ASSESSMENT REPORT 20

DESERT WILDLIFE PARK AND BOTANIC GARDENS, ALICE SPRINGS

ENVIRONMENTAL ASSESSMENT REPORT

AND

RECOMMENDATIONS

by the

ENVIRONMENT PROTECTION UNIT
CONSERVATION COMMISSION OF THE NT

SEPTEMBER 1994

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EXECUTIVE SUMMARY

This report assesses the environmental impact of a proposal by the Conservation Commission of the Northern Territory to establish and manage a Desert Wildlife Park and Botanic Gardens in Alice Springs, central Australia.

The report reviews the Draft Environmental Impact Statement (DEIS) and the Supplement to the Draft EIS. It is based on information and advice provided by Northern Territory Government agencies.

Environmental impact assessment fully defines those elements of the environment which may be affected by a proposed development and the significance, risks and consequences of the potential impacts of the development at a local and regional level.

This report assesses the adequacy of the EIS in achieving this and evaluates the undertakings and environmental safeguards proposed by the proponent to mitigate against the potential impacts. Further safeguards are recommended as appropriate.

The contents of this report form the basis of advice to the Northern Territory Minister for Conservation on the environmental issues associated with the Desert Wildlife Park and Botanic Gardens.

Issues

The issues associated with the construction and operation of the Desert Wildlife Park and Botanic Gardens arising from the assessment and review of the draft EIS and Supplement are listed below and are the focus of the contents of this assessment report.

- Land use and capability
- Soil salinity
- Water management
- Waste management

Recommendations

It is acknowledged that during detailed implementation of proposals, flexibility is necessary to allow for minor and non-substantial changes to the designs and specifications which have been examined as part of this assessment. It is considered that subsequent statutory approvals for this proposal could make provision for such changes where it can be shown that the changes are not likely to have a significant effect on the environment.

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards identified in the Environmental Impact Statement, or as modified by this assessment report or an approved Environmental Management Plan.

Recommendation 2

The proponent shall carry out an inventory of soils and vegetation on the Core Development Area based on a 100 metre by 100 metre grid to determine soil texture, drainage and salinity factors and the correlation between particular species and soil types.

Recommendation 3

The proponent shall consult with the Power and Water Authority regarding contingency discharges of saltpan overflows to the Alice Springs town sewage system.

Conclusion

It is considered that all significant environmental issues associated with the development and operation of the Desert Wildlife Park and Botanic Gardens have been identified. Some have been resolved through the assessment process, and others will be addressed during the detailed design and construction stages. There is a requirement for ongoing environmental management, and this will be supported by monitoring programmes to inform Park management about the status of soil erosion and salinity, irrigation regimes, water use and so on.

Development and operation of the Park will not result in any significant residual impacts provided that the environmental safeguards and recommendations contained in the EIS and this report are adopted. It is considered that the formulation and implementation of an environmental management plan supported by appropriate monitoring programmes will ensure that the Park enhances the amenity of the local environment.

1 INTRODUCTION AND BACKGROUND

This report assesses the environmental impact of a proposal by the Conservation Commission of the Northern Territory to establish a combined Wildlife Park and Botanic Gardens on the western outskirts of Alice Springs in central Australia.

The Park will exhibit different habitats of the Australian arid zone, emphasising Aboriginal traditional use of flora and fauna.

The report reviews the Draft Environmental Impact Statement (DEIS), public comments on the DEIS and the proponent's responses to these comments in the Supplement to the DEIS. The DEIS and the Supplement together constitute the final EIS. The report also relies on comments and advice provided by Northern Territory Government agencies.

1.1 Environmental Assessment Process

Environmental impact assessment fully defines those parts of the environment which may be affected by a proposed development, and quantifies the significance, risks and consequences of the potential impacts of the proposal at a local, regional and global level, as appropriate.

This report will assess the adequacy of the EIS to gauge the environmental impacts of developing and operating the proposed Desert Wildlife Park and Botanic Gardens, and will evaluate the undertakings and environmental safeguards proposed by the proponent to mitigate or avoid those impacts. Further safeguards may be recommended as appropriate.

The safeguards may be implemented at various stages within the planning process of a project. These stages are:-

- **Site selection**
- **Layout of facilities**
- **Design of facilities**
- **Processes used in facilities**
- **Management of processes and facilities**

The recommendations arising from the assessment of a proposal will refer to these different aspects of the project.

1.2 Environmental Assessment History

A Master Plan was prepared to refine the Conservation Commission's original Concept Plan and provide guidelines for more detailed planning, design and construction of the Park. The Master Plan was prepared so that it could also serve as a Draft Environmental Impact Statement in accordance with the requirements of the *Environmental Assessment Act 1982*.

The DEIS was made available for public review and comment on 22nd April 1994. Copies were placed on public display in the Darwin and Alice Springs public libraries, Conservation Commission Regional offices in Alice Springs, Darwin and Katherine, tourist information offices in Alice Springs and Tennant Creek, the Tangentyere and Arrernte

Aboriginal Council offices in Alice Springs and the Arid Lands Environment Centre. The relevant Northern Territory Government departments and agencies were also invited to comment. The public review period ended on the 20th May 1994.

A total of 16 written submissions were received on the DEIS: 14 from Northern Territory Government departments and agencies and two from public bodies.

A list of the respondents to the DEIS is provided at Appendix 1 of this report. Appendix 2 provides a breakdown of the issues and sub-issues raised.

The Supplement to the DEIS was received on 5th August 1994 and distributed to Northern Territory Government departments and agencies for examination and comment. These comments are incorporated as appropriate in this report.

2 THE PROPOSAL

The 1,100 hectare Park will extend westwards from Heavitree Gap to the West MacDonnells National Park boundary, and south from Larapinta Drive to the southern foothills of Heavitree Range (Figure 1).

