OUR LAND AND WATER | Toitū te Whenua, Toiora te Wai | National Science Challenges

Expression of interest

Working Group 1: Design an Environment Monitoring System

Background

The Our Land and Water (OLW) National Science Challenge (Toitū te Whenua Toiora te Wai) has a vision which looks to a future where catchments contain mosaics of land uses that are more resilient, healthy and prosperous than today. This is a future in which all New Zealanders can be proud of the state of our land and water and share the economic, environmental, social and cultural value that te Taiao offers.

Te Taiao is the environment that contains and surrounds us. It has four major components, Whenua (land), Wai (water), Āhuarangi (climate) and Koiora (all living communities). It encourages us to aspire to a future where humanity and the natural world sustain each other in an interconnected relationship of respect.

To ensure the vitality of wai, land stewards need to be confident that their actions will be effective. In partnership with central government, we have identified critical knowledge gaps in the design of environmental monitoring capable of verifying the impact of action on the ground as well as the most appropriate technologies for facilitating verification of actions.

We know that improvements in the design and technology used in freshwater monitoring must give effect to Te Mana o Te Wai and push toward a holistic and connected view that supports the wellbeing of te Taiao. In doing so, there is an opportunity to improve visibility of cultural values in monitoring design, and to improve the technology used to support cultural indicators.

As part of its Future Landscapes research theme, OLW is establishing three streams of work. The first two working groups have been initiated. The third will be a new working group, followed by an integrated programme. Expressions of interest are currently available for working groups 1 and 2. The scope of working group 3 will be further refined before expressions of interests are called.

Working group 1: Monitoring Design The design of environmental monitoring programmes to enable a holistic and more certain understanding of freshwater outcomes resulting from land management actions taken within a catchment or a freshwater management unit (FMU).

Working group 2: Monitoring Technology Defining what technologies are available (or soon will be) that can be successfully used for the measurement of holistic freshwater values, as related to freshwater use or contaminant discharge; with specific regard to how useful these technologies would be for regulating water use or contaminant discharge.

Working group 3 and programme: Māori knowledge systems in Monitoring Design and Technology Options for embedding Māori assessments of water wellbeing into regional decision-making frameworks, including opportunities to improve technology use in assessment processes.

In this document we are seeking expressions of interests from experts interested in joining Working Group 1: Monitoring Design only. If you are interested in joining Working Group 2, there is a separate Expression of Interest document.

Timeframe and Budget

Up to $300k will be allocated among the working group as determined by the Lead Contractor to undertake this project over a term of 6 months between July 2020 and January 2021.

General Scope and Deliverables

Key research topics to be addressed are:

1. Review existing sources of environmental data and monitoring networks and their purpose and objectives. The review should focus on identifying catchments/examples of monitoring programmes specifically focussed on holistic management actions aiming at improving freshwater quality, cultural and/or ecological outcomes.
2. Develop a nationally consistent framework for the design of monitoring programmes to assess the effectiveness of on-the-ground management actions in affecting the state and direction of travel for a range of freshwater environmental indicators of ecological, recreational and cultural values. The framework must be applicable nationally and be consistent with the principles of Te Mana o te Wai.
3. Test and verify the Monitoring Design Framework in at least three catchments or sub-catchments that cover a range of characteristics and conditions (including exemplar At Risk Catchments). This means demonstrating how the Framework would work in each of these catchments or sub-catchments. It does not include the implementation of the monitoring programmes, in these and other catchments, which will be tested in subsequent work.

The project's main deliverable will be either a manuscript ready for submission to a high-quality journal (preference) or a high impact report co-designed with key stakeholders. Emphasis is on public dissemination and presentation of the results, by providing open access to these results for use by the relevant New Zealand communities.

Themain deliverable will outline the design of a holistic monitoring "Framework" and its testing in a small number of catchments and sub-catchments. It is envisaged that the Framework will be based on a decision support system with associated background information. Wherever possible, the monitoring methods should be consistent with existing national or international monitoring methods and protocols.

