



QUEENSLAND
WATER
MODELLING
NETWORK

EXTERNAL ENGAGEMENT PROGRAM

*Skills and Knowledge Audit Response Report
January 2020*



AUTHORSHIP – THE QWMN SKILLS AND KNOWLEDGE AUDIT WORKING GROUP

This report was authored by the Queensland Water Modelling Network (QWMN) with input from the Skills and Knowledge Audit Working Group, a cross-sector group convened to bring together expertise from a range of employer and organisational types with a stakeholding in the future of the workforce of the Queensland water modelling and use sector.

- **Chair and Lead Author** – Dr. Brian S. McIntosh, International WaterCentre / QWMN External Engagement Program
- **Queensland Government Representatives:**
 - Jean Erbacher – Department of Environment and Science / QWMN
 - Jenny Riches – Department of Environment and Science / QWMN
 - Daniel Brough – Department of Environment and Science
- **QWMN External Engagement Program Representatives:**
 - Dr. Piet Filet, International WaterCentre / QWMN External Engagement Program
 - Dr. Chris Carroll, Independent / QWMN External Engagement Program
- **Local Government Representative** – Anna Hollingsworth, Gold Coast City Water and Waste Directorate
- **Higher Education Representatives:**
 - Dr. Badin Gibbes, University of Queensland
 - Professor Les Dawes, Queensland University of Technology
- **Consultancy Representative** (but also see below under Professional Association Representatives):
 - Peter Comino, Cardno
- **Professional Association Representatives:**
 - Charlene Wong, Australian Water Association Young Water Professionals / Engeny Water Management
 - Anthony Gaffney, Engineers Australia QLD Water Panel Representative / AECOM
 - Martin Jacobs, Engineers Australia QLD Water Panel Representative / pitt&sherry

TABLE OF CONTENTS

1. Introduction	4
2. Methodology	4
3. Challenges Faced by the Sector	6
4. Responses to the Challenges	11
5. Summary and Conclusions	16
Appendix – Additional Priority Challenge Response Options	18

1. INTRODUCTION

In July 2019 the QWMN released the Skills and Knowledge Audit Report (Audit Report). The Audit Report is available for download from <https://watermodelling.org/resources/external-engagement-program-skills-and-knowledge-audit>.

The purpose of the Skills and Knowledge Audit was to characterise both current and future water modelling workforce skill and knowledge needs as perceived by personnel working for a cross section of employer types from the Queensland water modelling and use sector. The attitudes of different types of organisation (i.e., 1. Government; 2. Consulting; 3. Research/Higher Education) within the water modelling sector on workforce skill and knowledge needs were captured using a mix of interviews, a workshop and an online survey.

Within and between these types of organisations a distinction between “providers” and “clients” was also made when analysing results. The “provider” category included individuals and organisations that develop models and/or produce model-derived information. The “client” category refers to individuals and organisations that use model results to inform their activities.

The Audit Report presents a detailed analysis of the results of the interviews, workshop and online survey that were collected. The Audit Report focused on capturing challenges for sector capability such as recruitment, workforce planning, retention, enhancing staff skills and knowledge (current and emerging). The Audit Report identified the challenges, issues and opportunities for consideration by the QWMN and wider modelling sector and clients.

In response, the Skills and Knowledge Audit Working Group (Working Group) was formed to act as a temporary cross-sector advisory group. Comprising key employer types, professional associations, and encompassing both younger and more experienced professionals, the group critically considered a range of responses to the key skill, knowledge and workforce challenges facing the water modelling and use sector in Queensland. This Response Report presents the outputs of the Working Group and provides some degree of critical reflection on how the challenges identified by the Audit Report along with the response recommendations of the Working Group are viewed more widely across the sector.

The Response Report is structured to:

- Provide a summary of the methodology used to generate and analyse responses to the Audit Report by a wider cross section of employees from the QLD water modelling and use sector.
- Describe the key skills, knowledge and workforce challenges in the Audit Report as viewed by the members of the Working Group and then how these relate to wider sectoral perceptions of the key challenges
- Describe the responses (what should be done by whom) that were identified by the members of the Working Group and how those responses relate to wider sectoral perceptions of how we should respond to the challenges

2. METHODS

A cross-sector Working Group (see membership on page 2 of this report) provided an initial response to the Audit Report findings. This enabled perspectives from across the range of employer types that comprise the QLD water modelling and use sector to consider the report findings in the context of their business, and help identify and prioritise actions for short, medium and long-term investment.

The membership of the Working Group included representatives from:

- Local Government
- Higher Education
- Consultancy
- Professional Associations
- Young Water Professionals
- Queensland Government
- The QWMN Secretariat and External Engagement Program (International WaterCentre)

The authorship list on page 2 of this report details the specific organisations and people involved.

The method involved four stages:

1. Working Group members reviewed the Audit Report.
2. A Working Group workshop (21 August 2019) catalysed thinking and produced a *draft set of Response recommendations* – actions that should be taken to respond to the challenges identified in the Audit Report:
 - a. Agreeing on the most important skills, knowledge and workforce capability challenges that were identified in the Audit Report and prioritising these for the sector.
 - b. Identifying the response actions that could be undertaken to address each of the highest priority challenges from step 1.
 - c. Identifying which organisations or types of organisation from within the sector should (or could) lead or contribute to different response actions.
3. Testing the *draft Response recommendations* from step 2 with a broader cross-section at a QWMN Community of Practice event (28 August 2019) that had a young water modelling professionals focus (refer Figure 1 for composition). Figure 1 and Table 1 below shows the composition of this broader cross-section of water modelling professionals. There were 23 professionals involved with an average number of years of working in the sector of 8.5 years.
4. Creation of this Response Report based on the feedback from steps 1 -3 above.



