

ASSESSMENT REPORT 49

ALICE SPRINGS WATER REUSE SCHEME

**SOIL AQUIFER TREATMENT AND
HORTICULTURE SCHEMES**

ENVIRONMENTAL ASSESSMENT REPORT

AND

RECOMMENDATIONS

by the

OFFICE OF ENVIRONMENT AND HERITAGE

NORTHERN TERRITORY GOVERNMENT

June 2005



Northern Territory Government

Office of Environment and Heritage

GLOSSARY & ABBREVIATIONS	iii
EXECUTIVE SUMMARY	iv
LIST OF RECOMMENDATIONS	v
FIGURE 1 – An overview of the area.....	ix
FIGURE 2 – Aerial photograph indicating the location of the infiltration basins and the proposed horticultural blocks	x
1 INTRODUCTION AND BACKGROUND.....	1
1.1 Environmental Assessment Process	2
1.2 Environmental Impact Assessment History	2
2 THE PROPOSAL	3
2.1 Detailed Description of the Proposal	3
2.2 Justification, Alternatives and Public Consultation	4
3 ENVIRONMENTAL IMPACT ASSESSMENT	6
3.1 Introduction	6
3.2 Summary of Major Environmental Issues	7
3.3 Issues not included in the scope of this environmental impact assessment	7
3.4 Soil Disturbance and Salinity	8
3.4.1 Increase in Soil Salinity and Sodidity	8
3.4.2 Soil Compaction and Erosion	9
3.4.3 Nutrients	10
3.5 Groundwater and Hydrogeology	10
3.5.1 Potential impacts.....	11
3.5.2 Remedial Actions.....	13
3.5.3 Quality and quantity of Reclaimed Water.....	13
3.5.4 Recovery of Banked Water.....	14
3.6 Biting Insects.....	15
3.7 Waste Management	16
3.7.1 SAT Scheme	16
3.7.2 Horticultural Scheme	17
3.8 Biodiversity	17
3.8.1 Flora.....	18
3.8.2 Fauna	19
3.8.3 Vegetation Removal	20
3.8.4 Weeds	20
3.8.5 Bushfires.....	21
3.8.6 Pest Species	21
3.9 Heritage and Cultural issues	22
3.9.1 Heritage issues	22
3.9.2 Aboriginal Sites	22
3.10 Socio-economic issues	22
3.10.1 Odours	23
3.10.2 Noise.....	24
3.10.3 Dust.....	24
3.10.4 Spray drift	25
3.10.5 Public Health	26
3.10.6 The Buffer Zone	26
3.10.7 Planning considerations	27

4	MONITORING AND ENVIRONMENTAL MANAGEMENT.....	28
5	CONCLUSIONS	29
6	REFERENCES.....	30
	APPENDIX 1 – Respondent Matrix	31
	APPENDIX II – Table of Commitments by the Proponent in the PER.....	33

GLOSSARY & ABBREVIATIONS

AAPA	Aboriginal Areas Protection Authority
AZRI	Arid Zone Research Institute
BOD	Biological Oxygen Demand
DBIRD	Northern Territory Department of Business, Industry and Resource Development
DHCS	Northern Territory Department of Health and Community Services
DIPE	Northern Territory Department of Infrastructure, Planning and Environment
EPBC	Environment Protection and Biodiversity Conservation Act
PER	Public Environmental Report
EMP	Environmental Management Plan
km	Kilometres
m	Metres
NOI	Notice of Intent
NT	Northern Territory
OEH	Office of Environment and Heritage
SAT	Soil Aquifer Treatment
WSP	Alice Springs Waste Stabilisation Ponds
WTP	Alice Springs Wastewater Treatment Plant

The consultant HLA-Envirosciences Pty Limited
Palmerston

The proponent Power and Water Corporation
and
Department of Business, Industry and Resource Development

EXECUTIVE SUMMARY

This report assesses the environmental impacts of the proposal by Power and Water Corporation (the proponents); to develop a water recycling scheme in a joint initiative with the Department of Business, Industry and Resource Development (DBIRD) for the township of Alice Springs, by reusing treated wastewater (reclaimed water) from the Alice Springs Wastewater Treatment Plant.

Currently, secondary treated wastewater from the Alice Springs Waste Stabilisation Ponds is evaporated in evaporation ponds, some reclaimed water is reused for irrigation at Blatherskite Park and the tree farm to the west of the wastewater treatment plant and the excess reclaimed water is discharged to Iparpa swamp. The disposal of this nutrient-rich water has contributed to the growth of non-native grasses and reeds in the swamp, and provides a habitat for mosquito breeding. The current licence for discharge to the Iparpa Swamp requires Power and Water Corporation to cease dry weather discharges as of December 2005.

Environmental assessment is the process of defining those elements of the environment which may be affected by a development proposal and of determining the significance, risk and consequences of the potential impacts of the proposal. Recommendations arising from the assessment address the methods to mitigate these impacts.

Major Issues

The principal environmental issues associated with the proposed project are:

- Soil Disturbance and Salinity;
- Groundwater and Hydrogeology;
- Waste Management;
- Biodiversity;
- Heritage and Cultural Issues; and
- Socio-Economic Issues.

Conclusions

The Office of Environment and Heritage (OEH) considers that the environmental issues associated with the proposed project have been adequately identified. Appropriate environmental management of these issues has been resolved through the assessment process with continuous monitoring and management actions detailed in a comprehensive Environmental Management Plans (EMPs) to be resubmitted to the OEH for approval.

The final EMPs for the construction and operational phases of the SAT scheme and horticultural schemes will be subject to review and approval by relevant NT Government agencies. They will be working documents for the life of the project and will require continual review in the light of operational experience and changed circumstances.

Based on its review of the PER and submissions from relevant NT Government agencies and the public, OEH considers that the SAT scheme and horticultural schemes can be managed in a manner that avoids unacceptable environmental impacts, provided that the environmental commitments, safeguards and recommendations detailed in the PER, this Assessment Report and in the final EMPs are implemented, with regular reporting and compliance auditing.

LIST OF RECOMMENDATIONS

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards:

- Identified in the Public Environmental Report, Alice Springs Water Reuse Scheme; and
- Recommended in this Assessment Report (No 49).

All safeguards and mitigation measures outlined in the revised PER are considered to be commitments by the proponent and are included in Appendix II of this report.

Recommendation 2

In accordance with clause 14A of the Administrative Procedures of the *Environmental Assessment Act 1982* the proponent shall advise the Minister of any changes to the proposal for determination of whether or not further environmental impact assessment is required.

Recommendation 3

The safeguards, monitoring and remedial actions for salinity and sodicity described in the PER should be included in revised Environmental Management Plans for the construction and operation of the SAT scheme and horticultural scheme, for approval by the Office of Environment and Heritage.

Recommendation 4

It is recommended that the slope of the basins should be no greater than 1:4 on soils with a medium to high erosion hazard and no greater than 1:6 on soils with an extreme erosion hazard.

Recommendation 5

Erosion and sediment control materials, such as geotextiles, rocks or vegetation are to be used to line the SAT basin walls to protect them from wind and water erosion. Each of the basins will require an energy dissipater at the point of inflow to prevent erosion of the basin floor.

Recommendation 6

The proposed management and monitoring measures for soil nutrient issues as outlined in the PER should be incorporated into the operational EMP for the SAT proposal.

Recommendation 7

Prior to any discharge of reclaimed water into the infiltration pits, the proponent shall obtain a Groundwater Recharge Licence under the *Water Act* and comply with any conditions of such a licence.

Recommendation 8

In the event that monitoring indicates that there may be a deleterious impact on Tertiary sediments currently used for private groundwater abstraction, the proponent shall identify the cause, and provide alternative water supplies as directed by the Controller of Water Resources.

Recommendation 9

The proponent shall monitor the movement, extent and characteristics of the saline plume derived from irrigation at Blatherskite Park. In the event that monitoring indicates that there may be a deleterious impact on groundwater below the AZRI site, the proponent shall undertake the necessary intervention to the satisfaction of the Controller of Water Resources.

Recommendation 10

Reclaimed water or groundwater extracted from the AZRI site shall not be injected into the Shannon Formation as part of this project. Future proposals for alternative water disposal methods are to be provided to the Office of Environment and Heritage for consideration under the *Environmental Assessment Act*, in accordance with Recommendation 2 of this Assessment Report.

Recommendation 11

The operational EMP for the SAT component of the proposal is to outline contingencies in the event that monitoring indicates that the water quality is not suitable for infiltration.

Recommendation 12

All proposed treatment methods and options for the use of reclaimed water both prior to and following SAT shall form part of the application for approval by the Department of Health and Community Services.

Recommendation 13

Prior to any expansion of the scheme beyond a rate of 600 Megalitres per year, approval shall be sought from the Controller of Water Resources, and shall be based upon the demonstration of successful operation and environmental management of the initial scheme, to the satisfaction of the Office of Environment and Heritage and the Controller of Water Resources.

Recommendation 14

The total area proposed and prepared for horticulture should be commensurate with the anticipated availability of reclaimed water from the SAT scheme, as outlined in Recommendation 11.

Recommendation 15

All proposed irrigation application methods for reclaimed water both prior to and following SAT shall form part of the application for approval by the Department of Health and Community Services.

Recommendation 16

In order to prevent the creation of successful mosquito breeding sites, the proponent should provide a Mosquito Management Sub-Plan which sets out 5-day wetting and drying cycles, within the Environmental Management Plans, for approval by the Medical Entomology Branch of the Department of Health and Community Services.

Recommendation 17

Handling and disposal methods of organic waste produced in the infiltration basins will need to form part of the application for approval by Department of Health and Community Services.

Recommendation 18

A revised Waste Management Sub-Plan shall be submitted as part of the Construction and Operational Environmental Management Plans, for approval by the Office of Environment and Heritage. This plan should clearly outline issues including all waste streams, their disposal, contingency plans, spills and emergencies, and the allocation of responsibilities (i.e. any contractual agreements with the horticulturalists). It should also include the safeguards, monitoring and remedial actions as described in the PER, and the following issues:

- The composting of crop waste and any other organic waste in both the SAT and horticultural schemes should be monitored for odours and pests, and remedial actions should be identified such as disposal off-site;
- Waste water from the fruit packing system should be routinely tested for pesticides as appropriate (i.e. pesticides used on the fruit previously); and
- The responsibility for routine inspections for and removal of litter such as plastic waste on-site and off-site should be clearly allocated, especially because this plastic waste could be sourced from any of the horticultural blocks.

Recommendation 19

Handling and disposal methods for both wastewater and all organic matter/ algal particles will need to form part of the application for approval by the Department of Health and Community Services.

Recommendation 20

A list of all species of flora likely to be disturbed by the proposal is to be prepared in order to discover the presence of any threatened, vulnerable or endangered flora and its abundance at the site. Targeted surveys are to be conducted for significant flora species (*Minuria tridens*, *Einadia nutans ssp nutans*, *Ixiochlamys nana* and *Maireana lobiflora*).

If species of conservation significance are discovered, then the Parks and Wildlife Herbarium is to be contacted for further advice.

Recommendation 21

A list of all species of fauna likely to be disturbed by the proposal is to be prepared in order to discover the presence of any near threatened, threatened, vulnerable or endangered fauna, and fauna of national conservation significance, and its abundance at the site. Targeted surveys are to be conducted for any of these listed species.

Recommendation 22

A revised Flora and Fauna Management Sub-Plan shall be submitted as part of the Construction and Operational Environmental Management Plans, to the satisfaction of Conservation and Natural Resources and for approval by the Office of Environment and Heritage.

Recommendation 23

Sufficient ground cover and native vegetation should remain on the land for the purpose of controlling dust in the Declared Erosion Hazard Area.

Recommendation 24

A Weed Management Plan is to be submitted for approval by the Office of Environment and Heritage, for inclusion in the Construction and Operational EMPs demonstrating how the proponent will meet its obligations under the *Weeds Management Act* (such as preventing the land being infested with a declared weed and preventing a declared weed or potential weed on the land spreading to other land).

Recommendation 25

The proponent should liaise with the AAPA and obtain Authority Certificates for all areas necessary to ensure that all works are covered by Authority Certificates. The works should not commence until an Authority Certificate has been issued by the AAPA. The conditions of the Authority Certificate should be followed at all times.

Recommendation number 26

Further consideration should be given to noise management in a Noise Management Plan located within the revised EMPs, to be submitted for approval by the Office of Environment and Heritage. Issued to be addressed include:

- All sources of noise and alternatives/ management measures; and
- an investigation into alternatives for the use of scare guns for the various crops.

Recommendation 27

The operational EMP for the horticultural component of the proposal is to ensure that the activity is managed in such a manner as not to diminish future development opportunities of the AZRI site.

Recommendation number 28

It is recommended that the buffer zone along the eastern boundary is reassessed in order to address the uncertainty of the impacts of noise, dust, odours and spray drift. This can be addressed in the submission of the revised EMPs, for approval by the Office of Environment and Heritage.

Recommendation 29

Revised Environmental Management Plans covering construction and operation of the SAT and horticultural schemes are to be submitted to the Office of Environment and Heritage for approval prior to commencement of construction and operation respectively.

In preparing each Environmental Management Plan, the proponent will include any additional measures for environmental protection and monitoring contained in this Assessment Report and recommendations made by the NT Government with respect to the proposal.