The level of detail must be enough to enable the direct implementation of the Framework to a range of situations and conditions in New Zealand; this will be demonstrated by "testing" the Framework in at least three real life example catchments (topic 3 above). The project's focus is monitoring on-the-ground management actions (both on land and within the waterbodies) and their effectiveness at improving freshwater outcomes; it does not cover other monitoring objectives, such as State of the Environment monitoring and reporting or Regional Plan effectiveness monitoring.

The scope includes:

- All freshwater systems, including groundwater
- The monitoring of various types of on-the-ground management actions, including actions taken on land and within the waterbodies
- The monitoring of freshwater indicators relating to ecological, recreational and cultural freshwater values

The scope does not include:

- Policy or planning instruments and policy effectiveness monitoring
- State of the environment monitoring

- Establishing dose-response relationships (e.g. between water quality and ecological indicators)
- The development of catchment models
- The development of field protocols (reference should rather be made to existing national standards or protocols)
- Estuarine or coastal environments
- Detailed design for integration of cultural values in regional decision-making frameworks (to be covered by Working Group 3).

Eligibility Criteria of Working Group Members

Applicants must have a willingness to collaborate in mission-led research and take a multi-disciplinary, co-innovation approach that has te ao Māori at its centre.

The intention is to form a team of individuals who hold a diverse, yet relevant, skill/competency set that includes knowledge about:

- The current freshwater issues and management frameworks in New Zealand and/or overseas
- The principles of Te Mana o Te Wai
- Freshwater values (including ecological, recreational and cultural values) and linked attributes and indicators
- Freshwater quality and quantity attributes, and indicators and their monitoring
- Freshwater ecosystem health attributes and indicators and their monitoring
- Mātauranga Māori, Cultural Health Indicators and their monitoring
- Land and farm management practices and their monitoring
- In-stream and in-lake mitigation measures and their monitoring
- Groundwater monitoring and processes

The team should have skill sets to reflect the need to produce statistically robust and practical monitoring networks that can be readily implemented.

Guiding Principles

1. The work must recognise Te Mana o te Wai and include culturally defined actions and monitoring methods. Upholding Te Mana o te Wai requires that in using water you must also provide for Te Hauora o te Taiao (the health of the environment), Te Hauora o te Wai (the health of the waterbody) and Te Hauora o te Tangata (the health of the people).
2. The work must recognise the interactions, ki uta ki tai (from the mountains to the sea) between fresh water, land, associated ecosystems and the coastal environment.
3. The work must recognise that Te Mana o te Wai incorporates a range of “shared values” (of tangata whenua and the wider community) in relation to each water body.
4. The monitoring design must incorporate measurements of:
    a) Management Actions (on the land and within freshwater ecosystems)
    b) Environmental indicators and information, including, but not limited to freshwater attributes from the National Objectives Framework (Appendix 2 of the NPSFM) and mātauranga Māori records, measures and indicators.
5. The work must identify how the above measurements will be linked to the shared values. A conceptual example of these linkages is provided in Figure 1 in Appendix 2 of this document.

6. The work must identify barriers and gaps to using cultural and/or values-based information for decision making. It should identify the scalability of the Monitoring Design Framework within and across catchments and regions.
7. It is acknowledged that work in this area is incomplete, and the Monitoring Design Network should identify commonalities in existing mātauranga Māori monitoring systems/frameworks and may suggest an approach based on key principles and a range of tools that may be used ("toolbox" approach) that could be further developed in Working Group 3.

Additional Considerations:

