

**Alberta Transportation's Guidelines for Conducting Wetland Assessments to Meet *Water Act* Application Requirements**

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More information regarding “Alberta Transportation’s Guidelines for Conducting Wetland Assessments to Meet *Water Act* Application Requirements” may be obtained by contacting:

**Provincial Transportation Environmental Coordinator, Alberta Transportation**  
**2<sup>nd</sup> Floor, Twin Atria Building**  
**4999-98<sup>th</sup> Ave, Edmonton, AB T6B 2X3**  
**Phone: (780) 644-8354**

## **Acknowledgements**

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## **PURPOSE**

The purpose of this document is to provide general Guidelines for conducting wetland assessments and outline Alberta Transportation's requirements for components that form a *Water Act* application for wetland disturbance. Wetland assessments must be conducted by a qualified wetland professional. Therefore, the intended users of these Guidelines are qualified wetland professional, as outlined in the glossary of terms provided in Appendix 1.

Information cited in these Guidelines has been retained from Alberta Transportation's *Water Act Application Standardization Components*, the *Provincial Wetland Restoration/Compensation Guide, 2007* and Green Plan Ltd. Environmental Consultants (Green Plan) experience in conducting wetland assessments.

## **A: COMPONENTS OF A WATER ACT APPLICATION FOR WETLAND DISTURBANCE**

Outlined below are the core components of a complete *Water Act* application for wetland disturbance.

### **1.0 Cover Letter and Water Act Application Form**

- 1.1.1 Brief description of the project and project need
- 1.1.2 Provide total area of wetland disturbance
- 1.1.3 Include start and stop dates for earthwork activities
- 1.1.4 Alberta Transportation personnel must sign the *Water Act* application

### **2.0 Wetland Assessment**

A wetland assessment report with all pertinent information is outlined in Part B: *Guidelines for Conducting Wetland Assessments*.

Note: If wetland credits from the Department's wetland bank are proposed as compensatory mitigation, a wetland assessment for the 'credit(s)' is also required to be submitted with the *Water Act* application.

### **3.0 Monitoring Requirements**

Depending on the form of proposed compensation, a monitoring plan may be required. Refer to Alberta Transportation's *Standard Monitoring Protocols for Evaluating Wetland Performance for Constructed 'Habitat' Wetlands*, 2012.

Specific monitoring requirements should be discussed with local Alberta Transportation and/or Alberta Environment and Sustainable Resource Development staff.

## **B GUIDELINES FOR CONDUCTING WETLAND ASSESSMENTS**

These Guidelines are subject to change pending regulatory requirements.

The wetland assessment should include, at a minimum, the following information:

### **1.0 Project Information**

The wetland assessment should include an introductory section that describes the following:

**1.1** Detailed description of the proposed project and why it is required;

**1.2** Environmental/regional setting.

This Section should include a detailed description of the following:

**1.3.1** Ecology and land use

**1.3.2** Topography and geology

**1.3.3** Surface water

**1.3.4** Groundwater

**1.3.5** Soils and vegetation

**1.3.6** Fish and wildlife

### **2.0 Wetland Evaluation**

For each wetland the project has the potential to impact, include a detailed description of the following:

**2.1** Date of wetland assessment

**2.2** Name, contact information and qualifications of assessor

**2.3** Wetland location and hydrology assessment

**2.4** Water Survey of the Canada sub-basin code

**2.5** Wetland vegetation

**2.6** Wildlife

**2.7** Substrate

**2.8** Soils

- Soils display indicators due to wet/saturated conditions, even after vegetation is removed and the surface hydrology is altered. An understanding of how soils develop and the soil properties related to hydric characteristics such as color, texture, and permeability are used to identify indicators of hydric soils.



Physical and chemical soil properties can be used to identify and delineate wetlands. Much research has been conducted in the United States and documents, manuals, and policies are publicly available. The U.S. Army Corps of Engineers Wetland Delineation Manual (1987) is widely used in the U.S. to identify and delineate wetland soils. Parent material and climate distinctions between the U.S. and Alberta will exclude select indicators that are not relevant in Alberta (Pecocan Land Evaluation Ltd 2014).

