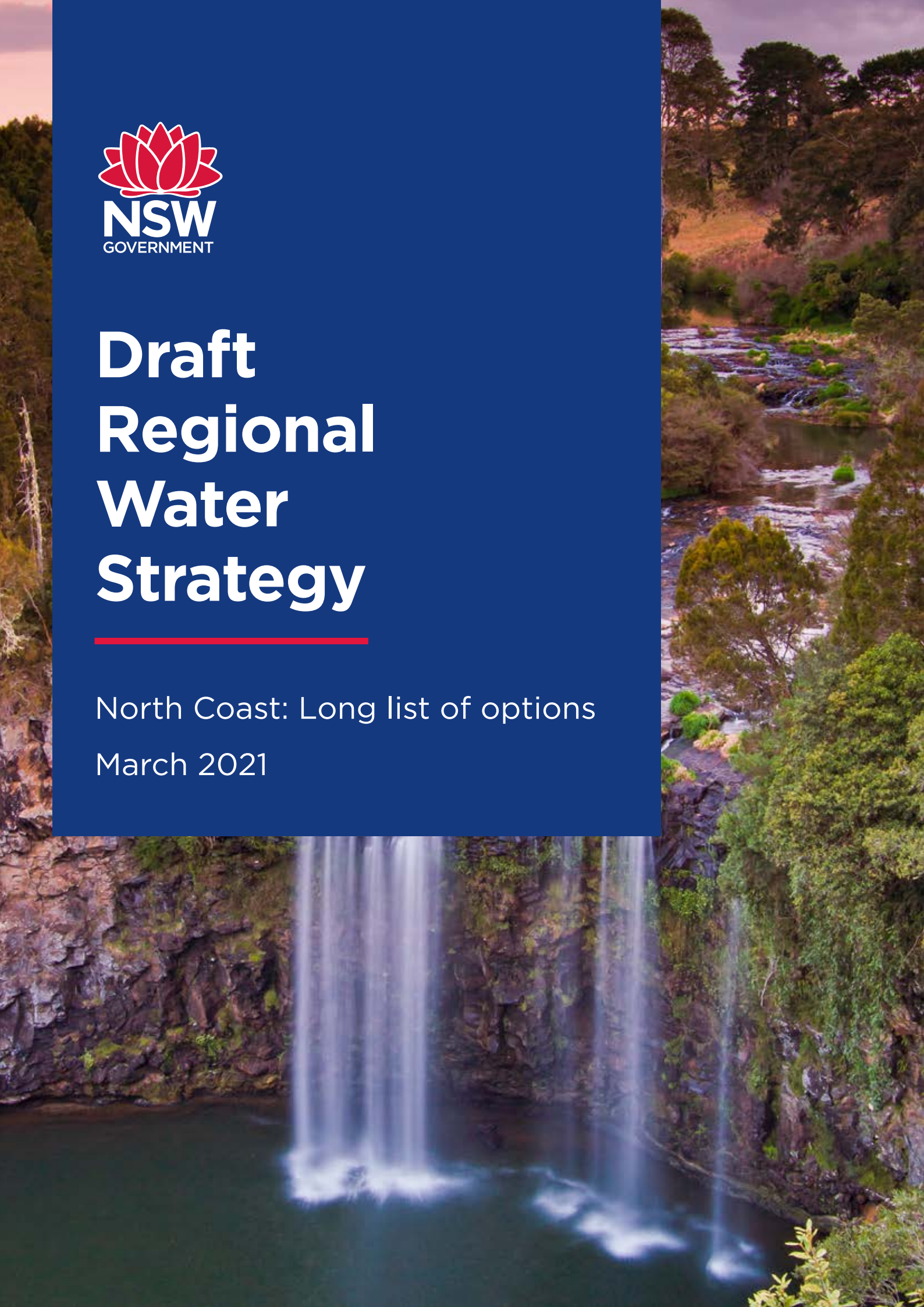


NSW GOVERNMENT

Draft Regional Water Strategy

North Coast: Long list of options

March 2021

Published by NSW Department of Planning, Industry and Environment

dpie.nsw.gov.au

Title: Draft Regional Water Strategy

Subtitle: North Coast: Long list of options

First published: March 2021

Department reference number: PUB20/310

Cover image: Image courtesy of Destination NSW.

More information: www.dpie.nsw.gov.au/north-coast-regional-water-strategy

Acknowledgements: The input and collaboration of these NSW Government agencies is acknowledged: NSW Health, Office of Local Government and Aboriginal Affairs NSW. The feedback of these groups on the Aboriginal Water Advisory Group is also acknowledged: NSW Aboriginal Land Council, NTSCORP, Murray Lower Darling Rivers Indigenous Nations and Northern Basin Aboriginal Nations.

Acknowledging Aboriginal people: The NSW Government acknowledges Aboriginal people as Australia's first people practising the oldest living culture on earth and as the Traditional Owners and Custodians of the lands and waters.

We acknowledge that the people of the Anaiwan, Biripi, Bundjalung, Dunghutti, Githabul, Gumbaynggirr and Yaegl Nations hold a significant connection to the lands in which the North Coast Regional Water Strategy falls upon.

The North Coast Region holds areas of great spiritual, cultural and economic importance to Aboriginal people and the NSW Government recognises the connection of the water to the people of these nations.

We recognise the intrinsic connection of Traditional Owners to Country and acknowledge their contribution to the management of the North Coast Regional Water Strategy area landscape and natural resources.

NSW Department of Planning, Industry and Environment understands the need for consultation and inclusion of Traditional Owner knowledge, values and uses in water quality planning to ensure we are working towards equality in objectives and outcomes.

NSW Department of Planning, Industry and Environment is committed to continuing future relationships and building strong partnerships with Aboriginal people. We thank the Elders, representatives of the Anaiwan, Biripi, Bundjalung, Dunghutti, Githabul, Gumbaynggirr and Yaegl Nations and Aboriginal community members who provided their knowledge throughout the regional water strategy development process.

Options for the Draft North Coast Regional Water Strategy

As outlined in the Draft North Coast Regional Water Strategy, we have developed a long list of options that could be included in the final strategy.

It is important to note that the options have not been ordered or prioritised, or costed at this stage.

In preparing this list, we recognise the previous work that has been done over the last few years to identify initiatives that could improve water management, water security and water reliability in the North Coast region. We have collated options from previous studies and supplemented them with further options derived from recent experience, consultation with local councils, current NSW Government initiatives and programs. The options incorporate insights from other regional water strategies—particularly the draft strategies prepared for Far North Coast and Border Rivers region. Some options are identical to those in other draft regional water strategies, including options related to policy reform, improved data collection and investigations into the potential impact of sea level rise and saline intrusion to the region's water sources and their users.

These options aim to address the challenges the region may face in the future, while maximising opportunities arising from growing regional centres, emerging and expanding industries, and new investments in transport and community infrastructure. Bringing all of the options together will help to align and better sequence the various water reform processes underway to deliver the best outcomes for the North Coast region.

The current long list of options focuses on:

- maintaining and diversifying water supplies
- protecting and enhancing natural systems
- supporting water use efficiency and conservation.

Face-to-face engagement with Aboriginal communities on the North Coast region was delayed due to the COVID-19 pandemic. However, we are committed to ensuring that options with a primary focus on recognising Aboriginal people's water rights, interests and access to water are also included in the strategy following further consultation with Aboriginal communities. Partnering with Aboriginal communities in the development of options will also assist us in preserving the North Coast's important natural systems and include the extensive knowledge of our Traditional Owners in water management decisions.

Table 1 shows a snapshot of how we have matched the draft options with these three categories and the challenges and opportunities we identified in the Draft North Coast Regional Water Strategy.

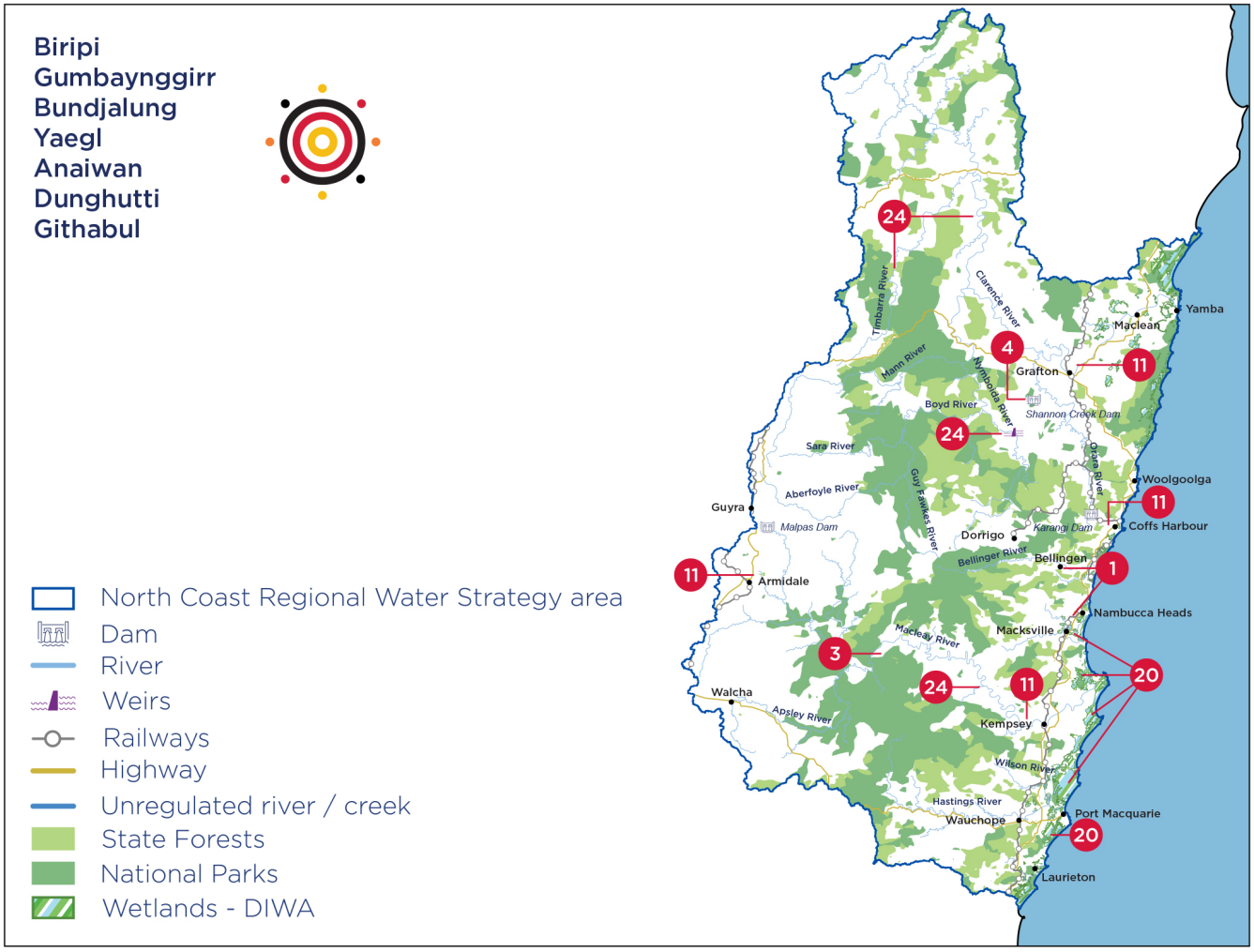
Table 1. Draft long list of options matrix

Category	Maintaining and diversifying water supplies	Protecting and enhancing natural systems	Supporting water use and delivery efficiency and conservation
Region-specific risks and challenges	• Region is vulnerable to extended dry periods • town water supplies can be affected by high turbidity and other water quality issues • no new licences available for surface water extraction, with competition for water high during periods of low river flow • industry demands for water are shifting away from predominately rain-fed crops • saline intrusion due to sea level rise and increases in storm surges may affect future water security.	• Major rivers in the region are under hydrologic stress particularly during periods of low river flow when competition amongst users is highest • highly connected groundwater sources are vulnerable to extended dry periods, increased extraction from surface waters and saline intrusion • past and current land use practices have impacted both riverine and estuarine water quality • protecting native and threatened aquatic species • limited surface water and groundwater water use and monitoring data to guide sustainable management • extraction limits are premised largely on historic licensed extraction, rather than risk assessments of high priority environmental needs • new climate data and modelling suggests significant changes to river flows.	• Completely unregulated system, with limited options for inter-connections across catchments • rural demands for water are likely to increase as intensive horticulture expands • limited measurement data on water use • regulatory and administrative barriers to innovative and efficient water use • limited strategic planning to inform local decision making • skill and training limitations to foster best practice water management and encourage efficient water use.
Opportunities to address risks and challenges	• Support greater flexibility to communities, towns and/or industries in securing their existing and future water needs • clarify existing rules to ensure water take is equitable, transparent and sustainable • support local councils to upgrade existing infrastructure to ensure water is available when needed • improve the collection of water use and monitoring data to better understand existing demands and constraints on water resources • improve the region's understanding of the impact of climate change, sea level rise and saltwater incursions on water access by towns, communities and agricultural industries.	• Extraction rules are sustainable and protect environmental function, diversity and health • support long-term planning and management of the region's water resources • improve monitoring of coastal groundwater sources • protect and enhance riparian functions, ecosystems and species • provide the right conditions for connectivity between the region's rivers, wetlands, groundwater and estuaries • support improved land use practices that protect catchment health • foster local stewardship of the region's water resources.	• Encourage innovation and adoption of new 'clean and green' technologies • build capacity to support water stewardship and local decision making • ensure consistency and transparency in water management and response to drought • improve the collection of water use and monitoring data to better understand current patterns and opportunities for conservation.

Table 1. Draft long list of options matrix (continued)

Category	Maintaining and diversifying water supplies	Protecting and enhancing natural systems	Supporting water use and delivery efficiency and conservation
Options	1. Expand the Clarence-Coffs Harbour *Regional Water Supply Scheme* 2. Portable desalination 3. Emergency water supply provided by new pumped hydro storage projects 4. Augment Shannon Creek Dam 5. Upgrade major town water treatment facilities 6. Repurpose existing assets to provide emergency storage for local industries 7. Vulnerability of surface water supplies to sea level rise and saline intrusion 8. New industry and rural licence category within major council storages 9. Protecting coastal groundwater resources for town water supplies and rural water users 10. Remove impediments to water reuse projects 11. Increase use of recycled wastewater for intensive horticulture 12. Indirect potable reuse of purified recycled water 13. Direct potable reuse of purified recycled water 14. Increased harvestable rights 15. Increased on-farm water storage.	16. Establish sustainable extraction limits for North Coast surface water and groundwater sources 17. Convert low-flow water access licences to high-flow water access licences 18. Long-term water plans to support healthy coastal waterways 19. Characterising coastal groundwater resources 20. Protecting ecosystems that depend on coastal groundwater resources 21. Improve stormwater management 22. Bringing back riverine and estuarine habitats and threatened species 23. Fish-friendly water extraction 24. Improve fish passage in the North Coast region 25. Addressing cold water pollution 26. Coastal, regional focused water reference groups 27. Planning for climate change impacts on coastal groundwater resources 28. River Recovery Program for the North Coast: a region-wide program of instream works, riparian vegetation and sediment control.	29. Improved data collection on water use and patterns 30. Active and effective water markets 31. Apply the *NSW Extreme Events Policy* to the North Coast region 32. Regional demand management program 33. Regional network efficiency audit 34. Regional capacity building program and skills hub 35. Support for local councils to lift performance standards 36. Regional framework to manage restrictions for non-urban water users of town water.

Figure 1. North Coast long list of options and government commitments map



Options not shown on the map are not location specific.

Long list of options

Maintaining and diversifying water supplies

1. Expand the Clarence-Coffs Harbour *Regional Water Supply Scheme*
2. Portable desalination
3. Emergency water supply provided by new pumped hydro storage projects
4. Augment Shannon Creek Dam
5. Upgrade major town water treatment facilities
6. Repurpose existing assets to provide emergency storage for local industries
7. Vulnerability of surface water supplies to sea level rise and saline intrusion
8. New industry and rural licence category within major council storages
9. Protecting coastal groundwater resources for town water supplies and rural water users
10. Remove impediments to water reuse projects
11. Increase use of recycled wastewater for intensive horticulture
12. Indirect potable reuse of purified recycled water
13. Direct potable reuse of purified recycled water
14. Increased harvestable rights
15. Increased on-farm water storage

Protecting and enhancing natural systems

16. Establish sustainable extraction limits for North Coast surface water and groundwater sources
17. Convert low-flow water access licences to high-flow water access licences
18. Long-term water plans to support healthy coastal waterways
19. Characterising coastal groundwater resources
20. Protecting ecosystems that depend on coastal groundwater resources
21. Improve stormwater management and estuarine habitats
22. Bringing back riverine and estuarine habitats and threatened species
23. Fish-friendly water extraction
24. Improve fish passage in the North Coast region
25. Addressing cold water pollution
26. Coastal, regional focused water reference groups
27. Planning for climate change impacts on coastal groundwater resources
28. River Recovery Program for the North Coast: a region-wide program of instream works, riparian vegetation and sediment control

Supporting water use and delivery efficiency and water conservation

29. Improved data collection on water use and patterns
30. Active and effective water markets
31. Apply the *NSW Extreme Events Policy* to the North Coast region
32. Regional demand management program
33. Regional network efficiency audit
34. Regional capacity building program and skills hub
35. Support for local councils to lift performance standards
36. Regional framework to manage restrictions for non-urban water users of town water

Not all options in this long list will be progressed. Only feasible options will be progressed, following the evidence-based assessment process described in the *Regional Water Strategies Guide*. The final package of options will also consider how the implementation of the preferred options should be staged.