FIGURE 1 – AN OVERVIEW OF THE AREA

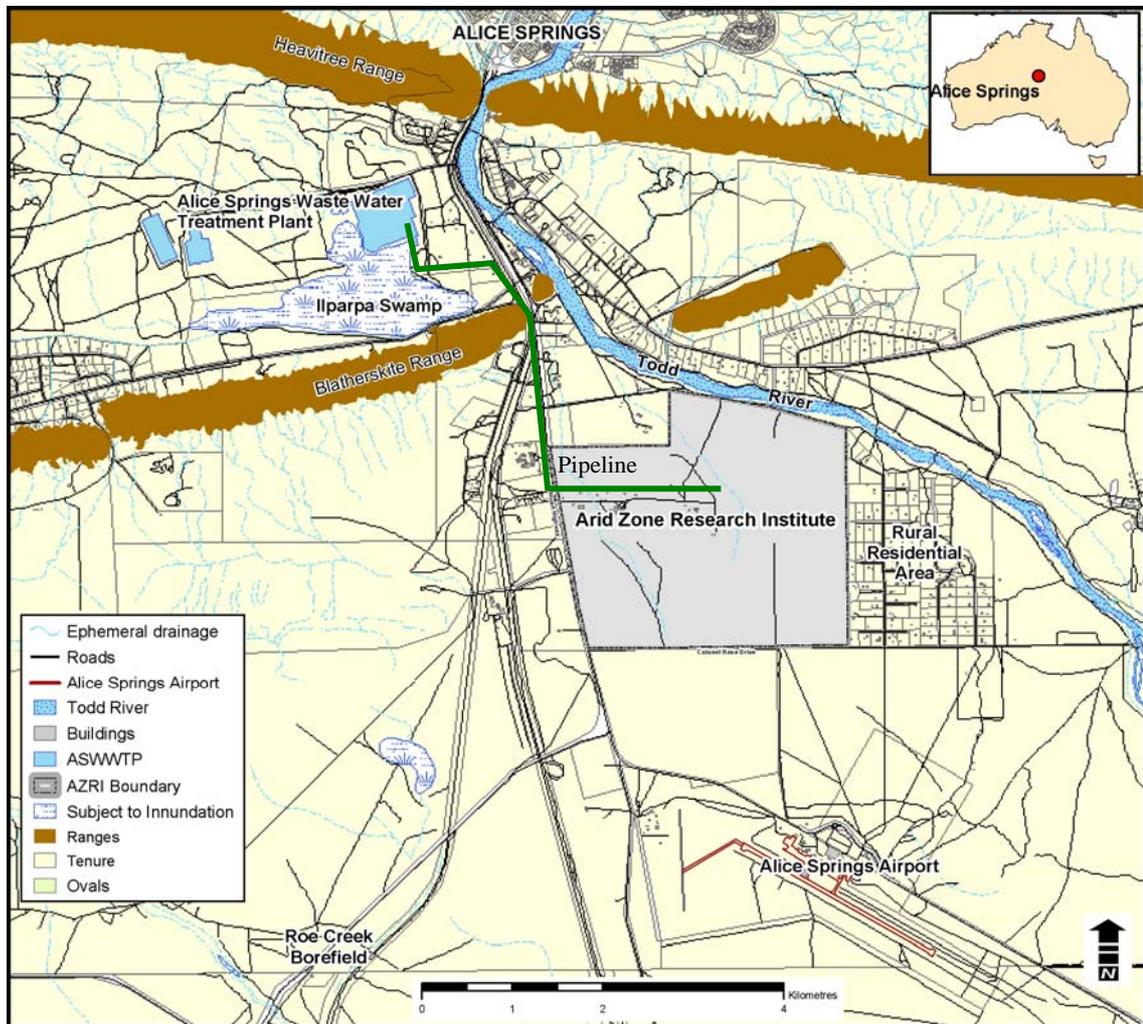
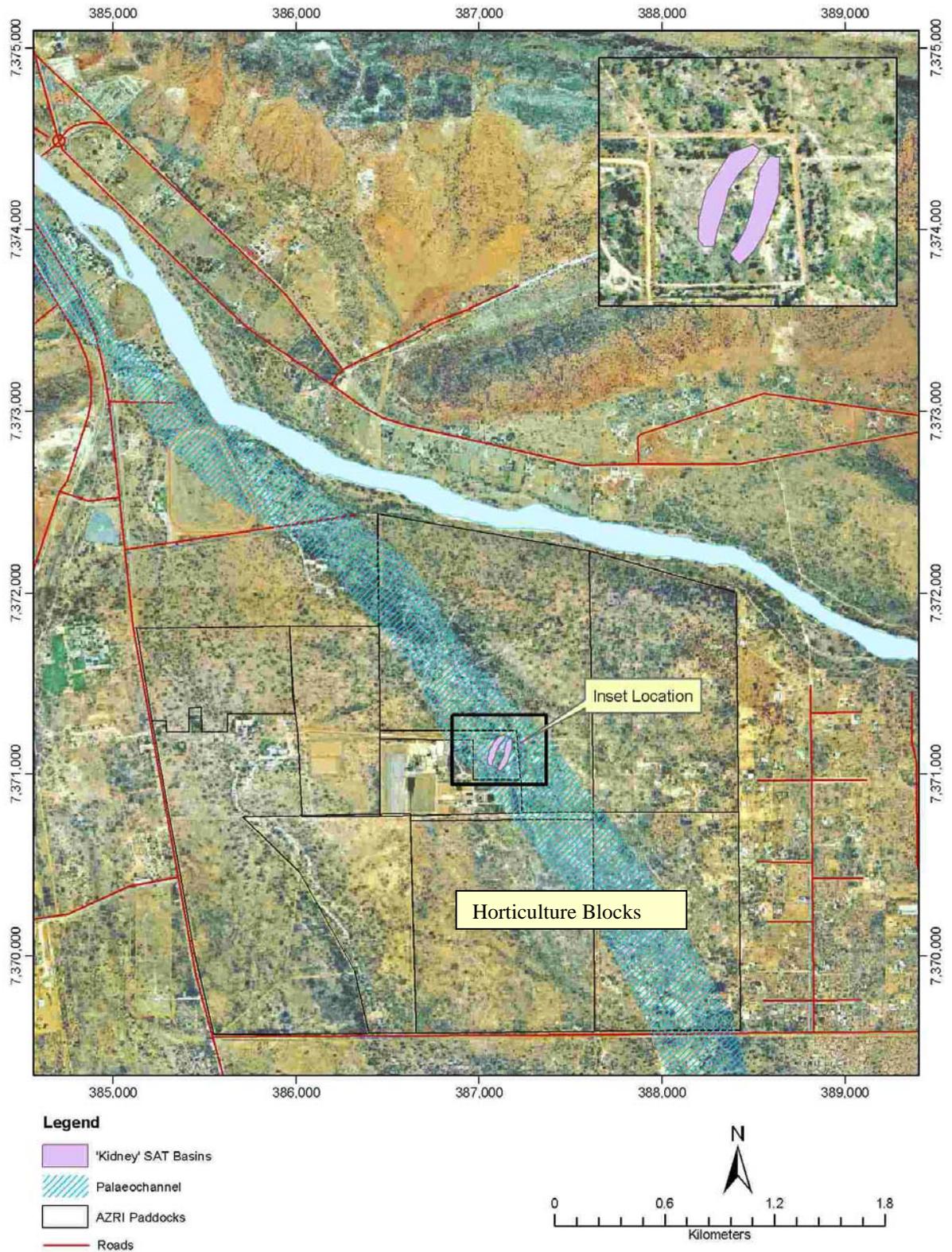


FIGURE 2 – Aerial photograph indicating the location of the infiltration basins and the proposed horticultural blocks



1 INTRODUCTION AND BACKGROUND

This report assesses the environmental impacts of the proposal by Power and Water Corporation (the proponents); to develop a water recycling scheme in a joint initiative with the Department of Business, Industry and Resource Development (DBIRD) for the township of Alice Springs, by reusing treated wastewater (reclaimed water) from the Alice Springs Wastewater Treatment Plant.

Currently, secondary treated wastewater from the Alice Springs Waste Stabilisation Ponds is evaporated in evaporation ponds, some reclaimed water is reused for irrigation at Blatherskite Park and the tree farm to the west of the wastewater treatment plant and the excess reclaimed water is discharged to Ilparpa swamp. The disposal of this nutrient-rich water has contributed to the growth of non-native grasses and reeds in the swamp, and provides a habitat for mosquito breeding. The current licence for discharge to the Ilparpa Swamp requires Power and Water Corporation to cease dry weather discharges as of December 2005.

The proposal covered under the scope of the Public Environment Report (PER) is for:

- Infiltration of initially 600 Megalitres per year of reclaimed water by Power and Water through the soils into an underlying aquifer. Infiltration will provide for additional treatment of the reclaimed water, and hence the term Soil Aquifer Treatment (SAT);
- Storage of the reclaimed water in an aquifer (an ancient water channel at depth) by Power and Water;
- Later extraction of the reclaimed water stored in the aquifer for reuse in a horticultural scheme. The extraction will be conducted by DBIRD initially and at a later stage by private horticulturalists; and
- Reuse of the extracted reclaimed water for horticultural irrigation by DBIRD initially and at a later stage by private horticulturalists.

Prior to infiltration, the secondary treated wastewater from the treatment plant will be tertiary treated by Power and Water using a Dissolved Air Flotation (DAF) system. This will significantly reduce the suspended solids in the water, mostly in the form of algae, and an additional disinfection process by chlorination to significantly reduce the potential pathogen concentrations. This additional treatment of the reclaimed water is considered necessary for the successful delivery of the project by the proponents but it is outside of the scope of the current PER.

The proposed SAT and horticultural schemes are to be located at the Arid Zone Research Institute (AZRI), 10 km south of Alice Springs, in the outer Farm Basin. The site is bound to the north by the Todd River, to the south by Colonel Rose Drive, the Stuart Highway to the west and rural residential properties to the east. Figure 1 shows an overview of the area, and Figure 2 contains an aerial photograph, indicating the infiltration basins and the location of the proposed horticultural blocks.

The development will consist of an 8 km pipeline from the Alice Springs Wastewater Treatment Plant to the AZRI site (not covered under the scope of the current PER), shallow infiltration basins at the AZRI site, groundwater extraction bores, and horticultural developments covering 100 ha. The pipeline has been constructed. The DAF additional water treatment system, the SAT basins and irrigation infrastructure are planned for construction in late 2005.

This Environmental Assessment Report is based on a review of the Public Environmental Report (PER) and advice from Northern Territory (NT) Government agencies and comments

from the public. A list of respondents to the revised PER and issues raised in their submissions are provided in Appendix I.

Approvals needed for the project include approvals under the Public Health Act and the Water Act.

1.1 Environmental Assessment Process

One of the major objectives of environmental impact assessment is to fully define those elements of the environment that may be affected by a proposed development and to determine the significance, risks and consequences of the potential impacts of the proposal. The potential impacts are considered at both local and regional levels.

This report evaluates the adequacy of undertakings and environmental safeguards proposed by the proponent to avoid or mitigate the potential impacts identified in the assessment process. The safeguards can be implemented at various levels within the planning framework of a project and include (among other approaches):

- Design and layout of infrastructure on site such as pipelines, ponds and drainage systems;
- Management of construction activities of the SAT and the horticultural development; and
- Management of operational activities of the SAT and the horticultural development.

A list of undertakings made by the proponent in the PER is provided in Appendix II. Additional safeguards are recommended in this Assessment Report where appropriate, as “recommendations” in bold writing. .

The contents of this Assessment Report form the basis of advice to the NT Minister for the Environment and Heritage on the environmental issues associated with the project.

1.2 Environmental Impact Assessment History

The proponent lodged a Notice of Intent (NOI) with the Office of Environment and Heritage (OEH) on 19 April 2004 for the project. It was considered that the environmental issues associated with the proposal were sufficiently significant to warrant assessment under the NT *Environmental Assessment Act* at the level of a PER.

On 29 June 2004 the Minister for the Environment and Heritage (“the Minister”) directed that a PER be prepared for the proposal. Draft guidelines covering issues to be addressed in the PER were subject to public review from 13 July to 27 July 2004. Final guidelines were prepared; taking into account the comments received from the public and government agencies. The Minister issued the final guidelines and a direction to the proponent to prepare the PER on 16 August 2004.

The PER was submitted on 15 April, 2005 and placed on public review for four weeks from 25 April 2005 to 23 May 2005. Members of the public requested additional time to review the PER in order to provide comments, and the Minister decided to extend the public review period by one week, in consultation with the proponent and the Minister for Essential Services.

2 THE PROPOSAL

2.1 Detailed Description of the Proposal

The proposed development will involve the infiltration of tertiary treated wastewater (reclaimed water) from the Alice Springs Waste Water Treatment Plant into an aquifer located at the Arid Zone Research Institute (AZRI), 8 km south east of the wastewater treatment plant.

The reclaimed water will be intermittently ponded in two infiltration basins, with wetting and drying cycles of 7 days each. As the infiltrate moves to the watertable below the basins, the soil acts as a natural treatment process to reduce the physical, chemical and microbial constituents of the infiltrating water. Treatment occurs through filtration, adsorption onto soil of inorganic and organic substances and removal through in-situ reactions or degradation by in-situ micro-organisms. Cyclic wetting and drying prevents clogging of surface layers; it optimises bacterial activity (breaking down organic matter and nutrients) and it prevents mosquito breeding.

The reclaimed water is to be stored or “banked” in an ancient palaeochannel, which is an old river bed that intersects the AZRI site at a depth of between 18 and 30 m. The palaeochannel is approximately 400 metres wide and at least several kilometres long. The palaeochannel consists of permeable soils that are interbedded in between less permeable soil layers and it can act as a medium to store water. As the reclaimed water moves down gradient, it can be extracted and reused.

It is envisaged that the initial reuse of the reclaimed water will be for horticultural enterprises located within the AZRI site, for a range of crops. However, use of the reclaimed water is also proposed for Blatherskite Park and other potential users along the pipeline route. The PER states that this will have the benefit of improving the quality of water currently being supplied to Blatherskite Park under existing arrangements and there will also be the benefit of a reduced usage of the Roe Creek Borefield water, should other users substitute current use of town water for reclaimed water (not for potable use).

The AZRI site shows little topographic relief (<10 m) with elevations grading from 558 m AHD in the northwest to 546 AHD on the southeast. The site is dissected by two ephemeral drainage systems, St. Mary’s Creek to the west and an overflow channel of the Todd River through the centre of the property.

The proposal for the **SAT development** consists of:

- The construction of two elongated infiltration basins which are to be used intermittently, to allow for wetting and drying cycles for each basin. Each basin will be 0.75 ha in size with a water depth of 0.3 m. The infiltration rate is expected to be 0.3 m per day, based upon a conservative estimate from field trials. There will be four sub-basins within each of the main basins, three of which will be used for the infiltration of the reclaimed water. Both fourth sub-basins are intended to contain excess reclaimed water should the three sub-basins fill during rainfall events. It is proposed to use natural design, topography and buffer zones to ensure that SAT basins are not visible outside of AZRI land.
- The construction of extraction wells with associated access road, power and pipeline infrastructure which are to be located down gradient of the SAT basins. These will be placed at a sufficient distance from the basins to provide the required groundwater residence time, to ensure that water quality standards are met.

No new buildings are required for the SAT scheme.

The proposal for the **development of the horticultural blocks** consists of:

- A perimeter fence to enclose the horticultural area (a total of 100 ha) and the buildings area (5 ha);
- Five irrigation blocks, each 4 ha in size, are to be developed in the first year. A further 5 irrigation blocks will be developed each year. It is proposed that these blocks are placed to accommodate the desired soil types for the plants, the required buffer zones, significant ecological sites and the most efficient irrigation design layout;
- Machinery and produce processing sheds within the buildings area. These would consist of a fruit packing shed, cold storage rooms, a fertiliser shed, a filter & pump shed, manager's house and a diesel storage tank.
- 50 m buffer zones between existing rural residential areas and sub-surface drip irrigated areas for odour mitigation;
- 50 m buffer zones between existing rural residential areas and bore pumps, irrigation pumps and cold rooms for noise mitigation;
- 100 m buffer zones between existing rural residential areas and extracted water holding dams for odour mitigation;
- Possible water holding ponds for the horticulturalists for temporary storage of irrigation waters; and
- Associated infrastructure such as roads, power, telecommunications and pipelines. This would consist of a bitumen access road from Colonel Rose Drive, a staff car park (gravel) and access to facilities such as the electricity grid, town water supply, reclaimed water supply, 3 electric pump enclosures and electric irrigation pump enclosure.

2.2 Justification, Alternatives and Public Consultation

The Alice Springs Water Reuse Scheme is expected to deliver benefits to the Alice Springs Region, these include environmental and health improvements associated with the rehabilitation of Ilparpa swamp, and opportunities for developments using reclaimed water.

