Methods for Assessing Wetland Functions

Volume II: Depressional Wetlands in the Columbia Basin of Eastern Washington

Part 2: Procedures for Collecting Data

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Overview of Part 2

This is the second of two parts of a document containing methods to assess depressional wetlands in the Columbia Basin. The first part provides background information on the Washington State Wetland Function Assessment Project, the technical basis of the method, a brief description of how to apply the methods, and methods for three wetland subclasses. This volume contains detailed descriptions of how to apply the methods in the field including procedures for collecting data and data forms.

To obtain the best results with these methods it is recommended that the wetland to be assessed be visited during both the spring and fall. Though the methods will provide relatively reasonable results with one site visit, the highly variable nature of depressional wetland water regimes in the Columbia Basin may prevent accurate identification of the boundaries of hydrologic regimes and water depth classes unless at least two site visits are conducted.

Chapter 1 provides background information on how the data are used, and the expertise and time needed to apply the methods and collect the data. It also introduces the data forms used to record the data.

Chapter 2 recommends 11 steps for completing the assessments, including gathering site-specific information such as maps and photography, dividing a wetland into different assessment units when appropriate, and collecting the data.

Chapter 3 consists of the detailed procedures for collecting each datum used in the assessment models for the three depressional wetland types in the Columbia Basin.

The appendices contain data forms, profiles of the subclasses (also provided in Part 1), a summary form to record the numeric results and qualitative rating of opportunity, lists of common plants, and other useful tools.

These procedures do not work if the ground is frozen or covered in snow or ice. The methods can only be used after the winter thaw.

1. Introduction

1.1 How Data Are Used

Specific data are needed to calculate an index of performance for each function. Examples of data include the number of Cowardin vegetation classes present in a wetland and the presence, or absence, of an outlet. An individual datum may be used directly to represent a variable, or it may be combined with other data to represent a variable. When several data are used to represent a variable, the data are often combined in an equation to calculate a value for a variable that is then scaled from 0 to 1.

1.2 Expertise Needed to Collect the Data

Technical expertise in wetland science is needed to apply the methods and to collect and record the data accurately and consistently. The data are based on observations made at the site being assessed. A strong background in wetland science is, therefore, needed. At a minimum, the level of expertise needed to apply the methods should be similar to that needed to delineate wetlands.

The methods are designed for technical specialists with a strong background in wetland science.

We strongly recommend that users of these methods be trained in how to apply the methods and collect the data. The skills needed to conduct assessments include:

- Mapping
- Plant identification
- Interpreting air photographs
- Understanding of water regimes
- Soils
- Basic wetland delineation

Although it is possible to assess a wetland as an individual, better results can be achieved if the data are collected by a multidisciplinary team with specific expertise in mapping, plants, soils, and water regimes (hydrology).

1.3 Time Needed to Collect Data

The time needed to collect data will vary depending on the complexity and size of the area being assessed (assessment unit) and how difficult it is to collect data and move within it. Larger sites with dense stands of cattails or bulrushes may involve more time and strenuous effort. In some cases, you may not be able to access portions of the site. You may need to combine your direct observations at the site, interpretation of aerial photographs, and a combination of other resources to collect all the data required.

We estimate that it will take from several hours to a day to collect data in most cases. Please note that in some cases identifying assessment unit boundaries within a complex wetland system may be more time consuming than collecting the data.

This estimate does not include the time required to delineate the wetland boundary if that is necessary for other reasons. Some of the data, however, can be collected while the boundary delineation is being performed.

1.4 Using the Data Forms

Data are recorded on one of three data forms. A separate data form is used for depressional, freshwater, long-duration (Appendix 2 A); depressional, freshwater, short-duration (Appendix 2 B); and depressional alkali wetlands (Appendix 2 C). Three forms have been developed because data needed to assess functions for each wetland type are not always the same.

Data are collected on 47 different characteristics or attributes of a wetland. Each characteristic is called a "datum," though many are divided into several sub-items. Each datum is individually numbered on the data form. For example, D16 is Cowardin vegetation classes expressed as a % of the area of the unit being assessed. D16 is subdivided into:

D16.1 - Forest
D16.2 – Scrub-scrub
D16.3 - Emergent
D16.4 – Aquatic Bed

The datum number is used to link the wetland characteristic to the calculations of an index of function. The same datum numbers are used in all three data forms. If a datum is not used in models assessing that wetland subclass, the space is left blank on the data form.

The data forms are loosely organized by subject, such as landscape, water regime, vegetation, habitat characteristics, and soils and substrates. These subjects **do not** necessarily relate to types of functions. Don't assume, for example, that data in the water regime section are used only for the water quantity functions.

***All measurements of area and distance should be recorded on the data form in the metric system (this does not apply to rainfall)**. If you plan to collect data using the "English" system please convert the information before recording it. Appendix 2 D provides a conversion table for the measurements of area and distance.*

The forms should always be used in conjunction with the written procedures in this volume. The forms contain selected notes as to how to collect data but <u>are not inclusive</u> of all that must be considered during data collection. For example, many data have to meet a minimum size requirement to be recorded.

Some data, such as number of plant species and presence of many of the habitat characteristics (presence of snags, rocks, islands, steep banks, grazing, and structures in the buffer), can be recorded as you walk around the assessment unit. Other data, such as the %

of the assessment unit with different vegetation classes, must be recorded after your reconnaissance is complete and the maps have been finalized.

The data forms that we provide in the appendices are up to seven pages long (not including the hydrogeomorphic classification key), partly because many of the questions involve descriptive keys and/or graphics or "text boxes" with additional guidance. You may, however, want to use a computer to scan the data forms and compress them onto a smaller number of pages. A dichotomous key to help you determine the hydrogeomorphic classification is included as part of the data forms.

2. Steps for Completing an Assessment

Collecting data may seem daunting. By following the steps described, however, the "task" can be broken down into several simpler tasks. The steps describe, in general, the materials to be obtained and reviewed prior to going to the field, how to classify the area(s) being assessed, how to identify the assessment units, and how to collect the data and calculate the results.

Step1: Read and Understand the Methods and Procedures for Collecting Data

Before collecting data, it is important that you understand the methods and the models. This includes information on what the methods don't do, what the numeric results represent, and how the data are used. This information is provided in Part 1. It is also critical that you read and understand the profiles describing the characteristics of wetland subclasses (Appendix 2E) and the procedures for collecting each datum provided in this volume.

Step 2: Gather Site Information and Equipment

A number of tools such as aerial photographs and maps can be used to orient you to the site and create a master map. Below is a list of photographs, maps, and information that you will need. Some are required, whereas others are helpful. The list of those that are helpful is not inclusive of everything you could use, but are offered as examples. You should gather and review the information prior to going to the site. A list of recommended equipment is also provided.

Materials Required

Aerial Photographs –Aerial photographs are needed as a basic mapping tool. Those at a scale of 1:12,000 are usually suitable. It is best, however, to obtain the largest scale and the most recent photograph available. If only small-scale photos are available (1:63:000 or smaller), the original can be enlarged using a photocopier. True color or infrared are superior to black and white. It is also good to have stereo pairs so you can observe the area being assessed through a stereoscope.

Copies of the Aerials or Mylar Overlays - You will need to make various maps of the site to complete the data forms. This includes, for example, a sketch of the boundary of the AU, Cowardin classes, areas of inundation, and areas of different vegetation heights. These maps can be made by either drawing directly on the photocopy enlargements of the air photos or on mylars overlaid on the aerial enlargement.

In some cases, enlarged aerials may not be large enough to accurately map features of the wetland being assessed. This will most likely occur with vernal wetlands (short-

duration). Under these circumstances, a hand drawn sketch of the wetland should be made that is to scale as best you can draw it. If possible, the sketches should have identifying landmarks that relate to features visible on the photograph.

Topographic Maps – The maps should cover the watershed of the area being assessed, usually a minimum of 1:24000 (1"=2000'). As with aerial photographs, the larger the scale the better.

Each Map You Create Should Contain the Following

- ***Title Block -*** *The assessment unit identification number, classification, date data was collected, who collected the data, and the content of the map, for example, "areas covered by Cowardin vegetation classes."*
- ***North Arrow***
- ***Legend -*** *A key to map conventions used.*
- ***Scale -*** *Very important if the original was enlarged or reduced.*
- ***Tick Marks*** *- If you are using mylar over aerial photographs to create maps, make marks on the mylar that line up with features in the photo. For example, trace photo numbers, roads, and streams, on each mylar map you create for that site.*

Helpful Information

National Wetland Inventory Maps (to determine the approximate boundary of the wetland while in the office)
Watershed Reports
Flood Hazard Maps
"Lakes of Washington" by Walcott, 1973 for lake depths and size
"Peat Resources of Washington" by Riggs, 1954 for descriptions of wetlands with significant peat deposits
Local Wetland Inventory Maps
Local Land Use Maps
Other Local Government Maps
Washington Department of Fish and Wildlife Department's maps of priority species and habitats
Soil Surveys –Soil information is also valuable to orient you to the site and to determine its approximate boundary

Other Materials and Equipment Needed

The following table lists some additional materials and equipment that you will need for fieldwork. Many items on this list are the usual equipment used by wetland professionals who do field work. *This is not an all-inclusive list.*

REQUIRED	Helpful
Data forms	First aid kit
Part 2 of methods document	Rubber boots (Preferably Hip Boots)
Shovel	Bug repellent, Sun Screen
pH paper or pH meter	Camera and film
Conductivity meter	Magnifier or portable stereoscope to view aerials in the field
Something to measure height of flood marks	Colored pencils and sharpener, or acetate markers for mapping
Small ruler and/or caliper	Gazetteer/road maps
Tape measure	Clipboards
"Land Locator" or something to estimate size and % cover (planimeter, GIS, or CAD system)	Field guides and plant keys
Map wheel	Directional compass
Field notebook	Binoculars
Compass with pencil to map the 1 km and 2 km circle around assessment unit	Rain Gear

Step 3: Review Information and Make Preliminary Observations

Use the aerial photos and other maps and information to identify a **preliminary** boundary and classification of the site being assessed. Soil maps, photo interpretation of aerial photos, and the National Wetlands Inventory (NWI) maps are especially helpful to determine the approximate boundary. Remember that soil surveys and NWI maps are often incorrect for various reasons. For example, many agricultural wetlands are not mapped.

> *The approximate boundary of the wetland and the assessment units need to be confirmed or revised in the field.*

Aerial photographs and other information can also be used to help make a preliminary classification of the site. You can also note if there are areas within the wetland that might need to be assessed as individual assessment units (AU). Assessment units should be assessed separately when there is more than one class or subclass within the wetland, or when other criteria are met, as described Step 5 and 7.

Step 4: Visit the Wetland and Identify Its Approximate Boundary

Determine the location and approximate boundaries of the wetland on-site, confirming or revising the preliminary boundary you mapped in the office. This does not mean that a **precise** delineation of wetlands must be undertaken to complete data collection, unless this information is required as a part of your project.

> *Steps 4-8 do not have to be completed sequentially. However, notes have to be carefully recorded and features mapped to fill out the data form accurately for each AU.*

Field data can be collected while the boundary and assessment units are being established. Great care, however, must be taken to **clearly** record in field notes and on maps where different features were observed and the extent of the various coverages so that data can be recorded accurately for each assessment unit.

Step 5: Determine the Hydrogeomorphic Class(es) of Potential Assessment Unit(s)

One of the tasks to be completed at a site is to determine the hydrogeomorphic (HGM) classification of the wetland. The possible HGM classes that could be present are:

Riverine
Lacustrine
Slope
Depressional

Do not use the depressional methods for any other wetland types (e.g. riverine, slope). Other methods currently being used by the investigator, or recommended by the agency with jurisdiction over the project, should be used to assess wetlands in classes or subclasses for which methods have not yet been developed.

Determining the correct HGM class is critical in choosing the appropriate methods(s) and data form(s) to use. You should only apply these methods to wetlands in the Depressional Class. The methods are meaningless when applied to wetlands of other subclasses.

If there are multiple HGM classes present within the wetland being assessed, each area should be assessed as a separate assessment unit (called AU). For example, one continuous wetland may contain a riverine, a depressional, and a slope class of wetlands within its boundary. Each of these areas would be a different assessment unit (Figure 1).

Use the descriptions in the profiles (Appendix 2 E) and the dichotomous key attached to each data form (Appendices 2A, 2B, and 2C) for information on classifying a unit into its appropriate hydrogeomorphic class. Remember to develop a **master map** to record the classification and boundaries as you proceed from Step 5 through 7.

Open water in the Depressional Wetland Class

If a depressional wetland contains deep-water areas greater than 3 m (9.9 feet) deep but less than 8 hectares (20 acres) in size, include this area as part of the depressional class. Otherwise, a wetland contiguous with deep water areas greater than 8 hectares would be classified as "lacustrine."

Identifying Riverine Wetlands in a depressional setting

Frequent overbank flooding from a stream or river is an important characteristic distinguishing the riverine class. "Frequent" is defined as at least once every two years. It is often not possible, however, to determine the frequency with which an area is inundated by a stream or river without detailed data on the local water regime and elevations. During reconnaissance at the site, use the following field indicators to determine if the area is receiving frequent, overbank flooding and therefore parts of the depression should be classified as riverine.

If the AU is in a river valley, but does not have a stream or river running through it or adjacent to it, you will have to judge from its position in the landscape, and the strength of the other indicators, whether it is frequently flooded.

Indicators of "Frequently Flooded" for Riverine Wetlands

- AU surface has scour marks
- There is evidence of recent sediment deposition (little vegetation growing through sediments.)
- The vegetation is damaged or bent in the direction of the flood flow.
- The soil, especially near the stream bank, may show alternating levels of different sediment size, or layers of sediment and organic matter.
- The vegetation along the stream bank shows signs that it has been flooded to levels that are higher than the AU surface (color differences in bark, fine sediments trapped in the interstices of the bark, or debris trapped in branches.)

You have gauge data for the river or stream that can be used to calculate that the AU lies within the area that is flooded at least once every two years (two years return cycle).

Step 6: Map Potential Hydrogeomorphic Sub-class(es) for the Wetland

Once you have determined that the potential AU is in the depressional HGM class, you must determine if there are more than one depressional type within the wetland boundary. The possible HGM subclasses and families are as follows:

Depressional, Freshwater, Long-duration
Depressional, Freshwater, Short-duration
Depressional, Alkali

Again you should you should use the descriptions in the profiles (Appendix 2 E) and the dichotomous key attached to each data form (Appendices II A, B, and C) when identifying the HGM subclasses present.

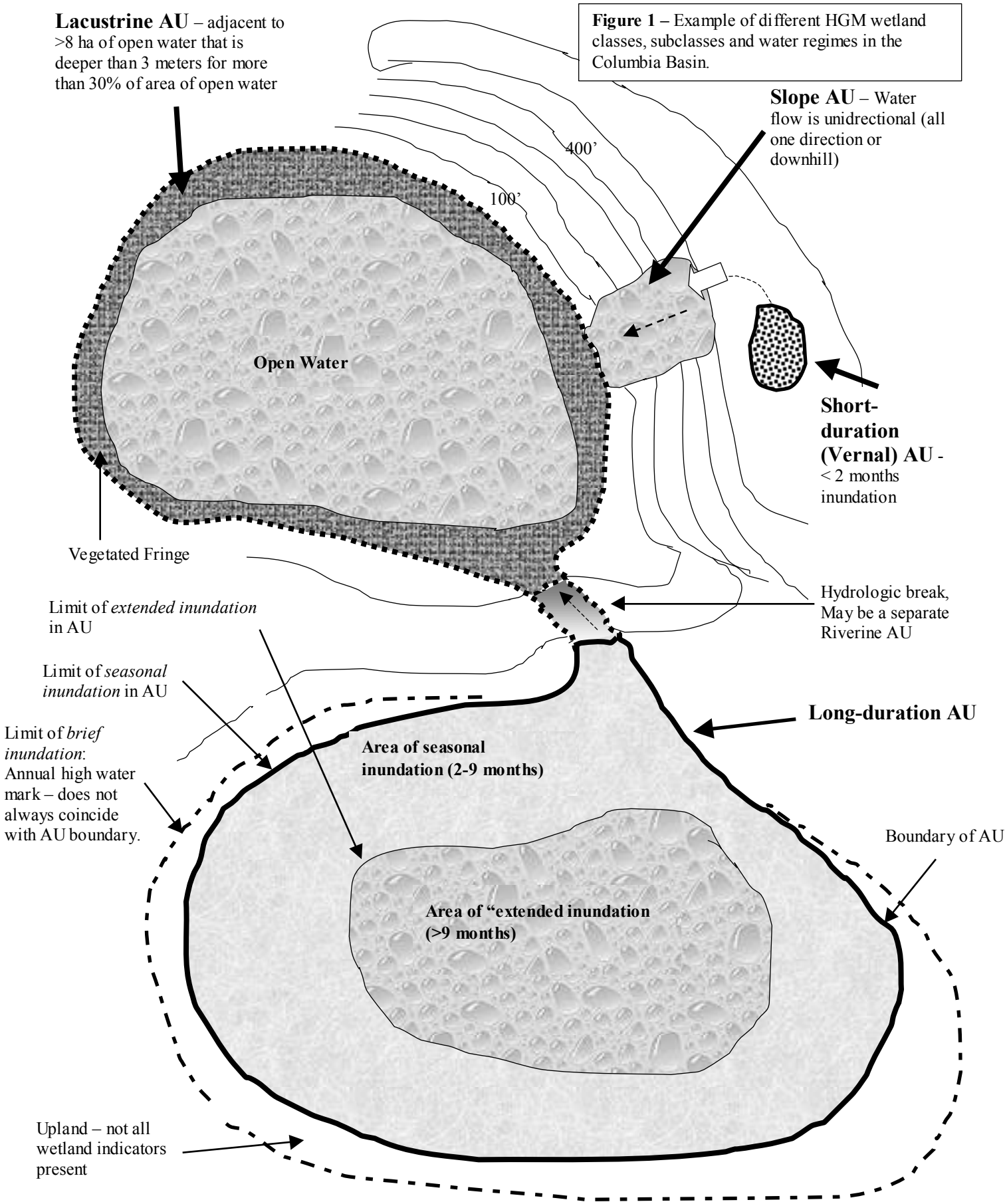


Figure 1 – Example of different HGM wetland classes, subclasses and water regimes in the Columbia Basin.

Step 7: Determine Final Boundaries of AU

During the field visit, determine what the final boundary or boundaries should be for the AU(s) of the wetland you are assessing. As a general rule, if there is a physical break or change in the water regime then a separate AU should be created. The criteria below identify some of the common circumstances under which separate AUs should be established. Develop a final master map of the AU(s) that will be used for recording data.

Identifying Assessment Units Using Differences In Water Regime

In some instances a wetland may be large with several natural constrictions, or may be a long, linear feature bisected by a road or railroad. In such cases the unit of wetland to assess may not be easily established. An important criterion that should be used to identify assessment units is differences or "breaks" in water regime. Boundaries between units should be set at the point where the volume, flow, or velocity of the water changes rapidly, whether created by natural or human-made features. (See Figure 1.)

You will encounter some wetlands with complex water regimes that are not easily classified during one site visit. For example, a short-duration wetland may appear to be part of a long-duration wetland during the winter, but will be a separate depressional wetland during the majority of the growing season with a distinct outlet to the area with longer inundation. If the outlet represents a hydrologic break the wetland should be split into two different assessment units. Do not separate a wetland, however, into two AUs on the basis of areas with distinct hydrological regimes (long-duration and short-duration) if there is no hydrologic break between them. (See Figure 1).

Examples of Changes in Water Regimes

1. *Berms, dikes, cascades, rapids, falls and other features suggest that volume, flow, or velocity of water changes rapidly.*
2. *The presence of drainage ditches that significantly reduce water detention in one area of a wetland.*

Identifying Assessment Units in Depressional Wetlands with Constrictions

Depressional wetlands may also contain constrictions where the wetland narrows between two or more depressions. You will have to use your judgment when to assess the wetland as one or more assessment units. The key consideration is the direction of flow through the constriction. If the water moves back and forth then it is not a separate unit. If the flow is unidirectional, down-gradient, with an elevation change from one part to the other, then a separate unit should be created. The justification for separating assessment units increases as the flow between two areas becomes more unidirectional and has a higher velocity.

Identifying Assessment Units when Wetlands Form a Patchwork on the Landscape (Mosaic)

If the area proposed for assessment consists of a patchwork or mosaic of wetlands, the entire patchwork **should be considered one assessment unit** when:

All of the patches are inundated to a level that is above any constrictions between the patches during the winter or spring; and
Each patch is less than 0.4 hectares (1 acre); and
Each patch is less than 30 m (100 feet) apart, on the average; and
The area of wetland is more than 50% of the total area of both wetlands and uplands.

If these criteria are not met, each area should be considered as an individual assessment unit.

Identifying Assessment Units when Wetlands Are Bisected by Human-Made Features

When a wetland is divided by a human-made feature, for example a road embankment, the wetland should not be divided into different AUs if the surface-water connection is level between the two parts of the wetland. Water should be able flow between the areas and organisms have the freedom to move in both directions. For example, if there are wetlands on either end of a culvert under a road, and both sides of the culvert are partially or completely underwater, the wetland should be assessed as one. Make the down gradient area a separate assessment unit if the bottom of the culvert is above the high water marks in the receiving wetland.

There May be Other Circumstances not Covered Here…..

The guidance on identifying assessment units is provided to improve consistency in dividing wetlands into assessment units. It does not, however, cover all situations that may be encountered in the field. A wetland may be broken into multiple assessment units under circumstances not described here. There is, therefore, a certain amount of subjectivity involved with making judgments about assessment units. Most important, the logic and rationale for dividing a wetland into AUs must be adequately documented

Cases when a Wetland Should Not be Divided into Assessment Units

Differences in land uses within a wetland should not to be used to define assessment units, unless they coincide with the circumstances described above. For example, if half a wetland has been recently cleared for farming and the other half left intact, the entire area functions as, and should be assessed as, one unit (if the water regime is intact.) However, if the farmed area has been ditched and no longer retains surface water, it might be made a separate assessment unit.

In assessment units with different land uses, the performance indices will be an average of the altered and unaltered portions for functions in which vegetation variables predominate. Such areas may provide different habitats but as long as the water regimes are closely linked, many of the other functions may be interconnected. For example, an impact to wetland processes in a pastured area may have a significant impact on processes in the hydrologically contiguous, adjacent emergent area.

Step 8: Collect Data in the Field

Now that you have identified boundaries and classified the unit to be assessed, copy the appropriate form(s) from the appendices for recording data. You should also create an individual map of each unit to be for recording data.

Some data can be recorded directly on data forms as you complete your site visit to the area of wetland being assessed (the assessment unit or AU). However, estimates of percentages and area or distances are best completed after your data collection is complete and maps have been finalized. It is always advisable, however, to draw maps at the site, so questions about the data can be confirmed. Some information, such as the area of the AU and its contributing basin should be estimated after the field visit when you have an idea of how the AU is situated in the landscape. You do not need to collect data "in the order presented" on the data form.

These procedures do not work if the ground is frozen or covered in snow or ice. These methods can only be used after the winter thaw.

We recommend you visit all parts of the assessment unit to collect the required data. If areas are inaccessible, use vantage points in other parts of the AU, aerial photography, and your other sources of information to complete the assessment. As you conduct your reconnaissance, create the necessary maps to record the locations and extent of features, such as the area dominated by non-native vegetation, the locations where soil samples were taken and where signs of *seasonal inundation* were noted. Also note the areas that were inaccessible.

Making Areal Estimates

Some data are recorded as % of AU occupied by a specific feature. These are called areal estimates. Areal estimates are made using the mapped boundary of the feature as viewed from the air. Areal estimates are, therefore, best made from maps drawn on a copy or an overlay of recent aerial photographs. If aerial photographs are not available, or are at a scale too small to draw polygons, areal measurements can be derived from hand-drawn maps prepared at the site. Boundaries of different wetland characteristics can then be drawn on a base map and the percent area estimated.

Areal Estimates vs. % Cover

Areal estimates are easily confused with "percent cover." "Percent cover" is used to describe the amount of ground covered by a particular plant species or vegetation type as viewed from above. In a given area, therefore, several plants or vegetation classes can cover the same area of the ground if they overlay each other or occur in different strata. Percent cover is used, for example, when determining the "Cowardin" vegetation classes present in an AU. "Cowardin" vegetation classes are identified by the vegetation type that occupies the uppermost stratum and covers at least 30% of the ground in that stratum as seen from above.

If a percent area of the assessment unit or a percent cover is requested on the data form, it should be recorded as a number between 0 and 100, not as a fraction or using the % symbol.

Estimates of % cover can also be done using the dot or grid method or visual estimates. Appendix 2G provides a Vegetation Profile Board that can assist you with making visual estimates of percent cover.

> *Estimates of percent area should only be made from maps you have prepared. Visual estimates of percent area of a feature are notoriously inaccurate.*

Step 9: Complete Data Form

After completing your fieldwork, use your field notes and maps to develop the data that you have not already noted on the data form during your site visit. Make sure you include the dichotomous key used to help determine the classification of your AU in your final report.

Step 10: Calculate the Indices of Potential Performance, Habitat Suitability, and Opportunity

Use the completed data sheets as the basis for calculating the indices of potential performance, habitat suitability, and opportunity for each function. There are two ways in which the indices can be calculated. The first is to take the data recorded on your data sheet and input each datum into the Excel spreadsheet appropriate for the subclass that is on the diskette provided. Once all data are input, the spreadsheet will calculate the indices for the AU and show them in a summary worksheet. More detailed information on using the spreadsheet is available on the diskette in the README.TXT file on the diskette.

The second way to calculate the index is to use the tables presented in the methods in Part 1 under the headings of "Calculation of Potential Performance" or "Calculation of Opportunity" for each function. These tables describe the variables used for each function and the specific data needed for the calculations. One of the columns lists the data numbers (from the data sheet) needed and how to calculate the scaled score for each variable. The equation used to calculate the index is also provided on the calculation page.

NOTE 1: The calculations compute the numeric values for each variable using the data collected. Each datum may be used in several variables, and in different ways. When necessary, calculations add, subtract, and/or combine a datum with others to get what is needed for each variable. This simplifies the data collection because each datum has to be recorded once, and in one format.

NOTE 2: The numeric equations in the spreadsheets may not be identical to the numeric equations described in the text. Both will, however, generate the same scaling for a variable. The equations in the text were developed so a user can calculate the index by hand. The equations in the spreadsheet may involve shortcuts that are possible because of the way the spreadsheet actually does its calculations.

Step 11: Complete Summary Sheet

All results (indices and judgments) should be recorded on a summary sheet. Appendix 2-O contains a sheet called "Summary of Method Results" that can be used for this purpose. It also provides space to record:

- Rationale for dividing the wetland into multiple AUs (if needed)
- Description of areas that were not directly observed and an explanation as to why
- Information of special note such as the presence of endangered or threatened species
- General comments

In addition to the data sheet and summary sheet, all information used to make the assessment should be provided in any report documenting the results, including all data sheets, photo maps, sketches, and documentation of the rationale you used to make decisions concerning the AU or the data collected.

Simplifying the Data Collection Process

We have tried to simplify the data collection process as much as possible. The choice was between developing complex data collection procedures and simple calculations or vice versa. We chose to simplify the data collection since the complex calculations can be done by a spreadsheet.

The calculations compute a numeric index for each function using the data collected. Each datum may be used in several variables, and in different ways. When necessary, calculations add, subtract, and/or combine a datum with others to get what is needed for each variable. This simplifies the data collection because each datum has to be recorded once, and in one format.

3. Procedures for Collecting Data

The following section describes the procedures for collecting each datum. All data needed for the three subclasses are numbered and described in order below. Some data are specific only to one type of wetland, and these are noted. Data not used in the assessment of a specific subclass or family are left blank on the data form.

D1: Area of assessment unit

Estimate the size, in **hectares**, of the AU being assessed using the scaled map you developed in the field. Estimates of area can be done using graphic methods such "squares," "dots" or "grids," a planimeter, or using geographic information system (GIS) software. Record the information to two significant digits (e.g. 1.2 hectares, 120 hectares, and 1,200 hectares). Unless you have considerable experience, visual estimates of size are unreliable.

D2: Area of contributing basin

Estimate the area of the contributing basin, in **hectares**, using any of the methods described above. A smaller scale map (1:100,000 or 1:250,000) may be needed to outline the contributing basin in some cases. Record the information to two significant digits (e.g. 120 hectares, 1200 hectares, and 120,000 hectares).

Appendix 2-H provides guidance for outlining the boundaries of the basin contributing surface water flows to the AU, using topographic maps (Roth et al. 1993).

NOTE: The area of the AU should be included in the calculation of the area of the contributing basin. This is especially important in small basins where the assessment unit may represent a relatively large part of the basin.

D2.1: Average slope of contributing basin

Estimate the average slope of the contributing basin from the topographic map. Identify the highest and lowest points on the edge of the contributing basin mapped in the datum above. Take the average of these two numbers as the average elevation of the outside edge of the basin. Determine the elevation of the AU and subtract the two estimates of elevation to establish the average "drop" in the contributing basin. Next estimate the "straight line" distance from the farthest edge of the basin to the center of the AU. Finally divide the average "drop" by the "straight line" distance to estimate the slope and record that as a percent. For example, the contributing basin for an AU is 1.5 km long and the average drop in elevation is 100 meters. The ratio is 100/1500 or 0.067. When this is converted to percent it becomes 6.7%. **PLEASE NOTE**: English or metric measures can be used to calculate the percent slope. **It is critical, however, that the units in both the denominator and the numerator are the same (m/m, ft/ft, mi/mi).** The distance measurements need to be converted to the same units as the elevations.

D3: AU is within boundaries of the Reclamation Project

Using the map provided in Appendix 2-L to determine whether the AU being assessed is located within the boundaries of the Reclamation Project. In general, the majority of the wetlands found within the project area boundaries will be located in Grant County and south.

D4: AU has a water regime influenced by irrigation or other types of man-controlled water impoundments

If the AU has its water regime influenced by irrigation or by other man-controlled water impoundments enter a [1] on the data form. This would include AUs south and southwest of the Potholes Reservoir that are "downgradient" of the reservoir, and other wetlands that are adjacent to the project boundaries that receive groundwater and surface water influenced by the reclamation project. Wetlands that are influenced by smaller water impoundment projects, such as small irrigation/drinking water dams should also be categorized as being influenced by a water project.

For example, Blue Lake in the Sinlahekin Valley of Okanogan County has been dammed to provide irrigation water for farmers downstream. Even though the lake is only moderate in size, an adjacent reference wetland (CB 80 located 1 mile south) is influenced by the lake level fluctuations. Releases from the lake do not always correspond to natural hydrological patterns, and the water regime in the reference wetland was impacted. Observations of water levels in CB 80 in 1999 showed that the water level in October was up substantially from that seen in May, which is the reverse pattern of other local wetlands not influenced by water supply projects (Figures 2 and 3).

Good indicators of water regimes that are not "natural" are:

- Very small water level fluctuations over the year (less than 30 cm). The converse, however, is not a good indicator. Wetlands influenced by a manipulated water regime can have large fluctuations in levels.

- A "reverse" water regime, where the highest water levels occur in the summer or early fall.

- A low conductivity (<1.0 milliSiemens) in areas where the average annual precipitation is 10 inches or less.

D5: Land uses within 1km of the AU

Estimate the **percentage of the area** within a 1km radius of the edge of the AU that is in each land use category listed below. The area includes upland or other wetland areas outside the AU.

D5.1 Natural Areas– forests, grasslands, undeveloped areas, rocks and lithosol habitats, other wetlands, and open water.

D5.2 Untilled agriculture – untilled field or pasture used for grazing or hay. This includes rangelands and grazed shrub/steppe communities.

D5.3 Agriculture, tilled and irrigated – tilled areas with irrigation

D5.4 Agriculture, tilled and not irrigated- tilled areas without irrigation

D5.5 Urban/commercial – areas where over 50% of the area is in urban or commercial uses. This means that 50% of the land in an area has buildings, roads, parking lots, or landscaped vegetation. Draw polygons only around areas where structures and roads cover more than 50%. If coverage is less then 50% break into smaller polygons.

D5.6 High density residential – areas with apartments, town houses, and individual homes where there is more than one residence per 0.4 hectares (1 acre)

D5.7 Low density residential - individual homes on parcels of 0.4 hectares (1 acre) or more

D5.8 Not Fitting Above Categories

NOTE: Golf courses should be entered under D5.3, gravel pits under D5.5, unpaved roads and docks under D5.7.

We suggest that you draw a 1 km "circle" from the outside edge the AU on a copy of the base map and outline the land uses within this "circle." Do not use the center of the AU to draw your circle. During the field reconnaissance, confirm that the land uses are approximately those identified from the aerial photos. Many areas in the Columbia Basin are rapidly being developed by agriculture so an aerial photograph taken several years ago may be inaccurate.

Percentages can be estimated by using the "dot" method or a planimeter without actually calculating the area involved. The ratio of (#dots per land use / #dots in 1 km circle) x 100 = percent area.

Figure 2. Reference wetland CB80, Blue Lake in the Sinlahekin Valley. Photo taken southeast on 5/12/99. The edge of the white band represents the upper boundary of *seasonal inundation* and is covered with dried aquatic bed species

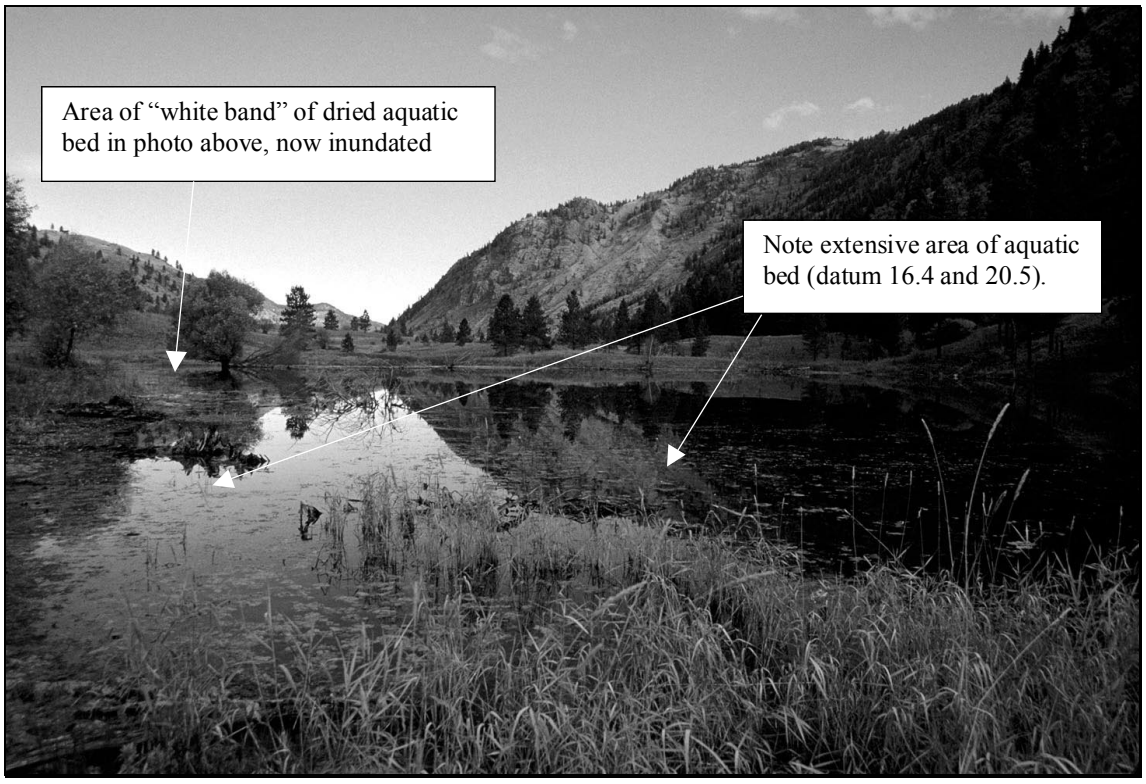


Figure 3. North view of Blue Lake on 10/12/99. The area of the white band from the photo above is now inundated (left or west edge) despite being late in the growing season.

D6: Habitat types within 1km of AU

Determine how many of the following upland habitat types are present within 1 km of the AU and record a [1] for each present. Use air photos to assist in determination. **Habitat type must be at least 0.1 ha in size (1/4 acre) to count.**

D6.1 Forest. Areas where tree cover (canopy) is greater than 30% of the ground.

D6.2 Riverine. Perennial or intermittent streams or stream beds with an associated riparian zone. Do not record this habitat type unless the riparian zone is at least 10 m (33 ft) wide and vegetated with native species.

D6.3 Shrub steppe - ungrazed –The shrub-steppe areas in the Columbia Basin can be roughly divided into the following five zones (Taylor 1992).

Standard zone – Dominant Species - tall sagebrush (*Artemisia tridentata*), hopsage *(Atriplex spinosa),* bitterbrush (*Purshia tridentata),* rabbit brush (*Chrysothamnus nauseosus*), various grasses such as needle and thread grass (*Stipa comata),* bluebunch wheatgrass (*Agropyron spicatum*), and steppe bluegrass (*Poa secunda*) and lupine and balsamroot species (*Lupinus* spp and *Balsamorhiza* spp).

Lithosol zone – stiff sagebrush (*Artemisia rigida*), desert buckwheat (*Eriogonum* spp), and dwarf goldenweed (*Haplopappus acaulis*).

Sand dune zone – Rabbit brush (*Chrysothamnus nauseosus*), tall sagebrush (*Artemisia tridentata*), sand dock *(Rumex venosus), and* Indian rice grass (*Oryzopsis hymenoides*),

Talus zone – Service berry (*Amelanchier alnifolia*), squaw currant (*Ribes cereum*), purple sage (*Salvia dorrii*), Oregon sunshine (*Eriophyllum lanatum*), and desert buckwheat *(Eriogonum* spp*).*

Saline zone – Greasewood and saltgrass (*Sarcobatus vermiculatus, Distichlis spicata*), hopsage (*Atriplex spinosa*), and winterfat (*Eurotia lanata*).

D6.4 UnvegetatedTalus and/or Cliffs. Rocky habitats where the vegetation cover is less than 5%.

D6.5 Natural Areas. Includes open water and other wetlands

D7: Land uses in the contributing basin of AU

Estimate the percentage of the area within the contributing basin (watershed) of the AU that is in each land use category listed below. Appendix 2-H provides guidance on how to determine the contributing basin from a topographic map.

NOTE: Include the "land use" category of the AU in your estimates since the AU is part of its own contributing basin.

Land uses in the entire contributing basin:

D7.1 Natural Areas– forests, grasslands, undeveloped areas, rocks and lithosol habitats, other wetlands and open water.

D7.2 Untilled agriculture – untilled field or pasture used for grazing or hay. This includes rangelands and grazed shrub/steppe communities.

D7.3 Agriculture, tilled and irrigated – tilled areas with irrigation.

D7.4 Agriculture, tilled and not irrigated- tilled areas without irrigation.

D7.5 Urban/commercial – areas where over 50% of the area is developed in urban or commercial uses. This means that 50% of the land in an area has buildings, roads, parking lots, or landscaped vegetation.

D7.6 High density residential – areas with apartments, town houses, and individual homes where there is more than one residence per 0.4 hectares (1 acre).

D7.7 Low density residential - individual homes on parcels of 0.4 hectares (1 acre) or more.

D7.8 Not Fitting Above Categories – this includes different habitat types, rocks, other wetlands, and open water outside the AU.

Land uses in contributing basin that generate sediments within 1km of AU

Determine if the following land uses are present in the part of the contributing basin that is within 1km of the AU. To estimate this datum, superimpose the land uses map developed for D5 on a map of the contributing basin.

7.9 Are there tilled fields in the contributing basin close to the AU (within 1 km)?

D7.10 Are there pastures or grazed rangelands in contributing basin close to the AU (within 1 km)?

