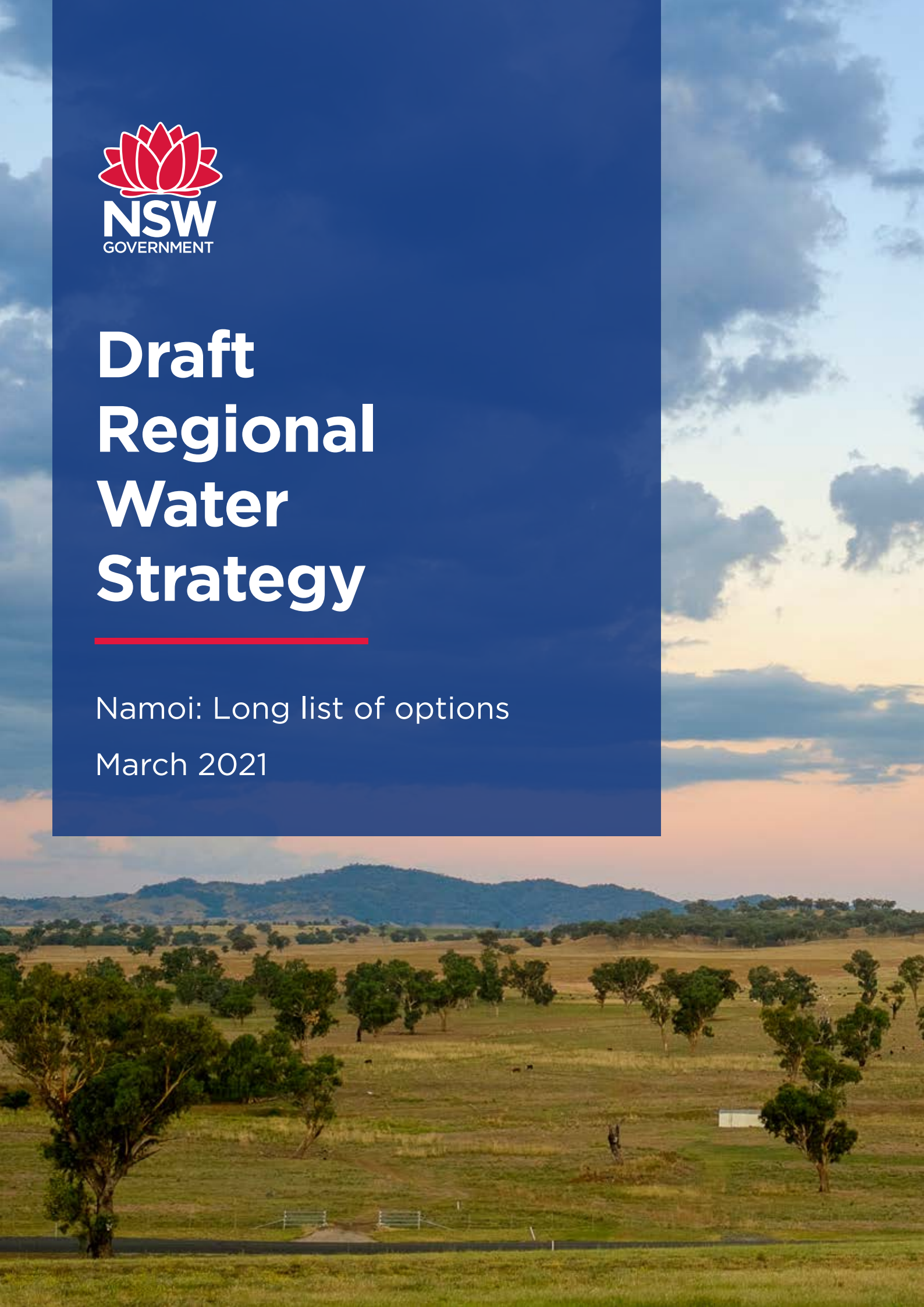
NSW GOVERNMENT

Draft Regional Water Strategy

Namoi: 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: Namoi: Long list of options

First published: March 2021

Department reference number: PUB20/314

Cover image: Image courtesy of Destination NSW.

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

Acknowledgements: The input and collaboration of these NSW Government agencies is acknowledged: WaterNSW, 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 practicing 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 Gomeroi/Kamilaroi/Gamilaroi/Gamilaraay Nations hold a significant connection to the lands upon which the Namoi Regional Water Strategy falls. Please note, throughout this document we will refer to Gomeroi/Kamilaroi/Gamilaroi/Gamilaraay as the Gomeroi/Kamilaroi Nation, to be consistent with Native Title.

The Namoi 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 Namoi 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. Due to the COVID-19 pandemic, face-to-face engagement with Aboriginal communities has been put on hold. We are committed to engaging with the Elders, representatives of the Gomeroi/Kamilaroi nation and Aboriginal community members about the regional water strategy in early 2021.

Image courtesy of Destination NSW.

Options for the Draft Namoi Regional Water Strategy

As outlined in the draft Namoi Regional Water Strategy, we have developed a long list of options and government commitments that could be included in the final strategy.

The options seek to address a diverse range of challenges and opportunities for water management in the Namoi. It is important to note that the options have not been prioritised and not all options have been costed. Only select options will be progressed as part of the regional water strategy.

In preparing this list, we recognise that a great deal of work has been done over the last few years to identify initiatives that could improve water management, water security and water reliability in the Namoi region. We have collated options from previous studies and supplemented them with further options derived from recent experience, community engagement and current NSW Government initiatives and programs. Bringing all these options together will also help to align and sequence the various water reform processes underway to deliver the best outcomes for the Namoi region.

These options aim to address the challenges the region may face in the future, while maximising opportunities arising from the growing agricultural and mining sectors, other emerging and expanding industries such as poultry, and new investments in transport and community infrastructure.

The draft long list of options and government commitments focus on:

- maintaining and diversifying water supplies
- protecting and enhancing natural systems
- supporting water use efficiency and conservation
- strengthening community preparedness for climate extremes
- improving the recognition of Aboriginal people's water rights, interests and access to water.

Table 1 provides a snapshot of how we have matched the draft options and government commitments with these five categories and the challenges and opportunities we identified in the draft Namoi Regional Water Strategy.

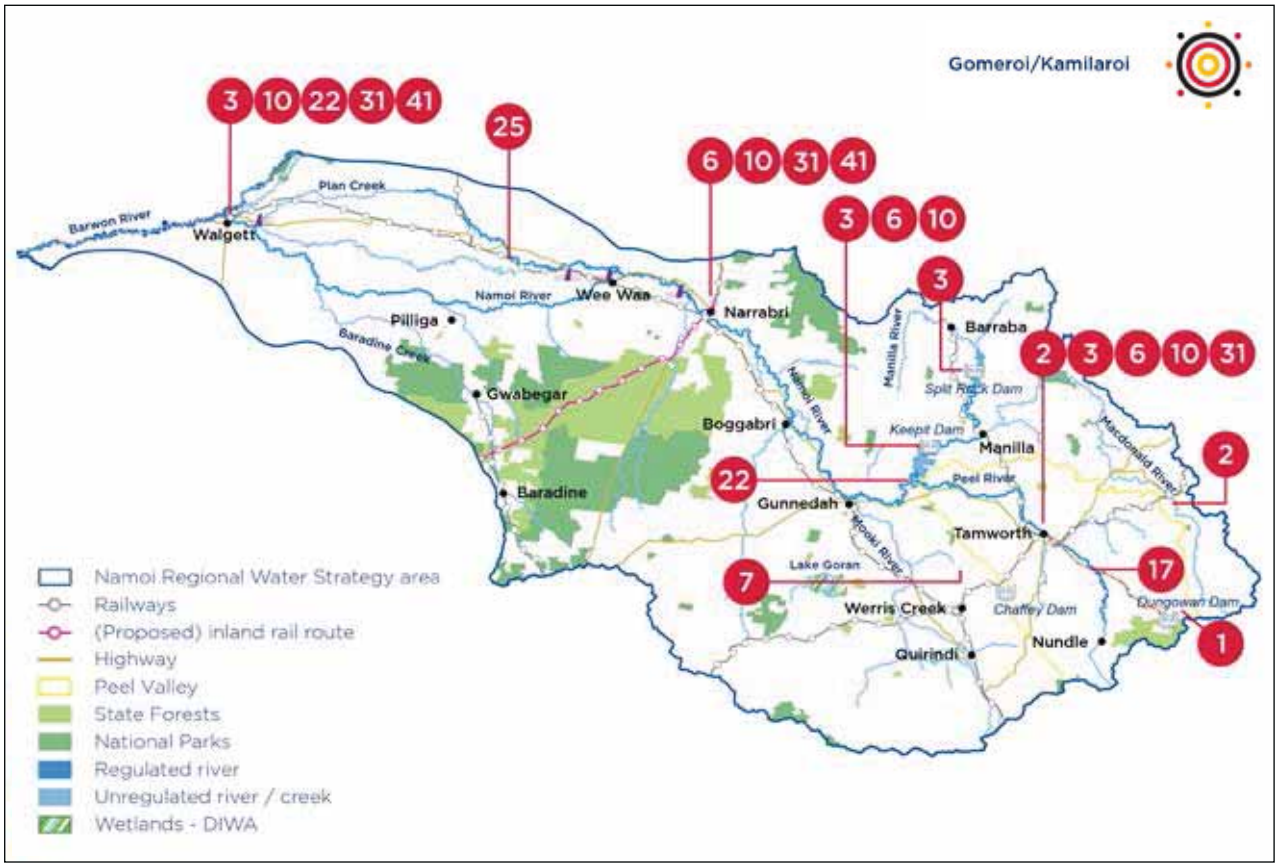
Overall, all options that are progressed will need to contribute to the liveability of the region.

Table 1. Draft long list of options matrix

Category	Maintaining and diversifying water supplies	Protecting and enhancing natural systems
Region-specific challenges and opportunities	**Risks/Challenges:** • increased climate variability and climate change is likely to reduce water security and reliability for towns and industries • increased climate variability and climate change is likely to require more effective methods to conserve water • increasing demand and changing water needs due to population growth and expanding or new industries • balancing water needs between different water users • declining groundwater levels and quality pose risks to towns and other water users completely reliant on groundwater. **Opportunities:** • diversify sources of supply for regional towns • maintain or improve water quality • install cost efficient water infrastructure for smaller towns.	**Risks/Challenges:** • increased climate variability and climate change pose greater risks to ecosystems and species • delivering sufficient environmental flows to the end of the system and ensuring it achieves its intended purpose • dams, flood works and in-stream infrastructure alter natural flow regimes and impact on water quality, native species and ecosystems • maintaining connectivity between river systems and with the Barwon-Darling for fish and aquatic animal passage • protecting critical environmental assets, in-stream ecological values and threatened species • protecting groundwater dependent ecosystems. **Opportunities:** • improve our knowledge and understanding of the region's water resources • sustainable access to groundwater resources for all water users • improve recognition of wider community benefits that the natural environment provides • improve coordination and planning to strengthen environmental outcomes • support on-ground works to improve the aquatic environment • improve ecosystem health and water quality.
Options and government commitments	• New Dungowan Dam • Inter-regional pipelines, including inland diversion of water from the Macleay or Barnard rivers to the Namoi region • Intra-regional pipelines • Suspension of water sharing plan provisions for planned environmental water for critical needs in the Peel River • Investigate the use of advanced water treatment technologies for towns • Reuse, recycling and stormwater projects • Connect the Peel Regulated River System to Quipolly Dam • Managed aquifer recharge investigations and policy • Reliable access to groundwater by towns • Investigate opportunities for dual water systems • Investigate the development of a water access licence for critical human needs • Investigate groundwater desalination for industry • Joint exploration for minerals and groundwater with the NSW Geological Survey • Water security for small communities	• NSW Fish Passage Strategy • Providing incentives to landholders to conserve and rehabilitate riparian, wetland and floodplain vegetation • Cold water pollution mitigation measures • Riparian habitat restoration and re-establishing threatened species • Diversion screens to prevent fish extraction at pump offtakes • Modification and/or removal of floodwork structures causing adverse impacts • Implementation of surface water quality mitigation measures • Improve connectivity with downstream systems • Revise water sharing plan provisions for planned environmental water • Improve understanding of water use in unregulated water sources • Ability to redirect supplementary flows that are in excess of needs • Improved understanding of groundwater processes • Implementation of a groundwater quality monitoring program • Reducing risk of sediment compaction due to over-extraction of groundwater • Protecting ecosystems that depend on groundwater resources • Improving information about impacts of State Significant Development and State Significant Infrastructure projects on water

Supporting water use and delivery efficiency and conservation	Strengthening community preparedness for climate extremes	Improving the recognition of Aboriginal people's water rights, interests and access to water
Risks/Challenges: • difficulty in delivering water to towns at the end of the system in dry periods • large on-farm storages inefficiently store water • retaining potable water sources for where they are needed • ensuring groundwater extraction levels are sustainable. **Opportunities:** • improve water conservation efforts • maintain and improve productivity and efficiency in water delivery • refine demand management, water trading systems and technology • manage groundwater resources sustainably.	**Risks/Challenges:** • ensuring water quality is maintained during extended or frequent droughts • providing critical human needs water during extreme events such as drought • providing opportunities to maintain amenity during drought • increasing community acceptance of alternative water supplies • improving community understanding about water resource management and water trading. **Opportunities:** • fit-for-purpose policies and regulation to protect water for critical human needs • support sustainable industries and promote industry diversification in the region • maintaining community resilience and wellbeing during extreme events • more efficient and innovative industry water use • educate and build capacity on climate change, water conservation and sustainability.	**Risks/Challenges:** • Aboriginal people's rights and obligations are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions • Aboriginal people have limited access to water allocations to use for cultural and economic purposes • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways • lack of culturally appropriate information about how governments manage water • ensuring Aboriginal cultural values are protected. **Opportunities:** • protect and strengthen cultural landscapes, practices, knowledge and traditions • support the empowerment, self-determination and economic advancement of Aboriginal people • strengthen the community wellbeing of Aboriginal people.
• Water efficiency projects (towns and industries) • Improve water supply reliability • Review of water markets in the Namoi region • Review urban water restriction policy • Implementing the Great Artesian Basin Strategic Management Plan	• New drought operational rules (Namoi and Peel rivers) • Review of water accounting and allocation process • Investigation of licence conversions • Improved data collection • Training and information sharing programs • Maintain amenity for regional towns during drought • Improving understanding of low water availability on water dependent industries • Sustainable access to groundwater by all users • Improved transparency in managing groundwater resources sustainably • Land use change and population growth impacts on water resources	• Integrating Aboriginal knowledge into groundwater decision making • Culturally appropriate water knowledge program • Water dependent cultural practices and site identification project • Secure flows for water dependent cultural sites • Shared benefit project (environment and cultural outcomes) • Regional Cultural Water Officer employment program • Establish a regional Aboriginal Water Advisory Committee • Water allocations for Aboriginal communities • Co-management investigation of Travelling Stock Reserves • Aboriginal cultural water access licence review • River Ranger Program

Figure 1. Namoi 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. New Dungowan Dam
2. Inter regional pipelines, including inland diversion of water from the Macleay or Barnard rivers to the Namoi region
3. Intra regional pipelines
4. Suspension of water sharing plan provisions for planned environmental water for critical needs in the Peel River
5. Investigate the use of advanced water treatment technologies for towns
6. Reuse, recycling and stormwater projects
7. Connect the Peel Regulated River System to Quipolly Dam
8. Managed aquifer recharge investigations and policy
9. Reliable access to groundwater by towns
10. Investigate opportunities for dual water systems
11. Investigate the development of a water access licence for critical human needs
12. Investigate groundwater desalination for industry
13. Joint exploration for minerals and groundwater with the NSW Geological Survey
14. Water security for small communities

Protecting and enhancing natural systems

15. NSW Fish Passage Strategy
16. Providing incentives to landholders to conserve and rehabilitate riparian, wetland and floodplain vegetation
17. Cold water pollution mitigation measures
18. Riparian habitat restoration and re establishing threatened species
19. Diversion screens to prevent fish extraction at pump offtakes
20. Modification and/or removal of floodwork structures causing adverse impacts
21. Implementation of surface water quality mitigation measures
22. Improve connectivity with downstream systems
23. Revise water sharing plan provisions for planned environmental water
24. Improve understanding of water use in unregulated water sources
25. Ability to redirect supplementary flows that are in excess of needs
26. Improved understanding of groundwater processes
27. Implementation of a groundwater quality monitoring program
28. Reducing risk of sediment compaction due to over extraction of groundwater
29. Protecting ecosystems that depend on groundwater resources
30. Improving information about impacts of State Significant Development and State Significant Infrastructure projects on water

Supporting water use and delivery efficiency and conservation

31. Water efficiency projects (towns and industries)
32. Improve water supply reliability
33. Review of water markets in the Namoi region
34. Review urban water restriction policy
35. Implementing the Great Artesian Basin Strategic Management Plan

Strengthening community preparedness for climate extremes

36. New drought operational rules (Namoi and Peel rivers)
37. Review of water accounting and allocation process
38. Investigation of licence conversions
39. Improved data collection
40. Training and information sharing program
41. Maintain amenity for regional towns during drought
42. Improving understanding of low water availability on water dependent industries
43. Sustainable access to groundwater by all users
44. Improved transparency in managing groundwater resources sustainably
45. Land use change and population growth impacts on water resources

Improving the recognition of Aboriginal people's water rights, interests and access to water

46. Integrating Aboriginal knowledge into groundwater decision making
47. Culturally appropriate water knowledge program
48. Water dependent cultural practices and site identification project
49. Secure flows for water dependent cultural sites
50. Shared benefit project (environment and cultural outcomes)
51. Regional Cultural Water Officer employment program
52. Establish a regional Aboriginal Water Advisory Committee
53. Water allocations for Aboriginal communities
54. Co management investigation of Traveling Stock Reserves
55. Aboriginal cultural water access licence review
56. River Ranger Program

Not all options in this long list will be progressed. Only select feasible options that represent the best possible outcomes will be progressed, following the evidence based assessment process described in the *Regional Water Strategies Guide*.[1] Each final package of options will also consider how the implementation of the preferred options should be staged.

This document describes each option and government commitment, its intent and the challenges it seeks to address (Figure 1). 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 Namoi 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 these objectives.

Figure 2. 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.

1. *Regional Water Strategies Guide*, www.industry.nsw.gov.au/water/plans-programs/regional-water-strategies/about

Image courtesy of the Department of Planning, Industry and Environment.

Namoi: Long list of options and government commitments

Image courtesy of the 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.

Government commitment 1. New Dungowan Dam	
Source: The NSW Government has committed to progressing a detailed business case, planning delivery for replacing the existing Dungowan Dam. This project is state significant infrastructure and assessments are being fast-tracked through the Water Supply (Critical Needs) Act 2019	
Description	Construction of the new Dungowan Dam (22.5 GL in size) downstream of the existing Dungowan Dam and associated infrastructure including an augmented pipeline.
Intent	The new Dungowan Dam aims to improve water security for the growing city of Tamworth. Replacing the existing Dungowan Dam is also intended to allow Chaffey Dam to be networked via a 'Peel pipeline' to the new Dungowan Dam. This will include replacing the existing pipeline and increasing the capacity of the pipeline to help provide town water security and other users as Tamworth grows.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries.
Potential combinations	This option could be combined with: • Option 2. Inter-regional pipelines, including inland diversion of water from the Macleay or Barnard rivers to the Namoi region • Option 3. Intra-regional pipelines • Option 32. Improve water supply reliability in the Lower Namoi • Option 37. Review of water accounting and allocation process • Option 38. Investigation of licence conversions • Option 41. Maintain amenity for regional towns during drought. This option could also be combined with other options to mitigate potential impacts from dams such as: • Option 17. Cold water pollution mitigation measures • Option 21. Implementation of surface water quality mitigation measures.

