U. S. LENTIC WETLAND ECOLOGICAL HEALTH ASSESSMENT (Survey)
USER MANUAL
(Current as of 6/14/2023)

This document is intended to accompany the *U. S. Lentic Wetland Ecological Health Assessment (Survey) Form* for the rapid evaluation of the functional health status of lentic (still water) wetlands. Other forms are available for lotic (flowing water) wetlands.

ACKNOWLEDGEMENTS

Development of these assessment tools has been a collaborative and reiterative process. Many people from many agencies and organizations have contributed greatly their time, effort, funding, and moral support for the creation of these documents, as well as to the general idea of devising a way for people to look critically at wetlands and riparian areas in a systematic and consistent way. Some individuals and the agencies/organizations they represent who have been instrumental in enabling this work are Dan Hinckley, Tim Bozorth, and Jim Roscoe of the USDI Bureau of Land Management in Montana; Karen Rice and Karl Gebhardt of the USDI Bureau of Land Management in Idaho; Bill Haglan of the USDI Fish and Wildlife Service in Montana; Barry Adams and Gerry Ehlert of Alberta Sustainable Resource Development; Lorne Fitch of Alberta Environmental Protection; and Greg Hale and Norine Ambrose of the Alberta Cows and Fish Program.

BACKGROUND INFORMATION

Introduction

Public and private land managers are being asked to improve or maintain wetland (lentic) habitat and water quality on lands throughout the western North America. Three questions that are generally asked about a wetland site are: 1) What is the potential of the site (e.g., climax or potential natural community)? 2) What plant communities currently occupy the site? and 3) What is the overall health (condition) of the site? For a lentic (still water) site, the first two questions can be answered by using the U.S. Lentic Wetland Inventory Form along with a document such as *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995), *Classification and Management of USDI Bureau of Land Management's Riparian and Wetland Sites in Eastern and Southern Idaho* (Hansen and Hall 2002), *Classification and management of upland, riparian, and wetland sites of USDI Bureau of Land Management's Miles City Field Office, eastern Montana USA* (Hansen and others 2008), or a similar publication written for the region in which you are working.

This *Lentic Wetland Ecological Health Assessment (Survey)* is a method for rapidly addressing the third question above: What is the site's overall health (condition)? It provides a site rating useful for setting management priorities and stratifying wetland sites for remedial action or closer analytical attention. It is intended to serve as a first approximation, or coarse filter, by which to identify lentic wetlands in need of closer attention so that a manager can more efficiently concentrate effort. We use the term lentic (still water wetland) health to mean the ability of a lentic wetland to perform certain functions. These functions include sediment trapping, shoreline maintenance, water storage, aquifer recharge, wave energy dissipation, maintenance of biotic diversity, and primary production.

Flowing Water (Lotic) vs. Still Water (Lentic) Wetlands

Cowardin and others (1979) point out that no single, correct definition for wetlands exists, primarily due to the nearly unlimited variation in hydrology, soil, and vegetative types. Wetlands are lands transitional between aquatic (water) and terrestrial (upland) ecosystems. Windell and others (1986) state that "wetlands are part of a continuous landscape that grades from wet to dry. In many cases, it is not easy to determine precisely where they begin and where they end."

In the semi-arid and arid portions of western North America, a useful distinction has been made between wetland types based on association with different aquatic ecosystems. Several authors have used ***lotic*** and ***lentic*** to separate wetlands associated with running water from those associated with still water. The following definitions represent a synthesis and refinement of terminology from Shaw and Fredine (1956), Stewart and Kantrud (1972), Boldt and others (1978), Cowardin and others (1979), American Fisheries Society (1980), Johnson and Carothers (1980), Cooperrider and others (1986), Windell and others (1986), Environmental Laboratory (1987), Kovalchik (1987), Federal Interagency Committee for Wetland Delineation (1989), Mitsch and Gosselink (1993), and Kent (1994).

Lentic wetlands are associated with still water systems. These wetlands occur in basins and lack a defined channel and floodplain. Included are permanent (i.e., perennial) or intermittent bodies of water such as lakes, reservoirs, potholes, marshes, ponds, and stockponds. Other examples include fens, bogs, wet meadows, and seeps not associated with a defined channel.

Lotic wetlands are associated with rivers, streams, and drainage ways. They contain a defined channel and floodplain. The channel is an open conduit, which periodically or continuously carries flowing water. Beaver ponds, seeps, springs, and wet meadows on the floodplain of, or associated with, a river or stream are part of the lotic wetland.

Functional vs. Jurisdictional Wetland Criteria

Defining wetlands has become more difficult as greater economic stakes have increased the potential for conflict between politics and science. A universally accepted wetland definition satisfactory to all users has not yet been developed because the definition depends on the objectives and the field of interest. However, scientists generally agree that wetlands are characterized by one or more of the following features: 1) ***wetland hydrology,*** the driving force creating all wetlands, 2) ***hydric soils,*** an indicator of the absence of oxygen, and 3) ***hydrophytic vegetation,*** an indicator of wetland site conditions. The problem is how to define and obtain consensus on thresholds for these three criteria and various combinations of them.

Wetlands are not easily identified and delineated for jurisdictional purposes. Functional definitions have generally been difficult to apply to the regulation of wetland dredging or filling. Although the intent of legislation is to protect wetland functions, the current delineation of jurisdictional wetland still relies upon structural features or attributes.

The prevailing view among many wetland scientists is that ***functional wetlands need*** to meet only one of the three criteria as outlined by Cowardin and others (1979) (e.g., hydric soils, hydrophytic plants, and wetland hydrology). On the other hand, ***jurisdictional wetlands need to*** meet all three criteria, except in limited situations. Even though functional wetlands may not meet jurisdictional wetland requirements, they certainly perform wetland functions resulting from the greater amount of water that accumulates on or near the soil surface relative to the adjacent uplands. Examples include some woody draws occupied by the *Fraxinus pennsylvanica*/*Prunus virginiana* (green ash/chokecherry) habitat type and some floodplain sites occupied by the *Artemisia cana*/*Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type or the *Pinus ponderosa*/*Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type. Currently, many of these sites fail to meet jurisdictional wetland criteria. Nevertheless, these sites do provide important wetland functions and may warrant special managerial consideration. The current interpretation, at least in the western United States, is that not all functional wetlands are jurisdictional wetlands, but all jurisdictional wetlands are functional wetlands.

Lentic Wetland Ecological Health

The health of a lentic site (a still water wetland) may be defined as the ability of that system (including the saturated and inundated near-shore emergent wetland and all the shoreline area that is influenced by the lentic waters) to perform certain wetland functions. These functions include sediment trapping, shoreline maintenance, water storage, aquifer recharge, wave energy dissipation, primary biotic production, and wildlife habitat. A site's health rating may also reflect management considerations. For example, although *Centaurea maculosa* (spotted knapweed) or *Euphorbia esula* (leafy spurge) may help to trap sediment and provide soil-binding properties, other functions (i.e., productivity and wildlife habitat) will be impaired; and their presence should be a management concern. Excellent sources of practical ideas and tips on good management of wetland sites are found in *Caring for Shoreline Properties* (Valastin and others 1999) and *Caring for the Green Zone* (Adams and Fitch 1995), and *Riparian Areas: A User's Guide to Health* (Fitch and Ambrose 2003).

No single factor or characteristic of a wetland site can provide a complete picture of either site health or the direction of trend. The lentic wetland ecological health assessment is based on consideration of physical, hydrologic and vegetation factors. It relies heavily on vegetative characteristics as integrators of factors operating on the landscape. Because they are more visible than soil or hydrological characteristics, plants may provide early indications of riparian health as well as successional trend. These are reflected not only in the types of plants present, but also by the effectiveness with which the vegetation carries out its wetland functions of stabilizing the soil, trapping sediments, and providing wildlife habitat. Furthermore, the utilization of certain types of vegetation by animals may indicate the current condition of the wetland and may indicate trend toward or away from potential natural community (PNC).

In addition to vegetation factors, an analysis of site health and its susceptibility to degradation must also consider physical factors (soils and hydrology) for both ecologic and management reasons. Changes in soil or hydrologic conditions obviously affect the function of a wetland ecosystem. Moreover, degradation in physical characteristics are often (but not always) more

difficult to remedy than vegetative degradation. For example, downcutting of an unstable overflow point may lower the water table and thus change site potential from a *Typha latifolia* (common cattail) habitat type to an *Agropyron smithii* (western wheatgrass) habitat type or even to an upland type. Sites experiencing significant hydrologic, edaphic (soil), or climatic changes will likely also have new plant community potential.

This ecological health assessment is not designed to serve as an in-depth and comprehensive analysis of ecologic processes. Such analysis may be warranted on a site and can be done after this evaluation has identified particular areas of concern. Nor does this approach yield an absolute rating to be used in comparison with wetlands in other areas or of other types. Appropriate comparisons using this rating can be made between neighboring wetlands of similar size and type and between subsequent assessments of the same site.

The assessment procedure has been tested in Montana, Idaho, North Dakota, South Dakota, and other surrounding states and western Canada since 1992. Some potential uses for this rating are: 1) for stratifying wetlands by degree of ecologic dysfunction, 2) for identifying ecologic problems, and 3) when repeated over time, for monitoring to detect functional change. A less direct, but also important, value of an environmental assessment of this kind is its educational potential. By getting land managers to focus on individual riparian functions and ecologic processes, they may come to better understand how the parts work together and are affected by human activities.

A single evaluation provides a rating at only one point in time. Due to the range of variation possible on a wetland site, a single evaluation cannot reliably indicate trend (whether the site is improving, degrading, or stable). To monitor trend, ecological health assessments should be repeated in subsequent years during the same time of year. Evaluation should be conducted when most plants can be identified in the field and when hydrologic conditions are most nearly normal (e.g., not during peak spring runoff or immediately after a major storm). Management regime should influence assessment timing. For example, in assessing trend on rotational grazing systems, one should avoid comparing a rating after a season of use one year to a rating another year after a season of rest.

There are some visible changes to riparian area health which we have no simple way to measure. An obvious and commonly encountered example is excess entrained sediment. This may indicate serious degradation, but we leave it out of the assessment due to difficulty in knowing how much is normal. Instead, we address on-site causes of sediment production: bare ground, shoreline with poor root mass protection, and human-caused structural damage to the shoreline.

Polygon Delineation

The lentic wetland inventory process incorporates data on a wide range of biological and physical categories. The basic unit of delineation within which this data is collected is referred to as a ***polygon.*** A polygon is the area upon which one set of data is collected. One inventory form is completed (i.e., one set of data is collected) for each polygon. One or more (usually several) polygons constitute a project. A lentic (still water) wetland polygon is a wetland, or portion of a wetland, which is not associated with a waterway (stream or river) and which has no defined channel. Polygons are delineated on topographic maps before observers go to the field. It is important to clearly mark and number the polygons on the map.

If aerial photos are available, polygon delineations can be based on vegetation differences, geologic features, or other observable characteristics. On larger systems with wide wetland areas, aerial photos may allow delineation of multiple vegetation-based polygons away from the water source. In these cases, where polygons can be drawn as enclosed units a minimum mapping unit of possibly 2 to 4 ha (5 to 10 ac) should be followed. The size of the minimum mapping unit should be based on factors such as management capabilities, available funds, and capabilities of data collection.

If pre-delineated polygons are drawn on the maps, and pre-assigned numbers are given, be sure the inventoried polygons correspond exactly to those drawn. Observers are allowed to move polygon boundaries, create new polygons, or consolidate polygons if the vegetation, geography, location of fences, or width of the wetland zone warrant. If polygon boundaries are changed, the changes must be clearly marked on the field copies of the maps. Observers should draw the complete polygon boundary onto their field maps if possible at the 1:20,000 or 1:50,000 scale.

