



CITY OF MOLALLA
POTENTIAL UGB EXPANSION AREA ANALYSIS

DRAFT NATURAL RESOURCES SUMMARY

Prepared for:

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INTRODUCTION

The City of Molalla may need to expand its Urban Growth Boundary (UGB) to meet long-term population and employment growth needs. This technical report addresses Task 2 of the City of Molalla’s Potential UGB Expansion Area Analysis. It provides an analysis of natural resource areas within the urban growth boundary study area. This information will be useful in addressing Statewide Planning Goal 14 “locational factors” in assessing the relative values of each of four identified study areas surrounding the City’s existing UGB. Natural resources (Goal 5) are considered constrained lands and are removed from the mapping of Goal 3 agricultural land resources. This natural resource data provides a factual basis for the evaluation of Urban Growth Alternatives.

Specifically, this report identifies and maps potentially significant wetland, riparian and wildlife habitat areas that may limit the potential for future growth within the study area. This analysis includes review of aerial photographs and soil data analysis, followed by a reconnaissance level field investigation. Exhibit A provides a map of Natural Resource Areas.

CITY WATER RESOURCE GOAL AND POLICIES

The City is committed to working with Clackamas County to protect Molalla’s natural water resource areas as the UGB is expanded and urban development occurs over time. The Goal 5 administrative rule (OAR Chapter 660, Division 23) includes “safe harbor” provisions for protecting locally significant wetlands and riparian corridors. As part of the 2006-07 plan update process, the City has adopted provisions to protect significant wetlands and riparian corridors within the existing and expanded 20-year UGB and 50-year Urban Reserve Area (URA).

Water Resources Goal:

Coordinate with Clackamas County to protect riparian corridors and wetlands – and associated open space, fish and wildlife habitat and riparian vegetation – within the Molalla Urban Growth Boundary (UGB) and Urban Reserve Area (URA).

Water Resources Policies:

1. Consider the results of the Molalla Natural Resources Report as a means of addressing potential environmental consequences prior to establishing a 50-year urban reserve area boundary and prior to expansion of the 2006 Molalla UGB.
2. Adopt Goal 5 “safe harbor” provisions to protect significant riparian corridors and wetlands within the expanded Molalla UGB.
3. Maintain natural wildlife corridors along protected creeks and drainageways.
4. Give priority to preservation of contiguous parts of that network which will serve as natural corridors throughout the City for the protection of watersheds and wildlife.

5. Provide for residential density transfer from protected water resource areas to adjacent buildable land.
6. Conserve significant trees and vegetation within protected water resource areas.
7. Require planting of native vegetation/trees within protected water resource areas.
8. Development projects that may have an impact on natural resource areas as identified on the LWI map shall be reviewed by the Department of State Lands (DSL) for possible mitigation.

STUDY AREAS

The overall study area covers approximately 4,212 acres of land outside of Molalla’s UGB (Figure 1). This land is divided into four study areas (north, east, south and west) based on several factors that included transportation and land use characteristics. Major roads form the primary divisions between the study areas. The study areas range in size from 798 to 1,623 acres. The study areas are ordered in a clockwise manner, beginning with North and ending with West as shown on Table 1. The location, size and characteristics of each Study Area are summarized in Table 1.

Table 1. Study Area Location, Size and Resource Characteristics

Study Area	Location/boundaries	Size (acres)
1. North	Located east of Hwy. 213 and west of Hwy. 211, extending north from City UGB approx. ½ mile to Vaughan Rd.	970
2. East	Located south of Hwy. 211, east of Mathias Rd/Hy Oaks Ln, west of Adams/Adams Cemetery Rd., north of Herman Rd.	821
3. South	Located east of Hwy. 213 and west of Mathias Rd, extending south from City UGB approx. 1 mile to near Herman Rd.	1,623
4. West	Located west of Hwy. 213/City UGB, east of Cramer Rd, north of Barbara Way, south of Barnards Rd.	798

EXISTING LAND USE

Land uses within the study area are dominated by agriculture, including pastureland, row crops, nurseries, and vineyards. Older residential areas are scattered throughout the study area. Several stream corridors and drainageways pass through the study area. Undeveloped forest lands are also occur within the study area, some located along the stream corridors.

DEFINITIONS

Floodplain – a stream or river valley apart from the channel that is inundated only in a flood event, attenuating the flood discharge. The 100-year floodplain shows the flood with a 100-year recurrence interval.

Special Status Species – a plant and animal species that is a federal listed, proposed, or candidate species; federal “species of concern”; or State of Oregon listed, proposed, or sensitive species.

Riparian Corridor – an area along a river, lake, or stream which includes the water areas, fish habitat, wetlands, and adjacent riparian areas that marks the transition from an aquatic ecosystem to a terrestrial ecosystem.

