.

Glenn-Gibson

The Glenn-Gibson watershed terrain is steep, particularly in the upper reaches, with flatter slopes near the basin outlet. Creeks flow down steeper gradients than on the valley floor and stream channels tend to be narrow and generally lack broad floodplain or riparian areas (Schott and Lorenz 1999). Hydric soils are limited to the lower reaches of Glenn and Gibson Creeks (**Map 6-7**).

The majority of hydric soils are mapped in three main areas in the Glenn-Gibson watershed:

1. The Turnage Brook sub-basin contains a belt of hydric soils along the base of the hills to the north. Land use is mainly residential and some commercial.
2. The confluence of Glenn and Gibson Creeks contains extensive hydric soils. About half of the historic wetland area lies just outside Salem's city limits at the base of an old river terrace. Glenn Creek flows across the Willamette River floodplain at the base of the terrace. The NWI maps indicate the presence of palustrine emergent and forested wetlands at this location. The rest of the hydric soil is mapped in a residential area just south of Gibson Creek.
3. The third large historic wetland was located along Glenn Creek as it flows north across agricultural land and into the Willamette River. This site is actually within the Willamette River floodplain. The NWI shows the presence of palustrine forested and scrub-shrub wetlands at this location.

Claggett

Claggett Creek drains most of east Salem from State Street north, including land along Lancaster Drive. The creek then flows north through the City of Keizer, into Clear Lake, and finally drains into a slough of the Willamette River. Mapped hydric soil complexes are abundant in the relatively flat terrain of the Claggett Creek watershed (**Map 6-8**).

Large hydric soil complexes are located in four main areas:

1. Long linear stretches of hydric soil are mapped in the upper portion of the watershed in east Salem. The location of hydric soils found in the watershed is typical of historic swales that once covered the flat valley floor of the Willamette River. Most of these swales have been filled, culverted and piped underground for development. There are limited opportunities for restoration in this area of the watershed.

2. An extensive belt of hydric soils is mapped in north Salem. The area includes the State Fairgrounds. Land use for most of the remaining area is industrial and residential with some commercial along Silverton Road.
3. Salem Industrial Drive lies in the middle of a historic wetland that stretches from Cherry Avenue to the Salem Parkway. The area is primarily used for industrial purposes, however, this area is under development, includes the Northgate Urban Renewal project, and vacant land is still present.
4. The largest historic wetland in the Claggett Creek watershed is Lake Labish. Once an extensive wetland, this area has been drained with a series of ditches. The west side of Lake Labish drains into Claggett Creek via the Labish Ditch. The area is now used intensively for row crops. Marion County Public Works is looking closely at the restoration potential of Lake Labish as part of its "Natural Heritage Park Selection and Acquisition Plan" (Marion County Public Works 2000). According to the plan, the peat soils of Lake Labish once supported a rare shrubland ecosystem. Restoration of the lake would improve water quality and could reduce flooding problems in the area. Because there are large land holdings within the area, restoration of large areas may be possible. Marion County has already begun negotiation with some the landowners to examine restoration potential.
5. Marion County Public Works (2000) also identified Mission Bottoms as a potential restoration site. The confluence of Claggett Creek and the Willamette River lies within the proposed project area. Restoration would include restoring riparian and wetland habitat along the Willamette River and restoring isolated oxbows on the Willamette River floodplain.

Mill

In the Mill Creek watershed, most of the hydric soil complexes are found on alluvial fan materials deposited by the North Santiam River and on older courses of the Willamette River. Previous channels of Mill Creek, "meander scrolls,'' can be observed in some parts of the bottomlands, but grading and filling have removed most of the undulating topography typically observed in floodplains (MWVCOG 2000).

Four areas with extensive hydric soils are found in the Mill Creek watershed (**Maps 6-9** and **6-10**):

1. A large belt of hydric soil extends south and east from State Penitentiary property on State Street to another piece of State Penitentiary property just east of Kuebler Blvd. Land use is dominated by industrial and public uses. Large gravel pits can be found in areas adjacent to Mill Creek. Historic wetlands on currently farmed land, owned by the State Penitentiary, may be restorable if farming ceased.

2. Extensive hydric soils are mapped at the confluence of Battle Creek, Waln Creek and Powell Creek. This confluence is located on the Battle Creek Golf Course between Sunnyside Road and Commercial Street.
3. McKinney Creek drains the south part of the Mill Creek watershed. Extensive hydric soil complexes are mapped along the entire length of McKinney and some of its tributaries. The branching pattern of hydric soils found east of McKinney Creek is typical of historic swales that once covered the flat valley floor of the Willamette River. McKinney Creek and its tributaries have mostly been channelized and are used extensively for irrigation purposes. Land south and southeast of Turner was identified by Marion County Public Works (2000) as having potential for wet prairie restoration.
4. Just north and east of Highway 22 and east of Aumsville, Beaver Creek and its tributaries once supported a large wetland complex in a small flat valley. Since settlement, Beaver Creek has been channelized and the wetlands converted to cropland. Marion County Public Works (2000) identified Beaver Creek and a tributary, Simpson Creek, as a potential site for wetland restoration. The Grenz Wetland Mitigation Bank is located in the Beaver Creek watershed and may provide the opportunity for Marion County to acquire a restored, shrubland ecosystem.
5. Historically, the area south and southwest of Aumsville was wet prairie. Much of the land is now unmanaged pasture. Marion County suggests that further examination is needed to determine the potential for wet prairie restoration southwest of Aumsville and in areas adjacent to the county-owned Aumsville Wetlands (Marion County Public Works 2000). Using the Aumsville Wetlands as a core area, a large wetland complex could be restored in this part of the watershed.