In most cases involving small bodies of water or small lentic wetlands, the inventoried polygon will be a single unit of area. Around larger lakes, extensive marshes, or other large lentic wetlands, it may be necessary to divide the wetland into separate polygons (Figure 1). Polygons should be divided at distinct locations such as fences, stream entrances or exits, or other features easily recognized in the field. When selecting representative sites, consideration should be given to the differences

presented by landform position (i.e., point vs. bay, or windward vs. leeward side of the water body). ***Polygons should not cross fences between areas with different management.***

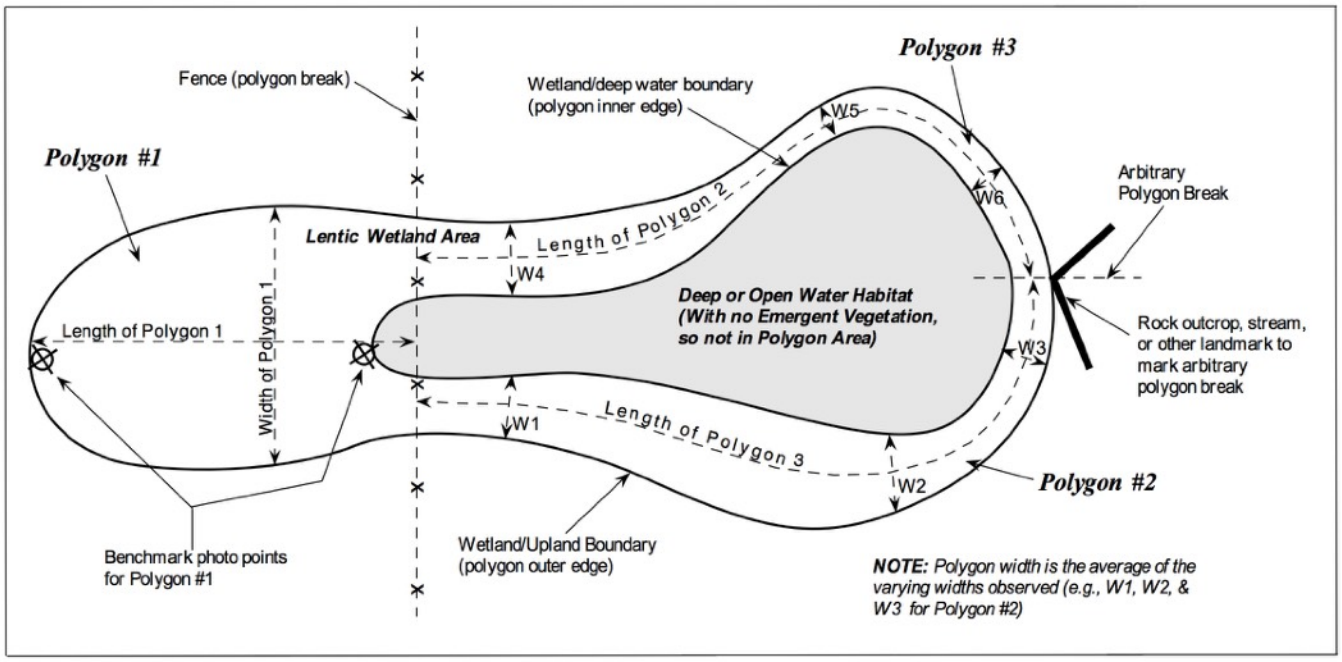

Figure 1. Schematic drawing of a lentic (still water) wetland showing: 1) delineation of polygons on larger systems, i.e. those too big to inventory as a single polygon (more than about 1.6 km [0.5 mi] in length) or those with managerial breaks crossing them; 2) a typical relationship between deep water habitat (lacking emergent vegetation) and surrounding lentic wetland, which includes all areas of persistent emergent vegetation in standing water.

The outer boundaries of polygons are usually at the wetland ecosystem outer edges. These boundaries are sometimes easily determined by abrupt changes in the landform and/or vegetation, but proper determination often depends on experienced interpretation of more subtle features. Do not include deep water habitat within the polygon area. The inner polygon boundary is the landward edge of the deep-water habitat, or where persistent emergent vegetation gives way to open water. In concept, deep-water habitat is the area covered by surface water deeper than 2 m (6.6 ft), or where sunlight cannot penetrate to support persistent, erect, rooted, plant life. Persistent emergent vegetation consists of species that normally remain standing at least until the beginning of the next growing season, e.g., *Typha* species (cattails) or *Scirpus* species (bulrushes). In practice, include all emergent vegetation (i.e., go out to open water) regardless of depth. If emergent vegetation has been removed by human activity, include out to where it would be expected in the absence of that impact. If there is no emergent vegetation, and there is no apparent potential for it, then stop the polygon where persistent vegetation ends and the open water begins.

In cases where observer access and visibility on part of the site to be assessed is impeded by deep water that may have extensive areas of emergent vegetation, the observer may choose, with documented reason, to either:

- Break the area into separate polygons in cases where large areas are utilized differently, such as where the landward area (onshore) is heavily impacted by human use and the wetted area (marsh) is unimpacted;
- Draw an arbitrary outer edge of the polygon that does not include all of the area with emergent vegetation, in which case the observer must carefully document the delineation and the rationale employed; or
- Include the entire dry and wet area together in a single polygon with careful commentary noting any areas that may be impacted differently due to having such greatly different conditions.

NOTE: **Determining (lentic) polygon with no water (therefore no excluded area)**
The length is to be the long axis of the waterbody even if you only assess a portion of it, which may be longer than "width" or not (may need to use air photo to determine). Width will be determined perpendicular to that long axis and the benchmark photos are to be taken at the end of each length. If the benchmarks do not capture the entire view and water level conditions than additional benchmarks are to be taken. In situations with no inner boundary, make sure to take photos inside tall vegetation as well as outside. Take a central photo which is considered the "inner" benchmark.

When using the inventory on artificial or artificially enlarged water bodies (e.g. dugout, manmade pond, reservoirs), use the same criteria, but remember that there will be questions that are difficult to apply appropriately. Focus on consistently applying the methods, including site boundaries, as well as recording all decisions made in applying the methodology. The goal of this exercise is to assess the ability of the site to perform riparian functions ***to its potential.***

Identification of plant communities by vegetation type (such as Hansen and others 1995, Hansen and others 2008, Hansen and Hall 2002, or other classification appropriate to the region where you are working) will be useful both in site selection and, later, in determining appropriate management. These communities may be in a mosaic difficult to map. An area may have a mix of herbaceous communities, shrubs, and forest. These communities have diverse resource values and may respond differently to a management action, but it is seldom practical to manage such communities separately. Community composition can be described as percentages of component types. Management actions can then be keyed to the higher priority types present.

DATA FORM ITEMS

Record ID No. This is the unique identifier allocated to each polygon. This number will be assigned in the office when the form is entered into the database.

Administrative Data
A1. Agency or organization collecting the data.

A2. Funding Agency/Organization.

A3a. BLM (Bureau of Land Management) State Office.

A3b. BLM Field Office/Field Station.

A3c. BLM Office Code (recorded in the office).

A3d. Is the polygon in an active BLM grazing allotment (recorded in the office)?

A3e, f. For BLM polygons, the BLM Office Code, whether the polygon is in an active BLM grazing allotment, and the Allotment Number is supplied by the BLM. These items are entered into the computer in the office; the computer then references a master list of Allotment ID's to complete the remaining Allotment information. Because some polygons incorporate more than one Allotment, space is provided to enter two sets of Allotment information. The master Allotment list is periodically updated by the BLM National Applied Resource Sciences Center to make needed corrections.

A4. USDI Fish and Wildlife Service Refuge name.

A5. Indian Reservation name.

A6. USDI National Park Service Park/National Historical Site name.

A7. USFS (Forest Service) National Forest name.

A8. Other location.

A9. Year the field work was done.

A10. Date of field work by day, month, and year.

A11. Names of all field data observers.

NOTE: Information for items **A12a-h** is found in the office; field evaluators need not complete these items.

A12. The several parts of these items identify various ways in which a data record may represent a resampling of a polygon that may have been inventoried again at some other time. The data in this record may have been collected on an area that coincides precisely with an area inventoried at another time and recorded as another record in the database. It may also represent the resampling of only a part of an area previously sampled. This would include the case where this polygon overlaps, but does not precisely and entirely coincide with one inventoried at another time. One other case is where more than one polygon inventoried one year coincides with a single polygon inventoried another year. All of these cases are represented in the database, and all have some value for monitoring purposes, in that they give some information on how the status on a site changes over time. ***This is done in the office with access to the database; field evaluators need not complete these items.***

A12a. Has any part of the area within this polygon been inventoried previously, or subsequently, as represented by any other data record in the database? Such other records would logically carry different dates.

A12b. Does the areal extent of this polygon exactly coincide with that of any other inventory represented in the database? In many cases, subsequent inventories only partially overlap spatially. The purpose of this question is to identify those records that can be compared as representing exactly the same ground area.

A12c. Does this record represent the latest data recorded for this site (polygon)?

A12d. If A12b is answered Yes, then enter the record ID number(s) of any other previous or subsequent re-inventories (resampling) of this exact polygon for purposes of cross-reference.

A12e. Enter the years of any records recorded in item A12d as representing other inventories of this exact polygon.

A12f. Even though this polygon is not a re-inventory of the exact same area as any other polygon, does it share at least some common area with one or more polygons inventoried at another time?

A12g. Enter the years of any other inventories of polygons sharing common ground area with this one.

A12h. If A12f is answered Yes, then enter the record ID number(s) of any other polygon(s) sharing common ground area with this one.

A13a. Has a management change been implemented on this polygon?

A13b. If A13a is answered Yes, in what year was the management change implemented?

A13c. If A13a is answered Yes, describe the management change implemented.

Location Data
B1. State in which the field work was done (recorded in the office).

B2. County or municipal district in which the field work was done (recorded in the office).

B3. This field for allotment, range, or management unit is intended for entities other than the BLM to use for grouping polygons by management unit. The BLM management units are grouped using the grazing allotment information in A3 above.

B4a. For lentic polygons the area is usually listed as a lake name, or other local designation that identifies the area where the inventory is conducted. If possible, use a name that is shown on the 7.5 minute topographic map.

B4b. Record the stream (if there is one) with which the inventoried lentic wetland is associated. Such association may be by inlet or outlet surface flow, or by general ground water (sub surface) connection.

B4c, d. Polygons are grouped together for management purposes. For example, all polygons around Henry's Lake in the Idaho Falls Field Office could be identified as Group Name: Idaho Falls Field Office; Group Number: 1 (recorded in the office).

B5. Polygon number is a sequential identifier of the portion of the area assessed. This is referenced to the map delineations. Sequences normally progress clockwise.

B6. Elevation (feet or meters) of the polygon midpoint. Elevation is interpolated from the topographic map(s).

B7a. Record the latitude and longitude of the polygon, along with the GPS projection and accuracy. Record the degrees, minutes, and seconds, along with decimal degrees. ***NOTE: All of North America is latitude = North, and longitude = West.***

B7b. Record any comments pertaining to the "other" location.

B8. Identity the hydrologic unit code(s) (HUC) associated with the reach of stream contained in the polygon are recorded. The HUC data is obtained from the US Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2012). Based on the finest level of resolution available from the USGS for the stream reach, the levels of HUC information are entered by the computer onto the form. The USGS has divided the nation into successively smaller hydrologic units, based on drainage basins and watersheds. These units fit into hierarchical levels, uniquely identified by a pair of digits for each successive level (i.e., an eight-digit number identifies a drainage at the fourth (subbasin) level; and a twelve digit HUC identifies one at the sixth (subwatershed) level (Figure 2).

As defined by the USGS (2012), a ***hydrologic unit*** is "a drainage area delineated to nest in a multi-level, hierarchical drainage system. Its boundaries are defined by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream or similar surface waters. A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, non-contributing, and diversions to form a drainage area with single or multiple outlet points. Hydrologic units are only synonymous with classic watersheds when their boundaries include all the source area contributing surface water to a single defined outlet point."

Provision is made on the data form for multiple HUC units, because a polygon may include all, or part, of more than one HUC unit (especially when finer levels, such as the subwatershed [sixth] level, are identified).

The HUC data provided includes these items:

- HUC identification number to as many digits as have been delineated by USGS, down to the sixth level (12 digits);
- River miles of the stream from this HUC unit that fall within this polygon;
- Percent of the polygon stream reach that is located in this HUC unit (e.g., 100 percent if the entire polygon is all in one HUC unit;
- Name of the region (first level of the HUC) (and its size in square miles);
- Name of the subregion (second level of the HUC) (and its size in square miles);
- Name of the basin (third level of the HUC) (and its size in square miles);
- Name of the subbasin (fourth level of the HUC) (and its size in square miles);
- Name of the watershed (fifth level of the HUC) (and its size in square miles); and
- Name of the subwatershed (sixth level of the HUC) (and its size in acres).