8. Legislative framework: It is recognised that the legislative framework is fast evolving, which creates uncertainty. In particular, the content and promulgation date of the final Essential Freshwater Package is unknown. The work should be consistent with the requirements of the freshwater legislation in force at the time of writing the outputs.
9. Management Actions should include a range of on-the ground actions specifically undertaken to improve freshwater outcomes. Actions may occur at various scales, such as nutrient management, critical source area management, riparian planting, land use change. Actions are typically undertaken by a range of land stewards such as landowners (individuals and/or collectives), community / catchment groups, iwi and councils. They may include actions taken on the land (e.g. nutrient management), and within water bodies (e.g. in-lake flocculent application, weed harvesting). Management actions exclude policy instruments, such as regional plans.
10. Environmental indicators must include:
    a) the Attributes in the National Objectives Framework
    b) mātauranga Māori records, measures and indicators
11. Prioritisation and cost-effectiveness. Recognising that human and financial resources are limited, and the severity of issues and the degree of urgency varies across regions and catchments, the Monitoring Design Framework should provide a tool or functionality to prioritise monitoring and reporting effort and assess its cost-effectiveness within each FMU/catchment.
12. End users/Audience. The Monitoring Design Framework should be accessible and usable by a range of end users, including community/catchment groups, iwi, stakeholders and regional councils. To that end, the Framework may include several "levels" of detail, technology and cost to encourage uptake by different end users.
13. Use of information: The Monitoring Design Framework must consider how the information and data, including mātauranga Māori, is handled, analysed, reported and communicated in a way it can guide decision-making.
14. Time scale: Recognising the tension between the relatively long-time scales associated with environmental response and the desire to measure progress within shorter timeframes, the Monitoring Design Framework should be explicit with regards to the time scale applicable to the various environmental indicators. It should include methods and indicators able to provide confidence in direction of travel within 5 years or less.
15. Spatial scale: The Monitoring Design Framework should be able to function at different scales, from sub-catchment to whole of FMU or catchment; monitoring results should also be able to be used for national scale analysis and reporting. It must provide guidance with regards to the appropriate scale at which monitoring should be undertaken in relation to management actions to optimise the chances of confidently detecting improvement (or the lack thereof). For example, there may be challenges in detecting catchment-scale of effects of small-scale management actions; monitoring freshwater outcomes at a smaller scale may be more appropriate in this instance. It should also consider the interactions ki uta ki tai with upstream and downstream environments.
16. Sources of uncertainty: The Monitoring Design Framework should identify or provide a tool to identify and, where possible, quantify sources of uncertainty, including (but not limited to) in

monitoring methods and measurements, travel times, load quantification and temporal trend analyses.

17. Monitoring protocols: Developing specific monitoring protocols (e.g. laboratory analytical methods, field sampling protocols) is outside the scope of this work; wherever possible the Monitoring Design Framework should identify and refer to existing, established monitoring protocols, such as National Environmental Monitoring Standards (NEMS). Monitoring Technologies are covered in Working Group 2.
18. Data and Information sources: The Monitoring Design Framework should consider the range of information and data sources that may form part of the monitoring programme, including monitoring that may be undertaken by councils and other government organisations, iwi and hapū, non-government organisations and community groups;
19. Data quality: The work must consider data quality (quality control and quality assurance) and provide explicit guidance as to the usability of various data in the context of informing management decisions.
20. Data storage systems: The Project scope does not cover data storage or analysis systems, such as databases; however, consideration should be given to the risks that might be associated with the collection, storage and dissemination of sensitive or confidential data or information.

What Happens Next

The Challenge has appointed Dr Olivier Ausseil (Aquanet Consulting) as the Lead Contractor, who will manage the programme of work and bring together a team of about 6 technical experts to collaborate to deliver the work. Expressions of interest should be made via email to ourlandandwater@agresearch.co.nz by **9am on the 22nd of June 2020**.

If you require any further information regarding this EOI, please contact:

- Olivier Ausseil (Lead Contractor – Monitoring Design) olivier@aquanet.co.nz (027 2277400)
- Dave Houlbrooke (Theme Leader 'Future Landscapes' – OLW) David.Houlbrooke@agresearch.co.nz (027 4544630)
- Richard McDowell (Chief Scientist – OLW) richard.mcdowell@agresearch.co.nz (021 569680)

Expressions of Interest should provide a CV and brief description of relevant technical experience including evidence of collaboration, delivery and impact.

We expect to notify people of the outcome of the selection process in late June, with Aquanet Consulting commencing with contracting the successful individuals for the Working Group from July 2020. OLW will put you in touch with Olivier Ausseil for this process.

Advisory Group

A small advisory group of stakeholders and technical experts will be appointed to cover both Monitoring Design and Monitoring Technologies. The advisory group will include the Ministry for Environment and the Waikato River Authority. As part of this Advisory Group, members are expected to attend and contribute at regular meetings and forums, by challenging thinking and sharing their expert advice.

