SOUTH DESCHUTES COUNTY LOCAL WETLAND INVENTORY REPORT

Prepared for
Deschutes County

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Funded by:
Oregon Watershed Enhancement Board
Deschutes River Mitigation and Enhancement Program

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1.0 INTRODUCTION

The South Deschutes County Local Wetland Inventory (LWI) has been prepared and funded through an Oregon Watershed Enhancement Board (OWEB) Technical Assistance Grant which also leverages funding from the Deschutes River Mitigation and Enhancement program. ESA Adolfson (ESA) has prepared this report and mapping with technical assistance by Deschutes County and Oregon Department of State Lands (DSL). ESA was assisted in the field inventory by Paul Adamus and Harper Houf Peterson Righellis Inc., (HHPR). As requested by the County, Paul Adamus also provided technical expertise in the use of the Oregon Rapid Wetland Assessment Protocol (ORWAP).

Local wetland inventories are used by local governments to identify water resources during comprehensive plan development to meet statewide planning goals. The South Deschutes County Local Wetland Inventory (LWI) will allow the County to better identify potential wetland areas that provide important water quality functions and identify areas where development will avoid or minimize impacts to those wetlands. The LWI will also help identify areas where restoration projects may improve water quality and other wetland functions. Similarly the LWI may assist landowners in planning for potential project permitting for development of a property. Most impacts to wetlands and streams are regulated by DSL and the U.S. Army Corps of Engineers (Corps) and usually require an approved wetland delineation report as well as permits prior to site development. This inventory did not include wetland delineations or detailed studies necessary to support permitting of a specific project.

LWI requirements are outlined in the LWI Rule (Oregon Administrative Rule [OAR] 141-086-0180 through 141-086-0240).

1.1 Overview of the Inventory Process

The LWI process involves survey, identification and mapping of all wetland areas larger than 0.5 acre that occur within a defined study area. For the South Deschutes County LWI, the study area covers 18,937 acres from Sunriver to south of LaPine (Figure 1, Appendix A). This is the largest LWI that has been completed in Oregon to date. A local wetland inventory is also a refinement of the National Wetland Inventory (NWI), which was a national effort undertaken by the U.S. Fish and Wildlife Service in the 1980s. The NWI shows the likely location of wetlands across the nation; however, these maps are not as accurate as LWIs because they were derived from high altitude images of the landscape and are based on imagery from the 1980s.

Deschutes County (County), citizens, wetland scientists from ESA, and the Oregon Department of State Lands (DSL) have all played a role in the inventory process for South Deschutes County. The County began the effort by scheduling a public meeting to inform citizens of the LWI and by obtaining permission from landowners to allow wetland scientists to access private property. ESA compiled existing data on wetlands including NWI maps, aerial photos and soils maps, and then conducted field observations to confirm the information sources. Where needed and where property access was

permitted, ESA collected data on the vegetation, soils, and hydrology of a parcel to determine if the area is or is not a wetland. ESA also assessed the functions and values of the wetlands using the ORWAP. DSL reviewed the draft LWI to ensure it was conducted according to state standards and to provide quality control/quality assurance.

The final LWI consists of a set of maps that show the approximate location of wetlands and streams, and descriptive information about the wetlands and the main functions they provide. Functions that are evaluated include wildlife habitat quality, contribution to fish habitat or water quality improvement, and floodwater retention capability. Every attempt was made to map wetlands correctly on parcels and to map wetland boundaries to an accuracy of at least 5 meters (m) or 16.4 feet. There may be areas where the boundary is less accurate, especially on large tracts with few geographic reference points, and areas where property access was denied.

Ultimately, the LWI will replace the National Wetland Inventory (NWI) map for South Deschutes County and improve the accuracy in the identification of jurisdictional wetland characteristics in the upper Deschutes Basin. Upon approval of this report and mapping, Deschutes County will formally adopt the LWI into its Comprehensive Plan and Goal 6 Inventory.

Staff members who participated in the South Deschutes County LWI include the following wetland scientists from ESA: John Gordon, Sarah Hartung, Alison Sigler, Aaron Booy, Rosemary Baker, and Adam Merrill. In addition, the project team included local wetland scientists Paul Adamus and Alessandra Capretti from HHPR. Project principals from ESA include Tom McGuire, Cathie Conolly, and Teresa Vanderburg. All field staff received training from Paul Adamus in the ORWAP methods prior to field investigations. Refer to Appendix B for a complete list of staff qualifications and experience.

1.2 Public Involvement

The County organized the public involvement efforts for this project. Letters describing the project and seeking property access permission were sent to all property owners whose tax lots intercepted hydric soil layers and/or NWI-mapped wetlands and streams, or whose tax lots showed soil saturation (darker areas) indicative of wetlands in the aerial photographs. Access permission was granted to 1,286 of 4,652 properties within the study area, for a permission rate of 28 percent.

A public open house was held at Sunriver on March 16, 2010, at the Three Rivers Elementary School, 56900 Enterprise Drive. Approximately 100 members of the public attended the meeting.

The County conducted a second public meeting on November 16, 2010, to present the draft LWI results. The County will also schedule and facilitate a public meeting to present the final LWI results in 2011. Dates, times, and locations for these future meetings will be determined by the County.