Benefits to Ilparpa swamp

Secondary treated wastewater is currently discharged from the waste water treatment plant to the nearby Ilparpa swamp. The nutrient-rich water contributes to the growth of non-native grasses and invasive reeds in the swamp. Excessive algal growth has been observed and is considered to be a direct result of the nutrient-rich wastewater inflow. Under a natural system, Ilparpa swamp would only hold water during rainfall events, allowing native plants to be re-established. Cessation of wastewater overflow into Ilparpa swamp will allow rehabilitation of the natural environment and enhance its value to the community (i.e. recreation, bird watching, tourism and cultural aspects).

Increase in reed growth at Ilparpa swamp reduces wave action resulting from wind, providing ideal conditions for mosquito breeding. There are approximately 15 species of mosquito within the Alice Springs area, and several of these have been shown to be vectors for Ross River Virus and Murray Valley Encephalitis. The cessation of wastewater overflow into Ilparpa swamp will significantly reduce the availability of standing water for mosquito breeding.

Community consultation

In August 2000, the Alice Springs Urban Water Management Strategy Workshop was held. A discussion point for the workshop was appropriate use of the precious resource of water and potential reuse within the arid landscape of Alice Springs. The current proposal will significantly reduce the amount of water currently lost to evaporation and increase the range

of potential uses of the water because of its higher quality than that currently being discharged to Ilparpa swamp or used in direct irrigation at Blatherskite Park.

A survey of 539 Alice Springs residents identified that there is a significant concern about conservation of water and that water reuse is preferred to continued evaporation and discharge. It was also considered that expansion of the waste water treatment plant was not an option, due to an increase in land required and the potential to exacerbate existing odour and reclaimed water issues for the area. It would also not address the current issues for Ilparpa swamp.

A formal Community Consultation Strategy was developed in 2003, which outlined the key stakeholders, key messages, effective methods of communication and methods of evaluating consultation effectiveness. The consultations have taken the form of:

- Interviews on local radio;
- Advertisements and press releases in local printed media;
- Information fliers and posters placed at local shopping centres and receptions of government areas;
- Workshops;
- Open days at the Waste treatment Plant and the ARZI site to demonstrate the research that has been undertaken;
- Stakeholder newsletters;
- Letters to residents nearby the AZRI site;
- Articles on DIPE and Power and Water websites;
- Attendance at local community group meetings such as the Alice Springs Rangelands Ecology and Biology Technical Group and the Rural Areas Association;
- Responses to written and verbal enquiries from stakeholders and residents; and
- Public meetings.

Regional Industry Development

The existing groundwater quality is too saline for most horticultural crops to grow successfully. The current proposal provides an opportunity to develop a horticultural industry.

Choice of Water Treatment Scheme

Other recharge methods were considered, such as bore injection and continuous pond infiltration, but SAT was selected because of its capability to improve water quality. Another option for tertiary treatment by micro-filtration and desalination for reuse of reclaimed water in town water was considered but was too expensive, as it has very high infrastructure costs.

To mitigate soil salinity impacts, the preferred irrigation method in the horticultural scheme is the use of sub-surface drippers. However, as drippers tend to clog quickly if the amount of particulates in the water is high, the reclaimed water will need additional treatment to DAF and chlorination alone to further remove particulates. The SAT scheme provides this additional treatment.

Comparison with water reuse schemes elsewhere has shown that a range of options are available for wastewater treatment and reuse. These options include construction of infiltration basins or use of naturally occurring wetlands for the purpose of SAT. The use of wetlands such as Ilparpa swamp was not considered feasible because of the environmental issues this has created in the past. A trial was previously conducted at the Alice Springs water treatment plant to test the level of filtration of particulates from wastewater through gravel

bed. This was proven to be effective but the a large area would be required to produce a quality of water suitable for reuse.

Alternative Sites

A number of sites were considered for the establishment of the SAT and the horticultural schemes, and four were considered at a detailed level within the PER:

- AZRI site;
- Alice Springs airport;
- Owen Springs; and
- Brewer Estate.

The AZRI site was selected as the most preferred site for the project because:

- The purpose of the AZRI site is for research and knowledge development, which has synergies with the proposed programme;
- AZRI already has horticultural expertise to support the scheme;
- Infrastructure, such as power, water and sewage is already in place;
- Government ownership provides the flexibility to effectively manage reclaimed water use;
- AZRI has established links with similar initiatives, such as the Desert Knowledge Precinct, the Bush Foods Industry, and the Camel Industry; and
- The AZRI site has the appropriate soil types and hydrogeology for the development of a SAT scheme.

If the horticultural site at the AZRI does not proceed, the proponent has advised that the pipeline route has been placed such that other users along the pipe line may be considered for potential water supply, and a final contingency is that pasture irrigation may occur as a disposal mechanism to create a demand.

3 ENVIRONMENTAL IMPACT ASSESSMENT

3.1 Introduction

The main purpose of this Environmental Assessment Report is to determine if the proposed project can proceed without unacceptable environmental impacts. It does this by identifying all relevant potential environmental impacts and evaluating the feasibility and likely effectiveness of environmental safeguards as proposed by the proponent. Where the proposed safeguards were considered incomplete, inadequate or insufficiently clear, or for safeguards that are particularly crucial, this Assessment Report makes recommendations to complete or emphasise the safeguards and commitments made by the proponent.

The environmental acceptability of the project is based on consideration of the following, from the PER:

- Adequacy of information outlining the proposal (particularly which activities are likely to impact on the environment);
- Adequacy of information on the existing environment (particularly environmental sensitivities);
- Adequacy of information on the range and extent of potential impacts; and
- Adequacy of the proposed safeguards to avoid or mitigate potential impacts.

The outcome of the environmental impact assessment for this proposal is that the Minister for the Environment and Heritage believes that the project can be implemented without unacceptable environmental impacts. This outcome is dependent on the proponent implementing the environmental safeguards identified in its PER in addition to recommended measures for environmental management as described in this Environmental Assessment Report.

Subject to decisions that permit the project to proceed, the primary recommendation of this assessment is:

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards:

- **Identified in the Public Environmental Report, Alice Springs Water Reuse Scheme; and**
- **Recommended in this Assessment Report (No 49).**

All safeguards and mitigation measures outlined in the revised PER are considered to be commitments by the proponent and are included in Appendix II of this report.

Recommendation 2

In accordance with clause 14A of the Administrative Procedures of the Environmental Assessment Act 1982 the proponent shall advise the Minister of any changes to the proposal for determination of whether or not further environmental impact assessment is required.

3.2 Summary of Major Environmental Issues

The principal environmental issues raised by the proponent and identified through the assessment of the PER by government agencies and public submissions include:

- Soil Disturbance and Salinity;
- Groundwater and Hydrogeology;
- Biting Insects;
- Waste Management;
- Biodiversity;
- Heritage and Cultural Issues; and
- Socio-Economic Issues.

The remainder of Section 3 deals with issues raised in the submissions to the PER and the proponent's commitments to environmental management provided within the PER. In addition, recommendations to complement or strengthen environmental management strategies and safeguards are presented.

3.3 Issues not included in the scope of this environmental impact assessment

The following issues are not covered in the scope of the current PER:

- the additional tertiary treatment of the wastewater by Dissolved Air Flotation (DAF) and chlorination;

- the construction of the pipeline from the Wastewater Treatment Plant to the AZRI site; and
- Reuse of reclaimed water to other users along the pipeline, prior to arrival at the infiltration basins.

3.4 Soil Disturbance and Salinity

3.4.1 Increase in Soil Salinity and Sodicity

The PER states that the AZRI soils are not sodic, but that the soils could be modified due to sodium in the irrigation water. A high level of sodium in clayey soils can cause the soils to become more prone to dispersion and erosion, and less permeable (hence impacting on crop health due to poor root penetration). The soils at the AZRI site are generally in the mechanically dispersive category and as such require careful management to ensure long-term productive use for horticulture.

The Sodium Absorption Ratio of the reclaimed water varies widely from 3.2 to 9. However, the high flows in winter and spring are expected to have a better water quality, and therefore periods for infiltration could be selected when the reclaimed water quality is more suitable.

Irrigation with reclaimed water (assumed salinity at around 1,000 mg/L TDS) is expected to raise the salinity of the soil water between rainfall events. While rainfall events are expected to prevent the dispersion from occurring and keep the soil structure open, the use of gypsum in the irrigation water or applied to the wetted zone of the soil can also assist in maintaining soil stability.

Data obtained from current reclaimed water disposal sites at Blatherskite Park and the Tree Lot (similar soils to the AZRI site) indicates that poorly managed irrigation with reclaimed water over the past twenty years has significantly increased the soil exchangeable sodium percentage. Therefore, appropriate management of this issue is important.

The PER describes the need for the appropriate management of the irrigation system, so that the movement of excess water to the groundwater is minimised, but still provides sufficient flow to flush salts through the root zone and prevent accumulation in the surface soils.

The PER outlines that salinisation of agricultural and horticultural soils can be prevented through efficient irrigation methods and/ or soil treatment. It is proposed that:

- Low volume water emitters are used to minimise irrigation water usage and thus salt build up;
- Soil moisture probes are installed to ensure that adequate, but not excessive, moisture is used;
- Organic matter is applied to the soils to increase soil cation exchange capacity, and improve water holding capacity;
- Calcium is applied to displace sodium from the root zone (gypsum);
- Flushing of the root zone will occur during rain periods;
- Salt tolerant rootstocks will be used for the grapevines and other species where possible;
- An inline monitoring system will be used to monitor salinity levels of the irrigation water, with a view to shutting off supply should salinity levels exceed that required under reclaimed water use guidelines for irrigation; and
- The soil must be properly drained and adequately leached to prevent salt build-up.

Summarising, the PER is proposing to manage the issue of soil salinity and sodicity by:

- monitoring the salinity and sodicity of irrigation waters and soils;
- using appropriate irrigation techniques such as sub-surface drip irrigation;
- using mulch to prevent evaporation;
- monitoring delivery rates of irrigation waters (the soils should not be visibly wet); and
- choosing salt tolerant crops.

If the salinity and/ or sodicity of the soils is found to increase, remedial actions proposed include:

- increasing the tertiary treatment of the reclaimed water;
- leaching of soils through short-term increased flow of irrigation waters;
- the application of gypsum to the soils; and/ or
- cease the irrigation activities.

The PER has addressed the issues in relation to the potential increase in salinity and sodicity of soils in sufficient detail.

Recommendation 3

The safeguards, monitoring and remedial actions for salinity and sodicity described in the PER should be included in revised Environmental Management Plans for the construction and operation of the SAT scheme and horticultural scheme, for approval by the Office of Environment and Heritage.

3.4.2 Soil Compaction and Erosion

The light soils of the entire AZRI site are prone to compaction, due to low clay percentage and poor structure. Compaction through inappropriate cultivation and traffic, or chemical dispersion could easily occur and result in the formation of very dense material. The quality of the water extracted from the SAT scheme is potentially likely to be ranked as medium to poor at a nominal inferred value of 1,000 mg/L TDS, so maintenance of uncompacted soils is very important to ensure continued high infiltration levels.

The PER proposes to manage erosion and compaction during both construction and operation of the SAT and horticultural schemes by:

- minimising vehicle access;
- prevent movement on soils when wet; and
- fitting earthmoving machinery with low flotation tyres (used in the various construction activities and in the maintenance of the infiltration basins).

Regular inspections of work site and roads are proposed in order to ensure that these measures are followed.

The PER has addressed soil compaction and erosion in sufficient detail for the horticultural elements of the proposal. Revised EMPs should address the allocation of responsibilities of monitoring and complying with all proposed measures in more detail.

The proposed sites for the SAT basins and the horticultural venture are situated on Land Units considered to have very good capability for shallow excavations and horticulture, but high (land unit 4.05) and severe (land unit 4.09) erosion risks for development. DIPE's Draft Erosion and Sediment Control Guidelines (2000) indicate that a maximum batter slope of 1:4 would be more practical on soils with a medium to high erosion hazard and a maximum batter slope of 1:6 on soils with an extreme erosion hazard. Similarly, erosion and sediment control measures will need to be applied to the basin design to minimise the potential for soil erosion.

Recommendation 4

It is recommended that the slope of the basins should be no greater than 1:4 on soils with a medium to high erosion hazard and no greater than 1:6 on soils with an extreme erosion hazard.

Recommendation 5

Erosion and sediment control materials, such as geotextiles, rocks or vegetation are to be used to line the SAT basin walls to protect them from wind and water erosion. Each of the basins will require an energy dissipater at the point of inflow to prevent erosion of the basin floor.

3.4.3 Nutrients

Phosphorous is readily bound into the soil structure and is only released when the phosphorous concentration in the soil water falls below an equilibrium threshold. This means that many soils have the capacity to adsorb phosphorous for an extended period of up to several decades before becoming saturated. Once the soil's phosphorous sorption capacity is exhausted, excess nutrients will leach to the groundwater. The soils at the AZRI site are expected to have a relatively low phosphorus-sorption capacity.

If it were assumed that tertiary treatment removed only a minimal amount of nutrient, then it is more likely that phosphorus sorption could reach saturation quite quickly in the infiltration basins. In the longer term, after the soil is saturated for phosphorus and if phosphorus present in the reclaimed water is not removed, then phosphorous could move into the groundwater.

Other sources for phosphorous addition to the soil is through the application of fertilisers for crops.

The PER describes safeguards and monitoring measures for increasing nutrient concentrations, in the reclaimed water and the soils in the basins and the horticultural blocks:

- For the SAT scheme, annual maintenance of the floor of the infiltration basins to remove organic material built-up and alternate sub-basin use. Monitoring of the incoming reclaimed water quality, and in-basin monitoring of soil nutrients. Possible remedial actions include increasing the tertiary treatment to provide further polishing or ceasing the SAT operations.
- Avoiding the addition of excess nutrients during the horticulture activities, and monitoring of the soil parameters. The application of fertilisers could be modified or changed as a possible remedial action.

It is considered that the PER has addressed soil nutrient issues in sufficient detail.

Recommendation 6

The proposed management and monitoring measures for soil nutrient issues as outlined in the PER should be incorporated into the operational EMP for the SAT proposal.

3.5 Groundwater and Hydrogeology

The geology and associated groundwater resources underlying the Alice Springs region is relatively complex. The PER contains a summary of the existing groundwater systems and their interactions, including descriptions of the known recharge and discharge mechanisms.

Alice Springs obtains its drinking water supplies from three key sources within the Amadeus Sedimentary Basin: the Mereenie Sandstone; the Shannon Formation; and the Parcoota Sandstone. These formations are generally overlain by more recent Tertiary and Quaternary aged sediments. Existing monitoring and investigation data demonstrates that there is no groundwater flow connection between the more recent sediments and those used to source drinking water, and this project therefore poses no significant risk to the Alice Springs drinking water supply.