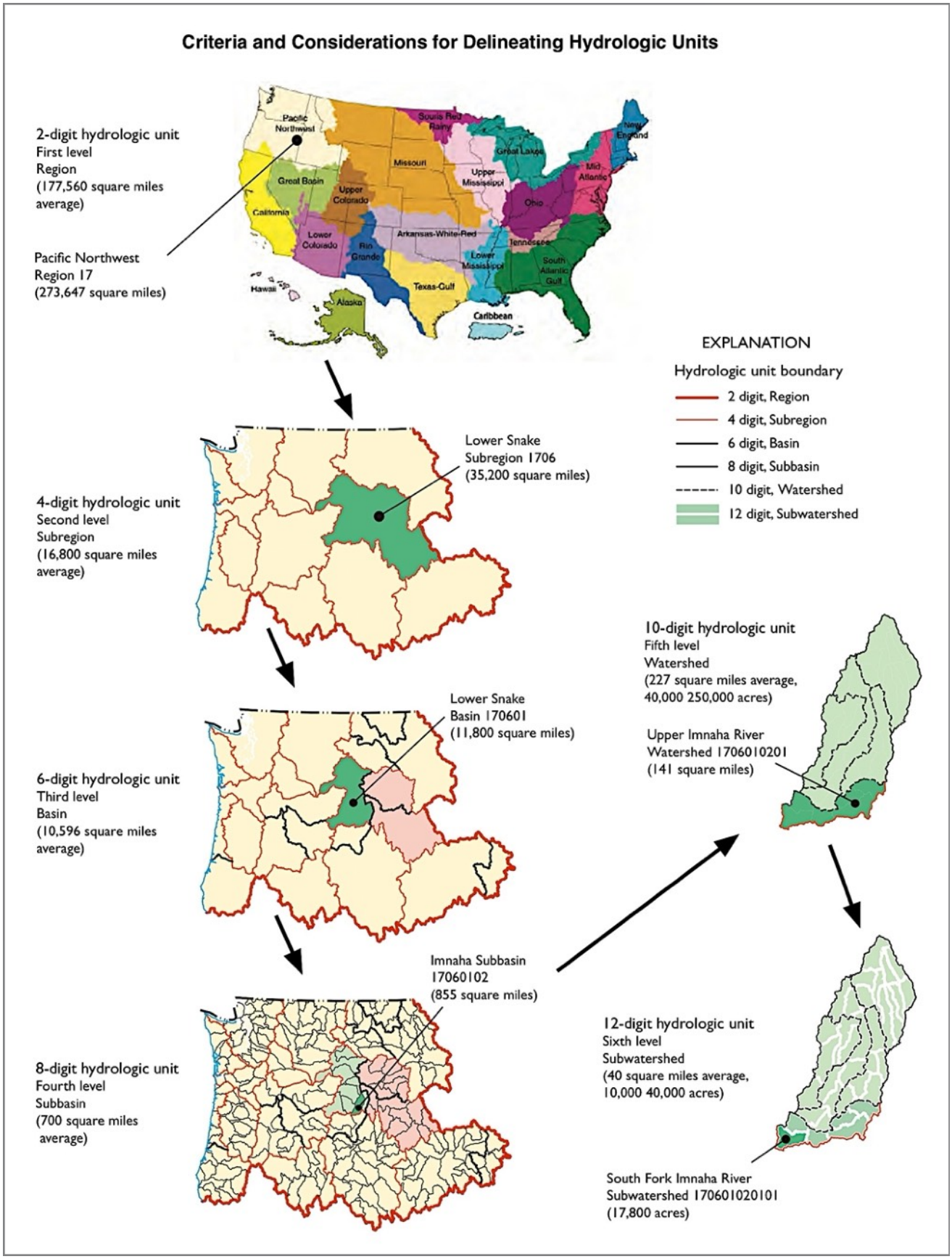

Figure 2. Hierarchy for the six nested levels of hydrologic units, as they are successively subdivided, and the numbering scheme increases by two digits for each level of greater resolution (adapted from the USGS 2012)

Selected Summary Data

C1. Wetland type is a categorical description of predominant polygon character. Select from the following list of categories that may occur within a lentic system the one that best characterizes the majority of the polygon. Evaluators will ***select only one category*** as representative of the entire polygon. If significant amounts of other categories are present, indicate this in the General Comments, or consider dividing the original polygon into two or more polygons.

Category Description

Wet Meadow. A grassland with waterlogged soil near the surface, but without standing water for most of the year. This type of wetland may occur in either riparian (lotic) or in still water (lentic) systems. A lotic wet meadow has a defined channel or flowing surface water nearby, but is typically much wider than the riparian zone associated with the classes described above. This is often the result of the influence of lateral groundwater not associated with the stream flow. Lotic and lentic wet meadows may occur in proximity (e.g., when enough groundwater emerges to begin to flow from a mountain meadow, the system goes from lentic to lotic). Such communities are typically dominated by herbaceous hydrophytic vegetation that requires saturated soils near the surface, but tolerates no standing water for most of the year. This type of wetland typically occurs as the filled-in basin of old beaver ponds, lakes, and potholes.

Marsh. A frequently or continually inundated wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions. A marsh generally has a mineral soil substrate and does not accumulate peat.

Fen. A peat-accumulating wetland that receives some drainage from surrounding mineral soil and usually supports marsh-like vegetation.

Bog. A peat-accumulating wetland that has no significant inflows or outflows and supports acidophilic mosses, particularly sphagnum.

Spring/Seep. Groundwater discharge areas. In general, springs have more flow than seeps. This wetland type may occur in a riparian (lotic) or still water (lentic) system.

Reservoir. An artificial (dammed) water body with at least 8 ha (20 ac) covered by surface water.

Stock Pond. An artificial (dammed) body of water of less than 8 ha (20 ac) covered by surface water.

Lake. A natural topographic depression collecting a body of water covering at least 8 ha (20 ac) with surface water.

Pothole or **Small Mountain Lake.** A natural topographic depression collecting a body of water covering less than 8 ha (20 ac) with surface water.

Other. Describe any other wetland type encountered, which is not associated with a surface water channel.

Upland. This designation is for those areas which are included in the inventoried polygon, but which do not support functional wetland vegetation communities. Such areas may be undisturbed inclusions of naturally occurring high ground or such disturbed high ground as roadways and other elevated sites of human activity.

C2. The size (acres/hectares) of polygons large enough to be drawn as enclosed units on topographic maps is determined in the office using a planimeter, dot grid, or GIS. For polygons too small to be accurately drawn as enclosed units on the maps, polygon size is calculated using polygon length (item C5) and average polygon width (item C7a).

C3a-d. Evaluators may be asked to survey some areas that have not been determined to be wetlands for the purpose of making such a determination. Other polygons include areas supporting non-wetland vegetation types. A "Yes" answer indicates that no part of the polygon keys to a riparian habitat type or community type (HT/CT). Areas classified in item C8 as any vegetation type described in a riparian and/or wetland classification document for the region in which you are working are counted as functional wetlands. Areas listed as UNCLASSIFIED WETLAND TYPE are also counted as functional wetlands. Other areas are counted as non-wetlands, or uplands. The functional wetland fraction of the polygon area is listed in item C3c in acres and as a percentage of the entire polygon area in item C3d.

C4. Lentic wetlands associated with open water, like lakes and ponds, typically have a shore. The ***shore*** is defined as a variable width area that contains all points reached over time by the water's edge along the water body between its high stage and current water level—i.e., the area that is visibly affected by periods of inundation and drying between seasonal and longer cyclic high and low water levels. (The time frame is generally taken to mean the recent period of hydrologic record, or the extent indicated by physical evidence present.) The ***shoreline*** is defined much more narrowly as a 1-2 m (3.3-6.6 ft) band stretching along the landward side of the water's edge TODAY. A defined shoreline means there is narrow band or line that is distinctive and distinguishable. Therefore, the actual position of the shoreline shifts over time with water level.

C5. Polygon length is measured in the field or by scaling from the map. This data is considered accurate to the nearest 0.16 km (0.1 mi). Polygon length may be the same as shoreline length, but may not be in cases of much curved shoreline, or for polygons that have no shoreline (i.e., wet meadows or marshes). The shoreline is defined as a linear feature extending at the time of observation along the water's edge 1 m (3 ft) wide back from the water onto the land.

C6. In some cases, the polygon data is used to characterize, or represent, a much larger, or longer, area. The length represented by the polygon is given here. For example, a 0.8 km (0.5 mi) polygon may be used to represent 3.2 km (2 mi) of total shoreline length. In this case, 0.8 km (0.5 mi) is the shoreline length in the polygon (item C5), and 3.2 km (2 mi) is the overall shoreline length entered in item C6.

C7a. Record average width of the polygon, which in smaller wetlands corresponds to the width of the entire wetland area. The width (average, minimum and maximum) will be determined in the field as the distance perpendicular to the longest axis.

C7b. Record the range of width (ft/m), narrowest to widest, of the wetland area in the polygon.

C8. List the riparian habitat type(s) and/or community type(s) found in the polygon using a manual for identifying types in the region in which you are working, such as *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995), *Classification and Management of USDI Bureau of Land Management's Riparian and Wetland Sites in Eastern and Southern Idaho* (Hansen and Hall 2002), *Classification and management of upland, riparian, and wetland sites of USDI Bureau of Land Management's Miles City Field Office, eastern Montana USA* (Hansen and others 2008), or a similar publication written for the region in which you are working. If the habitat type cannot be determined for a portion of the polygon, then list the appropriate community type(s) of that portion. If neither the habitat type nor community type can be determined for any portion of the polygon (or in areas where the habitat and community types have not been named and described), list the area in question as unclassified wetland type and give the dominant species present. Indicate with the appropriate abbreviation if these are habitat types (HT), community types (CT), or dominance types (DT), for example, PSEMEN/CORSTO HT. For each type listed, estimate the percent of the polygon represented. If known, record the successional stage (i.e., early seral, mid-seral, late seral, and climax), or give other comments about the type. As a minimum, list all types which cover 5% or more of the polygon. The total must approximate 100%. Slight deviations due to use of class codes or to omission of types covering less than 5% of the polygon are allowed. ***NOTE:*** For any area classified as an unclassified wetland type, it is important to list any species present which can indicate the wetness or dryness of the site.

NOTE: Open water in the polygon that does not have emergent vegetation, but that is less than 2 m (6.6 ft) deep is counted as a type called Open Water.

C9a-c. Fire plays an important role on shaping our landscape. Fire can dramatically alter the vegetational expression of a polygon, especially woody vegetation. This question pertains to the more recent fire history and the affect on the polygon.

C10.Woody Vegetation Removal Other Than By Browsing. Excessive cutting or removing parts of plants or whole plants by agents other than browsing animals (e.g., human clearing, cutting, beaver activity, etc.) can result in many of the same negative effects to the community that are caused by excessive browsing. However, other effects from this kind of removal are direct and immediate, including reduction of physical community structure and wildlife habitat values. ***Do not include natural phenomena such as natural fire, insect infestation, etc. in this evaluation.***

Removal of woody vegetation may occur at once (a logging operation), or it may be cumulative over time (annual firewood cutting or beaver activity). This question is not so much to assess long-term incremental harvest, as it is to assess the extent that the stand is lacking vegetation that would otherwise be there today. Give credit for re-growth. Consider how much the removal of a tree many years ago may have now been mitigated with young replacements.

Invasive woody species or genera are excluded from consideration because these are aggressive, invasive exotic plants that should be removed. They are *Elaeagnus angustifolia* (Russian olive), *Rhamnus cathartica* (common buckthorn), *Caragana arborescens* (common caragana), and *Tamarix* species (saltcedar; tamarisk).

Determine the extent to which woody vegetation (trees and shrubs) is lacking due to being physically removed (i.e., cut by beaver, cut by humans, mowed, trimmed, logged, or otherwise removed from their growing position). The timeframe is less important than the ecological effect. Time to recover from this kind of damage can vary widely

with site characteristics. The objective is to measure the extent of any damage remaining ***today*** to the vegetation structure resulting from woody removal. We expect that the woody community will recover over time (re-grow), just as an eroding bank will heal with re-growing plant roots. This question simply asks how much woody material is still missing from what should be on the site? The amount of time since removal doesn't really matter, if re-growth has been allowed to progress. If 20 years after logging, the site has a stand of sapling spruce trees, then it should get partial re-growth credit, but not full credit, since the trees still lack much of their potential habitat and ecological value. (***NOTE:*** In general, the more recent the removal, the more entirely it should be fully counted; and conversely, the older the removal, the more likely it will have been mitigated by re-growth.)

This question is really looking at volume (three dimensions) and not canopy cover (two dimensions). For example, if an old growth spruce tree is removed, a number of new seedlings/saplings may become established and could soon achieve the same canopy cover as the old tree had. However, the value of the old tree to wildlife and overall habitat values is far greater than that of the seedling/saplings. It will take a very long time before the seedlings/saplings can grow to replace all the lost habitat values that were provided by the tall old tree. On the other hand, shrubs, such as willows, grow faster and may replace the volume of removed plants in a much shorter time. Answer this question by estimating the percent of woody material that is missing from the site due to having been removed by human action or other methods regardless of timeframe. Select a range category from the choices given that best represents the percent of missing woody material.