Government commitment 1. New Dungowan Dam (continued)

Considerations	The NSW Government and Australian Government are providing funding for progressing a business case and planning approvals for the construction of the new Dungowan Dam. The business case will assess the preferred option for construction and operation of the dam, including: • configuration and dam type, including design measures to mitigate cold water pollution • cost estimates and cost implications for water users • potential changes to water sharing arrangements and whether that will require water sharing plan rule changes • ensuring compliance with the Murray-Darling Basin Plan's sustainable diversion limits and the requirement for no net reduction in the protection of planned environmental water. The project will be required to assess the potential social, environmental and economic impacts and benefits of the dam, including on: • water security for existing water users • Aboriginal cultural heritage and water use • the requirements under the Murray-Darling Basin Plan and planned environmental water • the environment, dependent ecosystems and dependent biota (including threatened species) from altered hydrology and surface water availability, such as reduced flow variability, reduced in-channel habitat, reduced connectivity, reduced fish passage (downstream and upstream of the dam) and cold water pollution • hydrologic connectivity • possible measures to mitigate impacts such as biodiversity offsets, environmental flows and fish passage in accordance with the requirements of the *Fisheries Management Act 1994*. Stakeholder views will need to be considered, including feedback from communities, councils, water users, Aboriginal communities and environment groups.
Objectives	
Further information	**WaterNSW** **www.waternsw.com.au/projects/new-dams-for-nsw/dungowan-dam**

Option 2. Inter-regional pipelines, including inland diversion of water from the Macleay or Barnard rivers to the Namoi region

Source: WaterNSW 20 Year Infrastructure Options Study and Tamworth Regional Council 2015 Drought Management Plan

Description	In regional NSW, climate and rainfall patterns can vary vastly between catchments at different times. This option would investigate opportunities to develop large-scale pipelines that could connect water supplies across different catchments to improve the water security of different catchment areas. These may include: • **Macleay catchment to Namoi:** building a pipeline to transfer water from Gara River in the Macleay catchment to Roumalla Creek in the Gwydir catchment, and then transfer to a discharge point in the upper Macdonald River • **Manning catchment to Peel:** building a diversion structure and pipeline transfer from the upper Barnard River to Chaffey Dam • **pipeline from the Great Artesian Basin** to towns in the Namoi catchment. These inter-regional pipelines could help to distribute water between regions and diversify water sources in the Namoi.
Intent	• Increase the connections between water supplies to provide access to more than one water source, in order to increase security and reliability of supply for towns. • As coastal valleys (Macleay and Barnard) can experience different weather patterns than inland valleys, this option enables surplus water to be transferred to inland valleys during drought.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries.
Potential combinations	This option could be combined with Option 37. Review of water accounting and allocation process.

Option 2. Inter-regional pipelines, including inland diversion of water from the Macleay or Barnard rivers to the Namoi region (continued)

Considerations	This option will need hydrological, hydraulic and flood modelling to determine the optimal option and design. The option will also need to: • assess the potential benefits and impacts on water users, including the impacts of the pipeline on water security for users that rely on the water source from which the pipeline is transferring water • assess the impacts on water availability for users and environment in the donor catchments • assess the level of risk to security and reliability for specific towns which would need to be confirmed through a secure yield analysis as part of the development of an integrated water cycle management strategy or regional town water strategy prepared by local councils • give consideration to other towns such as Armidale using the Gara River for town water supply and assess the capacity to supply a secure water supply to numerous towns • assess the impacts on groundwater recharge, the environment and the downstream Barwon-Darling system, and the distribution of these benefits and impacts • assess the impacts on the environment, dependent ecosystems and dependent biota, including threatened species, from altered hydrology and surface water availability such as reduced flow variability, altered or reduced in-channel habitat, reduced connectivity, reduced fish passage and reduced connectivity with the Barwon-Darling River • consider how compliance with the sustainable diversion limit will be maintained • consider how to meet the Murray-Darling Basin Plan requirement for no net reduction in the protection of planned environmental water • assess the impacts on Aboriginal people's water rights, interests and access to water (including cultural heritage) • consider potential changes to water sharing plan rules • consider the implications of new water from eastern diversions not subject to the Murray-Darling Basin Plan sustainable diversion limit compliance • explore the strategic opportunity to use the water utility licence for the Hunter Barnard Scheme should it not be required once the power stations close in 2035.
Objectives	
Further information	www.waternsw.com.au/projects/infrastructure-studies/20-year-infrastructure-options-study **Tamworth Regional Council 2015, Drought Management Plan:** www.tamworth.nsw.gov.au/live/water-and-wastewater/water-restrictions

Option 3. Intra-regional pipelines

Source: WaterNSW 20 Year Infrastructure Options Study and Tamworth Regional Council 2015 Drought Management Plan

Description	Delivery efficiency is a major challenge in the Namoi region due to the often large distances between users and dams. Pipelines in some instances enable water managers to more effectively transmit water between towns, industrial/agricultural hubs and the environment. This option would investigate potential large-scale pipelines connecting water supplies across areas within the catchments including: • pipeline from Dempsey Bridge to Pian Creek (Near Walgett Weir) • pipeline from proposed new weir at Blue Hole (Option 32) to Split Rock Dam • pipeline from the end of the Peel River to Keepit Dam with a small weir on the Peel River • pipeline between Keepit Dam and Tamworth Calala Lane Water Treatment Plant for an emergency water supply • operating the Chaffey to Tamworth pipeline constantly. This pipeline is currently only operated during temporary drought periods. These intra-regional pipelines will improve the efficiency of water being distributed within the region, as well as diversify water sources for users.
Intent	Increase the connections between water supplies to provide access to more than one water source, in order to increase security and reliability of supply for towns and industries.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries.
Potential combinations	This option could be combined with: • Option 32. Improve water supply reliability in the Lower Namoi • Option 37. Review of water accounting and allocation process.
Considerations	This option will need hydrological, hydraulic and flood modelling to determine the optimal option and design. The option will also need to: • assess the potential benefits and impacts on water users, including the impacts of the pipeline on water security for users that rely on the water source from which the pipeline is transferring water • assess the level of risk to security and reliability for specific towns which would need to be confirmed through a secure yield analysis as part of the development of an integrated water cycle management strategy or regional town water strategy by local councils • assess the impacts on the environment and the downstream Barwon-Darling system and the distribution of these benefits and impacts • assess the impacts on the environment, dependent ecosystems and dependent biota (including threatened species) from altered hydrology and surface water availability such as reduced flow variability, altered or reduced in-channel habitat, reduced connectivity, reduced fish passage and reduced connectivity with the Barwon-Darling River • consider how compliance with the sustainable diversion limit will be maintained • consider how to meet the Murray-Darling Basin Plan requirement for no net reduction in the protection of planned environmental water • give consideration to an environmental contingency allowance and an asset watering plan to support important natural assets, Indigenous sites and fish refugia requirements • assess impacts on Aboriginal people's water rights, interests and access to water (including cultural heritage) • assess potential changes to water sharing plan rules • assess infrastructure construction impacts on the environment and landholders • give consideration to supplying other users along pipeline routes • consider the volume of water in Keepit Dam and upstream of Split Rock Dam and if water can be set aside for emergency supply purposes • give consideration to construction timeframes.

Option 3. Intra-regional pipelines (continued)

Objectives	
Further information	www.waternsw.com.au/projects/infrastructure-studies/20-year-infrastructure-options-study **Tamworth Regional Council 2015, Drought Management Plan:** www.tamworth.nsw.gov.au/live/water-and-wastewater/water-restrictions

Image courtesy of the Department of Planning, Industry and Environment.

Option 4. Suspension of water sharing plan provisions for planned environmental water for critical needs in the Peel River

Source: Tamworth Regional Council 2015 Drought Management Plan

Description	The Water Sharing Plan for the Peel Regulated River Water Source 2010 requires a minimum release of 3 ML per day from Chaffey Dam to support the needs of the environment. This release is minus any extraction, excluding flows needed to support basic landholder rights, access licence extractions and/or environmental contingency allowance flows. This option involves amending the water sharing plan to allow for the minimum daily release rules to be suspended during extreme droughts. Alternatively, this option could replace the minimum daily release on an ongoing basis with an equivalent volume of water that could be more actively managed; for example, through an environmental contingency allowance. In December 2019, the clause in the water sharing plan was suspended as the Peel Regulated River Water Source was declared as Stage 4 (Critical Drought) under the *NSW Extreme Events Policy*. The rule was suspended until June 2020.
Intent	Ensure water sharing plan rules are flexible enough to enable critical human water needs to be secured during drought.
Challenges addressed	• Providing critical human needs water during extreme events such as drought. • Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries.
Potential combinations	This option could be combined with: • Government commitment 1. New Dungowan Dam • Option 37. Review of water accounting and allocation process.
Considerations	Consideration would be given to: • the Namoi Long-Term Water Plan • impacts on environmental assets and ecosystems along the length of the Peel catchment • impacts on groundwater recharge • impacts on basic landholder rights that may rely on this environmental flow • amendment provisions to water sharing plans in the Peel • how to meet the Murray-Darling Basin Plan requirement for no net reduction in the protection of planned environmental water • consultation with the environmental water holder.
Objectives	
Further information	**Tamworth Regional Council 2015, Drought Management Plan:** **www.tamworth.nsw.gov.au/live/water-and-wastewater/water-restrictions**

Option 5. Investigate the use of advanced water treatment technologies for towns

Source: Namoi Economic and Spatial Supply Chain Assessment Report (2019) (MacroPlanDimasi)

Description	This option would investigate opportunities for the installation of advanced water treatment technologies such as reverse osmosis treatment facilities in the Namoi region. The implementation of these technologies would aim to diversify water sources by removing impurities—improving water quality and thus increasing water supply in the region. These treatment plants could be used at large scale to supplement town water supplies in Tamworth or at small scale to improve the quality of water in areas with low water quality. This option will improve access to poor quality water sources that can be treated to appropriate standards. Tamworth and Baiada for example, are considering a new advanced water treatment plant facility in Tamworth to support future industry and population growth to treat the waste water and allow the reuse of around 90% of the water. Advanced water treatment plants could improve access to non-potable surface and groundwater sources for domestic uses. This may include: • saline groundwater • sodic groundwater (e.g. from the Surat groundwater source) • impacted surface water.
Intent	• Increase water supply to the Namoi region through recycling water. • Maintain or improve water quality.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries.
Potential combinations	This option could be combined with: • Option 6. Reuse, recycling and stormwater projects • Option 8. Managed aquifer recharge (MAR) investigations and policy • Option 9. Reliable access to groundwater by towns • Option 21. Implementation of surface water quality mitigation measures.
Considerations	This option requires: • further research into which water source would be the most cost effective • investigations into the use of saline groundwater, including assessment of long-term sustainability of the water source, impacts to the environment and existing water users • investigation of the use of water treatment technologies for manufacturing and processing plants in the Namoi region • assessment of funding options by local, state and federal governments for infrastructure to support these technologies for towns and industry in the Namoi region • investigation into the management of brine created during treatment of saline waters.
Objectives	

Option 6. Reuse, recycling and stormwater projects

Source: Department of Planning, Industry and Environment—Water and consultation with Councils

Description	The capture and reuse of stormwater runoff and wastewater in urban areas can help to diversify town water sources and reduce the demand on potable water in dams. Typically non-potable runoff and wastewater is released or channelled into local waterways. Under this option non-potable water will be captured, reused and recycled by towns and water users prior to being released into the environment. This option will include working with local water utilities to identify opportunities to maximise the capture and reuse of urban runoff and wastewater through a range of initiatives. This option will include: • reviewing and modernising the regulatory framework around water reuse and recycling • explore options for exchanging entitlements for river water with access to treated recycled water for irrigation • community education and behavioural change campaigns around water recycling • enabling local water utilities to trade treated waste water for entitlements that can be used for potable purposes • encouraging or requiring new commercial developments and industries to use reused water for non-potable purposes • investigate opportunities to support the capture and storage of stormwater including development of weirs or detention basins that are connected to the Peel River • strengthening requirements and incentives around the use of rainwater tanks • a review of the potential for developing water sensitive urban design in urban areas in the Namoi catchment, including implementation plans and designs for towns and communities that could include rain gardens, sediment ponds, wetlands, detention ponds and channels used to capture and manage runoff • linking land use planning and subdivision and development requirements, including for roads and drainage, to encourage water sensitive urban design approaches.
Intent	• Support water managers to reduce demand on the regulated water supply and improve long term water security of the region. • Increase water security for individual towns in the Namoi region and maintain local parks, town water lakes and green spaces during droughts. • Encourage innovation in the water reuse and water recycling sector. • Make it easier for local water utilities to treat and manage harvested stormwater.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increased climate variability and climate change is likely to require more effective methods to conserve water. • Providing opportunities to maintain amenity during drought. • Increasing community acceptance of alternative water supplies.
Potential combinations	This option could be combined with other options such as: • Option 5. Investigate the use of advanced water treatment technologies for towns • Option 8. Managed aquifer recharge (MAR) investigations and policy • Option 31. Water efficiency projects (towns and industries).

Option 6. Reuse, recycling and stormwater projects (continued)

Considerations	Councils in the Namoi region have told us that key barriers to implementing water reuse activities include regulatory barriers, cost and community attitudes. Considerations for this option include: • investigation of council harvesting opportunities and rule changes needed to support improved efficiency of stormwater harvesting and treatment • consultation with local councils and communities to understand the level of acceptance for these alternative water supply and reuse options. This particularly relates to the use of recycled wastewater • ensure there are incentives for local water utilities to reduce demand on the regulated system • investigate suitable opportunities to improve stormwater capture • interaction of options with individual town integrated water cycle management strategies. For cases where there is no integrated water cycle management strategy, consultation is critical to understand the council and community appetite for such initiatives • whether changes to state-wide policy and regulation are required to support water recycling and reuse in urban centres for the needs identified • whether water sharing plan rules will need to be amended to support these projects • funding options by state and federal governments for infrastructure to support these projects for towns in the Namoi region • partnership opportunities with private landholders in suitable geographic locations for storage, use or access • investigation of when access to these flows can occur to minimise impacts on other users and the environment • Section 60 approvals for water reuse under the *Local Government Act 1993.*
Objectives	

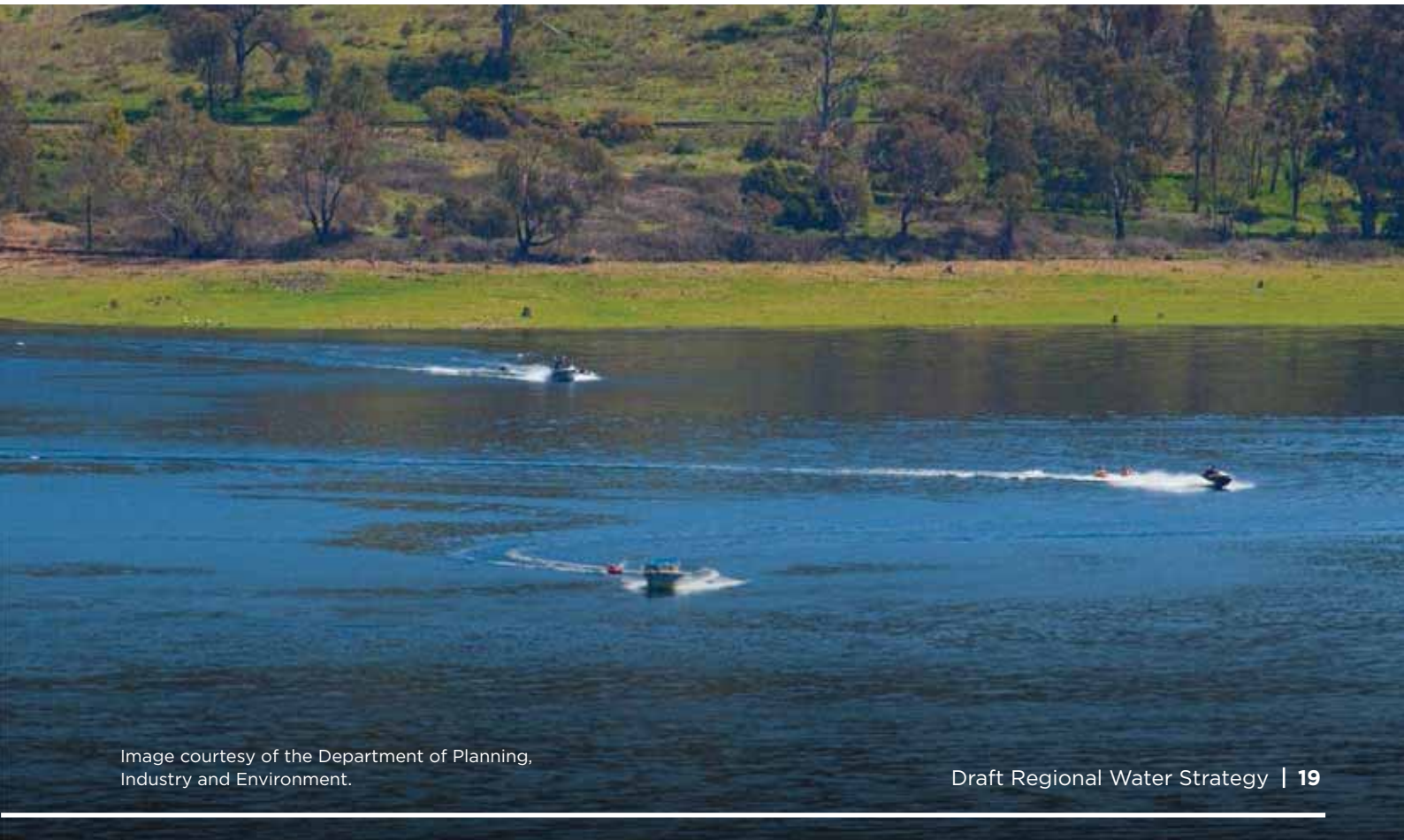


Image courtesy of the Department of Planning, Industry and Environment.

Option 7. Connect the Peel Regulated River System to Quipolly Dam

Source: Consultation with council

Description	Quipolly dam is an 8.1 GL dam located in the Namoi Valley north east of Quirindi. This dam is managed by Liverpool Plains Shire and is primarily fed by Quipolly Creek. The dam is the major water storage for the shire and supplies water to many towns, such as Werris Creek. During recent dry periods, water restrictions were placed over the region as Quipolly's levels dropped. This option would look at connecting the Peel Regulated River System to Quipolly Dam to improve the water security of towns that are reliant on water from the dam.
Intent	Improve security of Quipolly Dam to support users and local water supply.
Challenges addressed	Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries.
Potential combinations	This option could be combined with: • Government commitment 1. New Dungowan Dam • Option 2. Inter-regional pipelines, including inland diversion of water from the Macleay and Barnard rivers to the Namoi region.
Considerations	• Consultation will need to be undertaken with local water utilities, industry and communities to establish feasibility, including cost versus outputs and demand. • Level of risk to security and reliability for specific towns would need to be confirmed through a secure yield analysis as part of the development of an integrated water cycle management strategy or regional town water strategy prepared by local councils.
Objectives	

Image courtesy of the Department of Planning, Industry and Environment.