The AZRI area is located in an area known as the Outer Farm Basin. The Basin consists generally of Quaternary alluvial sediments overlying a relatively uniform surface of Tertiary clays at a depth of approximately 18 metres below ground level. Investigations have identified a palaeochannel containing coarse grained quaternary sediments incised into the Tertiary clays to a depth of approximately 30m. Details of the palaeochannel are presented in the PER. Existing water quality within the palaeochannel varies from moderately to highly saline, and no registered users of this aquifer have been identified. The location of the palaeochannel and groundwater flow direction beyond Colonel Rose Drive (south of the AZRI site) is not well understood, however the monitoring required under the recharge licence will ensure that no deleterious effects on downgradient beneficial users occurs.

Detailed hydrogeological investigations, including field infiltration trials and groundwater flow modelling, have been carried out in order to characterise the Outer Farm Basin palaeochannel and confirm its suitability for use in SAT technology. The results of the studies are summarised in the PER (pages 92-103) demonstrate that the AZRI site, and in particular the palaeochannel feature, provides the appropriate hydrogeological conditions for the establishment of a SAT scheme.

3.5.1 Potential impacts

Existing groundwater users

The thickness and extent of Tertiary clays underlying the palaeochannel and other Quaternary sediments is sufficient to restrict vertical migration of SAT infiltration water into underlying aquifers used for drinking water supplies.

Extraction of groundwater from Tertiary sediments currently occurs within the AZRI site and at various residential properties along the eastern boundary of the site. Water quality within the sediments is poor and the water is only suitable for some irrigation purposes. The potential for the SAT scheme to impact on the Tertiary aquifer due to movement of saline groundwater through existing bore on the AZRI site has been identified in the PER (page 88), although this risk is considered to be small. This issue can be addressed through suitable monitoring and management measures.

The Inner Farm Basin is protected from migration of water from the AZRI site by an existing large hydraulic head difference.

Waterlogging and Salinity

Waterlogging of low-lying areas could occur due to the development of perched aquifer conditions or shallow preferential flow pathways. This can lead to salinity and/or biting insect breeding habitats. Monitoring of groundwater levels and visual observations will be required in order to identify potential problem areas, and management solutions may be required as identified in the PER table 22.

Potential issues in relation to irrigation are discussed in Section 3.5.4 of this Assessment Report.

This Assessment Report concludes that, for the proposed project:

- It is expected that there will be no deleterious effect on the potential beneficial use of the receiving water, and a waste discharge licence is therefore not required at this time;
- It will be possible to monitor anticipated effects of groundwater recharge on the receiving and surrounding environment;
- The timeframes for groundwater system response are sufficiently long to allow for adaptive monitoring and management, and the development of contingency measures if some deleterious offsite effect is subsequently predicted; and
- Pollution of waters from either construction or operation of the project is unlikely.

The project will require the issue of a Groundwater Recharge Licence pursuant to section 67 of the *Water Act*, which will be framed around adaptive monitoring and periodic review of the effects of groundwater recharge and subsequent re-extraction. The objectives of the recharge licence will be to:

- Ensure that there are no deleterious effects from shallow groundwater levels on the land surface overlying the aquifer system to be recharged.
- Ensure that there are no deleterious effects on pre-existing groundwater users, including proximate aquifer systems such as the Tertiary aquifers supplying users in adjacent rural-living areas.
- Ensure that there are no deleterious effects on down-gradient aquifer systems having a potentially “higher” beneficial use such as public water supply.

The recharge licence will include monitoring conditions in order to achieve these objectives. Monitoring conditions will not be taken directly from the information provided in the PER, but will be framed taking into account the principles upon which the PER has relied. Further details and requirements for groundwater monitoring are given in the Assessment Report in Section 4 Monitoring and Environmental Management.

A number of issues with the potential to impact on the groundwater system have been identified through the assessment process. These issues have been adequately addressed in the PER, through discussions with the proponent, and through the development and implementation of a suitable groundwater monitoring program in the revised Environmental Management Plan that will be resubmitted for approval by the Office of Environment and Heritage.

Recommendation 7

Prior to any discharge of reclaimed water into the infiltration pits, the proponent shall obtain a Groundwater Recharge Licence under the *Water Act* and comply with any conditions of such a licence.

Recommendation 8

In the event that monitoring indicates that there may be a deleterious impact on Tertiary sediments currently used for private groundwater abstraction, the proponent shall identify the cause, and provide alternative water supplies as directed by the Controller of Water Resources.

Upstream issues

Irrigation at Blatherskite Park over the last 20 years has resulted in the development of a plume of saline groundwater, which is slowly moving in a south-easterly direction. Although improvements and changes to irrigation methods and reclaimed water quality application at Blatherskite Park mean that there may be a long term moderation of the plume, this plume has the potential to impact on the groundwater under the project site in the future.

Recommendation 9

The proponent shall monitor the movement, extent and characteristics of the saline plume derived from irrigation at Blatherskite Park. In the event that monitoring indicates that there may be a deleterious impact on groundwater below the AZRI site, the proponent shall undertake the necessary intervention to the satisfaction of the Controller of Water Resources.

Management of flood events

The AZRI site lies outside of the Todd River Q100 flood levels, based on 1999 flood mapping studies carried out by DIPE, and upstream creeks do not reach the site. The risk of flooding impacting on the SAT basins is considered to be low. In the event that flooding does threaten to inundate the SAT basins, the flow of water to the basins will be stopped in order to prevent reclaimed water mixing with the flood water. The SAT operational EMP will be required to address management methods and contingencies in the event of potential floods, including the use of early warning systems and monitoring of water levels in ponds.

3.5.2 Remedial Actions

The PER identifies a number of remedial actions or contingency measures in the event that impacts to the groundwater system occur due to SAT operation, as outlined in Table 22 of the PER. The proposal to extract groundwater from the AZRI site for injection into the Shannon Formation in the event that the SAT scheme impacts on local groundwater systems is not supported because this aquifer currently provides a proportion of the Alice Springs drinking water.

Recommendation 10

Reclaimed water or groundwater extracted from the AZRI site shall not be injected into the Shannon Formation as part of this project. Future proposals for alternative water disposal methods are to be provided to the Office of Environment and Heritage for consideration under the *Environmental Assessment Act*, in accordance with Recommendation 2 of this Assessment Report.

3.5.3 Quality and quantity of Reclaimed Water

The SAT scheme will be receiving tertiary treated water from the Alice Springs waste water treatment plant. The proposed treatment methods are described in the PER, and include the planned additional treatment of DAF and chlorination. Proposed treatment methods and required water quality of input water will be the subject of approval by the Department of Health and Community Services.

The PER briefly describes contingency measures in the event that the water quality of upstream reclaimed water is unsuitable for infiltration, and describes the decision making process. These measures include the possibility of recirculating water within the waste water treatment plant and diversion to an existing evaporation/storage basin. Also briefly discussed are the various options for utilisation of excess treated reclaimed water in the event that more reclaimed water is generated than can be directed to the SAT site, and the reuse of reclaimed water for irrigation at Blatherskite Park and other potential users (as yet unidentified) along the pipeline route. All of these options will be the subject of approval by the Department of Health and Community Services, to protect public health and the health of workers as the reclaimed water from the pipeline is of lower quality than that following the SAT.

Recommendation 11

The operational EMP for the SAT component of the proposal is to outline contingencies in the event that monitoring indicates that the water quality is not suitable for infiltration.

Recommendation 12

All proposed treatment methods and options for the use of reclaimed water both prior to and following SAT shall form part of the application for approval by the Department of Health and Community Services.

The Scheme aims to develop a water recycling scheme that makes productive use of up to 1800 ML/yr of wastewater. It is proposed that an initial volume of 600 ML/yr is diverted to the SAT scheme, and this represents the median value of effluent overflows that currently occur to Ilparpa swamp. An infiltration rate of 600 ML/yr was used for the three dimensional numerical groundwater flow modelling. Based on actual infiltration rates measured during pilot studies, the proponents consider that the aquifer has the capacity to accept a much greater rate of infiltration, however this will depend upon the results of monitoring to determine the success of the project, and should be determined through the further development and verification of groundwater flow modelling.

Recommendation 13

Prior to any expansion of the scheme beyond a rate of 600 ML/yr, approval shall be sought from the Controller of Water Resources, and shall be based upon the demonstration of successful operation and environmental management of the initial scheme, to the satisfaction of the Office of Environment and Heritage and the Controller of Water Resources.

3.5.4 Recovery of Banked Water

It is proposed that the water recovered from the SAT scheme is used for irrigated horticulture within the AZRI site. The extraction of water will be licensed under the *Water Act* and through approvals from the Department of Health and Community Services. The location of extraction bores is not yet determined, but would be based on detailed hydrogeological information and the final location of horticultural plots.

There are some discrepancies in the PER in relation to the amount of proposed irrigated horticulture to be developed in the AZRI site, compared with the proposed rate of infiltration and water re-use from the SAT scheme. The PER indicates that the water to be used by irrigation at AZRI would all be supplied from the SAT scheme, and this is the basis of the project being assessed through this Assessment Report. A staged irrigation scheme is proposed, with a plan to develop 20 ha per year for five years, resulting in a total horticultural area of 100 ha.

The water requirements for irrigated horticulture in Central Australia are commonly based on a maximum water requirement of 10 ML/ha/yr, as quoted in the PER. Based on an initial water recycling rate of 600 ML/yr, this corresponds to a total irrigation potential of approximately 60 ha.

Recommendation 14

The total area proposed and prepared for horticulture should be commensurate with the anticipated availability of reclaimed water from the SAT scheme, as outlined in Recommendation 11.

The proposed initial management of water supply for irrigation is not well documented in the PER, but has been clarified through discussions with the proponent. Due to the inherent time delay in SAT water reaching the proposed extraction bores, it is possible that irrigation demand will be much higher than the possible rate of recovery of banked water during the early stages of operation. The water in the recovery bore(s) may initially be unsuitable for crop irrigation due to elevated salinity. It is therefore proposed that in the early phases of development, some water is supplied directly from tertiary -treated reclaimed water. All application methods for reclaimed water will require approval from the Department of Health and Community Services. The PER states that occasional flood irrigation may be used as one of the management options for removing any potential salt accumulation from the root zone. It should be noted that it is unusual for flood irrigation to be given approval by the Department of Health and Community Services, mainly due to the possibility of mosquito breeding with ponding water and potential odour problems.

Recommendation 15

All proposed irrigation application methods for reclaimed water both prior to and following SAT shall form part of the application for approval by the Department of Health and Community Services.

3.6 Biting Insects

There are approximately 15 species of mosquito within the Alice Springs area, with several species known to be vectors for Ross River Virus and Murray Valley Encephalitis. Mosquitos present a serious health issue for residents of Alice Springs, and Iparpa swamp currently provides ideal conditions for mosquito breeding. Cessation of dry weather overflows to Iparpa swamp from the Waste Storage Ponds will significantly reduce the availability of standing water for mosquito breeding.

As there is the potential for wet weather overflows to continue into Iparpa Swamp, it is recommended that as much wastewater as possible from the WSP is converted to recycled water and piped to the SAT site during the dry season, so that when the wet season arrives the wastewater levels at the WSP are as low as possible, so more rainwater can be contained before overflowing into Iparpa Swamp. This method should decrease the amount of wet season overflow into Iparpa Swamp and therefore decrease mosquito breeding.

The potential for the proposed project to create new mosquito breeding sites has been recognised by the proponent, and a number of measures have been proposed in order to prevent ponded water from creating new breeding sites. A commitment is made to use a 7-day wetting/drying cycle for the operation of the infiltration ponds, in order to prevent successful mosquito breeding. Medical Entomology (Department of Health and Community Services) has advised that, although this cycle is generally sufficient for some mosquito species, other species can complete their larval stages in 6 days, and a 5-day cycle is therefore recommended. The construction and operational Environmental Management Plans should include measures that limit the time water is allowed to pool on site. Also, a wetting/drying cycle of 5 days should be implemented for the infiltration ponds.

Mosquito monitoring should be carried out for all situations and particularly where surface water may pond for more than 5 consecutive days. Results of monitoring should be forwarded to Medical Entomology Branch via the local Environmental Health Officer for identification and evaluation. Dependent on which species are found to be breeding, variation of the monitoring program and wetting/drying schedule may be suggested by Medical Entomology Branch.

In the event that mosquito control is required, advice should be sought from the Medical Entomology Branch of the Department of Health and Community Services.

Any re-use of reclaimed water should be in accordance with the Medical Entomology Branch Guidelines “The prevention of mosquito breeding in sewage treatment facilities”, and “Recommendations for design details of sewage pond effluent re-use or disposal facilities to prevent mosquito breeding”.

Other situations that have the potential to create mosquito breeding habitats are listed below, and operations should be managed to ensure that there is no surface ponding of water for more than 5 days:

- pulse scheduling irrigation, with an occasional heavy application of water;
- flood irrigation;
- residual ponding at the edges of erosion prevention structures (as shown in the example Water Inlet on page 71 of the PER). Mosquitos generally breed in prolific numbers in high nutrient water with emergent vegetation;
- waterlogging due to perched shallow aquifers and lateral movement of reclaimed water;
- water holding ponds that can be used by the horticulturalists for temporary storage of water prior to irrigation; and
- alternative disposal methods for excess water, such as evaporation ponds.

Recommendation 16

In order to prevent the creation of successful mosquito breeding sites, the proponent should provide a Mosquito Management Sub-Plan which sets out 5-day wetting and drying cycles, within the Environmental Management Plans, for approval by the Medical Entomology Branch of the Department of Health and Community Services.

3.7 Waste Management

The PER identifies wastes that will be generated on site during both the construction and operational phases of the SAT and the horticultural development.

3.7.1 SAT Scheme

The main waste product generated by the SAT scheme is organic matter that forms on the bottom of the infiltration basins and that mainly consists of algae. The PER describes options for drying and composting the material either on-site and subsequently re-using it as a soil conditioner or at the landfill site. The reuse of this material is preferred to the disposal of the material to landfill.

Issues that would need to be addressed and closely monitored on an ongoing basis are odours and pests. The PER mentions that if the material is spread in thin layers, dried in the sun and possibly mixed with coarse material such as wood chips, the odours could be managed.

The PER questions whether the organic wastes produced on the SAT basin floors can be considered a biosolid. The National Water Quality Management Strategy, Guidelines for Sewerage Systems, Biosolids Management, November 2004, appears to include material such as the organic wastes produced on the SAT basin floors and accordingly it will need to be treated, reused or disposed of in consultation with the Department of Health and Community Services.

Recommendation 17

Handling and disposal methods of organic waste produced in the infiltration basins will need to form part of the application for approval by Department of Health and Community Services.

3.7.2 Horticultural Scheme

The PER describes the main waste streams that are generated during the horticultural scheme and the management of this waste:

- all organic material waste from the fruit packing system will be composted on site and re-incorporated with the soil under the irrigated plants;
- waste water from the fruit packing system will be collected in a sump pit and used on-site as an organic soil amendment. There is a potential for wastewater from the cleaning of product in the packaging process to contain pesticide residuals, which may make the wastewater unsuitable for disposal in the horticulture allotments;
- paper and cardboard packaging will be recycled;
- agrochemical and similar containers will be recycled through agrochemical drum recycling programs or through a licensed contractor;
- plant prunings will be mulched in-situ and returned to the soil, and so will all plant and fruit waste; and
- plastic used in the packaging process and on grapevines will be disposed of as general waste. This plastic could become litter and routine inspections are recommended.