2.0 STUDY AREA AND LANDSCAPE SETTING

The South Deschutes County study area is located in south central Deschutes County in the Upper Deschutes River sub-watershed (Figure 1, Appendix A). The study area covers 18,937 acres. This is the largest LWI that has been undertaken in the state. The Upper Deschutes River sub-watershed is within the U.S. Geological Survey eight-digit hydrologic unit codes (HUC) 17070301 and 17070302, and includes portions of the Deschutes River, Little Deschutes River, and Fall River. The Fall River and the Little Deschutes River flow into the Deschutes River near Three Rivers, Oregon. The Deschutes River flows north into the Columbia River.

Deschutes County is situated between the Cascades Mountains to the west and the high desert to the east. Deschutes County's land use consists mostly of forested land at higher elevations and agricultural and rural residential land at the lower elevations. The forested land tends to be fragmented and is dominated by lodgepole pine (*Pinus contorta*) with some ponderosa pine (*Pinus ponderosa*) (Franklin and Dyrness, 1988). The study area terrain is mostly flat, characteristic of wide floodplains, and is predominantly publicly-owned national forest land with scattered privately held farms, ranches, and housing tracts. Irrigated agriculture is used to produce hay and provide pasture. In recent years, Deschutes County has been one of the fastest growing counties in Oregon.

Little Lava Lake is the headwaters of the Deschutes River and is located northwest of La Pine. Most of the water in the Upper Deschutes is diverted for irrigation and two reservoirs are located upstream from the study area. Wetlands located on these large river systems tend to be wetland/upland mosaics dominated by only a few wetland plant species. Common wetland species include water sedge (*Carex aquatilis*), Nebraska sedge (*Carex nebrascensis*), narrowleaf willow (*Salix exigua*), grey alder (*Alnus incana*) and lodgepole pine (*Pinus contorta*).

Weather in and around Deschutes County consists of cold winters with snow and hot, dry summers, typical of the High Lava Plains physiographic province (Franklin and Dyrness, 1988). The growing season is short and day and night temperature fluctuations can be great.

3.0 METHODS

The Local Wetland Inventory process is described in OAR 141-086-0180 through 141-086-0240. Methods used to inventory wetland resources in the South Deschutes County study area are in conformity with these state rules. However, due to the extensive area covered by the South Deschutes LWI, DSL has agreed to the presentation of the inventory information on maps at a one inch to 660 foot (1" = 660') scale instead of the standard 1" = 200' scale. Also due to the large scale of this LWI, Cowardin habitat classes greater than 0.5 acre within a wetland were mapped as separate polygons, instead of those greater than 0.25 acre in size as written in the OARs. This adjustment to the methods was approved by DSL and the County.

3.1 Preliminary Mapping and Research

Preliminary mapping and research was completed prior to field investigations to determine which sites within the study area were likely to contain wetlands. The County compiled preliminary wetland maps based on NWI mapped wetlands (Figures 2.1 to 2.7 in Appendix A). The County also provided wetland delineations obtained from DSL. ESA reviewed and expanded the preliminary wetland mapping provided by the County based on existing wetland delineation data and a review of aerial photographs, soil survey maps (Figures 3.1 to 3.7, Appendix A), and topographic mapping. These preliminary wetland maps were used to determine which residents to contact for access permission.

ESA identified and recommended tax lots to which access should be requested for conducting wetland field work. The County sent access requests to the owners of those tax lots and then provided preliminary maps indicating the lots where access was granted.

3.2 Required Information Sources

The South Deschutes County LWI is based on several sources of information, including the following GIS data layers and technical documents:

- Geographic Information Systems (GIS) layers of:
    - Aerial digital imagery (Deschutes County, 2010);
    - LWI study area (Deschutes County, 2010);
    - Tax lot access permissions (Deschutes County, 2010);
    - Tax lots (Deschutes County);
    - Potential wetlands (ESA, 2010);
    - Wetland assessment units (ESA, 2010);
    - La Pine/Wickiup Junction Local Wetland Inventory (DSL, 1996);National Wetlands Inventory (NWI), (U.S. Fish and Wildlife Service, 2009);
    - Soil Survey of Upper Deschutes River Area, Oregon (NRCS, 1992);

  - Streams (Deschutes County, 2007);
  - Rivers (Deschutes County, 2006); and
  - Public Land Survey System reference grids (Deschutes County, 2005)
- DSL existing wetland delineations/determinations (various citations).
- USGS quadrangle maps including: La Pine, Finley Butte, Anns Butte, Pistol Butte, Round Mountain, Masten Butte and Wickiup Dam.

Other information sources used to develop the LWI include local landowner knowledge.

3.3 Wetland Determinations

Wetland determinations were made for all wetlands based on either on-site or off-site investigations, depending on access permission. Refer to Appendix C for the Wetland Determination Forms.

3.3.1 On-site Determinations

For parcels with access permission, on-site determinations were made according to the Corps 1987 Manual (Environmental Laboratory, 1987), Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Corps, 2010) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Corps, 2008). During the first week of field work (May 3 to 7, 2010) field crews utilized the Arid West Supplement when conducting investigations. However, after speaking with DSL scientists who have worked in the Deschutes area, ESA was directed to instead use the Western Mountains Supplement. All data collected after May, including field investigations conducted on June 21 through 25 and August 9 and 10, 2010, were collected using the Western Mountains, Valleys, and Coast Regional Supplement.

