

Department of Planning and Environment

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# Response to the CSIRO Independent Review of the Draft Far North Coast Regional Water Strategy

Response to recommendations

June 2022





# Acknowledgement of Country

The Department of Planning and Environment acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

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Published by NSW Department of Planning and Environment

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Response to the CSIRO Independent Review of the Draft Far North Coast Regional Water Strategy

First published: June 2022

Department reference number: DOC22/136820

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TMP-MC-R-DC-V1.2

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# Introduction

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## Regional water strategies

Valuable and essential water resources are under pressure across New South Wales (NSW). Challenges like a more variable climate, changing industries and growing populations are making water management decisions difficult.

To address these challenges the NSW Government is developing regional water strategies that will help us balance the various demands for this vital resource. They bring together the best and latest climate evidence with a wide range of tools and solutions to manage water sustainably into the future.

The regional water strategies have been designed to meet five key objectives:

- deliver and manage water for local communities,
- enable economic prosperity,
- recognise and protect Aboriginal water rights, interests and access to water,
- protect and enhance the environment, and
- identify least-cost policy and infrastructure options.

The [NSW Water Strategy](#),<sup>i</sup> together with the regional water strategies and two metropolitan water strategies, will form the strategic planning framework for water management in NSW. The NSW Water Strategy guides the strategic, state-level actions that we need to take, while the regional water strategies will prioritise how those state-wide actions, as well as other region-specific solutions, should be staged and implemented in each region.

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## The Far North Coast regional water strategy

The [Draft Regional Water Strategy for the Far North Coast](#)<sup>ii</sup> was released for public exhibition in October 2020. The draft strategy contained a long list of options designed to meet the future challenges and opportunities of the region. The department has used public and stakeholder feedback, expert advice and rigorous analyses to prioritise the key challenges facing the region.

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## Independent review of the Far North Coast regional water strategy

The Far North Coast has a unique and complex set of challenges. The region has strong population growth which, together with a changing climate, may lead to future periods of lower water availability. On the other hand, flooding is also a major challenge in the region. Historical changes to the landscape together with high levels of development on the floodplains have led to large urban

flooding risks. This has been highlighted in the recent catastrophic flood events that have affected the communities of the Far North Coast region.

There is a lot of uncertainty around these challenges and significant community interest about proposed water management infrastructure in the Far North Coast. These factors led the Department of Planning and Environment (DPE, the department) to seek advice on its strategic direction for the region. DPE engaged the Commonwealth Scientific and Industrial Research Organisation (CSIRO) to provide an independent review of the Far North Coast regional water strategy. The review considered the strategy in the context of water security, flood risk management and river health. There was a focus on the Richmond River catchment due to the large flood risks in the Richmond compared to the other catchments in the region. The review took a systems approach and considered how the department can start to build systems thinking into the regional water strategies program. The review commenced in October 2021 and the final report was delivered in February 2022.

The CSIRO refers in several places to a consultation paper. The consultation paper was initially prepared to support public exhibition of the Far North Coast regional water strategy in early 2022. The department has modified its approach to community engagement following the catastrophic flood events in the Far North Coast region in early 2022. The consultation paper will now be published to support the next phase of public exhibition, intended for later in 2022.

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## Review findings

CSIRO were generally supportive of the department's approach to developing regional water strategies. The review made 41 recommendations that fit into 10 high-level actions. These actions have been proposed across three timeframes and are summarised below.

### Activities to support finalisation of the RWS over the coming months

- Identify and describe environmental assets in the region and identify associated assessment metrics
- Revise hydrological model performance assessment using cross-validation
- Clarify and update future climate data
- Start to build in elements of a broader systems approach
- Finalise supporting documentation

### Priority activities to support delivery of the RWS – up to five years from implementation

- Develop and test models that enable a combined assessment of flood and water security options.
- Detailed studies
- Develop and apply a systems approach
- Distill long-list to short-list options

### Guidance to improve regional water strategies at review

- Revision of Regional Water Strategy guidance

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## The department's response to the review

Of the 41 recommendations in the CSIRO review, 20 are supported, 13 are partially supported and 8 are not supported. The department generally supports the recommendations aimed at building in a systems approach and improving the clarity of the strategy documents. The department generally does not support the recommendations to revise hydrological model performance assessment and to develop new integrated models. Detailed responses to each of the recommendations are provided below.

The CSIRO has recommended that many of the activities are completed over the coming months. The department recognises that some of these activities are important but not as precursors to finalising the Far North Coast regional water strategy. The significant amount of time and resources involved in some of these actions require us to plan them into our long-term program improvements.

Several departmental agencies have provided input to this review. These include DPE Water, DPE Environment and Heritage, and DPI Agriculture. Where a response is from a particular agency it has been specified as such in the text.

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## How will this review be used?

The department will use the CSIRO review to improve the Far North Coast regional water strategy. Some of the recommendations will also be used to improve other regional water strategies and the regional water strategies processes. The department also hopes that this review and the department's responses will help inform the community about the process and rationale for the strategy's direction.

# Recommendations

The following details the department's responses to individual recommendations within the CSIRO's review.

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## Recommendation 1 – Supported

*PROVIDE A CONCISE SUMMARY OF BASELINE ANNUAL WATER AVAILABILITY IN THE REGION UNDER BOTH HISTORICAL AND FUTURE CLIMATE AND COMBINED WITH A CURRENT OR NO DEVELOPMENT SCENARIO.*

**Timeframe:** Finalisation of the RWS

**High level action:** Clarify and update future climate data

The department intends to embed this into the final regional water strategy.

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## Recommendation 2 – Partially Supported

*EXTEND THE CLIMATE PROJECTIONS BEYOND THE DRIEST SCENARIO FROM THE NARCLIM ANALYSIS TO INCLUDE OTHER MOST LIKELY SCENARIOS.*

**Timeframe:** Finalisation of the RWS

**High level action:** Clarify and update future climate data

It is difficult to identify 'most likely' climate scenarios. All climate scenarios modelled by the Intergovernmental Panel on Climate Change are plausible. Global decisions to address the threats posed by climate change will largely dictate which pathway eventuates.

The department's approach was intended to provide 'bookends' for understanding the likely upper and lower bounds of future climate impacts on water resource management. One bookend is provided by the paleoclimate-informed stochastic data set to represent current conditions. The second bookend chosen by the department is uses a worst-case 'dry' climate scenario based on RCP8.5 to model future conditions.

Options have been modelled using many climate realisations (1,000 realisations of 40-year duration) under each of the two climate scenarios. Additionally, the paleoclimate-informed data sets include periods that are significantly wetter – as well as drier – than in the observed record. This provides a robust assessment of the resilience of options under a wide range of plausible climate futures.

The choice of future climate scenarios is part of an ongoing process of embedding climate change into decision-making. The department will update the regional water strategies climate methodology at regular review points and as new versions of the [NARCLiM<sup>iii</sup>](#) data sets are published.

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## Recommendation 3 – Partially supported

*CLIMATE DATA AND MODELLING METHODOLOGIES SHOULD BE CONSOLIDATED INTO A SINGLE REPORT FOR EASE OF ACCESS.*

**Timeframe:** Finalisation of the RWS

**High level action:** Revise hydrological model performance assessment using cross-validation

The department has published [a report and a fact sheet](#)<sup>iv</sup> to clearly explain the new climate data and modelling approach informing the regional water strategies. The department plans to prepare a more detailed document describing the climate methodology in the future.

The department does not plan to consolidate climate and hydrological modelling methodologies into a single document. The climate methodology is relevant to the regional water strategies program whereas hydrologic modelling is tailored to the needs of each catchment. However, the department will consider if we can improve ease of access to these in the future and make the links between them clearer.

