Government of **Western Australia**
Department of **Water and Environmental Regulation**

Middle Canning River

surface water allocation plan:
2024 evaluation statement

The stretch of the Djarlgarro Beeliar (Canning River) running through the cities of Armadale, Gosnells, Kalamunda and Canning between the Canning Dam and Kent Street Weir (the 'middle Canning') is a highly modified system.

The middle Canning River provides water to 63 licensed users, and up to 30 properties with a riparian right, for purposes including the watering of gardens, orchards or vegetables for personal use, irrigation of pasture or stock watering, and irrigation of public open space areas.

Despite its altered nature and urbanised catchment, the middle Canning River retains significant values. It benefits the community, supports important ecological and cultural features, and contributes to the health of the Swan River.

The Canning River has cultural significance for the Whadjuk people, historically as a source of food, water and resources, and as a central part of their creation stories. The river marked a geographical boundary between two Whadjuk clans, the Beeloo and the Beeliar, and acted as a pathway between the coastal plain and the Darling Scarp (City of Canning 2024). The river also supported a third Whadjuk clan, the Waddarok group of the Mulgang clan, who lived by the gorge of the Canning and moved inland (Hallam and Tilbrook 1990).

Along with the rest of south-west Western Australia, the middle Canning River is facing challenges associated with climate change, such as the marked drying trend in rainfall since 1970. Future climate projections for this area indicate that rainfall will continue to decline and temperatures will be higher. These projections present significant challenges for managing the use of water from the river, as well as the river releases which support the river's ecological, cultural and community values.

The middle Canning River is facing other obstacles associated with the condition of the catchment and the management of drainage, stormwater and sediment. The river's long-term health depends on the involvement of the people living alongside it, including water users and community groups, as well as on the local and state government agencies responsible for managing the river and its broader catchment.

This statement evaluates whether the 2012 *Middle Canning River surface water allocation plan* has been meeting its objectives for managing use of this resource whilst maintaining the river and its surrounds as a significant urban river environment.

Acknowledgement of Country

The Department of Water and Environmental Regulation (the department) acknowledges the Whadjuk Noongar people as the Traditional Owners and custodians of the lands and waters covered by the *Middle Canning River surface water allocation plan*, and their deep and continuing connection to the land and waters of the region.

We pay our respects to their Elders past, present and emerging, and to all members of the Aboriginal communities in the Canning area and their cultures. We acknowledge that Traditional Owners have been custodians of Country for countless generations and that water is integral to life.

We recognise that Aboriginal people and their cultures across the Canning area are diverse and that continued custodianship of the land and water is fundamental to their health, spirit, culture and community.

We embrace the spirit of reconciliation, and we seek to listen, learn, and build strong partnerships with genuine opportunities for Aboriginal people throughout our business.

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1 Canning River water management

Water management along the Canning River has a long history.

The Whadjuk Noongar people are the Ancestral Custodians of the Djarlgarro Beeliar (Canning River) and its associated waterways. Djarlgarro signifies 'place of abundance', where the richness of Whadjuk Country allowed Whadjuk people to have one of the highest pre-colonisation population densities in Australia (Hughes-Hallet 2010).

The entire Djarlgarro Beeliar was used by Whadjuk people as an important trail to the Darling Range, and its lands are central to the Whadjuk Noongar peoples' Dreaming and wellbeing. Whadjuk people have a cultural responsibility to ensure the rivers and its lands support life now and into the future (Fulker in prep).

The Canning River channel was proclaimed under the *Rights in Water and Irrigation Act 1914* (WA) in 1942, shortly after construction of the Canning Dam was completed in 1940. The Canning Dam was Perth's primary water supply source up until the Serpentine Dam was constructed in 1961. Today, it remains an important part of Perth's integrated water supply scheme (IWSS).

After the dam was built, downstream river flows reduced dramatically. To meet the needs of licensed water users and landholders adjacent to the river who had a 'riparian right' to take water, release points were established along the river to allow some captured dam water to flow downstream when the remaining natural flows were inadequate. These so-called 'river releases' were generally turned on in late spring as natural flows began to recede and were turned off once flow increased again in autumn.

The reduction in natural river flow contributed to a range of environmental problems in the river, such as sedimentation, habitat loss and eutrophication. In 1996 the *Canning River interim allocation policy* was developed to optimise water management and mitigate some of these issues. It outlined notional minimum flow requirements to protect downstream ecological values and proposed a study of the river's ecological water requirements to develop scientifically based flow criteria. The interim allocation policy also outlined a series of licensing principles that the then Department of Water later adopted and implemented through the 2012 *Middle Canning River surface water allocation plan* and surface water licence conditions.

In 2002, the Swan River Trust and Water and Rivers Commission released *Caring for the Canning – a plan to revitalise the Canning, Southern and Wungong rivers*. This plan put forward several interim ecological water requirements for the river and included recommended actions and management programs for major stakeholders operating in the catchment. This included actions to determine environmental water provisions for the Canning River and for them to be included in a water allocation plan as river release arrangements.

In 2007, the Department of Water released a report on the *Environmental values, flow related issues and objectives for the Canning River*, which summarised the ecological and hydrological investigations undertaken.

In 2010, the department released:

- *Ecological water requirements for the lower Canning River*, which presented the results of a study to develop revised ecological water requirements for the lower Canning River between Araluen and Kent Street Weir.

- *Ecological study of the lower Canning River environmental water releases*, which assessed the effectiveness of river releases in maintaining ecological function and supporting the associated ecosystem processes and services in the lower Canning River.

These studies were used alongside social, cultural and economic considerations to develop the 2012 *Middle Canning River surface water allocation plan*. Since then, the plan has supported the department (now the Department of Water and Environmental Regulation) to manage the surface water resources of the middle Canning River from the base of the Canning Dam to Kent Street Weir in Wilson (Figure 2). It has directed our approach to the allocation and licensing of water from the river, as well as to the release of treated scheme water into the river from six release points between October and May.

Furthermore, we have used the 2012 plan to manage abstraction from the river, particularly in summer, whilst maintaining river health. Most surface water licences are located on the main channel between Araluen Pumpback and Nicholson Road, and the river releases support the stretch of the river from Araluen Pumpback to approximately Burslem Drive in Thornlie.

Upstream inflows into Canning Dam over the summer months are much less than they used to be (Figure 6). We have continued to release treated scheme water into the middle Canning River each year between October and May to maintain downstream flows. While originally these river releases supplied people living alongside the river with water for domestic and commercial purposes, this need has gradually reduced as the area has urbanised and access to public water supply from the IWSS has improved.

Though it is a highly modified system, the Canning River still retains important ecological, community and cultural values downstream of the dam that have been supported and maintained by the historical water regime, of which the river releases have been a part. The river sustains diverse communities of flora and fauna and has high fish and crayfish species richness relative to the broader south-west of Western Australia (Healthy Rivers 2024).

There is a strong community connection to the river and to its diverse ecology. The river provides important recreational and aesthetic values, as well as crucial ecosystem services to the community. The Canning River holds particular significance for the Whadjuk Noongar people, who have a deep sense of respect for, and kinship with, the river and adjacent Country. There are many places of cultural significance along the river, such as ancestral birthing, burial, hunting and gathering, camping, and fishing sites, which are still recognised and visited by Noongar people today (Fulker in prep).

However, in the face of rapidly declining rainfall and higher temperatures brought on by climate change, modern water resource management must find a balance between supporting the values that have relied on historical water regimes and ensuring ecosystems have the opportunity to adapt to new states. Building system resilience through targeted restoration of river habitat and broader catchment management is a key way to achieve this.

Drainage, stormwater, sediment management and other land planning issues play a major part in river health. Addressing these complex factors is not within the scope of a water allocation plan, but we will continue to work with other agencies, including with the Department of Biodiversity, Conservation and Attractions (DBCA), to help address these broader catchment issues. DBCA is currently developing the Swan Canning River Protection Strategy for Derbal Yirragan Djarlgarro (Swan–Canning river system) and Djarlgarro (Canning) Waterways Restoration Plan, both of which will assist in bringing together key stakeholders and aligning management objectives and actions for the Canning River, its tributaries and catchment.

Every year since 2012 we have reviewed the allocation plan's actions and monitoring results to ensure the plan's objectives are being met and have adapted the river release arrangements as required. Up until 2020, we provided a biannual summary of our findings and data related to the annual river releases to stakeholders via the Middle Canning River stakeholder group and after that to the multi-agency and stakeholder group developing the Djarlgarro (Canning) waterways restoration plan.

1.1 This evaluation statement

The internal evaluations described above show that the 2012 plan has predominantly met its objectives. However, we periodically conduct formal evaluations of the performance of water allocation plans as part of ongoing adaptive management. These evaluations allow us to continually review and improve how we manage water resources under the plans. This statement is the first published evaluation of the *Middle Canning River surface water allocation plan* covering the period 2012 to 2023.

This statement details the updated management arrangements we have put in place since the 2012 plan was published, or that we will implement as a result of this evaluation process (see Chapter 2). The statement also identifies that further adjustments to the current plan may be required. The evaluation shows that we need to review the river release arrangements for the middle Canning River in line with the changing climate.

Figure 1 Priority refuge habitats of the middle Canning River are areas of permanent water that support diverse communities of native aquatic fauna and flora through the dry seasons

Figure 2 Middle Canning River surface water allocation plan area

2 Updated management arrangements

Our evaluation of the 2012 *Middle Canning River surface water allocation plan* has identified ongoing risks to the river's water resources and dependent values. We have already addressed some of these issues as part of our annual allocation plan review process and implemented the appropriate management actions. We have also identified some new management actions as a result of this evaluation statement. Some of the key changes since 2012 are:

- increasing metering and reporting requirements for licensees (see Section 2.1)
- improving river release triggers and arrangements to better respond to climate conditions and provide consistency in management across all systems where river releases occur below IWSS dams (see Section 2.2 and Appendix A)
- reducing allocation limits as unused licensed entitlements are recouped to minimise the risk of water being re-allocated to new users (see sections 2.3 and 4.2)
- updating river water quality performance indicators to reflect relevant local or national standards (see Section 2.4 and Chapter 6).

This evaluation also reviewed the plan's current objectives (see Table 1 and Table 4).

Table 1 Objectives from the 2012 Middle Canning River surface water allocation plan

Water resource objectives	
R1	To maintain the river's capacity to supply water for use as needs change.
R2	To maintain sufficient flow regimes (summer and winter) in a changing climate to minimise risks to the riverine environment including: • maintaining summer baseflows • maintaining oxygen levels and pool connectivity • provision of occasional pulse flows to meet native fish requirements over the summer months.
Management objectives	
M1	To recover licensed entitlements to within the allocation limit.
M2	To improve water use efficiency.
M3	To reduce abstraction to allow the releases to be minimised following low-rainfall winters.
M4	To reduce unauthorised water use.

2.1 Statewide and local licensing policy

The Rights in Water and Irrigation Regulations 2000 stipulate that all licences with an annual entitlement equal to or greater than 10,000 kilolitres (kL) must have an approved measurement device installed on all water drawpoints (as of 31 December 2020). Water use data must be recorded and annually reported to the department via our Water Online portal (unless an alternative method has been approved). This regulation replaces local licensing policy 1.2 in the 2012 plan, which said that all licences with entitlements equal to or greater than 20,000 kL/year required a meter.

These more rigorous metering and reporting requirements help licensees to better manage their own water consumption and enhance our ability to accurately track water use, leading to better

regulatory decisions and improved management of the resource. For further information on the metering and measuring requirements, please see our website: Water metering and measurement.

2.2 River release arrangements

The river release arrangements set out in the 2012 plan were established to maintain key ecological function, provide water for licensed use, and contribute to maintaining the river's cultural and social values. The release rules were informed by the studies mentioned on page 1, including the 2007 environmental values study of the Canning River, the 2007 river release trials, and the 2010 ecological water requirements for the lower Canning River.

The river release arrangements are also embedded in the Water Resource Management Operating Strategy associated with Water Corporation's licence to take water from the Canning Dam for the IWSS.

Since the allocation plan was released in 2012, we have periodically amended the river release arrangements to help ensure the plan's objectives are being met, and to bring consistency to the management triggers across all systems where river releases occur below IWSS dams. See Appendix A for the current river release arrangements.

Changed river release triggers and removal of reduced-volume river release arrangements

To conserve scheme water in dry years when IWSS dam levels were low, the 2012 plan included a low-rainfall response to reduce river release volumes when winter rainfall was low (see Section 5.3 of the plan). Low-rainfall releases were implemented in the summer of 2012–13 (see Section 5.1).

In 2015, we replaced the low-rainfall trigger with a low-inflow trigger as inflows more accurately represent the status of public water supply volumes in the IWSS dams. As our climate has become drier and hotter, more rainfall is needed to generate the same volume of inflow into our dams. The low-inflow trigger was implemented in the summer of 2015–16.

Since the allocation plan was released in 2012, both annual rainfall and dam inflows have declined, and future climate modelling shows that this trend is likely to continue (see Section 8.1). As more regular years with low-inflow puts the river's downstream social and ecological values at greater risk and may affect the ability of licensed water users to take their entitlement, we will no longer activate the low-inflow trigger and low-inflow release arrangements for the Canning River.

We will instigate standard-year releases every year, regardless of rainfall or dam-inflow volumes. However, we may change the standard-year releases in the future, following a review of the river release arrangements in line with our changing climate.

New river release arrangements

To reduce risks to the Canning River's ecological values in dry years, we will no longer activate the low-inflow trigger and low-inflow release arrangements for the Canning River. This means we will instigate standard-year releases even in low-inflow years.