Determinations were made on parcels that were judged to have wetlands or wetland characteristics based on preliminary mapping and research efforts. Sample plots were established to document typical vegetation, soil, and hydrology characteristics and to determine the approximate location of the wetland boundary.

3.3.2 Off-site Determinations

ESA did not enter properties where property owners denied access. For those parcels, off-site determinations were made by observing site characteristics from adjacent public rights-of-way (e.g. public streets or sidewalks) or from nearby parcels with access permission. Where feasible, sample plots were established in road rights-of-way and labeled “off-site” to characterize wetland conditions for adjacent parcels where site access was denied by the property owner. Along several waterways (e.g. the Deschutes River and the Little Deschutes River), we were able to observe a number of inaccessible wetlands from parcels on the opposite shoreline where ESA was granted access. Binoculars were used to observe many of these inaccessible wetlands. Field observations

of hydrology and vegetation were assessed in combination with existing data such as published soil survey data, NWI maps and/or known DSL delineations, landscape setting, aerial photography, and staff experience. Positive off-site field observations of wetland hydrology were assessed by noting evidence of soil saturation (i.e. glistening on the surface or shallow inundation) in the wetland using the naked eye and/or binoculars.

Some wetlands could not be observed in the field from any vantage point due to lack of access to adjacent parcels, lack of public roads and/or unsafe road conditions (lack of shoulders). In these cases, where we lacked "visual access" ESA staff relied upon aerial imagery and observations of the general landscape to determine wetland boundaries. Sample plot data were not created for wetlands that could not be observed or accessed.

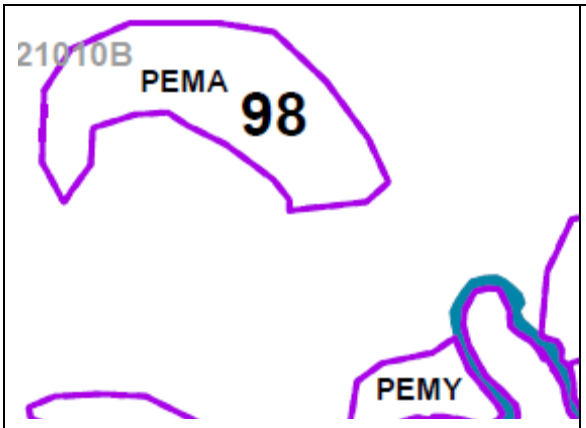
3.4 Field Mapping and Data Collection

All field data were collected and recorded using hand-held Trimble Yuma, Global Positioning System/Geographic Information System (GPS/GIS) data recorders. Prior to field investigations, aerial imagery and shapefiles of the study area were loaded onto the GPS units for reference in the field. The GPS/GIS units enabled field crews to digitize wetland boundaries in ArcPad and edit existing wetland boundaries as necessary, based on observations. Trimble GPS units were also used to map probable wetlands, mark artificial wetlands, and identify locations of sample plots and streams. Other information recorded on the GPS/GIS units includes field notes and wetland delineation/determination data on digital data forms. After the field work, data were uploaded onto a desktop computer for viewing and final editing.

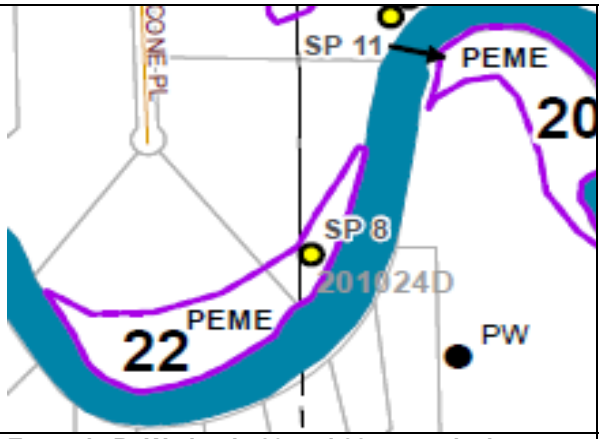
3.4.1 Wetlands

Wetland boundaries were mapped per OAR 141-086-0210 with an accuracy target of 5 m (16.4 feet) on sites where property access was obtained. The actual accuracy may be less for some wetlands that could not be visually confirmed in the field due to lack of access permission or lack of visual access from nearby roads. Wetlands greater than or equal to 0.5 acre were assigned a unique identification code (1, 2, 3, etc) generally from north to south within the study area. Wetlands were given unique numeric identifiers, with some exceptions, according to the following criteria:

- The wetland is separate from other wetland areas and lies further than 50 feet away from another wetland (Example A).
- The wetland is located on one side or the other of the Deschutes River (Example B). The Deschutes River is on average wider than 100 feet and wetlands that occurred on both sides of the channel were generally labeled as separate features.
- The wetland is a continuous feature that encompasses both sides of one of the smaller river or stream systems within the study area, including the Fall River, Little Deschutes River, Paulina Creek, and Long Prairie Slough (Examples C and D). These rivers and streams are on average less than 50 feet in width and wetlands that occurred on both sides of one of these channels were generally labeled as the same wetland.