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## Recommendation 4 – Supported

*RICHMOND AND TWEED REPORTS SHOULD BE REVISED TO INCLUDE UPDATED INFORMATION ON DATA QUALITY SUCH AS THE NUMBER OF GAUGING STATIONS AND THE AMOUNT OF EXTRAPOLATION BEYOND THE MAXIMUM GAUGED FLOW.*

**Timeframe:** Finalisation of the RWS

**High level action:** Revise hydrological model performance assessment using cross-validation

This information is included in our internal reports that describe the model builds. DPE Water plans to consolidate the model build reports into comprehensive modelling reports for each catchment in the future. However, time and resourcing constraints will prevent us from completing this before the regional water strategies are finalised.

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## Recommendation 5 – Not supported

*CONSIDER THE INCLUSION OF SUB-DAILY HYDROLOGICAL MODELS FOR MODELLING FLOOD IMPACT AS PART OF FUTURE MODELLING WORK UNDERTAKEN BY DPE IN THE FAR NORTH COAST REGION.*

**Timeframe:** <5 years from implementation

**High level action:** Develop and test models that enable a combined assessment of flood and water security options

Sub-daily hydrological models are routinely used for design flood estimation using design rainfall. This practice is well-established and is guided by the [Australian Rainfall and Runoff guideline](#),<sup>v</sup> which is considered best practice for flood estimation.

However, this recommendation is presented in the context of the general recommendation to integrate water security and flood risk analyses. CSIRO correctly notes that “hydrological models operating at daily time step may not be appropriate to characterise hydrological flow regime during

flood events in the Far North Coast region.” The hydrologic models developed for the regional water strategies are not fit-for-purpose for flood estimation and were never designed for this purpose.

The department supports the concept of better integrating flood modelling and water security modelling. However, using sub-daily hydrologic models is only required when proposing a more coupled model integration. Flood models are short duration, event-based models, while water resource models are long-term, continuous models. Integrating flood models and water resource models is not practical nor likely to be cost effective. See the response to recommendation 31 for more information on better integrating flood and water security models.

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## Recommendation 6 – Supported

*RICHMOND AND TWEED REPORTS SHOULD BE REVISED TO INCLUDE UPDATED INFORMATION ON RAINFALL–RUNOFF MODEL CALIBRATION METHODOLOGY, CALIBRATION STATISTICS AND VALUES OF PARAMETERS OBTAINED AT THE END OF THIS PROCESS.*

**Timeframe:** Finalisation of the RWS

**High level action:** Revise hydrological model performance assessment using cross-validation

This information is included in departmental internal reports that describe the model builds. DPE Water plans to consolidate its model build reports into comprehensive modelling reports for each catchment in the future. These reports will include model calibration methodology, statistics and parameter values. However, time and resourcing constraints will prevent us from completing this before the regional water strategies are finalised.

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## Recommendation 7 – Not supported

*CONDUCT A THOROUGH REVIEW OF RAINFALL– RUNOFF MODEL PERFORMANCE USING A RIGOROUS LEAVE-OUT VALIDATION SCHEME WHEN LONG STREAMFLOW RECORDS ARE AVAILABLE AS IS THE CASE IN THE FNC.*

**Timeframe:** Finalisation of the RWS

**High level action:** Revise hydrological model performance assessment using cross-validation

Split-sample validation techniques are popular with the academic community. The department accepts that they have merit in certain circumstances, such as when comparing models or calibration techniques.

DPE Water’s hydrologic modelling team has extensive experience with various modelling techniques. It has developed rigorous methods for hydroclimate data review and model calibration. The department has reviewed its approach and steered away from leave-out validation approaches following an external review of its modelling methodologies in 2013.

DPE Water’s validation approach is consistent with the [eWater best practice modelling guidelines](#).<sup>vi</sup> DPE Water has also determined that calibrating models with all good quality flow data leads to better model performance. This is true, provided consistent model performance can be established for:

- different time periods
- different flow ranges
- wet and dry periods separately.

The department also uses a broad range of calibration metrics and graphical techniques to improve confidence in model performance.

The CSIRO review notes that “once such a performance evaluation using a split-sample approach has been completed and reported, it is acceptable to recalibrate hydrological models using all data available.” DPE Water questions the purpose of the split-sample validation if the resulting calibration would not be used in a production parameter set. It is also unclear how this validation supports the integrity of the model reporting and review process because it leads to discrepancies between what is reported and what is used in the final model.

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## Recommendation 8 – Supported

*Richmond and Tweed conceptualisation reports should be updated to clarify river reach model calibration, particularly how transmission losses are setup, how they are calibrated and how much they amount to compared to inflows and outflows. Further clarification on how the hydrological models were calibrated to measure medium to low flows within the tidal zone is also recommended.*

**Timeframe:** Finalisation of the RWS

**High level action:** Revise hydrological model performance assessment using cross-validation

The Far North Coast hydrologic models were set up for the areas within tidal influence using the parameter regionalisation approach. Model performance within these areas was checked against observed water levels at tidal gauges.

Information on reach calibration methods is included in the department’s internal reports that describe the model builds. DPE Water plans to consolidate these model build reports into comprehensive modelling reports for each catchment in the future. However, time and resourcing constraints will prevent us from completing this before the regional water strategies are finalised.

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## Recommendation 9 – Not supported

*DEVELOP AND USE A RIGOROUS LEAVE-OUT VALIDATION SCHEME TO EVALUATE THE CAPACITY OF HYDROLOGICAL MODEL PERFORMANCE IN RESIDUAL CATCHMENTS IN EXTRAPOLATING BEYOND CALIBRATION CONDITIONS SIMILARLY TO RAINFALL-RUNOFF MODELS IN HEADWATER CATCHMENTS.*

**Timeframe:** Finalisation of the RWS

**High level action:** Revise hydrological model performance assessment using cross-validation

See response to Recommendation 7.

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## Recommendation 10 – Partially supported

*CONSIDER INTRODUCING EVALUATION METRICS, WHICH WILL BE SUITABLE TO COMPARE THE IMPACT OF OPTIONS ON SHORT DRY AND WET SPELLS (WATER SECURITY AND FLOOD RISK) WITHIN A GIVEN YEAR INSTEAD OF THE CURRENTLY USED MEAN ANNUAL DEMAND SHORTFALL.*

**Timeframe:** Finalisation of the RWS

**High level action:** Identify and describe environmental assets in the region and identify associated assessment metrics

Water shortfalls in the Far North Coast region tend to occur at a sub-annual scale. The department agrees that evaluation metrics that compare the impact of options on short dry and wet spells is important. For this reason, the regional water strategies use a large range of hydrological and water security metrics to assess options. The mean annual demand shortfall is only one of these metrics. The department's models shortfalls at a daily timescale and reports metrics at a monthly timescale.

However, the department does not agree with the recommendation to introduce evaluation metrics to the hydrologic models to assess flood risk. The models the department has developed for the regional water strategies program are not suitable for assessing flood risk. River levels are considered in hydrologic models, but this is only suitable for use in the regional water strategies environmental assessments.

Models suitable for assessing flood risk are event-based, not continuous like water security models. The department agrees that an option should be assessed for flood risk impacts wherever it has the potential to influence flood risk. However, this can be done cost-effectively and efficiently by using existing flood models for the region.

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## Recommendation 11 – Partially supported

*CONSIDER THE ADOPTION OF LOW FLOW METRICS TO COMPLEMENT THE WATER RESOURCE ASSESSMENT SUCH AS THE NUMBER OF DAYS DURING A YEAR WHERE SHORTFALL IS GREATER THAN, SAY, 10% OF THE TOTAL DEMAND FOR THE DAY.*

**Timeframe:** Finalisation of the RWS

**High level action:** Identify and describe environmental assets in the region and identify associated assessment metrics

The regional water strategies assessment process already identifies extractive shortfalls at a daily timescale. However, the current metrics do not report this. Water users represented in the hydrologic models for the Far North Coast region are generally not particularly susceptible to shortfalls for single days. It is longer dry periods that will impact extractive users and towns in the region. Storages should be used as a buffer where daily access to water extraction is critical. It is also possible that even when supply shortfalls do not occur, there still may be shortfalls for environmental needs.