FIGURE 1 COMPOSITION OF COMMUNITY OF PRACTICE EVENT ON 21/08/19 TO REVIEW DRAFT RESPONSE RECOMMENDATIONS BY EMPLOYER TYPE (N=23)

TABLE 1 COMPOSITION OF COMMUNITY OF PRACTICE EVENT ON 21/08/19 TO REVIEW DRAFT RESPONSE RECOMMENDATIONS BY JOB ROLE BREAKDOWN (N=23)

Job role	Number
Problem formulator	5
Model developer	11
Model driver	6
Computational specialist	3
Data collector or analyst	12
Data wrangler	3
Science / model output communicator	11
Decision-maker	1
Student	8
Other	1

3. CHALLENGES FACED BY THE SECTOR

The Working Group identified seven (7) priority skills, knowledge and workforce challenges faced by the sector in QLD (see Table 2), building on the Skills and Knowledge Audit Report!

The identified challenges spanned skills development of employees (both future and current); building sectoral capacity; communicating more effectively; workforce growth and planning; building sectoral capacity to better manage and use data; and better guaranteeing model standards and quality.

TABLE 2 SKILL, KNOWLEDGE AND BROADER WORKFORCE CHALLENGES FACING THE QUEENSLAND WATER MODELLING AND USE SECTOR IDENTIFIED BY THE SKILLS AND KNOWLEDGE AUDIT WORKING GROUP (AUGUST 2019)

Priority Challenge	Explaining the critical issues
1. Developing and improving modelling skills	Embedding modelling education in our Universities: <ul style="list-style-type: none"> • What kind of modelling curricula should we develop? • How long will it take and what would be involved in doing so?
	Continuous improvement: <ul style="list-style-type: none"> • Of skills of modellers in work • Building capacity and capability in organisations (ongoing)
	What skills should we focus on developing over the next 2-3 years so we: <ul style="list-style-type: none"> • Create an impact on modelling skills and capabilities? • Establish a platform for future response to changing skills needs?
2. Developing cross-disciplinary and systems approaches	Developing multi-disciplinary knowledge and skills in water modellers: <ul style="list-style-type: none"> • These skills come with age and experience right now, so how can we develop them at a younger age in the workforce? • Sharing knowledge across disciplines • Creating the desire to collaborate and to learn from others
	Enabling cross-sector learning: <ul style="list-style-type: none"> • Developing more complete knowledge of the whole of the modelling supply chain by developing knowledge and skills in different areas from model provider (technical) to decision maker (policy) • Joint sector capacity building needs • Creating the desire to collaborate and to learn from others
3. Communication of models, modelling and model outputs	How should the sector deal with modelling skeptics?
	Communication skills development: <ul style="list-style-type: none"> • Communicating with the public • Communicating with policy makers – translation skills • How to communicate modelling outputs simply and succinctly?
	Visualisation of complex systems
4. Workforce recruitment and retention	Fundamental skills/knowledge behind water modelling need to be stronger: <ul style="list-style-type: none"> • Graduate coding skills • Graduate physical process knowledge
	Difficult to recruit people with both right skills and interest in working in both water management and modelling
	Making modelling more attractive as a career choice: <ul style="list-style-type: none"> • Is modelling 'sexy'? • Getting students interested in water sector work generally is a challenge <ul style="list-style-type: none"> ○ General level of community water literacy might be inhibiting the sense that water modelling and water work more broadly are critically important • Having clear ways for graduates to get a foothold in and progress through a career in the water modelling sector • Having mechanisms to support early career water modelling professionals
5. Workforce planning and management	Succession planning
	Rewarding, developing and retaining talent? <ul style="list-style-type: none"> • Most employers only offer exposure to a limited set of water modelling areas, which in turn forces talent to move on to gain experience in a broader set of water modelling tools, approaches and applications • Market forces don't reward deep specialisation in any particular model so talent leaves to find other opportunities

Priority Challenge	Explaining the critical issues
	Poaching of modelling talent between employers
6. More and better data for models and modelling	Data science skills need to be developed: <ul style="list-style-type: none"> We are information rich but data poor We need to be better able to run real-time simulation and visualisation with and of that big data
	Need to develop improved data management capabilities: This will enable us to take advantage of the opportunity of increased access to data (gauges, terrain, gridded data)
	Improved model integration, interoperability and scalability: Requires better data management
7. Modelling standards and QA	We need a clearer set of modelling standards and literacy of those standards as they apply across the whole modelling cycle
	Professional opinion about how to model a particular process or set of issues sometimes fragments and clashes with existing specifications and standards – how should we handle this?

Table 3 shows how the Priority Challenges identified by the Working Group (see Table 2) relate to those identified in the Audit Report. The purpose of the table is to see whether the conclusions of the Working Group agree with the results of the Audit – in effect to validate the findings of the Audit

Table 3 shows that all of the challenge areas identified by the Audit were also identified by the Working Group as being important – offering a validation of the Audit. Table 3 also shows that the challenges associated with developing and improving modelling skills, workforce recruitment and retention, and workforce planning and management were viewed as being particularly important by the Working Group.