Option 8. Managed aquifer recharge investigations and policy

Source: Department of Planning, Industry and Environment—Water

Description	Managed aquifer recharge involves the reintroduction of surface water and runoff water into aquifers to more efficiently store and access available water in aquifers. This option would investigate opportunities to undertake managed aquifer recharge in the Namoi, including investigating the recharge capacity of sites, such as the Upper Namoi Alluvium Zone 1, for temporary storage of stormwater and river flows in aquifers. These investigations would consider the feasibility of potential recharge, including cost effectiveness and efficiency to access the stored water. This option would also involve the development of a supporting policy to regulate the storage and recovery of this water.
Intent	• More efficient use (by minimising evaporation) of stored water in areas where demand is high. • Providing additional recharge to groundwater sources could increase reliability for groundwater dependent users.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries. • Increased climate variability and climate change is likely to require more effective methods to conserve water.
Potential combinations	This option could be combined with: • Option 5. Investigate the use of advanced water treatment technologies for towns • Option 9. Reliable access to groundwater by towns. This option builds on options such as Option 43. Sustainable access to groundwater by all users.
Considerations	This option requires: • consideration of the distribution of benefits (e.g. additional water because of reduced evaporation) amongst consumptive water users and the environment • consideration of equity issues between industries and cross-subsidies in implementing a managed aquifer recharge policy • an assessment of the engineering and economic challenges of managed aquifer recharge • an assessment of the licensing and accounting framework for surface water temporarily stored as groundwater • an assessment of public acceptance of this option (including specific pilot schemes) • an assessment of required policy and legislative changes • an assessment of biosecurity and water quality risks associated with transferring water from surface water (especially stormwater) to groundwater • pumping screens • assessment of the impacts on Aboriginal cultural heritage.
Objectives	
Further information	**The Potential for Water Banking in Australia's Murray–Darling Basin to Increase Drought Resilience:** www.mdpi.com/2073-4441/12/10/2936 **Ross, A., Hasnain, S. 2018, Factors affecting the cost of managed aquifer recharge (MAR) schemes, Sustainable Water Resources Management 4, p.179-190, 2018**

Option 9. Reliable access to groundwater by towns

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

Description	Groundwater is an important and, at times, the only water source for many towns in the Namoi. For many communities in the region, groundwater is an essential water supply year-round whereas for other towns, especially in the Peel Valley, groundwater is an important back up supply that supports towns during drought. A strategic review of groundwater use by towns across the region is needed to improve understanding of the regional need, challenges and opportunities for towns to access groundwater. This option will identify: • towns where projected future water demands from increasing populations and growth in industries could exceed current capacity of groundwater resources (including consideration of the impacts of climate change), groundwater entitlements or current infrastructure • likelihood and consequences of such exceedances, including consideration of potential options to address any shortfall • other groundwater resources that could be used as a complementary water supply, such as the Great Artesian Basin • regulatory issues potentially slowing or preventing access to groundwater resources • maintenance or replacement of existing groundwater infrastructure including bore fields and pipelines • water treatment requirements to meet health guidelines and acceptable aesthetic levels, such as reducing groundwater hardness in the Liverpool Plains and Gunnedah areas • potential impact of changing groundwater access on other users, such as potentially reduced available water determinations and declining groundwater levels. This option would not replace the need for councils to have integrated water cycle management strategies; rather, this regional review would likely be informed by the integrated water cycle management strategies.
Intent	Increase the security and resilience of town water supplies by using a regional strategic approach to the use of groundwater resource.
Challenges addressed	Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries.
Potential combinations	This option could be combined with: • Option 2. Inter-regional pipelines, including inland diversion of water from the Macleay and Barnard rivers to the Namoi region • Option 3. Intra-regional pipelines • Option 8. Managed aquifer recharge (MAR) investigations and policy • Option 10. Investigate opportunities for dual water systems • Option 26. Improved understanding of groundwater processes • Option 41. Maintain amenity for regional towns during drought • Option 43. Sustainable access to groundwater by all users. This option would also need to be considered with town water specific options such as Option 5. Investigate the use of advanced water treatment technologies for towns.

Option 9. Reliable access to groundwater by towns (continued)

Considerations	This option requires consideration of the roles and responsibilities of state and local governments in ensuring secure access to town water supplies. The level of risk to security and reliability for specific towns would need to be confirmed through a secure yield analysis as part of the development of an integrated water cycle management strategy or regional town water strategy prepared by local councils. Further investigation is needed into: • access to reasonable quality groundwater for towns • potential impacts on existing groundwater users, groundwater dependant ecosystems and adjacent river flows • potential of accessing saline groundwater • the impacts on cultural values and heritage • how compliance with the sustainable diversion limit will be maintained • how to meet the Murray-Darling Basin Plan requirement for no net reduction in the protection of planned environmental water • consideration of government funding to enable small towns in the Namoi to obtain licences on the open market.
Objectives	

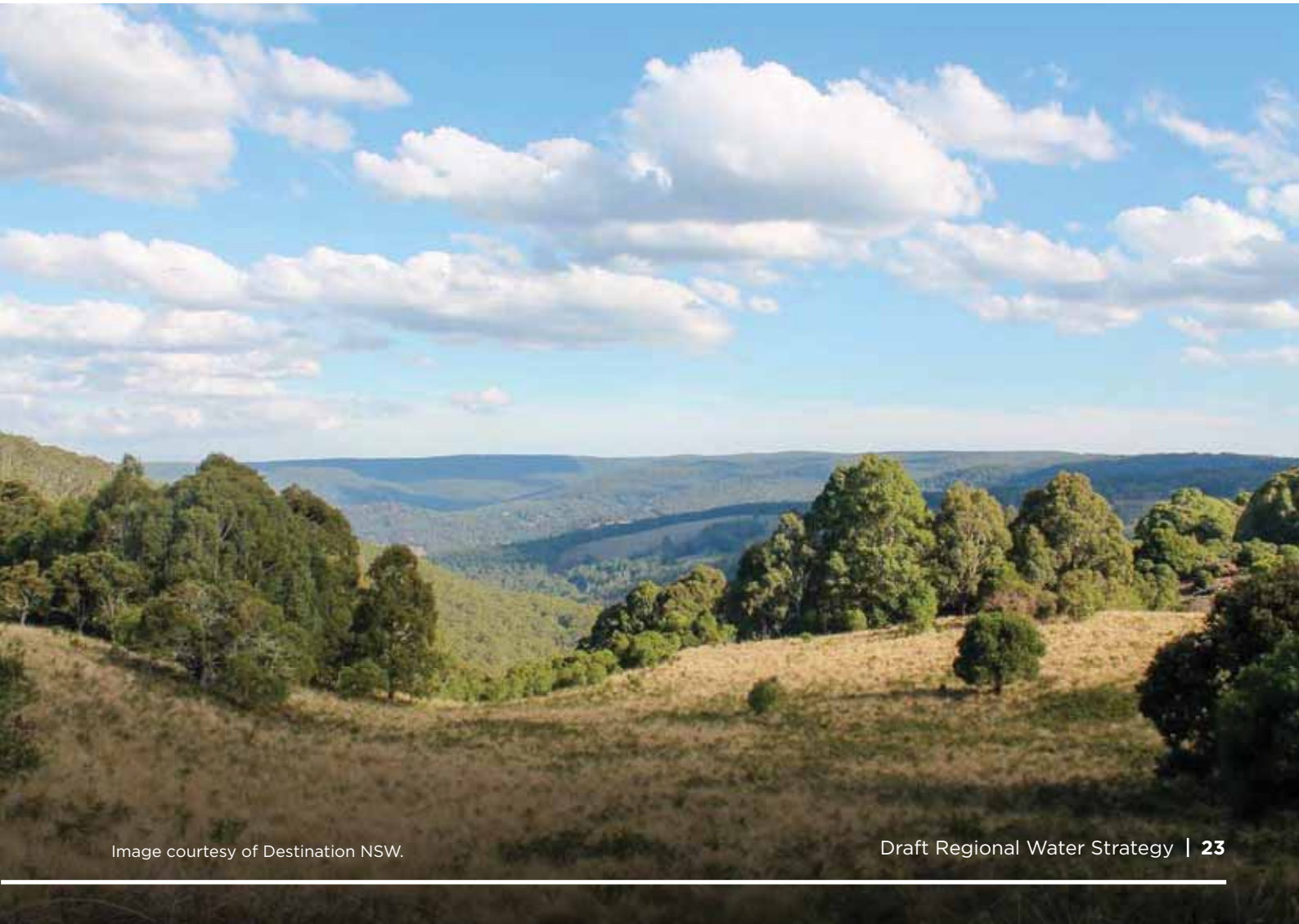


Image courtesy of Destination NSW.

Option 10. Investigate opportunities for dual water systems

Source: Department of Planning, Industry and Environment—Water

Description	Dual water systems enable communities and industry to access potable and non-potable water through different distribution networks. These systems allow water users to use and reuse water more efficiently for suitable purposes and help to protect and retain potable water for where it is most needed. This option would investigate the feasibility of implementing a dual water system in towns across the region. This investigation would include evaluation of the regional centres of Tamworth, Narrabri and smaller towns in the region and would include an assessment of ways to reduce demand on potable water by industry.
Intent	Improve town water security, efficiency of water use and availability of potable water for consumptive users.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries. • Increased climate variability and climate change is likely to require more effective methods to conserve water. • Retaining potable water sources for where they are needed. • Providing opportunities to maintain amenity during drought.
Potential combinations	This option could be combined with: • Option 6. Reuse, recycling and stormwater projects • Option 31. Water efficiency projects (towns and industries).
Considerations	• Consultation will need to be undertaken with local water utilities, industry and communities to establish feasibility including cost versus outputs and demand. • Dual systems form part of water sensitive urban design and should be considered as part of new development in regional towns. • Investigate incentives and/or rule changes to support use of dual water systems.
Objectives	

Option 11. Investigate the development of a water access licence for critical human needs

Source: Department of Planning, Industry and Environment—Water

Description	During extreme events, including prolonged dry periods, the highest priority is to secure water for critical human needs. This option would involve creating a 'critical human needs' water access licence, which could involve: • clearly defining what constitutes critical human needs—for example, what are the essential human water needs required for a town or landholders compared to the needs of industries in the town or region • defining the volume and quality of water needed to support critical human water needs in each region • subdividing existing water entitlements and licences into two or more categories—for example, a critical human needs licence could be a component of a local water utility licence so that water allocation for these essential human needs are prioritised over commercial uses.
Intent	This option would ensure a suitable quantity of water is available for critical human needs before other potential water users.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries. • Balancing water needs between different water users. • Providing critical human needs water during extreme events such as drought.
Potential combinations	This option could be combined with: • Option 31. Water efficiency projects (towns and industries) • Option 34. Review urban water restriction policy • Option 36. New drought operational rules (Namoi and Peel rivers) • Option 37. Review of water accounting and allocation process • Option 38. Investigation of licence conversions • Option 42. Improving understanding of low water availability on water dependent industries.
Considerations	This option requires a significant amount of research and engagement, including around: • assessment of quantities used for critical human needs across the region • impacts on the reliability of water by existing and future water users • whether towns would prefer to maintain industries even if that means domestic water is greatly restricted • assessment of impacts on the environment and the aquifer. This option may also require changes to the *Water Management Act 2000*.
Objectives	

Option 12. Investigate groundwater desalination for industry

Source: Department of Planning, Industry and Environment—Water

Description	Desalination of water involves taking salt out of water to make it more suitable for domestic or industrial purposes. This could provide an additional source of water that can be treated to different levels depending on the use (for example, some industries do not require potable water). Desalination plants can be constructed as decentralised units servicing specific water demands or, depending on town water supply infrastructure, can supply regional demands. Small-scale, modular plants can be sited close to a water demand and may be scaled up as water demand grows. This option would assess the feasibility of using saline groundwater for desalination plants within the region to augment water supply for industry.
Intent	Improve water security for existing towns and industrial water users.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries. • Balancing water needs between different water users. • Retaining potable water sources for where they are needed.
Potential combinations	This option could be combined with: • Option 5. Investigate the use of advanced water treatment technologies for towns • Option 10. Investigate opportunities for a dual water systems • Option 26. Improved understanding of groundwater processes.
Considerations	To operate a desalination plant efficiently, a high volume of water is required. Although some of the groundwater in the Namoi region is saline, finding a suitable volume of water is likely to be problematic. Much of the groundwater yields in the region are too low to provide an adequate source of water; however, there may be some suitable locations within the region, potentially in the Great Artesian Basin shallow groundwater sources, that could be investigated. The siting of a desalination facility would depend on the location, volume and quality of saline groundwater sourced. If the groundwater supply is feasible, the infrastructure requirements and costs, operating costs and energy demands indicate this option would likely be developed over the longer term. Disposal of brine created during the desalination process can be challenging. However, methods and technologies for brine disposal are advancing and it is possible to mitigate possible aesthetic and environmental impacts. Some disposal methods can have economic benefits (e.g. salt production). It will be important to collaborate with industry stakeholders on how desalination options could improve resilience in water supplies over the long term.
Objectives	

Option 13. Joint exploration for minerals and groundwater with the NSW Geological Survey

Source: Department of Planning, Industry and Environment—Water and NSW Geological Survey

Description	This option would develop a project for the joint exploration of fractured rock systems with the Geological Survey of NSW which undertakes mineral, energy and water exploration. Opportunities for maximising the use of fractured rock groundwater sources in the Namoi region, such as the New England Fold Belt and Peel Fractured Rock, depend on increasing our understanding of these resources. This option could provide information to improve town water supply security. This option would require detailed investigations as the fractured rock groundwater sources in the Namoi do not demonstrate high yields.
Intent	• Identifying reliable water supply and storage to support town and industry water security and support future growth. • Improving management of groundwater systems through quantifying groundwater supply potential.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries. • Balancing water needs between different water users.
Potential combinations	This option could be combined with: • Option 9. Reliable access to groundwater by towns • Option 26. Improved understanding of groundwater processes • Option 43. Sustainable access to groundwater by all users.
Considerations	This option requires: • assessment of the yields in the fractured rock • consideration of the reliability of this resource and if a secure town water supply can be achieved from these water sources • assessment of impacts on other users, the environment and the aquifer.
Objectives	

Option 14. Water security for small communities

Source: Department of Planning, Industry and Environment—Water

Description	Investigation of opportunities to improve water security for small communities that do not currently have access to secure water supplies. There are a number of small communities (<500 people) that source their own water supplies and are not directly connected to the water supply network of a major town. In addition, over one third of the region's population lives outside urban areas and has a non-reticulated domestic water supply. These communities and individuals depend directly on water from non-regulated rivers and creeks, aquifers, farm dams and rainwater tanks. These communities and households will face water security challenges from a drier climate. During times of drought, local water utilities often need to provide water carting to these communities and to households with a non-reticulated water supply. Development of alternative water supplies will make these communities and households more resilient to droughts in the future and reduce the stress that water carting places on the supply systems of major towns, which are often facing their own supply shortages. In addition to alternatives such as groundwater, this option could explore the potential for new and emerging technologies such as hydropanels or off-grid containerised water filtration units to provide additional water supply sources for small communities. These technologies may also be applicable at the household scale.
Intent	Improve the security and resilience of water supplies for small discrete communities by diversifying water supply options.
Challenges addressed	• Increasing climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increased climate variability and climate change is likely to require more effective methods to conserve water.
Potential combinations	This option could be combined with: • Option 9. Reliable access to groundwater by towns • Option 53. Water allocations for Aboriginal communities.
Considerations	• Level of risk to security and reliability for specific communities could be identified through a secure yields analysis as part of the development of integrated water cycle management strategy/drought management plan by local councils. • Assessment of available alternate water sources. • Effectiveness and reliability of proposed technologies. Different technologies may be better suited to different environments. • Assessment of funding options by local, state and federal governments to support these technologies or infrastructure for alternative supplies. • Assessment of impacts to the environment and existing water users.
Objectives	

Image courtesy of the Department of Planning, Industry and Environment.

Protecting and enhancing natural systems

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

Option 15. NSW Fish Passage Strategy

Source: Department of Primary Industries—Fisheries

Description	Many native fish species in the Namoi require unimpeded access through waterways to carry out natural reproductive and migratory processes. Physical waterway barriers such as weirs and dams can limit these processes, leading to a decline in the health and viability of native fish populations. The Department of Primary Industries—Fisheries has identified 162 barriers to fish passage in the Namoi region. Currently, native fish can only move through the Namoi system during high flow conditions when water overflows weirs and other in-stream barriers. This option will look at a staged remediation of fish passages at seven priority sites along the Namoi and Peel rivers, as well as sites along the Cockburn River, to facilitate fish access to more than 2,000 km of waterways in the Namoi catchment. These river sections have been identified as key habitat for threatened fish species such as the Olive Perchlet, Purple Spotted Gudgeon, Silver Perch and Murray Cod, and contain stretches of high-quality aquatic and riparian habitat. Proposed sites for stage 1 remediation works are Gunidgera Weir, Water Gauge Site 4, Pontibah causeway, Jewery Street, Calala Gauging Station, Paradise Falls and augmentation of Cockburn River bed control structures to mitigate bed erosion.
Intent	• Maintain and improve native fish access to core habitat in the Namoi region. • Improve fish movement through fishways and encourage breeding and spawning activities, especially for threatened species. • Enable fish to move to refuges during drought. • Restore catchment-wide connectivity to the Barwon River junction. • Improve recreational fishing and regional tourism opportunities.
Challenges addressed	• Dams, flood works and in-stream infrastructure alter natural flow regimes and impact on water quality, native species and ecosystems. • Increased climate variability and climate change pose greater risks to ecosystems and species. • Maintaining connectivity between river systems and with the Barwon-Darling for fish and aquatic animal passage. • Protecting critical environmental assets, in-stream ecological values and threatened species. • Ensuring Aboriginal cultural values are protected.

Option 15. NSW Fish Passage Strategy (continued)

Potential combinations	This option will have significant additional value when combined with other environmental options to protect native fish and support a healthy regional environment. This option could be combined with: • Option 17. Cold water pollution mitigation measures • Option 18. Riparian habitat restoration and re-establishing threatened species • Option 19. Diversion screens to prevent fish extraction at pump offtakes • Option 23. Revise water sharing plan provisions for planned environmental water • Option 25. Ability to redirect flows that are in excess of needs. There is also potential for fish passage remediation work to complement proposed options that support the objective to recognise and protect Aboriginal rights, interests and access to water. Specific shared benefits would be identified through consultation with Aboriginal groups.
Considerations	Suitable environmental water management settings need to be in place to secure hydrological connectivity between connected river reaches. Fish passage remediation assists in mitigating the impact of barriers to fish passage in hydrologically connected systems. The NSW Government could partner with local Aboriginal communities on these initiatives.
Objectives	
Further information	**Department of Planning, Industry and Environment—Environment, Energy and Science 2020, Namoi Long Term Water Plan Parts A and B:** www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/namoi **Department of Primary Industries—Fisheries 2006, The Assessment & Modification of Barriers to Fish Passage in the Namoi Catchment:** www.dpi.nsw.gov.au/fishing/habitat/threats/barriers/barriers **Barriers to fish passage:** www.dpi.nsw.gov.au/fishing/habitat/threats/barriers **Murray-Darling Basin Authority 2020, Native Fish Recovery Strategy:** www.mdba.gov.au/publications/governance/native-fish-recovery-strategy **Murray-Darling Basin Authority 2019, Basin-wide Environmental Watering Strategy:** www.mdba.gov.au/publications/mdba-reports/basin-wide-environmental-watering-strategy **Victorian Department of Sustainability and the Environment 2010, National Recovery Plan for the Murray Cod—Maccullochella peelii peelii:** www.environment.gov.au/resource/national-recovery-plan-murray-cod-maccullochella-peelii-peelii

Option 16. Providing incentives to landholders to conserve and rehabilitate riparian, wetland and floodplain vegetation

Source: Department of Planning, Industry and Environment—Environment and Energy and Science

Description	This option would provide incentives to landholders to improve land conservation and rehabilitate riparian, wetland and floodplain vegetation. A large portion of wetlands in the region are located on privately owned land. This option will improve the condition and resilience of habitats and landscapes through protection and enhancement of priority areas using best practice management while building the skills and sharing the knowledge of local landholders and community groups. Protection and active management of high conservation values can be achieved through incentive schemes for private landholders, councils and other agencies. These range from perpetual arrangements through to short-term landholder incentive agreements and projects could include: • supporting the move to native pasture that is more drought tolerant • soil control works to reduce runoff • changing rotations between grazing and cropping • information on land use and land management practices that will enable landholders to more effectively use rainfall onsite and minimise runoff • a buy-back program of land for habitat restoration. Conservation works will largely rely on the voluntary engagement of landholders. Other long-term conservation mechanisms and incentives include BioBanking, Conservation Agreements, Conservation Property Vegetation Plans and Landholder Incentive Agreements.
Intent	• Restore near natural river water habitats and vegetation with the necessary land management and conservation practices. • Mitigating the impact of intensive agriculture and grazing to provide opportunities for native vegetation to regenerate river sections and surrounding habitats. • Give landholders an incentive to adopt low-impact agriculture practices and develop native pastures to increase resilience to future droughts. • Avoid treatment costs in the drinking water supply network.
Challenges addressed	• Protecting critical environmental assets, in-stream ecological values and threatened aquatic species. • Increased climate variability and climate change pose greater risks to ecosystems and species.
Potential combinations	This option will have significant additional value when combined with other environmental options to support a healthy regional environment. This option could be combined with: • Option 15. NSW Fish Passage Strategy • Option 17. Cold water pollution mitigation measures • Option 18. Riparian habitat restoration and re-establishing threatened species • Option 19. Diversion screens to prevent fish extraction at pump offtakes • Option 21. Implementation of surface water quality mitigation measures • Option 23. Revise water sharing plan provisions for planned environmental water • Option 56. River Ranger Program. This option could also be combined with options to improve the recognition of Aboriginal people's rights, interests and access to water.