OLW also welcomes expressions of interest for this group. If you are interested in joining the advisory group please submit a separate application including a CV and brief description of relevant technical and/or cultural experience including evidence of collaboration, delivery and impact to Ourlandandwater@agresearch.co.nz by **9am on the 22nd of June 2020**.

Appendix I: Additional background information

Recent documents that were critical in shaping this document are:

- National Policy Statements for Freshwater Management (NPS-FM, [URL link])
- OLW 2019-2024 Strategy. [URL link]
- Controller and Auditor General report on freshwater management [URL link]
- Controller and Auditor General report on government investment freshwater clean-up. [URL link]
- Ministry for the Environment (MfE) 2019 Essential Freshwater Package [URL link]
- Environmental reporting and State of the Environment (SOE) Reports 2019 [URL Link]
- Ministry for the Environment (MfE)/Stats NZ Our Freshwater 2020 [URL Link]
- MfE Freshwater Biophysical Ecosystem Heath Framework [https://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/freshwater-ecosystem-health-framework.pdf]

These documents, including the legislative requirements, are important to this EOI. They provide the need for the work and a set of guiding principles for freshwater values and attributes, as well as monitoring and reporting requirements, which will need to be considered and covered by the Proposal. Summarised, these documents describe that:

- Regional councils must, through engagement and discussion with the community, including tangata whenua, develop and implement regional plans which must set freshwater values, objectives and management methods (e.g. limits). These regional plans must consider and recognise Te Mana o te Wai in the management of fresh water.
- The 2019 Essential Freshwater Package signals a tightening of the timeframe for regional plan development and a desire to measure water quality improvements within 5 years. MfE and other organisations are developing a substantial programme of work related to catchments that are at risk or already degraded.
- The Our Land and Water National Science Challenge (OLW), Toitū te Whenua Toiora te Wai, has a vision that future landscapes contain mosaics of land use that are more resilient, healthy and prosperous than today. This is a future in which all New Zealanders can be proud of the state of our land and water and share economic, environmental, social and cultural value from them. OLW describes the need for a transformational shift in water management and, with that, to change to a Māori world view to better protect our land and water assets. This places the kaitiaki role, stewardship/guardianship, first. Te Mana o Te Wai principles, as put forward by, e.g., NPS-FM (section ***Error! Reference source not found.***) and the MfE, are a further focus on incorporation of mātauranga Māori in central government freshwater sustainability and environmental directives.
- Recent reports by the Controller and Auditor General advocate that a clearer guidance from central government towards better water management and freshwater clean-up is needed, because there is no clear agreement across central and local government about the vision for New Zealand's water resources. This lack of clarity creates inconsistency between councils on data and progress monitoring towards sustainable water management goals. Freshwater management and freshwater clean-up investments, as well as their underlying implementation and monitoring measures, need to be more coordinated and more consistent across regions; a national framework or strategy is recommended.
- The 2019 Essential Freshwater Package seeks to achieve a noticeable improvement in freshwater quality by 2025. This will require implementation of practices that will decrease contaminant losses, and monitoring methods to assess that improvement.

Data collection and analysis methods are sometimes inconsistent between regions and agencies, often as a result of a lack of national direction or nationally consistent monitoring protocols and frameworks. Data inconsistencies and data gaps are a challenge to developing a clear and detailed national picture of the state of our environment, whether it is getting better or worse. Beyond the acquisition of high-quality data, we also need to be able to interpret what data might be telling us. That means having expertise to hand that can make sense of it and translate findings towards solutions.

Working groups, led by OLW and MfE, will gather data in a series of three workshops to identify key research questions for current and future freshwater monitoring. The result is this document, that will form the basis for the EOI.

Critical Drivers; the NPSFM and Essential Freshwater Package

The current (2014, updated 2017) National Policy Statement for Freshwater Management ('2017 NPSFM') recognises the national significance of freshwater and sets Te Mana o te Wai as guiding principle.

Te Mana o te Wai is the integrated and holistic well-being of a freshwater body. Upholding Te Mana o te Wai acknowledges and protects the mauri of the water. This requires that in using water you must also provide for Te Hauora o te Taiao (the health of the environment), Te Hauora o te Wai (the health of the waterbody) and Te Hauora o te Tangata (the health of the people). Te Mana o te Wai incorporates the values of tangata whenua and the wider community ("Shared Values") in relation to each water body.