The Canadian System of Soil Classification has different names for categorizing soil Orders and Great Groups; however descriptions of soil properties such as mottles are essentially the same as used in the U.S. Many of the indicators of 'hydric' soils (U.S term) in the U.S. can be used as indicators of 'wetland soils' in Alberta (Pecocan Land Evaluation Ltd. 2014). The US Corps Manual and the Natural Resources Conservation Services (NRCS) have common indicators. Brief summaries of the indicators are provided in Appendix 2.

#### **2.9** Size of the wetland

- This should include the flooded portion of the wetland and the transition zone from aquatic to terrestrial vegetation

#### **2.10** Referenced photographs of the wetland, wetland area, wetland margin, and immediate upland area

#### **2.11** Wetland classification using **one** of the following, most appropriate classification systems:

- Stewart and Kantrud (1971) Wetland Classification System
- Canadian Wetland Classification System
- Alberta Wetland Classification System

#### **2.12** History of the wetland

- Include historical aerial photos and analysis of hydroperiod

#### **2.13** Potential effects of proposed development

### 3.0 Compensation Plan

Provide a detailed description outlining why impact to the wetland(s) cannot be avoided nor minimized, and any mitigation measures that are proposed. In addition, in tabular format, detail the following information for each corresponding delineated wetland that compensation is proposed for.

**3.1** Wetland classification

**3.2** Wetland location

**3.3** Total size (ha) of wetland

**3.4** Total size of impact (ha) to the wetland

**3.5** Condition of wetland

**3.6** Compensation ratios

- The proposed compensation ratio should be based on the assessors professional judgment

Examples of the above noted information summarized in a tabular format provided below Tables 1.0 and 2.0.

**Table 1.0 Description of Wetlands Assessed (Example)**

Site	Location	Wetland Classification (Steward and Kantrud 1971)	Total Wetland Area (ha)	Unavoidable Wetland Area (ha) to be Impacted	Condition of Wetland
1	NW 13-051-06 W5M	Class V	0.30	0.30	The wetland is well established with varying ecosites. A portion of the wetland is accessible to cattle. Evidence suggests that the wetland is used for stock-watering purposes.

**Table 2.0 Wetland Compensation Plan**

Site	Location	Wetland Classification (Steward and Kantrud 1971)	Unavoidable Wetland Area (ha) to be Impacted	Recommended Compensation Ratio	Method of Compensation
1	NW 13-051-06 W5M	Class V	0.30	3:1	Utilize banked wetland 'credits' stored in Alberta Transportation's wetland habitat bank.

In addition, a wetland function analysis of the parameters outlined below should also be assessed. The information should be taken into consideration when recommending the compensation ratio.

- 3.8 Hydrological function
- 3.9 Biogeochemical function
- 4.0 Habitat function
- 4.1 Ecological function
- 4.2 Social/cultural/commercial values
- 4.3 Aesthetic/recreational
- 4.4 Education and awareness

An example of a wetland function analysis is provided below in Table 3.0.

The compensation plan should also include a detailed summary of the total wetland area to be impacted and proposed compensation ratio in tabular format (refer to Table 2.0).

This Section should also provide a detailed description of the method of compensation, for example:

- Payment to a Wetland Restoration Agency (WRA) for restoration works in accordance with the *Provincial Wetland Restoration/Compensation Guide, 2007*
- Utilize banked wetland 'credits' stored in Alberta Transportation's wetland habitat bank
- Provide funds for wetland education programs
- Provide funds for academic research and development assistance
- Construct, enhance or restore wetlands near the area of impact
- Other initiatives that create or improve wetland habitat

