Department of Planning and Environment

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Extreme Events Policy

Policy framework for the management of NSW water resources during extreme events

August 2023

Acknowledgement of Country

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

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1 Introduction

NSW has experienced two record breaking droughts in the first two decades of this century. The millennium drought (2000 – 2010) which had its most severe impacts on surface water supplies in central and southern regional NSW, and the 2017 to 2020 drought which saw record low inflows into northern, central and Far West NSW major rural storages.

The Water Group of the Department of Planning and Environment is responsible for overall management of the State's water resources. In the context of water shortages, the department[1] determines how available limited water will be shared and the measures that may need to be applied in rural and regional areas to extend remaining supplies. This involves working closely with water authorities such as WaterNSW and local water utilities, and other government agencies to meet critical human needs and limit the damage to aquatic ecosystems.

While a surface water drought does not necessarily mean reduced groundwater availability, prolonged droughts can result in lowering of groundwater levels because of increased use of groundwater and reduced recharge from surface water flows and rainfall. This can have longer term detrimental impacts if groundwater levels fall too low to return to pre-drought levels.

Water quality can also be of concern during drought periods and also when flows re-commence or spread across floodplains after prolonged dry periods.

Climate data and updated hydrological modelling developed for the department's regional water strategies indicate that more extreme weather patterns could occur in the future with higher average temperatures and more extended periods of drought.

The Extreme Events Policy provides a framework to manage extreme water shortage and water quality events in a structured and proactive way.

The Extreme Events Policy was first published in October 2018 and has now been updated in response to the 2017 to 2020 drought which saw a number of river valleys reach the stage of critical water shortage as shown in Appendix A.

This updated policy continues to apply mainly to regional inland water resources as this is where the major regulated river systems, large aquifers and most extraction for commercial purposes occur.

[1] In this document reference to the department more specifically means the Water Group of the Department of Planning and Environment

2 Objective and purpose

The key objective of the Extreme Events Policy (the Policy) is to inform water users and regional communities on what measures can be expected during:

- drought and periods of severe water shortage, and then as conditions improve
- a water quality event of an intensity, magnitude and duration that renders water acutely toxic or unsuitable for human and ecological values.

The Policy:

- outlines how the allocation process and priorities for access to water change in extreme events
- establishes the guiding principles and tools to respond to extreme events in the Murray–Darling Basin as required under the Basin Plan and informs the development of valley specific Incident Response Guides
- sets out the stages for managing access to water leading up to, during and recovery from a surface water shortage
- sets out the stages for managing significant groundwater level or pressure declines
- sets out the stages for managing an extreme water quality event
- facilitates early intervention and delays the need to suspend water sharing plan arrangements.

3 Scope

The Extreme Events Policy applies specifically to all NSW water sources within the Murray–Darling Basin. Incident Response Guides have been prepared for each of the Basin water resource plan areas (surface water and groundwater) as a requirement of the Basin Plan outlining recent water shortage and water quality events and actions.

An extreme event is defined in the Basin Plan as an extreme dry period, extreme water quality event, and any other type of event that has led to a management plan previously being suspended in the past 50 years.

The definition of an extreme event in this context does not include floods. When NSW river systems experience severe flooding, water sharing plan rules continue to operate, and the flood emergency response is carried out under the State Emergency and Rescue Management Act 1989.

The main application of the Extreme Events Policy and the water shortage stages (set out in section 10) has been in the regulated river systems (both inland and coastal) and the unregulated Barwon–Darling River as these river systems are where most water is extracted and where specific actions

to manage supplies in response to water shortages or water quality concerns can be more actively applied.

To date, the stages have not been directly applied to groundwater systems. However, where longer-term groundwater level declines have occurred, management actions have been taken. The department is developing specific groundwater level drawdown triggers to signal increasing management actions which will result in use of the water shortage stages approach in the future for groundwater systems.

Along the coast, Sydney Water and Hunter Water are required to prepare drought response plans to manage their water supplies and demands in their areas. Smaller coastal urban water supplies are mostly managed by councils that are also responsible for developing drought management plans for their water supply systems and introducing town water restrictions in a staged approach.

Coastal water sharing plans provide the framework for managing access to water, including protecting certain low flows and pools from commercial access during dry periods, and also requiring some flows to be released from town water storages to provide water downstream.

In the future, the department may consider a staged water shortage approach more broadly in unregulated river catchments.

4 Priorities of access and the allocation process

The main legislation for the management of water in NSW is the Water Management Act 2000 (the Act). The Act sets out water management principles and establishes water licence categories and the priorities between these categories when making available water determinations (known more commonly as water allocations) for each licence category. The Act also provides for the preparation of statutory water sharing plans, which include environmental provisions and other rules for sharing water specific to a water source. A key water management principle is that the sharing of water must protect the water source and dependent ecosystems and basic landholder rights. These are not licensed entitlements, but in the process of determining water allocations in the regulated rivers, the department provides for basic landholder rights in the volumes set aside for high priority requirements and for meeting the environmental rules in the water sharing plan.

In terms of licensed entitlements in regulated rivers, the legislation (the Act, regulation and water sharing plans) then set the following order of priority:

1. local water utility, major utility and domestic and stock water supply, (high priority needs)
2. high security
3. conveyance (the water needed to deliver ordered water)
4. general security
5. supplementary.

For regulated rivers, NSW's allocation process is reflective of climate and hydrologic conditions. The allocation process takes into account the water in storage at the start of the water year (1 July), plus likely inflows to the system based on historical records and seasonal outlooks. In making allocations, the lowest recorded inflow sequence to the storage/s as at the commencement of the first water sharing plan is used, otherwise known as the 'drought of record'.

The allocation planning horizon varies between regulated rivers due to their different catchment size, inflow patterns and system demands. However, in the main, the process aims to provide for high priority water requirements (towns, domestic and stock, basic landholder rights, environmental provisions and high security) to be met for the current and the next water year, and then any unused general security allocation that has been carried over from the previous year, before making a new general security allocation.