D7.11 Are there urban/commercial areas in contributing basing close to AU (within 1 km)?

D7.12 Are there high density residential areas in contributing basing close to AU (within 1 km)?

NOTE: If the contributing basin to the AU is small and fits within a 1 km radius of the AU, then record a [1] for data D7.9-D7.12 if the corresponding data in D7.2 – 7.6 are greater than [0].

D8: Different wetland types within 2 km of AU

Using your aerial photograph or topographic map determine if there are any other wetlands that could be classified as different wetland types using the Hydrogeomorphic classification, or if there is a perennial stream or river within 2 km of the AU. Record a [1] for each type present within the 2 km radius. Profiles of the different wetland types are given in Appendix 2-E.

D8.1 Depressional - Freshwater long-duration

D8.2 Depressional - Freshwater short-duration

D8.3 Depressional - Alkali

D8.4 Riverine

D8.5 Lacustrine

D8.6 Slope (seeps)

D8.7 Perennial stream or river

Figure 4. The outlet from Reference wetland CB23 (Hog Canyon) is dry most of the year, except for the first few weeks of spring. Picture taken towards the south on 3/12/98

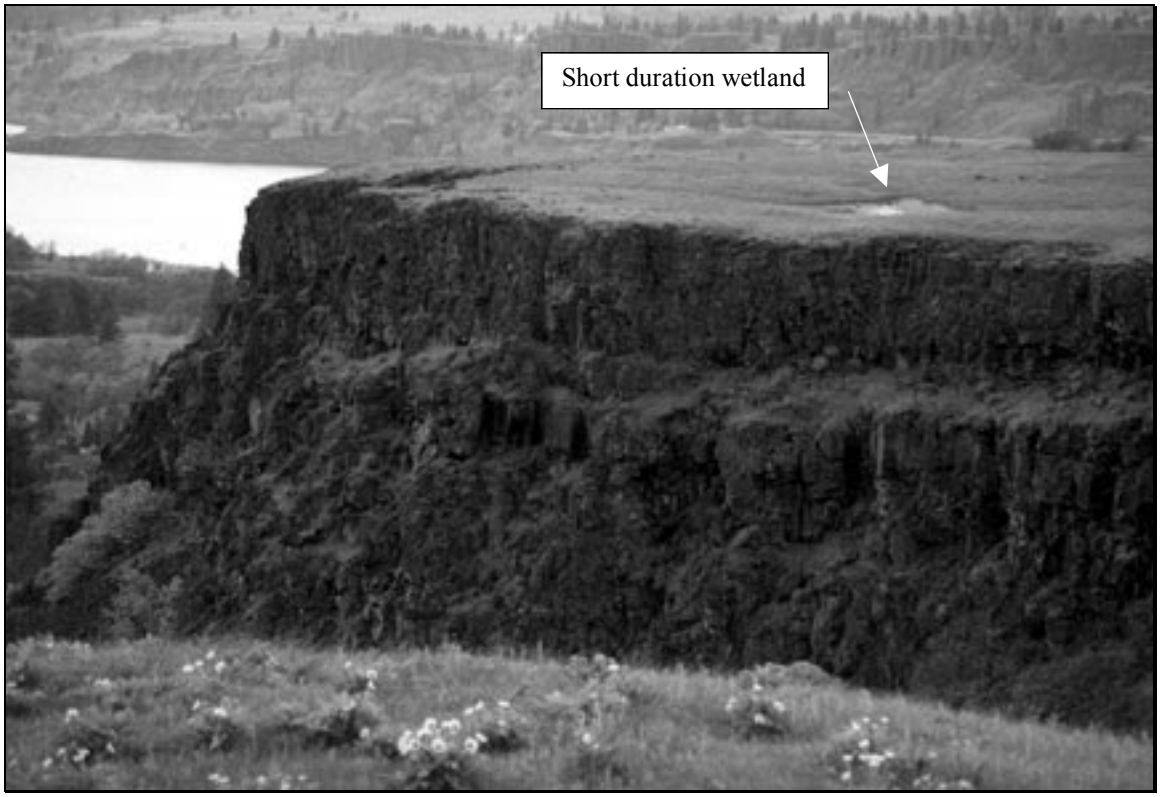


Figure 5. Some depressional wetlands have no outlet such as this Rowena short-duration wetland (vernal - CB68). Photo taken to the north in early April of 98.

D9: AU has a surface water outflow during some time of the year

If you determine that surface water leaves the AU through an outlet (either narrow or wide) record a [1] for this datum. Some depressional wetlands in the Columbia Basin only have surface outflows for a short period at the beginning of the growing season (Figure 4).

Indicators of surface outflow will, therefore, have to be used to determine if outflow occurs when assessments are made outside of this period. Indicators of surface outflow includes fine sediment deposits, debris including such things as Styrofoam and surface scour. Also use aerial photos to determine if outflows occur. Man-made ditches count as an outlet if they bisect the edge of the AU and drain surface water out of it.

D10: Duration of inundation

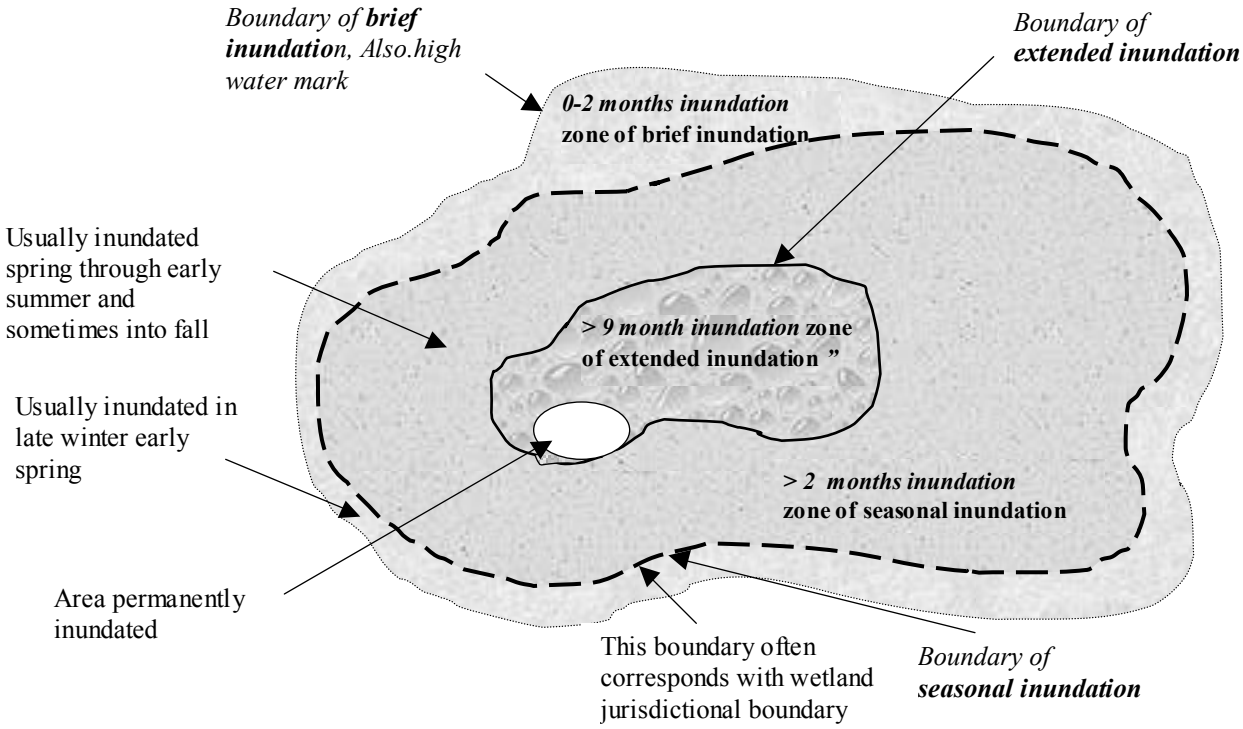
The percent of the AU that is ponded or inundated each year for different lengths of time is one of the more important characteristics used in the assessment. It is, however, one of the more difficult to determine during the dry season**.**

The length of time different parts of an AU may be inundated is broken up into four time periods for the purpose of this assessment (Figure 6). The longest duration is *permanently inundated* (inundated for 12 months in at least 8 or 9 years out of 10). The next time period is called *extended inundation* where an area of the AU is inundated for more than 9 months each year in most years. The third time category is called *seasonal inundation* where an area is inundated between 9 months and 2 months each year. The fourth time period is called *brief inundation*, where an area is inundated for less than 2 months a year in most years.

Most Columbia Basin wetlands experience considerable drawdown over the growing season (See Figures 7 and 8) because of the relatively lower level of precipitation coupled with a high rate of evaporation. There may be some exceptions to this, however, in wetlands whose water regime is modified by either surface water or groundwater from agricultural return flows. **When collecting data for this datum you will be required to note the presence/absence of permanent inundation and map the areal extent of the other three inundation regimes.**

A clear understanding of the four different inundation regimes present in Columbia Basin is central to the proper collection of these data. The following diagram illustrates generally where the areas of the four types of inundation can be found in a wetland.

Figure 6: Inundation Regimes in the Columbia Basin



The objective for this datum is to draw a map similar to Figure 6 for the AU being assessed and to calculated the percentage of the AU that is encompassed within each boundary. You will need to draw three boundaries of areas that are inundated: 1) areas inundated for more than 9 months (the boundary of *extended inundation*), 2) those that are inundated for more than 2 months (the boundary of *seasonal inundation*), and 3) those that are inundated for less than 2 months (the boundary of *brief inundation*). When locating these boundaries in the field think in terms of moving from the boundary of *brief inundation* inwards towards the boundary of *seasonal inundation* and then to the boundary of *extended duration* in the inner portion of the AU.

Figure 7. Reference Wetland CB19, Potholes #1. Photo taken on 3/9/99 at the eastern end of wetland at high water level. This wetland is classified as a Long-duration Wetland

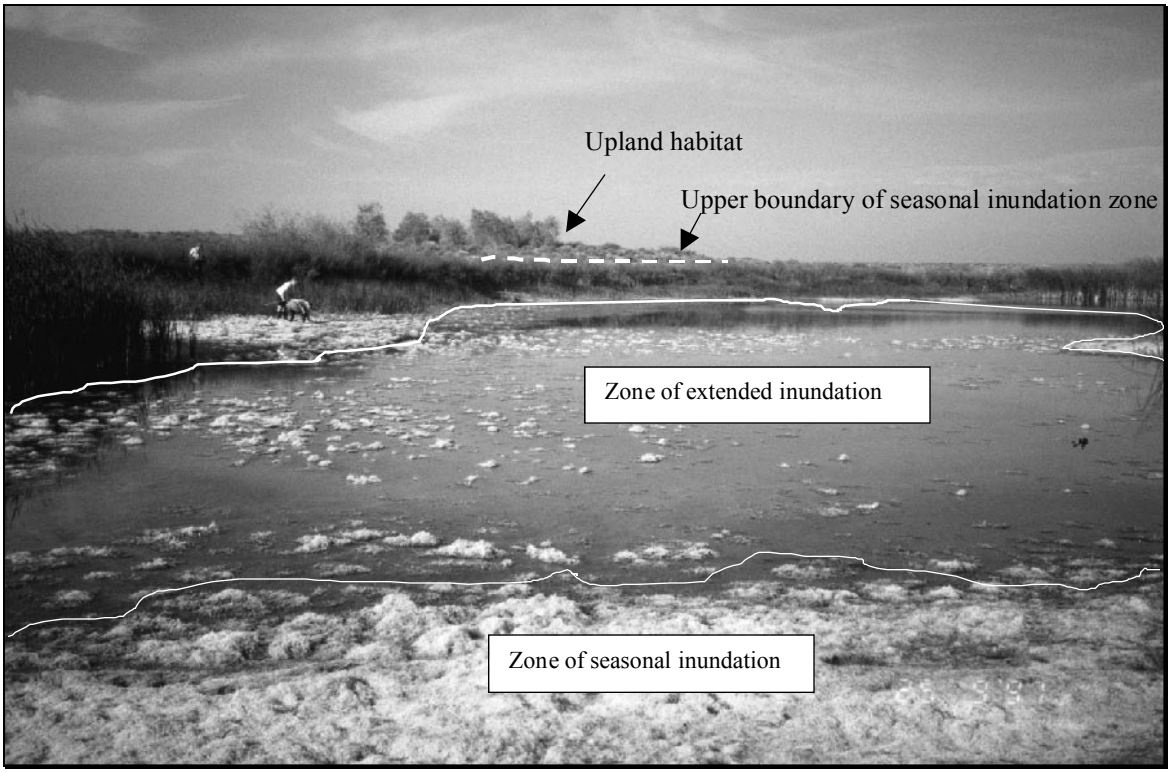


Figure 8. Same reference wetland and location as above, CB 19 but photo taken 9/27/97. Note that drawdown is below *Scirpus acutus* into mudflats where beds of dried coontail (whitish material) are present

NOTE: AUs classified as depressional, freshwater, long-duration wetlands will have all three boundaries or zones present. AUs classified as freshwater, short-duration, will not have a boundary for extended inundation. AUs classified as short-duration wetlands will all have a boundary of "*brief inundation*", but may, or may not, have a boundary for "*seasonal inundation*" as described below. AUs classified as depressional alkali will usually have an area with *extended inundation*, but it is not a pre-requisite for the subclass.

Depressional Freshwater, Long-duration Wetlands – these AUs have three zones of inundation, and may have areas with permanent inundation:

- The boundary of *brief inundation* (the upper boundary of any inundation) usually is formed early in the spring or late winter when run-off is at its peak (Figures 7 and 17). This boundary may often be found outside the delineated edge of the AU because the duration of inundation may not be long enough during the growing season to allow wetland plants to establish themselves (Figures 9 and 10). Upland plants will usually predominate in the zone of *brief inundation*. AUs whose water regime is influenced by the Reclamation Project, however, may have a different timing for this period of *brief inundation*.

- The boundary of *seasonal inundation* (boundary of 2 months of inundation) marks the boundary of the drawdown that occurs in the early growing season as the initial surge of winter runoff and snowmelt are lost from the AU. The boundary for *seasonal inundation* is typically marked by a transition from upland species to wetland vegetation (usually facultative) (Figure 8).

- The boundary of *extended inundation* (boundary of 9-month inundation) marks the lower zone of drawdown that usually occurs every year. This drawdown occurs throughout the summer and into fall and is caused by evaporation, evapotranspiration, and some leakage into groundwater. The amount of drawdown can be dramatic in the Columbia Basin (see Figure 8). Both the Field and Assessment Teams observed water level drops of up to 3 meters between spring and fall in some wetlands.

- In the fall, long-duration AUs may have have only a small central area of surface water left. This area can be surrounded by a ring of bare substrate that may be covered with dried aquatic bed plants (see Figure 2). In these cases, the zone of obligate emergent species such as bulrush and cattails are found upslope of the boundary of 9-month inundation (*extended inundation* boundary). See Figures 8, 26, and 35 for examples.

Figure 9. Reference Wetland CB 6. Short-duration Wetland adjacent to Lake Lenore. The duration of water in this wetland was too short to allow vegetation to become established. Photo taken 7/14/99.

Figure 10. Reference wetland CB49 on the McMillan property southwest of Medical Lake in Spokane. This Short-duration wetland has a high water level outside of the wetland boundaries. Note inundated Ponderosa pines. Photo taken 4/10/99.

> ***Some AUs classified as depressional short-duration wetlands are inundated for less than two months (brief inundation) over their entire surface.*** *Wetlands with only very brief periods of inundation may be difficult to delineate because one or more of the wetland parameters (i.e. plants, soils, hydrology) may be absent due to normal environmental conditions. These wetlands should be considered as Problem Area Wetlands, (e.g. vernals as specified under the State Wetland Delineation Manual). See Figure 9 for an example.*

Depressional, Freshwater, Short-duration Wetlands – These AUs include only one or two of the four categories of inundation:

- The boundary of *brief inundation* (the boundary of maximum inundation) usually is formed early in the spring or late winter when run-off is at its peak. This boundary may often be found outside the delineated edge of the AU because the duration of inundation may not be of sufficient length during the growing season to allow wetland plants to establish themselves.
- The boundary of *seasonal inundation* (boundary of 2 months of inundation) marks the boundary of drawdown that occurs in the early growing season as the initial surge of winter runoff and snowmelt are lost from the AU. It is usually the boundary of a jurisdictional wetland that meets all three parameters. The boundary of short-duration inundation is typically marked by a transition from wetland vegetation (usually facultative) to upland species.

Depressional Alkali Wetlands – AUs classified as depressional alkali will usually have an area with *extended inundation*, but it is not a pre-requisite for the subclass. Because alkali wetlands are typically points of groundwater discharge and are located in areas of lower precipitation, they usually do not have zones of *brief inundation*. The *brief inundation* zones are driven by rain on snow events and rapid runoff from snowmelt, which typically occurs in portions of the Columbia Basin with higher annual precipitation levels.

D10.1 Percent of the AU that is ponded or inundated each year in most years for any length of time – Boundary of Brief Inundation (i.e. maximum extent of annual inundation)

Map the boundary of Brief Inundation around the AU and estimate the area of the AU it represents (as a percent). The relative percent of the AU covered by this zone can be estimated by using either the dot method or a planimeter. On the data form record the total percent of the AU that is inundated as a number between 0 and 100. Aerial photos should also be used to determine the area of inundation.

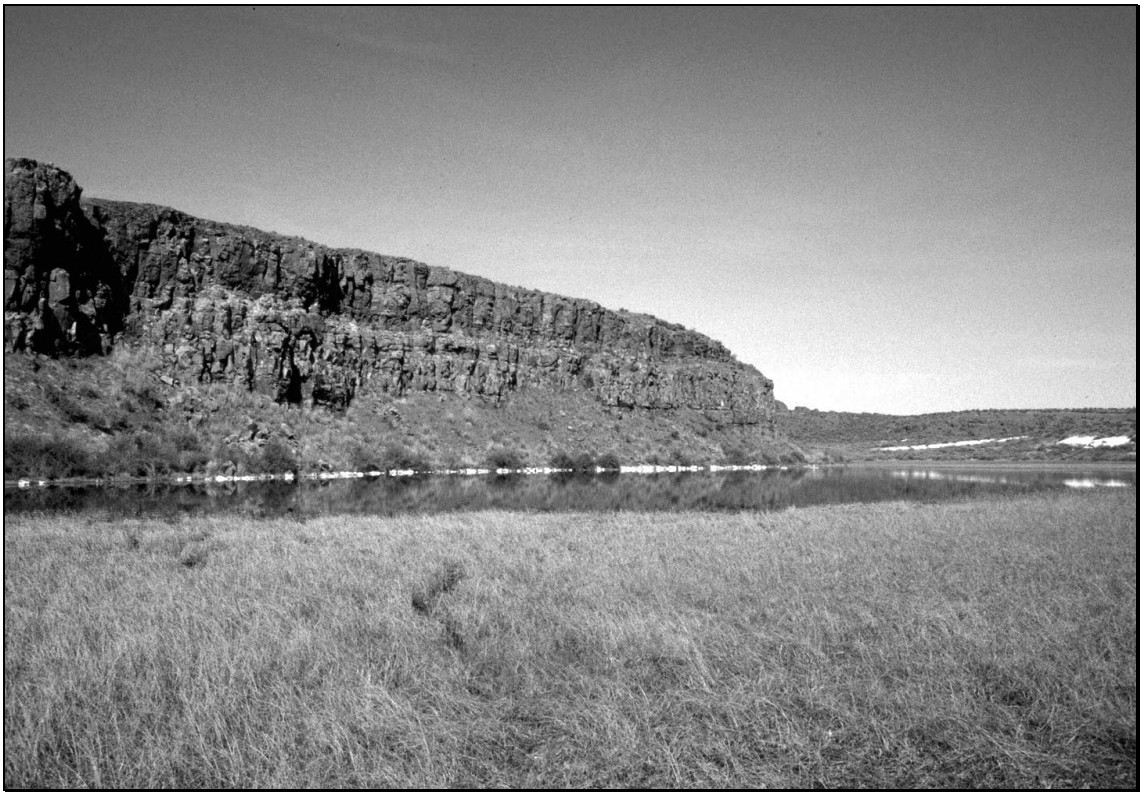


Figure 11. Halfmoon Lake (CB9-Alkali wetland) Salt tolerant vegetation surrounds open water consisting of *Scirpus maritimus, Juncus balticus, Distichlis spicata*. Note salt deposits. Photo taken 4/21/98

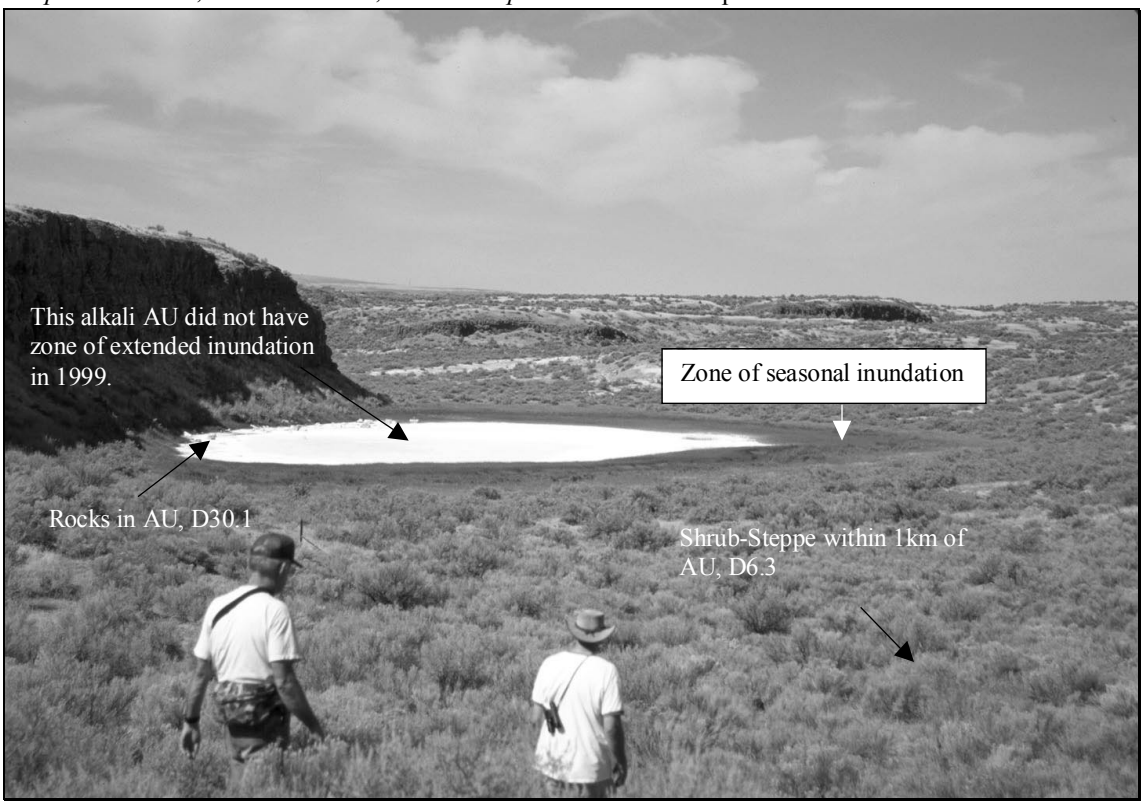


Figure 12 Halfmoon Lake wetland on 9/15/99. No standing water present, just extensive salt deposits.

Usually 100% of the AU will be within the boundary of *brief inundation*, because this boundary is typically in the uplands, above the delineated wetland boundary (Figure 16).

There are several cases, however, where this is not true.

- AUs with small seeps along their edges where the delineated boundary is above the zone of inundation

- AUs with small seasonal channels draining into it, and where wetland vegetation is found growing up into the channels. AUs with fine soils along the edges where surface saturation and wetland plants are maintained by capillary action.

If the site visit is done outside the time of maximum inundation, the following indicators can be used to identify the boundary of inundation.

- Water marks and sediment lines on rocks and vegetation (including herbaceous and woody vegetation). See Figure 14 & 15 for examples.

- Drift lines of debris (natural and of human origin) on the ground.

D10.2 Percent of the AU that is ponded or inundated for more than 2 months. This is the area of the AU that is within the boundary of the *seasonal inundation*. Map the boundary of *seasonal inundation* around the AU and estimate the area of the AU it represents (as a percent). This boundary will usually coincide with the delineated boundary of the AU, except as noted above. The relative percent of the AU covered by this zone can be estimated by using the dot method, a planimeter, or GIS. On the data form record the total percent of the AU that is inundated as a number between 0 and 100. Also use aerial photos to confirm the area of inundation.

The best indicator of the boundary where inundation lasts for more than two months is the upper boundary of the areas where wetland plants are dominant (>50% cover of facultative, facultative-wet, or obligate species). This boundary is often very distinct in the Columbia Basin. If a site is visited during the wet season and wetland vegetation stops before the edge of the area of inundation then the area outside of the wetland vegetation line is probably only briefly inundated. During the dry season, the boundary of areas inundated for more than 2 months (*seasonal inundation*) will have to be estimated by using one or more of the following indicators.

- The first line of wetland vegetation that is below or coincides with water/sediment/debris marks (Figures 14 and 15).

- Water stained vegetation lying on wetland surface (grayish or blackish in appearance such as downed and fragmented bulrush stems). See Figure 25 for an example.

- Dried algae left on the stems of emergent vegetation and shrubs and on the wetland substrate (See Figure 13).

Figure 13. Dried Algae left on emergent vegetation provides indication of level of *seasonal inundation*

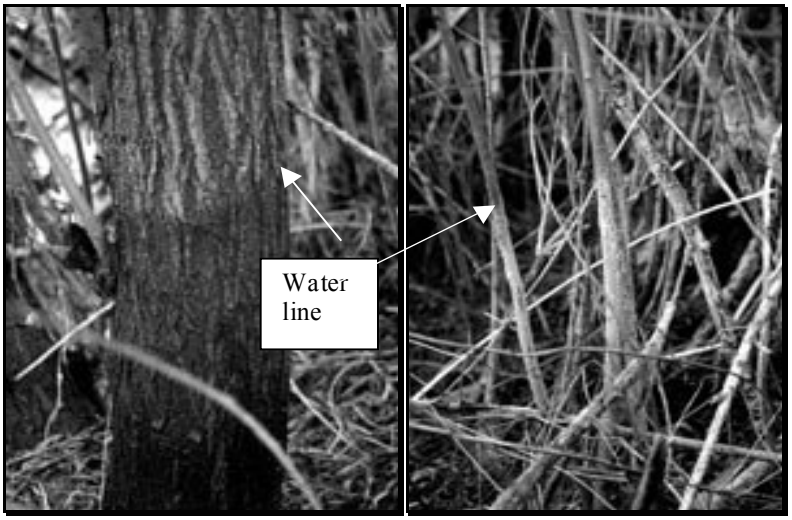


Figure 14 – Watermark left on willow trunk and, sediment deposits on emergent stems are good indicators of the annual high water mark (brief inundation)

To determine the area of inundation, walk in from the AU edge to the location where one or more of the indicators appear and mark the location on a map of the AU. Repeat this process at least four times at points that are about equidistant along the AU boundary (collect soil data at these four locations also).

Draw a line between the points that follow the approximate shape of the AU edge. When all four locations are connected on the map, you will have a polygon within the AU boundary that represents the approximate area of inundation. Record the % of the AU occupied by inundated areas on the data form.

Other guidance for collecting data for D10.2 is as follows:

- If you can't access all parts of the AU, choose four points as far apart as possible.
- If the AU contains upland islands within the area of *seasonal inundation*, their area will have to be subtracted from the total.
- It may be necessary to sample more than four locations around the AU edge if the AU is large (more than 4 hectares or 10 acres) or if the edge is highly irregular. As you walk through the AU you will have to judge whether the four sampling points provide an adequate mapping of the zones of inundation.
- Some AUs may contain several areas of inundation that are not contiguous. Sketch them on the map, estimate the % of the AU that each occupies, and add these together for this datum.

Figure 15. Note light color band of sediment on *Scirpus acutus*, which indicates high water mark for Datum 10.1. Picture taken at George Lake, Grant County 1/20/99

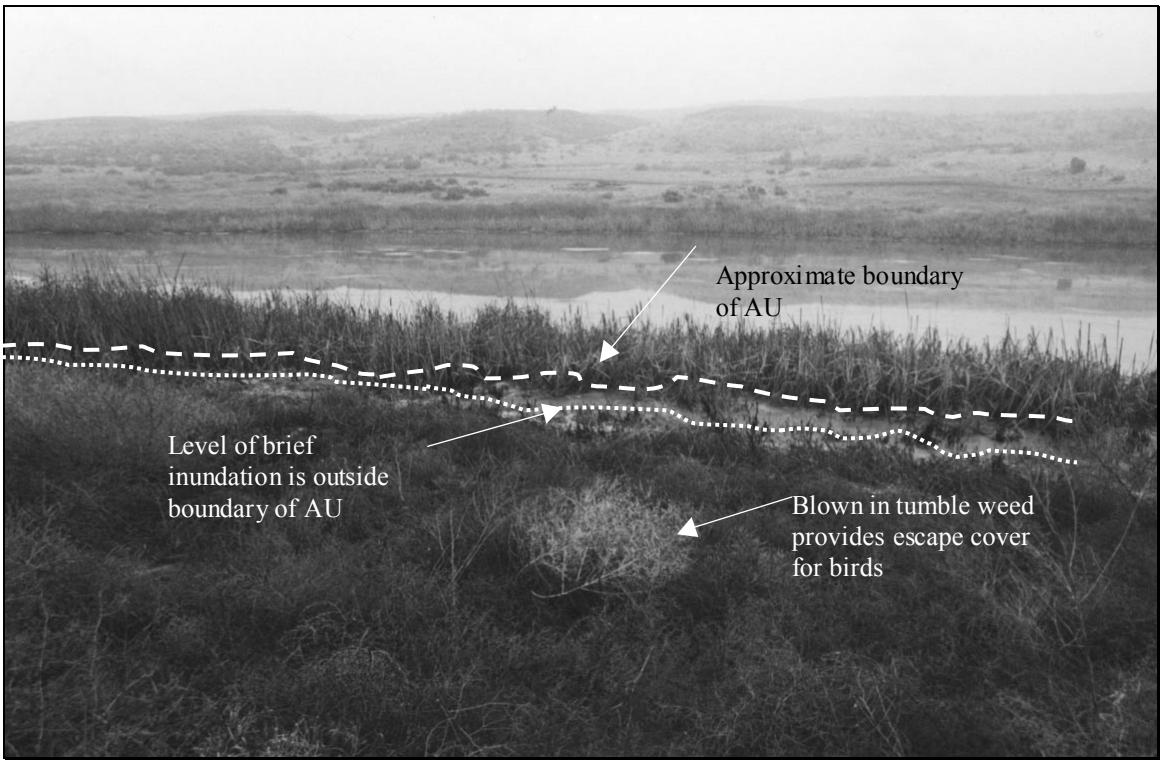


Figure 16. Level of brief inundation is landward of cattails (*Typha latifolia*) and within buffer area. The edge of the AU is marked by the outer edge of the cattails (boundary of seasonal inundation). Photo taken 1/20/99 at Neva Lake, Grant County, northwest shore (Reference Wetland CB 38)

Figure 17 Picture of Turnbull Wildlife Refuge Reference Wetland CB14 taken towards the southwest on 12/21/98. Surface water is frozen and represents annual high water (level of *brief inundation*). Area of bulrush (*Scirpus acutus*) is flooded to within 2 feet of top of plant.

Figure 18. Picture of Turnbull #4 Wetland from same angle and similar area as top picture during the fall (9/23/97). Most of the bulrush, burreed (*Sparganium emersum*) and cattail areas were not inundated except for a central area that had been previously dredged. Therefore, for Datum D10.3 (percent of AU with *extended inundation*), only the area within the dredged parts is recorded as the area of *extended inundation.* Similarly, the distribution of plants and water as found in the fall determines the interspersion between vegetation & *extended inundation* (D36.1).

D10.3 Percent of AU that is ponded or inundated for more than 9 months (extended inundation). *Includes the areas with extended inundation that are vegetated.*

Record the percent of the AU that has "*extended inundation*" standing or flowing water. Try to identify the lowest water levels that would typically be present during any single year. Areas with standing water in the zone of emergent, scrub/shrub, or forest vegetation are to be included in this datum if they remain inundated for more than 9 months. Also include areas that are categorized as "aquatic bed."

The area of extended inundation is defined as the area encompassed by the "ordinary low water mark."

The vegetated and open water areas can be mapped directly during late summer and fall when the water level for most Long-duration AUs will have stabilized at its lowest point.

During the winter and spring it may be difficult to identify the area that remains inundated throughout the summer. In general, the boundary will usually be at the edge, or below, the area dominated by large, obligate **emergent** plants such as *Scirpus acutus* or *Typha latifolia.*(Figures 8 and 34). Use the lower edge of this vegetation if it is impossible to determine the boundary any other way. Be advised, however, that some depressional long-duration AU's were observed to have low water levels considerably below these vegetated areas. The best results are obtained if one can visit the wetland during late summer as well as the spring. Additionally, for some wetlands within the Reclamation Project Boundaries, the area of extended duration may expand later in the growing season due to increased agricultural return waters, beyond the boundary set by obligate plants.

Any local information is very helpful in these cases, so check with local residents and land/wildlife managers to determine the ordinary low water mark.

D10.4 Percent of AU with open water (unvegetated) for more than 9 months each year. ***Includes areas of floating algal mats.***

Record the percent of the AU that has *extended inundation* with **open** water (Figure 34) as a percent of the total AU. Areas with extended inundation in the zone of emergent, scrub/shrub, or forest vegetation **are not to be** categorized as "open water." Also, areas that are categorized as "aquatic bed" using the Cowardin classification are not to be counted within the area of "*extended inundation* **open** water."

During winter and early spring months, check the substrate at the edge of what seems to be open water for any remains of last year's aquatic bed or emergent vegetation.

Draw the outline of the long-duration **open water** on your map and estimate its extent as a percent of the total AU.

Other suggestions for collecting data for D10.4 are as follows:

- *Extended inundation* with open water may include areas with aquatic bed vegetation if the area of aquatic bed does not meet the size threshold to be a separate category.

If the aquatic bed covers a larger area it should be classified separately and recorded in D16.4 (see Figures 2 and 3 for pictures of aquatic bed vegetation).

- Discontinuous areas of open water can be added together to estimate the total percent of the AU occupied by *extended inundation,* **open,** water.

D10.5: Percent of the AU with unvegetated bars or mudflats.

Some vegetated wetlands may contain small sandbars or mudflats within their boundaries. Record the area of unvegetated bars or mudflats as a percent of the total AU (Figure 34). **Bars and mudflats are counted only if they are outside the area of extended inundation.** Because there are no reliable indicators for this datum other than direct observation, rely on local experts and residents for presence of bars and mudflats if assessment is done during the spring or winter.

D10.6: Presence of any areas that are permanently inundated

Record the presence of any areas that are permanently inundated in the AU. These would include areas that are flooded for at least 12 months 9 out of 10 years **(note: areas inundated for more than 9 months in most years do not automatically qualify).** Use several years of aerial photos to confirm presence of this indicator in conjunction with local expertise and evidence of carp (see D33) or other fish in the AU (see D34).

D11: Types of water regimes present in AU

Identify the different types of water regimes present in the AU using the descriptions below. Record a [1] on the data sheet for **all** the regimes that might apply. Remember that different parts of an AU may have different water regimes, and that closed systems will probably not have a stream within their boundaries.

The purpose is to **identify the wettest water regime in different areas of the AU**. Thus, an area that is seasonally inundated in the spring, but only saturated to the surface during a field visit in the summer, would be categorized as "seasonally inundated," **not** "saturated" to the surface.

For AUs equal to or greater than 1.0 hectare (2.5 acres), a water regime type must occupy, at least, 0.1 hectares (1/4 acre) of the total AU to be recorded. For AUs less than 1.0 hectare, the threshold is 10% of the total area of the AU.

D11.1 Extended Inundation > 9 months
Surface water covers the land surface for at least 9 months out of a year, in most years (see discussion for D10.3).

D11.2 Seasonal Inundation (2-9 months) - Surface water is present for a relatively long periods (2 month to 9 months), but is absent by the end of the season in most years. During the summer dry season it may be difficult to determine the area of *seasonal inundation*. Use the indicators described in D10.2 to help you determine areas that are seasonally inundated.

D11.3 Brief Inundation (<2 Months) – Surface water is present for short periods (less than 2 months), typically early in the late winter and early growing season.. During the summer dry season it may be difficult to determine the area of *brief inundation*. Use the indicators described in D10.1 to help you determine areas that are seasonally inundated.

NOTE: If the AU boundary is at the edge of the seasonal inundation (D10.2 = 100%) the AU cannot have areas of "brief inundation" or "saturated."

D11.4 Saturated - The substrate is saturated to the surface for extended periods during the growing season, **but surface water is seldom present**. The latter criterion separates saturated areas from inundated areas. In this case, there will be no signs of inundation on plant stems or surface depressions.

D11.5 Perennial Stream – The AU contains a river, stream, channel, or ditch with water flowing in it throughout the year, in most years, that meets the size criteria for this datum.

D11.6 Intermittent Stream - The AU contains a river, stream, channel, or ditch in which water flow is of intermittent or seasonal and that meets the size criteria for this datum.

D12 Depths of inundation

12.1 Maximum depth of "brief inundation" (<2 months) above surface level of *extended inundation,* or the lowest point in the AU (if it is a "Short-duration wetland). Record the depth as the difference between the height at which you noted marks of *brief inundation* and the level of the water surface or bottom of the AU. Record to the nearest 30 cm (1ft.). NOTE: The level of brief inundation can be outside the AU boundary (Figure 19).

For AUs that have areas of *extended inundation*, the lowest point is the surface of *extended inundation* (as measured at its lowest point, typically in late summer and fall). See Figures 8, 26 and 27 for examples. You should estimate the depth of inundation above that. For AUs that have no areas of *extended inundation*, locate the lowest point in the AU and measure the depth of the flooding above that.

If the maximum high water mark, as measured in D10.1 is outside of the AU boundary, you must measure the water depth from that mark rather than the edge of the AU (see example below).

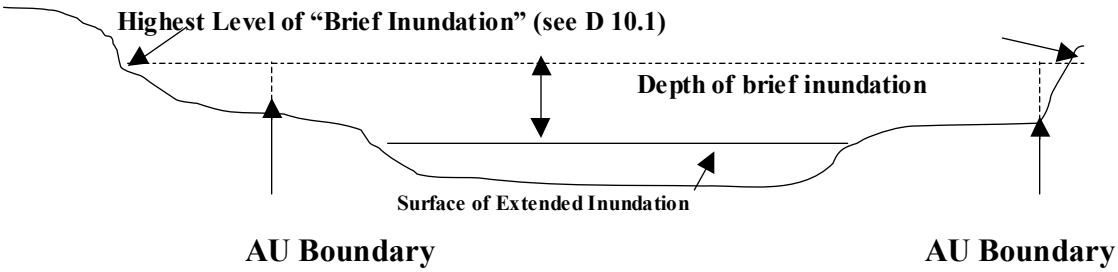


Figure 19 – Measuring maximum depth of brief inundation in a long-duration wetland.

D12.2: Maximum depth of "seasonal inundation" above surface of AU. Record the depth of seasonal inundation as the difference in elevation between the upper edge of the seasonal inundation and the low point of the AU (as described below). Record to the nearest 30-cm (1ft.).

For AUs that have areas of *extended inundation*, the lowest point is the surface of *extended inundation* (as measured at its lowest point, typically in late summer and fall). See Figures 8, 26 and 27 for examples. You should estimate the height of inundation above that. For AUs that have no areas of *extended inundation*r, locate the lowest point in the AU and measure the depth of the flooding above that.