High-temperature pulse releases

During periods of hot weather, river flows may decline due to increased abstraction, evapotranspiration from soil and plants, and evaporation from the river. This can result in the river ceasing to flow and river pools becoming disconnected, which can have a negative impact on water quality and ecology.

To reduce the risk of this scenario occurring, and in the face of increasing temperatures due to climate change, we have and will continue to implement 'high-temperature pulse releases' (see Appendix B). Between December and March – if temperatures are forecast to be ≥33°C for five days at Armadale meteorological station (no. 9001) – we increase the river releases for the following seven days to help support streamflow and water quality objectives. Releases of this nature were first implemented in 2019–20. During the past four years, generally we have made a maximum of two pulse releases per month from December to March. If an extended period of high temperatures is forecast, we work with Water Corporation to adjust the pulse releases to ensure minimum streamflow thresholds continue to be met.

If these high-temperature pulse releases were not made, water quality would likely deteriorate, and ultimately larger volumes of water would need to be released to replenish pools and re-establish river connectivity.

New river release arrangement in operation since 2019–20

Between December and March – if temperatures are forecast to be ≥33°C for five days at Armadale meteorological station (no. 9001) – we increase river releases for the following seven days to help support streamflow and water quality objectives.

Two-stage river release turn-off

Each year as winter approaches, river flows begin to increase in response to rainfall until river releases are no longer needed to maintain streamflow. However, Perth's autumn and early winter rainfall is diminishing (Figure 3) and, if the releases are switched off too soon, river baseflow may not be sufficient to meet minimum streamflow thresholds or water quality objectives. In some cases, flow may cease at points along the river.

Before 2015, we turned off the river releases once a cumulative rainfall volume of 40 mm was reached after 1 April. In some years the trigger was not reached until late May or even early June. In other years, the trigger was met in early April but followed by a dry period before typical winter rainfall started. With releases turned off, river flow ceased for a period of time (see Appendix B). This occurred even when the release points were turned off in stages – two at a time, starting from the furthest downstream and ending with the furthest upstream at one-week intervals.

From 2016 onwards we implemented a two-stage approach to turning the releases off, based on whether rainfall triggers are met in April and May. If 40 mm of rainfall is received in April, releases are reduced but not switched off. If 40 mm of rainfall is not received, releases continue until the end of April and are then reduced. Once 40 mm of rainfall is received in May, releases are turned off. If 40 mm of rainfall is not received in May, releases remain at the reduced rate until the end of the month and are then turned off. The previously used 'two-by-two switch-off' of release points has been abandoned.

We use rainfall measured at the Bureau of Meteorology's Jandakot Aero meteorological station (no. 9172) (see Section 3.1 and Appendix B).

New river release arrangement in operation since 2016

If 40 mm of rainfall is received in April, releases are reduced. If 40 mm of rainfall is not received, releases continue until the end of April and are then reduced. Once 40 mm of rainfall is received in May, releases are turned off. If 40 mm of rainfall is not received in May, releases remain at the reduced rate until the end of the month and are then turned off.

Pulse releases to support ecological values in June in dry years

In 2016 we developed late autumn/early winter pulse release arrangements. This enables us to make a river release for a short period up until 30 June to maintain river pools. The decision to make these releases is based on rainfall volumes at Jandakot Aero meteorological station,[1] the seven-day weather forecast (rain and temperature) at Armadale meteorological station, and streamflow at Seaforth gauging station (AWRC ref. 616027) and the six management reaches (Appendix A).

The staged turn-off and late autumn/early winter ecological pulse releases help to prevent unacceptable impacts to river-pool water quality associated with increasing variability in rainfall due to climate change.

New river release arrangement in operation since 2016

In dry years we make river releases for a short period up until 30 June to maintain river pools. The decision to make these releases is based on rainfall volumes, the seven-day weather forecast (rain and temperature) and streamflow.

2.3 Reduced allocation limits

Since the allocation plan was released in 2012, our process to recoup unused water entitlements has resulted in the general licensing component being reduced from 608,000 kL/year to 390,000 kL/year. We will continue to recoup unused water entitlements as licences are renewed and as recouping opportunities arise due to land use changes.

For more information on how we have recouped unused licensed water entitlements and reduced allocation limits, see Section 4.2.

2.4 Water quality performance indicators

We have updated some of the water quality performance indicators in the 2012 plan to match those of the Healthy Rivers program (which are based on local studies and national standards). Hence, we have increased:

- the acceptable range for dissolved oxygen (DO) from ≥2.5 mg/L to > 4 mg/L – based on the typical conditions where south-west native fish species have been found (Beatty et al. 2013)
- the acceptable range for pH from 5.0–8.0 to 6.5–8.0 – based on the 'acceptable range' for pH in lowland rivers in south-west Australia (ANZECC & ARMCANZ 2000).

For more information on our water quality and ecological monitoring program, see Chapter 6.

[1] See Appendix B for more information on the climate data that informs our application of river release rules.

Ecological values of the middle Canning River

Triennial river health assessments at four important refuge pools between 2009 and 2022 (see Figure 9) recorded the following aquatic species:

- Four species of freshwater fish endemic to south-west Western Australia: western pygmy perch (*Nannoperca vittata*), western minnow (*Galaxias occidentalis*), nightfish (Bostockia *porosa*) and freshwater cobbler (*Tandanus bostocki).*
- Four species of native estuarine fish (inhabiting freshwater): Swan River goby (*Pseudogobius olorum*), south-western goby (*Afurcagobius suppositus*), western hardyhead (*Leptatherina wallacei*) and sea mullet *(Mugil cephalus*). All species except mullet can complete their lifecycles in freshwater rivers.
- Three species of freshwater crustacean endemic to south-west Western Australia: smooth marron (*Cherax cainii*), gilgie (*Cherax quinquecarinatus*) and freshwater shrimp (*Palaemon australis).*
- Six species of exotic fish and a single species of exotic crayfish: pearl cichlid (*Geophagus brasiliensis*), one-spot livebearer (*Phalloceros caudimaculatus*), mosquitofish (*Gambusia holbrooki*), spangled perch (*Leiopotherapon unicolor*), goldfish (*Carassius auratus*), Koi carp (*Cyprinus carpio*) and yabby (*Cherax destructor*).

Carter's freshwater mussel (*Westralunio carteri*) and rakali (*Hydromys chrysogaster*) were qualitatively assessed and detected at several sites. These species are listed as Vulnerable and Priority 4 (monitoring required) respectively under the *Biodiversity Conservation Act 2016* (Western Australia).

River health assessments have found that sites further upstream on the Canning River are in better ecological health than sites further downstream. This is based on the relative abundance of native species compared with exotic species, aquatic habitat (density and diversity), and water quality conditions (particularly dissolved oxygen and water temperature).

In broad terms the middle Canning River is displaying signs of ecological stress, particularly at the sites lower down in the catchment where habitat and water quality are less favourable.

The pearl cichlid represents a high risk to the middle Canning's ecology as it may reduce biodiversity through competition and predation of native species and through habitat modification.

The survival of many of our endemic aquatic species relies on protecting permanent-water habitat (dry season refuges), which is increasingly under threat from a drying climate.

Maintaining or improving the condition of, and access of biota to, refuge habitats is vital to supporting ecological health and function in the middle Canning River. This not only supports biodiversity conservation but also the range of services that healthy ecosystems provide.

3 Status of the Middle Canning River water resources

3.1 Climate

Like other areas in south-west Western Australia, reduced rainfall due to climate change is impacting on streamflow in the Canning area. The region has experienced declining rainfall since the 1970s, particularly in autumn and early winter, and the declines have been larger than anywhere else in Australia. Mean temperatures have also increased by about 1.1°C since 1910, with the rate of warming higher since 1960 (DWER 2021).

In this chapter we have compared rainfall and inflow between the periods 1975–2008 (the period on which the assessment of river releases in the 2012 plan was based) and 2009–2023 (the period since the assessment).

Rainfall

Figure 3 shows average monthly rainfall at Jandakot Aero[2] meteorological station from 1975–2008 compared with average monthly rainfall from 2009–2023. The figure shows that the largest declines in monthly rainfall between the two periods have been in May, June and July.

Average annual rainfall for 1975–2008 was 839 mm at Jandakot Aero meteorological station. From 2009–2023 average annual rainfall fell by 11 per cent to 743 mm.

Between 1975 and 2008 summer rainfall events were common, and these supplemented river releases. Since then, summer rainfall events have decreased in frequency, and this – combined with higher temperatures – has affected the ability of the releases to meet minimum streamflow thresholds.

[2] The 2012 plan used rainfall data from Gosnells meteorological station. Due to changes in how data from Gosnells station was reported, we now use data from Jandakot Aero station. See Appendix B for details.

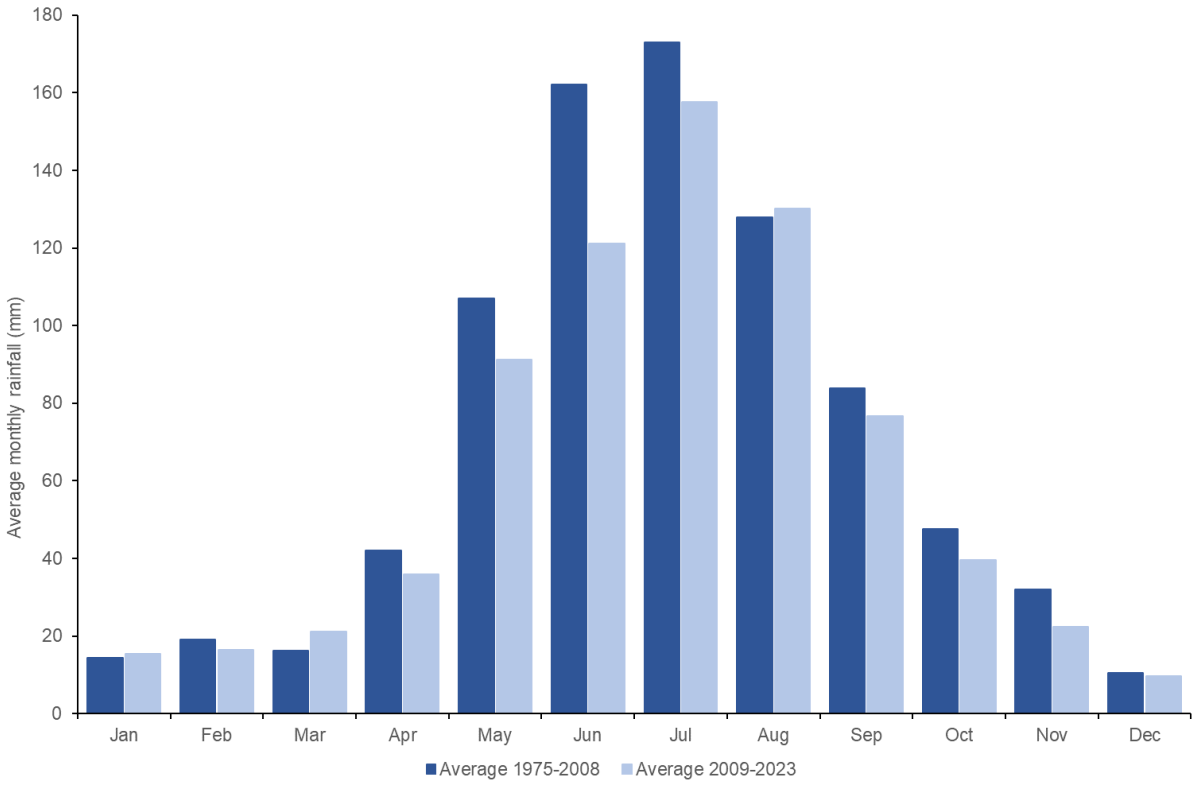

Figure 3 Comparison of average monthly rainfall at Jandakot Aero meteorological station between the periods 1975–2008 and 2009–2023

Temperature

From 1975–2008 to 2009–2023 there has been an increase in average monthly maximum and minimum temperatures recorded at Jandakot Aero meteorological station. Most significant is the increase during the summer months, which coincides with the period when most water is discharged from the release points below Canning Dam (Figure 4). For example, average monthly maximum temperatures have increased by 7 per cent in December, 5 per cent in January and 3 per cent in February.

We use the Armadale meteorological station for temperature forecasts for high-temperature pulse releases and Jandakot Aero station for data evaluation purposes (see Appendix B).