Out of the 7 priority challenges identified by the Working Group, the top 5 highest priority challenges were identified by the Working Group as being:

- Developing cross-disciplinary and systems approaches (#2 from table 2)
- Improving communication of models, modelling and model output (#3 from table 2)
- Improving workforce recruitment and retention (#4 from table 2)
- More and better data for models and modelling (#6 from table 2)
- Modelling standards and QA (#7 from table 2)

TABLE 3 PRIORITY CHALLENGES (SKILL, KNOWLEDGE AND BROADER WORKFORCE) IDENTIFIED BY THE WORKING GROUP (AUGUST 2019) IN RELATION TO THOSE IDENTIFIED IN THE AUDIT REPORT (JUNE 2019)

Audit Report: Challenges	Response Working Group: Priority Challenge (Challenge number indicated)
Need to enhance the quality of Australian trained graduates entering the sector	<ul style="list-style-type: none"> • Developing and improving modelling skills (#1)
Need to address/reverse the pressure to reduce effective teaching at University in fundamental maths, biophysical sciences, computation and data sciences	<ul style="list-style-type: none"> • Developing and improving modelling skills (#1)

Audit Report: Challenges	Response Working Group: Priority Challenge (Challenge number indicated)
Need to increase the number of early-mid career professionals available with suitable experience in the technical aspects as well as broader policy/regulatory settings	<ul style="list-style-type: none"> • Developing cross-disciplinary and systems approaches (#2) • Workforce recruitment (#4)
Need to provide ways to develop emerging skills needed across the sector workforce – programming, data analysis, visualisation/communication	<ul style="list-style-type: none"> • Developing and improving modelling skills • Communication of models, modelling and model outputs (#3)
Need to improve the number of suitably qualified Australian graduates available for recruitment into University research workforce	<ul style="list-style-type: none"> • Workforce recruitment and retention (#4)
Need ways to increase the number of early career professional employment opportunities at Universities	<ul style="list-style-type: none"> • Workforce recruitment and retention (#4)
Need to improve ways of retaining early-mid career staff, particularly in consulting firms	<ul style="list-style-type: none"> • Workforce planning and management (#5)
Need to improve succession planning and intra-organisational knowledge transfer for the workforce	<ul style="list-style-type: none"> • Workforce planning and management (#5)
Need to ensure that funding to invest in the science needed to underpin models is increased and that the science becomes more robust as a consequence	<ul style="list-style-type: none"> • More and better data for models and modelling (#6) • Modelling standards and QA (#7)
Need to better understand and break down potential financial and other barriers to collaboration across consulting firms and between consulting firms and research or government organisations	<ul style="list-style-type: none"> • Developing cross-disciplinary and systems approaches (#2)

To test the broader validity of the priority challenges identified by the Response Working Group these challenges were presented to the wider cross-section of professionals who participated in the QWMN CoP event held on 28th August (for details of participant composition at the event see Table 1 and Figure 1) who were asked to rank them in order of importance. A 5 point scale was used by participants to rank Challenges in terms of importance with higher scores meaning more important / higher priority to address. Figures 2 and 3 show the results of this second broader validation exercise. It should be noted that slightly different wordings were used to ensure that the challenges were understandable by the CoP event participants when shown during a live voting activity.

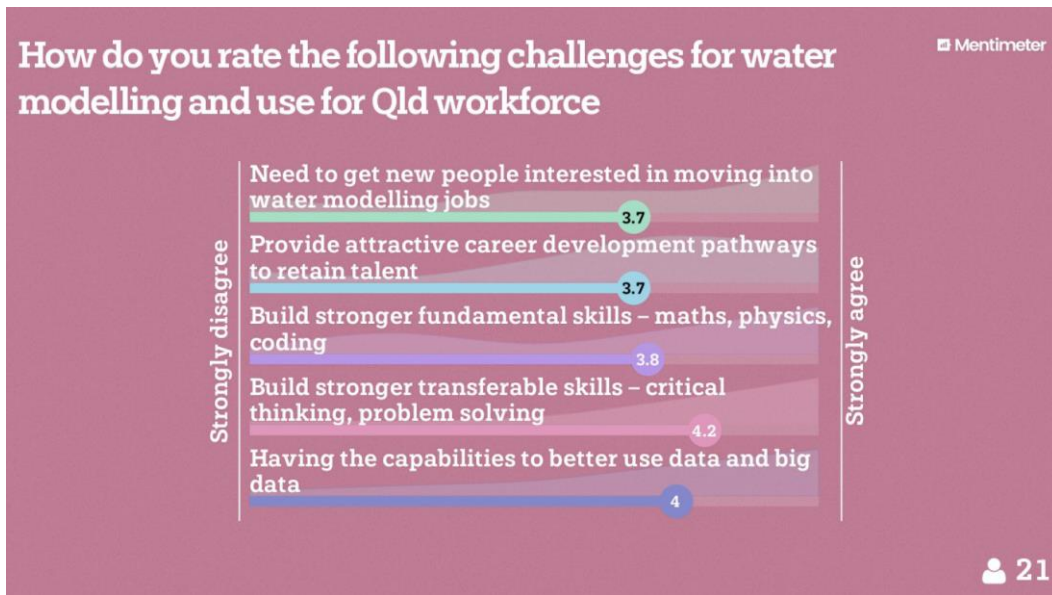


FIGURE 2 PRIORITY OF DIFFERENT SKILL, KNOWLEDGE AND BROADER WORKFORCE CHALLENGES AS SCORED BY PARTICIPANTS AT A QWMN COMMUNITY OF PRACTICE EVENT (AUGUST 2019) (THE NUMBER NEXT TO EACH CHALLENGE SHOWS IMPORTANCE AVERAGED ACROSS ALL PARTICIPANTS ON A 1-5 SCALE WITH 5 BEING MORE IMPORTANT, WHILST THE SHADING UNDERNEATH EACH CHALLENGE SHOWS THE DISTRIBUTION OF PARTICIPANT SCORING OF IMPORTANCE ACROSS ALL PARTICIPANTS)