In unregulated rivers and groundwater sources, local water utility, town and domestic and stock supply similarly have the highest priority in the allocation of water to licence holders. Licences specified as unregulated river access and aquifer access licences are generally for commercial purposes and have the same lower priority as general security licences. In unregulated rivers and groundwater systems, allocations are mostly 100% because the key measure for managing access to water is the pumping conditions that are applied to each licence. However, allocations for commercial users can be less than 100% if total extractions in previous water years exceeded the sustainable limits or access by higher priority users is at risk.

5 Managing water allocations and accounts during extreme events

The allocation process in NSW regulated rivers is designed to meet high priority commitments in all years except the most extreme. However, in a severe water shortage, provisions of water sharing plans may be suspended. During these times, the Act sets out that when making available water determinations for coastal areas, water for essential town services and domestic supplies for rural landholders (outside of towns), are the highest priority. The second priority is then the needs of the environment and then the third priority is other high priority licensed entitlements (including stock water) and high security entitlements.

This focus on securing critical needs in a drought year will typically result in reductions to allocations in regulated rivers. General security allocations are likely to be zero. Town, domestic and stock and high security allocations may be reduced. General security licence holders' access to their carried over water may also be restricted or suspended and some environmental water allowances, replenishment flows or end of system flow requirements in the water sharing plan suspended for a period.

In the Basin, a broader definition of critical human needs was incorporated into the Basin Plan. Consequently, the *Water Management Act 2000* was amended in 2018 to insert this additional level of priority in the case of an extreme event in the Murray–Darling Basin.

When all or part of a water sharing plan has been suspended because of an extreme event, the priorities outlined in Table 1 for rules of distribution apply to the making of an available water determination in the NSW Basin water sources.

Table 1. Priorities under an extreme event in the Murray–Darling Basin

Take type/use	Priority
Meeting critical human water needs, which means the needs for a minimum amount of water, that can only reasonably be provided from the Basin water resources, required to meet: (a) core human consumption requirements in urban and rural areas, and (b) those non-human consumption requirements that a failure to meet would cause prohibitively high social, economic, or national security costs.	First
To the extent these are not critical human water needs, the taking of water for: • domestic purposes by persons exercising basic landholder rights, and • domestic purposes or essential town services authorised by an access licence.	Second
Needs of the environment	Third
To the extent these are not critical human water needs, the taking of water for: • stock purposes by persons exercising basic landholder rights, and • in the case of regulated rivers, the taking of water authorised by a high security access licence, and • commercial and industrial activities authorised by a major utility access licence or local water utility access licence, subject to the water made available being in accordance with any drought management strategy established by the Minister for that purpose, and • electricity generation authorised by a major utility access licence, and • stock purposes authorised by stock access licence, and • conveyance under a conveyance access licence.	Fourth
Other purposes authorised by an access licence, to the extent these are not critical human water needs.	Fifth

6 What are critical human needs?

With regard to regulated rivers in the NSW Murray–Darling Bain, this is further defined as:

The minimum amount of water required to:

- supply essential town demands under high level town water restrictions
- supply essential basic landholder rights, and restricted high priority and high security requirements to those sections of the river where it does not result in unacceptable delivery losses
- operate the distribution system to efficiently deliver that water

The above is in the context that:

- supply to downstream river reaches may not be possible from regulated river releases if essential town water supply upstream is jeopardised because of excessive conveyance losses which would deplete dam levels. Water carting or alternative supply such as groundwater may then be required by downstream users, including for basic landholder rights.
- high priority and high security allocations may be reduced and potentially limited to minimum maintenance/operation requirements or may only be available from downstream inflows (not dam releases).

In unregulated rivers and groundwater systems, the priority is essential town water supply and basic landholder rights, as all commercial access is dependent on individual licences pumping conditions. If town water or basic landholder rights access to essential water is at risk, commercial extraction may be subject to further restrictions on the volumes, pumping rates or timing of access.

7 Impacts of water shortages on basic landholder rights

The *Water Management Act 2000* entitles an owner or occupier of a landholding to take water from a river, estuary, or lake to which the land has frontage, under basic landholder rights for household domestic consumption and grazing stock watering purposes, without the need for an access licence, or water supply work or water use approval. A similar right applies to Native Title holders to take and use water for cultural purposes.

A landholder can also take water for basic landholder rights purposes from any aquifer underlying their land – but in this case, while an access licence to use the water is not required, construction of a water bore is still subject to a works approval.

During droughts access to water for basic landholder rights may be limited or not available in unregulated rivers. The rules in water sharing plans are designed to protect the very low flows and

instream pools for basic landholder rights and environmental uses by requiring other licence holders to cease to pump. However, in severe water shortages a river can dry up completely and landholders will need to obtain water from other sources (groundwater, rainwater tanks, on farm storages, or carted water).

In regulated rivers, during drought, the constant delivery of water can result in significant system losses. In these circumstances, deliveries may be bulked up, resulting in only intermittent access for basic landholder rights. In extreme circumstances, releases to the downstream end of the river system, or in downstream distributaries, may be ceased altogether, as the water would simply be lost en-route.

Shallow groundwater systems may also dry out during drought periods. In deeper systems, groundwater levels may drop during drought because of increased pumping and reduced recharge, impacting on the supply for basic landholder rights if these bores are not deep enough.

As with all uses, restrictions can also be placed on the water taken under basic landholder rights if necessary. This could be by volume limits or, as occurred in some areas during the recent drought, further restrictions on how the water can be used in line with town water restrictions, for example bans on garden watering.

