

## **Assessment of Potential for a List of Vegetation Species To be Used as an Indicator of High Water Table or Groundwater Discharge in the Mixed Grass Prairie**

**Nov 20, 2018**

### **Objective**

PTAC project 15-SGRC-08 developed a scientific rationale document supporting an alternate closure protocol for salt-affected wellsites on native prairie grasslands. The PTAC project proposed that specific plants would be indicative of near surface groundwater (either high water table or groundwater discharge). In support of this protocol, a group of vegetation specialists from Salix Resource Management Ltd. (Salix) and Terrestrial Solutions Ltd. (Terrestrial) were asked to review vegetation species in the Mixed Grass or Dry Mixed Grass Natural sub-regions to determine if a list of species could be formulated to act as markers to determine the lack of an elevated water table or groundwater discharge, with the absence of the identified species being an indicator of a low likelihood of near surface groundwater.

### **Scope**

This project was intended as a preliminary assessment to determine whether it was felt that a list of species could be developed to act as markers for areas with increased water. The assessment was intended to be based on existing vegetation and plant community classification systems, as well as the professional experience of the individuals on the project. No field studies were planned as a part of this investigation.

### **Methodology**

In order to develop the desired list of species, the Alberta wetland classification<sup>1</sup> species list for swamps and marshes was utilized as a starting point. Swamps and marshes were chosen as they are the most prevalent wetland types within the subject area and exclude the obvious wetlands that have open water present. While the wetland classification system was utilized as a starting point for the species list, it should be noted that the objective is not to identify “wetlands”, but areas with the potential for upwards movement of water or groundwater discharge. Such areas may not always meet the definition of a “wetland”. For the purposes of this document these areas with upward movement of water, or groundwater discharge are referred to as “moist” ecosystems.

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<sup>1</sup> Alberta Environment and Sustainable Resource Development (ESRD). 2015. Alberta Wetland Classification System. Water Policy Branch, Policy and Planning Division, Edmonton, AB.

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The wetland list was then cross-referenced to the Alberta Biodiversity Monitoring Institute (ABMI)<sup>2</sup> species list for species noted to be present in the area of the mixed-grass or dry mixed-grass natural sub-regions. As the ABMI list is not referenced by natural sub-region, an area south of township 32 and east of range 26, west of the 4<sup>th</sup> meridian was used as a proxy for the two natural sub-regions.

The cross-referenced list produced a list of species which were noted to have been found in marshes and swamps, and have also been found south of township 32 and east of range 26, west of the 4<sup>th</sup> meridian (See Appendix A). The ABMI list does not separate species out as to prevalence. Therefore, many of the identified species are not common species in the subject area. Additionally, neither database utilized provides species found only in wetlands. Therefore, the list was then reviewed by senior vegetation specialists in Salix and Terrestrial to evaluate which species would be common enough in the subject area, or distinct enough to moist ecosystems, to be used as indicators of moist ecosystems. This ranking of species is found in Appendix A, with common wetland species given a “1”, species too present in uplands to be indicative given a “2”, and species not common enough in mixed grass prairie to be useful given a “3”.

## Results

The list of species produced by the comparison of the AB wetland and the ABMI lists consisted of 197 species (Appendix A). After review, 33 species were determined to be too common in uplands to be useful and 142 species were considered not common enough in the subject area to be used as indicator species. The remaining species produced a list of 23 species which were felt had the potential for being used as indicators of moist ecosystems (See Appendix B).

## Discussion

After the potential list was produced, the species were reviewed as a group to determine whether presence of any one of these species on a site would be a reasonable indicator of moist ecosystems (either high water table or groundwater discharge). From the experience of the Salix and Terrestrial staff, it was considered that the list would likely identify most of the wetland ecosystems within the subject area. However, some “moist” sites not meeting the definition of a “wetland” may not be identified, and the presence of any one of the species was considered to be so prevalent within upland systems, that the number of false positives (upland areas identified as moist areas) was considered to be too high to make the list a useful tool. Consideration was given to attempting to produce a list of plant associations that would be more indicative of wetlands. However, it was considered that the variability in wetland systems in the area made plant associations too unlikely to accurately identify most of the wetlands without resulting in the same high levels of false positives.