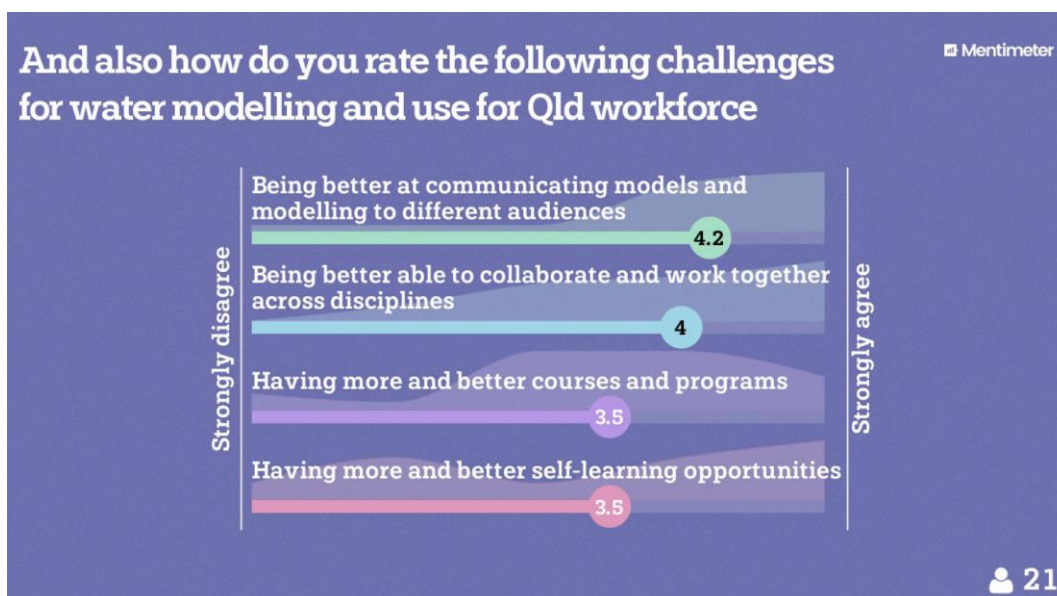


FIGURE 3 PRIORITY OF DIFFERENT SKILL, KNOWLEDGE AND BROADER WORKFORCE CHALLENGES AS SCORED BY PARTICIPANTS AT A QWMN COMMUNITY OF PRACTICE EVENT (AUGUST 2019) (THE NUMBER NEXT TO EACH CHALLENGE SHOWS IMPORTANCE AVERAGED ACROSS ALL PARTICIPANTS ON A 1-5 SCALE WITH 5 BEING MORE IMPORTANT, WHILST THE SHADING UNDERNEATH EACH CHALLENGE SHOWS THE DISTRIBUTION OF PARTICIPANT SCORING OF IMPORTANCE ACROSS ALL PARTICIPANTS)

Table 4 below shows how the Audit Report skill, knowledge and workforce challenges identified as highest priority by the Working Group relate to the prioritisation given to the Audit Report skill, knowledge and workforce challenges by the broader cross-section of Queensland water modelling and use sector professionals (as represented by the participants of the CoP event on 28th August).

TABLE 4 COMPARISON OF THE PRIORITY CHALLENGES IDENTIFIED BY THE WORKING GROUP VS THOSE IDENTIFIED BY CoP EVENT PARTICIPANTS (AUGUST 2019)

Response Working Group challenge prioritisation	CoP event participant challenge prioritisation	Match?
Developing cross-disciplinary and systems approaches (#2 from table 2)	Being better able to collaborate and work together across disciplines	Yes
Improving communication of models, modelling and model output (#3 from table 2)	Being better at communicating models and modelling to different audiences	Yes
More and better data for models and modelling (#6 from table 2)	Having the capabilities to better use data and big data	Yes
Improving workforce recruitment and retention (#4 from table 2)	Building stronger transferable skills (in water modelling professionals) – critical thinking, problem solving	No
Modelling standards and QA (#7 from table 2)	Building stronger fundamental skills – maths, physics, coding	No

Table 4 shows that there was agreement between the Working Group and the broader set of professionals in the form of the CoP event participants in relation to the following priority skill, knowledge and broader workforce challenges:

- Developing cross-disciplinary and systems approaches (priority challenge #2 from table 2)
- Improving communication of models, modelling and model output (priority challenge #3 from table 2)
- More and better data for models and modelling (priority challenge #6 from table 2) Data and interoperability of models

The reasons for the differences will be briefly explored in the discussion and conclusions section of this report.

4. RESPONSES TO THE CHALLENGES

The Working Group identified a range of possible response options to the top 5 highest priority challenges identified and also identified suggested roles that different kinds of organisation within the sector could play in terms of leading or implementing responses. Table 4 shows these responses and roles. All five Priority Challenges are included, not just the three where there was agreement with the broader cross-section of sector professionals as shown in table 4 (above).