The department can use cease-to-flow metrics as a proxy for short duration supply shortfalls and will therefore use future reviews of the regional water strategies to improve the modelling and

assessment processes. This may include broadening the range metrics used to include low-flow metrics such as those described in this recommendation.

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## Recommendation 12 – Supported

*CONSIDER INTRODUCING ADDITIONAL SUB- ANNUAL METRICS FOCUSING ON LOW FLOWS WITHIN A YEAR.*

**Timeframe:** Finalisation of the RWS

**High level action:** Identify and describe environmental assets in the region and identify associated assessment metrics

The department agrees that these metrics are important for assessing the impacts of options on the environment. Metrics that focus on sub-annual low flows have been developed for the detailed ecological assessments. However, these assessments were not available at the time CSIRO undertook this review.

Since then, the department has completed detailed ecological assessments of options. The department developed 20 flow metrics for the assessments, which included the:

- magnitude and duration of low flows,
- frequency and duration of cease-to-flow (no flow) events,
- magnitude of base flows,
- frequency of freshes (high flows),
- magnitude of large and infrequent bankful and overbank flows, and
- annual volume of flows.

The detailed economic and environmental analysis for the Far North Coast regional water strategy will be published during the next phase of public exhibition.

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## Recommendation 13 – Supported

*ENVIRONMENTAL ASSESSMENT OF PROPOSED OPTIONS SHOULD BE INCLUDED IN THE CONSULTATION PAPER TO ENABLE A ROBUST OPTIONS ASSESSMENT PROCESS THAT MEETS THE OBJECTIVES OF THE RWS. THIS SHOULD EXTEND TO INCLUDE A GREATER EMPHASIS ON ENVIRONMENTAL OBJECTIVES FOR WATER DEPENDENT SYSTEMS, AND REPORTING ON ENVIRONMENTAL ASSETS AND INDICATORS THAT ARE RESPONSIVE TO HYDROLOGICAL CHANGE.*

**Timeframe:** Finalisation of the RWS

**High level action:** Identify and describe environmental assets in the region and identify associated assessment metrics

The department has completed detailed environmental assessments of modelled options. These assessments were not available at the time CSIRO undertook this review. The department has now completed the detailed ecological assessments of options.

The condition and diversity of water-dependent ecosystems is mainly driven by flows. As such, the ecological assessments focussed on evaluating flow-based metrics. Different flows support the

needs of different species and ecological communities. Different requirements across species and ecosystems mean that variations in timing, frequency and duration of flows are important. These variations bring benefits such as nutrient cycling and fish breeding cues that support high diversity ecosystems.

The environmental assessment ideally should have been carried out by assessing against the environmental water needs (EWRs) for specific river reaches and environmental assets in the region. However, EWRs have not yet been developed for coastal catchments. Developing EWRs is a large and complex project that requires a high level of collaboration with experts across many fields.

The department recognises that this is an important knowledge gap. Development of EWRs will be progressed through proposed action 1.7 in the Far North Coast regional water strategy. This action will identify environmental water needs and objectives to support healthy coastal waterways. It will also identify and prioritise data and monitoring gaps.

Development of EWRs for the region will support future planning, policy and investment decisions. It will also inform future reviews of the Far North Coast regional water strategy.

No options that have been modelled and assessed through the draft Far North Coast regional water strategy have been shortlisted yet. As such, decisions that could impact flows can be deferred until they can be assessed against regional EWRs.

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## Recommendation 14 – Supported

*CONSIDER FURTHER INVESTIGATION INTO THE TIMING AND SEVERITY OF LOW FLOWS AND POOR WATER QUALITY (E.G. IMPACT OF NUTRIENT LOADS AND SALINITY) IN THE RICHMOND RIVER AND HOW THIS MAY BE MITIGATED.*

**Timeframe:** Finalisation of the RWS

**High level action:** Identify and describe environmental assets in the region and identify associated assessment metrics

Improving environmental health in the Far North Coast region requires us to improve our understanding of flows and water quality. Existing studies such as the *Richmond Ecohealth Project 2014*<sup>vii</sup> give some idea of the timing, severity and causes of poor water quality in the region. However, large gaps in data and knowledge remain.

Better and higher resolution data is needed to inform future decisions. However, conducting investigations and studies into water quality is time consuming and cannot be achieved before finalising the Far North Coast regional water strategy. The strategy recognises this and has proposed a number of actions to improve understanding of flows and water quality:

- proposed action 1.7 will identify environmental water needs to support healthy coastal waterways. It will collect information related to the volume, frequency, timing, and duration of flows for various flow classes, and the impacts from changes in baseline water quality.
- proposed action 1.6 will consider impacts of salinity and sea level rise on water quality.

Water quality investigations are also carried out by local councils through the coastal management programs.<sup>viii</sup>

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## Recommendation 15 – Not supported

*UNDERTAKE RELEVANT FLOOD RISK ASSESSMENTS FOR SMALL TO MODERATE FLOODS (<10% AEP) AND INCORPORATE FLOOD RISK MODELLING INTO HYDROLOGICAL ASSESSMENTS. OPTIONS SHOULD BE REVISITED IN LIGHT OF THIS NEW DATA.*

**Timeframe:** <5 years from implementation

**High level action:** Develop and test models that enable a combined assessment of flood and water security options

See responses to recommendations 5 and 31 that refer to integrating flood risk and hydrological modelling.

Floods smaller than the 10% AEP generally have limited impacts in urban areas. As a result, flood risk assessments for these small events are rarely completed under the department's Floodplain Management Program.

The impacts of these smaller flood events on communities have been limited by the significant work undertaken by local councils with the support of the department's Floodplain Management Program.<sup>ix</sup> Flooding impacts have been addressed through:

- implementing flood risk management works
- flood warnings
- land use planning
- emergency management planning decisions.

Most flood impacts in urban areas occur in events rarer than the 10% AEP event. The capacity of existing storages to provide flood mitigation services for large events, such as the recent floods that have impacted the region, is very low. At best they can hold less than 1% of flood waters in large events.

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## Recommendation 16 – Supported

*PRIOR TO FINALISATION, THE STRATEGY AND SUPPORTING DOCUMENTS ARE UPDATED TO ENSURE CONSISTENCY ACROSS THE RWS.*

**Timeframe:** Finalisation of the RWS

**High level action:** Finalise supporting documentation

The department agrees that consistency is important for good communication. We will commit to ensuring the terminology and approach used for the final strategy documents are consistent across the regional water strategies program. However, the department will not amend previously published documentation. Instead, final documentation will clarify all terms used across the suite of supporting documents.

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## Recommendation 17 – Supported

*UPDATE THE CONSULTATION PAPER TO INCLUDE FULL COVERAGE OF SHORT-LISTING, PRIORITISATION AND BUNDLING ASSESSMENTS AND ALL SENSITIVITY ANALYSES.*

**Timeframe:** Finalisation of the RWS

**High level action:** Finalise supporting documentation

This recommendation has been addressed through preparation of the detailed economic and environmental analysis of the draft Far North Coast regional water strategy. This document was not available at the time CSIRO undertook this review.

The detailed economic and environmental analysis of the Draft Far North Coast Regional Water Strategy will be published during the next phase of public exhibition on the Far North Coast regional water strategy.

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## Recommendation 18 – Supported

*PROVIDE GREATER CLARITY ON THE CURRENT LEVEL OF KNOWLEDGE AND PLANNING (WHERE THAT IS RELEVANT) FOR EACH OF THE OPTIONS UNDER CONSIDERATION.*

**Timeframe:** Finalisation of the RWS

**High level action:** Finalise supporting documentation

The department accepts that greater clarity on the current level of knowledge and planning for proposed actions is valuable. This will be improved in the final strategy documentation where it is relevant.

