Northern Territory Government

Discussion Paper

Towards an Area Plan for the Knuckey and Ironstone Lagoons Locality

- Investigation into Land Use Options –

JUNE 2013

NORTHERN TERRITORY PLANNING COMMISSION

EXECUTIVE SUMMARY

Environmental protection is a key philosophy underpinning appropriate land use and development when responding to opportunities for growth. There are very few situations where there is a greater need for adherence to this philosophy than in the Knuckey and Ironstone Lagoons locality with the significant natural features of the lagoons and connections with Holmes Jungle and the strategic position of the locality within the Darwin region. Current land use reflects the historic position of the area on the outskirts of early Darwin and later land use controls that responded to the constraints associated with the natural environment and the proximity to the airport.

Ties to the rural heritage and amenity are still strong with some residents and land owners keen to see the existing land use controls remain. However proximity to Darwin, Palmerston and Berrimah and East Arm is generating interest in land uses which are currently precluded. Opportunities for alternate use need to be considered within the context of the views of land owners and the community, the significant contributions the wetland habitat makes to the conservation of biodiversity, and the relationship of water resources to other environmentally sensitive areas in the broader locality, particularly Holmes Jungle.

The area immediately around Knuckey and Ironstone Lagoons is part of Litchfield Shire and shares some issues and opportunities with other localities within the shire, particularly rural amenity and the need for infrastructure to support any further development. Notwithstanding the similarities, there are also distinct differences. Proximity of the locality to the range of facilities and services available in urban areas suggests the natural environment, rather than local facilities and services, will provide the focus for development of a coherent local community. The area to the west of Vanderlin Drive is within Darwin City. The proximity to the urban area is generating interest in development opportunities in this section of the locality.

The Challenge

This Discussion Paper is the first step in exploring a sustainable approach to future use and development within the Knuckey and Ironstone Lagoons locality. The challenge is to examine the tensions between the various aspirations of land owners and the community within the context of the constraints associated with the natural environment and to explore options for future use. The outcome of these discussions will inform the preparation of a draft area plan.

TABLE OF CONTENTS

1. INTRODUCTION

Land use planning in the Darwin region is a dynamic process responding to various environmental and physical influences. While environmental sensitivity and external impacts are significant influences on land use and development in the Knuckey and Ironstone Lagoons locality, its strategic location and amenity value encourages some land owners to entertain alternate land use options.

The interests of land owners vary, as do opinions about the factors which contribute to the amenity and what is necessary to protect what is valued. Some consider that smaller rural residential or rural living lots would be detrimental to the environment. Others are keen to explore opportunities for smaller lots. Some consider that the low density of development associated with the existing larger lots should be maintained. Others are interested in more intense development of the existing larger lots, advocating such development has the potential to enhance recognition of the significance of the natural environment.

The existing zones reflect the past response to the constraints associated with proximity to the Darwin International Airport and the ecological importance of the lagoons.

Given the increasing significance of the strategic position of the locality, a review of current policy is timely to ensure any future development balances the tensions generated by various aspirations in relation to environmental protection, economic development and social equity.

The review is proposed as a two stage process. The first stage will involve consultation with land owners and the community about issues and opportunities and possible options which respond to these. This Discussion Paper is designed to inform that consultation.

The second stage of the process will involve refinement of the options, reflecting the outcomes of the community consultation and, depending on the outcome of that process, may include preparation of a draft Area Plan to be considered for inclusion in the NT Planning Scheme.

You, as a land owner in the Knuckey and Ironstone locality or as a member of the broader community, are invited to consider the issues and contribute to a discussion of possible future land use options.

1.1 Objectives of this Discussion Paper

The first objective of this Discussion Paper is to provide contextual background to the existing policy framework, zoning and land use.

The second objective is to identify land use issues and explore the implications of these for future use and development.

The third objective is to establish parameters which will inform future land use and identify options within the context of these parameters with a focus on protection of the natural environment and appropriate responses to opportunities associated with the strategic position of the locality in the region.

1.2 Study Area

Regional and Local Context

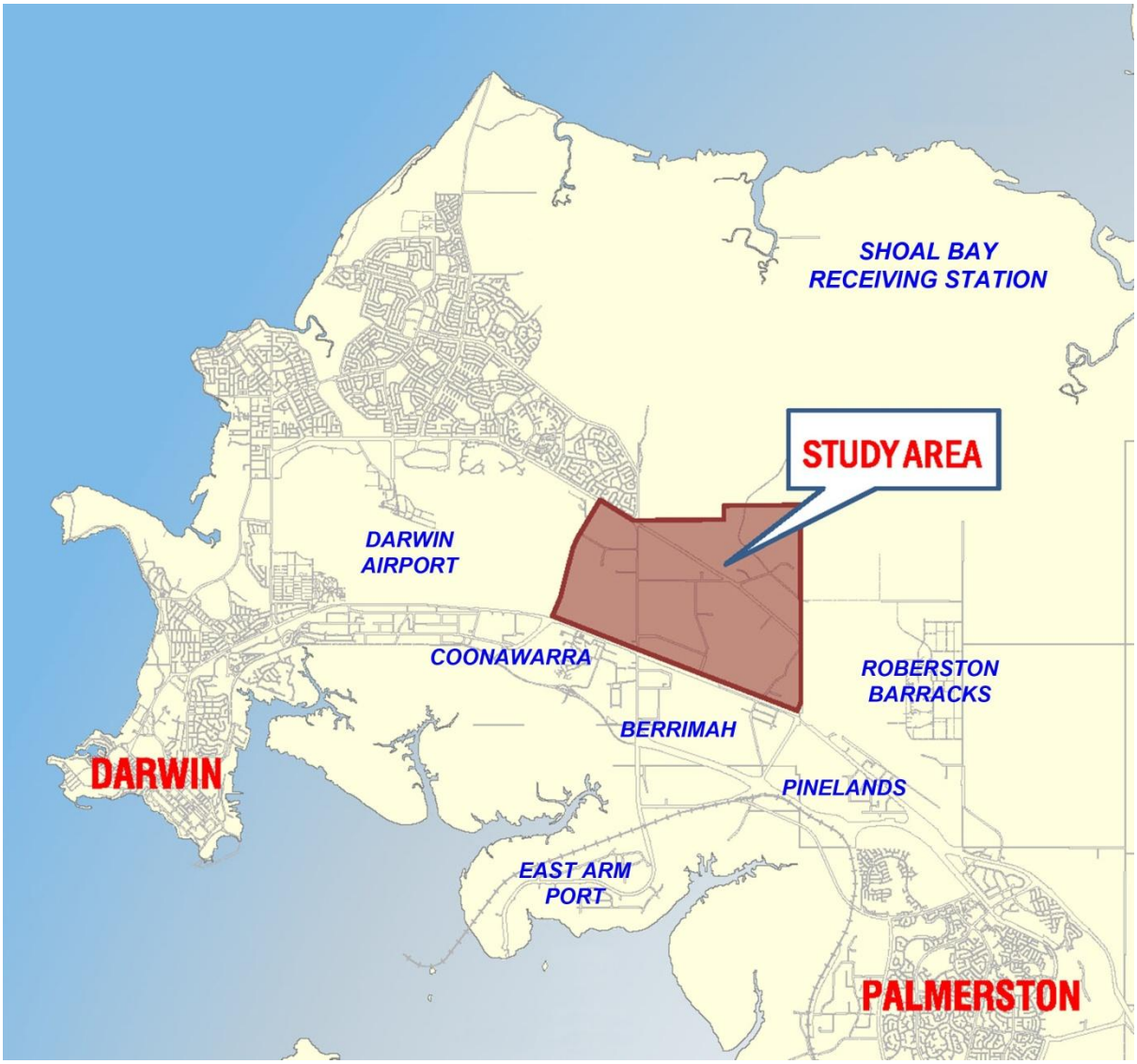
Knuckey and Ironstone Lagoons make a significant contribution to biodiversity conservation in the Darwin Region. The lagoons and wetlands and the hydraulic connection to Holmes Jungle via the aquifer that extends to Marlow Lagoon in Palmerston and Hudson Creek contribute to the importance of this habitat.

Current land use is characterised by a range of rural, rural living and commercial activities. The first influence on land use was the area's historical positioning on the outskirts of early Darwin, separated from the urban areas by the airport. The significance of the natural environment and the constraints associated with the proximity to the airport informed land use controls which continue to guide development.

Today, in the regional context, the locality is strategically located equidistant from Darwin and Palmerston and proximate to significant employment centres including Darwin International Airport, various Defence facilities and East Arm Port and associated industrial areas.

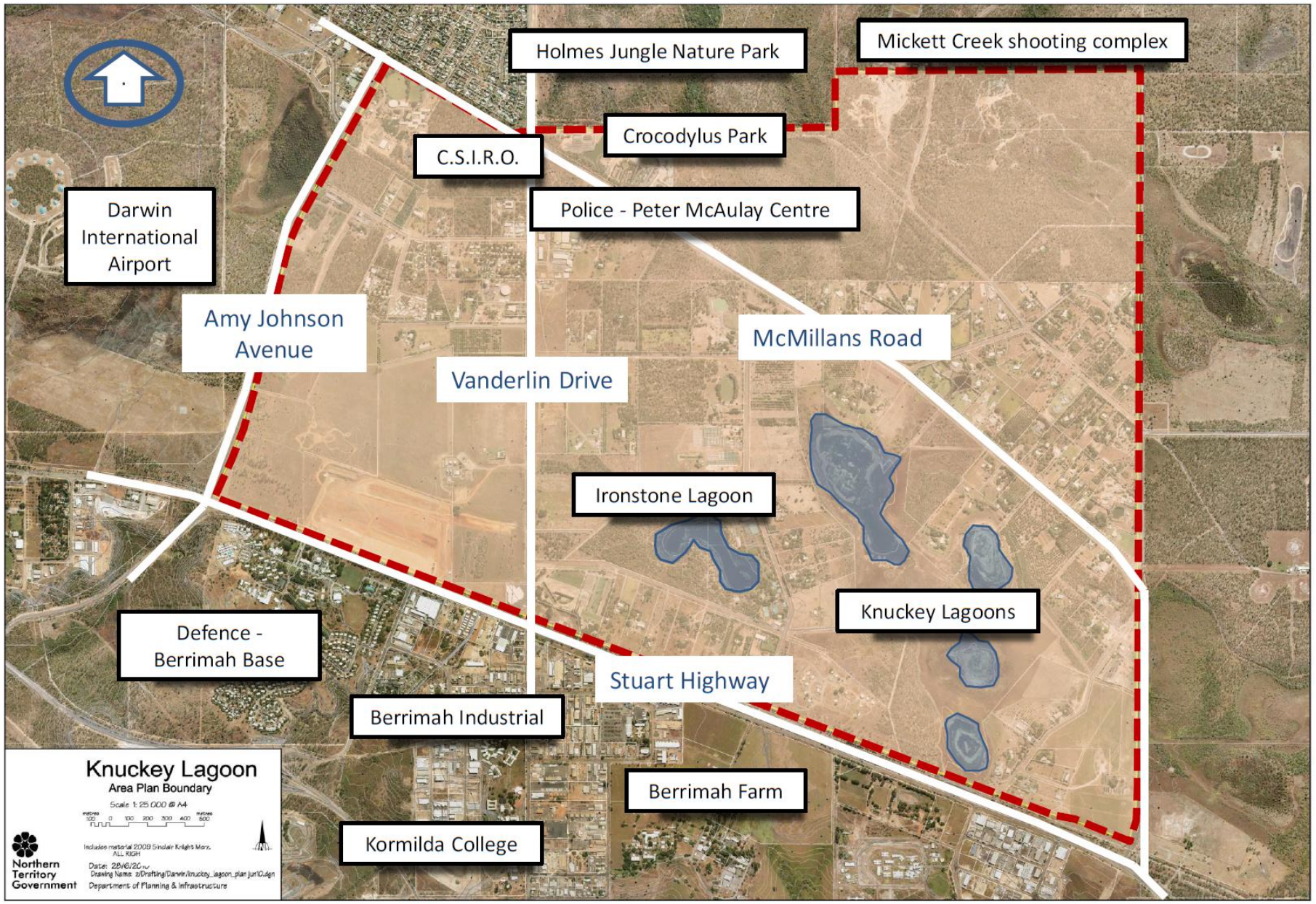
The Stuart Highway, McMillans Road, Amy Johnson Avenue and Vanderlin Drive form part of the arterial road network providing excellent access to and from the broader region.