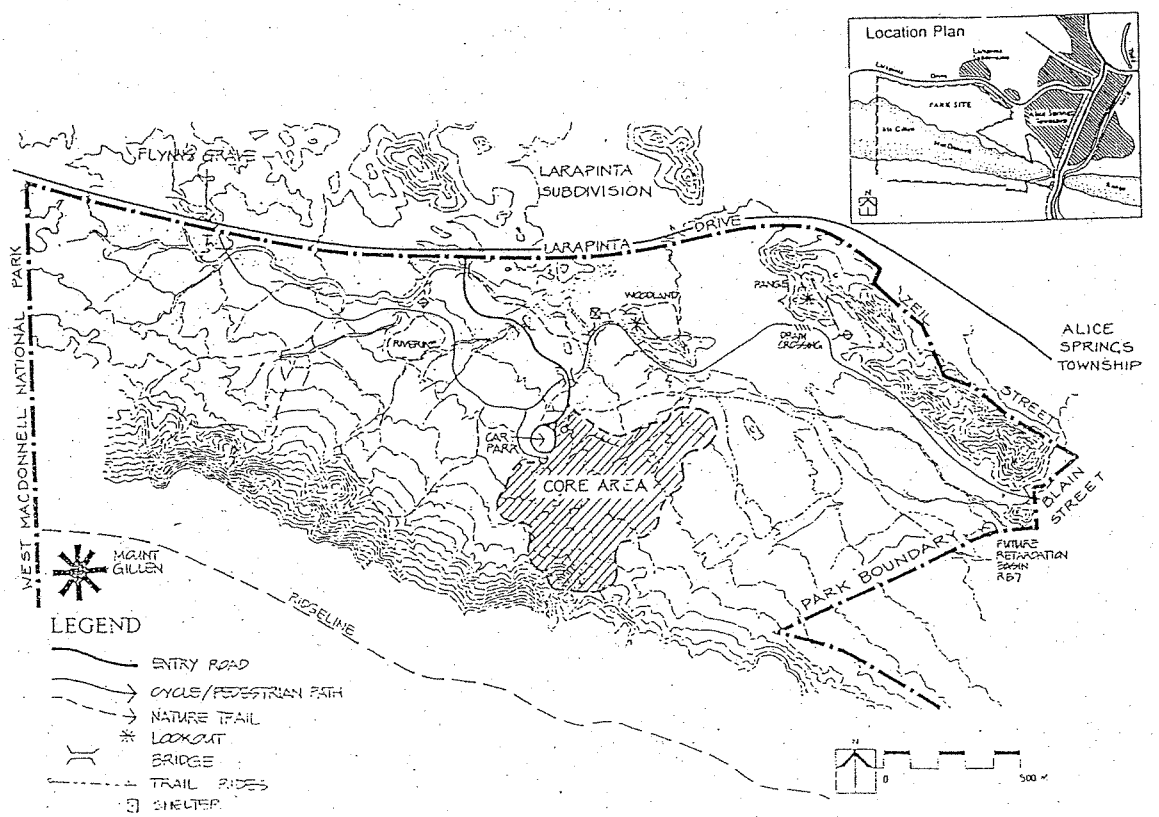

Figure 1 Greater Site and Core Area

2.1 The Park

Set within this larger Park site will be an intensively developed **Core Area** of 38 hectares where most of the exhibits, visitor services, and associated facilities will be developed (Figure 2). The Core Area contains several major elements:

- A **Visitor Centre** including a major Interpretive Centre, Administration and Education building, Food Service, Retail Area, and Visitor Amenities.
- Six major **Habitat Exhibits** along a 1.9 kilometre primary pedestrian path and three smaller plant community exhibits.
- A 250-seat **Nature Theatre**.
- A **Thematic Display Area**.
- A landscaped **Community Recreation Area** and adjoining **Event Terrace**.
- A shaded **carpark and drop-off** area will be strategically located adjacent to the Visitor Centre and Community Recreation Area.

