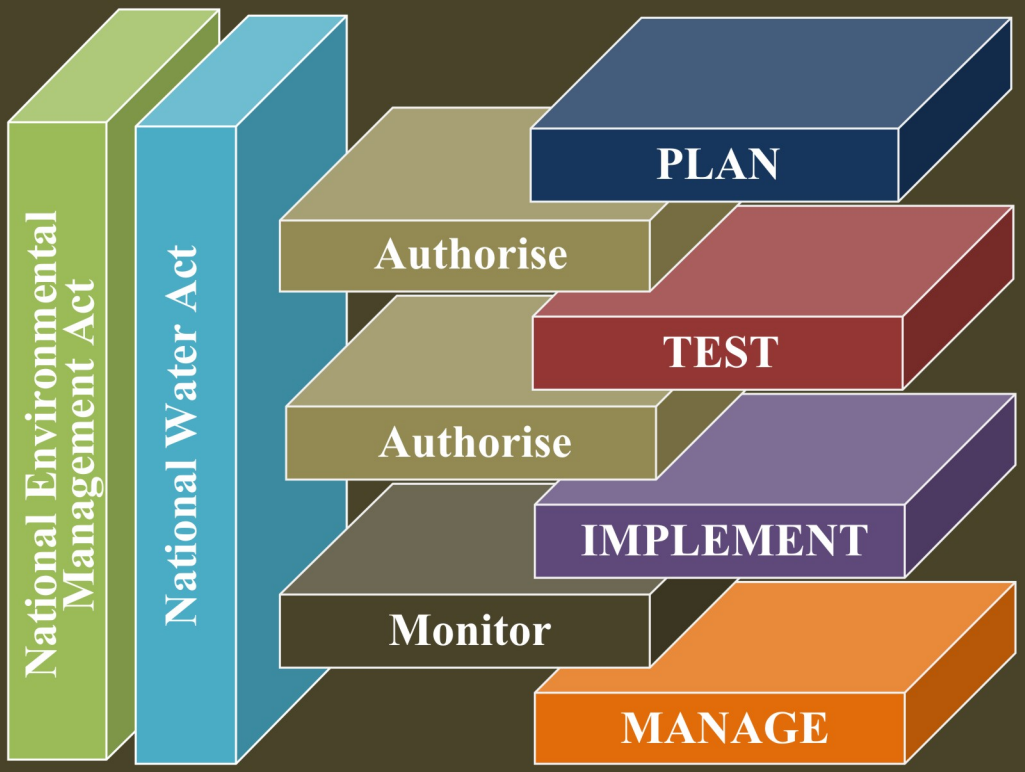
Planning and Authorising Artificial Recharge Schemes



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DWA witnessing artificial recharge testing at Prince Albert in July 2010

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1 INTRODUCTION

Artificial recharge schemes need to be licensed. The National Water Act (DWAF, 1998) states that the intentional recharging of an aquifer with any waste or water containing waste requires licensing. It also mentions that storing water requires a license. While it does not specifically mention that storing water in an aquifer requires a license, this can be implied, as the prime reason for undertaking artificial recharge is to store water.

This report is presented in the following manner:

1. Project Stages: This puts the authorisation process in line with the project as a whole.
2. Legal and regulatory issues: This describes the overarching legal framework before listing and describing the activities that will most commonly require authorisation.
3. Authorising artificial recharge projects: This provides a summary of the authorisation process and references the appropriate forms that may be required.

This document provides an update of the sections in the DWA artificial recharge strategy (DWAF, 2007) that deal with the current legislation and authorisation requirements. The update serves two functions:

1. To align the information with current legislation and regulations where this has changed
2. To capture the additional experience that has been gained in the roll out of the artificial recharge strategy between 2007 and 2010

For reference purposes, the complete document '**Artificial Recharge Strategy: Version 1.3**' (DWAF, 2007) can be downloaded from the DWA artificial recharge website: www.artificialrecharge.co.za. This document is essentially a handbook on artificial recharge. It contains a wealth of information, including scheme types, details on the "success criteria" and the artificial recharge strategy. In addition, '**A check-list for implementing successful artificial recharge projects**' (DWA, 2009) can be downloaded, providing a brief overview of the artificial recharge project stages, the pre-feasibility study check list and the feasibility study check list. These checklists are also attached to this document in **Appendix A**.

2 Project stages

It is important that artificial recharge projects follow the development stages of a normal water supply project, namely; planning, design, authorisation and implementation. Artificial recharge schemes cannot be considered simple interventions whereby excess surface water is transferred underground on an ad-hoc basis in the hope that this will solve water shortage problems. If the project is not properly planned, it is unlikely to have the expected benefits and could have negative repercussions. For example, the scheme could become inefficient due to clogging, or there may be legal or environmental issues that could lead to scheme failure.

Artificial recharge projects differ from conventional water supply infrastructure development projects in two significant ways:

- A significant period of testing is almost always required prior to developing the design and implementation plan.
- Artificial recharge projects are site specific and each project will have its own particular objectives.

While testing helps one to understand the project specific conditions, it is often important to start relatively small and have incremental increases in capacity as the variables of the particular situation are monitored and better understood.

Artificial recharge projects cannot be considered as mere management interventions, as there is always some level of infrastructure development associated with them.

Table 1 summarises the recommended artificial recharge project stages, key activities and authorisation requirements. The recommended authorisation process is described in detail in Section 4. The project stages have been developed and informed by lessons learnt assessing the feasibility of projects during the roll out of the DWA artificial recharge strategy.

2.1 Pre-feasibility Stage

The pre-feasibility study for all planned artificial recharge schemes serves three main purposes:

1. It requires the applicant to formulate the proposal.
2. It provides an initial assessment of the scheme's viability.
3. It identifies the authorisation requirements. Applicants must make the initial contact with DWA and DEA regional offices to establish which "water uses" will be applicable, the licensing requirements, and the environmental authorisation requirements. This relates to both the proposed scheme and artificial recharge tests (which usually form part of the feasibility stage).

During the Pre-feasibility Stage, the need for the proposed artificial recharge scheme must be justified; the volume of water to be recharged must be quantified; and the proposed method of recharge described. Based on existing information, the ability of the aquifer to accept and store the water, and the ability to recover the water, must be evaluated. Possible environmental impacts must also be identified, together with the potential for these to be appropriately mitigated.