Regional Context



Study Area

The principal focus of the study is the area extending from Amy Johnson Avenue in the west to McMillans Road in the east and from the Stuart Highway north to Holmes Jungle and the Mickett Creek Shooting Complex, which includes the conservation areas associated with Knuckey Lagoons and Holmes Jungle and various rural and community uses. Although relatively confined, the study area is significant in terms of linkages to adjacent natural areas and its location within a regional context. This confirms the need for consideration of both local and regional issues.


Holmes Jungle Nature Park
Mickett Creek shooting complex
Crocodylus Park
C.S.I.R.O.
Police - Peter McAulay Centre
Darwin International Airport
Amy Johnson Avenue
McMillans Road
Vanderlin Drive
Ironstone Lagoon
Knuckey Lagoons
Defence - Berrimah Base
Stuart Highway
Berrimah Industrial
Berrimah Farm
Kormilda College
Knuckey Lagoon
Area Plan Boundary
Scale 1: 25,000 @ A4
Northern Territory Government
Department of Planning & Infrastructure

Things to be considered:

Are there issues with the ongoing maintenance of the natural environment?

If there are issues how can they be addressed?

What are the factors which contribute to the amenity of the locality?

How should these be protected?

Should land uses in the locality be allowed to further diversify?

If so how are land use conflicts to be minimised?

Is there potential to create a more coherent community?

How might this be achieved?

What factors would contribute to a balance between protection of the natural environment and the amenity it provides and providing opportunities for development?

2. BACKGROUND

2.1 Strategic Context

As Darwin continues to grow the quality of life enjoyed by the existing community and future generations will depend on the management of that growth. Clear and coherent frameworks for future development in the region or for key localities within the region will assist in management of the future use and development of land.

Creative responses to the key interdependent imperatives of the needs of the natural environment and the human community that lives within it will provide for both immediate and long term needs. Effective, efficient and sustainable development responds to available opportunities within the context of prevailing constraints.

A vision for the Knuckey and Ironstone Lagoons locality may be characterised by:

- the creation of a place where people enjoy a strong sense of community and live in balance with the natural environment; and
- protection and appreciation of the value of biodiversity and the natural landscape.

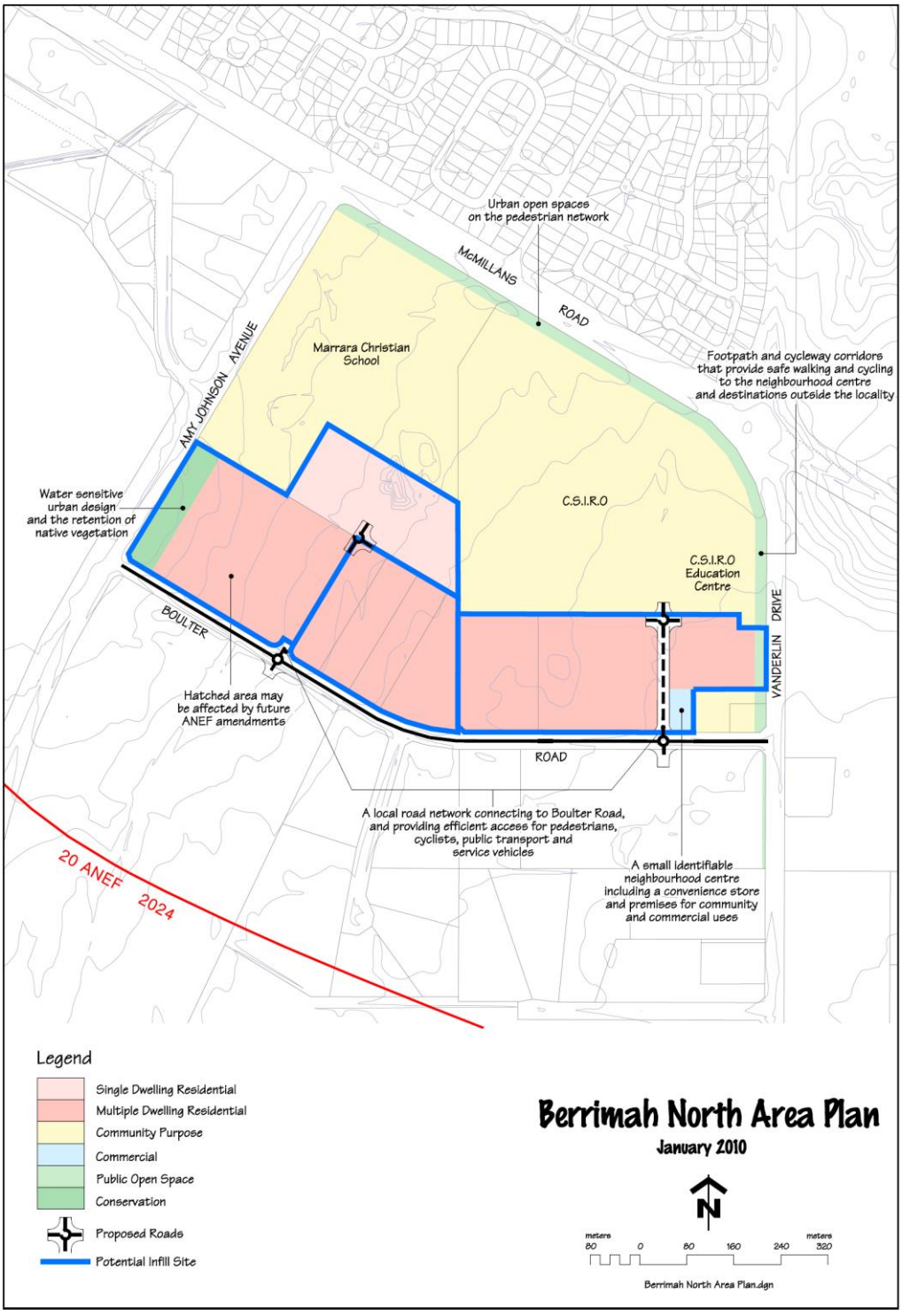
2.2 Regulatory Context and Land Use Policy

The use and development of land in the Ironstone and Knuckey Lagoons locality is regulated by the *Planning Act* and NT Planning Scheme. The Litchfield Planning Concepts and Land Use Objectives 2002, a policy in the Planning Scheme relevant to interpretation of specific provisions of the scheme, promulgates the intent of the Knuckey and Ironstone Lagoons locality to be continued development for rural living and community uses subject to consideration of issues associated with the proximity to the Darwin International Airport and the potential impacts on the natural environment.

The intention of the current review is to revisit the issues which informed the existing policy and zones and to identify possible changes and the implications of those changes.

The Berrimah North Planning Principles and Area Plan (in the NT Planning Scheme) establish the intended future use and development of land bounded by McMillans Road, Vanderlin Drive, Boulter Road and Amy Johnson Avenue.