This document describes each option, its intent and the challenges it seeks to address. Each option is aligned with one or more of the overarching objectives set for the NSW regional water strategies (Figure 2). Additional considerations and further work required to progress the option are identified.

This will need to be supplemented by further analysis and your feedback. Where possible, links and references are provided for further information on the option.

The list also identifies potential combinations of options. These combinations recognise that most options require associated works, further assessments and/or legislative, policy and planning changes to ensure they address the risks and challenges identified in the North Coast region and do not have unintended impacts. Our aim is to develop a final strategy with a balanced package of options that delivers on all of these objectives.

Figure 2. NSW regional water strategies: objectives

Deliver and manage water for local communities

Improve water security, water quality and flood management for regional towns and communities.

Enable economic prosperity

Improve water access reliability for regional industries.

Recognise and protect Aboriginal water rights, interests and access to water

Including Aboriginal heritage assets.

Protect and enhance the environment

Improve the health and integrity of environmental systems and assets, including by improving water quality.

Affordability

Identify least cost policy and infrastructure options.

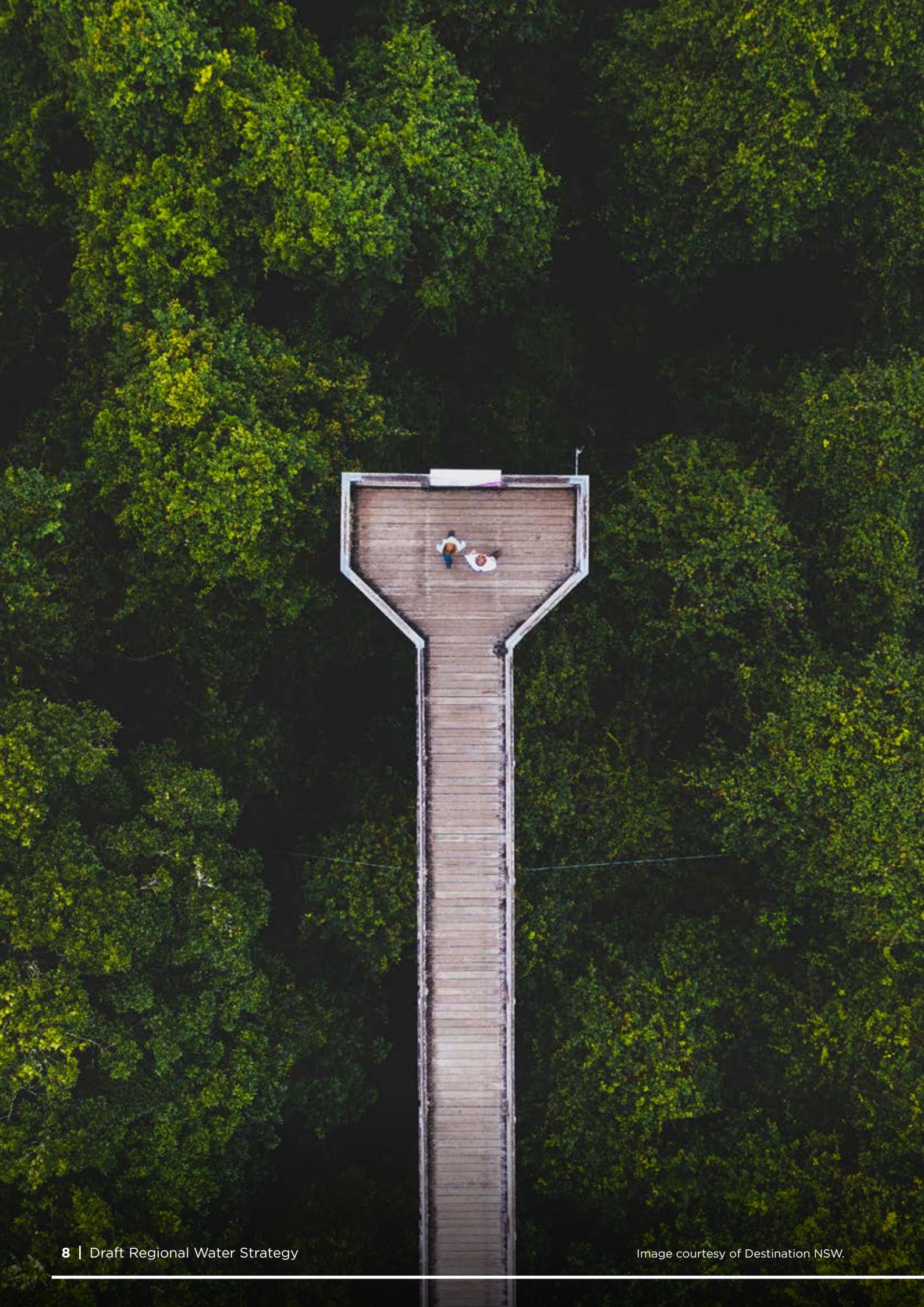


Image courtesy of Destination NSW.

North Coast: Long list of options

Image courtesy of Jaime Plaza Van Roo, Department of Planning, Industry and Environment.

Maintaining and diversifying water supplies

Opportunities to improve town water security, maintain suitable water quality and support growth and jobs in the region.

Option 1. Expand the Clarence-Coffs Harbour *Regional Water Supply Scheme*	
Source: Local councils and Department of Planning, Industry and Environment—Water	
Description	This option involves investigating the potential benefits of connecting Bellingen Shire Council and Nambucca Valley Council to the Clarence-Coffs Harbour *Regional Water Supply Scheme*. Bellingen Shire Council: • Due to its proximity to Karangi Dam, there is the potential to connect the town water supply network for Bellingen Shire Council into the Clarence-Coffs Harbour *Regional Water Supply Scheme*. The scheme could provide emergency water access for Bellingen. Nambucca Valley Council: • Nambucca Valley Council's entitlement is significantly greater than their average annual demand, and the council has constructed an emergency storage to ensure town water demand can be met during dry periods. However, the offtake for town water supply may be impacted by future sea level rise and saline intrusion; hence, there may be benefits in diversifying Nambucca's water supply in the future. All councils in the North Coast region, except Clarence Valley Council and Coffs Harbour City Council, own, manage and operate their own discrete urban water management systems. Many of these independent supplies have water security issues. The dry conditions experienced during the summer of 2019/20 showed Bellingen's town water supply to be particularly vulnerable to extended dry periods.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Support greater flexibility to communities, towns and/or industries in securing their existing and future water needs.
Challenges addressed	• Region is vulnerable to extended dry periods. • Saline intrusion due to sea level rise and increases in storm surges may affect future water security.
Potential combinations	This option could be combined with any of the other listed options aiming to improve access to town water across the region, including: • Option 2. Portable desalination • Option 4. Augment Shannon Creek Dam • Option 5. Upgrade major town water treatment facilities • Option 7. Vulnerability of surface water supplies to sea level rise and saline intrusion • Option 12. Indirect potable reuse of purified recycled water • Option 13. Direct potable reuse of purified recycled water. This option could also be combined with options identified to improve water use efficiency and conservation, such as: • Option 32. Regional demand management program • Option 33. Regional network efficiency audit.

Option 1. Expand the Clarence-Coffs Harbour *Regional Water Supply Scheme* (continued)

Considerations	Bellingen Shire Council extracts groundwater from the alluvial which is highly interconnected with flows in the Bellinger River. The exact capacity of the alluvial is unknown, and extraction from the bore during low-flows could trigger saline intrusion, leaving the groundwater source unusable. The Clarence-Coffs Harbour *Regional Water Supply Scheme* extracts water from the Nymboida weir, which is owned and managed by Essential Energy. The weir and associated infrastructure have not been maintained, and council is concerned about future access security. Clarence Valley Council and Coffs Harbour City Council are currently in discussion with the Department of Planning, Industry and Environment over the future ownership of this asset and the transfer of the associated town water licence. This option may also require augmentation of Shannon Creek Dam, which was designed such that the capacity could be increased up to 75 GL. Further work is required to understand the impact of this option on town water security for Clarence and Coffs Harbour. The additional demand will be during extended dry periods when Clarence Valley Council and Coffs Harbour City Council will also require access to stored water. The route, transfer rates, operational considerations, as well as governance arrangements, also need to be scoped. Interconnection options would also require consideration of governance and funding arrangements, including potential identification of new funding streams to facilitate these works.
Objectives	

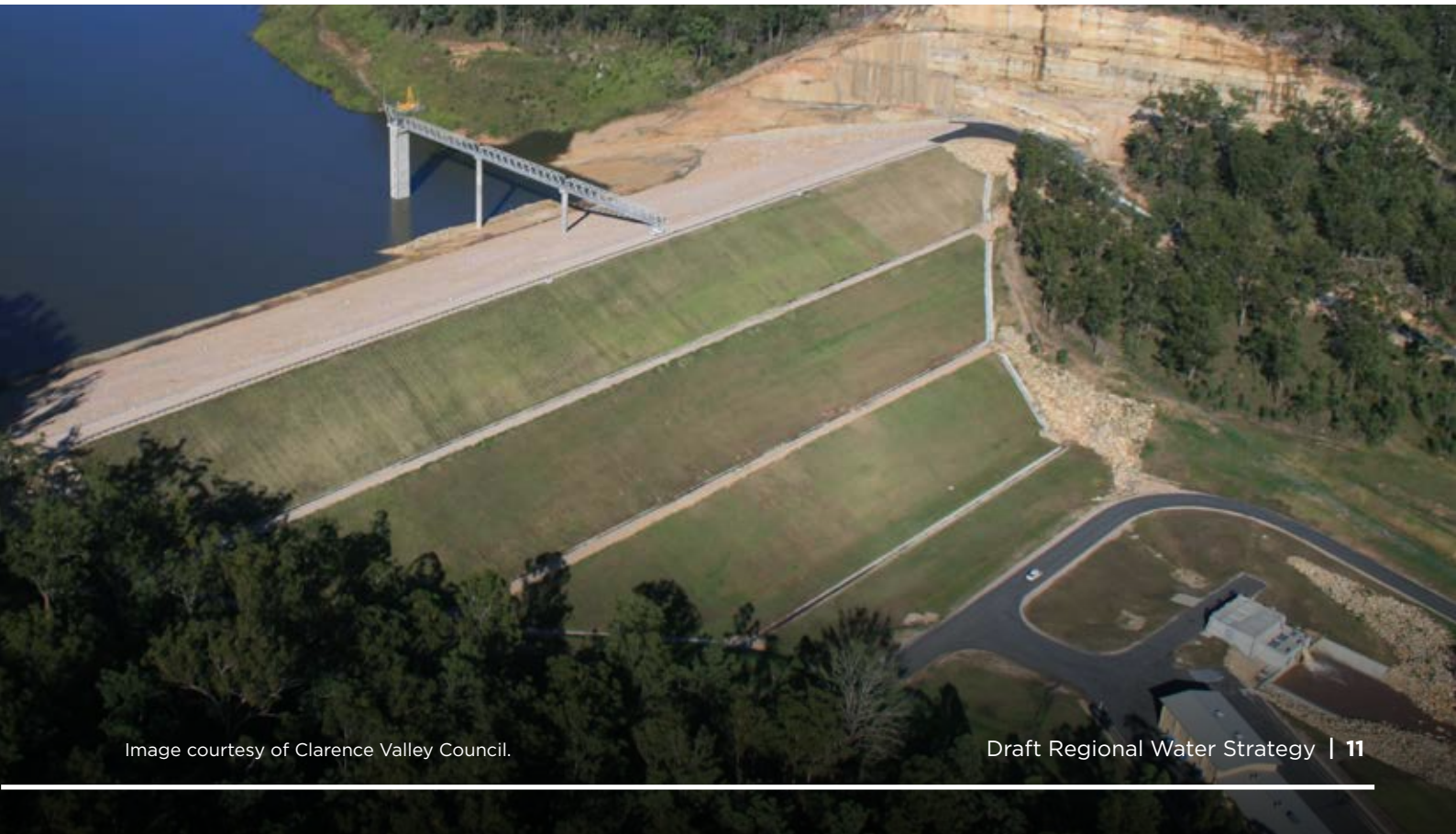


Image courtesy of Clarence Valley Council.

Option 2. Portable desalination

Source: Local councils and Lower Hunter Water Plan

Description	This option involves investigating the net benefits of constructing portable desalination units that can be deployed in the North Coast region: a) to meet town water needs during extreme dry periods; and/or b) to meet the water needs of other users (including industry). The investigation would also consider the differences between portable and fixed desalination units (noting that the latter may require additional water infrastructure, such as pipelines). Desalination can be an attractive option for coastal regions as it offers a climate-independent source of water. Portable units are typically small, modular and can potentially be deployed quickly during an extreme drought. Several local councils are considering desalination to improve town water security, including Port Macquarie-Hastings Council and Bellingen Shire Council.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Support greater flexibility to communities, towns and/or industries in securing their existing and future water needs.
Challenges addressed	• Region is vulnerable to extended dry periods. • Saline intrusion due to sea level rise and increases in storm surges may affect future water security.
Potential combinations	This option could be combined with any of the other listed options aiming to improve access to town water across the region, including: • Option 1. Expand the Clarence-Coffs Harbour *Regional Water Supply Scheme* • Option 4. Augment Shannon Creek Dam • Option 5. Upgrade major town water treatment facilities • Option 7. Vulnerability of surface water supplies to sea level rise and saline intrusion • Option 12. Indirect potable reuse of purified recycled water • Option 13. Direct potable reuse of purified recycled water. This option could also be combined with options identified to improve water use efficiency and conservation, such as: • Option 32. Regional demand management program • Option 33. Regional network efficiency audit.

Option 2. Portable desalination (continued)

Considerations	This type of option is also being investigated by Hunter Water as part of the *Lower Hunter Water Plan*. There is opportunity for the councils of the North Coast region to collaborate with Hunter Water to better understand the considerations (technical, regulatory and economic) in implementing portable systems. These considerations include: • site selection • maintenance requirements and costs • operating costs • brine disposal and associated environmental conditions and approvals • procurement options • optimal size and capacity of the units • licensing of water take. This option could be considered for all major centres in the region, with the exception of Armidale. These major centres are located within, or immediately upstream of, the tidal limit. The new climate data and modelling could be used to understand the likelihood of multiple demands on such units in the event of severe drought. Results indicate that dry periods impact the region to different extents, and hence there may be merit in designing a portable unit that can be used by any council across the region. This is likely to provide resource and cost savings. Decentralised but fixed units are also an option for the region. The advantage of fixed systems is that they are available whenever needed and can be readily scaled up as water demands increase (e.g. from population or industry growth) or to manage longer dry periods. Fixed units are likely to be more costly than portable units. Regional desalination is proposed as a potential option for the Far North Coast Regional Water Strategy. The North Coast region is significantly bigger and the major urban centres are scattered across the region. A regional, centralised desalination system would likely require an extensive pipe network.
Objectives	

Option 3. Emergency water supply provided by new pumped hydro storage projects

Source: Oven Mountain Pumped Hydro Energy Storage project

Description	This option involves investigating the potential for off-river pumped hydro projects to provide additional water security benefits (and emergency water supply for fire-fighting) for regional communities in the North Coast region. In October 2020, the NSW Government declared the Oven Mountain Pumped Hydro Energy Storage project as Critical State Significant Infrastructure. The proposed project has two reservoirs with a total capacity of 6 GL and is located between Armidale and Kempsey. There is another project in the planning and development phase that has a total reservoir capacity of 3.2 GL.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Support greater flexibility to communities, towns and/or industries in securing their existing and future water needs.
Challenges addressed	• Region is vulnerable to extended dry periods. • Saline intrusion due to sea level rise and increases in storm surges may affect future water security.
Potential combinations	This option could be combined with any of the other listed options aiming to improve access to town water across the region, including: • Option 2. Portable desalination • Option 5. Upgrade major town water treatment facilities • Option 7. Vulnerability of surface water supplies to sea level rise and saline intrusion • Option 13. Direct potable reuse of purified recycled water. This option could also be combined with options identified to improve water use efficiency and conservation, such as: • Option 32. Regional demand management program • Option 33. Regional network efficiency audit.
Considerations	The Oven Mountain Pumped Hydro Energy Storage project will require a special purpose access licence to initially fill the reservoir. Different access licence conditions would be required if the storage is used for emergency town water and fire-fighting as top up water requirements would be more (both in terms of volume and frequency) than the small amounts estimated to make up for losses from seepage and evaporation. This option will need to consider the access arrangements for all councils supplied with emergency water from the scheme, including: • licensing • additional infrastructure (pipes and pumps) • delivery losses (that is, the volume of water released compared to the volume delivered to the nominated town water supply network). The current proposal identifies Kempsey as the only town connected to the scheme. Provision of emergency water to Armidale could also be considered as part of this option. The dry conditions of the summer of 2019/20 had the greatest impact on water supply security for Armidale Regional Council. Consideration will also need to be given to when water is made available, the capacity for the scheme to meet the nominated town water demands during an emergency and the potential compensation provisions that would need to be established. Hydroelectricity is often used to meet peak demands, manage blackouts and to help reduce surges. These periods generally coincide with extended dry, hot spells, when access to town water supplies is also under pressure. An environmental impact statement will be required for the approval of the Oven Mountain Pumped Hydro Energy Storage project. This will be important in understanding the potential environmental impacts during construction and operation, including any risks posed from the initial fill.
Objectives	

