QUEENSLAND WATER MODELLING NETWORK

Consultation Report:

Reviewing the 2018-2020 Research, Development and Innovation (RD&I) Priority Actions for the Queensland Water Modelling Network (QWMN)

June 2021

Queensland Government

Consultation Report*:* Reviewing the 2018-2020 Research, Development and Innovation (RD&I) Priority Actions for the Queensland Water Modelling Network (QWMN)

The Queensland Water Modelling Network (QWMN) received 17 submissions to the *Discussion Paper: Reviewing the 2018-2020 Research, Development and Innovation (RD&I) Priority Actions for the QWMN.* They included representatives from across the sector including state and local government agencies, utilities, private companies and individuals. Overall, there was general support for the QWMN's progress to date delivering against the priority actions. This Consultation Report is two-part:

1. A Consultation Summary with general feedback against each priority, including four cross-cutting themes identified.
2. QWMN Response to the consultation including a status and recommendation for each priority action.

Priority actions were assessed as either delivered, partially delivered but requiring ongoing effort, not delivered, or superseded because they were found to no longer be a priority.

The revised priority actions following consultation serve to:

- Supersede activities that have been delivered by the QWMN or others or that are no longer a priority.
- Provide clarity and better links to policy/program objectives.
- Revise the proposed time horizons for each activity.

Any consultation feedback not reflected in this Consultation Report will be included in the full review of the RD&I Strategy scheduled in 2021/22.

Consultation Summary

Climate change and variability

Comprehensive feedback found climate change and variability continues to be a priority for the QWMN. The QWMN approach to this priority has been well received across the sector, especially through delivering the Critical review of climate change and water modelling in Queensland (Critical Review) and the momentum generated from responding to its recommendations. The consultation feedback strongly aligned with the recommendations of the Critical Review's Strategic Investment Portfolio. Key consultation themes included:

- Embed the Critical Review's recommendations and key outputs as standard knowledge/practice across the sector (e.g. through the QWMN's capability and capacity building program).
- Apply the Critical Review to existing water planning schemes/activities, especially in regional Queensland and in context of particular sectors (e.g. agricultural production).
- Develop a conceptual framework on the application of climate change and/or paleoclimate data and scenarios to water models used in land-use planning throughout Queensland with case studies in key regions.

Landscape restoration and redesign

This priority received strong support, highlighting the importance of using water quality models to guide design of targeted landscape interventions. The QWMN has delivered multiple projects under this priority, including the QWMN Fellowship (development of a gully erosion model (MERGE)), addressing uncertainty in coupled water models using machine learning techniques (in a SEQ catchment), a report on stream bank erosion in the Great Barrier Reef catchments, and a gully erosion framework to underpin rehabilitation and catchment modelling for Queensland. Key consultation themes included:

- Broaden this priority to include activities addressing urban development impacts and severely degraded landscapes (e.g. mine sites and stabilising roadsides).
- Increase investment and training for activities addressing communication and management of model uncertainty.
- Improve modelling of pollutants, including but not limited to load generation processes; microbial pathogens; nutrient and organic chemicals (pesticides/PFAS) in wetlands; sediment transport and sediment deposition in on-stream water storages.

Water planning, integration and management

Many actions currently listed under the Water Planning, Integration and Management priority were found to relate to the urban environment, with feedback suggesting there are more opportunities to address regional water challenges. More explicitly linking to policy/program objectives would strengthen the priority actions, ensure relevance and maximise impact. The priority actions have broad application in water modelling, with a key theme of:

- Promote 'fit for purpose' approach to models that avoid unnecessary complexity, particularly in linking surface water and groundwater models and using machine learning techniques.

Model management

There was general support for the model management priority. Feedback included the need for improving access, use and storage of data; better capability and resources to support communication of model uncertainty; and improving access of models and model outputs to decision-makers/end users. Key themes included:

- Scope how to integrate the psychology of decision-making and communication principles into water modelling activities.
- Invest in capability building, including a community of practice focussed on 'uncertainty communication.'

Additional cross-cutting themes identified:

- Integrate cultural values and traditional knowledge in water modelling activities
- Collaborate with natural resource management groups and other end-users to maximise on-ground impacts and decision-making capacity of water models.
- Apply a systems approach to water modelling; including building in relevant knowledge about hydrology, water quality, surface water and groundwater processes, cumulative impacts, ecology, climate change and variability etc.
- Consider the cultural, social, environmental and economic impacts and dimensions of water modelling activities.