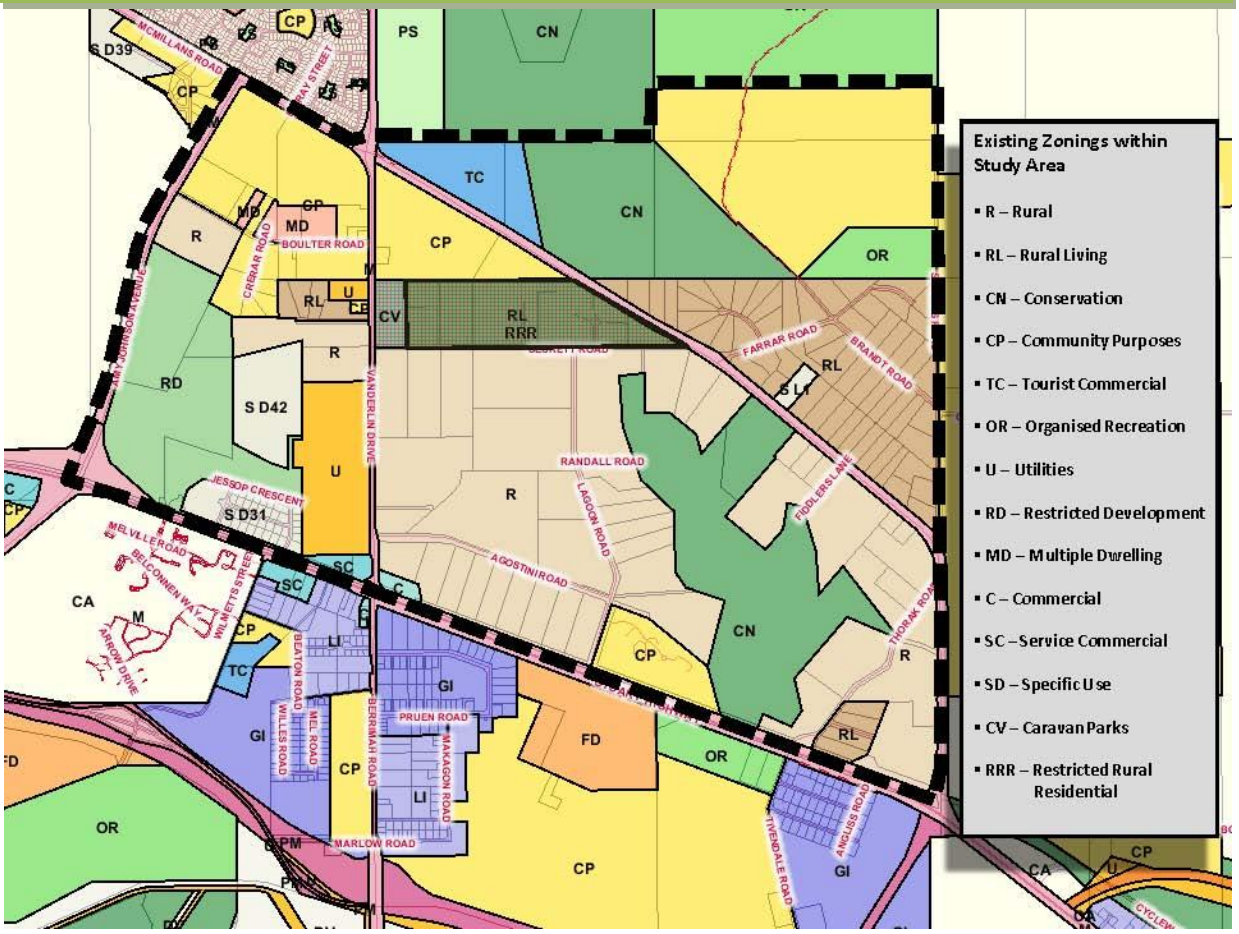
The Principles and Area Plan establish a framework for this part of the study area which provides for a diversity of uses and reinforces the focus of this area on urban land uses including residential, commercial and community purposes.



The existing zones within the study area reflect the intent of the policy established by the Litchfield Planning Concepts and Land Use Objectives.

The Knuckey Lagoons Conservation Reserve, Holmes Jungle Nature Park and associated drainage lines which form an integral part of the ecological system, are included in Zone CN (Conservation). This zone recognises the value of these natural environments and ensures that any development is sensitive to natural features and habitats.

Study Area



Zone CP (Community Purposes) provides for community services and facilities whether publicly or privately owned or operated, including facilities for civic or government administration. Government uses within the study area include the Peter McAulay Police Centre (31 ha) and the CSIRO facility (21 ha). Non government uses include the indigenous village on the Stuart Highway (20 ha), a private school (19 ha) and various community housing and support facilities on Crerar Road. Privately owned community purpose sites to the north of Boulter Road are being rezoned in accordance with the policy established by the Berrimah North Planning Principles and Area Plan.

The areas included in Zone R (Rural) have a minimum lot size of 8 ha and reflect the area previously subject to the Australian Noise Exposure Forecast (ANEF) 20 unit contour associated with the Darwin International Airport. Coincidentally, land within Zone R includes the areas that drain into Ironstone and Knuckey Lagoons. Therefore the limitation imposed on residential density by exposure to aircraft noise, also provided a degree of protection for the significant and unique systems associated with the lagoons.

Land to the north of Secrett and McMillans Road which drains to the north rather than into the lagoons is included within Zone RL (Rural Living) with a minimum lot size of 2 ha. The Rural Living area between Secrett Road and McMillans Road is subject to Restricted Rural Residential provisions to ensure clearing of native vegetation is subject to consideration of possible impacts on Holmes Jungle.

Land between Vanderlin Drive and Amy Johnson Avenue directly under the flight path and in close proximity to the main run way of Darwin International Airport is included within Zone RD (Restricted Development). This zone is intended to limit the number of people who reside and work in the area and retain the non-urban character of the land to ensure development does not prejudice the safety and efficiency of the airport. Land in this area not directly under the flight path is subject to specific use zones intended to facilitate development of the land for light industrial purposes that minimise the impacts from exposure to aircraft noise and do not inhibit the operation of the Darwin International Airport.

The major Power and Water infrastructure to the west of Vanderlin Drive is included within Zone U (Utilities) and various existing and proposed commercial activities are within Zone C (Commercial), Zone SC (Service Commercial) and Zone TC (Tourist Commercial) e.g. Crocodylus Park.

3. ISSUES AND OPPORTUNITIES

Various natural and physical attributes of the study area have and continue to influence the form and direction of land use. Some of these attributes appear to severely constrain options for future development but there is also potential that within the context of a focus on protection of key environmental assets, there may be opportunities for economic growth and creation of a socially cohesive community.

3.1 Land Capability

Land Units reflect the characteristics of soils, vegetation and land form and consequently provide a guide to the capability of land to support various land uses and an indication of areas where degradation may occur as a result of inappropriate land use. Land Units within the study area can be grouped in the following categories:

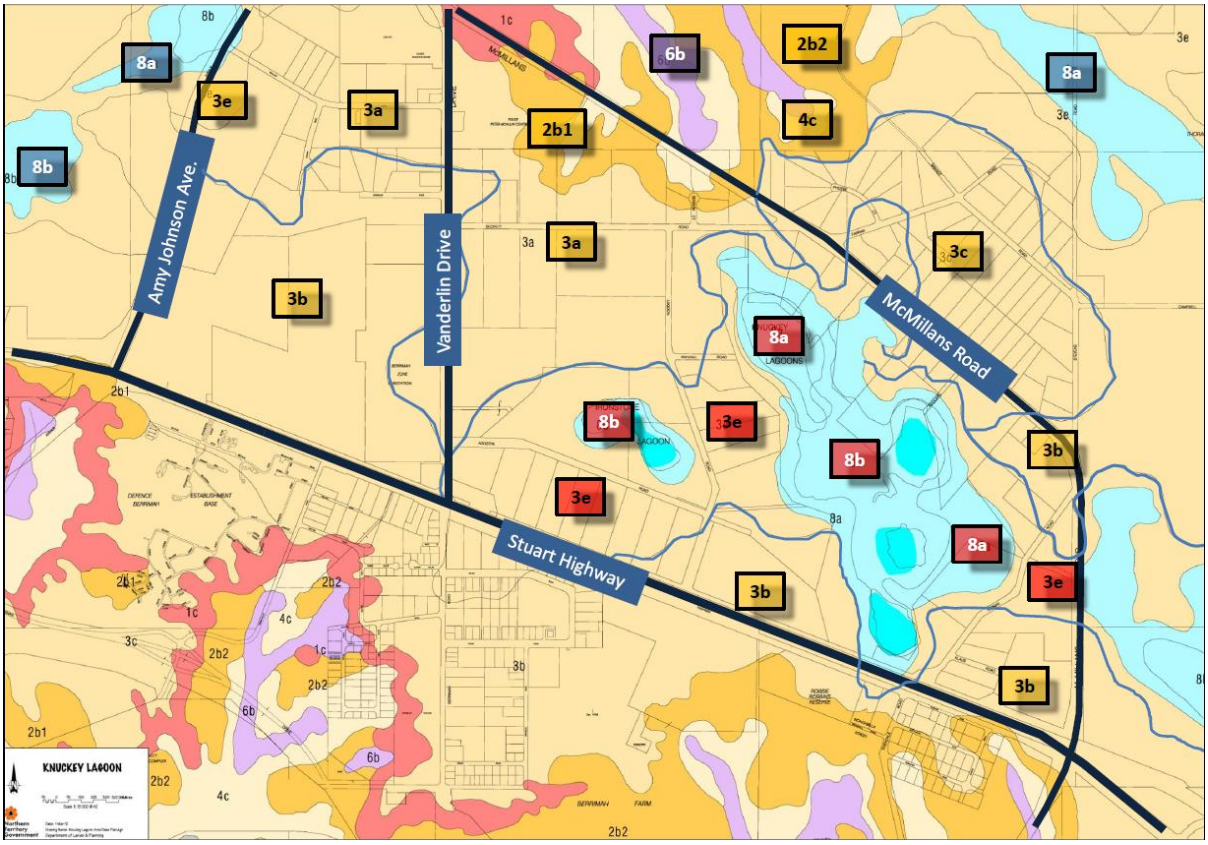
- **Rises**
    - 2b1 – moderately deep gravelly yellow massive earths along gentle side slopes.
- **Plains**
    - 3a, 3b and 3c - characterised by flat to gently undulating upland surfaces with soils ranging from deep red massive earth and minor yellow massive earths to gravelly yellow massive earths with minor lateritic lithosols; and
    - 3e – flat to undulating surfaces consisting of hard setting deep mottled yellow massive earths subject to high wet season water table.
- **Drainage Systems and Swamps**
    - 6b – broad lowland plains with minimal slope and underlain by deep sands;
    - 8a and 8b – upland depressions and floodways of the lagoons consisting of deep siliceous and earthy sands and surrounding swamp depressions characterised by ponded drainage and friable duplex soils.

Implications for land use

Land Units 8a and 8b centered on the lagoons are unsuitable for development. Development of Land Unit 3e, which borders the lagoons and floodways, will require detailed investigation of storm water infrastructure required to deal with the high wet season water table.

Land Units 3a, 3b and 3c which characterise the majority of the study area pose little constraint on development.

Land Units



3.2 Hydrology

Both surface and ground water issues will be significant influences in determining future land use in the study area.

Surface Water and Drainage

Darwin's high and concentrated wet season rainfall combined with the relatively flat landscape creates conditions where surface drainage is of particular concern.