The pre-feasibility report should include the following:

- The conceptual design of the project.
- Existing permits and licences.
- Existing data on water availability, borehole water levels and water quality, and existing and planned data monitoring systems.
- A report on the viability of the project, taking into account the ten criteria for successful implementation described in Section C.1 of the DWA artificial recharge strategy (DWAF, 2007). The report should identify information gaps and how these will be addressed in the feasibility study.
- A report on the listed activities in the testing phase that require environmental authorisation and water use licensing.
- The proposed tests to assess the feasibility of the scheme.
- The feasibility study plan and cost estimate.

TABLE 1 RECOMMENDED ARTIFICIAL RECHARGE PROJECT STAGES, KEY ACTIVITIES AND AUTHORISATION REQUIREMENTS

Project Stage	Key Activities	Authorisation requirements
Pre-feasibility Stage	Identify the potential AR project and describe the information currently available. Based on existing information, comment on the feasibility of the project. Describe the work required for the Feasibility Stage and estimate the cost of undertaking the feasibility study.	None
	Establish existing water use licence conditions and authorisation requirements from DWA and DEA.	
Feasibility Stage	If needed, obtain a water use licence and environmental authorisation for the recharge tests. Conduct the feasibility study. This should include AR testing (eg injection tests, infiltration tests, pumping tests, water quality assessments, etc) Develop a preliminary infrastructure design. Identify the project implementation phases if a phased approach is necessary (eg starting small and expanding after successive recharge cycles). Estimate the costs of the project. Identify funding sources Compile a detailed project implementation plan.	None, or a short-term water use licence for AR testing and possibly environmental authorisation for AR testing
Implementation Stage	Obtain the necessary water use licence and environmental authorisation for the AR scheme. Drilling and testing new injection and abstraction boreholes or infiltration basins Set up the groundwater and recharge water monitoring system Develop the detailed infrastructure design, carry out the tendering processes, and construct the project. Compile monitoring, operation & maintenance procedures.	Water use licence and possibly environmental authorisation
Operation and Maintenance Stage	Carry out performance monitoring during production. Modify operation & maintenance procedures based on scheme performance. Develop final monitoring and reporting system.	Compliance monitoring and reporting.

The pre-feasibility report must be submitted to DWA. DWA may need to convene an "Artificial Recharge Authorities Committee Meeting" where the report is discussed amongst the relevant departments (DWA, DEA, etc), and the applicant.

If a water use licence is required for the testing stage, the pre-feasibility report should accompany the licence application. If no licence is required, the applicant can continue with the tests, subject to the conditions set by the Artificial Recharge Authorities Committee Meeting.

In order to assess whether environmental authorisation is required for the planned tests, the applicant will need to identify listed activities that may trigger an environmental study and establish which activities exceed the trigger limits. The listed activities and their limits are contained in Tables 3 and 4. The applicant may

need to consult an Environmental Assessment Professional (EAP). If environmental authorisation is triggered by the planned artificial recharge tests, the applicant should submit the required documentation (Basic Assessment Report or Scoping Report) together with the pre-feasibility report. This is important to ensure that the authorisation process is processed in the shortest possible time.

2.2 Feasibility Stage

The purpose of the feasibility study is to determine whether the artificial recharge scheme is feasible, affordable and sustainable prior to implementing the scheme. This stage of the study usually involves the testing of the artificial recharge scheme – either at a pilot scale or at full scale.

Once authorisation has been received, testing can commence taking cognisance of the conditions set out by DWA and DEA. Besides water quality, water level, injection/infiltration rate and environmental monitoring, the authorities may require a public participation process prior to testing.

Site-specific information must be gathered during this stage to assess the ability of the aquifer to receive water, the efficiency of the artificial recharge process, and the hydraulic and environmental effects of recharging the aquifer. Data collected during the feasibility study will provide a baseline against which monitoring data can be compared in future.

Testing can last for six months or longer depending on the duration of the planned production/recharge cycles and the level of confidence required prior implementing the full-scale scheme. Typically, this will involve a period of infiltration/injecting followed by a period of monitoring the aquifer's response after the recharge tests, and then an abstraction period.

The feasibility study should report on all the items listed in the criteria for successful implementation:

1. A clearly defined need
2. The quantity and reliability of the source water
3. Aquifer hydraulics
4. Water quality
5. Artificial recharge method and engineering issues
6. Environmental issues
7. Legal and regulatory issues
8. Economics
9. Management and technical capacity
10. Institutional arrangements

The report should also include:

- Preliminary infrastructure design
- A detailed project implementation plan
- A funding plan identifying funding sources and requirements
- A comparison with other water supply alternatives.

The applicant should establish the environmental authorisation and water use licensing requirements and submit the appropriate applications together with the feasibility study to DWA. DWA may need to convene an Artificial Recharge Authorities Committee Meeting to decide whether the project can proceed to implementation and to set the conditions for implementation.

2.3 Implementation Stage

Once authorisation to proceed is received by the applicant, the Implementation Stage of the project can commence. This would typically consist of:

- Further groundwater infrastructure development (drilling & testing)
- Setting up the groundwater monitoring system (artificial recharge volumes, groundwater levels and water quality)
- Ensuring that the required water use licence and environmental authorisation is obtained
- Developing detailed infrastructure design, carrying out the tendering process and constructing the scheme
- Compiling the monitoring, operation & maintenance procedures.

2.4 Operation and Maintenance Stage

During the Operation and Maintenance, or Production Stage, monitoring of the artificial recharge scheme will focus on optimising the scheme performance and expanding its capacity where feasible. Activities include:

- Monitoring scheme performance and the aquifer response during recharge and abstraction
- Modifying operation and maintenance procedures
- Implementing incremental increases in the scheme's capacity (up to the authorised limits)
- Reporting on information required in terms of the water use licence and environmental authorisation.