Option 4. Augment Shannon Creek Dam

Source: Clarence Valley Council and Coffs Harbour City Council

Description	This option involves augmenting Shannon Creek Dam up to its designed maximum capacity of 75 GL to provide additional town water security for the Clarence and Coffs Harbour local government areas. The augmentation may provide additional benefit to any other towns connected to the Clarence-Coffs Harbour *Regional Water Supply Scheme* in the future.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Support local councils upgrade existing infrastructure to ensure water is available when needed.
Challenges addressed	Region is vulnerable to extended dry periods.
Potential combinations	This option could be combined with any of the other listed options aiming to improve access to town water across the region, including: • Option 1. Expand the Clarence-Coffs Harbour *Regional Water Supply Scheme* • Option 2. Portable desalination • Option 5. Upgrade major town water treatment facilities • Option 12. Indirect potable reuse of purified recycled water • Option 13. Direct potable reuse of purified recycled water. This option could also be combined with options identified to improve water use efficiency and conservation, such as: • Option 32. Regional demand management program • Option 33. Regional network efficiency audit.
Considerations	It is assumed Shannon Creek Dam will remain an off-river storage. Water will be diverted from the Nymboida River under the current licence arrangements and all flows in Shannon Creek would bypass the storage (as per the current arrangements). However, licence arrangements for extraction from the Nymboida River need to be clarified. The existing licence, as well as the associated infrastructure, is owned by Essential Energy. The licence is a special purpose licence for town water use only, meaning it cannot be used for power generation. However, the uncertainty regarding the existing arrangements are still considered a significant risk by Clarence Valley Council and Coffs Harbour City Council to the scheme's water supply security and would also be a risk to any augmentation plans. This option will need to consider funding, environmental impact, operation and maintenance of the asset. The dam is currently owned and operated by Clarence Valley Council. However, augmentation of the dam would benefit not only Clarence Valley Council but also Coffs Harbour City Council and any additional towns connected to the scheme. Turbidity issues during high-flow events impact the ability to extract water to supply Shannon Creek Dam. Augmenting Shannon Creek Dam would need to consider upgrading the water treatment facilities. This is likely to be a longer term option, given Shannon Creek Dam was constructed just over 10 years ago.
Objectives	

Option 5. Upgrade major town water treatment facilities

Source: Local councils

Description	This option would involve upgrading major town water treatment facilities to reduce water quality and water security risks and to provide operational flexibility for local councils in the North Coast. Many councils in the region cannot extract river water when turbidity levels are high, even if flows are sufficient. Councils that need to manage extraction based on turbidity to protect water quality include Clarence Valley Council, Kempsey Shire Council and Port Macquarie-Hastings Council, as well as Coffs Harbour City Council due to its connection with the Clarence-Coffs Harbour *Regional Water Supply Scheme*. High turbidity water is an issue during and after heavy rainfall, particularly if this follows a long dry period, bushfires or both. High turbidity can affect disinfection efficiency, and is also used as a surrogate indicator for other risks such as nutrients (algae potential) and pathogens. High turbidity can also limit or reduce extraction opportunities, potentially impacting town water security.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Support greater flexibility to communities, towns and/or industries in securing their existing and future water needs.
Challenges addressed	• Region is vulnerable to extended dry periods. • Town water supplies can be affected by high turbidity and other water quality issues.
Potential combinations	This option could be combined with any of the other listed options aiming to improve access to town water across the region, including: • Option 2. Portable desalination • Option 12. Indirect potable reuse of purified recycled water • Option 13. Direct potable reuse of purified recycled water. This option could also be combined with options identified to improve water use efficiency and conservation, such as: • Option 32. Regional demand management program • Option 33. Regional network efficiency audit.
Considerations	Water treatment will not completely solve a high turbidity problem, as councils will still need to protect water quality in their storages (usually the water is extracted straight to the storage and is treated later). New water treatment plants generally cost between $1.5 million and $3 million per megalitre. These upgrades also need to build in allowances such as for future growth and peak day demands. Water treatment plants may also require updating if the infrastructure is old. The requirements of the new drinking water quality guidelines may also require councils to upgrade their facilities, irrespective of the constraint posed by high turbidity. Maintaining and upgrading water treatment facilities is the responsibility of the asset owner. The Safe and Secure Water Program and the integrated water cycle management framework could provide a mechanism for assessing options to address risks, and potentially obtaining co-funding to upgrade facilities.
Objectives	

Option 6. Repurpose existing assets to provide emergency storage for local industries

Source: Department of Planning, Industry and Environment—Water and Coffs Harbour City Council

Description	This option would involve conducting an audit of decommissioned water infrastructure—storages and bores—and investigating the potential net benefits of these assets to enhance reliable water access for industries.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Support greater flexibility to communities, towns and/or industries in securing their existing and future water needs.
Challenges addressed	• Region is vulnerable to extended dry periods. • Industry demands for water are shifting away from predominately rain-fed crops. • No new licences available for surface water extraction, with competition for water high during periods of low river flow.
Potential combinations	This option could be combined with the following options: • Option 11. Increase use of recycled wastewater for intensive horticulture • Option 17. Convert low-flow water access licences to high-flow water access licences.
Considerations	Issues that need to be considered for this option include: • cost of recommissioning asset • potential growth in use • associated licence conditions on extraction • governance arrangements, for example: – ownership, management and maintenance of the asset – sharing arrangements if access to storage is from more than one user – any costs associated with these activities.
Objectives	

Option 7. Vulnerability of surface water supplies to sea level rise and saline intrusion

Source: Department of Planning, Industry and Environment—Water, Kempsey Shire Council and Bellingen Shire Council

Description	This option would investigate the potential impacts of sea level rise and increases in storm surges on surface water supplies and local water council infrastructure in tidal pools and estuaries. There is the potential need to develop an integrated hydrodynamic and salinity model for high-risk estuaries in the North Coast region to better understand the impacts of climate change, sea level rise and saline intrusion on water resource security. Many councils in the region extract surface water and/or groundwater (alluvial) immediately upstream of the tidal limit. This includes Kempsey Shire Council, Bellingen Shire Council, Nambucca Valley Council and Port Macquarie-Hastings Council. Climate change is likely to lead to sea level rise (globally) and affect the intensity and frequency of key meteorological drivers that influence storm surges. Both of these processes will impact the saltwater-freshwater interface of the region's water resources. The project involves: • reviewing key estuaries/tidal pools for investigation based on the volume of water extraction and location of water infrastructure • reviewing the availability and suitability of existing hydrodynamic and salinity numerical models at priority locations • updating and/or developing the numerical models necessary to determine how salinity dynamics and tidal inundation may change at key locations in the future due to sea level rise and future changes in hydrology • assessing risks to water users and local water utility infrastructure posed by sea level rise and future changes in hydrology • identifying options to address these risks for inclusion in future reviews of the North Coast Regional Water Strategy.
Intent	Strengthen the resilience of the region's water resources and users to future changes and climate extremes.
Challenges addressed	Saline intrusion due to sea level rise and increases in storm surges may affect future water security.
Potential combinations	This project could link in with work being carried out under Initiative 3 of the *Marine Estate Management Strategy* to understand the vulnerability of tidal wetlands to sea level rise. This option could be combined with any of the other listed options aiming to improve access to town water across the region, including: • Option 1. Expand the Clarence-Coffs Harbour *Regional Water Supply Scheme* • Option 2. Portable desalination • Option 12. Indirect potable reuse of purified recycled water • Option 13. Direct potable reuse of purified recycled water. This option could also be combined with options identified to improve water use efficiency and conservation, such as: • Option 32. Regional demand management program • Option 33. Regional network efficiency audit.

Option 7. Vulnerability of surface water supplies to sea level rise and saline intrusion (continued)

Considerations	This option will be coordinated with the work already underway by local councils. For example, Kempsey Shire Council, as part of its integrated water cycle management—Phase 2 issues paper, is conducting investigations on the impact of increasing demand and climate variability on the security of their existing groundwater licences. Bellingen Shire Council has commissioned a similar study. The option should also be coordinated with the implementation of the *Marine Estate Management Strategy* (Initiative 2/Action 2.2 Assess and manage cumulative and legacy impacts on foreshore development and land use change in the coastal zone), as well as any lessons learnt through similar projects completed for the Far North Coast and South Coast regional water strategies. Hydraulic studies will better inform the need for regional connections, particularly the extension of the Clarence-Coffs Harbour *Regional Water Supply Scheme* to include Bellingen Shire Council and Nambucca Valley Council. As the development of fit for purpose hydrodynamic and salinity models is resource intensive and expensive, model development will be prioritised based on a coastal-wide needs assessment. Several models already exist or are being developed to inform various coastal management initiatives. This project will build on this work to avoid duplication. The North Coast Regional Water Strategy may propose options that alter the hydrology of estuary and tidal pool inflows. Developing new or updated models will enable the salinity and inundation impacts of these options to be assessed.
Objectives	

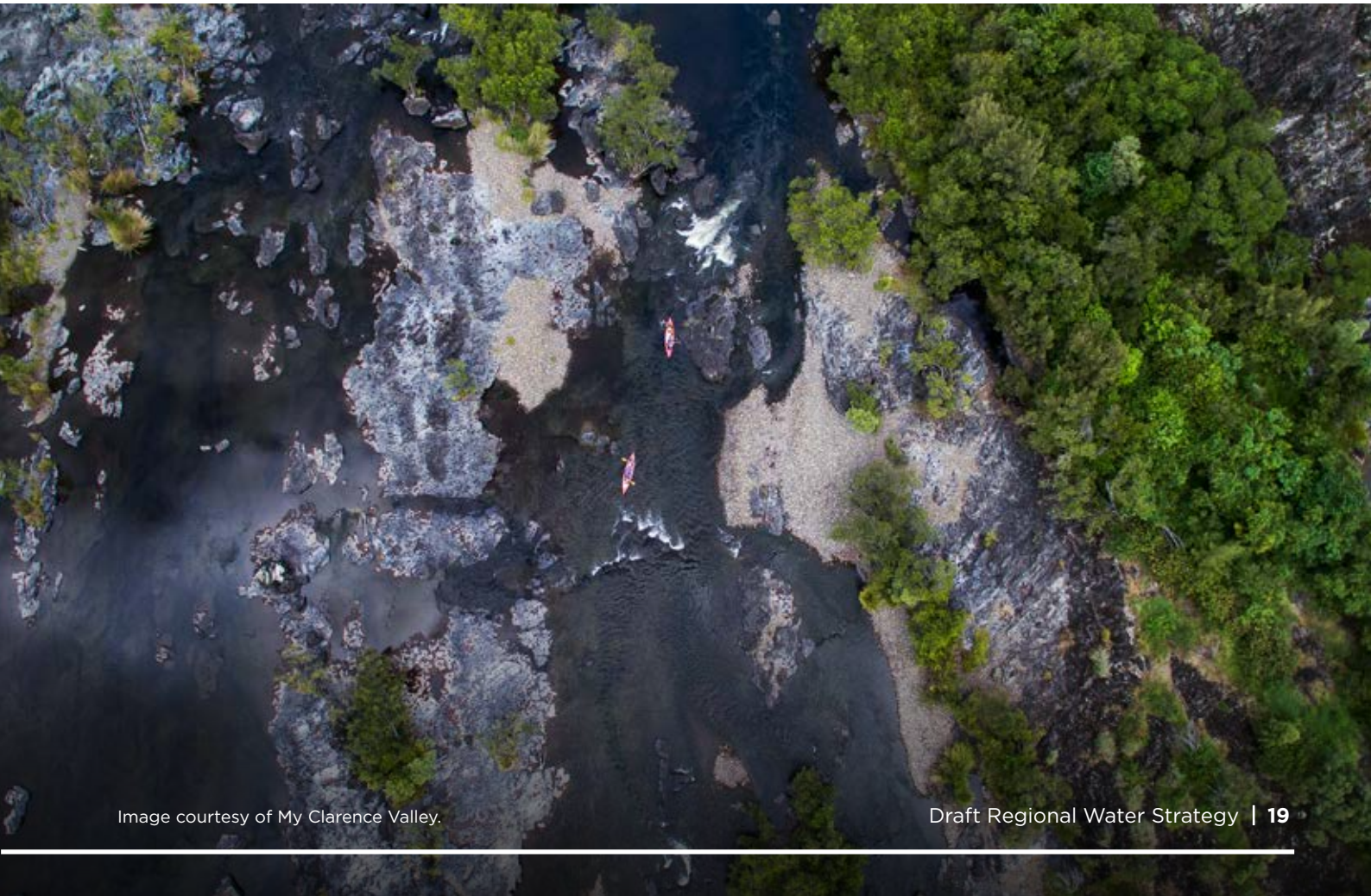


Image courtesy of My Clarence Valley.

Option 8. New industry and rural licence category within major council storages

Source: Department of Planning, Industry and Environment—Water

Description	This option would establish a new water access licence category that would enable new industries and rural users to take water from town water storages in the North Coast region. Local councils own and manage the only large water storages in the region. Many local council water supply systems provide water to local industries, including agriculture and intensive horticulture. This demand is likely to continue to increase, with rural businesses—particularly intensive horticulture—approaching councils regarding connecting to the town water supply network. Formalising this arrangement would clarify the extent rural businesses rely on town water supplies, ensure rural users are compliant against necessary conditions (e.g. restrictions during droughts) and ensure integrated water cycle management accounts for this use (and potential growth in use) in protecting future town water supplies. It would also ensure there is a process of enforcing reductions in use during dry periods by rural and industrial customers to protect town water supplies for potable demands.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Provide transparency and confidence to water users in the North Coast.
Challenges addressed	• Region is vulnerable to extended dry periods. • Industry demands for water are shifting away from predominately rain-fed crops.
Potential combinations	This option could also be combined with options identified to improve water use efficiency and conservation, such as: • Option 29. Improved data collection on water use and patterns • Option 32. Regional demand management program • Option 33. Regional network efficiency audit.
Considerations	Enabling councils to be bulk water sellers to industry would require an understanding of the legality of the current arrangements to determine whether any review and amendment of existing regulation is required. Currently there is no ability to increase a local water utility licence entitlement or issue them with some other specific purpose access licence for the purpose of supplying water to irrigators.[1] Unless a new type of specific purpose access licence is established through the *Water Management (General) Regulation 2018*, access licence entitlements to facilitate the development of irrigated agricultural businesses will need to be purchased through the water market by either the local council or the industry itself. The creation and issuing of a new type of specific purpose access licence for local councils to hold and use to facilitate new industries not currently supported by the regulations would raise significant equity concerns among existing licence holders who have purchased water licences and water allocations to develop and expand their businesses. One way to address equity concerns would be to make this new category of licence subject to higher access conditions. There would also be concern about the potential for the issuing of these new licences to cause a breach of the respective water sharing plan long-term average annual extraction limit, which would then lead to reduced allocations for lower priority licences. Before such a policy is considered, a better understanding of the current and future demand on council's water supply generally, and from irrigated agriculture, is required. Additionally, a review of the current long-term average annual extraction limits would allow a better understanding of water availability generally, and the likelihood of the issuing of these new licences causing a breach of that extraction limit. The current use of town water by rural users is not best practice and additional growth in use given current arrangements should not occur.
Objectives	

1. Section 66 (3) of the Act specifies the associated commercial activities that can be accommodated by local councils under their local water utility licence.