**Table 3.0 Wetland Function Analysis - Example**

<b>Wetland Function</b>	<b>Analysis Role and importance of the wetland being assessed</b>
Hydrological function	<p>Being in the headwaters of the Dogpound Creek watershed, the waterbody and associated wetland would play a significant role in the hydrology of the watercourse, moderating and maintaining flows and shoreline fluctuations, etc., especially as it is an impoundment formed by a small dam.</p> <p>The impounded waterbody and the associated marsh/meadow areas would tend to control erosion from the surrounding slopes, whether the land use is agricultural or industrial.</p>
Biogeochemical function	<p>Incrementally, the wetland would assist in metabolizing nutrients (phosphorus, nitrogen) from local/upstream agricultural runoff, turning it into biomass and preventing algal blooms and anoxic conditions resulting due to bacterial action.</p> <p>The wetland likely controls/stabilizes local sediment flow resulting from erosion on surrounding lands, as well as contaminants associated with particulate matter, thus enhancing water quality.</p>
Habitat functions	<p>Several species of waterfowl and many amphibians were observed in the wetland in the field reconnaissance: the open water, shallow marsh and deep marsh vegetation evidently provides nesting, rearing and feeding habitat.</p> <p>Although no fish capture was attempted, fish are known to inhabit Dogpound Creek. It is a mapped waterbody (Class D).</p> <p>The open water, deep marsh, shallow marsh and wet meadow habitats, overall, provide a variety of ecological niches, which enhances biodiversity.</p>
Ecological functions	<p>The wetland is an important link in the ecological connectivity of aquatic and riparian habitats in the upper reaches of Dogpound Creek with similar habitats downstream: loss or impairment would cut off other habitats upstream, resulting in overall fragmentation of critical wetland and riparian habitat.</p> <p>The wetland could be expected to have high primary and secondary biological productivity.</p> <p>There are fewer and fewer wetlands and open waterbodies of this type that are unaffected.</p>
Social/cultural/commercial values	<p>It is not known if the wetland played a significant role in Aboriginal or other (pre-)history.</p> <p>The waterbody and impoundment are part of a Ducks Unlimited conservation site based around wetland ecological and habitat values.</p> <p>The open water area is used for livestock watering.</p>
Aesthetic/recreational	<p>The wetland is visible from a major roadway.</p>
Education & awareness	<p>The wetland and impounded waterbody have the potential to be used for educational and interpretational features as part of the end use plan, depending on ownership and level of interest.</p>

## **4.0 Maps**

Maps must clearly identify the location of the proposed impacted wetland(s) in relation to the right-of-way (ROW);

- All wetlands must be clearly labeled
- Include legal land location description for all proposed wetlands to be impacted
- Maps (ideally in color)
- Project boundary and delineated wetland(s) must be depicted on map

## REFERENCES

Alberta Environment. 2007. Provincial Wetland Restoration/Compensation Guide.

Alberta Transportation, 2012. Prepared by Green Plan Ltd. Environmental Consultants. Development of Guidelines for Wetland Establishment on Reclaimed Borrow Bit in Alberta – Draft.

Alberta Transportation. *Water Act* Application Standardization Components.

Pedocan Land Evaluation Ltd. 2014. Wetland Identification and Delineation: Soil Indicators.

Natural Resources Conservation Services. Module 4 – Making a Decision if the Site, Under Normal Circumstances Supports a Predominance of Hydric FSA Soils. [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs141p2\\_036334.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_036334.pdf)

US Army Corps of Engineers. 1987. Corps of Engineers Wetland Delineation Manual. <http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf>

# **APPENDIX 1**

## *Definitions*

## Definitions

The following definitions are sourced from the *Alberta Environment Glossary of Reclamation and Remediation Terms* and the *Guideline for Wetland Establishment on Reclaimed Oil Sand Leases*, Oil Sands Wetlands Working Group, 2007, unless other source citation is specifically noted.

**Alberta Environment and Sustainable Resource Development (AESRD)** – the Ministry responsible for regulating activities such as wetland mitigation and development projects that affect water bodies under the authority of the *Water Act* (Provincial Wetland Restoration/Compensation Guide, 2007).

**Aquatic** - growing, living in or frequenting water; occurring or situated in or on water.

**Avoid** – to prevent impacts to a wetland by identifying an alternate project, activity, design, or site, or abandoning the project or activity altogether or by denial of an application by the regulator (Alberta Wetland Policy, 2013).