3 Legal and regulatory issues

All artificial recharge schemes need to be licensed and obtaining the necessary permits is thus crucial to the success of new projects. This section describes the applicable legislation, and section 4 describes the artificial recharge authorisation process in detail

The key legal issues regarding the assessment and operation of artificial recharge schemes include:

- Water use licensing for artificial recharge schemes
- Environmental authorisation requirements for both testing and implementing the scheme (i.e. Basic Assessment or Environmental Impact Assessment)
- Compliance with heritage legislation (Heritage Impact Assessment)
- Environmental Management Plans (EMPs)
- Compliance with regulations (e.g. relating to water reuse)
- Rights associated with the use of artificially recharged water.
- Compliance with the conditions and reporting requirements of the water use licence and environmental authorisation.

South Africa's water use and environmental legislation have not yet been tested with the processing of applications for artificial recharge schemes. However, both the National Water Act and the NEMA provide the framework for processing artificial recharge applications.

3.1 The Legislative Framework

The legislative framework governing artificial recharge projects is primarily the **National Water Act** and the **National Environmental Management Act** although for specific projects a number of other pieces of legislation and local bylaws may apply. The legislation is listed below and followed by a detailed description of the relevant aspects of the two key acts.

National Water Act (NWA), 1998 (No 36 of 1998), is the principal legal instrument relating to water resources management in South Africa and contains provisions for the protection, use, development, conservation, management and control of South Africa's water resources.

In addition to the NWA, there are many other policies and laws administered by a number of Departments that affect water resources. Of particular relevance are:

- The **Water Services Act**, 1997 (No. 108 of 1997), which relates to the provision of water services by water services institutions including the safe disposal of effluent. The Water Services Act also requires that Water Services Authorities (WSA's) produce an annual water audit including details of water conservation measures.
- The **National Environmental Management Act**, 1998 (No. 107 of 1998) is relevant to the management of water resources within the context of national environmental principles and legislation.

The **National Environmental Management Act** (No. 107 of 1998) (NEMA) and as amended (No. 56 of 2002, No. 8 of 2004 and No. 62 of 2008) provides for the control of listed activities. The Government Notices R. 543, R. 544, R. 545, R. 546 and R. 547 published in Government Gazette No. 33306 of 18 June 2010, and promulgated under Section 24(5), 24M and 44 of NEMA, have replaced the previous Government Notices R. 385, R. 386, and R. 387 published in Government Gazette No. 28753 on the 21st April 2006. These Government Notices, in turn, replaced the environmental impact assessment (EIA) regulations that were promulgated in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989) in 1997.

The **Environment Conservation Act** (No. 73 of 1989) (ECA) previously provided for the control of certain listed activities that 'may have a detrimental effect on the environment'. These activities were listed in Government Notice R1182 of 5 September 1997 (as amended). The Act further prohibits such activities until written authorisation was obtained from the Minister or his delegated authority. The regulations published in terms of the National Environmental Management Act have replaced the ECA Environmental Impact Assessment regulations with effect from 3 July 2006. However the ECA remains in force as it relates to waste disposal, and the Outeniqua Sensitive Coastal Areas regulations.

The purpose of the **National Heritage Resources Act** (No.25 of 1999) is to preserve South Africa's heritage resources for future generations. The act stipulates that the heritage resources of an area need to be mapped, described and preserved when construction projects are undertaken and when the size of those projects are more than certain limits.

While the NWA and the NEMA are the two primary acts that govern artificial recharge projects in South Africa, other legislation that may apply to specific projects includes:

- National Heritage Resources Act (No.25 of 1999)
- Water Services Act (Act 108 of 1997)
- National Environmental Management: Biodiversity Act (Act 10 of 2004)
- National Environmental Management: Protected Areas Act (Act 57 of 2003)
- Mineral and Petroleum Resources Development Act (Act 28 of 2002)

- Dam Safety Regulations (published in Government Notice R. 1560 of 25 July 1986)
- Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
- Promotion of Administrative Justice Amendment Act (Act 53 of 2002)
- National Environmental Management: Waste Act, (Act 59 of 2008)
- Local Bylaws

3.2 National Water Act (NWA)

The two key points relevant to artificial recharge are:

1. How artificial recharge is defined in the National Water Act
2. Whether artificial recharge needs to be licensed.

Chapter 4 of the NWA refers to the use of water and eleven uses are described in Section 21 of the Act (Table 2). Two of these "uses" clearly fall within the realm of artificial recharge, namely "storing water", and "the intentional recharging of an aquifer with any waste or water containing waste". Other uses such as "altering the bed, banks, course or characteristics of a watercourse", could be applicable in the case of a bank filtration artificial recharge scheme. Based on the definitions as contained in the NWA, artificial recharge can therefore be considered a water use.

In considering an application for a licence to store water the applicant would have to show that the aquifer ("storage unit") is able to contain the water and that it will not flow away from the capture zone before it is abstracted. Alternatively, licence conditions may require the water to be abstracted within a certain time period after recharge (i.e. prior to leakage out the aquifer or away from the capture zone).

In general a water use needs to be licensed unless it is: (NWA, 1998)

- Listed in Schedule 1
- Is an existing lawful use
- Is permissible under a general authorisation, or
- If a responsible authority waives the need for a licence.

Schedule 1 use includes, amongst others, small-scale domestic use, gardening, and watering of animals. Most artificial recharge schemes will apply to municipal or other large scale users and will therefore fall outside of Schedule 1 use. Examples of Schedule 1 use artificial recharge schemes include earth dams that farmers build to enhance groundwater recharge, and rainwater harvesting that involves sub-surface storage.

Existing lawful use refers to a legal water use prior to the commencement of the NWA in 1998. An example of this that relates to artificial recharge is Atlantis, which has historically discharged treated waste water into infiltration basins which, in turn, enhances recharge.

Permissible use under a general authorisation is described in Part 6 of the NWA (Section 39). The storage of water underground is specifically excluded from general authorisation in Government Notice No 399 of 26 March 2004. As a result, all artificial recharge is subject to being issued a water use licence by DWA.

Artificial recharge schemes need to be licensed because storing water underground is defined as a "water use" in the National Water Act.

Artificial recharge cannot be excluded from licensing under pretext of a general authorisation, as the storage of water underground is specifically excluded from general authorisation.

(Government Notice No 26187 of 26 March 2004)

A responsible authority could only waive the need for a licence if other legal requirements are met, such as those that may be required to meet environmental requirements. A responsible authority may only dispense with the requirement for a water use licence if it is satisfied that the objectives of the NWA will be met by the granting of a licence, permit or other authorisation under any other law.