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<sup>2</sup> Alberta Biodiversity Monitoring Institute (ABMI) <http://www.abmi.ca/home.html>

Submitted by;



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**Alberta Wetland Classification Species for Marshes and Swamps reported by ABMI to have been found in south of township 32, and east of range 26, west of 4th Meridean**

		Rating
<i>Achillea millefolium</i> L.	common yarrow	2
<i>Agoseris glauca</i> (Pursh) Raf.	yellow false dandelion	2
<i>Agrostis scabra</i> Willd.	rough hair grass	2
<i>Agrostis stolonifera</i> L.	redtop	2
<i>Alopecurus aequalis</i> Sobol.	short-awned foxtail	1
<i>Alopecurus pratensis</i> L.	meadow foxtail	3
<i>Amaranthus retroflexus</i> L.	red-root pigweed	3
<i>Amphiscirpus nevadensis</i> (S. Watson) Oteng-Yeb.	Nevada bulrush	3
<i>Androsace occidentalis</i> Pursh.	western fairy candelabra	3
<i>Artemisia biennis</i> Willd.	biennial sagewort	2
<i>Artemisia ludoviciana</i> Nutt.	prairie sagewort	2
<i>Astragalus americanus</i> (Hook.) Jones	American milk vetch	2
<i>Astragalus canadensis</i> L.	Canadian milk vetch	2
<i>Atriplex argentea</i> Nutt.	silver saltbush	3
<i>Atriplex prostrata</i> Bouch�er ex DC.	prostrate saltbush	3
<i>Beckmannia syzigachne</i> (Steud.) Fernald	sloughgrass	1
<i>Bidens cernua</i> L.	nodding beggarticks	3
<i>Bolboschoenus maritimus</i> ssp. <i>paludosus</i> (Nelson)Koyama	prairie bulrush	3
<i>Bromus inermis</i> Leyss.	smooth brome	2
<i>Calamagrostis canadensis</i> (Michx.) Beauv.	bluejoint	3
<i>Calamagrostis stricta</i> ssp. <i>inexpansa</i> (Gray) Greene	northern reed grass	1
<i>Calla palustris</i> L.	water arum	3
<i>Callitriche palustris</i> L.	vernal water-starwort	3
<i>Canadanthus modestus</i> (Lindl.) Nesom	large northern aster	3
<i>Capsella bursa-pastoris</i> (L.) Medik.	shepherd's purse	2
<i>Carex aquatilis</i> Wahlenb.	water sedge	1
<i>Carex atherodes</i> Spreng.	awned sedge	1
<i>Carex aurea</i> Nutt.	golden sedge	3
<i>Carex brevior</i> (Dewery) Mack ex Lunell	slender-beaked sedge	3
<i>Carex lacustris</i> Willd.	lakeshore sedge	3
<i>Carex pellita</i> Muhl. ex Willd.	woolly sedge	1
<i>Carex praegracilis</i> Boott	graceful sedge	3
<i>Carex prairea</i> Dewey ex Wood	prairie sedge	3
<i>Carex rostrata</i> Stokes	beaked sedge	1
<i>Carex utriculata</i> Boott	small bottle sedge	3
<i>Carex viridula</i> Michx.	green sedge	3
<i>Catabrosa aquatica</i> (L.) Beauv.	brook grass	3
<i>Cerastium arvense</i> L.	field mouse-ear chickweed	2
<i>Ceratodon purpureus</i> (Hedw.) Brid.	purple horn-toothed moss	3
<i>Chamerion angustifolium</i> ssp. <i>angustifolium</i> (L.) Holub	common fireweed	3
<i>Chenopodium album</i> L.	lamb's quarters	2
<i>Chenopodium capitatum</i> Aschers	strawberry blite	3
<i>Chenopodium glaucum</i> var. <i>salinum</i> (Standl.) B. Boivin	oak-leaved goosefoot	3

**Alberta Wetland Classification Species for Marshes and Swamps reported by ABMI to have been found in south of township 32, and east of range 26, west of 4th Meridean**