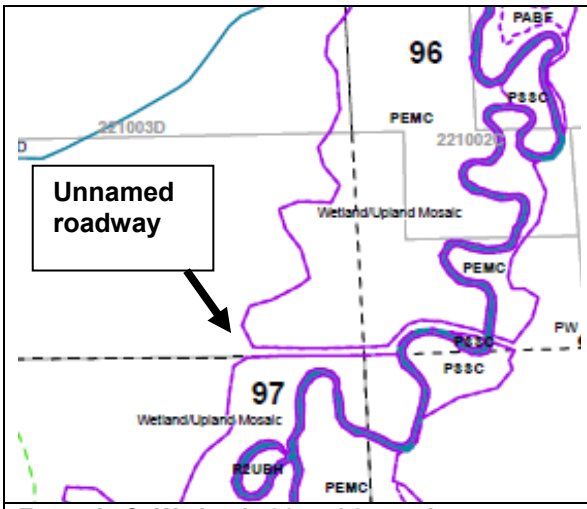


Example A: Wetland 98 is greater than 0.5 acre and not within 50 feet of another wetland.

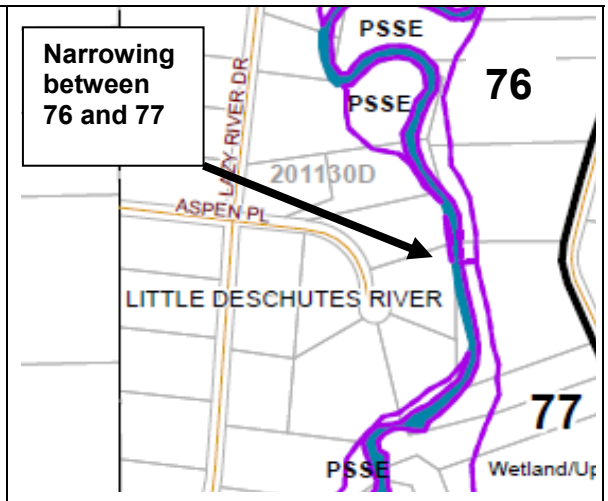


Example B: Wetlands 20 and 22 are typical features along the Deschutes River.

Wetlands 96 and 97 (Example C) are typical features of the Little Deschutes River floodplain that contain relic and current oxbows as well as upland hummocks. The breaks between these large, continuous features were often roadways or a narrowing of the feature.

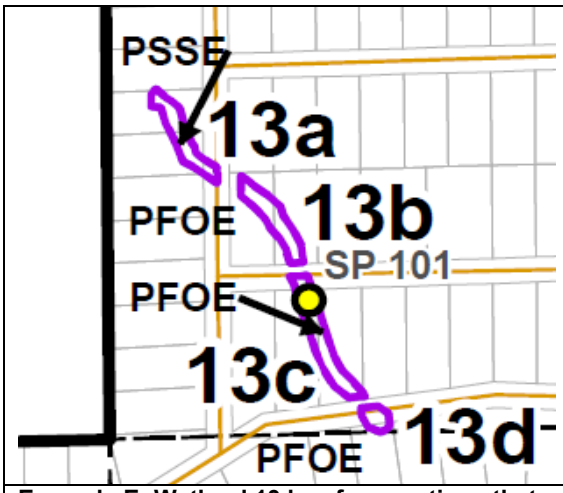


Example C: Wetlands 96 and 97 are large features along the Little Deschutes River and are separated by an unnamed road.

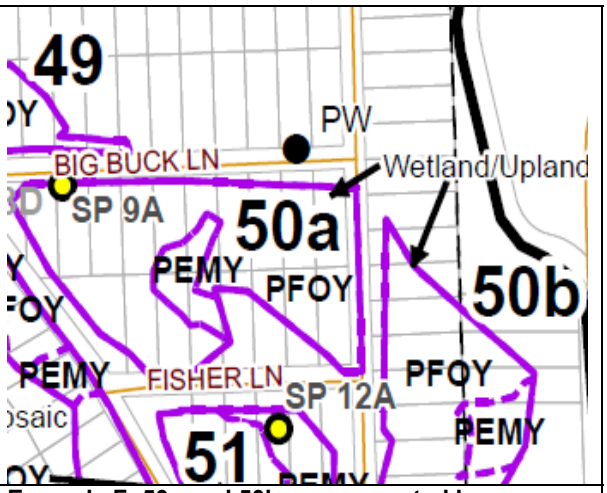


Example D: The dividing point between wetlands 76 and 77 is a narrowing east of Aspen Place.

Wetlands that were separated by a roadway and that were deemed hydrologically connected were assigned a letter after the unique numeric identifier to indicate the wetlands were considered sections of one wetland unit (Examples E and F).



Example E: Wetland 13 has four sections that are separated by roadways but hydrologically connected via culverts.



Example F: 50a and 50b are connected by a culvert, but no culvert was observed between 49 and 50a-b or 51 and 50a-b. Wetlands 49 and 51 are more than 50 feet away from 50a-b.