QWMN Response

	Climate change and variability	Landscape restoration and redesign	Water planning, integration and management	Model management
Short	Prepare a strategic review paper, identifying gaps and weaknesses in existing water models' coverage of climate change and its impacts. **Status** *Delivered* with strong support across the sector: • Critical review of climate change and water modelling in Queensland. **Recommendation** Replace with: • Undertake a regular refresh of the science underpinning the review (Medium-term) • Expand review to evaluate existing planning schemes' coverage of climate change in water models (Medium-term). • Address recommendations from the review in the context of particular sectors, and focus effort on recommendations relating to data, capability building, and impacts on water security and quality (Long-term).	Improve application of paddock-scale erosion processes and management interventions to the catchment scale to underpin better modelling of landscape system responses e.g. altered grazing regimes, enhanced wetlands, erosion control measures. **Status** *Partially delivered* (improved Source modelling and hillslope erosion prediction and QWMN Fellow's gully erosion model) but ongoing effort required. **Recommendation** Replace with: • Explore opportunities to transition from empirical erosion models to more process-based models (Short-term). • Identify key knowledge gaps for the development of new models or application of existing models in alignment with policy/programs (e.g. blue carbon modelling in an estuaries/wetland environment) (Short-term).	Review the science behind MEDLI and compare with APSIM and HowLeaky in terms of deep drainage and nitrate leaching. **Status** *Delivered*, project reports to be published. **Recommendation** Replace with: • Undertake a review of leading modelling approaches to drainage in three standard soil types to investigate and critically assess key differences, e.g. cumulative magnitude of differences, cumulative errors (Short-term). • Embed the outcomes of the MEDLI science review in larger scale catchment models (Long-term).	Revise and expand the QWMN Model Catalogue to include major models external to government. **Status** *Not delivered*. **Recommendation** • Delete this priority action as related work was undertaken in the QWMN Strategic Review of Models project.
	Development of stand-alone evaluation criteria for climate change and water models. **Status** *Delivered* • Making our water models climate change ready: Are they up to the task? **Recommendation** Replace with: • Embed evaluation criteria for climate change and water models as standard approach across sector (Long-term).	Develop robust, transparent and repeatable methods for assessing uncertainty in gully and stream process models. **Status** *Partially delivered* through several QWMN projects – not identified as a priority in consultation. **Recommendation** Delete this priority action as uncertainty is covered in Water Planning, Integration and Management, and Model Management priorities.	Model the impact of urban infill. **Status** *Not delivered*. **Recommendation** Delete priority action and reflect under the Landscape Restoration and Redesign priority.	Develop an agreed set of data standards and curation for use across government (and beyond). **Status** *Not delivered* but other teams in government are supporting this action. **Recommendation** Delete this priority action and revisit when the full RD&I Strategy is being revised.

Climate change and variability	Landscape restoration and redesign	Water planning, integration and management	Model management
Following development of a strategic review paper, consult with the QWMN Community of Practice to test the paper's findings and identify how they would apply in Queensland. **Status** *Delivered*. Three External Engagement Program - Community of Practice events held in 2019 & 2020. **Recommendation** Replace with: • Embed climate change as a focus topic in the QWMN's Community of Practice, considering application in regional Queensland (Short- term).	Enhance aspects of gully and streambank restoration modelling, implementing the recommendations of the Prosser review, extending the recent development of the gully classification methods and other modelling activities across government and external agencies. **Status** *Partially delivered* through several QWMN projects, including the QWMN Research Fellowship but ongoing effort required. **Recommendation** Replace with: • Explore opportunities to sponsor additional Queensland Government/university postdoctoral researchers following the QWMN Fellowship (Medium-term).	Improve understanding of implications of uncertainty in environment for water resources policy and management (pilot in the Great Barrier Reef). **Status** *Partially delivered* through several QWMN projects but ongoing effort required. **Recommendation** Replace with: • Develop estuarine health models across Queensland with a pilot in a Great Barrier Reef catchment (Short-term). • Pilot a project on machine learning and uncertainty applied to models in the Great Barrier Reef (Short-term).	
		Improve integration between surface-water models and the MODFLOW groundwater tool to allow surface-water groundwater interactions, including the effects of groundwater extractions, to be simulated.). **Status** *Partially delivered* but ongoing effort required. **Recommendation** Replace with: • Explore opportunities to build upon/extend the Queensland regional water supply security assessments (Short-term). • Explore collaborations with others in the development of improved decision-support for groundwater modelling and its application (Short-term). • Explore opportunities to dynamically link groundwater modelling to management (Medium-term). • Undertake a pilot project to appropriately link groundwater and surface water models (with a focus on simplicity rather than complexity) (Medium-term).	