Option 16. Providing incentives to landholders to conserve and rehabilitate riparian, wetland and floodplain vegetation (continued)

Considerations

Different types of arrangements and funding mechanisms are possible. Funding is available through regional Local Land Services, which coordinate grants available through the National Landcare Program and Catchment Action NSW. Fisheries Habitat Action Grants are also another possible source of funding.

A range of environmental and social benefits can be achieved through landscape restoration. These include:

- improved habitat for threatened species
- improvements in water quality arising from vegetated buffers
- bank stabilisation from replanting
- increased drought resilience.

Implementation of this option would need to work through a range of issues, including:

- long-term planning and maintenance of on-ground activities and their outcomes
- on a large scale, this option has the potential to produce major improvements to the river but on a small scale the benefits could be negligible
- engagement of private landholders
- multi-stakeholder partnerships including with government agencies
- opportunities for training and capacity building in land management activities for community groups and Aboriginal communities
- engagement and partnerships with Aboriginal land managers, including assistance in identifying native plant species that will help to improve water quality and provide biodiversity benefits
- development of management strategies to counteract effects of reduced flooding of riparian, wetland and floodplain vegetation and habitats.

This incentives program would also need to consider other existing incentives programs for land holders and work in with these to deliver best possible outcomes.

Objectives

Option 17. Cold water pollution mitigation measures

Source: Department of Primary Industries—Fisheries, Local Land Services and Department of Planning, Industry and Environment—Environment and Energy and Science

Description	Good water quality, including suitable water temperature, is essential to the protection and recovery of native fish populations. Cold water pollution has damaging impacts on riverine ecological function, particularly in summer where biological cues such as fish spawning are disrupted. Cold water pollution is widespread, including on the Peel River below Chaffey Dam and on the Namoi River below Keepit Dam. This option could involve: • trialling and assessing various technologies and operational protocols to mitigate cold water pollution from storages with problematic algal blooms • assessing the effectiveness of current variable level offtake of Chaffey Dam in mitigating cold water pollution • investigating the use of additional destratification technology and developing an operational plan in conjunction with WaterNSW • developing infrastructure to mitigate cold water pollution for Keepit Dam, which doesn't have a multi-level offtake, and assessing suitable options for destratification. Mitigating cold water pollution involves long-term collaboration between agencies, asset owners and river operators.
Intent	• Improve water quality in the Namoi and Peel rivers. • Increased recruitment, timing and success of reproduction, survivorship and distribution of the whole fish community, especially for key native fish species such as Murray Cod, Golden Perch, Silver Perch, Southern Purple Spotted Gudgeon, Olive Perchlet and Eel-tailed Catfish, resulting in improved population structures and expanded distributions. • Support natural levels of riverine productivity. • Job creation and investment in regional communities through construction and maintenance of cold water pollution mitigating assets. • Increased tourism opportunities as native fish populations increase, and water temperature improves for recreational uses. • Help deliver on some Aboriginal rights and interests, as native fish and good water quality are important Aboriginal cultural values.
Challenges addressed	• Dams, flood works and in-stream infrastructure alter natural flow regimes and impact on water quality, native species and ecosystems. • Protecting critical environmental assets, in-stream ecological values and threatened aquatic species.
Potential combinations	This option will have significant additional value when combined with other environmental options to protect native fish and support a healthy regional environment. This option could be combined with: • Option 18. Riparian habitat restoration and re-establishing threatened species • Option 19. Diversion screens to prevent fish extraction at pump offtakes • Option 21. Implementation of surface water quality mitigation measures • Option 23. Revise water sharing plan provisions for planned environmental water. There is also potential for these works to complement proposed options that recognise and protect Aboriginal rights, interests and access to water. Specific shared benefits would be identified through consultation with Aboriginal groups.

Option 17. Cold water pollution mitigation measures (continued)

Considerations	Future safety upgrades to Keepit Dam must consider the 'Managing Cold Water Pollution and Cyanobacteria in WaterNSW Rural Storages with Variable Offtake Structures' protocol. NSW Proposal for the Northern Basin Toolkit identifies Chaffey, Split Rock and Keepit dams as three priority dam structures in need of remediation. This option will need to investigate funding of cost effective and timely methods of sampling and testing for algal toxins. In 2004, the NSW Government adopted the *Cold Water Pollution Strategy* to reduce the significant effect of cold water pollution below the state's major storages. The strategy is designed to progress in five-year stages of planning, implementation and evaluation of outcomes. Progress towards remediating cold water pollution can be achieved by re-establishing the Cold Water Interagency Working Group to review Stage 1 and Stage 2 of the *Cold Water Pollution Strategy* implementation, and update the strategy to include a list of sites for strategic investigation and implementation.
Objectives	
Further information	**Department of Planning, Industry and Environment—Environment, Energy and Science 2020, Namoi Long Term Water Plan Parts A and B:** www.environment.nsw.gov.au/topics/water/water-for-the-environment/planning-and-reporting/long-term-water-plans/namoi **Department of Primary Industries 2012, NSW Cold Water Pollution Strategy. Report on the implementation of stage one:** www.industry.nsw.gov.au **Department of Planning, Industry and Environment 2019, Water quality management plan for the Namoi water resource plan area SW14:** www.mdba.gov.au/publications/mdba-reports/namoi-water-resource-plan Lugg, A. and Copeland, C. 2014, Review of cold water pollution in the Murray–Darling Basin and the impacts on fish communities, Ecological Management & Restoration, 15, p.71-79

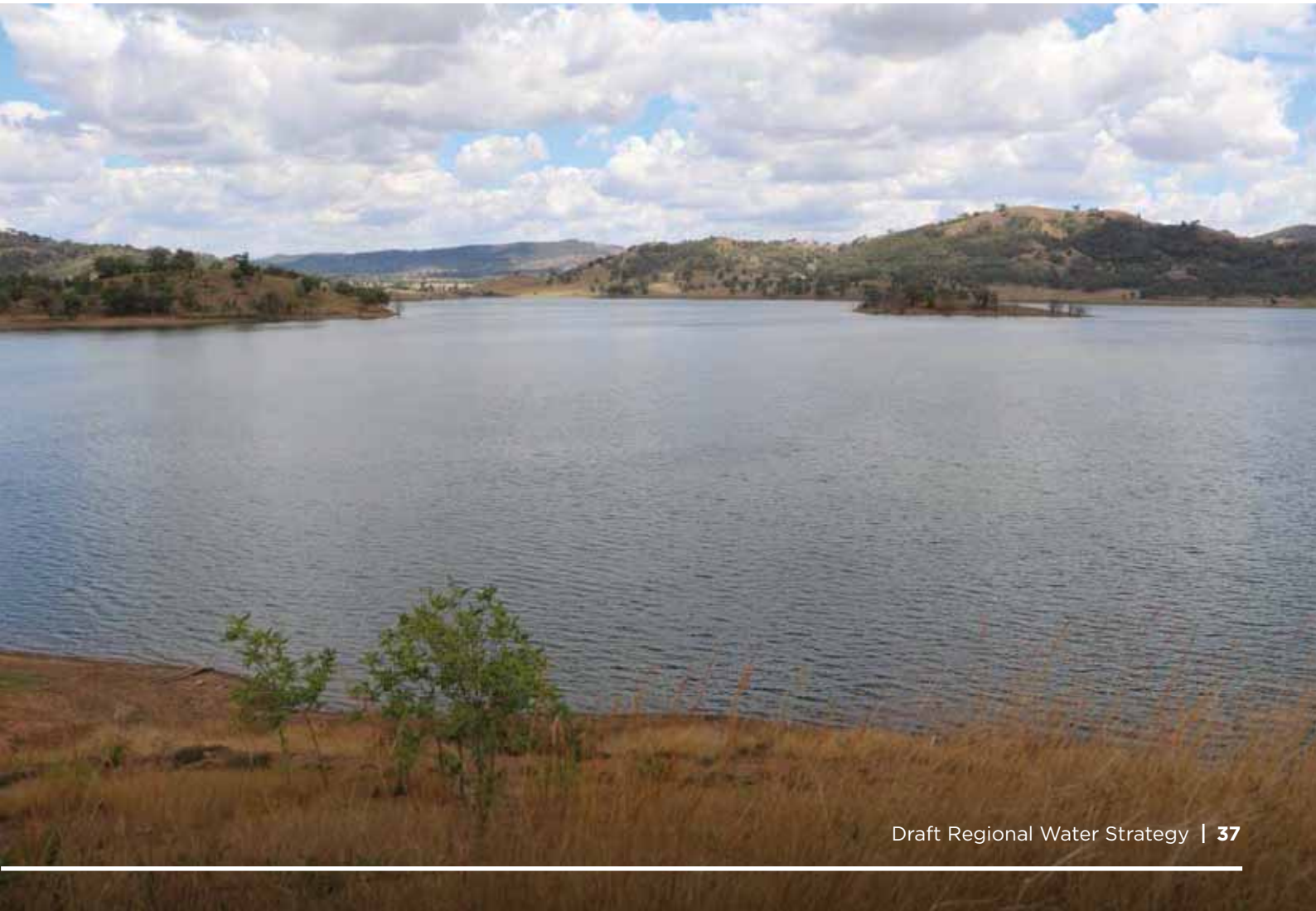
Option 18. Riparian habitat restoration and re-establishing threatened species

Source: Department of Primary Industries—Fisheries

Description	This option is a package of on-ground activities at targeted high priority locations to restore, conserve and protect riparian habitat and re-establish threatened species in the Namoi region. The ecosystem restoration project would use a catchment management framework and would be structured as a five-year partnership in three key phases. • Phase 1, 18 months: Undertake a scoping study, including stakeholder consultation, to identify target locations and landholders to establish a demonstration reach project. • Phase 2, 12 months: On-ground implementation of works. • Phase 3, in parallel with and continuing from Phase 2, 18 months: Undertake evaluation of environmental, social and economic outcomes. The following works could be scoped for their need and feasibility during Phase 1: • habitat mapping (wetland and riparian) including identification of high quality drought refugia • riparian restoration work (such as replanting, including aquatic planting) fencing, off-stream stock watering points • re-snagging • wetland management • landholder incentives • development of a monitoring and evaluation framework • threatened species reintroduction and protection.
Intent	• Develop a series of catchment-based strategies to support recovery of native fish through ecosystem restoration. • Improved water quality has additional benefits for the cultural, social and economic wellbeing of river reliant communities. • Avoid treatment costs in the drinking water supply network. • Improving town water security.
Challenges addressed	• Increased climate variability and climate change pose greater risks to ecosystems and species. • Protecting critical environmental assets, in-stream ecological values and threatened aquatic species. • Protecting groundwater dependent ecosystems. • Ensuring Aboriginal cultural values are protected.
Potential combinations	This option will have significant additional value when combined with other environmental options to protect native fish and support a healthy regional environment. This option could be combined with: • Option 15. NSW Fish Passage Strategy • Option 16. Providing incentives to landholders to conserve and rehabilitate riparian, wetland and floodplain vegetation • Option 17. Cold water pollution mitigation measures • Option 19. Diversion screens to prevent fish extraction at pump offtakes • Option 21. Implementation of surface water quality mitigation measures • Option 23. Revise water sharing plan provisions for planned environmental water • Option 56. River Ranger Program. There is potential for these works to complement proposed options that support the objective to recognise and protect Aboriginal rights, interests and access to water. Specific shared benefits would be identified through consultation with Aboriginal groups.

Option 18. Riparian habitat restoration and re-establishing threatened species (continued)

Considerations	Considerations include: • long-term planning and maintenance of on-ground activities and their outcomes • suitable environmental water management settings to help secure threatened species • distribution and population growth of threatened species and native fish in the long term • on a large scale, this option has the potential to produce major improvements to the river but on a small scale the benefits could be negligible • engagement of private landholders • engagement and partnerships with Aboriginal land managers, including assistance in identifying native plant species that will help improve riparian habitat and provide biodiversity benefits • multi-stakeholder partnerships including with government agencies • opportunities for training and capacity building in land management activities for community groups and Aboriginal communities.
Objectives	
Further information	**Northern Tablelands Local Strategic Plan 2016-2021:** www.lls.nsw.gov.au/what-we-do/plans-and-publications/strategic-plans



Option 19. Diversion screens to prevent fish extraction at pump offtakes

Source: Department of Primary Industries—Fisheries and Local Land Services

Description	Every year, large numbers of native fish are entrained by pumps and/or diverted into irrigation channels, never to return to the Namoi river system. A single water pump can remove up to 800 native fish per megalitre of water extracted. This option will support the installation of screens on major irrigation pumps and diversion channels to reduce the amount of fish being extracted at pump sites. This will improve the retention of native fish within the region's waterways by preventing entrainment of adults, larvae and eggs. Screening infrastructure also improves water delivery and extraction efficiency through fewer blockages caused by debris, resulting in on-farm cost savings. Demand for screens can also support regional economies.
Intent	• Significantly reduce the loss of native fish from the Namoi region, and increase fish populations. • Reduce costs, improve water delivery and extraction efficiency for the asset owner. • Improve environmental outcomes and water user benefits in the Namoi region.
Challenges addressed	• Protecting critical environmental assets, in-stream ecological values and threatened aquatic species. • Dams, flood works and in-stream infrastructure alter natural flow regimes and impact on water quality, native species and ecosystems.
Potential combinations	This option will have significant additional value when combined with other environmental options to protect native fish and support a healthy regional environment. This option could be combined with: • Option 15. NSW Fish Passage Strategy • Option 17. Cold water pollution mitigation measures • Option 18. Riparian habitat restoration and re-establishing threatened species • Option 21. Implementation of surface water quality mitigation measures • Option 23. Revise water sharing plan provisions for planned environmental water. There is also potential for diversion screening works to complement proposed options that support the objective to recognise and protect Aboriginal rights, interests and access to water. Specific shared benefits would be identified through consultation with Aboriginal groups.
Considerations	The program would require: • assessment of the cost-benefits of screening, including environment outputs, water delivery efficiency and long-term social and financial implications for water users • consideration of potential implementation options, such as incentive schemes for landholders to install screens. Long term, the benefits of diversion screening could be supported by ensuring that suitable environmental water management settings are in place to secure hydrological connectivity between river reaches. Diversion screens have been used successfully for decades overseas (for example, in western USA, Europe and New Zealand) and have been successfully installed at Trangie-Nevertire.
Objectives	

Option 20. Modification and/or removal of floodwork structures causing adverse impacts

Source: Department of Planning, Industry and Environment—Water and Department of Planning, Industry and Environment—Environment and Energy and Science

Description	Some vital ecological assets in the region rely on floodplain connection to replenish and maintain critical elements. Works undertaken on the floodplain can prevent water moving to these areas. This option would modify and/or remove identified priority floodplain structures and barriers that impede delivery of water to priority ecological assets, specifically in the Lower Namoi and Upper Namoi. This option would explore how Aboriginal cultural heritage values and ecological balance can be restored in partnership with Aboriginal communities.
Intent	Protect priority ecological assets and improve water security by identifying and removing the risks posed by identified priority floodplain structures.
Challenges addressed	• Dams, flood works and in-stream infrastructure alter natural flow regimes and impact on water quality, native species and ecosystems. • Protecting critical environmental assets, in-stream ecological values and threatened aquatic species. • Increased climate variability and climate change pose greater risks to ecosystems and species.
Potential combinations	This option will have significant additional value when combined with other environmental options to support a healthy regional environment. This option could be combined with: • Option 15. NSW Fish Passage Strategy • Option 16. Providing incentives to landholders to conserve and rehabilitate riparian, wetland and floodplain vegetation • Option 17. Cold water pollution mitigation measures • Option 18. Riparian habitat restoration and re-establishing threatened species • Option 19. Diversion screens to prevent fish extraction at pump offtakes • Option 23. Revise water sharing plan provisions for planned environmental water. There is also potential for this option to complement proposed options that support the objective to recognise and protect Aboriginal rights, interests and access to water. Specific shared benefits would be identified through consultation with Aboriginal groups.
Considerations	Modifying or removing existing floodwork structures may present significant costs. It also raises challenges in managing the permanent loss of production capability for some individuals.
Objectives	
Further information	**Floodplain Management Plan for the Upper Namoi Valley:** **www.industry.nsw.gov.au/water/plans-programs/healthy-floodplains-project/plans/upper-namoi** **Floodplain Management Plan for the Lower Namoi Valley:** **www.industry.nsw.gov.au/water/plans-programs/healthy-floodplains-project/plans/lower-namoi**

Option 21. Implementation of surface water quality mitigation measures

Source: Department of Primary Industries—Fisheries, Department of Planning, Industry and Environment—Water and Department of Planning, Industry and Environment—Environment and Energy and Science

Description	Implementation of surface water quality mitigation measures provides the opportunity to significantly improve water quality, contributing to major outcomes for native fish and riverine productivity across the Northern Basin, as well as enhancing social and economic outcomes from existing water recovery efforts. This option would investigate opportunities to support the water quality management plans that have been prepared for the Namoi surface water and groundwater water resource plans. This could include: • real time water quality monitors/loggers to monitor dissolved oxygen and other water quality parameters at key infrastructure and refuge pools to assist with environmental management decisions, including as part of an early warning network to detect potential fish kills • cost effective and timely methods of sampling and testing for algal toxins • investigation of diffuse pollution sources and pathways to improve our understanding of sources of pollution, specific pollution hotspots, and potential mitigation strategies • working with partner agencies to identify better flow management priority actions to mitigate the risk of harmful algal blooms • an environmental water quality allowance in the water sharing plans to help manage water quality issues (in addition to the existing volume of planned environmental water and licensed environmental water) • re-introduction of wetlands (rehabilitated or constructed) where a wetland may have been located within a water source in the past. Wetlands are natural filters that help to slow down flows and allow nutrients and other contaminants to be absorbed by soils and vegetation. They also promotes bird habitat and refugia, and potentially nurseries for juvenile fish during high flow events • designing a strategic plan to improve water quality in surface water sources.
Intent	• Reduce water quality impacts on water sources and the risks of blue-green algae outbreaks to provide better environmental and water quality outcomes. • Reduce the risk of blackwater events and fish kills. • Make progress towards the Murray-Darling Basin Plan water quality target. • Avoid treatment costs in the drinking water supply network.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increased climate variability and climate change pose greater risks to ecosystems and species. • Protecting critical environmental assets, in-stream ecological values and threatened aquatic species. • Dams, flood works and in-stream infrastructure alter natural flow regimes and impact on water quality, native species and ecosystems. • Ensuring Aboriginal cultural values are protected.
Potential combinations	This option will have significant additional value when combined with other environmental options to support a healthy regional environment. This option could be combined with: • Option 17. Cold water pollution mitigation measures • Option 18. Riparian habitat restoration and re-establishing threatened species • Option 19. Diversion screens to prevent fish extraction at pump offtakes • Option 23. Revise water sharing plan provisions for planned environmental water. There is also potential for these works to complement proposed options that support the objective to recognise and protect Aboriginal rights, interests and access to water. Specific shared benefits would be identified through consultation with Aboriginal groups.