Wetland – an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

INVENTORY METHODS

Review of Existing Information

A review of existing literature, maps, and other source materials was conducted to identify wetlands, stream corridors, floodplains, and special status species, or site characteristics indicative of these resources, within the study area. The document review included the following sources of information:

City of Molalla GIS data

- City of Molalla City Limits
- City of Molalla UGB
- City of Molalla Future Growth Study Areas
- Parcels
- Streets
- Streams

Other Sources

- Color ortho photography (Europa Technologies, 2007)
- Federal Emergency Management Act (FEMA) FEMA floodplains, Panels 415588 0290A and 415588 0405A (1987).
- Oregon Department of Forestry and Oregon Department of Fish and Wildlife stream classification and fish-bearing stream maps (2006). Source: <http://www.odf.state.or.us/GIS/fishpres/default.asp#huc>
- NWI Wetlands, USGS Molalla and Wilhoit, Oregon quadrangles, (1981 data)
- Oregon Department of State Lands, wetland determination files (Molalla area)
- Soils (U.S.D.A. Natural Resource Conservation Service, 1998)
- *Hydric Soils List, Clackamas County Area, Oregon*. U.S.D.A. Natural Resource Conservation Service (NRCS), 12/22/2006.
- U.S. Geological Survey (USGS) 7.5 minute topographic maps. Molalla and Wilhoit, Oregon quadrangles, 1981.

The City GIS parcel and street layers served as the base for the natural resource area mapping.

Several public agencies were contacted as part of this review. These agencies included:

- City of Molalla (Planning);
- Clackamas County Soil and Water Conservation District;
- Northwest Habitat Institute;
- Oregon Department of Fish and Wildlife (ODFW);
- Oregon Department of Forestry (DOF);
- Oregon Department of State Lands (DSL);
- Farm Service Agency (Clackamas Field Office);
- USDA Natural Resources Conservation Service;
- The Oregon Natural Heritage Information Center (ORNHIC).

Field Inventory

Winterbrook conducted off-site field observations of stream corridors and wetlands in November, 2007. Off-site observations were made from public rights-of-way and other public lands. This was a reconnaissance-level investigation of visible stream and wetland characteristics combined with a review of aerial photographs, topographic and soils maps, and other information noted above. Detailed on-site wetlands delineations and stream corridor mapping were not completed.

Field maps included aerial imagery and information on hydric soils, floodplains, streams, tax lots and streets. Observed characteristics such as dominant vegetation communities, wetlands and streams were noted in the field. For example, where visible from public streets, areas listed as wetlands on the NWI and areas containing hydric soils were viewed for wetland indicators such as wetland hydrology¹ or dominant hydrophytic vegetation². Where evidence of wetlands was present, boundaries were approximated on field maps. Winterbrook digitized the locations of probable wetlands, riparian corridors and sensitive habitats as polygon data on natural resource maps for each study area (Figures 2 through 5).

FINDINGS

This section describes the results of the review of existing information and field survey conducted during November, 2007. It also summarizes Winterbrook's review of source materials identified in the Methods section and our contacts with resource agencies.

¹ Indicators of wetland hydrology include visual observation of ponding or soil saturation, historic records of flooding, visual evidence of previous water inundation such as dry algae on bare soil or water marks on soils or leaves, sediment deposition and drainage patterns. It should be noted that no formal wetland sample plots were established for this study.

² The wetland indicator status of the dominant species within each vegetative strata (e.g., herb, shrub, tree) is used to determine if the plant community may be characterized as hydrophytic and can thereby meet the wetland vegetation criterion.

Wetlands

Local Wetland Inventory

In 2001, the City of Molalla completed a local wetlands inventory (LWI) and riparian assessment within the City's UGB³. Several mapped wetlands and riparian corridors extend to the City's UGB line and therefore could be expected to potentially extend into the present study area (see Figure 6). LWI wetlands and riparian corridors at the UGB were examined using available aerial photographs and mapping, and off-site field reconnaissance. In all cases, the riparian systems were found to be continuous and extend into the study area. In areas along the west, southeast and northeast edges of the UGB, wetlands were also found to extend into the study area.

The City's LWI wetlands also served as a reference for map interpretation: 2007 aerial imagery was examined for evidence of wetland signatures and hydric soil mapping was compared with LWI mapping to identify potential wetlands within the study area.

National Wetland Inventory

National Wetland Inventory (NWI) maps identify mixture of palustrine emergent, scrub-shrub, forested and open water wetlands within the study area. These wetlands are located primarily along Molalla stream corridors. NWI mapping is generally known to include a degree of error with respect to estimating wetland presence and size, especially in forested areas. Where possible, field verification of NWI wetlands from nearby vantage points was conducted. NWI wetlands for each planning subarea are discussed further below.

Hydric Soils

The Natural Resources and Conservation Service (NRCS) has defined hydric soils as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions, where oxygen is effectively absent from the environment, in the upper part of the soil profile. Hydric soils are indicative of wetlands.

Substantial areas of land within the study area contain hydric soils, particularly in the North and East Study Areas. Table 2 provides a list of hydric soils and soils with hydric inclusions within the study area, and indicates the local landform, capability class and area for each hydric soil type. As the table indicates, all lands with hydric soils are designated as Class III or IV soils.