8 Critical environmental needs

The Water Management Act 2000 provides that with regard to water sharing generally, protection of the environment is to be given priority over the protection of basic landholder rights and extraction under access licences. But during extended dry periods, as with water for all other purposes, there is likely to be limited water available for the environment. In the regulated rivers, many environmental water rules in the water sharing plan (known as planned environmental water) are tied to the availability of general security allocations or require a certain volume of dam inflows to trigger releases, which may not eventuate. Similarly, licences held for environmental purposes receive the same allocations as other water users and, as a result, may have limited water available in their accounts.

Protecting the environment and meeting the critical needs of the environment during a drought will therefore focus on avoiding loss of native species, communities and ecosystems or irretrievable damage that would prevent the ecosystems from recovering when conditions improve. Specific actions may include:

- maintaining river flow as part of the supply of 'critical human water needs'
- delivering environmental water (held or planned) where available to only the highest priority habitats
- protecting natural inflows by stopping or limiting water extraction by using temporary water restrictions
- managing weirs and/or regulators to provide refuge habitat
- operating weirs and/or regulators, where it is possible, to avoid the turnover of stratified pools

- when flows re-commence after a prolonged dry period, protecting these flows initially to replenish river pools for aquatic habitat as well as town and domestic supplies.

Long-term environmental watering plans have been developed for each Murray–Darling Basin river valley and provide information on the hydrological needs of environmental values and assets. Annual environmental water priorities are determined prior to the start of the water year, for each of the nine river valleys where environmental water is held.

9 Long-term water planning across NSW

The NSW Government has developed the NSW Water Strategy which sets the overarching vision for 12 regional and two metropolitan water strategies (Greater Sydney and Lower Hunter). At the regional town water supply level, local water utilities also undertake strategic planning for their water security.

NSW Water Strategy

The NSW Water Strategy addresses key challenges and opportunities for water management and service delivery across the state, supporting longer term management approaches that will contribute to improved drought resilience such as:

- providing access to climate risk information for water users, councils and local water utilities, and the community to support adaption to likely reduced water reliability
- reviewing water allocation frameworks and water sharing plan provisions in response to new extremes in water availability
- exploring mechanisms to safeguard water for human needs during extreme events, including development of a position on alternative water supplies where water security for towns cannot be guaranteed in extreme events
- developing a policy that sets out the framework for managed aquifer recharge in NSW (the use of groundwater aquifers to store water for use during surface water shortages) and identify where it is technically and economically viable.

Regional water strategies

The 20-year regional water strategies have been developed to plan for and manage the medium and long-term water needs of NSW's regional areas. The strategies include the results of new modelling on the likelihood and severity of future droughts and may recommend infrastructure, water recycling, improved water efficiency, as well as policy, regulatory, and water sharing plan changes.

Some key areas of further work include assessment of setting aside larger reserves in regional dams, consideration of conversion of some general security entitlement to high security entitlement, town water supply projects, and changes to increase connectivity with downstream catchments.

Local water utility strategic planning

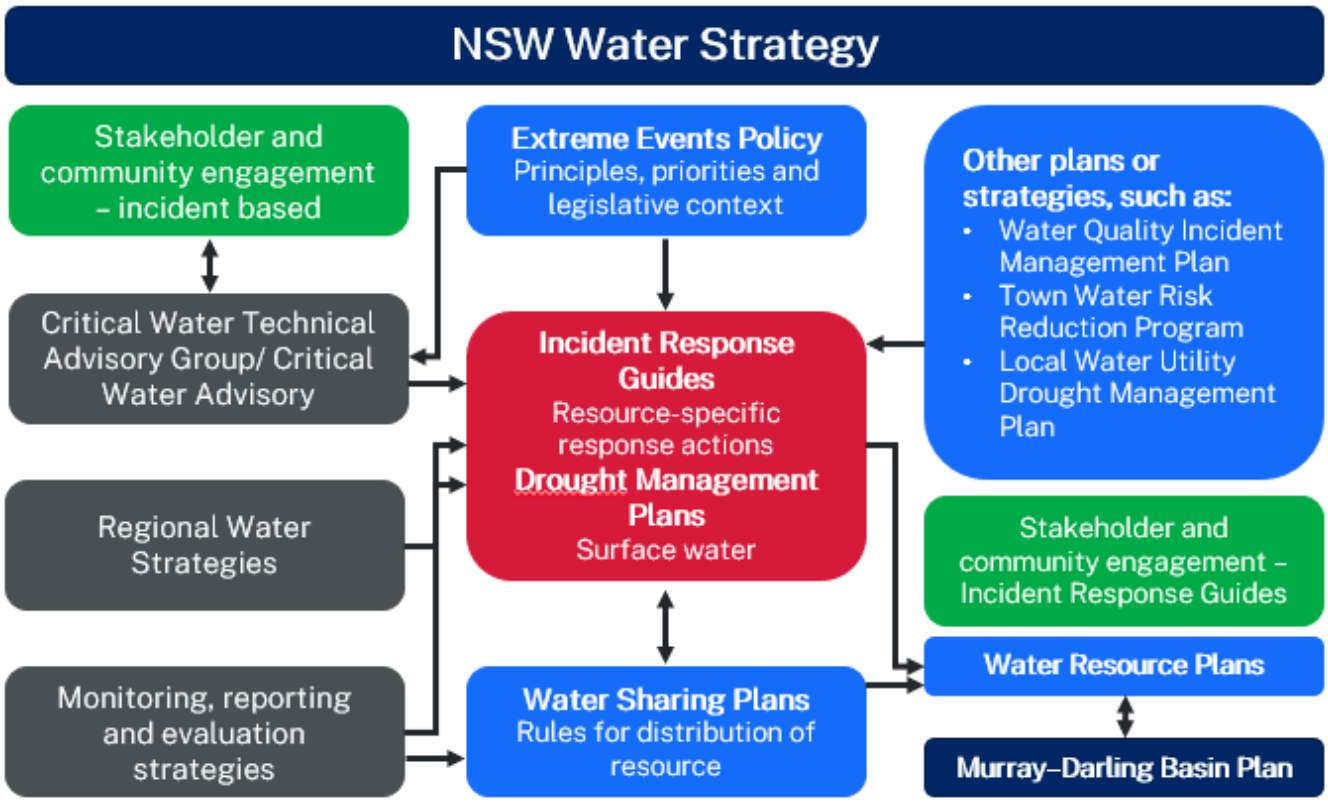
There are 92 local water utilities in the state, providing water to 1.8 million people in regional NSW. These local water utilities are responsible for delivering safe and secure water supply and sewerage services to their residents and for long term strategic planning as well as drought management, including applying town water restrictions when supplies are declining.