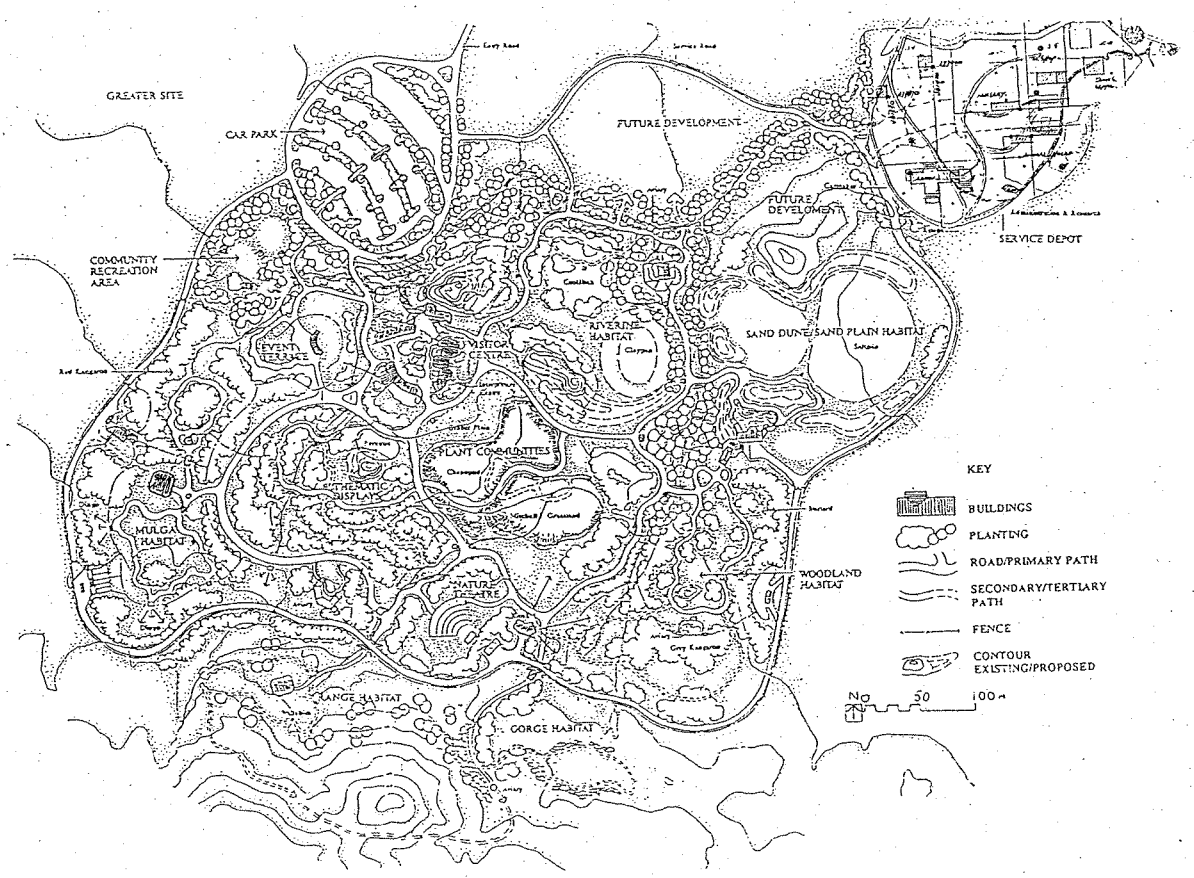

Figure 2 Core Area Concept Plan

- Two **Future Development Areas** have been identified for later requirements that might arise as the Park grows.

- A **Service Depot** will be located at the edge of the Core Area, but screened from the main visitor use areas, and include the following facilities:
  - plant nursery;
  - exhibit construction and materials storage;
  - animal holding and veterinary facility;
  - plant and animal quarantine areas;
  - administration and staff amenity centre;
  - research facilities; and
  - staff residences.

The remaining natural bushland will provide a backdrop for the Core Area developments. It will be managed to provide a recreation area for visitors and a buffer to the adjoining urban areas.

Power, water, telecommunications and natural gas will be brought into the Core Area directly off Larapinta Drive to the Visitor Centre and Service/Research Depot. Services will then be reticulated around the Core Area via a shared trench following the primary path system.

Fire detection and protection systems will be installed in the Park's major built areas.

2.2 Costs and Staged Development

The Park's total capital cost is estimated at $24.05M. The Park will be constructed in four main stages (Figure 3).

The first stage of development of the Park ($15.86M) will include the major attractions of the Visitor Centre and its facilities, Interpretive Centre and displays, Sand Dune Habitat Exhibits, Riverine Habitat Exhibits, Community Recreation Area and Event Terrace.

Staged development and the sequential opening of additional attractions will also encourage return visits by patrons. The staging of Park developments has been determined according to the need to offer memorable visitor experiences from opening day, the contiguity of features and logical grouping of attractions, minimising later construction disturbance, and funding.

2.3 Issues

Issues raised during the review of the DEIS and Supplement are listed below and are the focus of the contents of this assessment report.

