



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

Managed aquifer recharge





Perth's largest MAR operation - Water Corporation's Groundwater Replenishment Scheme. Image courtesy of Water Corporation.

Managed aquifer recharge

Managed aquifer recharge (MAR) can help to reduce demands on our natural groundwater and surface water resources and provide sustainable water supplies for community, industry and environmental needs.



Water use has increased with population growth, while at the same time climate change has resulted in reduced rainfall in some areas of the state, particularly in the south-west, affecting replenishment of aquifers, dams, watercourses and wetlands.

Groundwater is the biggest source of private and public water in Western Australia. Many groundwater resources are fully allocated and groundwater levels have dropped by nearly 2 metres across the Perth region since the mid-1970s. This has reduced the amount of water available for use by the community, industry and the environment. Vegetation and fauna that depend on groundwater in our ecosystems have been impacted by the drop in the water table and acid-forming soils have been exposed, making some lakes and wetlands acidic. Along many areas of the coast, and associated rivers and estuaries, saline water has moved further inland, making the water quality in some bores more saline and not suitable for purposes such as irrigation.

MAR may help to address these problems where hydrogeological and environmental conditions are suitable and costs are not prohibitive.

MAR is being successfully used today by water service providers and local governments in WA. Examples are provided at the end of this brochure (page 20).



What is MAR?

MAR is the intentional recharge of an aquifer under controlled conditions for later recovery, environmental benefit, or to mitigate the impacts of abstraction.

The department's policy, *Managed aquifer recharge in Western Australia*, and accompanying guideline provide useful information to assist people and organisations interested in undertaking MAR.

Aquifers are usually recharged using injection wells or bores, or infiltration structures such as ponds and trenches. Water can be recovered using one or more bores, or it can be left in the aquifer for environmental benefit. The MAR method selected depends largely on the hydrogeology of an area and the availability of land.

Water for MAR can be taken from a variety of sources, provided approvals are obtained from relevant agencies. Potential sources include natural ones such as watercourses or aquifers, and alternative sources such as stormwater and treated wastewater, which can be recycled and used for MAR.

Source water typically requires treatment before recharge to protect the quality of groundwater resources and human and environmental health. Recovered water may need further treatment to ensure it is fit for the intended purpose.

Figure 1 shows the sequence of obtaining source water, pre- and post-MAR treatment, use and monitoring for three common MAR scenarios – recharge by injection followed by recovery, recharge and recovery in a single bore, and recharge by infiltration followed by recovery. Infiltration or injection can also be undertaken for environmental benefit with no recovery.



Figure 1: Schematic examples of managed aquifer recharge

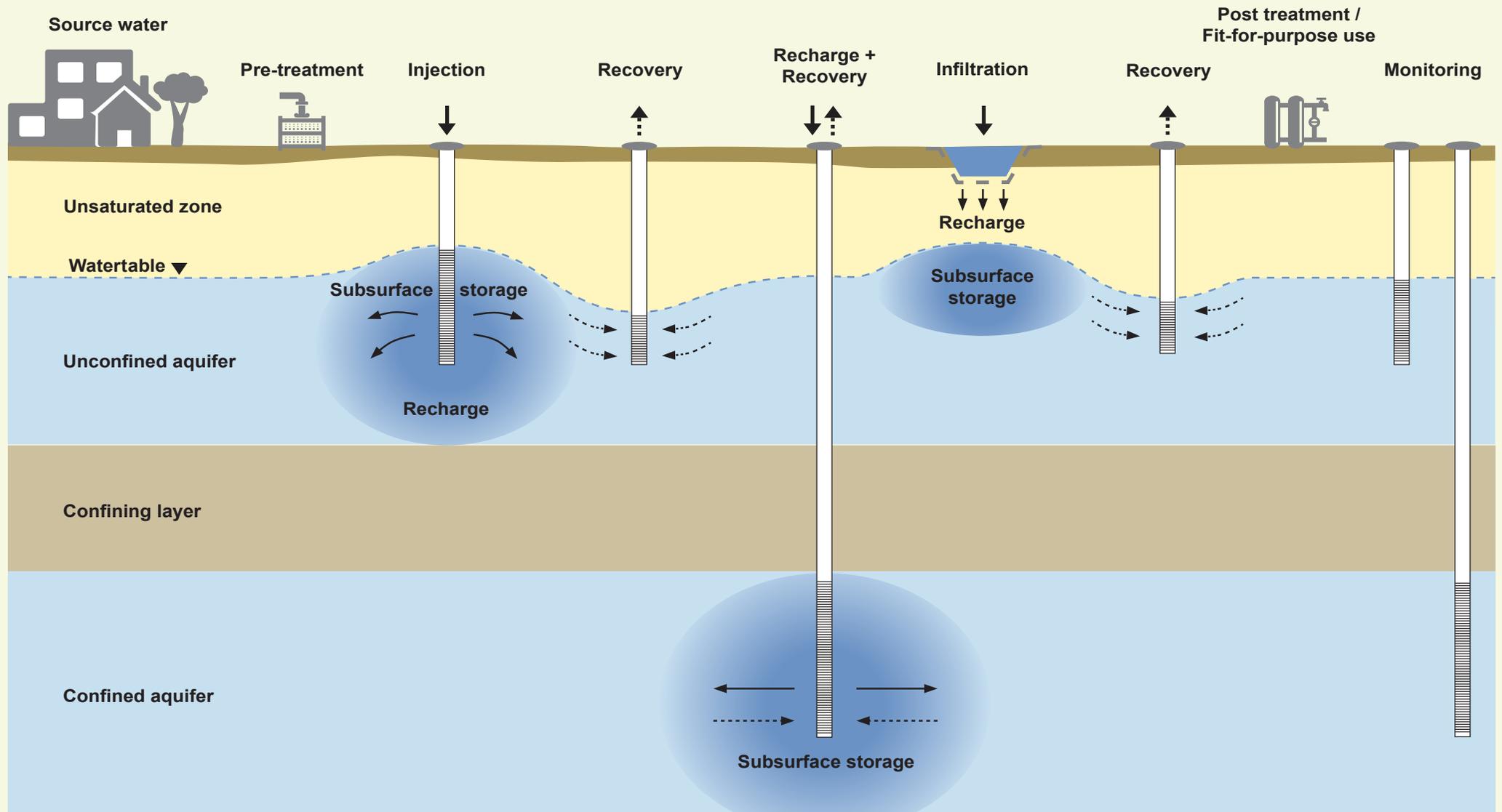
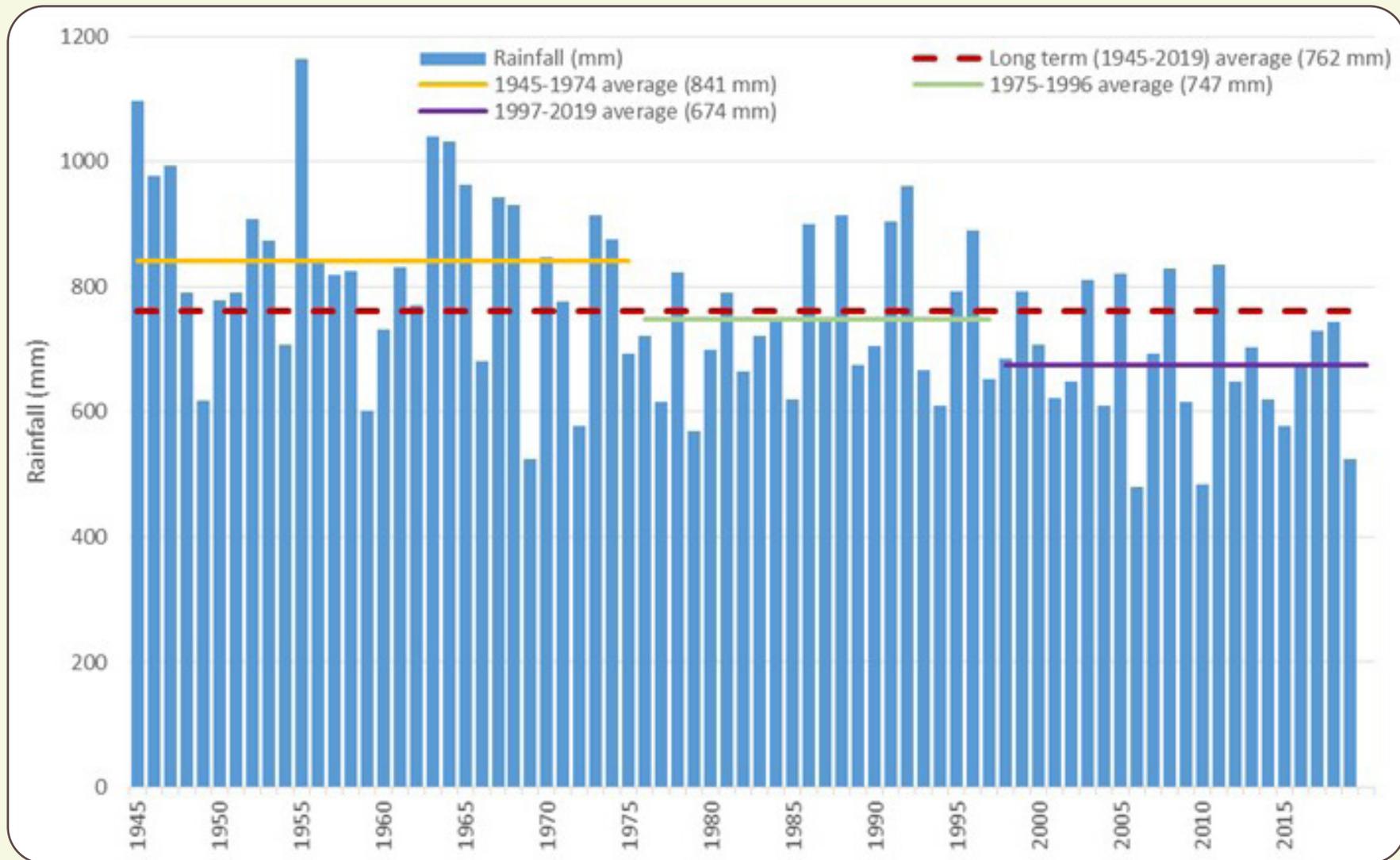
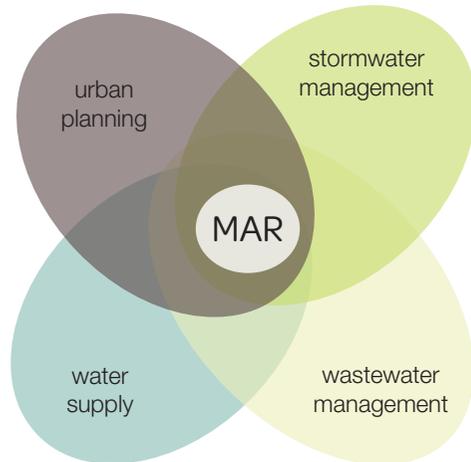
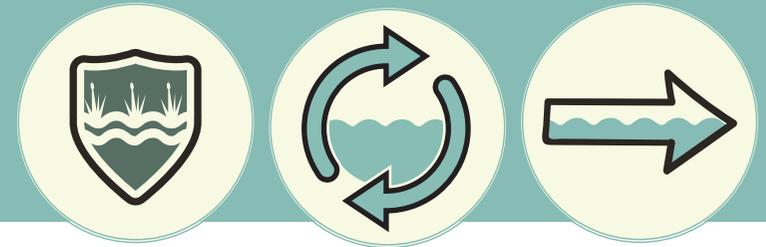


Figure 2: Declining rainfall in Perth



Why MAR?



*Waterlines,
National Water
Commission 2009*

MAR can help make the best use of our valuable water resources and create alternative water supplies to provide options for users, particularly where water availability is limited.

Storing water in aquifers using MAR also allows us to make better use of our water resources by limiting evaporation, creating more climate-resilient water supplies.

MAR can be used to ensure that water is available throughout the year, reducing water supply shortages.

Wastewater that was previously disposed of into rivers, oceans or pits in the ground is now seen as a valuable resource which can be recycled by treating it, storing in a suitable aquifer, and recovering it when needed for reuse.

Excess stormwater or surface water can be collected during wet periods, stored in a suitable aquifer, then used when demand is high, such as in summer.

MAR can also be used to reduce the impacts of abstraction and reduced rainfall (Figure 2). It can be used to maintain pressure in aquifers, preventing inland movement of sea and estuary water to protect existing bores and good-quality groundwater resources. It can also be used to maintain or increase groundwater levels to support valuable ecosystems such as wetlands, caves and vegetation.



SHADY TRANSPORT ROUTES AND PATHS ALLOW ACCESS.

BUILT FORM IS CLIMATE SUITABLE AND WATER EFFICIENT.

RAINFALL INFILTRATES WHERE IT FALLS.

ESTABLISHED TREES PROVIDE SHADE AND HABITAT.



LANDSCAPES DESIGNED TO REDUCE IRRIGATION REQUIREMENTS.

PEOPLE CONNECT TO WATER AND INDIGENOUS WATER KNOWLEDGE.

PLANTED SWALES TREAT RUNOFF BEFORE IT REACHES AQUIFERS AND WATERWAYS.

STORMWATER DRAINAGE IS INTEGRATED INTO URBAN ENVIRONMENTS.

HEALTHY AQUIFERS PROVIDE CLEAN BORE WATER TO GREEN PARKLANDS AND PUBLIC SPACES.

MAR can help towards a waterwise Perth

MAR will be an important part of the delivery of the Waterwise Perth Action Plan, which is part of the State Government's commitment to respond to the impacts of climate change. A waterwise Perth is cool, liveable, productive, green and sustainable – a place where people want to live, work and spend their time.

MAR can be an option to deliver waterwise outcomes, particularly in:



- supporting green spaces that include trees, wetlands and waterways to help reduce the urban heat island effect, making our suburbs cooler and more liveable
- creating climate-resilient parks and gardens, sporting grounds and other public open space



- designing waterwise urban developments that go beyond water efficiency and consider opportunities across the urban water cycle, including the ways in which urban water is collected, used and managed in an urban environment (water supply, wastewater and stormwater management systems).

Identifying opportunities to undertake MAR with alternative water sources such as stormwater and wastewater may be part of the solution in areas where limited or no groundwater is available, provided there are suitable aquifers with storage space available.

Where opportunities exist, conditions are suitable and costs are not prohibitive, MAR can help to achieve the important targets in the Action Plan to:

- use 10 per cent less groundwater across the Perth and Peel regions
- use recycled and alternative water supplies to make up 45 per cent of the projected gap between future water demand and supply.



Benefits of MAR

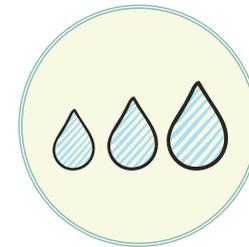
MAR can have many benefits where hydrogeological and environmental conditions are suitable, provided potential impacts on the environment, water users and public health are managed and acceptable. MAR can be used to:



generate additional water supplies from sources that may otherwise be wasted



supplement drinking water supplies



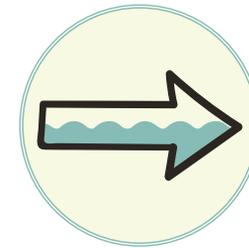
increase water availability for consumptive use



maintain groundwater-dependent ecosystems



store recharged water to meet needs in times of demand



reduce saltwater intrusion and maintain the water quality of existing bores

Options for MAR will vary from place to place, and potential proponents will need to carefully assess the costs and benefits of MAR against other possible options to determine the best solution.

A range of potential environmental, social and economic benefits may result from MAR operations, as listed in Table 1* on page 11.

Table 1. Potential benefits of managed aquifer recharge

Environmental benefits	Social benefits	Economic benefits
<ul style="list-style-type: none"> Reduces the need to take water from existing groundwater resources, potentially making more water available to groundwater-dependent ecosystems and connected surface waters May be used to restore groundwater levels and make more water available to the environment Protection of ecosystems from the impacts of abstraction by using MAR for supplementation or to create hydraulic barriers and maintain water levels Improvement of water quality in aquifers and connected ecosystems by introducing better quality water Smaller surface footprint than traditional water storages such as dams, with less impact on the environment 	<ul style="list-style-type: none"> Improved water security to safeguard against water shortage, through banking of excess water when available, allowing recovery during drought or when existing supplies are low Maintains existing water allocations by increasing water availability for consumptive use May provide an additional source for emergency water supply when the primary water supply is insufficient or unavailable, depending on the location Generates additional water supplies, or supplements existing supplies for socially beneficial uses (e.g. ensuring that water is available throughout the year to maintain socially beneficial spaces such as public open space and parks) Maintains water quality in existing bores by prevention/management of saltwater intrusion Maintains ecosystems valued by the community Uses aquifers for storage and allows land to be used for socially beneficial purposes No algae or mosquitoes where bores are used instead of surface storage 	<ul style="list-style-type: none"> Enables development when availability of natural water resources is limited by increasing water availability for consumptive use Ability to increase capacity in line with demand Ability to locate close to water demand centres where suitable aquifers are available, reducing costs of water transportation through pipelines Ability to use brackish or poor quality aquifers that could not be used directly, through recharge with better quality water May reduce costs of restoring environmental degradation Seasonal and longer-term banking and storage in aquifers can sustain supplies and avoid financial losses and the cost of providing alternate water supplies (i.e. by storing excess water during wet seasons and recovering during dry seasons or when demand is high) Defers expansion of water facilities that require major investment in new water sources and supply infrastructure Potentially lower capital costs than traditional water storages such as dams Reduced evaporation losses as the water is stored in aquifers instead of dams

*Table after Pyne (1995)

The department's MAR guideline provides guidance on the water and environmental issues to be considered for MAR projects.

Limitations

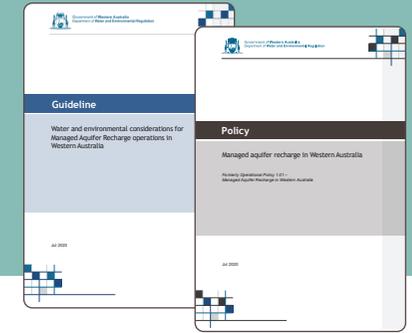
For MAR to be successful, hydrogeological and environmental conditions must be suitable. Permeable aquifers are needed that can accept a sufficient volume of water at a sufficient recharge rate. In some areas, MAR will not be possible (e.g. areas with clay soils and high watertables).

The location of sensitive areas such as wetlands, groundwater-dependent vegetation, or public drinking water source areas may also limit MAR activities, particularly within shallow aquifers.

The MAR policy and guideline provide guidance; contact the department's regional offices to discuss specific proposals (dwer.wa.gov.au/contact-us).

Cost effectiveness may also be a consideration for proponents and other options may be more viable. For example, direct use (with treatment as required) rather than first infiltrating or injecting source water could be preferable to MAR.

How we regulate MAR in WA



The MAR policy and guideline outline how we regulate MAR in WA and provide a management framework to facilitate options for MAR, while protecting the environment, water users and public health.

The management framework helps to ensure that:

- best use is made of water resources
- demands on natural water resources are reduced
- availability of water for productive use is increased
- proponents have confidence in the approvals process.

Options for MAR with beneficial water resource and environmental management outcomes may include:

- alternative water supplies – particularly where water resources are fully allocated
- fit-for-purpose water supply for drinking purposes as well as non-drinking purposes such as irrigation of public open space
- development of climate-resilient water supplies.

The department regulates MAR through water and environmental licences and permits as outlined in the MAR policy and guideline. MAR is managed separately to existing allocation limits for water resources. Recharge must be an addition to an aquifer and recovery volumes must not exceed recharge volumes, so that water is not taken from the existing groundwater resource.

The department's one-stop-shop approach to regulation helps streamline approvals required for MAR under state water and environmental legislation (dwer.wa.gov.au/one-stop-shop). Our Application Coordination Framework allows us to coordinate multiple application assessments relating to Part IV and V of the *Environmental Protection Act 1986* (EP Act) and the *Rights in Water and Irrigation Act 1914* (RIWI Act) to ensure consistency of approach and decision-making as far as the legislative requirements allow. The Framework also allows us to coordinate the timing of decisions where possible.

MAR proposals that are likely to have a significant effect on the environment should also be referred to the Environmental Protection Authority (EPA). Parallel assessments will be undertaken under Part V of the EP Act and the RIWI Act, consistent with the department's one-stop-shop approach to approvals and assessment.

Several other State Government agencies have a role in the approval and ongoing management of MAR operations, including the Department of Health, Department of Planning, Lands and Heritage, and local government. The MAR policy and guideline provide an outline of other agencies' requirements.

In addition to the department's MAR guideline and policy, the *National Water Quality Management Strategy* (Australian Government 2018) guidelines and documents provide detailed information on MAR feasibility, assessment and management (www.waterquality.gov.au/guidelines/recycled-water).

How MAR works in WA

Key elements of a MAR operation in WA are:

- any source of water may be suitable for MAR provided relevant approvals are obtained
- recharge and recovery volumes will be managed separately to existing allocation limits for water resources, since MAR contributes an additional input to a groundwater resource
- recharge and recovery operations need to be hydraulically connected and ideally undertaken within the same aquifer
- proponents may bank or store recharge water for a period of time if the water will be available for recovery when required and the impacts are acceptable
- recovery volumes should be less than the recharge or banked volumes, taking losses into account
- MAR management zones may be required to facilitate the licensing of MAR operations (see Figure 3)
- recharge and recovery volumes must be metered and reported
- ongoing groundwater monitoring and reporting will ensure there are no unacceptable impacts from MAR operations.

Please refer to the department's MAR policy and guideline for more details.

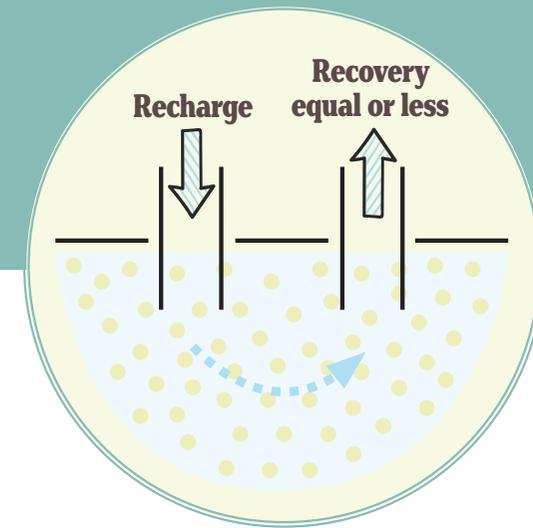
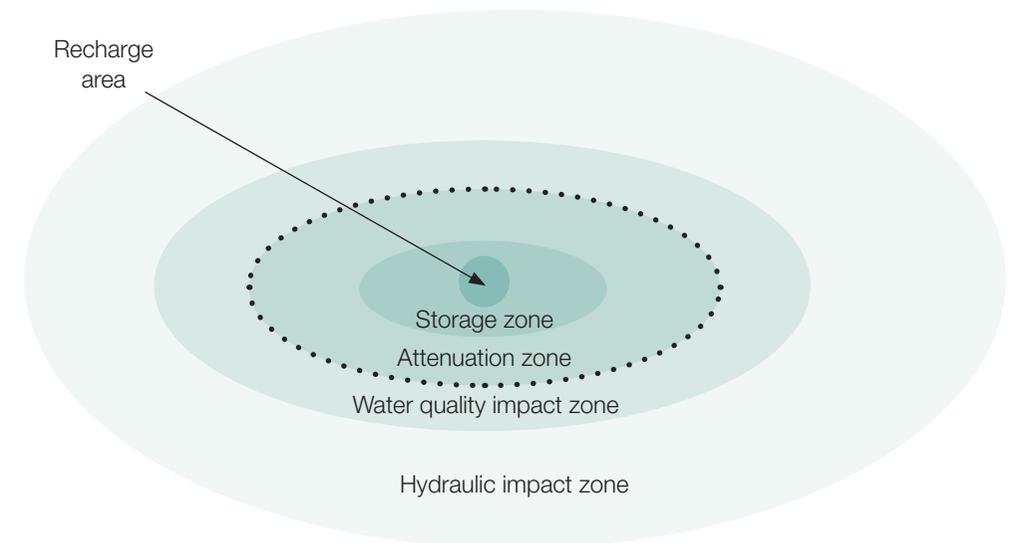


Figure 3: Schematic diagram of a MAR management zone



Australian guidelines for water recycling: Managed aquifer recharge 2009

How to obtain approvals for MAR

The MAR policy and guideline contain important information to assist with establishing a MAR project. These documents include:

- an outline of legislative requirements and how approvals will work
- approvals required for each stage of a MAR operation, including a summary of the approvals and supporting information that may be required for all government agencies and the Australian Government (Table 2)
- issues to consider in the location of MAR recharge and recovery works
- guidance on the proper construction of bores or wells
- information that may be needed to support applications, and the water and environmental issues to consider
- guidance on defining a MAR management zone
- guidance on water quality analysis and testing for reactions between recharge water and aquifer materials
- examples of different MAR scenarios in WA.

The policy lists common defined MAR activities.

Applicants are encouraged to contact the department and other relevant agencies early in the planning phases of a MAR project for guidance on specific requirements for their proposal (dwer.wa.gov.au/contact-us).

The MAR guideline steps through the approvals required for the different stages of a MAR project – from site selection, preparation and construction, to obtaining source water, to recharge and/or recovery. The approvals required may vary depending on the nature, scale and location of the proposed operation.

A summary table is included in the guidelines, with the approvals and supporting information that may be required for all government agencies.

For access to approval forms, online application systems and further information, go to the department's one stop shop (dwer.wa.gov.au/one-stop-shop).



Applications submitted to the department must be supported by additional information to demonstrate that the operation's impacts on the environment, and on other water users and public health, will be acceptable and manageable. This generally includes:

- a hydrogeological assessment with investigations and modelling
- a risk assessment following the department's MAR policy and guideline, and the processes outlined in the *Australian guidelines for water recycling: Managing Health and Environmental risks* (Phase 1, NRMCC, EPHC, AHMC, 2006 and Phase 2, Managed aquifer recharge, ARMCANZ & ANZECC, 2009)
- an operating strategy, including monitoring and reporting commitments.

To assist proponents with undertaking investigations and preparing this supporting information, the department's MAR guideline outlines the main water and environmental issues to consider. It also covers issues to consider when planning the location of MAR recharge and recovery works, and provides guidance on the proper construction of bores and wells to assist with the provision of this information in the hydrogeological assessment. The requirements for ongoing monitoring and reporting are also covered.



Table 2. Summary of MAR approvals that may be required in WA

Agency	Activity	Regulatory instrument	Supporting information required	Legislation	When required
Department of Water and Environmental Regulation	Clearing of native vegetation	Clearing permit (may also be authorised through a works approval or licence)	Information/surveys on existing vegetation, information on application form	<i>Environmental Protection Act 1986</i> (Pt V, Div.2)	Required unless exempt (under Schedule 6)
	Construction/alteration of wastewater treatment plant	Works approval to construct or to alter a wastewater treatment plant	Information on Pt V application form	<i>Environmental Protection Act 1986</i> (Pt V)	Prescribed Premises (or potential) (Category 54/85)
	Construction of injection bores/wells and infiltration works intercepting groundwater	Works approval	Information on Pt V application form	<i>Environmental Protection Act 1986</i> (Pt V)	Prescribed Premises (or potential) (Category 54/85)
		Licence to construct or alter a well	Information on application form	<i>Rights in Water and Irrigation Act 1914</i> (s.26D)	Proclaimed Groundwater Areas, artesian aquifers
	Construction of injection bores/wells and infiltration works above water table	Works approval	Information on Pt V application form	<i>Environmental Protection Act 1986</i> (Pt V)	Prescribed Premises (or potential) (Category 54/85)
	Taking of source water from aquifers or surface water resources in areas proclaimed under the <i>Rights in Water and Irrigation Act 1914</i>	Licence to take water	Hydrogeological assessment, risk assessment, operating strategy, groundwater monitoring program, information on application form	<i>Rights in Water and Irrigation Act 1914</i> (s.5C)	Proclaimed Groundwater Areas, artesian aquifers
	Licence to operate a MAR scheme/ discharge to the environment (wastewater, treatment concentrate, chemicals)	Pt V licence	Information on Pt V application form, Nutrient Irrigation Management Plan if irrigating with water from a MAR operation	<i>Environmental Protection Act 1986</i> (Pt V)	Prescribed Premises (or potential) (Category 54/85)
	Any activity or work that disturbs, destroys or interferes with the bed or bank of a watercourse or drain, or a wetland situated wholly or partly on crown land, or land demised by the Crown	Bed and Banks Permit		<i>Rights in Water and Irrigation Act 1914</i> (s.17, 17(1) and 17(3))	Proclaimed surface water area (including proclaimed river) or irrigation district
	Provision of water recharged or recovered through MAR (e.g. to the public or a third party)	Exemptions from water services licence (water service licences are issued by the Economic Regulation Authority – see below)	Exemption applications need to provide sufficient information on the proposal to determine whether the exemption is not contrary to the public interest, as set out on website: www.water.wa.gov.au/urban-water/water-services/water-service-licensing-and-licence-exemptions	<i>Water Services Act 2012</i> - exemption	To support applications for exemption from water services licences, which are assessed by the Department of Water and Environmental Regulation

Table 2. Summary of MAR approvals that may be required in WA (continued)

Agency	Activity	Regulatory instrument	Supporting information required	Legislation	When required
Department of Water and Environmental Regulation	Disposal or discharge onto or into the ground of any polluted water, or discharge into any well of any chemical, industrial waste, treated or untreated sewage, effluent or other matter that may pollute the underground water within a public drinking water source area (PDWSA)	<i>Metropolitan Water Supply, Sewerage and Drainage By-Laws 1981</i>	Information such as site investigation report and validation/verification monitoring program	<i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i>	Proclaimed public drinking water source areas under the <i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i>
	Depositing offensive matter within 300 m of the high-water mark or of any well or bore; depositing water containing refuse or other noisome matter in any part of a catchment area, where it may be carried by stormwater into any reservoir or well or bore, or pumping, draining; or discharge of any water or liquid waste from any quarry, mine pit, factory or industrial process	<i>Country Areas Water Supply By-Laws 1957</i>	Information such as site investigation report and validation/verification monitoring program	<i>Country Areas Water Supply Act 1947</i>	Proclaimed public drinking water source areas under the <i>Country Areas Water Supply Act 1947</i>
	Maintenance of infiltration works such as basins and galleries	Controlled waste licence		<i>Environmental Protection (Controlled Waste) Regulations 2004</i>	A carrier must hold a licence relevant to the type of controlled waste they transport
	Statutory requirement under <i>Contaminated Sites Act 2003</i> to advise on the suitability of land for subdivision or development, where a memorial has been registered on a land title due to confirmed or possible contamination		Classification of reported sites (Form 1) and part of hydrogeological assessment Feed into Development Approval	<i>Contaminated Sites Act 2003</i>	Need to ensure injected treated wastewater does not negatively impact contaminated sites (i.e. move plumes)
Environmental Protection Authority	Environmental Impact assessment under the <i>Environmental Protection Act 1986</i>	Pt IV environmental impact assessment, Ministerial Statement	Risk assessment, hydrogeological assessment, information/surveys on existing vegetation/ecosystems	<i>Environmental Protection Act 1986</i> (Pt IV)	When likely to have a significant effect on the environment
Department of Health	Approval to install a wastewater treatment system	Licence to construct or install an apparatus for the treatment of sewage	Drawings treatment train and their log removal targets	<i>Public Health Act 2016</i>	Water recycling plants that treat water to drinking water quality
	Approval to use recycled water	MoU, Recycled Water Quality Management Plan	Validation/verification monitoring program		Where protection of public health/ a drinking water source is required
Department of Planning Lands and Heritage for Western Australian Planning Commission	Development, including clearing where required	Planning approvals (e.g. Development Approval under Metropolitan Regional Scheme if required)	Planning/better urban water management requirements Evidence of consideration of conservation areas/wetlands/flora and fauna, etc. (e.g. information/surveys on existing vegetation)	<i>Planning and Development Act 2005</i> , various local Acts	Where applicable (e.g. rezoning of land, new development)

Table 2. Summary of MAR approvals that may be required in WA (continued)

Agency	Activity	Regulatory instrument	Supporting information required	Legislation	When required
Economic Regulation Authority	Provision of water recharged or recovered through MAR (e.g. to the public or a third party)	Water service licence	Business case The requirements for a water services licence application are specified in the ERA's Licence Application Guidelines: Electricity, Gas and Water Licences	<i>Water Services Act 2012</i>	There are three tests: The applicant has, and will retain: - the technical capacity to provide the water service - the financial capacity to provide the service - granting the licence would not be contrary to the public interest (which is assessed by advertising the application for public comment)
Local government authorities	Construction of infrastructure (e.g. infiltration works, wastewater treatment plants)	Application for development and/or use of land (e.g. Development Approval and Building Permit for construction of infrastructure such as infiltration works, wastewater treatment plants)	As per planning/better urban water management requirements	<i>Planning and Development Act 2005, Building Act 2011, Building Regulations 2012, Town Planning Schemes</i>	All areas with local planning schemes
Water Service Provider	Approval to use/access stormwater or wastewater from Water Service Provider's infrastructure	Formal Agreement to use/access water (e.g. Recycled Water Supply Agreement (RWSA)) Other approvals can be obtained on the basis of a "Letter of Intent to Supply" which confirms availability of water	Conditions of supply for RWSA (e.g. price, duration of agreement, quality)	<i>Water Services Act 2012</i>	Where applicable
	Disposal of effluent/treatment concentrate to ocean outlets/pipelines	Formal agreement (effluent services agreement) Trade Waste Discharge Permit Ministerial Statement conditions	Quality and volume of reject stream discharge to allow assessment of impacts (dependent on site – e.g. may impact on ability of the water service provider to comply with Ministerial Statement Conditions)		Where applicable
Federal Department of Agriculture, Water and the Environment	Prohibited actions under the Act that are likely to or will have a significant impact on the environment			<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Where applicable

Examples of MAR operations in WA

There are several successful MAR projects operating in WA, and more are under investigation.

These include MAR using treated wastewater to supplement public drinking water supplies, and using treated wastewater and stormwater to irrigate public open space, school grounds and golf courses. A brief outline of some of the existing MAR operations is given below.



MAR using treated wastewater to supplement Perth's drinking water supply



MAR using treated stormwater for irrigation in the City of Kalamunda



MAR using treated wastewater for irrigation in the City of Mandurah

MAR using treated wastewater to supplement Perth's drinking water supply

The largest MAR operation in WA is Water Corporation's [Groundwater replenishment](#) scheme in Perth, which recharges high-quality treated wastewater into a suitable confined aquifer of the Gnangara groundwater system.

Wastewater from the Beenyup Wastewater Treatment Plant is treated to drinking water standards via the Advanced Water Recycling Plant before injection into the aquifer. The water is recovered by Water Corporation to supplement Perth's public drinking water supply.

The scheme is regulated by the Department of Water and Environmental Regulation and the Department of Health. A MAR management zone is defined as part of the water quality management for the scheme, which involves regular monitoring and analysis.

A new groundwater model is being used to assess the best locations for reinjecting recycled water to maximise benefits to the groundwater system, and to help optimise where water is taken from, including new locations from deep aquifers that have less impact on the system. The model of the Gnangara groundwater system is the result of a four-year study recently completed by the department in collaboration with Curtin University and the University of Western Australia.



MAR using treated stormwater for irrigation in the City of Kalamunda

The City of Kalamunda, about 24 km east of Perth CBD, has a population of about 60,000. As more areas are subdivided, especially in the foothills, new public open space needs to be subdivided, including high-quality parks and sporting grounds that require irrigation.

The city manages Hartfield Park, a large multi-use reserve that accommodates a variety of sporting and recreation facilities, as well as encompassing an area of protected native bushland. In 2010, the city identified the need for additional irrigated sports fields as part of its Hartfield Park Master Plan. As the groundwater resources for the area were fully allocated, the city could not apply for an increase to its licensed water entitlement, and therefore needed to find an alternative water source for irrigation that would be sustainable in the long term.

A concept was developed by the city that proposed harvesting stormwater from a nearby Water Corporation main drain and injecting it into the local Leederville Aquifer. In this way, water that would normally be channeled away as urban stormwater run-off during winter, would be captured and stored in the aquifer for recovery during summer when needed for irrigation.

The city undertook the required investigations under the department's original MAR policy, and conducted a three-year trial to confirm feasibility. All regulatory approvals were obtained from the department, and from Water Corporation and the Department of Health.

The stormwater is treated before injection using a multi-stage filtration process specifically designed for the project, with three stages of filtering out solids to 70, 50 then 2 micron particle size, and finally removing total organic carbon through activated carbon filters before injection. This ensures that the aquifer is protected and clogging of the injection bore is minimised.

The city currently harvests 46,000 kL from the stormwater drain, providing an alternative water supply solution to meet the city's water needs.



MAR using treated wastewater for irrigation in the City of Mandurah

The population in the City of Mandurah has grown rapidly, particularly in the Dawesville area, which is approaching 10,000 people. The need to provide active recreational areas to the community, with poor quality and fully allocated groundwater resources, led the city to investigate alternative water sources. The use of treated wastewater through MAR was found to be the best option.

There are three wastewater treatment plants in the city's boundaries – Caddadup, Halls Head and Gordon Road – where Water Corporation, the state's largest water service provider, treats wastewater to a secondary level before it is infiltrated into the shallow superficial aquifer through on-site infiltration basins. This activity is regulated under Part V of the *Environmental Protection Act 1986*.

The city has established a MAR operation using infiltrated wastewater from the Caddadup Wastewater Treatment Plant. It accesses the treated wastewater through an agreement with Water Corporation and abstracts it under a licence from the department. The recovered water is used to irrigate two hectares of active open space at Ocean Road Primary School, and a one hectare oval at St Damien's Catholic Primary School. Five recovery bores extract water from the superficial aquifer, which has been recharged with the treated wastewater from the Caddadup plant. The recovered water is conveyed to the Ocean Road site through a 1.3 km recycled-water mainline and stored in holding tanks at the schools for use in irrigation systems as required. The pipeline includes offtakes for future use at other locations in the area.

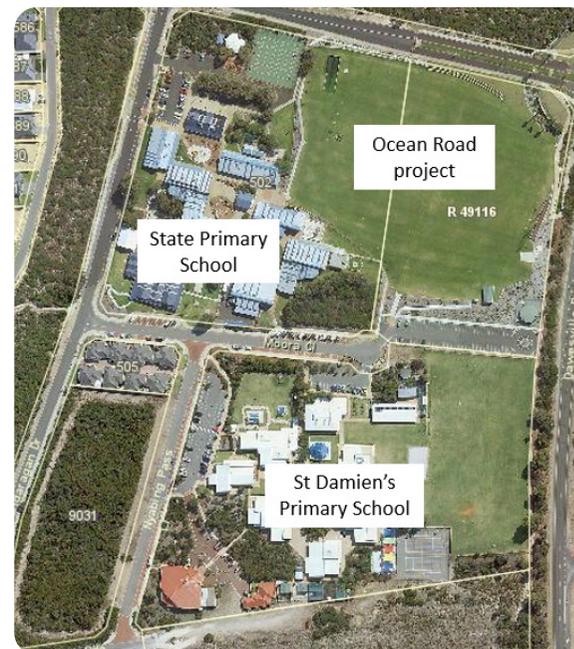
The water levels and quality are continuously monitored in recovery bores and the ovals are irrigated at night, allowing the water to be absorbed. This ensures that the water quality is fit-for-purpose and there is a low risk of exposure by people and animals. The volume abstracted is also metered.

Relevant approvals were obtained from the Department of Water and

Environmental Regulation, Department of Health and other government agencies. The city and the schools also have recycled water quality management plans that are approved by the Department of Health.

Analysis of options to maintain these active open spaces showed that recovering treated waste was the most sustainable long-term water supply option, and also produced cost savings. Treated wastewater has proven to be a climate-resilient, reliable and affordable water supply option for the city, enabling these sites to operate for sporting use today and in the future. It has also allowed the city to be more waterwise, by using fit-for-purpose non-drinking water for irrigation instead of groundwater or scheme water.

The city is working with the department to develop other MAR schemes associated with the Gordon Road Wastewater Treatment Plant and the Halls Head Wastewater Treatment Plant.



References and related documents

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Refer to the department's website for links to all published documents, regulatory information and framework at www.dwer.wa.gov.au.

Refer to the EPA website for EPA policy and assessments at www.epa.wa.gov.au.

In addition, the *National Water Quality Management Strategy* (ARMCANZ & ANZECC, 1994) guidelines and documents (www.waterquality.gov.au/guidelines/recycled-water) provide detailed information on MAR feasibility, assessment and management.



Contact us

if you would like to discuss any issues related to the MAR policy or guideline, or for advice on a specific proposal

(dwer.wa.gov.au/contact-us).

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