



Queensland Water Modelling Network

GENERAL ASSESSMENT (2017 TO 2019)

February 2020

Report prepared by

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The Queensland Water Modelling Network (QWMN) is an initiative of the Queensland Government that aims to improve the state's capacity to model its surface water and groundwater resources and their quality. The QWMN is led by the Department of Environment and Science in partnership with the Department of Natural Resources, Mines and Energy and the Queensland Reconstruction Authority, with key links across industry, research and government.

This report is the work of the author and does not represent the views or policies of the Queensland Government.

Executive summary

Context and purpose of the QWMN general assessment

Following a 2014 review of the Queensland Government’s water related science and research effort, the Queensland Water Modelling Network (QWMN) was established in February 2017 for an initial four-year period. The QWMN aims to fill critical research gaps in Queensland’s water modelling capability and support greater use of water modelling by policy makers.

The QWMN is delivered through three key streams: i) Research, Development and Innovation (RD&I) investment program; ii) capacity and capability building in government, research and private sectors that included an external engagement program (EEP); and iii) an underpinning effective governance process/structure.

The purpose of this general assessment is to assess and document QWMN achievements and impacts since its February 2017 launch. The general assessment provides a basis of understanding of the original intent of the program, the achievements to date, the drivers, networks and influence of the program and the future direction of the program.

Data sources

The general assessment has drawn on three key data sources. **Firstly**, a wide range of documentation on the network setup, activities, governance and outcomes has been reviewed. **Secondly**, an online survey using SurveyMonkey was designed and sent out to a wide range of QWMN stakeholders requesting their input. A total of 22 respondents completed the survey from 16 organisations. **Finally**, six targeted interviews allowed for coverage of a range of relevant stakeholders. Interviews were recorded and transcribed to allow for analysis using the NVivo software which enables a systematic approach to identifying and organising key themes within interviews.

Achievements and impacts of the QWMN

The following tables outline the activities as well as achievements and impacts of the QWMN under the three delivery streams.

Delivery stream: Governance
Activities
Established and implemented a governance structure. Developed and maintained a process for project selection and procurement. Undertook oversight of RDI projects delivery. Commissioned and responded to a mid-term review. Management of the EEP program (contracted to IWC).
Achievements and impacts
The program has been delivered reasonably on schedule and on budget. Analysis of the allocated versus actual budget by program stream shows a lower than expected budget percentage being expended on RDI with a corresponding increase in the capacity and capability stream (likely due to the addition of the EEP) and slight increase in the governance stream. Outputs have generally been delivered at a good quality and are beginning to lead to achievements of impacts and outcomes. Most respondents who had taken part in an RDI project indicated that the QWMN Secretariat administration of the project had met or exceeded expectations. The same response was received for the management of EEP activities and for the Secretariat’s management of governance of the program. It has recently been confirmed that a second four-year phase of the program will be funded without any major changes to the program objectives and structure.

Delivery stream: Research, Development and Innovation

Activities

Developed an RDI Strategy (2018-2020).

Supported 20 RDI projects covering the themes of model improvement, model integration and model management.

Supporting QWMN Fellow over three years to undertake research developing an improved model for representing gully erosion.

Established two complementary websites. One website run by DES that provides a formal accounting of the program projects and publications. The second set up under the EEP to provide a more flexible and engaging communication approach.

Achievements and impacts

Fostering integrated and scalable modelling to address water risks and opportunities

88% (n=14) of survey respondents who answered this question agreed or strongly agreed that the QWMN is fostering integrated and scalable modelling to address water risks and opportunities.

All RDI projects are aligned to the QWMN goals. Eight RDI projects have been initiated since the RDI Strategy development, all of which are aligned with the priorities outlined in the strategy.

Eight RDI projects have reports available on the DES or QWMN website (watermodelling.org), two were focussed on model improvements only so do not have an associated report; one focussed on migration of a model to a new website; one was to scope a second phase which is now in progress; and eight are still in progress.

Research topics of the Innovation Associates and Fellow aligned with the QWMN goals and two Associates as well as the Fellow are aligned with the RDI priorities outlined in the QWMN RDI Strategy.

Encouraged strategic co-investment and co-production in water modelling research, development and innovation

60% (n=9) of survey respondents who answered this question agreed or strongly agreed that the QWMN is encouraging strategic co-investment and co-production in water modelling RDI.

For a total investment of \$1.86M in RDI projects, the network has leveraged around \$2.07M in co-investment.

For each Innovation Associate, a QWMN investment of \$37,500 has been matched by a \$95,000 scholarship from a university.

Increased application of water modelling to inform decision-making

69% (n=10) of survey respondents who answered this question agreed or strongly agreed that the findings of QWMN funded projects had influenced their work.

70% (n=7) of government respondents to the survey (including decision makers) agreed or strongly agreed that the QWMN is improving application of water modelling to inform decision-making.

From July 2018 to January 2020, the DES QWMN website averaged 76 unique page views per month of the projects page and 62 unique page views per month of the publications page. The setup of the QWMN-specific webpage (watermodelling.org) in August 2019, led to a rapid increase in interest and this page has been averaging 268 page views a month.

RDI project reports have been downloaded 796 times over the 19-month period to January 2020

There is evidence of adoption of QWMN project results occurring across government, academia and the private sector.

Delivery stream: Capacity and capability building

Activities

Hosted formal and informal meetings to bring together modelers and policy makers within government.
Delivered a mentoring program run across five universities.
Established an Innovation Associates program
Convened a two-day Hack event.
Undertook a skills and knowledge audit
Initiated a website and monthly newsletter.
Hosted three QWMN forums
Delivered eight Community of Practice (CoP) events

Achievements and impacts

Build a state-wide network with national influence to deliver transformative change

76% (n=13) of survey respondents who answered this question agreed or strongly agreed that the QWMN is building a state-wide network with national influence

80% (n=12) of survey respondents who answered this question agreed or strongly agreed that they felt part of a network connecting water modelling professionals, users and decision makers.

Government participants (local, state, federal and utilities) averaged 36% of participants at CoP events with the remainder being private sector and academia (research and education).

Experts from academia and private sector are being enabled to connect more closely with government counterparts.

Innovation and Associates and Fellow are supported to meet regularly with key agencies in government that may benefit from their research.

Younger water modelling professionals are connecting with more established professionals through the mentoring program; events (CoPs, forums); Innovation Associates program and by working on RDI projects.

Due to the mentoring program, four student mentees indicated they were more interested in pursuing water modelling jobs and have personal connections to DNRME and to specific mentors.

The network is beginning to lay the foundations for national influence through several pathways: wider application of research; piloting the water modelling network model; and involving experts from other states in the QWMN.

Championed a community of practice to leverage expertise

75% (n=12) of survey respondents who answered this question agreed or strongly agreed that the QWMN is championing a CoP to leverage expertise, foster collaborations and enhance capacity.

There have been at least 20 participants and up to almost 90 participants at each of the CoP events.

The CoP events bring together a good mix of private sector, academia and government.

The regular CoP events are supported by an annual forum which had 110 participants in 2018 (an approximately 45% increase since the 2017 forum despite the introduction of registration fee). 94% of the 2018 forum attendees rated it as a good to excellent event.

Increasing engagement through the website is further evidence of an establishing community.

Between October 2018 and May 2019, the number of people registered to receive update emails through the EEP increased by 428% (from 131 to 561).

QWMN has supported the development of best practice guidelines and catalogues of models in use which have been discussed in CoP events. A skill and knowledge audit has been undertaken and informed discussion at a CoP event, and a website has been set up for the QWMN to enable sharing of best practice guidelines and results of QWMN funded projects.

Emerging issues influencing the network

Through the literature review, survey and interviews, 10 emerging issues have been identified that may influence future operations of the network.

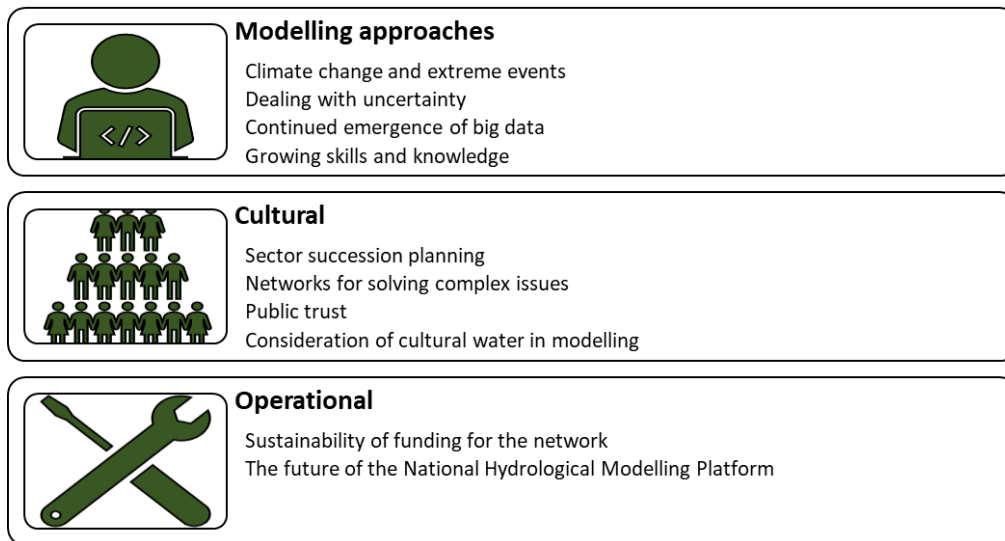
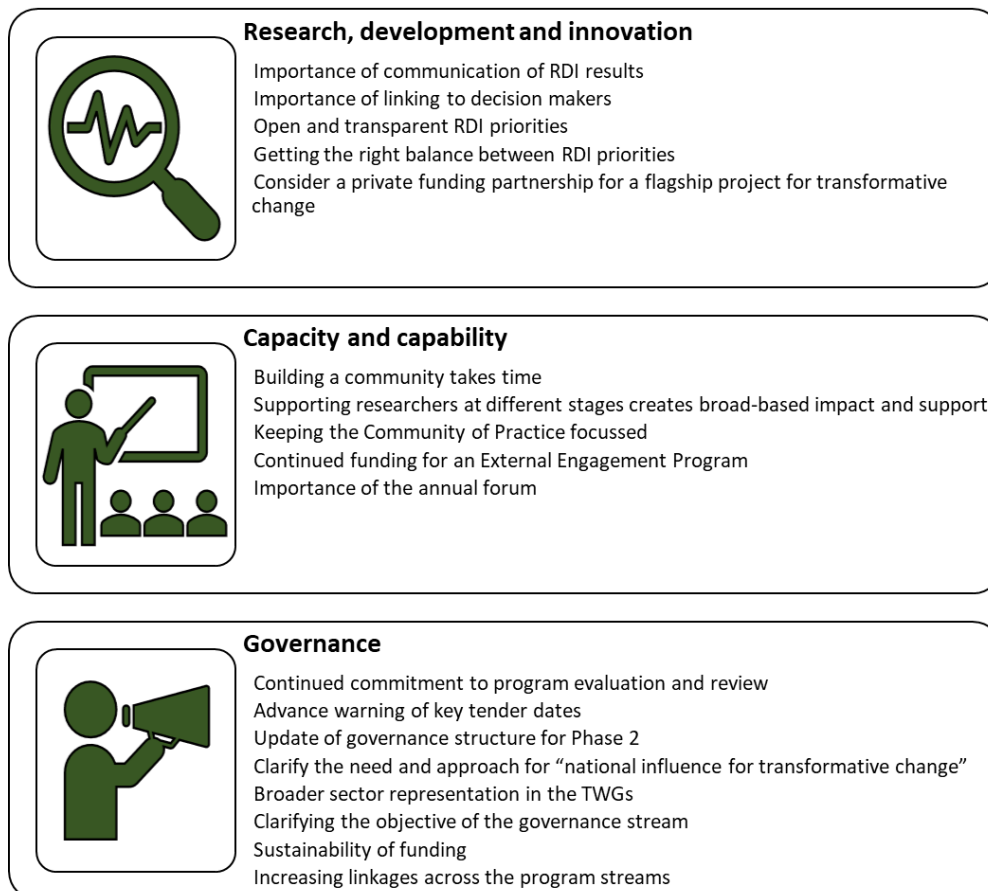


Figure E1: Emerging issues that may influence future operations of the QWMN

Lessons learned and recommendations for future operation of the QWMN

Lessons learned and recommendations identified for the QWMN whilst undertaking this general assessment are outlined in the figure below.

