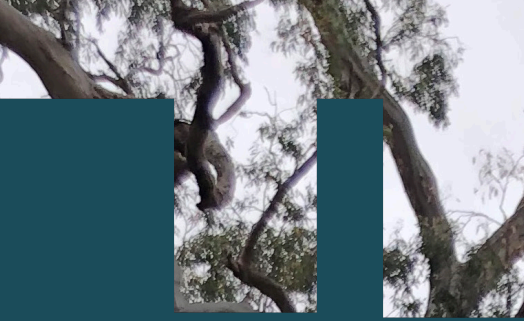
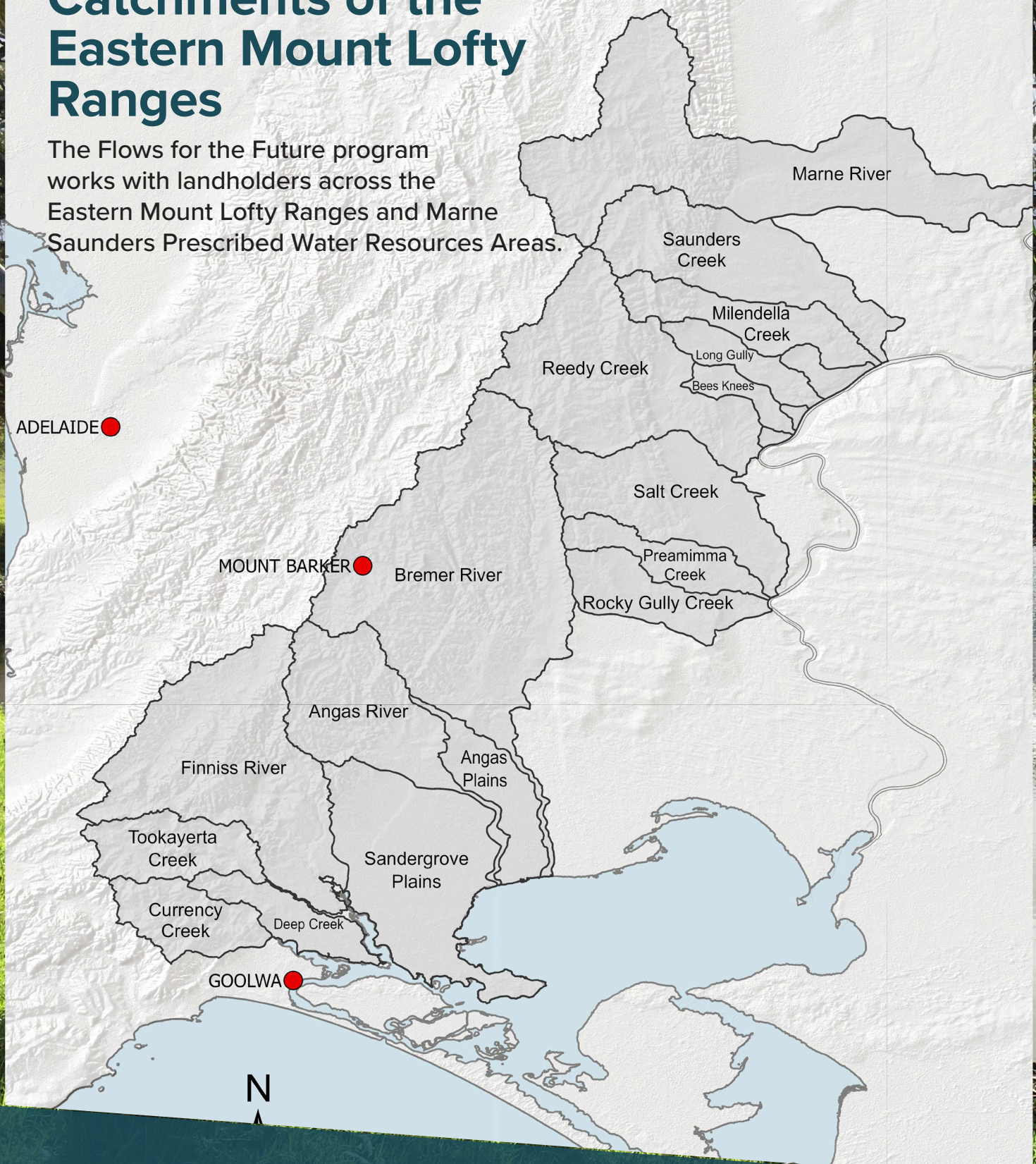


Flows for the Future Program guide

A guide to passing environmental flows
and supporting healthy catchments in the
Eastern Mount Lofty Ranges.

Catchments of the Eastern Mount Lofty Ranges

The Flows for the Future program works with landholders across the Eastern Mount Lofty Ranges and Marne Saunders Prescribed Water Resources Areas.



Acknowledgement of Country

Aboriginal people are the First Peoples and Nations of the lands and waters we live and work upon, and we pay our respects to their Elders past, present and emerging.

Water is central to the culture and identity of First Nations peoples and we acknowledge and respect the Traditional Owners of the Eastern Mount Lofty Ranges, including Ngadjuri, Kurna, Peramangk and Ngarrindjeri, whose spiritual, social, cultural and economic practices come from the lands and waters, bringing life and linking people and Culture to Country.



Contents

About Flows for the Future.....1

Environmental flows.....2

What are low flows?..... 2

How we are restoring low flows.....3

Change to flow season after installation
of a gravity low flow device.....4

How to get involved..... 5

Options for restoring environmental flows..... 6

 Gravity low flow device..... 7

 Manual siphon device.....11

 Dam removal.....15

Frequently asked questions.....17

Contact us.....18

Quick guide..... 19



The Flows for the Future program is delivered under the Basin Plan and is jointly funded by the Australian Government and the Government of South Australia.



About Flows for the Future

Sustainable water use in a catchment depends on well-connected systems that support equitable access for both environmental and human needs. In the Eastern Mount Lofty Ranges, Flows for the Future is focusing on sustainable practices to address long-term degradation and improve overall catchment biodiversity and health.

The Eastern Mount Lofty Ranges (EMLR) is a region renowned for its natural beauty, rich history and primary production. It is a popular tourist destination and home to a diverse community, including those seeking a rural lifestyle.