The disposal of human waste from employees onsite at the horticultural allotment has not been discussed in the PER and requires consideration.

The safeguards, monitoring and remedial actions described in the PER should be strictly adhered to.

Recommendation 18

A revised Waste Management Sub-Plan shall be submitted as part of the Construction and Operational Environmental Management Plans, for approval by the Office of Environment and Heritage. This plan should clearly outline issues including all waste streams, their disposal, contingency plans, spills and emergencies, and the allocation of responsibilities (i.e. any contractual agreements with the horticulturalists). It should also include the safeguards, monitoring and remedial actions as described in the PER, and the following issues:

- **The composting of crop waste and any other organic waste in both the SAT and horticultural schemes should be monitored for odours and pests, and remedial actions should be identified such as disposal off-site;**
- **Waste water from the fruit packing system should be routinely tested for pesticides as appropriate (i.e. pesticides used on the fruit previously);**
- **The responsibility for routine inspections for and removal of litter such as plastic waste on-site and off-site should be clearly allocated, especially because this plastic waste could be sourced from any of the horticultural blocks.**

Recommendation 19

Handling and disposal methods for both wastewater and all organic matter/ algal particles will need to form part of the application for approval by the Department of Health and Community Services.

3.8 Biodiversity

The AZRI site has been used for agricultural purposes since it was established in the 1950s. It has been used for intensive grazing by livestock, and there has also been an active programme

of pasture grass during this time. Therefore, the PER notes that the flora and fauna assessment should be considered in the context of a highly disturbed site, and since much of the vegetation is degraded, many of the fauna species which could otherwise be expected at the site, may not be present.

The proposed SAT and horticultural schemes may impact on the natural values of the AZRI site as a result of:

- Clearing of native vegetation for preparation for the SAT basins and associated infrastructure and clearing for crop planting and infrastructure establishment;
- Loss or alteration of habitat through vegetation clearance or changes to groundwater flows and heights;
- Disturbance to fauna activity during construction and operational phases, particularly birds and mammals;
- Changes to groundwater flow in shallow sands, resulting from changes to surface flow patterns or mounding of groundwater during infiltration;
- Disturbance of soils and subsequent establishment of new weed species, or expansion of existing weed infestations;
- Nutrifcation of soils and subsequent enhanced growth of weed species;
- Pollution of soils through leakage or spillage of hazardous compounds (e.g. fuels, oils) or inappropriate waste management practices;
- Erosion of soils (including creation of dust) resulting from water movement, vehicular traffic or inappropriate basin construction methods;
- Direct impact on species attracted to site, such as birds attracted to infiltration basins;
- Attraction of flying insects, including mosquitoes, to the site, resulting from unseasonal presence of surface water; and
- Reduction in the amount of connectivity of bushland between the airport and the Todd River.

The PER describes safeguards for these potential impacts; these are discussed in the following sub-paragraphs.

3.8.1 Flora

In the absence of detailed flora surveys for the proposed horticulture and SAT infiltration site, the PER assumes that the natural vegetation of the area is similar to plant communities found at the Alice Springs Airport and the proposed Desert Knowledge Precinct for which detailed surveys have been done.

The PER states that the AZRI site contains remnants of:

- Witchetty Bush and Ironwood on sandy loam rises, located north of the proposed horticultural area;
- Ironwood and Fork-leaved Corkwood on alluvial flats, the dominant plant community within the area proposed for the SAT basins and horticultural scheme; and
- Drainage depressions with Coolibah and Ironwood, located in patches along the drainage line east of the horticultural area. This vegetation type is considered a rare habitat.

It is unlikely that the AZRI site contains a wide range of plants, due to the grazing and agricultural history. Buffel Grass is a dominant understorey plant species across the AZRI site.

The status of conservation significant flora species is unknown in the proposed SAT and horticultural sites. As the actual presence of threatened, vulnerable or endangered flora on the AZRI site is unknown, the PER suggests that surveys may be necessary to be certain that protected flora and fauna are not inadvertently affected during vegetation clearing.

Recommendation 20

A list of all species of flora likely to be disturbed by the proposal is to be prepared in order to discover the presence of any threatened, vulnerable or endangered flora and its abundance at the site. Targeted surveys are to be conducted for significant flora species (*Minuria tridens*, *Einadia nutans ssp nutans*, *Ixiochlamys nana* and *Maireana lobiflora*).

If species of conservation significance are discovered then the Parks and Wildlife Herbarium is to be contacted for further advice.

3.8.2 Fauna

As with the vegetation, no fauna surveys have been conducted specifically within the AZRI site however previous fauna surveys have been carried out in the Desert Knowledge Precinct and at Alice Springs Airport.

No birds of national conservation significance were recorded at the Airport or within a three kilometre radius, but three species have been recorded that are classified as Near Threatened under the *Territory Parks and Wildlife Conservation Act*. The NT Parks and Wildlife Fauna Database also records the Australian Bustard (*Ardeotis australis*), which is classified as Vulnerable, as occurring in the area in 1986.

The Japan and Australia Migratory Birds Agreement (JAMBA) includes one type of migratory bird which may occur in the vicinity of the AZRI site as the Rainbow Bee-eater (*Merops ornatus*), The EPBC database includes a further two migratory bird species which may occur in the region, but which have not previously been recorded at the Airport.

The NT Parks and Wildlife Fauna Database records two species of reptiles classified as Data Deficient, the King Brown Snake (*Pseudechis australis*) and the Western Brown Snake (*Pseudonaja nuchalis*), as having been recorded in the region.

The EPBC database lists five species of native mammal which may occur in the region however it is highly unlikely that any of these species will be located at AZRI, as they have not been recorded in the Alice Springs area for many years and could be considered to be locally extinct.

Previous fauna studies in 2003 refer to the Endangered Slater's Skink (*Egernia slateri slateri*) as likely to have been present at the Airport until about 1970 and note that it has previously been recorded within 2 km of the site, which would include the AZRI land. However, this population appears to have suffered local extinction following the invasion of Buffel grass, and it is considered unlikely to currently occur at Alice Springs Airport.

The Kultarr (*Antechinomys laniger*) is classified as Near Threatened under the *Territory Parks and Wildlife Conservation Act*. This species of mammal has previously been recorded in the region in 1960 and 1965 and more recently in 2000, when a dead specimen was found on Colonel Rose Drive. It has not been located in recent fauna surveys at the Airport.

The PER states that it is possible that the Near Threatened Kultarr and the Endangered Slater's Skink might exist at the site.

Recommendation 21

A list of all species of fauna likely to be disturbed by the proposal is to be prepared in order to discover the presence of any near threatened, threatened, vulnerable or endangered fauna, and fauna of national conservation significance, and its abundance at the site. Targeted surveys are to be conducted for any of these listed species.

Recommendation 22

A revised Flora and Fauna Management Sub-Plan shall be submitted as part of the Construction and Operational Environmental Management Plans, to the satisfaction of Conservation and Natural Resources and for approval by the Office of Environment and Heritage.

3.8.3 Vegetation Removal

Removal of vegetation can cause dust nuisance issues and loss of topsoil. The PER describes the following safeguards to minimise environmental impacts of the vegetation clearing:

- Vegetation clearing should be undertaken in a staged approach, removing only those areas of vegetation immediately required for use. In the first year, this would mean that only the area for the SAT basins and the first 20 ha of horticulture should be cleared. This minimises the extent of the impact in a given period. Care should also be taken to ensure that only the areas requiring clearing are impacted upon and all areas to be cleared must be approved by AAPA;
- Adjacent vegetation should be protected during the clearing process, by ensuring that operators are aware of the boundaries for proposed clearing. This can be managed by marking trees to be left and the boundary of areas to be cleared. Vehicles and plant should be parked in designated areas, such as existing roads and tracks, rather than in areas of vegetation;
- The final shape of the infiltration basins should be designed to accommodate vegetation in the immediate vicinity, specifically trees identified as being culturally significant;
- Vegetative matter obtained during the clearing process could be mulched on site and used to enhance the buffer areas, or applied elsewhere on the site to assist in dust control;
- Important habitat elements, such as hollow logs, should be moved to areas of the buffer zone requiring enhancement. This has the dual purpose of providing habitat as well as enhancing soil stability; and
- The horticultural and SAT sites should be fenced to prevent access by grazing animals, which have the potential to further destabilise soil and impact on vegetation.

The PER addresses the issue of vegetation removal in sufficient detail. The revised EMP should include all the measures described in the PER.

Recommendation 23

Sufficient ground cover and native vegetation should remain on the land for the purpose of controlling dust in the Declared Erosion Hazard Area.

3.8.4 Weeds

The NT Parks and Wildlife Fauna Database provides records of 35 species of naturalised plants, consisting of forbs, grasses and sedges and not including Buffel Grass, which is widespread across the site.

The proposed construction activities and ongoing horticultural activities can potentially cause the establishment of weeds on the site.

The PER describes the following safeguards for the prevention of weeds at the site:

- Weed control will be undertaken at the SAT site and within the horticultural site, as required. Disturbance of soils generally leads to weed establishment, so it is highly likely that weed control will be required;
- At the SAT site, mechanical weed control is recommended, to avoid the risk of herbicides entering the infiltrate. The use of erosion control matting on the basin walls will have the dual purpose of stabilising the walls as well as reducing weed growth;
- At the horticultural site, weed control will be undertaken as part of best practice procedures for maximising crop productivity. It is proposed that glyphosate-based products will be used for weed control. This product breaks down on the soil surface over time and does not pose residual soil contamination risks; and
- It is highly likely that the pasture grass, Buffel Grass, will establish in some disturbed areas. In the absence of other ground cover species to maintain soil stability, it is unlikely that control of Buffel Grass will be undertaken. Instead, it should be managed, through fenced grazing and maintenance of firebreaks, to reduce the fire risk.

Recommendation 24

A Weed Management Plan is to be developed to the satisfaction of Conservation and Natural Resources, for inclusion in the Construction and Operational EMPs demonstrating how the proponent will meet its obligations under the *Weeds Management Act* (such as preventing the land being infested with a declared weed and preventing a declared weed or potential weed on the land spreading to other land).

3.8.5 *Bushfires*

The PER outlines that the AZRI site currently has a well-maintained network of 4 m wide (minimum) firebreaks and access tracks. It is highly likely that a new firebreak will be required along the northern boundary of the proposed horticultural site, to minimise the impact of fires coming into the area from the north. Existing firebreaks within the proposed horticultural area will be retained or, if positioned in an area required for crops, new breaks established.

Currently, AZRI avoids open fires on site and this practice would be maintained. All members of the workforce should be inducted into fire prevention and management and fire fighting equipment should be kept at strategic locations (*e.g.* at each facility/building and in vehicles).

In the event that a fire does occur, AZRI staff and local fire fighters would be involved in fire fighting. It is expected that the current policy of fire prevention would be continued.

Fire management legislation requires landholders to ensure that a 4-metre firebreak is installed and maintained along all boundaries.

3.8.6 *Pest Species*

A range of feral animals have previously been recorded at the Alice Springs Airport, these include the Feral Camel (*Camelus dromedaries*), the Feral Cat (*Felis catus*), the European Rabbit (*Oryctolagus cuniculus*) and the House Mouse (*Mus domesticus*). It is likely that each of these, except the Feral Camel, will also occur on the AZRI site.

The PER states that the main feral animal issue expected on site relates to rabbits. Rabbits will need to be managed for the horticultural project, as well as to assist in maintaining the vegetative buffers. Therefore, rabbit-proof fencing of the horticultural site will be required.

3.9 Heritage and Cultural issues

3.9.1 Heritage issues

The PER has included the results from the archaeological survey that the proponent commissioned for this project. It acknowledges the fact that the ten artefact scatters are prescribed archaeological objects under the *Heritage Conservation Act* 1991 and the need to apply for permission to disturb them. The proponent has followed the appropriate regulatory steps by already having made an application for permission to disturb the ten artefact scatters that were recorded.

The Safeguards section provides adequate information on what steps should be taken in order to protect significant places or objects, such as a policy of education and prevention. For example, cultural awareness training is recommended for all members of the workforce and the possibility of fencing off significant sites. Also in order to prevent inadvertent disturbance of significant sites, contractors will be advised to confine earthmoving equipment and worker's vehicles to set parking areas.

DIPE records show that to date there are no nominated, proposed or declared heritage places situated within the grounds of the Arid Zone Research Institute.

3.9.2 Aboriginal Sites

The Aboriginal Areas Protection Authority (AAPA) is currently processing an Application for an Authority Certificate from the DBIRD to cover the works. In processing this application, the AAPA is required to determine the wishes of Aboriginal custodians in relation to the extent to which sacred site features should be protected. Consultations with custodians have substantially progressed and the AAPA is currently in discussions with DBIRD regarding identification of work areas where disturbance to these sites would be minimised.

It is anticipated that an Authority Certificate will be issued to DBIRD for the project, however the Certificate will contain conditions for the protection of sacred sites.

The PER states that an Authority Certificate has been issued over the Desert Knowledge Precinct (Lots 4572, 4573 and the western portion of Lot 800). Authority Certificate C2003/058 was issued to the Department of Chief Minister for the purposes of construction of the Desert Knowledge Precinct. This Certificate was issued on the basis of an understanding between the Desert Knowledge Precinct management and custodians regarding minimal tree removal. The Certificate does not necessarily cover the works included in the PER.

Recommendation 25

The proponent should liaise with the AAPA and obtain Authority Certificates for all areas necessary to ensure that all works are covered by Authority Certificates. The works should not commence until an Authority Certificate has been issued by the AAPA. The conditions of the Authority Certificate should be followed at all times.

3.10 Socio-economic issues

The PER outlines the surrounding land-uses of the AZRI to include two significant landholders; the Alice Springs Airport, located to the south; and an existing residential area located to the east. The northern and western boundaries to the proposed site are buffered by vegetation and infrastructure and thus should not experience any localised impacts. There are no current proposals for future residential expansion immediately surrounding AZRI, however the potential for residential development in the long-term future can not be discounted.

The Alice Springs Airport Masterplan identifies a number of future developments including horticultural and residential areas as well as commercial operations.

The residents in the area to the east of the AZRI site enjoy a rural lifestyle and are concerned about a loss of their rural residential amenity. These concerns are centred on issues of noise, odour, pesticide and fertiliser use and increased vehicular traffic. The effects on these residents will vary according to their proximity to the horticultural area, with the most likely affected people being those residents that are directly adjacent to the horticultural block. With an increased distance from the site, the ability to detect any effects will decrease and the propensity to identify and report adverse affects will also decrease.

A major social factor to the development of the water reuse scheme appears to be the impact of current waste management practices on the recreational and aesthetic values in the Ilparpa Valley. The current situation at the Alice Springs WSP has resulted in a loss of amenity for the residents of Alice Springs, and relate to mosquito/ health concerns, offensive odours and burning practices aimed at managing the introduced reeds.