Option 21. Implementation of surface water quality mitigation measures (continued)

Considerations	Water quality management plans have been completed for the Namoi surface water and alluvial water sources. This option would need to consider broader land management and catchment management options—improving water quality requires water land, soil, vegetation and water management as well as good agronomic practices.
Objectives	
Further information	**Water quality management plan (surface water):** www.mdba.gov.au/publications/mdba-reports/namoi-water-resource-plan **Water quality management plan (groundwater):** www.mdba.gov.au/publications/mdba-reports/namoi-alluvium-water-resource-plan **Water resource plan (surface water):** www.mdba.gov.au/publications/mdba-reports/namoi-water-resource-plan **Water resource plan (groundwater):** www.mdba.gov.au/publications/mdba-reports/namoi-alluvium-water-resource-plan

Option 22. Improve connectivity with downstream systems

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

Description	The Peel catchment provides approximately 50% of the inflows into the Namoi River. The Namoi River provides approximately 25% of the inflows into the Barwon-Darling over the long term. The Barwon-Darling River and communities along the river rely on flows from Queensland as well as the Border Rivers, Gwydir, Namoi and Macquarie-Castlereagh catchments. Improving connectivity to the Barwon-Darling River was a recommendation of the *Independent Assessment of the 2018/19 Fish Deaths in the Lower Darling* (Vertessy Report), the Natural Resources Commission's review of the Barwon–Darling water sharing plan, the Natural Resources Commission's review of the Peel water sharing plan and the *Independent Panel Assessment of the Management of the 2020 Northern Basin First Flush Event*. Potential options to improve connectivity between the Peel and Namoi catchments, and the Namoi region and the Barwon-Darling River include: • establishing additional end of system flow targets • using environmental water to achieve connectivity objectives • using temporary water restrictions more frequently to achieve connectivity objectives—this would need to be developed in conjunction with stakeholders, with clear guidance on when these would be triggered, and the targets for lifting such restrictions • reviewing the targets and implementing the North West Unregulated Flow Management Plan • reviewing water sharing rules in the northern tributary valleys to enable greater connectivity with downstream catchments. This could involve including rules and targets around first flush management in water sharing plans or other regulatory instruments.
Intent	Enable critical human and environmental needs to be met downstream during extreme dry periods.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Providing critical human needs water during extreme events such as drought. • Maintaining connectivity between river systems and with the Barwon-Darling for fish and aquatic animal passage. • Increased climate variability and climate change pose greater risks to ecosystems and species. • Difficulty in delivering water to towns at the end of the system in dry periods.
Potential combinations	This option could be linked to Option 25. Ability to redirect supplementary flows that are in excess of needs. This option could be combined with targeted environmental works and options that would improve native fish movement and habitat such as: • Option 15. NSW Fish Passage Strategy • Option 16. Providing incentives to landholders to conserve and rehabilitate riparian, wetland and floodplain vegetation • Option 17. Cold water pollution mitigation measures • Option 18. Riparian habitat restoration and re-establishing threatened species • Option 19. Diversion screens to prevent fish extraction at pump offtakes • Option 21. Implementation of surface water quality mitigation measures • Option 23. Revise water sharing plan provisions for planned environmental water.

Option 22. Improve connectivity with downstream systems (continued)

Considerations	This option requires: • assessment of impacts of existing government reforms to improve connectivity • assessment of potential impacts on the environment and water users in the Namoi region • assessment of changes to existing river flow patterns and planned environmental water, including from unregulated tributary flows • assessment of the relative contribution of all major tributaries to the Barwon-Darling River • assessment of what instruments are best placed to include rules around connectivity and whether relevant water sharing plans or legislation will provide sufficient flexibility to account for variations between connectivity events and across regions. In assessing potential connectivity improvements, consideration may need to be given to whether the options can help maintain system function during dry times, allow for replenishment flows that provide or maintain connectivity and provide an adequate level and quality of water in weir pools and waterholes (drought refugia). Note: This option will be informed by connectivity options arising from the Western Regional Water Strategy and the Western Weirs Program.
Objectives	
Further information	**NSW Natural Resources Commission May 2020, Final Report: Review of the Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010:** www.nrc.nsw.gov.au/2019-2020-wsp-reviews **Northern Basin First Flush Assessment:** www.industry.nsw.gov.au/water/allocations-availability/northern-basin-first-flush-assessment

Image courtesy of Sarah Horne.

Option 23. Revise water sharing plan provisions for planned environmental water

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

Description	Reduced rainfall, increased evapotranspiration and any additional regulation and storage of flows will likely lead to longer and more frequent cease-to-flow periods, lower average flows and longer dry periods, increasing the need for environmental water to support ecological outcomes. Planned environmental water is water committed for ecosystem health or other specified environmental purposes and managed through rules in the water sharing plans. The Water Sharing Plan for the Peel Regulated River Water Source contains provisions for the protection of planned environmental water and an Environmental Contingency Allowance. This option involves reviewing or amending provisions in water sharing plans to support the release of planned environmental water based on environmental water requirements in the Namoi Long Term Water Plan. These amendments could maintain low flows in unregulated tributaries to provide habitat connection. It would also consider a proposal to replace the minimum daily release from Chaffey Dam with an equivalent volume of water that could be more actively managed. This option is based on recommendations raised by the Natural Resources Commission review on the Water Sharing Plan for the Peel Regulated River Water Source and will be considered in the review of the water sharing plan.
Intent	• Improve flow management to provide better environmental and water quality outcomes in the Peel Valley and broader Namoi Valley. • Ensure delivery of water to environmental assets and other users. • Identify and adequately protect and restore the environmental values of pools. • Improve environmental outcomes downstream.
Challenges addressed	• Increased climate variability and climate change pose greater risks to ecosystems and species. • Delivering sufficient environmental flows to the end of the system and ensuring it achieves its intended purpose. • Maintaining connectivity between river systems and with the Barwon-Darling for fish and aquatic animal passage. • Protecting critical environmental assets, in-stream ecological values and threatened species.
Potential combinations	This option could be combined with: • Option 21. Implementation of surface water quality mitigation measures • Option 22. Improve connectivity with downstream systems.

Option 23. Revise water sharing plan provisions for planned environmental water (continued)

Considerations	This option aligns with recommendations made in the Natural Resource Commission's review of the Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010. Consideration would be given to: • the Namoi Long Term Water Plan • impacts on the environment, other users and native fish and aquatic species. This option will also need to consider any changes to the water sharing plan provisions on existing licence holders in the Peel and Namoi.
Objectives	
Further information	**NSW Natural Resources Commission 2020, Review of the Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010:** www.nrc.nsw.gov.au/2019-2020-wsp-reviews **Water sharing plans in the Namoi region:** www.industry.nsw.gov.au/water/plans-programs/water-sharing-plans/status/namoi-region

Image courtesy of the Department of Planning, Industry and Environment.

Option 24. Improve understanding of water use in unregulated water sources

Source: Department of Planning, Industry and Environment—Water and Department of Primary Industries—Agriculture

Description	Information about water use in unregulated water sources is limited. The majority of surface water is extracted from regulated rivers in NSW. As a result, most of the surface water river models and metering requirements have historically been focused on regulated rivers. This option aims to improve understanding of water use in unregulated rivers by: • understanding how much water is being extracted from unregulated water sources through the implementation of new metering regulations (an existing NSW Government commitment) • improving our river flow monitoring systems through the installation of additional gauges at the end of the system and in unregulated water sources where there is high level of extraction • monitoring to determine if the number or volume of farm dams is increasing • developing our hydrologic models of unregulated water sources. This information can be used to inform: • future water planning and management decisions in the region • review of the water sharing plans for the Namoi and Peel Unregulated Rivers Water Sources • risk assessments for environmental outcomes and assets • risk assessments for town water supplies from unregulated water sources.
Intent	Provide information on water flows and water take in unregulated systems to improve system management.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries. • Protecting critical environmental assets, in-stream ecological values and threatened species.
Potential combinations	This option could be combined with Option 22. Improve connectivity with downstream systems.
Considerations	This option would need to be sequenced as follows: 1. implementing metering and gauging 2. implementing monitoring program for farm dams 3. developing modelling. A key consideration would be the costs associated with installing and maintaining monitoring systems. An assessment would be needed of the impacts on all users in the Namoi region.
Objectives	
Further information	**Department of Primary Industries—Water 2017, New South Wales Namoi Water Resource Plan (Surface Water SW14), Status and Issues Paper:** **www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/status** **Water sharing plans in the Namoi region:** **www.industry.nsw.gov.au/water/plans-programs/water-sharing-plans/status/namoi-region**

Image courtesy of the Department of Planning, Industry and Environment.

Option 25. Ability to redirect supplementary flows that are in excess of needs

Source: Department of Planning, Industry and Environment—Water

Description	Supplementary flows generally occur over wet periods when water flowing through a waterway is surplus to current demand and cannot be captured for future use. This water is important for supporting river health and natural floodplain processes, as well as supplementing licence holders who may access this water for on property storage. This option would introduce rules for managing supplementary water events to allow the NSW Environmental Water Manager to direct (where possible) the environment's share of those events to specific environmental assets in the Namoi regulated or unregulated river water sources. The NSW Environmental Water Manager could also direct water not taken by supplementary licences holders to environmental assets after a certain flow volume is triggered. This could reduce the possibility of flooding agricultural land during key harvesting times. This option will provide the NSW Environmental Water Manager with flexibility to adaptively manage environmental assets in the Namoi region.
Intent	Improve environmental assets and overall ecosystem health in the Namoi region.
Challenges addressed	• Delivering sufficient environmental flows to the end of the system and ensuring it achieves its intended purpose. • Maintaining connectivity between river systems and with the Barwon-Darling for fish and aquatic animal passage. • Protecting critical environmental assets, in-stream ecological values and threatened species. • Ensuring Aboriginal cultural values are protected.
Potential combinations	This option could be combined with other environmental options, such as targeted flood works and measures to promote fish movement and habitat.
Considerations	Stakeholder engagement and public consultation undertaken for the Draft Namoi Surface Water Resource Plan has informed development of this option. Any redirection of supplementary flows must be done in a manner that avoids socio-economic impacts. An annual report prepared by the Department of Planning, Industry and Environment—Environment, Energy and Science at the start of the water year would detail the environmental asset being targeted. The long-term watering plan provides ecological information related to the known environmental assets and their watering requirements for natural functioning. This information supports planning processes and the NSW Environmental Water Manager would work with the Operator (WaterNSW) to direct water to environmental assets.
Objectives	
Further information	**Draft Namoi Surface Water Resource Plan:** **www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/status**

Option 26. Improved understanding of groundwater processes

Source: Department of Planning, Industry and Environment—Water and consultation with Namoi joint organisations and councils

Description	Groundwater management decisions are made using the best available information. To improve the management and sustainable use of groundwater sources, our knowledge about groundwater needs to continually improve based on the latest science. This option would progress the scientific understanding of five key groundwater processes: • recharge rates and their spatial-temporal variations, including the impacts from climate variation/change, on- and off-farm water efficiency projects, and adapting river operations • dynamics of groundwater levels under stressed and evolving development conditions (e.g. shift from seasonal crops to permanent plantings) • connectivity between groundwater and surface water systems • changing patterns in groundwater quality over time • water needs of ecosystems that are partly or wholly dependent on groundwater and the impact on these ecosystems under different development scenarios. This would consider what ecosystems need in terms of groundwater levels or baseflows from aquifers to river systems. This option would be delivered in collaboration with consultancies and research centres. The outcomes from this option would provide the scientific evidence-base for future groundwater management decisions. For example, numerical groundwater models will be updated with the latest climate variability data and inform the review and implementation of water sharing plans.
Intent	Increase scientific knowledge of the processes occurring in NSW's groundwater resources, from areas of recharge to areas of discharge and the complex interactions in-between.
Challenges addressed	• Ensuring groundwater extraction levels are sustainable. • Improving community understanding about water resource management and water trading. • Declining groundwater levels and quality pose risks to towns and other water users completely reliant on groundwater. • Protecting groundwater dependent ecosystems.
Potential combinations	This option would build on Option 39. Improved data collection. It provides the basis for: • Option 9. Reliable access to groundwater by towns • Option 40. Training and information sharing programs • Option 43. Sustainable access to groundwater by all users • Option 44. Improved transparency in managing groundwater resources sustainably.
Considerations	This option requires an assessment of how this option could be implemented given the time required for scientific studies and the timing of the revision/replacement of water sharing plans across the state. A numerical groundwater model for the Peel alluvium is already under development.
Objectives	

Option 27. Implementation of a groundwater quality monitoring program

Source: Department of Planning, Industry and Environment—Water

Description	Groundwater quality determines what the groundwater within an aquifer can be used for and whether it needs further treatment. Groundwater quality can be naturally poor—such as the high uranium concentration in the Peel Fractured Rock groundwater source. However, declining groundwater quality can impact current and future water users (for example, groundwater with increasing salinity can become unsuitable for irrigating crops or watering stock). Declining groundwater quality can also have a negative impact on the environment and on groundwater dependent ecosystems. Poor groundwater quality is difficult and slow to remediate, so the right information is critical to taking a proactive approach to prevent this issue from occurring. This option would: • improve groundwater quality monitoring so that risks to groundwater quality can be identified early, including auditing the current bore network (and expanding the network if required) and implementing a regular sampling program • provide better information to inform groundwater quality management decisions and prevent degradation of groundwater quality, including implementing a data management program to improve data quality and sampling compliance, and collating groundwater quality data from industry and government sources into one database • improve methods for managing groundwater quality, including updating bore approval rules to include water quality parameters • revise policy and legislation to more effectively manage groundwater quality, such as reviewing legislation around point and diffuse pollution sources (including definition of roles and responsibilities across government agencies) and developing policy on the risk of mining activities increasing groundwater salinity • develop 3D geological, numerical flow and reactive transport models to inform future water quality management practices.
Intent	Improve long-term management and sustainability of groundwater quality.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Ensuring groundwater extraction levels are sustainable. • Declining groundwater levels and quality pose risks to towns and other water users completely reliant on groundwater. • Protecting groundwater dependent ecosystems.
Potential combinations	This option could be combined with: • Option 29. Protecting ecosystems that depend on groundwater resources • Option 30. Improving information about impacts of State Significant Development and State Significant Infrastructure projects on water • Option 44. Improved transparency in managing groundwater resources sustainably.
Considerations	Coordination between different government agencies is required to carry out tasks involving reviewing legislation and auditing the bore network (asset is owned by WaterNSW). The Department of Planning, Industry and Environment—Water is currently undertaking a water quality monitoring pilot program across New South Wales.
Objectives	

Option 28. Reducing risk of sediment compaction due to over-extraction of groundwater

Source: Department of Planning, Industry and Environment—Water

Description	Sediment compaction can occur when large amounts of water are extracted from an aquifer via pumping. The sediments compact because the water is partly responsible for holding the ground up. When the water is withdrawn, the sediments collapse. Sediment compaction can cause the land surface to subside and damage infrastructure such as roads, pipelines and foundations, and cause the collapse of bores. It can permanently reduce how much water can be stored within an aquifer. Inland alluvial groundwater systems like the Namoi have been identified as high risk for sediment compaction because the aquifers consist of fine grained, compressible sediments and there is significant decline in groundwater levels. Recent investigations undertaken in the Lower Namoi by the Department of Planning, Industry and Environment, Department of Planning, Industry and Environment—Water and the CSIRO have found negligible long-term aquifer compaction. However, a long-term sediment compaction monitoring program is needed to ensure it does not occur in the future. This option would: • review the bore monitoring program in areas of high risk of sediment compaction to collect data at sufficient frequency to capture the peak maximum drawdown near production bores • review the current extent of land subsidence monitoring benchmarks and expand if necessary • establish a land subsidence benchmark monitoring program • explore potential collaboration with Geoscience Australia to monitor ground surface displacement in areas of high levels of extraction.
Intent	Advance our knowledge about how to assess the long-term risk of sediment compaction in aquifers and develop an effective management strategy to target hotspots of declining groundwater levels in high risk/high priority aquifers.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Ensuring groundwater extraction levels are sustainable. • Declining groundwater levels and quality pose risks to towns and other water users completely reliant on groundwater. • Protecting groundwater dependent ecosystems.
Potential combinations	This option could be combined with: • Option 27. Implementation of a groundwater quality monitoring program • Option 39. Improved data collection • Option 45. Land use change and population growth impacts on water resources.
Objectives	

Image courtesy of the Department of Planning, Industry and Environment.

Option 29. Protecting ecosystems that depend on groundwater resources

Source: Department of Planning, Industry and Environment—Water

Description	A critical but often overlooked element of the water cycle is groundwater and groundwater dependent ecosystems. Groundwater dependent ecosystems support a range of species and provide important ecosystem services such as habitats. They also have inherent environmental value. Groundwater dependent ecosystems are classified broadly as terrestrial (vegetation communities), aquatic (wetlands and springs) or subterranean (aquifers and caves). These ecosystems support a variety of fauna and flora communities. It is critical that groundwater dependent vegetation is maintained during droughts when groundwater is also needed to support communities. This option would advance our knowledge and management of groundwater dependent ecosystems by: • understanding how changes to groundwater, including from climate change, determine threshold changes to groundwater dependent ecosystems • updating policy and guidelines to manage and protect groundwater dependent ecosystems—for example, providing guidance on how to characterise a groundwater dependent ecosystem and what an environmental impact assessment should consider • improving methodologies to identify and monitor groundwater dependent ecosystems, such as the vegetation condition of groundwater dependent ecosystems (including root depth and response to drought). The outcomes from this option could be used to review and amend water sharing plans to list high-priority groundwater dependent ecosystems.
Intent	• Support groundwater dependent ecological processes that support soils, fauna and flora. • Manage and protect valuable environments.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water available for ecosystems and species. • Ensuring groundwater extraction levels are sustainable. • Protecting critical environmental assets, in-stream ecological values and threatened species. • Protecting groundwater dependent ecosystems.
Potential combinations	This option could be combined with: • Option 26. Improved understanding of groundwater processes • Option 27. Implementation of a groundwater quality monitoring program • Option 39. Improved data collection.
Considerations	This option requires: • an expanded bore network to target groundwater dependent ecosystem locations for monitoring and evaluation • educational and communications material to promote awareness of groundwater dependent ecosystems including the relationships between above and underground processes and benefit to the local environment • consideration and inclusion of Aboriginal cultural connections to groundwater dependent ecosystems.
Objectives	

Option 30. Improving information about impacts of State Significant Development and State Significant Infrastructure projects on water

Source: Department of Planning, Industry and Environment—Water

Description	State Significant Developments (SSDs) and State Significant Infrastructure (SSIs) projects, such as coal mines, new dams or large road and rail projects, require access to water but may result in community concerns around the impact of the development on water sources. This option would make the impacts on water by these projects more transparent and accountable. It would advance knowledge for both the project proponents and the community about NSW Government requirements to address a project's water-related impacts and the availability of water resources to support the project. SSDs and SSIs are currently assessed under the *Environmental Planning and Assessment Act 1979*. This means that the Department of Planning, Industry and Environment—Water and the NRAR are not the consent authority but have a statutory advisory role. Under this option, the Department of Planning, Industry and Environment—Water would: • in consultation with other government agencies, review and publish a series of guidelines about how to assess and monitor water impacts for pre and post consent activities that could be referenced in exploration licence and development consent conditions. This includes reviewing existing guidelines referenced in the Secretary's Environmental Assessment Requirements (SEARS) • in collaboration with the Department of Regional NSW, improve the process and transparency of measured and modelled information submitted by project proponents and operators, including post approval reporting and actions taken by the department or the NRAR, as relevant. For example, this could include consolidating and publishing data in one place or providing guidance on how data should be reported. A consistent water reporting framework would be developed • expand water-specific compliance activities from water take to aquifer interference more broadly. This would be done using Aquifer Interference Approvals and would require a review of the Aquifer Interference Policy 2012. This review could also include greater clarification around where the Aquifer Interference Policy applies • investigate a suitable approach to entitlements and allocations for interference activities (with passive take, where the take cannot be reduced) versus other activities.
Intent	Provide transparency and accountability of water impacts from State Significant Developments and State Significant Infrastructure projects.
Challenges addressed	• Improving community understanding about water resource management and water trading. • Increasing demand and changing water needs due to population growth and expanding or new industries.