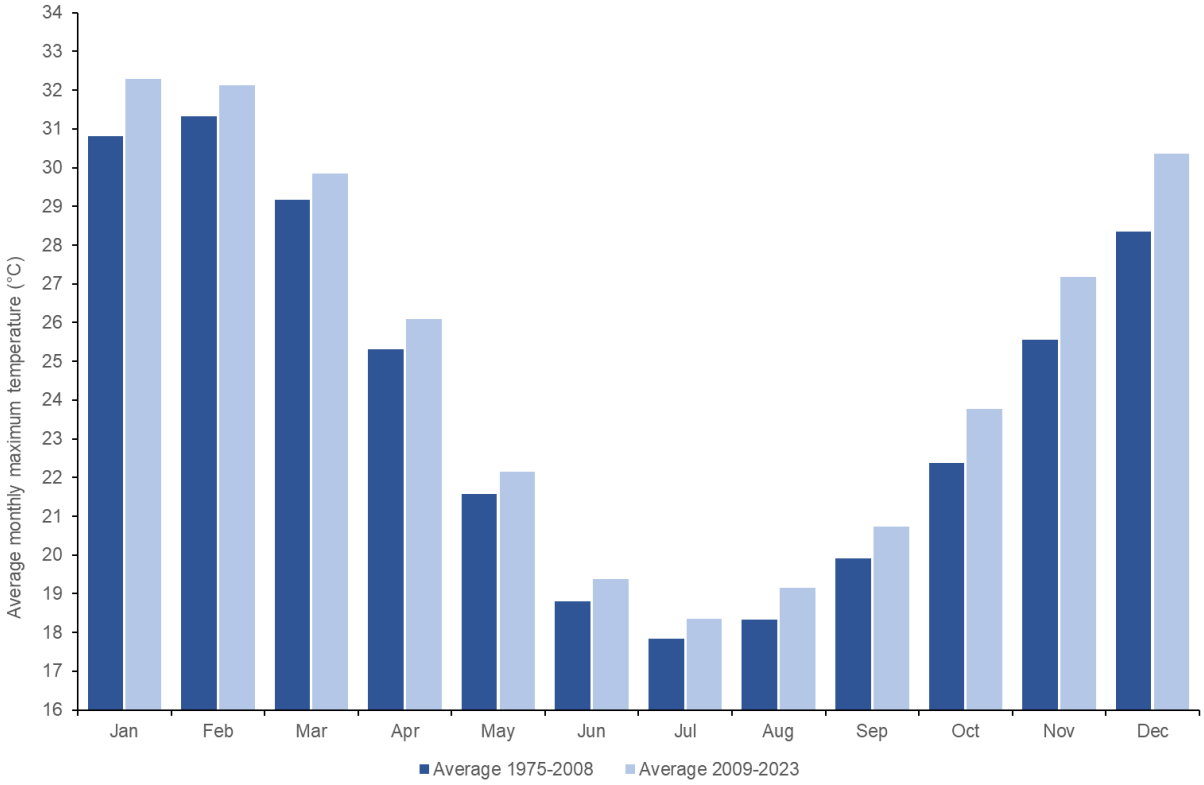

Figure 4 **Comparison of average maximum temperatures at Jandakot Aero station between the periods 1975–2008 and 2009–2023**

3.2 Dam inflows

Surface water for the IWSS comes from 11 dams, including the Canning Dam. Since the 2012 plan was developed, inflows into IWSS dams have declined significantly. Low inflow has occurred even in years of moderate rainfall. MacFarlane et al. (2020) describes how the rainfall-runoff relationship in catchments in south-west Western Australia has changed over time and notes that annual runoff has reduced about three times per unit reduction in rainfall. Lower groundwater levels in catchments are one of the factors that has contributed to reducing runoff.

Between the periods 1975–2008 and 2009–2023, average inflows to Canning Dam declined by 66 per cent (Figure 5). Monthly summer inflows have decreased so much that the dam's presence now has almost no impact on downstream flows over summer (Figure 6).

Canning Dam and desalinated water

Canning Dam is used to store desalinated seawater from Perth's desalination plants. This means natural inflows into the dam are not the only input affecting dam storage levels. Desalinated seawater is stored in dams during periods of low demand so that it can be distributed within the IWSS during the hotter months to supply to Perth's residents during periods of peak demand.

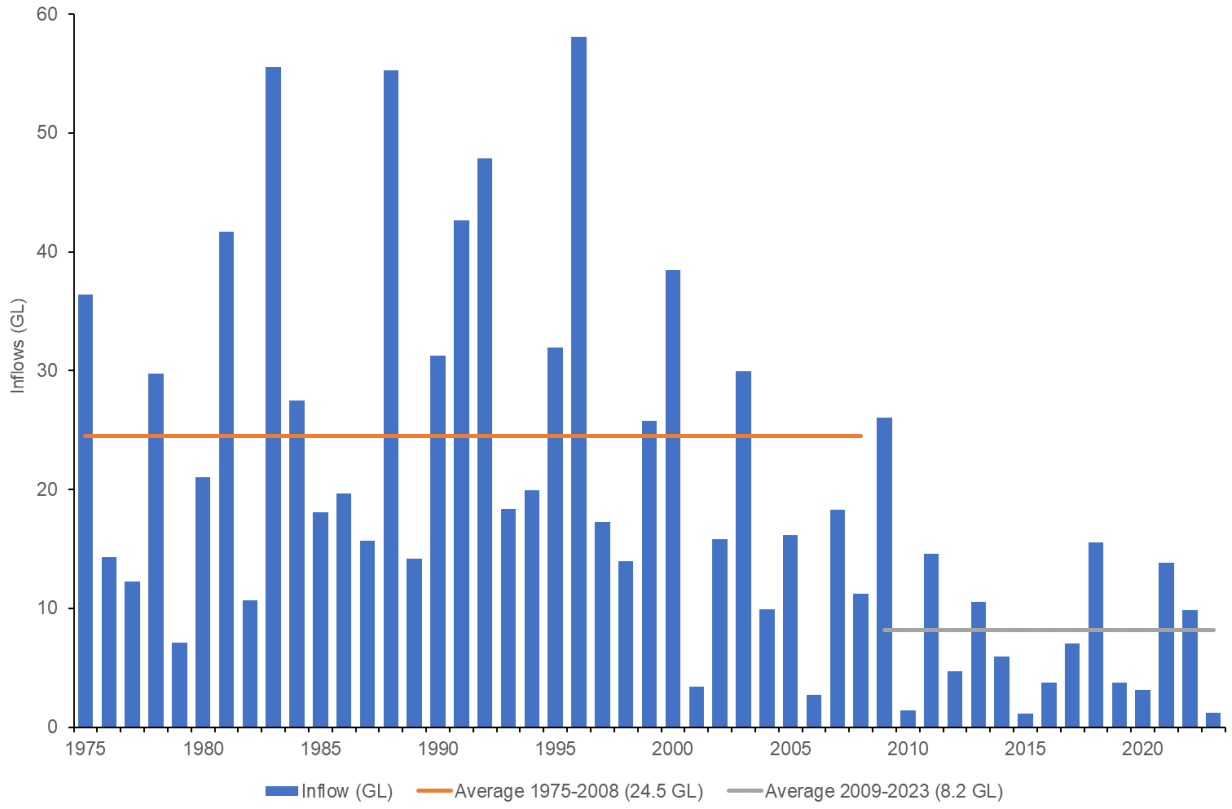

Figure 5 Inflows into Canning Dam

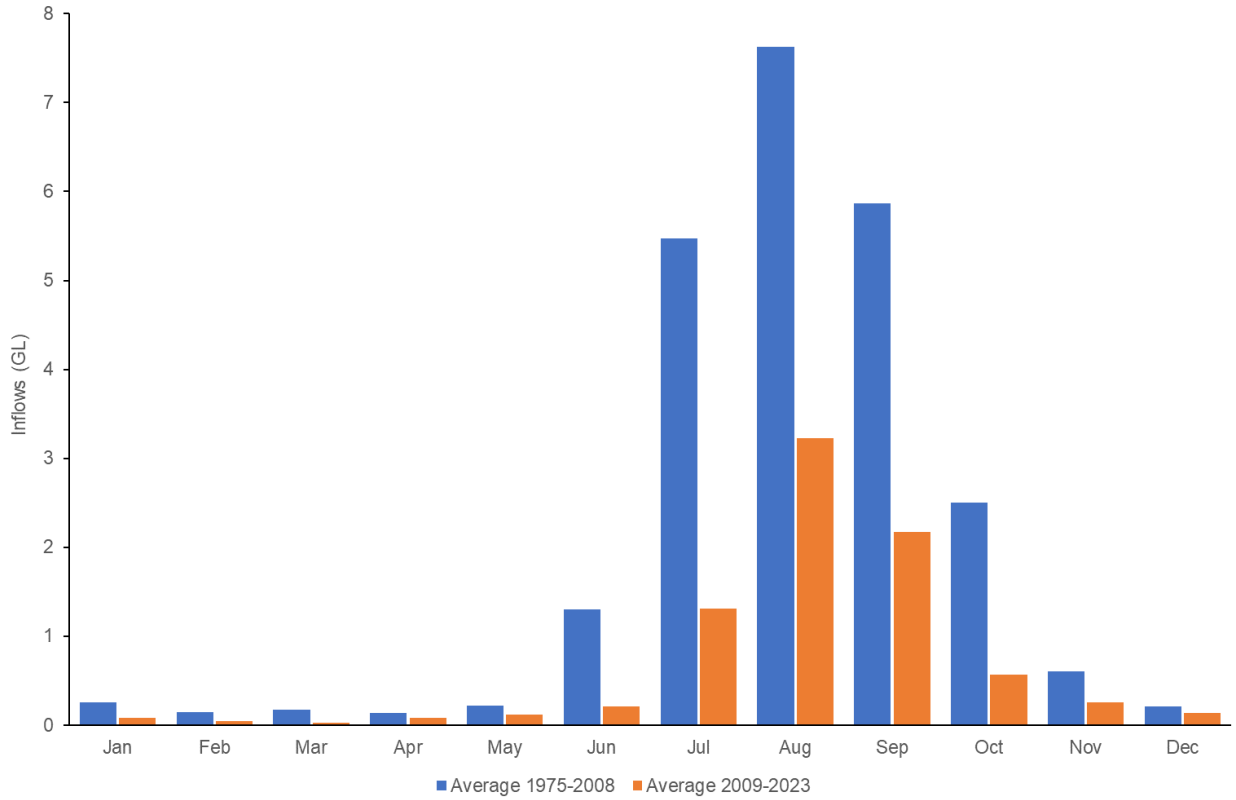

Figure 6 Changes in monthly inflows into Canning Dam

4 Status of water use

The 1996 *Canning River interim allocation policy* outlined principles for licensing that were later adopted in the 2012 allocation plan, namely:

- no additional water allocations will be made
- water use is to be progressively reduced to a level that matches availability
- water users must adopt best-practice conservation and efficiency measures
- pumping restrictions will be applied during periods of inadequate streamflow.

When the *Canning River interim allocation policy* was published in 1996 there were 125 users licensed to take water from the middle Canning River. In line with the objective to reduce surface water use, this number had reduced to 80 licensees by the time the 2012 plan was released. The number has now reduced further to 63 users currently licensed to take water.

Most licensed entitlements (40) are less than 5,000 kL/year and are for uses such as watering gardens, orchards or vegetables for personal use, irrigating pasture and stock watering. Two of the larger licences are held by local governments for irrigating public open space areas.

As of June 2024, the total volume of licensed surface water entitlements from the middle Canning River was 407,365 kL/year. Despite a licence of 75,000 kL/year recently being issued to the City of Kalamunda for the irrigation of Hartfield Park (see below), the overall licensed entitlement volume remains on a declining trend. The current estimated volume of surface water use exempt from licensing is discussed in Section 4.4.

Could surface water users switch to groundwater use to protect river flows?

Groundwater is difficult to access in the eastern part of the middle Canning area. This is because groundwater resources in this area are mostly fractured rock – a hydrogeologically variable source from which abstraction reliability cannot be predicted. On the coastal plain (downstream from around Gosnells) groundwater is being abstracted for use, but because the Canning River receives input from groundwater baseflow in parts of this area, such use may be impacting on river flow. The groundwater modelling being undertaken for the Jandakot and Perth South groundwater areas allocation plan (in preparation) will help us to understand how groundwater baseflow on the coastal plain may be affected by groundwater abstraction, land use change and reducing rainfall due to climate change. We will review groundwater allocation limits near the river to prevent any detrimental impacts to surface water flow from reductions to groundwater baseflow caused by groundwater use.

4.1 Water availability

The surface water resources of the middle Canning River have been fully allocated since the *Canning River interim allocation policy* was released in 1996. Although surface water use has reduced over time as the catchment has urbanised and access to the IWSS has improved, the reduction in abstraction from the river has not led to an increase in river flow. This is because the long-term declines in rainfall caused by climate change are driving continuing reductions in streamflow.

4.2 Recoup of unused licensed water entitlements

Unused water entitlements pose a risk to water resources that are already under stress – additional impacts on values would be likely if those entitlements were activated. The 2012 plan's recovery strategy is for the department to recoup unused water entitlements (or the unused portion of an entitlement) in accordance with our statewide policy *Management of unused licensed water entitlements* (DWER 2020).

The plan specified that recovered water would not be re-allocated. As such we have lowered the allocation limit three times when water was recouped and the licensed volume fell below the general licensing component of the allocation limit – in 2017, 2019 and 2021 (see Table 2). Since 2017, we have conducted a detailed assessment of each licence that has come up for renewal, focusing on unused entitlements, metering requirements and legal access requirements.

Recouping unused entitlements

After allocation limits were first set for the middle Canning River in 2010 and since the plan was released in 2012, recouping of unused water entitlements has resulted in the general licensing component limit being reduced from 608,000 kL/year to 390,000 kL/year (see Table 2).

In line with ongoing declines in rainfall and surface water streamflow, we will continue to recoup unused water entitlements and review and reduce the allocation limit so that:

- total entitlements are below the general licensing component of the allocation limit
- total entitlements fall to within 5 per cent of the allocation limit.

Table 2 Changes to allocation status on the middle Canning River since the plan was implemented (volumes in kL/year).

Date	Allocation limit[1]		Allocation limit components[2]		
			Licenseable[3]		Exempt from licensing
			General licensing		Small-scale riparian rights
	From	To	From	To	
2/11/2010	Not set[4]	650,000[5]	Not set	608,000	42,000
28/9/2017	650,000	575,000	608,000	533,000	42,000
29/11/2019	575,000	450,872	533,000	408,872	42,000
28/4/2021[6]	450,872	432,000	408,872	390,000	42,000

1 The total volume of water set aside for annual take from a resource. This includes water available for licensing and water for uses exempt from licensing such as small-scale riparian use.