Option 9. Protecting coastal groundwater resources for town water supplies and rural water users

Source: Local councils and Department of Planning, Industry and Environment—Water

Description	In this option, Department of Planning, Industry and Environment—Water, in consultation with councils, would build on the information collated in Option 19. Characterising coastal groundwater resources to collect further information on: • current and future water demands including critical human needs • surface water reliability • current borefield capacity • aquifer capacity (around the borefield, as distinct from the water-source scale) • quality of groundwater in aquifer surrounding borefield. Up-to-date maps of aquifer availability and vulnerability would be created. For those towns at high risk, monitoring bores would be installed in the aquifer around the borefields and a process established to collate information from the bores into a state-owned database. This information will allow the NSW Government to plan where to best target resources, while allowing local councils to prepare for future droughts. This option would also: • clarify roles and responsibilities between the NSW Government and local councils for securing groundwater access for critical human and high priority needs • address policy gaps with respect to local water utility access to groundwater • improve communication campaigns to rural water users leading up to and during drought • consider the viability of a groundwater supply network that feeds into local water utility infrastructure during drought • assess the need for a raw water supply network for rural water users to access during drought. This option does not replace or pre-empt any current or future reviews of integrated water cycle management guidelines, section 60 approval processes, local government reforms and the like.
Intent	Ensure towns and rural groundwater users are prepared for drought.
Challenges addressed	• Region is vulnerable to extended dry periods. • Completely unregulated system, with limited options for inter-connections across catchments.
Potential combinations	This option would build on Option 19. Characterising coastal groundwater resources and Option 21. Improve stormwater management.
Considerations	This option requires an assessment of the roles and responsibilities of state versus local government. Development of groundwater sources is an opportunity in coastal regions—in particular, to increase reliability of water supply in drought times.
Objectives	

Option 10. Remove impediments to water reuse projects

Source: Department of Planning, Industry and Environment—Water and local councils

Description	Councils report that cost and regulatory barriers impede their ability to implement reuse projects. This option aims to support greater adoption of projects that reuse wastewater or stormwater and may include: • a review to better understand the extent of the barriers impeding implementation of water reuse projects. The review will include cost, pricing, regulatory, community acceptance or engineering constraints • development of options for reconfiguring cost or regulatory requirements • plans to support implementation of on-site reuse projects by industry. Reuse of wastewater and stormwater can play an important role in reducing demands on potable water supplies and managing water quality impacts from urban runoff and wastewater discharge. Reuse projects are much more accepted now by the community than they have been in the past and have been successfully implemented at different scales and with various end uses across Australia and internationally. There are opportunities in the region to use recycled water as an additional water resource. Many local councils have already implemented water reuse projects, particularly reusing treated wastewater, and other projects are in the planning stages. The application of treated wastewater includes irrigation of local horticulture, non-potable uses by industry (vehicle washdown, golf course irrigation) and irrigation of council-owned farms. Some councils also plan to connect residential areas to treated wastewater through a third pipe for non-potable water demands.
Intent	• Support implementation of water reuse projects by local water councils and industry. • Reduce demand on potable water supplies by supplying fit-for-purpose reuse water. • Manage diffuse pollution from urban developments.
Challenges addressed	• Region is vulnerable to extended dry periods. • Past and current land use practices have impacted both riverine and estuarine water quality. • Regulatory and administrative barriers to innovative and efficient water use.
Potential combinations	This option could be combined with any of the other listed options aiming to improve access to town water across the region, including: • Option 11. Increase use of recycled wastewater for intensive horticulture • Option 12. Indirect potable reuse of purified recycled water • Option 13. Direct potable reuse of purified recycled water. This option could also be combined with Option 32 Regional demand management program.
Considerations	The review will need to consider the diverse demographics of the region and that concerns and impediments may vary. The potential impacts on waterway health from elevated concentrations in contaminants also need to be considered in understanding the barriers to adoption.
Objectives	

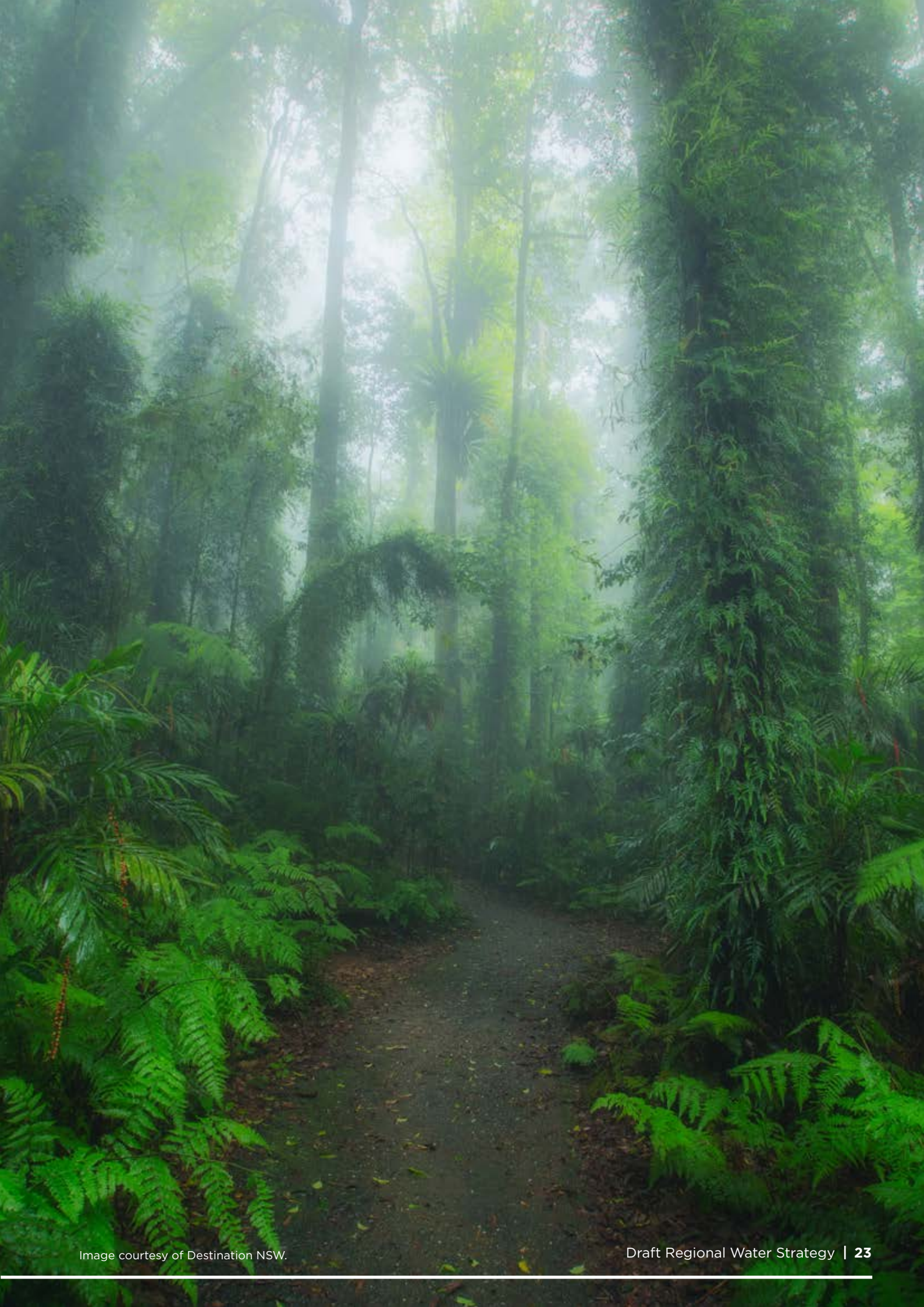


Image courtesy of Destination NSW.

Option 11. Increase use of recycled wastewater for intensive horticulture

Source: Local councils and Department of Planning, Industry and Environment—Water

Description	This option could include: • identifying current and future horticultural demand in close proximity to wastewater treatment facilities • planning for 'horticulture parks' (similar to an industrial park) to maximise opportunities for future use of treated wastewater by intensive horticultural businesses • constructing third-pipe reticulation systems to supply treated wastewater to these businesses • supporting businesses to develop closed-loop systems to recycle their own water where possible. Highly treated recycled wastewater from sewage treatment plants has the potential to be a reliable, safe and climate-independent water source for other industries. Treated wastewater is already being provided to rural users in the North Coast region, but there is the potential for growth in use, particularly from the intensive horticultural industry. Potential locations for new or expanded reuse schemes include the local government areas of Coffs Harbour, Clarence Valley, Kempsey and Armidale.
Intent	• Maximise use of urban wastewater. • Rural demands for water are likely to increase as intensive horticulture expands.
Challenges addressed	• Major rivers in the region are under hydrologic stress particularly during periods of low river flow when competition amongst users is highest. • No new licences available for surface water extraction, with competition for water high during periods of low river flow. • Region is vulnerable to extended dry periods. • Industry demands for water are shifting away from predominately rain-fed crops.
Potential combinations	This option could be combined with other options aimed at improving water access, as well as water efficiency and conservation practices, by industry including: • Option 10. Remove impediments to water reuse projects • Option 14. Increase harvestable rights • Option 15. Increased on-farm water storage • Option 29. Improved data collection on water use and patterns • Option 30. Active and effective water markets. This option could also benefit from the following options aimed at protecting and enhancing natural systems: • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 17. Convert low-flow water access licences to high-flow water access licences.

Option 11. Increase use of recycled wastewater for intensive horticulture (continued)

Considerations	Issues that need to be considered for this option: • there can be large distances between existing wastewater treatment plants and the operations that would need access to treated wastewater. It is more cost effective and practical to develop opportunities for wastewater reuse relatively close to treatment plants • sewerage treatment plant releases in the region may provide important flows to waterways and to some extent can help offset impacts caused by extractions. This option will need to consider the impacts on waterways of removing these relatively consistent flows, particularly during low-flow or dry periods • use of treated wastewater for irrigation of horticultural crops can lead to elevated phosphorus levels in downstream waterways if crop fertilisation is not adjusted to account for the different chemical composition of treated wastewater to river or groundwater • it may be more beneficial for some industrial users to recycle their own water. Investigations would be required to understand how best to balance these different kinds of reuse scenarios and develop supporting policies • consideration will need to be given to equity of supply and the distribution of benefits between those who are able to access recycled water schemes and those who do not have access • opportunities for integrating wastewater reuse into coastal management programs being developed across the region may prove beneficial as a water quality improvement measure • the cost of recycled water often compares poorly to the cost of extracting water from river and groundwater sources.
Objectives	

Image courtesy of NSW Farmers.

Option 12. Indirect potable reuse of purified recycled water

Source: Department of Planning, Industry and Environment—Water

Description	Investigate the opportunity to discharge highly purified wastewater into existing council storages to reduce council demand on river and groundwater extraction. Highly treated wastewater from sewage treatment plants has the potential to be a reliable, safe and mostly climate-independent water source. The levels of treatment required depend on whether the water will be stored or conveyed by rivers or groundwater, and what the end uses are. Water for drinking requires higher levels of treatment and purification than water used by agriculture and industry. For the North Coast region, the adoption of indirect potable reuse would involve augmenting drinking water supplies through discharging purified wastewater either upstream of the town extraction point or directly into the town storage.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Support greater flexibility to communities, towns and industries in securing their existing and future water needs.
Challenges addressed	• Region is vulnerable to extended dry periods. • Past and current land use practices have impacted both riverine and estuarine water quality.
Potential combinations	This option could be combined with: • Option 10. Remove impediments to water reuse projects • Option 13. Direct potable reuse of purified recycled water • Option 32. Regional demand management program.
Considerations	Experience in developing recycled water solutions for drinking water supply in Australia and overseas has demonstrated that community trust and acceptance need to be built carefully and may take around 10 years. The community's willingness to consider purified recycled water for drinking purposes requires careful consultation and testing. Any risk of system failure resulting in inadequately treated water entering the potable network would need to be overcome. Recycling wastewater and stormwater avoids discharge to rivers and the ocean of water likely to contain sediment or nutrients, reducing pollutants released to waterways. Instead, nutrients can be recovered and used beneficially. Due to advanced treatment requirements and associated infrastructure, recycled wastewater options generally have higher energy requirements than surface water options, although less than desalination options. We have received feedback from some councils that opportunities for wastewater reuse schemes within the local government area are unlikely to proceed as they are expensive and there is little support from the community (the perceived environmental benefits are not enough on their own). The advanced treatment requirements may also make it challenging for local councils to implement water reuse projects due to the lack of qualified reuse system operators in the industry. Injecting purified recycled wastewater into local council storages may not be viable given many are used for emergency water supply only.
Objectives	

Option 13. Direct potable reuse of purified recycled water

Source: Department of Planning, Industry and Environment—Water

Description	This option involves investigating the recycling of highly purified wastewater into the potable water supply network. Like Option 12. Indirect potable reuse of purified recycled wastewater, this option has the potential to be a reliable, safe and mostly climate-independent water source. A pilot project is proposed as part of the Far North Coast Regional Water Strategy to test and promote the widespread adoption of wastewater reuse. If this option progresses through the regional water strategy options assessment process, and is implemented in the Far North Coast, the North Coast Regional Water Strategy will be able to leverage the findings. In particular, it will provide a better understanding of the likely technical, economic and social impediments that may impact similar projects on the North Coast. The project could be supplemented by social research to understand the North Coast region's community's willingness to connect to a direct potable water reuse scheme and any specific concerns about this water source.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Support greater flexibility to communities, towns and/or industries in securing their existing and future water needs.
Challenges addressed	Region is vulnerable to extended dry periods.
Potential combinations	This option could be combined with: • Option 10. Remove impediments to water reuse projects • Option 32. Regional demand management program.
Considerations	Experience in developing recycled water solutions for potable water supply in Australia and overseas has demonstrated that community trust and acceptance need to be built carefully and may take around 10 years. The community's willingness to consider purified recycled water for drinking purposes needs to be the subject of careful consultation and testing. Risk of system failure resulting in inadequately treated water entering the potable network would need to be overcome. There is a lack of qualified reuse system operators in the industry. This can make it challenging for local water utilities to successfully implement and operate reuse schemes, particularly direct potable reuse schemes.
Objectives	

Option 14. Increased harvestable rights

Source: Landholders and Department of Planning, Industry and Environment—Water

Description	This option considers increasing the proportion of rainfall that can be captured in farm dams as a harvestable right, which is a form of basic landholder right. In recent years, some coastal landholders have requested that the NSW Government review its policy for harvestable water rights in coastal catchments. The argument put forward by these landholders is that because coastal catchments are shorter and experience higher rainfall than inland catchments, they should be able to sustain a higher proportion of water being taken under harvestable rights. A review of harvestable rights is currently underway and is considering the effects of increased harvestable rights and of allowing dams to be built on larger tributaries within NSW catchments that drain to the coast. It aims to determine if greater access to water for agricultural ventures could be allowed, while ensuring enough water is available for downstream water users and the environment. **The review is an existing NSW Government commitment. In December 2020, the Department of Planning, Industry and Environment published a discussion paper and detailed supporting information of the potential benefits and impacts of increasing the harvestable rights percentage, as well as allowing harvestable rights dams on third order streams. Public consultation, including a submission period, on the paper is scheduled for early 2021.**
Intent	Support greater flexibility to communities, towns and industries in securing their existing and future water needs.
Challenges addressed	• Region is vulnerable to extended dry periods. • Rural demands for water are likely to increase as intensive horticulture expands. • No new licences available for surface water extraction, with competition for water high during periods of low river flow. • Major rivers in the region are under hydrologic stress during periods of low river flow when competition amongst users is highest.
Potential combinations	This option could be combined with: • Option 15. Increased on-farm water storage • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 17. Convert low-flow water access licences to high-flow water access licences • Option 30. Active and effective water markets.
Considerations	The review (as described in the discussion paper) has considered the benefits of increasing harvestable rights on industry productivity, as well as ancillary benefits such as additional water storage for firefighting. It has also considered potential impacts on river flows, water pricing, the environment and downstream water users such as water access licence holders and town water supplies. Key outcomes from the review that will need to be considered in any future assessment of this option include: • implications associated with potential changes to long-term average annual extraction limit rules would need to be considered if harvestable rights limits were increased • impacts during dry years to licensed access by downstream users • impacts on the duration and frequency of freshes, and low to no-flow periods • water quality impacts from dams overtopping during high-rainfall events.
Objectives	
Further information	www.industry.nsw.gov.au/water/licensing-trade/landholder-rights/harvestable-rights-dams

Option 15. Increased on-farm water storage

Source: Department of Planning, Industry and Environment—Water

Description	Lack of water storage is a major constraint to balancing water supply and demands for agricultural users in North Coast catchments. Water storage options that facilitate water extraction during medium and high flows can reduce pressures on low flows, while meeting water demands during dry periods. This option would assess: • the current levels of farm dam implementation and use • the hurdles to constructing on-farm storages • the value of on-farm storages to various industries in the North Coast region • regional consequences of low on-farm water security • risks to downstream water users and the environment from an increase in on-farm dams across the region. On-farm water storage may assist in developing industry responses to emerging markets as they provide greater flexibility in access to water.
Intent	• Increase water security for industry. • Improve drought resilience of industry. • Reduce extractive pressures on low streamflows.
Challenges addressed	• Region is vulnerable to extended dry periods. • Major rivers in the region are under hydrologic stress during period of low river flow. • Industry demands for water are shifting away from predominately rain-fed crops.
Potential combinations	This option could be combined with: • Option 14. Increased harvestable rights • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 17. Convert low-flow water access licences to high-flow water access licences.
Considerations	As farm dams can increase how much water is taken under water access licences, this option may risk placing further pressure on rivers and streams already under hydrologic stress. Increasing on-farm storage is most attractive when considered in conjunction with options looking to shift extractive pressures from low streamflows to high streamflows, as it offers benefits to both extractive water users and river ecology. Increases in on-farm storage may also have impacts on water availability for extractive use, depending on current and future capacity and regulatory settings. They can also reduce runoff to waterways, impacting water quality and ecosystem health. Changes to harvestable rights will have an impact on this option. An increase in harvestable rights may make licenced dams less attractive (noting, the intent of harvestable rights dams is not to support large scale irrigation). An increase in both harvestable rights dams and licensed dams are likely to have a cumulative impact on river and groundwater flows, which would need to be considered in the review of current long-term average annual extraction limits and any related policies or rules. Turbidity from higher flow events may impact on water quality within on-farm storages from nutrient loads encouraging blue-green algae. Dam safety requirements (*Dams Safety Act 2015*) will need to be assessed with consideration to potential impacts on downstream flood risk associated with dam failure.
Objectives	

Protecting and enhancing natural systems

Opportunities to protect and enhance environmental outcomes and realise broader community benefits through a healthy environment.

Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources

Source: Department of Planning, Industry and Environment—Water

Description	This option would: • review current long-term average annual extraction limit (LTAAEL) settings against updated inflow data • investigate methods for defining sustainable levels of extraction based on ecological, economic, social and cultural water needs • quantify the sustainable extraction volumes for surface water and groundwater sources in the North Coast based on best available science and understanding of surface water and groundwater processes, as well as knowledge of social and economic impacts • investigate methods for defining end of system flows to protect ecological needs of coastal lagoons, estuaries and wetlands. Water sharing plans set the LTAAEL for surface water and groundwater sources. In most cases, surface water LTAAELs for coastal valleys were set at the sum of existing entitlement plus basic land holder rights, and groundwater LTAAELs were calculated based on an assumed percentage of groundwater recharge. With the imminent remake of water sharing plans and access to improved information, there is scope to redefine LTAAELs based on ecological, economic, social and cultural water needs.
Intent	• Improve our understanding of the volume of water required to maintain and protect coastal river and groundwater systems. • Set sustainable extraction limits for surface and groundwater systems. • Strengthen the resilience of the region's water resources and users to future changes and climate extremes.
Challenges addressed	• Major rivers in the region are under hydrologic stress particularly during periods of low river flow when competition amongst users is highest. • Highly connected groundwater sources are vulnerable to extended dry periods, increased extraction from surface waters and saline intrusion. • Industry demands for water are shifting away from predominately rain-fed crops.
Potential combinations	This option would underpin or inform all options relating to increasing access to water for productive use or for the environment.

Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources (continued)

Considerations	Protection of the water source and its dependent ecology is a requirement of the *Water Management Act 2000*. The NSW Natural Resources Commission in its reviews of coastal water sharing plans has continually recommended the inclusion of sustainable, volumetric extraction limits in the plans. Developing a sustainable extraction limit requires ecological knowledge, social and economic analysis. Improvements in data collection and understanding of the ecological impacts of flow regulation will be needed to inform decision making and long-term water planning. This information could be collected as part of long-term planning to manage water for the environment in the North Coast region. A sustainable LTAAEL could also consider end of system flow requirements to the region's estuaries. Estuaries are important nurseries for inshore fish communities in the region and rely on freshwater inflows to support biophysical processes and protect and maintain biodiversity. Setting a sustainable LTAAEL also provides the opportunity to review current access arrangements, such as the environmental release rules conditioned on storages such as Shannon Creek Dam. The establishment of sustainable extraction limits would need to assess how the new climate datasets and modelling relevant to the North Coast should be used. As the climate changes, the volumes of water that can be extracted sustainably may also change. Other consequences of climate change, such as saltwater ingress to coastal aquifers, will also need to be considered. Further investigations may be required to gain a better understanding of these risks. The implementation of this option would be critical for protecting natural ecosystems particularly in the face of changing climates. Considerations should include an assessment of the impacts of changes of the flow regime on the natural stream function, including aquatic, riparian and ecosystem health, as well as any off-setting measures. Extraction limits could consider differentiating between types of unregulated water access entitlements. For example, licences to extract low flows are currently treated the same as licences linked to harvesting farm dams that have low-flow bypasses. These farm dams are likely to have a lesser impact on low flows than a licence to extract from the river during these periods. Establishing a sustainable LTAAEL would also need to consider a review of cease-to-take conditions, low-flow conversion licences and the impact on freshes, the existing allocation process and trade rules. For example, the trade-in volume will need to align with the defined LTAAELs.
Objectives	
Further information	**Managing water for the environment:** **www.industry.nsw.gov.au/water/environmental-water-hub/water-for-the-environment**

Option 17. Convert low-flow water access licences to high-flow water access licences

Source: Department of Planning, Industry and Environment—Water

Description	This option would include: • review the barriers to, and opportunities for, the conversion of low-flow to high-flow class access licences in North Coast surface water sources • consider amending existing policy settings to provide incentives for the conversion of licences within sustainable extraction limits • consider amending water sharing plans, where appropriate, to allow for greater opportunities to access high flows. Many of the region's rivers and creeks are under high or moderate hydrologic stress during low-flow periods. High-flow conversion is when an existing licence is converted to allow extraction of a greater volume of water, but only under high-flow conditions. This is an existing policy, but it currently applies only to limited areas.
Intent	• Mitigate the hydrologic risks of water extractions during low-flow periods. • Support greater flexibility to industries in securing their existing and future water needs.
Challenges addressed	• Major rivers in the region are under hydrologic stress particularly during periods of low river flow when competition amongst users is highest. • New climate data and modelling suggests significant changes to river flows. • Region is vulnerable to extended dry periods. • Industry demands for water are shifting away from predominately rain-fed crops.
Potential combinations	This option could be combined with: • Option 14. Increased harvestable rights • Option 15. Increased on-farm water storage • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 29. Improved data collection on water use and patterns • Option 30. Active and effective water markets • Option 32. Regional demand management program.
Considerations	This option has a direct inter-dependence with the options to establish sustainable extraction limits. This option requires: • detailed consideration of current policy, regulatory and water management constraints, and risks to other water licence holders • consideration of environmental implications, especially changes to water availability and flow delivery • consideration of how the conversion rate is determined (e.g. is there a common conversion rate for the entire length of the river or is a scaling factor, or similar, applied based on the distance the option is downstream of a given point) • feedback on public acceptance of the option.
Objectives	

Image courtesy of My Clarence Valley.

Option 18. Long-term water plans to support healthy coastal waterways

Source: Department of Planning, Industry and Environment—Water

Description	This option would look to develop a long-term plan to guide the management of water resources for the North Coast. A long-term water plan for the North Coast region would build on the experience and learnings of the NSW inland long-term water plans, noting that there is no held environmental water in the North Coast region. It would provide a single, coordinated plan to sustain and improve the health of priority environmental assets and ecosystem functions across the region. Aspects to be addressed in the plan would include: • environmental objectives for all species and ecosystems • specific and quantifiable objectives and targets for key species and functions • tolerances for key 'healthy water' indicators (e.g. upper and lower flow thresholds) • consolidated knowledge of environmental water requirements, including volume, frequency, timing and duration of flows for various flow classes, as well as the risks, constraints and complementary non-water measures that could contribute to meeting the ecological outcome • a framework for future monitoring and evaluation of plans and programs • governance arrangements for coordinating actions across various government agencies • opportunities to provide cultural benefits as part of meeting environmental water needs. The data collected in developing, monitoring and evaluating a long-term water plan for the North Coast would provide a consolidated and growing knowledge base to ensure decisions are made using the best available evidence and guide future management strategies, research and investment. The data would also be important in informing the review and revision of the region's water sharing plans.
Intent	• Strengthen the resilience of the region's water resources and users to future changes and climate extremes. • Support long-term planning and management of the region's water resources. • Improve monitoring of coastal groundwater sources. • Protect and enhance riparian functions, ecosystems and species. • Provide the right conditions for connectivity between the region's rivers, wetlands, groundwater and estuaries.
Challenges addressed	• Limited surface water and groundwater water use and monitoring data to guide sustainable management. • Limited strategic planning to inform local decision making.
Potential combinations	This option could be combined with: • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 29. Improved data collection on water use and patterns • Option 27. Planning for climate change impacts on coastal groundwater resources.

Option 18. Long-term water plans to support healthy coastal waterways (continued)

Considerations	• Coastal catchments do not currently have measurable environmental outcomes and targets endorsed by government to guide the management of water resources and development of long-term water plans. • Environmental water requirements for coastal rivers, as well as any broad themes, should reflect important coastal assets such as spiny crayfish, freshwater mussels and freshwater turtles. • The plan would need to be tailored to coastal and estuarine water requirements and consider the region's distinct characteristics, including the habitats, ecosystems and species that populate them. • Interlinkages and consistency (where appropriate) with existing programs would be considered, such as actions under the *Marine Estate Management Strategy* and the risk based framework being applied across coastal catchments. • The plan would need to consider synergies between environmental water needs and cultural water values. • Additional habitat mapping, monitoring and data collection on flow, habitats and species on environmental and ecological would be needed to inform plan development and to ensure it is effective (e.g. in supporting appropriate monitoring, evaluation and reporting). A review of the gauge network is necessary to ensure it is sufficient to support the implementation of this option.
Objectives	

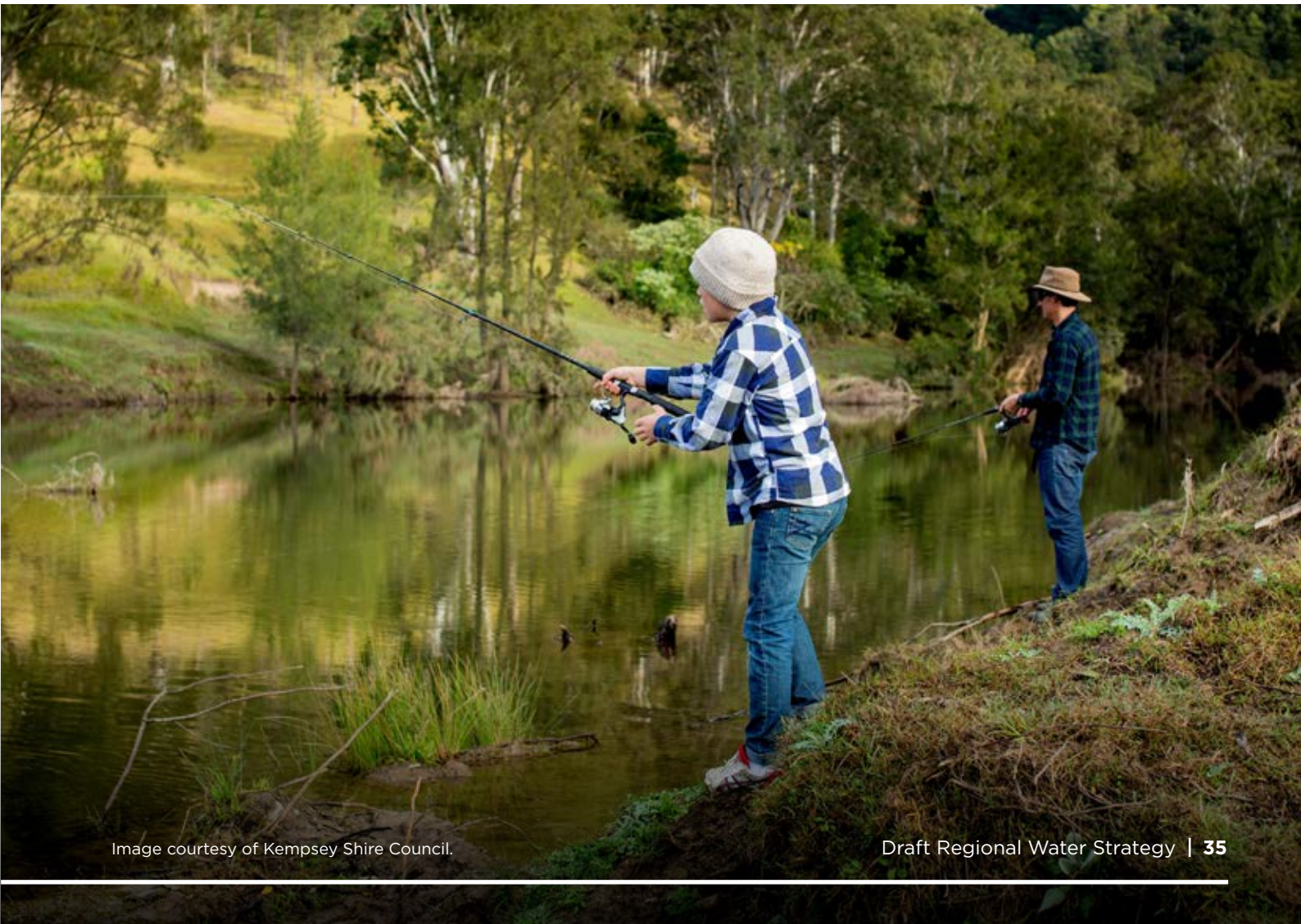


Image courtesy of Kempsey Shire Council.

Option 19. Characterising coastal groundwater resources

Source: Department of Planning, Industry and Environment—Water

Description	To respond effectively to groundwater management challenges over the next two decades, particularly during extended dry periods, this option proposes further investment in the characterisation of: • coastal sands • floodplain and upriver alluvials • underlying basement rocks, which may have viable hard-rock aquifers in zones of heavy fracturing • the connectivity of these groundwater sources with surface waters. In this option, the groundwater resources for these areas would be characterised in six steps: 1. Geological, geophysical, geochemical, ecological and hydrogeological field investigations combined with compilation of all available information via a comprehensive literature review. These investigations would be conducted by the Department of Planning, Industry and Environment-Water in collaboration with the NSW Geological Survey. This will provide baseline information on the availability and vulnerability of the resources (e.g. levels of fracturing, likely water quality, etc). 2. Expansion of the monitoring network and programs. Currently, the NSW Government has a network of monitoring bores and monitors water levels and quality parameters. This option would determine whether a new injection of funds to upgrade the network/programs is now required. 3. Metering of spearpoints, bores, wells and all other forms of groundwater take. This is being addressed by the NSW Government's metering reforms. Consideration should be given to whether there is a need for metering of smaller bores not currently captured by these reforms. 4. Development of conceptual groundwater models. Combining the data collected in the first three steps will give a better idea of how much groundwater is available, how it recharges, where it discharges and how the extraction impacts on the resource. Analysis and synthesis of the data into useful information and insights would be done by the Department of Planning, Industry and Environment—Water in collaboration with universities and other research institutions such as ANSTO and CSIRO. 5. Development of numerical groundwater flow and transport model(s). Historically, the NSW Government has modelled the six large inland alluvial aquifers, where most of the state's groundwater extraction occurs (predominately for irrigation). Numerical models are also needed for the coastal groundwater resources. This would involve consideration of the impacts of climate change on the availability of groundwater resources, given changes to recharge and the salinisation of coastal sands due to sea level rise. The priority for this work across the state will need to be determined through a risk assessment process. 6. Publishing of annual resource updates. These would be web-based and include a plain English version of the applicable regulations, explain who and what is impacting the resource, and identify any emerging risks.
Intent	Ensure the NSW Government and the community have the required data and knowledge to inform groundwater management frameworks and decisions.
Challenges addressed	• Lack of data to inform decision making. • Highly connected groundwater sources are vulnerable to extended dry periods, increased extraction from surface waters and saline intrusion.
Potential combinations	This option would provide the data for subsequent options, including: • Option 9. Protecting coastal groundwater resources for town water supplies and rural water users • Option 20. Protecting ecosystems that depend on coastal groundwater sources • Option 27. Planning for climate change impacts on coastal groundwater resources.

Option 19. Characterising coastal groundwater resources (continued)

Considerations	Development of groundwater sources is an opportunity in coastal regions—in particular, to increase reliability of water supply in drought times. This must only be done with an improved understanding of the resources and their dependent ecosystems. Good groundwater management is underpinned by area-specific knowledge of the groundwater resources. Our knowledge of a groundwater resource can always be improved. Consequently, there will always be a need to invest in characterising the resources. The level of investment required at a given time should be guided by the level of current and predicted risk to the resource and opportunities for its development. This option is consistent with the recommendations of the NSW Chief Scientist and Engineer's *Independent Review of the Impacts of the Bottled Water Industry on Groundwater Resources in the Northern Rivers Region of NSW*.
Objectives	
Further information	**www.chiefscientist.nsw.gov.au/independent-reports/bottled-water-in-the-northern-rivers**

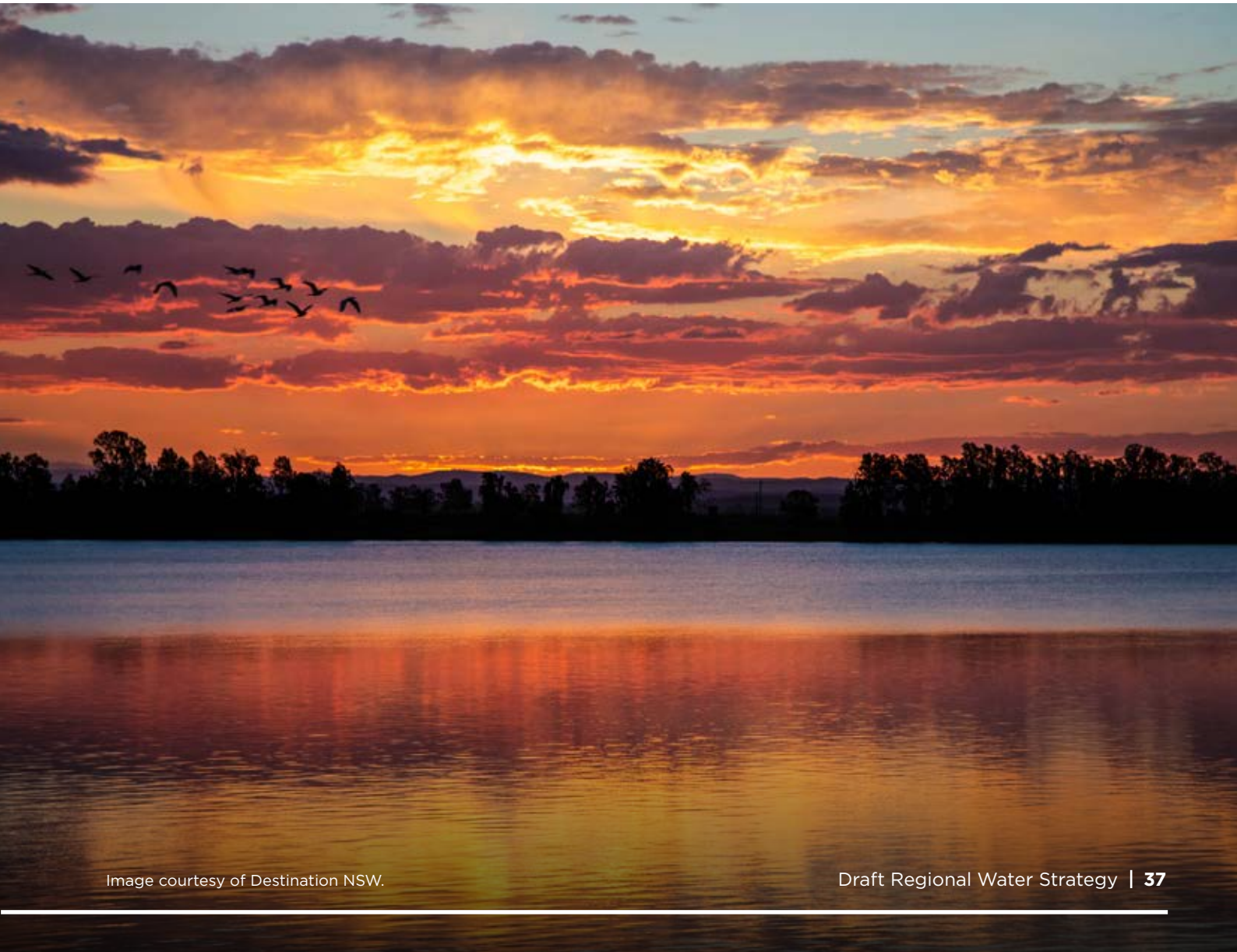


Image courtesy of Destination NSW.