- **Land use and capability**

- **Soil salinity**

- **Water management**

- **Waste management**

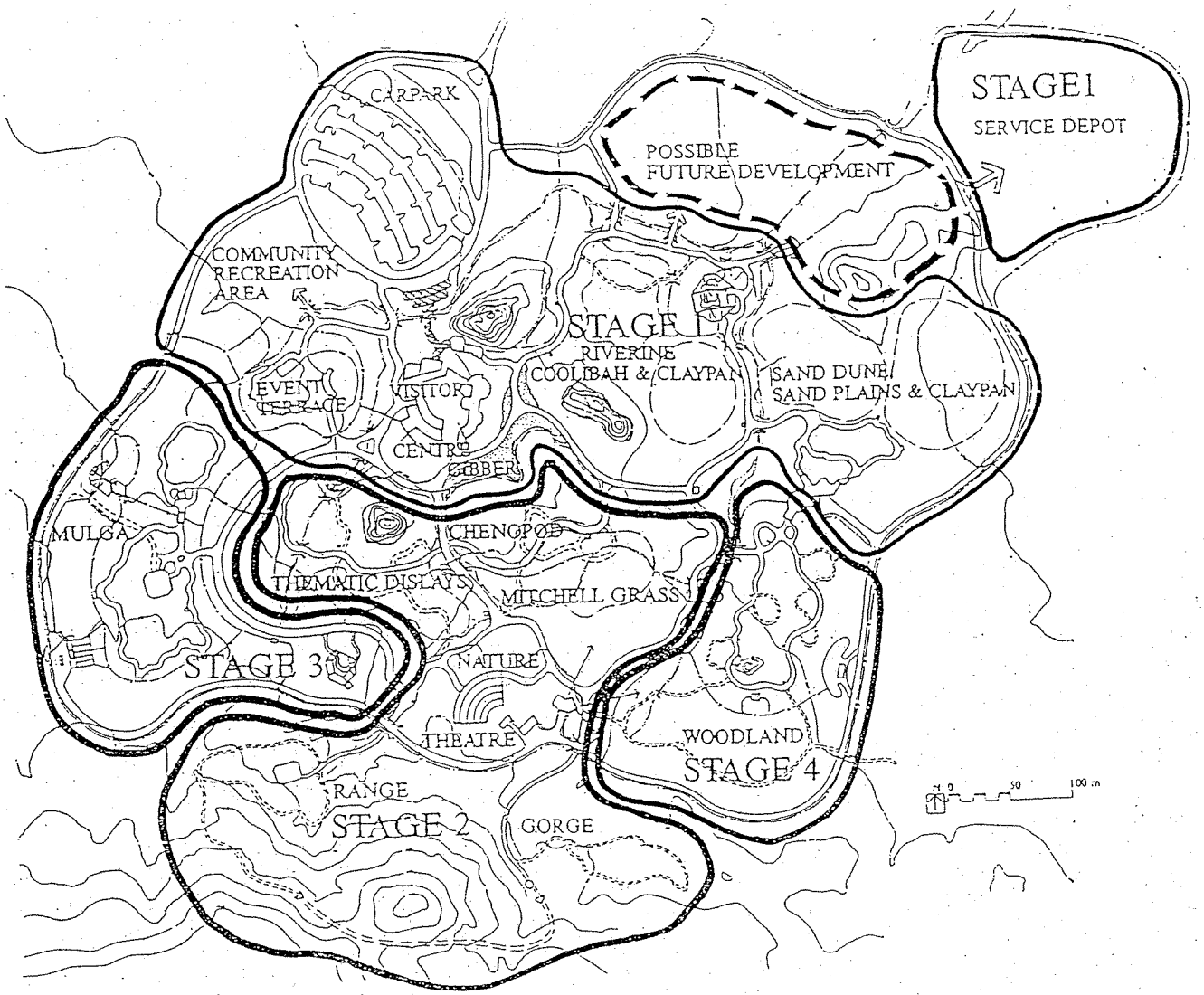

Figure 3 Construction Staging Plan

3 REGIONAL SETTING

3.1 Alice Springs

Alice Springs was established as an important staging post during the construction of the Overland Telegraph line from Adelaide to Darwin. Gold was discovered in the ranges to the east, and today the town has expanded to a population in excess of 25000 people. The population varies somewhat with seasonal trends in tourism.

Although Alice Springs provides a broad regional focus for the tourist, mining, pastoral and transport industries, the economic mainstay is from the steadily growing tourism sector.

3.2 Biogeography

The area is dominated by the MacDonnell Ranges stretching 150 kilometres to the east and 240 kilometres to the west of Alice Springs. Alluvial gravelly flats and sandy creek beds skirt the foothills of the ranges.

The dominant vegetation of the ridge crests and hillslopes is *Acacia macdonnelliensis* (Hill Mulga) and *Triodia* and *Plectrachne spp* (Spinifex), and the flats typically carry *Acacia kempeana* (Witchetty Bush) and *Acacia aneura* (Mulga Bush) with *Eucalyptus camaldulensis* (River Red Gum) in and near the creek beds.

Alice Springs is in the summer rainfall zone, but the mean annual rainfall of 250 mm is highly variable and the area may be subject to prolonged drought. Winter temperatures typically range from 4°C to 19°C and summer temperatures range from 21°C to 36°C. The highest summer temperature on record is 45.2°C. The incidence of frost is extremely variable and a Stevenson screen temperature below 0°C could be expected to occur on 50 to 90 days a year. The mean annual evaporation is 3000 mm with the highest rates of 13 mm a day in January.

The town groundwater supply is from the Mereenie aquifer system which is made up of Mereenie Sandstone underlain by Pacoota Sandstone and Jay Creek Limestone. The present water level of about 150 metres below ground level is being lowered by 1.5 m to 2 m annually as the recharge fails to replenish the annual extraction of 11 billion litres. A new borefield will have to be developed in about eight years time, further south of Alice Springs than the present source at the Roe Creek borefield.

3.3 Purpose of the Park

Although 70% of Australia is arid, there are no zoological or botanical gardens interpreting the vast and unique environment of an island continent whose flora and fauna have evolved in isolation from the other southern hemisphere land masses over the last 180 million years.

The Park incorporates the soaring cliffs of Mt Gillen, with alluvial gravel fans below the footslopes leading to sandy creek flats fringed with River Red Gums and interfluves dotted with Ghost Gums. This is an ideal setting for a series of habitat displays that will help visitors to know and understand more fully the desert environment which will enhance their enjoyment of the whole region.

Many desert creatures avoid exposure to the daytime heat and consequently visitors to the region are often unaware of their existence. The Park can reveal such animals in indoor intensive habitat displays where light regimes and other environmental factors can be readily controlled.

The culture of the Aboriginal people is intimately linked with the landscape and its plants and animals and the Park will provide a unique opportunity to introduce visitors to the relationship that the desert people have with their environment.

4 ENVIRONMENTAL ASSESSMENT

4.1 Introduction

It is important when interpreting this report that the recommendations in **bold type** are not considered in isolation: the text identifies concerns, suggestions and undertakings associated with the project.

It is acknowledged that during detailed implementation of proposals, flexibility is necessary and desirable to allow for minor and non-substantial changes to the designs and specifications which have been examined as part of this assessment. It is considered that subsequent statutory approvals for this proposal could make provision for such changes where it can be shown that the changes are not likely to have a significant effect on the environment.

Subject to decisions which permit the Desert Wildlife Park and Botanic Gardens to proceed, the primary recommendation resulting from the assessment is as follows:

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards identified in the Environmental Impact Statement, or as modified by this assessment report or an approved Environmental Management Plan.

Four major environmental issues were identified as being associated with the construction and operation of the Desert Wildlife Park and Botanic Gardens. A number of minor issues relevant to environmental management and monitoring were also identified, and the proponent has made a number of commitments to address these (see Appendix 3 and also Section 5).

4.2 Land Use and Capability

The main objective of a land use and capability study is to provide essential data for sustainable development of buildings, roads, tracks, irrigation, drainage and plantings.

Adequacy of description of existing environment

Landforms and land units have been mapped at a scale of 1:5000 and described in sufficient detail for some appraisal to be made of the capability of the land to support the developments proposed.

The Core Development Area of approximately 38 ha is composed mainly of low hills (Land Unit 1.3) and alluvial fans (Land Units 3.1 and 3.2). These units have moderately erodible soils with low to moderate salinity.

In the west of the Core Area are three small areas totalling 0.75 ha that are highly erodible, and two areas totalling 0.5 ha that are highly saline.

Although the Supplement provides an overview of the soils and landforms of the whole 1100 ha of the Park, it does not devote any particular attention to the Core Development area. For example, although 51 soil profile sites were chosen on the basis of five alternative development sites, only one soil profile was described on the chosen site.

However the Supplement does provide a description of the land units found on the site which is sufficient to draw attention to the limitations to development and the consequent engineering and management requirements.