<i>Chenopodium rubrum</i> L.	red goosefoot	3
<i>Cicuta maculata</i> L.	water-hemlock	1
<i>Cirsium arvense</i> (L.) Scop.	creeping thistle	3
<i>Conium maculatum</i> L.	poison hemlock	3
<i>Conyza canadensis</i> (L.) Cronquist	horseweed	3
<i>Crepis tectorum</i> L.	annual hawk's-beard	3
<i>Cyclachaena xanthifolia</i> (Nutt.) Fresen	false ragweed	3
<i>Deschampsia cespitosa</i> (L.) Beauv.	tufted hairgrass	1
<i>Descurainia sophia</i> (L.) Webb ex Prantl	flixweed	3
<i>Distichlis spicata</i> ssp. <i>stricta</i> (Torr.) Beetle	Inland saltgrass	3
<i>Elaeagnus commutata</i> Bernh. ex Rydb.	silverberry	2
<i>Elatine triandra</i> Schkuhr.	waterwort	3
<i>Eleocharis acicularis</i> (L.) Roemer & Schult.	needle spikerush	3
<i>Eleocharis palustris</i> (L.) Roemer & Schult.	creeping spike-rush	1
<i>Elodea canadensis</i> Mitchx.	Canada waterweed	3
<i>Elymus repens</i> (L.) Gould	quackgrass	2
<i>Elymus trachycaulus</i> (Link) Gound ex Shimmers	slender wheatgrass	2
<i>Epilobium ciliatum</i> Raf.	northern willowherb	3
<i>Epilobium palustre</i> L.	marsh willowherb	3
<i>Equisetum arvense</i> L.	common horsetail	2
<i>Equisetum fluviatile</i> L.	swamp horsetail	3
<i>Equisetum hyemale</i> L.	common scouring-rush	3
<i>Equisetum palustre</i> L.	marsh horsetail	3
<i>Erigeron lonchophyllus</i> Hook.	fleabane	2
<i>Erigeron philadelphicus</i> L.	Philadelphia fleabane	2
<i>Erysimum cheiranthoides</i> L.	wormseed mustard	3
<i>Fallopia convolvulus</i> (L.) Löve	wild buckwheat	3
<i>Fragaria vesca</i> L.	woodland strawberry	3
<i>Fragaria virginiana</i> Duchesne	wild strawberry	3
<i>Galeopsis tetrahit</i> L.	hemp-nettle	2
<i>Galium boreale</i> L.	Labrador bedstraw	3
<i>Galium trifidum</i> L.	small bedstraw	3
<i>Galium triflorum</i> Michx.	sweet-scented bedstraw	3
<i>Geum aleppicum</i> Jacq.	yellow avens	3
<i>Geum macrophyllum</i> Willd.	large-leaved yellow avens	3
<i>Geum rivale</i> L.	purple avens	3
<i>Glyceria borealis</i> (Nash) Batch.	northern manna grass	3
<i>Glyceria grandis</i> S. Wats.	common tall mannagrass	3
<i>Glyceria striata</i> (Lam.) Hitchc.	fowl manna grass	1
<i>Glycyrrhiza lepidota</i> (Nutt.) Pursh	wild licorice	3
<i>Gnaphalium palustre</i> Nutt.	marsh cudweed	3
<i>Gratiola neglecta</i> Torr.	clammy hedge-hyssop	3
<i>Hedysarum alpinum</i> L.	alpine hedysarum	3
<i>Helenium autumnale</i> L.	sneezeweed	3
<i>Helianthus nuttallii</i> Torr. & Gray	common tall sunflower	3

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<i>Heracleum sphondylium</i> ssp. <i>montanum</i> (Schleich.) Briq.	cow parsnip	3
<i>Hieracium umbellatum</i> L.	narrow-leaved hawkweed	3
<i>Hippuris vulgaris</i> L.	common maretail	3
<i>Hordeum jubatum</i> L.	foxtail barley	1
<i>Iva axillaris</i> Pursh	povertyweed	3
<i>Juncus balticus</i> Willd.	wire rush	1
<i>Juncus bufonius</i> L.	toad rush	3
<i>Juncus nodosus</i> L.	knotted rush	3
<i>Juncus tenuis</i> Willd.	slender rush	3
<i>Kochia scoparia</i> (L.) Schrad.	summer-cypress	3
<i>Lactuca serriola</i> L.	prickly lettuce	2
<i>Lathyrus ochroleucus</i> Hook.	cream-coloured vetchling	3
<i>Lemna minor</i> L.	common duckweed	3
<i>Lepidium densiflorum</i> Schrad.	common pepper-grass	2
<i>Limosella aquatica</i> L.	mudwort	3
<i>Lotus corniculatus</i> L.	bird's-foot trefoil	3
<i>Lycopus asper</i> Greene	western water-horehound	3
<i>Lysimachia maritima</i> (L.) Galasso, Banfi & Soldano	sea milkwort	3
<i>Lysimachia thyrsoflora</i> L.	tufted loosestrife	3
<i>Maianthemum stellatum</i> (L.) Link	star-flowered Solomon's-seal	3
<i>Matricaria discoidea</i> DC	pineappleweed	3
<i>Melilotus officinalis</i> (L.) Lam	yellow sweet-clover	3
<i>Mentha arvensis</i> L.	wild mint	1
<i>Monolepis nuttalliana</i> (Schult.) Greene	spear-leaved goosefoot	3
<i>Muhlenbergia asperifolia</i> (Nees & Meyen ex Trin.) Parodi	scratch grass	3
<i>Muhlenbergia richardsonis</i> (Trin.) Rydb.	mat muhly	3
<i>Myriophyllum sibiricum</i> Kom.	spike water-milfoil	3
<i>Osmorhiza longistylis</i> (Torr.) DC.	smooth sweet cicely	3
<i>Parnassia palustris</i> L.	northern grass-of-Parnassus	3
<i>Pascopyrum smithii</i>	western wheatgrass	2
<i>Persicaria amphibia</i> (L.) Gray	water smartweed	3
<i>Persicaria lapathifolia</i> (L.) Gray	pale persicaria	3
<i>Petasites frigidus</i> var. <i>sagittatus</i>	arrow-leaved coltsfoot	3
<i>Phalaris arundinacea</i> L.	reed canary grass	1
<i>Phalaris canariensis</i> L.	canary grass	3
<i>Phleum pratense</i> L.	timothy	2
<i>Plagiobothrys scouleri</i> (Hook.&Arn.) Johnst.	Scouler's allocarya	3
<i>Plantago eriopoda</i> Torr.	saline plantain	3
<i>Poa palustris</i> L.	fowl bluegrass	1
<i>Poa pratensis</i> L.	Kentucky bluegrass	1
<i>Polygonum achoreum</i> S.F. Blake	striate knotweed	1
<i>Polygonum erectum</i> L.	striate knotweed	3
<i>Polygonum ramosissimum</i> Michx.	bushy knotweed	3
<i>Populus deltoides</i> Bartr. ex Marsh.	plains cottonwood	1
<i>Potamogeton foliosus</i> Raf.	leafy pondweed	3