Wetlands that extend beyond the study area boundary were digitized to reflect only the area within the study limits. In some cases a wetland extends in and out of the study area resulting in two or more seemingly separate polygons; however, these polygons are considered one unit since they were on-site portions of a larger off-site wetland. Previously delineated or determined DSL wetland delineations within the study area were field verified and edited if the current size was found to be different from the recorded size.

3.4.2 Probable Wetlands

Areas that appeared to meet wetland criteria but were less than 0.5 acre within the study area were digitized as a point and recorded as a "probable wetland" (PW), as defined by OAR 141-086-0200. In some cases, a PW represents a small portion of a larger wetland that is located outside of the study area.

3.4.3 Wetland/Upland Mosaics

Wetlands with upland inclusions were identified on the maps as "wetland/upland mosaics." Wetland/upland mosaics are classified as a "landscape where wetland and non-wetland components are too closely associated to be easily delineated or mapped separately." Also the microtopography consists of, "ridges and hummocks supporting non-hydrophytic species are often interspersed throughout a wetland matrix having clearly hydrophytic vegetation, hydric soils, and wetland hydrology," (Corps, 2010).

A majority of the wetland/upland mosaics occurred on the floodplains of the Deschutes River, Little Deschutes River Fall River, Long Prairie Slough, and Paulina Creek. In most cases, we had minimal field access to these large wetland mosaic features. However, we observed an interspersion of wetland and upland habitats in each of the floodplain areas. In other cases a wetland was considered a mosaic due to uneven

excavation and fill within a degraded wetland. Aerial imagery was used in conjunction with field investigations to aid in determinations of wetland/upland mosaic conditions. Site-specific causes for designation as a wetland/upland mosaic are provided on the wetland summary sheets (Appendix D).

3.4.4 Sample Plots

Sample plots (SP) were established for each wetland (except wetlands on file with DSL) and for areas that appeared to have wetland characteristics. There were several deviations from this method related to wetland size. When there were many wetlands within a small area and the wetlands exhibited similar wetland characteristics, one sample plot was used to represent characteristics in all of the wetlands. Additional sample plots were established in larger wetlands when necessary to describe variable habitats. Sample plots located in upland areas were established based on the original assessment units to confirm that upland conditions were present. Refer to Appendix C for wetland determination forms. Sample plots were not established for wetlands for which no access was granted if these wetlands were not visually accessible from rights-of-way.

3.4.5 Guidance on How to Find Sample Plot Data and Other Information

For landowners and other users interested in finding sample plot data for a particular parcel, use the following steps:

Step 1) Go to the Local Wetland Inventory Index Maps and the appropriate location based on the sub-area maps (e.g. Map B.2).

Step 2) Pull-up the sub-area map (e.g. B.2) to identify the unique wetland code (in this example Wetland 5) and corresponding sample plot number(s) (e.g. SP 201).

Step 3) Using the sample plot number (e.g. SP 201), find the corresponding wetland determination form in Appendix C based on that sampling point (e.g. SP 201).

The sample plot symbol (SP 201) on Map B.2 is located in the right-of-way because access permission was not granted for the parcel and observations of the wetland were made from the side of the road.

The property owner or interested user may also obtain additional wetland information by reviewing the corresponding Wetland Summary Sheet from Appendix D. In this example, one would look for Wetland Code 5 for the appropriate Wetland Summary Sheet.

3.5 Overview of Oregon Rapid Wetland Assessment Protocol

The functions and values of each wetland in the study area were assessed using ORWAP. The ORWAP was developed to rapidly and qualitatively assess the functions and values of all types of wetlands throughout the state of Oregon. ORWAP is intended to be completed by wetland professionals and was designed for planning and educational purposes. The methodology, as outlined in The Manual to the Oregon Rapid Wetland

Assessment Protocol (version 2.0) (Adamus et al., 2009), consists of a series of questions with multiple-choice responses. The questions cover a wide variety of features that can be observed rapidly when visiting a wetland or in some cases, obtained from aerial imagery or other sources. These particular questions were designed to correlate with the relative levels of various functions that a wetland can perform and the values associated with those functions. After a user answers all the questions, ORWAP uses the responses to automatically compute a score for each function and its value.

"Functions" are actions that wetlands naturally perform, like hold floodwater, purify stormwater runoff, and provide waterfowl habitat (to name a few). Not all wetlands perform the same function equally. For example, some wetlands provide thermoregulation (i.e. temperature control), while others do not. The responses to ORWAP provide a relative index to quantify how well a wetland performs a given function. For example, water storage (if that function occurs in a given wetland) may be valued much more highly if buildings downstream are at risk of river flooding, because storage of water in wetlands located upstream can lessen the risk of those buildings being flooded. In contrast, the value of the wetland's flood storage function might be considered less if there are no buildings downstream.

Thus, as long as a function is being performed at some minimum level, its function and value scores are independent of each other. Function scores are mostly driven by physical and biological features in and around a wetland. In contrast, value scores are driven in by socioeconomic features located upslope and/or downslope of the wetland, or in some cases depend on whether social institutions have assigned a special designation to the particular wetland, its species, or the wetland type.