Figure E2: Lessons learned and recommendations for future operation of the QWMN



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1 Introduction

Following a 2014 review of the Queensland Government's water related science and research effort, the Queensland Water Modelling Network (QWMN) was established in February 2017 for an initial four-year period. The QWMN aims to fill critical research gaps in Queensland's water modelling capability and support greater use of water modelling by policy makers. This is being achieved through providing tools, information and collaborative programs to support best practice use of water models, and promoting the uptake of results by policy makers and managers.

Nearing the end of the first four year period of the QWMN provides an opportunity to reflect upon the achievements and lessons learned to date and inform the development of the next four years of the program to ensure it is effectively and efficiently achieving its goals. A formal stocktake of the first four years of the QWMN covering effectiveness and efficacy in project design and delivery, governance, update and outreach may also inform the design of the next phase of the network.

The purpose of this general assessment is to assess and document QWMN achievements and impacts since its February 2017 launch. This will create an understanding of achievements against the original documentation of the network and allow for a preliminary evaluation of effectiveness and efficiency in projects and governance. The general assessment provides a basis of understanding of the original intent of the program, the achievements to date, the drivers, networks and influence of the program and the future direction of the program.

The general assessment is structured as follows:

- **Chapter 2 – Description of QWMN and its objectives** – Describes the QWMN and its goals as established in the original documentation of the network and its evolution through the first years of operation.
- **Chapter 3 – Guiding questions for the assessment** - Outlines the set of questions that were used to frame and guide the general assessment, as well as the three key data sources utilised.
- **Chapter 4 – Achievements and impacts** – Draws on the guiding questions and data sources to outline achievements and impacts of the QWMN under the three key delivery streams of Research, Development and Innovation (RDI), building capacity/capability and governance.
- **Chapter 5 – Emerging issues influencing the network** – Outlines emerging issues that may influence QWMN operations in the future and what impact these issues may have on QWMN achievement of its goals.
- **Chapter 6 – Lessons learned and recommendations for future operation of the QWMN** - Documents lessons learned from the general assessment and how these may change implementation of the network in the future.

2 Description of the QWMN and its objectives

2.1 Drivers for establishment of the QWMN

In 2014, the Queensland Chief Scientist convened an expert review of the Queensland government's water science capability. The review found that government science investment and capability were predominantly operationally focused, with limited resources directed towards identifying or addressing emerging strategic issues. This exposed the government to significant future risks across all major water domains, from Reef water quality, through to sustainable groundwater management and mitigating flood risks. The review also found that total spend in water related science as well as Research and Development within government was less than a third of that spent outside of government.

The report detailed three key issues (Greenfield 2014):

- The Queensland Government's capability in water related science as well as Research and Development had diminished, particularly in relation to catchment hydrology and urban water issues.
- Limited investment in longer term strategic research on water-related science and technology issues.
- Combination of a dominant service provider model and reduced capability as a result of budget cuts and changes in program focus had led to a vulnerability in maintaining capability in the science areas related to core policy and business functions of line agencies.

To identify how best to address these issues, the Queensland Government held workshops to consult with a broad range of State government agencies. Out of these discussions, an interdepartmental modelling network, connecting the main water modelling groups in government with the key users of models and model outputs, was proposed as a key starting point. The workshops concluded that once this network was established and functional, broader engagement with modelling groups outside government would be appropriate, effectively mobilising a Queensland-wide network and tapping co-investment and co-production opportunities. Following a successful funding bid, the Queensland Water Modelling Network (QWMN) was resourced for four years (FY 2016-17 to 2019-20).

2.2 Goals of the QWMN

The QWMN is guided by five key goals (each comprising of sub-goals) and four supporting principles (Figure 1). The goals include:

1. Build a state-wide network with national influence to deliver transformative change by:
 - building a legacy of transformation through a priority model or suite of models
 - engaging across sectors with a stake in water modelling to inform investment in decision-making, planning, research and teaching
 - contributing to the state and national agendas through key initiatives and collaboration
 - addressing critical strategic gaps and weaknesses in water models at all scales.
2. Foster integrated and scalable modelling to address water risks and opportunities by:
 - improving integration of all Queensland hydrology, groundwater and water quality models, including Great Barrier Reef and Water Resource Planning models
 - integrating environmental monitoring activities with water modelling, particularly in priority catchments and basins
 - supporting development and implementation of finer-scale assessment and modelling frameworks to better prioritise and evaluate works.
3. Champion a community of practice to leverage expertise by:
 - improving the efficiency, application and use of models by practitioners providing advice to end-users
 - engaging with Queensland's broader modelling community seeking to partner with the academic, private, public research and government sectors
 - supporting the development of standards, best practices or requirements that improve water models over time.
4. Encourage strategic co-investment and co-production in water modelling research, development and innovation (RDI) by:

- identifying priority RDI opportunities to improve the efficiency and effectiveness of water modelling in Queensland
 - facilitating targeted co-production and co-investment with leading collaborative partners to advance shared goals.
5. Increase application of water modelling to inform decision-making by:
- enhancing ability of models to support assessment and consideration of water related cumulative impacts or responses to scenarios
 - seeking opportunities to harvest multiple data sources to improve model performance and applicability.



Figure 1: The five goals and four supporting principles of the QWMN

2.3 Structure of the QWMN

The QWMN's strategic direction, operation and delivery is coordinated by the Queensland Government. Within government, the Department of Environment and Science (DES) is responsible for the coordination of the QWMN in partnership with the Department of Natural Resources, Mines and Energy (DNRME), Queensland Reconstruction Authority (QRA) and other organisations. Technical working groups are formed to oversee specific initiatives of the network.

The QWMN is delivered through three key streams:

- A Research, Development and Innovation (RD&I) investment program including: i) strategic evaluations; ii) individual projects; and iii) reviews and responses;
- Capacity and capability building in government, research and private sectors that included an external engagement program (EEP); and
- An underpinning effective governance process/structure.

3 Guiding questions and data sources for the assessment

3.1 Guiding questions

The general assessment has focussed on the key guiding questions outlined in Table 3-1.

Table 3-1. Key guiding questions for the general assessment of the QWMN

	Guiding questions
Objectives	1. What were the original drivers for the QWMN?
	2. What are the key goals of the QWMN?
Activities	3. What actions are the QWMN taking to achieve these goals?
Achievements	4. What are the quantifiable achievements of the QWMN?
	5. What are the qualitative achievements of the QWMN?
Effectiveness and efficiency	6. How effective was the QWMN in achieving its goals?
	7. How efficient was the QWMN in achieving its goals?
	8. How could the QWMN have been more effective and efficient in achieving its goals?
Emerging issues	9. What emerging issues may influence QWMN operations in the future and what impact will these issues have on QWMN achievement of its goals?

Key questions 2 to 8 are framed against the three QWMN work streams: RD&I; building capacity/capability and governance.

3.2 Data sources

The guiding questions have been explored through three key data sources.

Review of available documentation: A wide range of documentation on the network setup, activities, governance and outcomes has been reviewed. This has included internal DES documentation, EEP documentation, published project reports, published reviews and the DES and QWMN websites (see Annex A for list of documents reviewed).

Survey of QWMN stakeholders: An online survey using SurveyMonkey was designed and sent out to a wide range of QWMN stakeholders requesting their input. Based on the findings of the literature review, a series of questions were developed that allow for quantitative analysis, as well as open questions to allow stakeholders to express their views on the program, identify actions that did or didn't work and identify new opportunities (see Annex B for the survey template). A total of 22 respondents completed the survey from 16 organisations. Within the respondents, there was a good representation from different organisation types (government, university and private sector), a predominance of modelers (but still some end users and capacity development practitioners) and a good representation of involvement across the three program streams (Figure 2).

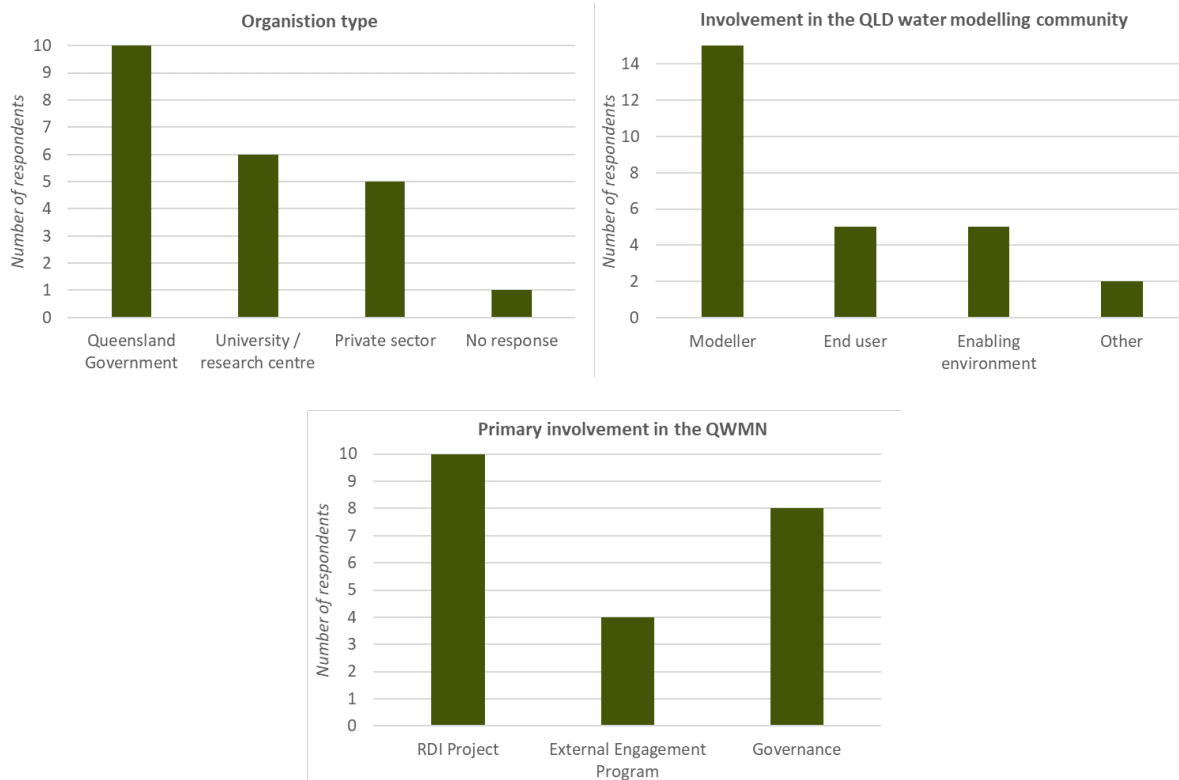


Figure 2. Categorisation of survey respondents by organisation type, self-identified involvement in the Queensland water modelling sector and primary involvement in the QWMN

Targeted interviews: The results of the online survey informed the selection of six key stakeholders for targeted interviews. Six interviews allowed for coverage of a range of relevant stakeholders including: i) government; ii) private sector; iii) recipients of research funding (post-graduate and PhD); and iv) a high level champion of the program (list of interviewees provided in Annex C). An interview template was designed to structure the interviews to allow interviewees the opportunity to explore reflections on lessons and opportunities to improve the program (see Annex C for the survey template). The interviews were recorded and transcribed to allow for analysis using the NVivo software. This software enables a systematic approach to identifying and organising key themes within interviews. The ability to systematically identify themes within the data using NVivo software ensures that interview analysis is performed with rigour, and ultimately ensures that all of the information gathered is considered equally and objectively, rather than cherry picking specific ideas.

4 Achievements and impacts

4.1 Research, development and innovation investments

Objectives

The following goals are assessed under this program stream:

- Fostered integrated and scalable modelling to address water risks and opportunities;
- Encouraged strategic co-investment and co-production in water modelling research, development and innovation (RDI); and
- Increased application of water modelling to inform decision-making.

Activities

Under the RDI investment stream, three key activities types have been undertaken: i) RDI projects; ii) development of an RDI strategy; and iii) support for a QWMN Fellow. In addition, the Innovation Associates program, funded under the capacity and capability delivery stream, has implications for RDI. Each of these activity types is described in more detail below.