TABLE 2 WATER USES RECOGNISED IN SECTION 21 OF THE NWA THAT MAY BE APPLICABLE TO ARTIFICIAL RECHARGE PROJECTS

Section	Water uses
s21(a)	Taking water from a water resource
s21(b)	**Storing water**
s21(c)	Impeding or diverting the flow of water in a watercourse
s21(d)	Engaging in a stream flow reduction activity (currently only commercial afforestation)
s21(e)	Engaging in a controlled activity – activities which impact detrimentally on a water resource (activities identified in s37(1) or declared as such under s38(1)) namely: - Irrigation of any land with waste or water containing waste which is generated through an industrial activity or a waterwork; - An activity aimed at the modification of atmospheric precipitation; - A power generation activity which alters the flow regime of a water resource; or - **Intentional recharge of an aquifer with any waste or water containing waste**
s21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit
s21(g)	Disposing of waste or water containing waste in a manner which may detrimentally impact on a water resource
s21(h)	Disposing in any manner of water which contains waste from, or has been heated in any industrial or power generation process
s21(i)	Altering the bed, banks, course or characteristics of a watercourse
s21(j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people
S21(k)	Using water for recreational purposes

There are sections in South African water law where artificial recharge is either mentioned or implied:

- In Section 37 of the NWA, intentional recharging of an aquifer with any waste or water containing waste is declared a controlled activity; and thus subject to authorisation. This would include recharging with wastewater or wastewater effluent, storm water and water containing any other substance considered waste.
- The storage of water underground is specifically excluded from general authorisation in Government Notice No 26187 of 26 March 2004. While this may refer to the storage of water in disused mine shafts and caves, etc, it nevertheless implies that all artificial recharge is subject to being issued a water use licence by DWA.

While an artificial recharge scheme may include a number of water uses that require a licence, the physical process of artificially recharging groundwater is not defined as a use in terms of the NWA. However, because in most instances the primary purpose of artificial recharge would be to store water in an aquifer, the "use" associated with artificial recharge projects will be s21(b), "the storing of water".

It is evident that subsurface storage was not considered at the time of drafting the legislation. Government notice No 26187 defines storage as follows: "storage" means storing water not containing waste, in a watercourse or off-channel storage. Further, the licence application form pertaining to storage (DW762 NWA Section 21b) describes the storage of water in dams and is inadequate to describe the storage of water in an aquifer.

The dam safety regulation will be applicable in recharge basins where the "dam" can contain more than 50 000 m^3 of water, and which has a wall of a vertical height of more than 5 metres, or which has been declared as a dam with a safety risk.

The responsibility of DWA in authorising an artificial recharge project is twofold: to ensure that the water resource (in his case the aquifer) is not damaged; and that the water use is both realistic and accurate. The applicant will have to provide adequate documentation of the following:

- Proof that the recharged water does not contain any waste
- Proof that the aquifer will actually store the water because authorisation to store water implies that the user has the right to re-abstract and use the stored water
- Aquifer hydraulics, including proof that the leakage rates of water from the aquifer are well understood and have informed the calculation of the proportion of water that can be re-abstracted and the time frame that the water may be re-abstracted.
- That the artificial recharge scheme will work without damaging the water resources, the environment or the rights of other lawful water users.
- The target volumes, injection rates, pumping rates, periods of both recharging and abstraction as well as the water quality aspects of the scheme

3.3 National Environmental Management Act (NEMA)

Regulations published under the National Environmental Management Act (Act 107 of 1998) (NEMA) do not specifically address artificial recharge as an activity, but some of the listed activities could be part of implementing an artificial recharge scheme. For example, authorisation is required for the construction of facilities or infrastructure exceeding 1000m for the bulk transportation of water in pipelines with an internal diameter of 0.36 m or more, or with a peak throughput of 120 L/s or more. Limits that trigger the need for environmental authorisation that could be applicable to artificial recharge schemes are listed in Tables 3 and 4.

Under the previous NEMA regulations (385, 386 and 387 of 2006) it was stipulated that environmental authorisation is required when the abstraction of groundwater exceeds the general authorisation volume issued in terms of the NWA. This authorisation duplication has been removed from the current regulations and no longer applies.

On 18 June 2010 new regulations were promulgated in terms of Sections 24(5), 24M and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA"). The regulations came into effect on 2 August 2010 and replaced the previous 2006 regulations.

The 2010 NEMA Regulations

- EIA procedures (Government Notice No. R. 543)
- Listing Notice 1 (listing activities for which a Basic Assessment process be conducted) (Government Notice No. R. 544)
- Listing Notice 2 (listing activities for which a Scoping/EIA process must be conducted) (Government Notice No. R. 545)
- **Listing Notice 3** (listing activities and sensitive areas per province, for which a Basic Assessment process must be conducted) (Government Notice No**. R. 546**)
- Environmental Management Framework regulations (Government Notice No. R. 547)

Environmental authorisation is required in instances where a listed activity associated with a planned artificial recharge scheme exceeds the limits set out in Tables 3 and 4.

TABLE 3 ACTIVITIES THAT REQUIRE BASIC ASSESSMENT, AS STIPULATED IN NEMA REGULATION 544 (2010)

Section	Activities
9	The construction of facilities or infrastructure exceeding 1000metres in length for the bulk transportation of water, sewage or storm water (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more, excluding where: such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse
11	The construction of: (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk storm water outlet structures; (vii) marinas; (viii) jetties exceeding 50 square metres in size; (ix) slipways exceeding 50 square metres in size; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more

