Requirements for Inland Wetlands Under the National Policy Statement for Freshwater 2020

Technical Advice to Support Implementation

August 2022

horizons
REGIONAL COUNCIL

Prepared for:

Lizzie Daly
Science Manager

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Prepared by:
Dr Fleur Maseyk
Emily Burns

CONTACT 24 hr freephone 0508 800 80 Help@horizons.govt.nz www.horizons.govt.nz

SERVICE CENTRES
Kairanga
Cnr Rongotea and
Kairanga-Bunnythorpe
Roads Palmerston North

Marton
19 Hammon Street

Taumarunui
34 Maata Street

REGIONAL HOUSES
Palmerston North
11-15 Victoria
Avenue

Whanganui
181 Guyton Street

DEPOTS
Taihape
243 Wairanu Road
Taihape

Woodville
116 Vogel Street

POSTAL ADDRESS Horizons Regional Council, Private Bag 11025, Manawatū Mail Centre, Palmerston North 4442

F 06-952 2929

THECATALYSTGROUP
planning and environment

REQUIREMENTS FOR INLAND WETLANDS UNDER THE NATIONAL POLICY STATEMENT FOR FRESHWATER 2020

TECHNICAL ADVICE TO SUPPORT IMPLEMENTATION

AUGUST 2022

USE OF THIS REPORT

This report has been prepared at the request of our client for the purposes for which they intended. Where we have relied on information from external sources, we have referenced these sources as appropriate and assumed them to be accurate. If you are unsure about interpretation of the content of this report, or its use beyond that for which the client intended, please get in touch with us at enquiries@thecatalystgroup.co.nz

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PREPARED BY:

Dr Fleur Maseyk

Emily Burns

.....

REVIEWED BY:

Greg Carlyon

.....

REPORT NUMBER:

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PREPARED FOR:

Horizons Regional Council

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p. +64 6 358 6300

e. enquiries@thecatalystgroup.co.nz

a. Level 3, 31 George Street,
PO Box 362, Palmerston North

www.thecatalystgroup.co.nz

EXECUTIVE SUMMARY

The National Policy Statement for Freshwater Management 2020 (NPS-FM) sets out specific requirements for natural inland wetlands. The NPS-FM both confirmed and built on existing policy settings and introduced ambitious new requirements that necessitate robust information data that is adequately fit for purpose. Horizons Regional Council (Horizons) is well-placed to deliver on the NPS-FM due to the comprehensive wetland policy provisions in the One Plan and a having initiated on-the-ground wetland protection and enhancement programmes over a decade ago. Therefore, while substantial additional effort is needed for some components (e.g., regional monitoring), for other components (e.g., mapping) Horizons can be confident they are already well-progressed towards delivery of the NPS-FM obligations for inland wetlands.

Despite not needing to start from scratch, delivery of the NPS-FM will require dedicated and sustained resourcing and well-thought out implementation plan. To assist, Horizons contracted The Catalyst Gap to provide technical advice and background material to support policy development and implementation to meet the NPS-FM obligations for inland wetlands.

This report:

- Presents the **gap analysis** undertaken to determine and describe any mismatch between current practice and the NPS-FM requirements for mapping, inventorying, and monitoring of inland wetlands (**Section 3**).
- Describes **three potential approaches in response to the NPS-FM** and evaluates each option against the NPS-FM requirements for inland wetlands (**Section 4**).
- Describes an approach to wetland mapping that allows for **continual increase in data** that capitalises on existing data and knowledge; recognises that mapping is never complete, and allows (via the use of confidence categories) the best available data to be considered at any point in time (**Section 5.1; Figure 1; Table 7**).
- Recommends a **prioritised, staged approach to mapping effort** that focuses first on remote methods to fill gaps in current mapping coverage before building on existing data and in doing so tackles the mapping requirements in more manageable way, while capturing (and protecting) wetlands in the interim (**Section 5.1.2; Table 8**).
- Conceptually illustrates how a regional monitoring framework can incorporate regional implementation of national monitoring frameworks alongside regionally-specific monitoring programmes (**Section 5.2.1; Figure 2**).
- Describes principles and characteristics of effective monitoring programmes (Section 5.2.2) and presents a check-list to guide the development of monitoring programmes that are adequate and appropriate for purpose (**Appendix 3**).

Key findings

1. The gap analysis confirms that there:
    - Is a shortfall between existing data and the NPS-FM requirements for natural inland wetlands – Horizons is not currently meeting these obligations.
    - Has been a lack of monitoring over time.
    - Is a lack of integration across work streams and data sources.
    - Is a disconnect between existing datasets and information relating to natural inland wetlands.
    - Existing data is, nonetheless, useful.
2. Implementation of the NPS-FM obligations for wetlands will be greatly facilitated by the formal recognition of the role and dedicated and sustained resourcing.
3. A concentrated effort to improve integration across work streams is required, noting it is more resource efficient to make use of the data and knowledge streams in place than to replicate this effort.
4. It is evident that meeting the monitoring requirements of the NPS-FM will require a substantial increase in effort and resourcing. However, there is considerable opportunity to maximise synergies with other existing or emerging monitoring programmes (e.g., terrestrial biodiversity monitoring , water quality monitoring) and current national work streams (e.g., national framework for biodiversity monitoring). Effort invested in monitoring will also have multiple benefits for decision-making down the track (e.g., policy performance).

Recommendations

We recommend that Horizons:

- **Progressively implements** the requirements of the NPS-FM (*Option B; Section 4*).
- **Recognises the implementation of the NPS-FM** as a specific role formalised through a job description and dedicates and sustains resourcing for the mapping and monitoring of inland wetlands (including associated data management and support systems and processes).
- **Prioritises mapping over monitoring** in the short term, and **prioritises gap-filling** of wetland mapping coverage prior to updating existing records and confirming presence of previously recorded values associated with wetland records (*Section 5.1.2*).
- **Commits to undertaking a sustained monitoring programme** and dedicates support for the necessary ongoing data management and systems, analysis, and reporting required.
- **Seeks synergies between national policy statements and combines wetland monitoring with regional terrestrial biodiversity monitoring** (e.g., as indicated in the NPS-IB Exposure Draft 2022) and undertakes regional implementation of the emerging national monitoring framework, rather than invest effort in designing a specific framework for the region (*Section 5.2*); and continues their **involvement and investment in current efforts** to develop a national biodiversity monitoring framework.
- **Establishes and maintains formalised and structured internal systems** to integrate data from other work streams into wetland databases to improve the integration between and synergies with other

programmes and policy directions (e.g. farm planning, water quality monitoring, development and implementation of a regional biodiversity strategy and enhancement programmes).

- **Pursues alternative and emerging methods and technologies** (e.g., use of drones, remote sensing, AI, modelling) to identify, map, and monitor wetlands.
- Regardless of purpose, **underpins any monitoring programme with the set of principles** and **characteristics** (as set out in Section 5.5.2) and **uses existing monitoring methods** in accordance with published guidelines, tested and accepted protocols, and which align with national monitoring frameworks and standards.
- **Establishes databases** to hold and enable analysis of wetland monitoring undertaken as condition of consent, and spatially identify all offset and compensation sites.
- **Designs and implements outcome and causal inference (policy effectiveness) monitoring** for enhancement expenditure, and bespoke monitoring for large-scale projects, in addition to regional-scale wetland monitoring.
- Creates the ability (e.g., using agreed and consistent tags or search words) in IRIS to **enable easy and complete identification of consent applications** that impact in any way on wetlands.
- **Retains the One Plan policies, methods, and Schedule F** as they relate to wetlands alongside the mapping exercise to assist interpretation and understanding of wetland types and values during consenting processes and as a continued back-stop for incomplete mapping to ensure uniform protection for all areas of wetland habitat within the Region.
- **Recognises the multiple benefits arising from monitoring** and increasing knowledge for decision-making in the future (e.g., policy performance, targeting interventions, reducing uncertainties in effects management).

TABLE OF CONTENTS

Figures:

1. INTRODUCTION

The National Policy Statement for Freshwater Management 2020 (NPS-FM) confirmed and built on existing policy settings. The NPS-FM also introduced ambitious new requirements for inland wetlands that necessitate robust information and data that is adequately fit for purpose. To assist in meeting these requirements, Horizons contracted The Catalyst Group to provide technical advice and background material for the purposes of supporting policy development and implementation in order to meet the NPS-FM 2020 requirements.

In particular, Horizons sought advice on:

a. The development of an implementation pathway that meets the requirements of Subpart 2 (National Objectives Framework, NOF) and Subpart 3 (Specific requirements) of the NPS-FM.

b. Prioritisation of implementing the NPS-FM requirements, specifically the identification and mapping of wetlands.

c. The extent to which existing information and data (e.g., Horizons' wetland inventory) can be incorporated into an approach to wetland management that meets the requirements of the NPS-FM.

The project scope is limited to natural inland wetlands and does not cover:

- A detailed work programme to implement the recommended approach to mapping and monitoring.
- Individual site identification or prioritisation.
- Detailed policy analysis of the One Plan against the requirements of the NPS-FM 2020.

Policy directions for wetlands (inland and coastal) are currently directed by two national policy statements, the NPS-FM (inland wetlands) and the New Zealand Coastal Policy Statement (NZCPS) with further provisions within the Resource Management (National Standards for Freshwater) Regulations 2020 (NES-F)[1]. The National Policy Statement for Indigenous Biodiversity (NPS-IB) Exposure Draft was released for consultation in June 2022. Although not yet gazetted, the NPS-IB (as currently drafted) includes requirements for the restoration of inland wetlands[2], and will bring a third NPS into play when considering wetlands generally. Although evaluation of the interplay of these three national policy statements and the NES-F is out of scope for this report, it is worthwhile considering the requirements of the NPS-FM within this wider context. We therefore provide brief comment on the interplay between the three policy statements below.

1.1 Relationship between national policy statements relevant to wetlands

Should the NPS-IB be gazetted as drafted, requirements for inland wetlands will split between the NPS-IB and the NPS-FM, with the regulatory, mapping and monitoring requirements driven by the NPS-FM and non-regulatory (restoration and enhancement) methods to manage wetlands driven by in NPS-IB. Wetlands in the

[1] The NES-F includes provisions for 'natural wetlands' as per the definition in the NPS-FM and was intended to include all natural wetlands including those in the Coastal Marine Area. The Ministry for the Environment is currently consulting on the application of the NES-F to wetlands (consultation is scheduled to close on 21 September 2022).

[2] NPS-IB Exposure Draft subclause 3.21(2)(d).