To date the QWMN has funded 20 RDI projects covering the themes of model improvement, model integration and model management (see Annex D for full list). These have been undertaken by a range of university and private sector partners and cover topics such as improvements to specific models, strategic reviews, model cataloguing, improving model visualisation and improving model processing approaches.

Following a mid-term review in July 2018 which identified the need for a focus on a small number of emerging themes, the QWMN developed an RDI Strategy (2018-2020). The strategy outlined decision rules and criteria for project selection as well as using the QWMN goals and four supporting principles (Figure 1) to frame RDI priorities in terms of:

- **Priority models:** HowLeaky; eWater Source; medli; MODFLOW; and MUSIC.
- **Priority regions:** Northern Australia; Great Barrier Reef Catchments; Northern Murray Darling Basin; and South East Queensland / Moreton Bay.
- **RDI priorities:** Climate change and variability; Landscape restoration and design; Water planning, integration and management; and Model management.

Under the RDI program stream, a QWMN Fellow is being supported over three years to undertake research developing an improved model for representing gully erosion. The primary purpose of the model is to better understand the processes of gully erosion and the impact of different management scenarios on reducing erosion in the catchments of the Great Barrier Reef, and to fill a known gap in the current Source Catchments model. The Fellow, based at the Australian Rivers Institute, Griffith University, is receiving core funding for their work (salary and expenses) as well as support from the QWMN Secretariat to engage with government agencies for data collection and model design as well as facilitate the adoption of the resulting model by decision makers. See Box 2 for further description of the Fellowship program.

An Innovation Associates program is being funded under the capacity and capability delivery stream and also has implications for RDI as the Associates' research is focussed on model improvements (program described in more detail in section 4.2 *Sector-scale capacity development program*). Through the program the Innovation Associates have identified government/industry end users that they are expected to meet with regularly. This will assist in ensuring that the model developments completed by the Associates are in line with government and industry requirements, thus improving the likelihood of application of modelling results to inform decision-making.

To promote the projects supported by the QWMN and make the results publicly available, the QWMN has established two complementary websites. The first is run by DES and provides a formal accounting of the program projects and publications (<https://science.des.qld.gov.au/government/science-division/water-modelling-network>). The second has been set up under the EEP to provide a more flexible and engaging

approach (<https://watermodelling.org/>). The two websites complement and support each other, having different operating constraints and key audiences. For example, the EEP developed website does not directly host project publications, it instead links to the publications provided on the DES website.

Achievements, efficiency and effectiveness

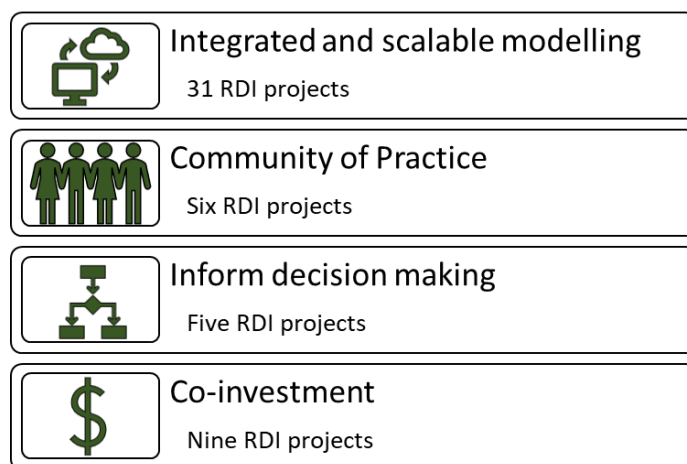
Fostering integrated and scalable modelling to address water risks and opportunities

To date the QWMN has funded 20 RDI projects, a Research Fellow and five PhD students (Innovation Associates) to undertake research and development on water modelling tools and their application.

All the reports that are coming out ... they're aligned, they're linked... and they're collectively advertised... (quote from interviewee)

A review of the RDI projects found that all are aligned to the QWMN goals (see Annex D). Eight RDI projects have been initiated since the RDI Strategy development. Of these projects, all are clearly aligned with the priorities outlined in the strategy (either through priority models, priority regions, RDI priorities or a combination) (see Figure 3 and Annex D). Not all the priorities in the strategy have received funding. For example, the review could not identify projects that incorporates the MUSIC model, or focussed on the priority region of Northern Australia.

Figure 3. RDI projects alignment to QWMN RDI strategy and goals. Note that no RDI project aligned directly with the QWMN goal of building a state-wide network



Critical to fostering improved modelling is ensuring that research results are made widely and easily accessible by the water modelling community. As of the writing of this report, the projects are in various states of implementation and communication of results. Eight have project reports available on the DES or QWMN website (watermodelling.org), two were focussed on model improvements only so do not have an associated report; one focussed on migration of a model to a new website; one was to scope a second phase which is now in progress; and eight are still in progress (see Annex D for detail).

It is too early to tell what the impact of the Innovation Associates and Fellow will be on fostering integrated and scalable modelling. A review of the research topics of the Innovation Associates (see Annex E) and Fellow show that all topics are aligned with the QWMN goals and two Associates as well as the Fellow are aligned with the RDI priorities outlined in the QWMN RDI Strategy (2019-2020). It therefore may be expected that their research results will have positive impacts in line with the focus of QWMN. Continued close review and oversight of these activities will need to continue to ensure this takes place.

According to the survey results, the QWMN community believe that the network is improving water modelling within Queensland. 14 survey respondents (88% of respondents who answered this question) agreed or strongly agreed that the QWMN is fostering integrated and scalable modelling to address water risks and opportunities. The one respondent who disagreed explained that the QWMN wasn't improving modelling within their technical focus area. Other comments from respondents included:

- The QWMN is funding novel project development activities that seek to integrate modelling approaches.
- Whilst still perhaps modest, and focused on only a few key areas, the QWMN is providing an avenue for model development and innovations discussion (e.g. Hackathon) to drive model development.
- Generally, the model reviews have been of high quality and relevant, projects have been thoughtfully prioritised and well delivered.
- The QWMN is only as good as the people and organisations that engage with it. I think some themes are being tackled stronger than others. Water quantity modelling and the integration across models is probably an area needing focus.
- There are a range of models identified within the Queensland Government Model catalogue developed by the QWMN. The QWMN is seeking to develop these models which operate at different scales.
- One example is the analysis of the Paddock to Reef catchment models of water quality where the Queensland Government works with universities and other states to address water quality issues with a long-term perspective.
- Bringing together pipeline of models: catchment to coast.
- QWMN is fostering modelling across a range of scales and building links between modellers working on different parts of the problem, which will ultimately foster integration.

Encouraged strategic co-investment and co-production in water modelling research, development and innovation

The QWMN looks for co-investment and co-production when developing RDI projects. Across the 20 RDI projects to date, for a total investment of \$1.86M in RDI projects, the network has leveraged around \$2.07M in co-investment (Figure 4). Examples include co-funding of research, sponsorship of software licenses, mentoring and in-kind support. The QWMN Fellow and Innovation Associates program are leveraging funding from universities. For each Associate, a QWMN investment of \$37,500 has been matched by a \$95,000 scholarship from each university. For the Fellowship, a \$605,000 QWMN budget is leveraging \$10,000 in direct funding and \$28,363 of in-kind funding from Griffith University.

According to the survey results, the QWMN community generally believe that the network is encouraging co-investment and co-production. 60% (n=9) of survey respondents who responded to this question agreed or strongly agreed that the QWMN is encouraging strategic co-investment and co-production in water modelling RDI. The remainder neither agreed or disagreed, primarily because they felt they did not have sufficient information to answer. One respondent who neither agreed or disagreed suggested that there didn't seem to be enough leverage and the market tends to be strongly competitive which does not necessarily encourage the collaboration goals of QWMN. Other comments from respondents included:

- A number of projects are co-invested particularly where state funds are concerned (DES in particular in relation to recent reef tenders). DNRME has also been looking for co-invest opportunities and has a potential one in the pipeline for consideration. Doing more of this and seeking external partners or grants (e.g. ARC) would be great.
- Generally, opportunities for collaboration and co-investment have been well pursued, occasionally with some encouragement and tactical use of networks.
- The co-investment provided is expressed often as in-kind contributions from the University and private sector into the R&D supported by the QWMN and through support for the various network interactions and activities.
- The QWMN Innovation Associates Program has, with a small government investment, drawn in much larger co-investment from universities in the form of scholarships as well as significant in-kind investment from industry partners.

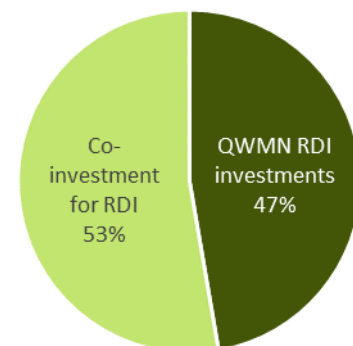


Figure 4. Co-investment versus QWMN investment for RDI projects

Increased application of water modelling to inform decision-making

There are two key aspects to consider when assessing whether the QWMN has led to increased application of water modelling to inform decision making. The first is whether the modelling practitioners are accessing and adopting the results of the RDI projects in their modelling work that may then influence decision-making. The second is whether decision makers are more likely to apply water modelling outputs in their decision making. See Box 1 for the definition of “decision-maker” that has been adopted by the QWMN.

Box 1: Who are decision makers?

The QWMN Skills and Knowledge Audit defines decision makers as: “A group of professionals, mainly from government organisations, that use the results/outputs from models to inform environmental management decisions or policy development. This group possesses a good knowledge of the regulatory frameworks that are relevant to a range of water related activities. Traditionally professionals in this group have also had past experience as model drivers (sometimes in fields outside of the water modelling field) and/or a sound knowledge of the generic modelling process... individuals in this role do not have any direct experience in any of the other modelling roles and are increasingly relying on model communicators and/or problem formulators to interpret model-derived information and place it in context of decision making frameworks.

There is evidence that the modelling community are accessing the RDI research outputs. From July 2018 to January 2020, the DES QWMN website averaged 76 unique page views per month of the projects page and 62 unique page views per month of the publications page (Figure 5). The setup of the QWMN-specific webpage (watermodelling.org) in August 2019, led to a rapid increase in interest and this page has been averaging 268 page views a month. The interest in both websites has led to 796 RDI project report downloads over a 19-month period to January 2020 (Figure 6). The release of the “Critical review of climate change and water modelling in Queensland” report in December 2019 led to a large increase in downloads over December 2019 and January 2020.

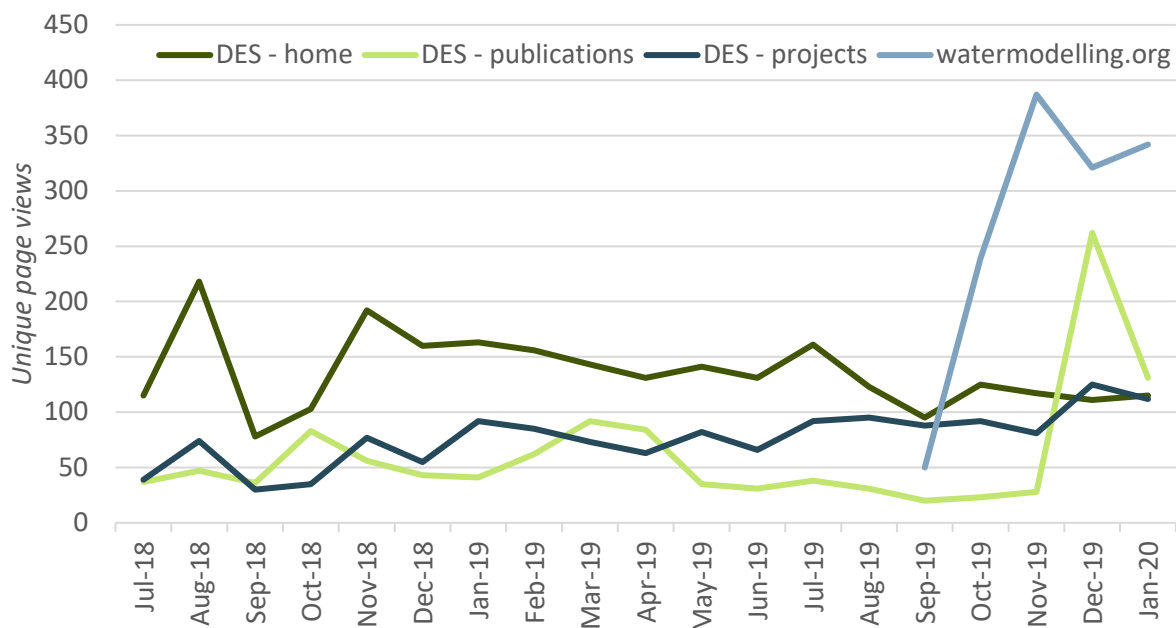


Figure 5. Unique page views per month of the DES QWMN and watermodelling.org websites (source: google analytics)

