



Manaaki Whenua  
Landcare Research

# Wetland delineation: Vegetation Tool

**Bev Clarkson**

Manaaki Whenua – Landcare Research

Hamilton



# NZ Wetland delineation

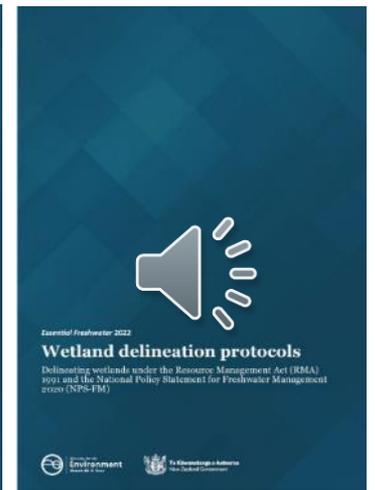
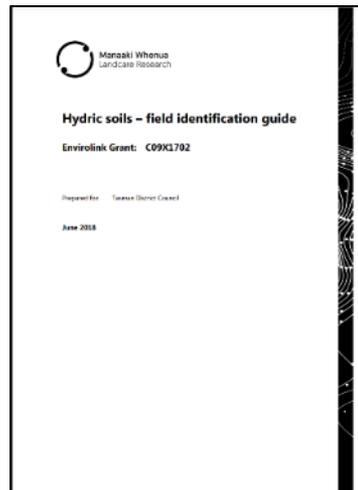
- Based on the US system: 3 criteria - vegetation, soils, water
  - all 3 criteria required for site to be a wetland
- Wetland vegetation tool (Clarkson 2014)
- Wetland soils tool (Fraser et al. 2018)
- Wetland hydrology tool (Lambie et al. 2021/MfE 2021)

Wetland delineation course San Diego 2012



# Wetland delineation toolkit

- Vegetation Clarkson 2014 <https://datastore.landcareresearch.co.nz/dataset/a-vegetation-tool-for-wetland-delineation-in-new-zealand>
- Pasture exclusion MfE 2022a <https://environment.govt.nz/publications/pasture-exclusion-assessment-methodology/>
- Hydric soils Fraser et al. 2018 <https://www.envirolink.govt.nz/assets/R13-5-Hydric-soils-field-identification-guide.pdf>
- Wetland hydrology MfE 2021 <https://environment.govt.nz/publications/wetland-delineation-hydrology-tool-for-aotearoa-new-zealand/>
- Process for using protocols MfE 2022b <https://environment.govt.nz/assets/publications/Wetland-delineation-protocols.pdf>



# Wetland plant indicator status ratings (based on typical wetland habitat)

- **OBL**: Obligate wetland. Rarely in uplands (drylands).
- **FACW**: Facultative Wetland. Usually in wetlands, occ. in uplands
- **FAC**: Facultative. Commonly occurs in wetlands and uplands
- **FACU**: Facultative Upland. Occasionally in wetlands but usually in uplands
- **UPL**: Obligate Upland. Rarely in wetlands, almost always in uplands



Carex secta Purei **OBL**



Harakeke **FACW**



Manuka **FAC**



Bracken **FACU**



Pohutukawa **UPL**

# New Zealand wetland plant indicator status ratings 2021

Clarkson B, Fitzgerald N, Champion P, Forester L, Rance B 2021. New Zealand wetland plant list 2021.