The EMLR is a major contributor to South Australia's economy, generating approximately \$440 million in agricultural production each year. Water storage is integral to this production, however, watercourse diversions and a network of more than 8,000 dams have created barriers to natural flows, disrupting natural patterns, timing and volume. Barriers have extended dry spells, disconnected aquatic ecosystems and compromised natural ecological breeding and regeneration cycles, resulting in an overall decline in catchment health.

The Flows for the Future program is tackling this challenge with the aim of achieving sustainable water management for both the environment and water users. Without healthy water sources, natural ecosystems will be compromised and our ability to use the land for production will be at risk.

Working collaboratively with landholders, the program uses innovative infrastructure solutions to restore critical flows (called environmental flows) downstream of dams and watercourse diversions. This improves catchment health and contributes to long-term sustainable water management for communities, industry and the environment. The internationally significant Coorong and Lakes Alexandrina and Albert Ramsar site also benefits from this work, receiving improved flows and catchment connectivity.

The program is jointly funded by the Australian and South Australian governments and is delivered by the Department for Environment and Water.

Landholder participation is voluntary, with materials and infrastructure installations fully funded and coordinated by the program.



Environmental flows

Environmental flows (e-flows) is the term given to any managed change in the flow regime of a watercourse intended to improve and maintain catchment health. The Flows for the Future program primarily focuses on the restoration of low flows, a specific type of environmental flow.

What are low flows?

Low flows are naturally occurring, regular small flow events that primarily occur at the beginning and end of a flow season. They are a small but vital part of the annual flow pattern in a catchment and are needed to maintain natural processes and catchment health.

Low flows help to maintain habitats and aquatic refuges, supporting the life-cycle of water-dependent plants and animals during the drier summer months. This is particularly the case throughout the EMLR, where many watercourses are ephemeral (only hold water for short periods).

The natural movement of water has been disrupted by the construction of dams, where flows are impeded until dams fill and spill. This change to flow patterns is a major driver of declining catchment health.

Reinstating low flows and reconnecting catchments has many environmental benefits...

Longer flow events

Topping-up and freshening pools

Maintenance of aquatic and riparian vegetation

Reduction in silt load and stagnation

Improved macroinvertebrate and native fish condition

Improved watercourse stability



How we are restoring low flows

Restoring low flows in EMLR catchments through the installation of infrastructure is the primary goal of the Flows for the Future program.

Infrastructure

Infrastructure installed by the program enables the low flow portion of every flow event to bypass dams and continue downstream while medium and high flows fill the dam as usual.

Higher flows account for the majority of water moving through catchments and are the main drivers of when dams fill and spill. Low flows only account for some of the overall volume of water passing down a catchment. They occur at critical times and enable water-dependent ecosystems to function as intended.

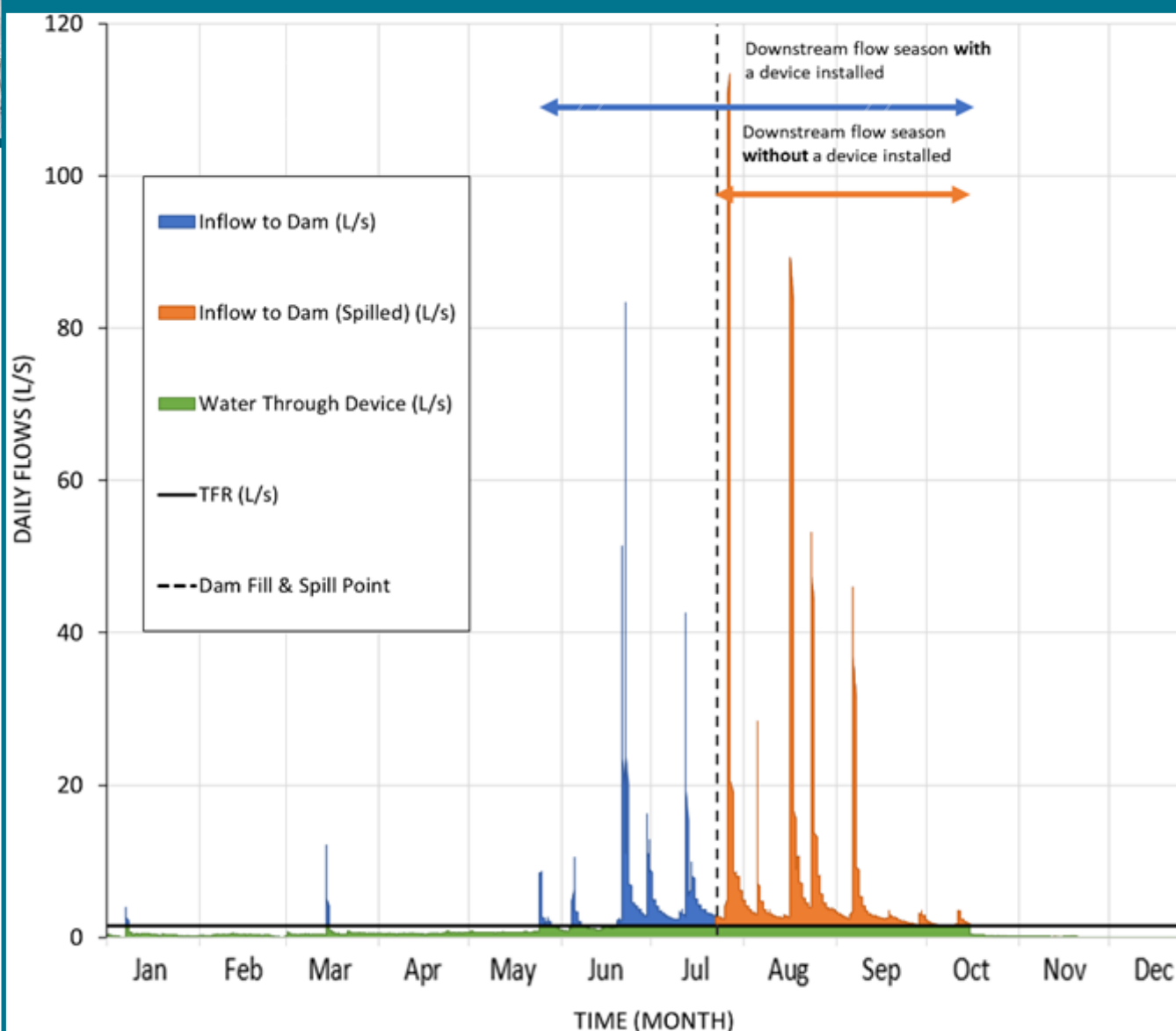
Improved catchment health, including better water quality also leads to healthier livestock and crops and ensures sustainable water resources for generations to come.