Note 1: *If the polygon does not have the ability to support (potential for) any trees and shrubs (example: saline conditions) and there is no evidence that it ever had any,* ***record as NA*** *and record the reason in the comment section.*

Note 2: *If the polygon has potential for trees and shrubs but they are not present, look for evidence (i.e. stumps or cut woody plants within the polygon or other indicators [e.g. adjacent lands, across the fence, surrounding landscape, personal communication, historical imagery]).*

Note 3: *When insufficient data/evidence is available to make a call,* ***record as NC*** *and record the reason in the comment section. Also used for old polygons when data was not collected.*

C11a, b. Human-Caused Bare Ground. Bare ground is exposed soil surface (not covered by plants, litter or duff, down wood, or rocks larger than 6 cm [2.5 in]). Hardened, impervious surfaces (e.g., asphalt, concrete, etc.) are not bare ground—these do not erode nor allow weeds sites to invade. Bare ground may result naturally from several processes (i.e., sedimentation, flood erosion, fire, tree fall, and exposure of lakebed by low water level), but that caused by human activity always indicates an impairment of wetland health. Exposed soil is vulnerable to erosion and is where weeds become established. Bare soil is not producing, nor providing habitat. Sediment deposits and other natural bare ground are excluded as normal and probably beyond management control. Human land uses often causing bare ground include livestock grazing, recreation, off road vehicle use, and resource extraction activities. After considering the causes of all bare ground on the site, the evaluator must estimate what percent of the site (polygon) area is human-caused bare ground.

C11c. Separate the exposed soil surface from C11b into two categories: that resulting from natural and human causes. These must total approximately 100 percent. Examples of human causes include livestock wallows and trails, hiking trails, ATV trails, roads, timber harvesting skid trails, mining, and construction activities.

C11d. Within both the natural and human-caused categories, record the proportions of exposed soil surface (bare ground) resulting from the listed causes. Within each category, the portions assigned to the individual causes must total approximately 100 percent. Explain whatever is put in the other category.

Natural processes are:

- **Erosional.** Natural flows and flood events often result in erosion that removes the soil cover. Attribute polygon bare ground to this process when there is no human cause apparent on the site that would cause the erosion.
- **Depositional.** The deposition of sediment by water flow is perhaps the greatest source of naturally occurring bare ground. If the source of sediment is some human activity (i.e., sheet erosion from plowed field, road surface, etc.), then list this bare ground under the most appropriate human-caused process.
- **Wildlife Use.** Trails and digging are common wildlife activities that result in natural bare ground.

- **Type Dependent.** Some vegetation types naturally space-out individual plants, leaving bare ground between. Typically this is a characteristic of arid land vegetation.
- **Saline/Alkaline.** The natural accumulation of mineral salts often reaches local concentrations that either support no vegetation, or support only sparse populations of adapted species. The observer should decide whether the source of such mineral accumulation is natural or caused by human activity. If unknown, then default to the natural cause.
- **Other.** Account for any naturally occurring bare ground that is not included in the categories named above, and describe what caused it in the field provided.

Human-caused bare ground may result from:

- **Grazing.** Livestock use often results in bare ground from trailing, trampling, hoof shear, and the removal of vegetation cover by overgrazing.
- **Cultivation.** Tillage and other mechanical activities in the process of cultivation of crops result in bare ground.
- **Timber Harvest.** Log skidding and other activities in the process of timber harvest may result in bare ground.
- **Mining.** Extraction and processing of minerals can result in bare ground. The deposition of waste rock (either cast aside overburden or processed tailings) is a common type of mining-caused bare ground.
- **Construction.** Construction activities of all kinds often involve excavation, earth moving, and other disruptions of the soil surface or natural soil covering.
- **Recreation.** Many modern forms of recreation involve use of mechanical vehicles that damage the vegetation cover and the integrity of soil. Even foot traffic along trails can result in significant areas of bare ground.
- **Other.** Account for any human-caused bare ground that is not included in the categories named above, and describe what caused it in the space provided.

C12. Human Alteration of Polygon Vegetation Community Composition. Human alteration of the vegetation is meant to include all changes to the plant community composition or structure on the polygon from human causes (e.g., logging, mining, roads, construction, or development) or by agents of human management (e.g., livestock). ***It is not meant to include transitory or short-term removal of plant material that does not alter long-term plant community composition*** (i.e., grazing at carefully managed levels or wood cutting that does not change long-term species composition of the community). Also include impacts caused by extreme concentrations of managed wildlife, rationale being that wildlife concentrations great enough to cause significant site damage are usually the result of human management choices. Beaver activities that alter vegetative communities will not be included in this question, but are included in the utilization question.

Of concern are the kinds of change that diminish or disrupt the natural wetland function of the vegetation. These include, but are not limited to, conversion of natural communities to lawns or hayfields (but not the actual mowing), changing plant community composition (e.g., causing replacement of willows with rose and snowberry, woody species with herbaceous species, etc.), replacing native plants with tame plants, replacing deep rooted plants with shallow rooted plants, and/or replacing tall species with short species. In a case where the vegetation community is altered, due to removal of woody cover that allows conversion to a long-term cover of a different kind of vegetation (i.e., cottonwoods/poplars are cut, and the site changes to a *Poa pratensis* [Kentucky bluegrass] cover), then the polygon gets a low score for both woody vegetation removal and for alteration of the vegetation community.

On polygons adjacent to water, remember that the polygon extends out to where the water is two meters deep. (***NOTE:*** Do not count the same area twice by including it as both a vegetative and a physical alteration, unless there clearly are both kinds of alteration. Decide into which category a particular effect should go. For example: A timber harvest may clear vegetation, but not necessarily cause physical damage on one area; while on another area it may cause both clearing of vegetation and disruption of the soil by heavy equipment.)

C13. Human Alteration of Polygon Physical Site. The purpose of this question is to assess physical change to the soil, bank/shore integrity, hydrology, etc. as it affects the ability of the natural system to function normally. Changes in shore and bank contour and any change in soil structure will alter infiltration of water, increase soil compaction, and cause increased sediment contribution to the water body. Every human activity in or around a natural site can alter that site. This question seeks to assess the accumulated effects of all human-caused change.

Include all changes to the physical attributes of the site caused by human actions (e.g., logging, mining, housing development) or by agents of human management (e.g., livestock) and also any effects from concentrated wildlife use (Rationale being that wildlife concentrations great enough to cause significant site damage are usually the result of human management activities.) The kinds of physical change that diminish or disrupt the natural wetland functions on the site

include, but are not limited to, hummocking, pugging, animal trails (livestock or wildlife), human roads, trails, buildings, landscaping, boat launches/docks, beach clearing and building, or rip-rapping of shores and banks. (***NOTE: Do not count the same area twice by including it as both a vegetative and a physical alteration, unless there clearly are both kinds of alteration. Decide into which category a particular effect should go.***) For example: A cottage owner may clear vegetation to gain a view of the lake without causing physical damage to one area; whereas, if he/she hauls in sand to enhance the beach, there may also be physical alteration of the same site.) This item is scored in two parts:

C14. Estimate the severity of the alteration, ***without regard to the portion of the polygon it might occupy.*** Full score is given only to polygons with no physical alteration by human activity. Four categories of alteration severity are described in terms of change to the site vegetation and hydrologic function. ***For sites with more than one severity type, select the type that describes the majority of the alteration area. Describe the other severity types in comments section.*** (***NOTE: This call uses vegetation change to indicate degree of alteration, but the alteration must be physical in nature, not just vegetative change alone; e.g., disruption of soil, hydrology, topography, etc.***) Document the severity of alteration with photos and commentary. Categories of severity are described below using conceptual guidelines. These guidelines are not comprehensive, but are intended as a relative scale by which the observer can judge his/her site. Every case is different, and there is no absolute measuring stick to apply. Use the following comparative descriptions to choose a category of alteration on your site:

- ***None***—No human-caused physical alteration observed on the polygon.
- ***Slight***—Physical site integrity is near natural. Human-caused alteration (including recovery from any past severe alterations) is apparent, but reflects minimal impact to plant communities and hydrological function in the altered areas (e.g., the plant community is little changed from that on nearby sites lacking physical alteration; any pugging and hummocking or other disruption of the soil profile is relatively shallow and is well vegetated with appropriate species).
- ***Moderate***—As compared with nearby unaltered sites, human-caused physical alteration on the polygon (including recovery from any past severe alterations) has noticeably altered the physical site integrity to the point that plant communities and hydrological function on the altered areas show visible impact. The plant community differs noticeably (by having introduced or missing components) from nearby sites that are on similar landscape position and that lack physical alterations. Pugging and hummocking or other disruption of the soil profile is moderate in depth and height of hummocks. Such alteration is either becoming re-vegetated with appropriate species, or is well covered with a mix of less desirable and appropriate species.
- ***Severe***—Human-caused physical site alteration on the polygon has compromised the physical integrity of the altered areas (even if only a small area is altered). Old alterations have not recovered and are still affecting the vegetation or hydrological functions (e.g., the plant community differs radically from nearby sites in similar position that lack physical alterations, reflecting altered hydrologic and/or soil conditions). Pugging and hummocking or other disruption of the soil profile is severe in depth of disturbance and/or height of hummocking. Alterations remain mostly bare of plant cover, or are becoming vegetated with invasive or undesirable species.

C15. Degree of Artificial Withdrawal or Raising of Water Level. Although water levels naturally fluctuate on a seasonal basis in most systems, many wetland systems are affected by human-caused (artificial) additions or withdrawals. This artificial changes of water level rarely follow a temporal regime that maintains healthy native wetland plant communities. The result is often a barren band of shore exposed or inundated for much of each growing season. This causes shore material to destabilize, and often provides sites for weeds to invade. Such conditions are extremely detrimental to healthy riparian function.

Not all lentic wetlands evaluated with this form will have surface water potential, but any wetland may have its water table degraded by draining, pumping, or diverting its surface or subsurface supply. On such lentic wetlands as marshes and wet meadows, look for evidence of drainage ditching, pumping, and the interruption of normal surface drainage inputs by livestock watering dugouts, cross slope ditches, or dams upslope.

In this item the evaluator is asked to categorize the degree to which the system is subjected to artificially rapid or unnaturally timed fluctuations in water level. Reservoirs intended for storage of water for power generation, irrigation, and/or livestock watering typically exhibit the most severe effects, but water may be diverted or pumped from natural systems for many other reasons (domestic use, industrial use, livestock watering, etc.). This item requires the evaluator to make a subjective call by choosing as a best fit one of the categories of drawdown severity described below. (***NOTE:*** Be careful to consider the scale of the water body as it relates to the scale of change. Pumping a small dugout full of water for livestock might severely impact a 0.8 ha (2 ac) slough, but be negligible to a lake covering a section of land.)

Be sure to document the grounds for your estimate. If there is no way to know with any reasonable degree of certainty how much water is being added or removed, it may be better to describe the situation and to zero out this item (not answer it). During periods of drought lakebeds become exposed, and often exhibit wide zones of almost barren shore. ***The evaluator must be careful not to attribute this natural phenomenon unfairly to a human activity.***

Severity Categories of Lentic Water Level Manipulation	
Not Subjected	The water body, or wetland, is not subjected to artificial water level change (e.g., drawdown, addition, stabilization, etc.). This category may include very small amounts of change that cause no detectible fluctuation in water level.
Minor	The water body or wetland is subject to no more than minor artificial water level change. The shore area remains vegetated, and withdrawal of water is limited or slow enough that vegetation is able to maintain growth and prevent soil exposure. A relatively narrow band affected by the water level fluctuation may support only annual plants.
Moderate	The water body or wetland is subject to moderate quantities, speed and/or frequency of artificial water level change. Where water is removed, it is done in a way that allows pioneer plants to vegetate at least half of the exposed area resulting from drawdown. Where water is added, some flooding may occur at levels or times not typical to the area/ season.
Extreme	The water body or wetland is subjected to extreme changes in water level due to volume (extent), speed and/or frequency of artificial water addition or removal. Frequent or unnatural levels of flooding occur where water is added, including extensive flooding into riparian and/or upland areas; or no natural annual drawdown is allowed to occur. In extreme artificial drawdown situations, a wide band of exposed bottom remains unvegetated.

C16. Polygon trend. Select the ***one category*** (Improving; Degrading; Static; or Status Unknown) which best indicates the current trend of the vegetative community on the polygon to the extent possible. Trend refers, in the sense used, not specifically to successional pathway change, but in a more general sense of apparent community health. By definition, trend implies change over time. Accordingly, a trend analysis would require comparison of repeated observations over time. However, some insights into trend can be observed in a single visit. For example, the evaluator may notice healing (revegetating) of a degraded shoreline and recent establishment of woody seedlings and saplings. This would indicate changing conditions that suggest an improving trend. If such indicators are not apparent, enter the category status unknown.