Section	Activities
	where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line
12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010;
13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres;
37	The expansion of facilities or infrastructure re for the bulk transportation of water, sewage or storm water where: (a) the facility or infrastructure is expanded by more than 1000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more excluding where such expansion: (i) relates to transportation of water, sewage or storm water within a road reserve; or (ii) where such expansion will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.
39	The expansion of (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk storm water outlet structures; (vii) marinas; within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, where such expansion will result in an increased development footprint but excluding where such expansion occur behind the development setback line.
41	The expansion of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, where the combined capacity will be increased by 50000 cubic metres or more.
42	The expansion of facilities for the storage, or storage and handling, of a dangerous good, where the capacity of such storage facility will be expanded by 80 cubic metres or more.
52	The expansion of facilities or infrastructure for the transfer of water from and to or between any combination of the following: (i) water catchments; (ii) water treatment works; or (iii) impoundments; where the capacity will be increased by 50 000 cubic metres or more per day, but excluding water treatment works where water is treated for drinking purposes.
53	The expansion of a dam where: (i) the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, was originally 5 metres or higher and where the height of the wall is increased by 2,5 metres or more; or; (ii) where the high-water mark of the dam will be increased with 10 hectares or more

TABLE 4 ACTIVITIES THAT REQUIRE A SCOPING STUDY AND AN EIA, AS STIPULATED IN NEMA REGULATION 545 (2010)

Section	Activities
2	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.
10	The construction of facilities or infrastructure for the transfer of 50 000 cubic meters or more per day, from and or between any combination of the following; (i) water catchments; (ii) water treatment works; or (iii) impoundments
6	The construction of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 m or higher or where the high-water mark of the dam covers an area of 10 hectares or more

Listing Note 3, Government Notice No. R. 546 (2010), lists a series of activities that require basic assessment in sensitive areas listed per province. For the purpose of this document it is sufficient to refer to the sections in Table 5 and direct the reader to the regulations for the classification of sensitive areas per section per province. The sensitive areas typically include protected areas, watercourses and wetlands.

TABLE 5 ACTIVITIES THAT MAY REQUIRE A BASIC ASSESSMENT FOR SENSITIVE AREAS DEFINED PROVINCIALLY IN NEMA REGULATION 546 (2010)

Section	Activities
2	The construction of reservoirs for bulk water supply with a capacity of more than 250 cubic metres.
12, 13 & 14	The clearance of vegetation where more than 70% of the vegetation is indigenous.
17	The expansion of reservoirs for bulk water supply where the capacity will be expanded by more than 250 cubic metres.
10	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres
23	The expansion of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage facilities will be expanded by 30 cubic metres or more but less than 80 cubic metres

While some of these activities may be triggered by an artificial recharge scheme, the act of artificially recharging groundwater would not trigger a Basic Assessment or a Scoping Study and EIA. However, under section 28 of NEMA, DEA needs to comment on (and can set conditions for) any activity that may have a potential environmental impact, even if that activity does not trigger a Basic Assessment or a Scoping Study and EIA.

In some provinces, DWA and the delegated DEA authority are developing Memoranda of Understanding regarding their co-operative relationship. These could cater for having a combined process for obtaining both a licence and environmental authorisation.

As is the case with the NWA, under Chapter 5 of NEMA Regulation 543, an applicant may apply for an exemption from any provision described in the NEMA Regulations. The NEMA Regulations stipulate the procedure to be followed when applying for exemption and factors that need to be taken into account when considering an application for exemption.

The NEMA regulation 543 provides timeframes of 14 days for administrative actions, 45 days for the review and decision-making on minor reports and between 60 and 105 days for the review and decision-making on complex reports.

3.4 National Heritage Resources Act (NHRA)

The National Heritage Resources Act (No.25 of 1999) (Government Gazette No. 19974, 28 April 1999) is administered nationally by the South African Heritage Resources Agency (SAHRA) and in provinces by the respective Provincial Heritage Resources Authorities.

The act makes no specific mention of artificial recharge but in section 38 it stipulates the process that has to be followed if one intends to undertake construction works above a particular size (Table 6). For pipelines the limit is greater than 300m in length, which would be applicable to most artificial recharge projects.

Section 38 stipulates that the applicant inform the responsible heritage authority at the earliest stage and the heritage authority will stipulate if a heritage impact assessment (HIA) is required and what needs to be studied based upon their knowledge of the heritage resources of that area.

TABLE 6 ACTIVITIES THAT MAY REQUIRE A HERITAGE IMPACT ASSESSMENT IN TERMS OF THE NATIONAL HERITAGE RESOURCES ACT (1999)

Section	Activities
38(1)	(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will change the character of a site (i) exceeding 5 000 m^2 in extent; or (ii) involving three or more existing erven or subdivisions thereof; or (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority; (d) the re-zoning of a site exceeding 10 000 m^2 in extent; or (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

4 Authorising Artificial Recharge projects

The recommended process for authorising AR schemes is captured in the flow chart in **Figure 1** and **Table 6** at the end of this section.

Typically an artificial recharge project would include three activities that require authorisation:

1. Abstraction of the source water from a water resource DW760 NWA Section 21a
2. Storing of water DW762 NWA Section 21b
3. Re-abstracting the water from the Aquifer DW760 NWA Section 21a

In addition, if one were intending to recharge with waste water one or both of the following would apply:

1. Waste discharge (controlled activities): DW765 NWA Section 21e – although 21e is the section dealing with recharging an aquifer with waste, this form is mainly geared to the irrigation using waste and is not specific to recharging an aquifer with waste
2. Water Discharge (into a water resource): DW766 NWA Section 21f – this form specifically requests information about the receiving water resource and the quality of the discharge

4.1 Authorisation Process

So far, no artificial recharge project has been authorised in South Africa and thus there is no authorisation precedent. Existing schemes were implemented prior to the new water laws and fall within the realm of "existing lawful use".

What follows is a recommended process that is based on current legislation. The only new development that is envisaged is the formation of an "Artificial Recharge Authorities Committee Meeting" (Authorities Meeting) that is held whenever an artificial recharge application is made. The Authorities Meeting would be convened by DWA, and include regional DWA and DEA officials and any other affected Department.