TABLE 5 POTENTIAL RESPONSES TO PRIORITY CHALLENGES IDENTIFIED BY THE WORKING GROUP AND SUGGESTED ROLES FOR DIFFERENT ORGANISATIONS

Priority Challenges	Response Options	Suggested involvement / role
Developing cross-disciplinary and systems approaches	Utilise CoP and CoP events: <ul style="list-style-type: none"> • Use CoP event follow on activities to facilitate cross role collaboration • Improve co-ordination between QWMN CoP and professional bodies including around respective roles? 	<ul style="list-style-type: none"> • QLD Water Panel (EA) could help with CoP facilitation – joint QWMN – QWP CoP events • All employers in the sector could sponsor/support employees to attend CoP events
	Create R&D partnership arrangements across research providers and clients: <ul style="list-style-type: none"> • Create opportunities for leverage funding • Collaboratively identify and scope R&D problems, undertake joint projects and build shared culture and knowledge 	<ul style="list-style-type: none"> • State and local governments could convene a problem identification forum then facilitate collaborative programs with Universities and private sector
	Create a set of independent expert panels for different (multi-disciplinary) topics/issues/problems	<ul style="list-style-type: none"> • State Government could convene such panels • Qld Water Panel (EA) could provide learned comment
	Build skills for better working together: <ul style="list-style-type: none"> • Employers to support staff to attend sector/industry knowledge sharing workshops (convened by industry, professional bodies and/or QWMN) • Learning from parallel industries such as energy – including such opportunities in education programs and as a diversity of workshops and papers in conferences 	<ul style="list-style-type: none"> • Professional associations (e.g. EA) could host cross-disciplinary and cross-functional knowledge sharing / networking conference / workshops • All employers in the sector could sponsor / support staff to participate in events
	Creating intern and visiting positions to enable learning across organisations and functional areas: <ul style="list-style-type: none"> • Create intern opportunities on complex projects that involve some boundary spanning e.g. policy to modelling, private to government or university • Create internships and visiting fellow positions for early and mid-career professionals 	<ul style="list-style-type: none"> • Consulting firms could take interns from government, client and research organisations • Local government could provide inter-governmental secondment opportunities
Improving communication of models, modelling and model output	Strengthen and use a Community of Practice mechanism to develop good communication practices:	<ul style="list-style-type: none"> • QWMN CoP could lead guideline development for designing a communication strategy

Priority Challenges	Response Options	Suggested involvement / role
	<ul style="list-style-type: none"> • Establish a communication working group in the QWMN CoP to flesh out the key elements for improving communication – communication strategy and implementation guidelines • Cross-work with other CoPs • Harness the knowledge brokering function of CoPs, and invite other professions to participate to enhance this 	<ul style="list-style-type: none"> • QWMN COP events could do this • QLD Water Panel (EA) could help with CoP facilitation • All employers in the sector could sponsor/support employees to attend CoP events
	<p>Develop a series of model case studies to showcase modelling to end user communication good practice:</p> <ul style="list-style-type: none"> • Cover decision making, model outputs, constraints and risks • Encourage critical thinking around these case studies by including them as resources in training 	<ul style="list-style-type: none"> • Qld Water Panel (Engineers Australia) could provide learned comment • All employers in the sector could help with this • Universities could help with this
	<p>Develop key communication capabilities and capacity:</p> <ul style="list-style-type: none"> • Run competitions to highlight particular areas e.g. ‘the communication of uncertainty competition’ • Telling stories rather than providing numbers – perhaps mandatory courses as part of undergraduate training • Learning how to design communication strategies that are appropriate for particular users of model outputs including community and decision makers • Learning how to engage with end users first, last and throughout modelling process to manage expectations and build understanding • Learning how to demystify models for the general community • For each modelling topic, review the state of play (re: models), identify key stakeholders and drivers then convene discussion groups to build relationships and understanding, and to create language for communication that could be re-used. 	<ul style="list-style-type: none"> • All employers in the sector could help with this • Universities could help with this

Priority Challenges	Response Options	Suggested involvement / role
	Establish common modelling terminology to help with clarity and consistency of communication	<ul style="list-style-type: none"> Qld Water Panel (Engineers Australia (EA)) could provide learned comment
More and better data for models and modelling	Move practice towards open data and data sharing: <ul style="list-style-type: none"> Build a better culture of data sharing Strengthen the perception of data as an asset Improve awareness across sector of what data can be sourced from where and from whom? 	<ul style="list-style-type: none"> All stakeholders to be involved Take a community / domain driven approach Utilise / link to existing groups and activities working on this Professional associations could assist with this
	Create data sharing and model interoperability infrastructure: <ul style="list-style-type: none"> Online open source data systems Document the cycle of data management for models – standards, use, purpose, model requirements (could the existing QWMN RD&I incorporate this task?) Data formats and standards Model interfaces to public data stores Model vocabulary standardisation Model and data exchange interfaces 	<ul style="list-style-type: none"> Qld Water Panel (EA) could provide learned comment Local government could pool and make data public / available All data owners
	Improve skills and capabilities for data manipulation and handling	<ul style="list-style-type: none"> Professional associations could play a role here Universities could play a role here
Improving workforce recruitment and retention	Improve understanding of what the modelling capabilities of students on different programs (undergrad and postgrad) are: <ul style="list-style-type: none"> Universities could map capabilities by program 	<ul style="list-style-type: none"> Universities could help with this
	Offer ways for students and young-mid career professionals to learn from industry or from academia through partnerships: <ul style="list-style-type: none"> Work-based learning placements as part of education programs Thesis project placements Placed PhD students / collaborative research Create intern or work exposure opportunities on complex projects that involve some boundary spanning e.g. policy to modelling, private to government or University 	<ul style="list-style-type: none"> Consulting firms could take interns from government and client organisations Local government could provide University placements / projects for students Local government could provide inter-governmental secondment opportunities NSW Government could be approached to partner around supporting graduate training Universities have a key role to play in this