**Benthic** – living at, in or in association with the bottom substrate of aquatic environments, including wetlands.

**Biodiversity** – the variety of living components in an ecosystem; it is most often expressed in terms of species diversity but can be assessed on the basis of genetic diversity or landscape diversity (e.g., variety of vegetation types across the landscape); it can also incorporate structural and functional elements.

**Candidate Site** – wetlands that have been constructed, enhanced or restored for the purpose of wetland compensation and have the potential to meet Alberta Transportation's criteria to be transferred and reflected in the Department's wetland habitat bank. Candidate sites may also be wetlands that have naturally evolved from decommissioned borrow or aggregate operations and have the potential to meet the Department's criteria (Alberta Transportation's Wetland Banking Initiative, 2013).

**Clay** – with reference to soils, a fine-grained textural class, made up largely of clay minerals, but commonly also having amorphous free oxides and primary minerals; with reference to particle-size, having a grain less than 0.002 mm equivalent diameter.

**Coarse-grained** – with reference to soil, the texture exhibited by sands, loamy sands, and sandy loams but not including very fine sandy loam; a soil containing large quantities of these textural classes.

**Conservation** – The management of wetland(s) to ensure they are sustained for future generations.

The planning, management, and implementation of an activity with the objective of protecting the essential physical, chemical and biological characteristic of the environment against degradation (Alberta Wetland Policy, 2013).



**Credit** – area of constructed, restored, or enhanced wetland stored in Alberta Transportation's wetland habitat bank available for use as a form of wetland replacement (Alberta Transportation's Wetland Banking Initiative, 2013).

**Ecosystem** – a complex of living organisms interacting with each other and their non-living environment, linked together by energy flows and material cycling.

**Emergent vegetation** – plant species that have a part extending below the normal water level; plants adapted to periodic flooding, including genera such as *Carex* (sedges), *Scirpus* (reeds), and *Typha* (cattails).

**End land use** – with reference to oil sands mining, the allowable use/s of disturbed land following reclamation; municipal zoning/approval may be required for specific land uses.

**Ephemeral water body** – A shallow water body that temporarily contains water after spring snowmelt or heavy rainfall and typically dries up within a matter of days to weeks (Alberta Wetland Policy, 2013)

**Equivalent land capability** (regulatory definition) – where the ability of the land to support various land uses after reclamation is similar to the ability that existed prior to the activity being conducted on the land, but the ability to support individual land uses will not necessarily be equal after reclamation.

**Erosion** – the wearing away and transportation of soils, rocks and dissolved minerals from the land surface, shorelines and river bottoms by running water, wind, ice, other geological agents, activities of man or animals, and including such processes as gravitational creep.

**Evaporation** – the conversion of water from liquid form in soils and aquatic environments to vapor form and release to the atmosphere.

**Evapotranspiration (ET)** – a collective term for the processes of evaporation of water from the soil surface and plant transpiration by which water is returned to the atmosphere from the land; see Potential evapotranspiration vs Actual evapotranspiration.

**Groundwater** – underground water supplies, also called aquifers; see Aquifer; water that is stored in the pores of subsurface geological deposits (strata) and flows in the direction of decreasing pressure.

**Habitat** – the specific area or environment in which a particular type of plant or animal lives.

**Hydraulic conductivity** – the measure of the ability of fluid to move through earth material; a function of both the soil medium and the fluid is sometimes used interchangeably with permeability.

**Hydrology** – a broad term that encompasses all hydrologic and hydraulic processes related to wetlands; the water balance and all water components.

**Hydrophyte** – a plant that grows in water, or in wet or saturated soils; water-loving; any plant growing in water or on a substrate.

**Inorganic** – not pertaining to or derived from plant or animal origins; a chemical of mineral origin which does not contain (with few exceptions) carbon or compounds of carbon.

**Intermittent** – with reference to aquatic environments, where the presence of water ceases for a time due to climatic conditions, including snow melt/spring runoff, seasonal storms and drought conditions.

**Littoral zone** – productive shallow-water zone of lakes, rivers or seas where light can penetrate to the bottom; often occupied by rooted aquatic plants; the biogeographic zone between the high- and low-water marks.