Summary

Riparian areas and wetlands provide many beneficial functions including fish and wildlife habitat, thermal regulation, flood storage, water quality and food chain support. Unfortunately, as a society we have neither understood nor valued these resources for the functions they provide us. Due to development, many riparian areas have been reduced to a thin strip of trees or have been fragmented extensively. Wetlands have been drained to accommodate agricultural practices and have been filled to make room for development. As wetlands and riparian areas disappear, water quality declines, flood levels increase, stream flows becomes flashy, and fish disappear from local streams.

Historically, riparian areas were once broad, and in some instances stretched several miles back from the streambanks. Wetlands covered large portions of our watersheds. Recent inventories of riparian and wetland resources indicate that the remaining wetlands and riparian areas are in critical need of protection, and in many cases are degraded and will require enhancement in order to recover lost functions.

Wetlands and riparian areas should be tools to manage urban landscapes. Land use policies should incorporate wetlands and riparian areas into the urbanizing landscape as mitigation for the impacts of increased impervious surfaces and to the changes in hydrology associated with urbanization. Taking advantage of the functions of riparian and wetland habitat will decrease the likelihood of having to pay for water quality improvements and flood damage at a later date. Protection measures such as ordinances, easements, land acquisition, and education for streamside property owners need to be established now to shield existing riparian and wetland habitat from further harm. Restoration and enhancement of riparian and wetland habitat should be incorporated into comprehensive plans, stormwater management plans, neighborhood plans, capital improvement plans, greenway development, Urban Renewal areas and soil erosion plans for farms.

Recommendations

All Basins

1. Gather data on riparian width and species composition of riparian areas not yet inventoried. Document baseline information.

2. Document stream reaches where the dominant understory species consist of invasive vegetation, and restore areas with plants native to the Willamette Valley and the local area.

3. Field verify streamside areas along the riparian corridor designated as low shade (red) on **Map 6-1** through **Map 6-5**, and determine feasibility of riparian enhancement.

4. Using available tools such as GIS (ArcView), map all unclassified stream sections and categorize into the high, medium, or low shade indexes. This will require more GIS time, field checking, and for some areas, better quality air photos.

5. The goal of all riparian projects should be to improve one or more of the four basic riparian functions: water quality, flood management, thermal regulation, and wildlife habitat. Use functional assessments to prioritize projects. A common resource goal should be to integrate the needs of both aquatic wildlife and local vegetation.

6. Develop a list of potential wetland restoration sites using the LWI, soils maps, historical and other appropriate data to determine availability and feasibility of restoring wetlands in areas that historically contained wetlands.

7. To assess site-specific restoration and enhancement potential, use an inventory and functional assessment as was done for Pringle Creek and Mill Creek in the local wetland/riparian inventories of Turner and Stayton. Use the assessment as one of many tools to determine which areas can feasibly be restored and/or enhanced.

8. Encourage the City of Salem and landowners and developers to accept the findings and recommendations provided in the newly completed Tree Canopy Analysis. The study's information should be used to strengthen the City's tree ordinance, complete a wetlands protection program and be incorporated into comprehensive plans as well as City plans for stormwater management, capital and infrastructure improvements, and neighborhoods. It also should be used in greenway development and in Urban Renewal areas.

9. In rural areas, actively manage the riparian zone to ensure LWD where feasible. In both urban and rural areas, riparian enhancement should include the long-term goal of establishing diverse patches of tree species, sizes, and age classes. This will improve habitat for both aquatic and terrestrial species.

10. Manage riparian areas at both the streamside level and at the larger landscape level. Protect what we have, and restore and enhance what has been degraded or lost.

11. Comply with the City of Salem's tree ordinance and provide input to improve the long term-ordinance, especially in protection of intermittent streams, adequate setbacks for development, and the protection of riparian habitat regardless of quality or whether or not native vegetation is intact.

12. Pursue wetland restoration opportunities in Lake Labish. Restoration of this drained and farmed wetland could provide substantial water quality and flood control benefits to both Claggett Creek and Pudding River watersheds. Restoration of this historic lakebed is also a priority of Marion County (Marion County Public Works 2000).

13. Identify wetlands outside urban growth boundaries. Contact appropriate landowners/agencies and initiate discussion about wetland protection measures, such as conservation easements and wetland enhancement/restoration projects.

14. Encourage Marion and Polk counties and all the municipalities in the watersheds to inventory and assess wetland and riparian resources. Encourage these agencies to provide protection for existing wetlands and riparian areas by developing ordinances that limit their development. Conservation easements and land acquisition could also be used to protect wetlands.