Option 20. Protecting ecosystems that depend on coastal groundwater resources

Source: Department of Planning, Industry and Environment—Water

Description	In this option, a series of projects would be initiated to advance our knowledge and management of groundwater dependent ecosystems (GDEs). These projects would: • review and develop new methods to monitor the vegetation condition of GDEs (including root depth and response to drought) • update the existing GDE Policy to support the recognition and protection of all GDE types including those that are only partially reliant on groundwater • develop a cost-effective method to monitor the vegetation condition of GDEs • formalise water quality guidelines for groundwater ecosystems • create guidelines on how to characterise a GDE and what an impact assessment should consider • develop a state-level sampling method and assessment guidelines for all GDE types • implement a citizen science project to assess groundwater biodiversity in wells across NSW • explore managed aquifer recharge as a tool/strategy for supporting GDEs, with an emphasis on water quality needs • establish baseline conditions for the groundwater health index on the coast. Currently no data on groundwater quality or ecosystem functions are available for coastal GDEs • identify groundwater bioregions to provide a basis for management and setting baseline conditions for future monitoring and create an information source for offsetting • determine groundwater regimes for GDEs and include climate change in determining threshold changes to GDEs • establish drawdown thresholds that are specific for each GDE type and species requirements • implement a groundwater health index monitoring program and establish baseline conditions for the groundwater health index on the coast • ground truth the GDE schedule in the water sharing plans and 'High Probability High Ecological Value Aquatic Ecosystems GDEs' identified from GIS analysis • standardise sample collection, data and reporting by third parties to feed into a centralised database • create a NSW 'single point of truth' portal for GDEs that includes government and industry data, and high quality metadata • collaborate with universities and other research organisations (e.g. via future projects included in the Water Science Research Prospectus) • revise the High Ecological Value Aquatic Ecosystems (HEVAE) GIS layer used for risk assessments • review and amend water sharing plans to list high priority GDEs.
Intent	Support groundwater dependent ecological processes that support soils, fauna and flora and establish and maintain environments that are valuable to coastal NSW.
Challenges addressed	• Past and current land use practices have impacted both riverine and estuarine water quality. • Limited surface water and groundwater water use and monitoring data to guide sustainable management.
Potential combinations	This option would build on information and understanding gained from Option 19. Characterising coastal groundwater resources and could be combined with Option 29. Improved data collection on water use and patterns.

Option 20. Protecting ecosystems that depend on coastal groundwater resources (continued)

Considerations	Development of groundwater sources is an opportunity in coastal regions, in particular to increase reliability of water supply in drought times. This must only be done while protecting the resources and their dependent ecosystems. This option requires: • increased bore network to target GDE locations for monitoring and evaluation • better quantification of the relationships between groundwater GDEs, availability and extraction volumes • understanding the role of natural recharge and flooding on GDEs • groundwater salinity monitoring and management • educational and communication material to promote awareness of GDEs including the relationships between above ground and underground processes and benefit to the local environment • inclusion of indigenous cultural connections to GDEs • consideration of changes to water sharing plans to include additional high priority groundwater dependent ecosystems.
Objectives	

Image courtesy of Destination NSW.

Option 21. Improve stormwater management

Source: Department of Planning, Industry and Environment—Water

Description	This option would identify and investigate potential locations for precinct-scale stormwater harvesting and reuse projects in new urban developments across the region to improve urban stormwater quality and reduce impacts on waterways within towns and regional centres. The option would adopt the principles of water sensitive urban design as well as support current initiatives and actions to reduce diffuse-source water pollution under the *NSW Marine Estate Management Strategy.*
Intent	• Support improved land use practices that protect catchment health. • Integrate urban water management into achieving broader community goals.
Challenges addressed	• Past and current land use practices are impacting both riverine and estuarine water quality. • Region is vulnerable to extended dry periods. • Support improved land use practices that protect catchment health.
Potential combinations	This option could be combined with Option 10. Remove impediments to water reuse projects.
Considerations	This option would need to consider: • stormwater is a climate-dependent supply, and storages need to be sized to manage the identified need during dry times • optimal size of storage verse cost and reliability • community willingness to pay (that is, through increased land prices in new developments) • water quality and other environmental benefits • other social benefits, such as amenity, reduction in urban heat island impacts, increases in property value • end use and any particular water quality requirements (e.g. sports field irrigation, sub-surface irrigation) • outputs from new climate data on lengths and frequency of dry spells • ecological impacts of reducing downstream flows, particularly under dry year scenarios. Integration would be required with urban planning, subdivision and urban development requirements, including for roadways and drainage. Cost of scheme and perceptions regarding maintenance and operation may be a constraint to adoption.
Objectives	

Option 22. Bringing back riverine and estuarine habitats and threatened species

Source: Department of Regional NSW—Fisheries

Description	This option proposes a new *Bringing Back Threatened Species* program to help restore riparian and wetland habitats by protecting and enhancing priority areas using best practice management. The program would improve the condition, connectivity and resilience of habitat and landscape through both instream and catchment-based initiatives. Flow on benefits could include improvements in water quality, which can provide benefits for the cultural, social and economic wellbeing of river-reliant communities. The project would use a catchment management framework and be structured as a five-year partnership with a scoping-study in the first phase to identify high priority targeted works, project partners and detailed costs. On-ground works and evaluation would proceed in Stage 2 of the project.
Intent	• Protect and enhance riparian functions, ecosystems and species. • Provide the right conditions for connectivity between the region's rivers, wetlands, groundwater and estuaries. • Support improved land use practices that protect catchment health.
Challenges addressed	• Past and current land use practices have impacted both riverine and estuarine water quality. • Major rivers in the region are under hydrologic stress during periods of low river flow.
Potential combinations	This option could combine with several options aimed at protecting and enhancing the environment and Aboriginal culture, including: • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 18. Long-term water plans to support healthy coastal waterways • Option 20. Protecting ecosystems that depend on coastal groundwater systems. • Option 24. Improve fish passage in the North Coast region.
Considerations	On-ground restoration projects require multi-stakeholder partnerships including Aboriginal and wider community groups and government agencies. Fostering a strong sense of engagement from communities is critical to meeting regional water strategy objectives—this is especially so when it comes to protecting and enhancing the environment. Engagement with the community will support efficient delivery of river and marine estate health outcomes, build a greater understanding of issues facing native fish populations, create ownership of local and regional projects, and provide the government with a significant return on its investment. This option would have links to the statewide *Saving Our Species* program, which is led by the Department of Planning, Industry and Environment—Environment, Energy and Science. Knowledge gleaned from the *Saving Our Species* program could add significant value to this option. This option will build on a number of *Marine Estate Management Strategy* initiatives, in particular Initiative 5: Reducing impacts on threatened and protected species.
Objectives	

Option 23. Fish-friendly water extraction

Source: Department of Regional NSW—Fisheries

Description	This option would involve the installation of screens on pump channels (referred to as diversion screening) to reduce the amount of fish being extracted at pump sites. Native fish can be inadvertently extracted by pumps and are then unable to return to the river system. Addressing fish extraction with diversion screening has benefits both for the environment and for pump owners/operators by reducing blockages caused by debris. This improves water delivery and extraction efficiency and results in on-farm cost savings. The *Screens for Streams* program will partner extractive water users with scientists and engineers to collaboratively reduce native fish mortality. This option for diversion screening will target high priority reaches or installations in the North Coast region.
Intent	• Reduce the loss of native fish in the North Coast region while improving water delivery and extraction efficiency. • Provide the right conditions for connectivity between the region's rivers, wetlands, groundwater and estuaries. • Protect and enhance riparian functions, ecosystems and species.
Challenges addressed	Protecting native and threatened aquatic species.
Potential combinations	This option could be combined with other environmental options to support a healthy regional environment, including: • Option 22. Bringing back riverine and estuarine habitats and threatened species • Option 24. Improve fish passage in the North Coast region • Option 28. River Recovery Program for the North Coast: a region-wide program of in-stream works, riparian vegetation and sediment control.
Considerations	Screens on pumps (diversion screening) have the following benefits for the community, pump owners and the environment: • it prevents entrainment of adults, larvae and eggs thereby reducing fish mortalities and supporting population growth. Research by the then Department of Primary Industries—Fisheries in 2013 found that well designed and installed screens can reduce fish deaths by up to 90%, as well as mortalities for other aquatic species • pump owners save money as a result of reduced costs for fuel and electricity, filters and maintenance. These funds are then available to reinvest in other areas of their business • screens improve water delivery and extraction efficiency through reduced debris blockages • demand for screens provides a boost for manufacturing and retail sectors • screening will deliver ecological outcomes to support regional water strategy objectives without requiring additional water allocations. The program would require: • assessment of the cost-benefits of screening, including environmental outputs, water delivery efficiency and long-term social and financial implications to water licence holders • assessment of incentive schemes for landholders to install screens. If the screens are a legislative requirement, a mandatory condition for applicable works approvals may need to be included in the relevant water sharing plans. This would enable enforcement and monitoring of the presence/absence of the devices. Note: Diversion screens have been used successfully for decades overseas (e.g. in western USA, Europe and New Zealand). Cost of screens may be an impediment to implementation.
Objectives	

Option 24. Improve fish passage in the North Coast region

Source: Department of Regional NSW—Fisheries and Department of Planning, Industry and Environment—Water

Description	This option would replace or remediate four high priority fish barriers, as identified in the *NSW Fish Passage Strategy*. These sites are the Nymboida Weir, a bridge on Timbarra River off Upper Rocky Creek Road, a bridge/box culvert on Dowlings Falls Road, and a bridge on Ewingar Road. Remediating these structures would: • improve the ability of native and threatened fish species to move along waterways to access important habitat and food sources • improve the ability of fish to access reproductive and spawning grounds in the system • improve growth and survivorship of native and threatened fish species. The *NSW Fish Passage Strategy* is scheduled to be carried out over multiple phases. Barriers to fish passage are a major contributor to the decline of native fish species. Reflecting this, they are listed as a key threatening process in NSW and Commonwealth threatened species legislation.
Intent	• Protect and enhance riparian functions, ecosystems and species. • Provide the right conditions for connectivity between the region's rivers, wetlands, groundwater and estuaries.
Challenges addressed	Protecting native and threatened aquatic species.
Potential combinations	This option could be combined with: • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 22. Bringing back riverine and estuarine habitats and threatened species • Option 23. Fish-friendly water extraction • Option 25. Addressing cold water pollution.
Considerations	Many native fish species in the North Coast region require unimpeded access through waterways to carry out natural reproductive and migratory processes. Physical waterway barriers such as weirs, bridges and culverts can limit these processes leading to a decline in the health and viability of native fish populations. Fish passage remediation can assist in mitigating the impact of barriers to fish passage in hydrologically connected systems. Suitable environmental water management settings need to be in place to secure hydrological connectivity between connected river reaches. Local council and water user access requirements, including funding, are considered in the design of new fishway structures to ensure reliability of supplies are not negatively impacted or are offset.
Objectives	
Further information	www.dpi.nsw.gov.au/fishing/habitat/threats/barriers www.marine.nsw.gov.au/strategy-implementation/delivering-healthy-coastal-habitats-with-sustainable-use-and-development/re-connecting-fish-habitats

Option 25. Addressing cold water pollution

Source: Department of Regional NSW—Fisheries and Department of Planning, Industry and Environment—Water

Description	Cold water pollution—an artificial decrease in the temperature of water in a natural river—is caused by cold water being released into rivers from large dams during warmer months. This can be detrimental to ecological health. Between spring and autumn, the water stored in large dams can form two layers: a warm surface layer overlying a cold bottom layer. This option aims to evaluate the degree of cold water pollution from existing storages in the North Coast and to work with asset owners to implement appropriate capital and operational responses to mitigate these impacts. This option is a five-year partnership, commencing with a scoping study in the first phase to assess the issues and identify suitable works and project partners.
Intent	• Restore near-natural river water temperature to provide native and threatened fish species in the North Coast systems with the necessary environmental cues to spawn, recruit, move and grow. • Improve social amenity through access to recreational activities.
Challenges addressed	Protecting native and threatened aquatic species.
Potential combinations	This could be combined with Option 24. Improve fish passage in the North Coast region.
Considerations	The major storages in the North Coast region vary in their likelihood of releasing cold water to the environment. There is a lack of monitoring sites upstream and downstream of storages in the region. This can make it difficult to determine the extent of cold water pollution. This option would include: • alignment with the NSW *Cold Water Pollution Strategy* • assessment of existing temperature metrics against best-practice frameworks for managing impacts on aquatic fauna • examination of the extent and magnitude of cold water pollution effects from storages in the region • an exploration of the potential for, and feasibility of, technologies (such as augmentation of dam outlets, improvements to mixing regimes and modifications to water delivery mechanisms) to mitigate cold water pollution effects.
Objectives	
Further information	**www.dpi.nsw.gov.au/fishing/habitat/threats/cold-water-pollution**

Option 26. Coastal, regional focused water reference groups

Source: Department of Planning, Industry and Environment—Water

Description	This option proposes to develop coastal water reference groups to deliver information to coastal communities and provide an opportunity for communities, Aboriginal people, environment groups and industry to have input into coastal specific water management development and reform across NSW. Areas that a water reference group may be consulted on could include regional water strategy implementation and review, coastal policy issues (including water and land use which may affect water resources), water sharing plans and funding Independent Pricing and Regulatory Tribunal of New South Wales (IPART).
Intent	• Improve communication channels between the NSW Government and key representatives on coastal, regional specific water management issues. • Build capacity to support water stewardship and local decision making. • Support long-term planning and management of the region's water resources. • Provide confidence that water extraction rules are sustainable and protect key environmental assets, while also facilitating access for consumptive uses.
Challenges addressed	• Limited strategic planning to inform local decision making. • Skill and training limitations to foster best practice water management and encourage efficient water use. • Past and current land use practices have impacted both riverine and estuarine water quality.
Potential combinations	This option is foundational to the policy options in the strategy and complements Option 34. Regional capacity building program and skills hub.
Considerations	Considerations for this option include: • representation—the composition of the group is likely to include representation from government, irrigators, domestic and stock users, local environment groups, local Aboriginal groups, mining or resources firms, and local water utilities/councils. The group could also include representatives from planning to help better integrate future land use and water resource planning. Considerations could also be given to having a joint panel with the Far North Coast region • reliance on other water sources outside the North Coast region—where communities receive water from a different catchment but have broader interests in the water management issues in the North Coast region (e.g. Walcha) • scope of the committee and potential overlap/interactions with stakeholder engagement committees that have been established (e.g. water and otherwise) • frequency and location of meetings—proposed to be twice a year at a location central to all members • funding arrangements.
Objectives	

Option 27. Planning for climate change impacts on coastal groundwater resources

Source: Department of Planning, Industry and Environment—Water

Description	Coastal groundwater resources provide fresh and easy-to-access water for communities and industries. They support baseflows to creeks and rivers and provide water for ecosystems. The shallow nature of coastal groundwater resources provides advantages but also means they are vulnerable to the impacts from climate change and sea level rise. Possible impacts include: • reduced water availability for consumptive use and the environment due to reduced groundwater recharge from changes in rainfall and increased evapotranspiration • salination of aquifers by seawater intrusion and inundation, impacting both water supplies and ecosystems that rely on groundwater • waterlogging, contamination (from septic tanks or inadequately designed or maintained bores) and flooding due to high groundwater tables. The expected magnitude of these impacts varies greatly depending on local conditions. In this option, the Department of Planning, Industry and Environment—Water would collaborate with Local Land Services, councils and universities to co-design and implement local-scale projects to: • identify areas at risk to one or more of the above impacts • undertake numerical modelling to predict the impacts • conduct a quantitative risk assessment of salinity induced by land management and pumping in all groundwater sources • create monitoring networks and programs to measure the impacts • establish a cross-agency governance group to annually review the above steps and publish its findings online for transparency and accountability. The projects would lead to better: • recharge estimates under various climate change scenarios • informed long-term annual extraction limits (reviewed every five to 10 years) for coastal groundwater sources • science to review assessment criteria for coastal groundwater applications.
Intent	Prepare for the impacts of climate change and sea level rise on groundwater sources in coastal regions.
Challenges addressed	• Region is vulnerable to extended dry periods. • Saline intrusion due to sea level rise and increases in storm surges may affect future water security. • Limited measurement data on water use.
Potential combinations	This option would build on Option 19. Characterising coastal groundwater resources.
Considerations	Development of groundwater sources is an opportunity in coastal regions, in particular, to increase reliability of water supply in drought times. This must only be done with an improved understanding of the resources and the impacts of climate change. The expected magnitude of the impacts varies greatly depending on local conditions. Consideration needs to be given to the roles and responsibilities of different agencies (as well as funding arrangements), as groundwater protection functions are spread across levels of government and different government agencies.
Objectives	

Image courtesy of My Clarence Valley.