**Macrophyte** - an aquatic plant that grows in or near water and is either emergent, submergent, or floating. In lakes macrophytes provide cover for fish and substrate for aquatic invertebrates, produce oxygen, and act as food for some fish and wildlife.

**Marsh** – a class of wetland described as having the following characteristics: periodically inundated by standing or slowly moving water; surface water levels may fluctuate seasonally, with declining levels exposing drawdown zones of matted vegetation or mud flats; waters are often eutrophic; substratum usually consists dominantly of mineral material, although some marshes are associated with peat or gyttja deposits; associated soils are dominantly Gleysols with some Humisols and Mesisols; characteristically show a zonal or mosaic surface pattern of pools or channels interspersed with clumps of emergent sedges, grasses, rushes and reeds; where open water areas occur, a variety of submerged and floating aquatic plants flourish.

**Mitigation** – Management activities taken to avoid and minimize negative impacts on wetlands, and to replace lost wetlands, where necessary (Alberta Wetland Policy, 2013).

**Node** – Place on the stem from where leaves grow. Nodes are separated by internodes (Weeds of the Prairies, 2000).

**Non-restorative replacement** - refers to a variety of alternatives that must support the maintenance of wetland value, by advancing the state of wetland science and wetland management. Acceptable non-restorative replacement measures include (Alberta Wetland Policy, 2013):

- Specified research into wetland restoration measures
- Provincial level monitoring of wetlands
- Specified wetland inventory work and data acquisition
- Specified landscape level wetland health assessment or modeling
- Public education and outreach programs
- Wetland securement for the purpose of long term conservation

**Off – site wetland compensation** – off-site compensation occurs when impacts to wetland area can neither be avoided nor minimized and the developer is required to compensate for unavoidable loss (Alberta Transportation's Wetland Banking Initiative, 2013).

Off-site compensation includes:

- In-lieu fee payment, whereby Alberta Transportation may choose to pay financial restitution for a wetland loss. These funds are allocated toward specific restorative or non-restorative measures, as determined by guidance documents. Under the provisions of ESRD's current guidance document, financial restitution is paid to a Wetland Restoration Agency (WRA) for restoration works, i.e. Ducks Unlimited Canada.

- Utilizing banked wetland credits stored in Alberta Transportation's wetland habitat bank;
- Constructed, enhanced, or restored wetlands near the area of impact;
- Provide non-restorative replacement
  - Specified research into wetland restoration measures
  - Provincial level monitoring of wetlands
  - Specified wetland inventory work and data acquisition
  - Specified landscape level wetland health assessment or modeling
  - Public education and outreach programs
  - Wetland securement for the purpose of long term conservation

**On-site wetland compensation** – on-site compensation occurs when impacts to wetlands or wetland area can neither be avoided nor minimized and the developer is required to compensate for unavoidable wetland loss (Alberta Transportation's Wetland Banking Initiative, 2013).

On-site compensation includes:

- Improvements (enhance or restore) to existing wetlands at or near the site of wetland impact;
- Constructing a wetland at the site of wetland disturbance (within contract limits); and naturalizing it as close as possible to a natural wetland in terms of biodiversity.

**Organic** – with reference to soils, those having  $\geq 20-30$  % organic matter content by weight, depending on clay content; the majority are saturated for most of the year, unless artificially drained; contain 17% or more organic carbon, and the surface layer must extend to a depth of at least 10-60 cm, depending on the bulk density properties; includes peat.

**Organic matter** – the organic fraction of the soil that includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population.

**Permeability** – the capacity of some structures (e.g., a porous rock, soil, or sediment) for allowing water to be transmitted without damage to the structure; the ease with which gases, liquids, or plant roots penetrate or pass through a bulk mass of soil or a layer of soil.

**Potential wetland opportunities** – potential wetland opportunities include:

- Wetlands constructed utilizing historical/decommissioned borrow or aggregate area;
- Restored naturally occurring wetland at the site of wetland disturbance; and
- Enhanced naturally occurring wetlands at the site of wetland disturbance.