FullName	Rating	Family	Code	Synonym	CommonName	BioStatus
<i>Abrotanella caespitosa</i>	FACW	Compositae	ABRcae			Endemic
<i>Abrotanella linearis</i>	FACW	Compositae	ABRLin			Endemic
<i>Acacia mearnsii</i>	UPL	Leguminosae	ACAmea		Black wattle	Exotic
<i>Acacia melanoxylon</i>	FACU	Leguminosae	ACAmel		Blackwood, Tasmanian blackwood	Exotic
<i>Acaena anserinifolia</i>	FACU	Rosaceae	ACAans		Bidibid, piri-piri	Endemic
<i>Acaena fissistipula</i>	FAC	Rosaceae	ACAfis			Endemic
<i>Acaena novae-zelandiae</i>	FACU	Rosaceae	ACAnov		Bidibid, Red bidibid	Non-Endemic
<i>Acaena rorida</i>	FAC	Rosaceae	ACAror			Endemic
<i>Acaena saccaticupula</i>	FACU	Rosaceae	ACAfac			Endemic
<i>Acaena tesca</i>	FAC	Rosaceae	ACAtes			Endemic
<i>Acer pseudoplatanus</i>	UPL	Sapindaceae	ACEpse		Sycamore	Exotic
<i>Achillea millefolium</i>	FACU	Compositae	ACHmil		Yarrow	Exotic
<i>Aciphylla aurea</i>	UPL	Umbelliferae	ACIaur		Golden spaniard, Golden speargrass	Endemic
<i>Aciphylla pinnatifida</i>	OBL	Umbelliferae	ACIpin			Endemic
<i>Aciphylla subflabellata</i>	UPL	Umbelliferae	ACIsub		Spaniard	Endemic
<i>Aciphylla traversii</i>	FAC	Umbelliferae	ACItrv		Chatham Island speargrass, Taramea	Endemic
<i>Actinotus novae-zelandiae</i>	OBL	Umbelliferae	ACTnov			Endemic
<i>Adenochilus gracilis</i>	FAC	Orchidaceae	ADEgra			Endemic
<i>Ageratina adenophora</i>	FAC	Compositae	AGEade		Mexican devil	Exotic
<i>Agrostis capillaris</i>	FACU	Gramineae	AGRcap		Browntop	Exotic
<i>Agrostis muscosa</i>	FAC	Gramineae	AGRmus		Pincushion grass	Endemic
<i>Agrostis stolonifera</i>	FACW	Gramineae	AGRsto		Creeping bent	Exotic
<i>Aira caryophyllea</i>	FACU	Gramineae	AIRcar		Silvery hair grass	Exotic
<i>Ajuga reptans</i>	FACU	Labiatae	AJUrep		Bugle	Exotic
<i>Alisma lanceolatum</i>	OBL	Alismataceae	ALIlan		Water plantain	Exotic
<i>Alisma plantago-aquatica</i>	OBL	Alismataceae	ALIpla		Water plantain	Exotic

<https://www.envirolink.govt.nz/assets/2122-HBRC259-New-Zealand-Wetland-Plant-List-2021.pdf> for Report

<https://datastore.landcareresearch.co.nz/dataset/nz-wetland-plant-indicator-status-ratings-2021> for Excel species list