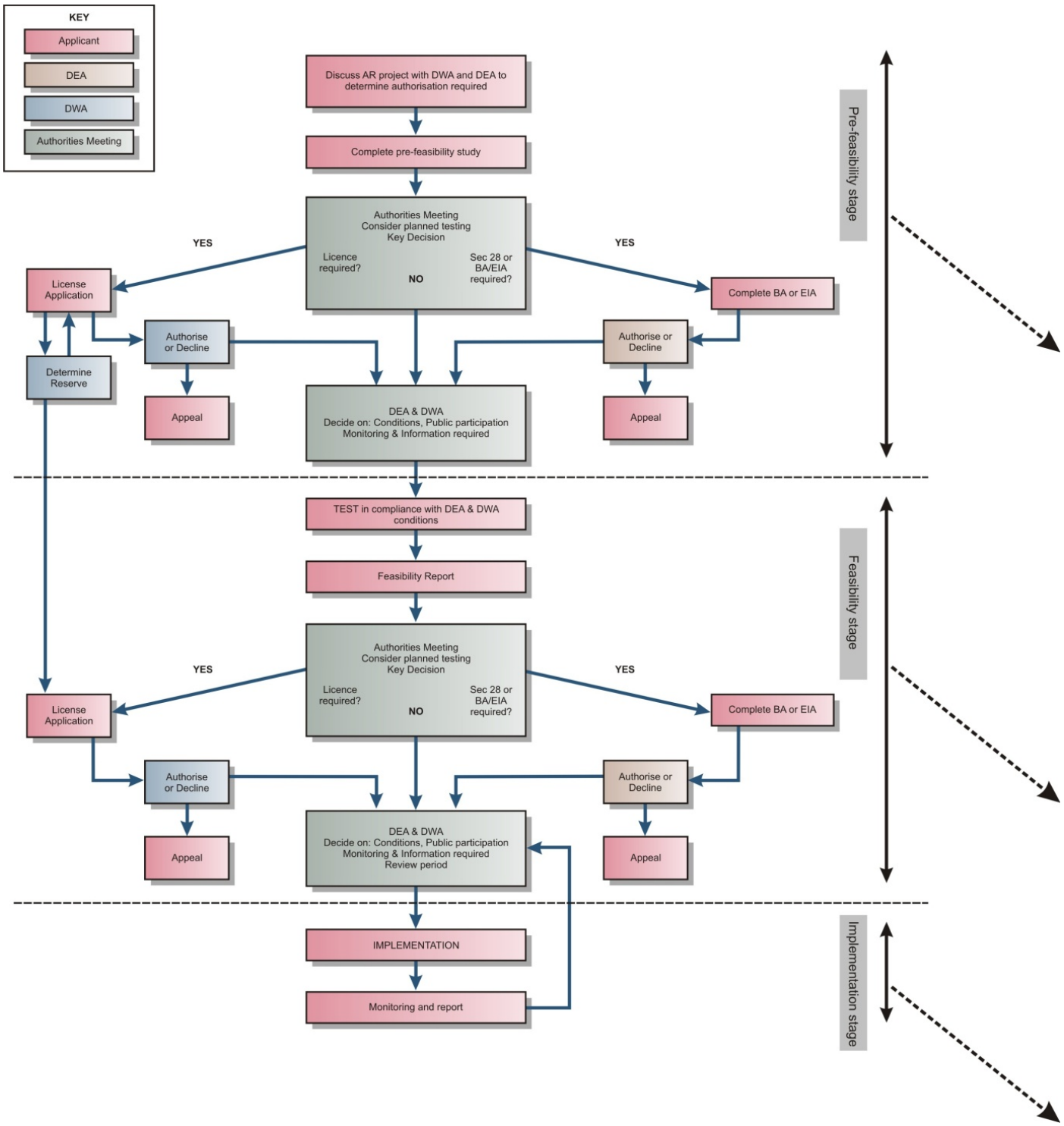
Artificial recharge projects can be authorised within the existing structures and systems of DWA and DEA. Technical support on artificial recharge issues would be required in the DWA regional offices and it is proposed that DWA head office ensure that an artificial recharge "expert" is available to attend Authorities Meetings with the regional DWA and DEA case officers. Both the NWA and NEMA require that authorisation processes are harmonised across departments and thus a single process for both authorisations (DWA and DEA) is proposed.

The Authorities Meeting is required at least twice during the process of artificial recharge scheme development:

1. The first is prior to the testing phase, at the end of the Pre-feasibility Stage. The Authorities Meeting must decide whether the testing requires water use licensing (DWA) and environmental authorisation (DEA). Conditions for testing would need to be prescribed.
2. The second is after the testing period, on completion of the Feasibility Stage. The Authorities Meeting needs to consider the feasibility study report and decide on the legal, monitoring and reporting requirements for project implementation.

In addition to the above, the Authorities Meeting would need to convene after a period of operation to review the monitoring data and to consider licence renewal. This may also be required from time to time during the Operation and Maintenance Stage of the project.

Figure 1 and Table 7 describe the proposed process for artificial recharge water use licensing and environmental authorisation.



Note: If a licence or Sec 28 or BA/EIA is not required prior to the Feasibility or Implementation Stages, conditions for testing/implementation should be set immediately at the "Authorities Meeting"