The department assists regional local water utilities by providing technical and financial assistance for their strategic planning and by co-funding water and sewerage projects where a high risk to water quality (public health), water security, and environment has been identified. Other support programs include:

- the Town Water Risk Reduction Program – in collaboration with local water utilities, this program identifies long-term solutions to challenges and risks to providing town water supply and sewerage
- the state-wide Water Efficiency Framework and Program – to promote water use efficiency programs in our cities, towns and regional centres.

Figure 1 shows the various policies and programs that address water quantity and quality issues.

Figure 1. Policy framework



10 A staged approach

While the broader NSW and regional strategic plans look at longer-term security options, the Extreme Events Policy provides a framework for responding to and managing water resources in real-time as events unfold. Higher levels of intervention will be introduced as the criticality of an event increases.

The Incident Response Guides for the Murray–Darling Basin water resources then tailor these stages and actions to the specific area and water resources.

The stages are:

Stage 1 is when all water can be delivered on demand or under normal dam and river operations practices. In most regulated river valleys, some new general security allocation is expected to be announced during the water year. It can include situations where inflows are lower than usual or where minor water quality incidents may have occurred. However, water in storage plus minimum expected inflows, is sufficient to deliver all water in accounts, and in unregulated rivers most normal pumping conditions can be met.

For groundwater, stage 1 is when groundwater levels remain within acceptable drawdown ranges, with annual recovery as expected given rainfall and/or river flow recharge.

Stage 2 is where it has become apparent that there is:

- an emerging water shortage or potential drought, characterised by:
  - water cannot be delivered under normal river operation practices to all sections of the regulated river system, there may be some delays in on demand deliveries or minor grouping of some orders
  - in unregulated systems, increasing periods where river levels are below the pump thresholds for commercial access and town weir and dam levels are declining
  - groundwater level and/or pressure declines potentially or actually impacting on groundwater availability to high-priority, groundwater-dependent ecosystems, basic landholder rights and/or local water utilities.
- an emerging water quality issue characterised by:
  - the need for minor adjustments to treat raw water to the minimum quality required for town and domestic use (minor cost)
  - water quality monitoring or environmental conditions are indicating a potential threat to the aquatic ecosystem.

Stage 3 is where there is:

- a severe drought and/or water shortage where one or more of the following applies:
  - dam levels have dropped significantly, and supply and delivery to regulated river users, particularly general security users, is restricted, or there is major grouping of releases to reduce transmission losses

  - water in storage, plus minimum inflows forecast, is insufficient to meet remaining general security and environmental water account balances
  - in unregulated rivers, flows consistently at low or very flow levels, impacting on town and basic landholder rights supply
  - there is an unacceptable decline in groundwater level or pressure
  - there are unacceptable drawdown impacts on 'efficiently constructed' basic landholder rights bores (i.e. levels below the pump or deeper than the bore)
  - groundwater drawdown to levels that could lead to sediment compaction.
- a severe local water quality event to the extent that:
  - major adjustments are needed to treat raw water to the minimum quality for town and domestic use (major cost)
  - water quality monitoring or environmental conditions show immediate threat to aquatic ecosystems. Urgent management response is required to avoid fish deaths or similar event of high ecological implications.

Stage 4 is where there is:

- a critical drought and/or water shortage where one or more of the following applies:
  - dam levels are approaching record low levels and only limited essential needs can be met.
  - the lower sections of river systems are not able to be supplied with regulated flows.
  - in unregulated rivers extended periods of cease to flow with the river contracting into isolated pools
  - the decline in groundwater levels pose a risk to long-term availability of the groundwater resources — subsidence, and/or mobilisation and induced flow of poorer water quality
  - access by 'efficiently constructed' basic landholder rights bores is significantly impacted.
- a critical water quality event where one or more of the following applies:
  - it is not possible to treat raw water with standard processes to meet Australian Drinking Water Guidelines
  - raw water is likely to remain untreatable over the longer term
  - water quality is a threat to survival of aquatic species with mass fish deaths likely.

As conditions improve, the stages will be eased, and a return to Stage 2 will indicate a recovering situation.

The general management approaches available during each stage are outlined in Table 2.

Table 2. Management approaches during water shortage or water quality stages

Stage based on level of risk	Agency/management approaches	WSP Normal rules	WSP Contingency operational measures	Suspension of parts of a WSP
Stage 1	Normal management operations — long-term planning, including drought security planning.	In force		

Stage 2	Initial operational adjustments or local impact measures may be required. Water Drought Coordinator and Drought Team appointed to coordinate drought response for water and provide contact for inter-agency consultation on broader drought measures and water quality issues. Activate inter-agency critical water technical advisory group and relevant panels for surface water sources and update regularly on surface water quantity and quality conditions and groundwater issues. Initiate resourcing for increased applications for groundwater approvals and water trading. Initial communications with potentially affected communities and stakeholders via: • launching drought/water quality/ groundwater level management webpages • commencing community drought information or local groundwater advisory sessions • distributing regular NSW water updates to licence holders via text, email and via the WaterInsights webpages • discussions with local water utilities on their supply situation or water quality treatment • engaging with WaterNSW river operations stakeholder consultation committees regarding potential operation and access adjustments if water shortage conditions deteriorate to Stage 3 or Stage 4.	In force	Possibly activated	
Stage 3	Further adjustments to management operations and access restrictions. Planning and approvals underway for emergency infrastructure requirements such as temporary weirs or installation of water quality measures such as aerators at strategic locations. Critical technical water advisory group and panels operational for surface water and local panels meeting for groundwater with regular Ministerial updates.	Possibly also in force	In force — specifically increased likelihood of temporary water restrictions	Possibly activated