2 Different components within each allocation limit help us account for different water uses and administer water licensing.

3 The general licensing component is the volume of surface water that can be licensed for most water uses.

4 The *Canning River interim allocation policy* (1996) did not set an allocation limit. The allocation limit was first set in 2010.

5 To protect the river's ecological, social and cultural values, while supporting the remaining beneficial uses of the resource, the allocation limit was set at 10 per cent below the current use as of 2 November 2010.

6 These allocation limits remain current as at May 2025.

Transfer of surface water licences

Surface water licences are NOT automatically transferred with the sale of a property. New owners are required to apply to the department to transfer the licence before settlement of a property. Transfer applications are subject to assessment. We have communicated this message to settlement agents and local real estate agents on several occasions via letters and presentations.

4.3 Hartfield Park managed aquifer recharge scheme

After the 2012 plan was released, the City of Kalamunda identified Hartfield Park in Forrestfield as the location for a sporting precinct that would service the needs of a growing community. As the city's groundwater allocations were insufficient for irrigating new public open space areas, it decided to trial an innovative managed aquifer recharge (MAR) scheme to harvest and store stormwater in an aquifer over winter for use in summer. A detailed technical analysis was undertaken to ensure that the project was feasible and environmentally sustainable.

In 2023, the department issued the city with a surface water licence, allowing it to take up to 75,000 kL/year of stormwater from Woodlupine main drain (Figure 2) during the wettest part of the year (between June and October). The scheme was designed so that after filtration, the stormwater would be injected into the Leederville aquifer from where it would be abstracted to irrigate ovals and playing fields at nearby Hartfield Park over the summer months.

The scheme is managed under an operating strategy to ensure there are no significant impacts on downstream aquatic environments. Abstraction from Woodlupine main drain only starts once a

constant streamflow has been established in the drain. The city's abstraction volumes do not exceed 50 per cent of the monthly streamflow and the total abstraction is less than 10 per cent of the total annual streamflow.

Woodlupine main drain joins the Canning River about 4.5 km upstream of Kent Street Weir. This is well below the reach of the main channel that is influenced by river releases (Figure 2). Furthermore, the licence issued to abstract water from the main drain will not affect winter and shoulder streamflow in the main channel.

4.4 Riparian rights – surface water use that is exempt from licensing

Riparian rights are detailed in Part III, Division B, sections 9 and 20 of the *Rights in Water and Irrigation Act 1914*. A riparian right grants landowners whose properties are contiguous with a watercourse a right to abstract water without a licence:

- for domestic and ordinary use
- for the watering of cattle or other stock not raised under intensive conditions (as defined in section 21(4) of the Act)
- to irrigate garden not exceeding 2 hectares (garden must not be used for commercial purposes but must be part of the riparian land and be associated with a dwelling on the land).

This right does not guarantee that water will be available.

In 2012, the plan estimated 30 properties historically had a riparian right. We are working with DBCA to determine how surface water use should be best managed in areas within the Swan Canning waterways. The Swan Canning waterways include the Canning River reserve created under the *Swan and Canning River Management Act 2006*, which is vested in the Swan River Trust. We will consider this work as part of an audit of properties with a riparian right.

Audit of properties with a riparian right and review of exempt water use

We will audit our estimate of the number of properties along the middle Canning River to confirm those that have a riparian right and update the volume of water use that is exempt from licensing.

5 Status of river releases

5.1 Summer releases

During the summer months, river releases are made from five release points on the Canning River downstream of Araluen Pumpback, and from one release point on Stinton Creek, a tributary of the Canning River (Figure 7 and Figure 8). The objective of the summer releases is to ensure the river does not stop flowing between the Araluen Pumpback and Kent Street Weir. The releases aim to maintain habitat inundation (priority pools and riffles and edge habitats); enable the movement of localised species (access between habitats); and support water quality (supply cooler/higher oxygen flows and reduce stratification and the risk of anoxic conditions).

Streamflow within the allocation plan area is measured at Seaforth gauging station (AWRC ref. 616027), which is located towards the end of a management reach supporting multiple licence holders (Figure 8). Seaforth gauging station is the only streamflow measurement point in the plan area. We make 'snapshot' streamflow observations at other management reaches during weekly or fortnightly site visits whilst the river releases are operating (Figure 8).

Decreased streamflow due to reduced summer rainfall and increases in temperature have prompted several changes to the river release arrangements to better meet the plan's objectives (see Section 2.2).

Streamflow observations

Fortnightly streamflow observations are made at each management reach (see Figure 8) during the period river releases are in operation. These include a staff gauge reading, an estimate of streamflow, and the measurement of riffle width and depth. Water quality measurements of temperature, dissolved oxygen, electrical conductivity and pH are also made. Weather conditions on the day are also recorded.

Figure 7 River release point at Orlando Street, one of the five release points on the main channel below Araluen Pumpback

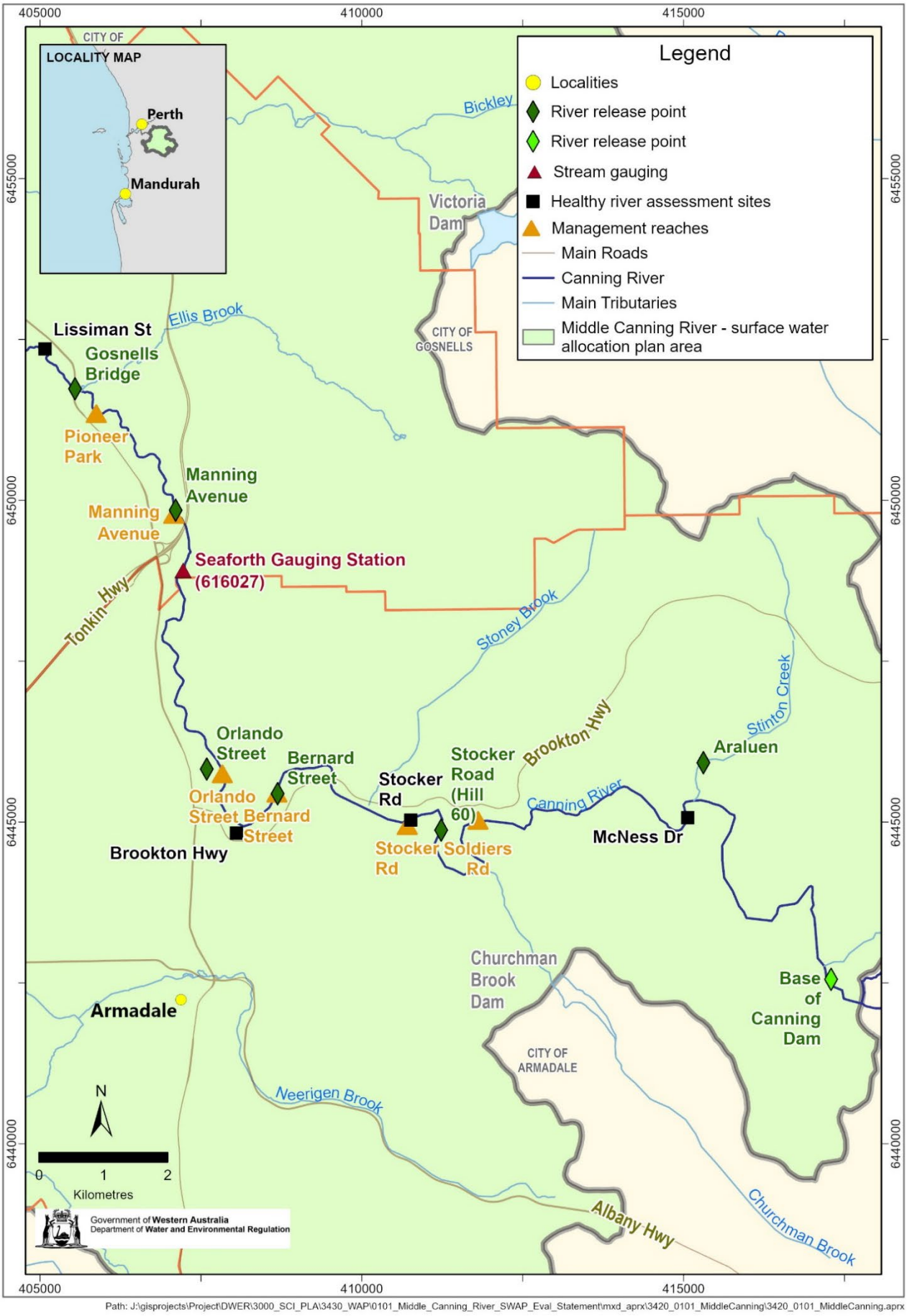

Figure 8 **Location of the river release points, management reaches and river health assessment locations along the middle Canning River**

Standard-year releases

We manage the standard-year river releases using a summer minimum streamflow threshold of 1.8 ML/day, measured at Seaforth gauging station. This minimum streamflow threshold was informed by an ecological water requirements study (Radin et al. 2010) that determined the volume of water required to submerge sufficient riffle habitat, maintain pool depth, maintain pool connectivity and prevent anoxic conditions in pools.

We have instigated standard-year releases in all years since the 2012 plan's release, other than 2012–13 and 2015–16 when we requested low-rainfall and low-inflow releases. Appendix C assesses whether the standard-year releases met the summer minimum streamflow threshold in each year between 2011–12 and 2022–23 (other than 2012–13 and 2015–16).

Since 2017–18, we have worked with Water Corporation to meter and alarm the release points to more accurately match the volumes of water released to the volumes of water we have requested (see Section 5.3). The metered and alarmed release points have helped to ensure that the releases come within 10 per cent of the requested volumes.

Reduced releases in low-rainfall or low-inflow year

Summer is a time of high ecological stress when low or no rainfall, high minimum and maximum temperatures, and high evapotranspiration coincide with peak periods of abstraction for irrigation. This results in large water losses from the river.

The years 2012–13 and 2015–16 were defined respectively as low-rainfall and low-inflow years under the 2012 river release rules. The volumes of water released were reduced (see Section 5.3 in the plan) and one of the major objectives was to maintain a summer minimum streamflow threshold of 0.86 ML/day, measured at Seaforth gauging station (see Appendix C).

In both years, despite the reduced summer minimum streamflow threshold being met at Seaforth for most of the time, streamflow was low or ceased to flow at other measurement locations. Thus, we did not meet the objective to ensure the river does not stop flowing between the Araluen Pumpback and Kent Street Weir.

In addition, water quality (dissolved oxygen) routinely fell below trigger levels at Seaforth and other measurement locations, meaning the releases did not meet the objective of preventing anoxic conditions. Ecological monitoring showed that the lower flows also affected aquatic biota, with reduced abundance of key species and reduced evidence of recruitment.

Monitoring clearly demonstrated that the low-rainfall and low-inflow-year releases and a minimum streamflow threshold of 0.86 ML/day failed to maintain sufficient summer baseflow, reduced water quality, and adversely affected aquatic biota. For these reasons, and with low-inflow years likely to occur more frequently in the future, we will no longer implement reduced-volume river releases in low-inflow years. Standard-year releases will now apply in all years. This policy will also help to ensure that licensed water users of the middle Canning can take their entitlement with less risk of surface water abstraction compromising flows that support the river's ecology.

We may make changes to standard-year releases in the future after a review of river release arrangements in line with the changing climate.

5.2 Shoulder season and winter flows

Radin et al. (2010) describes the following streamflow thresholds for the shoulder and winter periods to achieve critical flow-ecology linkages (measured at Seaforth gauging station):

- April to October – continuous flows of up to 10.7 ML/day to inundate emergent vegetation; provide habitat for macroinvertebrates, fish and waterbirds; and maintain emergent plants.
- June to October – continuous flows of up to 4.7 ML/day to provide sufficient water depth (at least 10 cm) over obstacles, so that upstream passage of small-bodied freshwater fish for spawning and reproduction is enabled.

These streamflow thresholds are based on the period 1975–2008, which was a much wetter period than what we have experienced since (Figure 3). Neither streamflow threshold has been met 100 per cent of the time since the plan was released. The most common periods when streamflow was below the thresholds were April–June and October. The low streamflow occurs even with river releases. This is directly linked to low rainfall (Figure 3) and, with the climate drying further, streamflow may go below the recommended thresholds more often during these shoulder periods.

Every three years we undertake river health assessments to assess streamflow, habitat, water quality and aquatic biota (see Chapter 6). These have helped us to evaluate whether we are meeting the 2012 plan's objectives. Notably the population structures of aquatic biota have remained stable over time, despite streamflow falling below the thresholds in some years. There was evidence of habitat degradation and deteriorating water quality in the most recent survey in 2021–22, which was likely driven by habitat and water quality issues associated with contaminants, sediment deposition or clearing of river corridors, rather than by changes in flow (see Chapter 6).

5.3 Operating river releases

Since the allocation plan was released in 2012, we have worked with Water Corporation to improve some of the processes and procedures around the operation of river releases, such as:

- creating better communication protocols
- metering all river release points to ensure that the daily volumes of water released are within 10 per cent of the requested volumes
- developing mitigation actions to manage situations when river release points are out of action for scheduled or unscheduled maintenance (these include increasing river release volumes at other release points to compensate for reduced streamflow, and adapting the timing or duration of maintenance works to minimise the impact of reduced streamflow on downstream environments).

The department conducts regular maintenance at the Seaforth gauging station and at other monitoring points to ensure the accuracy of the data being delivered by the monitoring infrastructure.

5.4 Alternative water sources for river releases

Implementation action no. 9 (detailed in Table 5 of the 2012 plan) commits the department to consider opportunities to use fit-for-purpose water to replace the use of scheme water for releases.