FIGURE 1 PROPOSED ARTIFICIAL RECHARGE PROJECT AUTHORISATION PROCESS

TABLE 7 SUMMARY OF TASKS FOR PROPOSED ARTIFICIAL RECHARGE AUTHORISATION

	TASKS FOR APPLICANT	TASKS FOR DWA	TASKS FOR DEA
Pre-feasibility Stage	Meet with DWA and DEA to discuss the project and authorisation requirements. Compile a Pre-feasibility report including the items listed below: ▪ A conceptual design of the project, information currently available and existing permits and licences. ▪ A description of existing data and the current systems in place for data collection. ▪ An assessment of the AR potential based on existing information and the 10 criteria for successful implementation. Identify the information gaps and how these will be addressed in the Feasibility Stage. ▪ A proposed sequence of tests for establishing the AR potential and a description of the activities requiring environmental and water use authorisation. ▪ A description of the work required and costs to undertake the feasibility study. Establish whether a water use licence and an environmental permit is required for conducting AR tests (to be carried out in the Feasibility Stage), and if so, apply to DWA and DEA for the necessary permission.	Meet with the applicant to discuss the project and authorisation requirements. Provide the applicant with guidance on the compilation of a Pre-feasibility report. On receipt of the application and/or Pre-feasibility report, undertake the following activities: ▪ Acknowledge receipt of the application and/or Pre-feasibility report within 14 days. ▪ Send DEA regional authority a copy of the application. ▪ Review the application and/or Pre-feasibility report and request further details or clarification from the applicant if needed. Consult with AR specialists as required. ▪ Formulate DWA requirements and conditions for proceeding with AR testing. ▪ Convene an Authorities Meeting with DEA and other affected Departments within 30 days of acknowledging receipt of the application. ▪ Set conditions for AR testing during the Feasibility Stage and describe the public participation processes requirements. ▪ Specify monitoring and reporting requirements (including pre-testing/baseline monitoring; monitoring requirements during testing; and post-testing monitoring). ▪ Inform the applicant of DWA/DEA requirements within 10 days. ▪ Process the licence application and initiate a reserve calculation if required. ▪ Set a time period for the validity of the AR testing.	On receipt of the application and/or Pre-feasibility report from DWA, undertake the following activities: Review the Pre-feasibility report and request further information or clarification from the applicant if needed. Formulate DEA requirements for the testing activities proposed. Establish whether a Basic Assessment or an EIA is required. Participate in the Authorities Meeting. Set conditions for AR testing during the Feasibility Stage and describe the public participation processes requirements. Specify monitoring and reporting requirements (including pre-testing/baseline monitoring; monitoring requirements during testing; and post-testing monitoring). Process the required environmental permits.
Feasibility Stage	If necessary, obtain a water use licence and an environmental permit from DWA and DEA **for AR testing**. Initiate a public participation process as and if required. Undertake monitoring and AR testing based upon the plans in the pre-feasibility study and the conditions set by DWA and DEA. Produce a Feasibility report including the following: ▪ An assessment of the AR potential based on the results of the AR tests, all available information and the 10 criteria for successful implementation. ▪ A preliminary infrastructure design. ▪ A description of project implementation phases and time frames, and clarify which phase the authorisation application covers. ▪ An economic assessment including estimates of the project implementation costs using lifecycle costing and comparing with alternative water supply options. ▪ A list of funding sources (ensure the feasibility study complies with all requirements of the proposed funder). ▪ A project implementation plan. Apply to DWA for a water use licence **for implementing and operating** the AR scheme, and to DEA for environmental authorisation.	Be available to clarify and discuss issues with the applicant. On receipt of the feasibility report: ▪ Schedule and convene an Authorities Meeting with DEA and other affected Departments within 30 days of receipt of the Feasibility report. ▪ Review the Feasibility report. ▪ Establish whether the conditions for carrying out AR testing were met. ▪ Formulate DWA's licence requirements for project implementation and production. ▪ Describe the public participation processes requirements. ▪ Stipulate monitoring and information reporting requirements. ▪ Inform the applicant within 10 days of the decisions taken at the Authorities Meeting.	Be available to clarify and discuss issues with the applicant. On receipt of the feasibility report: ▪ Review the Feasibility report. ▪ Establish whether the conditions for carrying out AR testing were met. ▪ Participate in the Authorities Meeting. ▪ Formulate DEA's requirements for project implementation and production. ▪ Describe the public participation processes requirements. ▪ Stipulate monitoring and information reporting requirements.
Implementation Stage	Implement the project. Report to DWA and DEA as per the authorisation agreements.	Review the compliance monitoring reports. Review the licence conditions at the interval stipulated in the licence agreement.	Review the compliance monitoring reports. Review the authorisation conditions.

5 Reference Documents

Below follows a list of related references and guideline documents:

Numerous documents on artificial recharge including the **Artificial Recharge Strategy: Version 1.3** (DWAF, 2007) can be downloaded from the DWA artificial recharge website: www.artificialrecharge.co.za.

DWA has a series of three guidelines that provide assistance to the potential water user on how to register their water use and how to apply for a license if required.

- **Registration Guide: Water Users**: A guide for the registration of Water User Information under the National Water Act,(Act 36 of 1998)
- **Registration Guide: Raw Water Uses**: A guide for the registration of Raw Water use under the National Water Act (Act 36 of 1998)
- **Application for a License or Registration of a Water Use**: A guide to completing registration or license application forms for waste discharge related water uses under the National Water Act (Act 36 of 1998)

The guidelines provide instructions to the potential applicant on:

Who needs to register

- Registration of the water **user**, which forms to complete and how to complete the forms
- Registration of the **raw water use and waste discharge**, which forms to complete and how to complete the forms
- Supplementary forms that apply to specific water uses and the monitoring of those activities

The guidelines and relevant forms to be completed can be downloaded from the DWA website at http://www.dwa.gov.za/Projects/WARMS/Registration/registration1.aspx. Example documents include:

- Procedure for Approving and Licensing Groundwater Development and Use (Parsons, *et al,* 2006).
- Department of Water Affairs and Forestry, 2000. Water Use Authorisation Process for Individual Applications. Revision 3, Chief Directorate: Water Conservation.
- Department of Environmental Affairs, 2010, regulation 543 to 547 ("NEMA")
- NEMA EIA Regulations Guideline & Information Document Series (DEA&DP, July, 2006 & November, 2006)
- Guidelines for Involving Hydrogeologists in EIA Processes (Saayman, 2005).

In addition to local guideline documents, recent documents pertaining to ASR that include discussion on authorisation are:

- Aquifer Storage Recovery: A Guide to Groundwater Recharge Through Wells. (Pyne, 2005).
- Draft Code of Practice for Aquifer Storage and Recovery. (Dillon, 2005).
- Recharge Information, Permit Applications and Guides including Application Guide, Underground Water Storage, Savings and Replenishment Program, Arizona Department of Water Resources (June 2010).

  Available from http://www.azwater.gov/AzDWR/WaterManagement/Recharge/

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Appendix A: Pre feasibility & feasibility study checklists

The pre-feasibility study check list

The pre-feasibility study, while giving an initial indication of the viability of the project, should present a project plan and budget for the feasibility study. It should outline what needs to be established in the feasibility study and how this should be done. The pre-feasibility study check list is given in Table A1.