	Communications with affected communities and stakeholders increased.			
Stage 4	Normal operations untenable, emergency management activated to focus on critical water needs or extreme water quality impacts. State agency/regional response implemented if required/triggered. Critical water technical advisory group and panels increased, with fortnightly to weekly Ministerial and Cabinet updates. Communications with affected communities and stakeholders increased.		In force	In force in some areas

11 Response actions

In the early stages, most management actions will focus on communication with stakeholders and across agencies, ongoing monitoring and smaller operational changes to manage supplies or water quality issues.

Critical water advisory panels may be formed when the level of a water shortage or water quality event reaches Stage 2 for surface water sources and Stage 3 for groundwater sources. Panel members may include State and Local Government and local stakeholder representatives. The Panels will focus on early and broad communications with potentially affected parties, and on bringing local area perspectives to the management response measures.

To provide technical advice during an extreme event, a critical water technical advisory group will also be formed in Stage 2. The advisory group will comprise agency experts in areas such as town water supplies, environment, planning, and agriculture and water quality and provide operational advice on drought progression and water quality conditions and appropriate measures.

The Minister for Water has statutory powers under the Water Management Act 2000 and the Local Government Act 1993 to manage water resources during extreme events to secure water for critical water needs. These include:

- the power to impose a temporary water restriction order to restrict access to water if it is in the public interest to cope with a water shortage, threat to public health or to manage water for environmental purposes – this is usually delegated to the department
- the power to impose a temporary water restriction order to restrict access to water if it is necessary to do so to maintain or protect aquifer water levels, water pressure, water quality or groundwater dependent ecosystems and prevent land subsidence– this is usually delegated to the department
- the power to suspend all or part of a water sharing plan, which has the effect of altering the rules of priority for the making of available water determinations and/or the making of

individual water allocations – this requires the concurrence of the Minister for the Environment

- the power to direct a council to take measures with respect to council's water supply works if an emergency exists.

Specific water supply authorities, such as Cobar Water Board and Essential Energy, and local councils can impose town water restrictions if water supplies are limited under Water Management and Local Government regulations.

A list of powers available to manage extreme events is included in Appendix A.

12 Principles

The following principles inform the approach to managing extreme events and the development and implementation of the Incident Response Guides.

Principle 1 – All water users have the responsibility for determining and planning for the risks to their operations of water scarcity.

It is important that all water users – including towns and commercial and rural users – review their water supplies and have contingency plans in place if their main water supply fails. This may mean ensuring they have appropriate levels of entitlement, back-up supplies or arrangements, for example, water carting or groundwater, or plans to scale down their operations.

Principle 2 – Operation of the statutory water sharing plans should be maintained for as long as possible

Water sharing plans have been developed to operate in a range of climate circumstances, and water availability decisions consider historical droughts and associated periods of very low inflows. Only in extreme circumstances would suspension of their provisions be required to meet critical water needs. For example, when the drought of record minimum inflows do not eventuate over successive years.

A Stage 4 level of criticality may require suspension of environmental rules or allowing individual water allocations to be made.

Principle 3 –The market will continue to operate for as long as possible during dry periods

The *Water Management Act 2000* provides significant opportunities for trade of water access licences and allocations. This allows commercial users to make decisions on whether to use water in their accounts or sell to another licence holder. Even in circumstances when no new general security allocations can be announced or high priority allocations have to be limited, there are often volumes of water unused in the accounts of licence holders in the regulated rivers which have been carried over from the previous year.

Principle 4 — Licence holders within licence categories should be treated equally for as long as possible

As a general rule, all licence holders of the same category or subcategory of access licence are treated equally i.e. when allocations are made, they receive the same percentage allocation.

However, individual allocations within a licence category are possible if a water sharing plan is suspended. In the past this has been required in some cases for individual local water utilities who would otherwise have insufficient supply to meet restricted town water demands or to provide limited contingency water for some commercial operations.

Principle 5 – Information should be available on potential restrictions to inform water users' decisions

The Extreme Events Policy and, more specifically, the Incident Response Guides are intended to inform water users of the potential type and nature of drought contingency measures that could be applied as water shortages intensify. These resources will assist water users in weighing up their risks in making business decisions for the coming water year.

Principle 6 – Management strategies will be fit for purpose

The Incident Response Guides identify a range of management strategies for that particular water source. These however are still guiding, so that the most appropriate measures to deal with the particular circumstances can be adopted.

Principle 7 – Local stakeholder consultation should inform management responses

Implementation of increasing measures during an extreme event will be discussed with local communities and through stakeholder committees such as those led by WaterNSW. However, some measures such as the actual allocation announcement and the imminent introduction of temporary water restrictions are market sensitive.

Principle 8 – Learnings from previous extreme events should be incorporated

The Incident Response Guides will be reviewed following each extreme event and updated if required, as has occurred after the more recent 2017-2020 drought.

The definition of criticality (event triggers) and response measures may change as new information becomes available or after a measure has been implemented, such as infrastructure enhancement works or change to policies, and this may require updates to the policy and guides.

Principle 9 – Delivery efficiency will be considered

In regulated river systems, if storages are at low levels, it may not be possible to continue to supply regulated flows along the full length of the river system without potentially bringing forward the emptying of the storage and putting supplies to towns at risk. The volumes required to run the river system will be taken into account in decisions on the timing of drought operation measures. In dry periods, transmission losses to deliver smaller volumes of restricted water supplies increase significantly.