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## Recommendation 19 – Partially supported

*ALL R&D, DATA AND REPORTS SHOULD BE SUBJECTED TO A PEER REVIEW PROCESS AND THIS PROCESS SHOULD BE CLEARLY DESCRIBED.*

**Timeframe:** <5 years from implementation

**High level action:** Distillation of long-list to short-list options

The department is committed to ensuring that the regional water strategies are based on reliable and high-quality information. For this reason, the following components of the hydrologic modelling and economic assessment processes have undergone a peer review process:

- the climate modelling methodology was reviewed by an independent expert panel.
- all modelling reports (conceptualisation; calibration; headwater; reaches; stitch flow; full flow) were reviewed in early 2021 by an external specialist in hydrologic modelling.
- the options assessment framework was reviewed by an expert advisory group. The group included economics and water resource officers from across the NSW Government and external organisations.

- the water valuation work was developed by Marsden Jacob Associates and reviewed by the Centre for Independent Economics.

The department acknowledges that information about these reviews can be difficult for the public to access. The department supports providing more clarity in the future regarding the descriptions of the review processes used in developing the regional water strategies.

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## Recommendation 20 – Partially supported

*THE FOLLOWING SPECIFIC SUGGESTIONS ARE OFFERED TO IMPROVE READABILITY PRIOR TO FINALISATION:*

- *THE CHARTS PROVIDED ON PAGE 4 IN APPENDIX 2 OF THE CONSULTATION PAPER APPEAR TO BE INTENDED TO SHOW ‘CUMULATIVE’ EFFECT. HOWEVER, THEY HIGHLIGHT SHOCKS AT A POINT IN TIME AS A RESULT OF WATER SHORTFALL IN TOWNSHIPS AND COULD PROVIDE CLEARER INSIGHTS INTO ‘PREDICTED ECONOMIC OUTCOMES’ IF THE DISTRIBUTION OF IMPACTS SHOWN WERE INCLUDED*
- *CONSIDER WHETHER IT MAY BE USEFUL TO PROVIDE A SERIES OF CHARTS THAT ENABLE A DIRECT COMPARISON BETWEEN OUTCOMES, INCLUDING ECONOMIC IMPLICATIONS, FOR TWO LOCATIONS.*

**Timeframe:** Finalisation of the RWS

**High level action:** Finalise supporting documentation

The cumulative shortfall charts do highlight shock points in our model runs. However, they also present these shortfalls for a range of the modelled climate realisations. This allows the reader to understand the shortfall risks across a wide range of climatic conditions. The charts are specifically designed to present shortfall risks for town water supplies. Understanding the distribution of impacts from town water supply shortfalls is beyond the scope of the regional water strategies.

Considering ways to compare outcomes for different locations may be useful for prioritising works for implementation. It may also be useful when implementing proposed action 3.4 that takes an ‘options and pathways’ approach to town water supply planning in the Far North Coast.

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## Recommendation 21 – Supported

*EXPLORE THE PERFORMANCE OF COMBINATION OR BUNDLED OPTIONS, IN PARTICULAR HOW A COMBINATION OF LEAST-COST OPTIONS PERFORM IN RELATION TO A LARGE INVESTMENT.*

**Timeframe:** <5 years from implementation

**High level action:** Distillation of long-list to short-list options

Large investments considered in the *Draft Regional Water Strategy for the Far North Coast\** are mostly limited to investment in town water supplies. The department has since updated actions that consider investment in town water supplies to take an ‘options and pathways’ approach as suggested by CSIRO. This allows consideration of the performance of least-cost options bundles compared to large investments for town water supplies at future decision points.

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## Recommendation 22 – Supported

*SHORT-LISTED OPTIONS SHOULD BE ASSESSED AGAINST ALL OBJECTIVES OF THE RWS TO UNCOVER POTENTIAL TENSIONS AND MALADAPTIVE OUTCOMES.*

**Timeframe:** <5 years from implementation

**High level action:** Distillation of long-list to short-list options

Current assessment processes have the capacity to assess options against the objectives of the environment, towns and communities and economic prosperity. Additionally, where an option is likely to impact flood risk, those impacts can be assessed with the department's existing flood models.

The department acknowledges there is currently a gap in our capacity to assess options against the objective of protecting Aboriginal peoples' water rights and interests in water. The department does not currently have enough evidence about potential impacts or benefits on Aboriginal communities to provide full assessments of the proposed actions. However, actions that the department will implement through the NSW Water Strategy,<sup>xi</sup> the NSW Aboriginal Water Strategy and the regional water strategies will help fill this gap.

Preliminary engagement with some Aboriginal communities in the Far North Coast region has identified that communities need specific information on how the proposed actions will affect them. Some of this information will not be available until more detailed analyses are undertaken for specific options that remain in the final regional water strategy shortlist. Some of this additional analysis may be identified for early action in the strategy's implementation plan.

Future reviews of the regional water strategies program will provide an ongoing opportunity to improve assessment processes. Implementation of proposed action 3.4 of the draft Far North Coast regional water strategy may provide an opportunity to test improvements.

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## Recommendation 23 – Not supported

*CONSIDER INCLUDING A GREATER FOCUS ON THE COST OF INVESTMENTS AS A MEANS OF DIFFERENTIATING OPTIONS. AN 'IMPACTS FRAMEWORK' IS SUGGESTED TO COMPLEMENT QUANTITATIVE AND QUALITATIVE ASSESSMENTS OF OPTIONS OR PORTFOLIOS OF OPTIONS.*

**Timeframe:** <5 years from implementation

**High level action:** Distillation of long-list to short-list options

The options assessment methodology used across the regional water strategies program adheres to the NSW Government Guide to Cost-Benefit Analysis (TPP 17-03).<sup>xii</sup>

The department has decided not to use the cost of investment for the regional water strategies assessments. It is a very simple measure that is not good at highlighting project risks, particularly when comparing a diverse range of options. For example, a large infrastructure investment may generate large economic benefits compared to a small project with small and uncertain benefits.

However, the department recognises the value in using a diverse range of measures and tools for our assessments. Future reviews of the regional water strategies program will provide an ongoing opportunity to improve our assessment processes. Consideration will be given to include the cost of investments and an impacts framework to complement our current assessment methodology at these review points.

The department will consider resourcing issues — such as the overall cost of options — when we move into implementation planning. This will be done from a broad perspective that considers multiple regions. It will focus on the department’s capacity to deliver.

Implementation of proposed action 3.4 of the Far North Coast Regional Water Strategy may provide an opportunity to test any changes to our assessment methodologies.

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## Recommendation 24 – Partially supported

*ECONOMIC ANALYSIS OF OPTIONS SHOULD BE EXTENDED TO INCLUDE THE POTENTIAL TO MITIGATE FUTURE FLOOD DAMAGES (I.E. THE OPPORTUNITY COST OF SAVING FUTURE COST IMPACTS), WITH A PARTICULAR FOCUS ON SMALL TO MODERATE FLOODS (<10% AEP).*

**Timeframe:** <5 years from implementation

**High level action:** Distillation of long-list to short-list options

Extending current economic analyses in this way is only warranted where an option could significantly affect flood behaviour. It is unlikely that the potential for water security options to mitigate small to moderate floods will significantly improve business cases.

However, the department acknowledges that this type of analysis is useful to differentiate between options. As CSIRO has highlighted in its review, where different options address water security equally, one may be preferable if it also provides flood risk reduction. The department will consider this when implementing proposed action 3.4 (support adaptive development of the regional water supply system). This can provide another useful way to compare town water supply options at future decision points.

This type of analysis is complex, particularly when water security measures are proposed on private land. For example, privately owned farm storages may provide some level of water security and flood risk reduction (see proposed action 3.3). The river recovery program (proposed action 1.4) may provide useful information on this. The program will be led by Local Land Services. It has been designed to deliver both flood risk reduction and water quality benefits and will include works on private land. This should inform our understanding of how to value the potential of privately owned assets to reduce flood risk.

The department will investigate how to extend its economic analysis to include the potential to mitigate flood risk. This will be done in the context of future reviews of the regional water strategies.