In 2019 Water Corporation assessed a range of alternative water source options that might be suitable to support, or be a substitute for, the existing scheme water river releases. Options included:

- sewer mining from a major pump station in the vicinity (Waterworks Road), and treating the wastewater to an appropriate standard
- using brackish groundwater, desalinated to an appropriate standard
- operating scour releases from the base of Canning Dam rather than the existing trunk main release points.

The investigation concluded that these options were not cost-effective sources to replace or supplement the current releases (Water Corporation 2019).

6 Status of ecological values

Under the department's Healthy Rivers program, we make standardised assessments of river health in strategic locations across south-west Western Australia, including in the Canning area. Healthy Rivers uses the South West Index of River Condition (SWIRC), a toolkit developed by the department to provide an integrated assessment of river health. SWIRC collects and interprets biological, water quality and habitat data on rivers and their catchments to support the development of strategies to best protect the environment.

We have conducted triennial river health assessments at four locations in the main channel immediately downstream (within 1 km) of the river release points since the river releases were established in 2010 (Figure 9). Monitoring is undertaken in several priority refuge habitats, which are areas of permanent water that support diverse communities of native aquatic fauna and flora through the dry seasons. Through the health assessments we have sought to understand how the river's ecology may be responding to changing streamflow and water quality conditions, as well as whether the 2012 plan has been effective for maintaining the riverine ecosystem's overall health.

In 2014–15 we adjusted some of the plan's original water quality performance indicators to match those used in the Healthy Rivers program and to ensure consistency across the state. Hence, we have increased:

- the acceptable range for dissolved oxygen from ≥ 2.5 mg/L to > 4 mg/L – based on typical conditions in south-west rivers where native fish species have been found (Beatty et al. 2013)
- the acceptable range for pH from 5.0–8.0 to 6.5–8.0 – based on the 'acceptable range' for pH in lowland rivers in south-west Australia (ANZECC & ARMCANZ 2000).

The most recent (2021–22) river health assessment looked at whether:

- key water quality parameters remained within ranges suitable to support the lifecycles of native fish and crayfish – this was measured within important refuge habitats throughout the dry season whilst river releases were operating
- habitat availability and complexity were maintained
- the richness, abundance and age distribution of fish and crayfish species were consistent with the 2009–10 sampling round.

The assessment found the richness, abundance and age distribution of fish and crayfish species were consistent with the results in 2009–10. This suggests that streamflow has been sufficient to provide for aquatic biota lifecycles. However, the assessment also revealed that the middle Canning River is showing signs of ecological stress, particularly at sites lower in the catchment where land use intensity and the impacts of drainage are affecting habitat and water quality, mostly because of sedimentation. Streamflow rates in this area are lower as the land is flatter, allowing for sediment to settle out and smother habitat.

During the 2021–22 survey, dissolved oxygen levels at the Lissiman Street site dropped to sub-optimal levels (below <4 mg/L) for two months continuously, while all other sites exhibited optimal or near optimal conditions. Oxygen levels only improved to >4 mg/L at the Lissiman site once temperatures cooled and rainfall in the catchment resulted in streamflow at Seaforth gauging station rising above 20 ML/day. This is a much higher level than the river releases could achieve, even if the volumes were increased significantly. The poor water quality conditions at the Lissiman site were attributed to low flows and local pressures (e.g. local run-off, sedimentation, and degradation of bank vegetation). This highlights the importance of riparian zone condition and in-stream habitat quality in maintaining river water quality at times of low flow. Water quality is better in parts of the river where there is in-stream and riparian vegetation for shading, oxygen production and removal of pollutants; and where there is large woody debris to improve mixing of flows and channel stability.

Despite the 2021–22 survey finding evidence of ecological stress, resilience exists in the system. Refuge pools are providing sufficient habitat and water quality to support native aquatic species through the high-stress periods, while promoting recolonisation in other areas of the river when conditions are more favourable. As the climate dries further, it will be crucial to protect and enhance these permanent water habitats to conserve biodiversity and the range of benefits that a healthy ecosystem provides.

To enhance the resilience of the middle Canning aquatic ecosystem, refuge pools need to be identified and prioritised for protection. Actions should focus on maintaining and improving the river's ecological health, aiming to ensure habitat availability (size and depth of pools and connectivity, via flow, with adjacent habitat which species use for foraging) and habitat quality (e.g. complexity of in-stream and streamside zone habitat).

Exotic species, such as the aggressive and invasive pearl cichlid (a freshwater fish native to South America which has been found in the Swan–Canning river system), represents a particularly high risk to the middle Canning's ecology and all involved agencies and land managers must continue to work collaboratively to limit its spread as much as practicable. Identifying refuge pools and inhibiting the spread of invasive species, along with other important ecological work, will also be key actions in the Djarlgarro (Canning) waterways restoration plan that DCBA is developing. The pressure from exotic species is expected to worsen in a drying climate as:

- remnant habitats shrink and there is more competition for space
- water quality conditions become less stable – invasive species can be more tolerant to changing conditions.

Figure 9 River health assessment at Lissiman Street (left) and McNess Drive (right)

7 Actions to implement the plan and evaluation of plan objectives

In evaluating the 2012 *Middle Canning River surface water allocation plan*, we considered recent information on rainfall, streamflow, allocation status and environmental values to understand whether the water resource objectives were being met.

The 2012 plan outlines the implementation actions and the performance indicators we are using to measure the performance of the plan against its objectives.

Table 3 below describes how we have met the plan's management actions since its release. We have made some modifications to the management actions and implementation actions since the plan was published so that we can better meet the plan objectives. These changes are also outlined in Table 3.

Table 4 below identifies whether the department met, partly met, or did not meet the plan's objectives for the period 2012–2023, and Table 5 below summarises how we performed against the plan's performance indicators. Also included in Table 5 under the heading 'future planning' are the considerations and management actions necessary to address some of the challenges we identified during the evaluation process for this statement.

Figure 10 One of the six monitored reaches along the middle Canning River

Table 3 Summary of progress against the implementation actions in the 2012 *Middle Canning surface water allocation plan*

Releases		
1	Manage summer releases in accordance with the rules.	Met

The department has successfully managed the river releases in accordance with the rules every year since the plan was released. We have made several changes to the river release rules as part of the plan's annual evaluation to help ensure its objectives are being met (see Section 2.2).

Updated management

To better respond to reduced rainfall and river streamflow and higher temperatures from climate change, we have:

- introduced high-temperature and autumn pulse releases
- introduced a two-stage river release turn-off.

We will no longer implement the reduced-volume river releases in low-rainfall/low-inflow years and will instead make standard-year releases. See Section 2.2 for details and Appendix A for the updated river release arrangements.

2	Notify users and announce in local media when releases and licensed entitlements will be altered in low-rainfall years.	Met Action no longer relevant

The department has instigated low rainfall/low-inflow releases twice since the plan's release – in 2012–13 and 2015–16.

We sent a letter to all licensed users before the releases were turned on. We asked them to:

- reduce their use
- access alternative sources, for example scheme water where available
- spread their water use out over the week (rather than draw all their water over a short period of time) and coordinate take with their neighbours
- observe the current sprinkler restrictions for scheme water users.

In both years we placed notifications about the low-inflow releases into local newspapers in the Canning area. We also engaged with the Middle Canning River stakeholder group on the reduced releases and contacted the Armadale Gosnells Landcare group to request that information about the reduced releases be included in their regular newsletter.

Updated management

We will no longer report on this action as the low-rainfall/low-inflow year releases will be replaced by standard-year releases (see Section 2.2).

3	If water is recouped below the allocation limit and flows consistently exceed flow thresholds, we will amend the releases to ensure the most effective use of scheme water.	Met Action no longer relevant

Since the plan was released, natural streamflow has not once been sufficient to meet the recommended streamflow thresholds, largely because of our changing climate. Despite the allocation limit for licensed entitlements reducing from 608,000 kL to 390,000 kL/year since 2012, we have had to increase the release volumes to meet minimum streamflow thresholds during extended periods of high temperatures and low rainfall (see Section 5.1).

Future climate projections show continued drying and increased temperatures, so it is unlikely that natural streamflow will ever again be sufficient to meet the recommended streamflow thresholds.

We will no longer report on this action.

Licensing		
4	Update Water Corporation licence conditions and operating strategy for the IWSS.	Met

The department meets annually with Water Corporation to discuss the river release arrangements for the Canning River and other systems where releases are made below IWSS dams.

We have updated Water Corporation's operating strategy for the IWSS with our amendments to the river release rules as needed since the plan's release (see Action 1). See also Section 2.2 and Appendix A.

Updated management

If the river release arrangements need further adjusting to meet the plan's objectives, we will amend the conditions of Water Corporation's operating strategy to reflect the new requirements.

5	All licensees with entitlements greater than or equal to 20,000 kL/year have a department approved meter installed within three years of the plan's release (2015).	Met Action no longer relevant

When the plan was published in 2012 there were four licensees with an entitlement greater than or equal to 20,000 kL/year. Those licensees were required to have a department-approved meter installed by 2015.

Under Regulation 41C of the Rights in Water and Irrigation Regulations 2000 (metering regulations) and in line with the *Policy – measuring the taking of water* (DWER 2019), all licensees in the plan area with an annual water entitlement equal to or greater than 10,000 kL/year must now meter their water use and submit metering data to us through Water Online (see Section 2.1).

Following the changes to statewide metering regulations, as of March 2024, 11 licensees were required to meter their water use. The department has amended their licences to include conditions to install the meter and to provide us with metering data at the beginning and end of each specified water year.

All licensees who are required to have a meter now have one, so we will no longer report on this action.

6	Conduct property surveys.	Met

The department's licensing officers surveyed properties with a surface water licence as part of:

- licence renewals
- licence transfers
- or when required.

7	Undertake an audit on riparian users. Identify unauthorised riparian use and investigate options for managing.	Partially met

The department keeps a record of all properties along the Canning River that have a licence to take water. We use this data to inform targeted compliance checks.

We are working with DBCA to determine how surface water use should be best managed in areas within the Swan Canning waterways. The Swan Canning waterways include the Canning River reserve created under the *Swan and Canning River Management Act 2006*, which is vested in the Swan River Trust. We will undertake an audit of the number of riparian users, considering the outcomes of the work with DBCA. This process will also help to identify any unauthorised riparian use.

Recovery strategy – over-allocated resources		
8	Review the allocation limit when: • water is recouped so that total entitlements are below the licensable component of the allocation limit • water is recouped so that total entitlements fall to within 5 per cent of the allocation limit.	Met

Since 2012, we have reviewed and amended the general component of the allocation limit on three occasions in response to recoups of licensed entitlements (see Section 4.2). We anticipate that the allocation limit will continue to be lowered as water is recouped through the licence renewal process and as recouping opportunities arise due to land use changes.

Water use efficiency		
9	Consider opportunities to use fit-for-purpose water to replace the use of scheme water for releases.	Met

Water Corporation investigated options for alternative sources to substitute/support the existing river releases of treated scheme water. The investigation concluded that there was no cost-effective source for substitution of the current release points (see Section 5.4).

Communication and evaluation statements		
10	Produce and publish an evaluation statement on the plan and its implementation.	Met

This statement is the first formal evaluation of the *Middle Canning River surface water allocation plan*. However, we have been conducting annual internal reviews of the plan's performance since its release in 2012.

Until 2020 we provided summaries of the annual reviews and information about the river releases to stakeholders via the Middle Canning River stakeholder group, and after that to the multi-agency stakeholder group developing the Djarlgarro (Canning) waterways restoration plan (led by DBCA).

Table 4 Evaluation against the objectives in the 2012 plan

Objectives		Status
Water resource objectives		
R1	To maintain the river's capacity to supply water for use as needs change.	Partially met
R2	To maintain sufficient flow regimes (summer and winter) in a changing climate to minimise risks to the riverine environment including: • maintaining summer baseflows • maintaining oxygen levels and pool connectivity • provision of occasional pulse flows to meet native fish requirements over the summer months.	Partially met
Management objectives		
M1	To recover licensed entitlements to within the allocation limit.	Met
M2	To improve water use efficiency.	Partially met
M3	To reduce abstraction to allow the releases to be minimised following low-rainfall winters.[3]	Partially met
M4	To reduce unauthorised water use.[4]	Partially met

[3] Releases will no longer be minimised following low-rainfall winters.

[4] Unauthorised use may be identified via water licence compliance checks or through periodic audits of riparian use.

Table 5 Assessment against the plan's performance indicators for the period 2012–2023

	Performance indicator	Objectives	Evaluation criteria
1	Releases over the summer months meet the required thresholds.	R1, R2 M3, M4	Releases over the summer months meet the required streamflow thresholds, i.e. during summer, daily flow measurements remain above 1.8 ML/day or 0.86 ML/day in reduced release years.

Assessment against performance indicator

Long-term streamflow monitoring at Seaforth gauging station shows that streamflow is decreasing, even with river releases, and it is becoming increasingly difficult to meet summer minimum streamflow thresholds. This is largely due to declining rainfall and increasing temperatures. The department has implemented high-temperature pulse releases since 2019–20 to help ensure minimum flow thresholds are met during periods of very hot weather (see Section 2.2). We are using a two-stage river release turn-off and pulse releases to support ecological values through to June in dry years to help ensure minimum flow thresholds are met in years of delayed wet-season rainfall (see Section 2.2).

Standard-release years

For standard-release years, the minimum streamflow threshold of 1.8 ML/day was met all summer in six out of 10 years. It was met for more than 95 per cent of the time in four out of 10 years. See Section 5.1 and Appendix C for more detail.