Principle 10 — Connectivity of systems should be considered, particularly in the protection of first flows

Connectivity between water sources will be considered in decisions during extreme events and as inflows occur. While in extreme cases it may not be possible to supply the lower reaches of a river system with regulated releases, downstream natural inflows will be prioritised for town, basic landholder rights and critical environmental needs. In particular the department is developing dry condition triggers for the northern inland valleys, which will require that restrictions be applied to any supplementary, floodplain harvesting or high unregulated river flows if there has been extended periods of no flows in the Barwon–Darling River and low levels in Menindee Lakes.

13 Determining and advising on stages of criticality

The department will determine the criticality stage for each area.

For water quantity in regulated rivers, WaterNSW provides the department with assessments of water availability at least monthly. This includes any recommendations on drought contingency measures that may be required. The drought stage for the regulated river valleys will be included in the department's Water Allocation Statements and on the WaterNSW Water Insights webpage.

Drought stages will also be reported for the Barwon–Darling unregulated river on the WaterInsights page and will align with increasing reduced flows and restricted pumping access.

For groundwater sources, the department is currently developing drawdown thresholds for monitoring bores across the state. These will trigger the water shortage stages and management actions.

WaterNSW provides regular monitoring of a range of water quality parameters, such as dissolved oxygen, salinity, and nutrients. Local water utilities test and treat the water supplied through their reticulated water supply systems to ensure that it is safe for drinking. The department, in partnership with NSW Health, provides advice to local water utilities about the risks and treatment options for poor water quality arising from high turbidity and salinity events, in particular, during and after prolonged droughts or bushfires. These events tend to be localised and actions and communication tailored to the particular case. Additional water treatment or boil water alerts may be required in some cases.

Algal blooms regularly occur in NSW rivers. The algal alert system already in place uses a green, orange and red warning system for more localised algal blooms and communication processes are well established through the Regional Algal Coordinating Committees and the algal alert maps published on WaterNSW's webpage. If a large-scale algal bloom spread along the length of a river, such as occurred in 1991 along the Darling or in 2009, 2010 and 2016 in the Murray, then a severe or critical water quality event would be declared. A large-scale event would require more coordination and resources than the routine management of isolated events.

During dry periods of low flows and above average temperatures, there is a high risk of hypoxic (low oxygen) water when river pools or weirs stratify and then turn-over as the result of inflows or sudden temperature drops. Similarly, when rivers re-start to flow after dry periods, the water at the head of the flow can be hypoxic as a result of the collection and decomposition of organic material. Higher overland flows from flooding can also cause hypoxic conditions when the water re-enters the river. These events can stress or kill aquatic species if they cannot move way, and in recent years critical water quality advisory groups have been established to advise on management and options. The Incident Response Guides provide triggers for action taking into account dissolved oxygen levels.

14 Toolkit of extreme event measures

The Incident Response Guides for the Murray–Darling Basin water resources provide a toolkit of measures for water managers to select from, allowing them to introduce more stringent measures to support the highest-priority needs as an event becomes more critical. The types of measures which could be applied in each stage for water shortage and water quality events are listed below (Table 3, Table 4). Measures applying at a lower stage can be continued or increased at more critical stages.

It should be noted that severe or extreme water quality events often occur during periods of water shortage and this will limit the amount of water that is available for any watering action.

Table 3. Stages and potential measures for water quantity extreme events

Criticality	Surface water	Groundwater	Measures
Stage 1 Normal management	All water can be delivered on demand or under normal dam and river operations practices based on resource assessments. In unregulated rivers most normal pumping conditions can be met.	Groundwater levels remain within acceptable ranges, with annual recovery as expected given rainfall and/or river recharge events	Normal allocation announcements and access, with likely increased general security allocations throughout the year. In unregulated rivers and groundwater systems, full allocations are available to all users. Long term water security and emergency/drought contingency planning continuing through development and implementation of strategic plans by local water utilities and the department's regional water strategies.
Stage 2 Emerging drought/ water shortage	Water cannot be delivered under normal river operation practices on demand to all sections of the regulated river system. In unregulated systems, increasing periods where river levels are below the pump thresholds for commercial access and town weir and dam levels are declining.	Groundwater level and or pressure declines potentially or actually impacting on groundwater availability to high priority ecosystems, basic landholder rights and/or local water utilities.	Initial operational measures such as minor grouping of continuing orders to some lower river sections in the current water year (regulated rivers). Discuss potential for increased operational measures with water users if shortage escalates to stage 3. Identify key refuge habitats and requirements for fish and aquatic species. Limit impacts on groundwater levels via trade restrictions and potential restrictions on aquifer access licences. Local water utilities to review and update drought management/ contingency plans and review water security.

Criticality	Surface water	Groundwater	Measures
Stage 3 Severe drought/ water shortage 	Dam levels have dropped significantly, and full supply and on-demand deliveries to users, particularly general security users, may not be possible. In unregulated rivers, flows are consistently at low or very flow levels, impacting on town and basic landholder rights supply.	Unacceptable groundwater level or pressure declines. Unacceptable drawdown impacts on 'efficiently constructed' basic landholder rights bores (i.e. levels below the pump or deeper than the bore). Drawdown to levels that could lead to sediment compaction.	Operational measures such as reduced replenishment flows to lower reaches and introduction of block releases (i.e. water orders grouped and only delivered via one or two releases from the dam). Restricting access to a portion of general security account water and associated trade restrictions. Targeting of environmental releases to high priority areas/assets. Cease announcing supplementary access in regulated rivers. Limit take by unregulated river access licences to protect supply for town or basic landholder rights. Restrict access under aquifer access licences from bores in all affected areas. Application of drought and demand management/restrictions, review all potential alternative supplies by local water utilities.
Stage 4 Critical drought/ water shortage 	Dam levels (regulated river and town dams) are approaching record low levels and resource assessments show only limited essential needs can be met. In unregulated rivers extended periods of cease to flow with the river contracting into isolated pools.	Water level declines pose a risk to long term availability of the groundwater resources - subsidence, and/or mobilisation and induced flow of poorer water quality. Access by 'efficiently constructed' basic landholder rights bores significantly impacted.	Suspension of some water sharing plan rules if required – to allow ceasing of some environmental rules and replenishment flows and/or to provide specific individual water allocations. Regulated river releases to lower reaches ceased and emergency works constructed such as temporary weirs or block banks. Severe restrictions such as complete suspension of account water to prioritise remaining supplies for limited essential critical needs only. Relocation of some key fish species to upstream reaches or hatcheries. Any natural inflows, including first flush flows after extended dry period, initially protected for critical human and environmental needs until critical dry condition triggers have been met.