15. Provide streamside and watershed resident education to prevent further degradation of the riparian and wetland areas.

16. Meet Statewide Planning Goal Five and Six requirements.

17. Support the required removal debris from streambanks and wetlands, decommissioning unused or abandoned stormwater drains, and bank stabilization prior to any new or further development.

18. Identify and propose solutions for conflicting public policies such as conveyance and fire suppression versus water quality and healthy riparian areas. There are examples in the City of Salem Sensitive Lands Management Handbook.

19. Identify site-specific early action items by watershed as known.

20. Support continuing student research projects and compile results in an area clearinghouse.

21. Support establishing riparian zones. Limit development and require setbacks to protect them.

22. Support location of buildings and infrastructure away from streams, wetlands and riparian areas. Minimize road crossings.

23. Require at least a superficial Environmental Impact Statement (EIS) prior to any site disturbance in areas known or suspected to be special areas.

24. Support establishment of wetland conservation districts, such as the West Eugene Wetlands Program.

Claggett Creek

1. Determine which wetlands with high or moderate enhancement potential are located on public land, vacant land or in an Urban Renewal area. Identify landowners and initiate contact with them to discuss wetland enhancement projects. Determine feasibility of enhancement project by doing a site assessment.

Pringle Creek

1. Actively recruit private landowners to enter their property into the Wetland Reserve Program (WRP). Encourage landowners to contact Marion Soil and Water Conservation District and the Natural Resource Conservation Service and enroll the land in the Wetland Reserve Program (WRP). This federal program provides cost-share money to enhance and restore wetlands. Work with Marion Soil and Water Conservation District and the Natural Resource Conservation Service in accomplishing this goal.

References

Barton, D., W. Taylor, and R. Biette. 1985. "Dimensions of Riparian Strips Required to Maintain Trout Habitat in Southern Ontario Streams." *North American Journal of Fisheries Management,* vol. 5, p. 364-378.

City of Salem. 2000. "Riparian Area Inventory and Assessment of Pringle Creek near Salem Hospital, Oregon School for the Deaf, and Pringle Park." Unpublished. Located at City of Salem Community Development Department, Natural Resources Division. Salem, OR.

City of Salem. 2001. *City of Salem's Tree Ordinance.* **http://www.open.org/~naturalr/Trees/Riparian_cor_summary.htm**

City of Salem Parks Operations Division. 2002. Parks Sensitive Area Management Handbook. Salem, OR.

Cowardin, L., V. Carter, F. Golet, and E. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* FWS/OBS-79/31. U.S. Fish and Wildlife Service. Washington D.C.

Fishman Environmental Services. 1998. *City of Stayton Local Wetlands and Riparian Inventory*. Project #97047. Stayton, OR.

Godwin, D. 2000. *Life on the Edge: Improving Riparian Function.* Oregon State University Extension. Corvallis, OR.

Marion County Public Works. 2000. *Natural Heritage Park Selection and Acquisition Plan. Draft.* Version 2B-12/06/00. **http://publicworks.co.marion.or.us/parks/nhpkplan.htm**

May, C., R. Horner, J. Karr, B. Mar, and E. Welch. 2000. "Effects of Urbanization on Small Streams in Puget Sound. " in T.R. Schueler and H.K. Holland (eds). 2000. *The Practice of Watershed Protection*. Center for Watershed Protection. Ellicott City, MD.

Mid-Willamette Valley Council of Governments (MWVCOG). 2000. *City of Turner Local Wetlands and Riparian Inventory.* Salem, OR.

Nehlsen. W., J. Williams, and J. Lichatowich. 1991. "Pacific Salmon at the Crossroads: Stock at Risk from California, Oregon, Idaho, and Washington." *Fisheries* 16(2), p. 4-21.

Oregon Division of State Lands (ODSL). 1998. *Urban Riparian Inventory & Assessment Guide.* Pacific Habitat Services, Inc. Salem, Oregon.

Oregon Division of State Lands. 1999a. *Wetland Functions and Assessment*. *Just the Facts #5.* Salem, OR.

Oregon Division of State Lands. 1999b. *About Compensatory Mitigation for Wetlands. Just the Facts* #*6*. Salem, OR.

Oregon Revised Statutes. Chapter 1996. Division 800. *Wetlands and Rivers; Removal and Fill; Ocean Resource Planning.* Secretary of State's Office. Salem, OR.

Roth, E., R. Olsen, P. Snow, and R. Sumner. 1996. *Oregon Freshwater Wetland Assessment Methodology*. Oregon Division of State Lands. Salem, OR.

Schott, M., and J. Lorenz. 1999. *Salem-Keizer Area Local Wetland Inventory of Marion and Polk Counties, Oregon.* Mid-Willamette Valley Council of Governments. Salem, OR.

Schueler, T. 2000. "The Architecture of Urban Stream Buffers." in T.R. Schueler and H.K. Holland (eds). 2000. *The Practice of Watershed Protection*. Center for Watershed Protection. Ellicott City, MD.

Watershed Professionals Network. 1999. *Oregon Watershed Assessment Manual.* Governor's Watershed Enhancement Board. Salem, OR.