The NPSFM sets a spatial management framework, composed of freshwater Management Units (FMUs). Within each FMU, the 2017 NPSFM requires that:

- The NPSFM be fully implemented by 2025 (or 2030, if certain criteria are met)
- Water quality be maintained or enhanced overall
- Freshwater values and objectives must be identified and formulated through discussions with communities, including tangata whenua
- Freshwater quality and quantity limits must be set by the regional council to give effect to the objectives
- Values be identified, which
    - must include two compulsory values of national significance (Ecosystem Health and Human Health for Recreation), and
    - may include other values, including the 11 Other National Values (defined in Appendix A1 of the NPSFM)
- Freshwater objectives be formulated, which
    - must include, at a minimum, the attributes listed in the National Objectives Framework (defined in Appendix 2 of the NPSFM) that are applicable to each value identified for the FMU, and
    - any other attribute that the regional council considers appropriate.
- Monitoring plans be developed by regional councils to monitor progress towards, and the achievement of freshwater objectives and the extent to which the values are being provided for. Monitoring methods, must include at least:
    - surveillance of microbial health risks to people at primary contact sites;
    - macroinvertebrate communities;
    - measures of the health of indigenous flora and fauna; and
    - mātauranga Māori.
- Monitoring plans must identify monitoring sites that are representative for each FMU and recognise the importance of long-term trends in monitoring results.

- Regional councils must maintain and operate a freshwater quality and quantity accounting system.

The 2019 Essential Freshwater Package, composed of a draft NPSFM, National Environmental Standard (NES) and RMA Section 360 regulations was released in late 2019. Although still a draft for consultation, the 2019 Essential Freshwater Package signals the following policy directions:

- It maintains Te Mana o te Wai as guiding principle, but establishes a hierarchy of obligations within its framework: to waterbodies first, then to the essential needs of people, and finally for other uses
- Strengthens the direction to maintain or enhance water quality everywhere (as opposed to "overall" in the 2017 version)
- Introduces additional Compulsory Values of Threatened Species and Mahinga Kai/Tangata Whenua value
- Revises the description of the existing compulsory Ecosystem Health value to identify five biophysical components that are necessary to all be managed. These are: water quality, water quantity, habitat, aquatic life and ecological processes (Appendix 1A of the NPSFM)
- Sets additional water quality and ecological attributes and associated National Bottom Lines (Appendix 2A and 2B of the NPSFM)
- Introduces the requirement to develop management plans to manage some attributes
- Introduces requirements to avoid the loss or degradation of natural inland wetlands and to manage fish passage, including monitoring
- Requires that the extent and ecosystem health of rivers and streams, and their associated freshwater ecosystems, are at least maintained
- Requires detailed reporting for each FMU of state and trends of attributes, progress against any targets, actions taken to implement the NPSFM.

The primary mechanism of implementation of the existing NPSFM, the proposed reform package and other land and water management legislation and regulations, is through regional councils developing and implementing regional policy statements and regional plans. This process is composed of two main phases, each with specific monitoring and reporting requirements:

- First, the development of statutory plans (and associated consultation and decision-making processes): This phase requires robust environmental monitoring data to define the state of values and attributes within each FMU, as well as the type and amount of resources used. It also requires a predictive capability to link management options (e.g. limits placed on land use) with freshwater outcomes (e.g. indicators of ecological health) and assess their respective costs and benefits. (What freshwater outcomes do we want for the FMU, and how will we get there?)
- Second, the implementation of the statutory plans and associated plan effectiveness monitoring and reporting: Have we achieved/are we progressing towards the desired freshwater outcomes? Where an improvement is required, are the management actions working and when do we expect we will measure an improvement?

Importantly, the existing and proposed legislative framework places a strong emphasis on engagement with tangata whenua to ensure that tangata whenua values and interests are identified and reflected in the management of waterbodies and freshwater ecosystems. Te Mana o te Wai is identified as the fundamental guiding principle of the NPSFM and mātauranga Māori must form part of the monitoring methods.