Evaluation of potential impacts and safeguards

Growth and survival of central Australian plants is dependant to a large degree on soil texture, salinity and local water regimes. Although one third of the Core Development Area is Land Unit 1.3, shallow soils with an abundance of rock outcrop, the scale of mapping means that there is uncertainty as to the variability of texture characteristics across the site. Similarly there is no inventory of plants and their health correlated with soil texture on site. Consequently the success or failure of various plantings cannot be predicted.

Potential impacts relate primarily to failure to match species to particular sites and soil types. Plantings that are intended to supplement existing growth or to mimic ex-situ habitats may fail partially or completely, leading to expensive remedial works or the need to redesign or reconstruct habitats.

As a safeguard an inventory of soil texture and associated vegetation (species and health) should be compiled based on a 100 m by 100 m grid. Anomalies can be checked and difficult or problem areas may be subsequently mapped in finer detail. Vegetation can be mapped from aerial photos and ground truthed in conjunction with soil mapping.

See Recommendation 2.

4.3 Soil Salinity

The management of irrigation in arid areas requires detailed knowledge of the location and depth of soil salinity and the drainage characteristics of the soils concerned.

Adequacy of description of soil salinity

All land units represented in the Core Development Area, except Land Unit 1.2, were tested for salinity. Only one soil test pit occurred in the Core Development Area. It is uncertain how representative these salinity tests are for the whole area within one land unit and it is unknown how representative they are for the Core Development Area.

It appears that there is at least some risk over the whole Core Development Area. Consequently the patterns of soil salinity need to be adequately determined for the Core Area and correlated with extant vegetation.

Evaluation of potential impacts and safeguards

Different arid zone plant species vary in their tolerance to soil salinity. Irrigation may exacerbate soil salinity by raising the local water table and bringing salt to the surface in solution. Surface evaporation may then concentrate this salt in the upper layers.

The mobilisation of salt upwards into the plant rooting space can be counteracted by applying sufficient irrigation water to maintain a net downward movement of water through the soil. However, the rate of application of irrigation water is dependent on the age and species of plants being established, and it may not be possible to vary rates without detriment to the plants. Where excess water percolates through a soil profile, saline seepage may appear at or near the surface in areas adjacent to the irrigated area.

This could also be a problem in ex-situ habitats, where there may be a major textural discontinuity between the original natural surface and imported materials used to reconstruct sand dunes or sand plains. Therefore it is essential that the surface and subsurface salinity and drainage characteristics of developed areas are determined.

The soil and vegetation mapping discussed in the previous section will provide the basis for a thorough appraisal of drainage and salinity of the Core Development Area. Anomalies can be subsequently investigated by mapping at a finer scale.

Recommendation 2

The proponent shall carry out an inventory of soils and vegetation on the Core Development Area based on a 100 metre by 100 metre grid to determine soil texture, drainage characteristics, salinity factors and the correlation between particular species and soil types.

4.4 Water Management

The four important aspects of water management that will need to be addressed are: sheet flooding, irrigation water supply, water storage, and surface seepage.

Adequacy of description of existing environment

Slope is a significant factor in storm water run-off rate. The topography of the Core Development Area is uneven, with slopes mostly in excess of 1% but usually not more than 3%. This indicates that sheet flooding could be a problem.

Although the DEIS recognises that stormwater is an important issue, it does not address the risk posed by sheet flooding. The comprehensive landforms and soils report by Grant and Mahney (1993) produced after the DEIS was completed indicates that a substantial portion of the Park's core area is at least at low risk of sheet flooding. Land Unit 3.1 and

Land Unit 3.2, comprising half the Core Development Area, are at moderate to high flood risk.

The Park's irrigation water needs are covered in detail in the DEIS and the Supplement shows that pumping from the Town Basin aquifer is an impractical option.The annual requirement of water from the reticulated supply (sourced from the Roe Creek borefield) is 80 million litres which is within the Power and Water Authority's capacity to provide.

The DEIS recognises the need for strict economy in the use of Alice Springs potable supply and mentions the possible use of a retardation basin in the Larapinta Valley to intercept and harvest floodwater. However there are no designs for this retardation basin and its feasibility is unknown.

The Park will operate a desalination plant using the reticulated supply to produce salt free water to create ephemeral wildflower blooms and to periodically flush out accumulated salts. No details were provided on any of these processes. The Supplement recognises that the choice of desalination method will depend on whichever option produces the required amount of fresh water at least monetary cost.

The Supplement adequately addresses the issue of potential mosquito breeding in water storage tanks. If the retardation basin is used for water storage, mosquito larvae should be controlled with biological control products such as Teknar and Skeetal.

There is no information on sub-surface drainage. The propensity for sheet flooding suggests impeded drainage or low water holding capacity in the surface and sub-surface horizons.

Evaluation of potential impacts and safeguards

Sheet flooding could be an impediment to the establishment of in-situ and ex-situ habitats and the proposed subterranean or partially buried facilities and displays. Pot grown plants transplanted to fragile, poorly structured soils, could be uprooted or otherwise sufficiently disturbed by flooding that they fail. Enrichment plantings on areas of high erosion risk should avoid excessive soil surface disturbance. The use of mulch or other surface stabilising materials should be used where possible, except where such surface treatment would be incongruous with the natural appearance of the habitat.

Those displays completely or partially set below ground level are at severe risk of flooding by surface flows and sub-surface drainage. To mitigate the potential difficulties and problems associated with sheet flooding, displays should be constructed either away from flood prone areas or with sufficient freeboard at surface openings to prevent surface flows from entering.

Rapid internal drainage of ex-situ habitats such as sand dunes and sand plains may cause water seepage at the junction of the introduced soil medium and the original surface. This will be especially pronounced if the local soil has impeded drainage properties, as this will create a major soil texture discontinuity.

Irrigation of local saline soils with impeded drainage horizons may produce saline seepage or higher saline water tables in areas downslope of those soils. If the seepage is sufficient

there will be saline ponding. These effects will be exacerbated by the addition of freshwater to flush out accumulated salts.