Table 2. Hydric Soil Characteristics

Map Unit	Soil Series	Hydric	Hydric Inclusion	Local landform	Capability unit	Acres
21	CONCORD SILT LOAM	Yes	Yes, Dayton and Huberly	terraces	IIIw	85
29	DAYTON SILT LOAM	Yes	Yes, Concord and Huberly	terraces	IVw	832

³ The LWI was approved by DSL in March, 2004.

Map Unit	Soil Series	Hydric	Hydric Inclusion	Local landform	Capability unit	Acres
30C	DELENA SILT LOAM	Yes	Yes, Borges	hillslopes, terraces	IVw	29
41	HUBERLY SILT LOAM	Yes	Yes, Dayton, Delena	swales, terraces	IIIw	99
84	WAPATO SILTY CLAY LOAM	Yes	Yes, Cove, Humaquepts	floodplains	IIIw	31

Source: U.S. Department of Agriculture, Natural Resources Conservation Service, 12/22/2006 (acres calculated by Winterbrook GIS).

Table 3 shows the hydric soils and total area of each soil type by study area.

Table 3. Hydric Soils by Study Area

Study Area	Hydric Soils	Total acres
1. North	CONCORD, DAYTON, HUBERLY, WAPATO	477
2. East	DAYTON	308
3. South	DAYTON, DELENA	154
4. West	CONCORD, HUBERLY, WAPATO	138

Clackamas County Soil and Water Conservation District / NRCS

Winterbrook contacted Kris Hamma at the Clackamas County Soil and Water Conservation District to request any available information on prior converted croplands and farmed wetlands⁴ within the study area. To date, no maps or information have been available for review.

Based on the field reconnaissance in November 2007, Winterbrook believes that there are numerous prior converted croplands within the study area that were tilled or otherwise drained to eliminate hydrology. These lands are typically located within areas of poorly-drained, hydric soils and could be expected to revert to wetlands without regular maintenance of drainage systems. Several areas of farmed wetlands also appear to be present within the study area, again based on off-site observations.

Oregon Department of State Lands

Winterbrook contacted Heather Howard, Peter Ryan, and Jo Ann Miles at the Department of State Lands (DSL) to review the state's available wetland determination data for the Molalla study area. Wetland determination files were reviewed at DSL offices in Salem. Of the 23

⁴ "Prior converted cropland" is land that was drained, filled, or manipulated prior to December 23, 1985; was cropped prior to that date; was not abandoned; and does not meet farmed wetland criteria. Prior converted cropland is not subject to wetland conservation regulations unless it reverts to wetland as a result of abandonment. "Farmed wetland" is an area that was manipulated and planted prior to December 23, 1985, but still meets wetland criteria. These wetlands may be farmed and maintained in the same manner as long as they are not abandoned.

determinations identified by DSL, only seven were located within the planning area. Of these, several reports were incomplete or contained no specific wetland mapping. Where mapping was completed or other useful wetland characteristics were identified, this information was digitized and incorporated into this report. Where accessible, Winterbrook also conducted off-site observations of DSL-reviewed wetlands.

Table 4 summarizes the available DSL determination files with study area.

Table 4. DSL Wetland Determination Status and Location

Study Area	WetDet No.	Comments	Location	Township/Range/Section	Tax Lot
South	WD2006-0265	Incomplete report	North of Molalla, Forest Rd, East of S. Molalla Ave and S. of 8th St	05S02E16	2400
South	WD2003-0323	Possible wetlands	S Molalla Ave and E 5th St.	05S02E16BB	100
South	WD2001-0596	Report and map	Between 5th St., Molalla Forest Rd., Molalla Ave. & Mathias Rd.	05S02E16	2400, 2406, 2891
South	WD2000-0057	Incomplete report	Mathews Rd/Molalla Forest Rd.	05S02E16D	2400
West	WD2002-0574	Mitigation site, report and map	Hwy 213, across from Big Meadows Dr.	05S02E05	2500
North	WD1998-0029	Wetlands present, no map	TL 300, near high school	05S02E09	300
North	WD1993-0118	Possible wetlands, no map	S Molalla Ave, E 5th St.	05S02E09	900

Wetland mapping

Winterbrook prepared a preliminary mapping of wetlands (Figures 2 through 5). This mapping should be treated with caution, however, since it was not possible to view many of the mapped areas, nor was it possible to access any sites to examine soil, hydrology and vegetation conditions. For these areas, mapping was based primarily on aerial photo-interpretation, NWI wetlands, adjacent LWI wetlands, and mapped hydric soils. For those areas that could be viewed, particularly farmed areas, it was evident that extensive tillage and/or drainage modifications have significantly altered the hydrology of some potential wetlands.

Riparian Corridors

Four stream corridors flow through the study area. These streams include, in order from north to south, an unnamed Molalla River tributary (near Vaughan Road), Creamery Creek, Bear Creek, and Kaiser Creek. The first three streams flow to the Molalla River, while Kaiser Creek flows to the Pudding River. All streams are tributaries to the Willamette River⁵ and flow from east to west through the study area.