FACTORS FOR ASSESSING LENTIC WETLAND HEALTH (SURVEY)

Some factors on the evaluation will not apply on all sites. For example, sites without potential for woody species are not rated on factors concerning trees and shrubs. Vegetative site potential can be determined by using a key to site type (e.g., Hansen and others 1995, 2008, Kovalchik 1987, or another appropriate publication). On severely disturbed sites, vegetation potential can be difficult to determine. On such sites, clues to potential may be sought on nearby sites with similar landscape position.

Most of the factors rated in this evaluation are based on ocular estimations. Such estimation may be difficult on large, brushy sites where visibility is limited, but extreme precision is not necessary. While the rating categories are broad, evaluators do need to calibrate their eye with practice. It is important to remember that a health rating is not an absolute value. The factor breakout groupings and point weighting in the evaluation are somewhat subjective and are not grounded in quantitative science so much as in the collective experience of an array of riparian scientists, range professionals, and land managers.

The evaluator must keep in mind that this assessment form is designed to account for most sites and conditions in the applicable region. However, rarely will all the questions seem exactly to fit the circumstances on a given site. Therefore, try to answer each question with a literal reading. If necessary, explain anomalies in the comment section. Each factor below will be rated according to conditions observed on the site. The evaluator will estimate the scoring category and enter that value on the score sheet.

1. Vegetative Cover of the Polygon. Around lentic water bodies vegetation cover helps to stabilize shorelines, control nutrient cycling, reduce water velocity, provide fish cover and food, trap sediments, reduce erosion, reduce the rate of evaporation (Platts and others 1987), and contributes primary production to the ecosystem. This question focuses on how much of the entire polygon area is covered by standing plant growth. Item 8 below assesses the amount of human-caused bare ground. Although there is some overlap between these two items, the bare ground to be counted in item 8 is strictly limited in definition, whereas all unvegetated area not inundated by water is counted in this item. The only area within the polygon exempt from consideration is area covered by water, including water between emergent plants such as cattails and bulrushes. Areas such as boat docks, hardened pathways, and artificial structures are counted as unvegetated along with any bare ground, downed wood, and other plant litter. The rationale is that all such unvegetated areas contribute nothing to several of the important lentic wetland functions.

The evaluator is to estimate the fraction of the polygon covered by plant growth. Vegetation cover is ocularly estimated using the canopy cover method (Daubenmire 1959). For field determination of vegetative cover related questions include ***all rooted plant material*** (live or dead). Do not include fallen wood or other plant litter. Do not consider the polygon area covered by water (such as between emergent plants). ***NOTE:*** For field determination of vegetative cover include ***all rooted plant material*** (live or dead). Do not include fallen wood or other plant litter. Do not consider the polygon area covered by water (such as between emergent plants).

Scoring:
6 = More than 95% of the polygon area is covered by rooted plant material (live or dead).
4 = 85% to 95% of the polygon area is covered by rooted plant material (live or dead).
2 = 75% to 85% of the polygon area is covered by rooted plant material (live or dead).
0 = Less than 75% of the polygon area is covered by rooted plant material (live or dead).

2. Invasive Plant Species (Weeds). Invasive plants (weeds) are alien species whose introduction does or is likely to cause economic or environmental harm. Whether the disturbance that allowed their establishment is natural or human-caused, weed presence indicates a degrading ecosystem. While some of these species may contribute to some riparian functions, their negative impacts reduce overall site health. This item assesses the degree and extent to which the site is infested by invasive plants. The severity of the problem is a function of the density/distribution (pattern of occurrence), as well as canopy cover (abundance) of the weeds. In determining the health score, all invasive plant species are considered collectively, not individually. A weed list should be used that is standard for the locality and that indicates which species are being considered. Common invasive plant species are listed on the form. Include both woody and herbaceous invasive plant species. ***Leave no listed species field blank, however;*** enter 0 to indicate absence of a value. (A blank field means the observer forgot to collect the data; a value means the observer looked.)

The site's health rating on this item combines two factors: weed density/distribution class and total canopy cover. A perfect score of 6 out of 6 points can only be achieved if the site is weed free. A score of 4 out of the 6 points means the weed

problem is just beginning (i.e., very few weeds and small total canopy cover [less than 1%]). A moderate weed problem gets 2 out of 6 points. It has a moderately dense weed plant distribution (a class between 4 and 7) and moderate total weed canopy cover (between 1% and 15%). A site scores 0 points if the density/distribution is in class 8 or higher, or if the total weed canopy cover is 15% or more.

2a. Total Canopy Cover of Invasive Plant Species (Weeds). The observer must evaluate the total percentage of the polygon area that is covered by the combined canopy of all plants of all species of invasive plants. Determine which rating applies in the scoring scale below. ***NOTE:*** For field determination of vegetative cover include ***all rooted plant material*** (live or dead). Do not include fallen wood or other plant litter. Do not consider the polygon area covered by water (such as between emergent plants).

Scoring:
3 = No invasive plant species (weeds) on the site.
2 = Invasive plants present with total canopy cover less than 1% of the polygon area.
1 = Invasive plants present with total canopy cover between 1 and 15% of the polygon area.
0 = Invasive plants present with total canopy cover more than 15% of the polygon area.

2b. Density/Distribution Pattern of Invasive Plant Species (Weeds). The observer must pick a category of pattern and extent of invasive plant distribution from the chart below (Figure 3) that best fits what is observed on the polygon, while realizing that the real situation may be only roughly approximated at best by any of these diagrams. Choose the category that most closely matches the view of the polygon.

Scoring:
3 = No invasive plant species (weeds) on the site.
2 = Invasive plants present with density/distribution in categories 1, 2, or 3.
1 = Invasive plants present with density/distribution in categories 4, 5, 6, or 7.
0 = Invasive plants present with density/distribution in categories 8, or higher.

CLASS	DESCRIPTION OF ABUNDANCE	DISTRIBUTION PATTERN
0	No invasive plants on the polygon	
1	Rare occurrence	
2	A few sporadically occurring individual plants	
3	A single patch	
4	A single patch plus a few sporadically occurring plants	
5	Several sporadically occurring plants	
6	A single patch plus several sporadically occurring plants	
7	A few patches	
8	A few patches plus several sporadically occurring plants	
9	Several well spaced patches	
10	Continuous uniform occurrence of well spaced plants	
11	Continuous occurrence of plants with a few gaps in the distribution	
12	Continuous dense occurrence of plants	
13	Continuous occurrence of plants associated with a wetter or drier zone within the polygon.	

Figure 3. Invasive plant species class guidelines (figure adapted from Adams and others [2003])

NOTE: Prior to the 2001 season, the health score for weed infestation was assessed from a single numerical value that does not represent weed canopy cover, but instead represents the fraction of the polygon area on which weeds had a well established population of individuals (i.e., the area infested).

3. Disturbance-Increaser Undesirable Herbaceous Species. Areas with historically intense grazing often have large canopy cover of undesirable herbaceous species, which tend to be less productive and which contribute less to ecological functions. A large cover of disturbance-increaser undesirable herbaceous species, native or exotic, indicates displacement from the potential natural community (PNC) and a reduction in upland health. These species generally are less productive, have shallow roots, and poorly perform most upland functions. They usually result from some disturbance, which removes more desirable species. Invasive plant species considered in the previous item are not reconsidered.

A list of disturbance-increaser undesirable species that are counted is presented below. Other disturbance-increaser undesirable species may also be present on a site, but consistency and comparability will be maintained by always counting the same set of species.

Achillea millefolium (common yarrow)	*Agropyron repens* (quackgrass)	*Antennaria* species (everlasting; pussytoes)
Artemisia ludoviciana (cudweed sagewort)	*Descurainia sophia* (fixweed)	*Fragaria virginiana* (wild strawberry)
Juncus balticus (Baltic rush)	*Lepidium perfoliatum* (clasping pepperweed)	*Medicago lupulina* (black medick)
Mentha arvense (field mint)	*Plantago major* (common plantain)	*Poa pratensis* (Kentucky bluegrass)
Potentilla anserina (silverweed)	*Sisymbrium* species (tumblemustard)	*Taraxacum officinale* (common dandelion)
Thlaspi arvense (field pennycress)	*Trifolium* species (clover)	*Verbascum thapsus* (common mullein)

NOTE: For field determination of vegetative cover include ***all rooted plant material*** (live or dead). Do not include fallen wood or other plant litter. Do not consider the polygon area covered by water (such as between emergent plants).

Scoring:
3 = Less than 5% of the site covered by disturbance-increaser undesirable herbaceous species.
2 = 5% to 25% of the site covered by disturbance-increaser undesirable herbaceous species.
1 = 25% to 50% of the site covered by disturbance-increaser undesirable herbaceous species.
0 = More than 50% of the site covered by disturbance-increaser undesirable herbaceous species.

4. Preferred Tree and Shrub Regeneration. (Skip this item if the site lacks potential for trees or shrubs; for example, the site is a herbaceous wet meadow or marsh.) Not all riparian areas can support trees and/or shrubs. However, on those sites where such species do belong, they play important roles. The root systems of woody species are excellent bank stabilizers, while their spreading canopies provide protection to soil, water, wildlife, and livestock. Young age classes of woody species are important for the continued presence of woody communities not only at a given point in time but into the future. Woody species potential can be determined by using a key to site type (Thompson and Hansen 2001, 2002, 2003). On severely disturbed sites, the evaluator should seek clues to potential by observing nearby sites with similar landscape position. (***NOTE:*** Vegetation potential is commonly underestimated on sites with a long history of disturbance.)

The following species are excluded from the evaluation:

- *Artemisia cana* (silver sagebrush), including subsp. *cana* and *viscidula*;
- *Artemisia frigida* (fringed sagewort);
- *Crataegus* species (hawthorn);
- *Gutierrezia sarothrae* (broom snakeweed);
- *Juniperus horizontalis* (creeping juniper)
- *Opuntia* species (prickly pear);
- *Rosa* species (rose);
- *Sarcobatus vermiculatus* (greasewood);
- *Symphoricarpos* species (snowberry);
- T*etradymia canescens* (gray horsebrush)
- *Yucca glauca* (soapweed); and
- All introduced (non-native) woody species (e.g., *Elaeagnus angustifolia* [Russian olive], *Tamarix* species [saltcedar; tamarisk], etc.).

These are species that may reflect long-term disturbance on a site, that are generally less palatable to browsers, and that tend to increase under long-term moderate-to-intense grazing pressure; ***AND*** for which there is rarely any problem in maintaining presence on site. Examples of the latter include *Artemisia cana* (silver sagebrush) and *Sarcobatus vermiculatus* (greasewood). Both are considered climax species in many riparian situations and rarely have any problem maintaining a presence on a site. Only under extreme long-term grazing pressures will these species be eliminated from a site. On the other hand, *Elaeagnus angustifolia* (Russian olive) and *Tamarix* species (saltcedar; tamarisk) are especially aggressive, undesirable exotic plants.

The main reason for excluding these plants is they are far more abundant on many sites than are species of greater concern (i.e., *Salix* species [willows], *Cornus sericea* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon serviceberry], and many other taller native riparian species), and they may mask the ecological significance of a small amount of a species of greater concern. ***FOR EXAMPLE:*** A polygon may have *Symphoricarpos occidentalis* (western snowberry) with 30% canopy cover showing young plants for replacement of older ones, while also having a trace of *Salix exigua* (sandbar willow) present, but represented only by older mature individuals. We feel that the failure of the willow to regenerate (even though there is only a small amount) is very important in the health evaluation, but by including the snowberry and willow together on this polygon, the condition of the willow would be hidden (overwhelmed by the larger amount of snowberry).

For shrubs in general, seedlings and saplings can be distinguished from mature plants as follows. For those species having a mature height generally over 1.8 m (6.0 ft), seedlings and saplings are those individuals less than 1.8 m (6.0 ft) tall. For species normally not exceeding 1.8 m (6.0 ft), seedlings and saplings are those individuals less than 0.45 m (1.5 ft) tall or which lack reproductive structures and the relative stature to suggest maturity. Count plants installed by human planting if they have survived at least one full year after planting. To be successfully the new plants need to have at least one complete growing season on the site. Many new plants do not survive the first growing season. (***NOTE:*** Evaluators should take care not to confuse short stature resulting from intense browsing with that due to young plants.)

Scoring: (*If the site has no potential for trees or shrubs [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA. If the observer is not fairly certain potential exists for preferred trees or shrubs, then enter NC and explain in the comment field below.*)
6 = More than 15% of the total canopy cover of preferred trees/shrubs is seedlings and/or saplings.
4 = 5% to 15% of the total canopy cover of preferred trees/shrubs is seedlings and/or saplings.
2 = Less than 5% of the total canopy cover of preferred tree/shrubs is seedlings and/or saplings.
0 = Preferred tree/shrub seedlings and saplings absent.