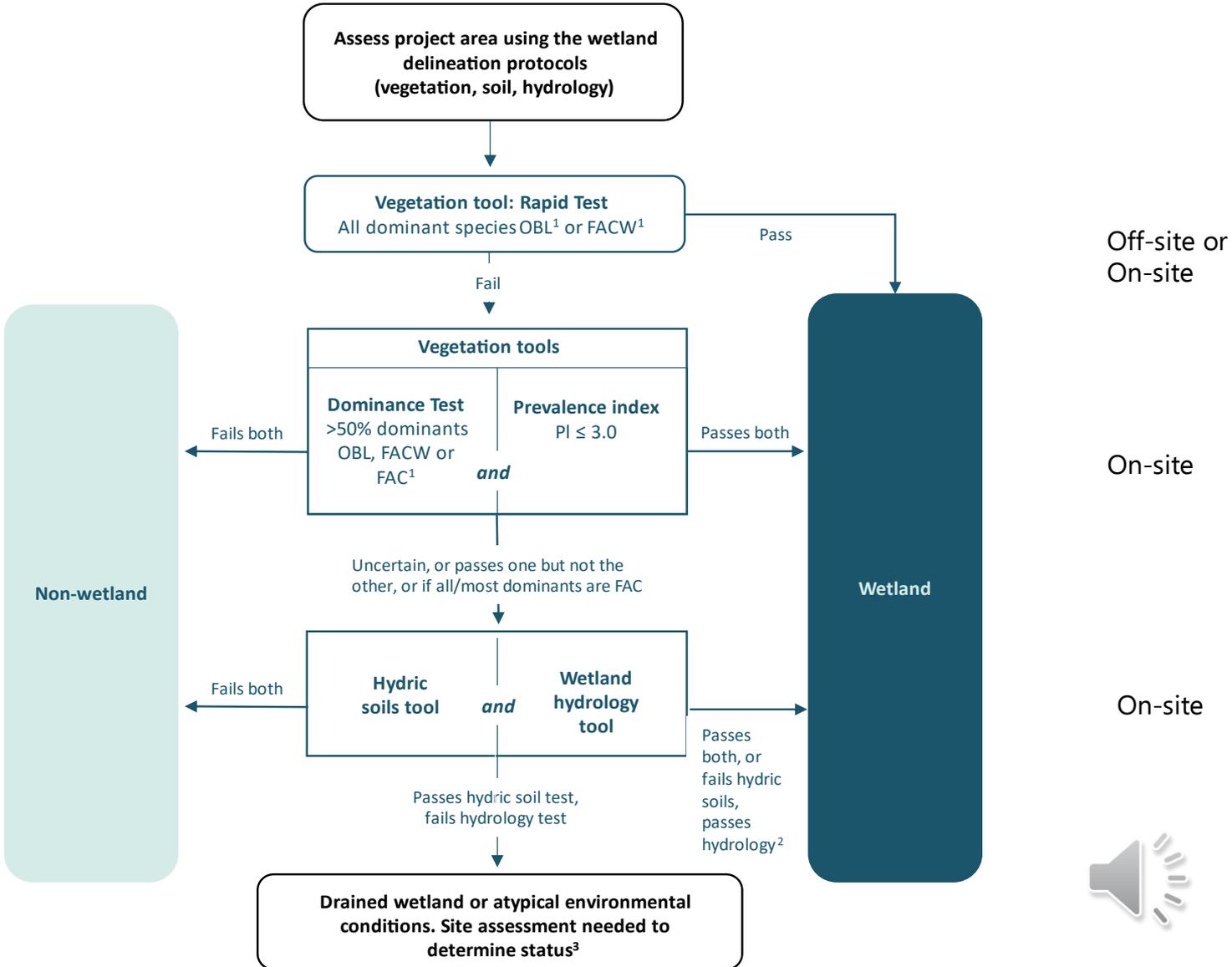
Currently 1124 taxa comprising 741 native and 363 exotic taxa with wetland indicator status rating

# Wetland vegetation determination

- Rapid Test: visual assessment – all dominant species are OBL or FACW
- Dominance Test: plot % cover data – dominant species
- Prevalence Index: plot % cover data – all vascular species
  
- New Zealand vegetation tool:
  - Dominance Test and Prevalence Index need to agree if only using Vegetation Tool
  - If not, add soils and hydrology



# Flow chart for wetland delineation protocols



**Footnotes:**

<sup>1</sup> Wetland indicator status abbreviations: FAC = facultative, FACW = facultative wetland, OBL = obligate wetland.

<sup>2</sup> For example, recent wetland.

<sup>3</sup> The US procedures for atypical or problematic situations are recommended.

# Vegetation sampling method

- Stratify site into different landscape/landform units
- Map broad vegetation types. If dominated by OBL or FACW species use Rapid Test.
- If Rapid Test fails, establish representative plot in each vegetation type
- Calculate Dominance Test
- Calculate Prevalence Index
- If Dominance Test and Prevalence Index don't agree or are marginal, use Soil Tool and Hydrology Tool



# Map or sketch potential wetlands and vegetation types



Make the wetland determination in each vegetation type (plant community)