ORWAP evaluates each wetland for the following functions and values:

1) water storage (WS),
2) sediment retention and stabilization (SR),
3) phosphorous retention (PR),
4) nitrate removal (NR),
5) thermoregulation (T),
6) carbon sequestration (CS),
7) organic matter export (OE),
8) aquatic invertebrate habitat (INV),
9) anadromous (FA) and non-anadromous fish habitat (FR),
10) amphibian and reptile habitat (AM),
11) waterbird habitat including feeding (WBF) and breeding (WBN),
12) songbird, raptor, and mammal habitat (SBM),
13) pollinator habitat (POL),
14) native plant diversity (PD),
15) wetland sensitivity, (Sens)
16) wetland ecological condition, (Cond)
17) wetland stressors, (Stress)
18) public recognition and use (PUv), and
19) provisioning services (PSv).

ORWAP scores for both functions and values are expressed on a scale of zero to 10. However the range of scores for each function or value across a group of assessed wetlands will vary. While ideally or theoretically each function or value score may range from zero to ten actual real world conditions may rarely combine to result in scores that cover the entire range.

Because of the diversity of functions and values and the sometimes contradictory factors that control them, no "overall" or "average" wetland score is given. While ideally or theoretically each function or value score may range from zero to 10, actual real world conditions may rarely combine to result in scores that cover the entire theoretical range. Individual function or value scores may be compared relative to that particular function or value score across the assessed wetlands. This provides a relative basis to distinguish among assessed wetlands but the scores should not be interpreted on an absolute scale of zero to ten, nor as a direct comparison or ranking between functions or values.

It is rare for any given wetland to be considered "perfect" for any single function, let alone for all or most of the 16 separate functions in the ORWAP methodology. To get an idea how wetlands in Oregon generally score for functions and values, a user can compare scores from a particular wetland with those from scores calculated for 221 wetlands of all types throughout Oregon during ORWAP field testing. The state-wide results are summarized in the excel spreadsheet ORWAP_SuppInfo file, AllSites tab, availablefrom the DSL web site: http://www.oregonstatelands.us/DSL/WETLAND/or_wet_prot.shtml. Navigate to the ORWAP Supplemental Information link to open or download the file.

A common misperception is that only pristine or unaltered wetlands are highly functioning. Although it is true that pristine wetlands usually provide valuable functions, other wetlands can also be highly functioning. For example, impounding water by placing small berms or dikes in an otherwise unaltered but seasonally dry wetland may enhance water storage functions and habitat for nesting waterfowl, although perhaps at some cost to other wetland functions such as anadromous fish habitat.

3.5.1 ORWAP Methods

A majority of wetland assessments were completed during the May 2010 field visit. All wetlands with access permission were assessed on-site. When permission was not granted, wetlands were assessed off-site with visual access from a public right-of-way or adjacent parcels in combination with aerial imagery. In cases where no public or view access existed, wetlands were assessed using current aerial photographs and other existing data compiled for the LWI as well as the wetland scientists' experience with similar conditions.

After field efforts were completed, the data were entered into an ORWAP template spreadsheet, which contains formulas that simultaneously process and display data from all 114 wetlands.

4.0 RESULTS

4.1 Wetlands

ESA identified and recorded 114 wetlands within the study area totaling 3,459 acres. Summaries of the 114 mapped wetlands and tax lots for each wetland are provided in Appendix D. Acreages for each wetland are presented in Table 1. Additionally, 71 probable wetlands (PW) and 29 artificial wetlands were identified and mapped for the study area. Refer to Attachment 1 for the LWI index and individual maps. A glossary of terms to aid in review of the LWI maps is provided in Appendix E.

Table 1. Summary of Wetlands in the South Deschutes County LWI

Wetland Code	Size (acres)	Wetland Code	Size (acres)
1	3.5	58	0.9
2	1.0	59	2.2
3	12.7	60	3.9
4	2.2	61	2.1
5	8.0	62	3.1
6a-b	0.6	63	10.4
7	0.7	64	2.0
8	1.1	65	0.7
9	6.8	66	1.4
10	9.2	67	0.8
11	3.8	68	0.3
12	2.2	69	39.1
13a-d	0.7	70	0.6
14	9.8	71a-b	0.5
15	4.3	72	0.9
16	2.0	73	46.8
17	2.5	74a-c	94.9
18	10.7	75	0.7
19	2.3	76	72.7
20	3.7	77	23.4
21	7.8	78	0.5
22	4.5	79	142.2
23	1.1	80	91.6
24	3.0	81	17.3
25	5.0	82	10.4
26a-b	2.5	83	93.7
27a-c	12.1	84	7.9
28a-b	1.8	85	32.0
29a-c	5.8	86	95.2
30	1.7	87a-b	41.1
31	0.8	88	1.4
32	1.4	89	85.0
33	3.7	90	65.5
34	4.3	91	2.9
35	2.5	92a-b	48.8
36	2.4	93a-b	340.0

Wetland Code	Size (acres)	Wetland Code	Size (acres)
37	1.9	94	104.1
38	2.3	95	69.1
39	1.8	96	82.3
40	3.5	97	64.3
41	34.0	98	7.7
42	34.8	99	232.7
43a-e	32.3	100a-b	15.0
44	12.3	101	1.2
45	21.0	102	2.3
46	25.3	103a-b	200.4
47	2.8	104a-b	1.2
48	27.4	105	97.2
49	1.5	106	159.3
50a-c	14.8	107	100.4
51	3.4	108	48.0
52	2.4	109	112.8
53	4.2	110	221.0
54	36.8	111	8.6
55	4.0	112	15.3
56	8.5	113	78.0
57	0.9	114	31.0
		TOTAL	3,458.9

4.2 Deepwater Habitat

There is no deepwater habitat within the South Deschutes County study area.