Option 28. River Recovery Program for the North Coast: a region-wide program of instream works, riparian vegetation and sediment control

Source: Department of Planning, Industry and Environment—Water

Description	Land clearing associated with European settlement has had detrimental impacts on river catchments in the North Coast region. Due to the removal of vegetation and straightening of rivers, water now moves more quickly through the catchment, leading to less water being stored in the landscape and consequently longer dry periods. Furthermore, water now moves through the landscape with more energy, eroding land and degrading water quality by increasing sediment loads. Recent bushfires in the region have considerably exacerbated these challenges. Instream works such as log jams, rock chutes and log weirs, along with riparian vegetation, can help reverse this degradation by slowing the movement of water through the landscape, reducing erosion and decreasing sediment loads in streams. This option will consider the costs and benefits of a region-wide program to better manage catchment hydrology and erosion by providing landholders with financial assistance and technical expertise. Such a program would build on previous work, as well as current programs such as the coastal management programs that are being developed by local councils.
Intent	• Protect and enhance riparian functions, ecosystems and species. • Support improved land use practices that protect catchment health.
Challenges addressed	• Past and current land use practices have impacted both riverine and estuarine water quality. • Skill and training limitations to foster best practice water management and encourage efficient water use.
Potential combinations	This option could be combined with Option 15. Increased on-farm water storage.

Option 28. River Recovery Program for the North Coast: a region-wide program of instream works, riparian vegetation and sediment control (continued)

Considerations	A River Recovery Program that is properly resourced to address policy, technical and financial resources could be designed and delivered through a regional delivery model involving collaboration between the Department of Planning, Industry and Environment—Water, Department of Planning, Industry and Environment—Environment, Energy and Science, Department of Regional NSW—Fisheries and the North Coast Local Land Services. It would also require collaboration with local councils and Native Title holders. Although there are considerable benefits to be gained there is also scope for instream works to have detrimental effects on the environment and water users if not properly implemented or if implemented in the wrong places. A program such as this needs significant scientific/technical support to ensure the options being considered are suitable for their proposed locations. Strategic planning to identify suitable locations will be required. Instream works are also expensive, often require the most productive land to be taken out of production and their benefits may take years to be fully realised. Instream works must also be designed and constructed by experts in the fields of river engineering and fluvial geomorphology. There are numerous examples across the state where poorly designed and poorly constructed works have exacerbated rather than reduced soil erosion. The NSW Government has previously provided financial incentives and technical expertise to construct instream works. However, there have been varying degrees of uptake of these types of programs in NSW in the past. This option could also incorporate existing (or new) measures aimed at minimising water quality impacts from catchment land use practices. This option supports a number of actions proposed by the *NSW Marine Estate Management Strategy 2018-2028*, including: Action 1.3.2: Riparian vegetation improvements by planting native trees, shrubs and ground covers and fencing out stock from waterways. Action 1.3.4: Bank protection works to reduce sediment input into estuaries from eroding river banks. Action 1.2.11: Conducting social research into behaviour around what drives different agricultural industry groups and communities to adopt change and how to influence the adoption of agricultural best management practice for priority industries. Action 1.3.6: Road and track improvements, such as road surface sealing or stormwater runoff controls, to reduce sediment input into waterways from unsealed roads.
Objectives	
Further information	***NSW Marine Estate Management Strategy 2018-2028*:** **www.marine.nsw.gov.au/marine-estate-programs/marine-estate-management-strategy**

Supporting water use and delivery efficiency and conservation

Opportunities to improve the efficiency of existing water delivery systems, increase productivity and address water security challenges through demand management options.

Option 29. Improved data collection on water use and patterns

Source: Department of Planning, Industry and Environment—Water and Natural Resources Commission

Description	This option would investigate opportunities to better monitor and track water extraction. The North Coast region suffers from a paucity of extraction and gauging data for both surface and groundwater sources. Additionally, around 31% of water supply works will be subject to the new metering rules under the NSW Government's non-urban metering framework. This makes it difficult to assess whether the current rules for extraction are being followed—and hence effective in protecting water for the environment and sharing access equitably amongst users. This option would involve: • potential incentives for voluntary uptake of metering and telemetry, or a review of current policy thresholds on pump sizes requiring metering • feasibility of alternative methods for collecting water use data, such as the use of – application of GIS databases and hydrological models to track use in areas of high irrigation demand – use of digital infrastructure and agriculture technologies (ag tech) to monitor data use – mapping work being completed by the Department of Regional NSW—Department of Primary Industry – calibrating electricity meters to track pump rates and use – collecting water usage data such as pairing spatial analysis • coordinating with WaterNSW to undertake an audit of monitoring bore integrity and a hydrometric review of existing gauges • investigating opportunities to refurbish existing infrastructure (such as groundwater monitoring bores) and installing new infrastructure and technology to enable more efficient collection of water flows and levels.
Intent	Inform future water management decisions in the North Coast region.
Challenges addressed	Limited measurement data on water use.
Potential combinations	This option would support the design, development and implementation of all future options for the North Coast region.

Option 29. Improved data collection on water use and patterns (continued)

Considerations	This option would need to consider: • adequacy of the existing network to support the proposed opportunities • feasibility of remote sensing in the wetter areas of the coast • costs and user willingness to pay for telemetry metering, as well as incentives to encourage adoption (this could include the need to review the existing non-urban water metering framework for coastal regions) • prioritising requirements for improved data collection across the region; for example, based on the hydrologic stress of a water source • funding and governance arrangements • provision of guidance/guidelines on data provision • setting requirements for standardising data loggers and data formats • how to improve data quality and increase sampling compliance by implementing a quality management program • availability of required technicians (or equally the need to upskill local people) • opportunities to integrate other catchment data (such as water quality and rainfall as well as flood warning systems).
Objectives	
Further information	**NSW Non-urban metering framework:** **www.industry.nsw.gov.au/water/metering** **Important Agricultural Land Mapping in NSW:** **www.dpi.nsw.gov.au/agriculture/lup/agriculture-industry-mapping/important** **Khan et al., Role of GIS, remote sensing and hydrology in the environmental management of rice growing areas:** **www.regional.org.au/au/gia/14/452khan.htm** **Regional Digital Connectivity program:** **www.nsw.gov.au/snowy-hydro-legacy-fund/regional-digital-connectivity-program**

Option 30. Active and effective water markets

Source: Department of Planning, Industry and Environment—Water

Description	This option would review the efficiency and effectiveness of water markets (unregulated and groundwater) in the North Coast, including: • their ability to contribute to improved water security outcomes in the region • encouraging water entitlement holders to trade to more efficient areas of the catchments • transparency of information to enable the market to operate effectively.
Intent	• Provide transparency and confidence to water users. • Educate water users about the operation of and rules governing water trade. • Improve and broaden the market to create opportunities to move water more effectively.
Challenges addressed	• Region is vulnerable to extended dry periods. • Rural demands for water are likely to increase as intensive horticulture expands. • No new licences available for surface water extraction, with competition for water high during periods of low river flow. • Regulatory and administrative barriers to innovative and efficient water use.
Potential combinations	This option could be combined with several options aimed at improving water efficiency and sustainable water use, including: • Option 14. Increased harvestable rights • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 17. Convert low-flow water access licences to high-flow water access licences • Option 29. Improved data collection on water use and patterns.
Considerations	This option would need to consider: • existing regulatory barriers such as the rules under the *Water Management Act 2000*, water rights, use and pricing • administrative constraints • hydrological and operational (delivery and metering) challenges • potential environmental impacts if inactive allocations are used and extraction from the water source increased • the impact of trade zones and rules to basic landholder rights and the environment, including sensitivity of receiving and source environments to trade rules, and the sensitivity of the environment within a particular trade zone • risk assessment frameworks being developed for coastal catchments • previous work conducted as part of the review of the *Water Sharing Plan for the Bellinger River Area unregulated and alluvial water sources.*
Objectives	

Option 31. Apply the *NSW Extreme Events Policy* to the North Coast region

Source: Department of Planning, Industry and Environment—Water

Description	This option would: • amend the *Extreme Events Policy* to apply to all of NSW • establish a Critical Water Advisory Panel for the North Coast region • develop an incident response guide for the North Coast region. The *NSW Extreme Events Policy* provides a clear and transparent framework for making decisions during extreme events, including what those decisions are, when they are made and who makes them. This information allows water users to make plans during extreme events with more confidence and provides more certainty for the water market. The policy is designed to facilitate early intervention and delay the need to suspend certain water sharing arrangements so that suspension will only occur during more severe water stress and water quality events. The policy establishes the principles for managing extreme events for major water sources. It provides a transparent decision making framework based on an assessment of risk and need in the face of competing priorities and demands.
Intent	Provide clarity in decision making during periods of severe dry periods and water quality events.
Challenges addressed	• Region is vulnerable to extended dry periods. • Limited strategic planning to inform local decision making.
Potential combinations	This option could be combined with: • Option 9. Protecting coastal groundwater resources for town water supplies and rural water users • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 18. Long-term water plans to support healthy coastal waterways • Option 29. Improved data collection on water use and patterns • Option 32. Regional demand management program.
Considerations	This option would need to consider: • information and data requirements to ensure the extension of the *Extreme Events Policy* meets the needs of coastal areas • triggers for rural users accessing town water supplies • catchment-based versus regional or coastal-wide triggers and thresholds • possible improvements to the existing *Extreme Events Policy* for inland regions based on experience and lessons learnt from the recent drought • necessary regulatory changes • ecological data required and collected as part of future long-term water planning.
Objectives	
Further information	**Extreme Events Policy:** **www.industry.nsw.gov.au/water/what-we-do/legislation-policies/eep**

Option 32. Regional demand management program

Source: Department of Planning, Industry and Environment—Water

Description	This option would consider the coordination of a region-wide demand management program that would include all local councils in the North Coast. The program could also include rural water users within the council areas of the region. This could bring consistency in approach and efficiencies in monitoring and water conservation practices across the North Coast region. Other opportunities for regional demand management include: • education and awareness and development of consistent messages to the community through public education resources, regional advertising and recognition programs • purchasing and improving economies of scale • improved training for relevant local council staff • common guideline development (e.g. for rainwater tanks and irrigation) • centralised monitoring and data intelligence services that could be used to detect leakage that might otherwise go undetected.
Intent	• Improve consistency in approach to demand management across the region. • Improve efficiency of monitoring and implementation.
Challenges addressed	• Region is vulnerable to extended dry periods. • Completely unregulated system, with limited options for inter-connections across catchments.
Potential combinations	This option could be combined with: • Option 1. Expand the Clarence-Coffs Harbour *Regional Water Supply Scheme* • Option 12. Indirect potable reuse of purified recycled water • Option 13. Direct potable reuse of purified recycled water.
Considerations	This option requires: • investigation into the current demand management arrangements to understand if there are flaws to be addressed • impacts of industrial and rural users on demand management • careful consideration of governance arrangements for administration of the program. This option was identified through the development of the Draft Far North Coast Regional Water Strategy, and was also considered relevant to the Draft North Coast Regional Water Strategy. Barriers to regional demand management identified through consultation on the Far North Coast Regional Water Strategy include: • there is currently no legislative or planning driver that exists to bring together demand management planning or initiatives across the region • there are differing demand management priorities between councils • regional demand management activities must be compatible with existing plans and achieve balance between regional cooperation and remaining locally relevant • each council is at a different stage of implementation of demand management • differing demographics across councils meaning that a 'one size fits all' approach to engagement and education programs may not be suitable • generic water efficiency messages are no longer effective. People will respond to specific offers/actions relevant to their circumstances and this may be dependent on particular target audiences within each council area • some councils have limited human and budget resources. This option could include development of a monitoring and evaluation program to ensure that demand management initiatives continue to perform well over the long-term.

Option 32. Regional demand management program (continued)

Objectives	
Further information	A regional demand management plan was developed in 2015 by the Northern Rivers Water Group. The group comprised representatives from Clarence Valley Council and Coffs Harbour City Council who worked collaboratively on regional water issues. The plan did not set a detailed demand management plan, but rather identified priorities and implementation actions, and laid the groundwork for understanding the constraints and opportunities for demand management at the regional scale.

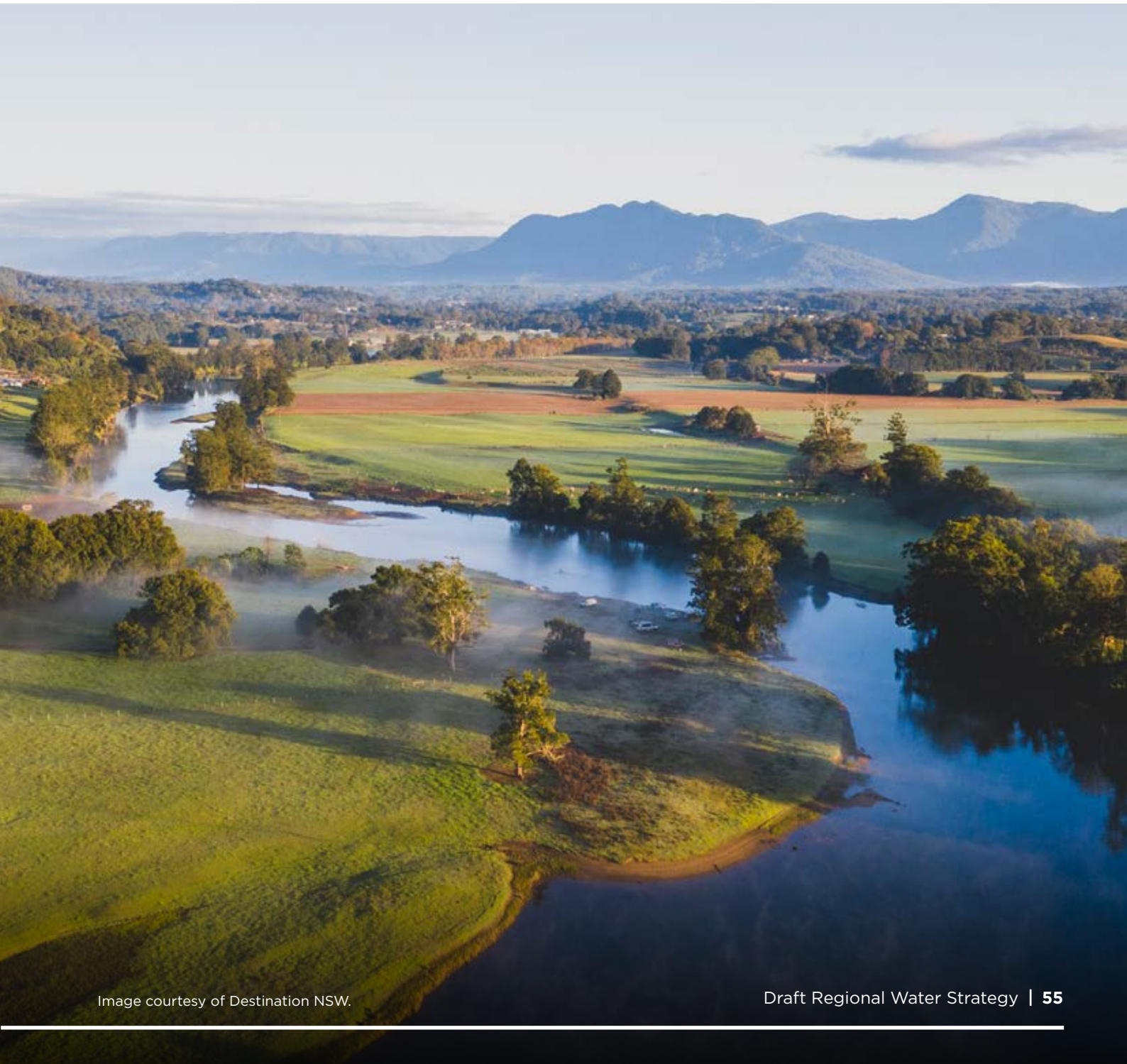


Image courtesy of Destination NSW.