Reduced-volume river release arrangements

We instigated reduced-volume releases in 2012–13 and 2015–16. The minimum streamflow threshold of 0.86 ML/day was met in one out of the two years. In 2015–16 it was not met for a short period in February coinciding with hot weather. See Section 5.1 and Appendix C for more detail.

To reduce risks to ecological values in dry years, we will no longer be activating low-inflow trigger and low-inflow release arrangements for the Canning River and will instead make standard releases (see Section 2.2). We will no longer report on reduced releases.

Other supporting information

To help meet this performance indicator, we have also put other measures in place:

- actively recouping unused licensed entitlements and making corresponding adjustments to allocation limits to reduce the risk of increased water use resulting from activation of 'sleeper' licences (see Section 4.2)
- placing water use efficiency conditions on licences for irrigating lawns and gardens to restrict the daytime use of sprinklers (since 2007) and enforcing the winter sprinkler ban (since 2010)[5]
- increasing metering and reporting requirements (see Section 2.1)
- during the reduced release years of 2012–13 and 2015–16, undertaking a targeted education campaign to encourage licensees and riparian users to employ a range of measures to improve their water use efficiency and reduce the impact of pumping on the river
- installing meters on all river release points to improve the accuracy of release volumes (see Section 5.3)
- working with Water Corporation to improve the efficiency of processes and procedures, not only to ensure effective implementation of the river releases, but also to manage any operational issues quickly and expediently (see Section 5.3).

Future planning

Meeting minimum streamflow thresholds and water quality targets is becoming increasingly difficult as rainfall declines, temperatures increase and streamflow reduces. Future climate projections for the Perth area indicate rainfall will continue to decline and that temperatures will continue to increase (see Section 8.1). It will be a significant challenge to maintain the river's capacity to supply water for use if the future is drier and hotter.

The river release arrangements for the middle Canning River need to be reviewed to ensure they remain contemporary in a drying climate.

We will continue to reduce water use and recover licensed entitlements as land use alongside the river changes and use of water from the river is no longer required.

Catchment and water resource management actions need to occur in tandem with one another to obtain the maximum benefit from river flows or river releases and meet the plan's objectives. We will continue to work with local governments and DBCA to develop and implement appropriate and effective management actions to meet river health and private water supply demands in the face of climate change (see Section 8.2).

2	Maintain water quality during the summer period above the required levels.	R2	Measurements of water quality are within an acceptable range of the baseline levels for: • total nitrogen – ≤ 1.2 mg/L • total phosphorus – ≤ 0.065 mg/L) • dissolved oxygen – ≥ 4 mg/L (was ≥ 2.5 mg/L) • pH – between 6.5 and 8.0 (was between 5.0 and 8.0).

Assessment against performance indicator

In 2014–15 the department adjusted two of the water quality target ranges to align with those used in the Healthy Rivers program (see Chapter 6).

Total nitrogen and phosphorus may influence the occurrence of algal blooms in the lower reaches. Levels for both were within the required ranges for most of the time in all years. Total nitrogen and phosphorus concentrations in 2021–22 were very low and not likely to be causing the declines in dissolved oxygen. Rather, these declines are a result of periods of low to no flow, sediment and biological oxygen demand. The presence of fine sediment may provide more substrate for bacterial or algal activity, which increases oxygen demand. Other factors such as higher water temperatures due to reduced shading can also affect dissolved oxygen levels by affecting algal and bacterial activity. Dissolved oxygen fell below 2.5 and 4 mg/L at Seaforth and other sites lower down the system during periods of high temperatures and corresponding increases in water temperature (see Chapter 6). The pH levels at all four Healthy Rivers program sites were within acceptable ranges, based on accepted natural ranges for freshwater rivers of south-west Western Australia.

Future planning

We will work with DBCA and local governments to implement land use and catchment planning activities/remediation to deal with sediment at the source and reduce its input and impacts on high organic load. This work, along with improving shading of the waterway, is expected to support improvements in dissolved oxygen.

3	Presence of freshwater fish species.	R2	Determine presence or absence of native fish species: • every three years • in the second summer if two successive reduced release years occur.

Assessment against performance indicator

The department has been monitoring aquatic biota as part of river health assessments since the river release arrangements were established in 2010. We have conducted triennial monitoring of important refuge pools along the middle Canning in 2012–13, 2015–16, 2018–19 and 2021–22. We have not experienced two consecutive low-flow years, so additional monitoring was not required.

The 2021–22 assessment found that the richness, abundance and age distribution of fish and crayfish species was consistent with those sampled in 2011. This suggests that summer streamflow provided by river releases has been sufficient to provide for aquatic biota lifecycles.

The triennial assessments indicate a slight decline in the condition of river ecology and the spread of exotic species, and that land use intensity and drainage impacts are affecting water quality and habitat integrity/availability.

We will no longer determine or report on the presence or absence of native fish species in the second summer if two successive reduced release years occur because from now on, we will only make standard-year releases.

Performance indicator		Objectives	Evaluation criteria
4	The total volume of licensed entitlements is less than or equal to the allocation limit.	M1, M2	Compare the volume of water licensed against the allocation limit for each resource. Report on the volume of unused water entitlements recouped.

Assessment against performance indicator

The department has actively recouped unused licensed entitlements for the middle Canning. Since the 2012 plan, we have revised the allocation limit down on three occasions to ensure the resource remains fully allocated and no additional surface water is re-allocated for licensing. See Section 4.2 for more information.

Since 2017, we have conducted a detailed assessment of each licence that has come up for renewal, focusing on unused entitlements, metering requirements and legal access requirements.

Future planning

We will continue to actively recoup unused licensed entitlements and lower the allocation limit accordingly.

5	Meters installed as per the licensing policy.	M2	Number of meters fitted. Number of meter reading reports submitted each year.

Assessment against performance indicator

New statewide metering regulations came into effect from 31 December 2020. These require that all licensees in the plan area with an annual water entitlement equal to or greater than 10,000 kL/year must meter their water use and submit metering data to the department (see Section 2.1). As of March 2024, 11 licensees met this requirement. All have installed a meter and eight are compliant with reporting requirements. We have followed-up with the users who are non-compliant and are working with them to ensure future compliance.

6	Number of riparian users.	M1, M4	Three-yearly assessment of the number of riparian users.

Assessment against performance indicator

We are working with DBCA to determine how surface water use should be best managed in areas within the Swan Canning waterways. The Swan Canning waterways include the Canning River reserve created under the *Swan and Canning River Management Act 2006*, which is vested in the Swan River Trust. This work will be considered as part of an audit of the number of riparian users and a subsequent recalculation of the volume of water use exempt from licensing.

The licensing of water abstraction creates a clearer picture of the demand on a resource than when users take water under riparian rights, and it allows us to monitor and regulate water use. Licensing informs us about who is using water for what and where water is being taken, which can help us to manage the resource. Licences also provide a mechanism for conducting regular compliance checks.

[5] Water use efficiency actions have also been implemented under the *Waterwise Perth action plan* (Government of Western Australia 2019), *Kep Katitjin – Gabi Kaadadjan Waterwise Perth action plan 2* (Government of Western Australia 2022), and *Kep Katitjin – Gabi Kaadadjan Waterwise action plan 3* (Government of Western Australia 2024).

8 Our response and future planning

8.1 Future climate projections

Climate change will continue to affect the availability of surface water resources in the middle Canning plan area. To date, the rainfall decline affecting south-west Western Australia has been greater than anywhere else in Australia, and the region is very likely to continue drying in the future (IPCC 2021; 2022).

The south-west region, including the middle Canning plan area, is projected to have:

- less rainfall in winter and spring and lower annual rainfall
- increased intensity of heavy rainfall events
- increased drought duration
- increased evaporation rates, reduced soil moisture and runoff.

The Bureau of Meteorology has developed future climate projections based on global climate models from the World Climate Research Programme's Coupled Model Intercomparison Project 5 (CMIP5). These are based on a suite of models that best represent Australian conditions and include two greenhouse gas emissions scenarios: one high representative concentration pathway (RCP) 8.5) and one medium (RCP 4.5). The department has analysed future climate projections for the middle Canning area at the nearby Jandakot Aero meteorological station.

Concurrent with this evaluation statement, we developed updated guidelines (DWER 2024) for using future climate projections for water management with specific reference to the National Hydrologic Projections (NHP) dataset. The updated guidelines are part of a State Government initiative delivering up-to-date climate science resources for WA's water community. See *Guide to future climate projections for water management in Western Australia*.

We used the full NHP dataset to examine the range of plausible future climate projections for the 2012 plan's evaluation. Consistent with historical rainfall trends, the future climate projections show a continued decreasing trend in rainfall, particularly winter rainfall (Figure 11). Reduced rainfall would result in declines in streamflow. This would mean more regular breaches of the summer minimum streamflow threshold and, without river restoration actions and improvement in catchment condition, lower water quality and impacts to ecological values.

Where historical autumn rainfall typically started in April, the future climate projections tend towards a delayed start to the wet season, with rainfall projected to start more commonly in May and June. Given the river releases are currently stopped when a set volume of cumulative rainfall is received after 1 April, the projections indicate that releases may need to be regularly extended until the end of May or even to June.

The future climate projections also indicate a continued trend towards hotter summers, particularly the number of days exceeding the high-temperature pulse release criteria of 33°C. This may result in the department needing to implement more high-temperature pulse releases in the future.

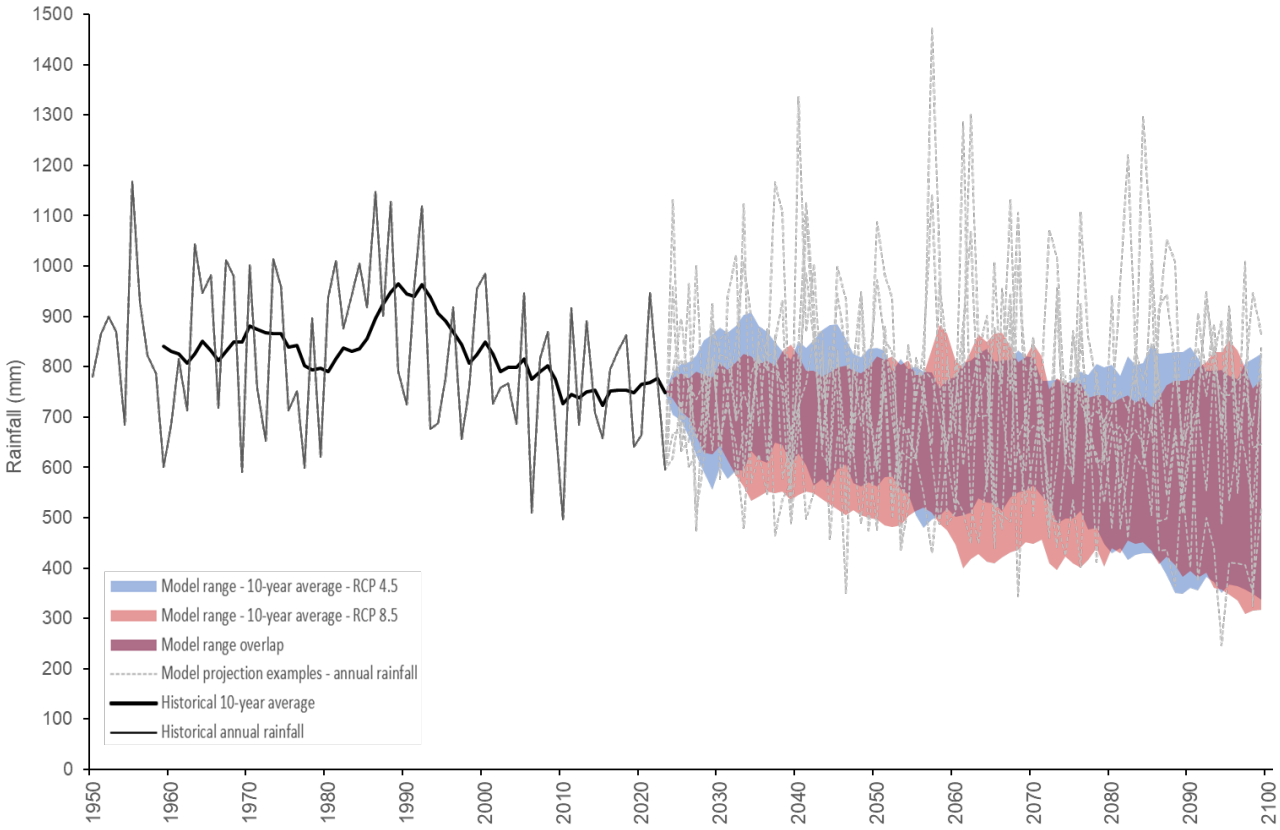

Figure 11 Historical and projected rainfall at Jandakot Aero meteorological station under future scenarios of high (RCP 8.5) and mid (RCP 4.5) levels of greenhouse gas emissions

8.2 Ecological water requirements and river release arrangements

This evaluation has confirmed that we need to review the ecological water requirements and river release arrangements (including a review of release infrastructure) for the middle Canning River. This is because of declining river streamflow, increasing difficulty in meeting the summer minimum streamflow threshold, stakeholder concerns about river health, and future climate change risk to ecological water requirements. We will consult with the community, Traditional Owners and licensees on any proposals to make further changes to the river release arrangements for the middle Canning River.

Linking river releases with river restoration

River releases are only one factor contributing to the overall health of the middle Canning River. The 2012 plan does not include strategies for addressing drainage, stormwater, sediment management and other land planning issues. We will continue to work with the responsible agencies, including DBCA, which is currently developing the Djarlgarro (Canning) Waterways Restoration Plan to help address these issues.