⁵ The study area is contained within the Upper Willamette River watershed, and fish runs in these streams are generally considered “Upper Willamette River” runs.

The condition of the riparian corridor along these streams varies significantly by stream and by stream segment. Large segments of stream pass through farmland and contain limited streamside vegetation. Common vegetation along these segments includes soft rush and cattails. Other segments have scattered Oregon ash trees along their banks, and may connect to wetland areas. Still other stream segments flow through denser forests dominated by ash and occasionally black cottonwood in the lowlands and Oregon white oak and Douglas fir at higher elevations.

Bear Creek is designated as a fish-bearing stream by the Oregon Department of Forestry and Oregon Department of Fish and Wildlife (see also discussion of fish under Habitat for Special Status Species, below). This designation applies to the section of Bear Creek downstream (west) of Highway 213 in the West study area. The closest designated state-designated Essential Salmon Habitat is along the Molalla River, outside of the study area.

Table 4 lists stream corridors by study area and provides information on stream corridor length, area, and fish-bearing characteristics.

Table 5. Riparian Corridors

Study Area	Stream Corridors	Fish-bearing Stream	Size (acres)	Length (feet)
1. North	Creamery Creek	No	9.5	3,800
	Molalla River tributary	No	34.7	16,700
2. East	Bear Creek	No	9.9	4,500
3. South	Bear Creek	No	38.8	13,600
	Kaiser Creek	No	22.6	9,500
4. West	Creamery Creek	No	4.0	1,500
	Bear Creek	Yes	5.4	2,100
	Kaiser Creek	No	3.7	2,900

Special Status Species and Habitats

Several resource agencies and published sources provided information on special status species and habitats within the planning area. Special status species for the purposes of this review include a federal listed, proposed, or candidate species; federal “species of concern”; or State of Oregon listed, proposed, or sensitive species. A summary of available data on species within the Molalla area is provided in Table 6 at the end of this section.

Oregon Natural Heritage Information Center

Winterbrook requested and received information from the Oregon Natural Heritage Information Center (ORNHIC) on special status species and their documented or potential occurrence within one mile of the study area. Three species records were found in the area: one historic plant record (peacock larkspur) and two fish records (Chinook salmon and steelhead trout).

Additional data on listed species was obtained from the *Rare, Threatened and Endangered Species of Oregon* (ORNHIC, 2007). Supporting information on fish presence within the Molalla area was obtained from Streamnet, at <http://www.streamnet.org/>.

Oregon Department of Fish and Wildlife

Winterbrook contacted ODFW Habitat Biologist Susan Barnes and ODFW Threatened and Endangered Species Coordinator Charlie Bruce for information on special status wildlife species within the study area.

Using existing data and consultations with resource agency personnel, special status species documented or with potential to occur in the study area were evaluated. The availability of suitable habitat for these species was noted during the off-site field investigation; however, no sensitive species surveys were completed.

Special Status Species and Habitats in the Molalla Area

The following table identifies the federal and state status of the species and their known or potential presence within the study area. The table contains plants, wildlife, fish, and habitat categories, and is organized alphabetically by common name. This list represents a compilation of available ORNHIC and ODFW information on recorded species and habitats within approximately one mile of the study area; it does not include other potential species that may occur within the area.

Table 6. Special Status Species and Habitats

Common Name	Scientific Name	Federal Status	State Status	Remarks
Plants				
Peacock larkspur	<i>Delphinium pavonaceum</i>	SoC	LE, OCS	ORNHIC historic record from 1980 located at edge of East Study Area
Wildlife				
Acorn woodpecker	<i>Melanerpes formicivorus</i>	SOC	OCS, proposed SV	Associated with oak habitat; identified near S. Sawtell Rd. in South Study Area
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Delisted in 2007	LT	Bald eagle nest site along Molalla River ½ mile northeast of study area. Site name: Liberal (T4S, R2E, Sec 34 SW)
Chipping sparrow	<i>Spizella passerina</i>	-	OCS	Identified in South Study Area; potential elsewhere
Northern red-legged frog	<i>Rana aurora aurora</i>	SOC	SV, OCS	Identified along Bear Creek and wetlands in South Study Area; potential elsewhere
Northwestern pond turtle	<i>Actinemys marmorata marmorata</i>	SOC	SC, OCS	Potential along Bear Creek and associated ponds, wetlands; documented in Molalla River and tributaries
Pileated woodpecker	<i>Dryocopus pileatus</i>	-	SV	Identified in South Study Area; potential elsewhere; proposed to be removed from state list in Willamette Valley
Slender-billed nuthatch	<i>Sitta carolinensis</i>	-	OCS, proposed SV	Identified in South Study Area; potential elsewhere
Western bluebird	<i>Sialia mexicana</i>	-	SV, OCS	Identified in South Study Area; potential elsewhere