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<i>Potamogeton gramineus</i> L.	various-leaved pondweed	3
<i>Potentilla anserina</i> (L.) Rydb.	silverweed	2
<i>Potentilla gracilis</i> Douglas ex. Hook.	graceful cinquefoil	3
<i>Potentilla norvegica</i> L.	rough cinquefoil	3
<i>Potentilla rivalis</i> Nutt.	brook cinquefoil	3
<i>Prunus virginiana</i> L.	choke cherry	3
<i>Puccinellia nuttalliana</i> (Schult.) Hitchc.	Nuttall's salt-meadow grass	1
<i>Ranunculus acris</i> L.	tall buttercup	3
<i>Ranunculus cymbalaria</i> Pursh	seaside buttercup	3
<i>Ranunculus gmelinii</i> De Candolle	yellow water crowfoot	3
<i>Ranunculus macounii</i> Britt.	Macoun's buttercup	3
<i>Rorippa palustris</i> (L.) Besser	marsh yellow cress	3
<i>Rumex crispus</i> L.	curled dock	1
<i>Rumex maritimus</i> L.	golden dock	3
<i>Rumex triangulivalvis</i> (Danser) Rech. f.	narrow-leaved field dock	3
<i>Ruppia cirrhosa</i> (Petagna) Grande	widgeon-grass	3
<i>Sagittaria cuneata</i> Sheld.	arum-leaved arrowhead	3
<i>Salicornia rubra</i> A. Nels.	samphire	3
<i>Salix exigua</i> Nutt.	sandbar willow	1
<i>Salsola kali</i> L.	Russian-thistle	3
<i>Schoenoplectus acutus</i> var. <i>acutus</i> (Muhl. ex Bigelow)	great bulrush	3
<i>Schoenoplectus heterochaetus</i>	slender bulrush	3
<i>Schoenoplectus pungens</i> var. <i>pungens</i> (Vahl) Palla	three-square rush	3
<i>Schoenoplectus tabernaemontani</i> (Gmel.) Palla	common great bulrush	3
<i>Scirpus microcarpus</i> J. & K. Presl	small-fruited bulrush	3
<i>Scolochloa festucacea</i> (Willd.) Link	spangletop	3
<i>Scutellaria galericulata</i> L.	marsh skullcap	3
<i>Senecio congestus</i> (R. Br.) DC	marsh ragwort	2
<i>Sisyrinchium montanum</i> Greene	common blue-eyed grass	3
<i>Sium suave</i> Walter	common waterparsnip	1
<i>Solidago canadensis</i> L.	Canada goldenrod	3
<i>Solidago gigantea</i> Aiton	late goldenrod	3
<i>Sonchus arvensis</i> L.	perennial sow-thistle	3
<i>Sonchus asper</i> (L.) Hill	prickly annual sow-thistle	3
<i>Sparganium angustifolium</i> Michx.	narrow-leaved bur-reed	3
<i>Spartina gracilis</i> Trin.	alkali cordgrass	3
<i>Spartina pectinata</i> Line	prairie cord grass	3
<i>Spergularia salina</i> J. & K. Presl	salt-marsh sand spurry	3
<i>Stachys palustris</i> L.	marsh hedge-nettle	3
<i>Stellaria calycantha</i> (Ledeb.) Bong.	northern stitchwort	3
<i>Stellaria crassifolia</i> Ehrh.	fleshy stitchwort	3
<i>Stellaria longifolia</i> Muhl. ex Willd.	long-leaved chickweed	3
<i>Stuckenia pectinata</i> (L.) Börner	sago pondweed	3
<i>Suaeda calceoliformis</i> (Hook.) Moq.	western seablite	3
<i>Symphyotrichum boreale</i> (Torr. & Gray) A. & D. Löve	marsh aster	3