TABLE A1 THE PRE-FEASIBILITY STUDY CHECK LIST

Success Criteria	Check list
1. The need for an artificial recharge scheme	1. What are the primary and secondary objectives? (Eg Primary: increase security of supply by ensuring aquifers are full prior to the onset of the dry season; secondary: water treatment) 2. Is artificial recharge the best option to meet the primary objective? (Better options may be, for example, to expand the existing wellfield, develop a new aquifer or introduce better water conservation measures). 3. Will artificial recharge meet the primary objective? (Eg If the aquifer is full prior to the onset of the dry season, will it provide the envisaged security?)
2. The source water	1. Roughly what volume of water is available for recharge? 2. When is it available?
3. Aquifer hydraulics	1. Will the aquifer receive the water? a) Is there sufficient space in the aquifer to receive the water? (Eg. If you need to store 1Mm^3 before the onset of the dry season, will the aquifer be able to receive that volume?). b) Is the aquifer permeable enough to receive it at the planned supply rate? (Eg If you need 10 x 10L/s injection boreholes, are there enough drilling targets or existing boreholes that will allow for these rates?). 2. Will the water be retrievable when you want it? Or will it flow down gradient and away from the planned abstraction area?
4. Water quality	1. Is the source water quality suitable for recharge? Eg. Is the water not too turbid, saline or rich in organic material? Are there any particular worrying determinands, like heavy metals, disinfection by-products, etc, that could affect the final water quality? 2. Describe the natural groundwater quality. 3. Will in situ blending likely improve the natural groundwater quality or make it worse? Estimate the concentrations of key determinands in the final water quality. 4. Comment on clogging concerns.
5. The artificial recharge method and engineering issues	1. How will the water be transferred into the aquifer? 2. What infrastructure will be needed to treat, inject and extract the water? 3. What are the engineering challenges and how significant are they?
6. Environmental issues	1. What are the potential environmental benefits, risks and constraints?
7. Legal and regulatory issues	1. Are there legal constraints? Eg Securing source water rights, etc. 2. Is there an existing groundwater licence and what are the conditions regarding use? 3. What type of authorisation is required from DWA and DEA to do the feasibility tests?
8. Economics	1. How much will the feasibility study cost? 2. Roughly, how much will the scheme cost? 3. Roughly, how much will 1 m3 of supplied water cost and how does this compare to other options for water supply?
9. Management and technical capacity	1. What skills will be necessary to manage, operate and maintain the scheme and are they available or obtainable?
10. Institutional arrangements	1. Who will be responsible for supplying the source water? 2. Who will pay for the source water? 3. Who will ensure that it's quality is suitable for recharge? 4. Who will regulate the scheme?

The feasibility study check list

The feasibility study should establish:

i) Whether the project will be a success or not
ii) The key factors that affect its success
iii) A project implementation plan
iv) A budget for construction and a cost estimate for operation and maintenance
v) Information (data) that needs to be gathered during operation in order to optimize the scheme (some tests cannot be done during the feasibility study, eg far-field water level monitoring or large-scale in situ water quality monitoring, and need to be incorporated into the initial operation period).

TABLE A2 THE FEASIBILITY STUDY CHECK LIST

Success Criteria	Check list
1. The need for an artificial recharge scheme	1. List the primary and secondary objectives. 2. Describe how the scheme will work to meet the primary objective. Describe the artificial recharge and abstraction cycle in relation to expected source water availability and recovered water needs. 3. Define the minimum (annual) injection volume that would make the project worthwhile. 4. Quantify the additional assured yield of the aquifer with AR.
2. The source water	1. Quantify the source water's assured yield (per month). Discuss risks of under-supply.
3. Aquifer hydraulics	1. Will the aquifer receive the water? a) Quantify the volume of water the aquifer is able to receive when water is available for recharge. This should be based on historical water level and abstraction data. b) Quantify the artificial recharge rates. Depending on the artificial recharge method, this should be done by soil infiltration tests or borehole injection tests. If injection tests are not possible (because of the logistics of getting source water to boreholes), then pumping tests should be done. The purpose and method of all tests must be clearly defined. 2. Describe the groundwater flow regime and comment on envisaged losses down-gradient of the wellfield.
4. Water quality	All aspects that define water quality need to be assessed, including chemistry (organic and inorganic), microbiology and physical characteristics such as turbidity, etc. 1. Describe the source water quality. 2. Describe the groundwater quality. 3. Discuss whether there are concerns around the expected blended water quality, and if so, assess them. 4. Discuss whether there are concerns around water-rock interactions, and if so, assess them. 5. Estimate the concentrations of key determinands in the final water quality. 6. Describe expected types of clogging and prevention and management considerations. 7. Establish whether pre-treatment is necessary and if so, what form. 8. Describe whether post-treatment will be required and if so, what form. 9. The purpose and method of all tests must be clearly defined.
5. The artificial recharge method and engineering issues	1. Identify the project implementation phases if a phased approach is necessary. 2. Develop a preliminary infrastructure design for the treatment and conveyance infrastructure, and for the recharge facility. 3. Describe how the design will minimise clogging. 4. Compile a detailed project implementation plan.
6. Environmental issues	1. Identify environmental benefits and constraints. Certain tests may need to be designed specifically to establish environmental impacts. 2. Discuss unforeseen risks, such as the use of reclaimed water for any purposes that were not intended, discharge of a recharged, full aquifer into the environment, etc.
7. Legal and regulatory issues	1. Describe the current legal status and new requirements for an artificial recharge scheme. 2. Obtain authorisation, if needed, from DWA and DEA to do the feasibility tests. 3. Establish authorisation requirements for full-scale operation.
4. Economics	1. Cost the project based on the preliminary infrastructure design. 2. Establish the cost per 1 m3 of supplied water.

Success Criteria	Check list
	3. Compare these costs to those of other supply options. 4. Describe (or cost) other quantifiable and non-quantifiable economic benefits that relate to the secondary objectives.
5. Management and technical capacity	1. Describe the skills needed to operate the scheme. Include management, scheme maintenance, hydrogeological, etc. 2. List the available skills and shortfalls. 3. Articulate the outstanding skills needed to operate a successful scheme.
6. Institutional arrangements	1. Describe the institutional arrangements and include: ▪ Who will be responsible for supplying the source water. ▪ Who will pay for the source water. ▪ Who will ensure that its quality is suitable for recharge. ▪ Who will do the necessary monitoring (water levels and quality). ▪ How the scheme will be regulated in terms of the licence conditions (particularly relating to source water quality, final water quality, water levels, recharge rates and environmental monitoring requirements).