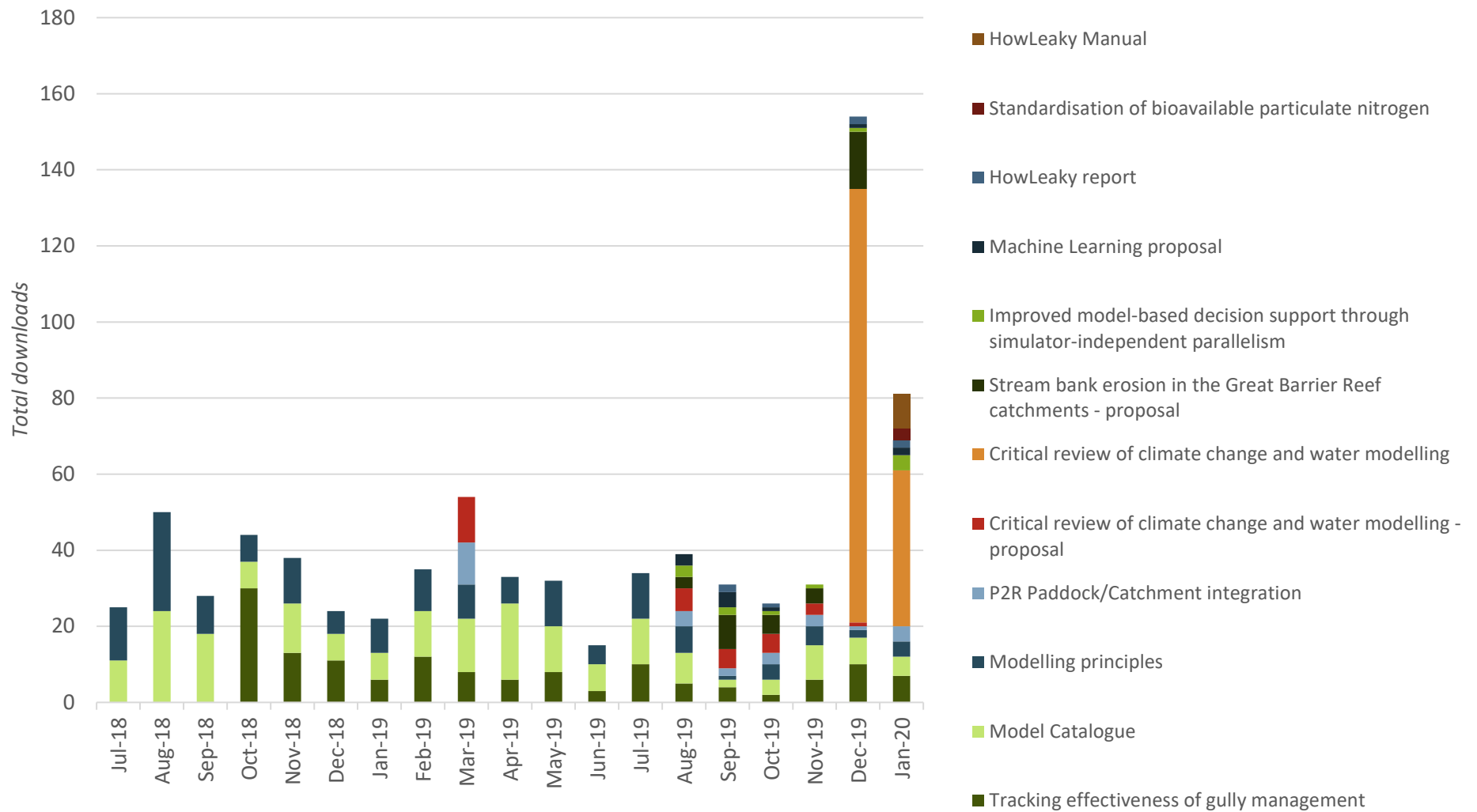


Figure 6. Unique RDI report downloads from the DES QWMN website (source: google analytics provided by DES)

As further evidence that the QLD water modelling community are accessing and adopting the RDI research outputs, 69% (n=10) of survey respondents who answered this question agreed or strongly agreed that the findings of QWMN funded projects had influenced their work. Several explanations were put forward on how this has occurred including: i) direct adoption of research findings; ii) direct use of recommendations and standards; iii) improved technical understanding of key modelling issues; iv) use of newly developed or refined water modelling tools; vi) leveraging of funding and new collaborators; vii) direct funding for work; viii) opportunities to engage with the authors of RDI research; and ix) opportunities to engage with and better understand the needs of government.

The adoption of QWMN project results is occurring across government, academia and the private sector. For example, one government representative stated that the QWMN climate modelling review had provided guidance on how to consistently handle climate change scenarios which they were then using in their current climate change scenario modelling work. A private sector representative revealed that their company had adopted an improved model parallelization approach developed through a QWMN RDI project.

In undertaking RDI Projects, the QWMN is taking several measures to improve application of water modelling to inform decision-making. These steps include: i) strong government engagement in the selection of RDI projects; ii) QWMN Secretariat support for the Fellow to engage within government on model requirements, data collection and model development (see Box 2 for more detail); iii) requirement for the Innovation Associates to work with end user organisations in industry and government to conduct targeted research that directly meets current decision-making; and iv) targeting of government engagement in External Engagement Program activities. As a result of these government engagement efforts, 70% (n=7) of government respondents to the survey (including decision makers) agreed or strongly agreed that the QWMN is improving application of water modelling to inform decision-making.

As an example of a QWMN project that is informing decision making, DES has reported that the “Critical review of climate change and water modelling in Queensland” report has sparked interest in several government agencies (e.g. QLD Department of Agriculture and Fisheries, SEQwater and the Bureau of Meteorology). The Climate Change and Sustainable Futures division in DES has integrated the climate priorities outlined in the report into their science plan which will shape how the division develops policy and planning in response to climate change. In addition, a SEQwater representative indicated that they had used the report to provide evidence and justification in their work.

Comments from government and other respondents included:

- *There is a current QWMN project that is focused on communicating model outputs to decision makers.*
- *Feedback from users and decision makers has generally been very positive.*
- *There is a strong discipline of assessing the benefit of investment for the end user including for tools that support policy makers. The diversity within the governance arrangement helps to foster that connection through to decision maker.*
- *There have been activities around this but there should be a mechanism for evaluation, providing independence for the project leaders, and on-going support.*
- *There are at least two water quality projects that are firmly directed at water modelling to inform decision making.*
- *The modelling pipeline is now more routinely used and there is a greater awareness of resources available (e.g., climate change data) that can complement water modelling applications.*
- *The QWMN EEP program (through the Innovation Associates program) has brought together 5 universities with 5 end-user organisations in industry and government to conduct targeted research that directly meets current decision-making needs while also developing PhD-level capability for the future.*
- *The private sector is being given opportunities to engage with and better understand the requirements of government, and therefore will be better positioned to deliver modelling that meets their needs.*

Box 2: The QWMN Fellow

Gully erosion is a primary contributor of sediment reaching the Great Barrier Reef (GBR). In response to this critical Queensland Government priority, the QWMN has funded several projects investigating the issue. A key initial study identified the need to improve process-based gully erosion models as the current models don't allow the user to investigate the impact of possible interventions.

Following a competitive recruitment process, the inaugural QWMN Fellow was appointed in early 2018, based in the Australian Rivers Institute at Griffith University. Following a collaborative process to identify the research theme, the three-year fellowship is focused on developing novel mathematical models of gully erosion in Great Barrier Reef catchments. The intended outcome of the research is to target on-ground interventions in a bid to reduce sediment runoff to the Great Barrier Reef.

Salary and expenses for the Fellow is being covered over three years. The Fellow's work can be divided into three key elements: i) development of the new modelling tools; ii) engagement with government; and iii) engagement with the broader water modelling sector in Queensland. Key outputs will include the model itself which will be supported by a manual. In addition, the development of the model will be documented in journal papers, presentations at national and international conferences and, if successful, the *Scientific Consensus Statement for the Great Barrier Reef*.

Key initial successes include the presentation of the modelling approach and national and international conferences, publication of journal articles, good engagement with government through spending one day a week based at DES, and strong engagement with the broader modelling sector through the External Engagement Program.

The engagement with government is particularly critical to ensuring the model is adopted. The Fellow spends one day a week at DES which enables close engagement with the intended end users of the model being developed. This assists the Fellow in obtaining information to inform the model development, so it aligns with government needs – e.g. key soil parameters used by the Queensland Government – and also engages the intended end users in the development of the model which should lead to improved buy-in to the final product.

The Fellowship is just over midway through and therefore concrete outcomes are hard to identify at this stage. That said, strong groundwork has been laid for substantial achievement of the goals of the QWMN.

4.2 Sector scale capacity development program

Objectives

The following goals are assessed under this program stream:

- Built a state-wide network with national influence to deliver transformative change; and
- Championed a community of practice to leverage expertise.

Activities

The sector-scale capacity development program is being delivered in two key parts. The first is the efforts of the QWMN Secretariat to engage Queensland Government personnel. This has been completed through formal and informal meetings to bring together modelers and policy makers within government as well as engaging a broad range of government counterparts in the formal governance processes of the QWMN.

Secondly, following discussions in 2017 within the QWMN Core Group and with broader QWMN stakeholders, an increased focus has been placed on external engagement, its delivery and its objectives. Subsequently a two-year contract to a consortium of university and other partners was awarded in June 2018 to address a range of external engagement and capacity building initiatives. The External Engagement Program (EEP) is being delivered through a consortium of Queensland based research institutions (Australian Institute of Marine

Science, Griffith University, Queensland University of Technology, The University of Queensland, and the University of Southern Queensland) led by the International WaterCentre.

Activities delivered by the EEP to date include:

- Delivered a mentoring program run across five universities.
- Established an Innovation Associates program (an industrial PhD approach) including a call for proposals; workshopping and selection of five research programs with Associates linked with industry as well as government representatives; Innovation Program kick-off event; and ongoing support to the Associates.
- Convened a two-day Hack event (see Box 3 for further detail).
- Undertook a skills and knowledge audit through more than 25 skills and knowledge audit interviews; and convening of a Working Group to respond to the skills and knowledge audit report.
- Initiated a website and monthly newsletter.

In addition, the EEP has run a range of water modelling events including:

- A Community of Practice (CoP) design workshop.
- A QWMN Forum in 2017, 2018 and 2020.
- A Young Water Professionals skills and career CoP event.
- An urban water and regional water management CoP event.
- A landscape restoration CoP event.
- A physical modelling and coastal processes CoP event.
- A skills and knowledge audit response CoP event.
- A climate change CoP event.
- A climate data CoP event.
- A Forum event for the QWMN sister program in NSW.

Box 3: The QWMN hackathon (edited from the watermodelling.org website)

A hackathon event aims to bring together experts to rapidly come up with solutions to a problem. The low fidelity/prototype solution, the hack, needs to be viable and robust, but does not need to be a fully functional product.

A pilot QWMN Hackathon took place on 5 and 6 July 2019 at the University of Southern Queensland (USQ). Twenty professional and aspiring water modellers formed teams to generate ideas on addressing the theme of ‘connecting and integrating water, energy and landscapes to create value for our communities’.

For the QWMN Hackathon the theme was set as follows: *“The year is 2029. Queensland is in the grip of extreme climatic uncertainty, with severe drought in some areas and flooding in others. Despite these challenges, through a greater understanding of the connectedness and integration of water, energy and landscapes and their value for our communities, the state’s economy and communities are thriving in the face of this adversity. Your hack is something that you initiated in 2019 and which has underpinned this success.”*

The first day started off with scene setting presentations. This included discussions on water security, energy security and ecological security. Following a short team building activity, the group was left to form teams and begin the hacking. After a few hours, teams had begun to form and ideas begun to be generated. The rest of the first day solidified the teams and ideas, which then progressed to adding details and designing prototypes.