**Alberta Wetland Classification Species for Marshes and Swamps reported by ABMI to have been found in south of township 32, and east of range 26, west of 4th Meridean**

<i>Symphotrichum ciliatum</i> (Ledeb.) Nesom	rayless aster	3
<i>Symphotrichum ciliolatum</i> (Lindl.) A. & D. Löve	Lindley's aster	3
<i>Symphotrichum ericoides</i> (L.) Nesom	tufted white prairie aster	2
<i>Symphotrichum lanceolatum</i> (Willd.) Nesom	western willow aster	2
<i>Tanacetum vulgare</i> L.	common tansy	3
<i>Taraxacum officinale</i> Weber ex Wiggers	common dandelion	2
<i>Thalictrum venulosum</i> Trel.	veiny meadow rue	2
<i>Thlaspi arvense</i> L.	stinkweed	2
<i>Trifolium hybridum</i> L.	alsike clover	2
<i>Trifolium repens</i> L.	white clover	2
<i>Triglochin palustris</i> L.	slender arrow-grass	3
<i>Typha latifolia</i> L.	common cattail	3
<i>Urtica dioica</i> L.	common nettle	2
<i>Utricularia vulgaris</i> L.	common bladderwort	3
<i>Veronica anagallis-aquatica</i> L.	speedwell	3
<i>Veronica peregrina</i> L.	hairy speedwell	3
<i>Vicia americana</i> Muhl. ex Willd.	wild vetch	3
<i>Viola renifolia</i> Gray	kidney-leaved violet	3
<i>Zannichellia palustris</i> L.	horned pondweed	3
<i>Zizia aptera</i> (A. Gray) Fernald	heart-leaved Alexanders	3

**Rating Legend**

1	mainly wetland species, and fairly common
2	too present in uplands to be indicative
3	not common enough in mixed grass prairie



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**APPENDIX B - MIXED-GRASS SPECIES COMMON TO SWAMPS AND MARSHES**

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<i>Alopecurus aequalis</i> Sobol.	short-awned foxtail
<i>Beckmannia syzigachne</i> (Steud.) Fernald	sloughgrass
<i>Calamagrostis stricta</i> ssp.inexpansa (Gray) Greene	northern reed grass
<i>Carex aquatilis</i> Wahlenb.	water sedge
<i>Carex atherodes</i> Spreng.	awned sedge
<i>Carex pellita</i> Muhl. ex Willd.	woolly sedge
<i>Carex rostrata</i> Stokes	beaked sedge
<i>Cicuta maculata</i> L.	water-hemlock
<i>Deschampsia cespitosa</i> (L.) Beauv.	tufted hairgrass
<i>Eleocharis palustris</i> (L.) Roemer & Schult.	creeping spike-rush
<i>Glyceria striata</i> (Lam.) Hitchc.	fowl manna grass
<i>Hordeum jubatum</i> L.	foxtail barley
<i>Juncus balticus</i> Willd.	wire rush
<i>Mentha arvensis</i> L.	wild mint
<i>Phalaris arundinacea</i> L.	reed canary grass
<i>Poa palustris</i> L.	fowl bluegrass
<i>Poa pratensis</i> L.	Kentucky bluegrass
<i>Polygonum achoreum</i> S.F. Blake	striate knotweed
<i>Populus deltoides</i> Bartr. ex Marsh.	plains cottonwood
<i>Puccinellia nuttalliana</i> (Schult.) Hitchc.	Nuttall's salt-meadow grass
<i>Rumex crispus</i> L.	curled dock
<i>Salix exigua</i> Nutt.	sandbar willow
<i>Sium suave</i> Walter	common waterparsnip