There is a fundamental link between land use impacts in the catchment and the river's water quality, condition of in-stream habitat areas and ecological health. There is also a fundamental link between river flow and river health, but there is less benefit to be gained from providing river release volumes to the downstream environment if habitat areas are affected by other stressors.

To achieve the full benefit of river releases from Canning Dam to the downstream environment, priority must be given to implementing river restoration activities and improving the condition of the catchment.

The National Environmental Science Program (NESP) has embarked on a four-year project (2023–26) entitled 'Enhancing the resilience of urban rivers: informing the regional restoration of the Djarlgarro Beeliar (Canning River, Perth)'. The project aims to:

- assess the current condition of the Canning River
- identify priority areas to protect, manage or restore, including refuge pools
- evaluate past restoration actions
- recommend what to do at priority sites
- recommend what and how to monitor.

The outcomes of the NESP work, as well as that of the Djarlgarro (Canning) Waterways Restoration Plan, will be important considerations for any proposed changes to river releases.

Traditional Owners

Six Noongar Regional Corporations were established in late 2022 to represent each of the Noongar Native Title Agreement Groups (Agreement Groups) recognised under the South West Native Title Settlement (the Settlement). The Settlement formally commenced on 25 February 2021 and saw the execution of Indigenous Land Use Agreements (ILUAs) for each of the six Agreement Groups. Under the ILUAs, one of the key roles of the Noongar Regional Corporations is to directly assist the Agreement Groups and their members to manage, use and advocate for the land and waters within the region to which they have a cultural connection. The middle Canning River is part of the Whadjuk ILUA area, so our engagement with the Whadjuk Aboriginal Corporation will be undertaken in accordance with the Whadjuk ILUA.

Our *Innovate Reconciliation Action Plan 2022–2024* (DWER 2022) focuses on the key principles of reconciliation – unity, race relations, historical acceptance, institutional integrity, equality and equity – to strengthen our partnerships, collaboration and understanding to empower Aboriginal and Torres Strait Islander peoples and communities. Our *Bring Together Walk Together* report (Walley & Grant 2021) provides a framework to foster, build and maintain strong partnerships for Aboriginal land and water through the sharing and threading of knowledge in a respectful way.

We will ensure engagement on our review of river releases is built around the principles from our reconciliation action plan and the framework from *Bring Together Walk Together.*

8.3 Further information

For further information on the 2012 plan and this evaluation statement, contact the department using the details provided below.

Subject	Responsible area	Contact details
Enquiries concerning the Canning region	Swan Avon regional office	Phone: (08) 6250 8000 Email: ellam.reception@dwer.wa.gov.au
General licensing enquiries	Business Support Unit (Water)	Phone: 1800 508 885 Email: licence.enquiry@dwer.wa.gov.au
General water allocation planning enquiries	Water Allocation Planning	Email: allocation.planning@dwer.wa.gov.au
All other matters	As applicable	Phone: (08) 6364 7000 Email: info@dwer.wa.gov.au

Appendices

Appendix A — Updated river release arrangements

Table A1 River release rules

When and how are releases turned on? Releases are turned on based on streamflow measured by the Department at Seaforth gauging station (AWRC 616027) from 1 October onwards.	Releases will be: • turned on to 6.4 ML/day when streamflow falls below 5 ML/day at Seaforth gauging station in two phases: - first week: Stocker Road (2.0 ML/day), Bernard Street (0.7 ML/day) and Orlando Street (1.6 ML/day). - second week: Araluen (1.4 ML/day), Manning Avenue (0.2 ML/day) and Gosnells Bridge (0.5 ML/day). • turned up to 8.5 ML/day when streamflow falls below 5 ML/day at Seaforth gauging station again. Release point breakdown: - Araluen (2.5 ML/day), Stocker Road (2.0 ML/day), Bernard Street (0.7 ML/day), Orlando Street (1.6 ML/day), Manning Avenue (0.5 ML/day) and Gosnells Bridge (1.2 ML/day).
What will happen if a number of days of hot weather are forecast? Between 1 December and 31 March releases can be turned up for up to seven days if hot weather is forecast at Armadale meteorological station (ref. no. 9001).	If the Bureau of Meteorology forecasts five consecutive days of temperatures >33°C, releases can be turned up to a maximum of 11 ML/day for up to seven days. Release point breakdown: • Araluen (2.5 ML/day), Stocker Road (2.0 ML/day), Bernard Street (1.5 ML/day), Orlando Street (2.0 ML/day), Manning Avenue (1.0 ML/day) and Gosnells Bridge (2.0 ML/day). If flow at Seaforth gauging station is >5 ML/day, releases will not be turned up.
How and when are releases turned down and off? From 1 April, releases are turned down and then off based on rainfall at Jandakot Aero meteorological station (no. 9172).	Releases are turned: • down to 5.7 ML/day when 40 mm of cumulative rainfall is received after 1 April. If 40 mm of cumulative rainfall is not received in April, releases will be reduced to 5.7 ML/day on 1 May. Release point breakdown: - Araluen (1.2 ML/day), Stocker Road (1.5 ML/day), Bernard Street (0.7 ML/day), Orlando Street (1.6 ML/day), Manning Avenue (0.2 ML/day) and Gosnells Bridge (0.5 ML/day). • off when 40 mm of cumulative rainfall is received after 1 May • if 40 mm of cumulative rainfall is not received in May, releases will be turned off on 31 May.

When and how are pulse releases made for the environment following a dry start to winter – up to 30 June? At any point between the time releases are turned off and 30 June we can make a release for a short period to top up pools. This is based on streamflow at Seaforth gauging station.	In May/June after release points have been turned off and: • there have been no events of daily rainfall >10 mm for 14 days at Jandakot Aero meteorological station and/or: • streamflow at Seaforth gauging station falls below 5 ML/day for three consecutive days Releases of up to 5.7 ML/day can be made for a period of up to seven days. Release point breakdown: • Araluen (1.2 ML/day), Stocker Road (1.5 ML/day), Bernard Street (0.7 ML/day), Orlando Street (1.6 ML/day), Manning Avenue (0.2 ML/day) and Gosnells Bridge (0.5 ML/day). Before turning releases back on, consider the seven-day rainfall forecast for Armadale meteorological stations.
Releases below Canning Dam Between 15 January and 31 March pulse releases can be made to maintain minimal pool connectivity and water quality. Releases may be turned on for a maximum of 25 days. Two releases of shorter duration may be made.	If fortnightly monitoring of water levels or water quality in key pools falls below triggers, a pulse release of up to 2 ML/day can be made for up to 25 days.

Appendix B — Climate data that informs application of river release rules

Meteorological stations in the area

Figure 2 shows the location of the three meteorological stations used to help inform and manage river releases in the Middle Canning. Table B1 below shows the data recorded at each station and the time periods used.

Table B1 Meteorological stations, data available and how it is used to inform and manage river releases

Meteorological station	Data available	What data is used to manage river releases or analyse objectives
Jandakot Aero	Daily rainfall	Since 2018 – turning releases down and off. Assessment of effectiveness of trigger to turn releases down and off. Environmental pulse releases in June trigger.
	Daily temperature	Assessment of effectiveness of high temperature pulse release triggers.
Gosnells	Daily rainfall up until 2018 (combination of recorded data and SILO[6])	Until 2018 – turning releases down and off.
	Daily temperature (SILO)	Assessment of the effectiveness of high-temperature pulse release trigger.
Armadale	7-day temperature forecast	High-temperature pulse release trigger
	7-day rainfall forecast	Environmental pulse releases in June trigger.

Gosnells versus Jandakot Aero meteorological stations

From 2018, daily rainfall data from Gosnells meteorological station was not routinely updated on the Bureau of Meteorology's website. The City of Gosnells was responsible for operating the station via their volunteer network and reported operational difficulties that potentially affected the accuracy and quality of the data collected.

We compared rainfall records from Gosnells and Jandakot Aero meteorological station, 11 km south-west of Gosnells (Figure 2) and found that the rainfall data from Jandakot Aero could be used as a substitute for the data from Gosnells.

From 1975–2022 about 8 per cent of records are not available from Gosnells station, while about 4 per cent of the Jandakot Aero station records are not available. Since 2009, 12 per cent of data is missing from the Gosnells station but only 1 per cent from the Jandakot Aero station.

[6] SILO (Scientific Information for Land Owners) data refers to a comprehensive dataset compiled and maintained by the Queensland Government in Australia. SILO gathers and provides a range of climate data, including rainfall, temperature, solar radiation and evapotranspiration, derived from various sources such as meteorological stations, satellites and climate models. These data are used by for studying climate trends, assessing agricultural suitability, and making informed decisions related to land management and environmental planning.

SILO data was used to fill the gaps in the Gosnells rainfall record to allow for comparison between the two sites. The annual rainfall is strongly correlated. A more detailed analysis of April and May rainfall shows the volumes of rainfall match well (Figure B1). This autumn/early winter period is important because this is when rainfall triggers the turning-off of river releases (Table B1).

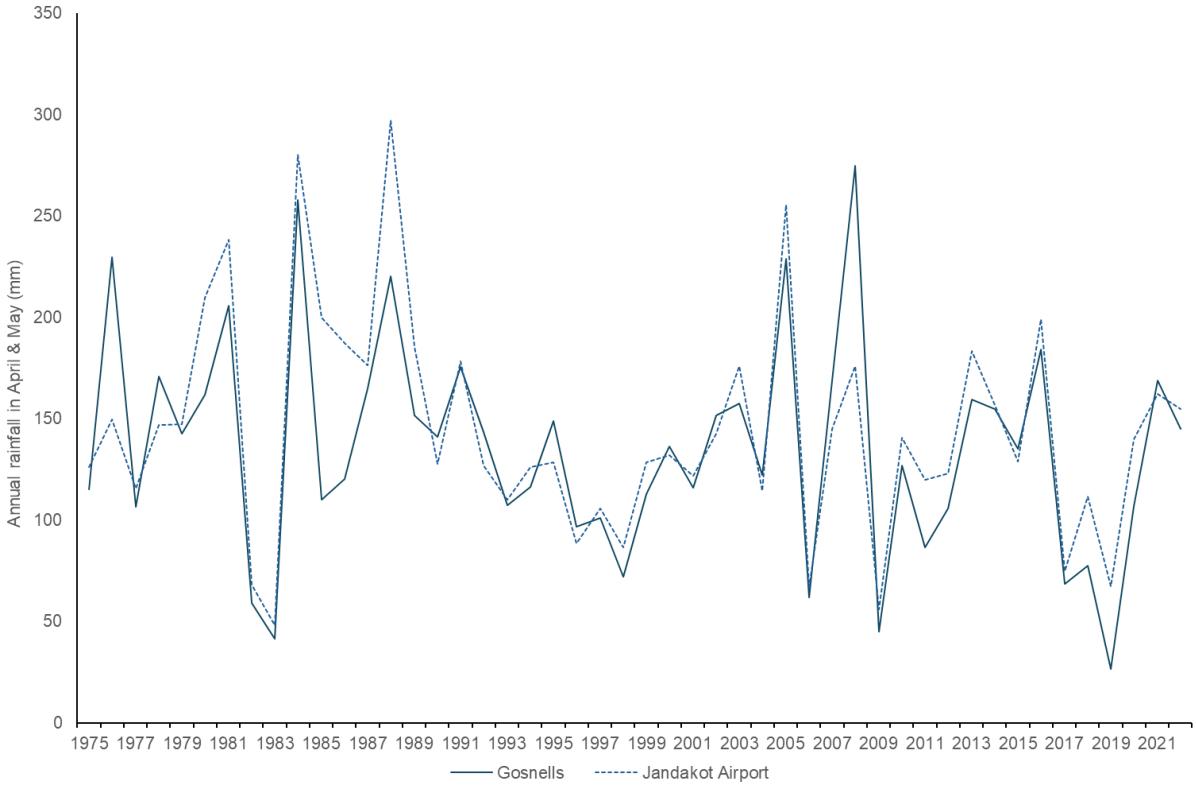

Figure B1 April and May rainfall from Jandakot Aero meteorological station and Gosnells meteorological station/SILO data

High-temperature pulse releases

Armadale meteorological station was chosen to trigger high-temperature pulse releases as it has a seven-day weather forecast and is closest to downstream reaches. Gosnells meteorological station/SILO data was used to help develop the trigger value and data validation.