The undertaking in the Supplement to provide subterranean drainage as required is supported. Where feasible, all potentially saline drainage generated by irrigation should be diverted to the salt pan for disposal by evaporation.

4.5 Waste Management

The principal wastes to be removed are sewage and brine. The main source of brine will be the desalination plant but saline drainage from irrigation will also need appropriate disposal.

Adequacy of description of existing environment

The proposed Park sewage system will deliver up to 30 000 litres a day of treated effluent with a salt load of 0.6 gm per litre to soakage trenches alongside the natural drainage lines in the riverine habitat exhibit and along the western margin of the Service Depot. The system will be designed to enable diversion of effluent to the town system as required.

The soakage trench system is estimated to have an open surface area of 0.8 ha. Monthly evaporation rates for winter and summer are given in the EIS but not the extent or probability of high rainfall events.

The Supplement and the DEIS describe in some detail how up to 25 000 litres a day of brine containing 2 gm of salt per litre will be produced by the desalination plant and then fed either to a salt pan or the Alice Springs sewage system. The salt pan will be 0.88 ha in extent with a maximum depth of 100 mm and will not receive any run-off from outside.

No detail is given on the hourly rates at which brine reaches the salt pan and evaporates to salt.

Evaluation of potential impacts and safeguards

Disposal of up to 30 000 litres of treated effluent per day to the soakage trenches may have deleterious effects on native flora. This is particularly so in the riverine habitat, where the River Red Gums would be subject to an artificial watering regime - the usual hydrological pattern in central Australia is a short flood and long drought cycle. This species has been successfully irrigated as young stands (up to 9 years) in firewood lots using fresh or low salinity water on non-saline soils. Adverse soil and hydrological changes have resulted from effluent irrigation trials of River Red Gums at the Alice Springs sewage ponds.

It is considered that on site disposal of treated effluent may lead to salinity problems in the soakage trenches and saline ponding in adjoining natural drainage systems if not managed carefully. Consequently, the Park sewage system should be connected to the town system to allow diversion of effluent when there is a risk of salinity or waterlogging in the soakage trench areas. Effluent **must** be directed to the town system in wet weather when the saltpan overflows (see following text).

5 ENVIRONMENTAL MANAGEMENT AND MONITORING

The EIS recognises the need for a comprehensive management plan, and that details of biophysical monitoring requirements cannot be specified until the project's detailed designs and operational procedures have progressed beyond the Master Plan stage. Topics identified for inclusion in a management plan include measures to control and manage fire, soil erosion, water, soil salinity, waste, feral animals and weeds.

There will be different management requirements during the construction stages and the operational stage. Management of the construction activities will need to take account of the undertakings given in the EIS (Appendix 3) and this report in regard to preliminary site investigations and design matters. The management plan covering the operational stage will be the main focus of the following section, which considers the objectives for ongoing environmental management and monitoring.

5.1 Fire Management

The primary objective is to protect the public and the staff and assets of the Park from wildfires. The plan should take in to account the resources needed to protect the Park (fuel reduction, firebreaks, plant and equipment, people and training) as well as measures to prevent fires from originating in the Park. There may also be a need to manipulate some habitats using fire to mimic natural conditions. Such habitat manipulation should be based on expert scientific advice as well as considering traditional Aboriginal fire practices.

The proponent has undertaken to prepare a Fire Management Plan in collaboration with the Bushfires Council and Conservation Commission rangers. Comment and endorsement of the Fire Management Plan will be sought from the Northern Territory Fire Service.

5.2 Soil Erosion

The minimum objective should be to minimise erosion to a level concomitant with natural processes on undisturbed sites. In practice, it should be possible to establish greater stability by site hardening methods such as mulching and by managing storm water drainage. Monitoring of high risk areas will need to be more intensive during construction, and reducing to an appropriate level once the site is stabilised.

5.3 Water

The primary objective should be to contain and control rainfall on the site, and maximise its use for plant growth and for flushing salt from irrigated soils. Management will thus entail monitoring salinity buildup in irrigated areas and treated effluent disposal areas. Plant health and soil condition will also need to be monitored in areas receiving artificially high levels of water and nutrients to ensure sustainability of use of the site.

Water levels in the saltpan may need to be actively managed during periods when high rainfall is likely and there is insufficient freeboard to contain rainfall. However, the Power and Water Authority will need to be consulted on the acceptable level of discharges to the sewer.

Routine disposal of brine into the town sewage system is not appropriate as it would add to the existing salt load that the town system carries - currently 0.8 to 1.0 gm per litre. Although the cumulative impacts may well be minor, it is not considered best practice for a development such as this which wishes to project a positive environmental image.

It is considered that brine and saline drainage water should be disposed of by evaporation in the saltpan, with only contingency discharges in very wet conditions to the Alice Springs sewage system.

Evaporation of water from brine in the salt pan will exceed the assumed delivery rate of about 1000 litres an hour on most days of the year, except in wet or overcast weather. To prevent uneven deposition of salt on the saltpan, it may be necessary to distribute brine evenly across the pan. The depth of dry salt deposited each year should be less than 5 mm, an amount which can be easily managed.

As discussed in the Supplement, the saltpan will require an impermeable layer to prevent intrusion of saline water into local groundwater. Additionally, the saltpan will need to be isolated from the natural drainage system so that it only receives water from saline drainage systems or rainfall falling directly on the saltpan. No overland flow should enter the saltpan, and it will be necessary to engineer a bund around the site. It is considered that a bund of perhaps 300 to 400 mm could be designed to merge with the surrounding terrain so that it is not evident to visitors. Sufficient freeboard within the saltpan will be necessary to contain water from major rainfall events, but a design figure was not given in the EIS apart from a maximum preferred depth of 100 mm. Data from the Bureau of Meteorology indicates that a 72 hour (3 day) rainfall event for an Average Recurrence Interval (ARI) of 20 years would result in a total of about 193 mm of rain.