Day two involved finalising the prototypes and the teams writing their submission to the judging panel. They also created a short three-minute film to effectively communicate their ideas.

An Expert Panel selected *Team Mirror* as the winning QWMN Hack team. The winning idea aimed to bring together available data sets to enable provision of new environmental services to citizens.

Achievements, efficiency and effectiveness

The EEP has developed and is reporting against its own Monitoring and Evaluation Framework that delves into greater detail on the logic and intended outcomes of each of its activities. In this general assessment, we draw on the results of this finer detailed analysis, but aim to report at a higher level with a focus on the two QWMN goals that most closely align with this program stream: built a state-wide network with national influence to deliver transformative change; and championed a community of practice to leverage expertise. It should be noted that the activities undertaken by the Secretariat and the EEP under this program stream also contribute to the goal of fostering integrated and scalable modelling to address water risks and opportunities, sometimes directly (e.g. the Innovation Associates) and sometimes indirectly (e.g. the Forums and Hackathon).

For the purposes of this general assessment, we have drawn on the following definitions¹:

- A **network** refers to a set of relationships, personal interactions, and connections among participants who network have personal reasons to connect.
- A **community** refers to the development of a shared identity around a topic or set of challenges. It represents a collective intention to steward a domain of knowledge and to sustain learning about it.

Build a state-wide network with national influence to deliver transformative change

The QWMN has been successful in building a state-wide network and is laying the foundation for national influence to deliver transformative change. 76% (n=13) of survey respondents who responded to this question agreed or strongly agreed that the QWMN is building a state-wide network with national influence and 80% (n=12) agreed or strongly agreed that they felt part of a network connecting water modelling professionals, users and decision makers.

This network gives us the time and opportunity to engage with each other, see what's happening, share experiences and knowledge (quote from interviewee)

Despite the strong agreement that the QWMN is building a state-wide network, there were areas identified where this could be strengthened. Several respondents suggested that the network is South East Queensland focussed. For example, attendees of the CoP events have largely been Brisbane based. In addition, several respondents felt that whilst there was strong buy-in from state government, there could be greater representation of utilities, councils and local government. Finally, a small number of respondents felt that their specific technical area was not being well engaged through the network (e.g. flood modelling and ecology).

Further comments from survey respondents in relation to establishment of a state-wide network include:

- *Although I don't often attend events - the network is there and I know I can call on it if required.*
- *I have attended a number of CoP events, and identify strongly with being a member of the QWMN. I see this as my professional community, that will shape and inform my research. I value being connected to a Network that is not "university" focussed, but explicitly builds to connect water modelling professionals across sectors (and silos).*
- *EEP functions and the annual Forums have been very successful, engaging and rewarding to participate in.*
- *I am seeing the role the QWMN plays in my work much more clearly now and I am therefore able to see how I can assist through promotion of the network, disseminating the outputs of QWMN investment, encouraging attendance at the annual forum and connecting QWMN with opportunities to promote its work in government.*
- *The opportunities for engagement with other professionals have been greatly received.*
- *I don't feel exceptionally engaged partly because it is unclear why certain areas in the modelling domain are being funded and prioritized over others.*
- *This is perhaps one of the things I am most enjoying about the QWMN. It is providing different events for the community to come together and discuss issues related to their views on model effectiveness to deal with water-related issues in QLD at a time of fast change in technology.*

¹ Wenger et al (2011) Promoting and assessing value creation in communities and networks: a conceptual framework. Open Universiteit, Netherlands.

- *There was nothing available before the QWMN and it now provides leadership*
- *Good connections are being made however the network still requires support to ensure continued progress and implementation of outputs.*
- *QWMN is starting to tackle some broad reaching themes that straddle public, private and academic sectors. Strategic projects such as the climate change review are good ways to tackle issues that help across sectors but in doing so also promote the QWMN as a group that drives collaboration and innovation.*
- *The network has engaged with government, industry and university sectors within the state and nationally.*
- *Transformative change is occurring through strategic and collaborative engagement and ensuing project identification and capacity building*
- *Annual symposium useful for bringing researchers together annually. Regular events also useful for specific areas of modelling. Innovation Associates is excellent initiative.*
- *At present it is underpinning change in the modelling associated with QLD government requirements and provides very good involvement of QLD modelling and end user community.*

To consider the successful development of the network in more detail, it is useful to consider two key types of connections being developed: i) academia and private sector to government; and ii) younger water modelling professionals to more established professionals.

The biggest success has been bringing a bunch of stakeholders together who usually don't talk to each other (quote from interviewee)

Experts from academia and the private sector are connecting more closely with government counterparts through a range of QWMN activities including: events (CoPs, forums, hackathon); RDI projects; mentoring program; Innovation Associates; and the Fellowship.

For example, government participants (local, state, federal and utilities) averaged 36% of participants at CoP events with the remainder being private sector and academia (research and education). The Steering Group for each RDI project is comprised primarily of government representatives. The Innovation and Associates and Fellow are supported to meet regularly with key agencies in government that may benefit from their research. These engagements are particularly strong within the QWMN due to senior people in government, universities, private sector and not for profit, who are consistently involved.

The primary benefit of better connecting the private and research sector with government is that it's analogous to connecting the modelling practitioners to the end users or decision makers (noting that there are also model practitioners within government). These connections lead to a better understanding of the end-user / decision making requirements; identify emerging issues for the decision makers; increase likelihood of adoption of modelling results as the end users better understand or have had input to model development and data collection; and create more open communication channels between modellers and end users.

Younger water modelling professionals are connecting with more established professionals through the mentoring program; events (CoPs, forums); Innovation Associates program and by working on RDI projects. For example, the mentoring program was initially run with four Griffith University student mentees, one DRNME mentee and two DNRME mentors. The program was built around developing skills in hydrological model set up and using SOURCE applied to real catchments but also emphasised career development support.

The primary benefits of better connecting younger water modelling professionals with more established professionals is promoting the sector as a career option and building the capacity of future water modelling experts. For example, due to the mentoring program, the four student mentees indicated they were more interested in pursuing water modelling jobs and have personal connections to DNRME and to specific mentors. The program has been expanded to James Cook University where similar results are expected.

As noted in the mid-term review, the intention of the QWMN is to develop a state-wide network in the first phase and look to establish national influence in the second phase of funding. While the QWMN is establishing a state-wide network, the extent to which it is having national influence is not as apparent. That said, the network is beginning to lay the foundations for national influence through several pathways:

- **Wider application of research:** Much of the modelling research, particularly that related to model development and improvement, will be applicable outside of Queensland. For example, the gully erosion model being developed by the QWMN Fellow is process-based which means it will likely be able to be used across Australia and potentially internationally.
- **Piloting the water modelling network model:** When the QWMN began, there was no other state water modelling network in Australia. If proven to be an effective model the approach could be adopted by other states or broadened into a national network. For example, New South Wales has established the Monitoring and Modelling Hub (MaMH) which is based on the QWMN. There are strong links and information sharing between QWMN and the MaMH – e.g. shared collaborative session at MODSIM 2019.
- **Involving experts from other states in the QWMN:** As no other similar network existed in Australia, practitioners from other states have begun attending and benefitting from QWMN events. RDI projects have also included modelling experts from other states where they are part of a research consortium (e.g. University of Western Australia) or where there is a shared R&D interest (e.g. groundwater).

Championed a community of practice to leverage expertise

It generally takes up to two years for a Community of Practice (CoP) to be established. With the establishment of the EEP occurring in late 2018, it is too early to confirm whether a CoP has been formed. Progress is clearly being made as 75% (n=12) of survey respondents who responded to this question agreed or strongly agreed that the QWMN is championing a CoP to leverage expertise, foster collaborations and enhance capacity. To further understand the extent to which the groundwork for a CoP is being established, this general assessment

This is the first time I came across a government-led initiative to bring together the entire modelling community (as much as practicable) to effectively drive the future of water modelling... (survey respondent)

looks at the three key elements of a Community of Practice²: i) domain (a learning need or theme); ii) community (the bringing together of different stakeholders); and iii) practice (how the interactions produce resources that change practice).

The domain focus of the CoP is improving water modelling in Queensland and its application in decision making. Reflecting the broad nature of this theme, the EEP has held several CoP events on more focussed topics such as career development, urban water and regional water management; landscape restoration; physical modelling and coastal processes; and climate change and climate data.

Some interview and survey respondents suggested that the theme is too broad and needs to be sharpened for an ongoing CoP to be established. During the 2020 QWMN Forum, participants proposed the creation of small and/or short-lived working groups around highly focused topics.

In terms of the formation of a community, there has been at least 20 participants and up to almost 90 participants at each of the CoP events (Figure 7). The events bring together a good mix of private sector, academia and government (Figure 7). The varying size of attendance likely reflects the interest in each topic but may also be due to factors outside of the organisers control. The regular CoP events are supported by an annual forum which had 110 participants in 2018 (an approximately 45% increase since the 2017 forum despite the introduction of registration fee). 94% of the 2018 forum attendees rated it as a good to excellent event.

Increasing engagement through the website (see Figure 5) is further evidence of an establishing community. In addition, between October 2018 and May 2019, the number of people registered to receive update emails through the EEP increased by 428% (from 131 to 561). If a CoP continues to form over the next years, then event, online and external event engagement would be expected to continue to increase.

In terms of practice, the QWMN has supported the development of best practice guidelines and catalogues of models in use which have been discussed in CoP events. A skill and knowledge audit has been undertaken and informed discussion at a CoP event. A website has been set up for the QWMN to enable sharing of best practice guidelines and results of QWMN funded projects.

² Wenger-Trayner, E and Wenger-Trayner, B (2015) Communities of practice: a brief introduction.

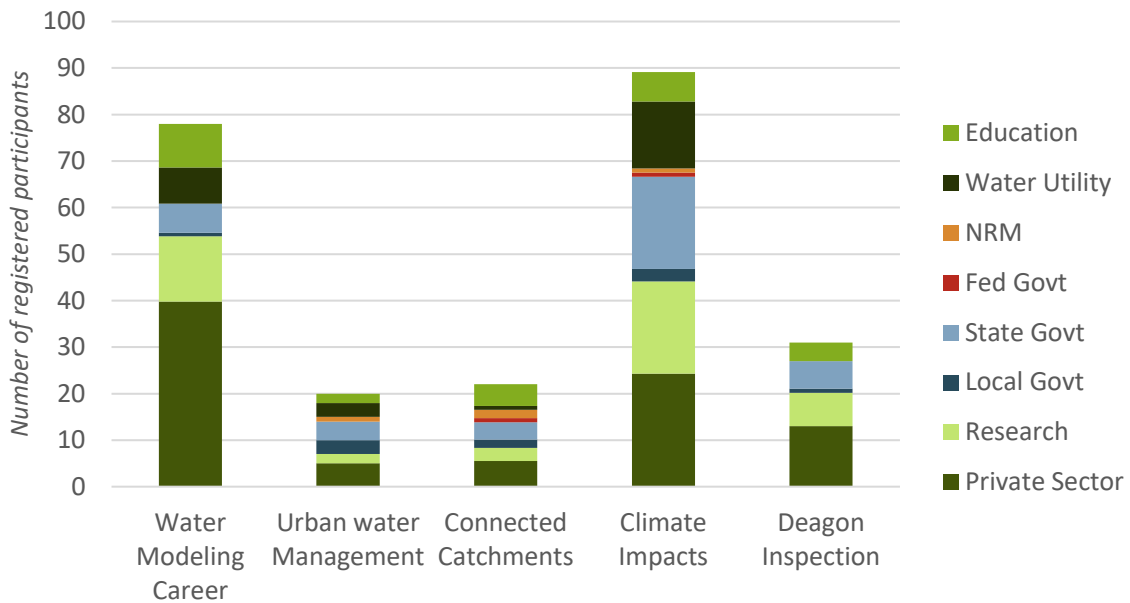


Figure 7. Number of registered participants at CoP events

4.3 Governance

Objectives

The governance stream does not have associated QWMN Goals to shape its objectives. Rather, effective and efficient governance is critical to the overall delivery of the program. The objective of this delivery stream is therefore assumed to be governing the QWMN efficiently and effectively, so it achieves its intended outcomes and creates the basis for an ongoing supported program of the QLD Government.