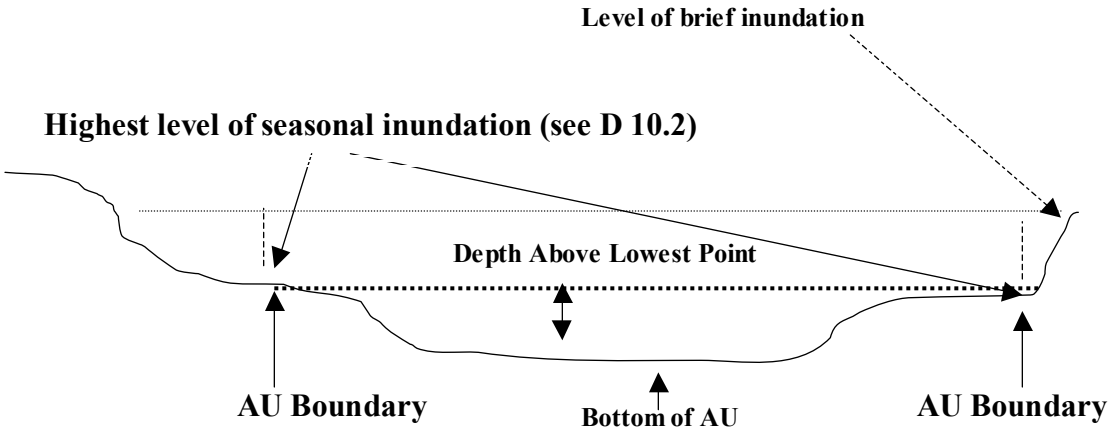


Figure 20 – Measuring maximum depth of seasonal Inundation in a short-duration wetland

D13: Topographic cross-section of area of annual water level fluctuation

Identify the diagram on the data form (D13.1 – D13.3) that best matches the cross section of the AU at its **widest point** in the area **that is inundated in most years**. Record a [1] for the appropriate diagram. Do not try to judge the shape of the area below the surface of *extended inundation* (Figure 21). This datum is used to estimate the "live" storage in the AU, or the amount of water the AU will store in most years. Thus the volume of water in the areas that are inundated for most of the year are excluded.

Consider the surface of extended inundation as the bottom of the diagram, i.e. the bottom of cross-sectional area that is annually inundated.

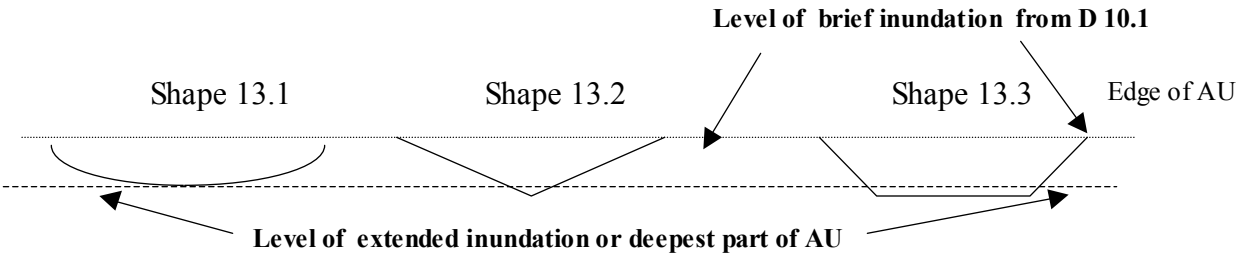


Figure 21. Diagrams of three geometric shapes for characterizing the live storage in the AU.

It is very important that you accurately locate the high water mark for inundation (D10.1) before selecting which basin shape above best fits the assessment unit. An example of a common error that may occur in assessing this datum is illustrated below.

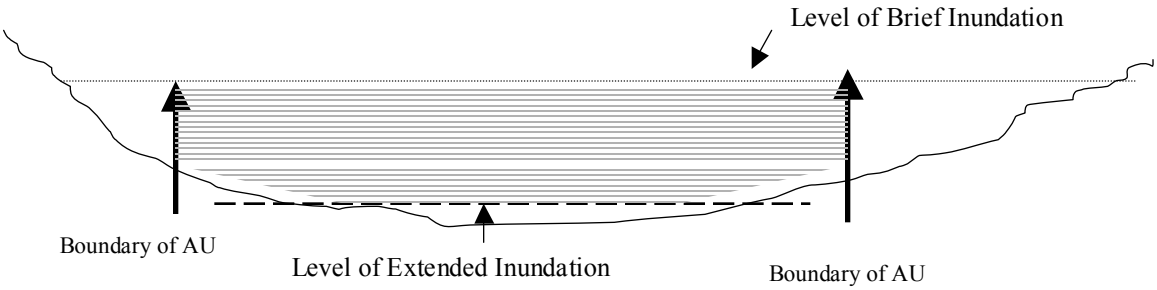


Figure 22 – Determining Appropriate Cross Section for Measuring Live Storage

Correct shape of basin in Figure 21 would be diagram 13.3 and not 13.1. You are not selecting the basin shape above the edge of the AU or below the level of *extended inundation* because this would not represent the potential flood storage capacity within the AU. It is the area above the level of *extended inundation*, but within the AU boundary (see shaded area in Figure 22), that is providing the potential flood storage capacity of the AU. Storage outside the boundary of the AU is not part of a wetland function, but a function of the surrounding uplands.

NOTE: Some assessment units have complex topography that includes several of the cross sections types. In these cases, use the diagram that is most characteristic of the **dominant** cross section in the assessment unit.

D14: Water depths in areas of "extended inundation"

Identify all the categories of water depths listed below that are present in the AU in the areas of *extended inundation*. You may have to use indicators to determine the water depth categories if your site visit is at the time of maximum inundation. One indicator for depth is the absence of vegetation. Inundated areas without vegetation are typically deeper than 1.3

meters. Record a [1] on the data form for each category present if it extends for at least 0.1 ha (1/4 acre) or 10% of the AU.

D14.1 Water depth 0 - 50 cm (20 inches).

D14.2 Water depth 50 cm to 130 cm (20 - 51 inches).

D14.3 Water depth ≥ 130 cm (51 inches).

This datum applies only to depths found within the area of "extended inundation" as determined in datum 10.3.

NOTE: If an AU has deep water (>130 cm) and steep banks, you need to assess whether the extent of the shallower categories is large enough to qualify. For example, AUs in deep "kettle holes" may have steep banks and very narrow zones of the shallower waters that do not meet the size criteria.

D14.4 Water depth in permanent surface water is greater than 130 cm (51 inches). Answer this question only if D10.6 is a [1]. The best way to estimate water depths in permanent water is to use a fishing line with a bobber set at 1.3 m from the weight. If the bobber is submerged when cast into the middle of the water, the depth is more than 1.3 m.

NOTE: If the site is flooded above the level of permanent water you will have to add your estimate of the current depth of inundation above the level of permanent water to properly set the distance to the bobber (see Data 12.1 and 12.2).

D15: Width of outlet (if no outlet record 0 m)

Measure the width of the outlet, in meters, of the AU. The width of the outlet must be measured at the high water mark in the wetland (From D10.1). This can be determined by observing water stains, drift debris (wood, vegetative material, Styrofoam, other trash, and sediment lines). If the high water mark is above the lip of the wetland depression, then measure the entire length of the end of the AU with the outlet (measure along a line perpendicular to the main direction of flow).

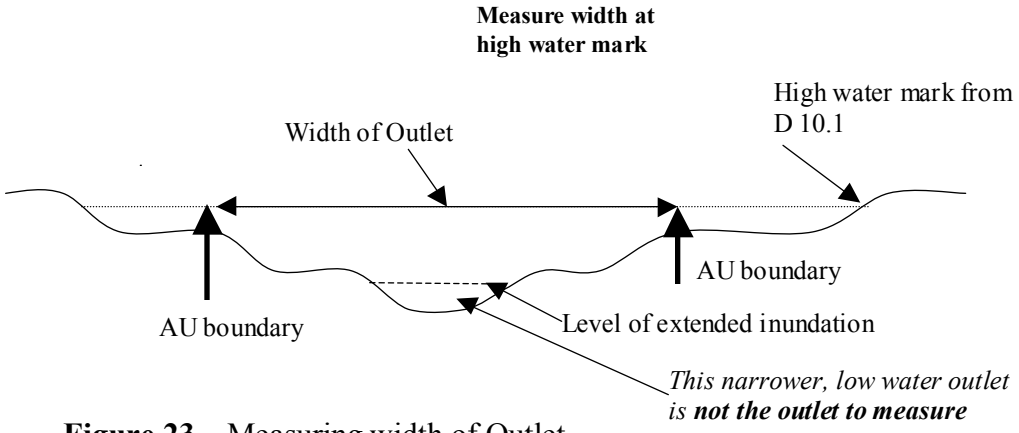


Figure 23 – Measuring width of Outlet

D16: "Cowardin" vegetation classes as percent of AU

"Cowardin" vegetation classes are distinguished on the basis of the uppermost layer of vegetation (forest, shrub, etc.) that provides more than 30% surface cover within the area of its distribution. Examples are provided below. Appendix 2-N provides an example of "mapping" Cowardin classes on an air photo. Appendix 2-G provides a Vegetation Profile Board, which graphically represents different percentages of cover, to help your estimate of percent cover. Examples of how different areas might be classified are given below.

- An area (polygon) of trees having a 50% cover with an understory of shrubs that have a 60% cover would be classified as a "forest" class.

- An area with 20% cover of trees overlying a shrub layer with 60% cover would be classified as a "scrub-shrub" class.

- An area where trees or shrubs each cover less than 30%, but together have a cover greater than 30% is classified as "scrub-shrub."

- When trees and shrubs together cover less than 30% of an area, the zone is assigned to the dominant plant class below the scrub-shrub (e.g. emergent, aquatic bed, mosses and lichens) if these have greater than 30% cover.

If the total cover of vegetation is less than 30% the area does not have a vegetation class. It should be identified as open water or sand/mud flat.

A sample map of an AU with several vegetation classes is provided in Appendix 2-N.

> *Make sure that the cover of open water (D10.3), unvegetated mudflats/bars (D10.5) and all vegetation classes (D14.1, D14.2,D14.3,D14.4) equal 100%.*

Criteria for each Cowardin vegetation class

D16.1 Forest - A forested class is any area where woody vegetation over 6 m (20 ft.) tall (such as cottonwood, aspen and some willow species, etc.) covers at least 30% of the ground. **Trees need to be rooted in the AU** in order to be counted towards the estimates of cover. Some small wetlands may have canopy but the trees are not rooted within the AU. In this case the AU does not have a forested class.

> *For AUs equal to or greater than 1.0 hectare (2.5 acres), the class must cover at least 0.1 hectare (0.25 acre) of the AU to be recorded. For AUs that are smaller than 1.0 hectare, the threshold for listing a class is 10% of the AU. If vegetation types are patchy, patches can be added together when 10 patches or less are needed to meet the size threshold (average patch size is greather than 10% of threshold).*

16.2 Scrub-shrub - A scrub-shrub class is any area where woody vegetation less than 6

meters .(20 ft. tall) is the top layer. Examples includes species such as willow, native rose, alder, dogwood. To count as a class, scrub-shrub vegetation must provide at least 30% cover and be the uppermost layer.

16.3 Emergent – An emergent class is the area covered by erect, herbaceous plants excluding mosses and lichens. To count as a class, emergent vegetation must provide at least 30% cover and be the upper most layer.

16.4 Aquatic Bed – An aquatic bed class is any areas of open water covered by plants that grow principally on or below the water surface for most of the growing season (Figure 2). Aquatic bed species are "non-persistent" and include submerged or floating plants that are rooted. **Non-rooted plants (e.g. duck weed), algal mats, and submerged mosses are not counted under this datum**.

Aquatic Bed plants do not always reach the surface and care must be taken to look beneath the water's surface. Because waterfowl can heavily graze certain species of aquatic bed early in the growing season, it can be incorrectly concluded that aquatic bed is not present if the assessment is made during this time period**. Therefore, examine the substrate in open water areas for evidence of last year's growth of aquatic bed species.** It is best, however, to assess for aquatic bed later in the growing season. If this is not possible, contact local biologists and residents to verify if it is present at some point during the growing season. If an AU is assessed very late in the growing season, when either the standing water is gone or very limited in extent, examine mudflats and adjacent vegetated areas for the presence of dried aquatic bed species (Figure 2). For example, the Field and Assessment Teams observed thick beds of coontail (*Ceratophyllum demersum*) on mudflats at the edge of the receding water.

NOTE 1: If vegetation types are patchy, patches can be added together when 10 patches or less are needed to meet the size threshold (average patch size is greather than 10% of threshold).

D17: Percent area of herbaceous understory

Estimate the percent of the forested and scrub/shrub areas (D16.1 & 16.2) that have an understory of herbaceous plants. The cover of herbaceous plants has to be greater than 20% to be included in the estimate of percent area. Record only the % of the area within these two classes. Treat the area of (D16.1 + D16.2) as the total area over which you are estimating a percent. **Do not try to extrapolate the % area of the entire AU**.

D18: Aquatic bed and emergent species are dominant in same area at different seasons

Record whether aquatic bed species are dominant (>50%cover) in an area that is later dominated by emergent species. Though aquatic bed species can be present in both long and short-duration AUs early during the growing season, in some cases emergent vegetation will be dominant later in the growing season within the same area due to reduced water levels.

Examine emergent vegetation for dried remnants of aquatic bed species. Record a [1] on the data sheet if the zone where these two plant types intermix is greater than 10 m^2.

D19: Presence of algal mats

Record the presence of algal mats in the AU if they cover more than 10 m^2.

D20: Structure categories in vegetation

Record the number different categories of plant structures in the AU. To be counted, a structure category must cover at least 0.1 ha or 10% of the ground within the AU. The structure categories are as follows:

D20.1 0 - 30 cm emergent

D20.2 31 - 100 cm emergent

D20.3 > 100 cm emergent

D20.4 scrub/shrub

D20.5 rooted aquatic bed. Areas of emergent and aquatic bed that are mixed together qualify for this datum.

For AUs equal to or greater than 1.0 hectare (2.5 acres), the category must cover at least 0.1 hectare (0.25 acre) of the AU to be recorded. For AUs that are smaller than 1.0 hectare, the threshold for listing a category is 10% of the AU.

Do not count the actual vertical height of vegetation that is broken or lying down (Figure 35) when identifying structure categories. Use the estimated vertical height of vegetation before it was knocked down. A maximum of five structure categories can be present in any one wetland. Please note that you will also need **to develop a rough map** of the extent of the different vegetation structures for D37.

NOTE If a category is patchy, patches can be added together when 10 patches or less are needed to meet the size threshold (average patch size is greather than 10% of threshold).

D21: Plant Richness

As you walk through the AU, keep a list of the different plant species you find. You should try to identify plants to genus and species if possible. If identification is not possible, your list can distinguish different plants by listing species 1, species 2, species 3, etc. The goal is to identify at least 80% of the plants that you observe at the time of the site visit. Appendices 2-I and 2-J provide lists of common wetland plants in the Columbia Basin.

In order to capture the full range of plant species present during one season, record any species that are dead and recognizably different than the other species present. Record as "species 1, species 2, etc.." if plants cannot be identified.

Procedures for Collecting Data

You can use a "check sheet" to keep a record of plants you see or use copies of Appendix 2-J. It will, however, be helpful to keep two lists, one for native species and one for non-natives.

D21.1 The number of native species present

At the end of the field reconnaissance, record the number of **native** species you found in the AU. Common native species are listed in Appendices -2-I,J.

D21.2 The number of non-native species present

Record the number of non-native species. Common non-native species are listed in Appendices 2-I and 2-J.

D21.3 The number of aquatic bed plant species

Record the number of aquatic bed. Common aquatic bed species are listed in Appendix 2-I and 2-J. Early in the growing season, aquatic bed species such as *Potamageton* spp. may be heavily grazed by waterfowl and may be missed during assessment. Many aquatic bed species can still be identified late in the growing season, from the dried "rafts" of aquatic bed on mudflats by the edge of perennial water (Figure 2).

Additional guidance:

- While identifying the non-native plant species present, also note the % of the AU in which non-native species are dominant or co-dominant. This information is used to answer D24.

- Generally, you should identify at least 80% of the species in the AU to species level. If you cannot identify 4 out of 5 species you should seek help from a botanist or other expert.

- Species you can't identify to genus and species should be allocated to the native/non-native categories in the same proportions as those you could identify. For example, if you are able to identify 20 out of 24 species and 15 of those species are native, the 4 unidentified ones should be considered as 3 native and 1 non-native.

D22: Cover of special plant species within AU

Note the presence of the following plant species. If any of the following plants are present record the appropriate number (ranging from 0 to 5) corresponding to the appropriate amount of cover.

0 - plant species is not present in AU
1 - species is present but not dominant or co-dominant within any location
2 - area of AU covered is 1-25% with species as dominant or co-dominant
3 - area of AU covered is 26-50% with species as dominant or co-dominant
4 - area of AU covered is 51-75% with species as dominant or co-dominant
5 - area of AU covered is 76-100% with species as dominant or co-dominant

D22.1 Milfoil

Milfoil can typically be identified by its dense growth and characteristic miniature "horsetail" appearance. The bulk of its biomass is in the water column, unlike pondweed (*Potamogeton spp*.) which concentrates its biomass on the water's surface. Also do not confuse Milfoil with coontail (*Ceratophyllum demersum*), a native aquatic with similar appearance but that has "forked" leaves.

D22.2 Purple loosestrife (*Lythrum salicaria*)

D22.3 Phragmites (*Phragmites spp*.)

D23: Presence/ Absence of *Scirpus* spp.

This datum applies only to freshwater, short-duration, AUs. Note the presence/absence of *Scirpus* spp (Figure 15) in the AU. There is no size threshold for this datum.

D24: Area of AU in which non-native plants are dominant or co-dominant within their plant community

Identify if any non-native plants (see Appendix 2-I or 2-J for list of common species) are a dominant or co-dominant within parts of the AU. If so, map the areal extent of these areas, and estimate the percentage of the total AU this represents. Different assemblages of non-native species should be added together to calculate the total. Record a [1] on the appropriate data line based on the total coverage of non-native plant assemblages in the AU.

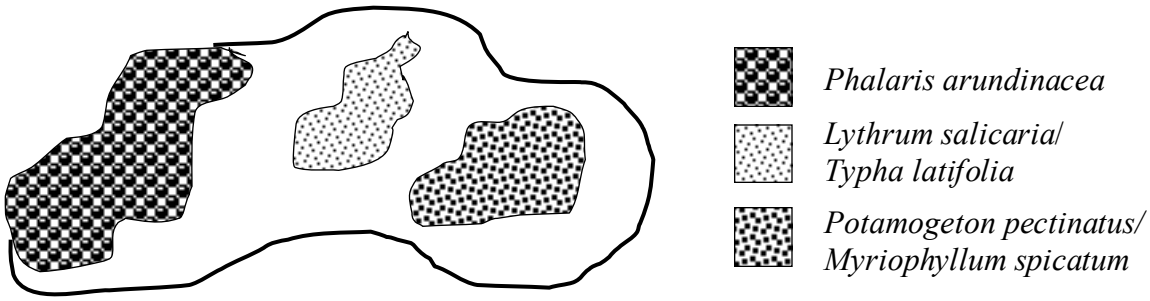


Figure 24 – Mapping Non-Native Plant Communities

In Figure 24, the first plant assemblage is dominated by the non-native grass, *Phalaris arundinacea* (100% cover); in the second assemblage, the non-native purple loosestrife (*Lythrum*) covers 60% of the mapped polygon and the native cattail (*Typha*) is a co-dominant

Definition of Dominance and Co-Dominance

Areas where a single species is dominant. For a single species to be considered the dominant it must cover at least 50% of the surface of the ground. Use the aerial photo or your judgment in the field to determine if a species cover meets the 50% criterion. Areas where several co-dominants are present. Co-dominance is defined as species that cover between 20 to 50% of the surface of the ground. Thus, an area defined by co-dominant species can have between 2 and 5 co-dominants.

with a 40% cover. The third plant assemblage consists of a dominant native aquatic, pondweed (*Potamogeton*) and the co-dominant Eurasian water-milfoil (*Myriophyllum spicatum*) at 25% cover. When the area of the three plant communities are added together and divided by the total area of the AU, approximately 38% of the AU is covered by non-native plant assemblages. You would then record a "1" for D24.3, and zeroes for the other data.

D24.1 if area of non-natives **>75%**.

D24.2 if area is **50-75%**.

D24.3 if area is **25-49%**.

D24.4 if area is **>0% - 24%** .

D24.5 if AU has no cover of non-native species.

D25: pH of open or standing water in AU

Use pH strips, or a pH meter, to determine the pH of open or standing water in the AU. If there is no standing or open water in the AU, record [7] on the data form. If there is standing water, measure the pH of the water just below the surface (no deeper than 10cm.) Take two measurements, one at either end of the open water area and record the average pH. If you do not have a pH meter, you may need to have two different pH strips. The first is a strip with a broad range (pH 4-12) to measure alkaline wetlands or those with a conductivity above 0.7 – 0.8 mSiemens. If, however, you are assessing wetlands that are only fed by rainwater (vernal pools) use pH strips that will work in water with low ionic strength and that measure a range of 4-7. If you use pH strips you should test them against a calibrated pH meter. Our experience with some strips has been that they may consistently be one pH unit below a meter reading.

NOTE: The pH strip for low ionic strength waters should be immersed in the water for a full minute.

D26: Conductivity

Datum not needed for assessing functions. Conductivity measurements are now part of the Classification Key, in Appendices 2A,B and C.

D27: Salt residues in or at the edge of the AU

Record a [1] on the data sheet if you observe salt encrustation along the edges of the AU, on the surface of the AU, or on rocks that stick out of the water (Figure 12 and 24). The salt encrustations should be evident around the edge of the AU for at least 50% of its circumference, or on most rocks breaking the water surface before you can record a [1] for this datum. Small, and infrequent, patches of salt do not count for this datum.

D28: Presence of drains, tiles or ditches in AU

Look for physical evidence of tiles, drains, or ditches that divert water out of the AU and that reduce residence time of surface waters in the AU. In some case the only outlet of the AU may be a human-made ditch. The local office of the NRCS will often have maps or actual field knowledge that indicates the location and date of installation of agricultural drain tiles. This datum applies primarily to AUs that are, or have been, farmed.

D29: Average annual precipitation in AU

Average annual rainfall data can be obtained on the Internet at www.wrcc.dri.edu/summary/climswa.html. If the AU is not immediately adjacent to one of the locations where data are collected you can chose locations that straddle the AU and estimate an average between the two. A precipitation map covering the southern part of the Columbia Basin is provided in Appendix 2-M. Enter the average annual rainfall associated with that location. Record the rainfall in inches: this is the one datum you **do not need** to convert to metric.

D30: Structures for refuge within AU

Record the presence of any the following special habitat features within the AU:

D30.1 Rocks Rocks >10cm in diameter within the area inundated for more than 2 months (Figure 12).

D30.2 Snags present in the AU that are > 10 cm in diameter at breast height (1.5 meter minimum height).

D30.3 Large woody debris > 10cm diameter present in AU (Figure 28).

D30.4 Plant litter that covers more than 10 m^2 (includes downed bulrush and cattail leaves) with no soil surface showing (Figure 26).

D30.5 Presence of erect emergent vegetation within the area of *extended inundation (applies only to depressional long-duration AUs*). The area of inundated emergent vegetation must be greater than 10 m^2.

D31: Steep banks of fine material for denning

Look for banks that are at least 10 meters long, 0.6 meters high **within or immediately** adjacent to the AU and determine if they have the following characteristics: steep bank of at least 45 degrees slope, with at least a one meter depth of fine soil such as sand, silt, or clay. If these conditions are met record a [1] on the data form.

D32: Impacts of Grazing in AU or in its buffer (within 100m)

Record a [1] for this datum if there are indications that the AU or its buffer are showing impacts of grazing. You have to see impacts to the wetland and its buffer to record a [1] for

this datum. Look for evidence of cropped vegetation, destruction of cryptogammic soil layer (moss/lichen layer), paths through the buffer or wetland, and areas of exposed ash. **Do not rely on cow droppings as the only indicator of grazing** because cow droppings can last for longer than two years in the Columbia Basin. Another indicator is evidence of recent trampling along the edge of the AU or paths through the emergent plants along the fringe. For this datum you are not trying to assess the severity of grazing impacts. If impacts is present, record them.

NOTE: This datum is very important in establishing the correct level of performance for several functions. It is important that you determine the presence, or absence, of grazing impacts as best you can. You should consult with the local land-owner if at all possible regarding the grazing history of the area.

D33: Carp present in AU

(*This datum applies only to depressional, freshwater, long-duration wetlands*). Note if carp are present in the inundated areas of the AU. Indicators for the presence of carp include shallow open water areas devoid of emergent vegetation, suspended sediment in water column, carp scales and bones along the edge of the AU, and direct observation of carp in the water or jumping. Also use interviews with local fisheries biologists and fishermen to determine if fish are present. If carp are present record a [1] for this datum and please also note on the data form the type of indicator found present or source used to confirm presence.

D34: Fish, other than carp, present in AU

(*This datum applies only to depressional, freshwater, long-duration wetlands*). Note if other fish species are present in the perennial surface waters of the AU. Indicators for the presence of fish include scales and fish bones at the edge of the wetland, fishing tackle, and direct observation. Also use interviews with local fisheries biologists and fishermen to determine if fish are present**. Carp do not qualify for this datum point**. If fish are present record a [1] for this datum and please also note on the data form the type of indicator found present or source used to confirm presence.

D35: Bullfrogs present in AU

Record a [1] for this datum if any of the following indicators are present:

- direct observation of bullfrogs during site assessment;
- sightings of large tadpoles (larger than 10cm);
- or hearing their distinct calls within the AU.

Also note on the data form the type of indicator found present or source used to confirm presence of bullfrogs.

Figure 25. Wetland south of Soda Lake. Note presence of salt residue around edge of wetland. Conductivity 7830 µS/cm, pH 10. Photo taken 9/1/99.

Figure 26. Example of plant litter (from *Scirpus acutus* leaves) on wetland substrate, datum D30. This area would have to total 10 square meters in order to qualify for this datum. The dark linear "trail" leading to the vegetation has been made by a muskrat, foraging on *Scirpus* leaves.

Figure 27. Picture of Turnbull Wildlife Refuge Reference Wetland CB13 taken on 12/20/98 towards the southwest. Predominant emergent vegetation is bullrush (*Scirpus acutus*).

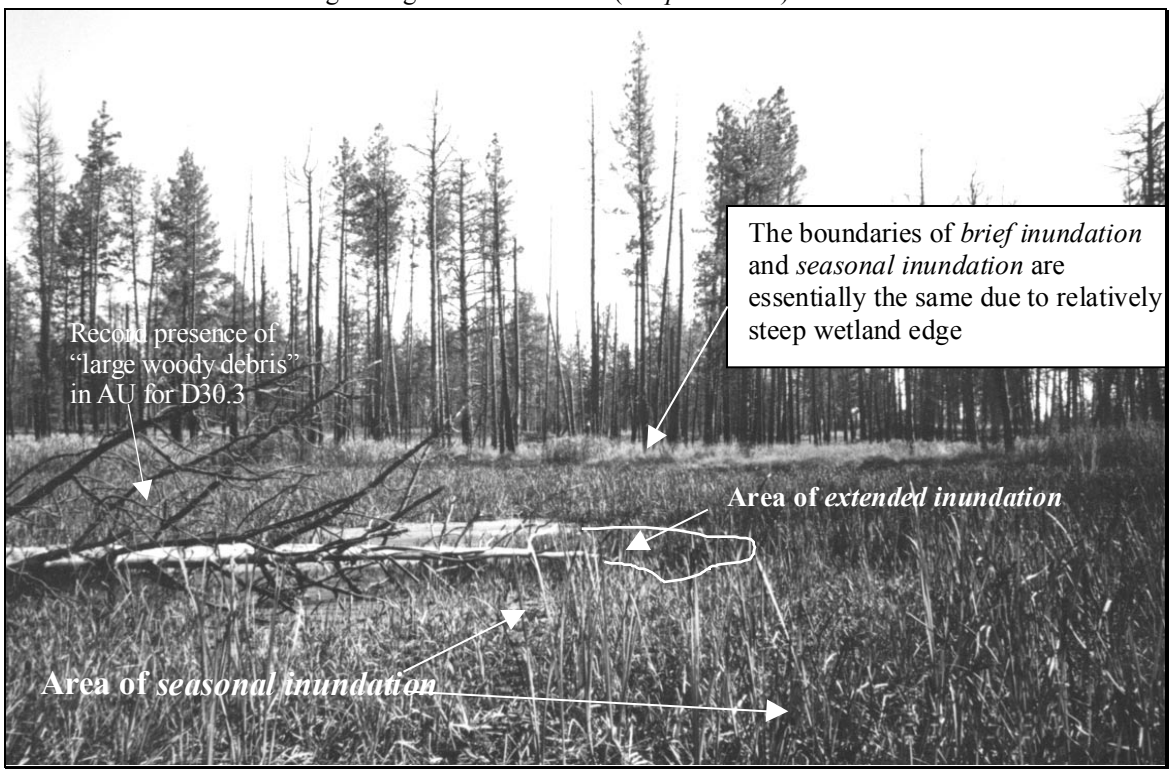


Figure 28. Picture of same wetland as above in fall ((9/23/97) taken from approximately same angle and location. The area of *extended inundation* (D10.4) is immediately beneath the downed tree. Based on the winter conditions, the maximum depth of inundation (D12.1) is approximately 60 cm above the level of *extended inundation* Note that the AU has substantially more emergent vegetation relative to winter (or early spring conditions).

D36: Interspersion between open water and persistent vegetation

D36.1 Rating interspersion between persistent erect vegetation and areas of extended inundation with open water. *This datum does not apply to depressional, short-duration AUs (see datum 36.2 for short-duration AUs).*

If the AU has an "*extended inundation*" open water category (D10.4 > 0) and/or aquatic bed vegetation class (D16.4>0), rate the amount of interspersion between these areas and the areas with persistent erect vegetation (persistent emergent, shrub, or trees) using the diagrams in the data form as a guide, and those in Figure 29. Use your maps of D10.4 and D16.4 to represent the water part of the diagram. There are four ratings of interspersion, numbered from 0-3. Identify the category that best matches the interspersion in the AU and record its number on the data form row D36.

NOTE: If the area of extended inundation is below the edge of persistent emergent vegetation then the rating is LOW by default. The rating of NONE applies only to AUs where the entire area of extended inundation is vegetated with persistent emergent species.

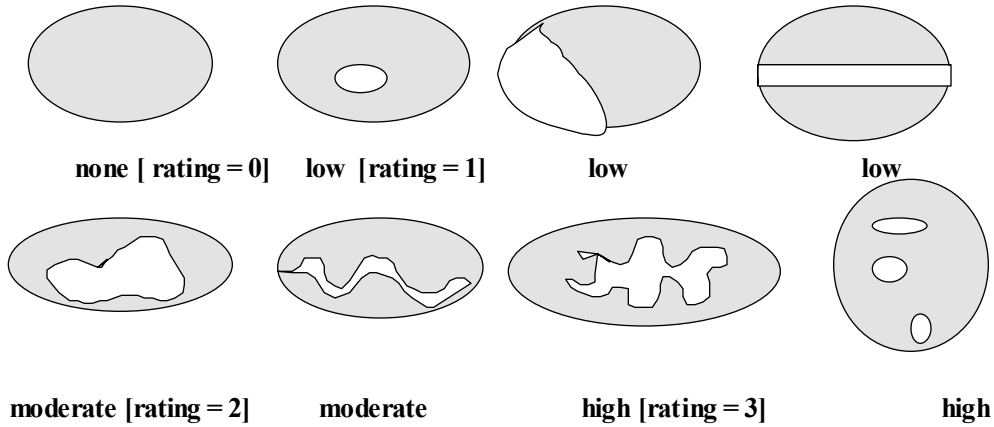


Figure 29 Diagrams for Rating Interspersion between Vegetation and water of Extended Duration

D36.2 Interspersion between persistent erect vegetation and seasonal open water areas of AU. *This datum applies only to depressional,short-duration AUs.*

If the short-duration AU has an area of *seasonal inundation* without persistent emergent vegetation in it (e.g. surface of seasonal water is above any dead or living vegetation), rate the amount of interspersion between this seasonal open water and the areas with persistent erect vegetation (persistent emergent, shrub, or trees) using the diagrams in the Figure 29 as a guide. There are four ratings for interspersion, numbered from 0-3.

D37: Interspersion between different structure categories of vegetation

Map the areas where the following vegetation structure categories are found within the wetland: 1) emergent 0-30cm; 2) emergent 30cm-1m; 3) and emergent >1m), 4) areas of aquatic bed; 5)scrub/shrub. Using the diagrams in Figure 31, rate whether the interspersion is high, moderate, low, or none. Each structure category must meet the size threshold (0.1 hectare or for AUs smaller than 1.0 hectare, the threshold is 10% of the AU) to be counted. Record the ratings as follows

High = 3, Moderate = 2, Low = 1, None = 0

In the example below (Figure 30), the interspersion would score "high", because three classes of vegetation heights are present and they are of irregular shapes. If the three classes, however, were arranged in regular circular bands, as is found with many Columbia Basin wetlands, then the wetland would have a "moderate" rating.

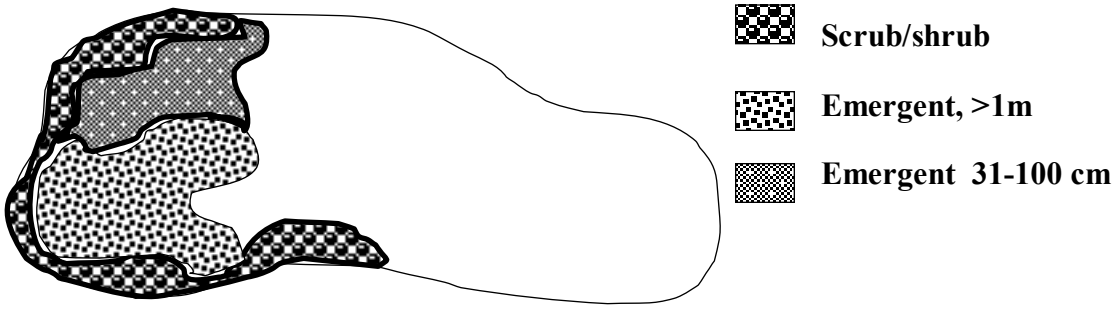


Figure 30 – Mapping different categories of vegetation structure. This AU would rate a "high" for interspersion of different vegetation categories.

NOTE: AUs with only one structure category score a 0. AUs with only 2 structure categories can only score a moderate [2] or low [1], and AUs with 3 classes can rate either a moderate or high depending on the amount of interspersion present. **AUs with 4 or 5 structure categories score a high [3] regardless of the interspersion**.

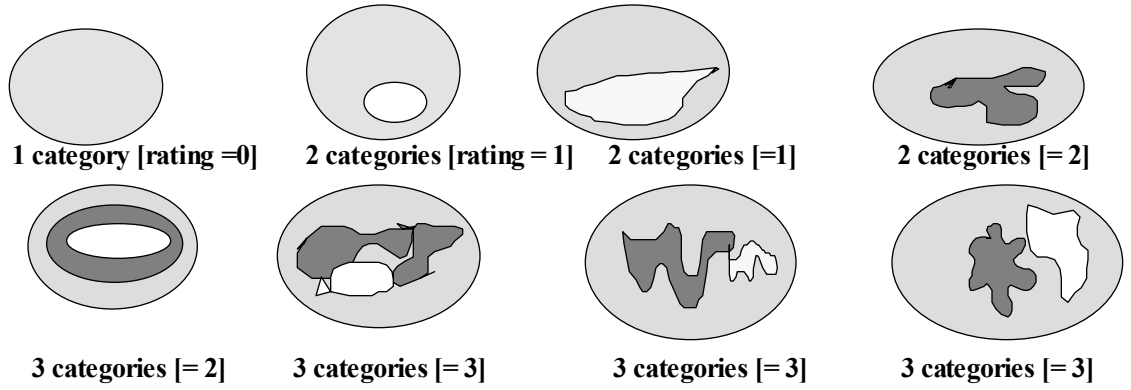
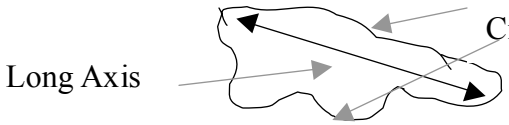


Figure 31 Diagrams for Rating Interspersion Between Different Structures of Vegetation

D38: Edge of AU: The characteristics of the edge between AU and uplands or adjacent wetlands

D38.1 Ratio of circumference of AU to length (estimate of sinuosity).

With the map wheel measure the length of the AU along its longest axis. Next, measure the circumference of the AU. Divide the circumference by the "axis" length of the wetland and record that result for this datum.



$$\frac{\text{Circumference}}{\text{Long Axis}} = \text{Ratio}$$

Figure 32 – Diagram Illustrating How to Calculate Sinuosity

D38.2 Determine if the difference in vegetation height along the edge (i.e. anywhere within 2 m of the exact boundary) of the AU is greater than 2 m for at least 25% of the AU circumference. Different parts of the circumference can be added if they equal 25%.

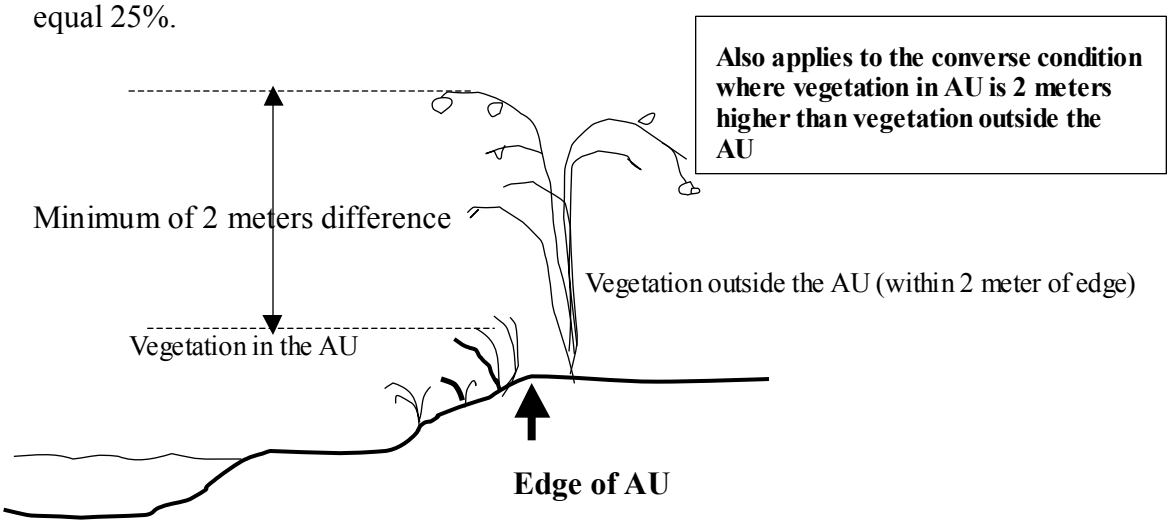


Figure 33 – Example of a difference in vegetation height at the edge of AU

Figure 34. Big Swamp reference wetland (CB 50) south of Medical Lake (near Cheney). Example of high interspersion of "extended duration water with vegetated areas (datum 36). Photo taken 6/7/99.