Coastal Marine Area remain the domain of NZCPS (and the NES-F), as wetlands in the coastal environment are explicitly excluded from the NPS-FM and the NPS-IB.

Although the NPS-IB is not yet in force, it is of some relevance to managing the region's wetland asset that is worth considering, especially in terms of potential synergies in delivery of both policy statements. The NPS-IB requires regional biodiversity strategies to be developed and for regional councils to undertake monitoring of indigenous biodiversity.[3] It would make considerably more ecological and practical sense to incorporate wetlands into the delivery of these requirements. Further potential synergies between the NPS-IB and the NPS-FM may occur via the requirement for regional councils to record areas that are highly mobile fauna areas[4] (outside of significant natural areas) as several of the highly mobile fauna specified in NPS-IB are wetland species.

Horizons is currently the lead agency in the Manawatū-Whanganui Region for the management and protection of biodiversity, which it implements through the regulatory and non-regulatory provisions of the One Plan. Under the NPS-IB, the protection and management of Significant Natural Areas (SNAs), excluding wetlands, is the responsibility of local territorial authorities. Although yet to be confirmed[5], the gazetting of the NPS-IB could therefore have considerable implications for Horizons more generally. However, the responsibility for the identification and mapping of wetlands (under the NPS-FM[6]) remains with Horizons.

Parallel to implementing the mapping requirements of the NPS-FM, we recommend Horizons retain the One Plan policies, methods, and Schedule F as they relate to wetlands[7]. The non-complying activity status associated with wetlands (classified as Threatened or Rare habitat types in Schedule F) aligns with the policy direction of the NPS-FM[8] and will continue to provide for wetlands[9] whether mapped (as per the NPS-FM) or not. This would also have the added advantage of retaining provisions for coastal wetlands and acknowledging wetlands as matters of national importance under section 6(c) of the Resource Management Act 1991 (which the NPS-FM) does not.

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3 NPS-IB Exposure Draft clause 3.23.

4 NPS-IB Exposure Draft subclause 3.20(1) and Appendix 2.

5 Councils have sought further clarification from the Ministry for the Environment as to potential extent of regional council responsibilities for SNAs.

6 Although we note that the NPS-FM does not recognise wetlands as matters of national importance under section 6(c) of the RMA.

7 Subclauses 4.3(1) and 4.3(3) of the NPS-FM allow for this.

8 The loss of extent of natural inland wetlands is avoided, their values are protected, and their restoration is promoted' (subclause 3.22(1)).

9 With some exceptions as the size threshold within the One Plan for wetland types classified as Threatened (saltmarsh; lakes, lagoons, and their margins; swamp and marsh; bog and fen) is 0.1 ha and will therefore not capture areas of wetland of these types that are < 0.1 ha in extent. The size threshold for wetland types classified as Rare (seepage and spring, pakihi; ephemeral; and dune slack) is 0.05 ha in line with the NPS-FM mapping requirements (subclause 3.23(1)).

1.2 Document structure

This report is divided into key parts:

1. **Section 3** details the gap analysis process and conclusions.
2. **Section 4** sets out three potential approaches to meet the NPS-FM requirements and an evaluation of each approach, concluding with a recommended option to pursue.
3. **Section 5** provides guidance and recommendations on implementation of the mapping and monitoring requirements of the NPS-FM.

We preface these sections with a brief summary of the requirements of natural inland wetlands under the NPS-FM (**section 2**).

2. NPS-FM REQUIREMENTS FOR NATURAL INLAND WETLANDS

2.1 Definition of natural inland wetland

'Natural inland wetland' is defined in the NPS-FM to mean: *a natural wetland that is not in the coastal marine area*.

'Natural wetland' as defined in the NPS-FM 2020 is subject to revision as shown in the Exposure Draft of amendments to the NPS-FM released by the MfE for public consultation in May 2022. These revisions have come about in response to the 'managing our wetlands' consultation process and further detailed in documents supporting the amendments to the NPS-FM (MfE 2022). Although, not yet in force, consideration of the revised definition is warranted as an indication of scope for the definition of inland wetland, and therefore the associated requirements within the NPS-FM. Both definitions are provided in Table 1.

Table 1: Definition of 'inland wetland' as set out in clause 3.21 of the NPS-FM 2020 and the May 2022 Exposure Draft of amendments to the NPS-FM 2020.

NPS-FM 2020	May 2022 Exposure Draft of amendments to the NPS-FM 2020
Natural wetland means a wetland (as defined in the Act) that is not:	
(a) a wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or (b) a geothermal wetland; or (c) any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain-derived water pooling	(a) a deliberately constructed wetland other than a wetland constructed to offset impacts on, or to restore, an existing or former natural wetland as part of giving effect to the effects management hierarchy; or (b) a geothermal wetland; or (c) a wetland that (i) is within an area of pasture and; (ii) has ground cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species (see clause 1.8)); and (iii) is not known to contain threatened species

Clause 3.22 of the NPS-FM directs regional councils to include policy in regional plans to the following effect: "*The loss of extent of natural inland wetlands is avoided, their values are protected, and their restoration is promoted…"*. This clause includes exceptions to the 'avoid policy' including for activities necessary for the construction or upgrade of 'specified infrastructure' (3.22(1)(b)), where that infrastructure will provide national or regional benefit, and there is a functional need for the infrastructure in that location. The definition of specified infrastructure is proposed to be amended to include '*any water storage infrastructure"*[10]. However, this exclusion is not without qualifications, such that effects of such activities must be managed through applying the effects management hierarchy.

Therefore, the scope of mapping and monitoring of natural inland wetlands should include areas of wetland that meet the NPS-FM definition, including those natural inland wetlands associated with water storage infrastructure. For the avoidance of doubt, the NPS-FM definition captures all inland wetland types supporting wetland vegetation communities including wetland forests.

Herein, we take the term 'wetland' to mean natural inland wetland as defined as set out above unless otherwise stated.

2.2 Requirements of the NPS-FM relating to natural inland wetlands

The NPS-FM has two clauses specific to natural inland wetlands:

- Clause 3.22 Natural inland wetlands
- Clause 3.23 Mapping and monitoring natural inland wetlands

These clauses contain a number of discrete requirements that can be broadly grouped into three categories (Table 2). Specific requirements are discussed in more detail in later sections.

Table 2: Summary of requirements for natural inland wetlands under the NPS-FM 2020 .

Category	Summary of requirement	Subclause
Preventing further loss	• Include in regional plans policy to avoid loss of extent of natural inland wetlands, and protection of wetland values	3.22(1)
	• Manage adverse effects on natural inland wetland of activities associated with exceptions to the avoid policy (including specified infrastructure) through applying the effects management hierarchy	3.22(1)(b)(iv) 3.22(2)
	• Not grant a resource consent unless the application demonstrates how each step of the effects management hierarchy will be applied to any loss of extent or values	3.22(3)(a)

[10] May 2022 Exposure Draft of amendments to the NPS-FM 2020.

Category	Summary of requirement	Subclause
	• Not grant a resource consent without conditions that apply the effects management hierarchy	3.22(3)(b)(i)
	• Have methods that enable a response if monitoring detects loss of wetland extent or values	3.23(6)(b)
Information and knowledge	• Identify and map wetlands outside of public conservation lands or waters	3.23(1) 3.23(2)
	• Prioritise mapping of wetlands and complete mapping within 10 years (2030)	3.23(4)
	• Establish and maintain an inventory of mapped wetlands	3.23(5)
	• Identify wetlands within each freshwater management unit (FMU)	3.8(3)(e)
	• Identify the location of habitats of threatened species within each FMU	3.8(3)(c)
	• Include a consent condition requiring monitoring of the impacted wetland	3.22(3)(b)(ii)
	• Identify sites to be used for monitoring within each FMU	3.8(3)(a)
	• Develop and undertake a monitoring plan that monitors wetland condition	3.23(6)(a)(i)
	• Ensure the monitoring plan enables policy effectiveness to be monitored	3.23(6)(a)(ii)
Active restoration and enhancement	• Include in regional plans policy to promote restoration of natural inland wetlands	3.22(1)
	• Include objectives, policies, and methods in the regional plan to provide for and promote the restoration of wetlands	3.22(4)

This report focuses on the 'information and knowledge' category of requirements, although it should be emphasised that the three categories of requirements set out in Table 2 work in combination to provide for wetlands and inform each other.

3. GAP ANALYSIS

To determine and describe any mismatch between current practice and the NPS-FM requirements for mapping, inventorying, and monitoring wetlands, we undertook a gap analysis of existing wetland data and monitoring programmes against the NPS-FM requirements. This involved three steps:

1. The identification of all data and information source held by Horizons that was related (in full or part) to wetlands, their location, values, or management.
2. Review and summary of each the data items.
3. An evaluation of the potential for each data item to provide the necessary information to meet the requirements of the NPS-FM for natural inland wetlands.

We used an online questionnaire, designed in collaboration with the Horizons' project team to identify all data and information relating to wetlands that Horizons staff were aware of, and to gather descriptive information about each item. Twelve specific 'items' (including spatial datasets, monitoring programmes, databases, and reports) that related to wetlands (in full or part) were identified. A summary of these items is provided Table A1.1, Appendix 1. Key descriptive qualities of each item were then identified to enable a more informed evaluation of the potential of each item in responding to the NPS-FM requirements. A summary of this evaluation is provided in Table A1.2, Appendix 1. Finally, we conducted an evaluation of each item against the specific NPS-FM requirements. The findings from this assessment are set out below.

3.1 Key findings

The NPS-FM requires mapping within 10 years of the commencement data of the NPS-FM (2030). This is an important consideration when designing mapping programmes (see section 5.1). However, in the context of the gap analysis this has less relevance as we were primarily interested in understanding the extent to which existing datasets and information currently meet the requirements of the NPS-FM. Therefore, we focused our summary analysis on the applicability of the data items to the following NPS-FM requirements:

In relation to mapping requirements:

- Mapping of every natural inland wetland ≥0.05 ha in the region [3.23(1)(a)]
- Mapping of every natural inland wetland ≤0.05 ha known to contain a threatened species in the region [3.23(1)(b)]

In relation to requirements to establish and maintain an inventory of all natural wetlands, whether the data item provided the following information:

- Identifier and location [3.23(5)(a)(i)]
- Area and GIS polygon [3.23(5)(a)(ii)]
- Classification of wetland type [3.23(5)(a)(iii)]
- Existing monitoring data [3.23(5)(a)(iv)]

Our evaluation is based on the information provided by Horizons (via the questionnaire) relating to each data item, and we did not explore the actual datasets or spatial layers. The questionnaire was designed to target key relevant details, but our understanding and subsequent evaluation is subject to the level of information provided by Horizons (and their understanding of data items) and our interpretation of that information. We were also informed by further discussions with Horizons' project team. To the best of our knowledge our analysis (summarised in Table 3) is a fair broad-level reflection of the potential to use existing data and information to fulfil the NPS-FM requirements, but acknowledge there may be some discrepancies at a more detailed level. For example, generally a given database may not provide specific information, but that same database may contain some records that do provide specific information.