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## Recommendation 25 – Supported

*HIGHLIGHT IN RWS ACTIVITIES OR COMPLEMENTARY COMMITMENTS WHAT OTHER AGENCIES OR ACTORS ARE WHOLLY OR JOINTLY UNDERTAKING. PARALLEL WORK THAT COMPLEMENTS THE OBJECTIVES OF THE RWS SHOULD BE DOCUMENTED IN ORDER TO SUPPORT A MORE INTEGRATED APPROACH, NOTING THAT THE EXTENT TO WHICH THIS IS UNDERTAKEN IS A NEGOTIATED PROCESS.*

**Timeframe:** Finalisation of the RWS

**High level action:** Start to build in elements of a broader systems approach

Consulting with regional interagency panels has been an important part of the regional water strategy program since its inception. The interagency panels bring together agency representatives from across the NSW Government. They ensure that the regional water strategy work is effective and coordinated with complimentary work and commitments.

The department will ensure that final strategy documentation makes this complimentary work clearer.

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## Recommendation 26 – Partially supported

*ASSESSES HYDROLOGICAL MODEL PERFORMANCE IN BOTH HEADWATER AND RESIDUAL CATCHMENTS USING A WELL-ESTABLISHED CROSS-VALIDATION APPROACH. THE PERFORMANCE METRICS TO BE REPORTED SHOULD INCLUDE AT LEAST MEAN DAILY SIMULATION BIAS, DAILY NASH-SUTCLIFFE EFFICIENCY AND DAILY NASH-SUTCLIFFE EFFICIENCY COMPUTED FROM RECIPROCAL TRANSFORMED FLOWS [SEE CHAPTER 6 FOR FULL RECOMMENDATION].*

**Timeframe:** Finalisation of the RWS

**High level action:** Revise hydrological model performance assessment using cross-validation

See response to Recommendation 7 regarding the assessment of model performance using cross-validation.

DPE Water assesses hydrologic model performance against several criteria that are important to water-related outcomes in river systems. These metrics include the daily Nash-Sutcliffe efficiency and mean daily simulation bias.

Several other metrics are reported that are critical to presenting a more complete description of model performance. An alternate low-flow metric and residual mass curve are used that provide insights into model performance at a macro level. These formulations are less complex and just as robust as those mentioned in this recommendation. They are also easier to communicate in modelling reports. These metrics will be included in final modelling reports.

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## Recommendation 27 – Partially supported

*CONSIDER REPLACING STATIC MONTHLY SCALING FACTORS WITH MORE APPROPRIATE METHODS SUCH AS QUANTILE-QUANTILE MAPPING IMPLEMENTED FOR DIFFERENT TIME WINDOWS OR POTENTIALLY MORE ADVANCED METHODS SUCH AS THE MULTIVARIATE RECURSIVE NESTING BIAS CORRECTION APPROACH.*

**Timeframe:** Finalisation of the RWS

**High level action:** Clarify and update future climate data

The regional water strategy climate modelling method uses a fixed level of development and a consistent climate dataset. Outcomes are analysed from a 10,000-year dataset of plausible 'current conditions' and compared to the 10,000-year 'climate change' dataset. Models do not consider a gradual shift in conditions over time. Rather, they compare current climatic conditions to different future climatic conditions.

The department's climate modelling methodology will be improved over time as recommended by the *Independent review of the climate risk method for the NSW Regional Water Strategies Program*. The appropriateness of these different methods will be considered when the climate methodology is next reviewed.

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## Recommendation 28 – Supported

*IDENTIFY AGENCIES FOR POTENTIAL COOPERATION. IDENTIFY AGENCIES WITH CARRIAGE OF STRATEGIES AND PLANS WITH COMPLEMENTARY VISIONS AND OBJECTIVES, AS POINTERS TO COOPERATION IN A BROADER PLACE-BASED SYSTEMS CONTEXT IN THE LONGER TERM. INCLUDE IN RWS.*

**Timeframe:** Finalisation of the RWS

**High level action:** Start to build in elements of a broader systems approach

Collaboration with other agencies and plans is an important part of implementation planning. Implementation planning has highlighted several actions that will be led by other agencies or that complement other strategies and plans.

The department will document these cooperative activities more clearly in final strategy documentation.

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## Recommendation 29 – Partially supported

*INCLUDE AN ACTIVITY TO MAP OPTIONS OR COMBINATIONS OF OPTIONS TO MULTIPLE OBJECTIVES/BENEFITS. BUILDING ON THE EXAMPLES OFFERED IN THE SYSTEMS REVIEW, MAP OUT A BROADER SUITE OF OPTIONS CONNECTED TO THE WATER SUBSYSTEM, INCLUDING FOR EXAMPLE CONSIDERATION OF GREEN INFRASTRUCTURE, THAT COULD HAVE MULTIPLE BENEFITS AND HELP ACHIEVE IMPROVED COST-BENEFIT RATIOS ACROSS MULTIPLE BENEFITS TO COMMUNITY AND THE ENVIRONMENT.*

**Timeframe:** Finalisation of the RWS

**High level action:** Start to build in elements of a broader systems approach

The department agrees that this type of systems approach can help to deliver better outcomes, and it will be undertaken to support implementation planning. Some of this will be completed prior to release of final strategy documentation. More detailed mapping exercises can be completed for business cases, detailed implementation planning and future reviews of regional water strategies.

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## Recommendation 30 – Supported

*MAP OUT LONGER-TERM PATHWAYS TO PROJECT DEVELOPMENT, ASSESSMENT AND FINANCING. THERE ARE MANY CHANGES UNDERWAY NOT ONLY IN THE COMMUNITIES AND PLACES OF THE FAR NORTH COAST, BUT ALSO IN THE CONTEXT WITHIN WHICH STRATEGIES MIGHT BE IMPLEMENTED THROUGH PROJECTS OVER THE NEXT FEW YEARS. GAINING A CLEARER LINE OF SIGHT OVER THESE CHANGES AND ADJUSTING STRATEGY DEVELOPMENT TO ALIGN IS AN OPPORTUNITY TO MANAGE RISKS AND STRENGTHEN IMPLEMENTATION PATHWAYS.*

**Timeframe:** Finalisation of the RWS

**High level action:** Start to build in elements of a broader systems approach

Mapping out longer-term pathways to project development is a foundational step in implementation of regional water strategies. The strategies will be reviewed every 3–4 years, which will facilitate agility and management of risks as they emerge.

A cross-agency committee will support implementation governance for each regional water strategy. These committees will include agencies with responsibility for complementary projects. They will provide clarity over future changes to the communities and contexts within which the regional water strategies will be developed.

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## Recommendation 31 – Partially supported

*CONSIDER INVESTING IN SIMPLIFIED FLOOD MODELS FOR THE FNC REGION THAT CAN BE COMBINED WITH OUTPUTS FROM EXISTING HYDROLOGICAL MODELS TO PROVIDE A RAPID ASSESSMENT OF FLOODING IMPACTS. THE MAIN BENEFIT OF THESE MODELS WILL BE TO ENABLE JOINT ASSESSMENT OF WATER SECURITY AND FLOOD MITIGATION OPTIONS. A SIMPLIFIED HYDRODYNAMIC (FLOOD RISK) COMPONENT SHOULD BE ABLE TO ESTIMATE FLOODING EXTENT IN THE REGION FOR A WIDE RANGE OF MULTI-YEAR STOCHASTIC SCENARIOS. THIS COULD BE SUPPORTED BY MORE DETAILED 1D OR 2D HYDRODYNAMIC MODELS FOR SPECIFIC HIGH-RISK AREAS SUCH AS LISMORE. IDEALLY THE MODEL WILL EXTEND TO COVER THE RICHMOND AND TWEED CATCHMENTS TO ALLOW THE SETUP OF A FULLY DYNAMIC CONNECTION BETWEEN THESE AREAS [SEE CHAPTER 6 FOR FULL RECOMMENDATION].*

**Timeframe:** <5 years from implementation

**High level action:** Develop and test models that enable a combined assessment of flood and water security options

The department supports improving integration of flood models with hydrologic models. Processes can be improved by using information from new hydrologic models in flood models, where appropriate. However, the department does not agree on the need to invest in new simplified flood models or to develop coupled water security/flood models.