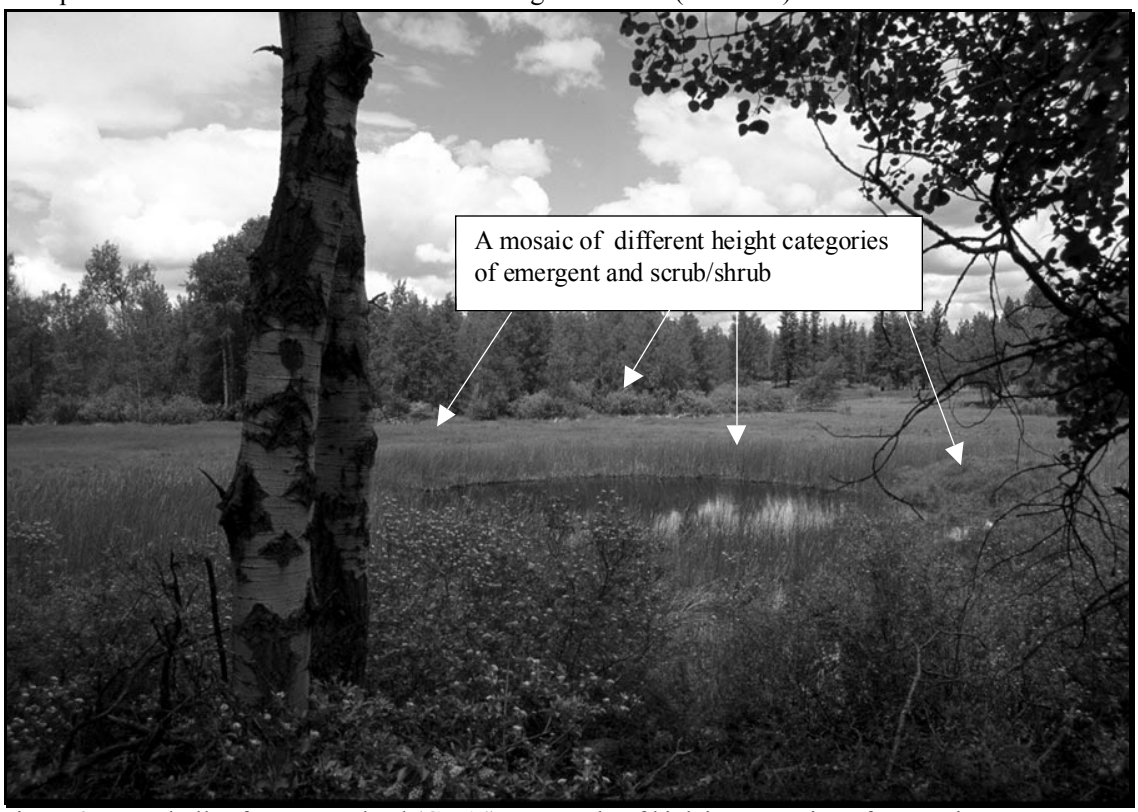


Figure 35. Turnbull reference wetland (CB 14). Example of high interspersion of vegetation structure categories (datum 37). Photo taken 6/7/99.

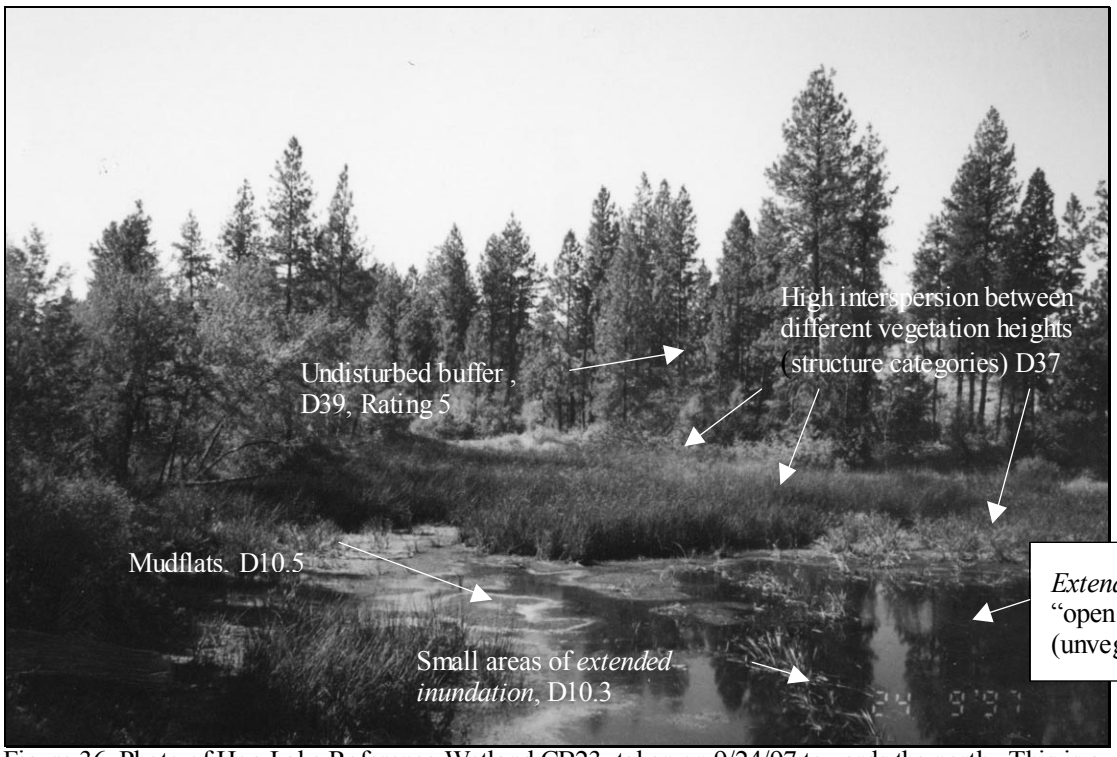


Figure 36. Photo of Hog Lake Reference Wetland CB23, taken on 9/24/97 towards the north. This is a good example where the area of "*extended inundation*" is lower than the edge of obligate emergent species such as bulrush and cattails.

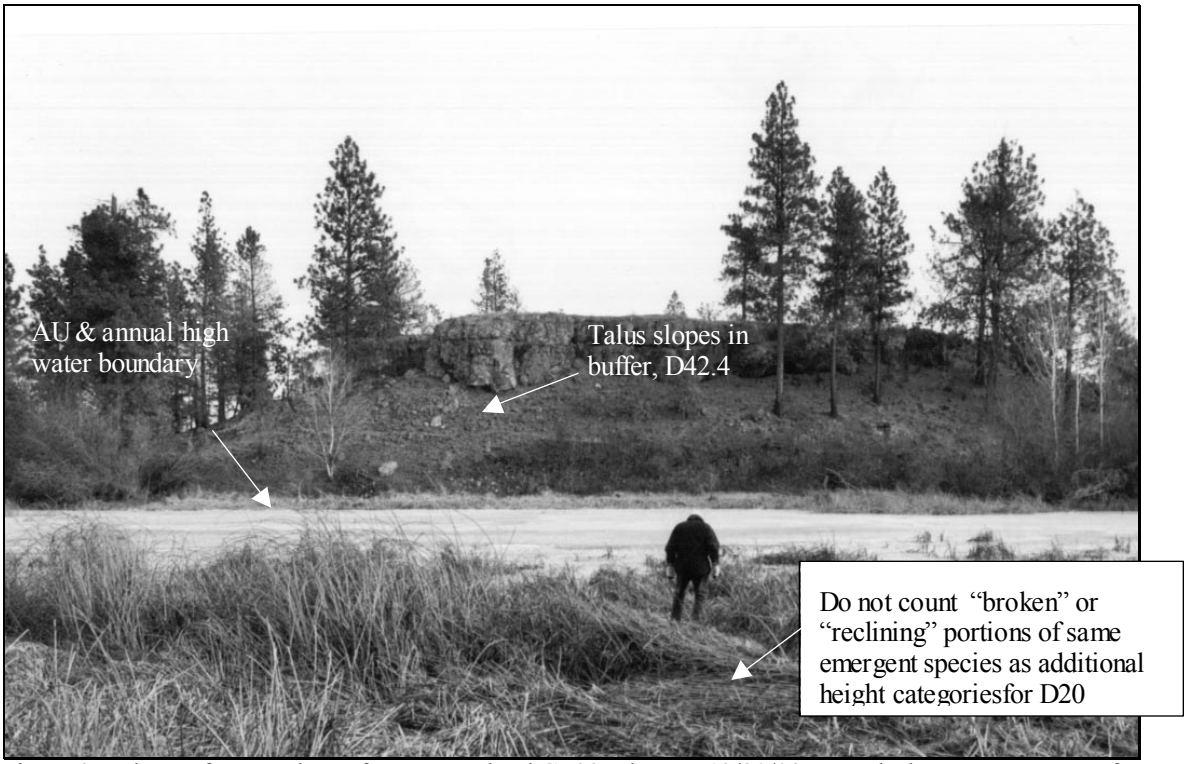


Figure 37. Photo of Hog Lake Reference Wetland CB23 taken on 12/20/98 towards the east. Because of the steep banks surrounding this wetland, the AU boundaries coincide with the high water mark. The high water mark or "brief inundation" zone does not extend outside of the AU boundaries.

D39: Condition of the buffer

Rate the condition of the buffer around the AU using the rating in the data form. If the condition of the buffer does not match the description exactly, use the category that most closely matches. The rating focuses on the width of the relatively undisturbed areas and its relative length along the circumference of the AU. The buffer areas adjacent to the AU may be wetland, deep open water (lacustrine), or upland areas.

First determine if there are any relatively undisturbed areas of forest, shrub-steppe, grassland (not currently grazed or tilled, see D34 for grazing indicators), or open water in the buffer. The buffer is defined as the area within 100 m (330 ft.) of the edge of the AU. If the AU is next to wetlands of a different hydrogeomorphic class or subclass, the latter are considered part of the buffer of the AU being assessed.

Determine which of the following descriptions best fit the buffer and enter the corresponding "rating number" listed on the left on the data form.

Rating

5	**100 m (330ft) of relatively undisturbed (no grazing in last 2 years)** naturally vegetated areas, rocky areas, or open water > 95% of circumference. No developed areas within undisturbed part of buffer (Figure 32). *Any heavily used paved or gravel roads, residential areas, lawns, or actively grazed pastures within a zone along the edge would disqualify the buffer from being "relatively undisturbed." Infrequently used gravel or paved roads or vegetated dikes in a relatively undisturbed buffer can be ignored as a "disturbance." Open water that is not part of the AU is considered part of the buffer.*
4	**100 m (330 ft) wide for > 50% circumference** of relatively undisturbed naturally vegetated areas, rocky areas, or open water, **OR** **50 m (170ft) wide for >95% circumference** of relatively undisturbed naturally vegetated areas, rocky areas, or open water.
3	**100 m (330ft) wide for > 25% circumference** of relatively undisturbed naturally vegetated areas, rocky areas, or open water, **OR** **50 m (170ft) wide for > 50% of circumference** of relatively undisturbed naturally vegetated areas, rocky areas, or open water
If the AU does not meet any of the above criteria, then check the following:	

2	**No paved areas or buildings within 25 m (80ft) of wetland > 95% circumference**. **OR***)* **No paved areas or buildings within 50m of wetland >50% circumference** *(Light to moderate grazing, or lawns are acceptable***)**
0	**Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference**
1	**Heavy grazing or does not meet any of the criteria above**

Determine the extent of these relatively undisturbed areas around the AU as a percent of the total circumference. Cutoff points are 95%, 50%, and 25% of the circumference.

NOTE: The criteria for categorizing the buffer are hierarchical. This means that you determine if the buffer meets the first criterion. If it does, it is rated a 5. If it does not have a relatively undisturbed area of 100 m (330 ft) or more for more than 95% of its circumference, you determine if it matches the criterion for a buffer with a rating of 4. If none of these criteria can be met, go to the criteria for category 3, etc.

D40: Does the AU have a surface water inflow through any type of stream, channel, ditch, or pipe?

As you walk around the edge of the AU look for the presence of streams, channels, drains, or ditches that bring surface water from the contributing basin into the AU. The channels do not have to have permanently flowing water in them to count.

D41: Ongoing human disturbances in AU and its buffer

Identify if any of the following types of human disturbance are presently occurring in the AU or its buffer (100 m). If a listed activity no longer occurs and previous impacts are no longer affecting the wetland, enter a [0] for all. Otherwise, rate the impact of the human disturbances for the following listed activities. Give a rating of [2] for high impact use; [1] for low impact; and [0] for not an impact.

D41.1 Boating

D41.2 Fishing

D41.3 Hunting or target practice

D41.4 Passive recreation (e.g. bird watching, biking, etc.)

D41.5 Grazing

D41.6 Permanent development in the form of paved roads or heavily used gravel roads.

D41.7 Permanent development, residential and urban (including structures, as well as dumping of car bodies and other large deposits of refuse)

D41.8 Other impacts not listed above such as fill or dumping. Also use this datum to note that human disturbance is present but the type of disturbance cannot be identified. If the impacts are cumulative in nature, and of high impact then a [2] should be entered; otherwise, if they are individual impacts with low impacts, a [1] should be entered.

Indirect evidence of the above types of disturbance includes trails around the edge of wetlands created by fishermen; the presence of fishing tackle; trash for recreational use; large bare areas where camping and/or parking has occurred; recent tire tracks; disturbance or destruction of the cryptogamic soil surface

D42: Habitat Structures in the buffer

Identify if any of the following habitat characteristics are present within the buffer (within 100 m of AU edge) and record a [1] if present. Habitat areas should be greater than $10m^2$ in size in order to qualify. However, you only need one downed log (>10 cm diameter (4") or snag (>10 cm diameter) to count.

D42.1 Upland trees (Figure 33)

D42.2 Scrub-shrub or shrub-steppe (Figure 13)

D42.3 Rock outcrops, cliffs, fractured basalts (Figures 12 & 34)

D42.4 Talus slopes or boulder fields (Figure 34)

D42.5 Downed woody debris > 10 cm diameter or blown in brush such as tumbleweed (Figure 17).

D43: Rating of corridors

Corridors in eastern Washington can include both riparian and upland corridors. Both types of corridors allow for the migration of wetland organisms (mammals, amphibians, invertebrates) between two or more wetlands. Riparian corridors must have surface water present during some part of the year. Riparian corridors typically include creeks (perennial or intermittent), drainage swales and ditches.

The corridor cannot be broken to count. Potential breaks in a riparian corridor include road grades without culverts, or culverts with grates on them to discourage passage by animals. Upland corridors are not considered to be present if the vegetated corridor is bisected by a paved road, railroad, residential areas, or heavily used gravel roads.

The information about corridors is divided into two sections. The first is used to describe the characteristics of the riparian corridor; the second to describe the relative amount of

vegetation in any corridor (either upland or riparian). Identify which of the following best describes the natural corridors to and from the AU. Record the appropriate rating for this datum. Aerial photos should be used to assist in rating the corridors. Please note that the height of vegetation in the corridor is not as important as the percent cover.

NOTE 1: Corridors are defined as a connection of relatively undisturbed natural habitat. If a paved road or heavily used gravel road bisects an otherwise undisturbed area it **cannot** be categorized as a corridor. Tilled fields, grazed fields, residential, or urban areas **do not count** as relatively undisturbed corridors even if they are partially vegetated because they are regularly disturbed.

NOTE 2: To qualify as **vegetated**, a corridor needs to have at least a 5% cover of plants.

D43.1 Riparian Corridors (must have unbroken surface water present at some point in the year throughout the corridor)

1) Is the AU connected to another wetland within 1 km by a **riparian corridor** ?

If YES go to question # 2 **If NO** go to question #4

2) Does the riparian corridor have permanent water at least 0.5 m deep in most places?

If NO go to question # 3 **If YES = [3]**

3) Does the riparian corridor have seasonal water at least 0.5 m deep in most places or permanent water between 5 - 50 cm?

If NO = [1] **If YES = [2]**

4) Is AU within 1 km of any permanent stream, open water or other wetland?

If NO = [0] **If YES = [1]**

D43.2 Vegetated Corridors

1) Is the AU connected to another wetland within 1 km by a relatively undisturbed **vegetated corridor** (either upland or riparian**)** (>5% cover of vegetation) that is at least 5m wide?

If YES go to question # 2 **If NO** go to question #4

2) Is the AU connected by a vegetated corridor that is >= 5m wide with >=75% plant cover

If NO go to question # 3 **If YES = [3]**

3) Is the AU connected by a vegetated corridor that is >= 5m wide with >=30% plant cover

If NO = [1] **If YES = [2]**

4) Is the AU within 1 km of any vegetated corridor or natural area with at least 75% vegetation cover?

If NO = [0] **If YES = [1]**

SOILS and SUBSTRATES in Area of Seasonal Inundation

There are several data about the soils and surface conditions in the AU that need to be determined at four points that are approximately equidistant within the AU. The four sampling locations should be within the interior of the AU, not along the edge, but still within the area of *seasonal inundation*. Do not sample within the area of *extended inundation*.

To sample the soil and surface for D44, D45, and D47, dig a hole that is at least 60 cm deep (about 2 ft), or use a soil auger. The data to be collected at each hole are: 1) the soil typejust below the level of the ground surface (top 15 cm), 2) the presence and type of duff layer on top of the soil, and 3) the infiltration rate of the soils. Some guidance of field indicators for different soil types and infiltration rates are given in Appendix 2-K. Record the presence/absence data in the appropriate box for each site sampled. Check one box in each of the first two categories and rate the infiltration rate as fast or slow in the last one. A copy of the information on the data sheet is shown below. First, record the dominant soil type in the top 15 cm of the soil profile. Then record the type of duff layer at the site. If no duff layer is present, record a 0. Finally, record the infiltration rate of the least permeable layer in the top 60 cm of the soil profile.

Soil	site 1	site 2	site 3	site 4
Peat (undecomposed organic soil)	☐	☐	☐	☐
Decomposed Organic Soil	☐	☐	☐	☐
>20% organic, dark stains on fingers, do not confuse with mineral soils that have some organic (<20%)				
Mineral with clay fraction <30%	☐	☐	☐	☐
Mineral Clay (clay fraction >30%)	☐	☐	☐	☐
Organic surface layer (duff) *Record only if present*				
Un-decomposed duff layer	☐	☐	☐	☐
Decomposed duff layer	☐	☐	☐	☐
Infiltration rate	___	___	___	___

NOTE 1: Some wetlands may have a very thin layer of organic muck, or ash, at or near the surface. Do not count these as a soil unless they are at least 2 cm thick.

NOTE 2: If the AU has large areas that are seasonally inundated at the time of your visit, you will need to judge what the soils might be in those areas.

NOTE 3: Many users have trouble differentiating a true organic soil from a mineral soil with a high organic content**. A black mucky soil is not necessarily organic using the NRCS definition.** Organic content has to be greater than 20% to count as an organic soil. A mineral soil, however, may look black and have a mucky consistency when the organic content is as low as 5%. Generally, if a soil feels gritty it is a mineral soil and not an organic soil, regardless of color. Organic soils, such as peats, also may have significant amounts of plant fibers in them that are easy to see and feel.

D44: Soil Types in AU

Once you have collected data at each of the four sites, count how many times you identified the soil type for all of the four sites and record that number in the correct datum. For example if you found peat soil in sites 2 and 4 but not 1 and 3, you would enter a "2" for datum point D44.1. Repeat this exercise for each of the remaining three soil types (D44.2 through 44.4).

Do not confuse decomposed surface layers with peat and organic soils (D44.1). Decomposed surface materials from recently deposited plant material do not constitute a soil. See D45 for more guidance on identifying surface layers.

D45: Duff layer at soil pits

At each of the four sampling sites used above to identify soil types, observe the surface layers above the soils and determine if there is any decomposed or un-decomposed plant material. This would be recently deposited plant material including leaves from willows, quaking aspens, pine trees, and stems and leaves from aquatic plants such as bulrush, cattails, rushes, and sedges. Surface or duff layers typically do not have roots from

established plants within them. The duff layer should be the dominant feature of the surface to be counted. That means covering at least 50% of the surface for at least $1m^2$ around the soil pit.

D46: Types of surfaces present in AU

Note the type of non-living surfaces present on the surface between stalks or stems of plants and in unvegetated, exposed areas **throughout the AU**. Record a [1] on the data sheet for every category present in the **areas that are <u>not</u> permanently inundated**. This datum does not apply to the substrate of areas with extended inundation. The categories are:

D46.1 Un-decomposed duff layer (except pine needles)

D46.2 Decomposed duff layer (organic)

D46.3 Fines (clays and silt)

D46.4 Coarse materials (sand or coarser)

D46.5 > 25% cover of pine needles

*The minimum size threshold for any category to be counted is 10 m^2. Patches smaller than this should not be recorded. In this case different areas of the AU **cannot be combined** to meet size threshold.*

NOTE 1: Areas covered by mosses or other bryophytes have no exposed surface visible, and therefore have no non-living surface layer exposed.

NOTE 2: Each category must cover at least $10m^2$ of contiguous surface.

D47: Infiltration rate of soils

Rate the infiltration rate of the soils in the parts of the AU that has *seasonal inundation*. <u>If your AU does not have any area of *seasonal inundation* </u>(i.e. D10.1 or D 10.2=0), record a [0] for all categories of infiltration rate.

Choose several locations in the areas specified above depending on the class of the AU. As mentioned previously, these holes can be combined with the holes needed fof D44. Dig a soil hole 60cm deep (2ft) or use a soil auger to determine the type of soil present between the surface and 60-cm (24-in.). Determine whether the infiltration rate is "fast" or "slow" based on the soil description in 47.1 and 47.2. Record a [1] on the data sheet for the appropriate rating.

D47.1 FAST. If > 50% of the soil is sand, gravel, or cobbles (or a mixture of the three), and the rest is loamy sand, or sandy loam, then the infiltration rate is judged to be "fast."

D47.2 SLOW. If the soil cannot be described as in D47.1 (e.g. clays, silts or organic matter) then the infiltration rate is judged to be "slow."

NOTE 1: Record the **<u>least</u>** permeable layer if there are several layers of soil within the top 60cm.

References Cited

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Appendix 2-A Data form for Depressional Freshwater Long-duration Wetlands and Classification Key

Washington Wetland Function Assessments

Classification Key
Columbia Basin

Wetland Name_____**ID #**_____
Location _____**Date**_____

1. Is the wetland contiguous with > 8 ha (20 acres) of perennially inundated open water; where at least 30% of open water area is deeper than 3 m (10 ft)?
   NO – go to Step 2
   YES – Lacustrine Fringe

2. Is the wetland on a slope (note that slope can be very gradual), and does the water flow through the wetland in one direction (unidirectional) and exit the wetland without being impounded? Much of the flow is in the shallow subsurface zone and results in saturated conditions with little surface water present. The source of water is primarily from seeps or precipitation. If any surface flow is present it is typically not confined to a single channel.
   NO - go to Step 3
   YES – Slope

3. Is the wetland in a valley or stream channel where it gets flooded more than once every two years by overbank flooding from that stream or river?
   NO - go to Step 4
   YES – Riverine

4. Is the wetland in a topographic depression where surface water is present at some point in the year and the surface water has an average conductivity **greater** than 2.0 milliSiemens (or millimhos). Vertical fluctuations in the wetland water levels are the dominant type of water movement.
   NO – go to Step 5
   YES – Depressional Alkali

5. Is the wetland in a topographic depression where surface water is present for **9 months or more** (this includes wetlands with permanent surface water) in most years (>5 out of 10 years)?
   NO – Depressional Short-duration (This includes wetlands with periods of surface inundation that range from 2 weeks to 9 months. Areas where water remains less than 2 months, however do not develop the characteristic wetland vegetation).
   YES – Depressional Long-duration

WETLAND NAME_____ **ID # AU-**

Date _____ Data collected by:_____

Columbia Basin
Depressional - Freshwater - Long Duration

Data Sheet is to be used in conjunction with written guidance

AU = Assessment Unit: the area of wetland being assessed

Record only numbers, yes/no answers are recorded as a [1] or [0]

Average Conductivity _____milliSiemens

Estimate/ Score/ Rating		**LANDSCAPE DATA**
_____ ha	D1	Area of AU
_____ ha	D2	Area of contributing basin (upgradient watershed, including AU)
_____ 0-2	D2.1	Average slope of contributing basin (<1% = 0, 1-5% = 1, >5% = 2)
_____ 0/1	D3	AU is within boundaries of the Reclamation Project
_____ 0/1	D4	AU has a water levels that are dominated by irrigation practices or by a manipulated water storage
	D5	Land use (as % of total area) within 1km of AU (include contiguous AUs of different class)
_____ %	D5.1	Natural areas - forests, grasslands, undeveloped areas, rocks, other wetlands, and open water
_____ %	D5.2	Untilled agriculture (pasture, grazing)
_____ %	D5.3	Agriculture -tilled and irrigated
_____ %	D5.4	Agriculture - tilled and not irrigated
_____ %	D5.5	Urban/commercial
_____ %	D5.6	High density residential (> 1residence/acre)
_____ %	D5.7	Low density residential (<= 1 residence/acre) and/or roads
_____ %	D5.8	Not fitting above categories

Golf courses enter under D5.3, gravel pits under D5.5 unpaved roads and docks under D5.7.

	D6	Habitat types within 1km of AU
_____ 0/1	D6.1	Forest (tree cover >30%)
_____ 0/1	D6.2	Riverine
_____ 0/1	D6.3	Shrub steppe
_____ 0/1	D6.4	Unvegetated Talus and/or cliffs
_____ 0/1	D6.5	Other natural areas, open water, and/or other wetlands

Habitat type must be at least 0.1 ha in size (1/4 acre) to count. For natural habitat/areas such as grasslands, sand dunes, lithosols enter them under D6.5

	D7	Land use (as % of total area) in contributing basin *(include AU in contributing basin)*
_____ %	D7.1	Natural areas - forests, grasslands, undeveloped areas, rocks, other wetlands, and open water
_____ %	D7.2	Untilled agriculture (pasture, grazing)
_____ %	D7.3	Agriculture -tilled and irrigated
_____ %	D7.4	Agriculture - tilled and not irrigated
_____ %	D7.5	Urban/commercial
_____ %	D7.6	High density residential (> 1residence/acre)
_____ %	D7.7	Low density residential (<= 1 residence/acre) and/or roads
_____ %	D7.8	Not fitting above categories

Golf courses enter under D7.3, gravel pits under D7.5, unpaved roads and docks under D7.7.

WETLAND NAME_____(long duration) **ID # AU-**

Land uses in contributing basin that generate sediments

_____ 0/1 D7.9 Are there tilled fields in the contributing basin close to the AU (within 1km)?
_____ 0/1 D7.10 Are there pastures or grazed rangelands in contributing basin close to the AU (within 1km)?
_____ 0/1 D7.11 Are there urban/commercial areas in contributing basin close to AU (within 1km)?
_____ 0/1 D7.12 Are there high density residential areas in contributing basin close to AU (within 1km)?

D8 Different wetland hydrogeomorphic types and streams within **2km** of AU

_____ 0/1 D8.1 Depressional - Freshwater- long duration
_____ 0/1 D8.2 Depressional - Freshwater - short duration
_____ 0/1 D8.3 Depressional - Alkali
_____ 0/1 D8.4 Riverine
_____ 0/1 D8.5 Lacustrine
_____ 0/1 D8.6 Slope - (seeps)
_____ 0/1 D8.7 Perennial stream or river

WATER REGIME

_____ 0/1 D9 AU has a surface water outflow during some time of the year

D10 Duration and Area of Inundation *No size thresholds for D10*

_____ % D10.1 Percent of AU that is ponded or inundated in most years
_____ % D10.2 Percent of AU that is ponded or inundated for > 2 months out of the year
_____ % D10.3 Percent of AU that is ponded or inundated for > 9 months each year (includes vegetated areas)

D10.3 includes all areas of permanent surface water

_____% D10.4 Percent of AU with open water > 9 months each year (include areas of floating algal mats)
_____ % D10.5 Percent of AU with unvegetated bars or mudflats
_____ 0/1 D10.6 The AU has areas that are permanently inundated (for 12 months in 9 out of 10 years)

NOTE: D10.1>= D10.2>= D10.3 >= D10.4

D11 Inundation regimes (Types of water regimes present in the AU)

_____ 0/1 D11.1 "Extended inundation"- Areas inundated >9 months (include vegetated areas)
_____ 0/1 D11.2 "Seasonal inundation" - Inundated for 2 - 9 months
_____ 0/1 D11.3 "Brief inundation"- Inundated < 2 months (*count only if within AU boundary*)
_____ 0/1 D11.4 Saturated but seldom inundated
_____ 0/1 D11.5 Perennial stream *(make sure it meets size threshold)*
_____ 0/1 D11.6 Intermittent stream *(make sure it meets size threshold)*

Size threshold for each regime:
0.1ha or 10% of AU

D12 Depths of annual inundation

_____ m D12.1 Maximum depth of "Brief " inundation (<2 months) above "Extended" inundation
_____ m D12.2 Maximum depth of "Seasonal" inundation (2-9 months)
(record to nearest 0.3 m: 0m, 0.3m, 0.6m, 0.9m, 1.2m etc.)

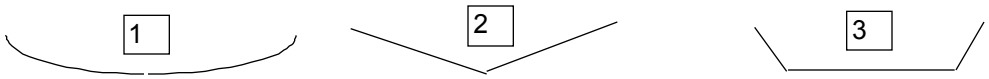
NOTE: D12.1>= D12.2

WETLAND NAME_____**(long duration)** **ID # AU-**

D13 Topographic cross-section of area of annual (brief and seasonal) inundation

_____ 0/1 D13.1 Cross section 1
_____ 0/1 D13.2 Cross section 2
_____ 0/1 D13.3 Cross section 3

Use surface of extended inundation as bottom



D14 Water depths in areas with extended inundation

Size Threshold for each water depth category: 0.1ha or 10% of AU

_____ 0/1 D14.1 0-50cm (<20in)
_____ 0/1 D14.2 50-130cm(20-51in)
_____ 0/1 D14.3 >130cm (>51in)
_____ 0/1 D14.4 Water depth in permanent surface water is greater than 130 cm (51 inches).
_____ m D15 Width of outlet (if no outlet record 0m)

VEGETATION

D16 Cowardin Vegetation classes in AU (as % area of AU)

Size threshold for each class: 0.1ha or 10% of AU

_____% D16.1 Forest
_____ % D16.2 Scrub-shrub
_____ % D16.3 Emergent
_____ % D16.4 Aquatic Bed

If vegetation types are patchy, add patches to meet threshold if patches that are greater than 100m2 (~1000ft2)
Do not include filamentous algae or mosses for D16.4

MAKE SURE D10.4 + D10.5 + D16.1 + D16.2 + D16.3 + D16.4 = 100

_____ % D17 % area of herbaceous understory **in forest and shrub areas** (not % area in entire AU)
_____ 0/1 D18 Aquatic bed plants and emergent are dominant in same area at different seasons
_____ 0/1 D19 Algal mats present over more than 10 square meters

D20 Structure categories in vegetation

Size threshold for each category: 0.1ha or 10% of AU

_____ 0/1 D20.1 0 - 30 cm emergent
_____ 0/1 D20.2 31 - 100 cm emergent
_____ 0/1 D20.3 > 100 cm emergent
_____ 0/1 D20.4 Scrub/shrub
_____ 0/1 D20.5 Rooted aquatic bed plants (not to be confused with Cowardin Class)

D21 Plant Richness

Exclude mosses, algae, and liverworts

_____ # D21.1 Record number of native plant species found in AU
_____ # D21.2 Record number of non- native plant species found in AU
_____ # D21.3 Record the number of aquatic bed plant species

D22 Special plant species within AU

Scoring D22:
0 - plant species is not present in AU
1 - species is present but not dominant or co-dominant
2 - area of AU covered is <25% as dominant or co-dominant
3 - area of AU covered is 26-50%
4 - area of AU covered is 51-75%
5 - area of AU covered is 76-100%

_____ 0-5 D22.1 Milfoil
_____ 0-5 D22.2 Purple loosestrife
_____ 0-5 D22.3 Phragmites

WETLAND NAME_____**(long duration)** **ID # AU-**

D23

D24 Area (%) of AU where non-native are dominant or co-dominant

_____ 0/1 D24.1 % area of non-native species >75%
_____ 0/1 D24.2 % area of non-native species 50-75%
_____ 0/1 D24.3 %area of non-native species 25-49%
_____ 0/1 D24.4 % area of non-native species 1-24%
_____ 0/1 D24.5 NO cover of non-natives in the AU

HABITAT CHARACTERISTICS

_____ [4-12] D25 pH of open or standing water (average of at least 2 locations) ***record a 7 if no standing water***

_____ 0/1 D27 Salt residues present in or at edge of AU
_____ 0/1 D28 Drains or tiles present in AU that reduce residence time of surface waters
_____ in. D29 Average annual precipitation in AU

D30 Structures for refuge within AU

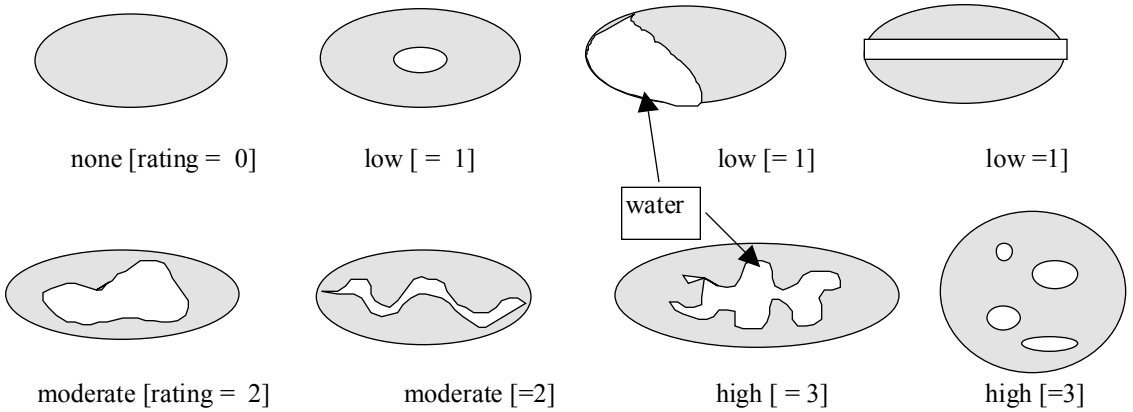
_____ 0/1 D30.1 Rocks >10cm present in areas inundated for more than 2 months
_____ 0/1 D30.2 Snags present in AU (not in buffer)
_____ 0/1 D30.3 Large woody debris > 10cm diameter present in AU
_____ 0/1 D30.4 Plant litter > 10 square meters with no soil surface showing
_____ 0/1 D30.5 Presence of erect emergent vegetation within the area of extended inundation (> 10 square meters)

_____ 0/1 D31 Steep banks of fine material (>45 degrees slope, >10m long, >0.6m high) *may be a dike*
_____ 0/1 D32 Impacts of grazing in AU or in its buffer (within 100m)
_____ 0/1 D33 Carp present in AU - evidence or source_____
_____ 0/1 D34 Fish, other than carp, present in AU - evidence or source _____
_____ 0/1 D35 Bullfrogs present in AU - evidence or source _____

D36 Interspersion between open water and persistent vegetation

_____ [0-3] D36.1 Rating interspersion between persistent erect vegetation and areas of extended, **open**, inundation

Choose the diagram that best fits field conditions and record rating above



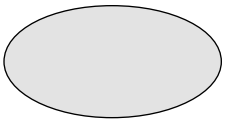
WETLAND NAME_____**(long duration)** **ID # AU-**

_____ [0-3] D37 Rating interspersion between different structure categories of vegetation **(use pictures below)**

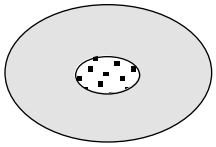
Count a structure category ***only if marked in D20***

0 - 30 cm emergent
31 - 100 cm emergent
> 100 cm emergent
Scrub/shrub
Attached aquatic bed plants

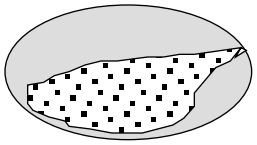
**AUs with only 1 structure in D20 rate a 0*
**AUs with only 2 structure categories in D20 can only rate a moderate[2] or low [1]*
** AUs with 3 categories can rate a moderate (2) or a high (3)*
****AUs with 4 or 5 categories rate a high (3)***



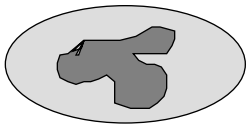
none [rating = 0]



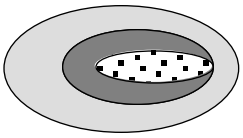
low [=1]



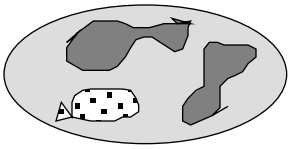
low [=1]



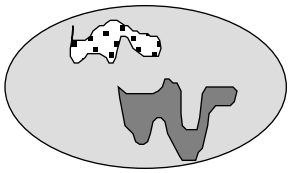
moderate [=2]



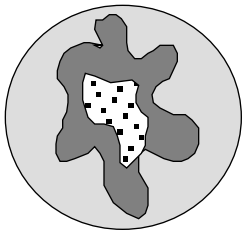
moderate [=2]



high [=3]



high [=3]



high [=3]

D38 Edge of AU

_____ ratio D38.1 Ratio of edge of AU to length (estimate of sinuousity by calculating circumference/length)

_____ 0/1 D38.2 Is the difference in vegetation height along the edge of the AU greater than 2m for at least 25% of the circumference?
(within 2 m of the edge)

WETLAND NAME_____(long duration) **ID # AU-**

_____ [0-5] D39 BUFFER of AU: Choose the description that best represents condition of buffer of AU

Rating

** Open water or adjacent wetlands are considered part of the buffer*
**Infrequently used gravel or paved roads or vegetated dikes in a relatively undisturbed buffer can be ignored as a "disturbance"*

5 **100 m (330ft) of relatively undisturbed (no grazing in last 2 yrs.)** naturally vegetated areas, rocky areas, or open water >95% of circumference. No developed areas within undisturbed part of buffer

4 **100 m (330 ft) of relatively undisturbed (no grazing in last 2 yrs.)** naturally vegetated areas, rocky areas, or open water > 50% circumference **OR** 50 m (170ft) of naturally vegetated areas, rocky areas, or open water >95% circumference. No developed areas within undisturbed part of buffer

3 **100 m (330ft) of relatively undisturbed (not grazing in last 2 yrs.)** naturally vegetated areas, rocky areas, or open water > 25% circumference, **OR** 50 m (170ft) of relatively undisturbed naturally vegetated areas, rocky areas, or open water > 50% circumference

If AU does not meet any criteria above

2 **No paved areas** or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. OR no paved areas or buildings within 50m of wetland >50% circumference

0 **Vegetated buffers are <2m** wide (6.6ft) for more than 95% of the circumference

1 **Heavy grazing or does not meet any of the criteria above**

_____ 0/1 D40 Does the AU have a surface water inflow through any type of stream, channel, ditch, or pipe?

D41 Rate the impact of current human disturbances in AU and its buffer for the following activities
Give a rating of [2] for high impact use; [1] for low impact; and [0] for not an impact

_____ [0-2] D41.1 Boating
_____ [0-2] D41.2 Fishing
_____ [0-2] D41.3 Hunting and/or target practice
_____ [0-2] D41.4 Passive recreation (e.g. bird watching, biking, etc.)
_____ [0-2] D41.5 Grazing
_____ [0-2] D41.6 Permanent development- roads
_____ [0-2] D41.7 Permanent development- residential and urban
_____ [0-2] D41.8 Other impacts not listed above

D42 Structures in buffer (within 100m of AU edge)

_____ 0/1 D42.1 Upland trees
_____ 0/1 D42.2 Shrubs
_____ 0/1 D42.3 Rock outcrops, cliffs, fractured basalts
_____ 0/1 D42.4 Talus slopes, boulder fields
_____ 0/1 D42.5 Downed woody debris > 10 cm diameter, tumbleweed, snags

WETLAND NAME_____**(long duration)** **ID # AU-**

D43 Connections of AU: Rate corridors and connections using following key *(record rating of 0,1,2,or 3)*

_____ [0-3] D43.1 1) Is the AU connected to another wetland within 1 km by a riparian corridor ?

If YES go to question # 2 If NO go to question #4

2) Does the riparian corridor have permanent water at least 0.5 m deep in most places?