Activities

Largely driven by the QWMN Secretariat, a range of activities have been undertaken under the governance stream. Key activities include: i) establishing and implementing a governance structure; ii) developing and maintaining a process for project selection and procurement (RDI, Fellow and Innovation Associates); iii) oversight of project delivery; iv) the commissioning and response to a mid-term review; and v) management of the EEP program (contracted to IWC).

The QWMN has established a clear governance structure that includes representatives from DES and DRNME as well as three external experts and an external observer (see Figure 8 and further detailed in Annex F). The number and focus of the Technical Working Groups (TWG) has evolved with the initial five groups being reduced to three (Model Improvement and Model Integration TWGs merged; Building Model Capacity and Uptake TWG and Communication and Engagement TWG discontinued (roles taken over by the EEP)).

The Core Group and Steering Panel have met quarterly since the initiation of the program (except for one quarter missed by the Core Group). Whilst the original intention of the TWGs was to use formal meetings to initiate proposals, coordinate work and review technical outputs, the approach and role has evolved. The TWGs now focus on providing technical advice on the evaluation of tenders; review and sign off by email on funding proposals; and involvement on project steering groups. As most of this doesn't require a formal meeting, the TWGs have not been meeting regularly.

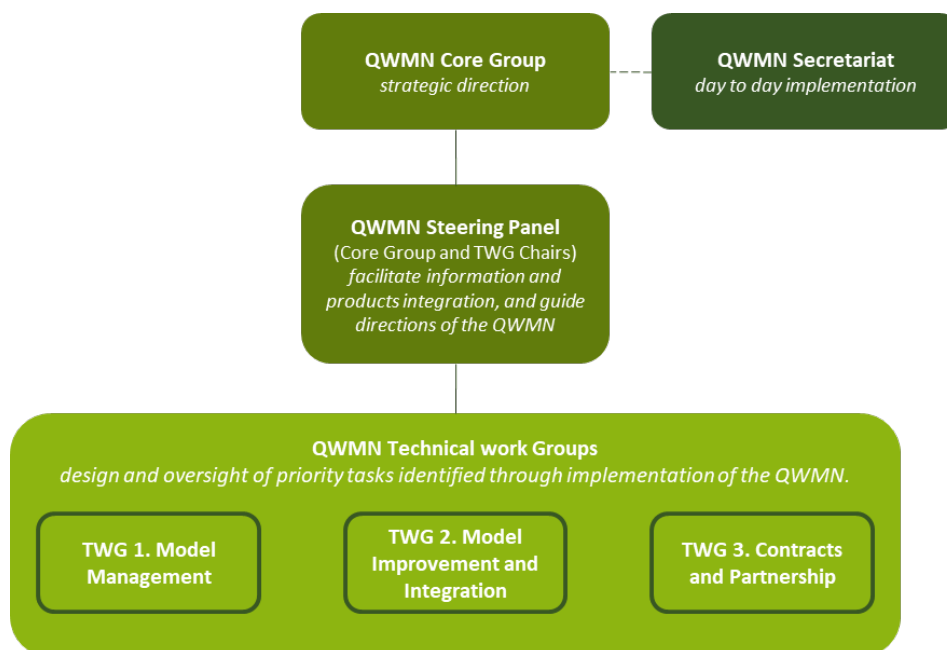


Figure 8: The current QWMN governance structure

In 2019, the QWMN Secretariat, with support from the procurement team within DES, developed and ran a two-stage tender process for selection of RDI projects (in line with QLD Government procurement requirements). The first stage was an open call for call for Expressions of Interest against “challenge statements” (descriptions of issues which the proposed projects need to address). The submitted Expressions of Interest were then shortlisted and those ranked as competitive by the relevant TWG invited to submit a full proposal. These full proposals were then assessed by the relevant TWG and the highest ranked proposals contracted for implementation. The Secretariat continues to monitor and support the project implementation through to project closure.

A mid-term review of the QWMN was commissioned in mid-2018 to assess alignment of activities and objectives as well as provide recommendations on improving uptake and impact. The review found that *“overall, the QWMN has started reasonably well – the current investment activities have yielded positive results, there is the start of a “community of interest”, and the organization, while lean, has been shown to be efficient and has shown a willingness to adapt to feedback and changing pressures.”* The review made four key recommendations. These are summarised in Table 4-1 along with a summary of the QWMN’s responses led by the Secretariat.

Table 4-1. Mid-term review recommendations and responses

Recommendation	Response
RDI investments should be more strategic and less opportunistic	RDI Strategy developed and released in late 2018
Governance structure of the QWMN should be modified to reflect the greater focus on external engagement, strategic investment and dissemination of QWMN outputs	Governance structure changed by: i) altering the TWG focuses; and ii) inviting EEP observer on to the Steering Panel
Large investments into the Research Fellowship and the External Engagement Program mean that special attention needs to be paid to their delivering the agreed outputs and to the appropriate integration of their activities with the relevant government agencies. Assessing the impact of individual activities	M&E of the EEP program has been undertaken on an ongoing basis with annual report. Evaluation of the overall EEP is being undertaken as part of this report, and also through the specific EEP M&E Framework

Recommendation	Response
within the EEP (e.g. workshops, training activities, etc.) should occur on an ongoing basis so that improvements can be introduced into the program.	
There needs to be an increased emphasis on demonstrating the role of and the value of water models in developing and implementing or maintaining effective policy and management positions	No specific response identified

Achievements, efficiency and effectiveness

The Queensland Government Program Evaluation Guidelines outline three key factors to consider when evaluating whether a program has been governed successfully:

- Implemented on schedule and on budget
- Delivered the agreed outputs, at an acceptable quality, to the agreed audience
- Met the requirements of stakeholders.

The program has been delivered reasonably on schedule and on budget. Analysis of the allocated versus actual budget by program stream shows a lower than expected budget percentage being expended on RDI with a corresponding increase in the capacity and capability stream (likely due to the addition of the EEP) and slight increase in the governance stream. The overall split is 68% on RDI, 23% on capability and capacity and 19% on governance. It is noted that actual expenditure in 2016/17 was well below budget because the expenditure did not begin in earnest until the appointment of the Program Manager in February 2017 (meaning only a partial financial year for expenditure).

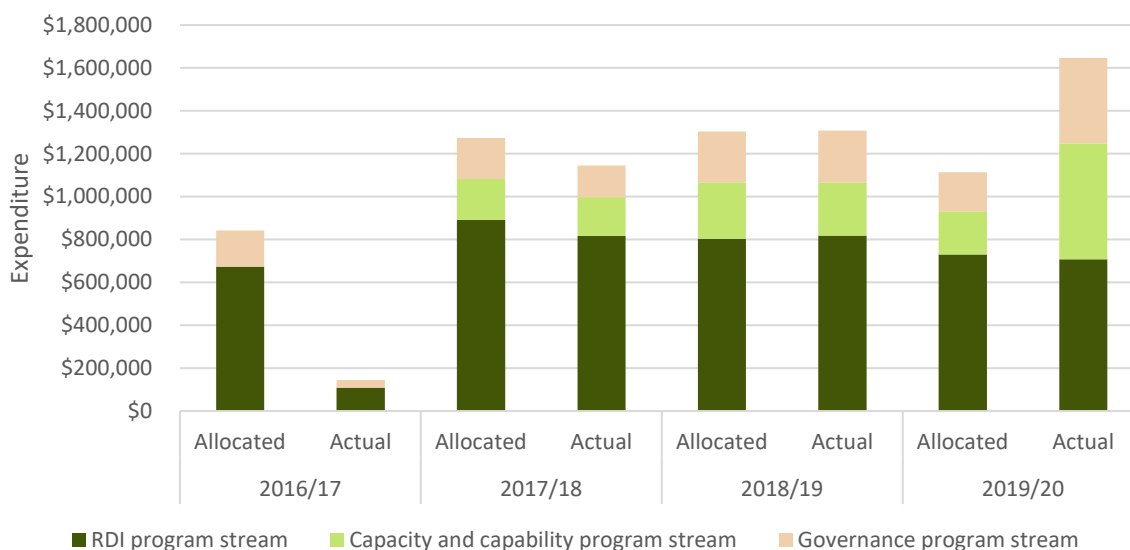


Figure 9: QWMN allocated versus actual expenditure

Assessment of whether the agreed outputs have been delivered, at an acceptable quality, to the agreed audience has been covered in Sections 4.1 *Research development and innovation investments*, and Section 4.2 *Sector scale capacity development program*. In summary, the outputs have generally been delivered at a good quality and are beginning to lead to achievements of impacts and outcomes.

To understand whether the program has met the requirements of stakeholders, it is useful to reflect on the survey and interview results. Most respondents who had taken part in an RDI project indicated that the QWMN

Secretariat administration of the project had met or exceeded expectations. The same response was received for the management of EEP activities and for the Secretariat's management of governance of the program.

Specific comments in relation to administration of RDI projects included:

- *They keep everyone on track and ensure intent of the project is achieved.*
- *Prompt and efficient project administration and easy and timely access to support / admin staff when needed.*
- *Follow-up has been excellent to ensure that work is on track, and where changes have been necessary (it is research after all) these have been actively discussed and collaboratively dealt with.*
- *The secretariat takes great care in procuring and contract managing projects. This helps to deliver quality outcomes.*
- *The key people in the secretariat provide exceptional service and advice.*
- *I have been involved in three RDI projects. Always the relationship with the Secretariat has been timely, very positive and helpful.*
- *Sometimes I feel the deadline to put the proposals in are a bit tight. We do get them in, but it'd be nice if they were more generous with timelines to put proposals in or more planned.*
- *Sometimes the tenders that come out at very short notice and often not at good times for academics to be able to respond.*

Specific comments in relation to management of EEP activities included:

- *Appeared to be organised by social scientists and not modellers, so emphasis more on the “woo woo” and less on the numeric. Not such a bad thing for modellers to experience.*
- *I have found all activities to be well organised and productive events.*
- *Generally, there have been both relevant, high quality and interesting technical inputs and good networking opportunities.*
- *The program has been well managed and there has been useful follow up from the events.*
- *Activities were professionally conducted and provided good opportunities for interaction.*
- *Connection with industry, mentoring and Innovation Associate catch-ups are developing a great cohort structure and likely increasing the outcomes including the probability of successful PhD completions.*
- *In general, sessions I was involved in were enjoyable and a good opportunity to network.*

Specific comments in relation to Secretariat management of QWMN governance included:

- *Ongoing and regular engagement with oversight groups.*
- *Generally, there has been very good administration of agendas, papers, minutes, follow up actions etc. There have been some timing and discussion time challenges and overlaps in Core group and Steering group considerations.*
- *The secretariat and support for the QWMN punches above its weight. It is a small but committed team. The framework of a steering committee and a separate technical body is a great way of separating the detail from the strategic oversight so that the vision of the QWMN is tackled from both angles.*
- *The support for the Steering panel and subgroups has been exceptional.*
- *The Secretariat have been strongly engaged throughout.*

Perhaps the strongest evidence that the program is meeting the requirements of key stakeholders is the recent confirmation that a second four-year phase of the program will be funded without any major changes to the program objectives and structure.

5 Emerging issues influencing the network

Through the literature review, survey and interviews, a range of emerging issues have been identified that may influence future operations of the network.

5.1 Modelling approaches

Climate change and extreme events:

Model capability and modellers' capacity to integrate climate change and extreme weather events into modelling scenarios will become increasingly important. This includes understanding resilience to drought and extreme events as well as the effect of bushfire on water quality and hydrology. Capacity and capability also need to link beyond hydrological modelling to include social, economic and environmental models.

Dealing with uncertainty:

Dealing with uncertainty in water resources modelling and decision making is becoming more critical with the emergence of climate change and other factors. The technical skills for properly dealing with uncertainty are not currently widespread within the state and nationally.

Continued emergence of big data:

With the emergence of the Internet of Things (IoT) and advances in micro-sensors, there is going to be much more data collected in the future that could be used to improve modelling. It will be important for water resource models as well as modelling practitioners to be capable of handling these increased levels of data and trying to make sense of it. The interlinkages between monitoring and modelling are critical and also influence how decision-makers trust modelling.