5a. Browse Utilization of Available Preferred Trees and Shrubs. (*Skip this item if the site lacks trees or shrubs; for example, the site is a herbaceous wet meadow or cattail marsh, or all woody plants have already been removed.*) Livestock and/or wildlife browse many riparian woody species. Excessive browsing can eliminate these important plants from the community and result in their replacement by undesirable invaders. With excessive browsing, the plant loses vigor, is prevented from flowering, or is killed. Utilization in small amounts is normal and not a health concern, but concern increases with greater browse intensity.

The following species are excluded from the evaluation:

- *Artemisia cana* (silver sagebrush), including subsp. *cana* and *viscidula*;
- *Artemisia frigida* (fringed sagewort);
- *Crataegus* species (hawthorn);
- *Gutierrezia sarothrae* (broom snakeweed);
- *Juniperus horizontalis* (creeping juniper)
- *Opuntia* species (prickly pear);
- *Rosa* species (rose);
- *Sarcobatus vermiculatus* (greasewood);
- *Symphoricarpos* species (snowberry);
- T*etradymia canescens* (gray horsebrush)
- *Yucca glauca* (soapweed); and
- All introduced (non-native) woody species (e.g., *Elaeagnus angustifolia* [Russian olive], *Tamarix* species [saltcedar; tamarisk], etc.).

These are species that may reflect long-term disturbance on a site, that are generally less palatable to browsers, and that tend to increase under long-term moderate-to-intense grazing pressure; ***AND*** for which there is rarely any problem in maintaining presence on site. Examples of the latter include *Artemisia cana* (silver sagebrush) and *Sarcobatus vermiculatus* (greasewood). Both are considered climax species in many riparian situations and rarely have any problem maintaining a presence on a site. Only under extreme long-term grazing pressures will these species be eliminated from a site. On the other hand, *Elaeagnus angustifolia* (Russian olive) and *Tamarix* species (saltcedar; tamarisk) are especially aggressive, undesirable exotic plants.

As discussed above, the main reason for excluding these plants is that they are far more abundant on many sites than are species of greater concern (i.e., *Salix* species [willows], *Cornus sericea* [red-osier dogwood], *Amelanchier alnifolia* [Saskatoon serviceberry], and many other taller native riparian species), and they may mask the ecological significance of a small amount of a species of greater concern. ***FOR EXAMPLE:*** A polygon may have *Symphoricarpos occidentalis* (western snowberry) with 30% canopy cover showing young plants for replacement of older ones, while also having a trace of *Salix exigua* (sandbar willow) present, but represented only by older mature individuals. We feel that the failure of the willow to regenerate (even though there is only a small amount) is very important in the health evaluation, but by including the snowberry and willow together on this polygon, the condition of the willow would be hidden (overwhelmed by the larger amount of snowberry).

Consider as available all tree and shrub plants to which animals may gain access and that they can reach. For tree species, this means mostly just seedling and sapling age classes. When estimating degree of utilization, count browsed second year and older leaders on representative plants of woody species normally browsed by ungulates. Do not count current year's use, because this would not accurately reflect actual use when more browsing can occur later in the season. Browsing of second year or older material affects the overall health of the plant and continual high use will affect the ability of the plant to maintain itself on the site. Determine percentage by comparing the number of leaders browsed or utilized with the total number of leaders available (those within animal reach) on a representative sample (at least three plants) of each tree and shrub species present. Do not count utilization on dead plants, unless it is clear that death resulted from over-grazing. ***NOTE:*** If a shrub is entirely mushroom/umbrella shaped by long-term intense browse or rubbing, count browse utilization of it as heavy.

> **Scoring:** (*Consider all shrubs within animal reach and seedlings and saplings of tree species. If the site has no woody vegetation [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA.*)
> **3** = None (0% to 5% of available second year and older leaders of preferred species are browsed).
> **2** = Light (5% to 25% of available second year and older leaders of preferred species are browsed).
> **1** = Moderate (25% to 50% of available second year and older leaders of preferred species are browsed).
> **0** = Heavy More than 50% of available second year and older leaders of preferred species are browsed).

5b. Live Woody Vegetation Removal by Other Than Browsing. Excessive cutting or removing parts of plants or whole plants by agents other than browsing animals (e.g., human clearing, cutting, beaver activity, etc.) can result in many of the same negative effects to the community that are caused by excessive browsing. However, other effects from this kind of removal are direct and immediate, including reduction of physical community structure and wildlife habitat values. ***Do not include natural phenomena such as natural fire, insect infestation, etc. in this evaluation.***

Removal of woody vegetation may occur at once (a logging operation), or it may be cumulative over time (annual firewood cutting or beaver activity). **This question is not so much to assess long-term incremental harvest, as it is to assess the extent that the stand is lacking vegetation that would otherwise be there today.** Give credit for re-growth. Consider how much the removal of a tree many years ago may have now been mitigated with young replacements.

Invasive woody species or genera are excluded from consideration because these are aggressive, invasive exotic plants that should be removed. They are *Elaeagnus angustifolia* (Russian olive), *Rhamnus cathartica* (common buckthorn), *Caragana arborescens* (common caragana), and *Tamarix* species (saltcedar; tamarisk).

Determine the extent to which woody vegetation (trees and shrubs) is lacking due to being physically removed (i.e., cut by beaver, cut by humans, mowed, trimmed, logged, or otherwise removed from their growing position). The timeframe is less important than the ecological effect. Time to recover from this kind of damage can vary widely with site characteristics. The objective is to measure the extent of any damage remaining ***today*** to the vegetation structure resulting from woody removal. We expect that the woody community will recover over time (re-grow), just

as an eroding bank will heal with re-growing plant roots. **This question simply asks how much woody material is still missing from what should be on the site?** The amount of time since removal doesn't really matter, if re-growth has been allowed to progress. If 20 years after logging, the site has a stand of sapling spruce trees, then it should get partial re-growth credit, but not full credit, since the trees still lack much of their potential habitat and ecological value. (***NOTE:*** In general, the more recent the removal, the more entirely it should be fully counted; and conversely, the older the removal, the more likely it will have been mitigated by re-growth.)

This question is really looking at volume (three dimensions) and not canopy cover (two dimensions). For example, if an old growth spruce tree is removed, a number of new seedlings/saplings may become established and could soon achieve the same canopy cover as the old tree had. However, the value of the old tree to wildlife and overall habitat values is far greater than that of the seedling/saplings. It will take a very long time before the seedlings/saplings can grow to replace all the lost habitat values that were provided by the tall old tree. On the other hand, shrubs, such as willows, grow faster and may replace the volume of removed plants in a much shorter time. **Answer this question by estimating the percent of woody material that is missing from the site due to having been removed by human action or beaver (active or inactive) or other methods regardless of timeframe. Select a range category from the choices given that best represents the percent of missing woody material.**

Note 1: *If the polygon does not have the ability to support (potential for) any trees and shrubs (example: saline conditions) and there is no evidence that it ever had any,* ***record as NA*** *and record the reason in the comment section.*

Note 2: *If the polygon has potential for trees and shrubs but they are not present, look for evidence (i.e. stumps or cut woody plants within the polygon or other indicators [e.g. adjacent lands, across the fence, surrounding landscape, personal communication, historical imagery]).*

Note 3: *When insufficient data/evidence is available to make a call,* ***record as NC*** *and record the reason in the comment section. Also used for old polygons when data was not collected.*

> **Scoring:** (*If the polygon does not have the ability to support [potential for] any trees and shrubs and there is no evidence that it ever had any, replace both Actual Score and Possible Score with* ***NA****. When insufficient data/evidence is available to make a call, replace both Actual Score and Possible Score with* ***NC****.*)
> **3** = None (0% to 5% of live woody vegetation expected on the site is lacking due to cutting).
> **2** = Light (5% to 25% of live woody vegetation expected on the site is lacking due to cutting).
> **1** = Moderate (25% to 50% of live woody vegetation expected on the site is lacking due to cutting).
> **0** = Heavy (More than 50% of live woody vegetation expected on the site is lacking due to cutting).

6. Human Alteration of Polygon Vegetation Community Composition. Human alteration of the vegetation is meant to include all changes to the plant community composition or structure on the polygon from human causes (e.g., logging, mining, roads, construction, or development) or by agents of human management (e.g., livestock). ***It is not meant to include transitory or short-term removal of plant material that does not alter long-term plant community composition*** (i.e., grazing at carefully managed levels or wood cutting that does not change long-term species composition of the community). Also include impacts caused by extreme concentrations of managed wildlife, rationale being that wildlife concentrations great enough to cause significant site damage are usually the result of human management choices. Beaver activities that alter vegetative communities will not be included in this question, but are included in the utilization question.

Of concern are the kinds of change that diminish or disrupt the natural wetland function of the vegetation. These include, but are not limited to, conversion of natural communities to lawns or hayfields (but not the actual mowing), changing plant community composition (e.g., causing replacement of willows with rose and snowberry, woody species with herbaceous species, etc.), replacing native plants with tame plants, replacing deep rooted plants with shallow rooted plants, and/or replacing tall species with short species. In a case where the vegetation community is altered, due to removal of woody cover that allows conversion to a long-term cover of a different kind of vegetation (i.e., cottonwoods/poplars are cut, and the site changes to a *Poa pratensis* [Kentucky bluegrass] cover), then the polygon gets a low score for both woody vegetation removal and for alteration of the vegetation community.

On polygons adjacent to water, remember that the polygon extends out to where the water is two meters deep. (***NOTE:*** Do not count the same area twice by including it as both a vegetative and a physical alteration, unless there clearly are both kinds

of alteration. Decide into which category a particular effect should go. For example: A timber harvest may clear vegetation, but not necessarily cause physical damage on one area; while on another area it may cause both clearing of vegetation and disruption of the soil by heavy equipment.)

Scoring:
6 = Less than 5% of polygon vegetation community composition is altered by human activity.
4 = 5% to 15% of polygon vegetation community composition is altered by human activity.
2 = 15% to 35% of polygon vegetation community composition is altered by human activity.
0 = 35% or more of polygon vegetation community composition is altered by human activity.

7. Human Alteration of Polygon Physical Site. The purpose of this question is to assess physical change to the soil, bank/shore integrity, hydrology, etc. as it affects the ability of the natural system to function normally. Changes in shore and bank contour and any change in soil structure will alter infiltration of water, increase soil compaction, and cause increased sediment contribution to the water body. Every human activity in or around a natural site can alter that site. This question seeks to assess the accumulated effects of all human-caused change.

Include all changes to the physical attributes of the site caused by human actions (e.g., logging, mining, housing development) or by agents of human management (e.g., livestock) and also any effects from concentrated wildlife use (Rationale being that wildlife concentrations great enough to cause significant site damage are usually the result of human management activities.) The kinds of physical change that diminish or disrupt the natural wetland functions on the site include, but are not limited to, hummocking, pugging, animal trails (livestock or wildlife), human roads, trails, buildings, landscaping, boat launches/docks, beach clearing and building, or rip-rapping of shores and banks. (***NOTE: Do not count the same area twice by including it as both a vegetative and a physical alteration, unless there clearly are both kinds of alteration. Decide into which category a particular effect should go.***) For example: A cottage owner may clear vegetation to gain a view of the lake without causing physical damage to one area; whereas, if he/she hauls in sand to enhance the beach, there may also be physical alteration of the same site.) This item is scored in two parts:

7a. Estimate the percentage of the polygon that is altered by human activities.

Scoring:
12 = Less than 5% of the polygon is physically altered by human activity.
8 = 5% to 15% of the polygon is physically altered by human activity.
4 = 15% to 35% of the polygon is physically altered by human activity.
0 = More than 35% of the polygon is physically altered by human activity.

7b. Estimate the severity of the alteration, ***without regard to the portion of the polygon it might occupy.*** Full score is given only to polygons with no physical alteration by human activity. Four categories of alteration severity are described in terms of change to the site vegetation and hydrologic function. ***For sites with more than one severity type, select the type that describes the majority of the alteration area. Describe the other severity types in comments section.*** (***NOTE: This call uses vegetation change to indicate degree of alteration, but the alteration must be physical in nature, not just vegetative change alone; e.g., disruption of soil, hydrology, topography, etc.***) Document the severity of alteration with photos and commentary. Categories of severity are described below using conceptual guidelines. These guidelines are not comprehensive, but are intended as a relative scale by which the observer can judge his/her site. Every case is different, and there is no absolute measuring stick to apply. Use the following comparative descriptions to choose a category of alteration on your site:

- ***None***—No human-caused physical alteration observed on the polygon.
- ***Slight***—Physical site integrity is near natural. Human-caused alteration (including recovery from any past severe alterations) is apparent, but reflects minimal impact to plant communities and hydrological function in the altered areas (e.g., the plant community is little changed from that on nearby sites lacking physical alteration; any pugging and hummocking or other disruption of the soil profile is relatively shallow and is well vegetated with appropriate species).
- ***Moderate***—As compared with nearby unaltered sites, human-caused physical alteration on the polygon (including recovery from any past severe alterations) has noticeably altered the physical site integrity to the point that plant communities and hydrological function on the altered areas show visible impact. The plant community differs noticeably (by having introduced or missing components) from nearby sites that are on similar landscape position and that lack physical alterations. Pugging and hummocking or other disruption of

the soil profile is moderate in depth and height of hummocks. Such alteration is either becoming re-vegetated with appropriate species, or is well covered with a mix of less desirable and appropriate species.