Table 3: An evaluation of potential application of each item held by Horizons relating to wetlands for meeting the requirements of the NPS-FM 2020. Consideration is given to the current potential applicability and not whether will meet requirements in the future (i.e., by 2030). Darker blue/grey shading indicates where existing data items can contribute towards meeting the NPS-FM requirements, lighter blue/grey shading indicates where they partially contribute to meeting the requirements.

ITEM	NPS-FM MAPPING REQUIREMENTS [relevant subclause]					
	Item can contribute to the mapping of:		*Item includes required inventory data including:*			
	Wetlands ≥0.05 ha [3.23(1)(a)]	Wetlands ≤ 0.05 ha with threatened species [3.23(1)(b)]	Location [3.23(5)(a)(i)]	Area and GIS polygon [3.23(5)(a)(ii)]	Classification of wetland type [3.23(5)(a)(iii)]	Monitoring information [3.23(5)(a)(iv)]
Brown mudfish data	No Data does not include extent of wetland	Yes Brown mudfish is a threatened species that is primarily found in wetlands	Yes Location of wetland is provided	No	No	Potentially Data is routinely collected on species presence/absence in wetlands, unspecified if the same sites are sampled over time
Coastal lakes capture zones	Partially Does not show wetland or extent of wetland, but provides indication of likely wetland presence	No Flora or fauna is not described	No Does not include location of wetland habitat associated with coastal lakes	No	No	No Groundwater extent data NB: May contribute towards baseline data
Farm plans	Yes Presence of wetland likely to be indicated and potentially extent mapped	No Unlikely to reference presence of threatened species unless already known	Yes Presence of wetland likely to be indicated and potentially extent mapped	Yes Wetland area indicated on farm map and GIS layers	No	No

ITEM	NPS-FM MAPPING REQUIREMENTS [relevant subclause]					
	Item can contribute to the mapping of:		*Item includes required inventory data including:*			
	Wetlands ≥0.05 ha [3.23(1)(a)]	Wetlands ≤ 0.05 ha with threatened species [3.23(1)(b)]	Location [3.23(5)(a)(i)]	Area and GIS polygon [3.23(5)(a)(ii)]	Classification of wetland type [3.23(5)(a)(iii)]	Monitoring information [3.23(5)(a)(iv)]
Freshwater and Partnerships database	Yes Data shows location and extent of site	No Flora and fauna is not described	Yes Data shows location and extent of site	Yes GIS spatial information	Potentially Database differentiates between wetland, lake, and river; classification of wetland type may be included in description	No NB: May contribute towards baseline data
IRIS database	Yes Presence of wetland indicated, more specific location of wetland may be given	No Flora and fauna is not described	Yes Consent documents reference wetlands Specific location of wetland may be given	No Size of wetland (area) may be referenced within consent documents and associated compliance data but IRIS does not include GIS layers	Potentially Classification of wetland type may be included in description of area within consent documents	No NB: May contribute towards baseline data

ITEM	NPS-FM MAPPING REQUIREMENTS [relevant subclause]					
	Item can contribute to the mapping of:		*Item includes required inventory data including:*			
	Wetlands ≥0.05 ha [3.23(1)(a)]	Wetlands ≤ 0.05 ha with threatened species [3.23(1)(b)]	Location [3.23(5)(a)(i)]	Area and GIS polygon [3.23(5)(a)(ii)]	Classification of wetland type [3.23(5)(a)(iii)]	Monitoring information [3.23(5)(a)(iv)]
Lake monitoring for seasonal variation	Potentially Data indicates lake location but does not show wetland or extent	Yes Flora and fauna is described; threatened species would be noted	Potentially Data indicates lake location but does not show wetland or extent	No	Potentially Wetland type is not classified, however vegetation community data could be used to inform classification	Yes Physical chemical water quality Vegetation communities that could comprise wetland
Lakes SOE monitoring data	Potentially Can indicate presence of wetland habitat associated with lakes	No Flora and fauna is not described	No Shows location of lakes but is not specific on location of associated wetlands	No	No	Yes Physical chemical water quality
Lakes SPI	Potentially Data may give indication of presence of wetland habitat though not extent.	Partially Floral species are described in the data; threatened species would be noted	No Exact location of wetlands are not recorded	No	No	No
LUC/ SLUI database	Yes Location of wetland and extent is described	No Vegetation communities but not specific species	Yes Wetland locations are recorded	Yes	Potentially Wetland type may be classified	No NB: May contribute towards baseline

ITEM	NPS-FM MAPPING REQUIREMENTS [relevant subclause]					
	Item can contribute to the mapping of:		*Item includes required inventory data including:*			
	Wetlands ≥0.05 ha [3.23(1)(a)]	Wetlands ≤ 0.05 ha with threatened species [3.23(1)(b)]	Location [3.23(5)(a)(i)]	Area and GIS polygon [3.23(5)(a)(ii)]	Classification of wetland type [3.23(5)(a)(iii)]	Monitoring information [3.23(5)(a)(iv)]
						data
Rapid Ecological Assessment (REA) / Ecobase / REA GIS layers	Yes Maps site extent	Yes Where presence of threatened species is known or detected during survey	Yes Location and extent of wetland sites are described	Yes in GIS layers linked to Ecobase records	Potentially Descriptions of wetland and vegetation communities can be used to classify wetland type	No NB: Baseline data for each site is recorded, but repeat surveys of the same site over time confined to only a few sites
Threatened freshwater-dependent plant data	Potentially May give indication of presence of wetland habitat, but does not map extent	Potentially Describes distribution of threatened freshwater plant species, may indicate if they occur within an area of wetland, but does not map the extent of the wetland	No Wetland locations are not recorded	No	No	No

ITEM	NPS-FM MAPPING REQUIREMENTS [relevant subclause]					
	Item can contribute to the mapping of:		*Item includes required inventory data including:*			
	Wetlands ≥0.05 ha [3.23(1)(a)]	Wetlands ≤ 0.05 ha with threatened species [3.23(1)(b)]	Location [3.23(5)(a)(i)]	Area and GIS polygon [3.23(5)(a)(ii)]	Classification of wetland type [3.23(5)(a)(iii)]	Monitoring information [3.23(5)(a)(iv)]
Top 100 Wetlands dataset and report	Yes Provides location and extent of 100 wetlands in the region	No Vegetation communities are described but species are not listed	Yes Provides location and extent of 100 wetlands in the region	No	Yes Wetlands are classified and vegetation communities are described	No NB: Baseline data is held but sites are not monitored over time

The data items that were found to be relevant in some form to the NPS-FM requirements were then categorised according to the extent of their comprehensiveness and coverage of the region (Table 4)

Table 4: Coverage of existing data items in context of NPS-FM requirements to map and monitoring natural inland wetlands across the region.

Category	Data items/ monitoring programmes
Opportunistic / Ad-hoc Data on wetlands becomes available in association with other work programme or other form of passive detection. No strategic or systematic approach for geographic coverage.	Farm plans; IRIS database; LUC/SLUI
Specific Data is collected for a specific purpose, scope and location confined to select place, time, or value(s), and sampling attributes. Includes data and monitoring programmes where the spatial scope of programme is regional, but target is environmentally or geographical confined to specific attributes or target system or species (e.g., coastal zone). Data may be adequately comprehensive for baseline data or bespoke monitoring programme, but coverage maybe sub-regional, or coverage of targeted attribute(s) not complete. Can include programmes in progress.	Brown mudfish dataset; Coastal lakes capture zones; Lake monitoring; Lakes SOE monitoring; Lakes SPI; Threatened freshwater-dependent plant data; Top 100 wetlands dataset and report
Comprehensive Scope of programme is regional, data adequately comprehensive for high-level baselines, coverage of region not complete. Can include programmes in progress.	Freshwater and Partnerships database; Rapid Ecological Assessment (REA)
Exhaustive Data is adequately comprehensive for high-level baselines or ongoing monitoring programmes and coverage of region is complete.	–

In summary, from the gap analysis we conclude:

- **Shortfall of existing data and NPS-FM requirements**. Although there is much useful information contained within Horizons' historic and contemporary datasets, no single or combined dataset fully meets all the NPS-FM requirements, nor critically, provides comprehensive regional coverage so as to be confident that 'every' wetland had been captured.
- **Lack of monitoring over time.** Although Horizons has several datasets relating to wetlands and a fairly sizable (albeit now aging) wetland inventory, little repeat monitoring over time has been conducted and there is no established monitoring programme. This represents the biggest gap between current practice and the NPS-FM requirements for Horizons.
- **Lack of integration across work streams and data sources.** Other work programmes, such as SLUI, farm planning, and consenting and compliance processes can provide useful spatial data pertaining to inland

wetlands. In some instances these programmes and processes can also yield useful data on other wetland values. The current disjoint between council work streams and limited established systems for sharing data represents a lost opportunity for a more joined-up approach to managing wetlands in the region.

- **Existing datasets and information are disconnected**. Currently the various datasets, pieces of information, and reports relating to wetlands are not centralised or able to be accessed via a central hub. Initiatives are underway to create an umbrella metadata file which will help remedy this issue.
- **Existing data is, nonetheless, useful**. In particular, existing datasets can provide a useful and still relevant spatial information for mapping purposes, and contribute to inventory requirements. However, as much of the information is getting dated its application may need some rationalisation. Where confidence in the accuracy of existing data is reduced, it can still pay a useful role. For example, providing interim indications of potential wetland locations, or historic information to help inform trends over time.

Furthermore, the gap analysis confirms that Horizons is currently not meeting its obligations under the NPS-FM for wetlands. However, we do note that Schedule F of the One Plan provides a useful back-stop for the identification of areas that would qualify as wetland habitat for consenting purposes in the interim until the mapping is completed.