Priority Challenges	Response Options	Suggested involvement / role
	<ul style="list-style-type: none"> • Create visiting fellow positions for early and mid-career professionals at Universities 	
	<p>Advocate for the importance, excitement and value of a career in the water sector to students and younger people more broadly:</p> <ul style="list-style-type: none"> • Water utilities and QLD Government to create advocacy / marketing programs – perhaps professional bodies could 	<ul style="list-style-type: none"> • Universities could do this • QWMN CoP could do this • Professional associations could do this
	<p>Understand what skills are important to retain and develop staff and deliver them:</p> <ul style="list-style-type: none"> • Engage early-mid career professionals at networking event(s) to identify gaps in capability that should be filled • Capture internal industry skills and knowledge base, and engage graduates/staff in learning from it 	<ul style="list-style-type: none"> • Qld Water Panel (EA) could provide learned comment • Consulting firm HR functions could create technical career development streams • Universities could work to create and credential models/short courses that add value and are of benefit to young-mid career professionals in the industry • Universities could host learning events (seminars/fora etc.) for professionals and students • Universities and employers could create learning partnerships to encourage recruitment
Modelling standards and QA	<p>Need to better ways of updating and ensuring consistency of adherence to published QA guidance on how to model different processes for different purposes:</p> <ul style="list-style-type: none"> • Consistency of assumptions employed • Need to ensure industry uses one point of truth (e.g. AR&R) for model QA • Identify the key risks to model output credibility and use this as a way to identify model QA guidance 	<ul style="list-style-type: none"> • Qld Water Panel (EA) and other professional associations could provide learned comment • Consulting firms could assist with the business case for funding industry modelling QA guidance (e.g. for AR&R)
	<p>Need to improve industry understanding of risk and uncertainty:</p> <ul style="list-style-type: none"> • Advocate for the development of lecture series on uncertainty and risk management 	<ul style="list-style-type: none"> • Qld Water Panel (EA) and other professional associations could provide learned comment

Priority Challenges	Response Options	Suggested involvement / role
	<ul style="list-style-type: none"> • Need to improve how risk is understood in relation to different modelling purposes 	

5. SUMMARY AND CONCLUSIONS

The work of the Working Group as presented in this Response Report has:

- Validated the findings of the Audit report in relation to Priority skill, knowledge and workforce Challenges facing the water modelling and use sector in Queensland. These can be summarised as being a need to:
 - Develop and improve modelling skills (amongst those joining and already in the workforce)
 - Develop cross-disciplinary and systems approaches (to working across the sector)
 - Improve communication of models, modelling and model outputs
 - Improve workforce recruitment and retention
 - Improve workforce planning and management
 - Provide more and better data for models and modelling
 - Improve and provide certainty over required modelling standards and QA
- Been validated against the views of a broader cross section of professionals from the water modelling and use sector in Queensland in relation to the highest priority Challenges:
 - Three out of the five Priority Challenges identified by the Working Group were also identified by the broader cross section of professionals (at the August CoP event)
 - There was a difference in relation to the other two Priority Challenges. The Working Group identified improving workforce recruitment and retention, and improving modelling standards and QA as higher priority whilst the broader cross section of professionals identified improving transferable and fundamental modelling skills as higher priority. This may be explained by the younger demographic at the CoP event where there were 8 students present and the fact that the Working Group was comprised of people who had line management, recruitment and staff development responsibilities.
- Shown that there are diverse range of Response Options available to the sector in Queensland to address the Priority Challenges (see table 5) including, broadly, in an implementation sense, opportunities for:
 - Directing existing QWMN activities towards some of the Challenges
 - Forming new partnerships between different types of organisations to address some of the Challenges
 - Co-ordinating between different kinds of organisations to agree on the Challenges

What should be done next? The Working Group did not prioritise Response Options as this would require a cost-benefit assessment and also an analysis of whether there are existing activities that could be used synergistically and this was beyond the scope and resourcing of the Working Group.

Some of the response actions identified in table 5 involve less effort and time whereas others are more involved and in some cases less defined, with a need to scope them out more fully first. As a consequence, the response actions described in table 5 provide a smorgasbord of options rather than a tightly prescriptive set of recommendations.

There is now a need to take the Response Options forward in some way with other actors in the sector – the question is how? One option is for the QWMN to invite partners and collaborators to consider potential actions and partnerships responding to the needs articulated by the Challenges and potential Responses. This might be done through a combination of using the QWMN external website www.watermodelling.org, through hosting an event to develop the engagement and buy-in of major employers and support actors in the sector to act.

APPENDIX – ADDITIONAL PRIORITY CHALLENGE RESPONSE OPTIONS

In addition to the response options generated by the Working Group, the participants at the QWMN CoP event in August 2019 were asked to generate potential responses to the Working Group's top 5 Priority skill, knowledge and broader workforce Challenges:

1. Developing cross-disciplinary and systems approaches (#2 from table 2)
2. Improving communication of models, modelling and model output (#3 from table 2)
3. Improving workforce recruitment and retention (#4 from table 2)
4. More and better data for models and modelling (#6 from table 2)
5. Modelling standards and QA (#7 from table 2)

These broader response action recommendations are detailed below in figures 4 to 13. They are presented here not for comparison with the responses recommended by the Working Group but rather as additional options – additional input for future consideration in relation to action planning.



FIGURE 4 HOW TO IMPROVE COMMUNICATION OF MODELS, MODELLING AND MODEL OUTPUTS - PART I

What are the key aspects of communication wrt to water modelling results and application that need to be improved?

Mentimeter

The public needs to be included more and considered when publishing reports/results in terms of understanding it (communicate to a 6 grader).

Communication needs to suit intended audience

visualization (videos, infographics, clips) useful tools for other professionals

What the client is after, needs and results. Then correctly interpreting the results.