- ***Severe***—Human-caused physical site alteration on the polygon has compromised the physical integrity of the altered areas (even if only a small area is altered). Old alterations have not recovered and are still affecting the vegetation or hydrological functions (e.g., the plant community differs radically from nearby sites in similar position that lack physical alterations, reflecting altered hydrologic and/or soil conditions). Pugging and hummocking or other disruption of the soil profile is severe in depth of disturbance and/or height of hummocking. Alterations remain mostly bare of plant cover, or are becoming vegetated with invasive or undesirable species.

Scoring:
3 = ***No physical alterations*** to the site by human activity.
2 = Human alterations to the physical site are ***slight*** in effect.
1 = Human alterations to the physical site are ***moderate*** in effect.
0 = Human alterations to the physical site are ***severe*** in effect.

8. Human-Caused Bare Ground. Bare ground is exposed soil surface (not covered by plants, litter or duff, down wood, or rocks larger than 6 cm [2.5 in]). Hardened, impervious surfaces (e.g., asphalt, concrete, etc.) are not bare ground—these do not erode nor allow weeds sites to invade. Bare ground may result naturally from several processes (i.e., sedimentation, flood erosion, fire, tree fall, and exposure of lakebed by low water level), but that caused by human activity always indicates an impairment of wetland health. Exposed soil is vulnerable to erosion and is where weeds become established. Bare soil is not producing, nor providing habitat. Sediment deposits and other natural bare ground are excluded as normal and probably beyond management control. Human land uses often causing bare ground include livestock grazing, recreation, off road vehicle use, and resource extraction activities. After considering the causes of all bare ground on the site, the evaluator must estimate what percent of the site (polygon) area is human-caused bare ground.

Scoring:
6 = Less than 1% of the polygon is human-caused bare ground.
4 = 1% to 5% of the polygon is human-caused bare ground.
2 = 5% to 15% of the polygon is human-caused bare ground.
0 = 15% or more of the polygon is human-caused bare ground.

9. Degree of Artificial Withdrawal or Raising of Water Level. Although water levels naturally fluctuate on a seasonal basis in most systems, many wetland systems are affected by human-caused (artificial) additions or withdrawals. This artificial changes of water level rarely follow a temporal regime that maintains healthy native wetland plant communities. The result is often a barren band of shore exposed or inundated for much of each growing season. This causes shore material to destabilize, and often provides sites for weeds to invade. Such conditions are extremely detrimental to healthy riparian function.

Not all lentic wetlands evaluated with this form will have surface water potential, but any wetland may have its water table degraded by draining, pumping, or diverting its surface or subsurface supply. On such lentic wetlands as marshes and wet meadows, look for evidence of drainage ditching, pumping, and the interruption of normal surface drainage inputs by livestock watering dugouts, cross slope ditches, or dams upslope.

In this item the evaluator is asked to categorize the degree to which the system is subjected to artificially rapid or unnaturally timed fluctuations in water level. Reservoirs intended for storage of water for power generation, irrigation, and/or livestock watering typically exhibit the most severe effects, but water may be diverted or pumped from natural systems for many other reasons (domestic use, industrial use, livestock watering, etc.). This item requires the evaluator to make a subjective call by choosing as a best fit one of the categories of drawdown severity described below. (***NOTE:*** Be careful to consider the scale of the water body as it relates to the scale of change. Pumping a small dugout full of water for livestock might severely impact a 0.8 ha (2 ac) slough, but be negligible to a lake covering a section of land.)

Be sure to document the grounds for your estimate. If there is no way to know with any reasonable degree of certainty how much water is being added or removed, it may be better to describe the situation and to zero out this item (not answer it). During periods of drought lakebeds become exposed, and often exhibit wide zones of almost barren shore. ***The evaluator must be careful not to attribute this natural phenomenon unfairly to a human activity.***

Severity Categories of Lentic Water Level Manipulation	
Not Subjected	The water body, or wetland, is not subjected to artificial water level change (e.g., drawdown, addition, stabilization, etc.). This category may include very small amounts of change that cause no detectible fluctuation in water level.
Minor	The water body or wetland is subject to no more than minor artificial water level change. The shore area remains vegetated, and withdrawal of water is limited or slow enough that vegetation is able to maintain growth and prevent soil exposure. A relatively narrow band affected by the water level fluctuation may support only annual plants.
Moderate	The water body or wetland is subject to moderate quantities, speed and/or frequency of artificial water level change. Where water is removed, it is done in a way that allows pioneer plants to vegetate at least half of the exposed area resulting from drawdown. Where water is added, some flooding may occur at levels or times not typical to the area/ season.
Extreme	The water body or wetland is subjected to extreme changes in water level due to volume (extent), speed and/or frequency of artificial water addition or removal. Frequent or unnatural levels of flooding occur where water is added, including extensive flooding into riparian and/or upland areas; or no natural annual drawdown is allowed to occur. In extreme artificial drawdown situations, a wide band of exposed bottom remains unvegetated.

Scoring:
9 = The water body, or wetland, is ***not subjected*** to artificial water level change.
6 = The degree of artificial water level change is ***minor.***
3 = The degree of artificial water level change is ***moderate.***
0 = The degree of artificial water level change is ***extreme.***

Calculating the Lentic Health Score
To arrive at the overall site health rating, the scores are totaled for all the factors, and that total is divided by the possible perfect score total. An example score sheet is shown below.

Vegetation Factors	**Actual Pts**	**Possible Pts**
1. Vegetative Cover of Polygon	6	6
2a. Total Canopy Cover of Invasive Plant Species (Weeds)	1	3
2b. Density/Distribution Pattern of Invasive Plant Species (Weeds)	1	3
3. Disturbance-Increaser Undesirable Herbaceous Species	2	3
4. Preferred Tree and Shrub Regeneration	2	6
5a. Browse Utilization of Available Preferred Trees and Shrubs	2	3
5b. Live Woody Vegetation Removal by Other Than Browsing	3	3
6. Human Alteration of Polygon Vegetation Community Composition	4	6
Vegetative Score:	**21**	**33**
Soil/Hydrology Factors		
7a. Percent of Polygon Physical Site Altered by Human Activities	8	12
7b. Severity of Human-Caused Alteration of Polygon Physical Site	2	3
8. Human-Caused Bare Ground	2	6
9. Degree of Artificial Withdrawal or Raising of Water Level	9	9
Soil/Hydrology Score:	**21**	**30**
TOTAL SCORE:	**42**	**63**

Health Rating Formula: Health Rating = (Total Actual Score) / (Total Possible Score) x 100%

Health Rating = (42) / (63) x 100% = 67%

Health Category: 80 to 100% = Proper Functioning Condition (Healthy)
60 to less than 80% = Functional At Risk (Healthy, but with Problems)
Less than 60% = Nonfunctional (Unhealthy)

A manager should realize that a less than perfect score is not necessarily cause for concern. An area rated at 80% is still considered to be functioning properly. At the same time, ratings of individual factors can be useful in detecting strengths or weaknesses of a site. A low score on any factor warrants management focus. For example, the sample score sheet shown above has low scores for invasive plant species, tree and shrub regeneration, and bare ground (items 2, 4, and 8). These are factors in which a management change might result in improvement on a subsequent assessment.

10. Polygon Trend. Select the ***one category*** (Improving; Degrading; Static; or Status Unknown) which best indicates the current trend of the vegetative community on the polygon to the extent possible. Trend refers, in the sense used, not specifically to successional pathway change, but in a more general sense of apparent community health. By definition, trend implies change over time. Accordingly, a trend analysis would require comparison of repeated observations over time. However, some insights into trend can be observed in a single visit. For example, the observer may notice healing (revegetating) of a degraded shoreline and recent establishment of woody seedlings and saplings. This would indicate changing conditions that suggest an improving trend. If such indicators are not apparent, enter the category status unknown.

11. Comments and Observations. Add any necessary commentary to explain or amplify the data recorded. Do not leave this space blank. Describe any unique characteristics of the site and other observations relating to the vegetation or to the physical conditions of the site. Each item in the health rating has a small space provided for specific information to enlighten the score given. This larger space is the place for more general commentary to help the reader understand the larger context of the data. Such things as landscape setting and local land use history are appropriate.

ADDITIONAL MANAGEMENT CONCERNS

The following items do not contribute to a site's ecological health assessment rating. Rather, they may help to quantify inherent physical site characteristics that reveal structural weaknesses or sensitivities or to assess the direction of change on a site. These data can be useful for planning future site management.

12. Overflow Structure Stability. Often the most dynamically unstable point in a lentic system is at the overflow, or outlet. Natural systems usually evolve behind a relatively stable outlet structure, but the overflow structures, or spillways, of human-made water bodies often become unstable and erode, wash out, or downcut causing severe disruption to the lentic system dependent on that body of water. Indicate where on the water body the overflow structure is located, even if it is not within the polygon.

Scoring: (If the water body is not human constructed nor structurally altered, and lacks an overflow structure, replace both Actual and Possible Scores with NA.)
6 = The overflow structure is made of concrete, pipe, or armored rock and appears stable.
4 = The overflow structure is unprotected or is made of other material, but still appears stable.
2 = The overflow structure is made of concrete, pipe, or armored rock, but appears unstable.
0 = The overflow structure is unprotected or is made of other material and appears unstable.

13. Shoreline Rock Volume and Size. The composition of shoreline materials influences the susceptibility of the shoreline to erosion caused by trampling, wave action, or other disturbance. In general, larger rocks provide better protection against disturbance than smaller materials. Thus, shoreline composed primarily of silts and clays—characteristic of many lentic systems in the Great Plains—require more vegetative protection to compensate for the smaller particle sizes.

13a. Shoreline Rock Volume. Rate the shoreline rock volume as the highest appropriate of the following categories:

Scoring:
3 = More than 40% of shoreline volume is rocks at least 6.4 cm (2.5 in).
2 = 20% to 40% of shoreline volume is rock at least 6.4 cm (2.5 in).
1 = 10% to 20% of shoreline volume is rock at least 6.4 cm (2.5 in).
0 = Less than 10% of shoreline volume is rocks at least 6.4 cm (2.5 in).

13b. Shoreline Rock Size. Rate the shoreline rock size for the polygon as the highest appropriate of the following categories:

Scoring:
3 = At least 50% of rocks present are boulders and large cobbles (>13 cm [5 in]).
2 = 50% of rocks present are small cobbles and larger (>6.4 cm [2.5 in]).
1 = At least 50% of rocks present are coarse gravels and larger (>1.5 cm [0.6 in]).
0 = Less than 50% of rocks present are coarse gravels and larger (>1.5 cm [0.6 in]).

14. Vegetation Use by Animals. Record the rating category, which best describes the vegetation use by animals (Platts and others, 1987).

Code	Category Description
0% to 25%	Vegetation use is light or none. Almost all plant biomass at the current development stage remains. Vegetative cover is close to that which would occur without use. Unvegetated areas (such as bedrock) are not a result of land uses.
26% to 50%	Vegetation use is moderate. At least half the potential plant biomass remains. Average stubble height is more than half its potential at the present stage of development.
51% to 75%	Vegetation use is high. Less than half the potential plant biomass remains. Plant stubble height is usually more than 5 cm (2 in) (on many ranges).
76% to 100%	Vegetation use is very high. Only short stubble remains (usually less than 5 cm [2 in] on many ranges). Almost all plant biomass has been removed. Only the root systems and parts of the stems remain.

15. Susceptibility of Parent Material to Erosion. The soils derived from shale or having a large clay content are highly susceptible to compaction and trampling when wet. There is evidence that trampling by hooves and subsequent loss of herbaceous vegetation when soils are wet are major contributions to site degradation. In contrast, those sites having soils derived from sandstone or any of the hard metamorphosed rock found in the Rocky Mountains commonly have a fine sandy loam to loam texture and are more resistant to damage when wet. Intermediate of these soils are those having textures of clay loam to loam. Texturing the soil by the ribboning technique or by feel will be required for this determination. Rate the polygon soil according to one of these categories based on indicators as described above.

Scoring:
3 = Not susceptible to erosion (well armored).
2 = Slightly susceptible to erosion (moderately armored).
1 = Moderately susceptible to erosion.
0 = Extremely susceptible to erosion.