If NO go to question # 3 **If YES = [3]**

3) Does the riparian corridor have seasonal water at least 0.5 m deep in most places or permanent water between 5 - 50 cm?

If NO = [1] **If YES = [2]**

4)Is AU within 1 km of any permanent stream, open water or other wetland?

If NO = [0] **If YES = [1]**

_____ [0-3] D43.2

1) Is the AU connected to another wetland within 1 km by a relatively undisturbed vegetated corridor (either upland or riparian) (>5% cover of vegetation) that is at least 5m wide?

If YES go to question # 2 If NO go to question #4

2) Is the AU connected by a vegetated corridor that is >= 5m wide with >=75% plant cover

If NO go to question # 3 **If YES = [3]**

3) Is the AU connected by a vegetated corridor that is >= 5m wide with >=30% plant cover

If NO = [1] **If YES = [2]**

4) Is the AU within 1 km of any vegetated corridor or natural area with at least 75% vegetation cover?

If NO = [0] **If YES = [1]**

SOILS and SUBSTRATES in Areas of Seasonal Inundation

worksheet for sampling in the field

Soil	**site 1**	**site 2**	**site 3**	**site 4**
Peat (undecomposed organic soil)	☐	☐	☐	☐
Decomposed Organic Soil	☐	☐	☐	☐
>20% organic, dark stains on fingers, do not confuse with mineral soils that have some organic (<20%)				
Mineral with clay fraction <30%	☐	☐	☐	☐
Mineral Clay (clay fraction >30%)	☐	☐	☐	☐
Organic surface layer (duff) *Record only if present*				
Un-decomposed duff layer	☐	☐	☐	☐
Decomposed duff layer	☐	☐	☐	☐
Infiltration rate	____	____	____	____

D44 Spatially Dominant Soil Types near surface in areas of seasonal inundation

Record the number of times each type was checked off (maximum of 4)

_____ [0-4] D44.1 Peat (undecomposed organic soil)

_____ [0-4] D44.2 Decomposed Organic Soil

_____ [0-4] D44.3 Mineral with clay fraction <30%

_____ [0-4] D44.4 Clay (clay fraction >30%)

Record the soil type in the top soil layer (1-15cm) located immediately below any surface accumulation of recently deposited plant material

D45 Duff Layer *(Record the number times checked off above)*

_____ [0-4] D45.1 Un-decomposed duff layer

_____ [0-4] D45.2 Decomposed duff layer (organic)

WETLAND NAME_____(long duration) **ID # AU-**

D46 Types of surfaces present anywhere in AU

_____ 0/1 D46.1 Un-decomposed duff layer (except pine needles)

_____ 0/1 D46.2 Decomposed duff layer (organic)

_____ 0/1 D46.3 Fines (clays and silt)

_____ 0/1 D46.4 Coarse materials (sand or coarser)

Record a 1 for each category present if its area is > 10 square meters. Note: bare earth from animal tunnels does NOT count

_____ 0/1 D46.5 > 25% cover of pine needles in seasonally or extended inundated areas

D47 Infiltration rate of soils in seasonally inundated areas

_____ 0/1 D47.1 Fast >50% sand, and the rest cobbles, gravel, loamy sand, or sandy loam

_____ 0/1 D47.2 Slow - anything else

** Record the infiltration rate of the least permeable layer if there are several down to 60cm. Least permeable layer needs to be at least 2cm deep.*
** Record infiltration rate of soils with greatest areal extent (3 or 4 soil pits).*
** If 2 pits are "Fast" and 2 pits are "Slow" record as "Fast"*

COMMENTS and NOTES

Appendix 2-B Data Form for Depressional Freshwater Short-duration Wetlands and Classification Key

Washington Wetland Function Assessments

Classification Key
Columbia Basin

Wetland Name_____**ID #**_____
Location _____**Date**_____

1. Is the wetland contiguous with > 8 ha (20 acres) of perennially inundated open water; where at least 30% of open water area is deeper than 3 m (10 ft)?

NO – go to Step 2
YES – Lacustrine Fringe

2 Is the wetland on a slope (note that slope can be very gradual), and does the water flow through the wetland in one direction (unidirectional) and exit the wetland without being impounded? Much of the flow is in the shallow subsurface zone and results in saturated conditions with little surface water present. The source of water is primarily from seeps or precipitation. If any surface flow is present it is typically not confined to a single channel.

NO - go to Step 3
YES – Slope

3. Is the wetland in a valley or stream channel where it gets flooded more than once every two years by overbank flooding from that stream or river?

NO - go to Step 4
YES – Riverine

4.. Is the wetland in a topographic depression where surface water is present at some point in the year and the surface water has an average conductivity **greater** than 2.0 milliSiemens (or millimhos). Vertical fluctuations in the wetland water levels are the dominant type of water movement.

NO – go to Step 5
YES – Depressional Alkali

5. Is the wetland in a topographic depression where surface water is present for **9 months or more** (this includes wetlands with permanent surface water) in most years (>5 out of 10 years)?

NO – Depressional Short-duration (This includes wetlands with periods of surface inundation that range from 2 weeks to 9 months. Areas where water remains less than 2 months, however do not develop the characteristic wetland vegetation).
YES – Depressional Long-duration

WETLAND NAME_____ **ID # AU-**

Date _____ Data collected by:_____

Columbia Basin
Depressional - Freshwater - Short Duration

Data Sheet is to be used in conjunction with written guidance

AU = Assessment Unit: the area of wetland being assessed

Record only numbers, yes/no answers are recorded as a [1] or [0]

Estimate/ Score/ Rating

Average Conductivity _____milliSiemens

LANDSCAPE DATA

_____ ha	D1	Area of AU
_____ ha	D2	Area of contributing basin (upgradient watershed, including AU)
_____ 0-2	D2.1	Average slope of contributing basin (<1% = 0, 1-5% = 1, >5% = 2)
_____ 0/1	D3	AU is within boundaries of the Reclamation Project
_____ 0/1	D4	AU has a water levels that are dominated by irrigation practices or by a manipulated water storage

D5 Land use (as % of total area) within 1km of AU (include contiguous AUs of different class)

_____ %	D5.1	Natural areas - forests, grasslands, undeveloped areas, rocks, other wetlands, and open water
_____ %	D5.2	Untilled agriculture (pasture, grazing)
_____ %	D5.3	Agriculture -tilled and irrigated
_____ %	D5.4	Agriculture - tilled and not irrigated
_____ %	D5.5	Urban/commercial
_____ %	D5.6	High density residential (> 1residence/acre)
_____ %	D5.7	Low density residential (<= 1 residence/acre) and/or roads
_____ %	D5.8	Not fitting above categories

Golf courses enter under D5.3, gravel pits under D5.5, unpaved roads and docks under D5.7.

D6 Habitat types within 1km of AU

_____ 0/1	D6.1	Forest (tree cover >30%)
_____ 0/1	D6.2	Riverine
_____ 0/1	D6.3	Shrub steppe
_____ 0/1	D6.4	Unvegetated talus and/or cliffs
_____ 0/1	D6.5	Other natural areas, open water, and/or other wetlands

Habitat type must be at least 0.1 ha in size (1/4 acre) to count. For natural habitat/areas such as grasslands, sand dunes, lithosols enter them under D6.5

D7 Land use (as % of total area) in contributing basin *(include AU in contributing basin)*

_____ %	D7.1	Natural areas - forests, grasslands, undeveloped areas, rocks, other wetlands, and open water
_____ %	D7.2	Untilled agriculture (pasture, grazing)
_____ %	D7.3	Agriculture -tilled and irrigated
_____ %	D7.4	Agriculture - tilled and not irrigated
_____ %	D7.5	Urban/commercial
_____ %	D7.6	High density residential (> 1residence/acre)
_____ %	D7.7	Low density residential (<= 1 residence/acre) and/or roads
_____ %	D7.8	Not fitting above categories

Golf courses enter under D7.3, gravel pits under D7.5, unpaved roads and docks under D7.7.

WETLAND NAME_____**(short duration)** **ID # AU-**

Land uses in contributing basin that generate sediments

_____ 0/1 D7.9 Are there tilled fields in the contributing basin close to the AU (within 1km)?
_____ 0/1 D7.10 Are there pastures or grazed rangelands in contributing basin close to the AU (within 1km)?
_____ 0/1 D7.11 Are there urban/commercial areas in contributing basin close to AU (within 1km)?
_____ 0/1 D7.12 Are there high density residential areas in contributing basin close to AU (within 1km)?

D8 Different wetland hydrogeomorphic types and streams within **2km** of AU

_____ 0/1 D8.1 Depressional - Freshwater- long duration
_____ 0/1 D8.2 Depressional - Freshwater - short duration
_____ 0/1 D8.3 Depressional - Alkali
_____ 0/1 D8.4 Riverine
_____ 0/1 D8.5 Lacustrine
_____ 0/1 D8.6 Slope - (seeps)
_____ 0/1 D8.7 Perennial stream or river
_____ 0/1 D8.8 A depressional wetland with permanent water

WATER REGIME

_____ 0/1 D9 AU has a surface water outflow during some time of the year

D10 Duration and Area of Inundation *No size thresholds for D10*

_____ % D10.1 Percent of AU that is ponded or inundated in most years
_____ % D10.2 Percent of AU that is ponded or inundated for > 2 months out of the year

NOTE: D10.1>= D10.2

_____ % D10.5 Percent of AU with unvegetated bars or mudflats

D11 Inundation regimes (Types of water regimes present in the AU)

_____ 0/1 D11.2 "Seasonal inundation" - Inundated for 2 - 9 months
_____ 0/1 D11.3 "Brief inundation"- Inundated < 2 months (*count only if within AU boundary*)
_____ 0/1 D11.4 Saturated but seldom inundated

Size threshold for each regime: 0.1ha or 10% of AU

_____ 0/1 D11.6 Intermittent stream *(make sure it meets size threshold)*

D12 Depths of annual inundation

_____ m D12.1 Maximum depth of "Brief " inundation (<2 months) above lowest point of AU
_____ m D12.2 Maximum depth of "Seasonal" inundation (2-9 months)
(record to nearest 0.3 m: 0m, 0.3m, 0.6m, 0.9m, 1.2m etc.)

NOTE: D12.1>= D12.2

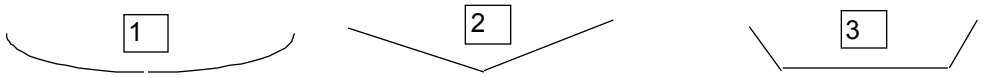
WETLAND NAME_____**(short duration)** **ID # AU-**

D13 Topographic cross-section of area of annual inundation

_____ 0/1 D13.1 Cross section 1

_____ 0/1 D13.2 Cross section 2

_____ 0/1 D13.3 Cross section 3



_____ m D15 Width of outlet (if no outlet record 0m)

VEGETATION

D16 Cowardin Vegetation classes in AU (as % area of AU)

Size threshold for each class: 0.1ha or 10% of AU

_____ % D16.1 Forest

_____ % D16.2 Scrub-shrub

_____ % D16.3 Emergent

_____ % D16.4 Aquatic Bed

If vegetation types are patchy, add patches to meet threshold if patches that are greater than 100m2 (~1000ft2)
Do not include filamentous algae or mosses for D16.4

MAKE SURE D10.4 + D10.5 + D16.1 + D16.2 + D16.3 + D16.4 = 100

_____ % D17 % area of herbaceous understory **in forest and shrub areas** (not % area in entire AU)

_____ 0/1 D18 Aquatic bed plants and emergent are dominant in same area at different seasons

_____ 0/1 D19 Filamentous algal mats present over more than 10 square meters

D20 Structure categories in vegetation

Size threshold for each category: 0.1ha or 10% of AU

_____ 0/1 D20.1 0 - 30 cm emergent

_____ 0/1 D20.2 31 - 100 cm emergent

_____ 0/1 D20.3 > 100 cm emergent

_____ 0/1 D20.4 Scrub/shrub

_____ 0/1 D20.5 Rooted aquatic bed plants (not to be confused with Cowardin Class)

D21 Plant Richness

Exclude mosses, algae, and liverworts

_____ # D21.1 Record number of native plant species found in AU

_____ # D21.2 Record number of non- native plant species found in AU

_____ # D21.3 Record the number of aquatic bed plant species

D22 Special plant species within AU

Scoring D22:
0 - plant species is not present in AU
1 - species is present but not dominant or co-dominant
2 - area of AU covered is <25% as dominant or co-dominant
3 - area of AU covered is 26-50%
4 - area of AU covered is 51-75%
5 - area of AU covered is 76-100%

_____ 0-5 D22.1 Milfoil

_____ 0-5 D22.2 Purple loosestrife

_____ 0-5 D22.3 Phragmites

WETLAND NAME_____**(short duration)** **ID # AU-**

note presence only of following

_____ 0/1 D23.1 *Scirpus* spp present in AU

D24 Area (%) of AU where non-native are dominant or co-dominant

_____ 0/1 D24.1 % area of non-native species >75%

_____ 0/1 D24.2 % area of non-native species 50-75%

_____ 0/1 D24.3 %area of non-native species 25-49%

_____ 0/1 D24.4 % area of non-native species 1-24%

_____ 0/1 D24.5 NO cover of non-natives in the AU

HABITAT CHARACTERISTICS

_____ [4-12] D25 pH of open or standing water (average of at least 2 locations) ***record a 7 if no standing water***

_____ 0/1 D27 Salt residues present in or at edge of AU

_____ 0/1 D28 Drains or tiles present in AU that reduce residence time of surface waters

_____ in. D29 Average annual precipitation in AU

D30 Structures for refuge within AU

_____ 0/1 D30.1 Rocks >10cm present in areas inundated for more than 2 months

_____ 0/1 D30.2 Snags present in AU (not in buffer)

_____ 0/1 D30.3 Large woody debris > 10cm diameter present in AU

_____ 0/1 D30.4 Plant litter > 10 square meters with no soil surface showing

_____ 0/1 D31 Steep banks of fine material (>40 degrees slope, >10m long, >0.6m high) *may be a dike*

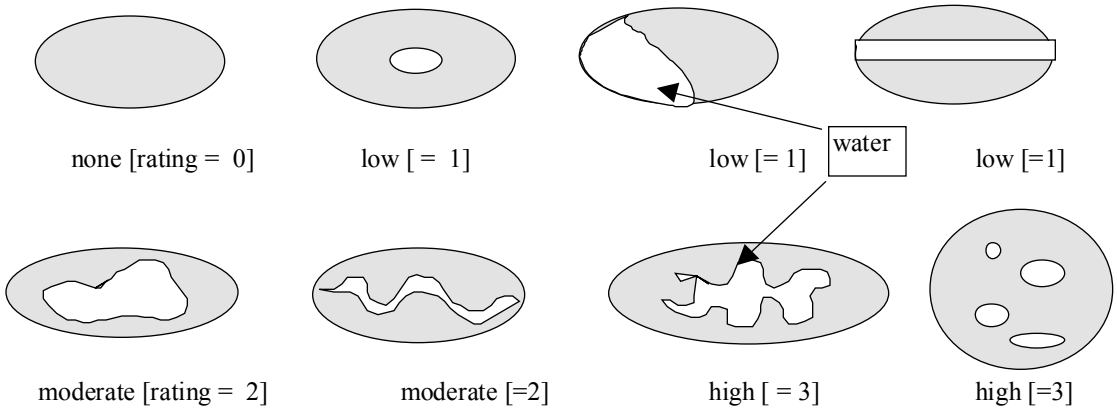
_____ 0/1 D32 Impacts of grazing in AU or in its buffer (within 100m)

_____ 0/1 D35 Bullfrogs present in AU - evidence or source _____

D36 Interspersion between open water and persistent vegetation

_____ [0-3] D36.2 Interspersion between persistent erect vegetation and **open** surface water in AU (when inundated)

Choose the diagram that best fits field conditions and record rating above



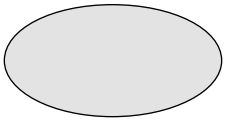
WETLAND NAME_____(short duration) **ID # AU-**

_____ [0-3] D37 Rating interspersion between different structure categories of vegetation **(use pictures below)**

Count a structure category ***only if marked in D20***

0 - 30 cm emergent
31 - 100 cm emergent
> 100 cm emergent
Scrub/shrub
Attached aquatic bed plants

**AUs with only 1 structure in D20 rate a 0*
**AUs with only 2 structure categories in D20 can only rate a moderate[2] or low [1]*
** AUs with 3 categories can rate a moderate (2) or a high (3)*
****AUs with 4 or 5 categories rate a high (3)***



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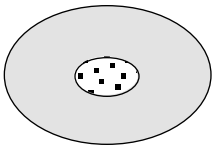

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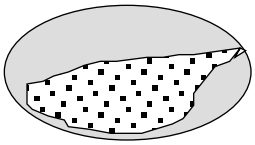

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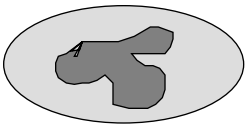

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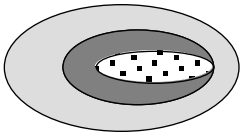
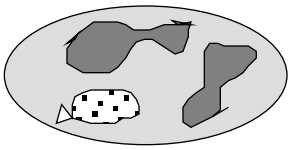
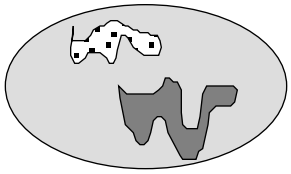


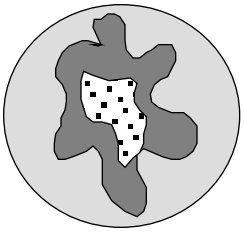
moderate [=2]



high [=3]



high [=3]



high [=3]

D38 Edge of AU

_____ ratio D38.1 Ratio of edge of AU to length (estimate of sinuousity by calculating circumference/length)

_____ 0/1 D38.2 Is the difference in vegetation height along the edge of the AU greater than 2m for at least 25% of the circumference?
(within 2 m of the edge)

WETLAND NAME_____(short duration) **ID # AU-**

_____ [0-5] D39 BUFFER of AU: Choose the description that best represents condition of AU buffer

Rating

** Open water or adjacent wetlands are considered part of the buffer*
**Infrequently used gravel or paved roads or vegetated dikes in a relatively undisturbed buffer can be ignored as a "disturbance"*

5 **100 m (330ft) of relatively undisturbed (no grazing in last 2 yrs.)** naturally vegetated areas, rocky areas, or open water >95% of circumference. No developed areas within undisturbed part of buffer

4 **100 m (330 ft) of relatively undisturbed (no grazing in last 2 yrs.)** naturally vegetated areas, rocky areas, or open water > 50% circumference **OR** 50 m (170ft) of naturally vegetated areas, rocky areas, or open water >95% circumference. No developed areas within undisturbed part of buffer

3 **100 m (330ft) of relatively undisturbed (not grazing in last 2 yrs.)** naturally vegetated areas, rocky areas, or open water > 25% circumference, **OR** 50 m (170ft) of relatively undisturbed naturally vegetated areas, rocky areas, or open water > 50% circumference

If AU does not meet any criteria above

2 **No paved areas** or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. OR no paved areas or buildings within 50m of wetland >50% circumference

0 **Vegetated buffers are <2m** wide (6.6ft) for more than 95% of the circumference

1 **Heavy grazing or does not meet any of the criteria above**

_____ 0/1 D40 Does the AU have a surface water inflow through any type of stream, channel, ditch, or pipe?

D41 Rate the impact of current human disturbances in AU and its buffer for the following activities
Give a rating of [2] for high impact use; [1] for low impact; and [0] for not an impact

_____ [0-2] D41.1 Boating
_____ [0-2] D41.2 Fishing
_____ [0-2] D41.3 Hunting and/or target practice
_____ [0-2] D41.4 Passive recreation (e.g. bird watching, biking, etc.)
_____ [0-2] D41.5 Grazing
_____ [0-2] D41.6 Permanent development- roads
_____ [0-2] D41.7 Permanent development- residential and urban
_____ [0-2] D41.8 Other impacts not listed above

D42 Structures in buffer (within 100m of AU edge)

_____ 0/1 D42.1 Upland trees
_____ 0/1 D42.2 Shrubs
_____ 0/1 D42.3 Rock outcrops, cliffs, fractured basalts
_____ 0/1 D42.4 Talus slopes, boulder fields
_____ 0/1 D42.5 Downed woody debris > 10 cm diameter, tumbleweed, snags

WETLAND NAME_____**(short duration)** **ID # AU-**

D43 Connections of AU: Rate corridors and connections using following key *(record rating of 0,1,2,or 3)*

_____ [0-3] D43.1

1) Is the AU connected to another wetland within 1 km by a riparian corridor ?
If YES go to question # 2 If NO go to question #4

2) Does the riparian corridor have permanent water at least 0.5 m deep in most places?
If NO go to question # 3 **If YES = [3]**

3) Does the riparian corridor have seasonal water at least 0.5 m deep in most places or permanent water between 5 - 50 cm?
If NO = [1] **If YES = [2]**

4)Is AU within 1 km of any permanent stream, open water or other wetland?
If NO = [0] **If YES = [1]**

_____ [0-3] D43.2 1) Is the AU connected to another wetland within 1 km by a relatively undisturbed vegetated corridor (either upland or riparian) (>5% cover of vegetation) that is at least 5m wide?
If YES go to question # 2 If NO go to question #4

2) Is the AU connected by a vegetated corridor that is >= 5m wide with >=75% plant cover
If NO go to question # 3 **If YES = [3]**

3) Is the AU connected by a vegetated corridor that is >= 5m wide with >=30% plant cover
If NO = [1] **If YES = [2]**

4) Is the AU within 1 km of any vegetated corridor or natural area with at least 75% vegetation cover?
If NO = [0] **If YES = [1]**

SOILS and SUBSTRATES in Areas of Seasonal Inundation
worksheet for sampling in the field

Soil	**site 1**	**site 2**	**site 3**	**site 4**
Peat (undecomposed organic soil)	☐	☐	☐	☐
Decomposed Organic Soil	☐	☐	☐	☐
>20% organic, dark stains on fingers, do not confuse with mineral soils that have some organic (<20%)				
Mineral with clay fraction <30%	☐	☐	☐	☐
Mineral Clay (clay fraction >30%)	☐	☐	☐	☐
Organic surface layer (duff) *Record only if present*				
Un-decomposed duff layer	☐	☐	☐	☐
Decomposed duff layer	☐	☐	☐	☐
Infiltration rate	____	____	____	____

D44 Spatially Dominant Soil Types near surface in areas of seasonal inundation
Record the number of times each type was checked off (maximum of 4)

_____ [0-4] D44.1 Peat (undecomposed organic soil)
_____ [0-4] D44.2 Decomposed Organic Soil
_____ [0-4] D44.3 Mineral with clay fraction <30%
_____ [0-4] D44.4 Clay (clay fraction >30%)

Record the soil type in the top soil layer (1-15cm) located immediately below any surface accumulation of recently deposited plant material

D45 Duff Layer *(Record the number times checked off above)*

_____ [0-4] D45.1 Un-decomposed duff layer
_____ [0-4] D45.2 Decomposed duff layer (organic)

WETLAND NAME_____(short duration) **ID # AU-**

D46 Types of surfaces present anywhere in AU

_____ 0/1 D46.1 Un-decomposed duff layer (except pine needles)

_____ 0/1 D46.2 Decomposed duff layer (organic)

_____ 0/1 D46.3 Fines (clays and silt)

_____ 0/1 D46.4 Coarse materials (sand or coarser)

_____ 0/1 D46.5 > 25% cover of pine needles in seasonally or extended inundated areas

Record a 1 for each category present if its area is > 10 square meters. Note: bare earth from animal tunnels does NOT count

D47 Infiltration rate of soils in seasonally inundated areas

_____ 0/1 D47.1 Fast >50% sand, and the rest cobbles, gravel, loamy sand, or sandy loam

_____ 0/1 D47.2 Slow - anything else

** Record the infiltration rate of the least permeable layer if there are several down to 60cm. Least permeable layer needs to be at least 2cm deep.*
** Record infiltration rate of soils with greatest areal extent (3 or 4 soil pits).*
** If 2 pits are "Fast" and 2 pits are "Slow" record as "Fast"*

COMMENTS and NOTES

Appendix 2-C Data Form for Depressional Alkali Wetlands and Classification Key

Washington Wetland Function Assessments

Classification Key
Columbia Basin

Wetland Name_____**ID #**_____
Location _____**Date**_____

1. Is the wetland contiguous with > 8 ha (20 acres) of perennially inundated open water; where at least 30% of open water area is deeper than 3 m (10 ft)?

NO – go to Step 2
YES – Lacustrine Fringe

2 Is the wetland on a slope (note that slope can be very gradual), and does the water flow through the wetland in one direction (unidirectional) and exit the wetland without being impounded? Much of the flow is in the shallow subsurface zone and results in saturated conditions with little surface water present. The source of water is primarily from seeps or precipitation. If any surface flow is present it is typically not confined to a single channel.

NO - go to Step 3
YES – Slope

3. Is the wetland in a valley or stream channel where it gets flooded more than once every two years by overbank flooding from that stream or river?

NO - go to Step 4
YES – Riverine

4.. Is the wetland in a topographic depression where surface water is present at some point in the year and the surface water has an average conductivity **greater** than 2.0 milliSiemens (or millimhos). Vertical fluctuations in the wetland water levels are the dominant type of water movement.

NO – go to Step 5
YES – Depressional Alkali

5. Is the wetland in a topographic depression where surface water is present for **9 months or more** (this includes wetlands with permanent surface water) in most years (>5 out of 10 years)?

NO – Depressional Short-duration (This includes wetlands with periods of surface inundation that range from 2 weeks to 9 months. Areas where water remains less than 2 months, however do not develop the characteristic wetland vegetation).
YES – Depressional Long-duration

WETLAND NAME_____ **ID # AU-**

Date _____ Data collected by:_____

Columbia Basin Depressional - Alkali

Data Sheet is to be used in conjunction with written guidance

AU = Assessment Unit: the area of wetland being assessed

Record only numbers, yes/no answers are recorded as a [1] or [0]

Estimate/ Score/ Rating

Average Conductivity _____milliSiemens

LANDSCAPE DATA

_____ ha D1 Area of AU

_____ ha D2 Area of contributing basin (upgradient watershed, including AU)

_____ 0-2 D2.1 Average slope of contributing basin (<1% = 0, 1-5% = 1, >5% = 2)

D5 Land use (as % of total area) within 1km of AU (include contiguous AUs of different class)

_____ % D5.1 Natural areas - forests, grasslands, undeveloped areas, rocks, other wetlands, and open water

_____ % D5.2 Untilled agriculture (pasture, grazing)

_____ % D5.3 Agriculture -tilled and irrigated

_____ % D5.4 Agriculture - tilled and not irrigated

_____ % D5.5 Urban/commercial

_____ % D5.6 High density residential (> 1residence/acre)

_____ % D5.7 Low density residential (<= 1 residence/acre) and/or roads

_____ % D5.8 Not fitting above categories

Golf courses enter under D5.3, gravel pits under D5.5, unpaved roads and docks under D5.7.

D6 Habitat types within 1km of AU

_____ 0/1 D6.1 Forest (tree cover >30%)

_____ 0/1 D6.2 Riverine

_____ 0/1 D6.3 Shrub steppe

_____ 0/1 D6.4 Unvegetated talus and/or cliffs

_____ 0/1 D6.5 Other natural areas, open water, and/or other wetlands

Habitat type must be at least 0.1 ha in size (1/4 acre) to count. For natural habitat/areas such as grasslands, sand dunes, lithosols enter them under D6.5.

D7 Land use in contributing basin (as % of total area) *(include AU in contributing basin)*

_____ % D7.1 Natural areas - forests, grasslands, undeveloped areas, rocks, other wetlands, and open water

_____ % D7.2 Untilled agriculture (pasture, grazing)

_____ % D7.3 Agriculture -tilled and irrigated

_____ % D7.4 Agriculture - tilled and not irrigated

_____ % D7.5 Urban/commercial

_____ % D7.6 High density residential (> 1residence/acre)

_____ % D7.7 Low density residential (<= 1 residence/acre) and/or roads

_____ % D7.8 Not fitting above categories

Golf courses enter under D7.3, gravel pits under D7.5, unpaved roads and docks under D7.7.

WETLAND NAME_____(alkali) **ID # AU-**

Land uses in contributing basin that generate sediments

_____ 0/1 D7.9 Are there tilled fields in the contributing basin close to the AU (within 1km)?
_____ 0/1 D7.10 Are there pastures or grazed rangelands in contributing basin close to the AU (within 1km)?
_____ 0/1 D7.11 Are there urban/commercial areas in contributing basing close to AU (within 1km)?
_____ 0/1 D7.12 Are there high density residential areas in contributing basing close to AU (within 1km)?

D8 Different wetland hydrogeomorphic types and streams within **2km** of AU

_____ 0/1 D8.1 Depressional - Freshwater- long duration
_____ 0/1 D8.2 Depressional - Freshwater - short duration
_____ 0/1 D8.3 Depressional - Alkali
_____ 0/1 D8.4 Riverine
_____ 0/1 D8.5 Lacustrine
_____ 0/1 D8.6 Slope - (seeps)
_____ 0/1 D8.7 Perennial stream or river

WATER REGIME

_____ 0/1 D9 AU has a surface water outflow during some time of the year

D10 Duration and Area of Inundation

_____ % D10.1 Percent of AU that is ponded or inundated in most years *No size thresholds for D10*
_____ % D10.2 Percent of AU that is ponded or inundated for > 2 months out of the year
_____ % D10.3 Percent of AU that is ponded or inundated for > 9 months each year (includes vegetated areas)

D10.3 includes all areas of permanent surface water

_____% D10.4 Percent of AU with open water > 9 months each year (include areas of floating algal mats)
_____ % D10.5 Percent of AU with unvegetated bars or mudflats
_____ 0/1 D10.6 The AU has areas that are permanently inundated (for 12 months in 9 out of 10 years)

NOTE: D10.1>= D10.2>= D10.3 >= D10.4

D11 Inundation regimes (Types of water regimes present in the AU)

_____ 0/1 D11.1 "Extended inundation"- Areas inundated >9 months (include vegetated areas)
_____ 0/1 D11.2 "Seasonal inundation" - Inundated for 2 - 9 months
_____ 0/1 D11.3 "Brief inundation"- Inundated < 2 months (*count only if within AU boundary*)
_____ 0/1 D11.4 Saturated but seldom inundated
_____ 0/1 D11.6 Intermittent stream *(make sure it meets size threshold)*

Size threshold for each regime:
0.1ha or 10% of AU

D12 Depths of annual inundation

_____ m D12.1 Maximum depth of "Brief " inundation (<2 months) above "Extended" inundation
_____ m D12.2 Maximum depth of "Seasonal" inundation (2-9 months)
(record to nearest 0.3 m: 0m, 0.3m, 0.6m, 0.9m, 1.2m etc.)

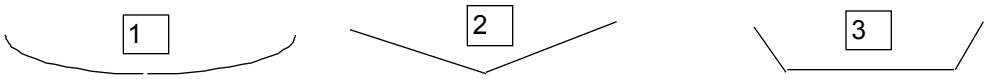
NOTE: D12.1>= D12.2

WETLAND NAME_____**(alkali)** **ID # AU-**

D13 Topographic cross-section of area of annual (brief and seasonal) inundation

_____ 0/1 D13.1 Cross section 1
_____ 0/1 D13.2 Cross section 2
_____ 0/1 D13.3 Cross section 3

Use surface of extended inundation as bottom for AUs with this hydrologic feature.



D14 Water depths in areas with extended inundation

Size Threshold for each water depth category: 0.1ha or 10% of AU

_____ 0/1 D14.1 0-50cm (<20in)
_____ 0/1 D14.2 50-130cm(20-51in)
_____ 0/1 D14.3 >130cm (>51in)
_____ 0/1 D14.4 Water depth in permanent surface water is greater than 130 cm (51 inches).
_____ m D15 Width of outlet (if no outlet record 0m)

VEGETATION

D16 Cowardin Vegetation classes in AU (as % area of AU)

Size threshold for each class: 0.1ha or 10% of AU

_____% D16.1 Forest
_____% D16.2 Scrub-shrub
_____% D16.3 Emergent
_____% D16.4 Aquatic Bed

If vegetation types are patchy, add patches to meet threshold if patches that are greater than 100m^2 (~1000ft^2)
Do not include filamentous algae or mosses for D16.4

MAKE SURE D10.4 + D10.5 + D16.1 + D16.2 + D16.3 + D16.4 = 100

_____% D17 % area of herbaceous understory **in forest and shrub areas** (not % area in entire AU)
_____ 0/1 D18 Aquatic bed plants and emergent are dominant in same area at different seasons
_____ 0/1 D19 Algal mats present over more than 10 square meters

D20 Structure categories in vegetation

Size threshold for each category: 0.1ha or 10% of AU

_____ 0/1 D20.1 0 - 30 cm emergent
_____ 0/1 D20.2 31 - 100 cm emergent
_____ 0/1 D20.3 > 100 cm emergent
_____ 0/1 D20.4 Scrub/shrub
_____ 0/1 D20.5 Rooted aquatic bed plants (not to be confused with Cowardin Class)

D21 Plant Richness

Exclude mosses, algae, and liverworts

_____# D21.1 Record number of native plant species found in AU
_____# D21.2 Record number of non- native plant species found in AU
_____# D21.3 Record the number of aquatic bed plant species

D22 Special plant species within AU

Scoring D22:
0 - plant species is not present in AU
1 - species is present but not dominant or co-dominant
2 - area of AU covered is <25% as dominant or co-dominant
3 - area of AU covered is 26-50%
4 - area of AU covered is 51-75%
5 - area of AU covered is 76-100%

_____ 0-5 D22.2 Purple loosestrife
_____ 0-5 D22.3 Phragmites

WETLAND NAME_____**(alkali)** **ID # AU-**

D23

D24 Area (%) of AU where non-native are dominant or co-dominant

_____ 0/1 D24.1 % area of non-native species >75%
_____ 0/1 D24.2 % area of non-native species 50-75%
_____ 0/1 D24.3 %area of non-native species 25-49%
_____ 0/1 D24.4 % area of non-native species 1-24%
_____ 0/1 D24.5 NO cover of non-natives in the AU

HABITAT CHARACTERISTICS

_____ [4-12] D25 pH of open or standing water (average of at least 2 locations) ***record a 7 if no standing water***

_____ 0/1 D27 Salt residues present in or at edge of AU
_____ 0/1 D28 Drains or tiles present in AU that reduce residence time of surface waters
_____ in. D29 Average annual precipitation in AU

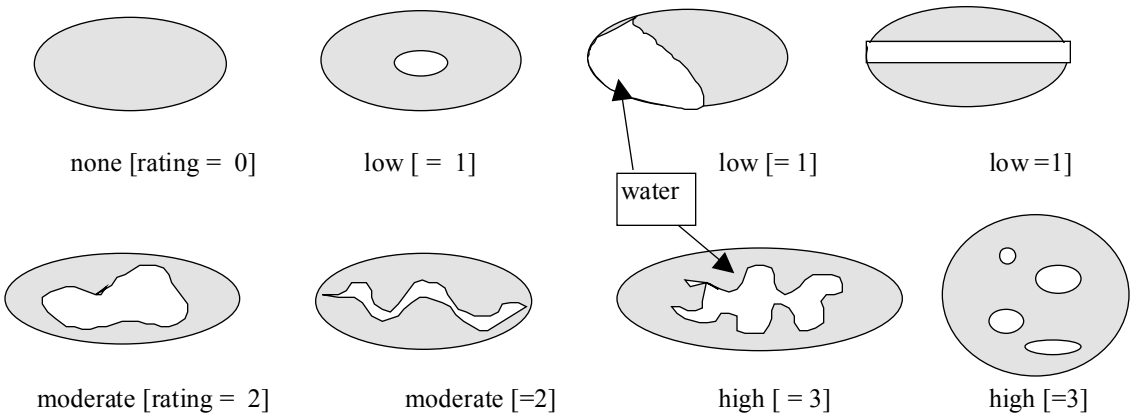
D30 Structures for refuge within AU

_____ 0/1 D30.1 Rocks >10cm present in areas inundated for more than 2 months
_____ 0/1 D30.2 Snags present in AU (not in buffer)
_____ 0/1 D30.3 Large woody debris > 10cm diameter present in AU
_____ 0/1 D30.4 Plant litter > 10 square meters with no soil surface showing
_____ 0/1 D30.5 Presence of erect emergent vegetation within the area of extended inundation (> 10 square meters)
_____
_____ 0/1 D31 Steep banks of fine material (>45 degrees slope, >10m long, >0.6m high) *may be a dike*
_____ 0/1 D32 Impacts of grazing in AU or in its buffer (within 100m)

D36 Interspersion between open water and persistent vegetation

_____ [0-3] D36.1 Rating interspersion between persistent erect vegetation and areas of extended, **open**, inundation

Choose the diagram that best fits field conditions and record rating above



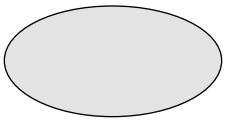
WETLAND NAME_____(alkali) **ID # AU-**

_____ [0-3] D37 Rating interspersion between different structure categories of vegetation **(use pictures below)**

Count a structure category ***only if marked in D20***

0 - 30 cm emergent
31 - 100 cm emergent
> 100 cm emergent
Scrub/shrub
Attached aquatic bed plants

**AUs with only 1 structure in D20 rate a 0*
**AUs with only 2 structure categories in D20 can only rate a moderate[2] or low [1]*
** AUs with 3 categories can rate a moderate (2) or a high (3)*
****AUs with 4 or 5 categories rate a high (3)***



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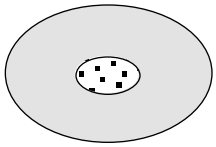
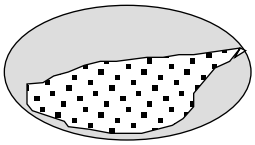
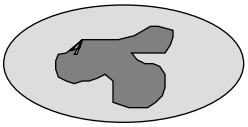


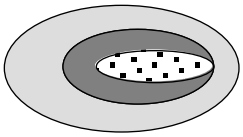
low[=1]



low [=1]



moderate [=2]



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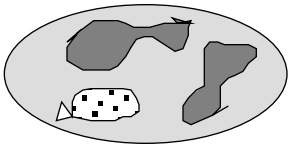

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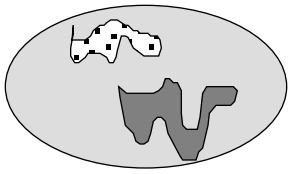

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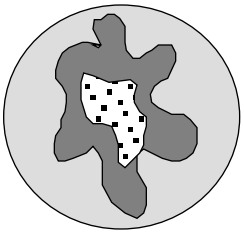


high [=3]

D38 Edge of AU

_____ ratio D38.1 Ratio of edge of AU to length (estimate of sinuousity by calculating circumference/length)

_____ 0/1 D38.2 Is the difference in vegetation height along the edge of the AU greater than 2m for at least 25% of the circumference?
(within 2 m of the edge)

WETLAND NAME_____(alkali) **ID # AU-**

_____ [0-5] D39 BUFFER of AU: Choose the description that best represents condition of AU buffer

Rating

** Open water or adjacent wetlands are considered part of the buffer*
**Infrequently used gravel or paved roads or vegetated dikes in a relatively undisturbed buffer can be ignored as a "disturbance"*

5 **100 m (330ft) of relatively undisturbed (no grazing in last 2 yrs.)** naturally vegetated areas, rocky areas, or open water >95% of circumference. No developed areas within undisturbed part of buffer

4 **100 m (330 ft) of relatively undisturbed (no grazing in last 2 yrs.)** naturally vegetated areas, rocky areas, or open water > 50% circumference **OR** 50 m (170ft) of naturally vegetated areas, rocky areas, or open water >95% circumference. No developed areas within undisturbed part of buffer

3 **100 m (330ft) of relatively undisturbed (not grazing in last 2 yrs.)** naturally vegetated areas, rocky areas, or open water > 25% circumference, **OR** 50 m (170ft) of relatively undisturbed naturally vegetated areas, rocky areas, or open water > 50% circumference

If AU does not meet any criteria above

2 **No paved areas** or buildings within 25 m (80ft) of wetland > 95% circumference. Light to moderate grazing, or lawns are OK. OR no paved areas or buildings within 50m of wetland >50% circumference

0 **Vegetated buffers are <2m** wide (6.6ft) for more than 95% of the circumference

1 **Heavy grazing or does not meet any of the criteria above**

_____ 0/1 D40 Does the AU have a surface water inflow through any type of stream, channel, ditch, or pipe?

D41 Rate the impact of current human disturbances in AU and its buffer for the following activities
Give a rating of [2] for high impact use; [1] for low impact; and [0] for not an impact

_____ [0-2] D41.1 Boating
_____ [0-2] D41.2 Fishing
_____ [0-2] D41.3 Hunting and/or target practice
_____ [0-2] D41.4 Passive recreation (e.g. bird watching, biking, etc.)
_____ [0-2] D41.5 Grazing
_____ [0-2] D41.6 Permanent development- roads
_____ [0-2] D41.7 Permanent development- residential and urban
_____ [0-2] D41.8 Other impacts not listed above

D42 Structures in buffer (within 100m of AU edge)

_____ 0/1 D42.1 Upland trees
_____ 0/1 D42.2 Shrubs
_____ 0/1 D42.3 Rock outcrops, cliffs, fractured basalts
_____ 0/1 D42.4 Talus slopes, boulder fields
_____ 0/1 D42.5 Downed woody debris > 10 cm diameter, tumbleweed, snags

WETLAND NAME_____**(alkali)** **ID # AU-**

D43 Connections of AU: Rate corridors and connections using following key *(record rating of 0,1,2,or 3)*

_____ [0-3] D43.1

1) Is the AU connected to another wetland within 1 km by a riparian corridor ?