# Vegetation sampling: plots (three strata)

1. Tree:  $\geq 10$  cm dbh

Circular plot 10 m radius

2. Sapling/Shrub:  $< 10$  cm dbh

Circular plot 5 m radius

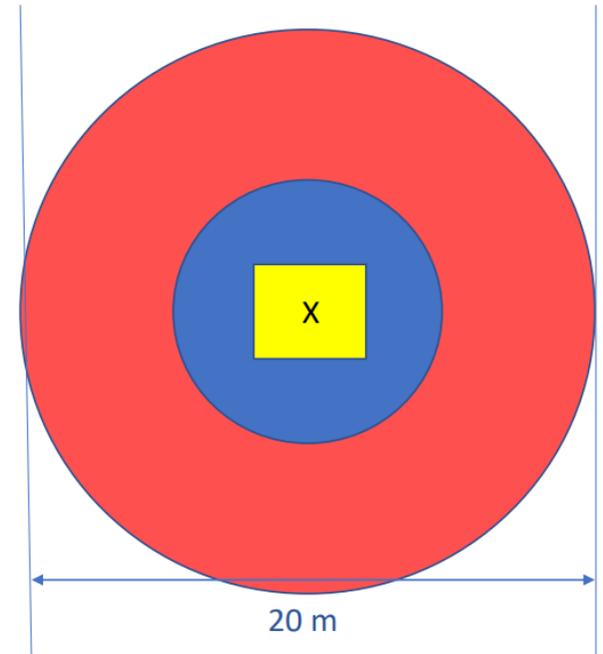
3. Herb: all non-woody (grass/sedge/rush/herb)

2m  $\times$  2 m quadrat



# Nested plots – start with herbs work outwards

- Randomly locate 2m x 2m quadrat
- If shrubs are rooted in/overhang a radius of 5 m from the centre of the herb plot
- If trees in the same vegetation type are rooted in/overhang a radius of 10 m from plot centre, add a 10 m radius tree plot
- NB: *Ignore any trees or shrubs that overhang from a different vegetation type/landform, e.g. adjacent slope.*



# Rotopiko/Lake Serpentine wetland vegetation

Plot	Dominance Test %	Wetland vegetation?	Prevalence Index	Wetland vegetation?
1	100	Yes	1.99	Yes
2	100	Yes	2.44	Yes
3	75	Yes	2.70	Yes
4	50	No	3.61	No
5	50	No	3.52	No

**Wetland threshold (both required)**

**Dominance Test** >50% of dominant species are OBL, FACW or FAC

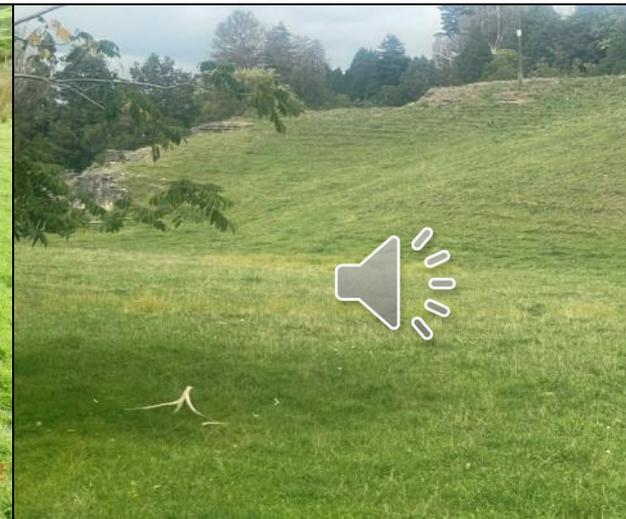
**Prevalence Index** < or = 3



# Pasture Exclusion

NPS-FM policy: excludes any wetland that:

- is within an area of pasture used for grazing; and
- has vegetation cover comprising more than 50% exotic pasture species (as identified in the *National List of Exotic Pasture Species* using the *Pasture Exclusion Methodology*), unless:
- is a location of a habitat of threatened species



# Multiple vegetation tiers

- Pasture species confined to the Herb Stratum
- However, all vegetation strata (Herb, Shrub/Sapling, and Tree) used for the pasture exclusion assessment
- Absolute Cover (%) for each species in each stratum used
- Pasture Exclusion Test calculation is  $P/TVC \times 100 = \text{___} \%$
- P = Pasture cover, TVC = Total vegetation cover (pasture exclusion data form)
- Pasture Exclusion Test passed if  $> 50\%$