Growing skills and knowledge:

The recently completed skills and knowledge audit undertaken under the EEP showed a need to better develop the programming, data analysis and visualisation/communication capacity of the state's water modelling workforce – particularly for working with big data.

5.2 Cultural

Sector succession planning:

The recently completed skills and knowledge audit showed a need to improve the sector's approach to succession planning and knowledge transfer in the modelling workforce – particularly in government and research/higher education organisations.

Networks for solving complex issues:

Networks are becoming an increasingly effective way to solve complex issues and cross organisational implementation programs. The QWMN can assist the modelling community to develop and maintain a *decentralised* network of modellers and model users to collaboratively solve the complex and cross organisational challenges of the future.

Public trust:

Public belief and trust in modelling predictions will be critical in the future as modelling is further adopted to inform decision-making and therefore is further thrust into the public arena.

Consideration of cultural water in modelling:

The concept of cultural water – flows managed by First Nations to improve the spiritual, cultural, environmental, social and economic conditions of the Nations – has begun to be properly considered in water resources planning. In the future, modelling approaches will need to be developed to integrate cultural flows into modelling and decision-making processes.

5.3 Operational

Sustainability of funding for the network:

With changing government and public priorities, the network needs to begin to think about sustainability to ensure ongoing funding for maintaining the community being established. This may include accessing funding outside of the Queensland Government – for example through membership costs or federal funding such as Australian Research Council Linkage Projects.

The National Hydrological Modelling Platform:

The future of the National Hydrological Modelling Platform (as realised through the eWater Source software) and how the QWMN is linked to the platform may influence the shape and focus of the network in the future.

6 Lessons learned and recommendations for future operation of the QWMN

Several lessons learned and recommendations have been identified for the QWMN whilst undertaking this general assessment.

6.1 Research, development and innovation

Importance of communication of RDI results:

Whilst useful research is being undertaken and the modelling community is accessing the findings, the adoption of this research is crucial to the QWMN's success and therefore more work can be done to ensure broad awareness and access by the Queensland modelling community and more widely. Opportunities for greater outreach on the results of RDI projects include: requirement of a communication and adoption plan to be developed by all RDI projects; improved integration with EEP events; and supporting attendance at conference (state and national) for presentations of results.

Importance of linking to decision makers

There is good groundwork being established to increase the use of modelling results in decision making, and evidence of this occurring. As this is a critical consideration for the funders of the QWMN, further emphasis could be placed on ensuring it occurs. This could include requiring all projects to receive sign-off by the intended end-user; or to present their findings and policy implications to a forum of relevant Government agencies.

Open and transparent RDI priorities

With the publishing of the RDI Strategy (2018-2020) the QWMN has been open and transparent about its RDI priorities and how they are selected. The development and release of the next Strategy will be critical and could take a more open and consultative prioritisation process to ensure that all stakeholders feel they have had an opportunity to put their case forward.

Getting the right balance between RDI priorities

Funded RDI projects have tended to focus on a small number of the identified RDI priorities (e.g. the Great Barrier Reef Catchments; or the eWater Source, medli and HowLeaky models). Either a more balanced funding across the priorities should be considered, or alternatively given the limited resources available the next RDI Strategy could provide comment on the intended balance, or provide a much sharper focus. Improvements in scoping of projects along underinvested themes would assist QWMN in both getting the investment in those areas but also draw relevant modelling providers and users into the network more strongly.

Private funding partnership for a flagship project for transformative change:

Co-funding to date has predominantly been from other government agencies or universities. To further leverage its limited funding, the QWMN could explore opportunities for partnering with the private sector for co-funding. Such an arrangement could enable the QWMN to identify a flagship project that creates a step change in innovation to assist with a big water resource management issue.

6.2 Capacity and capability

Building a community takes time

The QWMN is laying the groundwork for a lasting community, yet the network still in its infancy. A continued focus on developing and fostering the community will be needed throughout Phase 2 to ensure the network continues to be established as a trusted place for seeking collaboration as well as technical and capacity building advice.

Supporting researchers at different stages creates broad-based impact and support

The QWMN has been supporting researchers at various stages of their career from undergraduates (mentoring program), PhD candidates (Innovation Associates) and post-graduates (Fellowship). By ensuring that multiple levels of experience are being supported, and growing interest in water resources modelling at all these levels, the QWMN is facilitating both a short term and long term impact on the human resources of the sector.

Keeping the CoP focussed

CoP tend to be successful when they are focussed on a topic that has a broad range of interest. Whilst the EEP has had success in building the groundwork for a CoP, some respondents raised concern that water modelling as a topic was too broad. Others suggested a more fluid CoP model where specific CoPs are encouraged to develop and fade away as specific demands arise and are dealt with. It is recommended that the QWMN undertake a review of the CoP to identify where its focus should be moving forward.

Continued funding for an External Engagement Program

Over the past two years the EEP has had success in bringing together a network and community. To further consolidate this progress, a version of the EEP should continue to be funded under Phase 2 of the QWMN.

Importance of the annual forum

QWMN stakeholders see the annual forum as a great networking and knowledge sharing opportunity. This has strongly contributed to the sense of network and community formation. The forum should therefore continue to be supported through Phase 2.

6.3 Governance

Continued commitment to program evaluation and review

The QWMN has shown a commitment to review, evaluation and improvement of the program. For example, the mid-term review assisted the network to refocus and stay on track. This should be continued through phase 2 and the M&E framework being developed will provide a more coherent and consistent structure for this to happen. To assist with future progress reporting the M&E Framework needs to ensure that project impacts are tracked – for example. Projects that are improving the application of models in decision making.

Advance warning of key tender dates

Several survey and interview respondents requested more advance warning of key tender dates and more time for tender responses. The tight timelines can make it very difficult for top quality responses to be developed and submitted, especially if they happen to clash with other key events (e.g. large grant deadlines or exam marking). If possible, within the Queensland Government procurement requirements, then the Secretariat should seek to address this request.

Update of governance structure for Phase 2

Over the past few years the governance structure has evolved, for example the number and name of TWGs as well as their responsibilities has changed. This is not necessarily a problem in itself, and shows the flexibility of the governance framework to best deliver the program, but should be formally documented as part of initiation of Phase 2.

Clarify the need and approach for “national influence for transformative change”

The QWMN is establishing a state-wide network but the progress for national influence is less clear. It is recommended that the QWMN clarify whether there is a need for national influence and if so then what the purpose is and what is the strategy to achieve it.

Broader sector representation in the TWGs

With the widening focus of the RDI projects from government priorities to broader sector priorities and a greater focus on broader sector engagement, consideration should be given to broadening the departmental and wider sector representation in the governance structure, particularly the TWGs or Steering Panel (recognising the need to balance this with potential conflicts of interest). This may lead to broader interest and engagement in the program. A broader basis of support will assist in ensuring sustainability of the program.

Clarifying the objective of the governance stream

If governance is to be considered a distinct program stream, particularly within the M&E Framework, rather than a underpinning requirement for achievement of program goals, then clarity is needed on what the objective of the governance stream is – e.g. to effectively and efficiently deliver the program as designed or pilot a new approach to program delivery.

Sustainability of funding

The QWMN should consider whether steps need to be taken to ensure sustainability of funding of the network in the case that government funding is withdrawn. There is a range of approaches that could be considered – e.g. through a membership or sponsor arrangement.

Increasing linkages across the program streams

With the EEP now up and running, there is an opportunity to better integrate across the QWMN program streams. For example, use seminars and CoPs to get RDI project results out to the sector or use CoPs to collaboratively develop research topics. As one interviewee noted *“if you know who's doing what, then you can contact them.... because there's reading papers but then going to a seminar being able to call the person who wrote the paper and say, 'I'm reading this paragraph, I don't agree with it,' or, 'I'm reading this paragraph and I don't understand what the point is here.'”*

Annexes

Annex A: List of reviewed documents

2014 Greenfield review of water related science capability in Queensland

2015 Follow up to 2014 Greenfield Review - Addressing Strategic Water Related Research Threats & Opportunities in Queensland

2018 Greenfield midterm review of the Queensland Water Modelling Network

QWMN Research, Development and Innovation Strategy

QWMN membership, governance structure

Queensland Government Program Evaluation Guidelines

QWMN External Engagement Program Monitoring and Evaluation Plan

QWMN External Engagement Program Monitoring and Evaluation Year 1 Report

QWMN External Engagement Program Year 2 Workplan

QWMN External Engagement Program Year 1 Outcomes Report

QWMN External Engagement Program Skills and Knowledge Audit June 2019

QWMN Technical Forum 2018 (program)

Project reports published on QWMN web pages (<https://watermodelling.org/> and <https://science.des.qld.gov.au/government/science-division/water-modelling-network>)

QWMN 2017 concept paper outlining four focal areas going forward

QWMN project list, collaborators, outputs, budget, co-investment

List of initial priorities for the network

QWMN external engagement program

Annex B: Online survey

Background information provided to participants

Following a 2014 review of the Queensland Government's water related science and research effort, the Queensland Water Modelling Network (QWMN) was established in February 2017. The QWMN aims to fill critical research gaps in Queensland's water modelling capability and support greater use of water modelling by policy makers. This is being achieved through providing tools, information and collaborative programs to support best practice use of water models, and promoting the uptake of results by policy makers and managers.

The QWMN is delivered through three key streams:

- A Research, Development and Innovation (RD&I) investment program including: i) strategic evaluations; ii) individual projects; and iii) reviews and responses.
- Building capability in Queensland's water modelling sector. This is primarily through an External Engagement Program (EEP) delivered through a consortium of Queensland based research institutions (AIMS, Griffith, QUT, UQ, USQ) led by the International Water Sector. The EEP delivers a range of activities such as Communities of Practice, mentoring programs, innovation program, hack events and skills and knowledge audit as well as a website and monthly newsletter.
- An underpinning effective governance process/structure comprising a Core Group, Steering Panel, Technical Working Groups and Secretariat.

The end of the first four years of the QWMN provides an opportunity to reflect upon the achievements and lessons learned to date and inform the development of the next four years of the program to ensure it is effectively and efficiently achieving its goals. A formal stocktake of the first four years of the QWMN covering project design and delivery, governance and outreach aims to justify and inform the design of the next phase of the network.

This survey will inform the assessment of the first four years of the QWMN. Thank you for your time.

Background information and involvement

1. *Where do you work and what is your position?*
2. *What is your role within your organisation?*
3. *Which of the following best describes your involvement in the Queensland modelling community?*
 - *Part of the Queensland modelling community itself (private, government and research sectors)*
 - *An end user (policy makers, planners and investment programs)*
 - *Part of the enabling environment (university sector, workplace capability and direction setters)*
 - *Other (please specify)*
4. *What has been your primary involvement in the QWMN (refer to the introduction text for a description of each)?*
 - *Research, Development and Innovation Project*
 - *Capability and capacity building through the External Engagement Program*
 - *Governance*
 - *Other (please specify)*

Achievements

5. *Please indicate the extent to which you agree or disagree with the following statement: The QWMN is building a state-wide network with national influence to deliver transformative change.*
 - *Strongly agree*
 - *Agree*
 - *Neither agree or disagree*
 - *Disagree*

- *Strongly disagree*
6. *Please explain your answer using quantitative evidence or examples where possible*
 7. *Please indicate the extent to which you agree or disagree with the following statement: The QWMN is fostering integrated and scalable modelling to address water risks and opportunities.*
 - *Strongly agree*
 - *Agree*
 - *Neither agree or disagree*
 - *Disagree*
 8. *Please explain your answer using quantitative evidence or examples where possible*
 9. *Please indicate the extent to which you agree or disagree with the following statement: The QWMN is championing a community of practice to leverage expertise.*
 - *Strongly agree*
 - *Agree*
 - *Neither agree or disagree*
 - *Disagree*
 10. *Please explain your answer using quantitative evidence or examples where possible*
 11. *Please indicate the extent to which you agree or disagree with the following statement: The QWMN is encouraging strategic co-investment and co-production in water modelling research, development and innovation (RDI).*
 - *Strongly agree*
 - *Agree*
 - *Neither agree or disagree*
 - *Disagree*
 12. *Please explain your answer using quantitative evidence or examples where possible*
 13. *Please indicate the extent to which you agree or disagree with the following statement: The QWMN is increasing application of water modelling to inform decision-making.*
 - *Strongly agree*
 - *Agree*
 - *Neither agree or disagree*
 - *Disagree*
 14. *Please explain your answer using quantitative evidence or examples where possible*
 15. *Please indicate the extent to which you agree or disagree with the following statement: the findings of QWMN funded projects have influenced my work.*
 - *Strongly agree*
 - *Agree*
 - *Neither agree or disagree*
 - *Disagree*
 16. *Please explain your answer using quantitative evidence or examples where possible (.e.g. leveraged funding, new collaborators, enhanced scientific or technical understanding).*

17. Please indicate whether you agree or disagree with the following statement: *I feel part of a network that is connecting water modelling professionals, users and decision makers.*

- *Strongly agree*
- *Agree*
- *Neither agree or disagree*
- *Disagree*

18. Please explain your answer using quantitative evidence or examples where possible

Implementation

19. If you have taken part in a QWMN funded Research, Development and Innovation Project, how effectively was the project administered by the QWMN secretariat?