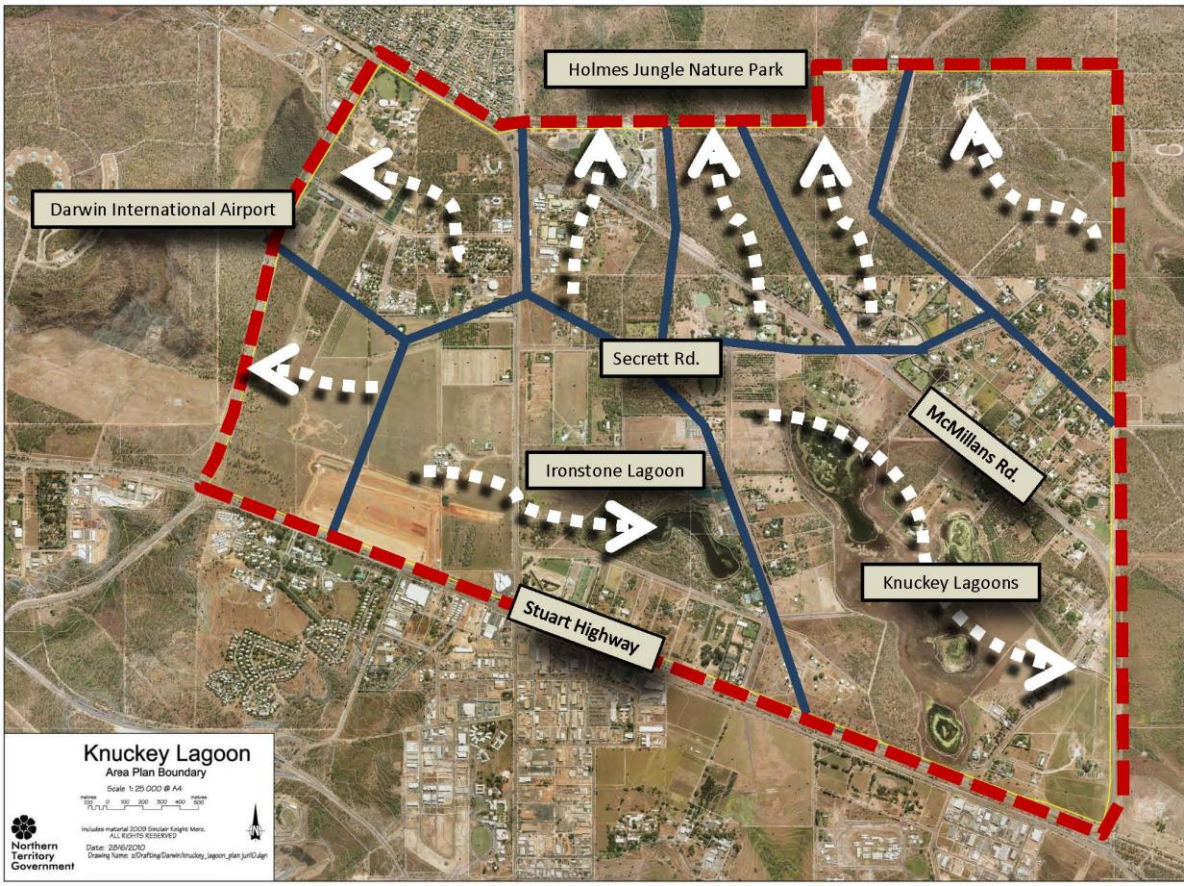
Nowhere is this more relevant than in less well drained localities such as the Ironstone and Knuckey Lagoons locality.

The area to the west of Lagoon Road and south of Secrett Road drains towards Ironstone Lagoon which discharges to the south east to Knuckey Lagoons. The area to the east of Lagoon Road and south of Farrar and Brandt Roads also drains into Knuckey Lagoons which then discharges to the east. The area to the north of Secrett and Farrar Roads drains to the north-west via Palm Creek to Holmes Jungle, the area to the north of Brandt Road drains to the north east and the area to the north of Bowerlee Road and the west of Vanderlin Drive drains to north west to Marrara Swamp.

The lagoons function as large natural storage basins and, in association with constructed overflow outlets on the lagoons, provide a degree of flood attenuation.

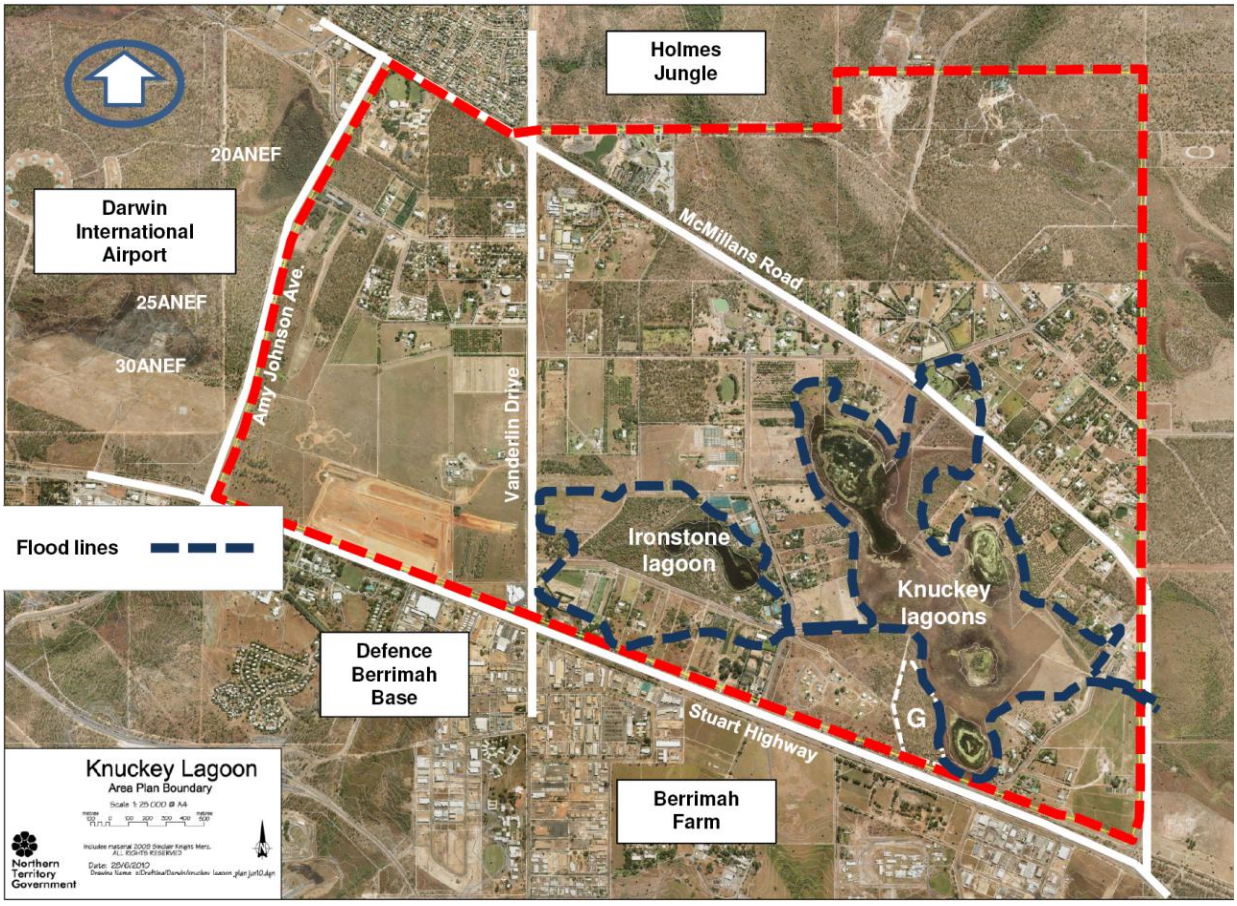
In addition to the natural drainage from Ironstone Lagoon into Knuckey Lagoons storm water drains along Agostini and Secrett Roads concentrate and channel runoff into Knuckey Lagoons.

Surface Drainage



The 1% AEP flood identified in a Stormwater Drainage Study in 1984 provides a guide to the extent of land subject to inundation in the Ironstone and Knuckey lagoons locality. This study also considered possible drainage improvement works with regard to the reduction of the area of land subject to flooding. Given the complexity of the system and the interaction with the environment, the study concluded there was little opportunity to significantly reduce the effects of flooding.

1% AEP Flood line



Implications for Land Use

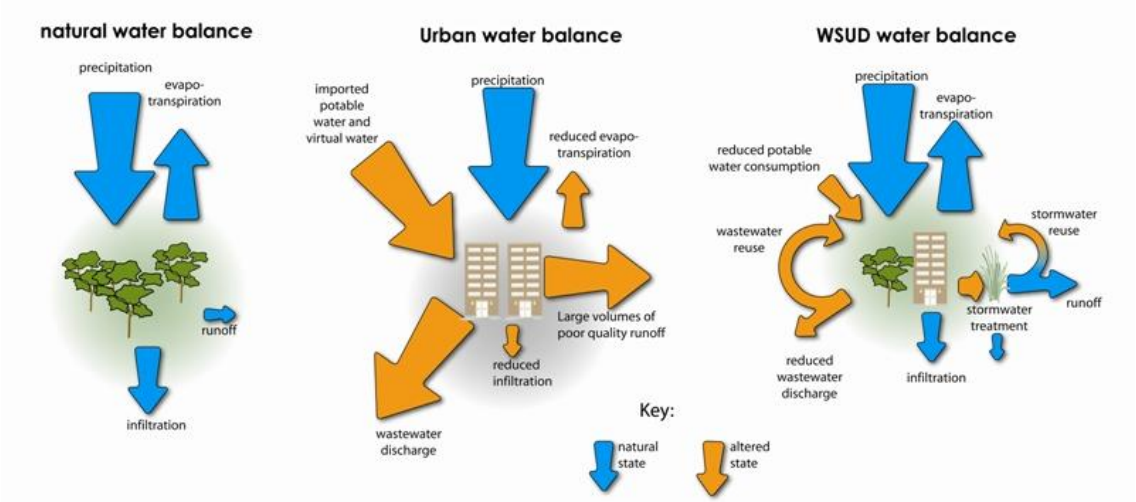
Development in the study area, whether it be in the catchment of the lagoons or Palm Creek, presents numerous challenges and will require demonstration of effective engineering solutions to maintain both quantity and quality of surface water flow into the lagoons and environmental values.

Maintenance of the flood peak attenuation provided by the natural storage basins of the lagoons will depend on maintaining the relationship between the storage and discharge. Increased concentration of runoff associated with more intense development has the potential to affect the existing balance. Potential impacts

include increases in the level of inundation around the lagoons and / or exacerbation of flood peaks downstream of the lagoon.

The potential for concentration of runoff to carry contamination from fertilizers, pesticides, weeds, or silt from erosion, hydrocarbons and other contaminants are issues of significance given the potential detrimental impacts on the water quality and environment of the lagoons.