4.3 Artificially Created Wetlands

Twenty-nine (29) artificially created wetlands were found in the study area; three stormwater treatment ponds, two irrigation channels, two excavated ponds, three golf course ponds, two fish hatchery ponds, one landscape pond, eleven stock ponds, two dammed ponds, and three other ponds. Artificially created wetlands may or may not be state or federally jurisdictional.

4.4 Summary of Probable Wetlands (PWs)

Seventy-one (71) probable wetlands (PWs) were mapped within the study area. Probable wetlands appeared to have wetland characteristics but were either less than 0.50 acre or were small and of an undetermined size. PWs may or may not be state or federally jurisdictional.

4.5 ORWAP Results

ORWAP summary statistics are presented in Table 2 (functions) and Table 3 (values) below. The median of a list of numbers can be found by arranging all the observations

from lowest value to highest value and selecting the number in the middle position. If there is an even number of observations, the median is defined as the average of the two middle values. The 75th percentile is the score for which 75 percent of the wetlands scored lower and only 25 percent higher. The 90th percentile is the score for which 90 percent of the wetlands scored lower and only 10 percent higher. ORWAP raw data results for wetlands in the study area are located in Appendix F. Summary scores for the individual site functions and values are shown in Appendix G.

The summary statistics indicate that most wetlands in the Upper Deschutes are currently capable of performing all functions commonly attributed to wetlands except for Anadromous Fish Habitat and Waterbird Nesting Habitat (Table 2). Lack of the former is due simply to lack of access to the project area by anadromous fish, and lack of the latter is due to scarcity of large wetlands that remain ponded throughout the summer. Waterbirds do nest in riverine wetlands along the Deschutes River within the study area, but even this nesting is very limited.

Table 2. Summary Statistics for Function Scores of South Deschutes County Wetlands (n=114)

Functions	Median	Min	Max	75TH percentile	90 TH percentile
Water Storage & Delay (WS)	2.52	0.00	6.00	3.05	3.70
Sediment Retention & Stabilization (SR)	4.40	2.58	10.00	5.08	6.47
Phosphorus Retention (PR)	4.47	1.94	10.00	4.88	7.74
Nitrate Removal & Retention (NR)	3.85	2.81	10.00	4.54	5.43
Thermoregulation (T)	3.00	0.00	5.83	3.61	4.42
Carbon Sequestration (CS)	2.24	1.41	3.95	2.39	2.78
Organic Matter Export (OE)	**6.61**	**0.00**	**8.58**	**7.12**	**7.60**
Aquatic Invertebrate Habitat (INV)	**4.82**	**2.68**	**7.07**	**5.34**	**5.85**
Anadromous Fish Habitat (FA)	0.00	0.00	0.00	0.00	0.00
Non-anadromous Fish Habitat (FR)	3.25	0.58	7.69	4.26	4.77
Amphibian & Reptile Habitat (AM)	3.72	1.83	6.87	4.10	5.90
Waterbird Feeding Habitat (WBF)	3.93	2.15	5.98	4.33	4.63
Waterbird Nesting Habitat (WBN)	0.00	0.00	5.51	2.09	4.26
Songbird, Raptor, & Mammal Habitat (SBM)	3.98	2.14	5.79	4.84	5.15
Pollinator Habitat (POL)	**5.79**	**3.19**	**7.36**	**6.52**	**7.05**
Native Plant Diversity (PD)	4.49	2.63	5.58	4.89	5.16

Note: Functions with a high median score are shown in **bold.**

High scoring functions include: Organic Matter Export, Aquatic Invertebrate Habitat, and Pollinator Habitat. Some functions show relatively little variation among the project wetlands (e.g., Carbon Sequestration, Native Plant Diversity), while others vary considerably (e.g., Nitrate Removal, Organic Matter Export).

Table 3 includes a summary of the values scores for the 114 wetlands evaluated.

Table 3. Summary Statistics for Value Scores of South Deschutes County Wetlands (n=114)

Values	Median	Min	Max	75TH percentile	90 TH percentile
Water Storage & Delay (WS)	**6.46**	**1.25**	**7.29**	**6.46**	**7.29**
Sediment Retention & Stabilization (SR)	6.09	3.25	8.19	7.44	7.83
Phosphorus Retention (PR)	**6.18**	**3.03**	**6.99**	**6.51**	**6.68**
Nitrate Removal & Retention (NR)	5.12	3.37	5.75	5.35	5.56
Thermoregulation (T)	3.33	0.00	3.33	3.33	3.33
Aquatic Invertebrate Habitat (INV)	**7.00**	**3.54**	**7.69**	**7.00**	**7.00**
Anadromous Fish Habitat (FA)	3.93	2.15	5.98	4.33	4.60
Non-anadromous Fish Habitat (FR)	3.33	1.75	7.48	6.95	7.14
Amphibian & Reptile Habitat (AM)	4.00	0.67	7.33	4.00	7.33
Waterbird Feeding Habitat (WBF)	6.00	0.67	10.00	6.00	10.00
Waterbird Nesting Habitat (WBN)	4.00	0.50	7.33	4.00	5.50
Songbird, Raptor, & Mammal Habitat (SBM)	6.00	1.00	6.00	6.00	6.00
Pollinator Habitat (POL)	1.94	0.00	10.00	10.00	10.00
Native Plant Diversity (PD)	6.00	2.91	6.87	6.00	6.23
Public Use & Access (PUv)	1.67	0.00	4.00	2.33	3.33
Provisioning Services (PSv)	0.00	0.00	2.00	2.00	2.00
Ecological Condition (Cond)	5.10	2.16	7.41	5.73	6.90