If YES go to question # 2 **If NO** go to question #4

3) Does the riparian corridor have seasonal water at least 0.5 m deep in most places or permanent water between 5 - 50 cm?

If NO go to question # 3 **If YES = [3]**

3) Does the riparian corridor have seasonal water at least 0.5 m deep in most places?

If NO = [1] **If YES = [2]**

4)Is AU within 1 km of any permanent stream, open water or other wetland?

If NO = [0] **If YES = [1]**

D43.2 1) Is the AU connected to another wetland within 1 km by a relatively undisturbed vegetated
_____ [0-3] corridor (either upland or riparian) (>5% cover of vegetation) that is at least 5m wide?

If YES go to question # 2 **If NO** go to question #4

2) Is the AU connected by a vegetated corridor that is >= 5m wide with >=75% plant cover

If NO go to question # 3 **If YES = [3]**

3) Is the AU connected by a vegetated corridor that is >= 5m wide with >=30% plant cover

If NO = [1] **If YES = [2]**

4) Is the AU within 1 km of any vegetated corridor or natural area with at least 75% vegetation cover?

If NO = [0] **If YES = [1]**

SOILS and SUBSTRATES in Areas of Seasonal Inundation

worksheet for sampling in the field

Soil	**site 1**	**site 2**	**site 3**	**site 4**
Peat (undecomposed organic soil)	☐	☐	☐	☐
Decomposed Organic Soil	☐	☐	☐	☐
>20% organic, dark stains on fingers, do not confuse with mineral soils that have some organic (<20%)				
Mineral with clay fraction <30%	☐	☐	☐	☐
Mineral Clay (clay fraction >30%)	☐	☐	☐	☐
Organic surface layer (duff) *Record only if present*				
Un-decomposed duff layer	☐	☐	☐	☐
Decomposed duff layer	☐	☐	☐	☐
Infiltration rate	____	____	____	____

D44 Spatially Dominant Soil Types near surface in areas of seasonal inundation

Record the number of times each type was checked off (maximum of 4)

_____ [0-4] D44.1 Peat (undecomposed organic soil)

_____ [0-4] D44.2 Decomposed Organic Soil

_____ [0-4] D44.3 Mineral with clay fraction <30%

_____ [0-4] D44.4 Clay (clay fraction >30%)

Record the soil type in the top soil layer (1-15cm) located immediately below any surface accumulation of recently deposited plant material

D45 Duff Layer *(Record the number times checked off above)*

_____ [0-4] D45.1 Un-decomposed duff layer

_____ [0-4] D45.2 Decomposed duff layer (organic)

WETLAND NAME_____(long duration) **ID # AU-**

D46 Types of surfaces present anywhere in AU

_____ 0/1 D46.1 Un-decomposed duff layer (except pine needles)

_____ 0/1 D46.2 Decomposed duff layer (organic)

_____ 0/1 D46.3 Fines (clays and silt)

_____ 0/1 D46.4 Coarse materials (sand or coarser)

Record a 1 for each category present if its area is > 10 square meters. Note: bare earth from animal tunnels does NOT count

_____ 0/1 D46.5 > 25% cover of pine needles in seasonally or extended inundated areas

D47 Infiltration rate of soils in seasonally inundated areas

_____ 0/1 D47.1 Fast >50% sand, and the rest cobbles, gravel, loamy sand, or sandy loam

_____ 0/1 D47.2 Slow - anything else

** Record the infiltration rate of the least permeable layer if there are several down to 60cm. Least permeable layer needs to be at least 2cm deep.*
** Record infiltration rate of soils with greatest areal extent (3 or 4 soil pits).*
** If 2 pits are "Fast" and 2 pits are "Slow" record as "Fast"*

COMMENTS and NOTES

Appendix 2-D Conversions: Metric to Standard

Conversions: Metric to Standard

Length		
U.S. Customary Units	U.S. Equivalents	Metric Equivalents
Inch	0.083 foot	2.540 centimeters
Foot	1/3 yard, 12 in.	0.305 meter
Yard	3 feet, 36 in.	0.914 meter
Mile	1,760 yards, 5,280 feet	1.609 kilometers

Area		
U.S Customary Units	U.S. Equivalents	Metric Equivalents
Square inch	0.007 square foot	5.452 square centimeters
Square foot	144 square in.	929.030 square centimeters
Square yard	1,296 square in., 9 square feet	0.836 square meters
Acre	43,560 square feet, 4,840 sq. yards	4,047 square meters
Square mile	640 acres	2.590 square kilometers

Metric	
Unit	Approximate U.S. Equivalent
Hectare (10,000 m^2)	2.477 acres

Metric Conversions (Length)		
When You Know:	Multiply By:	To Find:
Millimeters	0.04	Inches
Centimeters	0.39	Inches
Meters	3.28	Feet
Kilometers	0.62	Miles
Inches	25.40	Millimeters
Inches	2.54	Centimeters
Feet	30.48	Centimeters
Miles	1.61	Kilometers

Metric Conversions (Area)		
When You Know:	Multiply By:	To Find:
Square centimeters	0.16	Square inches
Square meters	1.20	Square yards
Square kilometers	0.39	Square miles
Hectares (10,000 m^2)	2.47	Acres
Square inches	6.45	Square centimeters
Square feet	0.09	Square meters
Square yards	0.84	Square meters
Square miles	2.60	Square kilometers
Acres	0.40	Hectares

Appendix 2-E Profiles of Wetland Classes and Subclasses in the Columbia Basin

Region: Columbia Basin

Class: Depressional

Depressional wetlands occur in topographic depressions that exhibit closed contours on three sides. Elevations within the wetland are lower than in the surrounding landscape. The shape of depressional wetlands vary, but in all cases, the movement of surface water and shallow subsurface water from at least three directions in the surrounding landscape is toward the point of lowest point in the depression.

Depressional wetlands in the Columbia Basin may be isolated with no surface water inflow or outflow through defined channels, or they may have intermittent surface water flows that connects them to other surface waters or other wetlands. Outflow from depressional wetlands usually occurs early in the growing season in wetlands outside the area of the Reclamation Project. Many depressional wetlands within the Reclamation Project, however, gain surface water later in the growing season from irrigation waters, and may in some cases have occasional outflow late in the summer.

The predominant source of water for most Columbia Basin depressional wetlands outside of the Reclamation Project is from the discharge of groundwater moving laterally through the fractured interface between individual basalt flows or from surface flow during "rain-on-snow" events or summer storms.

Depressional wetlands lose most of their water evaporation, evapotranspiration, and/or infiltration into the ground. Surface water outflows usually represent a small part of the water lost in these wetlands. Wetlands in the Basin can accumulate salts and become "alkali" where mineral rich groundwaters provide the major source of water.

Wetlands that are not alkali are thought to have some regular exchange with groundwater because evaporation rates exceed rainfall throughout the region. To maintain their low alkalinity they must discharge somehow to groundwater through the underlying fractured basalt formations. This is thought to occur later in the growing season when inflow from surface water, shallow groundwater (interflow) and deeper groundwater has ceased. Wetlands situated within deeper loess or wind blown deposits may lose water in a similar manner, but the discharge to groundwater will be primarily through coarser loess sediments and less through fractured basalts. Wetlands whose water regime is dominated by water from irrigation are also not usually alkali.

The Columbia Basin has many areas of small depressions on the surface of impermeable basalt bedrock. The soils in these depressions are shallow, or not present, and they are

inundated for only brief periods during the spring that usually last less than 90 days. The inflow to these wetlands is dependent upon precipitation, which is then rapidly lost through evaporation and evapotranspiration. These depressions with a brief period of inundation are often called "vernal" pools and represent an important habitat resource in the Basin.

Some wetlands within the Reclamation Project boundaries have unusual hydrologic characteristics due to the influence of irrigation waters. Overall, limited research has been conducted in Eastern Washington to characterize and quantify the relationship between depressional wetland water regimes, groundwater, and surface water dynamics.

Depressional wetlands in the Columbia Basin are located in the following geomorphic settings: 1) channeled scablands created by Lake Missoula floods, 2) wind blown loess outside the area scoured by Lake Missoula floods, 3) Wind blown sand dunes within the channeled scablands, 4) glacial kettles or potholes located in Douglas County, and 5) alluvial and basalt terraces, particularly along the Columbia River.

Depressional wetlands in the Basin are divided into two subclasses based on their conductivity and further subdivided by the length of time surface water is present in the wetland. These two environmental characteristics were judged to be the most important in establishing how depressional wetlands function in the Basin.

NOTE: The classification of wetlands into different hydrogeomorphic types can sometimes be very difficult. Classification imposes a categorization on natural systems that oversimplifies actual conditions. By categorizing natural systems into "boxes" the ecological information we are trying to assimilate is in smaller more manageable units that can be more readily understood and used by us. Natural systems, however, do not consistently conform to the boundaries of the "boxes" we have created.

The environmental conditions used to categorize wetlands occur along gradients of scale and intensity. As a result, wetland functions change gradually as the gradients change. In order to classify wetlands, however, we are forced to define sharp boundaries on these environmental gradients and assume that the functions also change significantly at these boundaries. Wetlands in which environmental conditions fluctuate around these boundaries may be difficult to classify and one will have to use his/her judgement in classifying.

For example, we have established the boundary between alkali and freshwater wetlands at a conductivity of 3000µS/cm. A wetland whose conductivity is 12,000 µS/cm during the entire year is easy to classify, but one whose conductivity fluctuates between 1700 µS/cm in the spring (during runoff) to 2400 µS/cm at the end of the summer is more difficult. Users of this method will have to use other indicators such as vegetation and their judgement to classify a wetland whose conditions lie on the boundary between wetland types.

Field Characteristics for Depressional wetlands in the Columbia Basin:

Depressional wetlands in the Columbia Basin lie in topographic depressions, and that are **not** within the active channel of a stream or river. Wetlands in an active channel or that are frequently flooded (at least once every two years) are classified as "Riverine." Depressional wetlands are also separated from lacustrine wetlands based on the area and depth of open water present. If areas of open water within the depression are less than 8 hectares (20 acres) in size and less than 3 meters in depth in more than 70% of the open water areas, the entire aquatic area is considered to be a depressional wetland. Depressional wetlands adjacent to or located within a channelized topography (e.g. Palouse) are separated from slope and riverine systems if they have a distinct restriction in their outlet and impound water in a depression behind the restriction and are usually flooded by high groundwater levels rather than by overbank flooding.

The Assessment Team has not found any depressional wetlands in the Basin whose water regime could be categorized as only "saturated." The initial classification developed prior to any field-work did include a subclass for depressional wetlands that were only saturated (i.e. without any surface water at any time of the year). In the absence of any evidence for such wetlands, however, a decision was made not include a third subclass.

Subclass – Alkali

Depressional alkali wetlands are defined as those whose conductivity is usually above 3000 µSiemens/cm. The water regime in alkali wetlands is dominated by groundwater inflow, evaporation, and evapotranspiration. Wetlands with a high conductivity are points of groundwater discharge in arid and semi-arid environments, rather than groundwater recharge (Hayashi et al. 1998).

Alkali wetlands in the Basin may lie adjacent to freshwater wetlands, though most of them are located in the drier parts of the Basin. It is difficult to predict whether a wetland will be freshwater or alkali based on its topographic position or surface geology. It is the subsurface fracturing of basalts and the flow of the local groundwater that will determine whether a wetland is freshwater or alkali. These characteristics cannot be easily determined from an examination of surface conditions.

Alkali wetlands are not as common on the landscape as freshwater wetlands in the Columbia Basin, but they do provide some unique habitat features. The ecological processes in these wetlands are dominated by the high salt concentrations in the water. The most visible result of the salt is a unique set of plants that have adapted to these conditions. Only a few species have adapted to these conditions and the species richness in alkali systems is much lower than in freshwater systems. Although richness may be low, abundance can be very high for those species that have adapted (especially among some invertebrates).

Many plants found in alkali systems are unique, or only found along the seashore. These plants tend to be sparse and relatively short (<1m). As a result, alkali systems often have extensive mudflats and meadows of short grass that attract certain species of waterfowl and shorebirds. Alkali wetlands provide critical habitat for many species of migratory birds.

Alkali wetlands were not subdivided into families based on duration of inundation because the number of alkali reference sites was too low to allow this division to be accurately made. The assessment team did not visit enough alkali wetlands where water was impounded for less than 9 months to determine if their functions were different for wetlands with a longer period of inundation.

Field indicators for the presence of alkali wetlands are as follows:

- The conductivity of the water is above 3000 µS. If it is between 1700 and 3000 you will have to use your judgement using the other field indicators listed below.

- A pH generally greater than 9. Note that some freshwater, long-duration wetlands, in the Columbia Basin may have a relatively high pH (>9) but a low conductivity (significantly less than 1.7 milliS/cm). These wetlands, however, will be dominated by freshwater plants. The few freshwater reference sites found with a high pH were all heavily used by cattle. One hypothesis for the high pH is that it is caused by the ammonia excreted by the cattle.

- Large areas of the wetland are dominated by salt tolerant vegetation such *as Distichlis spicata, Scirpus maritimus* or *Scirpus americanus*. These species may sometimes be found along the edges of freshwater systems, but they rarely become a dominant there.

- The presence of invertebrate species that are tolerant of high salt concentrations (Brine shrimp, some species of *Daphnia*).

- The presence of large numbers of shorebirds feeding in the wetland. Shorebirds prefer the short vegetation often found along the edges of open water in alkali systems. The freshwater systems tend to be dominated by high emergent species (> 1m tall) at the edge of the open water.

- The presence of tiger salamanders.

- Heavy encrustations of salt on surface of rocks within the wetland and on the surface of the wetland in areas without standing water.

- The presence of a very black and slimy hydrogen sulfide deposits at or near the surface layer of the wetland soil (this is not to be confused with an organic muck).

Subclass – Freshwater

Depressional freshwater wetlands are defined as those whose conductivity is consistently below 2000 µSiemens/cm. The water regime in non-alkali wetlands tends to be dominated by surface runoff or groundwater in areas where inflow exceeds water losses through evaporation or evapotranspiration.

Family – Long-duration

Depressional, Freshwater, Long-duration, wetlands are defined as those wetlands that have some surface water present for at least 9 contiguous months in most years. This family includes all depressional wetlands that are permanently inundated as well (the surface water is present the entire year). The surface water can be either open (unvegetated) or ponded between the stems of emergent or shrub plants. The 9 months of inundation do not have to occur within a calendar year, but rather within one dry/wet annual cycle. The driest part of the water cycle is usually from October to December for many wetlands in the Basin except for those whose water regime is modified by irrigation.

The 9 month minimum for the presence of surface water was established based on the presence of specific families and genera of invertebrates that is found in these "long-duration" wetlands. These invertebrate groups are associated with wetlands that have surface water present all, or most of, the time. Up to now, the assumption was that wetlands in which these "obligate" species were found had surface water present during the entire year. Data collected by Dr. Bruce Lang over the last few years (Lang, unpublished results), however, suggests that many invertebrate groups associated with the permanent surface water wetlands can withstand some periods of drying, but not more than 3 months. For example, two and three year old larvae of the Ditiscid beetle were found in a wetland that dried out briefly during the summer of 1999 (reference site CB04). These larvae are completely aquatic and require the presence of surface water to feed and grow. Thus, the site had enough moisture present during the last three years to support these larvae, even if the surface water may have disappeared for short periods.

Wetlands where surface water was present for less than 9 months had different families and genera of invertebrates are associated with them.

Wetlands in which surface water remains for at least 9 months, also have characteristic plants that are not found in the drier wetlands. Long-duration wetlands will have areas dominated by wetland plants such as cattails (*Typha latifolia, T. angustifolia*), bulrush (*Scirpus acutus*), white water buttercup (*Ranunculus aquatilis*), burreed (*Sparganium emersum*) or American water-plaintain (*Alisma plantago-aquatica*) often will also have areas of aquatic bed plants present such as coontail (*Ceratophyllum demersum*), pondweeds (*Potamogeton natans, Potamogeton pectinatus*), water ladysthumb (*Polygonum amphibium*), and ditchweed (*Ruppia maritima*).

The "9 month" criterion for classifying long-duration wetlands is intended only to be a guideline because the water regimes in the Basin are highly variable both in time and space. Consider the other indicators of long-duration wetlands described below when classifying your wetland.

- A ring of bulrush (*Scirpus spp*.) or cattails (*Typha* spp.) around an area of open water (or mudflats in very dry years).

- The presence of species such as white water buttercup *(Ranunculus aquatilis*), burreed (*Sparganium emersum*) or American water-plaintain *(Alisma plantago-aquatica*).

- The presence of standing or open water in September or October as shown in air photos or verified onsite.

- The presence of dried aquatic bed species (listed above) or dried obligate emergent species such as American water-plaintain (*Alisma plantago-aquatica*) late in the growing season.

- Information from local sources (farmers, fishermen, wildlife agents) who know the wetland.

Wetlands influenced by irrigation (either high groundwater or surface runoff) may have surface water present over a longer period of time relative to similar "non irrigation" influenced wetlands, but the level of standing water may fluctuate less because the wetlands are subject to two pulses of water. One inflow of water occurs during the spring that results from the natural rain and snow patterns, and one during the late summer that results from irrigation.

Family – Short-duration

Depressional Short-duration wetlands are defined as those wetlands where surface water (inundation) is present for less than 9 months in most years. This type of wetland also includes short-duration wetlands known as "vernals" that typically have surface water present for less than 90 days in the growing season.

The flora and fauna associated with the short-duration wetlands can be significantly different from those associated with long-duration wetlands. For example, the families and genera of invertebrates associated with short-duration wetlands are distinctly different from those found in long-duration wetlands. Data collected by Dr. Bruce Lang over the last 10 years (Lang, unpublished results) suggests that the groups associated with the short-duration wetlands may be found in long-duration wetlands, but the converse is not true. Taxa associated with long-duration wetlands drop out of the invertebrate population as the period of inundation falls below 9 months.

Some field indicators that indicate a wetland has only a short-duration, or seasonal, surface inundation are listed below:

- Surface inundation is mostly precipitation-driven: if groundwater is present it usually only increases the duration of surface saturation.

- Soils will almost always be mineral. Organic layers will be very shallow or non-existent because any organic debris is usually oxidized during the dry period.

- Wetlands with surface inundation between 3-9 months will usually be completely vegetated; those with surface inundation less than 3 months (vernal pools) will have extensive areas where vegetation cover is sparse or non-existent.

The assessment method for short-duration wetlands does not separate between vernal wetlands and those with slightly longer period of inundation. The assessment team was

unable to define characteristics or functions that are unique to vernal systems and they are considered a subset of the short-duration family of wetlands. Vernal wetlands, however, are important in the landscape of the Columbia Basin and there is some interest in managing vernal wetlands as a separate type. Characteristics that can be used to separate vernal pools from the other short-duration wetlands for the purpose of managing them better are summarized in the following table.

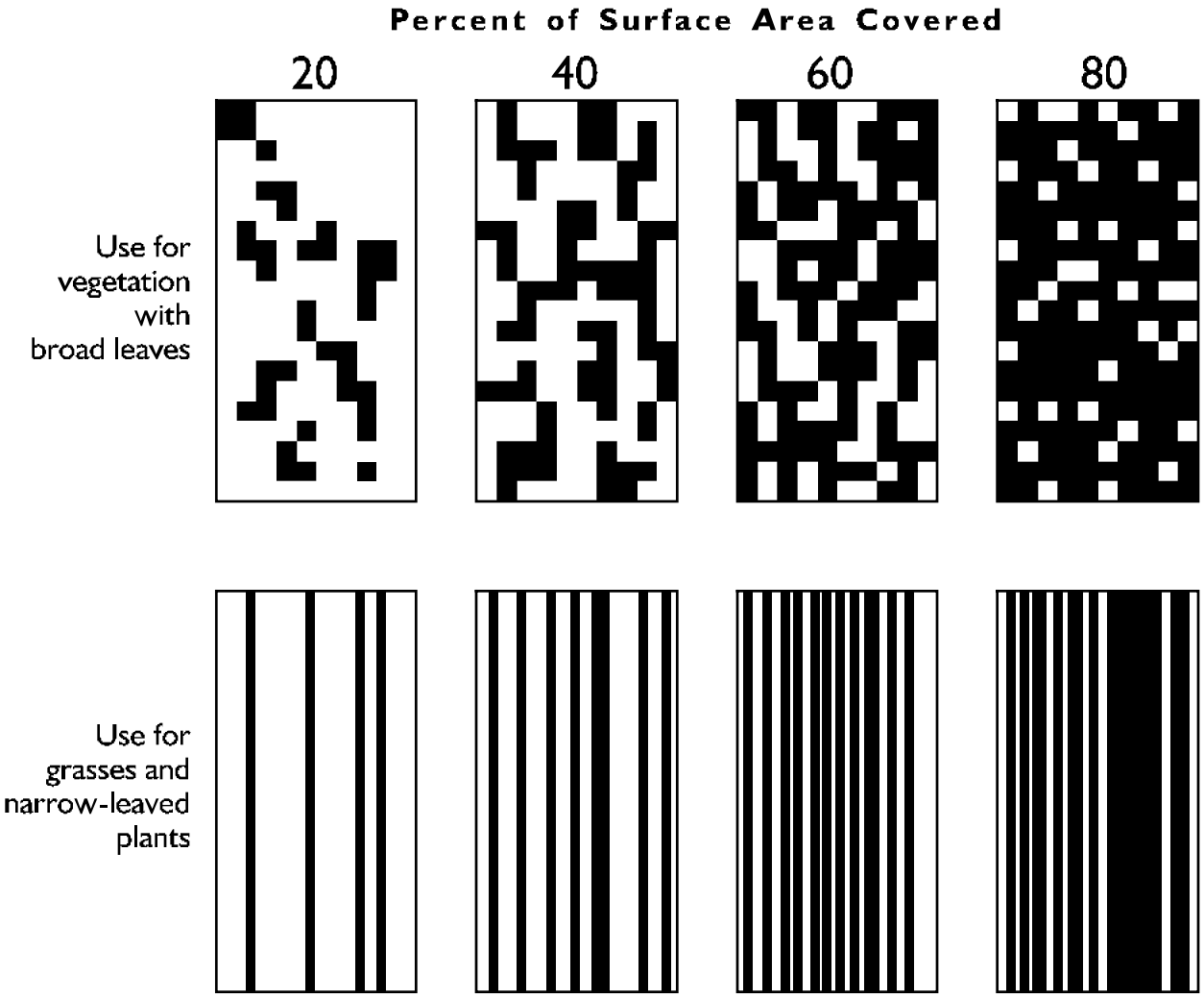
Short-duration	Vernal
Water regime is precipitation driven, but groundwater may contribute to maintaining soil saturation	Water regime mostly precipitation-driven, no groundwater influences except possibly from nearby shallow subsurface flows; substrate impermeable close to the surface.
Substrate may be deep or shallow; soil texture varies. Organic soils are very infrequent.	Substrate is shallow to a hardpan or bedrock (often < 30 cm); soil texture varies. Organic soils are never present.
Average water level may be relatively deep (2m) early in the growing season; water or saturated soils may persist well into late summer/early fall	Average water level is generally very shallow early in the growing season (< 30 cm) and dries by May or June. Period of soil saturation after water levels drops is very short. Soil surface may appear cracked as it dries
Vegetation generally dominated by wetland perennials; mostly one major vegetation association per year; upland or facultative upland annual and biennial species can be found growing within the wetland boundary late in the growing season	Vegetation generally dominated by annuals appearing in two vegetation associations: obligate or facultative wetland annuals dominate early in the season; as pools dry, facultative upland to upland annual or biennial exotics invade and persist throughout fall
Rhizomatous species generally present	Rhizomatous species mostly absent except possibly in deepest portions of pool
Vegetation may be woody or emergent and is generally relatively tall	Vegetation is mostly emergent and generally less than 30 cm tall at maturity

Appendix 2-F Ordering Fish and Wildlife Data From the Washington Department of Fish and Wildlife

The Washington Department of Fish and Wildlife maintains a database that contains location information on important fish and wildlife species that should be considered in land use decisions and activities.

WDFW provides standard products that answer the most common questions concerning the presence of important fish and wildlife species. This information, and order forms for hard copies, can be accessed on the WDFW web pages. The Internet address for the order form is – http://www.wa.gov/wdfw/hab/release.htm

Appendix 2-G Vegetation Profile Board for Estimating Percent of Surface Covered



Source: Hays et al. 1981

Appendix 2-H Interpretation of Topographic Maps and Mapping Contributing Basins

Interpretation of Topographic Maps and Watershed Delineation

This section is adapted from the Oregon Freshwater Wetland Assessment Methodology (OFWAM) (Roth et al 1996). For more information on the OFWAM contact:

Wetlands Program
Oregon Division of State Lands
775 Summer St. NE
Salem, OR 97310
(503) 378-3805

For watershed delineation you will need the following;

- Topographic map
- Ability to interpret topographic maps
- Planimeter or dot grid

The term "watershed" is used in many contexts and may have different meanings. For this reason the term "contributing basin" is used in the assessment methods to define a specific type of watershed. For the purpose of the Washington Function Assessment Methods, a contributing basin is defined as the geographic area that contributes surface water runoff to a watercourse or wetland. This is often also called its watershed. The method requires that an evaluator measure the watershed area of the wetland being assessed, unless this information is already available.

This appendix describes a method for delineating a watershed on a topographic map such as a U.S. Geological Survey quadrangle sheet.

How to interpret a topographic map

In order to successfully delineate a watershed boundary, the evaluator must visualize the landscape as represented by a topographic map. This is not difficult once the following basic concepts of the topographic map are understood.

Each contour line on a topographic map represents a ground elevation or vertical distance above a reference point such a sea level. A contour line is level with respect to the earth's surface just like the top of a building foundation. All points along any contour line are at the same elevation.

The difference in elevation between two adjacent contours is called the contour interval. This is typically given in the map legend. It represents the vertical distance you would need to climb or descend from one contour elevation to the next.

The horizontal distance between contours, on the other hand, is determined by the steepness of the landscape and can vary greatly on a given map. On relatively flat ground, two 20-foot contours can be far apart horizontally. On a steep cliff face, two 20-foot contours might be directly above and below each other. In each case the vertical distance between contour lines would still be 20 feet.

One of the easiest landscapes to visualize on a topographic map is an isolated hill. If this hill is more or less circular the map will show a series of more or less concentric circles (Figure H-1). Imagine that a surveyor actually marks these contour lines onto the ground. If two people start walking in opposite directions on the same contour line, beginning at point A, they will eventually meet face to face.

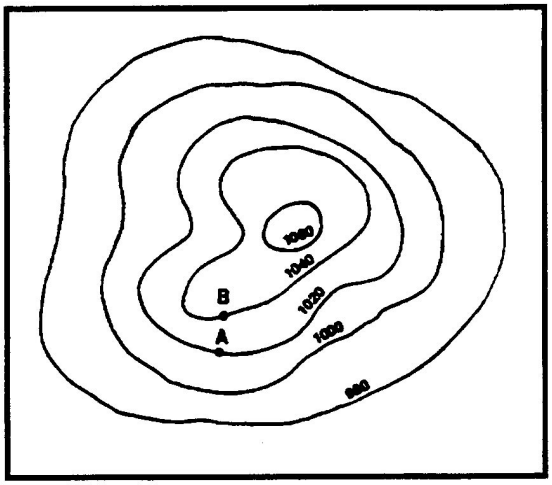


Figure H-1

If these same two people start out in opposite directions on different contours, beginning at points A and B respectively, they will pass each other somewhere on the hill and their vertical distance apart would remain 20 feet. Their horizontal distance apart could be great or small depending on the steepness of the hillside where they pass.

A rather more complicated situation is where two hills are connected by a saddle (Figure H-2). Here each hill is circled by contours, but at some point toward the base of the hills, contours begin to circle both hills.

How do the contours relate to water flow? A general rule is that water flow is perpendicular to contour lines. In the case of the isolated hill, water flows down on all sides of the hill. Water flows from the top of the saddle or ridge, down each side in the same way water flows down each side of a garden wall (see arrows on Figure H-2).

As the water continues downhill in flows into progressively larger watercourses and ultimately into the ocean. Any point on a watercourse can be used to define a watershed. That is, the entire drainage area of a major river like the Columbia can be considered a watershed, but the drainage areas of each of its tributaries are also watersheds.

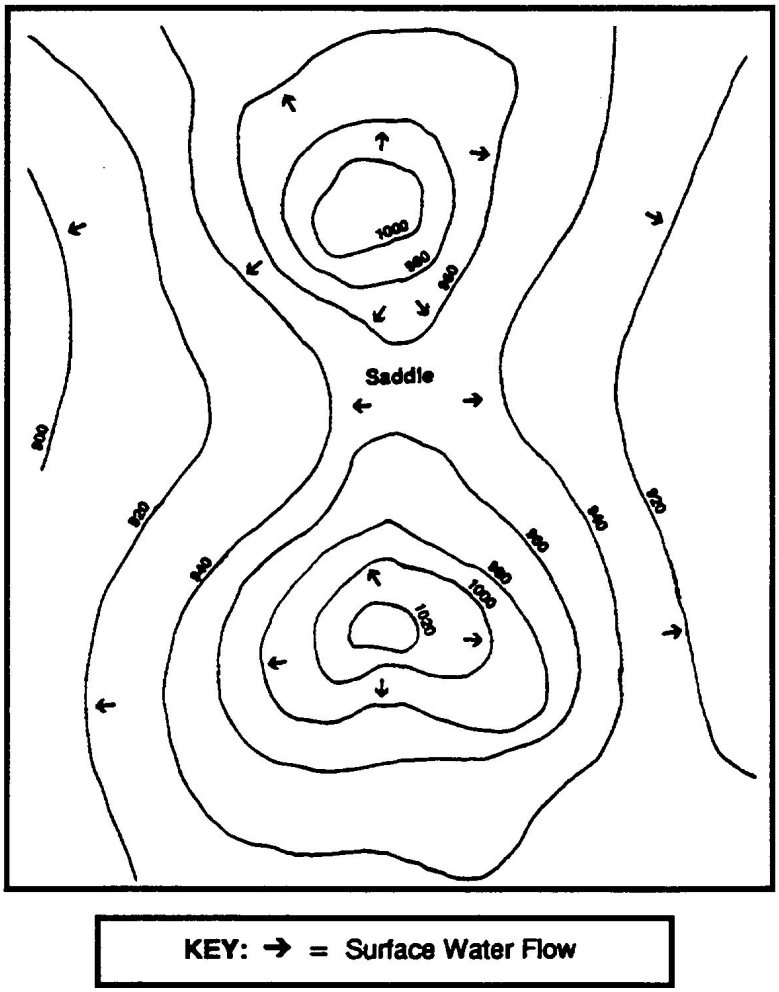


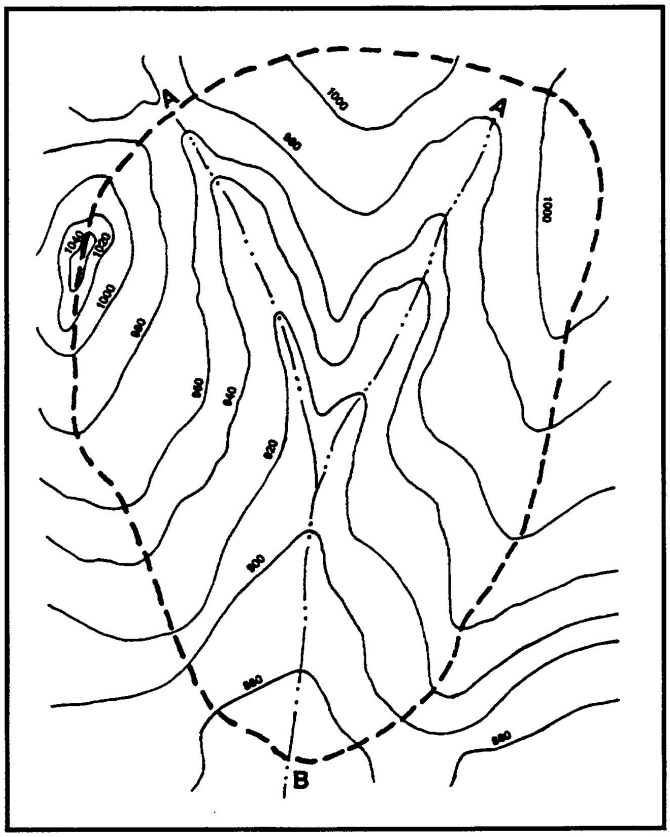
Figure H-2

Each tributary in turn has tributaries, and each one of these smaller tributaries has its own watershed. This process of subdivision can continue until very small, local watersheds are defined which might drain only a few acres.

Figure H-3 shows an idealized watershed of a small stream. Water always flows downhill perpendicular to contour lines. As one proceeds upstream, successively higher and higher contour lines first parallel then cross the stream. This is because the floor of a river valley rises as you go upstream. Likewise, the valley slopes upward on each side of the stream. A general rule is that topographic lines always point upstream. With that in mind, it is not difficult to make out drainage patterns and the direction of flow on the landscape even when

there is no stream depicted on the map. In Figure H-3, for example, the direction of streamflow is from point A to point B.

Figure H-3



Ultimately, you must reach the highest point upstream. This is the head of the watershed, beyond which the land slopes away into another watershed. At each point on the stream the land slopes up on each side to some high point then down into another watershed. If you were to join all these high points around the stream you would have the watershed boundary. (High points are generally hill tops, ridge lines, or saddles).

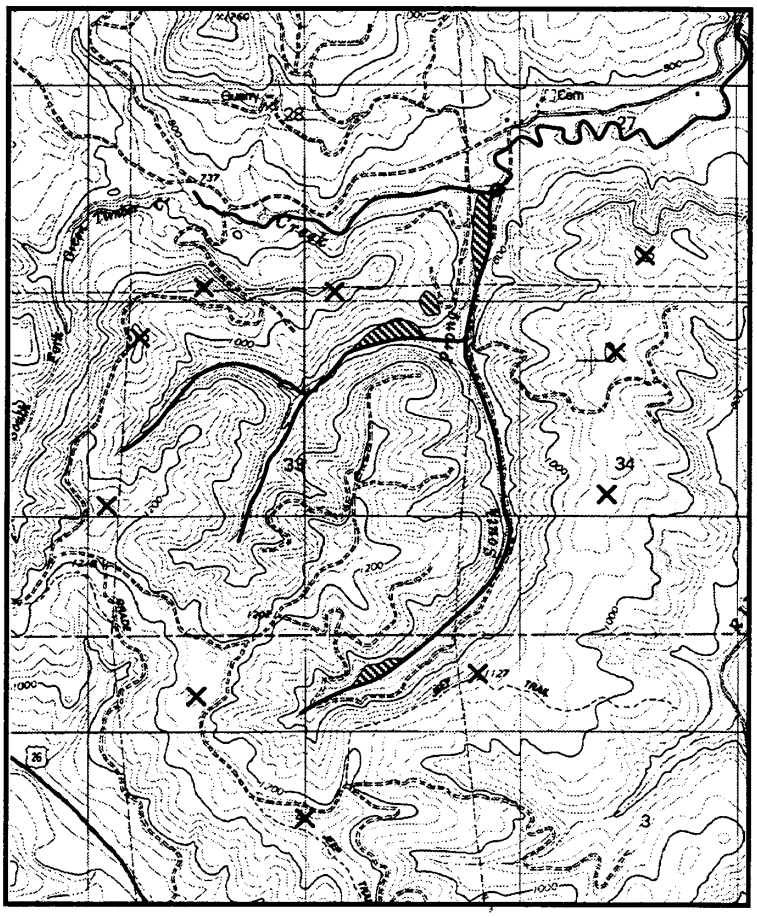


Figure H-4

How to delineate a watershed

The following procedure and example will help you locate and connect all the high points around a watershed on a topographic map shown in Figure H-4. Visualizing the landscape represented by the topographic map will make the process much easier than simply trying to follow the method by rote.

1. Draw a circle at the outlet of the wetland, or downstream point in question (the wetland is the hatched area shown in Figure H-4.)

2. Put small X's at the high points along one side of the watercourse, working your way upstream toward the headwaters of the watershed. If you have a closed depression without any inflowing streams, put the X's on the highest points closest to the wetland.

3. Starting at the circle that was made in step one, draw a line connecting the X's along each side of the watercourse. This line should always cross the contour lines at right angles (i.e. it should be perpendicular to each contour line it crosses).

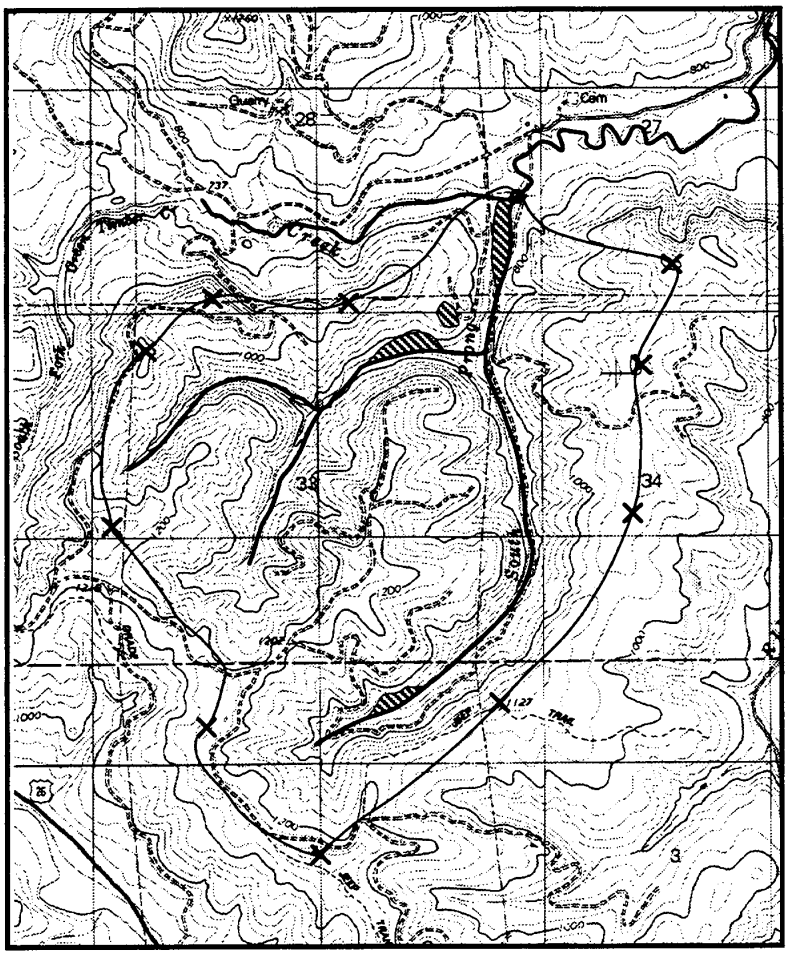


Figure H-5

4. Continue the line until it passes around the head of the watershed and down the opposite side of the watercourse. Eventually it will connect with the circle from which you started. At this point you have delineated the watershed of the wetland being assessed.