# NEW ZEALAND WETLAND DELINEATION DATA FORM: PASTURE TEST

# SECTION C – SOIL AND HYDROLOGY

## SECTION A – SITE INFORMATION

Site: \_\_\_\_\_ Region: \_\_\_\_\_ Sampling point/ID: \_\_\_\_\_  
 Owner/address: \_\_\_\_\_ Date: \_\_\_\_\_ Land use: \_\_\_\_\_  
 Landform: \_\_\_\_\_ Local relief: \_\_\_\_\_ Land cover: \_\_\_\_\_  
 Is the land drained? YES \_\_\_ NO \_\_\_ UNKNOWN \_\_\_ Investigator(s): \_\_\_\_\_ Slope\*: \_\_\_\_\_  
 GPS (NZTM): \_\_\_\_\_ Altitude m: \_\_\_\_\_ Photo Nos: \_\_\_\_\_

Are climatic/hydrologic conditions on the site typical for this time of year? YES \_\_\_ NO \_\_\_ (if NO explain in Remarks)  
 Are Vegetation \_\_\_ Soil \_\_\_ or Hydrology \_\_\_ significantly disturbed? Are 'Normal Circumstances' present? YES \_\_\_ NO \_\_\_  
 Are Vegetation \_\_\_ Soil \_\_\_ or Hydrology \_\_\_ naturally problematic? Explain answers in Remarks if needed

### SUMMARY OF FINDINGS—Attach site map showing sampling point locations, transects, important features etc.

Pasture exclusion? YES  NO   
 Hydrophytic vegetation present? YES  NO   
 Hydric soils present? YES  NO   
 Wetland hydrology present? YES  NO   
 Is the sampled area within a wetland? YES  NO

## SECTION B – VEGETATION

Use scientific names of plants.	Absolute % cover	Dominant Species?	Indicator Status	Pasture % cover
Tree Stratum (Plot size: _____)				
1. _____				
2. _____				
3. _____				
4. _____				
Total tree cover (TT) = _____	50%		20%	
Sapling/Shrub Stratum (Plot size: _____)				
1. _____				
2. _____				
3. _____				
4. _____				
5. _____				
Total sapling/shrub cover (TS) = _____	50%		20%	
Herb Stratum (Plot size: _____)				
1. _____				
2. _____				
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
10. _____				
11. _____				
12. _____				
13. _____				
14. _____				
15. _____				
16. _____				
17. _____				
18. _____				
Total herb cover (TH) = _____	50%		20%	
Total (T) = _____				
<b>Total Vegetation Cover (TVC): TT+TS+TH = _____ 50%</b>				

**Pasture Exclusion Test:**  
 Pasture cover/Total vegetation cover (P/TVC) x100 = \_\_\_\_\_ %  
 Rapid Pasture Test  
 Pasture Exclusion Test is >50%

**Dominance Test:**  
 No. Dominant Spp. OBL/FACW/FAC (A) \_\_\_\_\_  
 Tot. Dominant Spp. across strata (B) \_\_\_\_\_  
 % OBL/FACW/FAC (A/B) \_\_\_\_\_

**Prevalence Index:**  
 Total % cover of: Multiply by:  
 OBL \_\_\_\_\_ x 1 = \_\_\_\_\_  
 FACW \_\_\_\_\_ x 2 = \_\_\_\_\_  
 FAC \_\_\_\_\_ x 3 = \_\_\_\_\_  
 FACU \_\_\_\_\_ x 4 = \_\_\_\_\_  
 UPL \_\_\_\_\_ x 5 = \_\_\_\_\_  
 Total (A) \_\_\_\_\_ (B) \_\_\_\_\_  
 Prevalence Index (B/A) = \_\_\_\_\_