The ARI also indicates a strong probability that the salt pan would overflow once in five years at the design depth of 100 mm. It is suggested that a minimum of 200 mm be adopted, to allow for drainage and rainfall in extended wet periods.

The saltpan should have an overflow spillway to control discharges during very wet periods, and the discharge should be directed to the sewage system. It is anticipated that such contingency discharges would not place an undue salt burden on the sewage system, as such overflow discharges should be mainly fresh rain water which overlies denser salt water.

Rainfall events which exceed this capacity would also result in extensive flooding around the site, and any water released from the pan by overtopping would be diluted and discharged to the natural drainage systems. Consequently, it is expected that there will be no significant impacts from overtopping with a design freeboard of about 200 mm.

The proponent will need to consult with the Power and Water Authority to refine the design features and to determine the acceptability of the potential discharges to the sewer.

Recommendation 3

The proponent shall consult with the Power and Water Authority regarding contingency discharges of saltpan overflows to the Alice Springs town sewage system.

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Water levels in the saltpan may need to be actively managed during periods when high rainfall is likely and there is insufficient freeboard to contain rainfall. However, the Power and Water Authority will need to be consulted on the acceptable level of discharges to the sewer.

5.4 Waste

The primary objectives as stated in the EIS are to minimise waste generation through avoidance, and to re-use and recycle where feasible. Wastes which cannot be avoided, re-used or recycled should be appropriately treated and disposed of offsite.

5.5 Feral Animals and Weeds

The primary objective should be to prevent detrimental impacts on the flora and fauna of the Park. Specific measures will be required to prevent the introduction of weeds via imported materials during construction, to eliminate those already onsite, and to prevent the spread of any weeds to adjoining land.

6 CONCLUSION

It is considered that all significant environmental issues associated with the development and operation of the Desert Wildlife Park and Botanic Gardens have been identified. Some have been resolved through the assessment process, and others will be addressed during the detailed design and construction stages. There is a requirement for ongoing environmental management, and this will be supported by monitoring programmes to inform Park management about the status of soil erosion and salinity, irrigation regimes, water use and so on.

Development and operation of the Park will not result in any significant residual impacts provided that the environmental safeguards and recommendations contained in the EIS and this report are adopted. It is considered that the formulation and implementation of an environmental management plan supported by appropriate monitoring programmes will ensure that the Park enhances the amenity of the local environment.

APPENDIX 1 SUBMISSIONS RECEIVED (WITH RELEVANCE FOR DEIS)

Submission Number	Date Received	Organisation	Address	Nature of Organisation	Issue Number
1	11 May	Land Conservation Unit, Conservation Commission	CCNT P.O. Box 1046 Alice Springs NT 0871	Specialist Unit within CCNT	1, 2, 3, 12, 13, 14, 26
2	12 May	Department of Mines and Energy	G.P.O. Box 2901 Darwin NT 0801	NT Government Department	24
3	18 May	Bushfires Council of the Northern Territory	CCNT P.O. Box 1046 Alice Springs NT 0871	Specialist Unit within CCNT	22
4	20 May	Department of Primary Industries and Fisheries	P.O. Box 8760 Alice Springs NT 0871	NT Government Department	6, 7, 23
5	20 May	Power and Water Authority	G.P.O. Box 1921 Darwin NT 0801	NT Government Department	8, 10, 12, 15
6	20 May	Department of Health and Community Services	P.O. Box 40596 Casuarina NT 0811	NT Government Department	9, 10, 11, 15, 27, 28
7	20 May	Environment Unit, Conservation Commission	CCNT P.O. Box 1046 Alice Springs NT 0871	Specialist Unit within CCNT	17, 18, 20, 21, 23
8	23 May	Museums and Art Galleries of the Northern Territory	G.P.O. Box 4646 Darwin NT 0801	NT Government Agency	3, 4, 15, 19, 29
9	23 May	Greening Australia	P.O. Box 9081 Alice Springs NT 0871	Community Group	16, 25, 30, 31
10	30 May	Alice Springs Town Council	P.O. Box 1071 Alice Springs NT 0871	Local Government	5

APPENDIX 2

SUBJECT AREAS AND ISSUES RAISED IN SUBMISSIONS

Section	Subject Areas and Issues	Submission Number
4.1	**Soils**	
	1 Inadequate soil description in site analysis	1
	2 Inadequate soil description of core development area	1
4.2	**Flooding**	
	3 Inadequate assessment of flood risk, particularly sheet flooding	1, 8
	4 Impacts of works on inundation of adjoining areas	8
	5 Operational responsibility for proposed retardation basin	10
4.3	**Site Disturbance**	
	6 Impacts of ex-situ habitat creation	4
	7 Impacts of saltpan creation	4
4.4	**Water Supply and Irrigation**	
	8 Alternative irrigation water supplies	5
	9 Rainwater storage and mosquito breeding	6
	10 Excessive irrigation rates and overflow	5, 6
	11 Brine production and disposal	6
4.5	**Salinity**	
	12 Salinity risks and appropriate irrigation regimes	1, 5
	13 Saline soils within core development area	1
	14 Plant selection and salinity	1
4.6	**Sewage Disposal**	
	15 Suitability and potential problems with proposed sewage disposal/re-use system	5, 6, 8

Section	Subject Areas and Issues	Submission Number
	Plant and Animal Management	
4.7	16 Impacts of Kangaroo enclosures	9
	17 Weed control during construction and operation	7
	18 Potential for spread of non-endemic plant species	7
	19 Feral animal control	8
4.8	**Operations, Monitoring and Wastes**	
	20 Monitoring requirements	7
	21 Energy and wastemanagement	7
	22 Need for fire management plans and equipment	3
4.9	**Off-site Implications**	
	23 Extraction of construction materials/fill	4, 7
	24 Sources of rammed earth	2
	25 Remnant bush along entrance corridor	9
4.10	**Miscellaneous**	
	26 Understated rockfall hazard	1
	27 Rehabilitation of existing tip sites	6
	28 Retention of "example rubbish"	6
	29 Government endorsement of selected site	8
	30 Replication of claypan and Coolibah communities	9
	31 Fence screening	9