4. APPROACHES TO MEET THE NPS-FM REQUIREMENTS

Taking into consideration the findings of the gap analysis, we considered three potential approaches that Horizons could undertake to work towards compliance with the NPS-FM (Table 5), and then evaluated each of these three approaches against the specific requirements of the NPS-FM for wetlands (Table 6). In considering these approaches we took a wider view of the NPS-FM requirements (e.g., engagement of mana whenua) but otherwise restricted evaluation to the requirements for wetlands.

There is a fourth option not included in Table 5 – the 'do nothing' option. In this context, this option would be to in effect 'sit' on current knowledge but not incorporate this knowledge into NPS-FM responses, policy or wider decision-making relating to wetlands. The do nothing options lowers the bar from what Horizons is already achieving. On the assumption that this would be, in reality, an unpalatable option we did not consider it here. Needless to say, a 'do nothing' approach would not meet the NPS-FM requirements for wetlands.

Table 5: Three potential approaches in response to the NPS-FM requirements for wetlands.

Option A: *Status quo*	Option B: *Progressive implementation*	Option C: *Fully bespoke*
• Rely only on existing data and information • Immediate inclusion of FMU information in inventory / spatial layers • Ad-hoc inclusion of data from consenting / compliance processes	• Utilise all existing data • Immediate inclusion of FMU information in inventory / spatial layers • Spatial analysis of threatened species and wetland overlays • Undertake progressive mapping to fill gaps (starting now) • Develop systematic and formalised ongoing capture of new information (farm plans, consents etc.) • Continue to contribute to and invest in development of national framework for biodiversity monitoring • Implement and sustain region-wide state and trend monitoring as soon as national framework development is concluded to stage where implementable • Design additional regional-bespoke monitoring as required • Provide opportunities to engage with tangata whenua to determine relevant monitoring attributes and metrics / co-design monitoring programme • Investigate and pursue new methods (drone imagery, AI modelling etc.)	• Design and implement a bespoke mapping project to fully meet the requirements of the NPS-FM 2020 and update all existing data • At outset, meaningfully engage with tangata whenua / co-design a state and trend monitoring programme for region-wide monitoring and implement immediately • Formalised ongoing capture of new information (farm plans, consents etc.) • Investigate and pursue new methods (drone imagery, AI modelling etc.)

Table 6: Evaluation of whether each of the three potential approaches meets the specific requirements of the NPS-FM for wetlands. Option A = Status quo; Option B = Progressive implementation; Option C = Fully bespoke. * Unlikely to conclusively be able to confirm 'every' wetland is captured.

NPS-FM requirement	Option A:	Option B:	Option C:
Identify and map every* wetland ≥ 0.05 ha within 10 years	Partially	Yes*	Yes*
Identify and map every* wetland ≤ 0.05 ha where threatened species known within 10 years	Possibly*	Partially*	Yes*
Establish and maintain inventory	Partially	Yes	Yes
Develop and undertake a monitoring plan	No	Yes	Yes
Identify sites within each FMU to be used for monitoring	No	Yes	Yes
Include specific methods and attributes	No	Yes	Yes
Implementable now	Yes	Partially	No
Resourcing commitment	High	High	Very high
Meets the NPS-FM requirements for natural inland wetlands	**Falls short**	**Yes**	**Yes**

We **recommend** Horizons implements Option B.

5. MAPPING AND MONITORING INLAND WETLANDS

5.1 Mapping

Understanding the extent, distribution, and condition of wetlands, as well as their responses to surrounding landuse is necessary to target management and enhancement interventions. However, mapping is typically a resource hungry undertaking, especially when in-field methods are relied on. In mandating the mapping of all wetlands down to 0.05 ha in extent (and less than 0.05 ha for wetland types naturally small in extent where these areas are known to support threatened species), the NPS-FM requirements are particularly onerous.

However, Horizons is in a relatively fortunate position due to:

- Existing spatial data layers showing location and extent of wetlands which provides at least some knowledge on a considerable proportion of the region's wetlands (if somewhat patchy and becoming dated).
- The Landcover Database (LCDB5) includes detailed wetland data for the Manawatū-Whanganui Region (Dymond et al. 2021).
- The comprehensive policy framework for wetland habitat within the One Plan (including areas of wetland down to 0.05 ha and 0.01 ha for naturally rare wetland habitat types).

Therefore, mapping of the region's wetlands requires gap-filling rather than starting from scratch. However, even gap-filling is a considerable task for a region the size of the Manawatū-Whanganui and we recommend a two-pronged approach to undertaking mapping and inventory whereby:

1. Mapping and inventory are explicitly acknowledged as ongoing tasks that are never 'finished'; allowing for progressive and continual increase in data and knowledge.
2. A staged approach to gap-filling (see section 5.1.1).

We suggest that this approach can assist the implementation of the NPS-FM mapping and inventory requirements in a more manageable way, while capturing (and protecting) wetlands in the interim. Partial information is adequate and acceptable where that is the best available, and it is preferable (in the context of a declining resource) to include partial information rather than wait until perfect knowledge exists across the board. Due to the threatened status of wetland habitat regionally and nationally, it is appropriate to be precautionary. However, when relying on partial or imperfect data it is important this is taken into account. We therefore recommend that mapping and inventory records are categorised (Figure 1).

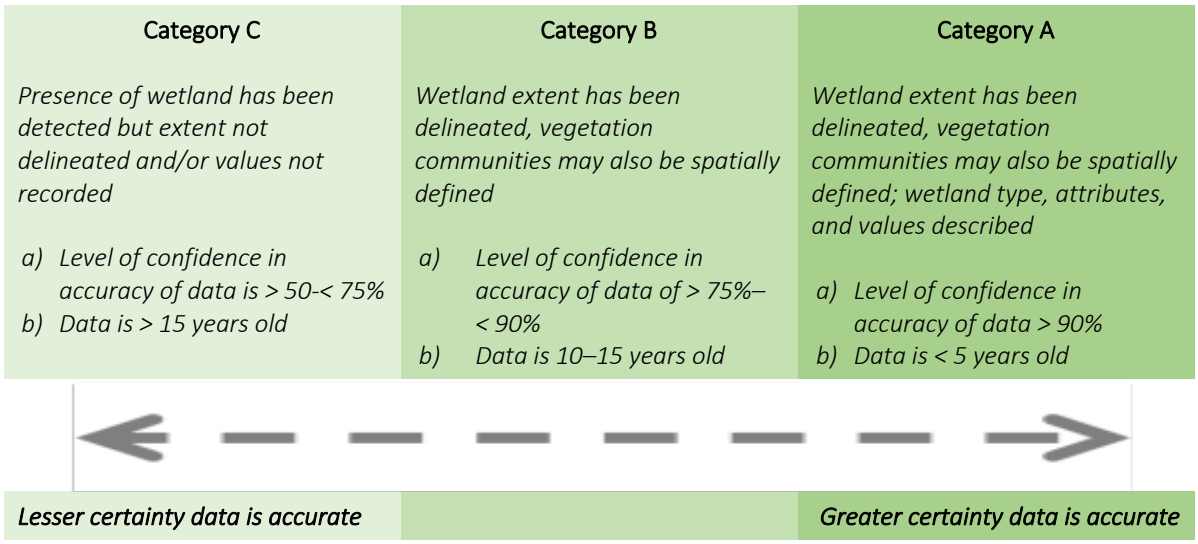


Figure 1: Confidence categories for use in association with a continual approach to mapping and inventory requirements for natural inland wetlands under the NPS-FM. Wetland data and information will likely sit across the three categories at any one time.

In general, the same data sources (e.g., existing data) may be used to inform confidence category. For example:

- Historic records
- Opportunistic records
- Farm plans and SLUI plans
- Consent applications
- Compliance activities
- Predictive modelling

- Remote sensing
- Field survey / monitoring programmes
- Regional spatial habitat layers

However, which confidence category to assign to records will be dependent on the age, quality, and confidence in the specific piece of data (e.g., an existing historic dataset dated in the 1990s compared with an existing dataset collected in the last five years) as illustrated in Table 7.

Table 7: Contribution of various data sources to the three confidence categories associated with continual mapping approach.

	C	B	A
Compliance activities Consent applications Farm plan data	Presence of wetland indicated	Extent of wetland mapped	Wetland mapped, wetland type and values and attributes described
Field-survey data	> 15 years old	between 10 & 15 years old	≤ ten years old
Model outputs	Less confidence in accuracy	← - - - - - →	More confidence in accuracy
Remote sensing (extent)	Less confidence in accuracy	More confidence in accuracy	
Remote sensing (values)	Less confidence in accuracy		More confidence in accuracy

While the level of confidence varies between confidence categories, all provide adequate knowledge to inform policy. A clear understanding of specific values (beyond presence and extent) is important for decision-making, and can be determined at the time of consent application. This is especially appropriate given the reduced and declining state of the wetland resource. The same applies to any property-scale disputes on the delineation of, or values contained within. That is, such disputes can also be resolved at the time they arise (i.e., at the time of application for resource consent or other decision-making process). Additionally, the commencement of the regional monitoring programme required under the NPS-FM will provide the opportunity to transition many wetland records from category C to category A.

5.1.1 Mapping wetlands known to contain threatened species

Existing records noting the presence and distribution of threatened species can be used as spatial overlays to identify and map associated wetland habitat. As for all other data sets, the degree of confidence in this data should be indicated. In-lieu of species records, species-habitat associations can be used as indication of potential presence of threatened species (which can be confirmed at time of decision-making, e.g., during a resource consent application process, or as part of a regional monitoring programme).

The NPS-FM requirements restricts the mapping of wetlands known to contain threatened species[11] to those wetland types that are *naturally less than 0.05 ha*[12]. However, in light of both the precarious state of threatened species and the difficulties (and expense) in mapping such small areas, we recommend that Horizons extend this consideration of threatened species to all inland wetlands, regardless of wetland type or extent. Wetland types in the Horizons region that are naturally small and known to support threatened species (e.g., dune slack wetlands) are provided for by the One Plan (down to a size of 0.01 ha).

The technical report to support the development of the One Plan (Maseyk 2007) included a list of threatened species (including Threatened, At Risk and regionally uncommon) in the Manawatū-Whanganui Region. Using this information as a basis, a list of species of concern associated with inland wetland habitat is provided in Appendix 2. Although the NPS-FM only requires the identification of wetlands known to support Threatened species, we have also included At Risk species given the continual decline of wetland habitat and the vulnerability of these species to shift down threat classification. This broad-brush information can be used (when overlain with wetland spatial data layers) as a first cut to indicate potential presence of species of concern in wetland habitat. However, given the age of this information and change in conservation status of species over time, a review and update of this evaluation would be worthwhile.