Models for water security and for flood risk use very different approaches. Understanding water security requires long-term, continuous models, while understanding flood risk requires short-term, event-based models. It is challenging to develop a model that is fit-for-purpose to understand both water security and flooding conjunctively. The investment and resources required for this would far exceed what is required to test options with our existing flood models.

Flood models currently exist that can be adapted to support the assessment of flood impacts from options in regional water strategies. Proposed action 1.11 of the Far North Coast regional water strategy will improve catchment-scale flood modelling in the Richmond River catchment.

These existing models and future improvements will facilitate better understanding of the impacts on and benefits to the community from new or modified water resource management infrastructure. Where changes to the flow regime are significant, understanding of these impacts can be improved by testing options with hydraulic flood models.

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## Recommendation 32 – Not supported

*LAND CAPABILITY ASSESSMENT – THE REVIEW TEAM SUPPORTS THE CURRENT DPE THREE-YEAR PROGRAM TO IDENTIFY AND MAP IMPORTANT AGRICULTURAL LANDS. DEPENDING ON THE EXTENT OF THIS WORK, MORE DETAILED INVESTIGATIONS ARE RECOMMENDED TO BE UNDERTAKEN AS PART OF LAND SUITABILITY ASSESSMENT. THE OUTPUT, DIGITAL LAND SUITABILITY DATA AND MAPS OF THE REGION, WILL IDENTIFY AREAS THAT ARE MORE OR LESS SUITABLE UNDER DIFFERENT COMBINATIONS OF LAND USE AND IRRIGATION SYSTEMS, AS WELL AS FOR AQUACULTURE.*

**Timeframe:** <5 years from implementation

**High level action:** Detailed studies

DPI Agriculture is currently mapping important agricultural land through the State Significant Agricultural Land project. The maps will inform the state planning framework by providing insights on where the most productive agricultural land is in NSW.

The mapping activity does consider water availability. However, the maps are based on existing data sets and DPI Agriculture is not carrying out on-ground assessments as part of the project.

The type of study proposed by CSIRO requires a significant amount of time and resources. Examples of this type of study can be seen in [Tasmania](#)<sup>xiii</sup> and [South Australia](#),<sup>xiv</sup> both of which took many years to complete.

Agricultural land capability assessment could be a useful input to future reviews of regional water strategies. Responsibility for these assessments lies with DPI Agriculture. The department will liaise with DPI Agriculture regularly regarding this work. The department will also support DPI Agriculture to define possible triggers for commencing this detailed work.

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## Recommendation 33 – Not supported

*AGRICULTURE VIABILITY AND SOCIO-ECONOMICS – THE BENEFIT ASSESSMENT FOR THE RWS ASSUMES THAT AGRICULTURAL PRODUCTION CAN BE EXPANDED IF MORE WATER IS SECURED OVER TIME. THIS ASSUMPTION NEEDS TO BE EVALUATED TO BETTER UNDERSTAND HOW AGRICULTURE WITHIN THE FNC REGION MAY BE EXPANDED IN RESPONSE TO WATER AVAILABILITY AND EFFICIENCY OF USE. A STUDY IS RECOMMENDED TO MODEL PREDICTED LAND USE CHANGE AND IMPACTS THAT COULD INFORM SELECTION AND DEVELOPMENT OF OPTIONS, WHICH WOULD BE COMPLEMENTED WITH A SPATIAL ECONOMETRIC STUDY TO EVALUATE DIRECT BENEFITS TO THE REGION AS WELL AS FLOW-ON OF BENEFITS (INCLUDING REGIONAL VALUE ADDED) TO THE REGION AND STATE.*

**Timeframe:** <5 years from implementation

**High level action:** Detailed studies

This type of assessment is beyond the scope of regional water strategies, which are high-level strategic plans. Additionally, the *NSW Government Guide to Cost-Benefit Analysis (TPP 17-03)*<sup>xv</sup> recommends that flow-on benefits are typically not considered in project evaluations. The department acknowledges that there can be value in understanding the broader context of economic benefits to a region. However, this broader context is unlikely to have a large impact on the outcomes of any future economic assessment of options.

There is already a high level of uncertainty regarding forecasts for economic activity. The type of detailed study recommended would also entail a high degree of uncertainty. For this reason, the department's assessments have used an upper bound of agricultural production from increased water use. These assume that all additional water secured through an option can lead to increased agricultural production. However, even with this assumption, there were no options aimed at increasing agricultural activity that produced positive economic benefits.

This recommendation may be revisited if any options produce a positive economic result in the future. Additionally, this type of study may be warranted for developing a detailed business case. In these cases, it may be useful to understand the upper limit of agricultural production.

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## Recommendation 34 – Partially supported

*SURFACE WATER STORAGE OPTIONS – MORE DETAILED ANALYSES OF SURFACE WATER STORAGES THAN THAT SUGGESTED IN THE CONSULTATION PAPER IS RECOMMENDED IN ORDER TO PROVIDE A COMPREHENSIVE OVERVIEW OF THE DIFFERENT SURFACE WATER STORAGE OPTIONS IN THE REGION, INCLUDING THE POTENTIAL TO USE EXISTING STORAGES MORE EFFECTIVELY (E.G. TOONUMBAR DAM). THIS SHOULD EXTEND TO INCLUDE PRE-FEASIBILITY ASSESSMENT OF A RANGE OF INSTREAM AND OFF-STREAM STORAGES AND THE POTENTIAL TO LOCATE THESE AS DISTRIBUTED SYSTEMS ON PUBLIC AND / OR PRIVATE LAND.*

**Timeframe:** <5 years from implementation

**High level action:** Detailed studies

More detailed studies of surface water storages options will be completed through several of the actions proposed for the Far North Coast Regional Water Strategy.

Proposed action 3.4 will take an agile approach to developing the regional water supply system. As part of this action, additional studies will be identified and progressed to assess all regional-scale supply options. This will include considering the potential to use existing storages more effectively.

Proposed action 3.3 will investigate increasing on-farm storage to improve both water security and environmental outcomes. This action will consider both in-stream and off-stream storages. The outcomes of proposed action 2.8 to consider the impacts of increased harvestable rights limits at the catchment scale will also inform the feasibility of in-stream storages.

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## Recommendation 35 – Supported

*GROUNDWATER – FURTHER STUDIES, AS EMPHASISED IN THE CONSULTATION PAPER, TO CHARACTERISE GROUNDWATER AQUIFERS IN THE FNC REGION ARE SUPPORTED IN ORDER TO UNDERSTAND HOW: GROUNDWATER RESOURCES COULD SUPPORT NATURAL SYSTEMS; MAY BE USED TO BUFFER WATER SUPPLY; AND BETTER UNDERSTAND THE POTENTIAL FOR GROUNDWATER RECHARGE USING FLOOD WATER DURING SMALL TO MEDIUM EVENTS [SEE CHAPTER 6 FOR FULL RECOMMENDATION].*

**Timeframe:** <5 years from implementation

**High level action:** Detailed studies

These studies are addressed through a number of actions in the Far North Coast Regional Water Strategy.

Understanding the potential for groundwater recharge using flood water will be considered in proposed action 3.5. However, this is likely to have little benefit for communities as small to medium flood events generally have little impact in urban areas. Negative impacts on the community from altered flood behaviour or flood storage capacity will also be considered.