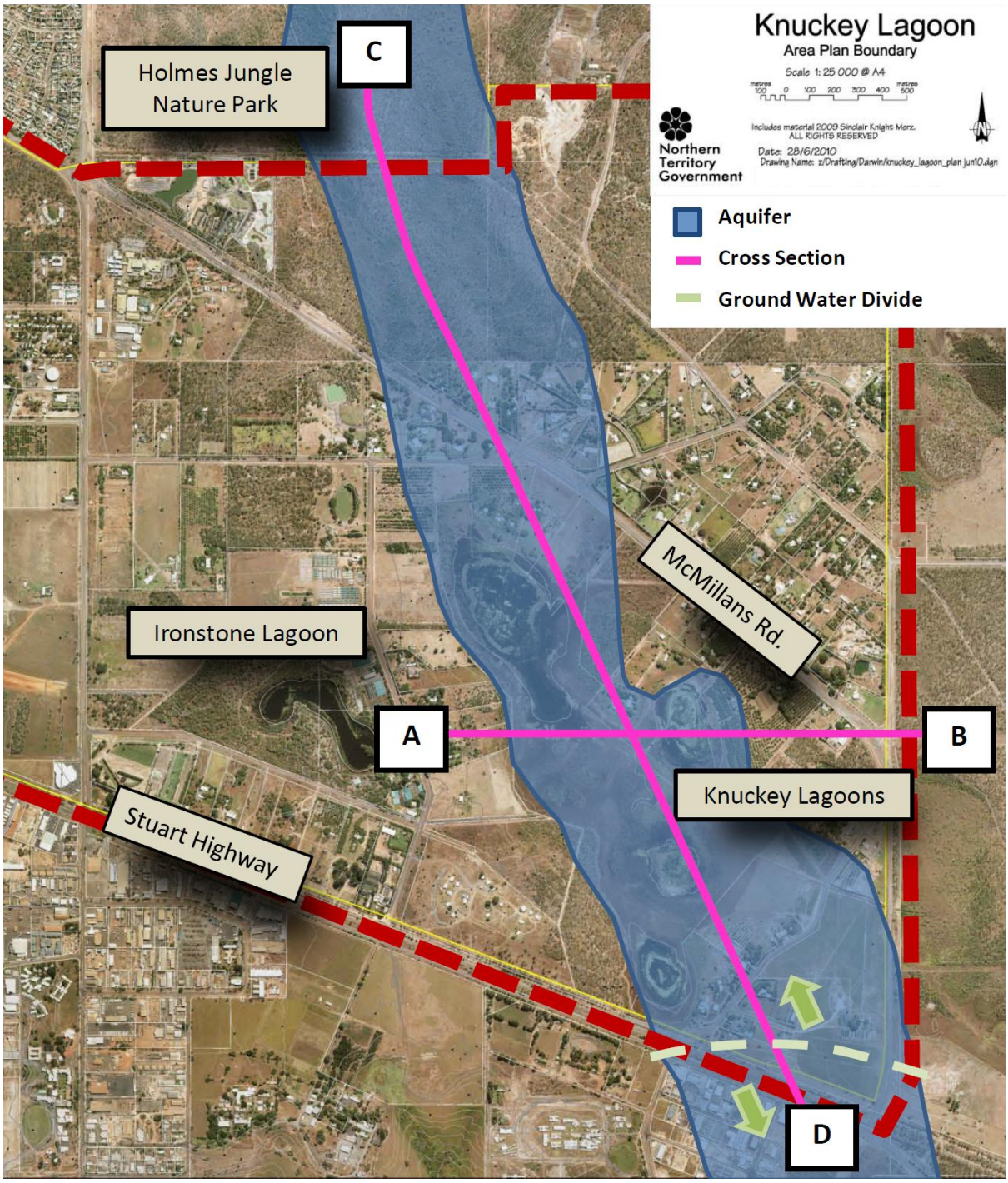
Water sensitive urban design which focuses on stormwater management which is sensitive to natural hydrological and ecological processes may provide a mechanism to ameliorate any potential impacts of development on both and quality and quantity of runoff.

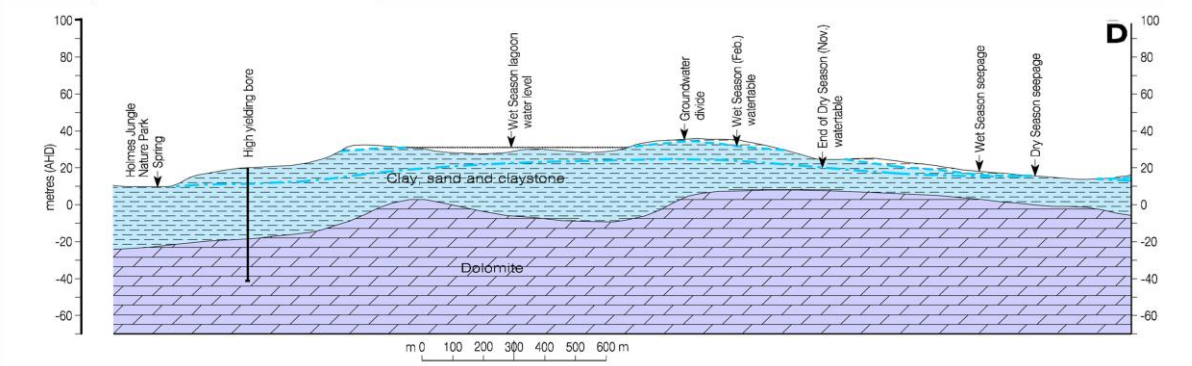


Groundwater

The study area is underlain by a narrow dolomite aquifer 700m wide and 7 km long which extends from Holmes Jungle in the north to Hudson Creek in the south. A groundwater divide is located immediately to the south of Knuckey Lagoons on the alignment of the Stuart Highway. From this divide, the groundwater flows north to emerge as springs at the sudden drop in topographic elevation within the aquifer. These springs sustain perennial Palm Creek and Holmes Jungle. The gradual drop in the land surface to the south results in diffuse discharge through perennial seepage over a wider area.

Groundwater

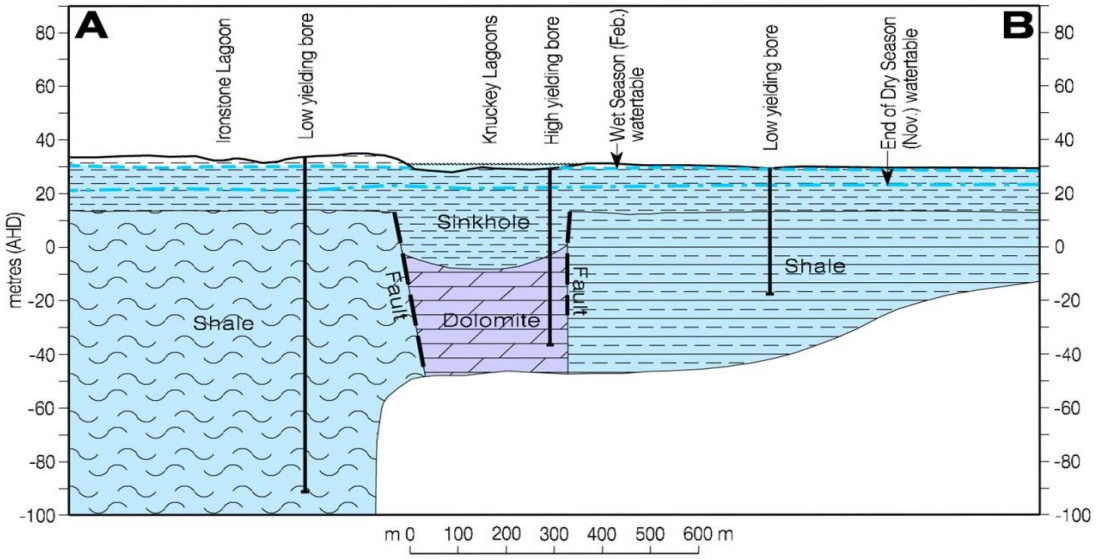




SCHEMATIC CROSS SECTION C - D
LOOKING EAST

Knuckey Lagoons are karstic depressions likely to be associated with sink holes in the dolomite aquifer which provide a hydraulic connection between surface runoff and the cavernous and fractured aquifer. The diagram below illustrates how the lagoons link surface runoff and the spring which sustains Holmes Jungle.

The water level in the aquifer below the lagoons varies from approximately 31.5 m AHD during the Wet season to 27 m AHD in the dry season. Although the bottom of the lagoons at 28 m AHD is above the dry season level in the aquifer, capillary action maintains the moisture levels in the lagoons.



SCHEMATIC CROSS SECTION A - B
LOOKING NORTH

The quality of the water in the lagoons differs from the quality of the groundwater. Lagoon water, surface water derived from rain, is acidic with low pH and TDS. The

groundwater is high in pH, EC and TDS and is bicarbonate water containing Ca and Mg derived from the dissolution of the dolomite by infiltrating acidic water. Water in the springs and Palm Creek originates from groundwater. Water quality data indicates that approximately 30% of the water in the lagoon infiltrates into the aquifer.

Groundwater discharges to the south and north are estimated to be similar in quantity and estimates of that discharge suggests an average annual recharge rate to the aquifer of about 3 500 ML. The 30% of the water in the lagoons that infiltrates into the aquifer contributes about 500 ML to the total recharge. The remainder results from diffuse recharge and equates to approximately 30% of the mean annual rainfall falling on the area overlying the aquifer.

Implications for land use

The continued health of Holmes Jungle is largely controlled by the maintenance of groundwater flow. Investigations into the hydrology of the Knuckey lagoons and Holmes Jungle Nature Park (Report N0. 43/2001) suggest that either additional artificial groundwater discharge or reduced discharge due to increased extraction of groundwater has the potential to adversely impact on the ecosystem of Holmes Jungle.

Consideration of the potential impacts on groundwater will be particularly important when determining appropriate development in the locality.