	Climate change and variability	Landscape restoration and redesign	Water planning, integration and management	Model management
Medium	Prepare a conceptual design for inclusion of climate scenarios in major models used for water resource planning and water quality with case studies on the Great Barrier Reef, Murray-Darling Basin and South East Queensland. **Status** *Not delivered*. Strong support for this action, revised below to provide clarity. **Recommendation** Replace with: • Develop a conceptual framework on the application of climate change and/or paleoclimate data and scenarios to water models used in land-use planning throughout Queensland (with case studies in Great Barrier Reef, Murray-Darling Basin, South East Queensland/Moreton Bay) (Short-term).	Develop standard approaches and tools to model key processes and outcomes (gullies, bio-available nutrients, etc.). **Status** *Partially delivered* through several QWMN projects but ongoing effort required. **Recommendation** Delete this priority action and reflect in other Landscape Restoration and Redesign priority actions.	Collaborate with the QWMN Community of Practice and the CRC for Water Sensitive Cities on an urban water research project. **Status** *Not delivered.* **Recommendation** Delete priority action and explore in to , better clarify the task and links to policy/management.	Improve access to models for policy makers and general users. **Status** *Partially delivered* through various QWMN projects but ongoing effort required. **Recommendation** Replace with: • Scope how to integrate the psychology of decision-making and communication principles into water modelling, e.g. investment in user experience testing (Medium-term).
	Model the impact of likely climate change scenarios on water quality and quantity. **Status** *Partially delivered* with involvement by multiple actors across the sector. **Recommendation** • Delete this priority action as it is reflected under the Climate Change and Variability priority (e.g. 'Implement relevant recommendations from the Critical review of climate change and water modelling in Queensland').	Identify the impact and importance of 'coarse sediment' (implications for infrastructure, water supply, etc.). **Status** *Partially delivered.* **Recommendation** Replace with: • Explore opportunities to survey Queensland dams while storages are low to confirm if most coarse sediment is deposited before reaching the dam (Medium-term).	Review riverine vegetation impacts on flooding outcomes and restoration response within models. **Status** *Partially delivered* through initiatives of multiple actors across the sector, but ongoing effort required. **Recommendation** Replace with: • Review impact of riverine vegetation (streambank and instream) on flooding outcomes and restoration response within models, including estuarine models (Short-term).	Improve treatment and communication of model uncertainty through the development and sharing of case studies (e.g. Reef reporting, DCAP, etc.). **Status** *Partially delivered* but ongoing effort required. **Recommendation** Replace with: • Investigate establishment of an 'uncertainty communication' community of practice to share case studies and experiences (Short-term).

	Climate change and variability	Landscape restoration and redesign	Water planning, integration and management	Model management
Long	Embed climate science scenarios in water models used in Queensland. **Status** *Partially delivered* with involvement and strong support by multiple actors across the sector. **Recommendation** • Delete this priority action as currently being delivered by others in the sector.	Develop nutrient offset assessment methodology and tools. **Status** *Partially delivered* through several initiatives but ongoing effort required. **Recommendation** Replace with: • Develop baseline measurements informing model-based inputs and assumptions to guide restoration and offsets investments (Short-term).	Develop robust approaches for the integration of urban water models/modelled outputs with other models (e.g. eReefs, climate, groundwater, etc.) to support decision making. **Status** *Partially delivered* through initiatives of multiple actors across the sector, but ongoing effort required. **Recommendation** Replace with: • Develop robust approaches for the appropriate integration of urban water models/modelled outputs with other models to support decision making (Medium-term).	Facilitate improved and open access to models and supporting data. **Status** *Partially delivered* but ongoing effort required. **Recommendation** Replace with: • Incorporate online tutorials and key datasets for training and mentoring through the QWMN's Capability and Capacity Building Program (Medium-term).
	Improve water modelling capability to handle longer simulation periods. **Status** *Partially delivered* with involvement and strong support by multiple actors across the sector. **Recommendation** Replace with: • Develop a conceptual design for inclusion of paleoclimate scenarios into water resource planning and extending water planning beyond a single ~100-year time (Medium-term). • Improve understanding of water security and the impacts to/implications for water plan models if stochastic rainfall/streamflow data were used (Long-term).	Develop a sediment quality model - modelling sources and transport of clay minerals responsible for marine pollution. **Status** *Partially delivered* but ongoing effort required. **Recommendation** Replace with: • Develop a water quality model that reflects modelling sources and transport of marine pollutants (adsorbed and in solution) (Medium-term).		