ENVIRONMENTAL REQUIREMENTS OR COMMITMENTS

Requirement/Commitment	Page Number *
4.1 Soils	
• Apply land unit capability assessments in siting and detailed planning and design of developments.	22
4.2 Flooding	
• Consider 1 in 100 flood risk in detailed design of facilities in Service Depot's north-east corner.	25
• Consider moderate inundation risk and moderate to high sheet flow risks in detailed design of developments/displays in riverine habitat exhibit, community recreation area, part of Service Depot, part of visitor car park, and sections of access road.	26, 27
• Consider sheet flow risks in siting and detailed design of all developments, especially subterranean and partially-buried facilities.	27
• Apply water harvesting principles and consider drainage requirements in detailed design of developments and landscaping.	28
• Investigate practicality of dual stormwater retardation and harvesting/diversion roles in design and operation of RB7.	29
4.3 Site Disturbance	
• Address effective and reliable containment of brine as a priority in detailed design of saltpan in sand dune and plains habitat exhibit, including design and management requirements and monitoring. Provide detailed designs and operating guidelines to Conservation Commission Environment Unit for comment/endorsement.	32-3, 39
• Investigate alternative saltpan presentation options - if warranted.	33

* refers to page number in the Supplement.

Requirement/Commitment	Page Number
4.4 Water Supply and Irrigation	
• Include tank covers, to control evaporation and mosquito breeding, in provision of water storage tanks in Service Depot.	34-5
• Refine and vary irrigation for lawns within community recreation area to achieve maximum water efficiency and cost-effectiveness, install appropriate measures to avoid ponding in stormwater system of required.	36
• Address avoidance of ponding in stormwater system in detailed design of developments, displays and landscaped areas.	36
• Investigate most appropriate water desalination technology and plant type, provide details of preferred system to Conservation Commission Environment Unit for comment/ endorsement.	37
• Investigate alternative or back-up brine waste water disposal systems in collaboration with Power and Water Authority, provide details of preferred system to Conservation Commission Environment Unit for comment/endorsement.	39
4.5 Salinity	
• Undertake continuing investigations, planning, design, trial, operational and monitoring efforts into the prevention and management of irrigation-induced or exacerbated salinity - particularly in the longer term.	40,42
• Investigate proposed "salt flushing" strategy and sub-surface drainage options as possible irrigation and salinity management measures.	43
• Consider localised soil salinity in selection of plant species in/around Visitor Centre complex.	

Requirement/Commitment	Page Number
• Identify appropriate bitumen grade specifications for sections of access roads and visitor carpark over highly or moderately saline soils.	44, 45
• Investigate site-specific soil salinity, and possible alternative screen/shade planting species, across visitor carpark site.	45
4.6 Sewage Disposal	
• Identify measures to overcome blockages and subdivide soakage fields during detailed design of sewage distribution/absorption system, provide detailed designs to Conservation Commission Environment Unit for comment/endorsement.	46,47
• Consider potential for contamination of proposed waterbodies during detailed siting and design of sewage disposal/re-use system and riverine habitat exhibit.	48
• Acknowledge nearby highly saline soils during detailed siting and design of sewage disposal/re-use system.	48
4.7 Plant and Animal Management	
• Undertake continuing weed monitoring and control measures, with heightened control efforts during and immediately following construction activity.	50, 51
• Eradicate outlying Couch Grass infestation near Service Depot prior to start of earthworks or construction at this site.	51
• Identify special protection guidelines to limit spread of Couch Grass from Larapinta Drain, especially during construction of proposed pedestrian/bicycle path.	51
• Assess "escape and establishment" risk of non-endemic plants and animals in preparation of collection plans.	52-3

Requirement/Commitment	Page Number
• Consider escape risks, particularly for venomous or potentially dangerous species, in detailed design of animal displays.	53
• Prepare set of emergency animal recapture procedures.	53
• Include more frequent monitoring of downstream River Red Gum woodlands, and sites adjoining core area displays, for control of any non-endemic plant species in weed control programme.	53
4.8 Operations, Monitoring and Wastes	
• Prepare monitoring plan during Stage 1 of Park's development, provide to Conservation Commission Environment Unit for comment/endorsement.	55
• Review/update monitoring plan at least every 3 years.	55
• Consider energy efficiency and waste minimisation from detailed design stage onwards, include energy efficiency requirement in all design briefs.	56
• Consider energy demands during detailed design of nocturnal displays, investigate practicalities of "half-phase" nocturnal displays.	56
• Include waste minimisation and management guidelines in Park's standard operating procedures.	56
• Prepare energy and waste management plan during Stage 1 of Park's development, provide to Conservation Commission Environment Unit for comment/endorsement, review regularly.	56-7
• Prepare Fire Management Plan and subsequent Fire Action Plans, provide to Northern Territory Fire Service and Bushfires Council for comment/endorsement.	57

Requirement/Commitment	Page Number
• Include small fire tender with tank, and other mobile fire fighting equipment, in Park's equipment requirements.	57
4.9 Off-site Implications	
• Undertake necessary environmental assessment and approval processes for winning of construction materials, fill, display and biological material from non-approved natural areas off-site.	58
• Ensure any off-site removal/collection of biological material accords with scientific collection guidelines and advice from Conservation Commission wildlife or botanical specialists.	58
• Detail landscape treatment of Larapinta Drive along northern boundary and main access road in Park's Landscape Overview.	59
4.10 Miscellaneous	
• Undertake detailed assessment of local rockfall hazard prior to, or during, detailed design of range and gorge habitat exhibits.	61
• Ensure adequate compaction of filled and rehabilitated degraded sites.	61
• Ensure careful selection of any "example rubbish" retained for interpretive use, exclude use of putrescible waste.	62
• Detail screening of boundary and core area fencing in Park's Landscape Overview.	65
• Consider visual impacts in siting and design of core area fence.	65