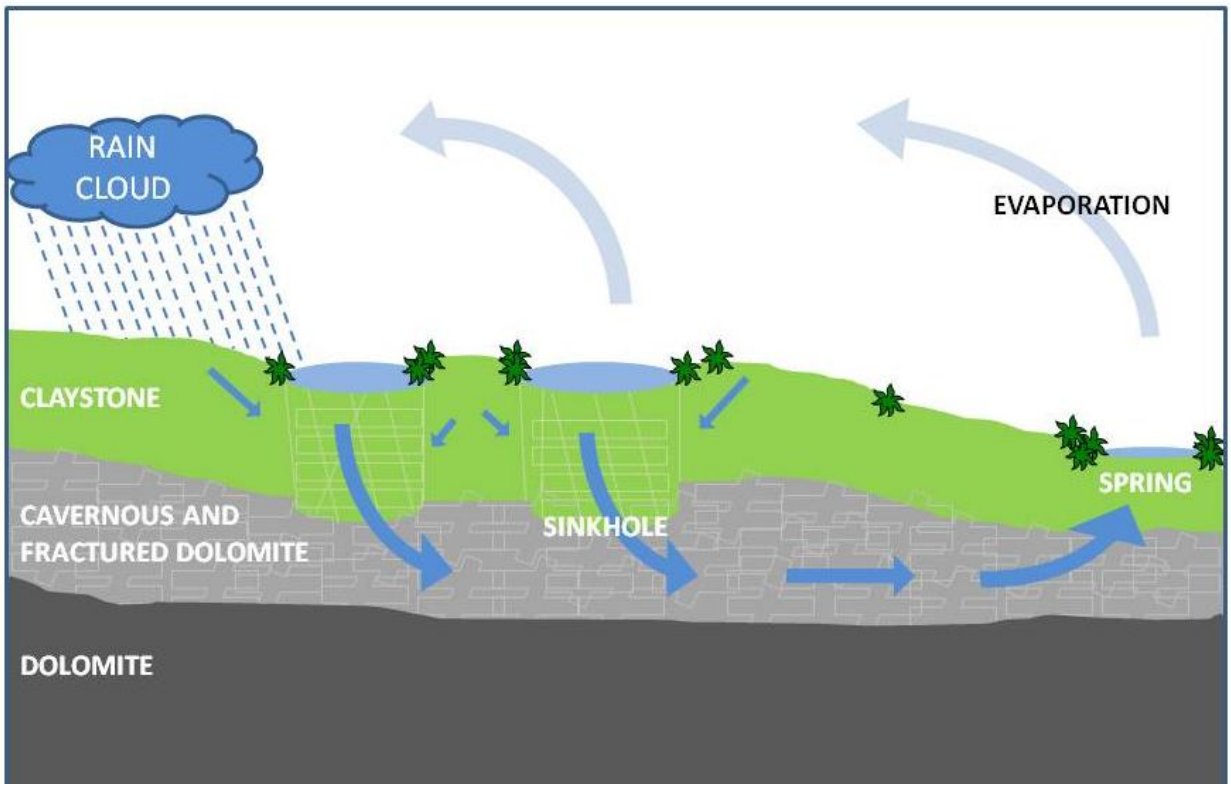
The hydraulic link the lagoons provide between the surface water and the aquifer create potential for either surface runoff or discharge from on-site waste disposal systems to enter the subsurface groundwater. Effectiveness of engineering solutions to minimise any potential adverse impacts will need to be demonstrated.

Also requiring consideration is the possible impact of more intense development on the diffuse recharge of the aquifer. The increased runoff associated with more intense development has the potential to impact on the quantity of recharge. Much of the land overlying the aquifer is constrained not only by the need to protect diffuse recharge but also by land units characterised by a high wet season water table. Areas with potential for development which may impact on diffuse recharge are limited to the area to the east of Knuckey Lagoons around Thorak Road and the area to the north of the lagoons to McMillans Road.

3.3 Environmental Sensitivity

The Knuckey Lagoons Conservation Reserve includes Section 2933 (110 ha) which was declared a protected area under Section 22 of the Territory Parks and Wildlife Conservation Act in 1985. The Reserve and the Crown Lease in Perpetuity over NT Portion 2852 (14.5 ha), which is vested in the Conservation Land Corporation recognise the ecological sensitivity of the area and the significance of the connection to Holmes Jungle.

Water Cycle



Both the Knuckey Lagoons Conservation Reserve and the Holmes Jungle Nature Park are subject to Management Plans and managed by the Parks and Wildlife Commission.

The management plan for the Knuckey Lagoons Reserve recognises the importance of the wetlands as part of the 'Top End' wetland system and to the local community. An indication of the significance of the area to the local community is the formation of the Knuckey Lagoons Wildlife Sanctuary Incorporated, a community group which has a formal agreement with the Parks and Wildlife Commission to assist with the planning and management of the Reserve.

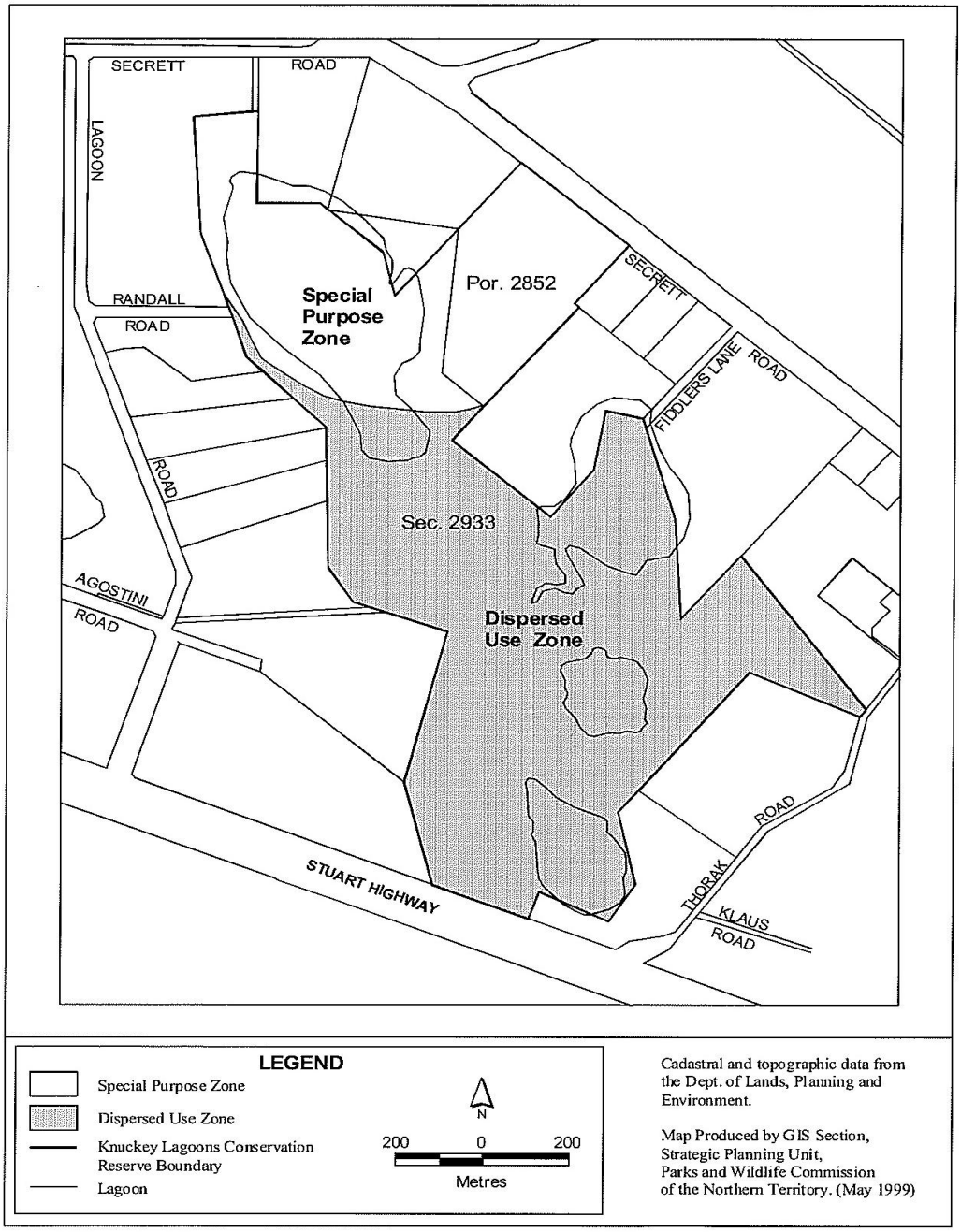
The primary values of the reserve are associated with the wetland habitat and include:

- cultural - the use of the area by the Larrakia people who continue to collect traditional food;
- recreation – the large congregations of waterbirds including magpie geese, egrets and curlews which attract birdwatchers particularly during the dry season; and
- natural – the locally significant wildlife refuge provided during the late dry season and the presence of the vulnerable species the Darwin Cycad (*Cycas Armstrongii*.)

The Reserve is within Zone C (Conservation) under the NT Planning Scheme. The Management Plan identifies 'zones' which inform the management of activity within the Reserve. The two zones within the Management Plan are focused on the conservation of the values and the protection of the wetland lagoons and their habitat. The distinction between the zones is that:

- the Dispersed Use Zone may provide for low key recreational facilities in a natural setting including a rest and viewing area and walking and cycling trails on elevated boardwalks; and
- the Special Purpose Zone provides particular protection of the bird habitat at the northern section of the Reserve and does not provide for visitor facilities.

FIGURE 2 – ZONING SCHEME KNUCKEY LAGOONS CONSERVATION RESERVE



KNUCKEY LAGOONS CONSERVATION RESERVE MANAGEMENT PLAN 7

Parks and Wildlife management objectives are currently focused on:

- protecting the natural values of the Reserve;
- maintaining low-key, non-vehicular access for bird watchers; and
- supporting the needs of the Aboriginal custodians to maintain their connection to country.

Challenges to achievement of these objectives fall into three broad categories: environmental, social and managerial.

Environmental issues include fire and weeds which are exacerbated by the high groundwater levels which limit access until well into the fire season and the proximity to major arterial roads which creates traffic management issues during burn off operations. The location of the reserve at the end of road side drains and surrounded by rural blocks contributes to the spread of noxious weeds in the locality.

Social factors which require specific and targeted management accidental fire, litter and dumping, and illegal hunting and various views and interests of neighbours.

The prioritisation assessment of Parks and Wildlife assets also influences what management can achieve. The Reserve is not a high priority in terms of biodiversity conservation or level of visitor services. This evaluation influences the priority and resources available to tackle issues.

Implications for land use

Further development in the locality combined with the strategic regional location and accessibility of the reserve have the potential to generate increased interest in low impact recreation and tourism activities focused on the aesthetic, natural and historic values of the reserve. While this increased activity will bring pressure to increase management and infrastructure, there is potential for a framework for future development to address some of the current management challenges.