Common Name	Scientific Name	Federal Status	State Status	Remarks
Western gray squirrel	<i>Sciurus griseus</i>	-	SU, OCS	Identified in South Study Area; potential elsewhere; proposed SV
Western Painted turtle	<i>Chrysemys picta</i>	-	SC, OCS	Potential along Bear Creek and associated ponds, wetlands; documented in Molalla River and tributaries
Fish (nearby study area)				
Chinook salmon, Upper Willamette River ESU, spring run	<i>Oncorhynchus tshawytscha</i>	LT	-	Spring Chinook occur in Molalla River, ¼ mile east of study area; rearing and migration up to River Mile (RM) 19.58; spawning and rearing above there
Chinook salmon, Upper Willamette River ESU, fall run	<i>Oncorhynchus tshawytscha</i>	LT	-	Fall Chinook occur in Molalla River, ½ mile east of study area; spawning and rearing up to RM 16.68 (Hwy. 211)
Steelhead, Lower Columbia River ESU, summer run	<i>Oncorhynchus mykiss</i>	LT	SC	Summer steelhead occur in Molalla River, ¼ mile east of study area; migration up to RM 18.20; spawning and rearing above there
Steelhead, Lower Columbia River ESU, winter run	<i>Oncorhynchus mykiss</i>	LT	SC	Winter steelhead occur in Molalla River (¼ mile east) and Rock Creek (¾ mile south); rearing and migration up to RM 19.58; spawning and rearing above; spawning and rearing in Rock Creek
Habitats				
Oregon white oak woodland	<i>Quercus garryana</i>		OCS	OCS oak woodland mapping is currently being completed for Clackamas County, but mapping is not yet available; some mixed oak woodlands were noted in the field but OCS designation cannot yet be determined.

Key:

ESU: Evolutionarily Significant Unit (a unique group of Pacific salmon or steelhead)

Federal Status: **LT**=Threatened, **SOC**= Species of Concern

State Status: **LE**=Endangered, **SC**= Sensitive-Critical, **SV**=Sensitive-Vulnerable, **SU**=Sensitive-Undetermined,

OCS=Oregon Conservation Strategy species/habitats

Floodplains

The source of floodplain data was the Federal Emergency Management Act (FEMA) floodplain maps for the Molalla area. The primary floodplain in the area is the Molalla River floodplain. This floodplain is located outside of the study area, approximately 1,500 feet east of the northeast corner of the East Study Area.

Thus, no floodplains or Goal 7 flood hazards are located within the study area.

STUDY AREA SUMMARIES

The following section summarizes the location, quantity and quality of natural resources within individual planning study areas. The study areas range in size from 798 to 1,623 acres, and have a combined size of 4,212 acres of land outside of Molalla’s UGB (Figure 1).

Resources are identified by codes based on the resource type and stream watershed; for example, W-BC-01 is a Wetland (W) in the Bear Creek (BC) watershed. Wetland numbers are relative to the mouth of the stream, i.e., wetland W-BC-01 is located at the downstream end of Bear Creek. Riparian resource codes reflect stream reaches, also numbered from downstream to upstream. Hence, R-BC-01 is the lowest reach of Bear Creek within the study area. These resource codes are generally consistent with the codes used for the City’s LWI and riparian corridor mapping. Similarly, sensitive Habitat (H) and Species (S) codes are also based on stream watershed, and numbered generally in a west to east manner.

Study Area 1, North

Study Area 1 is 970 acres in size and located east of Hwy. 213 and west of Hwy. 211, extending north from the City UGB approximately one-half mile to Vaughan Road (Figure 2).

Table 7 summarizes the natural resource findings for Study Area 1 (North). Study Area 1 contains four distinct riparian corridors, four wetlands, and one sensitive habitat area. Additional Oregon Conservation Strategy oak woodland habitats may also be present, but state mapping of these resources has not yet been completed. These resources provide low to high quality functions, as described in the table below.

Table 7. North Study Area Natural Resources

Resource Type	Resource Code	Location	Quality	Quantity (acres)
Wetlands	W-MR-01	Near Vaughan Road and Molalla Avenue	Forested wetland mosaic with Oregon ash and white oak. Moderate to high quality habitat functions.	37.3
	W-MR-02	Along S. McCown Road	Wetland in pasture area with scattered Oregon ash. Lower quality habitat functions.	1.4
	W-MR-03	South of Vaughan Road, west of Hwy. 211	Wetland along drainage with ash woodland to west and pastureland to east. Moderate quality habitat functions.	21.7
	W-MR-04	North of Vaughan Road, east of McCown Road	Wetland along drainage with ash woodlands. Moderate quality habitat functions.	23.7
Riparian Corridors	R-CC-01	Creamery Creek, west end of area, south of Vick Road	Two linear (excavated) channels merge into one, with scattered Oregon ash and other trees. Low shade and habitat functions; high enhancement potential	9.5