Option 30. Improving information about impacts of State Significant Development and State Significant Infrastructure projects on water (continued)

Potential combinations	This option could be combined with: • Option 26. Improved understanding of groundwater processes • Option 39. Improved data collection • Option 43. Sustainable access to groundwater by all users • Option 44. Improved transparency in managing groundwater resources sustainably.
Considerations	The option would need to consider: • the respective roles of the Department of Planning, Industry and Environment—Water, the Department of Planning, Industry and Environment—Planning, the Department of Regional NSW—Mining, Exploration and Geoscience, the relevant regulatory bodies and other agencies within the licensing, assessment and approvals framework. These roles would need to be assessed and agreed, including developing a single point of contact for external stakeholder • enforceability of data provision and reporting requirements • adequate resourcing to investigate aquifer interference issues and enforce compliance.
Objectives	

Image courtesy of the Department of Planning, Industry and Environment.

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.

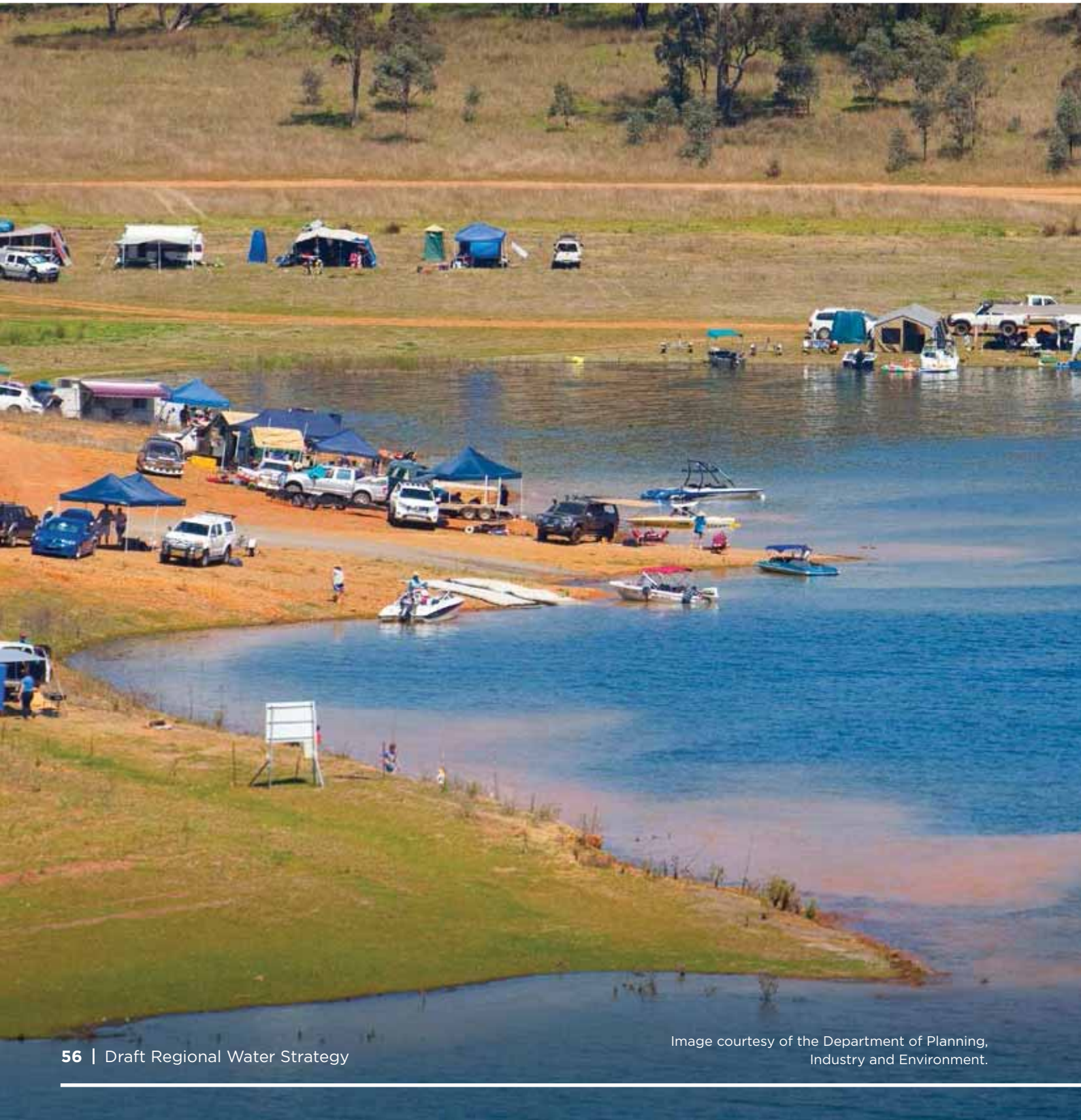


Image courtesy of the Department of Planning, Industry and Environment.

Option 31. Water efficiency projects (towns and industries)

Source: Department of Planning, Industry and Environment—Water and consultation with Councils

Description	This option would identify opportunities to investigate water efficiency projects for regional communities and businesses. This will include helping to identify, promote and provide incentives for the use of water efficient technologies, techniques and products; identifying opportunities for water reuse and recycling; and increasing the efficiency of on-farm storages. This option may require further research and development to identify suitable towns and businesses (including irrigators and the food processing sector) and direct appropriate information, education and incentives to various water users. This option could also be used to enable more water to be left in rivers for environmental purposes during droughts.
Intent	• Improve water security for regional communities and encourage water efficiency measures for industries to maintain and drive regional economic growth and productivity. • Reduce demand on water within the region.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increased climate variability and climate change is likely to require more effective methods to conserve water. • Large on-farm storages inefficiently store water. • Difficulty in delivering water to towns at the end of the system in dry periods.
Potential combinations	This option could be combined with other options designed to maintain and diversify water supplies, including reuse, recycle and stormwater projects and the review of urban water restrictions policy.
Considerations	This option requires: • collaboration with councils, including consideration of each council's integrated water cycle management strategy and any other policies • assessment of viable opportunities within and across the regions. Considerations include: • findings of water efficiency investigation projects • possible implementation programs to assist industry and local water utilities • collaboration between state government, local councils and key stakeholders to ensure projects are resourced and the successful implementation of pilot projects • whether there is a need to provide incentives to improve water efficiency.
Objectives	

Option 32. Improve water supply reliability

Source: WaterNSW 20 Year Infrastructure Options Study and Walgett Shire Council

Description	Delivering water along the length of the Namoi River can be challenging, particularly during warmer months when large amounts of water seep into the river bed and evaporate. Under climate change scenarios, the prospect of hotter average temperatures, higher evaporation and lower inflows into dams will further exacerbate the reliability of flows for users. Similarly, it is not unusual for general security licence holders to receive low or no allocations given the variable climate and large portion of water reserved for high priority needs. This option would explore infrastructure projects identified by Walgett Shire Council, and in the WaterNSW 20 Year Infrastructure Options Study for the Namoi region, that aim to improve efficiencies around delivering water along the length of the river, or improve reliability for licence holders. This includes: • a new weir at Blue Hole and transfer pipeline to Split Rock Dam—diverting high flows from the Namoi River upstream of Keepit Dam to Split Rock Dam, which has significantly less evaporation rates • Mollee Weir raising—increasing storage capacity and regulation of flows in the Lower Namoi. This could include providing recreational amenities for the town • a new re-regulation weir north of Boggabri—improving delivery efficiency for downstream users. The new weir could provide additional storage capacity and capture tributary flows that currently bypass Boggabri. This would also have benefits for nearby mine sites • a new 10 GL off-river storage near Tamworth to improve water security for Tamworth • a new weir and fish ladder on the Namoi River east of the junction with the Barwon River to support Walgett township and water flows in the Barwon-Darling River. This infrastructure option would raise water levels in the Namoi River by two meters to create a water body near the town that could be used for flow regulation, fishing, recreational and town amenity purposes.
Intent	• Enable greater operating flexibility for delivering flows to the lower reaches of the Namoi system. • Reduce losses from the system due to evaporation and seepage. • Improve reliability for water users in the Lower Namoi.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Difficulty in delivering water to towns at the end of the system in dry periods.
Potential combinations	This option could be combined with: • Option 2. Inter-regional pipelines, including inland diversion of water from the Macleay or Barnard rivers to the Namoi region • Option 3. Intra-regional pipelines.

Option 32. Improve water supply reliability (continued)

Considerations	This option requires assessment of the potential social, environmental and economic impacts and benefits of the infrastructure proposals, including: • consideration of the distribution of benefits (such as additional water because of reduced evaporation) amongst consumptive water users and the environment • protection of basic landholder rights • an assessment of the engineering and economic challenges of proposed projects • ensuring projects do not disproportionally impact on the environmental and natural functions of waterways • impacts on Aboriginal cultural heritage and water use • impacts on the environment, dependent ecosystems and dependent biota (including threatened species) from altered hydrology and surface water availability such as reduced flow variability, reduced in-channel habitat, reduced connectivity, reduced fish passage (downstream and upstream of the dam) and cold water pollution • connectivity to the downstream Barwon-Darling system • possible measures to mitigate impacts such as biodiversity offsets, environmental flows and fish passage in accordance with requirements of the *Fisheries Management Act 1994*.
Objectives	
Further information	**Water NSW website:** **www.waternsw.com.au/projects/infrastructure-studies/20-year-infrastructure-options-study**

Image courtesy of the Department of Planning, Industry and Environment.

Option 33. Review of water markets in the Namoi region

Source: Department of Planning, Industry and Environment—Water and Department of Primary Industries—Agriculture

Description	A review of the efficiency and effectiveness of water markets in the Namoi, 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 Namoi and Peel systems • transparency of information to enable the market to operate effectively.
Intent	• Provide transparency and confidence to water users in the Namoi, as well as educating water users about the operation of and rules governing the water trade in the Namoi. • Decrease delivery losses and increase allocation reliability through the use of market mechanisms.
Challenges addressed	Improving community understanding about water resource management and water trading.
Potential combinations	Depending on the outcome of the review, this option could be combined with water efficiency and policy options such as the review of water accounting and allocations.
Considerations	• The review could investigate accounting for losses, trade timeliness, the ability to broaden the trading framework into unregulated systems once metering has been implemented and real-time trading of supplementary allocation, as well as other initiatives in line with the ACCC's Inquiry into Murray-Darling Basin water markets. • The review would need to take account of previous work completed as part of the Namoi (surface water) water resource plan. • This option requires greater consideration of environmental implications and basic landholder rights, especially around changes to water availability and flow delivery. • This option would need to consider existing rules in the *Water Management Act 2000* and requirements under the *Commonwealth Water Act 2007* and the Murray-Darling Basin Plan. Changes to trading rules would involve negotiation with affected landholders and review of water sharing plan rules. • Trade restrictions should be based on real physical constraint and avoidance of third-party impacts on the water rights of those not party to the trade. It would also need to consider the potential for market dominance by larger water buyers or large entitlement holders.
Objectives	
Further information	**ACCC Inquiry into Murray-Darling Basin water markets:** **www.accc.gov.au/focus-areas/inquiries-ongoing/murray-darling-basin-water-markets-inquiry**

Option 34. Review urban water restriction policy

Source: Department of Planning, Industry and Environment—Water

Description	Development of a comprehensive policy on water use standards and appropriate temporary water restriction triggers and levels for regional towns. The investigation would complement the Namoi Incident Response Guide and assist councils and local water utilities to revise drought management plans.
Intent	Demand management approaches, such as temporary water restrictions, have proven to be a very effective way to avoid major augmentations to date for some local water utilities in NSW. They also assist local water utilities manage water supply shortages during drought by slowing the depletion of available supplies. Applying temporary urban water restrictions for residents and commercial operators in regional New South Wales is the responsibility of the state's 92 local water utilities. This has resulted in state-wide inconsistencies in: • water restriction definitions and gradings • triggers for introducing and lifting of urban water restrictions • the delegated authority for imposing and lifting urban water restrictions (e.g. Mayor, General Manager). The intention of this option is for the NSW Government to investigate the range of issues that are relevant to improving the consistency of temporary urban water restrictions in NSW and identify options for delivering improvements in this area of urban water demand management. This option could be complemented by the development of community water efficiency campaigns.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increased climate variability and climate change is likely to require more effective methods to conserve water.
Potential combinations	This option could be combined with other demand and supply options for regional towns including: • Option 31. Water efficiency projects (towns and industries) • Option 36. New drought operational rules (Namoi and Peel rivers).
Considerations	Considerations include: • a facilitation role for joint organisations • consistency in water restriction definitions • flexibility for individual councils to apply restrictions based on local circumstances • consideration of the water restrictions levels on economic outputs, productivity and employment in the Namoi region • consideration of a consistent process across NSW.
Objectives	

Option 35. Implementing the Great Artesian Basin Strategic Management Plan

Source: Department of Planning, Industry and Environment—Water

Description	The Great Artesian Basin Strategic Management Plan was developed by the Australian, state and territory governments. The Strategic Management Plan sets out guiding principles to manage the Great Artesian Basin to achieve economic, environmental, cultural and social outcomes. Under this option, NSW would develop and fund an implementation plan to deliver the Strategic Management Plan outcomes within NSW. This would require a policy framework that includes: • management of the recovery of groundwater pressures and associated water savings from infrastructure projects to reduce wastage of groundwater from the Great Artesian Basin (such as reserved and planned environmental water made available as new access licences via controlled allocations, incentives for private investment to save water and access to groundwater for towns) • bore owners' rights and responsibilities with respect to infrastructure installation and maintenance, and education and compliance programs to promote the shared management of the resource • the design and implementation of water use practices that minimise the amount of groundwater extracted. This would include developing a policy for reasonable use guidelines for domestic and stock bores.
Intent	Improve long-term management and sustainability of groundwater systems.
Challenges addressed	• Ensuring groundwater extraction levels are sustainable. • Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increased climate variability and climate change pose greater risks to ecosystems and species. • Protecting groundwater dependent ecosystems.
Potential combinations	This option could be combined with: • Option 26. Improved understanding of groundwater processes • Option 43. Sustainable access to groundwater by all users.
Objectives	
Further information	**Great Artesian Basin Strategic Management Plan:** **www.agriculture.gov.au/water/national/great-artesian-basin/strategic-management-plan**

Image courtesy of the Department of Planning, Industry and Environment.

Strengthening community preparedness for climate extremes

Opportunities to develop fit for purpose policies and regulation to protect town water security, strengthen community health and wellbeing and better manage risks.

Option 36. New drought operational rules (Namoi and Peel rivers)	
Source: Department of Planning, Industry and Environment—Water	
Description	The Namoi Incident Response Guide outlines the framework for managing extreme events in the Namoi based on the principles outlined in the *NSW Extreme Events Policy*. This guide provides an expanding toolkit of approaches for water managers to select from as an event becomes more severe. Applying the new climate data and updated modelling undertaken for the regional water strategies, this option would review the effectiveness of the NSW Namoi Incident Response Guide, including assessing the merit of changing the current system operation rules. For example, limiting the delivery of water to different sections of the regulated river has been used to minimise delivery losses during extreme events. However, this approach can impact on flows necessary to sustain refuge pools and lead to severe impacts on threatened species and ecological communities, especially those that require permanent water.
Intent	Improve water delivery and maintain effective reserves for high priority needs (regional towns, stock and domestic users and high-security entitlement holders) during extreme events.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Providing critical human needs water during extreme events such as drought. • Increased climate variability and climate change is likely to require more effective methods to conserve water.
Potential combinations	This option could be combined with: • Option 4. Suspension of water sharing plan provisions for planned environmental water for critical needs in the Peel River • Option 37. Review of water accounting and allocation process • Option 38. Investigation of licence conversions.

Option 36. New drought operational rules (Namoi and Peel rivers) (continued)

Considerations	This option requires: • assessment of the potential water security risk to regional towns and stock and domestic users in the Namoi and Peel valleys • assessment of potential environmental impacts (such as impacts on threatened species and ecological communities) and implications for planned environmental water (for example, changing the timing and nature of water releases could have implications on threatened species populations in some sections of the regulated river) • consideration of possible (environmental) offsets needed to meet Murray-Darling Basin Plan requirements • consideration of whether amendments to the current water sharing plans for the Peel and Namoi regulated rivers are required • assessment of the impacts on water licence holders in the lower catchment • equity considerations between different types of water users and different locations • feedback on public and industry acceptance of the option. A review of the effectiveness of the incident response guide may require changes to the Namoi Surface Water Resource Plan, which would likely trigger the review and amendment requirements in the Murray-Darling Basin Plan. This option could be supported by local water utility drought management plans that consider the possibility of an extreme drought, an order of magnitude larger than has been experienced previously, and a strategy to implement if such an event unfolds. Note: This option would provide operational efficiency to meet acceptable levels of supply risk, but feedback from the community is required on the potential impacts on environmental, stock and domestic, cultural and groundwater users.
Objectives	
Further information	**Extreme Events Policy:** www.industry.nsw.gov.au/water/what-we-do/legislation-policies/eep **Incident Response Guide for the Namoi:** www.mdba.gov.au/publications/mdba-reports/namoi-water-resource-plan

Option 37. Review of surface water accounting and allocation process

Source: Department of Planning, Industry and Environment—Water

Description	The option would review several settings of the current water accounting and water allocation process in the Namoi and Peel regulated river systems, and consider whether and how the new climate data should be used when making water allocation decisions. This option would include: • reviewing the water allocation process • examining the effects of updating the 'worse inflow sequence' reference in the water sharing plan for the Namoi and Peel regulated rivers (for example, to incorporate more recent inflow records and climate change considerations) and what this means for allocating water to different users • investigating changes to the volume of water stored in Chaffey, Keepit and Split Rock dams for regional towns, stock and domestic water users and high security licence holders (and applying different water delivery mechanisms) • review of the allocation and management of water in the linked Peel Regulated River and alluvial aquifer systems in light of the experience in the recent droughts • investigating how conveyance 'losses' are accounted for • investigating the inclusion of provisions for cultural flows • reviewing the process for releasing available water determinations and introducing additional steps to the process to improve water security and reliability, access to information and transparency.
Intent	More effectively meet basic landholder rights, stock and domestic water users and high priority users in the Namoi (additional buffer to support town water security in the Namoi).
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Balancing water needs between different water users.
Potential combinations	This option could be combined with: • Option 31. Water efficiency projects (towns and industries) • Option 36. New drought operational rules (Namoi and Peel rivers).
Considerations	• The review would need to take account of previous work completed as part of the Namoi Surface Water Resource Plan. • This option could investigate a more conservative water allocation process to ensure more water is kept in storage for basic landholder rights, stock and domestic and high security licence holders. It could also provide an additional buffer to support town water security in the Namoi. • Consideration would need to be given to the likely benefits or impacts of any changes (including any accounting or operational changes to the delivery of water) on key environmental processes and cultural values.
Objectives	
Further information	www.industry.nsw.gov.au/water/allocations-availability/allocations/how-water-is-allocated