A system for evaluating the hydrological and ecological importance of wetland ecosystems was put forward by Environment Canada (1998). These important functions and values could be applied to whether the wetland is being constructed, enhanced, or restored. Wetland functions and values include:

- Hydrological function;
- Biogeochemical function;
- Habitat function;
- Ecological function;
- Social/cultural/commercial values;
- Aesthetic/recreational values; and

- Education and public awareness.

Potential wetland opportunities are assessed by a Qualified Wetland Professional using Alberta Transportation's criteria to determine and evaluate wetland functionality. Constructed, enhanced or restored wetlands will be transferred into Alberta Transportation's wetland habitat bank (Alberta Transportation's Wetland Banking Initiative, 2013).

**Qualified wetland professional** - Alberta Transportation defines an individual qualified to conduct wetland assessments as someone whom, but is not necessarily limited to (Alberta Transportation's Wetland Banking Initiative, 2013):

- (i) possesses
  - (A) a post-secondary degree in biological sciences, soils and hydrology,
  - (B) a technical diploma in biological sciences, soils and hydrology or
  - (C) educational equivalencies, and
- (ii) has a detailed knowledge of the aquatic environment, wetland soils, hydrology and wetland margin habitat and their management or assessment; and
- (iii) is experienced with
  - (A) wetland habitat and aquatic environment assessment methods;
  - (B) the determination of ecological impacts relative to mitigation needs, and
  - (C) the determination of mitigation measures required to maintain the productive capacity of the aquatic environment, including wetland and wetland margin habitats in Alberta that may be adversely affected by the carrying out of works in and adjacent to the water, bed and shore of water bodies.

A qualified professional may also be defined as someone whom possesses a:

- (i) P.Bio designation recognized through the Alberta Society of Professional Biologists
- (ii) R.P.Bio designation recognized through College of Applied Biology British Columbia
- (iii) R.B.Tech designation recognized through the College of Applied Biology British Columbia

**Reclamation (regulatory definition)** – the process of reconvertng disturbed land to its former or other productive uses; all practicable and reasonable methods of designing and conducting an activity to ensure: (1) stable, non-hazardous, nonerodible, favourably drained soil conditions, and (2) equivalent land capability; the removal of equipment or buildings or other structures and appurtenances, the decontamination of buildings or other structures or other appurtenances, or land or water, the stabilization, contouring.

**REC:** Regional Environmental Coordinator for Alberta Transportation.

**Replacement** – where avoidance and minimization efforts are not feasible or prove ineffective, wetland replacement is acknowledged as the last resort in the mitigation process. Wetland replacement can be divided into two overarching categories; restorative replacement and non-restorative replacement (Alberta Wetland Policy, 2013).

Replacement can be further divided into two subcategories:

- *In-lieu fee payment*, whereby the approval holder may choose to pay financial restitution for a wetlands loss.

- *Permittee – responsible replacement*, whereby the approval holder may choose to actively engage in restorative replacement, in accordance with criteria and guidance from the Government of Alberta.

**Restorative replacement** – refers to replacement activities that attempt to make up for the permanent loss of a wetland through restoration, enhancement, or construction of another wetland (Alberta Wetland Policy, 2013)

**Rhizomes** - A horizontal, underground stem with buds and roots at the nodes (Weeds of the Prairies, 2000).

**Riparian margin** – refers to terrain, vegetation or simply a position adjacent to or associated with a stream, flood plain, lake or wetland.

**Substrate** – any solid surface which forms the place of attachment or place of dwelling of an organism; may be rocks, sand, mud, or the surface of a plant; most often refers to that part of the surface of the wetland soil profile that provides biological and chemical support for the growth of hydrophytic plants; defined by function rather than by a specific soil type.

**Submergent vegetation** – plant species that have no part extending above the normal water level, but which are rooted in a substrate (not floating) Succession – the natural sequence or evolution of plant communities, each stage dependent on the preceding one, and on environmental and management factors; primary succession occurs on newly created surfaces, while secondary succession involves the development or replacement of one stable successional species by another on a site having a developed soil; secondary succession.