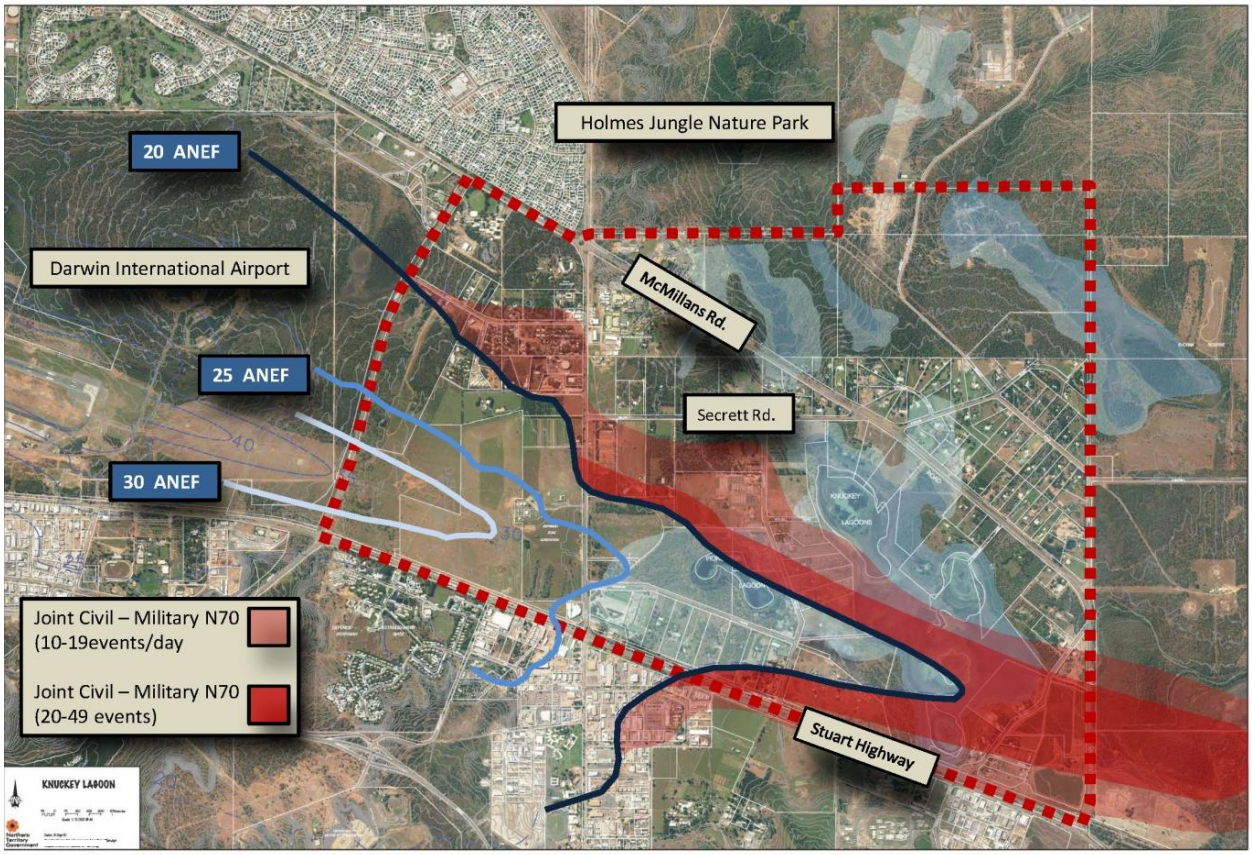
Provisions requiring improved setbacks from the boundaries of the lagoons and associated drainage areas may improve accessibility for both users and maintenance vehicles so improving management particularly of fires and weeds. Increased activity and associated passive surveillance may also assist in reducing some of the social challenges of management.

3.4 Proximity to the flight paths of Darwin International Airport

The Australian Noise Exposure Forecast (ANEF) take account of a number of factors including the movement, frequency and types of aircraft, the qualities and duration of their noise during take off and landing, and the daily distribution of aircraft arrivals and departures into one index value. When equal ANEF values are plotted, the resulting ANEF 'contours' are the widely used planning tool for land use around

airports.

ANEF Contours that affect the study area



The ANEF is the measure of aircraft noise impact referenced by the NT Planning Scheme and in association with Australian Standard 2021 – 2000 (AS 2021) provides guidance for the siting and construction of buildings to minimise aircraft noise intrusion for defined uses in the vicinity of airports.

Table 2.1 from AS 2021, shown below, uses ANEF contours to indicate whether the extent of aircraft noise intrusion would make a building 'acceptable' (no need for noise attenuation measures); 'conditionally acceptable' (noise attenuation required); or 'unacceptable' (building should not be constructed).

Building Site Acceptability Table			(Table 2.1 from AS2021)
BUILDING TYPE	ACCEPTABLE	CONDITIONAL	UNACCEPTABLE
House, home unit, flat, caravan park	Less than 20 ANEF	20 TO 25 ANEF	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 TO 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF	20 TO 25 ANEF	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF	20 TO 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF	20 TO 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 TO 35 ANEF	Greater than 35 ANEF
Light Industrial	Less than 30 ANEF	30 TO 40 ANEF	Greater than 40 ANEF
Other Industrial	Acceptable in all ANEF zones	Acceptable in all ANEF zones	Acceptable in all ANEF zones

The table indicates that residential buildings, including caravan parks, may be conditionally acceptable between the 20 and 25 ANEF contour but these conditions are difficult to meet in a tropical climate where natural ventilation has other appeal and benefit. The implication is that in the tropics the ANEF 20 contour establishes the limit of land suitable for permanent residential uses. Some residential land uses, such as short stay tourist accommodation, may be acceptable up to ANEF 25.

Although ANEF contours are a very practical planning tool, the national agenda on aircraft noise has moved towards providing additional information to better inform the community on the nature of impacts in noise sensitive areas. The draft National Airports Safeguarding Framework is concerned with managing the impacts of noise from airports, and advocates that best practice land use planning for airports should consider the range of noise information available. Airport Master Plans now provide much of this additional information in the form of swoosh diagrams indicating aircraft movements and N70 charts which indicate the number of aircraft noise events greater than 70 decibels (dB). The lighter red shading on the ANEF map on page 22 indicates 10 to 19 events above 70 dB per typical day and the darker red indicates 20 to 49 events per day.

The draft Guidelines recognise that there is often a need to balance housing demand against the operational needs of the airport and that there may be circumstances where increasing settlement in the area exposed to some degree of aircraft noise would be desirable given other benefits the area has to offer.

Implications for land use

Consideration of the proximity of the Knuckey and Ironstone Locality to the Darwin International Airport and the associated ANEF contours and N70 charts will be particularly relevant to the identification of opportunities for more intense residential use and limitations under the runway approaches.

Another possible influence of the proximity of the airport is the risk of bird strike in approach paths. These risks are currently being assessed by Darwin International Airport.

3.5 Biting Insects

Uncontrolled mosquito breeding can provide both a significant nuisance and a serious health risk. Although there has not been any baseline mosquito trapping in the Knuckey and Ironstone Lagoons Locality, ad hoc trapping (mostly in response to complaints) has revealed moderate to high levels of vectors responsible for transmission of Ross River, Barmah Forest and Murray Valley Encephalitis viruses and malaria and pest mosquitoes.

The shallow grassy and semi aquatic reed areas of the Knuckey Lagoons system are the major mosquito breeding sites affecting the area mainly between March and August when water levels recede, leaving behind isolated shallow vegetated pools free from mosquito larvae predators. There may be another short spike in numbers in the mid wet season associated with widespread shallow flooding around the lagoons. Other potential localised breeding sites include the two small paperbark swamps to the north of Campbell Road, ineffective on-site waste disposal systems (including the Lagoon Road Crocodile Farm effluent ponds) and drainage swales and other seasonally flood areas.

The deep open water and the absence of adjacent seasonally flooded grassy areas around Ironstone Lagoon mean it is a minimal breeding site.

Implications for land use

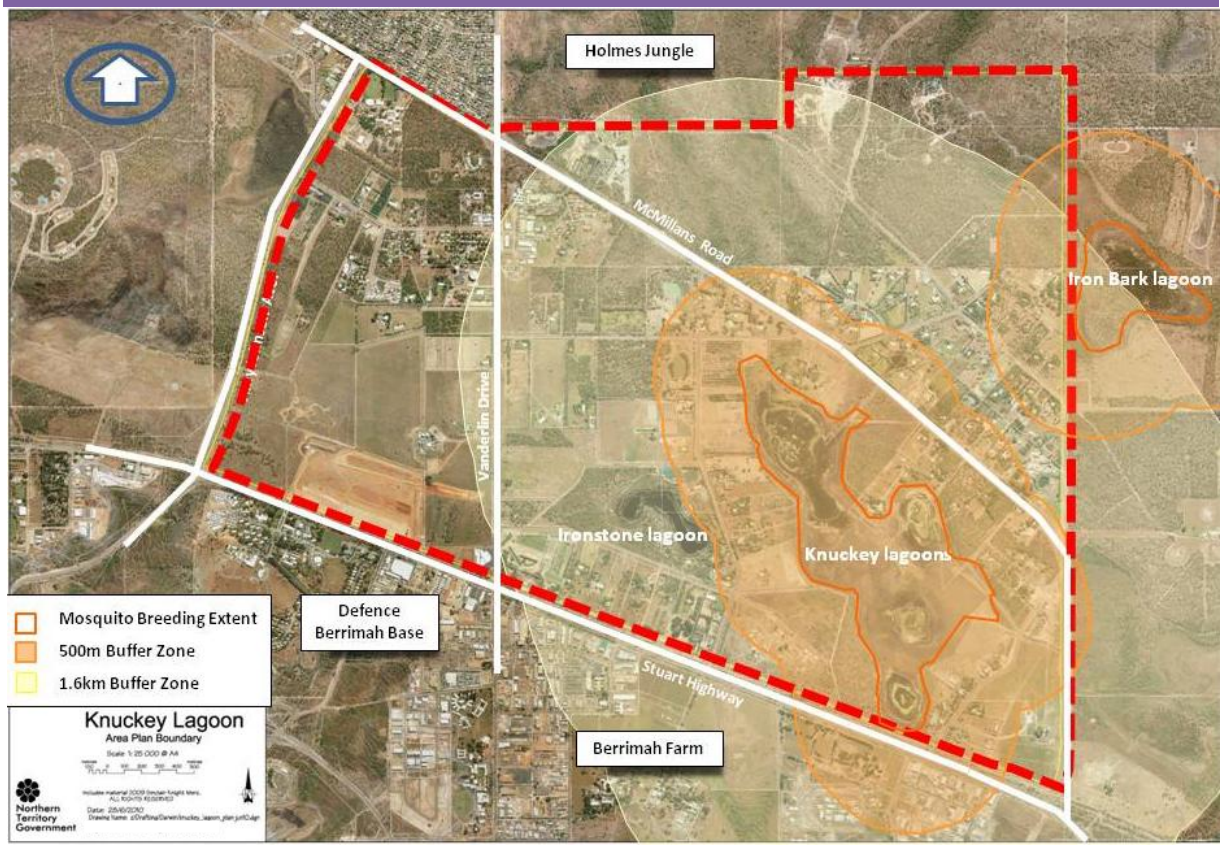
The standard buffer of 1.6 km required between significant mosquito breeding areas and urban development impacts on that part of the Knuckey and Ironstone Lagoons locality to the east of Vanderlin Drive. A recommended minimum lot sizes within 500 m of the seasonally flooded extent of the lagoons is 2 ha with a minimum of 4 000m^2 between 500 m and 1.6 km. The extent of these buffers is indicated on the figure below.