Option 38. Investigation of licence conversions

Source: Department of Planning, Industry and Environment—Water

Description	This option would consider the potential benefits from voluntary conversion of general security to high security licences. This investigation would help determine the level of water security in the Namoi region. This option would also review and audit the impacts of surface water licence activation on other water users and licences.
Intent	Provide greater flexibility in agricultural production, including: • long-term transition to higher value enterprises (such as vegetables and horticulture) that may require high security water • support more water efficient cropping systems and methods.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Difficulty in delivering water to towns at the end of the system in dry periods.
Potential combinations	This option could be combined with: • Government commitment 1. New Dungowan Dam • Option 36. New drought operational rules (Namoi and Peel rivers) • Option 37. Review of water accounting and allocation process.
Considerations	This option requires: • consideration of current policy, regulatory and water management constraints and risks to other water licence holders and planned environmental water • consideration of impacts on general security users during dry periods • consideration of environmental implications, especially changes to flow regime, water availability and flow delivery • consideration of the types of licences able to be converted • consideration of how the conversion rate is determined (for example, 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 the dam) • amendments to the water sharing plans for the Peel and Namoi regulated water sources • feedback on public acceptance of the option • significant consultation to ensure the methodology for determining the conversion rate is accepted by key stakeholders. This option would also address the recommendation from the Natural Resources Commission to investigate licence activation risks and consider economic scenarios and propose options to manage risks. Note: Conversions from general security to high security are not currently permitted under the water sharing plan. Significant consultation will be required to ensure the methodology for determining the conversion rate is accepted by key stakeholders.
Objectives	

Option 39. Improved data collection

Source: Department of Planning, Industry and Environment—Water, Department of Primary Industries—Agriculture and consultation with joint organisations and councils

Description	This option would improve data collection around water use by industry, the environment and towns in the Namoi region. This would generate better information to inform future water management decisions in the region. This option would investigate opportunities to refurbish existing infrastructure (e.g. groundwater monitoring bores) and install new infrastructure and technology to enable better collection of water flows, levels and quality parameters. It would also investigate ways to harness water data collected by industries (e.g. in Environmental Impact Statements and annual compliance reports). The option would review the water monitoring programs that use the monitoring infrastructure and prepare a unified state-wide monitoring program strategy.
Intent	Inform future water management in the Namoi region (such as the operation of water sharing plans and water resource plans).
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Declining groundwater levels and quality pose risks to towns and other water users completely reliant on groundwater. • Ensuring groundwater extraction is sustainable.
Potential combinations	This option would provide the basis for: • Option 26. Improved understanding of groundwater processes • Option 43. Sustainable access to groundwater by all users • Option 44. Improved transparency in managing groundwater resources sustainably. It can also be combined with Option 30. Improving information about impacts of State Significant Development and State Significant Infrastructure projects on water.
Considerations	The implementation of the NSW Government's non-urban water metering framework will assist in improving data collection on water use. Further investigation is required to identify the level of water quality required for different water users (for example, industry users versus town water users). Consideration would also need to be given to how this option can contribute to monitoring, evaluation and reporting as part of an adaptive management approach for managing water in the Namoi and its hydrologically connected systems. Assessment would be needed of funding options by the NSW and Australian governments to undertake these projects. Note: The department received comments on the need for improved climate data during consultation on the water resource plan development.
Objectives	

Option 40. Training and information sharing programs

Source: Department of Planning, Industry and Environment—Water

Description	This option would deliver: • training and information sessions on the new regional water strategies climate data and modelling to build confidence in the new approach and identify opportunities for wider use of the new datasets • training and information about groundwater resources and how they are managed to assist councils and other water users to make more informed decisions about their water supply security • information sessions on NSW water market products, systems and processes, as well as on water trading rules between water sources within NSW, to facilitate water moving to higher value uses that will support the regional economy. These sessions would also provide information to water users around understanding the risk profile of water availability. This option would also consider how best to publicly share data, and what data analytics and information products are needed for different types of water users including councils, Aboriginal people, environmental water managers and industries. This option could also include training for councils around water quality and monitoring.
Intent	Assist water users to make informed decisions about their water supply security, provide greater transparency around water management and water modelling, and inform councils in the development of their own Integrated Water Cycle Management Strategies and Regional Town Water Strategies.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Improving community understanding about water resource management and water trading.
Potential combinations	This option could be linked to other options designed to strengthen community preparedness for climate extremes, maintaining and diversifying water supplies, and protecting and enhancing natural systems.
Objectives	

Option 41. Maintain amenity for regional towns during drought

Source: Department of Planning, Industry and Environment—Water, Tamworth Regional Blueprint and Narrabri Shire Council

Description	During droughts or extended dry periods, maintaining the amenity of water dependent town greens spaces, public pools and recreational areas can be challenging for local land managers. This option will investigate opportunities to improve the availability of water for the maintenance of important public spaces, with a focus on promoting the liveability and amenity of regional towns during dry periods. This option could include investigating: • opportunities to maintain a minimum water level in dams such as Keepit, Chaffey and Split Rock to allow for sporting and water pursuits • the installation of a new weir on the Peel River close to Tamworth to provide water-related activities, amenity and tourism opportunities, including for water-based recreation such as swimming, canoeing and boating • installation of a new weir on Narrabri Creek to provide recreation, amenity and tourism benefits for Narrabri.
Intent	Support regional communities to remain green during dry periods to: • ensure town amenity, liveability and recreational opportunities • maintain social, mental and physical health of communities • support towns in retaining and attracting people and businesses.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Providing opportunities to maintain amenity during drought.
Potential combinations	This option could be combined with: • Option 6. Reuse, recycling and stormwater projects • Option 31. Water efficiency projects (towns and industries).
Considerations	This option requires: • identification of high value community 'green' assets • an assessment of the amount of water needed to maintain 'green' regional centres and to maintain recreational activities • an assessment of available alternative water sources, including treated wastewater and groundwater and harvested stormwater • an assessment of how the options should interact with individual town integrated water cycle management strategies • consideration and assessment of the impact of drought on regional economies and mental health due to lost tourism, recreational, sporting, educational activities. Tamworth Regional Council is undertaking a feasibility study to assess if a weir or series of weirs is viable in the Peel River. The results of this study would inform further development of this option and would require additional assessment of potential impacts and benefits, including: • distribution of benefits amongst consumptive water users and the environment • engineering and economic challenges • environment, hydrology and natural function of waterways, including dependent ecosystems and biota • Aboriginal rights, cultural heritage, interests and access to water • connectivity downstream of the weir • possible measures to mitigate impacts such as biodiversity offsets, environmental flows and fish passage.
Objectives	
Further information	www.tamworth.nsw.gov.au/develop/integrated-planning/blueprint-100

Option 42. Improving understanding of low water availability on water dependent industries

Source: Department of Primary Industries—Agriculture and Namoi Unlimited

Description	This option would undertake a study using the new climate data and modelling methods to understand how sequential years of low water availability may affect on- and off-farm water dependent industries, including town water dependent industries. The study could: • provide insights into the changing economic risks of sequential years of low water availability on farm business risks • provide a regional understanding of how sequential years of low water availability may change the secondary industries that rely on water dependent agriculture (e.g. cotton gins or abattoirs) • indicate the types of industries or crops that could be suited to the region in a more variable or drier future climate. During single or short periods of low water availability, growers respond by reducing planting, which results in reduced cashflow and subsequently reduced operating expenditure. However, with sequential low water availability years, this may flow in to reduced capital expenditure. This option could provide information about when some industries become unviable due to the reduced capital investment in on- and off-farm infrastructure. This could feed into long-term business planning and training packages for businesses. This option could be implemented through a partnership between government, joint organisations, academia and agricultural research and development corporations.
Intent	Increasing resilience of businesses in the Namoi region.
Challenges addressed	Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries.
Potential combinations	This option could be combined with: • Option 31. Water efficiency projects (towns and industries) • Option 39. Improved data collection • Option 40. Training and information sharing programs.
Considerations	This option could involve collaboration between a range of research institutions including Department of Primary Industries—Agriculture, research and development corporations and joint organisations.
Objectives	

Option 43. Sustainable access to groundwater by all users

Source: Department of Planning, Industry and Environment—Water

Description	Groundwater extraction limits balance environmental, economic and social benefits and impacts. This option would establish a systematic state-wide process to ensure ongoing access to groundwater resources by the environment, landholders, towns, agriculture, mining and other industries. It would review existing groundwater resource extraction limits to incorporate up-to-date information, including: • scientific studies that incorporate new climate variation/change datasets to give an improved understanding of groundwater processes • insights into ways to improve the integration of surface water and groundwater management • knowledge about social and economic impacts under different development scenarios. The option would investigate: – present and predicted trends in water levels and recharge rates to aquifers using updated modelling and climate variability/change data – the connection between groundwater and surface water resources, including the impact of water efficiency projects on return flows – what resource extraction limits will need to be set in the future to ensure sustainable access to groundwater by consumptive users and the environment – ways to better manage those systems where the entitlement exceeds the resource extraction limit, particularly those systems where extraction is now at or near the extraction limit.
Intent	This option would consider what groundwater resource extraction limits would need to be set in the future to ensure sustainable access to groundwater by both consumptive water users and the environment.
Challenges addressed	• Ensuring groundwater extraction levels are sustainable. • Declining groundwater levels and quality pose risks to towns and other water users completely reliant on groundwater. • Protecting groundwater dependent ecosystems. • Ensuring Aboriginal cultural values are protected.
Potential combinations	This option would use the outcomes from Option 26. Improved understanding of groundwater processes. It provides the basis for Option 43. Sustainable access to groundwater by all users.
Considerations	This option would need to consider: • required policy or regulatory changes • commitments made under the Murray-Darling Basin Plan and the mandatory review of sustainable diversion limits in 2026.
Objectives	

Option 44. Improved transparency in managing groundwater resources sustainably

Source: Department of Planning, Industry and Environment—Water, consultation with joint organisations and councils and Natural Resources Commission

Description	This option would review, revise and develop the necessary policies to give greater transparency and certainty in managing: • extraction within sustainable diversion limits. This would require a review of account rules and the annual groundwater allocation process. It would make the assessment process for Available Water Determinations more formulaic and transparent (currently underway) • groundwater systems where the entitlements plus basic landholder rights exceed the extraction limit. This project would look at better ways to proactively manage these systems. This could include investigating and managing risks associated with inactive licences activating. It would give clarity to water users about how overallocated groundwater systems will be managed as activation and use increases over the next 30 years. This action was also recommended in the Natural Resources Commission's review of the Peel water sharing plan • areas where there are high levels of extraction or groundwater interference (i.e. groundwater extraction is causing declines in water levels to unacceptable levels). This project would develop a policy with a series of escalating management actions corresponding to stages of water level decline. It would provide certainty to all water users about what actions government will take and when (currently underway).
Intent	Within a framework of sustainable access to groundwater by all users (Option 43), this option would provide greater transparency and certainty to water users about actions that the NSW Government will take to manage groundwater resources at the water source and local scales.
Challenges addressed	• Ensuring groundwater extraction levels are sustainable. • Declining groundwater levels and quality pose risks to towns and other water users completely reliant on groundwater. • Protecting groundwater dependent ecosystems. • Ensuring Aboriginal cultural values are protected. • Improving community understanding about water resource management and water trading.
Potential combinations	This option would use the outcomes from: • Option 26. Improved understanding of groundwater processes • Option 43. Sustainable access to groundwater by all users.
Considerations	This option may require policy or regulatory changes.
Objectives	
Further information	**NRC Review of the Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010:** www.nrc.nsw.gov.au/2019-2020-wsp-reviews

Option 45. Land use change and population growth impacts on water resources

Source: Department of Planning, Industry and Environment—Water and Namoi Joint Organisation of Councils

Description	This option would investigate the potential impacts on water resources due to land use changes and projected population growth in the Namoi region. This option includes: • reviewing land use trends and population projections to assess potential impacts on water quality and availability • assessing the adequacy of current land use planning controls to protect water resources. This option could also investigate methods for implementing planning controls to mitigate impacts on water dependent Aboriginal cultural sites. The Namoi Joint Organisation of Councils is investigating a project around aligning land use, water resources and agricultural industries.
Intent	Provide important information for local councils and the NSW Government to help in decision-making processes regarding current land use and future land use applications in the region.
Challenges addressed	• Increased climate variability and climate change is likely to reduce water security and reliability for towns and industries. • Increasing demand and changing water needs due to population growth and expanding or new industries. • Balancing water needs between different water users. • Protecting critical environmental assets, in-stream ecological values and threatened species. • Protecting groundwater dependent ecosystems. • Ensuring Aboriginal cultural values are protected.
Potential combinations	This option could be combined with: • Option 16. Providing incentives to landholders to conserve and rehabilitate riparian, wetland and floodplain vegetation • Option 18. Riparian habitat restoration and re-establishing threatened species • Option 20. Modification and/or removal of floodwork structures causing adverse impacts • Option 26. Improved understanding of groundwater processes • Option 27. Implementation of groundwater quality monitoring program.
Considerations	This option requires: • detailed assessment of existing planning controls • improved understanding of impacts on water resources from land use changes • close collaboration with other government agencies.
Objectives	

Image courtesy of the Department of Planning, Industry and Environment.

Improving the recognition of Aboriginal people's water rights, interests and access to water

Opportunities to protect and strengthen cultural landscapes, practices, knowledge and traditions. Supporting empowerment, self determination and economic advancement of Aboriginal people, as well as strengthening community wellbeing.

Given the challenges and risks raised by COVID 19 in 2020, the Department of Planning, Industry and Environment has not yet engaged with Aboriginal communities in the Namoi region on the Draft Namoi Regional Water Strategy. Engagement will begin in early 2021. The options that follow are options raised by Aboriginal communities in other regions. We have included these options here as a starting point for discussions. These options will be amended or replaced based on the specific feedback and aspirations of the Namoi Aboriginal communities.

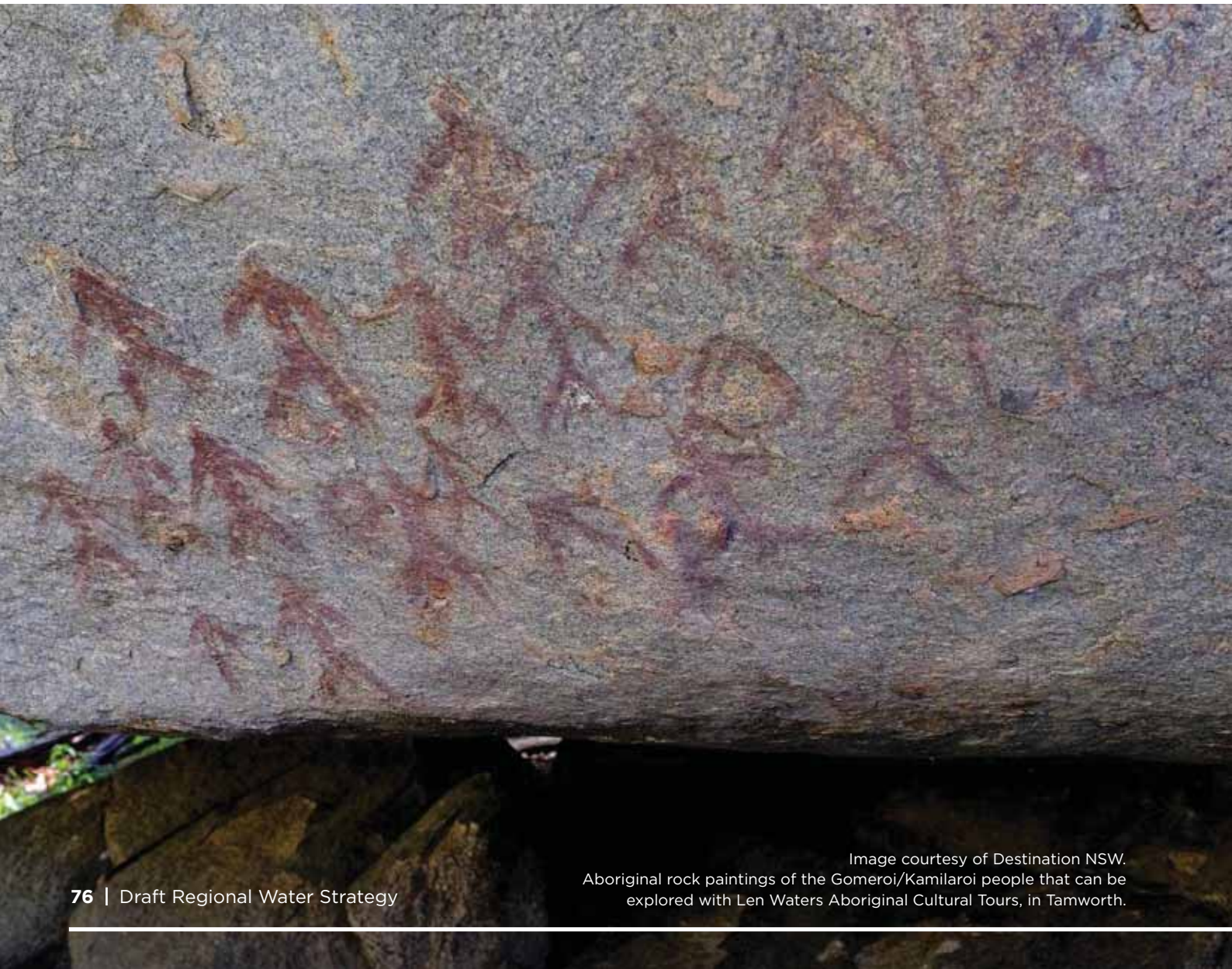


Image courtesy of Destination NSW.
Aboriginal rock paintings of the Gomeroi/Kamilaroi people that can be explored with Len Waters Aboriginal Cultural Tours, in Tamworth.