The PER states that the use of reclaimed water at AZRI has the potential to have a range of both positive and negative impacts on the Alice Springs social and economic environment. In broad terms, the development of a wastewater treatment plant and reuse process will have significant benefits to the environment, community and the local economy. This will be achieved through the elimination of dry weather discharges to Ilparpa Swamp and an associated significant reduction of potential biting insect, and by providing opportunities for horticultural industry providing job opportunities for local residents. The reuse of reclaimed water to produce high value horticultural crops would be more beneficial for the environment and more sustainable than losing the water through evaporation in evaporation ponds.

There are several potential impacts on local residents in Heffernan, Petrick and Schaber Roads. The PER states that these can be anticipated and managed and should not adversely affect neighbouring stakeholders. In the following paragraphs, a summary is provided of the potential impacts on local residents, safeguards and mitigation measures.

3.10.1 Odours

There are two potential areas for odours, the SAT infiltration ponds and the pre-irrigation reclaimed water storage area. If odours are created at the SAT or horticultural sites, they are likely to be constant because of the continuous nature of the operations. The PER states that the potential for offensive odours is low due to the treatment process that the reclaimed water has undergone (i.e. chlorination) and the constant replenishment as the reclaimed water is moved through the site.

The potential for odours to be recognised and perceived as an impact will largely depend on the strength and direction of the wind. In general, the winds increase in strength as the day continues, calming at night, and the prevailing winds are normally from the south east. Under these conditions during the day there will be low likelihood of sensing the odours in the adjacent residential area and a slightly greater likelihood in sensing the odours at night and in the early morning. In the event of a westerly wind there may be a greater likelihood of noticing any odour.

The PER describes the following safeguards to prevent/ mitigate odour nuisance to local residents:

- Tertiary treatment of reclaimed water prior to delivery to AZRI and SAT basins, and further polishing through SAT;
- The use of sub-surface irrigation, minimising exposure of reclaimed water to the air;
- Reclaimed water is stored in aquifers (compared with above ground storage areas) which reduces potential for odour or spillage;

- A minimum of 50 m has been set aside between residential areas and the proposed horticultural area as a buffer zone for odour and noise; and
- A minimum of 100 m between the residential areas and the holding area for reclaimed water as a buffer for odour.

3.10.2 *Noise*

The PER discusses various sources of noise created through horticultural activity. Noise produced during the development of the site will be from the construction of temporary access tracks, vegetation clearing, excavation of basins, landscaping and revegetation of disturbed areas.

Relatively constant sources of noise will be from tractors, vehicles, chemical spraying equipment, water pumps and bird deterrents (such as gas guns) during farm operations. The use of high-volume sprayers to fertilise and apply fungicide can generate a large amount of noise; this would be restricted to times in January, September, October and November, for table grape crops. It is expected that the gas gun will be used every September, October and November. This source of noise may have a significant impact on a large number of residents due to the high volume of the noise and the early hours of operation.

The number of people that will be affected by noise will largely depend on the time of day that the noise is created. Activities such as the use of tractors and spraying equipment at night will be noticed by more people than day-time activities.

Another possible source of noise, which has not been included in the PER is that associated with control of frost. Alice Springs does have frost periods in the winter months and in southern States, it is common for “Frost Fans” to be utilised for prevention of formation of frost. These are operated through the night and can sound like a helicopter. Use of such devices may have impacts on adjacent residents to the horticultural area.

The PER describes that noise can be managed by implementing controls such as restricting hours of operation. It is recognised that the current practice of using gas guns to control birds away from horticultural crops has created concern amongst residents. Therefore, it is recommended that alternative methods of bird control be investigated. If alternative bird deterrents are not cost effective or appropriate then the current practice of advertising intended use times needs to be continued. The PER references the draft Waste Management and Pollution Control (Environmental Noise) Regulations. There are no current Noise Regulations and the issue of noise will need to be addressed through a Noise Management Plan within the EMPs.

Recommendation number 26

Further consideration should be given to noise management in a Noise Management Plan located within the revised EMPs, to be submitted for approval by the Office of Environment and Heritage. Issued to be addressed include:

- **All sources of noise and alternatives/ management measures; and**
- **an investigation into alternatives for the use of scare guns for the various crops**

3.10.3 *Dust*

Due to the arid location and proposed horticultural activities at AZRI, dust will be produced during construction and general operations. This will be caused by earth moving equipment, tractors and farm vehicles. The construction phase is expected to be approximately two months for the SAT basins and three months for the horticultural scheme.

Additional dust will be created during planting of the crops and the installation of the irrigation. This will involve periods of relatively high dust production as each four hectare lot is prepared. During horticultural operations there will be activities that produce dust which may include the use of farming machinery and vehicles.

The potential for dust to adversely impact on the neighbouring residents is relatively low due to the prevailing south-easterly winds. However in the event of a westerly wind, or an atmospheric inversion during high-dust producing operations, there is the potential to adversely impact on the neighbouring residents. The PER contains a variety of approaches that can be adopted to ensure that dust is not adversely impacting on any neighbouring residents; these include appropriate design and implementation, containment of dust and site improvement.

The layout of the site and the installation of an internal road network is expected to significantly reduce the level of dust leaving the site. The use of firebreaks as vehicle routes should be strictly limited to use for property management by AZRI and not used for horticultural purposes, as this will limit the amount of dust that can affect neighbours. Appropriately designed and constructed roads will also reduce the amount of dust that is produced.

The planned staged clearing of land (five, four hectare lots per year to be placed under cultivation) will ensure that vegetation is retained, thus reducing dust production. The vegetation that is cleared can potentially assist in dust suppression by placing significant habitat features (trunks, hollow bearing logs *etc.*) in the vegetation buffer and all other green waste can be mulched on-site. Use of this mulch on-site can assist in dust and weed control.

The enhanced vegetation buffer will act as means of containing dust that is produced within the AZRI during operations.

The use of town water to suppress dust during high production activities such as the ripping of planting lines may be necessary if there are adverse weather conditions. Alternatively, if the weather conditions are adverse it may be appropriate to wait for more appropriate conditions to conduct the works.

If there are areas, such as in the rows between trellises, which are producing high amounts of dust that is not being contained, then it may be necessary to apply some form of cover. Options for this may include organic mulch, hydromulch, or appropriate grasses.

3.10.4 Spray drift

The PER describes a variety of chemicals that may be used in the horticultural operations including herbicides, fungicides, insecticides, growth regulators and fertilisers, and their potential impact on local residents:

- Damage to gardens and surrounds;
- Effects on non-target crops and pastures;
- Effects on water quality and aquatic life;
- Effects on bee populations; and
- Effects on human health and livestock.

All agricultural chemicals are registered with the Australian Pesticides and Veterinary Medicines Authority (APVMA) whose role is to ensure that chemicals are effective and do not harm human health. The APVMA assesses the risk of spray drift and communicates this to users. Adherence to the advice and regulations provided by the APVMA reduces the risk of adverse impacts.

The PER describes safeguards in the form of commonly used practices to reduce the possibility of spraydrift occurring:

- Use of an enhanced vegetative buffer of a minimum of 50 m around the proposed horticultural area;
- Take into account the nearby residents and other facilities on/near the site by only spraying in low wind conditions and preferably when any spraydrift would not move towards the nearby residents;
- Avoid spraying in adverse weather conditions including westerly winds, in high temperatures with low humidity;
- Keep records of pesticide use as per acceptable industry practice;
- Ensure that all operators are appropriately trained; and
- Ensure that all equipment is maintained and calibrated appropriately and follow all other accepted industry practices.

3.10.5 Public Health

The PER outlines the following measures to protect human health:

- Provision of chlorinated (disinfected) water to the SAT basins, with infiltration expected to further decrease the level of pathogens in the recycled water;
- A minimum period required before extraction of recycled water for reuse, to allow natural microbial processes to enhance water quality even further;
- Use of sub-surface application of recycled water to minimise spraydrift and use of low impact ground spray irrigators for any pasture irrigation, positioned away from residential areas;
- Incorporation of a minimum 50 m buffer between the horticultural site and residential areas; and
- Contingencies to shut-off irrigation water supplies in the event that monitoring shows that there is an unacceptable level of pathogens in the irrigation water (as per the SA guidelines for recycled water reuse).

Also, under the *Public Health Act*, all projects utilising recycled water require endorsement and approval from the Department of Health and Community Services. These approvals can prescribe mechanisms to negate adverse impact to public health arising from exposure to treated recycled water and associated elements including soil contact and aerosol exposure, should it be decided that these are necessary in addition to the safeguards proposed.

3.10.6 The Buffer Zone

The impacts of odours, noise, spray drift and dust to local residents are dependent on the daily winds. The prevailing winds in winter are from the south east which would mitigate these impacts. However in the summer there are winds from the south west, north west and north east. The westerly winds would increase these impacts.

The PER proposes a 50 metre wide buffer strip between the horticultural project and the five acre rural blocks off Heffernan Road. It is considered that there is no certainty that a buffer of 50 metres will adequately protect residents from the impacts of noise, dust, odours and spray drift. There is a need for the buffer zone distance to be reassessed.

3.10.7 Planning considerations

The use of the AZRI site for the horticultural component of the proposal has the potential to impact upon the potential future land uses of the AZRI land not identified in the PER. The Department of Infrastructure, Planning and Environment has expressed concern that this land use could, in effect, sterilise the land for future residential development, arguing that the AZRI site is readily developable for a variety of purposes and is therefore a significant land asset for Alice Springs in meeting future development needs of the Town.

Accordingly, it is important that in the event that the horticultural element of the proposal is to gain approval at this site, the activity needs to be managed in such a way as to not diminish future development opportunities at this locality, either through land contamination or the potential (due to poor management practices) for land use conflict with a more sensitive land use.

Recommendation 27

The Operational EMP for the horticultural component of the proposal is to ensure that the activity is managed in such a manner as not to diminish future development opportunities of the AZRI site.

Recommendation 28

It is recommended that the buffer zone along the eastern boundary is reassessed in order to address the uncertainty of the impacts of noise, dust, odours and spray drift. This can be addressed in the submission of the revised EMPs, for approval by the Office of Environment and Heritage.

4 MONITORING AND ENVIRONMENTAL MANAGEMENT

The PER includes 4 draft Environment Management Plans (EMPs) as follows:

- SAT Construction EMP;
- Horticulture Construction EMP;
- SAT Operation EMP; and
- Horticulture Operation EMP.

Despite outlining in some detail the management and monitoring strategies, the draft EMPs contain considerable typographical errors and, more importantly, inappropriate monitoring measures and duplication of responsibilities. The proponent has since indicated that the EMPs should not be included in their present form as part of this Assessment, and that revised EMPs will be re-submitted for approval following the assessment of the PER.

The PER describes the overall responsibility for the main components of the project as follows:

Power and Water Corporation

- Construction of SAT basins; and
- Operation of SAT basins, including monitoring of input water quality.

DBIRD

- Extraction of recycled water;
- Application of recycled water – through lease agreements with private horticulturalists; and
- Monitoring of extracted recycled water quality.

The draft EMPs include management sub-plans including the following components associated with construction and operation:

- Soil and erosion;
- Water;
- Waste;
- Hazardous substances;
- Vegetation, fauna and habitat;
- Weeds and pest species;
- Fire;
- Heritage;
- Air quality;
- Noise;
- Odour; and
- Access and public safety.

The EMPs will need to be revised to incorporate the additional measures for environmental protection and monitoring that are contained in this Assessment Report. Details of monitoring programmes should be addressed in the EMPs, and include relevant responsibilities, reporting requirements and trigger levels. The EMPs should also be consistent with any monitoring

conditions to be included in the Groundwater Recharge Licence and approvals under any other legislation.

It is considered that the current EMPs do not clearly address the responsibilities for management of environmental issues. This is particularly so for the private lease holders undertaking horticultural activities. For example, some queries remain:

- It is not clear who will employ the environmental officer/ manager and what role this person will have. What type of corrective/ preventative actions will this person be able to take in case of non-conformances during all stages of the project. Will this person also be responsible for audits and monitoring, to ensure that all management measures are adhered to (such as dust control measures, spraydrift, correct use and storage of chemicals, weeds, prevention of compaction by the use of low flotation tyres and no movements to occur on wet soils).
- The EMP states that the horticulturalist is to provide cultural awareness training to the workforce, and induction training.

The responsibilities for undertaking the relevant management measures and safeguards can be addressed in the private lease agreement between the horticulturalist and DBIRD/ Power and Water, this should be reflected in the EMP.

The monitoring program will be essential to demonstrate the success of the project, the potential for impact on waters, and the feasibility of project expansion. The program should be designed to address the following impacts and potential issues for operation of the SAT and banking operation, the recovery of banked waters and irrigation practices associated with horticultural activities:

- The groundwater in the immediate vicinity of the SAT infiltration ponds;
- Impacts to waters within the palaeochannel at the boundary of the property;
- Impacts to waters at the margins of the property; and
- Impacts to waters remote from the AZRI site.

The EMPs will be referred to relevant NT Government agencies for review prior to finalisation and approval, after which they will become public documents. The EMPs will be the major vehicle for implementing management and monitoring commitments made by the proponent in the revised PER and the recommendations detailed in this Assessment Report. As such, they will be working documents for the life of the proposal and will require continual review in light of operational experience and changed circumstances.

Recommendation 29

Revised Environmental Management Plans covering construction and operation of the SAT and horticultural schemes are to be submitted to the Office of Environment and Heritage for approval prior to commencement of construction and operation respectively.

In preparing each Environmental Management Plan, the proponent will include any additional measures for environmental protection and monitoring contained in this Assessment Report and recommendations made by the NT Government with respect to the proposal.

5 CONCLUSIONS

The Office of Environment and Heritage (OEH) considers that the environmental issues associated with the proposed project have been adequately identified. Appropriate environmental management of these issues has been resolved through the assessment process

with continuous monitoring and management actions detailed in a comprehensive Environmental Management Plans (EMPs) to be resubmitted to the Office of Environment and Heritage for approval.

The final EMPs for the construction and operational phases of the SAT scheme and horticultural schemes will be subject to review and approval by relevant NT Government agencies. They will be working documents for the life of the project and will require continual review in the light of operational experience and changed circumstances.

Based on its review of the PER and submissions from relevant NT Government agencies and the public, OEH considers that the SAT scheme and horticultural schemes can be managed in a manner that avoids unacceptable environmental impacts, provided that the environmental commitments, safeguards and recommendations detailed in the PER, this Assessment Report and in the final EMPs are implemented, with regular reporting and compliance auditing.

6 REFERENCES

HLA –Envirosciences Pty Limited – Public Environment Report, Alice Springs Water Reuse Scheme, Soil Aquifer Treatment & Horticulture Schemes. Prepared for Power and Water Corporation and Department of Business, Industry and Resource Development, 11 April 2005.