- *Exceeded expectations*
- *Met expectations*
- *Below expectations*
- *Not sure*
- *Have not taken part in a QWMN funded Research, Development and Innovation Project*

20. Please explain your rating and provide evidence to support your assessment where possible/

21. Have you taken part in activities organised by the External Engagement Program? If so then please indicate the type of activity/ies you have been involved in.

- *Community of Practice (e.g. events, online discussions)*
- *Mentoring program (e.g. students and their mentors)*
- *Innovation program (e.g. Innovation Associates and their supervisors)*
- *Hack event (the 2019 Water Modelling Hack Challenge held 5 July 2019)*
- *Skills and knowledge audit*
- *Website and monthly newsletter*
- *QWMN Forum*
- *Other (please specify)*

22. How effectively were the External Engagement Program activities managed?

- *Exceeded expectations*
- *Met expectations*
- *Below expectations*
- *Not sure*
- *Have not taken part in an activity organised by the External Engagement Program*

23. Please explain your rating and provide evidence to support your assessment where possible.

24. If you have taken part in governance of the QWMN, how effectively was the governance managed by the QWMN secretariat?

- *Exceeded expectations*
- *Met expectations*
- *Below expectations*
- *Not sure*
- *Have not taken part in governance of the QWMN*

25. *Please explain your rating and provide evidence to support your assessment where possible.*

Areas for improvement

26. *How could implementation of the Research, Development and Innovation stream of the QWMN be improved?*

27. *How could QWMN capability and capacity enhancement activities be improved?*

28. *How could implementation of the Governance stream of the QWMN be improved?*

29. *If you could change one thing to improve the QWMN program, what would it be?*

Emerging issues

30. *What emerging issues may influence QWMN operations in the future?*

31. *How might these issues impact on QWMN achievement of its goals?*

Other

Is there anything other feedback you would like to provide regarding the QWMN?

Annex C: Interviewees and interview template

Name	Organisation	Representative of
Paul Greenfield	n/a	End users – academia, NGOs
Melanie Roberts	(QWMN Fellow) Griffith University	QLD modelling community - Innovation Associates and Fellows
John Vitovsky	Senior Hydrologist, Queensland Hydrology	End users - Government
Laura Bellis	(Innovation Associate) PhD candidate at Queensland University of Technology	QLD modelling community - Innovation Associates and Fellows
Aditya Singh	Senior Engineer, BMT	QLD modelling community – Private sector
Emma O’Neill; David Roberts and Michael Bartkow	SEQ Water	Enabling environment and end users – government

Interview Questions

Q1. Can you please give a quick overview of your interaction and involvement with the QWMN?

Response:

Q2. Initial survey results show that stakeholders believe the QWMN is establishing a strong state-wide network, but has not begun to reach its goal of transformative change with national influence.

What do you see as the key achievements in terms of QWMN establishing a state-wide network? What do you think are the challenges to achieving transformative change with national influence, and how can the QWMN overcome these challenges?

Response:

Q3. Initial survey results show that many stakeholders believe the QWMN has influenced their work through enabling collaborations, establishing networks and adopting research project findings.

Has the QWMN influenced your work? If so, then please explain how. If not, then please explain how the QWMN could better support your work.

Response:

Q4. Have you had experience in working with the QWMN on one or more of the delivery streams (research projects, building capacity and capability, governance)? If so, can you please reflect on the management and administration of the program?

Response:

Q5. If you could do one thing to improve program implementation, what would it be?

Response:

Q6. Initial survey results show that many respondents believe that climate change impact on drought and extreme events will be a key emerging issue that may influence QWMN in the future.

How do you think the QWMN can better prepare to respond to this emerging issue? Are there other emerging issues that you believe are more critical?

Response:

Q7. What do you think the biggest success of the program has been to date? And why?

Response:

Q8. Is there any other feedback on the QWMN that you would like to provide?

Response:

Thanks

Annex D: List of RDI projects funded by the QWMN

Theme	RDI project	Available output	Alignment with QWMN Goals	Alignment with RDI Strategy (if initiated after strategy development)
Model integration	Improvements to the Dynamic SedNet model	Model improvements	Foster integrated and scalable modelling; Encourage strategic co-investment	Great Barrier Reef Catchments; Landscape restoration and design
	Enhanced eWater software to inform water resource planning	Model improvements	Foster integrated and scalable modelling; Encourage strategic co-investment	Priority model
	Integrating paddock scale modelling and water Source models	Model improvements; Report online	Foster integrated and scalable modelling	Priority model
	Supporting regional groundwater supply security assessments in Queensland	<i>In progress</i>	Increase application of water modelling to inform decision-making	Priority model
Model improvement	Consensus based streambank and gully conceptual models in Queensland	Report online (not clearly linked to project description)	Foster integrated and scalable modelling	Great Barrier Reef Catchments; Landscape restoration and design
	Improved Source modelling to support catchment management investment decisions	Model improvements	Foster integrated and scalable modelling; Increase application of water modelling to inform decision-making; Encourage strategic co-investment	Priority model; Landscape restoration and design
	Prediction of daily rainfall and runoff peak rates to inform hillslope erosion prediction and improve water quality modelling	<i>In progress</i>	Foster integrated and scalable modelling	Great Barrier Reef Catchments; Landscape restoration and design
	Review of the science used in the MEDLI model	<i>In progress</i>	Foster integrated and scalable modelling; Encourage strategic co-investment	Priority model
	Stream bank erosion in the Great Barrier Reef catchments	<i>In progress</i>	Foster integrated and scalable modelling	Great Barrier Reef Catchments; Landscape restoration and design
	Tracking the effectiveness of gully management at reducing bioavailable nutrients	Report online	Foster integrated and scalable modelling Encourage strategic co-investment	Great Barrier Reef Catchments; Landscape restoration and design
	Addressing uncertainty in coupled water models using machine learning techniques	<i>In progress</i>	Foster integrated and scalable modelling	Model management



Theme	RDI project	Available output	Alignment with QWMN Goals	Alignment with RDI Strategy (if initiated after strategy development)
	Gully Erosion Framework to underpin rehabilitation and catchment modelling for Queensland	<i>In progress</i>	Foster integrated and scalable modelling; Champion a community of practice to leverage expertise; Encourage strategic co-investment	Great Barrier Reef Catchments; Landscape restoration and design
	Visualisation of coupled economic and Queensland water quality models	<i>In progress</i>	Foster integrated and scalable modelling; Increase application of water modelling to inform decision-making; Encourage strategic co-investment	Great Barrier Reef Catchments;
	Good modelling practice principles of the Queensland Water Modelling Network	Report online	Foster integrated and scalable modelling; Champion a community of practice to leverage expertise	Model management
	Development of an annotated catalogue of water models in use in government	Report online	Foster integrated and scalable modelling; Champion a community of practice to leverage expertise	Model management
	Improved model governance and management for HowLeaky (including Howleaky manual)	Available online	Foster integrated and scalable modelling; Champion a community of practice to leverage expertise	Priority model; Model management
	Detailed scope of work to support parallelism of models at the simulator level	Scope developed informed second stage	Foster integrated and scalable modelling	N/A
Model management	Improved model-based decision support through simulator-independent parallelism	Report online	Foster integrated and scalable modelling	Model management
	Model data portal to deliver catchment modelling data to end users	<i>In progress</i>	Foster integrated and scalable modelling; Increase application of water modelling to inform decision-making; Encourage strategic co-investment	Model management
	Strategic review of Queensland water models	<i>In progress</i>	Foster integrated and scalable modelling; Champion a community of practice to leverage expertise	Model management
	Critical review of climate change and water modelling in Queensland	Report online	Foster integrated and scalable modelling; Champion a community of practice to leverage expertise	Model management; Climate change and variability
	Data management and visualisation to support water quality modelling teams	Not readily available	Foster integrated and scalable modelling; Increase application of water modelling to inform decision-making; Encourage strategic co-investment	Model management



Annex E: Innovation Associates, PhD topics and alignment with QWMN goals and priorities

Innovation Associate	Academic Institution/s	Government counterpart	PhD topic	Alignment with QWMN goals	Alignment with RDI priorities
Laura Bellis	Queensland University of Technology	Queensland Hydrology	Improving the understanding of groundwater evapotranspiration from GDEs, with the aim of reducing the uncertainty inherent in modelling GDEs for water resource assessments.	Yes – improve integration of models; integrate environmental monitoring activities with water modelling; address critical strategic gaps in water models; enhance ability of models to support assessment and consideration of cumulative impacts	Not a clear alignment
Cherie O’Sullivan	University of Southern Queensland	Bureau of Meteorology	Investigating modelling methods, including using artificial intelligence to improve water quality forecasting of ungauged catchments that drain to the Great Barrier Reef.	Yes – support development and implementation of finer-scale assessment and modelling frameworks; address critical strategic gaps in water models	Yes – Great Barrier Reef catchments
Chinenye Ani	James Cook University and J2O Consulting	Australian Institute of Marine Science	Developing an improved biogeochemical model for the Great Barrier Reef that builds upon the existing world-class eReefs models, but better accounts for processes and responses relevant to climate change scenarios.	Yes – improve integration of models; integrate environmental monitoring activities with water modelling; address critical strategic gaps in water models	Yes – Great Barrier Reef catchments; Climate change and variability
Filipe Pinhati	The University of Queensland	SEQ Water	Modelling the impact of small on-farm reservoirs over water availability within catchments with extensive irrigated areas and the potential expansion of irrigated land within such catchments.	Yes – support development and implementation of finer-scale assessment and modelling frameworks; address critical strategic gaps in water models	Not a clear alignment
Chao Deng	Griffith University	Gold Coast City Council	Improving the way that Gold Coast City Council models flood risk.	Yes – improve integration of models; enhance ability of models to support assessment and consideration of cumulative impacts	Not a clear alignment



Annex F: QWMN Governance structure detail

Group	Responsibility	Membership	Reporting
QWMN Core Group	oversight of the Network's overall strategic direction and of its operation and delivery. There will be a mix of senior Departmental and external members to provide complementary perspectives and allow access to the broader modelling community.	QWMN Core Group membership will be made up of 2 representatives from DES as well as 2 external representatives. The Core Group will be chaired by a DES senior executive officer while Secretariat services will be provided by a dedicated DES staff member. From time to time, other organisations could be invited to participate, observe or provide guidance with agreement of the Core Group chair.	The QWMN Core Group will report as required.
QWMN Steering Panel	facilitate integration of information and products developed by the QWMN, and guide the directions of the QWMN. The Steering Panel comprises the Core Group and Chairs of the QWMN Technical Working Groups. An EEP representative will participate as an observer, as required.	QWMN Steering Panel membership will be drawn from DES, DNRME, a User Representative, and the Core Group members. The Panel will be chaired by a DES senior executive officer while Secretariat services will be provided by a dedicated DES staff member.	The QWMN Steering Panel will report through the QWMN Core Group, and to relevant interdepartmental committees as required
QWMN Technical Working Groups	undertake the role of design and oversight of the priority tasks identified through implementation of the QWMN. Members will be relevant departmental staff with expertise and interest in the particular topic. Technical Working Groups will be initiated by the QWMN Steering Panel and reviewed annually.	QWMN Technical Working Group membership will depend upon the focus of the group but could typically include DES, DNRME and DAF. Secretariat services will be sourced from within the group on a rotational basis.	The QWMN Technical Working Groups will report on progress to the QWMN Steering Panel quarterly or as required.