Option 46. Integrating Aboriginal knowledge into groundwater decision making

Source: Department of Planning, Industry and Environment—Water

Description	Groundwater is increasingly important for secure water supply to many users as surface water is becoming more unreliable and the number of applications for groundwater water supply works has significantly increased. While there are provisions within the water sharing plans and water resource plans to consider culturally significant sites in assessment process for these supply works, this process can be improved. This option would review the assessment and approval process for water supply works and dealings to better integrate Aboriginal knowledge into the decision-making process and protect significant sites into the future.
Intent	Review water supply work and dealing assessment process to better integrate knowledge of Aboriginal cultural significant sites.
Challenges addressed	• Aboriginal people's rights and interest are not adequately recognised or provided for in current water law and policies, and there are limited opportunities to influence management decisions. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This option could be combined with: • Option 48. Water dependent cultural practice and site identification project • Option 52. Establish a regional Aboriginal Water Advisory Committee.
Considerations	• This option could be considered at a state level through a state-wide Aboriginal water policy. • This option would need to ensure that any Aboriginal science or knowledge remains the property of Traditional Owners, is protected and managed appropriately.
Objectives	

Option 47. Culturally appropriate water knowledge program

Source: Department of Planning, Industry and Environment—Water and consultation with Aboriginal communities in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	The management of water can often be complex, with many layers of government playing different roles in the management and delivery of water across the Namoi region. This option would develop a culturally appropriate water knowledge program to increase the capacity of Aboriginal people across the Namoi so that they can more effectively participate in negotiations on water management and policy related matters that affect them. This program could include increased communication between Aboriginal groups and relevant government agencies on key topics.
Intent	• Improve the ability of Aboriginal community to understand the complexities of water management in NSW. • Improve water knowledge and participation across all ages and communities.
Challenges addressed	• Lack of culturally appropriate information about how governments manage water. • Aboriginal people's rights and obligations are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions.
Potential combinations	This could be combined with: • Option 48. Water dependent cultural practices and site identification project • Option 52. Establish a regional Aboriginal Water Advisory Committee • Option 56. River Ranger Program.
Considerations	Ensure program training is created and delivered in a culturally appropriate manner. This may include the following: • building skills and accreditations/qualifications in key community members who can take this back to the broader community • hosting training in the community or in appropriate settings • ensuring Aboriginal people have a chance to assist in the development and delivery of training programs • hosting training with school aged children at important sites to improve knowledge and appreciation. This option could be considered at a state level through a state-wide Aboriginal water policy.
Objectives	

Option 48. Water dependent cultural practices and site identification project

Source: Department of Planning, Industry and Environment—Water and consultation with Aboriginal communities in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	Classify and map water dependent cultural sites throughout the Namoi region. This would include the identification and mapping of cultural sites, places of spiritual significance and places used by Aboriginal communities for traditional and contemporary uses, such as hunting, recreation and economic uses. Intellectual property and cultural knowledge would be protected and retained by Aboriginal people.
Intent	• Develop a resource for Aboriginal people to help with planning of cultural and environmental water and possible impacts of other management and development decisions. • Enable Aboriginal communities to educate the wider community to develop a greater understanding of cultural values and connections to rivers and wetlands across the Namoi region.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways. • Ensuring Aboriginal cultural values are protected.
Potential combinations	This could be combined with options to protect and enhance natural systems, as well as Option 49. Secure flows for water dependent cultural sites.
Considerations	• We have heard from Aboriginal people in regions across NSW that they should retain ownership of information they share. • Mapping of different aspects of Aboriginal cultural values has previously been undertaken in the Namoi region by various agencies and organisations. These resources can assist with the implementation of this option. • The Aboriginal Waterways Assessment tool has been piloted by the Murray-Darling Basin Authority and is currently being used across the Basin. This option could be considered at a state level through a state-wide Aboriginal water policy.
Objectives	
Further information	**The Aboriginal Waterways Assessment program:** **www.mdba.gov.au/publications/mdba-reports/aboriginal-waterways-assessment-program**

Option 49. Secure flows for water dependent cultural sites

Source: Department of Planning, Industry and Environment—Water and Aboriginal consultation in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	Aboriginal people have a close spiritual connection with waterways. In the Namoi catchment, water dependent cultural sites (including places of spiritual significance and places of traditional hunting, recreation and cultural uses) are susceptible to dry conditions. We have heard through consultations and in other regions that Aboriginal communities are deeply affected during dry periods and drought due to the reduction in their ability to access water for cultural purposes. This option would investigate opportunities to improve the rate and consistency of flows to places of cultural significance. The places of cultural significance would be identified by Aboriginal community members. This option would also investigate supplying water to Aboriginal communities and assets.
Intent	• Improve the quality and consistency of flows at water dependent cultural sites across the Namoi catchment. • Improve recognition of cultural sites and their protection and management. • Ensure cultural sites are appropriately considered and supported in the Namoi water management system.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways. • Ensuring Aboriginal cultural values are protected.
Potential combinations	This option could be combined with: • Option 48. Water dependent cultural practices and site identification project • Option 51. Regional Cultural Water Officer employment program • Option 52. Establish a regional Aboriginal Water Advisory Committee • Option 56. River Ranger Program. This option could also be combined with environmental options for shared benefits.
Considerations	This option requires consideration of: • where water would be sourced—surface water or groundwater • how water would be delivered and whether new infrastructure is needed to deliver water. • work undertaken as part of the cultural site and practices mapping option • protecting groundwater discharges to springs and streams • use of planned and held environmental water • assessment of potential impacts on the environment and water users in the Namoi region. This option would be informed by connectivity options arising from the Western Regional Water Strategy.
Objectives	

Option 50. Shared benefit project (environment and cultural outcomes)

Source: Department of Planning, Industry and Environment—Water and Aboriginal consultation in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	Water for the environment plays a vital role in sustaining the health of rivers and wetlands, and supporting their ecological, cultural and economic values. This option would investigate opportunities for shared benefits from using water for the environment to also achieve cultural environmental outcomes, recognising it does not replace the provision of cultural flows. Shared benefits may include fish movement and support for populations of nesting fish species such as Murray Cod.
Intent	• Where shared benefits may exist, explore cultural outcomes from the use of water for the environment. • Support, incorporate and implement traditional Aboriginal ecological knowledge into water management action plans for the environment. • Support the cultural connection of Aboriginal people to water-sustained environments.
Challenges addressed	• Increased climate variability and climate change pose greater risks to ecosystems and species. • Delivering sufficient environmental flows to the end of the system and ensuring it achieves its intended purpose. • Aboriginal people's rights and obligations are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways. • Ensuring Aboriginal cultural values are protected.
Potential combinations	This option could be combined with other options linked to improving the recognition of Aboriginal people's water rights, interests and access to water, as well as options designed to protect and enhance natural systems.
Considerations	This option would need to consider: • development of capacity and resources within Aboriginal communities to support their participation in environmental water planning • appropriate channels for Aboriginal community members to engage with environmental water holders to identify shared watering needs • the need and frequency of watering at different times of the year to achieve cultural outcomes. Environmental water holders are responsible for the use of environmental water. The primary consideration in using this water is the achievement of environmental outcomes. Options that identify water dependent cultural practices and sites across river systems and waterways would provide more resources for Aboriginal people to work with environmental water holders. This option could be considered at a state level through a state-wide Aboriginal water policy.
Objectives	

Option 51. Regional Cultural Water Officer employment program

Source: Department of Planning, Industry and Environment—Water and Aboriginal consultation in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	Investigate models for establishing Cultural Water Officer roles to assist with engaging with Aboriginal people regarding water management in the Namoi. Responsibilities of this role could include: • increasing the general knowledge of the broader Aboriginal community about water management matters and the water licencing framework in a culturally appropriate way • coordinating engagement with local Aboriginal people on water management matters • promoting and supporting self-determination and representation • channelling information between Aboriginal people and government bodies and key stakeholders.
Intent	• Improve the awareness and involvement of local Aboriginal community members in the management of water resources across the Namoi. • Enable local Aboriginal people to use their local knowledge and skills to assist in decisions about water use and management. • Enable more equitable and collaborative relationships with stakeholders and codesigned programs.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science is not effectively integrated into water management in culturally appropriate ways. • Improving community understanding about water resource management and water trading.
Potential combinations	This option could be combined with Option 56. River Ranger Program.
Considerations	This option would need to consider: • the operational and project budget to support the program • the location of officers and whether they would sit within government or within an Aboriginal organisation. This option could be considered at a state level through a state-wide Aboriginal water policy.
Objectives	

Option 52. Establish a regional Aboriginal Water Advisory Committee

Source: Department of Planning, Industry and Environment—Water and Aboriginal consultation in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	Establish an Aboriginal Water Advisory Committee. This committee would improve the ability of Aboriginal groups across the region to have a unified voice on water matters that affect them and their communities. The committee could also be responsible for matters including: • guiding the purchase and management of water entitlements for Aboriginal Nations to receive cultural flows • defining the cultural water flow needs for Aboriginal people in the region • providing representation for the wider Aboriginal community including those not part of a peak organisation or representative body. This option could facilitate the input and application of Aboriginal knowledge principles to land and water management. It should also consider the priority areas under the National Agreement on Closing the Gap.
Intent	• Improve the representation of Aboriginal people in decision making. • Provide a point of contact for water managers to engage with the region's Traditional Owners. • Broadly representing Traditional Owners of the region who have cultural knowledge and can speak for Country.
Challenges addressed	• Aboriginal people's rights and obligations are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This option could be combined with other options linked to improving the recognition of Aboriginal people's water rights, interests and access to water, as well as options designed to protect and enhance natural systems.
Considerations	Aboriginal people have raised considerations such as having: • Aboriginal people with an interest in water and cultural authority to speak for Country • legislative backing for the committee. This option will need to consider how the regional committee would interact and be involved with other groups, the process for identifying and electing representatives to sit on the committee and the governance framework. It would also need to consider how Aboriginal people are involved in water decision making outside of this committee. This option could be considered at a state level through a state-wide Aboriginal water policy.
Objectives	

Option 53. Water allocations for Aboriginal communities

Source: Department of Planning, Industry and Environment—Water and Aboriginal consultation in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	Funding to support Aboriginal people to purchase water entitlements and infrastructure (such as pumps) that can be used to improve economic and cultural outcomes across the Namoi region.
Intent	Give Aboriginal people more secure access to water for spiritual, cultural, social, environmental and economic purposes, as well as open up opportunities for investment in water dependent initiatives and cultural projects.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This option could be combined with: • Option 47. Culturally appropriate water knowledge program • Option 52. Establish a regional Aboriginal Water Advisory Committee.
Considerations	The option would need to consider the following: • the Australian Government's pledge of $40 million in funds to support the acquisition of water entitlements for cultural purposes across the Murray-Darling Basin • lessons learned from the Murray-Darling Basin Authority Water Efficiency Measures program in supporting the purchase of water entitlements for cultural flows in NSW • providing sufficient funding to meet ongoing Aboriginal needs. Investigation will need to be undertaken into the level of demand. This option could be considered at a state level through a state-wide Aboriginal water policy.
Objectives	
Further information	**National Cultural Flows Research Project:** **www.culturalflows.com.au/**

Option 54. Co-management investigation of Travelling Stock Reserves

Source: Department of Planning, Industry and Environment—Water and Aboriginal consultation in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	Travelling Stock Reserves hold significant importance to Aboriginal people as they provide access and connection to Country, cultural practices and the protection of Aboriginal cultural heritage sites. However, Aboriginal people cannot always easily access—and are not resourced to be involved in management decisions about—these culturally significant sites. This option would investigate opportunities to improve the involvement of Aboriginal people in the co-management of Travelling Stock Reserves that connect them to waterways and water dependent sites of cultural importance.
Intent	• Improve access to waterways and other water dependent sites of cultural importance. • Protect cultural assets, songlines and important flora. • Improve environmental outcomes. • Support Aboriginal people's involvement in the management of Travelling Stock Reserves that connect Aboriginal people to waterways. • Support Aboriginal people to have more input on decisions that affect them and their cultural values.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science is not effectively integrated into water management in culturally appropriate ways. • Ensuring Aboriginal cultural values are protected.
Potential combinations	This option could be combined with: • Option 48. Water dependent cultural practices and site identification project • Option 51. Regional Cultural Water Officer employment program • Option 56. River Ranger Program.
Considerations	This option would need to consider the State-wide Plan of Management developed by Local Land Services to improve how Travelling Stock Reserves in NSW are managed, conserved and administered. This option could be considered at a state level through a state-wide Aboriginal water policy.
Objectives	

Option 55. Aboriginal cultural water access licence review

Source: Department of Planning, Industry and Environment—Water and Aboriginal consultation in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	Water access licences allow licence holders to take water from rivers, lakes or aquifers for certain uses. This includes a category of Specific Purpose water access licences that can only be held by Aboriginal people to access water for Aboriginal cultural uses. Use of this licence category is low. This option will undertake a review of water access licences for Aboriginal cultural uses to determine their effectiveness and identify opportunities for improvement. This could include more clearly defining what the licences can be used for and reviewing the licence application process.
Intent	• Optimise water sharing mechanisms that support cultural values and uses, both traditional and contemporary, recognising that Aboriginal cultural values and uses have adapted over time. • Develop a framework for cultural flow allocations. • Improve uptake of water access licences for Aboriginal cultural purposes. • Simplifying processes to make it easier for Aboriginal people to apply for licences. • Considering whether cultural access licences could be traded between Aboriginal communities.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways.
Potential combinations	This option could be combined with: • Option 47. Culturally appropriate water knowledge program • Option 51. Regional Cultural Water Officer employment program • Option 52. Establish a regional Aboriginal Water Advisory Committee.
Considerations	This option would need to consider: • the application and decision-making process for these water access licences • how the licences fit with the extraction and allocation limits within the region • supporting services—including education and knowledge sharing about water markets and licences. This option could be considered at a state level through a state-wide Aboriginal water policy.
Objectives	

Option 56. River Ranger Program

Source: Department of Planning, Industry and Environment—Water and Aboriginal consultation in the Macquarie-Castlereagh, Lachlan and Gwydir regions

Description	Investigate options for the establishment of an Aboriginal River Ranger Program to assist in maintaining the health and management of rivers and wetlands throughout the Namoi region. Rangers could be involved in: • pest management (fish and weeds) • remediation and mitigation of impacts on waterways • restocking native fish and vegetation species • protecting and managing riparian zones along waterways • working closely with compliance officers • monitoring, evaluation and research programs run by government.
Intent	• Improve the involvement of local Aboriginal people in the management and protection of waterways and water dependent cultural sites, including future generations. • Enable a closer relationship with environmental water managers across NSW. • Use local knowledge to improve water management outcomes in a way that is culturally appropriate and respects cultural knowledge and intellectual property.
Challenges addressed	• Aboriginal people's rights and interests are not adequately recognised or provided for in current water laws and policies, and there are limited opportunities to influence management decisions. • Aboriginal people have limited access to water allocations to use for cultural and economic purposes. • Aboriginal knowledge and science are not effectively integrated into water management in culturally appropriate ways. • Ensuring Aboriginal cultural values are protected. • Increased climate variability and climate change pose greater risks to ecosystems and species. • Improving community understanding about water resource management and water trading.
Potential combinations	This option could be combined with: • Option 16. Providing incentives to landholders to conserve and rehabilitate riparian, wetland and floodplain vegetation • Option 18. Riparian habitat restoration and re-establishing threatened species • Option 47. Culturally appropriate water knowledge program • Option 51. Regional Cultural Water Officer employment program • Option 52. Establish a regional Aboriginal Water Advisory Committee.
Considerations	Similar programs exist that may overlap these roles and/or provide partnerships and learnings. These include: • Indigenous Land Use Agreement land and waterway managers • Barkandji River Ranger Program • Local Land Services Healthy Rivers Program • Council pest species managers • Local Land Services Aboriginal Community Support Officer. This option could be considered at a state level through a state-wide Aboriginal water policy.
Objectives	

Options not progressed

Image courtesy of the Department of Planning, Industry and Environment.

A number of options that were proposed in the WaterNSW 20 Year Infrastructure Study and other studies are not included in the long list of options. Assessments since their publication have indicated that it is not viable to consider them further.

Option	Description	Reason for not progressing
Gunidgera Creek Channel desilting	A series of channel capacity constraints exist downstream of Gunidgera regulator that limit the delivery of supplementary and other water demand in years of high available water determinations. This option would improve delivery efficiency through Gunidgera Creek.	This option was progressed for further analysis; however, hydrological modelling identified negligible level of service benefit to the Lower Namoi system
Channel widening downstream of Gunidgera regulator	A series of channel capacity constraints exist downstream of Gunidgera regulator that limit the delivery of supplementary and other water demand in years of high available water determinations. This option would improve delivery efficiency through Gunidgera Creek.	Significant environmental impacts in widening the creek including the removal of many trees
New 360 GL Blue Hole Dam	Construction of a new dam to improve water availability, including reliability and security of supply.	Benefits of this option were constrained by the sustainable diversion limit under the Basin Plan 2012
Inland Diversion—small scale diversion from the Macleay River	Small scale diversion to improve water availability, including reliability and security of supply.	This option required extensive works to enable the transfer of water. The large scale option (Option 2) was considered to provide greater benefits for the amount of work
Keepit Dam—new outlet works valve chamber and two new valves	In 2013, the Murray-Darling Basin Authority prepared a report outlining the preliminary overview of constraints to environmental water delivery in the Murray-Darling Basin. One identified constraint was the release capacity of Keepit Dam. These constraints can impede the delivery of environmental flows at the end of the Namoi system.	This option will be considered as part of a capital works program by WaterNSW
Keepit Dam—increase size of one outlet works valve	In 2013, the Murray-Darling Basin Authority prepared a report outlining the preliminary overview of constraints to environmental water delivery in the Murray-Darling Basin. One identified constraint was the release capacity of Keepit Dam. These constraints can impede the delivery of environmental flows at the end of the Namoi system.	This option will be considered as part of a capital works program by WaterNSW
Keepit Dam—new valve system with branch from hydro-power penstock	In 2013, the Murray-Darling Basin Authority prepared a report outlining the preliminary overview of constraints to environmental water delivery in the Murray-Darling Basin. One identified constraint was the release capacity of Keepit Dam. These constraints can impede the delivery of environmental flows at the end of the Namoi system.	This option will be considered as part of a capital works program by WaterNSW

Option	Description	Reason for not progressing
Transfer open channel to Boggabri/Maules Creek coal mines	Large transmission losses are experienced when Keepit Dam releases water to major coal mining customers within the Maules Creek and Boggabri areas of the Lower Namoi. Losses into the groundwater system between Keepit and Boggabri dams can be high relative to dam release volumes. This infrastructure option could improve delivery efficiency and reliability downstream of Keepit Dam.	Significant cost for the relatively long channel/pipeline
Two sub-surface dams north of Boggabri to service Boggabri/Maules Creek coal mines	Large transmission losses are experienced when Keepit Dam releases water to major coal mining customers within the Maules Creek and Boggabri areas of the Lower Namoi. Losses into the groundwater system between Keepit and Boggabri dams can be high relative to dam release volumes. This infrastructure option could improve delivery efficiency and reliability downstream of Keepit Dam.	To be further considered once there is more clarity and knowledge about the feasibility and techniques for managed aquifer recharge (Option 8)
Dempsey Bridge to the end of Pian Creek (near Walgett Weir) open canal	There is a delivery efficiency issue in Pian Creek, with high transmission losses experienced when delivering supplies to both stock and domestic and regulated customers. There is also an unmet requirement for provision of replenishment environmental flows to the unregulated section twice per annum. This option could improve end of system flow delivery efficiency through Pian Creek.	Challenges with flat terrain, and susceptible to significant evaporation losses. Alternative pipeline option is being further considered
New Dungowan Dam (40 GL) and augment supply pipeline	This option could improve water availability in the Peel Valley.	Funding announced for New Dungowan Dam (22.5 GL) and augment supply pipeline
New Dungowan Dam (60 GL) and augment supply pipeline	This option could improve water availability in the Peel Valley.	Funding announced for New Dungowan Dam (22.5 GL) and augment supply pipeline
Chaffey networked with new Dungowan Dam (22.5 GL) and augment supply pipeline	This option could improve water availability in the Peel Valley.	Funding announced for New Dungowan Dam (22.5 GL) and augment supply pipeline
Chaffey networked with new 40 GL Dungowan Dam and augment supply pipeline	This option could improve water availability in the Peel Valley.	Funding announced for New Dungowan Dam (22.5 GL) and augment supply pipeline

Option	Description	Reason for not progressing
Chaffey networked with new 60 GL Dungowan Dam and augment supply pipeline	This option could improve water availability in the Peel Valley.	Funding announced for New Dungowan Dam (22.5 GL) and augment supply pipeline
Chaffey Dam second augmentation (180 GL)	This option could improve water availability in the Peel Valley.	This option was initially shortlisted for consideration; however, feasibility options were identified making the dam options unviable
Chaffey Dam second augmentation (120 GL)	This option could improve water availability in the Peel Valley.	This option was initially shortlisted for consideration; however, feasibility options were identified making the dam options unviable
Keepit to Tamworth pipeline with Keepit Dam (Namoi yield) augmentation	This option could improve water availability in the Peel Valley.	Not progressed due to low economic viability and social/environmental sustainability
Split Rock Dam transfer pipeline	This option could improve water availability in the Peel Valley.	This option was not supported by customers. This option was not considered due to low economic viability and social/environmental sustainability
Small scale inter-basin transfer from Apsley	This option could improve water availability in the Peel Valley.	Not progressed due to low economic viability and social/environmental sustainability
New dam on Mulla Creek	Constructing a new 16 GL dam on Mulla Creek within the Cockburn unregulated river system, with a bulk water transfer pipeline to Tamworth.	Assessment commissioned by Tamworth Council indicated that this option does not provide a significant water supply benefit over new Dungowan Dam or new off-river storage option, but is significantly more expensive and will have a major impact on the river system within the Cockburn River valley.
New dam on Swamp Oak Creek	Constructing a new 30 GL dam on Swamp Oak Creek within the Cockburn unregulated river system, with a bulk water transfer pipeline to Tamworth.	Assessment commissioned by Tamworth Council indicated that this option does not provide a significant water supply benefit over new Dungowan Dam or new off-river storage option, but is significantly more expensive and will have a major impact on the river system within the Cockburn River valley.
Copeton to Tamworth pipeline	Constructing a pipeline from Copeton Dam to Tamworth	An assessment commissioned by Tamworth Council showed this option would be far more expensive to construct and operate than other pipeline options, for similar water supply benefit.

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