Criticality	Surface water	Groundwater	Measures
			Application of emergency drought and demand management measures/severe town water restrictions by local water utilities.

Table 4. Stages and potential measures for water quality extreme events

Criticality	Surface water and groundwater	Measures
Stage 1 Normal management 	Raw water able to be treated with usual methods by local water utilities or acceptable quality for other consumptive purposes. Dissolved oxygen/blue-green algal counts/ salinity levels and climatic indicators within normal/tolerable ranges for aquatic ecosystems and recreational use of water.	Long term water quality management planning Ongoing monitoring and reporting of water quality and pollution events Water quality risk assessments
Stage 2 Emerging water quality issue 	Raw water required to be treated with some adjustments (minor cost) to usual methods by local water utilities. Flow and temperature conditions, plus declining dissolved oxygen levels approaching levels of concern for aquatic species or increasing spread of amber blue-green algal alerts.	Activate Water Quality Incident Management Plan. Deployment of additional treatment processes by local water utilities and ongoing implementation of Quality Assurance -Drinking Water Management System under the NSW Public Health Act. Establish critical water quality sub-group to monitor and report on conditions, identify key refuge areas impacted and identify possible actions such as use of environmental water allowances, timing and management of licensed releases or weir pool operations.
Stage 3 Severe local water quality event 	Raw water required to be treated with major adjustments (major cost) to usual methods by local water utilities or unacceptable quality for most other users. Notification of any pollution/contamination incidences by EPA. Water quality and condition monitoring indicate a high risk of fish or other aquatic species deaths.	Restricting/prohibiting access to water to protect public health and safety. Deployment of major treatment processes by local water utilities. Preparedness/deployment of emergency response measures by local water utilities. Communication of water quality risks to water users, such as landholders for domestic and stock supplies, and need for alternative supply or additional management measures.

Criticality	Surface water and groundwater	Measures
		Provide flushing or connectivity flows from upstream regulated systems through targeted releases if water is available and release would be effective. Provide dilution flows to key refuge areas and/or divert poor quality water away from key refuge areas. Manage timing and delivery of consumptive deliveries and operation of storages/weirs to improve water quality. Install aerators in storages or critical refuge pools.
Stage 4 Critical water quality event 	Raw water: • Unable to be treated to meet health-related values identified in the Australian Drinking Water Guidelines. • Likely to remain untreatable over the longer term. Mass fish or other aquatic species deaths likely or occurring.	Full implementation of supply side emergency measures by local water utilities. Employ *Essential Services Act 1988* and the *State Emergency and Rescue Management Act 1989* if required. Flush rivers if possible using stored water and uncontrolled (supplementary) flows. Fish rescues or re-locations to protect some critical breeding stock for later return to the system.

15 Returning to standard management practices

As conditions improve, a conservative, risk-based approach will be taken when concluding measures implemented during stages 2 to 4. This is to ensure that de-escalation does not exacerbate conditions, causing the decision to be reversed. Providing certainty to the market is also a key consideration.

For water quantity, a decision to de-escalate measures to lower stages will be made only where supply of account water will not be prejudiced for a period of 12 months and flows have extended along the river.

To recover fully from a severe or critical water shortage can take many months of above average rainfall or storm events to wet the catchment, re-commence river flows along the full river length

and improve water storage levels. Once a valley has been in prolonged drought, the first significant flows that occur are important for replenishing critical human, environmental and cultural needs along the river itself, but also for connected downstream systems.

Similarly, for groundwater levels to improve after dropping to unacceptable levels can take a prolonged period of high rainfall or surface water recharge and limits on groundwater extractions.

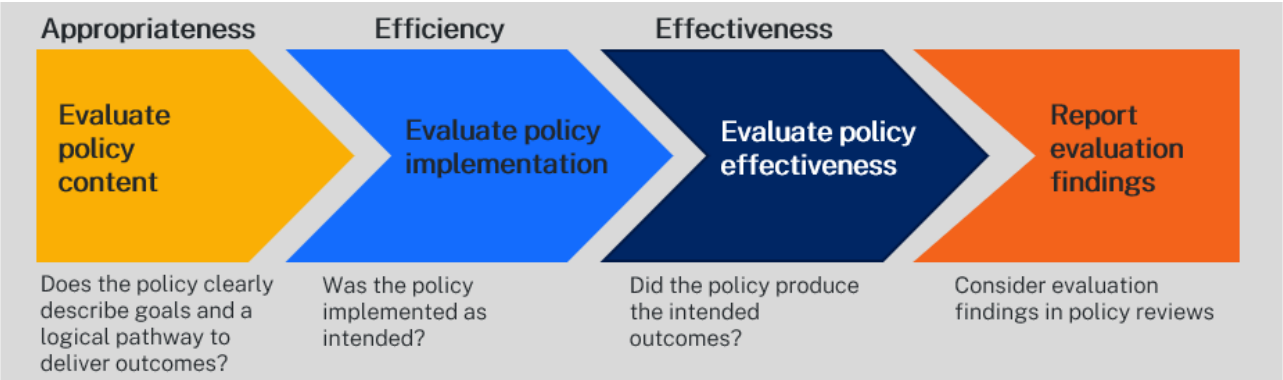
For water quality events, a return to standard operations and reporting will occur when raw water is able to be effectively treated with the usual methods and the water quality is suitable for other consumptive uses and for aquatic ecosystems.