5.1.2 Prioritisation of mapping effort

It is important to note, that prioritising effort to map the region's wetlands as required to comply with the NPS-FM is a different undertaking to conservation planning and resource allocation for restoration and protection (e.g., Zonation). While systematic conservation planning incorporates principles of complementarity, representativeness, adequacy, irreplaceability, vulnerability, and efficiency to ensure biodiversity and conservation objectives are met; the NPS-FM mapping requirements simply require every wetland to be identified and mapped. Thus, prioritisation is required not to determine which areas are included (and which are not), but rather simply to direct which wetlands are identified and mapped before others.

The NPS-FM provides high-level direction for prioritising and completing the regional mapping of wetlands at subclause 3.23(4):

> *(a) first, mapping any wetland at risk of loss of extent or values; then*
>
> *(b) mapping any wetland identified in a farm environment plan, or that may be affected by an application for, or review of, a resource consent; then*
>
> *(c) mapping all other natural inland wetlands.*

We suggest that the necessary mapping exercise (and necessary supporting processes and systems) can be further staged as we set out in Table 8. In general, we recommend that priority is given to remote identification and mapping of wetlands (and these areas assigned a confidence category in accordance with Figure 1) over detailed or in-field confirmation of wetland values; as needed to provide baseline condition data for monitoring change over time. This is because the primary intention of the mapping requirements set out in the NPS-FM is to better understand the presence and distribution of the region's wetland assets and to ensure protection to

[11] Nationally Critical, Nationally Endangered, or Nationally Vulnerable species as per the New Zealand Threat Classification System Manual.

[12] NPS-FM subclause 3.23(1)(a).

these areas ('loss of **extent** is avoided' subclause 3.22(1)), and this can potentially be delivered using remote methods with greater resource-efficiently and in a shorter time period.

We note that many types and areas of wetland habitat are hard to accurately detect (or delimit) remotely. Emerging and evolving technologies (e.g., predictive modelling and AI methods[13]) will continue to improve the accuracy in remote mapping of wetlands and provide adequate certainty for policy implementation; although the limitations of these methods needs to be understand, acknowledged, and accounted for.

While we consider the mapping of smaller wetlands (which are harder to detect remotely) to be of lower priority, the ecological value of small wetlands should not be overlooked. The One Plan provides important backstop protection for unmapped wetlands via resource consenting processes, which will also contribute to mapping and inventory efforts.

[13] See for example:
Lythe M, Davis C, Lowe M, Farrant S, Chapman OR, Stanley M, Knox D 2020. Literature review, data discovery and recommended approach for proof of concept for wetland mapping methods. Final, version 1. Morphum Project Number PO2262 prepared for the Ministry for the Environment by Morphum Environmental and Lynker Analytics.
Lythe M, Lowe M, Farrant S, Chapman Olsen R, Knox D, McCord J 2021. Proof of concept for wetland mapping methods. Final, version 1. Morphum Project Number PO2262 prepared for the Ministry for the Environment by Morphum Environmental and Lynker Analytics.

Table 8: Recommended staged approach to prioritise the identification and mapping of wetlands and establishment of support processes and systems.

IMMEDIATE (next 6 months)	
1.1	Obtain and sustain resourcing for dedicated role/responsibility for wetland data management.
1.2	Assign FMU to each existing wetland record (including GIS spatial layer and inventory).
1.3	Evaluate existing records and assign confidence category (see Figure 1 and Table 7).
1.4	Develop systematic process to migrate wetland information from other work streams, including farm planning, consent, and compliance processes).
1.5	Review and update evaluation of species of concern known to be associated with wetlands in the Region (Appendix 2).
1.6	Overlay wetland threatened species data with wetland spatial layer and update wetland records as required.
1.7	Create metadata for all existing wetland data and information.
1.8	Continue migration from Ecobase to the KiEco database.
ONGOING	
0.1	Migration of wetland information from other work streams into wetland spatial layers and inventory / database (e.g., farm planning, consent, and compliance processes; and potentially SNA mapping).
0.2	Investigate options and pursue opportunities to resource and apply emerging methods for wetland identification and mapping.
0.3	Update wetland records as threatened species information becomes available.
0.4	Curation of spatial layers and inventory, including update of confidence category of individual records, inclusion of new records, entry of data from monitoring programme(s).
0.5	Update confidence category (see Figure 1 and Table 7) of wetland records as new data and information becomes available and monitoring programme(s) are initiated.
0.6	Establish and sustain data sharing agreements with territorial local authorities where relevant and appropriate (e.g., SNA mapping).
0.7	Work with Department of Conservation to update threatened species distribution data where possible.
SHORT-TERM (years 2–4)	
2.1	Starting first within any priority FMUs, identify and map wetlands in Horowhenua and Manawatū Districts[14] (not already recorded) using best available remote methods.
2.2	Starting first within any priority FMUs, identify and map wetlands in the western lowland areas of the Rangitīkei and Whanganui (not already recorded) using best available remote methods.

[14] The recommended order of priority districts for identification and mapping of wetlands is informed by the natural distribution of wetlands in the Region (originally concentrated on the west coast) and vulnerability to further loss due to land tenure and ongoing intensive landuse and land management practices. This is not to say that wetlands occurring in other districts are not also vulnerable to impacts from surrounding land use and land conversion.

MEDIUM-TERM (years 5–7)	
3.1	Starting first within priority FMUs, identify and map wetlands in Tararua (not already recorded) using best available remote methods.
3.2	Starting first within priority FMUs, identify and map wetlands in hill country and western areas of Rangitīkei and Whanganui Districts (not already recorded) using best available remote methods.
3.3	Starting first within priority FMUs, identify and map wetlands in Ruapehu District (not already recorded) using best available remote methods.
LONG-TERM (years 8–10)	
4.1	Complete gap-filling across the Region.
4.2	Confirm and update remote identification and mapping of wetlands if / when improved remote sensing methods and techniques become available.

5.2 Monitoring

The NPS-FM obligations for monitoring of wetlands will require a monitoring programme that enables:

- Change in condition over time to be detected.
- The effectiveness of implementation of regional policies in achieving the 'no net loss of extent or values' goal.

Monitoring can take the form of input monitoring (e.g., how much money was spent; how many fence posts put in the ground, or quantum of possum bait deployed), output monitoring (e.g., number of wetlands with stock excluded, area subject to possum control), or outcome monitoring (e.g., change in the target values and areas due to interventions, or lack of interventions). We note that the same monitoring programme can be designed to provide data for different purposes and specific analysis and reporting, but this does require clearly stated objectives, careful selection of attributes, and an explicit monitoring framework to provide coherency and direction.

We suggest that the NPS-FM monitoring requirements for wetlands require outcome monitoring, but do not necessarily need a bespoke monitoring programme. In light of the existing and ongoing work[15] to develop a national framework for regional-scale biodiversity monitoring, we recommend that the NPS-FM requirements can be incorporated into, or developed in parallel to, a regional-scale indigenous biodiversity monitoring programme (e.g., as required under the NPS-IB Exposure Draft). However, this will require:

- Clear objectives for the monitoring programme.
- Design of the sampling regime to ensure sampling is adequate to extrapolate monitoring results across the wetland asset with adequate confidence; including wetlands that are subject to management and enhancement and wetlands that are not.
- Careful selection of attributes and metrics to enable reporting against the NPS-FM requirements; many attributes will be consistent with other terrestrial ecosystems (e.g., native dominance; threat presence) but will also require additional measures wetlands (e.g., hydrological regimes).

[15] Lead by the Regional Council Biodiversity Working Group in collaboration with the Department of Conservation.

- Data analysis and evaluation design (including counterfactual scenarios[16]) to determine causal inference of policy methods and rate-funded interventions.

We recommend that Horizons continues their involvement and investment in the current efforts to develop a national biodiversity monitoring framework, and works towards regional implementation of the national framework rather than develop an independent monitoring framework for terrestrial biodiversity monitoring. We suggest that the national framework development is implemented at the regional level as soon as it can be (this may involve partially implementation if not all elements have been finalised), rather than wait until it is 'perfect'.

We do note, however, that regional-specific monitoring measures (e.g. monitoring metrics as advised by hapū) and programmes (e.g., hapū-designed and led monitoring programmes, species-specific monitoring) can be incorporated as 'add-ons' alongside nationally consistent programmes under a regional monitoring framework, and these can commence at any time. We also note that the monitoring requirements under the NPS-FM are not time-bound and this provides time for the regional-sector work to progress and resourcing to implement and sustain monitoring be secured. In the interim, mapping and inventory requirements can be implemented as a priority. However, we also recommend that efforts to progress the development of a national framework are continued as a priority to ensure momentum and implementation sooner rather than later. Monitoring of indigenous biodiversity is well overdue and the requirement for monitoring in both the NPS-FM and the NPS-IB Exposure Draft provides a clear signal as to its importance.

5.2.1 Monitoring categories

To conceptually illustrate how a regional monitoring framework can incorporate regional implementation of national monitoring frameworks alongside regionally-specific monitoring programmes, we have grouped hypothetical programmes into three categories (Figure 2).

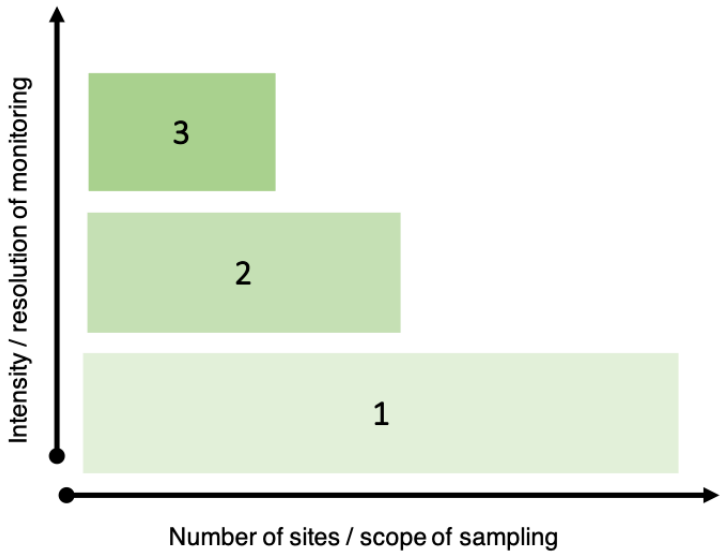
Category 1 monitoring programmes are long-term programmes designed to answer high-level questions about change in condition and extent over time at a regional-scale. These are large programmes, repeated regularly and relatively frequently (e.g., five years), although implementation can be on a rolling basis (e.g., one fifth of sampling conducting every year). The monitoring requirements under the NPS-FM (and the NPS-IB) regarding change over time falls into this category.