Note: Values with a high median score are shown in **bold.**

The functions which ORWAP indicates are currently of highest *value* in the project area are:

- Aquatic Invertebrate Habitat,
- Water Storage & Delay, and
- Phosphorus Retention.

The value of some functions varies little among the project wetlands (Nitrate Removal & Retention) while the value of others shows large spatial variation (Amphibian and Reptile Habitat, Waterbird Feeding Habitat).

4.6 Goal 6 Water Quality Resources

Several considerations are pertinent to deciding which wetland sites identified in the South Deschutes County LWI could be candidates for a Goal 6 Water Quality Resource (WQR) designation:

1. Which function or functions should be the basis for this designation? Should all functions be weighted equally?
2. To what extent should the current *values* of these functions be considered?
3. What should be the score threshold(s) that determines whether a particular site should be nominated as a Goal 6 Water Quality Resource?

ESA recommends that the Nitrate Removal function of wetlands be used as one of the principal determinants of site nomination for Goal 6 Water Quality Resource protection, with other functions used as secondary determinants, because nitrate contamination has been identified as a primary concern in the project area (Hinkle et al., 2007). Refer to the discussion on groundwater quality in Appendix H for more information. Specifically, we recommend that Goal 6 Water Quality Resources be those sites that meet any of the following three criteria:

Criterion 1. Nitrate Removal (NR) function score is equal to or greater than the 90th percentile of the scores for this function among all wetlands in the project area (i.e., 5.43); AND/**OR**

Criterion 2. Nitrate Removal (NR) function score is equal to or greater than the 75th percentile of the scores for this function among all wetlands in the project area (i.e., 4.54), AND the NR value score of the site is greater than the 75th percentile of the NR value score among all wetlands in the project area (i.e., 5.35); AND/**OR**

Criterion 3. The wetland's score for at least 3 other wetland functions are greater than or equal to the 90th percentile for those functions in the project area.

Based upon the above criteria, the analysis results in the following wetlands potentially designated as a WQR wetland in South Deschutes County:

1. Sites that meet Criterion 1 (12 sites): 3, 10, 13a-d, 21, 23, 26a-b, 27a-c, 28a-b, 29a-c, 75, 98, and 103a-b;

2. Sites that meet Criterion 2 (5 sites): 23, 36, 88, 105, and 106;

3. Sites that meet Criterion 3 (18 sites): 42, 63, 64, 65, 66, 67, 68, 69, 81, 82, 83, 84, 93a-b, 100a-b, 102, 109, 111, and 113. A summary of the high scoring

functions for the wetlands that meet Criterion 3 is provided in Table G4, Appendix G.

Application of these three criteria results in potential designation of 35 sites, which is 30 percent of all wetlands in study area.

Limitations of the ORWAP Analysis

Although ORWAP represents a significant technical advance over OFWAM (the method previously prescribed for use in Local Wetland Inventories in Oregon) and other methods for assessing wetland ecosystem services, like most rapid assessment tools, it does have several limitations. These are detailed in the ORWAP Manual (Adamus et al. 2009b), which may be found on-line at: http://www.oregonstatelands.us/DSL/WETLAND/or_wet_prot.shtml. The most significant limitations of ORWAP are:

1. ORWAP is not a mechanistic model of ecosystem processes and thus cannot be expected to account for many interactions and feedbacks among important variables. ORWAP uses only the variables that can be observed easily, but factors that control many functions are unobservable except with sophisticated equipment and long-term expensive sampling.

2. Like all rapid assessment methods for wetlands, ORWAP has not been validated against actual measures of the functions it estimates.

3. ORWAP is intended to simply be an estimate of function effectiveness averaged over an entire wetland assessment unit. For most functions, ORWAP does not account for wetland size, but size should be taken into account in some manner when proposing candidate sites (wetland assessment units) for WQR status. Determining the boundaries of wetland assessment units (not the boundary between wetland and upland) has a subjective component. Despite guidance in the ORWAP manual, decisions of whether and where to divide two hydrologically connected wetlands into multiple units for purposes of applying ORWAP are sometimes subjective.

5.0 LIMITATIONS

This report documents the investigation, best professional judgment, and conclusions of the investigators. It is correct and complete to the best of our knowledge and based upon the conditions observed during field work conducted in the spring and summer of 2010. Mapping provided should be considered a preliminary inventory map of wetlands and other waters and used for planning purposes only. A formal wetland delineation reviewed and approved by DSL is required for state removal-fill permits. Contact the DSL or Corps with any regulatory questions.

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