Option 33. Regional network efficiency audit

Source: Department of Planning, Industry and Environment—Water

Description	Leakage is the component of water that is lost in the system and does not make it to the customer. The type of leakage, or non-revenue water, can be categorised into one of three categories: • reported bursts—visible at the surface and reported by the public or utility staff • unreported bursts—not visible at the surface, and usually picked up through investigation or leak detection surveys • background leakage—small leaks that cannot be detected, which over time may gradually worsen until they can be detected. The proportion of non-revenue water is typically an average of 10% of a utility's system input. This option would establish a region-wide audit of major water supply network infrastructure leakage against agreed performance indicators. The audit would also identify opportunities and region-wide strategies to reduce leakage, for example through improved leak detection and hydraulic control.
Intent	• Improve resilience of town water supplies in the North Coast. • Improve efficiency of monitoring and implementation.
Challenges addressed	• Region is vulnerable to extended dry periods.
Potential combinations	This option could be combined with: • Option 29. Improved data collection on water use and patterns. • Option 32. Regional demand management program.
Considerations	Managing water loss is a core function of local water utilities. Research suggests that water supply customers expect utilities to do their best to minimise leaks and breaks and reduce water waste, especially when they are asked to save water during drought conditions. However, leakage reduction measures are sometimes less cost-effective than other options to improve water supply efficiency. We have heard from local councils that staffing and funding shortages are major impediments to improving water supply efficiency. According to the Water Services Association of Australia, water utilities across Australia use different strategies to reduce leakage including: • pressure management—reduction of excess average and maximum pressures • active leakage control—monitoring of flows in metered areas to identify leaks and repair before they become a greater issue • pipeline and assets management—material selection, installation, maintenance, rehabilitation and replacement, and is commonly associated with renewals • speed and quality of repairs—repairs done quickly and to a suitable standard. This option would assess the effectiveness of leakage strategies adopted by local councils in the North Coast region and identify opportunities for councils to work together to positively influence each other.
Objectives	
Further information	www.bom.gov.au/water/npr/

Option 34. Regional capacity building program and skills hub

Source: Local councils, Auditor-General Report 'Support for regional town water infrastructure'

Description	This option would establish a regional capacity building program to provide the necessary skills, information and technical assistance to better support best practice management of water in the North Coast. The program would support the capacity needs of urban, rural and commercial water managers. Components of the program could include: • training and upskilling of the local community; for example, design, implementation and maintenance of water sensitive urban design elements • coordinated communication material on water use during extreme events • knowledge and information sharing events; for example, on adoption of ag tech or other innovative water conservation projects. All councils in the region are in the process of preparing integrated water cycle management plans (as well as water security studies and secure yield analysis) that provide a clearer idea of local and regional water security needs and solutions. Effective implementation of these plans will require particular skills, information and behaviour change. Local skills and support will also be required to improve data collection on water use and to support greater adoption of best practice water management practices across rural users. The Natural Resources Access Regulator has also identified a significant level of non-compliance in parts of the North Coast region. A key cause of non-compliance is lack of information or clarity on rules, which a capacity building program could help to address.
Intent	Build capacity to support water stewardship and local decision making.
Challenges addressed	Skill and training limitations to foster best practice water management and encourage efficient water use.
Potential combinations	This option could be combined with any of the other listed options aiming to support sustainable water management practices, including: • Option 16. Establish sustainable extraction limits for North Coast surface water and groundwater sources • Option 18. Long-term water plans to support healthy coastal waterways • Option 21. Improve stormwater management • Option 32. Regional demand management program • Option 35. Support for local councils to lift performance standards.
Considerations	This option will need to consider: • priority needs of the program • funding for program • governance arrangements for administering the program • interactions with other local and state government programs and initiatives.
Objectives	

Option 35. Support for local councils to lift performance standards

Source: Local councils, Auditor-General report 'Support for regional town water infrastructure'

Description	This option would involve scoping the role of the North Coast Regional Water Strategy in addressing the recommendations from the Auditor-General report 'Support for regional town water infrastructure' and thereby lifting the performance standard of local councils in the North Coast to ensure a high quality water service delivery for their communities. This scoping work would include an assessment of: • how the current regulatory framework in the North Coast could be more effective, proportionate, transparent and accountable to provide the right level of support for local councils to ensure efficient water use and enable future strategic planning. This could involve reviewing the existing rules governing extractions for town water supplies, which have been identified by councils as a risk to their water security • how the regional water strategies could foster interagency coordination around local water utility sector regulation to improve town water security and quality in the North Coast • the interfaces between work undertaken for the regional water strategies and the support provided by the Department of Planning, Industry and Environment—Utilities to local councils in the North Coast • how future consultative arrangements with local councils could be set up to enable greater collaboration between local councils, and between councils and the NSW Government, to reduce risks to town water supplies. The Auditor-General report 'Support for regional town water infrastructure' found that the Department of Planning, Industry and Environment had not effectively supported town water infrastructure planning since 2014. The report makes seven recommendations aimed at improving the administrative and transparency of the department's oversight, support and funding for town water infrastructure, and at strengthening sector engagement and interagency coordination on town water planning issues and investments.
Intent	• Support long-term planning and management of the region's water resources. • Build capacity to support water stewardship and local decision making. • Provide greater flexibility to communities and towns in securing their existing and future water needs. • Clarify existing rules to ensure water take is equitable, transparent and sustainable.
Challenges addressed	• Limited strategic planning to inform local decision making. • Regulatory and administrative barriers to innovative and efficient water use. • Skill and training limitations to foster best practice water management and encourage efficient water use. • The region is vulnerable to extended dry periods.
Potential combinations	This option could be potentially combined with several options, including: • Option 29. Improved data collection on water use and patterns • Option 32. Regional demand management program • Option 33. Regional network efficiency audit • Option 34. Regional capacity building program and skills hub.

Option 35. Support for local councils to lift performance standards (continued)

Considerations	This option will need to consider: • actions already underway (both state and federal) to strengthen the long-term strategic planning framework for water management, reform and investments • any interactions with the work of the NSW Water Strategy outlining the NSW Government's long-term vision and performance expectations for the water sector • the implementation of a re-designed Safe and Secure Water Program with targeted funding based on comprehensive prioritisation of town water risks and funding for the development of local water utility strategic service planning • improvements to processes and data management systems for the monitoring of local water utility performance and strategic service planning • how local council feedback can be actively sought, documented and considered in its design. The option would also need to factor in the ongoing work with councils to improve the communication and coordination between local strategic service planning and the NSW Government regional water strategies to ensure the various strategies inform each other and align solutions to town water risks.
Objectives	
Further information	**Audit Office of New South Wales, 'Support for regional town water infrastructure':** **www.audit.nsw.gov.au/our-work/reports/support-for-regional-town-water-infrastructure**

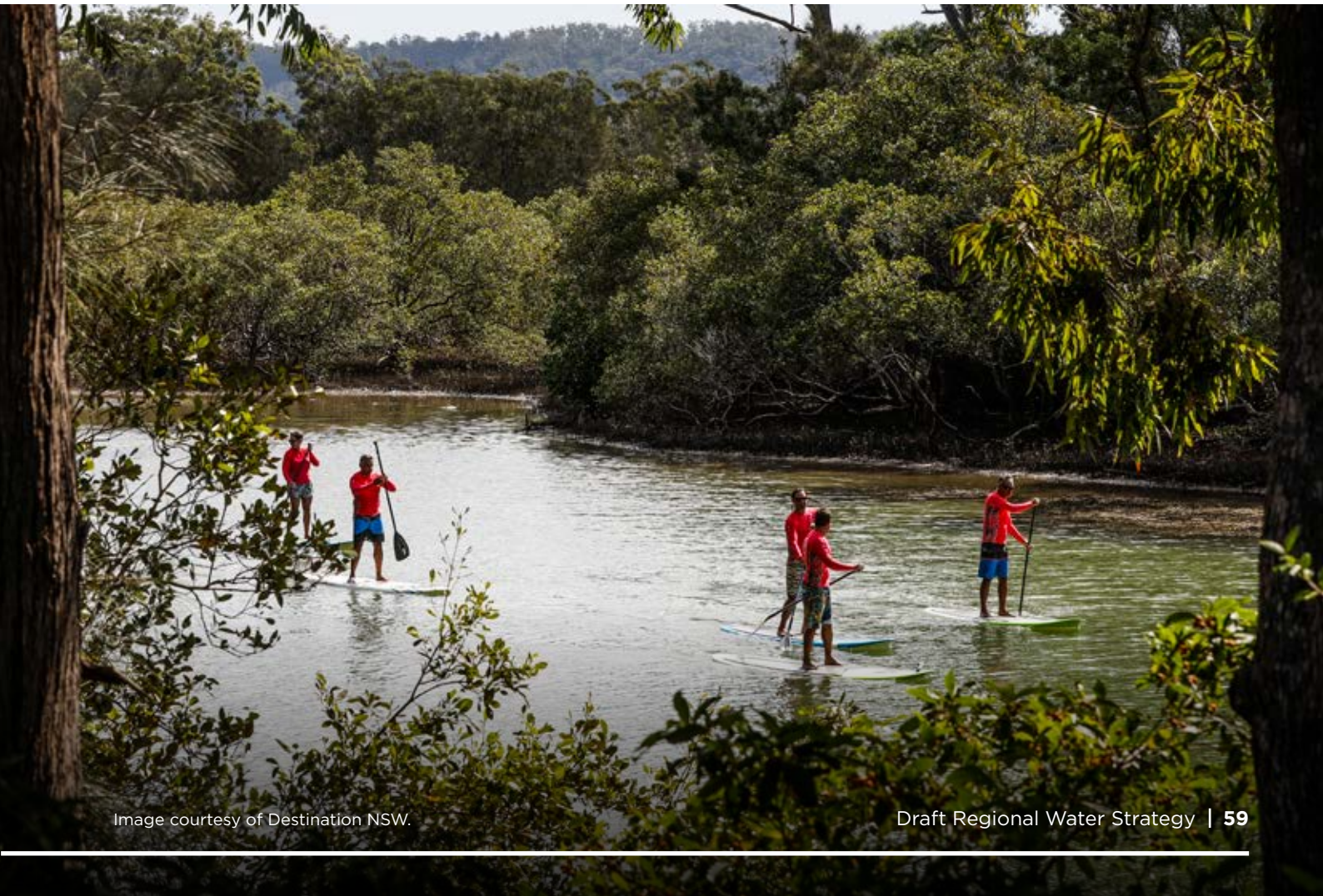


Image courtesy of Destination NSW.

Option 36. Regional framework to manage restrictions for non-urban water users of town water

Source: Department of Planning, Industry and Environment—Water

Description	This option proposes to develop a framework for managing water use during drought by commercial and rural water users connected to town water supply. This option recognises that town water supply networks supply numerous commercial and rural businesses, which can be a strain on town water security during extended dry periods.
Intent	Clarify existing rules to ensure water take is equitable, transparent and sustainable.
Challenges addressed	• Limited strategic planning to inform local decision making. • The region is vulnerable to extended dry periods.
Potential combinations	This option could be combined with: • Option 8. New industry and rural licence category within major council storages • Option 31. Apply the *NSW Extreme Events Policy* to the North Coast region.
Considerations	This option will need to: • confirm non-urban (particularly rural and food manufacturing) demands on town water supplies • understand the different types of non-urban water demands • establish reasonable levels of restriction and potentially set different levels of restriction for the various users • consider the integration (or any potential cross-over) with existing or proposed policy, such as the option to apply the *NSW Extreme Events Policy* to the North Coast region.
Objectives	

Options not progressed

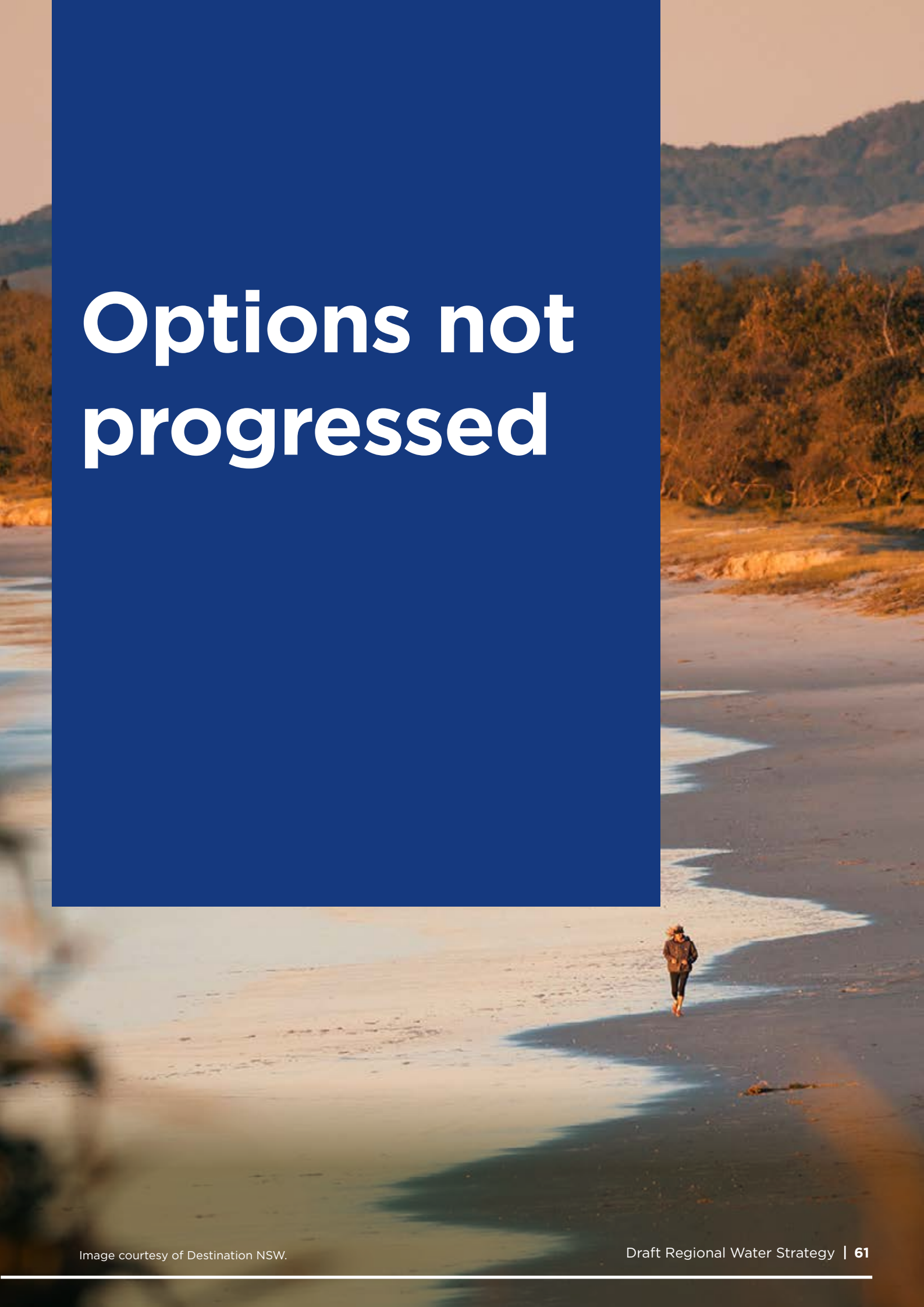


Image courtesy of Destination NSW.

Option	Description	Reason for not progressing
Clarence River dam to supply the entire northeast NSW area	SMEC/National Water Commission	This option proposes construction of a new 250 GL dam on the Clarence River upstream of Tabulam and Duck Creek. The option was considered by the National Water Commission in 2007 at the height of the Millennium Drought. It was proposed as a water security measure for southeast Queensland (with benefits for northeast NSW) prior to commissioning of the Gold Coast desalination plant in Tugun. In that context, it can be considered an emergency response to a severe water crisis. Since this option was originally proposed, the Gold Coast desalination plant has improved the water security for southeast Queensland. Additionally, the regional supply scheme in the North Coast region—part of which extracts water from the Nymboida River in the Clarence catchment—is reliable and considered secure for the next 20 years. Given this reduction in demand, the dam would essentially provide additional supply security mainly to the Far North Coast region. The significant ecological and capital costs associated with this proposal far outweigh the potential benefits to the region.

Inland diversion options

The Draft North Coast Regional Water Strategy does not identify an option to regulate (that is, dam) any of the major rivers in the region for the purpose of diverting water to inland catchments or storing water for use within the region. Such options were deemed to not yield any direct benefits for towns, communities, Aboriginal people or the environment in the region and were not considered to meet the water-related challenges identified in the draft strategy. Furthermore, diversion options have the potential to pose additional water security and access risks to water users in the North Coast.

Local councils in the North Coast have also voiced their concerns about and strong opposition to a diversion option that would take water out of the North Coast region due to potential water security risks for North Coast communities.

However, the draft regional water strategies for the Border Rivers and Namoi regions include options to divert flow from the North Coast region's rivers inland. These options are:

Border Rivers

- Option 7 (Intra- and inter-regional connections project investigation) proposes to investigate intra-regional pipeline connections in the east and north-east (presumably the Clarence River) to improve town water security for Glenn Innes Severn Council and Tenterfield Shire Council.

- Option 8 (Inland diversions from the east) proposes to investigate a broader diversion scheme from the east of the Great Dividing Range.

Namoi

- Option 1 (Inter-regional pipelines, including inland diversion of water from the Macleay or Barnard Rivers to Namoi region) proposes to investigate the potential of large-scale pipelines connecting water supplies across different catchments, including from the Gara River in the Macleay River catchment.

In previous investigations, WaterNSW eliminated options to divert water from the Clarence River catchment (see draft Gwydir Regional Water Strategy – options not progressed) due to excessive costs and marginal benefits. In addition, the investigations also highlighted the potentially significant environmental implications, including impacts on threatened species and biosecurity in the Clarence Valley.

The impact of these inland diversion options on water users (environment, towns and communities, cultural and industry) in the North Coast will be a key consideration in the options assessment process completed for the Border Rivers and Namoi Regional Water Strategies.

We welcome feedback from the community on these diversion options to help inform the options assessment process in the Border Rivers and Namoi regions.

dpie.nsw.gov.au