Category 2 monitoring programmes target fewer sites in more detail for the purposes of obtaining a deeper understanding of specific attributes (e.g., shift in indigenous composition or species recruitment over time) to further inform decision-making (e.g., monitoring associated with adaptive management for restoration projects or consent conditions).

Category 3 monitoring programmes are typically implemented at one (or a few) sites (e.g., large flagship projects where investment levels warrant a high level of monitoring and reporting) or as part of targeted research.

[16] That is, what would the outcome have been in the absence of the policies and interventions. See for example Ferraro 2009.

Any monitoring programme may contribute (alone or in combination) to evaluation and reporting on policy effectiveness, but care should always be taken to ensure the evaluation design includes the necessary elements (including counterfactual scenarios) to ensure casual inference can be drawn.



Category 1	Category 2	Category 3
Regional-picture monitoring programme; extent and condition values at high-level; use of proxies as well as direct measures likely to be common; regular sampling sustained overtime (e.g., five-year monitoring cycles)	Fewer sites; more comprehensive data collection; more likely to use direct measures rather than proxies; sampling frequency dependent on responsiveness of direct measures	Very few (or singular) sites; flagship projects or specific research questions; monitoring attributes and sampling frequency will be site and/or question-specific, including one off data collection or monitoring over short time durations

Figure 2: Conceptual illustration of three categories of monitoring programme.

5.2.2 Principles and characteristics for effective monitoring

Regardless of the purpose for or type of monitoring we recommend that any monitoring programme be underpinned by the following set of principles:

1. Goals are well defined.
2. Baselines against which change is measured are clearly established and defined.
3. Previous monitoring programmes and sampling regimes are built upon.
4. Existing data and information is utilised wherever possible.
5. Sampling methods are reputable and repeatable.
6. Synergies across projects are maximised.
7. Sampling regime is manageable in scale yet adequate to retain statistical power.
8. Frequency of monitoring is sufficient to detect change while also relevant to decision-making.
9. Monitoring programme is aligned with available resourcing.

10. There is a long-term commitment to the monitoring programme, data management, data analysis, and reporting.

In addition, we recommend that when deciding on attributes and metrics to include in a sampling regime, they should have the following characteristics:

- **Relevancy**. Attributes and metrics are relevant to inform (directly or as proxies) on state and trend in target values.
- **Resolution**. Attributes and metrics are of adequate resolution to detect change.
- **Responsiveness**. Chosen attributes and metrics are responsive to pressures and drivers of interest (related to goals and monitoring question).
- **Implementability**. Measures are easily understood, robust, and repeatable.

We suggest that these principles and characteristics can form the basis of a 'check-list' to guide the development of monitoring programmes that are adequate and appropriate for purpose. An example is provided in Appendix 3.

5.3 Data management systems

A number of initial data management tasks will be required as well as the establishment of systematic processes to allow for timing and accurate data management in the future, including:

1. Linking existing wetland across different datasets and spatial layers by creating a unique identifier for all wetland records or adding existing wetland identifiers to other records of the same wetland in other datasets.
2. Creating metadata that sits across all the relevant existing data and information sources.
3. Aligning existing inventory (e.g., KiEco) with NPS-FM requirements to enable retention of historic records and integration of new records. For example, by adding additional information (e.g., mapping confidence class and FMU identifier) to existing records.
4. Establishment of systematic process(es) to mitigate information from other workstreams into the wetland inventory. Including from:
    a. Consent applications
    b. Compliance activities
    c. Farm plan or SLUI plans
    d. Opportunistic observations
5. Cross-referencing between existing threatened species records and regional inventory to ensure wetland habitat supporting threatened species has been identified in inventory and threatened species data loaded against record.
6. Process to populate regional inventory with new wetland records, baseline information, and monitoring data.

It is our understanding that Horizons has already begun work on creating metadata files and is also in the process of migrating data from Ecobase to a new data management system. This is a good opportunity to design (or redesign) the structure of the database to ensure the NPS-FM inventory requirements are meet and can incorporate (or easily link to) monitoring data.

In addition, we recommend that additional databases are established to:

1. Hold and enable analysis (or easy extraction of data for analysis) of wetland monitoring undertaken as condition of consent.
2. Spatially identify all offset or compensation sites (created or managed as such), linked to consent application or compliance activity, and linked to monitoring conditions and data associated with the offset or compensation proposal.

While there is not a compulsory requirement under the NPS-FM, the NPS does enable offsetting and compensation (subclause 3.22(3)(a)) and requires monitoring conditions to accompany granted consents (subclause 3.22(3)(b)(ii)). We consider that having robust data management processes to support these activities will be crucial.

We anticipate that ongoing data management associated with implementation of the NPS-FM (and other policy directions) will be considerable in scope and require a degree of expertise. Dedicated and sustained resourcing will be required to undertake the data management systems needed to support compliance with the NPS-FM.

5.4 Recommendations for implementing mapping, monitoring, and inventory requirements

We recommend that Horizons:

- Prioritises mapping over monitoring in the short term, and prioritises gap-filling of wetland mapping coverage prior to updating existing records and confirming values.
- Commits to undertaking a sustained monitoring programme and dedicate support for the necessary ongoing data management and systems (as outlined in section 5.3), analysis, and reporting required. Ideally, this would be a specific role formalised through a job description.
- Combines wetland monitoring with regional terrestrial biodiversity monitoring (e.g., as indicated in the NPS-IB Exposure Draft 2022) and undertakes regional implementation of the emerging national monitoring framework, rather than invest effort in design a specific framework for the region.
- Prioritises gap-filling of wetland inventory (confidence Class C) prior to updating existing records and confirming values.
- Establishes and maintains formalised and structured internal systems to integrate data from other work streams into wetland databases to improve the integration between and synergies with other programmes and policy directions (e.g. farm planning, water quality monitoring, development and implementation of a regional biodiversity strategy and enhancement programmes).

- Pursues alternative and emerging methods and technologies (e.g., use of drones, remote sensing, AI, modelling) to identify, map, and monitoring wetlands.
- Uses existing monitoring methods in accordance with published guidelines, tested and accepted protocols, and which align with national monitoring frameworks and standards.
- Designs and implements outcome and causal inference (policy effectiveness) monitoring for enhancement expenditure, and bespoke monitoring for large-scale projects, in addition to regional-scale wetland monitoring.
- Create the ability (e.g., using agreed and consistent tags or search words) in IRIS to enable easy and complete identification of consent applications that impact in any way on wetlands.
- Retains the One Plan policies, methods, and Schedule F as they relate to wetlands alongside the mapping exercise to assist interpretation and understanding of wetland types and values during consenting processes and as a continued back-stop for incomplete mapping to ensure uniform protection for all areas of wetland habitat within the Region.

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APPENDIX ONE:

GAP ANALYSIS SUMMARY DATA

Table A1.1: Summary of existing data and information relating to wetlands held by Horizons.

Data item	Description
Brown mudfish data	The data is primarily presence/abundance data directed at policy performance. The data is in the form of excel spreadsheets but also has spatial data for localities. It follows a catch per unit approach with numerical metrics. Particular sites are covered. The data is ongoing (sampled annually) and the last entry date was 2021. In-field measurements are collected by HRC staff. The data is not analysed and used for reporting but could be analysis ready. It features in SOE reporting as an oddity rather than as metrics relating to community health. It is held in spreadsheets and in the New Zealand Freshwater Fish Database with no metadata. Spatial data has been transferred to spatial layers in some cases.
Coastal lake capture zones	A study of 26 lakes in the coastal region. The aim of the study is to provide HRC with information on groundwater flow into lakes and the areas that contribute to this. It will inform how water quality can be improved for the lakes where it is degraded. It is resource management and quantification data. The data is both quantitative and qualitative and is represented as a polygon of the groundwater influence area. Particular sites are covered. The data is contemporary and uses extent as the attribute. Data is gathered via a desktop study. This was modelled, analysed and used for reporting to answer specific research questions. Data was collected as required to inform decision making. GIS layers are held. There is metadata.
Ecobase database	This item holds information on regional biodiversity sites of all types. It contains information from REAs by Horizons staff as well as from old records, books and PNAP surveys. It is baseline, non-spatial data used for data storage. The data is both qualitative and quantitative represented in numerical metrics, categories and narrative descriptions. Flora, fauna, vegetation communities, habitats, threats, landowner details and landscape context are described. Attributes included are presence/absence, extent, condition and location. The data is ongoing - the earliest record in 1928 and the most recent on the 14th of February 2022. The sampling frequency is random as records become available or sites are visited. Both desktop and in-field sampling methods are used. Data is obtained from old reports and books by external agencies and HRC staff. The data is not analysed and used for reporting. It is in an access database with no metadata. Most has been transferred to spatial data layers. The Ecobase data is being transferred to a new programme called KiEco which will also store freshwater monitoring data.

Data item	Description
Freshwater and partnerships database	A GIS database containing information such as location, work done, landowner and cost etc on places where planting and fencing has been done. Each site is recorded as a river, lake or wetland. This is a spatial dataset used for reporting and is both quantitative and qualitative. Numerical metrics, categories and narrative descriptions represent data. The data is regional and describes the extent of habitat types. It is ongoing but currently covers 2016 to the 14th of March 2018. The sampling is variable -it is done as the work is done. It's done via desktop study and in-field measurements taken by HRC staff. The data is analysed and used for seasonal business reporting. There is no metadata.
Lake monitoring for seasonal variation	Baseline seasonal variation in water quality is measured to provide information for decision making. It is quantitative, report data represented as numerical metrics and narrative descriptions. It describes flora, fauna, vegetation communities and water quality for specific sites. Attributes include presence/absence and physiochemical data. The data is historic between 1977 and 1981 with a sampling frequency of both quarterly and six monthly/ one off. In field sampling measurements were taken in person. The data was analysed and used to inform decision making as a one-off. It is in a PDF report with no metadata. Spatial information has not been transferred to spatial layers.
Lake SPI	This item describes submerged macrophyte surveys of lakes as an indicator of ecological health on a regional basis. It is used for a high-level idea of lake health from one visit. It is baseline data in a report. It is qualitative data with numerical metrics, categories and narrative descriptions. The narrative gives an indication of water quality on the day visited. The flora present indicates condition of the lake. It is contemporary data from 2016 to 2021. Lakes were visited once then a subset were visited again approximately 4 years later. Sampling was done in-field by an external agency. The data is analysed and used for SOE reporting. This was presented as an update report each year. It is held in excel spreadsheets and GIS layers. Spatial layers exist but of varying quality. It is unknown if there is accompanying metadata.
Lakes SOE monitoring data	This is SOE data for monitoring of lakes in the region. It is state and trend over time, policy performance evaluation and reporting. It exists as spatial and time series water quality data. It is represented as narrative descriptions and numerical metrics for particular sites. The data describes physical chemical water quality and the phytoplankton community. Physical Chemical attributes are used as well as cell count and cyanobacteria biovolume. It is ongoing with the latest date entry in March 2022. Sampling takes places both monthly and quarterly. Measurements are taken in field by both continuous loggers and by a person. Data is analysed and used for SOE Reporting and State and Trend yearly. It is held in specialist software and an access database with metadata. Spatial information has been transferred to spatial layers.