**Stolons** - A creeping, above ground, horizontal stem that roots at the nodes (Weeds of the Prairies, 2000).

**Topsoil (engineering definition)** – the surface soil, usually containing organic matter; the uppermost part of the soil, ordinarily moved in tillage, or its equivalent in uncultivated soils, and normally ranging in depth from 5 to 45 cm.

**Water table** – elevation at which the pressure in the water is zero with respect to the atmospheric pressure; the upper limit of the soil or underlying rock material that is wholly saturated with water; marks the upper boundary of an aquifer.

**Wetland** – Land saturated with water long enough to promote wetland or aquatic processes as indicated by the poorly drained soils, hydrophytic vegetation, and various kinds of biological activity that are adapted to a wet environment (Alberta Wetland Policy, 2013).

**Wetland replacement** – Compensation for wetland value that has been permanently lost, due to human activity on the landscape. Replacement activities under the Alberta Wetland Policy include both restorative and non-restorative measures. Restorative measures may include wetland restoration, creation, or enhancement. Non-restorative measures may include those activities that indirectly advance the goal of conserving wetlands and their value such as research, securement, or education (Alberta Wetland Policy, 2013).

**Wetland Restoration Agency (WRA)** – an organization responsible for restoring drained wetlands to near natural conditions. Responsibilities include securing land rights, obtaining

approvals/licences under the authority of the *Water Act* and where applicable, the *Public Lands Act*, completing restoration works, operating and monitoring the restored wetlands, keeping records and reporting to Alberta Environment (Provincial Wetland Restoration/Compensation Guide, 2007)

## **APPENDIX 2**

### *Summary of U.S Wetland Delineation Indicators*

## Summary of US Wetland Delineation Indicators

The indicators are listed in order of reliability. Once an indicator is positive it is not required to continue down the list.

US Corps of Engineers Wetland Delineation Manual	USDA, Field Indicators of Hydric Soils in the United States.	Applicable in Alberta. Comments.
<b>44) a. Organic soil (&gt;40cm peat).</b>	<b>A1. Histisols - Organic soil (&gt;40cm peat)</b>	Yes. Organic Soils.
	<b>A2. Histic epipedon - &gt;20cm peat, aquic conditions or artificial drainage</b>	Yes. Peaty phases and variants.
<b>b. Histic epipedons. 20-40cm organic (&gt;20%) surface saturated for 30 consecutive days in most years.</b>	<b>A3. Black Histic - &gt;20cm peat, underlain by mineral soil with chroma 2 or less</b>	Yes. Peaty phases and variants.
<b>c. Sulfidic material. Sulfidic material within a few cm of soil surface.</b>	<b>A4. Hydrogen sulphide odor within 30cm of the soil surface.</b>	Yes.
<b>d. Aquic or peraquic moisture regime. Groundwater always at or near soil surface. It is implicit that the soil temperature is above biologic zero (5( C) at some time while the soil is saturated.</b>		Yes.
<b>e. Reducing soil conditions. - alpha-alpha dipyridyl turns pink/red under reducing conditions</b>		Potentially. Limitations: soils need to be wet when applying, iron needs to be abundant in the soil, cannot be used



		on organic soils, unknown supply source in Alberta.
	<b>A5. Stratified layers.</b>	
	<b>A6.- A10. – not applicable</b>	
<b>f. Soil colors.</b> - gleyed soils within 25cm of soil surface. - bright mottles / low matrix chroma. - matrix chroma <_2 in mottled soils. - matrix chroma <_1 in unmottled soils.	<b>A11. Depleted below dark surface.</b>	Yes. Gleying and mottling are currently used to describe soils in Canada using the The Canadian System of Soil Classification, Third Edition. Gleysolic Soils.
	<b>A12. Thick Dark Surface.</b>	
	<b>A13-A16 – not applicable</b>	
<b>g. Soils on hydric soils list.</b> - frequently saturated 30cm from soil surface.		Could be developed for Alberta from the Alberta Soil Names File.
<b>h. Iron and manganese concentrations.</b> - black or dark brown accumulations >2mm in diameter within 7.5cm of soil surface.		Yes but rare.

Source: Pedocan Land Evaluation Ltd. 2014. Wetland Identification and Delineation: Soil Indicators