APPENDIX 1 – RESPONDENT MATRIX

List of respondents to the revised PER and issues raised

Respondents	Issues discussed
Environmental Assessment – Office of Environment & Heritage - Department of Infrastructure, Planning and Environment	<ul style="list-style-type: none"> • <i>Soil disturbance and salinity</i> • <i>Groundwater and hydrogeology</i> • <i>Waste management</i> • <i>Flora and fauna</i> • <i>Socio-Economic issues</i>
Natural Resources - Alice Springs – Department of Infrastructure, Planning and Environment	<ul style="list-style-type: none"> • <i>Soil disturbance and salinity</i> • <i>Biodiversity/ flora and fauna</i> • <i>Socio-economic environment</i>
Heritage Conservation– Office of Environment & Heritage - Department of Infrastructure, Planning and Environment	<ul style="list-style-type: none"> • <i>Archaeological and heritage issues</i> • <i>Artefact scatters and approval under Heritage Conservation Act</i>
Greenhouse	<ul style="list-style-type: none"> • <i>No comments</i>
Waste & Pollution - Office of Environment & Heritage - Department of Infrastructure, Planning and Environment	<ul style="list-style-type: none"> • <i>Water quality</i>
Lands and Planning South Region – Department of Infrastructure, Planning and Environment	<ul style="list-style-type: none"> • <i>Land use issues with horticulture scheme</i> • <i>Water resources and Recharge/ Discharge Licences under the Water Act</i>
Aboriginal Areas Protection Authority	<ul style="list-style-type: none"> • <i>Sacred sites features</i> • <i>Authority Certificate</i>
Water Resources - Department of Infrastructure, Planning and Environment	<ul style="list-style-type: none"> • <i>Water recharge/ discharge licences under the Water Act</i> • <i>EMPs</i>
Conservation and Natural Resources - Department of Infrastructure, Planning and Environment	<ul style="list-style-type: none"> • <i>Erosion and Sediment control</i> • <i>Water supply and water allocation: no issues</i> • <i>Land use: no issues</i> • <i>Vegetation clearing</i> • <i>Weed management</i> • <i>Bushfires</i> • <i>Biodiversity: no comments</i> • <i>Parks: no comment</i>

Respondents	Issues discussed
Environmental Health – Department of Health and Community Services	<ul style="list-style-type: none"> • <i>Use of reclaimed water</i> • <i>Handling and disposal of organic waste and wastewater from packaging processes in horticultural scheme</i> • <i>Noise</i> • <i>Buffer zones</i> • <i>Approvals needed under the Public Health Act</i> • <i>Biting Insects</i>
Entomology - Department of Health and Community Services	<ul style="list-style-type: none"> • <i>Biting Insects</i>
Biodiversity Conservation - Department of Infrastructure, Planning and Environment	<ul style="list-style-type: none"> • <i>No comments</i>
Local Resident Mulla Mulla Road	<ul style="list-style-type: none"> • <i>Reuse of reclaimed water for existing facilities versus new activities</i> • <i>Need for assessment of an EIS by EPA</i> • <i>Access to PER</i> • <i>Community Consultation</i> • <i>Noise, including bird scaring gas guns</i> • <i>Use of chemicals</i> • <i>Groundwater pollution and salinity</i> • <i>Spray drift and buffer zones</i> • <i>Lack of disposal facilities for empty chemical containers</i> • <i>Dust</i> • <i>Mosquitos and health concerns</i> • <i>Bird habitat</i> • <i>Management measures in PER</i> • <i>EMP</i>
Local Resident	<ul style="list-style-type: none"> • <i>Heritage issues with name use of Ilparpa swamp and Blatherskite Range</i>
Alice Springs Rural Area Association Inc	<ul style="list-style-type: none"> • <i>Possibility for additional development and associated impacts</i> • <i>Recycling of organic waste on-site and associated concerns for odours and vermin</i> • <i>Buffer zones and number of residents potentially affected</i> • <i>Mosquito Management</i> • <i>Noise</i> • <i>Drought and possibility for increased road kills of native animals and traffic hazards</i>

APPENDIX II – TABLE OF COMMITMENTS BY THE PROPONENT IN THE PER

SUMMARY OF POTENTIAL IMPACTS, SAFEGUARDS, MONITORING AND REMEDIAL ACTIONS FOR SOILS AND SALINITY

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT	Erosion	Clearing Construction Rainfall Operation	Medium	<p>Clear only area required.</p> <p>Minimise vehicle access to that necessary.</p> <p>Incorporate erosion control measures into design.</p> <p>Stabilise basin walls with waste rock, matting or other suitable inert material.</p> <p>Have basin walls with gentle slope (1:2).</p> <p>Design basin with entry point for maintenance equipment.</p> <p>Include surge sub-basin in design of infiltration basins to accommodate excess water.</p> <p>Use dissipater at point of water inflow in infiltration basins.</p>	<p>Assess clearing extent during process.</p> <p>Weekly inspections of all erosion control measures.</p> <p>Daily inspection during rainfall periods.</p> <p>In-line monitoring of water levels in ponds.</p>	<p>Revegetate cleared areas.</p> <p>Redesign erosion control systems to better suit conditions.</p> <p>Modify surface of access roads, where expected high use.</p>
	Dust	Construction Clearing	High	<p>Minimise vehicle access to that necessary.</p> <p>Restrict movement on boundary firebreaks to that required for AZRI property management.</p> <p>Revegetate disturbed areas.</p> <p>Remove waste soil if not required for use on site.</p>	<p>Daily assessment of climatic conditions and dust generation during construction.</p>	<p>Cease activity during strong winds.</p> <p>Modify surface of access roads, where expected high use.</p>
	Compaction	Construction Operation	High	<p>Minimise vehicle access to that necessary.</p> <p>Fit earthmoving machinery with low flotation tyres.</p>	<p>Weekly inspection of work site and roads.</p> <p>Final inspection of basin floors.</p>	<p>Rip/furrow/aerate soils, including basin floor after construction, before leveling.</p> <p>Modify surface of access roads, where expected high use.</p>

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT <i>continued</i>	Change to nutrient status of soils	Operation	High	Annual maintenance to scarify basin floor and remove sediment and organic material build up. Alternate sub-basin use.	In-line monitoring of recycled water quality. In-basin monitoring of soil nutrients.	Increase tertiary treatment train to provide further polishing (<i>e.g.</i> filtration). Cease SAT operations.
	Clogging	Operation	High	Conservative basin design. Use of 7 day wet/dry cycle. Annual maintenance to scarify basin floor and remove sediment and organic material build up.	In-line monitoring of water levels in ponds and recycled water inflow rates to maintain water levels.	Modify wet/dry cycle. Increase frequency of basin floor maintenance. Increase pre-treatment of recycled water prior to disposal. Cease SAT operations.
Horticulture	Erosion	Clearing Construction Rainfall Operation	Medium	Clear only area required. Minimise vehicle access to that necessary. Incorporate erosion control measures into design.	Assess clearing extent during process. Weekly inspections of all erosion control measures. Daily inspection during rainfall periods.	Revegetate cleared areas. Redesign erosion control systems to better suit conditions. Seal access roads, where expected high use. Augment soils with gypsum to minimise dispersion tendency.
	Dust	Construction Clearing Operation	High	Minimise vehicle access to that necessary. Restrict movement on boundary firebreaks to that required for AZRI property management. Revegetate disturbed areas.	Daily assessment of climatic conditions and dust generation during construction.	Cease activity during strong winds. Modify surface of access roads, where expected high use.
	Compaction	Construction Operation	High	Minimise vehicle access to that necessary. Prevent movement on or working of soils when wet. Fit earthmoving machinery with low flotation tyres	Weekly inspection of work site and roads.	Rip/furrow/aerate soils. Modify surface of access roads, where expected high use.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
Horticulture <i>Continued</i>	Change to soil salinity and sodicity	Operation	High	<p>Monitor salinity and sodicity of irrigation water and soil.</p> <p>Use appropriate irrigation techniques to minimise salinity (e.g. sub-surface drip irrigation).</p> <p>Mulch around irrigation sites to reduce evaporation.</p> <p>Monitor delivery rate of irrigation water – surface soils should not be visibly wet.</p> <p>Choose salt tolerant crops.</p>	<p>In-line monitoring of irrigation water to ensure salinity and sodicity levels acceptable.</p> <p>Monitoring of soil parameters, including salinity, sodicity and moisture.</p>	<p>Increase tertiary treatment train to provide further polishing (e.g. filtration).</p> <p>Leaching of soils through short-term increased flow of irrigation waters.</p> <p>Augment soils with gypsum to maintain sodicity.</p> <p>Cease irrigation activities.</p>
	Change to soil nutrients	Operation	High	Avoid addition of excess nutrient.	Monitoring of soil parameters, including nutrient concentrations.	Cease or modify fertiliser activities.
	Change to soil pH	Operation	Medium	<p>Augment soils with organic matter e.g. mulch, to increase buffering capacity.</p> <p>Augment soil with soil pH adjustment products.</p>	Monitoring of soil parameters, including pH.	<p>Augment soils with appropriate chemical additions to increase buffering capacity</p> <p>Cease or modify irrigation.</p>

**APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER
2. SUMMARY OF POTENTIAL IMPACTS, SAFEGUARDS, MONITORING AND REMEDIAL ACTIONS FOR SOIL AQUIFER TREATMENT**

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT	Inadequate basin infiltration	Operation	Low	Conservative basin design. Use of 7 day wet/dry cycles. Annual maintenance to scarify basin floor and remove sediment and organic material build up.	Automatic monitoring of water levels in ponds and recycled water inflow rates to maintain water levels.	Modify wetting and drying cycle. Increase frequency of basin floor maintenance. Increase tertiary treatment train to provide further polishing (e.g. filtration).
	Localised surface seepage or ponding outside basin	Operation	Low	Use of low permeability bund construction material.	Weekly inspections of infiltration basins.	Installation of local cut-off barriers or shallow groundwater spears to intercept preferential flow pathways.
	Widespread surface seepage or ponding outside basin	Operation	Medium	Investigations of groundwater conditions, infiltration tests and groundwater flow modeling. Experience with similar palaeochannel conditions in Alice Springs.	Installation of extensive groundwater monitoring network targeting the palaeochannel and the more shallow permeable layers radiating outward from the SAT basins to the AZRI site boundaries.	Install infiltration bores though the lower permeability layer present immediately above the palaeochannel or extract groundwater and inject into Shannon formation. Decrease volume of recycled water disposed of through SAT. Cease SAT operations.
	Increase in long term, widespread groundwater levels standing within <10 m of the surface	Operation	High	Investigations of groundwater conditions, infiltration tests and groundwater flow modeling provide confidence. Groundwater of suitable depth to avoid mounding impacts on soils and vegetation. Experience with similar palaeochannel conditions in Alice Springs.	Installation of extensive groundwater monitoring network targeting the palaeochannel and the more shallow permeable layers radiating outward from the SAT Basins to the AZRI site boundaries.	Install infiltration bores though the lower permeability layer present immediately above the palaeochannel or extract groundwater and inject into Shannon formation. Decrease volume of recycled water disposed of through SAT. Cease SAT operations.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT <i>continued</i>	Significant lateral movement of groundwater outside palaeochannel	Operation	High	Investigations of groundwater conditions, infiltration tests and groundwater flow modeling provide confidence. Experience with similar palaeochannel conditions in Alice Springs.	Installation of extensive groundwater monitoring network targeting the palaeochannel and the more shallow permeable layers radiating outward from the SAT Basins to the AZRI site boundaries.	Do nothing where water quality or depth below ground surface is not considered an issue. Install infiltration bores though the lower permeability layer present immediately above the palaeochannel or extract groundwater and inject into Shannon formation. Cease SAT operations. Pump out of basins and remove off-site poor quality recycled water.
	Groundwater migration to other aquifer systems	Operation	Medium	Investigations of groundwater conditions, infiltration tests and groundwater flow modeling provide confidence. Experience with similar palaeochannel conditions in Alice Springs.	Routine monitoring of existing network of monitoring and operational extraction bores for potential changes.	Do nothing where water quality is not considered an issue. Cease SAT operations.
	Preferential flow of lower quality groundwater from quaternary systems to underlying Tertiary Systems along existing bore networks	Operation	Medium	Routine monitoring of water quality	Routine monitoring of water quality.	Do nothing where water quality is not considered an issue Replace or repair bore networks Cease SAT operations.
SAT <i>continued</i>	Recycled water volume in excess of infiltration capacity	Operation	Low	Divert recycled water to existing evaporation ponds. Direct use at Blatherskite Park and Tree Lot, but with improved irrigation efficiency and design.		

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
Horticulture	Minimal infiltration or mixing of recycled water into palaeochannel (<i>i.e.</i> poor or irregular water quality)	Extraction for horticulture	Low	Investigations of groundwater conditions, infiltration tests and groundwater flow modeling. Experience with similar palaeochannel conditions in Alice Springs.	Routine monitoring of water from extraction bores.	Install infiltration bores though the lower permeability layer present immediately above the palaeochannel. Investigate and redesign extraction bore network. Cease extraction operations.
	Variable reuse water quality	Irrigation	Medium	Irrigation water expected to be of higher quality than existing groundwater. Use of tertiary treatment train to provide (<i>e.g.</i> Dissolved Air Flotation). Augmentation of irrigation water to reduce pH, <i>e.g.</i> gypsum or sulfur.	Routine monitoring of water from extraction bores.	Use of holding tanks to mix the various extraction bore water sources. Increase tertiary treatment train to provide further polishing (<i>e.g.</i> filtration). If continued use unacceptable, revert to current irrigation programme and use of evaporation ponds in interim.
	Guarantee of supply of irrigation water	Irrigation	Low	Basin design incorporates minimum infiltration rates required for extraction of required volume of water.	Monitor volume of recycled water entering basins.	Adjust volume as required. Reduce horticultural activities.
External Factors	Overtopping of Todd River at AZRI site	Rainfall/flood events	Low	Erosion control methods in place within horticulture site. Early warning alert in place to provide time to shut down recycled water transfer pipe.	None required	Do nothing – freshwater will not affect water quality
	Overtopping of SAT Basins	SAT Construction	Low	Construction of walls of SAT basins to withstand 100% increase in volume of water contained. Early warning alert in place to provide time to shut down recycled water transfer pipe. Basin design includes surge sub-basins.	Automatic monitoring of water levels in ponds.	Cease transfer of recycled water. Undertake erosion remediation as required.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

3. SUMMARY OF POTENTIAL IMPACTS, SAFEGUARDS, MONITORING AND REMEDIAL ACTIONS FOR WASTES

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT	Disposal of accumulated algal materials on basin floor	Operation	Medium	Possible use as biosolid fertilizer/soil conditioner. If testing shows unacceptable levels of pathogens, treat with UV (sunlight) or mix with green wastes and compost (heat kills pathogens and composting eliminates odour).	Testing of material to determine concentrations of microbial organisms, chemicals and metals.	Disposal to licensed site, with appropriate approvals.
Horticulture	Disposal of green wastes, prunings, crop waste	Operation	Low	Compost on site. Use to augment soils in horticulture area.	None required.	Disposal to appropriate licensed green waste facility, with approvals if required.
	Disposal of water from packing system	Operation	Low	Collect in sump pit. Use on site for soil augmentation.	Routine monitoring of water quality prior to application on site.	Disposal through waste disposal contractor.
	Disposal of plastics	Operation	Low	Reuse where possible. Where reuse is not an option, dispose of with other refuse. Ensure does not become litter on horticultural site.	Routine inspection of area and collection of plastic blown from plants.	Disposal through waste disposal contractor.
	Disposal of cardboard and paper	Operation	Low	Recycle.	None required.	Disposal to appropriate waste facility.
	Disposal of agrochemical and similar containers	Operation	Low	Recycle.	None required.	Disposal to appropriate waste facility.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