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## Recommendation 36 – Supported

*WATER QUALITY – DECLINING RIVER AND CATCHMENT HEALTH REMAINS A CHALLENGE FOR THE FNC. THE FOCUS FOR THIS REVIEW HAS BEEN ON THE IMPACT OF LOW FLOWS ON THE ENVIRONMENT, AND SEVERAL RECOMMENDATIONS ARE PROVIDED. THE SYSTEMS REVIEW IDENTIFIED THE BENEFIT OF MAPPING OPTIONS TO COMPLEMENTARY POLICIES AND PROGRAMS, WHICH THEN OPENS UP THE OPPORTUNITY TO ADDRESS A RANGE OF PRACTICES THAT IMPACT WATER QUALITY IN THE RICHMOND RIVER (FOCUS OF THIS REVIEW) AND ELSEWHERE. BEYOND THIS, A COORDINATED APPROACH SHOULD BE ADOPTED TO BETTER UNDERSTAND AND ADDRESS THE HEALTH OF RIVERS AND ECOSYSTEMS IN THE FNC REGION, IDENTIFY ENVIRONMENTAL WATER NEEDS AND THE IMPACT OF WATER INFRASTRUCTURE ON ECOSYSTEM HEALTH AND AQUATIC ECOSYSTEMS IS RECOMMENDED.*

**Timeframe:** <5 years from implementation

**High level action:** Detailed studies

There is a need to better understand river health and the region's environmental needs to improve management of the Far North Coast's waterways. Proposed action 1.7 of the Far North Coast regional water strategy will establish objectives and water requirements for priority environmental assets across the region. It will also provide a framework to identify and prioritise data and monitoring gaps, and will develop methods to address these gaps. This action will take a coordinated approach to addressing river health that is collaborative and spans across agencies.

Proposed action 1.3 of the Far North Coast Regional Water Strategy will support improved catchment governance. It will support a collaborative and place-based method to address the range of practices that impact water quality in the Richmond River.

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## Recommendation 37 – Partially supported

DOCUMENTATION PROVIDED TO AND REVIEWED BY CSIRO DOES NOT SUPPORT A COMPREHENSIVE DISTILLATION OF LONG-LIST TO SHORT-LIST OPTIONS AND COMBINATIONS AT THIS STAGE. FOLLOWING COMPLETION OF MORE DETAILED STUDIES AND REVISED MODELLING OUTPUTS (USING UPDATED MODELLING METHODS), THE REVIEW TEAM RECOMMENDS THAT DPE USE A TRANSPARENT FRAMEWORK TO ‘RAPIDLY’ EVALUATE LONG-LIST OPTIONS AND CREATE A MEANINGFUL SHORT-LIST THAT COULD BE ASSESSED. SEVERAL KEY STEPS ARE NEEDED FOR THIS APPROACH TO BE EFFECTIVE:

- RESOLUTION OF KEY KNOWLEDGE GAPS:
  - UNDERSTANDING AND REPORTING ON THE IMPACT TO ENVIRONMENTAL ASSETS FROM HYDROCLIMATE CHANGE AND POTENTIAL DEVELOPMENT OPTIONS.
  - UPDATE REPORTING OF HYDROLOGICAL MODEL OUTPUTS TO SHOW SUB-ANNUAL STATISTICS.
  - UPDATE EXISTING HYDROLOGICAL MODELS TO IMPROVE SIMULATION OF EXTREME WET AND DRY PERIODS.
  - DEVELOPMENT OF AN INTEGRATED (LOOSELY COUPLED) FLOOD AND WATER SECURITY MODEL.
  - CLIMATE CHANGE SCENARIO INCLUDING ASSESSMENT OF IMPACT ON EXTREMES WET (FLOODS) AND DRY (DROUGHT) FLOW REGIMES AT SUB-ANNUAL LEVEL.
- DEVELOPMENT OF OPTIONS THAT ARE MORE LIKELY TO ALIGN WITH EMERGING PROJECT DEVELOPMENT, ASSESSMENT AND FINANCING REQUIREMENTS AT STATE AND NATIONAL LEVEL.
- MAP AND VALUE CULTURAL ASSETS AND THEIR ASSOCIATED WATER REQUIREMENTS.
- PRIORITISE NO OR LOW REGRETS OPTIONS UNTIL SUPPORTING STUDIES IMPROVE CRITICAL KNOWLEDGE GAPS.
- ADOPTION OF A SYSTEMS APPROACH TO OPTIONS DEVELOPMENT THAT ENCOURAGES THE CREATION OF OPTIONS / COMBINATIONS OF OPTIONS THAT REALISE MULTIPLE OBJECTIVES AND BENEFITS.
  - ADOPTION OF AN EVALUATION PROCESS THAT MORE ACCURATELY ACCOUNTS FOR COSTS AND BENEFITS, CONSIDERS SYSTEMIC RISK AND VALUE CREATION / BENEFIT FLOW OPPORTUNITIES.

**Timeframe:** <5 years from implementation

**High level action:** Distillation of long-list to short-list options

This recommendation refers to work proposed in a number of other recommendations. These have been addressed in responses to recommendations 5, 7, 9, 10, 12, 15 and 19-24.

CSIRO noted in the review that the department has developed a series of technical analyses and filters that describe the options assessment process. The detailed economic and environmental analysis of the draft Far North Coast regional water strategy will be published during the next phase of public exhibition.

This recommendation suggests that the documentation provided by the department does not support a comprehensive distillation of long-list to short-list options and combinations of options. The consultation paper titled *Shortlisted actions for the Far North Coast region* does not represent a comprehensive shortlisting process at this stage. Only one option from the *Draft Regional Water Strategy for the Far North Coast*<sup>xvi</sup> has been definitively removed (option 13 – New dam on Byrill Creek). All other options have been consolidated or are being addressed by other agencies. Proposed action 3.4 will take an adaptive approach to developing the regional water supply system. This approach leaves options open for as long as possible.

The Far North Coast regional water strategy prioritises no- or low-regrets actions. No-regrets decisions for town water supplies are addressed in proposed action 3.4. Other no-regrets actions that will be prioritised for implementation include:

- proposed action 1.4 – deliver a river recovery program)
- proposed action 2.4 – establish sustainable extraction limits for surface water and groundwater sources)
- proposed action 2.8 – address catchment-based impacts of increased harvestable rights limits).

Our understanding of climate change and its impacts on water systems is ongoing. The department has recently invested significantly in this work. Climate change scenarios for flooding are different to those designed for water security and focus on magnitude and frequency of flood events. Advice on this is provided in a number of government and industry guidelines.

The department agrees that mapping and valuing cultural assets is an important task. This will be carried out through action 2.5 of the [NSW Water Strategy](#).<sup>xvii</sup>

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## Recommendation 38 – Supported

*APPLICATION OF A SYSTEMS APPROACH INCLUDING BENEFIT COST ANALYSES THAT ACCOUNT FOR THE RWS OBJECTIVE OF AFFORDABILITY AND OF MULTIPLE BENEFITS ACROSS THE BROADER SYSTEM IS RECOMMENDED. A SYSTEMS APPROACH SHOULD ALSO ENSURE THAT PROPOSALS MEET THE EMERGING REQUIREMENTS OF INFRASTRUCTURE AUSTRALIA, INFRASTRUCTURE NSW, AND NUMEROUS OTHER FUNDING SOURCES [SEE CHAPTER 6 FOR FULL RECOMMENDATION].*

**Timeframe:** <5 years from implementation

**High level action:** Develop and apply a systems approach

The department supports improving the resilience of water systems. Infrastructure Australia and Infrastructure NSW have recently partnered on a research project that examines how infrastructure planning can increase resilience. This project, [A Pathway to Infrastructure Resilience](#),<sup>xviii</sup> recommends a whole-of-system approach to resilience planning. It outlines ten directions for system change across four system levels:

- governance and coordination
- place
- asset
- community.

The department acknowledges that it is important to bring its approach into alignment with that of Infrastructure Australia and Infrastructure NSW. We will address several of these ten directions by implementing some of the actions of the [NSW Water Strategy](#)<sup>xix</sup> and the regional water strategies. In particular, we will:

- test our capacity to manage uncertainty through scenario planning (direction 2) through proposed action 3.4 of the Far North Coast regional water strategy.