Resource Type	Resource Code	Location	Quality	Quantity (acres)
	R-MR-01	Molalla River tributary, east of Molalla Road, crosses S. Vaughan Road	Mostly forested riparian corridor with associated ash/oak habitat and wetland mosaic. Moderate to high shade and habitat functions.	13.3
	R-MR-02	Molalla River tributary, along S. McCown and Vaughan Roads	Degraded stream channel north of Vaughan and at nursery; habitat improves with ash forest corridor to south near East Clark Park.	13.2
	R-MR-03	Molalla River tributary, north of Vaughan Road between McCown and Hwy. 211	Scattered ash and oak along corridor with associated wetlands. Low to moderate shade and habitat functions; high enhancement potential	8.2
Sensitive Species/Habitats	H-MR-01	Forested area SE of Vaughan and Molalla Road intersection	Ash-oak forest habitat with stream and wetland mosaic	29
	Oak Woodlands	Potential OCS oak woodlands near S. McCown and Vaughan Roads	Oregon Conservation Strategy habitat. Consult OCS oak woodland map when available.	TBD

Study Area 2, East

Study Area 2 is 821 acres in size and located south of Hwy. 211, east of Mathias Road and Hy Oaks Lane, west of Adams/Adams Cemetery Road, and north of Herman Road (Figure 3).

Table 8 summarizes the natural resource inventory findings for Study Area 2 (East). This study area headwater tributaries to Bear Creek. It contains two riparian corridors and five wetlands. One sensitive plant species and several Oregon Conservation Strategy oak woodland habitats may also be present. These resources provide low to high quality functions, as described in the table below.

Table 8. East Study Area Natural Resources

Resource Type	Resource Code	Location	Quality	Quantity (acres)
Wetlands	W-MR-03	East of Hwy. 211, north of Shirley Street	Farmed wetland with low habitat value.	8.4
	W-BC-06	Along Bear Creek, north of Molalla Forest Road and east of Mathias Road	Oregon ash forested wetland along Bear Creek headwater branches. Moderate to high water quality and habitat functions.	19.8
	W-BC-07	East of Mathias Road, south of Feyrer Park Road	Farmed wetland along Bear Creek drainage. Some remaining trees but generally low quality.	10.9

Resource Type	Resource Code	Location	Quality	Quantity (acres)
	W-BC-08	East of Mathias Road, south of Feyrer Park Road	Farmed wetland with some ponding visible in November. Generally low quality. Large area of hydric soils and spotty ponding suggest larger wetland, but could not be confirmed.	14.7
	W-BC-09	South of Molalla Forest Road and east of Mathias Road	Oregon ash forested wetland with open water habitat. Moderate water quality and habitat functions.	4.5
Riparian Corridors	R-MR-03	Molalla River tributary along north edge of study area, east of Hwy. 211	Scattered ash and oak along corridor with associated wetlands. Low to moderate shade and habitat values; high enhancement potential	1.3
	R-BC-03	Bear Creek headwaters, east of Mathias Road	Generally free-flowing reach of Bear Creek through forested corridor with associated wetlands. High quality cover and habitat functions.	9.9
Sensitive Species/Habitats	S-BC-01	Peacock larkspur record near edge of study area	Federal species of concern, state listed Endangered and identified as a Oregon Conservation Strategy species; of high importance	One population
	Oak Woodlands	Potential OCS oak woodlands in vicinity of Molalla Forest Road	Oregon Conservation Strategy habitat. Consult OCS oak woodland map when available.	TBD

Study Area 3, South

Study Area 3 is 1,623 acres in size and located east of Hwy. 213 and west of Mathias Road, extending south from City UGB approximately one mile to near Herman Road. (Figure 4).

Table 9 summarizes the natural resource findings for Study Area 3 (South). This study area contains four distinct riparian corridors, five wetlands, and one sensitive habitat area. Additional Oregon Conservation Strategy oak woodland habitats may also be present, but state mapping of these resources has not yet been completed. These resources provide low to high quality functions, as described in the table below.

Table 9. South Study Area Natural Resources

Resource Type	Resource Code	Location	Quality	Quantity (acres)
Wetlands	W-BC-03	East of Hwy. 213 and south of Molalla Forest Road	Ash forested wetland in lowlying area with hydric soils. Moderate to high quality cover and habitat functions.	9.3
	W-BC-04	Along Bear Creek tributary, south of Molalla Forest Road	Small, ash forested wetland along stream. Moderate quality cover and habitat functions.	4.5

Resource Type	Resource Code	Location	Quality	Quantity (acres)
	W-BC-05	Along Bear Creek, north of Molalla Forest Road	Largest wetland complex in City, containing forested, scrub-shrub, emergent and open water wetlands. Linked to LWI wetlands, and DSL file WD 00-0057. High water quality and habitat functions.	70.2
	W-KC-02	Along Kaiser Creek, east of Hwy. 213 near Barbara Way	Part forested, part farmed (emergent) wetland with moderate quality cover and habitat functions.	15
	W-KC-03	Along Kaiser Creek, east of Hwy. 213 and W-KC-02	Forested and scrub-shrub wetland with moderate quality cover and habitat functions.	20.8
Riparian Corridors	R-BC-02	South of Molalla Forest Road and east of Ona Way	Linear drainage corridor with patches of ash forest and associated wetland. Low to moderate quality cover and habitat functions.	16.2
	R-BC-03	Bear Creek mainstem, north of Molalla Forest Road	Generally free-flowing reach of Bear Creek through forested corridor with associated wetlands. High quality cover and habitat functions.	10.2
	R-BC-04	East of Wilhoit Road	Linear drainage corridor through farmed areas and small forest patches. Low to moderate quality cover and habitat functions.	12.4
	R-KC-01	Kaiser Creek, east of Hwy. 213	Mix of farmed and forested corridor conditions, with stream-associated wetlands. Low to moderate quality cover and habitat functions.	22.6
Sensitive Species/Habitats	H-BC-01	Along Bear Creek, north of Molalla Forest Road	Forested habitat complex dominated by Oregon ash. Highest quality habitat in study area, contains variety of special status species (see Table 6)	29
	Oak Woodlands	Potential OCS oak woodland habitat scattered throughout site	Oregon Conservation Strategy habitat. Consult OCS oak woodland map when available.	TBD