3. SUMMARY OF POTENTIAL IMPACTS, SAFEGUARDS, MONITORING AND REMEDIAL ACTIONS FOR BIODIVERSITY

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT	Loss of vegetation	Clearing	High	<p>Minimise area to be cleared.</p> <p>Retain large/mature trees and shrubs.</p> <p>Obtain permission to clear from AAPA and through Land Clearing Guidelines.</p> <p>Confine earth moving vehicles, and workers vehicle to set parking areas (on existing service roads) and tracks to minimise the potential impact on native flora.</p>	Ensure only nominated area targeted during clearing operations.	<p>Revegetation</p> <p>Modify the surface of access roads, where expected high use creates dust impact on vegetation.</p>
	Loss of significant flora	Clearing	Medium	Undertake targeted survey prior to commencement of clearing.	Undertake targeted survey prior to commencement of clearing.	Seed collection and establishment in suitable site elsewhere or translocation (although this is generally difficult to achieve). Advice would need to be sought as to whether this is a controlled action under the EPBC Act for some species.
	Disturbance to fauna	Clearing Construction Operation	Medium	<p>Disturbance from machinery and equipment short term and minimal.</p> <p>Fence area holding infiltration basins to prevent wildlife/stock access.</p>	None required.	Dependent on issue and species involved, may require modification to basin to prevent access.
	Loss of significant fauna	Clearing	Medium	Undertake targeted survey prior to commencement of clearing.	Undertake targeted survey prior to commencement of clearing.	Translocation under the advice of Parks and Wildlife or maintenance of the habitat area, depending on its location. Advice would need to be sought as to whether this is a controlled action under the <i>EPBC Act</i> for some species.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT <i>continued</i>	Loss of habitat	Clearing	High	<p>Minimise area to be cleared.</p> <p>Retain large/mature trees and shrubs.</p> <p>Site of proposed activity has degraded habitat only.</p> <p>Retain any significant habitat elements, such as, fallen logs and hollow-bearing trees or relocated for use as artificial habitat areas elsewhere (<i>e.g.</i> in buffers).</p> <p>No vehicles are to enter the local drainage channels, such as St Mary's Creek.</p>	Ensure only nominated area targeted during clearing operations.	Revegetation.
	Weed establishment	Operation	Low	<p>Undertake mechanical or physical control of weeds around basins.</p> <p>Use of erosion control matting should assist in prevention of weed establishment.</p> <p>Imported fill must be certified weed free before being brought on site.</p>	Monitor weeds as part of annual basin maintenance programme.	Undertake mechanical or physical control of weeds around basins.
	Pest species	Construction Operation	Low	<p>Areas requiring drainage will be constructed so that no pooling can occur within the drains.</p> <p>Use of 7 day wet/dry cycles to disrupt mosquito breeding.</p> <p>Annual maintenance to scarify basin floor and remove sediment and organic material build up.</p> <p>Use amber external lighting on infrastructure fitted with lights.</p>	<p>Automatic monitoring of water levels in ponds and recycled water inflow rates to maintain water levels.</p> <p>Monitor effectiveness of wet/dry cycle of basins and alter as required to disrupt mosquito breeding cycle.</p>	<p>Modify wet/dry cycle, accordingly.</p> <p>Increase frequency of basin floor maintenance.</p> <p>Increase tertiary treatment train to provide further polishing (<i>e.g.</i> filtration).</p>

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
Horticulture	Loss of vegetation	Clearing	High	<p>Minimise area to be cleared.</p> <p>Retain large/mature trees and shrubs.</p> <p>Obtain permission to clear from AAPA and through Land Clearing Guidelines.</p> <p>Confine earth moving vehicles, and workers vehicle to set parking areas (on existing service roads) and tracks to minimise the potential impact on native flora.</p>	Ensure only nominated area targeted during clearing operations.	<p>Revegetation.</p> <p>Modify surfaced of access roads, where expected high use creates dust impact on vegetation.</p>
	Loss of significant flora	Clearing	Medium	Undertake targeted survey prior to commencement of clearing.	Undertake targeted survey prior to commencement of clearing.	Revegetation.
Horticulture <i>Continued</i>	Disturbance to fauna	Clearing Construction Operation	Medium	<p>Disturbance from machinery and equipment during construction short term and minimal.</p> <p>Fence horticulture area to prevent wildlife/stock access.</p> <p>Maintain a clean and tidy work area to ensure that native fauna are not attracted to the site.</p> <p>Use of bird fright as required, and after advertisement in media re schedule for use (following current practices).</p>	None required.	Dependent on issue and species involved, may require modification to basin to prevent access.
	Loss of habitat	Clearing	Medium	<p>Minimise area to be cleared.</p> <p>Retain large/mature trees and shrubs.</p> <p>Retain any significant habitat elements, such as, fallen logs and hollow-bearing trees or relocated for use as artificial habitat areas elsewhere (e.g. in buffers).</p> <p>No vehicles are to enter the local drainage channels, such as St Mary's Creek.</p>	Ensure only nominated area targeted during clearing operations.	Revegetation.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
	Weed establishment	Operation	Low	Undertake mechanical, physical or chemical control of weeds, as required. Buffel grass should not be removed in the absence of another suitable groundcover to stabilise soil. Imported soils must be certified weed free before being brought on site.	Monitor weeds as part of annual basin maintenance programme.	Undertake mechanical, physical or chemical control of weeds, as required.
	Pest species	Construction Operation	Low	Areas requiring drainage will be constructed so that no pooling can occur within the drains. Use amber or cool white external lighting on infrastructure fitted with lights. Maintain a clean and tidy work area to ensure scavenger birds are not attracted to the site. Ensure putrescible bins are closed and no wastes are left uncovered.	None required other than normal work site maintenance checks.	Undertake corrective action.
All Components	Fire	Construction Operation	High	Continued maintenance of fire breaks at AZRI. Installation of new firebreaks, as required around horticulture and infrastructure areas. Prevent use of open fires. Personnel induction to minimising fire risk. Have fire fighting equipment on site and in vehicles.	Annual firebreak maintenance programme.	None available.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

4. SUMMARY OF POTENTIAL IMPACTS, SAFEGUARDS, MONITORING AND REMEDIAL ACTIONS FOR HERITAGE, CULTURAL ASPECTS

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
All Components	Loss of or disturbance to significant trees	Clearing Construction Operation	High	Obtain permission to clear from AAPA and consultation with land custodians. Confine earth moving vehicles, and workers vehicle to set parking areas (on existing service roads) and tracks to minimise the potential impact on significant trees and areas. Undertake cultural awareness training with workforce.	Monitor clearing to ensure no inadvertent disturbance or damage.	Seek advice from AAPA.
	Disturbance to significant landforms	Clearing Construction Operation	Low	Outside of intended project area. Ensure significant landforms easily identifiable by personnel. Undertake cultural awareness training with workforce.	Monitor clearing to ensure no inadvertent disturbance or damage.	Seek advice from AAPA.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

5. SUMMARY OF POTENTIAL IMPACTS, SAFEGUARDS, MONITORING, REMEDIAL ACTIONS FOR SOCIO-ECONOMIC ENVIRONMENT

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT	Elimination of dry weather discharge to Ilparpa Swamp	Transfer of recycled water from waste stabilisation ponds to SAT site	Low	None required – environmental benefits to Ilparpa Swamp.	None required.	None required.
	Dust	Construction Clearing	High	Minimise vehicle access to that necessary. Avoid movement on boundary firebreaks. Revegetate disturbed areas. Remove waste soil if not required for use on site.	Daily assessment of climatic conditions and dust generation during construction. Maintain complaints register.	Cease activity during strong winds. Modify surface of access roads, where expected high use.
	Expansion of land use options	Operation	Low	None required – availability of recycled water provides opportunity for other development and synergies with Desert Knowledge Precinct	None required.	None required.
	Increase in long term, widespread groundwater levels standing within < 10 m of the surface	Operation	High	Investigations of groundwater conditions, infiltration tests and groundwater flow modeling provide confidence. Groundwater of suitable depth to avoid mounding impacts on soils and vegetation. Experience with similar palaeochannel conditions in Alice Springs.	Installation of extensive groundwater monitoring network targeting the palaeochannel and the more shallow permeable layers radiating outward from the SAT Basins to the AZRI site boundaries.	Install infiltration bores though the lower permeability layer present immediately above the palaeochannel or extract groundwater and inject into Shannon formation. Decrease volume of recycled water disposed of through SAT. Cease SAT operations.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT <i>continued</i>	Significant lateral movement of groundwater outside palaeochannel	Operation	High	Investigations of groundwater conditions, infiltration tests and groundwater flow modeling provide confidence. Experience with similar palaeochannel conditions in Alice Springs.	Installation of extensive groundwater monitoring network targeting the palaeochannel and the more shallow permeable layers radiating outward from the SAT Basins to the AZRI site boundaries.	Do nothing where water quality or depth below ground surface is not considered an issue. Install infiltration bores though the lower permeability layer present immediately above the palaeochannel or extract groundwater and inject into Shannon formation. Cease SAT operations. Pump out of basins and remove off-site poor quality recycled water.
	Groundwater migration to other aquifer systems	Operation	Medium	Investigations of groundwater conditions, infiltration tests and groundwater flow modeling provide confidence. Experience with similar palaeochannel conditions in Alice Springs.	Routine monitoring of existing network of monitoring and operational extraction bores for potential changes.	Do nothing where water quality is not considered an issue. Cease SAT operations.
	Preferential flow of lower quality groundwater from quaternary systems to underlying Tertiary Systems along existing bore networks	Operation	Medium	Routine monitoring of water quality.	Routine monitoring of water quality.	Do nothing where water quality is not considered an issue. Replace or repair bore networks. Cease SAT operations.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
SAT <i>continued</i>	Contamination of existing groundwater with microbial pathogens	Operation	High	Routine monitoring of extraction water quality.	Routine monitoring of extraction water quality.	Cease SAT operations. Install infiltration bores through the lower permeability layer present immediately above the palaeochannel or extract groundwater and inject into Shannon formation. Increase extraction to recover contaminated water. Increase tertiary treatment train to provide further polishing (<i>e.g.</i> filtration).
Horticulture	Dust	Construction Clearing Operation	High	Minimise vehicle access to that necessary. Avoid movement on boundary firebreaks. Revegetate disturbed areas. Design layout to place access roads in centre of site rather than on periphery. Enhance buffer areas with poor vegetative cover.	Daily assessment of climatic conditions and dust generation during construction. Maintain complaints register. Monitor revegetation success.	Cease activity during strong winds. Seal access roads, where expected high use.
	Increased economic activity	Operation	Low	None required – positive impact, employment opportunities and availability of fresh produce.	None required.	None required.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
Horticulture <i>continued</i>	Application of irrigation water with high pathogenic content	Operation	Medium	<p>Routine monitoring of extraction water quality.</p> <p>Use only if within recycled water use guidelines for different crop types.</p> <p>Regular chlorination of irrigation pipes to reduce build up of pathogens.</p>	Routine monitoring of extraction water quality.	<p>Cease irrigation.</p> <p>Increase tertiary treatment train to provide further polishing (<i>e.g.</i> filtration).</p>
	Pest species	Construction Operation	Low	<p>Areas requiring drainage will be constructed so that no pooling can occur within the drains.</p> <p>Use amber external lighting on infrastructure fitted with lights.</p> <p>Maintain a clean and tidy work area to ensure scavenger birds are not attracted to the site.</p> <p>Ensure putrescible bins are closed and no wastes are left uncovered.</p> <p>Use of sub-surface drippers to minimise pest species attracted to moist soil environments.</p> <p>Storage of water in sealed holding tanks.</p>	<p>None required other than normal work site maintenance checks.</p> <p>Maintain complaints register.</p>	Undertake corrective action.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
Horticulture <i>continued</i>	Odour	Operation	Low	<p>Experience elsewhere shows odour is not a problem.</p> <p>Use sub-surface drippers and sealed holding tanks to minimise exposure of recycled water to air.</p> <p>Maintain minimum 50 m buffer distance from residential areas around all sources of recycled water.</p> <p>Enhance buffer areas with poor vegetative cover.</p>	<p>Maintain complaints register.</p> <p>Monitor revegetation success.</p>	Identify source of odour and take corrective action, depending on source.
	Noise	Construction Operation	High	<p>Limit hours of construction work to between 0700 and 1900 hrs.</p> <p>Advertise intended use of bird fright (gas guns) as per current practice.</p> <p>Minimise frequency of use and prevent use before 0700 hrs.</p> <p>Maintain minimum 50 m buffer distance from residential areas.</p> <p>Design layout to place access roads in centre of site rather than on periphery.</p> <p>Enhance buffer areas with poor vegetative cover.</p>	<p>Maintain complaints register.</p> <p>Investigate alternative methods of pest bird removal.</p> <p>Monitor revegetation success.</p>	Take corrective action.

APPENDIX II – TABLE OF COMMITMENTS MADE BY THE PROPONENT IN THE PER

Project Component	Potential Impact	Activities	Risk Category	Safeguards	Monitoring	Remedial Actions
Horticulture <i>continued</i>	Spraydrift of pesticides or herbicides	Operation	Medium	<p>Maintain minimum 50 m buffer distance from residential areas.</p> <p>Only use chemicals in accordance with labeling and licensing .</p> <p>Use only herbicides and pesticides licensed for use on raw produce and crops grown.</p> <p>Minimise use of pesticides and herbicides to that necessary for efficient operations.</p> <p>Enhance buffer areas with poor vegetative cover.</p>	<p>Assessment and recording of climatic conditions on nominated days of intended use.</p> <p>Maintain register of chemical use.</p> <p>Monitor revegetation success.</p>	Cease activity during strong winds.
	Movement of pesticides or herbicides to groundwater	Operation	Low	<p>Arid climate with low rainfall minimises risk of infiltration.</p> <p>Use of sub-surface drippers minimises risk of infiltration from movement of surface water.</p>	<p>Maintain register of chemical use.</p> <p>Routine monitoring of groundwater quality.</p>	Cease application of chemicals and identify source, where possible (note, source could be off site, but this would be evident in groundwater monitoring results).
	Privacy	Operation	Medium	<p>Design layout to place access roads in centre of site rather than on periphery.</p> <p>Maintain minimum 50 m buffer distance from residential areas.</p> <p>Enhance buffer areas with poor vegetative cover.</p>	<p>Maintain complaints register.</p> <p>Monitor revegetation success.</p>	Take corrective action, depending on nature of complaint.