- improve data collection and sharing for informed planning, action and decision-making (direction 3) through proposed actions 1.7 and 1.10 of the Far North Coast regional water strategy.
- build trust through more inclusive decision-making (direction 9) through actions 2.1 and 2.4 of the NSW Water Strategy, and proposed action 1.1 of the Far North Coast regional water strategy.
- demonstrate embedding traditional ecological knowledge in decision-making (direction 10) through action 1.4 of the Far North Coast regional water strategy.

The department will improve adoption of a systems approach in the future. This will occur at regular regional water strategy review points and as the regional water strategy program evolves over time.

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## Recommendation 39 – Supported

*REVISION OF GUIDANCE AND PRODUCTION OF TEMPLATES TO REFLECT A SYSTEMS APPROACH TO THE DEVELOPMENT OF REGIONAL WATER STRATEGIES, ALIGNED WITH THE APPROACHES BEING OUTLINED BY INFRASTRUCTURE AUSTRALIA (IN COLLABORATION WITH INFRASTRUCTURE NSW), AND ACROSS OTHER AREAS OF AND LEVELS OF GOVERNMENT IN NSW.*

**Timeframe:** At RWS review

**High level action:** Revision of RWS guidance

See response to recommendation 38. The regional water strategies guidance and templates will be revised to reflect a systems approach. This guidance will be developed in close consultation with all relevant parts of government, including agencies responsible for flood risk management.

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## Recommendation 40 – Supported

*DISTINGUISH ‘REGIONAL WATER STRATEGY’ REGIONS, WHERE APPROPRIATE, TO BETTER DIFFERENTIATE SYSTEM RISKS, KNOWLEDGE GAPS AND OPPORTUNITIES. THIS PROCESS WOULD IDENTIFY WHERE MORE ATTENTION NEEDS TO BE GIVEN TO CERTAIN OBJECTIVES AND WOULD CREATE TRANSFERABILITY BETWEEN REGIONS ACROSS NSW WITH BROADLY SIMILAR CHALLENGES SUCH AS FLOOD RISK AND SEA LEVEL RISE (E.G. FAR NORTH COAST, MID NORTH COAST AND SOUTH COAST).*

**Timeframe:** At RWS review

**High level action:** Revision of RWS guidance

The department has developed the Far North Coast, North Coast and South Coast strategies in parallel as a ‘coastal group’ to leverage the fact that these regions have broadly similar challenges. As a result, these three strategies share many of the same proposed actions and primarily differ only in their context and to address region-specific issues.

These broad regional water strategy regions have been for internal purposes only. The department will make these broad regions more explicit in future revisions of the regional water strategy program and documentation.

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## Recommendation 41 – Not supported

CONSIDER WHETHER TO REBALANCE CURRENT LEGISLATED PRIORITY TO SERVICE BASIC LANDHOLDER RIGHTS AND ESSENTIAL TOWN WATER SUPPLIES, TOWARDS ALSO ADDRESSING THE MAINTENANCE OF ESSENTIAL ECOSYSTEM FUNCTION / SERVICES THAT UNDERPIN REGIONAL SYSTEMS AND PROSPERITY.

**Timeframe:** At RWS review

**High level action:** Revision of RWS guidance

This is already explicitly required by the NSW Water Management Act 2000<sup>xx</sup> (the Act) which is the principal legislation that governs water access in New South Wales. Its objective is to ‘provide for the sustainable and integrated management of the water sources of the state for the benefit of both present and future generations.’

The Act describes the priorities for water access. It establishes the environment as the top priority for access followed by basic landholder rights. Other extraction, such as that for economic benefit, must be considered in this context. Figure 1 shows this contextual consideration graphically. It should be noted that the Act does not preclude use of water for economic purposes when the needs of the environment and social uses are not fully met.

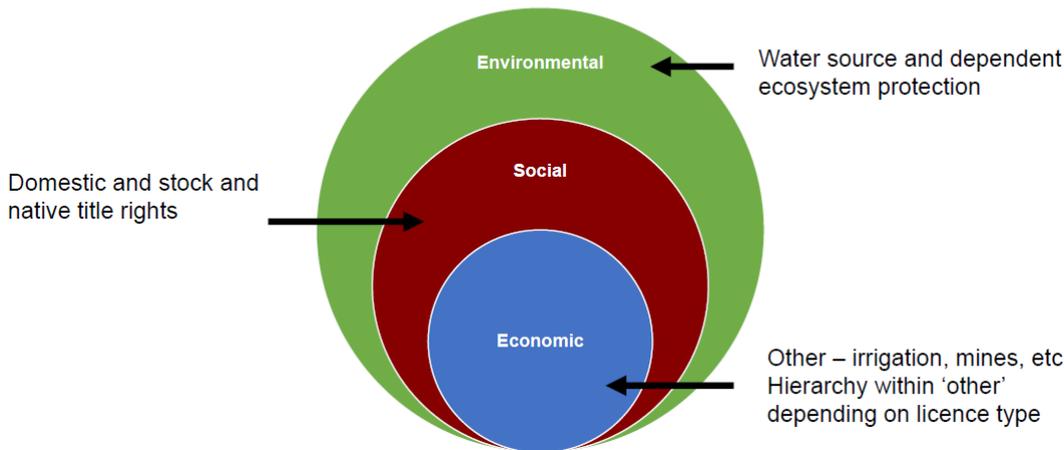


Figure 1 Water Management Act 2000 water access priorities

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## Weblinks

<sup>i</sup> <https://www.dpie.nsw.gov.au/water/plans-and-programs/nsw-water-strategy/the-strategy>

<sup>ii</sup> [https://www.dpie.nsw.gov.au/\\_data/assets/pdf\\_file/0017/329012/draft-rws-fnc-strategy.pdf](https://www.dpie.nsw.gov.au/_data/assets/pdf_file/0017/329012/draft-rws-fnc-strategy.pdf)

<sup>iii</sup> NSW and Australian Regional Climate Modelling

<sup>iv</sup> <https://water.dpie.nsw.gov.au/plans-and-programs/regional-water-strategies/climate-data-and-modelling>

<sup>v</sup> <https://arr.ga.gov.au/>

- vi <https://toolkit.ewater.org.au/Tools/Best Practice Modelling Guidelines/documentation>
- vii <https://www.rous.nsw.gov.au/page.asp?f=RES-YTL-27-12-83>
- viii <https://www.environment.nsw.gov.au/topics/water/coasts/coastal-management/programs>
- ix <https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-management-program>
- x [https://www.dpie.nsw.gov.au/\\_data/assets/pdf\\_file/0017/329012/draft-rws-fnc-strategy.pdf](https://www.dpie.nsw.gov.au/_data/assets/pdf_file/0017/329012/draft-rws-fnc-strategy.pdf)
- xi <https://www.dpie.nsw.gov.au/water/plans-and-programs/nsw-water-strategy/the-strategy>
- xii [https://arp.nsw.gov.au/assets/ars/393b65f5e9/TPP17-03\\_NSW\\_Government\\_Guide\\_to\\_Cost-Benefit\\_Analysis\\_0.pdf](https://arp.nsw.gov.au/assets/ars/393b65f5e9/TPP17-03_NSW_Government_Guide_to_Cost-Benefit_Analysis_0.pdf)
- xiii <https://nre.tas.gov.au/agriculture/land-management-and-soils/land-and-soil-resource-assessment/land-capability>
- xiv <https://www.environment.sa.gov.au/topics/soil-and-land-management/soils-of-sa/mapping-soil-and-land>
- xv [https://arp.nsw.gov.au/assets/ars/393b65f5e9/TPP17-03\\_NSW\\_Government\\_Guide\\_to\\_Cost-Benefit\\_Analysis\\_0.pdf](https://arp.nsw.gov.au/assets/ars/393b65f5e9/TPP17-03_NSW_Government_Guide_to_Cost-Benefit_Analysis_0.pdf)
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