The delineation appears as a solid line around the wetland. Generally, surface water runoff from rain falling everywhere in this area flows into the wetland being assessed. This means that the wetland has the potential to modify and attenuate sediment and nutrient loads from this watershed as well as store runoff that might otherwise result in downstream flooding.

Appendix 2-I List of Native and Non-Native Wetland Plants in the Columbia Basin

List of Native and Non-Native Wetland Plants in the Columbia Basin

WIS = Wetland Indicator Status (for assistance in identifying species based by general habitat preference)

N = native

NN = non-native

WIS	NAT/ NONNAT	SCIENTIFIC NAME	COMMON NAME	FAMILY	CHARACTERS
TREES					
FAC	N	*Betula papyrifera*	paper birch	BETULACEAE	drier sites, peely bark, acuminate tipped lvs
FACW	N	*Fraxinus latifolia*	Oregon ash	OLEACEAE	in southern sites (also W Cascades); lvs opposite, compound
FAC	N	*Pinus contorta*	lodgepole pine	PINAECAE	needles in bundles of 2, to 2" long
FACU-	N	*Pinus ponderosa*	ponderosa pine	PINACEAE	needles in bundles of 3 (5) > 2" long
FAC	N	*Populus balsamifera*	cottonwood	SALICACEAE	taller, leaf petioles rounded, leaves large, cordate
FAC+	N	*Populus tremuloides*	quaking aspen	SALICACEAE	often in "stands". leaf petioles flattened
FACU	N	*Pseudotsuga menziesii*	Douglas fir	PINACEAE	
FACU	**NN**	*Robinia pseudoacacia*	black locust	LEGUMINOSAE	compound leaves, twigs w/thorns
FACW	N	*Salix amygdaloides*	peach-leaf willow	SALICACEAE	long, narrow leaves—almost sickle-shaped, w/o glands at base of blade
SHRUBS					
FACW	N	*Alnus incana*	white alder	BETULACEAE	alt lvs ovate, veins evident, margins serrate; male flrs in long catkins, females in short woody "cones"
FACU	N	*Amelanchier alnifolia*	serviceberry	ROSACEAE	lvs alt, serrate from midpoint to tip; flrs white, berry dark
NL	**NN**	*Artemisia absinthium*	Absinth wormwood	COMPOSITAE	weedy, much-branched finely divided leaves, sagebrush odor
NL	N	*Artemisia tridentata*	big sagebrush	COMPOSITAE	trilobed linear leaves, sagebrush odor
FACW	N	*Betula occidentalis*	water birch	BETULACEAE	wetter sites
FACU	N	*Clematis ligusticifolia*	western clematis	RANUNCULACEAE	viny, pinnately tri-foliolate lvs, white flrs, hairy frs
FACW	N	*Cornus stolonifera*	red-osier dogwood	CORNACEAE	red stems, opposite leaves, edges of open water
NL	N	*Crataegus columbiana*	Columbia hawthorn	ROSACEAE	shrub to 5m tall, thorns 2-7 cm long, lvs mostly acute, berry dark red
FAC	N	*Crataegus douglasii*	black hawthorn	ROSACEAE	shrub to 8m tall, thorns 1-2 cm long, lvs often blunt, berry black
FAC	**NN**	*Elaeagnus angustifolia*	Russian olive	ELAEAGNACEAE	to 8m tall, alternate linear-lanceolate lvs to 7cm, spiny branches
NL	N	*Mahonia repens*	Oregon grape	BERBERIDACEAE	low shrub, edges of woods (wetlands?); thick, pinnately (5-7) cpd lvs w/small spines on margins
NL	N	*Quercus garryana*	Oregon oak	BETULACEAE	only oak, mostly in So. area; lvs lobed
NL	N	*Philadelphus lewisii*	mock orange	HYDRANGEACEAE	rarely along edges of wetlands; lvs opp, arcuate veined, flrs white, 4-merous
NL	N	*Physocarpus malvaceus*	ninebark	ROSACEAE	lvs alt, palmately lobed; flrs in term. corymbs
FACU	N	*Prunus emarginata*	bittercherry	ROSACEAE	lvs serrate, two glands @ base of blade; flowers in corymbs

FACU	N	*Prunus virginiana*	chokecherry	ROSACEAE	lvs serrate, two glands @ base of blade; flowers in racemes
NL	N	*Rhus glabra*	smooth sumac	ANACARDIACEAE	shrub to tree, lvs pinnately cpd, reddish, infl dense erect
NI	N	*Rhus trilobata*	squaw bush	ANACARDIACEAE	erect shrub to 6 ft tall, tri-foliolate and lobed lvs, irrigation sites, fr/fl in clusters in lf axils
FAC+	N	*Ribes aureum*	golden currant	GROSSULARIACEAE	unarmed, lvs strongly tri-lobed, smooth, flr yellow, fr yellow/red/black
NI	N	*Ribes cereum*	squaw currant	GROSSULARIACEAE	unarmed, lvs "flat" tipped, serrate, not strongly tri-lobed, lvs smaller than R. aureum, fl red to pink, fr red
NL	**NN**	*Rosa canina*	dog rose	ROSACEAE	prickles stout, recurved; petals wh-pink to 2cm across
FAC	N	*Rosa nutkana*	Nootka rose	ROSACEAE	prickles not recurved; sepals persistent; flrs >2.5cm, gen solitary
FACU	N	*Rosa woodsii*	Wood's rose	ROSACEAE	prickles not recurved; sepals persistent; flrs <2.5cm, clustered; most common rose in area
FACU	**NN**	*Rubus idaeus*	raspberry	ROSACEAE	erect, trifolioate, acutely tipped leaves; berry red
FACU	N	*Rubus ursinus*	trailing blackberry	ROSACEAE	trailing viny, trifoliolate lvs; berry black
FACU	N	*Sambucus cerulea*	blue elderberry	CAPRIFOLIACEAE	erect, opp pinnately cpd lvs, edges of wetlands; many small white flrs in clusters, blue berries
OBL	N	*Salix exigua*	coyote willow	SALICACEAE	
FACW+	N	*Salix lasiandra* var *caudata*	Pacific willow	SALICACEAE	long narrow leaves—w/o glands @ base of blade. Interior form of *S. lasiandra*?
FAC	N	*Salix scouleriana*	Scouler willow	SALICACEAE	leaves oblanceolate, reddish-hairy beneath
FAC or wetter	N	*Salix* spp.	willow	SALICACEAE	other species likely present
FACU+	N	*Sarcobatus vermiculatus*	black greasewood	CHENOPODIACEAE	few foot tall white-barked shrub with bright green, linear, somewhat succulent leaves: alkaline areas
NI	N	*Shepherdia canadensis*	buffalo-berry	ELAEAGNACEAE	unarmed shrub/tree w/opp lvs, green above, hairy brown beneath
FACW	N	*Spiraea douglasii*	spirea	ROSACEAE	tall, decid., lvs alt, oval to oblong w/serrate margins from mid to tip; pink flrs in many terminal spikes
FACU	N	*Symphoricarpos albus*	snowberry	CAPRIFOLIACEAE	short, decid., lvs opp, <1cm long; white flrs and white persistent berries
HERBS					
FACU	**NN**	*Achillea millefolium*	yarrow	COMPOSITAE	lvs highly dissected; flrs white in term. corymb
FACU	N	*Allium geyeri*	wild onion	LILIACEAE	lvs linear, thickened, onion smell; edges of vernals, mostly upland
NL	**NN**	*Amsinckia* spp (incl. *A. retrorsa, A. tesellata,* and others)	fiddleneck	BORAGINACEAE	weedy, mostly upl spp.; often bristly hairy to 1 -2 ' tall; usu. yellow flrs in helical (scorpioid) infl (cyme)
NL	N	*Anaphalis margaritacea*	pearly everlasting	COMPOSITAE	leafy erect; lvs lanceolate, alt, dark green; flrs many small whitish, papery, with yellow centers

FACU	N	*Asarum caudatum*	wild ginger	ARISTOLOCHIACEAE	low, aromatic, stoloniferous; lvs cordate; flrs weird red-brown at ground level, bearing long sepaloid processes
FAC-	N	*Asclepias fascicularis*	milkweed	ASCLEPIADACEAE	to 2.5' tall, lvs linear to lanceolate, opposite, milky latex; corolla pale to dark purple
FAC+	N	*Asclepias speciosa*	milkweed	ASCLEPIADACEAE	herb to 3', leaves large, opposite, milky latex, infl dense, whitish flrs complex - weird
NL	**NN**	*Asparagus officinale*	asparagus	LILIACEAE	common garden escape; well-branched with tiny needle-like leaves; frs red
FACW	N	*Aster brachyactis*	rayless alkali aster	COMPOSITAE	annual; often saline areas; lvs linear; rays lacking; disk flrs whitish
FACW+	N	*Aster frondosus*	leafy aster	COMPOSITAE	similar to above with short rays
FAC to FACW	N	*Aster* sp (all)	aster	COMPOSITAE	erect, aster-like flrs; rays lavender, disc flrs yellow
OBL	N	*Artemisia lindleyana*	riverbank wormwood	COMPOSITAE	southern spp; along major rivers and tribs, below OHWM
NL	**NN**	*Atriplex heterosperma*	orache	CHENOPODIACEAE	lvs alt. hastate-deltoid, mealy-textured, sour; frting bracts ovate-orbicular
FACW	N	*Atriplex patula*	saltbush	CHENOPODIACEAE	lvs alt. hastate-deltoid, mealy-textured, sour; frting elongate, denticulate
NL	N	*Balsamorhiza sagittata*	balsamroot	COMPOSITAE	upland herb, large deltoid lvs with basal lobes (sagittate), flrs 2-4" in dia., rays reflexing in age, leaving a "cone"
FAC-	**NN**	*Barbarea vulgaris*	yellow rocket	CRUCIFERAE	bien to per w/lyrate-pinnatifid basal lvs, stem lvs clasping and lobed; flrs yellow in term racemes; fr capsules to 3cm
FACW	**NN**	*Bassia hyssopifolia*	fivehook bassia	CHENOPODIACEAE	erect to >1m; lvs linear (reddish and finely hairy), fr flattened with five linear "hooks" hardened sepals
NL	**NN**	*Bellis perennis*	English daisy	COMPOSITAE	lawn/pasture weed; lvs in basal rosette, spatulate, serrate; flrs w/white rays, yellow disc flrs, on peduncles to 1dm
FACW+	**NN**	*Bidens cernua*	nodding beggar-ticks	COMPOSITAE	lvs sessile, lanceolate, serrate; fruits like ticks
FACW+	N	*Bidens frondosa*	nodding beggar-ticks	COMPOSITAE	lvs petiolate, pinn 3-5 cpd, fruits like ticks
FACW	**NN**	*Bidens tripartita*	beggar-ticks	COMPOSITAE	lvs petiolate, simple, three-lobed; fruits like ticks
NL	**NN**	*Brassica* spp. (all)	mustard	CRUCIFERAE	pasture/roadside weed; flrs 4-parted yellow
FACW-	N	*Camassia leichtlinii*	camas	LILIACEAE	lvs, basal, linear (grasslike); white-flrd lily, flrs racemose
FACW	N	*Camassia quamash*	camas	LILIACEAE	as above, blue-flrd
mostly FACW	N	*Cardamine* spp. (all)	bittercress	CRUCIFERAE	white 4-parted flrs; lvs often pinn cpd
NL	**NN**	*Cardaria draba*	white top, hoary cress	CRICUFERAE	strongly rhizomatous weed; flrs white in terminal corymbs
FACW+	N	*Carex amplifolia*	big-leaf sedge	CYPERACEAE	rhiz; lvs to 2cm wide, rough-edged; spikes elongate
OBL	N	*Carex lanuginosa*	wooly sedge	CYPERACEAE	rhiz.; spikes elongate (bristly from hairy awn); perigynia hairy

FACU+	N	*Carex scirpoidea*	single-spike sedge	CYPERACEAE	tufted and rhiz.; most ly w/basal lvs; spikes solitary; plant dioecious
OBL	N	*Carex utriculata (= C. rostrata)*	sedge	CYPERACEAE	robust, mostly in water; spikes long thick, with inflated perigynia ascending or reflexed, lt gr to reddish (w/age)
FAC to OBL	N	*Carex* spp. (all)	sedge	CYPERACEAE	triangular stems, lvs gen with strong midrib
OBL	N	*Castilleja exilis*	paintbrush	SCROPHULARIACEAE	lvs alt, linear-lanceolate, flrs with bightly colored reddish bracts; found in saline areas
NL	**NN**	*Centaurea* sp. (all)	knapweeds	COMPOSITAE	noxious weeds; lobed lvs in basal rosette; much branched w/linear or lobed lvs; head conical or egg-shaped, w/blackish fringed bracts; flrs appear linear purplish
FACU	N	*Cerastium arvense*	chickweed	CARYOPHYLLACEAE	lvs opp, petals large rel. to sepals
FACU	**NN**	*Cerastium vulgatum*	chickweed	CARYOPHYLLACEAE	lvs opp, petals < sepals
NL	N	*Chaenactis douglasii*	hoary chaenactis	COMPOSITAE	herb, yarrow-like lvs, heads w/disk flrs only, star-shaped
FAC	**NN**	*Chenopodium album*	goosefoot	CHENOPODIACEAE	lvs simple, gray-green hairy, occ. lobed, tiny flrs in clusters
NL	**NN**	*Chenopodium hybridum*	goosefoot	CHENOPODIACEAE	erect to 1.5m; blades simple deltoid, cordate, broadly lobed, tiny flrs in clusters; seed flattened
NL	**NN**	*Chrysanthemum leucanthemum*	ox-eye daisy	COMPSITAE	low; lower lvs spatulate, pinn lobed or divided, dentate; upper lvs clasping; heads large 4cm; rays white, disc flrs yellow
OBL	N	*Cicuta douglasii*	water hemlock	APIACEAE	tall, 1-3 x pinn. cpd lvs, lfts leaflike, serrate, lateral veins terminate at teeth tip; flrs in double umbels; invol bracts tiny or absent
FACU+	**NN**	*Cirsium arvense*	Canada thistle	COMPOSITAE	purple flrs, lvs smaller
FACU	**NN**	*Cirsium vulgare*	bull thistle	COMPOSITAE	purple flrs, lvs larger, clasping stem
FAC-	N	*Claytonia lanceolata*	western spring-beauty	PORTULACACEAE	small, rel. succ. lvs, flrs white, sepals 2
NL	N	*Collinsia parviflora*	blue-eyed mary	SCROPHULARIACEAE	low herb, linear lvs,"scroph" flrs, often blue and white, fr a two-lobed capsule
FACU	N	*Collomia linearis*	narrow-leaf collomia	POLEMONIACEAE	lvs linear, flr heads densely clustered, sticky, pink-salmon colored flrs
FACW-	**NN**	*Conium maculatum*	poison hemlock	APIACEAE	lvs finely dissected, stems purplish-mottled; flrs in double umbels; invol bracts few, lanceolate
FACU	N	*Conyza canadensis*	horseweed	COMPOSITAE	tall weed to 1m tall; lvs narrow; single stem, much branched above; heads small whitish numerous at branch ends
FAC-	N	*Cornus canadensis*	bunchberry	CORNACEAE	low growing, ovate lvs in one "whorl", veins prominent, arcuate, "single" white flower
FACU	**NN**	*Crepis* sp.	hawkweed	COMPOSITAE	generic yellow comp with dandelion-like leaves; gen upland
NL	N	*Cuscuta pentagona*	dodder	CUSCUTACEAE	orange thin-stemmed wiry "epiphytic" parasite
	N	*Delphinium* spp. (all)	larkspurs	RANUNCULACEAE	purplish flrs in raceme, colored sepals hood-like
FAC	**NN**	*Dipsacus sylvestris*	teasel	DIPSACACEAE	tall weed infl dense spiny-like a thistle

OBL	N	*Downingia elegans*	common downingia	CAMPANULACEAE	small ± succ. ann, in vernals; lvs bright grn, flrs (when visible) showy mostly blue with pronounced "lower" 3-lobed lip
NL	N	*Draba verna*	spring Whitlow grass	CRUCIFERAE	tiny annual, white mustard flrs, blooms very early in season, gen disturbed or open sites, edges of vernals
OBL	N	*Eleocharis* spp. (all) (incl *E. palustris, E. parvula*)	spikerushes	CYPERACEAE	rhiz; stems short (to .8m), round, with single apical spikelet
FACU+	N	*Epilobium angustifolium*	fireweed	ONAGRACEAE	erect to 5'+, lvs opp/lanceolate, flrs 4-parted, large, reddish; frs elongate
FACW-	N	*Epilobium ciliatum*	willowherb	ONAGRACEAE	erect to 2'+, lvs opp/lanceolate, flrs 4-parted, small, reddish; frs elongate
FACU	N	*Galium aparine*	bedstraw	RUBIACEAE	lvs in whorls of 6-8; retrorsely scabrous, flrs small; frs w/hooked bristles
FACU	N	*Galium boreale*	Northern bedstraw	RUBIACEAE	lvs in whorls of 4; widely branched, not retrorsely hairy, infl. term. cpd, much branched; flrs 4-lobed, relatively large
FACW+	N	*Galium trifidum*	bedstraw	RUBIACEAE	lvs in whorls of 6-8+; flrs solitary or in 2-3 borne term. or axillary; flrs 3 (4)-lobed, 1mm
FACW	N	*Geum macrophyllum*	largeleaf avens	ROSACEAE	cpd lvs in basal rosette, term lflt larger, hairy; flrs yellow 8-10mm; frs round w/stiff, bent "hairs"
FACU	N	*Geum triflorum*	old man's whiskers	ROSACEAE	cpd lvs in basal rosette, fruits with long fuzzy "tails"
FAC+	N	*Gnaphalium chilense*	cotton-batting cudweed	COMPOSITAE	to .8m; lvs linear to 5cm, lanceloate w/basal lobes; whitish wooly all over; flrs small in tiny heads
FAC+	N	*Gnaphalium palustre*	lowland cudweed	COMPOSITAE	smaller, lvs spatulate, whitish hairy; flrs small in tiny heads
FAC+	**NN**	*Gnaphalium uliginosum*	marsh cudweed	COMPOSITAE	small, lvs linear, whitish hairy; flrs small, brownish in tiny heads
OBL	N	*Gratiola ebracteata*	hedge hyssop	SCROPHULARIACEAE	fibrous-rooted ann; vernals; flrs small solitary in upper lf axils; small tubular corolla
FACU	N	*Grindelia nana*	gumweed	COMPOSITAE	from rosette; lvs gen serrate; resinous heads 1cm with "hooked" bracts, yellow rays
NL	N	*Haplopappus hirtus* var. *sonchifolius*	sticky goldenweed	COMPOSITAE	lvs lanceolate, mostly in basal rosette, serrate, glandular; heads to 2.5cm
FAC+	N	*Heracleum lanatum*	cow parsnip	UMBELLIFERAE	to 2m, lvs alt, very large, ternate w/palmate lobes; flrs white in term. double umbels
FAC	N	*Hesperochiron pumila*	dwarf h.	HYDROPHYLLACEAE	spatulate lvs in basal rosette; flrs 5-merous; large, white w/ yel centers; gen edge spp.
NL	**NN**	*Hieracium spp*	hawkweeds	COMPOSITAE	basal rosette, wh or yel dandelion-like flrs on long scapose peduncle; gen upland, not wetland
NL	**NN**	*Holosteum umbellatum*	jagged chickweed	CARYOPHYLLACEAE	small ann, basal rosette; flrs small white, umbellate, on ± scapose peduncle
OBL	N	*Hypericum anagalloides*	tinkers-penny	HYPERICACEAE	low, matted, lvs opp, petals < 6mm, stamens free

FAC	N	*H. formosum*	St. John's wort	HYPERICACEAE	erect, lvs opp, petals > 6mm, yellow 5-parted flrs, many stamens in groups, deltoid sepals and yellowish seeds
NL	**NN**	*Hypericum perforatum*	St. John's wort	HYPERICACEAE	erect, lvs opp, yellow 5-parted flrs, many stamens in groups, linear lanceolate sepals and brownish seeds
FACW+	N	*Iris missouriensis*	iris	IRIDACEAE	<1m iris, large grass-like flattened lvs (folded in each other @ base); blue iris flrs
OBL	**NN**	*Iris pseudacorus*	yellow-flag	IRIDACEAE	tall (to 1m) iris, large grass-like flattened lvs; large yellow iris flrs
FAC	**NN**	*Iva xanthifolia*	marsh-elder	COMPOSITAE	tall, coarse weedy annual to 2m; lvs opp, large, egg-shaped, coarsely dentate; branched above; many small heads, flrs tiny
OBL	N	*Juncus balticus*	Baltic rush	JUNCACEAE	rhiz; stems appearing as individual; stems rd in xs; infl clustered, lateral, located about 1/2-way down stem; brownish or greenish
FACW+	N	*Juncus bufonius*	toad rush	JUNCACEAE	ann; tufted; infl widely spreading; flrs distinct
FACW	N	*Juncus effusus*	soft rush	JUNCACEAE	tufted; stems rd in xs; infl clustered, lateral, brownish or greenish, located a short distance from tip
FACW	N	*Juncus kelloggii*	Kellogg's rush	JUNCACEAE	small annual, filiform lvs, tufted; usu. in vernals
FAC to wetter	N	*Juncus* spp. (all)	rush	JUNCACEAE	many; rd stems; either tufted or rhizomatous; flrs small, brownish
FAC	**NN**	*Kochia scoparia*	kochia, summer cypress	CHENOPODIACEAE	alkaline flats, weed w/red coloration; numerous tiny linear lvs; tiny greenish flrs in wooly clusters at branch tips
FACU	**NN**	*Lactuca serriola*	prickly lettuce	COMPOSITAE	tall herb, lvs mostly basal, less lobed than *Sonchus*, spiny margined w/spiny midrib underneath, flrs yellow
NL	N	*Lappula redowskii*	western stickseed	BORAGINACEAE	small ann/bien; hairy throughout; lvs many 6cm x 1cm to linear-oblanc; flrs small; fr ovoid, prickly
NL	**NN**	*Lepidium campestre*	peppergrass	BRASSICACEAE	basal lvs divided; stem lvs clasping; flrs white
FAC	**NN**	*Lepidium latifolium*	peppergrass	BRASSICACEAE	basal lvs simple; not clasping (large, petiolate); plant rhizomatous, knee-high; flrs white; invades wetland edges
FACU+	**NN**	*Lepidium perfoliatum*	peppergrass	BRASSICACEAE	basal lvs divided; stem lvs clasping; flrs yellow
OBL	N	*Limosella aquatica*	mudwort	SCROPHULARIACEAE	tiny; basal rosette; lvs 2" long, petiolate with spatulate blades; flrs inconspicuous
FACU	**NN**	*Linaria dalmatica*	toadflax	SCROPHULARIACEAE	knee-high to taller weed; lvs alt, ovate, w/sharp tip, palmate venation and clasping bases; yellow spured snapdragon-like flrs, frs rounded capsules, weedy
NL	N	*Lithospermum ruderale*	puccoon	BORAGINACEAE	low branched herb, lvs lanceolate, hairy, flr yellowish small, nutlets (4) large hard, shiny

NL	N	*Lomatium dissectum*	fern-leaved lomatium	UMBELLIFERAE	fr large, pumpkin-shaped, 8-10 mm in dia.; lvs dissected, not hairy; flrs in double umbels
NL	N	*Lomatium triternatum*	nine-leaf lomatium	UMBELLIFERAE	to 1.5', lvs highly divided, thread-like, fr winged, ribbed; flrs in double umbels
FAC	**NN**	*Lotus corniculatus*	birds-foot trefoil	LEGUMINOSAE	low; lvs alt, pinn. cpd w/5 lfts; flrs yellow, in umbels, pea-like; fruits, red-brown long pods
OBL	N	*Ludwigia palustris*	water purslane	ONAGRACEAE	succulent, semi-aquatic w/opp ovate to lanceolate lvs; flrs small, single in each lf axil
NL	N	*Lupinus sericeus*	silky lupine	LEGUMINOSAE	common silvery leaved lupine, flrs blue, pedicellate, banner hairy on back
FACU	N	*Luzula campestris*	woodrush	JUNCACEAE	grass-like, tufted; infl diffuse, small lily-like (rush-like flrs), stems and nodes hairy.
OBL	N	*Lycopus uniflorus* and *americanus*	bugleweed	LAMIACEAE	rhiz. semi-aquatic; lvs opp, w/irreg. incised, lobed, serrate margins; flrs tiny in whorls in lf axils
OBL	N	*Lysichitum americanum*	skunk cabbage	ARACEAE	in mud, early blooming, lvs very large (>1m), oval; skunk-like odor; flrs tiny in spike enveloped by single yellow leaf-like bract
FACW+	**NN**	*Lythrum salicaria*	purple loosestrife	LYTHRACEAE	tall, rhiz., aggressive weed; lvs opp lanceolate, entire; purple flrs in term spike-like infl; frs numerous small, brown capsules
FACU-	N	*Madia glomerata*	tarweed	COMPOSITAE	erect to 1.5', lvs small sticky, flowers small glandular; very lemony-odorous
NL	N	*Marah oregana*	wild cucumber	CUCURBITACEAE	twining viny herb; lvs alt, large, irreg. palmately lobed
FACW-	N	*Mentha arvensis*	mint	LABIATAE	rhiz, lvs opp, aromatic, petiolate, lanceolate w/serrate margins; flrs small, white-pink in whorls in lf axils
OBL	**NN**	*Mentha spicata*	spearmint	LABIATAE	similar to above exc. lvs sessile, larger; flrs mostly in term. spikes
NL	**NN**	*Medicago sativa*	alfalfa	LEGUMINOSAE	lvs trifoliolate, serrate only @ upper third of lf, fls small, many, purple, fr will be coiled, and somewhat spiny
FACU	**NN**	*Melilotus alba*	sweet clover	LEGUMINOSAE	lvs trifoliolate, flrs white
FACU	**NN**	*Melilotus officinalis/indica*	sweet clover	LEGUMINOSAE	flrs yellow; *off.* = >1m, flrs to 6mm; *ind.* =<1m, flrs to 3mm
FAC	N	*Moehringia laterifolia*	grove sandwort	CARYOPHYLLACEAE	*Arenaria* or *Stellaria*–like; small peren; lvs narrow, 4cm x 1cm; petals (wh) rounded
NL	N	*Montia linearis*	montia	PORTULACACEAE	weak succulent; lvs linear flrs white w/2 sepals
FAC	N	*Montia perfoliata (= Claytonia p.)*	Siberian springbeauty	PORTULACACEAE	weak succulent; lvs immediately subtending infl perfoliate, flrs white w/2 sepals
FACU	N	*Microsteris gracilis humilior*	false phlox	POLEMONIACEAE	tiny ann, <1' tall, branched, flrs tiny inconspicuous; lower lvs lin-lanc, opp; upper tending to be alt
FACW	N	*Mimulus breviflorus*	short-flowered monkeyflower	SCROPHULARIACEAE	annual, low; lvs opp, narrowly elliptic, flrs small, yellow, tubular w/open throat, lower lip flaring

OBL	N	*Mimulus guttatus*	monkeyflower	SCROPHULARIACEAE	low to knee-high; lvs opp, ovate, dentate, veins evident; flrs yellow tubular w/open throat, lower lip flaring
OBL	N	*Myosotis laxa*	forget-me-not	BORAGINACEAE	low, fibrous rooted; lvs alt, linear to lanceolate-spatulate; flrs blue small (5mm); in term. raceme; fr bilobed (heart-shaped)
OBL	**NN**	*Myosotis scorpioides*	forget-me-not	BORAGINACEAE	low, w/rhiz/stolons; lvs alt, wider, lanceolate-spatulate; flrs blue larger (10mm); in term. raceme; fr bilobed (heart-shaped)
OBL	N	*Myosurus aristatus* *Myosurus minimis*	mouse-tail	RANUNCULACEAE	tiny herbs, basal linear lvs; flrs tiny atop short peduncles, inconspicuous exc. in fr when receptacle elongates (achene beak long)
FAC	N	*Navarretia minima*	least navarretia	POLEMONIACEAE	ann, tiny, branched, flrs hidden in spiny bracts; vernals
FACU	**NN**	*Oenothera biennis*	evening primrose	ONAGRACEAE	1m tall from rosette; lvs alt, elliptic; flrs 4-parted 2cm wide, yellow, w/ long floral tube; fr long narrow capsules
FACU-	N	*Orthocarpus hispidus*	bristle owl's- clover	SCROPHULARIACEAE	small erect ann; flrs zygo in dense bracteate clusters; lower lip yellow w/3 lobes
FACW	N	*Physostegia parviflora*	purple dragon head	LABIATAE	mint; to 3'; lvs cauline, linear-elliptic to oblong, sessile; corolla purple to 16mm
FACW	N	*Plagiobothrys leptocladus*	popcorn flower	BORAGINACEAE	small, lvs in basal rosette, margins with saliently and variously fringed hairs, vernals
FAC	**NN**	*Plantago lanceolata*	plantain	PLANTAGINACEAE	lvs in basal rosette, lanceolate, long, w/prominent veins; flrs many, inconspicuous, in term. spike on long peduncle
FACU+	**NN**	*Plantago major*	English plantain	PLANTAGINACEAE	lvs in basal rosette, elliptical on long petioles, w/prominent veins; flrs many, inconspicuous, in term. spike on long peduncle
OBL	N	*Polygonum amphibium (= P. concinneum*)	water smartweed	POLYGONACEAE	semi-aq to aq; hairy or not; lvs alt, petiolate, lanceolate, w/membranous sheaths as stipules; flrs rose in term. oval spikes
FACW-	**NN**	*Polygonum aviculare*	knotweed	POLYGONACEAE	much branched, thin stems, often more terrestrial, weedy; lvs alt, linear-lanceolate; stipular sheaths memb. to 6mm long; flrs tiny, pinkish in lf axils
FACU	**NN**	*Polygonum cuspidatum*	Japanese knotweed	POLYGONACEAE	large (2m) perennial w/cane-like red-brwn stems; lvs large to 1.5dm, elliptic w/ cuspidate tip; flrs numerous, tiny in axillary and terminal panicles
OBL	**NN**	*Polygonum hydropiper*	waterpepper	POLYGONACEAE	semi-aq; rooting @ nodes; lvs alt, lanceolate to 7 cm, petiolate below, sessile above; memb., bristly stips to 15mm, shredding; flrs narrow panicles from axils or term.; flrs gr-wh to reddish (4mm long)

OBL	N	*Polygonum hydropiperoides*	water smartweed	POLYGONACEAE	semi-aq; rooting @ nodes; lvs alt, lanceolate to 12 cm, petiolate below, sessile above; memb. hairy stips to 2cm; flrs narrow term. panicles; flrs gr-wh to pink (3mm)
FACW	N	*Polygonum lapathifolium*	willow smartweed	POLYGONACEAE	semi-aq. much-branched annual; lvs as above, sessile, to 20 cm long; flrs in term and axillary loose panicles; flrs 2.5mm long
FACW	**NN**	*Polygonum persicaria*	lady's thumb	POLYGONACEAE	as in *P. lapathifolium*; lvs bearing a dark "chevron" blotch on upper side
OBL	N	*Potentilla anserina*	common silverweed	ROSACEAE	basal lvs pinnately cpd; silvery beneath (at least); stoloniferous (mat-forming as groundcover); can tolerate saline areas; flrs yellow
FAC	N	*Potentilla gracilis*	cinquefoil	ROSACEAE	erect, with basal lvs palmate (digitate) with coarsely serrate margins; flrs yellow (1.5cm) on long leafy stalks; fr an achene
FACU+	**NN**	*Prunella vulgaris*	self-heal	LABIATAE	to 1' usu. less; lvs opp, lanceolate, stems square; flrs purple in congested terminal spike
FACW	**NN**	*Ranunculus repens*	buttercup	RANUNCULACEAE	low, weedy, creeping, rooting @ nodes; lvs ternately cpd, hairy, dark green, on long petioles
FACU	N	*Rhus radicans*	poison ivy	ANACARDIACEAE	low, tri-foliolate and entire lvs, riparian areas, skin irritant
OBL	**NN**	*Rorippa nasturtium-aquaticum*	water-cress	BRASSICACEAE	plants aquatic; petals white; lvs pinnately compound
OBL	N	*Rorippa curvisiliqua* (and other similar spp.)	yellow water-cress	BRASSICACEAE	sometimes in vernal ponds; basal rosette of pinn. divided lvs; short racemes of small yellow 4-parted flrs; frs sickle-shaped long slender capsules
FACU+	**NN**	*Rumex acetosella*	sheep sorrel	POLYGONACEAE	rhiz, weak, basal lvs obviously hastate (w/two basal lobes); infl of tiny flrs in term. and upper axillary panicles
FAC+	**NN**	*Rumex crispus*	curly dock	POLYGONACEAE	erect; stout taproot; lvs alt, lanceolate, to 40 cm long x 5 cm wide, wavy-margined; flrs small in dense term. and upper axillary panicles; reddish tinged; frs triangular drying brownish
FACW+	**NN**	*Rumex occidentalis*	western dock	POLYGONACEAE	as above; lvs large, to 40cm long x 15 cm wide, ovate to oblong w/heart-shaped bases
OBL	N	*Sagittaria latifolia*	arrowhead, wapato	ALISMATACEAE	rooted, aq to emergent; lvs in rosette, submerged lvs lanceolate, floating or emergent lvs are arrow-shaped; flrs 3-parted, white, to 2cm across, borne in whorls @ each node; frs winged
OBL	N	*Salicornia rubra*	red glasswort	CHENOPODIACEAE	succ ann <1' tall; w/jointed (reddish) stems, and buds (bumps) at the nodes
FACU	**NN**	*Salsola kali*	Russian thistle	CHENOPODIACEAE	tumbleweed-type shrubby rounded herb to 3-4' in diameter; spiny lvs and frs; mostly found dried and windblown into wetland edges

OBL	N	*Scirpus acutus/validus*	hardstem bulrush, tule	CYPERACEAE	stout in dense stands, 1-3m; thick round stems; lvs basal, highly reduced; infl subterminal and lateral, somewhat open (spikes pedicellate) w/numerous brownish 1.5cm long spike(lets)
OBL	N	*Scirpus americanus*	three-square bulrush	CYPERACEAE	shorter in dense stands, to 1m; lvs narrow, somewhat tufted on rhizomes; infl subterminal and lateral, congested (spikes sessile) w/few brownish to 2cm long spike(lets)
OBL	N	*Scirpus maritimus*	saltmarsh bulrush	CYPERACEAE	to 1.5m (gen <1m); rhiz; mostly not tufted; lvs several, flat (to 1cm wide), invol bracts > infl, w/3-20 2cm x 1cm thick spikelets, tolerates alkali
OBL	N	*Scirpus microcarpus*	small-fruited bulrush	CYPERACEAE	tufted and rhiz; lvs numerous, flat and channeled (to 15mm wide), scabrous edged; infl diffuse, w/many small (to 8mm long) spikelets
FAC to wetter	N	*Senecio serra* (FAC), *S. triangularis* (FACW+), *S. hydrophilus* (FACW-)	groundsels, butterweed	COMPOSITAE	erect to 1m; alt lvs often triangular to lanceolate; numerous yellow heads; invol. bracts black-tipped
FACU-	**NN**	*Sisymbrium altissimum*	tumble mustard	CRUCIFERAE	weed; widely branched to 1m, linear to cpd lvs, flrs yellow; frs rigidly spreading
NL	**NN**	*Sisymbrium loeselii*	tumble mustard	CRUCIFERA	weed; pedicels to 2cm long, thinner than above; frs ascending to erect
FACU	N	*Sisyrinchium douglasii*	blue-eyed grass	IRIDACEAE	lvs flattened, grass-like; infl few blue 3-parted flrs, to 2 cm across, iris-like infl, 1-few in umbel, subtended by bract
OBL	N	*Sium suave*	water parsnip	UMBELLIFERAE	semi-aq; rooting @ lower nodes; lvs 1x pinn cpd, lflts lance-linear, serrate, lateral veins terminate in teeth sinuses; flrs wh-pink in double umbels; infl bracts 6 -10 foliaceous
FAC-	N	*Smilacena stellata*	star Solomon's seal	LILIACEAE	forested species; lvs ovate, alt, veins parallel; small white lily flrs in raceme
FAC	**NN**	*Solanum dulcamara*	nightshade	SOLANACEAE	climbing, viny, weak stemmed; lvs hastate; purple flrs; fr red berry
FAC to drier	**NN**	*Sonchus* spp. (all)	sow-thistle	COMPOSITAE	weed; somewhat thistle-like; lvs lyrate-pinnatifid; flrs yellow in heads
NL to FACW	N	*Solidago* spp. (all)	goldenrod	COMPOSITAE	erect, leaves lanceolate, appearing "whorled", numerous yellow heads in complex terminal panicles
FAC to NL	**NN**	*Sonchus oleraceus*	sow thistle	COMPOSITAE	tall herb, lvs mostly basal, pinnatifid to lobed, spiny margined, soft, fleshy, variable, heads yellow
FACW	N	*Spiranthes romanzoffiana*	hooded ladies' tresses	ORCHIDACEAE	lvs basal, linear-lanceolate, reduced above; infl congested twisted spike of small white orchid flrs
FACW-	N	*Stachys rigida*	hedgenettle	LABIATAE	erect herb, square stems; opp lvs; hairy, malodorous
FAC to wetter	N	*Stellaria* sp. (all)	chickweeds	CARYOPHYLLACEAE	weak stemmed, w/opp usu. ovate to linear-lanceolate lvs; tiny white flrs which form ovoid capsules
FACU	**NN**	*Taraxacum offinale*	dandelion	COMPOSITAE	dandelion; lvs basal rosette, lyrate; flowers all yellow, yellow, solitary on peduncle