Data item	Description
LUC/ SLUI database	This database holds all information on the land type and land use on farms around the region collected by the land team. Known and potential wetlands are referenced in different fields such as soil type, vegetation type, planned works and completed works. The land team use this to identify erosion areas and inform farm plans. It is a spatial baseline dataset that is both qualitative and quantitative. This is represented as numerical metrics and categories. The data describes vegetation communities, habitats, land use types and soil types. Attributes include presence/absence and extent. It began in 2005 and is still ongoing with mostly weekly sampling. Desktop and in-field measurements are taken by an external agency and HRC staff. The data is not analysed and used for reporting but is analysis ready. It is held in GIS layers and hand-written records. There is metadata and spatial information has been transferred to spatial data layers. Data types within the GIS database could indicate the presence of a wetland on a farm such as soil or vegetation type or mentions of wetland within the type of work being done.
Rapid Ecological Assessment (REA)	This item assesses native biodiversity values present at site using baseline data for potential inclusion in the Horizons priority sites protection programme. It is held as narrative descriptions and spatial files. Species of flora and fauna, vegetation communities, habitats and threats are described with presence/absence, extent and condition as attributes. It is ongoing and was last collected on the 19th of February 2022. Managed sites are sampled every 5 years and new sites are done when found. Both desktop and in-field methods are used. Data is obtained via a potential ecosystems GIS layer by HRC staff. It is reported quarterly for the Environment Committee and is held in specialist software, GIS layers, hand-written records, MS word files, PDFs and Ecobase. Spatial data has been transferred to spatial data layers.
Reports on coastal lake water balances	This data is contained within reports on coastal lake water balances used to understand groundwater interactions within lakes. It is baseline qualitative data within a report and spatial dataset represented as numerical metrics. The data is historic at catchment scale and describes extent of capture zones and water balances of various coastal lakes. Desktop sampling was carried out by HRC staff. The data is analysed and used to answer research questions.
Threatened freshwater-dependent plant data	Data is held on freshwater threatened vascular plants looking at distribution, status and threats to species. A report was produced with a data subset. This assessed threats facing threatened freshwater dependent plants in the region. The data is non-spatial in a report and records state and trend over time. It is both qualitative and quantitative represented by numerical metrics, categories and narrative descriptions. The report is national; however, the dataset is regional with presence/absence and condition attributes. Data goes back to the 1920's with the report done in 2021. Sampling was done via desktop, and data

Data item	Description
	was obtained in-field by an external agency and community/citizen science. The data is not analysed and used for reporting, but it may be analysis ready. Metadata is held in excel spreadsheets. The dataset held by HRC is museum record without the data for state and trend of these species for the report.
Top 100 Wetlands dataset and report	This is a set of wetlands in the region that are scored under a set of criteria to assess their suitability for management by Horizons under the Top 100 Wetlands project (an objective of the One Plan). These are scored under new criteria as of 2015. The data was obtained to fulfil a requirement/ objective of the One Plan to protect 100 of the region's top wetlands. The data exists as baseline data used for reporting. It is non-spatial and is both qualitative and quantitative. It is represented as narrative descriptions, categories and numerical metrics. It describes vegetation communities and habitats for the region detailing extent, condition, presence/absence and possibly hydrological data. The historic data was sampled as needed using desktop and in in-field methods. The data (currently held in spreadsheets) was analysed and used for state and trend reports yearly. It may have been transferred to spatial datasets but this is not found as yet. This programme was reviewed and scoring criteria was recommended, which sites were scored against.
Iris Database	This database holds records of all resource consents held including associated compliance data. The item picks up any issues raised through monitoring of consent conditions. The data is non-spatial and qualitative with associated narrative descriptions for across the region. Information listed includes the title, description and links to relevant documents. It is obtained via desktop by HRC staff. Information relating to wetlands is only extractable on this system by searching the description of consent field for the word 'wetland'. From this, a filtered sub set of consents can be accessed.

Table A1.2: Summary of descriptive qualities associated with each item of data relating to wetland held by Horizons.

ITEM	DESCRIPTIVE QUALITIES					
	Wetland related?	Purpose	Data	Attributes	Time period	Format
Brown mudfish data	Partially	Presence/absence of brown mudfish for policy performance	• Fauna	• Presence /absence	Ongoing Last data entry: 2021	• Excel spreadsheet • New Zealand Freshwater Fish Database
Coastal lake capture zones	Partially	To delineate groundwater capture zones in 26 coastal lakes	• Contributing groundwater catchment area for lakes	• Extent	Contemporary	• GIS Layers
Ecobase database	Partially	To hold ecological data for biodiversity sites	• Fauna • Flora • Vegetation • Habitats • Threats • Landowner details • Landscape context	• Presence/absence • Extent • Condition • Location	Ongoing 1928–14/02/2022	• Access database
Freshwater and Partnerships database	Partially	To record information for sites that where work has been done	• Habitat or habitat types	• Extent	2016–14/03/2018	• GIS layers
Lake monitoring for seasonal variation	Partially	To measure seasonal variation in water quality for 15 sand country lakes	• Fauna • Flora • Vegetation • Water Quality	• Presence/absence • Physiochemical	Historic 1977–1981	• PDF report

ITEM	DESCRIPTIVE QUALITIES					
	Wetland related?	Purpose	Data	Attributes	Time period	Format
Lakes SOE monitoring data	Partially	Monitoring for lakes within the region	• Physico-chemical water quality • Phytoplankton community	• Physico-chemical • Cell count and cyanobacteria biovolume	Ongoing Last Data Entry: March 2022	• Access database • Specialist software
Lakes SPI	Partially	To assess ecological health of lakes from oner visit	• Flora • Narrative of water quality	• Presence of flora and some fauna • Indication of lake condition	2016–2021	• Excel Spreadsheets • GIS Layers
LUC/ SLUI database	Partially	To identify erosion areas and inform farm plans	• Vegetation Communities • Habitat or habitat types • Land use types • Soil types	• Presence/absence • Extent	Ongoing 2005 to present	• GIS Layers • Handwritten records
Rapid Ecological Assessment programme	Partially	Baseline biodiversity values for native sites in the region.	• Fauna • Flora • Vegetation • Habitats • Threats	• Presence/absence • Extent • Condition	Ongoing Data entry: 19/02/2022	• Specialist software • Hand-written • GIS layers • Word/PDF Files • Ecobase
Reports on coastal lake water balances	Partially	To understand groundwater interactions with lakes	• Capture zones • Water balances	• Extent	Historic	• GIS Layers

ITEM	DESCRIPTIVE QUALITIES					
	Wetland related?	Purpose	Data	Attributes	Time period	Format
Threatened freshwater-dependent plant data	Partially	To assess threats facing freshwater dependent plants in the region	• Flora	• Presence/absence • Condition	Records go back to 1920s Report was done in 2021	• Excel spreadsheets
Top 100 Wetlands dataset and report	Yes	To assess wetlands for management under The One Plan	• Vegetation communities • Habitat or habitat type	• Presence/absence • Extent • Condition • Hydrological	Historic 2005-2015	• Excel spreadsheet

APPENDIX TWO:

THREATENED AND AT RISK SPECIES ASSOCIATED WITH NATURAL INLAND WETLANDS

Table A2.1: List of Threatened and At Risk species associated with inland wetland habitats known from the Manawatū-Whanganui Region. Data adopted from Maseyk (2007). Species threat status has been confirmed against the latest relevant publications. The brief habitat description provided relates only to inland wetland habitats and the listed species may also occur in other ecosystems and habitat types. This should not be considered an exhaustive list of threatened species that may be present in wetlands, and other threatened species (including species with a threat status other than Nationally Critical, Nationally Endangered, or Nationally Vulnerable) may be present within wetland habitats.

Species	Habitat description	Threat status (Umbrella category: Conservation status)	Water Management Zones or Sub-zones where species may occur
Birds (threat status follows Robertson et al. 2021)			
White heron, kotuku *Egretta alba modesta*	Wetlands, damp pasture	Threatened: Nationally Critical	Hoki_1a, Hoki_1b, Mana_10a, Mana_10d, Mana_13a, Mana_13e, Mana_13f, Mana_9a, Mana_9b, Mana_9c, Owha_1, Tura_1b, Tura_1c, West_5, West_7, West_8, Whai_2b, Whau_3e, Whau_4
Australasian bittern, Matuku *Botaurus poiciloptilus*	Tall, dense beds of raupo and reeds in freshwater wetlands	Threatened: Nationally Critical	Hoki_1a, Hoki_1b, Mana_10a, Mana_10c, Mana_10d, Mana_10e, Mana_11a, Mana_11b, Mana_11c, Mana_11d, Mana_11e, Mana_11f, Mana_12a, Mana_12b, Mana_12c, Mana_12d, Mana_12e, Mana_13a, Mana_13b, Mana_13c, Mana_13d, Mana_13e, Mana_13f, Ohau_1a, Ohau_1b, Rang_3a, Rang_4a, Rang_4b, Rang_4c, Rang_4d, Tura_1b, Tura_1c, West_1, West_2, West_3, West_4, West_5, West_6, West_7, West_8, West_9, Whai_7a, Whai_7b, Whai_7d, Whau_4
Banded rail, mohu-pereru *Gallirallus philippensis assimilis*	Rush-covered wetlands	At Risk: Declining	Hoki_1, Mana_7, Mana_8, Mana_9, Mana_10, Mana_11, Mana_12, Mana_13, Owha_1, Rang_2, Rang_3, Rang_4, Tura_1, West_1, West_2, West_3, West_4, West_5, West_6, West_7, West_8, West_9, Whai_2, Whai_3, Whai_4, Whai_5, Whai_6, Whai_7, Whau_2, Whau_3, Whau_4