**Hydrophytic vegetation indicators:**  
 Rapid Test  
 Dominance Test is >50%  
 Prevalence Index is ≤3.0<sup>1</sup>  
 Morphological adaptations<sup>1</sup> (supporting data in Remarks)  
 Problematic hydrophytic vegetation<sup>1</sup>  
 Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

**Hydrophytic vegetation present?**  
 YES  NO  UNCERTAIN

**Remarks:**

Profile description: (Describe to the depth needed to confirm indicator presence/absence, 30 cm default)

Depth (cm)	Matrix colour (moist)	Mottles colour (moist)	Mottles % <sup>1</sup>	Mottles Size <sup>2</sup>	Mottle location <sup>3</sup>	Material <sup>4</sup>	Remarks

<sup>1</sup>Use % area charts; <sup>2</sup>Use size classes; <sup>3</sup>Ped face, pore, within ped along roots, within matrix; <sup>4</sup>Organic (peaty), humic, mineral soil

**Hydric soil indicators:** Soil drainage (circle) W MW I P VP

**Organic layers:**  
 Organic soil material  
 Litter  
 Fibric  
 Mesic  
 Humic  
 Peaty topsoil  
 Peaty subsoil

**Concretions:**  
 Iron concretions  
 Manganese concretions  
 Nodular

**Consistence:**  
 Plastic  
 Sticky  
 Fluid

**Colours: profile form either:**  
 Mottled  
 Reductomorphic  
 Redox mottled  
 Redox segregations  
 Perch-gley features

**Horizon:**  
 Layers: Depth (cm) \_\_\_\_\_  
 Slow perm argillic  
 Pugged

**Cause of wetness (circle appropriate):**  
 Location: Depression Flat Valley Gully Slope  
 Water table: Depth (cm) \_\_\_\_\_  
 High GW Perched Seepage Tidal Lithic  
 Pans: Depth (cm) \_\_\_\_\_  
 Pan Humus Fe-pan Densi- Duri- Fragi Ortstein

Hydric soils present? YES  NO  UNCERTAIN  NZSC subgroup \_\_\_\_\_

**Primary hydrology indicators: minimum of 1 required; check all boxes that apply** Soil °C \_\_\_\_\_

<input type="checkbox"/> Surface water (1A)	<input type="checkbox"/> Algal mat/crust (2D)	<input type="checkbox"/> Aquatic invertebrates (2J)
<input type="checkbox"/> Groundwater <30 cm (1B)	<input type="checkbox"/> Iron deposits (2E)	<input type="checkbox"/> Hydrogen sulphide odour (3A)
<input type="checkbox"/> Soil saturation <30 cm (1C)	<input type="checkbox"/> Surface soil cracks (2F)	<input type="checkbox"/> Oxidised rhizosphere on roots (3B)
<input type="checkbox"/> Water marks (2A)	<input type="checkbox"/> Inundation on aerial imagery (2G)	<input type="checkbox"/> Reduced iron (3C)
<input type="checkbox"/> Sediment deposits (2B)	<input type="checkbox"/> Sparsely vegetated concave surface (2H)	<input type="checkbox"/> Reduced iron in tilled soil (3D)
<input type="checkbox"/> Drift deposits (2C)	<input type="checkbox"/> Salt crust (2I)	<input type="checkbox"/> High water table stunted/stressed plants (4A)

**Secondary hydrology indicators: minimum of 2 required; check all boxes that apply**

<input type="checkbox"/> Water-stained leaves (2K)	<input type="checkbox"/> Geomorphic position (4B)	FAC-neutral test (4D); refer to Section B: Vegetation 1. No. OBL & FACW dominant species _____ (A) 2. No. FACU & UPL dominant species _____ (B) 3. Total _____ (A+B) 4. FAC-neutral (>50%) _____ (A/A+B)*100
<input type="checkbox"/> Drainage patterns (2L)	<input type="checkbox"/> Shallow aquitard (4C)	
<input type="checkbox"/> Dry-season water table (3E)	<input type="checkbox"/> FAC-neutral test (4D)	
<input type="checkbox"/> Saturation in aerial imagery (3F)	<input type="checkbox"/> Frost-heave hummocks (4E)	

Wetland hydrology present? YES  NO

Sketch of site/vegetation types/sampling points:

Remarks:

# Rapid Pasture Test

- No need for a plot if, in the potential wetland:  
all dominant species are exotic pasture species (on National List))
- Fill out data field form with % cover to provide evidence

SECTION B – VEGETATION				
Use scientific names of plants.	Absolute % cover	Dominant Species?	Indicator Status	Pasture % cover
<b>Tree Stratum (Plot size: _____ m<sup>2</sup>)</b>				
1. _____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
Total cover (TT) = _____		50% _____	20% _____	
<b>Sapling/Shrub Stratum (Plot size: _____ m<sup>2</sup>)</b>				
1. _____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____
Total cover (TS) = _____		50% _____	20% _____	
<b>Herb Stratum (Plot size: _____ m<sup>2</sup>)</b>				
1. <i>Hol lan</i>	60	Y		60
2. <i>Lol per</i>	20	Y		20
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
5. <i>Pla lan</i>	20	Y		20
6. _____	_____	_____	_____	_____
7. _____	_____	_____	_____	_____
8. _____	_____	_____	_____	_____
9. _____	_____	_____	_____	_____

**Pasture Exclusion Test:**  
Pasture cover/Total vegetation cover (P/TVC) x100 = \_\_\_\_\_

Rapid Pasture Test

Pasture Exclusion Test is ≥ 50%

---

**Dominance Test:**  
No. Dominant Spp. OBL/FACW/FAC (A) \_\_\_\_\_  
Tot. Dominant Spp. across strata (B) \_\_\_\_\_  
% OBL/FACW/FAC (A/B) \_\_\_\_\_

---

**Prevalence Index:**  
Total % cover of:      Multiply by:  
OBL \_\_\_\_\_ x 1 = \_\_\_\_\_  
FACW \_\_\_\_\_ x 2 = \_\_\_\_\_  
FAC \_\_\_\_\_ x 3 = \_\_\_\_\_  
FACU \_\_\_\_\_ x 4 = \_\_\_\_\_  
UPL \_\_\_\_\_ x 5 = \_\_\_\_\_  
Total \_\_\_\_\_ (A)      \_\_\_\_\_ (B)  
Prevalence Index (B/A) = \_\_\_\_\_

---

**Hydrophytic vegetation indicators:**

Rapid Test

Dominance Test is >50%

Prevalence Index is ≤3.0<sup>1</sup>

Morphological adaptations<sup>1</sup> (supporting data in Remarks)



# Transect and plot placement

- If Rapid Tests fail, use transects and plots
- Run transect across veg type zones
- Random plot placement: randomise distance along tape and left/right of line
- Plots must not cross vegetation types, adjust plot shape or generate new random number if they do



# Do not cross vegetation types



Plot 2m x 2 m quadrat adjusted to 4m x 1m to fit within *Persicaria* herbfield



# Conclusions

- Vegetation tool on its own useful for delineation of 80-90% of wetlands
- For boundaries use landscape clues
- Caution where vegetation cover sparse, disturbed, or dominated by FAC species, or if Dominance Test and Prevalence Index don't agree
- In these cases, apply additional assessments of soils and hydrology
- Pasture exclusion test: same methodology/data form
- Methods and examples are in the vegetation tool and pasture exclusion reports





# Acknowledgements

- Karen Denyer for pasture tool development, photos and slides
- Paul Champion, Brian Rance, Lisa Forester, Peter Johnson, Philippe Gerbeaux, Kerry Bodmin, Paula Reeves, Neil Fitzgerald for vegetation tool development and wetland indicator ratings
- Scott Bartlam, Owen Spearpoint, Jack Warden, Philip Grove, Jeroen Lurling for pasture tool development
- Scott Fraser, Suzanne Lambie, for soil and hydrology tool development
- Charlie Newling, Jim Teaford, US Wetland Training Institute for advice
- MfE, MBIE and Meridian Energy for support & funding