FACU	N	*Toxicodendron diversiloba*	poison oak	ANACARDIACEAE	**don't touch**; viny herb with red or green trilobed lvs; often shiny, in southern portion of Basin
NL	**NN**	*Tragopogon dubius*	yellow salsify (goatsbeard)	COMPOSITAE	Herb, large flower, invol bracts >> rays flrs, produces tennis-ball sized fr head (giant dandelion)
NL	**NN**	*Trifolium arvense*	clover	LEGUMINOSAE	stoloniferous; lvs trifoliolate; pea-like flrs, flrs yellow in capitate clusters
NL	**NN**	*Trifolium dubium*	suckling clover	LEGUMINOSAE	as above, small, weedy; flrs small, yellow in tiny umbels
FACU	**NN**	*Trifolium pratense*	red clover	LEGUMINOSAE	as above, flrs red in larger umbels
FAC	**NN**	*Trifolium repens*	white clover	LEGUMINOSAE	as above, white in umbels
OBL	N	*Triglochin* spp. (all)	arrowgrass	JUNCAGINACEAE	occ. in alkaline areas; lvs basal, to 80 cm long; infl term. narrow congested spike, extending well above lvs
OBL	N	*Typha latifolia* and *angustifolia*	cattail	TYPHACEAE	semi-aq; large (to 2m) sword shaped lvs; infl brown sausage w/fluffy seed
FAC+	**NN**	*Urtica dioica*	stinging nettle	URTICACEAE	erect, aromatic; lvs opp w/stinging hairs, serrate; flrs tiny in droopy clusters from lf axils
FACW+	N	*Veratrum californicum*	false hellebore	LILIACEAE	tall, robust (to 2m), per. w/ large, alt, ovate to lanceolate lvs, entire margins, veins prominent; flrs many, green to white in term panicles
NL	**NN**	*Verbascum thapsus*	mullein	SCROPHULARIACEAE	large fuzzy lvs in basal rosette; flrs showy, yellow, in tall (to 3m) infl, turning brown hard
OBL	N	*Veronica americana*	American speedwell	SCROPHULARIACEAE	semi-aquatic, often in mud or slow moving waters; lvs opp, petiolate, flr blue in term. and axillary racemes; frs bilobed
OBL	N	*Veronica anagallis-arvensis*	speedwell	SCROPHULARIACEAE	as above, lvs sessile
OBL	**NN**	*Veronica scutellata*	speedwell	SCROPHULARIACEAE	semi-aq, often in ponded areas; as above; lvs linear-lanceolate, sessile
FAC to wetter	N	*Viola* spp. (all)	violet	VIOLACEAE	lvs heart-shaped; flrs, blue, white, yellow, or mixed
FAC	N	*Xanthium strumarium*	cockle-bur	COMPOSITAE	coarse annual to 2m; w/hand-sized triangular to cordate lvs; flrs in spiny heads which form 2-lobed burs w/hooks, invades seasonal wetlands
AQUATICS					
OBL	N	*Alisma plantago-aquatica*	water plantain	ALISMATACEAE	semi-aq; basal lvs in rosette, lvs oval to 20 cm long; petiole flattened and channeled; flrs 3-parted, white to 9mm across, in diffuse term panicles 3/node; fr oblong, winged, flattened
OBL	N	*Brasenia schreberi*	watershield	NYMPHAEACEAE	aquatic, floating lvs large round, peltate
OBL	N	*Callitriche heterophylla (and C. verna , C. stagnalis)*	water star-wort	CALLITRICHACEAE	aquatic, lax, w/small, linear to spatulate opp/whorled floating lvs that form a small rosette at surface
OBL	N	*Ceratophyllum demersum*	coontail	CERATOPHYLLACEAE	lvs 3/whorl, dichotomously divided, the divisions w/small marginal projections; pl floating, roots absent, but stems sometimes in mud
OBL	N	*Elodea canadensis*	waterweed	HYDROCHARITACEAE	lvs linear, 2mm wide x 15mm long, in whorls of 3, finely serrate; female flrs floating

OBL	N	*Hippuris vulgaris*	mare's-tail	HIPPURIDACEAE	lvs entire, linear, sessile, 4-12/whorl; limp in water or rigid when erect; flrs single in upper axils
OBL	N	*Lemna minor*	duckweed	LEMNACEAE	tiny; free-floating; few lvs; usu. covering surface of water
OBL	**NN**	*Myriophyllum aquaticum (brasiliense)* and *M. spicatum*	water milfoil	HALORAGACEAE	aquatic perennials with finely dissected whorled lvs (feather-like pinnation); *M. aq*. has lvs 5-6/whorl; flrs in axils; *M. sp*. has lvs 4/whorl; flrs in term spikes
OBL	N	*Nuphar luteum*	pond-lily	NYMPHAEACEAE	perennial aquatic w/large floating cordate lvs (lily pads) and large yellow flowers
OBL	N	*Nymphaea odoratum*	water lily	NYMPHAEACEAE	perennial aquatic w/large floating round lvs and white flowers w/many petals
OBL	N	*Potamogeton amplifolius* and *P. natans* (similar)	pondweed	POTAAMOGETONACEAE	robust from rhiz; root @ nodes; submerged lvs to 20cm long, 7cm wide; floating lvs flat ellptical to 10cm, thick; stipules white, sheath-like, to 10 cm long; infl <5cm long; flrs small in term. spikes
OBL	N	*Potamogeton filiformis*	pondweed	POTAAMOGETONACEAE	floating lvs absent; submerged lvs long and linear; infl short whorled term. clusters
OBL	N	*Potamogeton pectinatus*	fennel-lvd pondweed	POTAAMOGETONACEAE	floating lvs absent; submerged lvs apparently highly "divided"; infl short whorled term. clusters
OBL	N	*Ranunculus aquatilis*	water buttercup	RANUNCULACEAE	weak, much branched; submerged lvs finely dissected; floating lvs (when present) shallowly lobed; flrs small, white (submerged or floating)
OBL	N	*Ruppia maritima*	ditch grass	RUPPIACEAE	vegetatively almost indistinguishable from narrow-lvd *Potamogeton*s; fr peduncles tending to coil
OBL	N	*Sparganium emersum*	bur-reed	SPARGANIACEAE	rhiz; lvs long, linear, alt, w/sheathing bases, taller than infl; flrs in ball-shaped head, male/female separate; fruits hard, remain in globular clusters
OBL	N	*Sparganium eurycarpum*	giant bur-reed	SPARGANIACEAE	as above, larger (to 1.5m), rhiz; lvs shorter than infl stem
OBL	N	*Spirodela polyrhiza*	duckweed	LEMNACEAE	floating aquatic w/oval leaf (6x10mm), w/tiny roots; lf surface bright green w/dark dot in center
OBL	N	*Utricularia vulgaris* and *minor*	bladderwort	LENTIBULARIACEAE	free-floating; lvs alt thin, finely divided; small bladders (sacs) are apparent along stem; flrs yellow, tubular, 2-lipped
OBL	**NN**	*Vallisneria americanum*	tapegrass	HYDROCHARITACEAE	intro. Dry Falls Coulee (Grant Co.); lvs <1cm wide, very long, thin; fr on 1-2m long peduncle (coiled)
GRASSES					
NL	**NN**	*Agropyron cristatum (A. desertorum* complex*)* = *Elytrigia*	crested wheatgrass	GRAMINEAE	like *Ag spic* but spklts densely overlapping
FAC-	**NN**	*Agropyron repens* (= *Elytrigia*)	quackgrass	GRAMINEAE	rhiz, sod-forming; spikelets in spike; flt/spklt; placed flat against rachis
UPL	N	*Agropyron spicatum* (= *Pseudoroegneria sp.*)	bluebunch wheatgrass	GRAMINEAE	like *Ag repens*, tufted bunchgrass, spikelets overlapping minimally

FAC	N	*Agrostis scabra*	rough bentgrass	GRAMINEAE	tufted, lvs basal gen short; pan widely spreading, pedicels scabrous (rough) to lips; flrs tiny, @ ends of pan branches
FAC	**NN**	*Agrostis stolonifera* (all incl redtop [*A. gigantea* = *A. alba*], and *A. tenuis*)	bentgrass	GRAMINEAE	mostly rhizomatous, 1 flt/spklt; ligs 1 to 6 mm; infl open panicle
OBL	N	*Alopecurus aequalis* (and *A geniculatus)* *A. aequalis* with awn scarcely exserted from glumes (cf. with *A. genic.* awn >1.5mm longer than glumes)	water foxtails	GRAMINEAE	mat-forming perennial; semi-aquatic; lvs may be bent and float on surface; may have reddish tinge; infl spike-like, dense, pale green, to 8cm long; glumes with marginal bristles, lemmas awned
FACW	**NN**	*Alopecurus pratensis*	meadow foxtail	GRAMINEAE	meadow species; tufted/rhiz; culms to .9m tall; infl as above, purple; awn bent
FACU	**NN**	*Anthoxanthum odoratum*	sweet vernalgrass	GRAMINEAE	meadow species, tight panicle, brassy color in age; gen not wetland sp.
NL	**NN**	*Avena fatua* and *A. sativa*	wild oats	GRAMINEAE	spklts large, 2-3 grain-sized flrts/spklt, awn long twisted, bent
OBL	N	*Beckmannia syzigachne*	American sloughgrass	GRAMINEAE	robust annual to 1m; lvs flat to 1cm broad; infl well-branched, w/2 rows of flattened branches; 1-fl/spklt, flrts disk-like
NL	**NN**	*Bromus commutatus*	hairy brome	GRAMINEAE	awned, many flrts/spklt, spklts > 1.5 cm
NL	**NN**	*Bromus inermis*	smooth brome	GRAMINEAE	spklts red-brown, long, "closed"; drooping in panicles, weedy
NL	**NN**	*Bromus mollis (= B. hordeaceous)*	soft brome	GRAMINEAE	flts rounded, awns usu. < 12mm, lemma teeth < 2mm, weedy
NL	**NN**	*Bromus tectorum*	cheat grass	GRAMINEAE	flts very narrow, awns usu. > 12mm, lemma teeth > 2mm, weedy
NL	**NN**	*Cynosurus echinatus*	dogtail	GRAMINEAE	weedy ann; tufted; spklts in one-sided contracted, thick, pan; bristly from many awns
FACU	**NN**	*Dactylis glomerata*	orchardgrass	GRAMINEAE	stems flat @ base; spklts paniculate in 1 sided clusters; ligules memb. and long (to 9mm)
NL	N	*Danthonia unispicata*	one-spike oatgrass	GRAMINEAE	tufted; ligs (collars) hairy; single (occ. 2) large spklt; gl >> flts
FACW	N	*Deschampsia cespitosa*	tufted hairgrass	GRAMINEAE	densely tufted perennial; lvs dark green, 4 mm wide; panicles diffuse w/smll spklts - often purplish; gl < 5mm
FACW-	N	*Deschampsia danthonoides*	annual hairgrass	GRAMINEAE	as above, though annual and smaller in all respects; bl thin (<2mm broad); gl > 5mm
FAC+	N	*Distichlis spicata*	saltgrass	GRAMINEAE	rhiz; often in alkaline areas; lvs short, appearing 2-ranked/angling sharply from stem; infl spike-like panicles; several flrt/spklt, unawned
FACW	**NN**	*Echinochloa crusgalli*	barnyard grass	GRAMINEAE	weedy, loosely tufted annual; lvs flat wide (to 15mm); paniculate infl purplish, w/bristly appearance
FAC	N	*Elymus cinereus*	giant or Basin wildrye	GRAMINEAE	tufted, lvs > 8mm wide, ligs > 2mm, spklts > 2/node
FAC-	**NN**	*Festuca arundinacea*	tall fescue	GRAMINEAE	tufted, lvs bright green above, paler and slightly ribbed beneath; infl tall panicle; several flrt/spklt, awn short

FACU	N	*Festuca idahoensis*	Idaho fescue	GRAMINEAE	native tufted fescue, infl > 1', lemmas awned, lvs narrow, gray-green, linear, to 1/2 ht of culms
FAC	N	*Festuca rubra*	red fescue	GRAMINEAE	native tufted and rhiz, infl > 1', lemmas awned, lvs narrow, linear, green to 1/3 ht of culms
FACW to wetter	N	*Glyceria striata* (incl *G. borealis, G. grandis, G. elata*)	fowl mannagrass	GRAMINEAE	often in water; rhiz, though often appearing tufted; spklts either short or thin and elongate; lemma veins parallel; awnless; infl diffuse
FAC	**NN**	*Holcus lanatus*	velvetgrass	GRAMINEAE	weedy rhiz pasture grass; light colored infl, turning whitish; 2 flts/spklt; one w/hooked awn; glumes>lemmas
FAC+	**NN**	*Hordeum jubatum*	squirrel-tail barley	GRAMINEAE	weedy, with "fuzzy" heads; disarticulating easily; spklts in term. spike, spklts 2-3/node, awns everywhere
FACW	N	*Muhlenbergia asperifolia*	alkali muhly	GRAMINEAE	infl. diffuse (panicum-like); florets 1, with glumes< flt; saturated pond edges
FACW	N	*Muhlenbergia richardsonis*	mat muhly	GRAMINEAE	infl. a narrow panicle; flts 1, gl < flt; forms mats (open sandy/alk areas near water)
FACU+	**NN**	*Panicum capillare*	witchgrass	GRAMINEAE	weed; stems tufted and hairy; infl extremely diffuse; flrs rounded, hard
FACW	**NN**	*Phalaris arundinacea*	reed canarygrass	GRAMINEAE	coarse rhiz. perennial; aggressive; to 2m tall; lvs long, flat, wide; infl often purplish, dense term. panicles
FAC-	**NN**	*Phleum pratense*	timothy	GRAMINEAE	pasture grass; tuft and rhiz; culms w/purplish nodes; infl dense and spike-like; glumes awned (swallowtail-like)
FACW+	**NN**	*Phragmites communis*	common reed	GRAMINEAE	coarse, rhiz. perennial, aggressive; to 3m tall; infl feathery panicle, reddish or purplish, larger than *Phalaris*
FAC to FACW	**NN**	*Poa* spp (incl. *P. palustris, P. pratensis, P trivialis, P. bulbosa, P. secunda*)	bluegrasses	GRAMINEAE	rhiz. or stol.; ligs usu. > 3mm, lemma w/scant hairs, lemmas small usu. 2-3/spklt
NL	N	*Poa sandbergii*	Sandberg's bluegrass	GRAMINAE	tufted native upl bluegrass may be in margins of wet areas
FAC	**NN**	*Polypogon monspeliensis*	rabbits-foot grass	GRAMINEAE	distinctive grass with thick fuzzy compact infl; glumes tiny, long-awned
FACU	N	*Sporobolus cryptandrus*	sand dropseed	GRAMINEAE	hairy ("sticky-spiny") collars; round beadlike flrts
FACU-	**NN**	*Vulpia octoflora* and *V. bromoides*	annual fescue	GRAMINEAE	ann weedy fescue; often tufted; panicle open; spklts awned
FERNS and ALLIES					
FAC	N	*Athyrium filix-femina*	ladyfern	DRYOPTERIDACEAE	tufted to ca. 1m tall, fronds 2-3x pinn. cpd; crescent shape indusia
FAC	N	*Equisetum arvense*	horsetail	EQUISETACEAE	sterile stems branched ("whorled lvs"), fertile stems unbranched; rhizomatous; often <1m tall
OBL	N	*Equisetum fluviatile*	horsetail	EQUISETACEAE	branched fertile stems; to 1m tall

FACW	N	*Equisetum hyemale*	scouring rush	EQUISETACEAE	unbranched horsetail; aerial stems perennial; cone w/sharp tip
FACW	N	*Equisetum laevigatum*	scouring rush, horsetail	EQUISETACEAE	unbranched horsetail; aerial stems annual; cone w/o sharp tip
FACU	N	*Pteridium aquilinum*	brackenfern	PTERIDACEAE	stout, rhiz, to 2m; fronds large; stipes long, fronds 3x pinn. cpd; indusia lacking, pinna margin curl over sporangia; persistent and drying brown, stiff

Appendix 2- J Field Form for Recording Plant Species

NATIVE	NONNATIVE	SCIENTIFIC NAME	COMMON NAME
		TREES	
☐		*Betula papyrifera*	paper birch
☐		*Fraxinus latifolia*	Oregon ash
☐		*Pinus contorta*	lodgepole pine
☐		*Pinus ponderosa*	ponderosa pine
☐		*Populus balsamifera*	cottonwood
☐		*Populus tremuloides*	quaking aspen
☐		*Pseudotsuga menziesii*	Douglas fir
	☐	*Robinia pseudoacacia*	black locust
☐		*Salix amygdaloides*	peach-leaf willow
		SHRUBS	
☐		*Alnus incana*	white alder
☐		*Amelanchier alnifolia*	serviceberry
	☐	*Artemisia absinthium*	Absinth wormwood
☐		*Artemisia lindleyana*	wormwood
☐		*Artemisia tridentata*	big sagebrush
☐		*Betula occidentalis*	water birch
☐		*Clematis ligusticifolia*	western clematis
☐		*Cornus stolonifera*	red-osier dogwood
☐		*Crataegus columbiana*	Columbia hawthorn
☐		*Crataegus douglasii*	black hawthorn
	☐	*Elaeagnus angustifolia*	Russian olive
☐		*Mahonia repens*	Oregon grape
☐		*Philadelphus lewisii*	mock orange
☐		*Physocarpus malvaceus*	ninebark
☐		*Prunus emarginata*	bittercherry
☐		*Prunus virginiana*	chokecherry
☐		*Quercus garryana*	Oregon oak
☐		*Rhus glabra*	smooth sumac
☐		*Rhus trilobata*	squaw bush
☐		*Ribes aureum*	golden currant
☐		*Ribes cereum*	squaw currant
	☐	*Rosa canina*	dog rose
☐		*Rosa nutkana*	Nootka rose
☐		*Rosa woodsii*	Wood's rose
	☐	*Rubus idaeus*	raspberry
☐		*Rubus ursinus*	trailing blackberry
☐		*Sambucus cerulea*	blue elderberry
☐		*Salix exigua*	coyote willow
☐		*Salix lasiandra* var *caudata*	Pacific willow
☐		*Salix scouleriana*	Scouler willow
☐		*Salix* sp.	other willow
☐		*Sarcobatus vermiculatus*	black greasewood
☐		*Shepherdia canadensis*	buffalo-berry
☐		*Spiraea douglasii*	spirea
☐		*Symphoricarpos albus*	snowberry
		HERBS	
	☐	*Achillea millefolium*	yarrow
☐		*Allium geyeri*	wild onion
	☐	*Amsinckia* sp	fiddleneck
☐		*Anaphalis margaritacea*	pearly everlasting

Asarum caudatum	wild ginger
Asclepias fascicularis	milkweed
Asclepias speciosa	milkweed
Asparagus officinale	asparagus
Aster brachyactis	rayless alkali aster
Aster frondosus	leafy aster
Aster sp (all)	aster
Atriplex heterosperma	orache
Atriplex patula	saltbush
Balsamorhiza sagittata	balsamroot
Barbarea vulgaris	yellow rocket
Bassia hyssopifolia	fivehook bassia
Bellis perennis	English daisy
Bidens cernua	nodding beggar-ticks
Bidens frondosa	nodding beggar-ticks
Bidens tripartita	beggar-ticks
Brassica spp. (all)	mustard
Camassia leichtlinii	camas
Camassia quamash	camas
Cardamine spp. (all)	bittercress
Cardaria draba	white top, hoary cress
Carex amplifolia	big-leaf sedge
Carex lanuginosa	wooly sedge
Carex scirpoidea	single-spiked sedge
Carex utriculata (= C. rostrata)	beaked sedge
Carex spp. (all)	sedge
Castilleja exilis	paintbrush
Centaurea sp. (all)	knapweeds
Cerastium arvense	chickweed
Cerastium vulgatum	chickweed
Chaenactis douglasii	hoary chaenactis
Chenopodium album	goosefoot
Chenopodium hybridum	goosefoot
Chrysanthemum leucanthemum	ox-eye daisy
Cicuta douglasii	water hemlock
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Claytonia lanceolata	western spring-beauty
Collinsia parviflora	blue-eyed mary
Collomia linearis	narrow-leaf collomia
Conium maculatum	poison hemlock
Conyza canadensis	horseweed
Cornus canadensis	bunchberry
Crepis sp.	hawkweed
Cuscuta pentagona	dodder
Delphinium spp. (all)	larkspurs
Dipsacus sylvestris	teasel
Downingia elegans	downingia
Draba verna	whitlow grass
Eleocharis spp. (all)	spikerushes
Eplobium angustifolium	fireweed
Epilobium ciliatum	willowherb
Galium aparine	bedstraw
Galium boreale	Northern bedstraw
Galium trifidum	bedstraw
Geum macrophyllum	largeleaf avens
Geum triflorum	old man's whiskers
Gnaphalium chilense	cotton-batting cudweed

Gnaphalium palustre	lowland cudweed
Gnaphalium uliginosum	marsh cudweed
Gratiola ebracteata	hedge hyssop
Grindelia nana	gumweed
Haplopappus hirtus var. *sonchifolius*	sticky goldenweed
Heracleum lanatum	cow parsnip
Hesperochiron pumila	dwarf hesperochiron
Hieracium spp.	hawkweeds
Holosteum umbellatum	chickweed
Hypericum anagalloides	tinkers-penny
H. formosum	St. John's wort
Hypericum perforatum	St. John's wort
Iris missouriensis	iris
Iris pseudacorus	yellow-flag
Iva xanthifolia	marsh-elder
Juncus balticus	Baltic rush
Juncus bufonius	toad rush
Juncus effusus	soft rush
Juncus kellogii	Kellogg's rush
Juncus spp. (all)	rush
Kochia scoparia	kochia, summer cypress
Lactuca serriola	prickly lettuce
Lappula redowski	stickweed
Lepidium campestre	peppergrass
Lepidium latifolium	peppergrass
Lepidium perfoliatum	peppergrass
Limosella aquatica	mudwort
Linaria dalmatica	toadflax
Lithospermum ruderale	puccoon
Lomatium dissectum	fern-leaved lomatium
Lomatium triternatum	nine-leaf lomatium
Lotus corniculatus	birds-foot trefoil
Ludwigia palustris	water purslane
Lupinus sericeus	silky lupine
Luzula campestris	woodrush
Lycopus uniflorus and *americanus*	bugleweed
Lysichitum americanum	skunk cabbage
Lythrum salicaria	purple loosestrife
Madia glomerata	tarweed
Marah oregona	wild cucumber
Mentha arvensis	mint
Mentha spicata	spearmint
Medicago sativa	alfalfa
Melilotus alba	sweet clover
Melilotus officinalis/indica	sweet clover
Moehringia laterifolia	sandwort
Montia linearis	narrow-lvs montia
Montia perfoliata (= Claytonia p.)	Siberian springbeauty
Microsteris gracilis	microsteris
Mimulus breviflorus	short-flrd monkeyflr
Mimulus guttatus	monkeyflower
Myosotis laxa	forget-me-not
Myosotis scorpioides	forget-me-not
Myosurus minima/aristatus	mouse-tail
Navarretia minima	least navarretia
Oenothera biennis	evening primrose
Orthocarpus hispidus	bristle owl's clover

Physostegia parviflora	purple dragon head
Plagiobothrys leptocladus	popcorn flower
Plantago lanceolata	plantain
Plantago major	English plantain
Polygonum amphibium/concinnum	water smartweed
Polygonum aviculare	knotweed
Polygonum cuspidatum	Japanese knotweed
Polygonum hydropiper	waterpepper
Polygonum hydropiperoides	water smartweed
Polygonum lapathifolium	willow smartweed
Polygonum persicaria	lady's thumb
Potentilla anserina	common silverweed
Potentilla gracilis	cinquefoil
Prunella vulgaris	self-heal
Ranunculus repens	buttercup
Rhus radicans	poison ivy
Rorippa curvisiliqua (and others)	yellow water-cress
Rorippa nasturtium-aquaticum	water-cress
Rumex acetosella	sheep sorrel
Rumex crispus	curly dock
Rumex occidentalis	western dock
Sagittaria latifolia	arrowhead, wapato
Salicornia rubra	red glasswort
Salsola kali	Russian thistle
Scirpus acutus/validus	hardstem bulrush, tule
Scirpus americanus	three-square bulrush
Scirpus maritimus	bulrush
Scirpus microcarpus	small-fruited bulrush
Senecio serra and others	groundsels, butterweed
Sisymbrium altissimum	tumble mustard
Sisymbrium loeselii	tumble mustard
Sisyrinchium douglasii	blue-eyed grass
Sium suave	water parsnip
Smilacena stellata	star Solomon's seal
Solanum dulcamara	nightshade
Sonchus spp. (all)	sow-thistle
Sparganium emersum	bur-reed
Sparganium eurycarpum	giant bur-reed
Solidago spp. (all)	goldenrod
Sonchus oleraceus	sow thistle
Spiranthes romanzoffiana	hooded ladies' tresses
Stachys rigida	hedgenettle
Stellaria sp. (all)	chickweeds
Taraxacum officinale	dandelion
Toxicodendron diversiloba	poison oak
Tragopogon dubius	yellow salsify (goatsbeard)
Trifolium arvense	clover
Trifolium dubium	suckling clover
Trifolium pratense	red clover
Trifolium repens	white clover
Triglochin spp. (all)	arrowgrass
Typha latifolia and *angustifolia*	cattail
Urtica dioica	stinging nettle
Veratrum californicum	false hellebore
Verbascum thapsus	mullein
Veronica americana	American speedwell
Veronica anagallis-arvensis	speedwell
Veronica scutellata	speedwell

	Viola spp. (all)	violet
	Xanthium strumarium	cockle-bur
	AQUATICS	
	Alisma plantago-aquatica	water plantain
	Brasenia schreberi	watershield
	Callitriche heterophylla	water star-wort
	Ceratophyllum demersum	coontail
	Elodea canadensis	waterweed
	Hippuris vulgaris	mare's-tail
	Lemna minor	duckweed
	Myriophyllum aquaticum (brasiliense) and *M. spicatum*	water milfoil
	Nuphar luteum	pond-lily
	Nymphaea odoratum	water lily
	Potamogeton amplifolius	pondweed
	Potamogeton filiformis	pondweed
	Potamogeton pectinatus	fennel-lvd pondweed
	Ranunculus aquatilis	water buttercup
	Ruppia maritima	ditch-grass
	Spirodela polyrhiza	duckweed
	Utricularia vulgaris and *U. minor*	bladderwort
	Vallisneria americanum	tapegrass
	GRASSES	
	Agropyron cristatum complex	crested wheatgrass
	Agropyron repens (= *Elytrigia*)	quackgrass
	Agropyron spicatum (= *Pseudoroegneria*)	bluebunch wheatgrass
	Agrostis scabra	rough bentgrass
	Agrostis stolonifera (all incl redtop [*A. gigantea* = *A. alba*], and *A. tenuis*)	bentgrass
	Alopecurus aequalis (and *A geniculatus)*	water foxtails
	Alopecurus pratensis	meadow foxtail
	Anthoxanthum odoratum	Sweet vernal grass
	Avena fatua and *A. sativa*	wild oats
	Beckmannia syzigachne	American sloughgrass
	Bromus commutatus	hairy brome
	Bromus inermis	smooth brome
	Bromus mollis	soft brome
	Bromus tectorum	cheat grass
	Cynosurus echinatus	dogtail
	Dactylis glomerata	orchardgrass
	Danthonia unispicata	single-spike oatgrass
	Deschampsia cespitosa	tufted hairgrass
	Deschampsia danthonoides	annual hairgrass
	Distichlis spicata	saltgrass
	Echinochloa crusgalli	barnyard grass
	Elymus cinereus	giant or Basin wildrye
	Festuca arundinacea	tall fescue
	Festuca idahoensis	Idaho fescue
	Festuca rubra	red fescue
	Glyceria striata (incl *G. borealis, G. grandis, G. elata*)	fowl mannagrass

		Holcus lanatus	velvetgrass
		Hordeum jubatum	squirrel-tail barley
		Muhlenbergia asperifolia	alkali muhly
		Muhlenbergia richardsonis	mat muhly
		Panicum capillare	witchgrass
		Phalaris arundinacea	reed canarygrass
		Phleum pratense	timothy
		Phragmites communis	common reed
		Poa spp (incl. *P. palustris, P. pratensis, P trivialis*)	bluegrasses
		Poa sandbergii	Sandberg's bluegrass
		Polypogon monspeliensis	rabbits-foot grass
		Sporobolus cryptandrus	sand dropseed
		Vulpia bromoides/octoflora	annual fescue

FERNS AND ALLIES

	Athyrium filix-femina	ladyfern
	Equisetum arvense	horsetail
	Equisetum fluviatile	horsetail
	Equisetum hyemale	scouring rush
	Equisetum laevigatum	scouring rush, horsetail
	Pteridium aquilinum	brackenfern

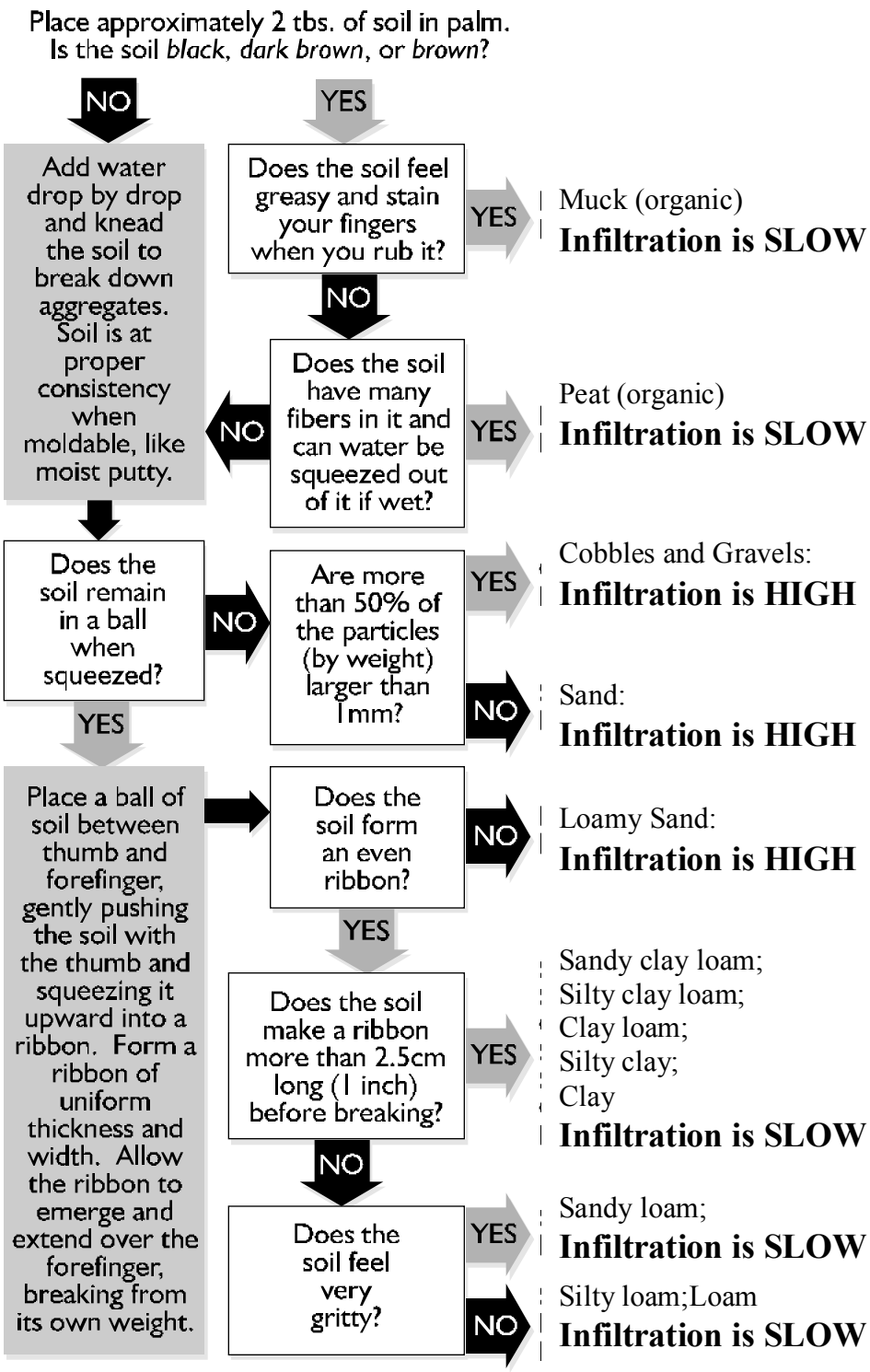
ADDITIONAL SPECIES

Natives

Non-Natives

		TOTALS

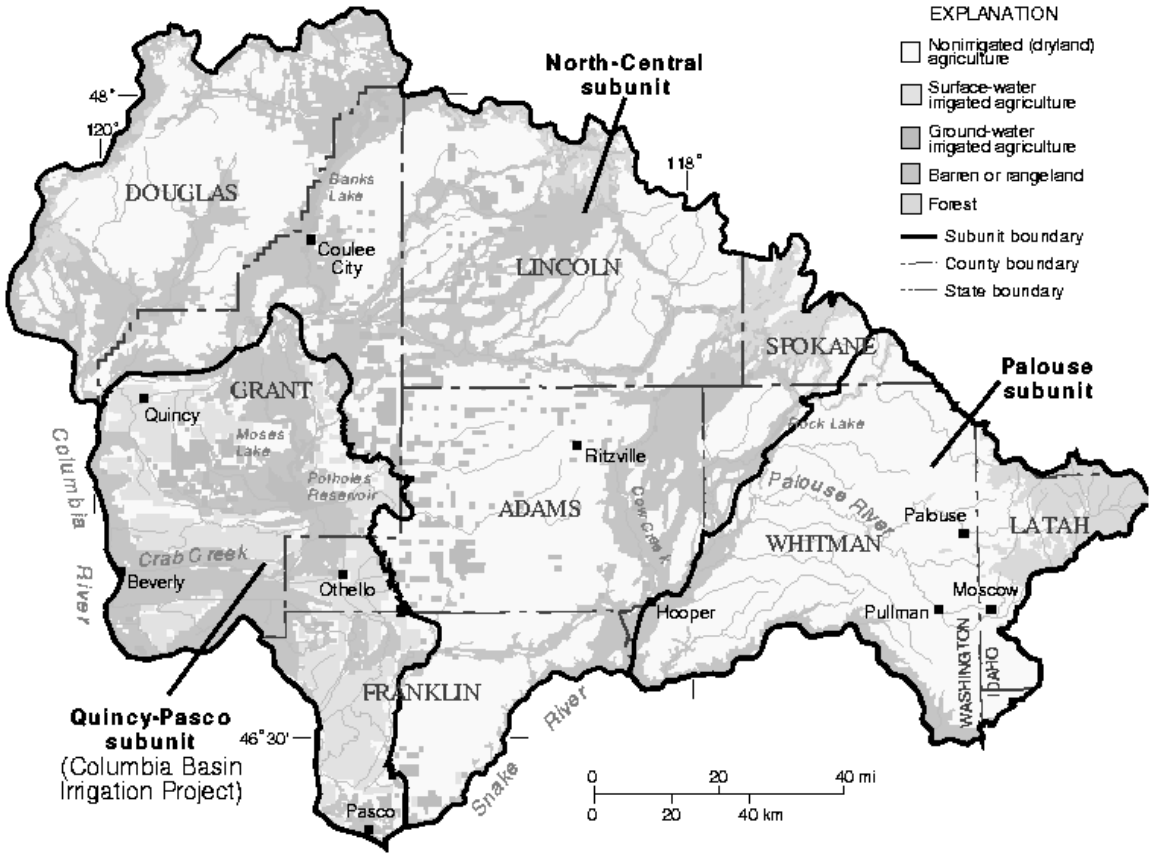
Appendix 2-K Rating Infiltration Rates



: Rating Infiltration Rate of Soils

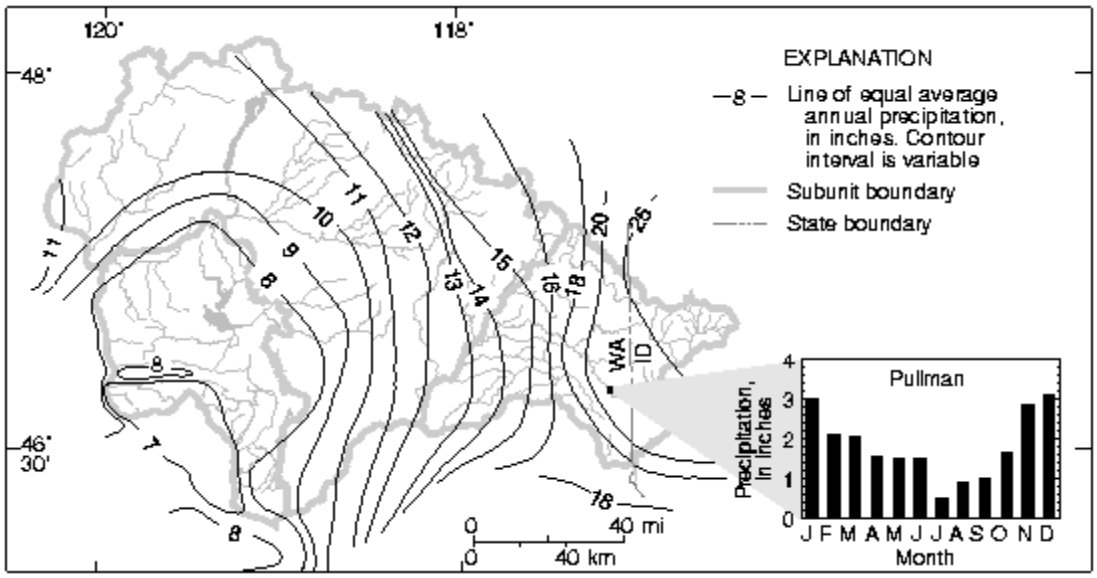
Appendix 2-L Map of Reclamation Project

From Williamson et al. (1998). A color version of this map is available for downloading from this document found on the Ecology web site http://www.wa.gov/ecology/sea/wfap/wfaphome.html.



Appendix 2-M Map of Average Annual Precipitation

From Williamson et al. (1998).



Appendix 2-N Example of Mapping Cowardin Classes on an Aerial Photograph


Aquatic Bed
Forest
AV Boundary
Perennial Open H2O
Scrub Shrub
Emergent

Appendix 2-O Tables for Summarizing Results

Summary of Function Assessments

Wetland Name: _____ **AU ID#:** _____
Date: _____ **T/S/R:** _____
Investigator Name: _____ **Size of AU** _____

Wetland Classification:

Depressional Long-duration ❒ Depressional Short-duration ❒

When box is shaded, then index or rating is not required

Function	Index For Potential/Suitability	Index For Opportunity
Water Quality Functions		
Removing Sediment		
Removing Nutrients/Nitrogen		
Removing Nutrients/Phosphorous		
Removing Metals & Toxic Organics		
Water Quantity Functions		
Reducing Downstream Erosion and Flooding		*Use Qualitative Rating (High, Moderate,Low) since opportunity could not be modeled*
Recharging Groundwater		**No opportunity rating required for long and short-duration All wetlands were judged to have high opportunity**

Function	Index For Potential	Index For Opportunity
Habitat Functions		
General Habitat		
Habitat for Invertebrates		
Habitat for Amphibians		
Habitat for Aquatic Birds		*Use Qualitative Rating (High, Moderate,Low) since opportunity could not be modeled*
Habitat for Aquatic Mammals Enter index for Long-duration Wetlands	**Short-duration wetlands were judged as unsuitable year round habitat**	
Richness of Native Plants		**No model developed since all wetlands were judged to have same opportunity**
Supporting Food Webs		

Rationale for dividing wetland into multiple assessment units

Information of special note in the AU (such as endangered/threatened species, local significance, etc.):

Description of areas that were not directly observed and explanation as to why:

General Comments:

Summary of Function Assessments

Wetland Name: _____ **AU ID#:** _____
Date: _____ **T/S/R:** _____
Investigator Name: _____ **Size of AU** _____

For Depressional Alkali Wetlands:

Function	Index For Potential	Index For Opportunity
Water Quality Functions	**Note: No Index for Potential or Opportunity was developed since there was insufficient information to develop model**	
Water Quantity Functions		
Reducing Downstream Erosion and Flooding		*Use Qualitative Rating (High, Moderate,Low) since opportunity could not be modeled*
Recharging Groundwater	**Function not performed so no models developed. Alkali wetlands are considered to be points of groundwater discharge.**	
Habitat Functions		
General Habitat		
Habitat for Invertebrates		
Habitat Amphibians		
Habitat for Aquatic Birds		*Use Qualitative Rating (High, Moderate,Low) since opportunity could not be modeled*
Habitat for Aquatic Mammals		
Richness of Native Plants		**No model developed since all wetlands were judged to have same opportunity**
Supporting Food Webs	**No model developed for Alkali wetlands since they all perform function at same level**	

Rationale for dividing wetland into multiple assessment units

Information of special note in the AU (such as endangered/threatened species, local significance, etc.):

Description of areas that were not directly observed and explanation as to why:

General Comments: