



# Managed Aquifer Recharge

## MAR ESSENTIALS

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# Presentation Outline

Overview of Managed Aquifer Recharge (MAR)

Establishing MAR Schemes

- A staged, risk-management approach

Technical Considerations for Successful Implementation  
(Russell Martin)



Beenyup Leederville Recharge Bore  
Image courtesy of Water Corporation



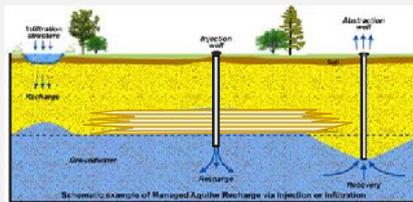
# MAR – An Overview

BRIEF INTRODUCTORY DESCRIPTION

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WATER RECHARGE SOLUTIONS

# Managed Aquifer Recharge (MAR)

The purposeful recharge of water to the groundwater system for subsequent recovery or environmental benefit.



Source: Department of Water website (modified)

Augment water supplies:

- Drinking water supplies
- Fit for purpose supplies (irrigation, third pipe)

Environmental benefit

- Maintaining water levels (lakes, GDE's)
- Mitigate saline intrusion (coastal bores)
- Net no-loss to aquifer (geothermal)

Re-inject excess water

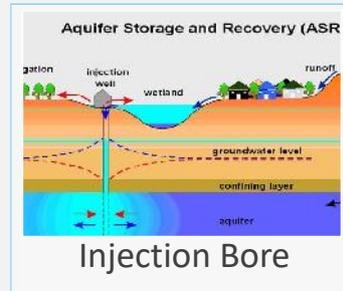
- Mine dewatering
- Construction dewatering

## Recharge Methods



Infiltration

- Unconfined aquifer
- Sufficient surface area
- Low/Med. tech
- Passive



Injection Bore

- Confined aquifer
- Limited surface area
- Med/High Tech
- Controlled
- Large volumes
- Recover from same bore (ASR)
- Recover from distant bore (ASTR)

## Western Australia Examples

Improved public amenity



1. Meadow Springs  
TWW Infiltration and recovery for irrigation

Increased groundwater allocation



2. Hartfield Park  
Stormwater capture and ASR



3. Kwinana Investigation  
Economically sustainable water recycling for industry

Protect GDE's and control SW intrusion

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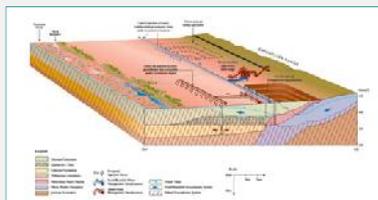
Examples will be discussed in detail in the MAR Essentials workshop:

## Western Australia Examples



Enhanced natural recharge

4. Minderoo: Upside down weir



5. FMG Cloudbreak MAR Scheme, one of the largest in Australia

Protecting important surface water features



Aquifer replenishment

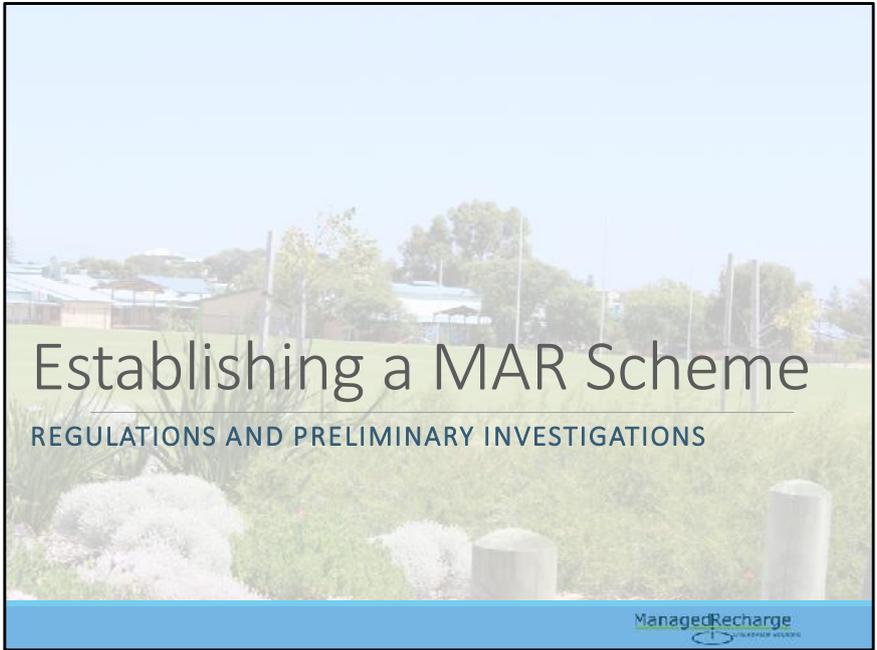


6. Beenyup GWRS  
Australian-first, currently commissioning operational scheme (14 GL/annum)

Augmenting drinking water supplies

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Examples will be discussed in detail in the MAR Essentials workshop:



# Establishing a MAR Scheme

REGULATIONS AND PRELIMINARY INVESTIGATIONS

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## Regulations in Western Australia

### Department of Water (DoW):

- Operational Policy 1.01 – Managed Aquifer Recharge in Western Australia, 2011

### Department of Environmental Regulation (DER) and Environmental Protection Agency (EPA):

- Contaminated Sites
- Mining
- Modifying lakes or environmental impact

### Department of Health

- Recycled water as a source



Operational Policy 1.01 – MAR in WA

The regulatory environment is currently under review following the recent amalgamation of a number of departments – but historically this is the regulatory environment under which MAR operates in WA.

## Australian MAR Guidelines

**A systematic, risk-management approach**

Stages of Project Development and Assessment

Australian MAR Guidelines (2009)

Western Australian policy references the Australian Guidelines for Managed Aquifer Recharge, and uses it as an overarching document, providing a template for the approvals process within the WA licensing perspective.

Provides a systematic, staged approach to the assessment and development process.

The guidelines provide more certainty to risk assessments used in the project approvals and speed up the approval process, as well as helping to prevent failures in MAR projects, thereby upholding the confidence of investors and the public in future innovations.

## Stage 1 – Desktop Study

High level viability assessment using available information and data

- Identified need/benefit
- Source water available
- Suitable aquifer present
- Acceptable use for recovered water
- Regulatory approval
- Planning requirements identified
- Information gaps?



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Determine the extent of work needed for the project's success

Identify knowledge gaps and potential technical and economic risks

## Entry-level Viability Assessment

Attribute	Fulfilled	Comment
<b>1. Intended water use</b>		
Is there an ongoing demand or clearly defined environmental benefit?	Yes	If not, MAR not recommended
<b>2. Available source</b>		
Adequate source of suitable quality water available?	Maybe	MAR not recommended if the required volume or water quality will adversely impact existing users/environment
<b>3. Hydrogeological assessment</b>		
Is there at least one aquifer capable of storing additional water?	Yes	MAR will only work where hydrogeological conditions are favourable – generally a high yielding aquifer.
<b>4. Space</b>		
Is there sufficient land available for water catchment and treatment?	Yes	Area required depends on system proposed.
<b>5. Technical Capacity</b>		
Are the technical skills and resources available to design, construct and operate a MAR scheme?	Maybe	Often overlooked - requirements will depend on degree of difficulty

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In the MAR Essentials workshop we will take you through the process of an entry level viability assessment, highlighting factors that need to be considered, such as:

- The intended use
- Availability and quality of source water
- Hydrogeological conditions
- Technical capacity
- Groundwater quality and recovery efficiency
- Geochemical reactions
- Clogging risk
- Proximity of connected ecosystems, and
- Planning requirements

## Degree of Difficulty Assessment

Easy to implement

Difficult to implement



Few resources  
Low level technical  
expertise

Many resources  
High level technical  
expertise

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Provides an early indication of the degree of difficulty that might be expected in a project, and allows informed decisions to be made with regard to level of commitment for further investigations and on-going financial and human resources.



# Stages 2 to 4

INVESTIGATIONS, TECHNICAL CONSIDERATIONS, DETAILED RISK ASSESSMENT, CONSTRUCTION AND COMMISSIONING