Study Area 4, West

Study Area 4 is 798 acres in size and located west of Hwy. 213 and the City's UGB. It is generally east of Cramer Road, north of Barbara Way, and south of Barnards Road (Figure 5).

Table 10 summarizes the natural resource findings for Study Area 4 (West). This study area contains three distinct riparian corridors, six wetlands, and one sensitive habitat area. This area contains Bear Creek, a state-designated fish-bearing stream. Additional Oregon Conservation Strategy oak woodland habitats may also be present, but state mapping of these resources has not yet been completed. These resources provide low to high quality functions, as described in the table below.

Table 10. West Study Area Natural Resources

Resource Type	Resource Code	Location	Quality	Quantity (acres)
Wetlands	W-CC-01	Northern boundary of study area, associated with Creamery Creek	Oregon ash forested wetland with moderate to high quality habitat function.	7.9
	W-WC-01	West of Hwy. 213 and north of Toliver Road	Remnant of a small drainageway feeding Wheeler Creek, lower quality emergent and scrub-shrub wetland (east portion in DSL file WD 02-0574)	17.7
	W-WC-02	West of Hwy. 213 and north of Toliver Road	South of above, lower quality emergent and scrub-shrub wetland (DSL file WD 02-0574)	7.4
	W-BC-01	South of Toliver Road	Forested and emergent wetlands along a fish-bearing reach of Bear Creek. Moderate to high quality cover and habitat functions.	10.2
	W-BC-02	South of Toliver Road	Treatment lagoon (open water) – low quality	73.9
	W-KC-01	Along Kaiser Creek, west of Hwy. 213 and north of Barbara Way	Forested wetland dominated by ash, with oak and Douglas fir at edges. Moderate to high quality cover and habitat functions.	9.7
Riparian Corridors	R-CC-01	Creamery Creek, north end of area, west of Hwy. 213	Channel with scattered Oregon ash and emergent vegetation, meeting forested wetland to west. Low shade and habitat functions; high enhancement potential.	4.0
	R-BC-01	South of Toliver Road	Fish-bearing stream segment with ash forest and associated wetland. Moderate to high quality cover and habitat functions.	5.4
	R-KC-01	Kaiser Creek, south end of area, west of Hwy. 213 and north of Barbara Way	Forested riparian corridor with mix of ash, oak and Douglas fir. Moderate to high quality cover and habitat functions.	3.7
Sensitive Species/Habitats	H-KC-01	Forested area west of Hwy. 213 and north of Barbara Way	Ash-oak-fir forest habitat with stream and wetland mosaic	27

CONCLUSION

Using the off-site methodology described in the Inventory Methods section, Winterbrook identified a total of 13 riparian corridors (reaches) with a combined length of 10.3 miles within the overall planning area. Winterbrook also identified 20 wetlands covering a total of 389 acres. Most wetlands were associated with riparian corridors. Three sensitive wildlife habitat areas were also noted. Additional Oregon Conservation Strategy oak woodland habitats are also likely to occur within the study area, and will be mapped by the state in the near future.

Each of the Molalla UGB expansion study areas contains a mix of wetlands, riparian corridors and wildlife habitat areas. The southern study area contains the greatest acreage of these natural resources but it is also the largest study area. A better comparison may be the percentage of land within a given study area that is constrained by natural resources. Using this approach, the West study area has the highest coverage of resources as shown in Table 11.

Table 11. Summary of Study Area Resources and Constrained Land Area

Study Area	Resources	Total area (acres)	Percentage of study area
1. North	4 wetlands, 4 riparian corridors, 1 habitat area	157	16
2. East	5 wetlands, 2 riparian corridors	70	8
3. South	5 wetlands, 4 riparian corridors, 1 habitat area	210	13
4. West	6 wetlands, 3 riparian corridors, 1 habitat area	167	21

For the purpose of this UGB expansion analysis, the wetlands, riparian corridors and sensitive habitat areas identified in Figures 2 through 5 should not be considered “buildable lands.” Winterbrook identified an impact area of 50 feet around most resource areas, and a 75-foot impact area around the fish-bearing lower reach of Bear Creek. We recommend that this area also be excluded for the purpose of the UGB expansion analysis.