Species	Habitat description	Threat status (Umbrella category: Conservation status)	Water Management Zones or Sub-zones where species may occur
Marsh crake *Porzana pusilla affinis*	Raupo swamps	At Risk: Declining	Throughout **except**: Rang_1, Rang_2c, Whai_1, Whai_2b, Whai_2c, Whai_2d, Whai_4d, Whai_5d, Whai_5e, Whau_1a, Whau_1b, Whau_1c, Whau_3b, Whau_3d
Spotless crake, puweto *Porzana tabuensis plumbea*	Raupo or sedge-dominated wetlands	At Risk: Declining	Throughout
North Island fernbird, matata *Bowdleria punctata vealeae*	Dense scrubby vegetation of drier wetlands, rush dominated frost-flats	At Risk: Declining	Throughout in habitats below 1000 m
Freshwater fish (threat status follows Dunn et al. 2018)			
Brown mudfish *Neochanna apoda*	Spring-fed wetlands	At Risk: Declining	Hoki_1a, Mana_10d, Mana_11f, Mana_13a, Mana_13c, Rang_4d, West_8
Giant kokopu *Galaxias argenteus*	Wetlands a short distance from the coast	At Risk: Declining	Hoki_1a, Rang_4a, Rang_4b
Vascular plants (threat status follows de Lange et al. 2018)			
Crassula peduncularis	Seasonally damp turfs and ephemeral wetlands	Threatened: Nationally Critical	Akit_1b, Akit_1c, East_1, Hoki_1a, Hoki_1b, Mana_12c, Mana_13a, Mana_13f, Ohau_1b, Owha_1, Rang_4a, Rang_4b, Tura_1b, West_1, West_2, West_3, West_4, West_5, West_6, West_7, West_8, West_9, Whai_7b, Whau_4
Leptinella dispersa subsp. *rupestris*	Margins of swamps, wetlands bordering saltmarsh	Threatened: Nationally Critical	West_1, West_2, West_3, Whai_7a, Whai_7b
Sebaea *Sebaea ovata*	Damp, sparsely vegetated dune slacks and depressions	Threatened: Nationally Critical	Mana_13a, Rang_4b, Tura_1b, West_1, West_4, West_5, West_6, West_7, Whai_7b, Whau_4
Carex strictissima	Swamps, lake margins	Threatened: Nationally Endangered	Rang_2c, Rang_2f, Whai_1, Whai_2b,Whai_2c, Whai_4d, Whai_5d, Whai_5e, Whau_1a, Whau_1b, Whau_1c, Whau_2, Whau_3b, Whau_3c, Whau_3d, Whau_3e
Swamp green hooded orchid *Pterostylis micromega*	Bogs, fens, and swamps	Threatened: Nationally Endangered	Tura_1c, West_1, West_2, West_3, West_4, Whai_2b, Whai_4d, Whai_5d, Whai_5e, Whai_7a, Whai_7b, Whai_7c, Whai_7d, Whau_1a, Whau_1c, Whau_3b, Whau_4

Species	Habitat description	Threat status (Umbrella category: Conservation status)	Water Management Zones or Sub-zones where species may occur
New Zealand iris, mikomiko *Libertia peregrinans*	Dune slacks and swales, margins of swamps	Threatened: Nationally Vulnerable	Akit_1b, Akit_1c, East_1, Hoki_1a, Hoki_1b, Mana_12c, Mana_13a, Mana_13f, Ohau_1b, Owha_1, Rang_2f, Rang_4a, Rang_4b, Tura_1b, West_1, West_2, West_3, West_4, West_5, West_6, West_7, West_8, West_9, Whai_7b, Whau_1a, Whau_1b, Whau_4
Ranunculus recens	Peaty soils developed over seepages	Threatened: Nationally Vulnerable	Rang_2c, Rang_2d, Rang_2e
Water brome *Amphibromus fluitans*	Fertile, seasonally dry wetlands and edges of lakes and lagoons	Threatened: Nationally Vulnerable	Hoki_1a, Hoki_1b, Mana_12c, Mana_13a, Mana_13f, Ohau_1b, Rang_4a, Rang_4b, Rang_4d, Tura_1b, West_1, West_2, West_3, West_4, West_5, West_6, West_7, West_8, West_9, Whai_7b, Whau_4
Dwarf musk *Mazus novaezeelandiae* subsp. *novaezeelandiae*	Lowland swamp forest	At Risk: Declining	Akit_1b, East_1, Hoki_1a, Hoki_1b, Mana_1a, Mana_1b, Mana_2a, Mana_2b, Mana_3, Mana_5a, Mana_5b, Mana_5c, Mana_5d, Mana_5e, Mana_6, Mana_7b, Mana_7c, Mana_8b, Mana_8c, Mana_8d, Mana_8e, Mana_9a, Mana_9c, Mana_9d, Mana_9e, Mana_10a, Mana_10d, Mana_11a, Mana_11b, Mana_11c, Mana_11d, Mana_11e, Mana_11f, Mana_12a, Mana_12b, Mana_12c, Mana_12d, Mana_12e, Mana_13a, Mana_13c, Mana_13d, Mana_13e, Mana_13f, Ohau_1b, Owha_1, Rang_3a, Rang_4a, Rang_4b, Rang_4c, Rang_4d, Tura_1b, Tura_1c, West_1, West_2, West_3, West_4, West_5, West_6, West_7, West_8, West_9, Whai_7a, Whai_7b, Whai_7c, Whai_7d, Whau_4

Species	Habitat description	Threat status (Umbrella category: Conservation status)	Water Management Zones or Sub-zones where species may occur
Greenhood *Pterostylis paludosa*	Peat bogs	At Risk: Declining	Rang_1, Rang_2a, Rang_2b, Rang_2c, Rang_2d, Rang_2e, Rang_2f, Whai_1, Whai_2a, Whai_2b, Whai_2c, Whai_2d, Whai_2e, Whai_2f, Whai_2g, Whai_3, Whai_4a, Whai_4b, Whai_4c, Whai_4d, Whai_5d, Whai_5e, Whau_1a, Whau_1b, Whau_1c, Whau_2, Whau_3b, Whau_3c, Whau_3d, Whau_3e
Gunnera *Gunnera arenaria*	Dune slacks and swales	At Risk: Declining	Hoki_1a, Hoki_1b, Mana_12c, Mana_13a, Mana_13f, Ohau_1b, Rang_4a, Rang_4b, Rang_4d, Tura_1b, West_1, West_2, West_3, West_4, West_5, West_6, West_7, West_8, West_9, Whai_7b, Whau_4
Selliera rotundifolia	Seasonally damp swales, ephemeral wetlands	At Risk: Declining	Mana_13a, Rang_4b, Rang_4b, West_5, West_6
Swamp leek orchid *Prasophyllum hectori*	Alpine wetlands	At Risk: Declining	Rang_2a, Whau_1a, Wahi_1, Whai_2b, Whai_2f Whai_5d
Swamp nettle *Urtica perconfusa*	Fertile swamps, lake margins, swamp shrubland and forest	At Risk: Declining	Throughout – lowland to montane. **Absent** from Whai_2f, Whai_2g, Whai_4b
Tufted hair grass, wavy hair grass *Deschampsia cespitosa*	Wetlands and lake margins	At Risk: Declining	Rang_2f, Whau_1b
Hairy willowherb *Epilobium hirtigerum*	Seepages on cliff faces, sparsely-vegetated wetland margins, lake edges, swamps	At Risk: Recovering	Akit_1a, Akit_1b, Akit_1c, East_1, Hoki_1a, Hoki_1b, Mana_1a, Mana_1b, Mana_1c, Mana_2a, Mana_2b, Mana_3, Mana_4, Mana_5a, Mana_5b, Mana_5c, Mana_5d, Mana_5e, Mana_6, Mana_7a, Mana_7b, Mana_7c, Mana_7d, Mana_8a, Mana_8b, Mana_8c, Mana_8d, Mana_8e, Mana_9a, Mana_9b, Mana_9c, Mana_9d, Mana_11c, Mana_13a, Mana_13c, Mana_13d, Mana_13e, Ohau_1a, Ohau_1b, Owha_1, West_7, West_8,West_9, Whai_2e, Whai_2f, Whai_2g, Whai_4b
Pygmy sundew *Drosera pygmaea*	Wetlands adjoining pakihi shrublands, especially peat bogs	At Risk: Relict	Rang_2f, Whau_1a, Whau_1b

APPENDIX THREE:

CHECKLIST FOR DESIGNING EFFECTIVE MONITORING PROGRAMMES

Table A3.1: Conceptual illustration of an example checklist based on the principles and characteristics of effective monitoring that can be used to guide the design of a monitoring programmes.

PURPOSE AND GOALS

☐	Is the purpose for monitoring well defined?
☐	Are goals and objectives clearly stated?
☐	Are baselines clearly established and defined?

GENERAL CONSIDERATIONS

☐	Have previous monitoring efforts been identified and consideration given to their relevance to this programme?
☐	Has consideration been given to existing data and information and opportunities to integrate this data been explored?
☐	Have other relevant projects and work streams been identified and opportunities for synergies explored?
☐	Has long-term commitment to resourcing been secured? For monitoring? Data management? Reporting?

SAMPLING METHODS, ATTRIBUTES, METRICS, AND MEASURES

☐	Are sampling methods reputable and robust; and/or follow published guidelines or sampling protocols?
☐	Has consideration been given to analysis and reporting in designing the sampling regime? Does the sampling regime allow for robust statistical analysis? Is the sample size adequate to ensure statistical power?
☐	Have target values been identified? Are they relevant to the purpose and objectives of the monitoring programme?
☐	Are sampling attributes and metrics (including proxies) relevant to, and able to inform change in target values?
☐	Are sampling attributes and metrics (including proxies) of adequate resolution to detect change?
☐	Are sampling attributes and metrics (including proxies) responsive to pressures, drivers of change, or conservation interventions as relevant to the purpose, goals, and objectives of the monitoring programme?
☐	Are sampling metrics and measures (including proxies) easily understood, robust, and repeatable? Do they lend themselves to descriptive and easily communicated reporting?
☐	Is the proposed sampling frequency sufficient to detect change and timely to inform decision-making?

THECATALYSTGROUP

planning and environment

horizons.govt.nz

24 hour freephone 0508 800 800
fax 06 952 2929 | **email** help@horizons.govt.nz
Private Bag 11025, Manawatu Mail Centre, Palmerston North 4442