In the last few years, the development and implementation of regional land and water policy has placed a strong emphasis on engagement processes, typically through catchment or FMU-based collaborative processes.

This has meant that environmental monitoring data needs to be accessed, understood and used by a wide range of stakeholders and interest groups. Environmental monitoring and modelling data must provide a reliable measure of key attributes and values, an understanding of cause/effects processes and inform catchment models. It is also relevant to note that environmental data are increasingly used in planning and/or legal processes such as regional plan or resource consent processes, and as such, must meet rigorous quality assurance and quality control standards. In that context, understanding and quantifying uncertainty is crucial. At a national level, there is also growing demand from central government agencies such as the Ministries or Statistics NZ to use environmental data for national scale data analysis, reporting and policy development.

Non-regulatory processes have also led to the formation of catchment or sub-catchment stakeholder groups within which there is a strong desire to better understand and measure the freshwater benefits of specific management measures (e.g. erodible land retirement, critical source area management, nutrient management, land use change, riparian and wetland restoration). This understanding is critical in order to better tailor a management response to the nature and scale of the issue and the characteristics of the catchment, prioritise actions and promote their uptake. The ability to quantify success of on the ground action will provide further confidence to new groups and finding bodies alike.

Appendix 2: A conceptualisation of shared values

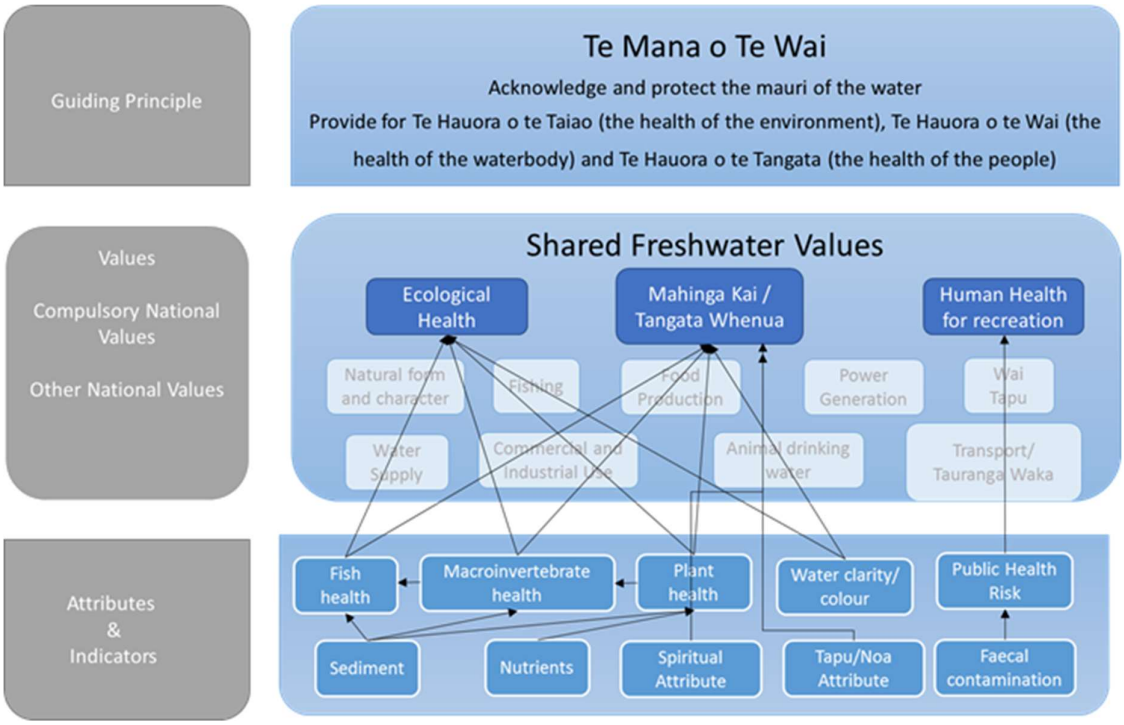

Figure 1: Conceptual representation of the linkages between Attributes and Values within Te Mana o Te Wai. Compulsory National Values are from the 2019 Draft NPSFM.