Rate of restored flow

A maximum low flow rate is calculated for each dam based on its unique set of characteristics, such as run-off conditions and the size of the upstream catchment. The calculation is based on providing a flow regime that can sustain water-dependent flora and fauna communities. The calculation also considers consumptive use limits, as per the water allocation process.

The maximum low flow rate is called the Threshold Flow Rate (TFR), and with a gravity low flow device in place, any inflows up to the TFR are passed around the dam and into the downstream watercourse. All flows above the TFR fill the dam as usual until the dam spills, slightly later in the season than it would have without a device in place. TFRs applied to devices range from 0.1 L/s (litres per second) to 10 L/s or more, depending on the characteristics described above.

Change to flow season after installation of a gravity low flow device



The graph demonstrates flow into and below a dam fitted with an environmental flow device (a gravity low flow device in this case) over a 12-month period.

In this example, the TFR is 1.5 L/s. The device enables low flows (in green) to continue into the catchment downstream, while medium to high flows fill the dam. The graph shows that there is an increase in the length of the flow season and that the volume of flows passed is very small compared to the volume captured.



How to get involved

Participation in the Flows for the Future program is voluntary, with no cost to landholders.

1

Let us know you're interested in being involved by contacting us on (08) 8391 2109 or at F4F@sa.gov.au

5

If you opt to proceed, the agreement is signed by both parties and construction planning commences.

2

A field officer will contact you to discuss the program and eligibility.

6

Construction of the device is undertaken by approved contractors.

3

We will organise a property visit with you to discuss and assess your dam.

7

Completed works are audited to ensure they achieve the intended outcomes.

4

A device options proposal may be prepared and presented to you with a management agreement for your consideration.

8

Device ownership is transferred to the landholder, including the responsibility for ongoing operation and maintenance.



Options for restoring environmental flows

There are 3 main options used to restore environmental flows. Flow for the Future works closely with landholders to determine the most suitable option for each property, based on site characteristics and water use needs. Once a suitable option has been identified, an engineered design is developed and then undertaken by qualified contractors.

Gravity low flow device

Passes low flows

Preferred option due to long-term functionality, low maintenance requirements and ability to respond to natural flow events.

Manual siphon device

Passes an approximation of low flows

An effective alternative when sites are not suitable for a gravity low flow device

Dam removal

Passes all flows

Provides maximum environmental benefit

Gravity low flow device

Restoring low flows in EMLR catchments through the installation of gravity low flow devices is the primary goal of the Flows for the Future program. Every device is customised to meet each site's unique characteristics and landholder needs.

Gravity low flow devices are the preferred option for restoring environmental flows, as they have minimal visual impact on the landscape, long-term functionality and low maintenance requirements.

Gravity low flow devices are inflow driven and deliver low flows reflective of the timing and volume of natural flow events. They offer a simple solution to restoring critical flows in waterways while still allowing medium and high flows to continue into dams.

They passively enable natural flow cycles, supporting other natural events, such as fish breeding and plant regeneration. In most cases, as it is only the low flow portion being redirected, the impact on a landholder's water security is minimal.

When planning construction, consideration is given to the size of the dam, surrounding soil type, presence of rock, native vegetation and the need for device fencing.

While gravity low flow devices continue to be the preferred method for restoring flow regimes in catchments, the device's design has evolved over time with landholder input, onsite learnings, and the utilisation of more readily available materials.



Device inlet with wing walls on each side to direct flows into the inlet.



How it works

A gravity low flow device is a passive structure that allows low flows to pass around a dam and continue down the natural watercourse.

The inlet of the device is installed upstream of the dam and as inflows occur, they flow into a grated sump and then into a pipe with a calibrated orifice cap which only allows low flows to pass through the pipe and travel downstream. Any flow in excess of the TFR will continue into the dam.

The pipe, which is laid around the dam in a graded trench, delivers low flows to the downstream watercourse at the pipe outlet.

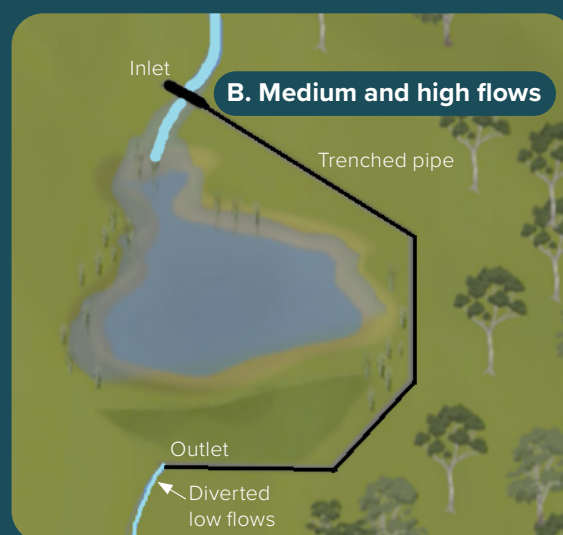
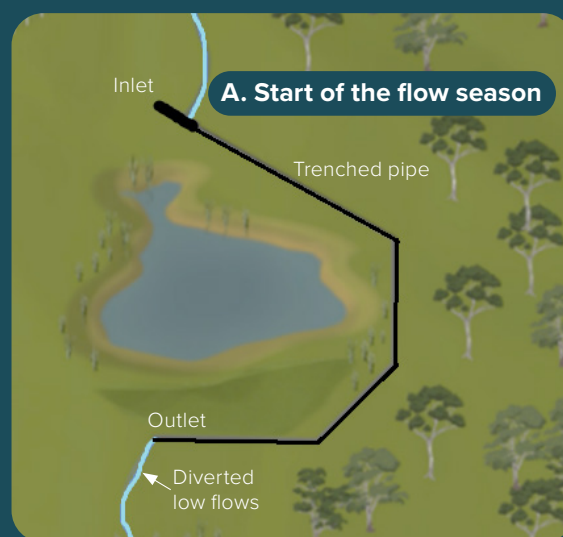
Hydrological modelling of the dam's upstream catchment helps determine what TFR the orifice is sized for. For most dams, installing a device has minimal impact on annual water storage volume but significantly changes the timing of low flows delivered to the downstream watercourse.

Gravity low flow devices have operated successfully in South Australia for more than 10 years.

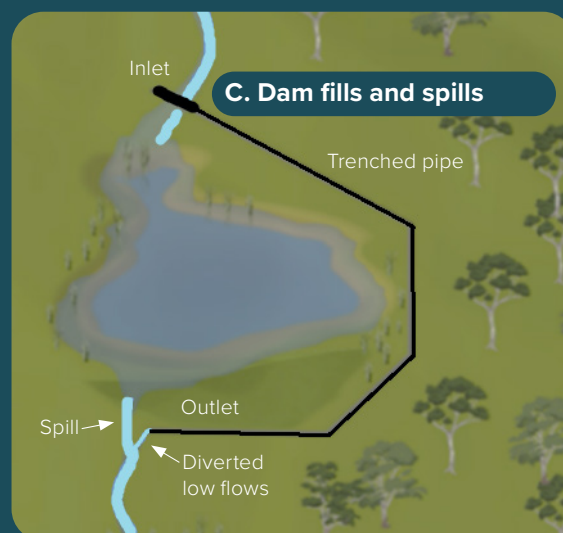
By returning low flows, landholders play a crucial role in restoring natural flow regimes and improving water quality and ecosystem health across catchments.



Pattern of flow with a gravity low flow device

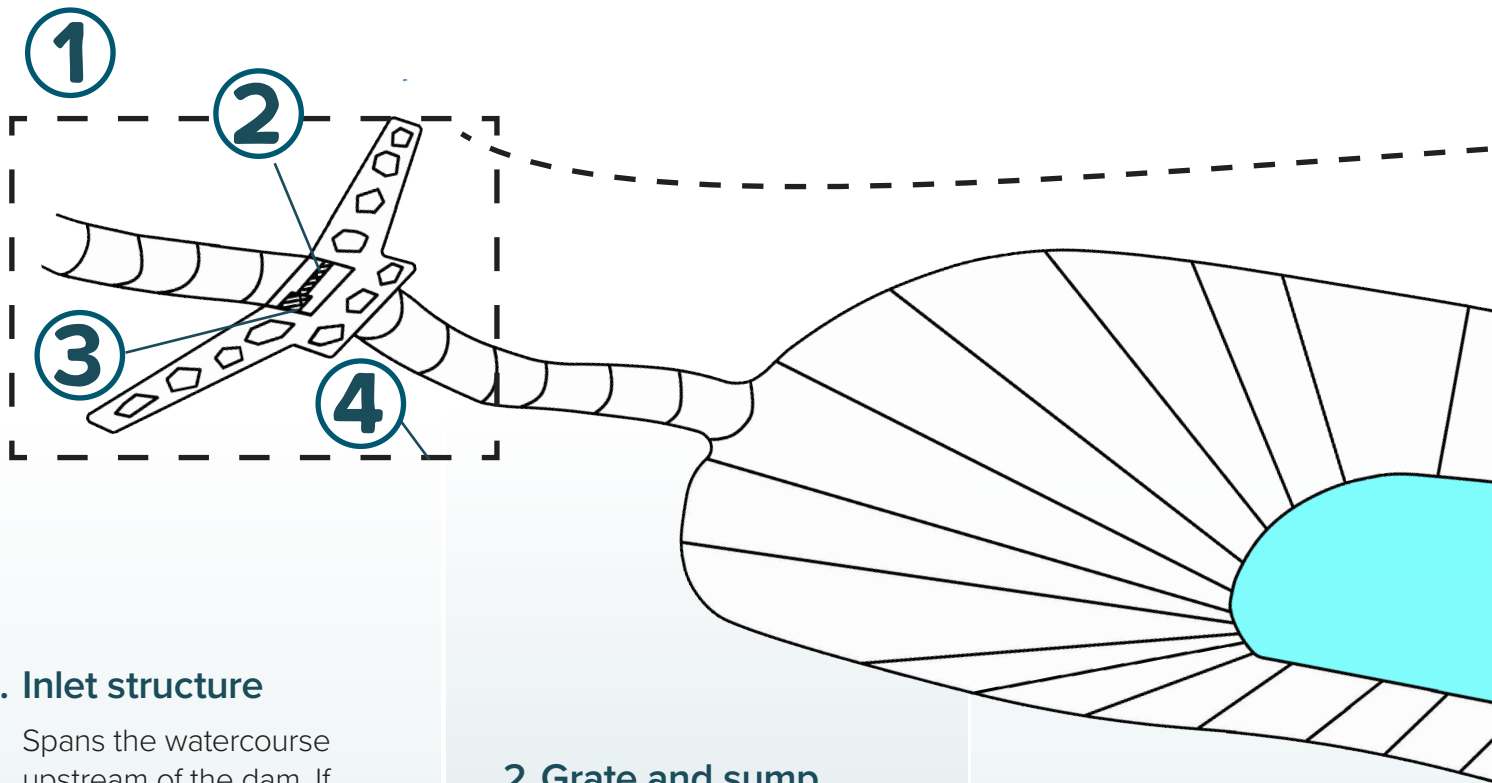


As the flow season progresses, bringing medium and high flows, the device diverts the low flow portion, while additional flow (above the TFR) fills the dam as usual.



Once the dam is full, the spill connects with the low flows downstream.

Gravity low flow device components



1. Inlet structure

Spans the watercourse upstream of the dam. If slope is lacking, device inlets can be placed further upstream to achieve the fall required to pass flows and self-clean.

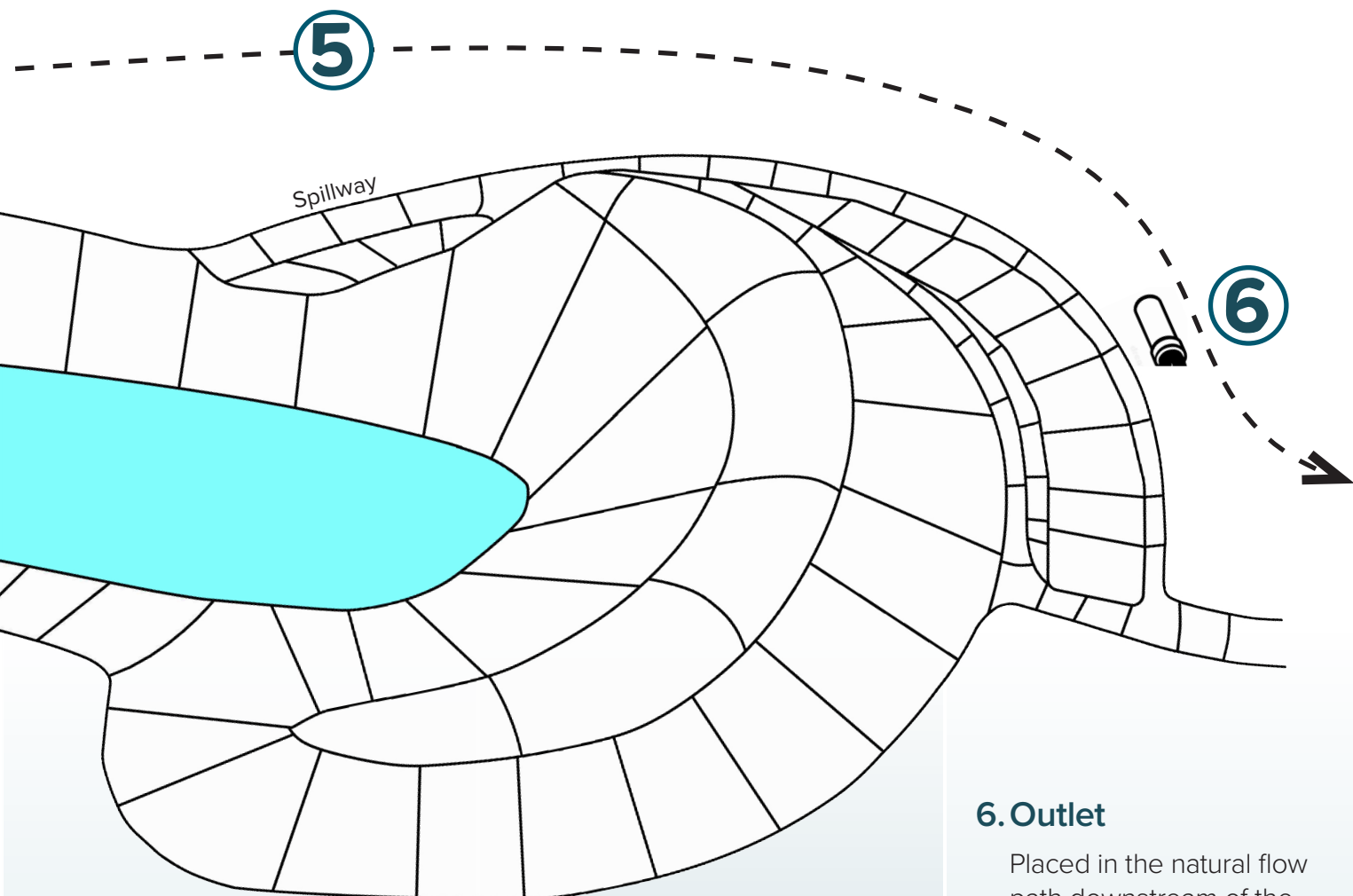
2. Grate and sump system

Within the inlet structure, a grated sump captures inflows.

3. Orifice

Located in the sump, low flows are passed through an orifice cap (sized to the TFR) and then downstream through the pipe. Any flow above the TFR continues over the inlet and into the dam.





4. Optional device fencing

Placed around inlet structure.



5. Trenched pipe

Allows low flows to travel to the outlet using gravity.



6. Outlet

Placed in the natural flow path downstream of the dam.



Manual siphon device

At some sites, a gravity low flow device may not be suitable due to inadequate slope, presence of rock, native vegetation, gardens or property boundaries. In cases like this, a manual siphon device can offer an effective alternative.



How it works

A manual siphon device releases flow directly from a dam via a manual valve operated by the landholder. The release is governed by a schedule of release dates that mimic environmental low flow timing.

As manual siphon devices are constructed from scratch, they can be tailored to suit individual landholder needs and site characteristics. In some cases, existing infrastructure, such as scour valves or taps, can be incorporated.

To protect landholder water security, a dam level is set at which the device will cease to release water, regardless of the schedule.

The manual siphon device also enables landholders to manually release volumes of water from their dam outside of the scheduled times, to reduce pressure on a dam wall or lower water volumes to allow dam maintenance, etc.

Siphon release systems are an economical alternative to gravity devices, with device maintenance involving simple checks for valve operation, leaks, stock damage and weed growth.

Release schedules

Reinstating flows downstream of a barrier early in the wet season is critical to catchment health and stream connectivity. In most scenarios, the scheduled rate of flow will be constant for the entire release period and targeted at the first half of the flow season, where modelling demonstrates dams are unlikely to be spilling.

The scheduled start date acts as a guide for landholders to start looking for inflows above their dam. Once inflows are observed after the scheduled start date, the siphon is manually turned on and allowed to run until the scheduled end date.

The scheduled start date reflects the timing where inflows are likely to be present, noting that in drier years when dam levels are low, releases may not be possible and the siphon may remain off until inflows are observed.

Siphon release schedule examples

These schedules are examples only. Each dam has different inflow characteristics and will receive a tailored release schedule.

Wetter catchment scenario (e.g. Finniss River)

Start date
10 APRIL

Release rate
4.5 L/S

End date
11 October

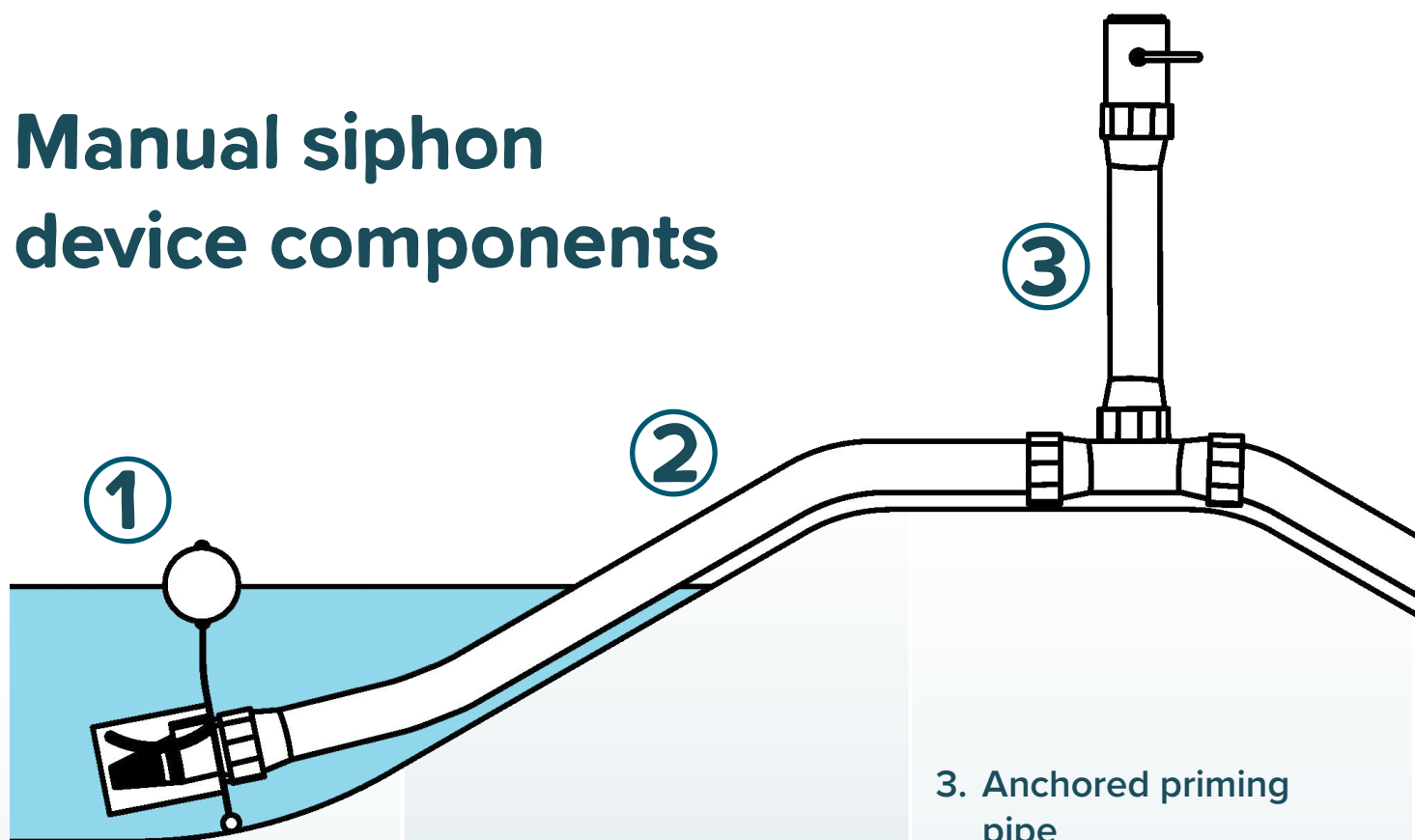
Drier catchment scenario (e.g. Marne River)

Start date
2 JUNE

Release rate
2 L/s

End date
25 September

Manual siphon device components



1. Inlet structure (including float)



2. Anchored suction blue line pipe

Runs from dam to crest of dam wall



3. Anchored priming pipe

Located on the dam wall (with a 900 mm tall priming riser, ball valve and T jointer connecting the suction pipe, riser and discharge pipe).

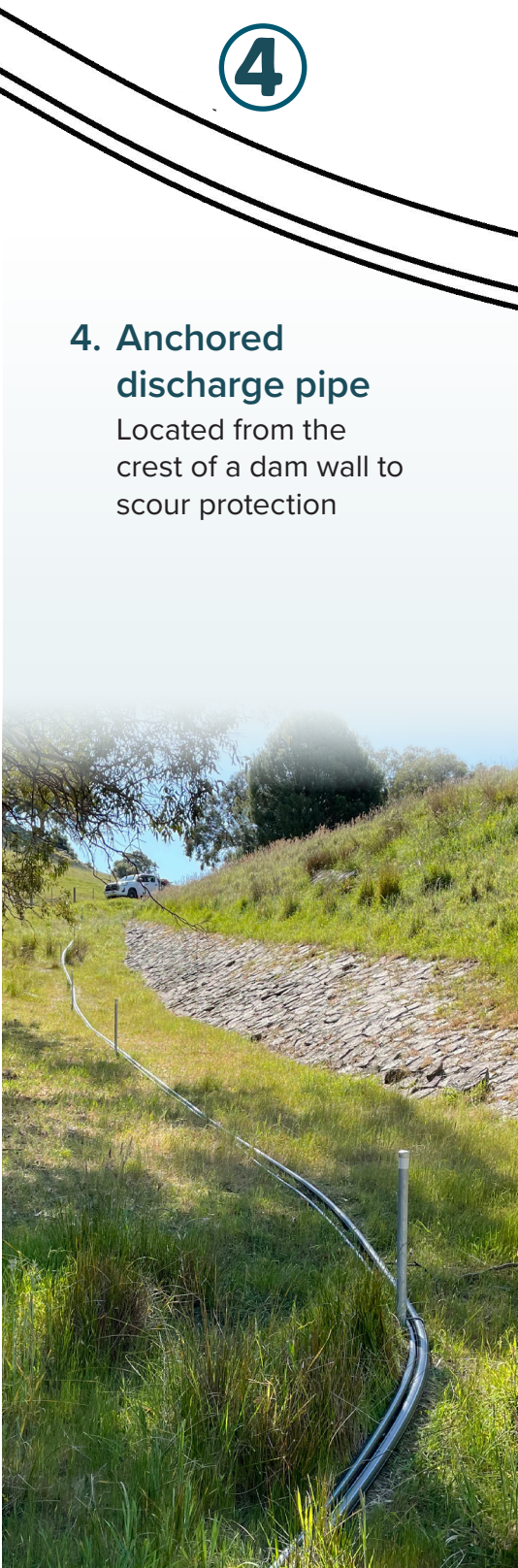
The below image shows a set-up with a high flow and low flow release option



④

4. Anchored discharge pipe

Located from the crest of a dam wall to scour protection



⑤

5. Calibration ball valve

For adjusting flow rate



⑥

6. Outlet

With flap fitted to prevent debris entering the pipe, concrete slabs above and below to protect and encourage sheet flow and scour protection below.



Dam removal

For many landholders, dam removal provides property management benefits and positive outcomes for catchment health.

When is removal an option?

There are 2 options for dam removal and while both fully remove the dam as a barrier to flow, one removes all the wall material while the other, called a breach and batter, leaves remnants of the wall in place in a safe, stable and tidy state.

When determining if dam removal is a viable option, consideration is given to:

- benefits of removal compared to potential impacts on native vegetation
- potential for repurposing land
- benefits of removing ongoing dam maintenance requirements
- dam structure issues or other potential safety issues
- access to specialist advice and engineered dam removal
- site restoration
- costs (no cost to landholder for removal work)
- water use efficiency
- water quality for stock.

Environmental benefits

- Total removal of the barrier to flow
- Support restoration of natural flow regimes in the local catchment
- Reinststate connectivity to support natural breeding and regenerative cycles

Dam removal process

Once a dam is assessed as eligible for removal, the program will organise the required approvals and implement the removal process.

• Approvals

- Development approvals
- Native vegetation clearance approval (minor clearance only - dams will not be removed if the benefits of removal do not significantly outweigh the impacts on native vegetation)
- Water Affecting Activity permits
- Other approvals as required.

• Work plan

- Site access maps
- Location of proposed works
- Location of areas for sediment redistribution
- Presence and management of pest species (e.g. willows, blackberry, gorse)
- Other plans as required.

• Watercourse reshaping and revegetation plan

• Site works

All works will be undertaken by experienced earthmoving contractors and meet best practice environmental procedures. Site works consist of 3 main phases:

1. Dewatering
2. Earthworks
3. Reseeding/revegetation.



Breach and batter of small dam wall

Rodwell Creek, Highland Valley

Breach and batter refers to the process of deliberately and safely breaching the dam wall and then battering the remaining wall structure to stabilise it.

The below images show a site before and after breach and batter works. The dashed line shows the dam wall and the circled tree on the right is a good reference for how much was removed.

In the 'After' image, the silt trap is in place while revegetation/regeneration with grasses and sedges takes place.

With the barrier removed, additional flow will help maintain a permanent pool downstream, which in this case, is home to the regionally endangered river blackfish.



Stages of removal

Dewatering

Dam dewatering and a drying period may be required before earthworks can commence.

Dewatering is undertaken slowly, by siphoning water into the downstream catchment. A suction pump is then installed to slowly remove any remaining water while staff capture and relocate native fish, turtles and yabbies. Landholder knowledge of native fauna, including fish species, is helpful during this process.

Once empty, the dam is left to dry before earthworks begin.

Earthworks

Silt will be removed from the bed of the dam, if it is present, and temporarily stored in an agreed area on the property. This will either be spread and compacted or used in the recontouring of the watercourse.

The dam wall is then removed in line with the chosen design (breach and batter or full wall removal). The removed wall material is reused to fill in the dam and reinstate the natural watercourse.

Erosion control measures are included to minimise the risk of the new waterway becoming incised. This may include rock armouring, depending on the watercourse's flow energy.

Any potential silt movement from the new watercourse is mitigated by installing temporary silt traps which may be removed once the watercourse has stabilised and regenerated.

Reseeding/revegetation

In consultation with the landholder, the area is reseeded with agreed seed mixes to help prevent wind and water erosion and fast-track the stabilisation of the reinstated watercourse.

All dam removal designs include an element of erosion control and site rehabilitation. Individual property needs differ and will be discussed in the planning phase. In some cases, the appropriate new ground cover may be pasture or native grasses and sedges. In others, it may include local semi-aquatic and riparian plant species along the "new" section of watercourse.

Frequently asked questions

Why are some dams more important for returning e-flows?

Not all dams present a significant barrier to flow. Small dams used for stock water or domestic purposes have less impact than large or licensed dams, and treating some combinations of dams can provide more benefit than other combinations.

Flow modelling conducted by hydrologists is used to help determine which combination of dams and watercourse extractions should be treated to achieve optimal benefit to the environment. Local-scale benefits are also addressed, with consideration given to which habitats and species may benefit from the return of flows in certain areas of the catchment.

I don't have a licence and only use water for stock and domestic purposes. Does this affect me?

Dams for stock and domestic use impede the natural water flow pattern in the same way as dams that are used for other purposes. However, it is generally the larger stock and domestic dams that present a significant barrier. EMLR landholders of unlicensed dams larger than 5 megalitres are encouraged to pass low flows.

Will the way my dam fills change?

With gravity low flow devices, low flows are only passed when there is a flow event in the catchment. The water already in the dam is not involved.

The device is designed to intercept flows before they enter the dam, and divert only the low flow portion to the downstream catchment, while allowing the medium and high flows to continue into the dam.

These medium and high flows generally occur later, after the early-season low flows. This means the timing of water capture is shifted, with the dam starting to fill later.

Manual siphon devices are designed to pass similar volumes at similar times to gravity low flow devices. The Flows for the Future team can provide information about any potential changes to your dam's fill/spill patterns and water security.

The graph on page 4 demonstrates how the flow season changes after installation of a gravity low flow device.



How is change being measured?

The negative impacts of water resource development on waterways have been observed through various ecological and hydrological monitoring studies across many years. More recently, some positive change has been recorded, as a result of mitigation actions being implemented

These studies have been assisted by the application of catchment modelling that simulates what flow patterns would look like if dams, diversions and extractions hadn't been built.

Flows for the Future has its own monitoring and evaluation program for measuring changes to water quality and flow, and the effects on macroinvertebrate, aquatic plant and native fish populations, following the passing of environmental flows.

Will passing environmental flows support my current water allocation?

The EMLR and Marne Saunders water allocation plans are developed in consultation with communities, industry and stakeholders of water resources that are prescribed under the *Landscape South Australia Act 2019*. The water allocation plans outline policy designed to achieve an equitable balance between environmental, social and economic needs for the extraction and use of water resources. Water usage limits specified under these plans assume that low flows will be passed by suitable dams.

For further information on water allocation plans, visit www.landscape.sa.gov.au/mr/water/water-allocation-plans

How do I continue to support long-term environmental outcomes after my device has been installed?

Once installed, your device is donated to you and becomes an asset on your property. You will be given guidance on the ongoing operation and maintenance of your device, which is a relatively straightforward process.

Following the first post-construction flow season, program staff will inspect your gravity low flow device for structural integrity and function, before ownership is officially handed over.

Low flow devices have a lifespan of approximately 25 years and should require minimal maintenance. We suggest cleaning the grate and sump at the beginning and end of each flow season, as outlined in the Operations and Maintenance Manual supplied with each build and available at www.environment.sa.gov.au/F4F#maintenance

Contact Us

Telephone: (08) 8391 2109

Email: F4F@sa.gov.au

www.environment.sa.gov.au/F4F



Quick guide

A guide to common Flows for the Future program language

Catchments rely heavily on early season rains to wet-up watercourses, and end of season rains to sustain watercourses over the summer. Summer storm events also play an important role in maintaining refuge pools.

Flows for the Future works with landholders to establish environmental flows (e-flows) and is one of the Sustainable Diversion Limit Adjustment Mechanism (SDLAM) supply projects contributing to implementation of the Basin Plan.

Flow Components

The flow through a watercourse can be broken into several broad components that help people discuss different parts of the flow regime and the achievement of e-flows.

- **Barriers to flow** - includes dams and watercourse extractions, both of which delay low flows, causing a decline in the environmental health of catchment systems.
- **Flow** - a general term used broadly to define any surface water runoff in any given catchment area.
- **Flow path** - the natural preferential path or direction of surface water flow, includes a drainage path.
- **Threshold Flow Rate (TFR)** - a calculated minimum volume of low flow to be returned to the downstream watercourse at a site, to sustain environmental processes.
- **Environmental flow** - the term given to any managed change in the flow regime of a watercourse, intended to maintain or improve catchment environmental health. There are a number of flow components (flows characterised by different patterns in timing and volume), as outlined in the flow components section.
- **Low flows** - Naturally occurring, regular, small flow events that are a vital part of the annual water flow pattern of a catchment. The timing for delivery of low flows in a catchment is critical to support natural regeneration, migration and breeding cycles.
- **Medium flows** - the flows that occur later in the winter/early spring as a result of increased rainfall and run-off in the upstream catchment.
- **High flows** - the larger volume flows that occur following significant rainfall events and generally occur when the watercourse is already achieving medium flows. High flows can still occur at any time in response to large rainfall events.
- **Freshes** - pulses of flow that refresh oxygen levels and dilute salts in isolated refuge pools and flush excess sediment from the stream bed. Different types of flushes in the water regime support different ecological processes.

More definitions are outlined in the Eastern Mount Lofty Ranges Water Allocation Plan.

Methods for e-flow delivery

Flows for the Future works with landholders in the EMLR to deliver environmental flows, using several well established methods, while continuing to explore alternative methods to increase viability across a range of scenarios.

Delivery methods are primarily through the implementation of infrastructure at dams or watercourse extraction points.

The program works with landholders to identify and install suitable e-flow delivery methods that best suit the site and characteristics of the catchment.

Different e-flows delivery methods have been implemented across the states managed water resources, with large scale delivery methods used in SA's River Murray system or downstream of SA Water reservoirs in the Mount Lofty Ranges, and smaller scale methods used in the EMLR.

Methods for dams and other barriers

There are several methods available for getting flows past dams and other barriers. The decision regarding which method is suitable for a site is based on multiple factors including site characteristics, flow rates and landholder collaboration. Each method has its own terminology that relates to its operation.

- **Gravity low flow device** - inflow driven and designed to intercept flows upstream of the dam, bypassing them downstream via a trenched pipe. It is the preferred flow option due to its ability to replicate the natural flow regime.
- **Manual siphon device** - a simple method of getting water past a dam that uses a siphon to lift water over the dam wall. The siphon rate is set using a combination of pipe diameter and taps and is determined by a release schedule. Devices are activated at a set time of the year and deactivated later. The flow rate and duration of release is

determined by the dam characteristics along with the size and characteristics (rainfall etc.) of the upstream catchment.

- **Dam removal** - offers the maximum environmental outcome. Removal follows Water Affecting Activity guidelines and adheres to program criteria to ensure that works are engineered and outcomes are long lasting.

The solutions outlined above are generic and often modified to suit the unique characteristics of a site.

Threshold Flow Rate (TFR)

Unique to each site, the program uses a TFR calculation to determine the minimum volume of low flow to be returned to the downstream watercourse to sustain environmental processes.

The TFR is quantified by x litres per second and the TFR is the rate of flow at, or below which, a device enables water to continue down its natural path beyond a dam and into the watercourse.

The TFR calculation is based on individual site characteristics (such as the catchment size) and modelling of the minimum flow required to achieve self-sustaining ecosystems.

A device will pass all low flows into the downstream catchment (up to the TFR). If the flow event is small, the low flow portion may comprise the entire event. If the event is a high flow, only the TFR will be passed.

As outlined in the Eastern Mount Lofty Ranges Water Allocation Plan (Principle 55-57, page 151), TFRs were calculated based on the size of freshes in the 2 transitional flow seasons, as these are the largest of the flow components that have been strongly affected by surface water resource development. The rate is based on the area of the upstream catchment (km²) by the unit threshold flow rate for the water management zone that the site lies within.

More information

For Flows for the Future news and updates, scan the QR code or visit www.environment.sa.gov.au/F4F



Contact us

Telephone: (08) 8391 2109

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www.environment.sa.gov.au/F4F



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Australian Government