16 Policy evaluation and review

The evaluation framework outlined below (Figure 2) will be used to assess the effectiveness of this policy and to inform policy reviews. The evaluation framework is consistent with NSW Government Program Evaluation Guidelines. This policy will be evaluated and reviewed if there are widespread stage 3 or 4 events, or changes to drought management through, for example, outcomes of the NSW Water Strategy or Regional Water Strategies. The review will:

- assess context and ongoing appropriateness of the policy approach
- assess whether implementation of the stages was efficient and as intended
- evaluate effectiveness of the framework in responding to water security or water quality outcomes during extreme events.

Figure 2. Policy evaluation framework



Appendix A – Application of the water shortage stages

The following water shortage stages (Figure 3) were declared in the regulated river valleys and the Barwon–Darling River from October 2018 when the stages framework commenced.

Figure 3. Progression of drought stages, October 2018 to April 2021

Drought Stages																															
	2018			2019												2020													2021			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Murray	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1
Lower Darling	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	2	2	2	2	2	2	2	2	2	2	2	1
Murrumbidgee	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lachlan	1	1	1	1	1	1	1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	1	1	1	1	1	1	1	1
Belubula	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	1
Macquarie	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	2	1	1	1	1	1	1	1	1
Cudgegong	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1
Lower Namoi	2	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	2	2	1	1	1	1
Upper Namoi	2	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1
Peel	1	1	1	1	1	1	1	2	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	2	2	1	1	1	1
Gwydir	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1
Border Rivers	1	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	1
Barwon-Darling	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	2	2	2	2	2	2	2	2	2	2	2	1
Bega and Brogo															2	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Richmond															2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hunter															1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1

Appendix B – Statutory powers

Table 5. Statutory powers applicable to management of extreme events in NSW

Legislation	Circumstance/trigger	Summary of powers/provisions
Sections 5(3), 58 (1) and 60(1) Water Management (WM) Act	Normal circumstances	Sets out principles for the sharing of water, priorities between different categories of licence, rules of distribution.
Section 58(2)	Reduced water allocations	Allocations to higher priority licences are to be diminished at a lesser rate than lower priority allocations.
Section 49A(1) WM Act	A severe water shortage	Minister may suspend the operation of any management plan (including a water sharing plan), either in whole or in part. Concurrence of the Minister for the Environment required.
Section 49B WM Act	An extreme event in relation to a particular Basin management area or part of the Basin water resources	Minister may suspend the operation of any Basin management plan, either in whole or in part. Concurrence of the Minister for the Environment required.
Section 59(1)(b) WM Act	While an order under section 49A and/or 49B is in place to suspend all or part of a management plan	Allows available water determinations (AWDs) to be made for one or more individual access licences in relation to one or more water source or water management area.
Section 60(3) WM Act	While an order under section 49A is in place to suspend all or part of a management plan	Provides the rules of distribution (priorities) for the making of an AWD to change with first priority for domestic purposes and essential town services.

Legislation	Circumstance/trigger	Summary of powers/provisions
Section 60(3A) WM Act	While an order under section 49B is in place to suspend all or part of a management plan in the Basin	Provides the rules of distribution (priorities) for the making of an AWD to change with first priority meeting critical human water needs.
Section 71(z) WM Act	To limit impacts on a stressed water source	May regulate the types of dealings (or trades) that can be made in certain circumstances, including temporary orders to limit or restrict some trades.
Section 324(1) WM Act	To cope with a water shortage or threat to public health or safety or to manage water for environmental purposes	Minister may in the public interest direct that for a period the taking of water from a water source is prohibited, or is subject to specified restrictions.
Section 324(2) WM Act	In relation to an aquifer, to: • maintain or protect groundwater levels • maintain, protect or improve water quality • prevent land subsidence or aquifer compaction, • protect groundwater dependent ecosystems, or • maintain pressure or ensure pressure recovery	Minister may in the public interest direct that within an area and for a period, the taking of water from that aquifer, or any other aquifer above, below or adjacent is prohibited, or is subject to specified restrictions.
Section 331 WM Act	To protect the environment, to preserve basic landholder rights or to overcome a threat to public health	May direct a landholder or person taking water under basic landholder rights or harvestable rights, to take specified measures.
Section 336B WM Act	To manage the taking and use of water under a domestic and stock right or a domestic and stock access licence	May establish mandatory guidelines for the taking and use of water for domestic consumption and stock watering.

Legislation	Circumstance/trigger	Summary of powers/provisions
Sections 110, 111 and 112 WM Act	To stop additional works, for example, for new groundwater bores in specific areas where contamination poses a threat to public health and other uses	May place a temporary or permanent embargo on the making of applications for new approvals.
Clause 141 Water Management (General) Regulation 2018	To conserve supplies of water in time of drought or other emergency	A water supply authority may regulate or restrict the: • purposes for which water may be used • times when water may be used • quantities of water that may be used • means or methods by which water may be used.
Clause 209 Water Management (General) Regulation 2018	If landholder supplied by a water supply authority fails to comply with a restriction	A water supply authority may cut off or restrict the supply of water to land.
Section 62 *Local Government Act 1993*	If an emergency exists that constitutes a threat to public health or public safety or that is causing or likely to cause damage to property	The Minister may direct a council to take measures with respect to water supply, sewerage and drainage works. Concurrence of the Minister for the Health required.
Clause 137 Local Government (General) Regulation 2021	If available stored water or available capacity is insufficient, or if there is a drought, or if available stored water or available capacity is so limited as to make extraordinary measures necessary	A council may restrict the: • purposes for which the water can be used, or • times when the water can be used, or • methods by which the water can be used, or • quantities of the water that can be used.