In addition to these mapped resource areas, it is important to note that the Molalla River is home to a diversity of sensitive fish and wildlife species, including bald eagle, western painted turtle, northwestern pond turtle, steelhead trout and Chinook salmon. From a natural resource conservation standpoint, growth of the City to the northeast (toward the Molalla River corridor) should be minimized, particularly in the North and northern part of the East Study Area.

MANAGEMENT RECOMMENDATIONS

Following are some general guidelines for stormwater management that may serve to conserve the streams and wetlands identified in this report.

Minimize direct stormwater impacts to streams and wetlands

This can be accomplished by siting stormwater facilities outside of streams and wetlands, maintaining natural drainages, and preserving riparian buffers. The goal is to capture and infiltrate rainwater as close to its source as possible, when soil and slope conditions allow. Integrated Management Practices (IMPs) are recommended in lieu of centralized stormwater ponds. These IMPs include the use of small-scale distributed runoff management features, together with minimization of impervious cover, and strategic placement of buildings, pavement and landscaping.

Preserve natural vegetative cover

Natural vegetation increases infiltration and helps to maintain predevelopment hydrology on a site, thereby reducing the reliance on large-scale stormwater ponds. Where it can be done without disturbance to trees, locate stormwater infiltration systems on hydrologic soil groups (HSG) A and B soils.

Minimize overall impervious cover

Paved roadways, sidewalks, driveways and parking areas are the primary sources of impervious surface area. Impervious areas alter runoff and recharge values and site hydrology. On the other hand, maintaining pervious surfaces encourages surface water infiltration and groundwater recharge. There are several methods that can be used to reduce the total runoff volume from impervious surfaces. These include:

- Substitute pervious surfaces for impervious wherever possible.
- Utilize the minimum required width for streets and roads.
- Where appropriate, avoid the use of curb and gutter. Utilize vegetated open swales, preferably “engineered swales” with a permeable soil base.
- Minimize excess parking space construction, utilize pervious pavers in low-use areas
- Minimize cul-de-sac diameters, use doughnut cul-de-sacs, or use alternative turnarounds.
- Minimize compaction of the landscape. In areas where soils will become compacted due to construction equipment, specify that the soils will be “disked” prior to seeding, and amended with loam or sand to increase absorption capacity.

“Disconnect” impervious areas

“Disconnecting” streets and parking areas from closed culverts allows drainage to be absorbed by nearby pervious surface areas. This occurs, for example, when downspouts drain to the yard, not the driveway. Disconnecting decreases the runoff volume and increases the time of concentration for reasons discussed below. Disconnected parking lots, for example, can provide sheet flow into bioretention areas or engineered infiltration swales.

Increase the travel time of water off of the site (Time of Concentration)

Replicating the pre-development Time of Concentration is a key aspect in maintaining predevelopment flow regime, and minimizing downstream impacts.

- Flatten grades for stormwater conveyance to the minimum sufficient to allow drainage.
- Increase the travel time in vegetated swales by using more circuitous flow routes, rougher vegetation in swales, and check dams.
- Utilize “engineered” swales in lieu of pipes or hardened channels.

Revegetate all cleared and graded areas

Revegetating graded areas, planting, or preserving existing vegetation can reduce hydrologic impacts by creating added surface roughness as well as providing for additional volume storage.

Provide sheet flow into natural open space

Wherever stream corridors and wetlands are preserved, ensure that they are made hydrologically functional by making them receiving areas for sheet flow, not concentrated flow. Use level spreaders to help spread water into the preserved areas. Ensure that flow volumes do not cause channelized flow and erosion in receiving areas.

Protect wetlands and stream corridors

Protecting significant wetlands and stream corridors is an essential management tool. Where wetlands and stream corridors are identified, they should be removed from the Buildable Lands Inventory.

REFERENCES

- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service. Publ. # FWS/OBS-79/31. 131 p.
- Dunne, Thomas and Luna Leopold. 1978. *Water in Environmental Planning*. W. H. Freeman and Company, New York.
- Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Hitchcock and Cronquist. 1973. *Flora of the Pacific Northwest*. University of Washington Press. Seattle, Washington.
- Natural Resources Conservation Service (NRCS). 1999. *National Soil Survey Handbook*. Section 622-4.
- Reed, P.B., Jr. 1997. *Revision of the National List of Plant Species that Occur in Wetlands: National Summary*. U.S. Fish and Wildlife Service, Washington, D.C. 253 pages.
- Reppert, R.T., W. Sigles, E. Stakhiv, L. Messman, and C. Meyers. 1979. *Wetlands Values: Concepts and Methods for Wetlands Evaluation*. Inst. for Water Resources, U.S. Army Corps of Engineers, Fort Belvoir, VA. Res. rpt. 79-R1.
- U.S. Fish and Wildlife Service. 1981. National Wetlands Inventory Maps. Molalla and Wilhoit, Oregon Quadrangles. USFWS Region 1, Portland, Oregon.
- See additional references listed in the Inventory Methods section.