Appendix C — Summary of release dates, volumes, temperature and rainfall and assessment against the summer minimum streamflow threshold in standard- and reduced-release years

Year	Releases implemented	Assessment against the summer minimum streamflow threshold at Seaforth gauging station (standard year – 1.8 ML/day; reduced releases – 0.86 ML/day)	Release dates and volumes of water released[1]	Rainfall (Gosnells 2011–2017 and Jandakot Aero 2018-2023) Temperature December–March (Jandakot Aero)	Comments
2011–12	Standard year	The summer minimum streamflow threshold of 1.8 ML/day was met 100% of the time while river releases were operating. Streamflow from river releases was supported by small rainfall events in December–March. Streamflow fell below 1.8 ML/day for 14 days between 20 May and 2 June after releases had been turned off. A seven-day pulse release was made to support streamflow in June.	Releases turned on – 24 November. Releases turned off – 16 May (staged turn-off over three weeks from downstream to upstream release points). Pulse release – 1 June for seven days to support streamflow. Requested volume of water to be released – 1.61 GL. Estimated volume of water released – 1.08 GL.	**Rainfall** 40 mm cumulative rainfall recorded at Gosnells in April – 29th. Rainfall recorded at Gosnells whilst river releases were operating: • December – 55.4 mm • January – 14.8 mm • February – 14.4 mm • March – 0 mm. **Temperature** Number of days recorded ≥33°C between December and March: 45.	
2012–13	Low-rainfall year	The summer minimum streamflow threshold of 0.86 ML/day was met 100% of the time while river releases were operating. Streamflow from river releases was supported by rainfall events in November, December and March. The standard-year threshold of 1.8 ML/day would have only been met 81.5% of the time whilst releases were operating.	Releases first turned on – 13 November (staged turn-on over two weeks). Releases at full volume – 3 December. Releases turned off – 27 May (staged turn-off over three weeks from downstream to upstream release points). Requested volume of water to be released – 1.27 GL. Estimated volume of water released – 0.98 GL.	**Rainfall** 40 mm cumulative rainfall was not recorded at Gosnells in April. Rainfall recorded at Gosnells whilst river releases were operating: • November – 39.4 mm • December – 25.4 mm • January – 7.5 mm • February – 1.2 mm • March – 75.6 mm. **Temperature** Number of days recorded ≥33°C between December and March: 42.	Aquatic biota and water quality monitoring undertaken. Abundance of aquatic biota and water quality, particularly at lower sites impacted by reduced flow.
2013–14	Standard year	The summer minimum streamflow threshold of 1.8 ML/day was met 100% of the time while river releases were operating. Streamflow from river releases was not supported by rainfall events.	Releases turned on – 9 November. Releases turned off – 17 June (staged turn-off over three weeks from downstream to upstream release points). Requested volume of water to be released – 1.45 GL. Estimated volume of water released – 1.38 GL.	**Rainfall** 40 mm cumulative rainfall was not recorded at Gosnells in April. Rainfall recorded at Gosnells whilst river releases were operating: • November – 10.4 mm • December – 2.4 mm • January – 0 mm • February – 0.1 mm • March – 4.9 mm. **Temperature** Number of days recorded ≥33°C between December and March: 42.	The minimum streamflow threshold of 1.8 ML/day was not met at the start of July. This was after river releases had been turned off. Winter rainfall had not commenced.
2014–15	Standard year	The summer minimum streamflow threshold of 1.8 ML/day was met 100% of the time while river releases were operating. Streamflow was only supported by small rainfall events in late November, January and March. The threshold was not met for two days after releases were turned off.	Releases first turned on – 12 November (staged turn-on over two weeks). Releases turned off – 12 May. Releases remained on as no follow-up rainfall was forecast. Requested volume of water to be released – 1.2 GL Metered volume of water released – 0.87 GL.	**Rainfall** 40 mm cumulative rainfall recorded at Gosnells in April – 15th. Rainfall recorded at Gosnells whilst river releases were operating: • November – 13.8 mm • December – 0.1 mm • January – 8.8 mm • February – 0 mm • March – 21.6 mm. **Temperature** Number of days recorded ≥33°C between December and March: 38.	
2015–16	Low inflow year	The summer minimum streamflow threshold of 0.86 ML/day was met 99% of the time while river releases were operating. It was not met for two days in mid-February, coinciding with high temperatures. The standard-year threshold of 1.8 ML/day would have only been met 75% of the time whilst releases were operating.	Releases first turned on – 14 October (staged turn-on over two weeks). Releases turned off – 25 May Requested volume of water to be released – 1.37 GL Metered volume of water released – 0.53 GL.	**Rainfall** First year two-staged river release turn-off implemented. 40 mm cumulative rainfall recorded at Gosnells: • April – 26th • May – 21st. Rainfall recorded at Gosnells whilst river releases were operating: • October – 28.7 mm • November – 49.1 mm • December – 15.4 mm • January – 4.4 mm • February – 2.4 mm • March – 24.8 mm. **Temperature** Number of days recorded ≥33°C between December and March: 37.	Aquatic biota and water quality monitoring undertaken. Abundances of aquatic species, including freshwater cobbler (*Tandanus bostocki*), and water quality were impacted by lower flow and higher temperatures.

Year	Releases implemented	Assessment against the summer minimum streamflow threshold at Seaforth gauging station (standard year – 1.8 ML/day; reduced releases – 0.86 ML/day)	Release dates and volumes of water released[1]	Rainfall (Gosnells 2011–2017 and Jandakot Aero 2018-2023) Temperature December–March (Jandakot Aero)	Comments
2016–17	Standard year	The summer minimum streamflow threshold of 1.8 ML/day was met 96% of the time while river releases were operating. It was not met for five days in February and three days in March, coinciding with high temperatures and reduced-release volumes. It was also not met for two days in November before river releases were turned on. Streamflow was only supported by small rainfall events in November, December and March, and a large event in February.	Releases first turned on – 14 November (staged turn-on over two weeks). Releases at full volume – 9 December. Releases reduced – 1 May. Releases off 23 May. Requested volume of water to be released – 1.33 GL Metered volume of water released – 1.07 GL.	**Rainfall** 40 mm cumulative rainfall recorded at Gosnells • April – not recorded • May – 21st. Rainfall recorded at Gosnells whilst river releases were operating: • November – 17.8 mm • December – 10.7 mm • January – 0.3 mm • February – 103.6 mm • March – 19.1 mm. **Temperature** Number of days recorded ≥33°C between December and March: 34.	
2017–18	Standard year	The summer minimum streamflow threshold of 1.8 ML/day was met 98% of the time while releases were operating. The threshold was not met before releases were turned up to their full volume for a standard year. Streamflow was only supported by small rainfall events in December and a large event in January.	Releases first turned on – 9 November (staged turn-on over two weeks). Releases at full volume – 6 December. Releases reduced – 3 May. Releases turned off – 29 May. Requested volume of water to be released – 1.46 GL Metered volume of water released – 1.56 GL.	**Rainfall** 40 mm cumulative rainfall recorded at Jandakot Aero: • April – not recorded • May – 25th. Rainfall recorded at Jandakot Airport whilst river releases were operating: • November – 1.6 mm • December – 27.2 mm • January – 122 mm • February – 0 mm • March – 3.8 mm. **Temperature** Number of days recorded ≥33°C between December and March: 34.	
2018–19	Standard year	The summer minimum streamflow threshold of 1.8 ML/day was met 100% of the time while river releases were operating. River releases were sufficient to maintain streamflow as no rainfall events were received until mid-March to replenish pools.	Releases first turned on – 12 November (staged turn-on over two weeks). Releases at full volume – 12 December. Releases reduced – 23 April. Releases turned off – 5 June. Requested volume of water to be released – 1.51 GL Metered volume of water released – 1.59 GL.	**Rainfall** 40 mm cumulative rainfall recorded at Jandakot Aero: • April – 20th • May – not recorded. Rainfall recorded at Jandakot Airport whilst river releases were operating: • November – 11 mm • December – 1.8 mm • January – 4 mm • February – 1.8 mm • March – 7.4 mm. **Temperature** Number of days recorded ≥33°C between December and March: 32.	Standard-year releases saw improvements in water quality, particularly dissolved oxygen, when compared with reduced releases in 2015–16. Good winter rainfall combined with higher river release volumes also increased the spawning success of small-bodied native fish with increased abundances recorded.
2019–20	Standard year	The summer minimum streamflow threshold of 1.8 ML/day was met 97% of the time while releases were operating. The threshold was not met for six days after high-temperature pulse releases were turned down (in accordance with the then release rules). It was a very hot and dry summer with no rainfall events to replenish pools until March.	Releases first turned on – 28 October. Releases at full volume – 11 November. First year high-temperature pulse releases implemented: • 13 December – 7 days • 13 January – 7 days • 23 January – 7 days • 3 February – 7 days • 20 February – 7 days. Releases reduced – 29 April. Releases turned off – 27 May. Requested volume of water to be released – 1.80 GL Metered volume of water released – 1.66 GL.	**Rainfall** 40 mm cumulative rainfall recorded at Jandakot Aero: • April – not recorded • May – 25th. Rainfall recorded at Jandakot Aero whilst river releases were operating: • November – 16.4 mm • December – 3.8 mm • January – 1.6 mm • February – 9.2 mm • March – 29.2 mm. **Temperature** Number of days recorded ≥33°C between December and March: 46. High maxima coincided with minimum temperatures ≥ 20°C.	
2020–21	Standard year	The summer minimum streamflow threshold of 1.8 ML/day was met 100% of the time while river releases were operating. The threshold was almost breached after high-temperature releases were turned down after the Christmas period. Streamflow was only supported by rainfall events in November, February and March.	Releases turned on – 16 October (staged turn-on over two weeks). Releases at full volume – 10 December. High-temperature pulse releases: • 21 December – 21 days to cover any periods of high temperatures over the Christmas shutdown period • 28 January – 7 days • 22 February – 7 days. Releases reduced – 29 April. Releases turned off – 20 May. Requested volume of water to be released – 1.80 GL Metered volume of water released – 1.78 GL.	**Rainfall** 40 mm cumulative rainfall recorded at Jandakot Aero: • April – not recorded • May – 7th. Releases not turned off until 20th as no follow-up rainfall was forecast. Rainfall recorded at Jandakot Aero whilst river releases were operating: • October – 18.6 mm • November – 81.4 mm • December – 2.2 mm • January – 0 mm • February – 47.4 mm • March – 41.6 mm. **Temperature** Number of days recorded ≥33°C between December and March: 45. High maxima coincided with minimum temperatures ≥ 20°C.	The Araluen release point had to be shut down for three days for unscheduled maintenance works. Landholders were informed and additional releases were made before and after to minimise impacts on connectivity and pool water levels. The were ongoing operational issues and maintenance requirements at the Stocker Road release point which restricted the ability to make releases. Flow rates at the Araluen and Bernard Street release points were turned up to compensate.

Year	Releases implemented	Assessment against the summer minimum streamflow threshold at Seaforth gauging station (standard year – 1.8 ML/day; reduced releases – 0.86 ML/day)	Release dates and volumes of water released[1]	Rainfall (Gosnells 2011–2017 and Jandakot Aero 2018-2023) Temperature December–March (Jandakot Aero)	Comments
2021–22	Standard year	The summer minimum streamflow threshold of 1.8 ML was met 100% of the time while river releases were operating. Streamflow declines coincided with high-temperature releases being turned down. High-temperature pulse releases were extended beyond seven days to support the streamflow threshold being maintained. It was a very hot and dry summer with no rainfall events to help replenish pools.	Releases turned on – 22 November (staged turn-on over two weeks). Releases at full volume – 8 December. High-temperature pulse releases: • 20 December – 17 days to cover any periods of high temperatures over the Christmas shutdown period and high temperatures in early January • 17 January – 21 days to cover an extended period of high temperatures and no rainfall • 15 February – 16 days to cover an extended period of high temperatures and no rainfall. Releases reduced – 3 May. Releases turned off – 24 May. Requested volume of water to be released – 1.63 GL Metered volume of water released – 1.62 GL.	**Rainfall** 40 mm cumulative rainfall recorded at Jandakot: • April – 27th • May – 23rd. Rainfall recorded at Jandakot Aero whilst river releases were operating (November to March): • December – 2.6 mm • January – 0 mm • February – 0 mm • March – 2.8 mm. **Temperature** Number of days recorded ≥33°C between December and March: 54. High maxima coincided with minimum temperatures ≥ 20°C.	Aquatic biota and water quality monitoring undertaken. Richness, abundance and age distribution of crayfish species consistent with those sampled in 2009–10. Signs of ecological stress at lower sites where land use intensity and impacts of drainage are affecting habitat and water quality. The were ongoing operational issues and maintenance requirements at the Stocker Road release point which restricted the ability to make releases. Flow rates at the Araluen and Bernard Street release points were turned up to compensate.
2022–23	Standard year	The summer minimum streamflow threshold of 1.8 ML/day was met 98% of the time while river releases were operating. It was not met for five days at the end of February coinciding with high-temperature releases being turned down. High-temperature pulse releases were extended beyond seven days on two occasions to support the streamflow threshold being maintained. It was a very hot and dry summer with extended periods of high temperatures. There were no rainfall events between December and the end of March to replenish pools.	Releases turned on – 7 November (staged turn-on over two weeks). Releases at full volume – 8 December. High-temperature pulse releases: • 20 December – 21 days to cover any periods of high temperatures over the Christmas shutdown period and high temperatures in early January • 19 January – 35 days to cover an extended period of high temperatures and no rainfall • 27 February – 7 days. Releases reduced – 28 April. Releases turned off – 29 May. Requested volume of water to be released – 1.82 GL Metered volume of water released – 1.65 GL.	**Rainfall** No rainfall events >2 mm recorded between 21 November and 30 March. 37.6 mm recorded 31 March. 40 mm cumulative rainfall recorded at Jandakot Aero: • April – 26th • May – not recorded. Rainfall recorded at Jandakot Aero whilst river releases were operating: • November – 22.8 mm • December – 0 mm • January – 0 mm • February – 0 mm • March – 40.4 mm (37.6 mm recorded on 31/03). **Temperature** Number of days recorded ≥33°C between December and March: 38. High maxima coincided with minimum temperatures ≥ 20°C.	There were operational issues with the Bernard Street release point which restricted the ability to make releases. The Stocker Road release point was turned up to compensate. There were ongoing operational issues and maintenance requirements with the Stocker Road release point. The Araluen release point was turned up to compensate.

1 Up until 2014, the department does not have metered data of the volumes of water released. The volumes provided by Water Corporation are based on the volumes that we requested Water Corporation to release to meet the stated flow thresholds.

Up until 2017–18, there was some discrepancy between the volumes of water we asked Water Corporation to release, and the volumes released. In some cases, the volumes of water released were less than those requested, which in some cases affected the minimum streamflow threshold. Releases points are now metered and alarmed to ensure that releases are within 10 per cent of requested volumes.

References

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