16. Percent of Shoreline Accessible to Large Animals. Record the percent of shoreline length accessible to large hoofed animals (livestock and wildlife). In general, only consider topography (steep banks, deep water, etc.) and dense vegetation as restricting access. Fences, unless part of an exclosure, do not necessarily restrict livestock access even though they may appear to be doing so at the time.

17. Quantify the Percent of Tree and Shrub Cover in the Polygon that is Dead and/or Decadent. A decadent plant is one having at least 30% of its upper canopy dead. Dead lower branches are not a problem if the upper canopy is vigorous.

18 and 19. Break down the polygon and the area adjacent to the polygon using the land uses (activities) listed to reflect what is contributing to the site health. Name any others observed.

No Land Use Apparent—using information provided as well as what is observed at the site suggests there is no human land use. Very light and well managed land uses that show little or no negative impacts should still be recored in the appropriate land use type, not “no land use;”
Turf Grass (Lawn)—ground has been broken and seeded or sodded;
Tame Pasture (Grazing)—lands that are purposefully converted to non-native species for the purpose of livestock grazing;

Native Pasture (Grazing)—refers to grazing environments that are usually dominated by native plants and may occur as grasslands or woodlands (i.e., land that has not been broken and seeded but may contain introduced/invasive species that have encroached due to land practices);
Recreation (ATV Path, Campsites, etc.)—various recreational activities for pleasure or enjoyment;
Development (Building, Corrals, Paved Lots, etc.);
Tilled Cropping—for the raising of crops, by plowing and harrowing;
Perennial Forage (e.g., alfalfa hayland)—herbaceous plants cultivated for livestock feed that have a life span of more than one year;
Roads—prepared/built surfaces used by vehicles;
Logging—process of cutting, processing, and moving trees to a location for transport;
Mining—extraction of valuable minerals or other geological materials;
Railroads—includes actual rail tracks and elevated lands they are built upon; and
Other—describe.

Photograph Data
NOTE: Take a number of photos from each of the four corners of the polygon, if possible. This applies even to situations where the polygon is at one end of an inventoried reach and one of the photos is taken into a non-inventoried area, as well as situations in which another polygon is adjacent to the one being inventoried.

When recording the photo number, also provide the compass bearing of the direction of view, so that future evaluations will be able to photograph the same ground—***Example:*** #0028 (245^{o}), #0029 (98^{o}). Care should be taken to minimize influence the photograph location by trampling.

E1. Photos at ***WPT1 (waypoint #1; e.g., one corner of the polygon).*** Take photos looking inside and outside of the polygon. (Remember to record the lat/long of the photo location.)

E2. Photos at ***WPT2 (waypoint #2; e.g., one corner of the polygon).*** Take photos looking inside and outside of the polygon. (Remember to record the lat/long of the photo location.)

E3. Photos at ***WPT3 (waypoint #3; e.g., one corner of the polygon).*** Take photos looking inside and outside of the polygon. (Remember to record the lat/long of the photo location.)

E4. Photos at ***WPT4 (waypoint #4; e.g., one corner of the polygon).*** Take photos looking inside and outside of the polygon. (Remember to record the lat/long of the photo location.)

E5. Additional photos of the polygon. (A number of photos can be taken at each location. Remember to record the lat/long of the photo location.)

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LENTIC WETLAND SURVEY ECOLOGICAL HEALTH ASSESSMENT
FIELD SCORE SHEET

1. Vegetative Cover of the Polygon. **Score:_____/ 6**

6 = More than 95% of the polygon area is covered by live plant growth.
4 = 85% to 95% of the polygon area is covered by live plant growth.
2 = 75% to 85% of the polygon area is covered by live plant growth.
0 = Less than 75% of the polygon area is covered by live plant growth.

2a. Total Canopy Cover of Invasive Plant Species (Weeds). **Score:_____/ 3**

3 = No invasive plant species (weeds) on the site.
2 = Invasive plants present with total canopy cover less than 1% of the polygon area.
1 = Invasive plants present with total canopy cover between 1% and 15% of the polygon area.
0 = Invasive plants present with total canopy cover more than 15% of the polygon area.

2b. Density/Distribution Pattern of Invasive Plant Species (Weeds). **Score:_____/ 3**

3 = No invasive plant species (weeds) on the site.
2 = Invasive plants present with density/distribution in categories 1, 2, or 3.
1 = Invasive plants present with density/distribution in categories 4, 5, 6, or 7.
0 = Invasive plants present with density/distribution in categories 8, or higher.

3. Disturbance-Increaser Undesirable Herbaceous Species. **Score:_____/ 3**

3 = Less than 5% of the site covered by disturbance-increaser undesirable herbaceous species.
2 = 5% to 25% of the site covered by disturbance-increaser undesirable herbaceous species.
1 = 25% to 50% of the site covered by disturbance-increaser undesirable herbaceous species.
0 = More than 50% of the site covered by disturbance-increaser undesirable herbaceous species.

4. Preferred Tree and Shrub Regeneration. **Score:_____/ 6**

(*If site lacks potential for woody species, replace both Actual and Possible Scores with NA.*)
6 = More than 15% of the total canopy cover of preferred trees/shrubs are seedlings and/or saplings.
4 = 5% to 15% of the total canopy cover of preferred trees/shrubs is seedlings and/or saplings.
2 = Less than 5% of the total canopy cover of preferred tree/shrubs are seedlings and/or saplings.
0 = Preferred tree/shrub seedlings and saplings absent.

5a. Browse Utilization of Available Preferred Trees and Shrubs. **Score:_____/ 3**

(*If the site has no woody vegetation [except for the species listed to be excluded], replace both Actual Score and Possible Score with NA.*)
3 = None (0% to 5% of available second year and older leaders of preferred species are browsed).
2 = Light (5% to 25% of available second year and older leaders of preferred species are browsed).
1 = Moderate (25% to 50% of available second year and older leaders of preferred species are browsed).
0 = Heavy (More than 50% of available second year and older leaders of preferred species are browsed).

5b. Live Woody Vegetation Removal by Other Than Browsing. **Score:_____/ 3**

(*If the polygon does not have the ability to support [potential for] any trees and shrubs and there is no evidence that it ever had any, replace both Actual Score and Possible Score with* ***NA****. When insufficient data/evidence is available to make a call, replace both Actual Score and Possible Score with* ***NC****.*)
3 = None (0% to 5% of live woody vegetation expected on the site is lacking due to cutting).
2 = Light (5% to 25% of live woody vegetation expected on the site is lacking due to cutting).
1 = Moderate (25% to 50% of live woody vegetation expected on the site is lacking due to cutting).
0 = Heavy (More than 50% of live woody vegetation expected on the site is lacking due to cutting).

6. Human Alteration of Polygon Vegetation Community Composition. **Score:_____/ 6**

6 = Less than 5% of polygon vegetation community composition is altered by human activity.
4 = 5% to 15% of polygon vegetation community composition is altered by human activity.
2 = 15% to 35% of polygon vegetation community composition is altered by human activity.
0 = 35% or more of polygon vegetation community composition is altered by human activity.

7a. Percent of Polygon Physical Site Altered by Human Activity. **Score:**_____/ 12

12 = Less than 5% of the polygon is physically altered by human activity.
8 = 5% to 15% of the polygon is physically altered by human activity.
4 = 15% to 35% of the polygon is physically altered by human activity.
0 = More than 35% of the polygon is physically altered by human activity.

7b. Severity of Human-Caused Alteration of Polygon Physical Site (Regardless of Percent Area). **Score:**_____/ 3

(For sites with more than one severity type, select the type that describes the majority of the alteration area. Describe the other severity types in comments section.)

3 = ***No physical alterations*** to the site by human activity.
2 = Human alterations to the physical site are ***slight*** in effect.
1 = Human alterations to the physical site are ***moderate*** in effect.
0 = Human alterations to the physical site are ***severe*** in effect.

8. Human-Caused Bare Ground. **Score:**_____/ 6

6 = Less than 1% of the polygon is human-caused bare ground.
4 = 1% to 5% of the polygon is human-caused bare ground.
2 = 5% to 15% of the polygon is human-caused bare ground.
0 = 15% or more of the polygon is human-caused bare ground.

9. Degree of Artificial Withdrawal or Raising of Water Level. **Score:**_____/ 9

9 = The water body, or wetland, is ***not subjected*** to artificial water level change.
6 = The degree of artificial water level change is ***minor.***
3 = The degree of artificial water level change is ***moderate.***
0 = The degree of artificial water level change is ***extreme.***

10. Comments and Observations.

_____
_____
_____
_____
_____

Overall Polygon Health Rating Calculation. The sum of scores assessed for all items is calculated as the Total Actual Score, and the sum of all possible item scores is calculated as the Total Possible Score. These Totals are entered into the Health Rating Formula shown to derive a percentage Health Rating for the polygon. The percentage Rating is then categorized into a Health Category as defined below.

Health Rating Formula: Health Rating = (Total Actual Score) / (Total Possible Score) x 100%

Health Category:	80 to 100%	= Proper Functioning Condition (Healthy)
	60 to less than 80%	= Functional At Risk (Healthy, but with Problems)
	Less than 60%	= Nonfunctional (Unhealthy)

ADDITIONAL MANAGEMENT CONCERNS

11. Polygon Trend. Select one: Improving, Degrading, Static, or Status Unknown **Trend:**_____

12. Overflow Structure Stability. **Score:**_____/ 6

(If the water body is not human constructed nor structurally altered, and lacks an overflow structure, replace both Actual and Possible Scores with NA.)

6 = The overflow structure is made of concrete, pipe, or armored rock and appears stable.
4 = The overflow structure is unprotected or is made of other material, but still appears stable.
2 = The overflow structure is made of concrete, pipe, or armored rock, but appears unstable.
0 = The overflow structure is unprotected or is made of other material and appears unstable.

13. Shoreline Rock Volume and Size.

13a. Shoreline Rock Volume. Rate the shoreline rock volume as the highest appropriate category: **Score:**_____/ 3

3 = More than 40% of shoreline volume is rocks at least 6.4 cm (2.5 in).
2 = 20% to 40% of shoreline volume is rock at least 6.4 cm (2.5 in).
1 = 10% to 20% of shoreline volume is rock at least 6.4 cm (2.5 in).
0 = Less than 10% of shoreline volume is rocks at least 6.4 cm (2.5 in).

13b. Shoreline Bank Rock Size. Rate the shoreline rock size for the polygon as the highest category: **Score:**_____/ 3

3 = At least 50% of rocks present are boulders and large cobbles (>13 cm [5 in]).
2 = 50% of rocks present are small cobbles and larger (>6.4 cm [2.5 in]).
1 = At least 50% of rocks present are coarse gravels and larger (>1.5 cm [0.6 in]).
0 = Less than 50% of rocks present are coarse gravels and larger (>1.5 cm [0.6 in]).

14. Vegetative Use by Animals. Use the categories below to score the amount of utilization. **Score:**_____/ 3

3 = 0% to 25% available forage taken.
2 = 26% to 50% available forage taken.
1 = 51% to 75% available forage taken.
0 = 76% to 100% available forage taken.

15. Susceptibility of Parent Material to Erosion. **Score:**_____/ 3

3 = Not susceptible to erosion (well armored).
2 = Slightly susceptible to erosion (moderately armored).
1 = Moderately susceptible to erosion.
0 = Extremely susceptible to erosion.

16. Percent of Shoreline Accessible to Livestock. **Percent:**_____

17. Percent of Tree and Shrub Cover in the Polygon that is Dead and/or Decadent. **Percent:**_____

18. Break Down the Polygon Area into the Land Uses Listed (must total to approx. 100%):

No Land Use Apparent:_____
Turf Grass (Lawn):_____
Tame Pasture (Grazing):_____
Native Pasture (Grazing):_____
Recreation (ATV Paths, Campsites, etc.):_____
Development (Buildings, Corrals, Paved Lots, etc.):_____
Tilled Cropping:_____
Perennial Forage (e.g., Alfalfa Hayland):_____
Roads:_____
Logging:_____
Mining:_____
Railroads:_____
Other:_____

Description of Other Usage Noted:_____
_____
_____

19. Break Down the Area Adjacent to the Polygon Into the Land Uses Listed (must total to approx. 100%):

No Land Use Apparent:_____
Turf Grass (Lawn):_____
Tame Pasture (Grazing):_____
Native Pasture (Grazing):_____
Recreation (ATV Paths, Campsites, etc.):_____
Development (Buildings, Corrals, Paved Lots, etc.):_____
Tilled Cropping:_____
Perennial Forage (e.g., Alfalfa Hayland):_____
Roads:_____
Logging:_____
Mining:_____
Railroads:_____
Other:_____

Description of Other Usage Noted:_____
_____
_____