Easy explanations to broader community, who doesn't has any knowledge about water modeling

Time of application and relevance

Communicate the results in plain Engels

Visualisation of results

Understandable terminology

27

FIGURE 5 HOW TO IMPROVE COMMUNICATION OF MODELS, MODELLING AND MODEL OUTPUTS – PART II

What are the key aspects of communication wrt to water modelling results and application that need to be improved?

Mentimeter

Communication at user level

Peer review controls

Infographics

Use of physical modelling

Public access and understanding

Cat videos

Ability for public to interrogate results

Good visualisations. Simplify.

Better visuAlisations. Simplify.

27

FIGURE 6 HOW TO IMPROVE COMMUNICATION OF MODELS, MODELLING AND MODEL OUTPUTS - PART III

How might we develop better skills in collaborating across disciplines and functions?

Mentimeter

- Events like this to share!
- Close collaboration
- Design charettes!
- Community of practice
- Investing ourselves with the parts of industry wishing to influence
- Interdisciplinary workshops and training
- Sharing knowledge and ideas
- I can only think about teamwork. Learn from each other
- Professional events to teach staff the concepts and levels of understanding used in those other fields. Finding points of common ground.

28

FIGURE 7 HOW WORKING BETTER ACROSS THE SECTOR MIGHT BE IMPLEMENTED – PART I

How might we develop better skills in collaborating across disciplines and functions?

Mentimeter

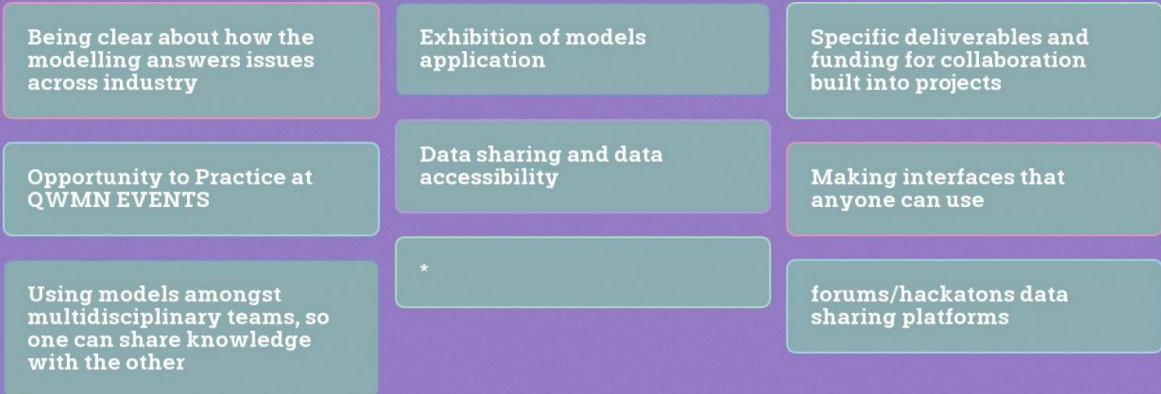
- If specific funding is allocated to integration and specific collaboration milestones and deliverables are built into projects it will happen.
- By doing more multidisciplinary projects at uni.
- Lunch and learns across disciplines, keeping in touch with universities and newest research.
- Maybe online courses
- Create a workgroup, communication board that enables users to communicate with each other easily
- Integrated water management
- collaborative projects conferences platform sharing open days/hackaton
- Opportunities to work across disciplines
- Look for projects which need integrated approach

28

FIGURE 8 HOW WORKING BETTER ACROSS THE SECTOR MIGHT BE IMPLEMENTED - PART II

How might we develop better skills in collaborating across disciplines and functions?

Mentimeter

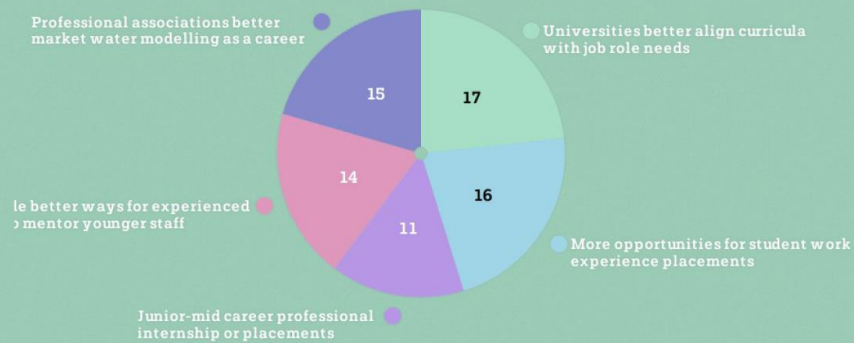


28

FIGURE 9 HOW WORKING BETTER ACROSS THE SECTOR MIGHT BE IMPLEMENTED - PART III

How do we best attract more new people into water modelling jobs?

Mentimeter



21

FIGURE 10 HOW TO IMPROVE RECRUITMENT AND RETENTION OF SKILLED STAFF

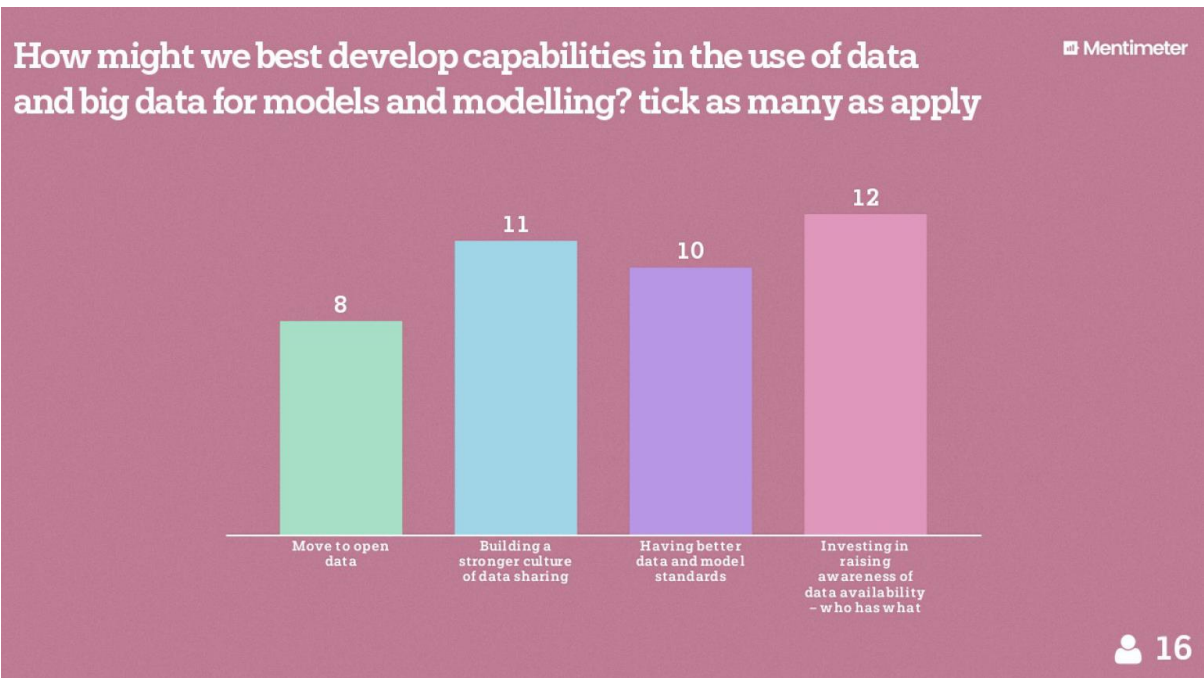


FIGURE 11 HOW TO IMPROVE THE USE OF DATA AND THE INTEROPERABILITY OF MODELS

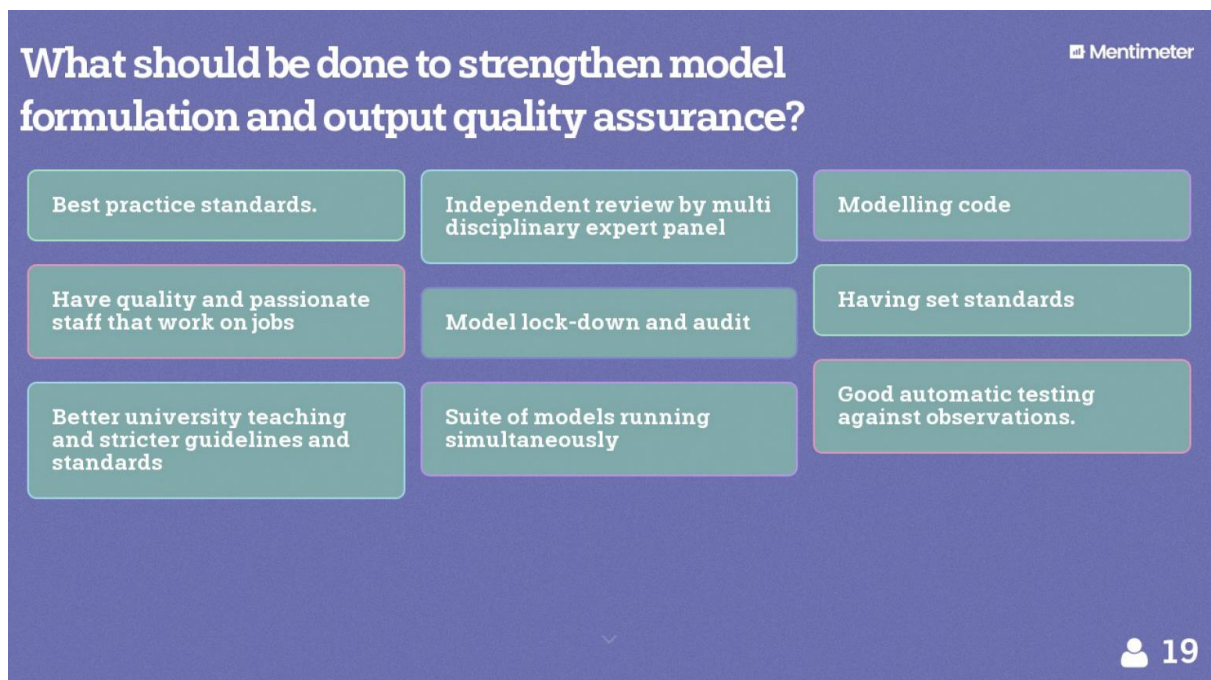


FIGURE 12 HOW TO STRENGTHEN MODELLING OUTPUT AND PROCESS QA - PART I

What should be done to strengthen model formulation and output quality assurance?

Mentimeter

- Follow stabilised scientific standards
- Budget
- standardized checklists and risk of assumptions through modelling steps and testing
- Require models be signed off against a relevant Australian Standard in same way RPEQ sign off on designs
- Data accuracy
- Independent organisation in the high level to check all the validation
- Running quality management system
- Enough data, science based development, protocol for uncertainty analysis
- Standards for both data input and model output. High levels of teaching to ingrain the skills that promote model accuracy and quality assurance.

19

FIGURE 13 HOW TO STRENGTHEN MODELLING OUTPUT AND PROCESS QA - PART II