Specific mosquito investigations which would involve fortnightly trapping for a 12 month period may support a reduction in these recommended buffers. The modification of the Knuckey Lagoons System to create steep sides, deep water, elimination of isolated ponds within seasonally inundated areas and elimination of (unlined) drainage swales would virtually eliminate the mosquito breeding sites and render the locality suitable for urban development.

There may also be potential for elimination of shallow isolated pools left behind as water levels recede and (unlined) drainage swales combined with control of weeds in seasonally inundated areas and / or aerial control to minimise potential breeding sites. Such an approach has the potential to reduce the buffer required between the lagoons and rural residential lots of 4 000m^2. Another response to the constraint associated with potential biting insect breeding sites may be the provision of larger (1 or 2 ha) lots directly adjacent to the lagoons as a buffer to more intense 4 000m^2 lots. The provision of reticulated sewerage would also assist in reducing the potential constraint to development associated with biting insects as it would eliminate the need for onsite waste disposal.

Further detailed investigation will be required to establish the potential costs and benefits of such an approach and the available implementation methods. Whether these investigations are required will depend on what is established as the vision for future use in this locality.

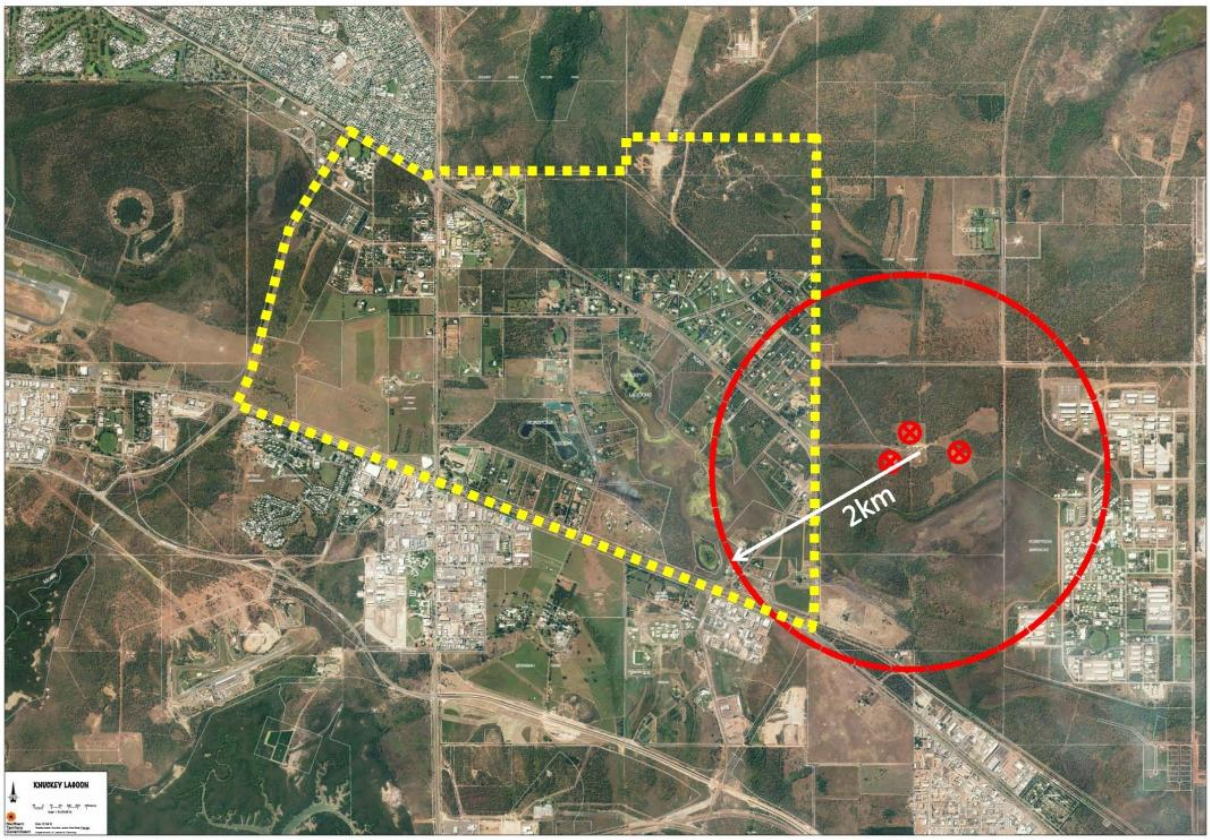
Biting Insects



3.6 Airservices Australia – Portion 2864

Airservices Australia is a Government- owned corporation providing services to the aviation industry. Portion 2864, situated on the eastern boundary of the study area, is in their ownership and currently accommodates aviation communications and radio navigation related infrastructure providing a service to the Darwin International Airport. There are specific protection zones applicable to the radar systems allocated on this property. The area of interest zone (2km radius) overlaps the eastern portion of the study area. This means that all development applications within this zone will be submitted to the VHF/HF technical authority for assessment.

Airservices Australia



3.7 Existing Land Use

Existing land uses within the study area are generally consistent with the currrent town plan zones. Historically this locality is one of the first rural living areas within greater Darwin and many residents on both 2 ha rural living lots and larger lots immediately adjacent to the lagoons are passionate about the unique environment within and surrounding the study area.

However there is increasing interest in alternate uses particularly on the larger lots bordering the lagoons. The strategic position of the locality in terms of accessibility is generating interest in more intense land uses considered by the proponents to have minimal potential impact on the environment. The need to accommodate continued growth in the Darwin region suggest interest will continue and in all likelihood increase. Current interests are summarised below:

LAND PORTION		EXISTING ZONING	ASPIRATIONS
A	Portion 4458	CV – Caravan Park	To implement existing land use rights
B	Portion 2834	R - Rural	To rezone to allow development of a caravan park / resort development.
C	Portion 4861 & 5200	R – Rural	To subdivide into 1 ha RR lots fronting Secrett and McMillans Roads
D	Area bounded by Fiddlers Lane, McMillans Road, Stuart Highway and Knuckey Lagoons	R – Rural	Mixed use development including accommodation village, diversity of housing and small scale commercial.
E.	Sections 3370 & 3371	R - Rural	To subdivide existing 4 ha lots
F.	Area bounded by Boulter Road and Bowerlee Road	R - Rural	To subdivide to create urban residential lots
G.	Area known as Jacks Melon Farm	R - Rural	To develop for industrial purposes.

Development Interests

An indication of the recent response to development interest is the Berrimah North Area Plan. This north-western corner of the study area includes some of the least constrained land in the locality and is currently being developed for urban related land uses.

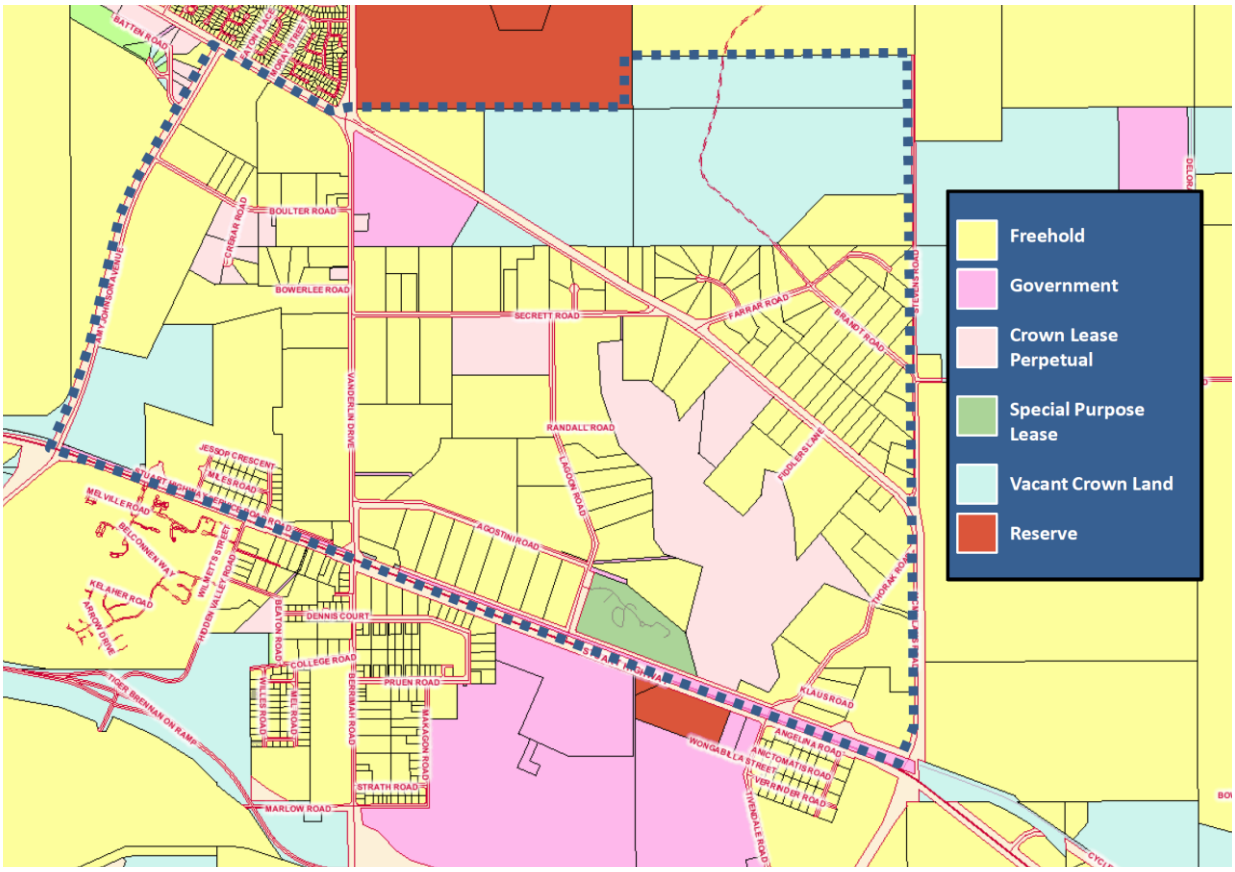
Implications for future land use

An adopted framework for future development will reduce the potential for detrimental impacts associated with ad hoc consideration of individual proposals. The inclusion of appropriate principles would provide the opportunity the opportunity to minimise the impacts of future development on those factors considered by the community to contribute to the amenity valued by many.

3.8 Land Tenure

The majority of properties within the study area are privately owned. The vision of these property owners as to the future of the area will be pivotal in determining the form of future development.

Land Tenure

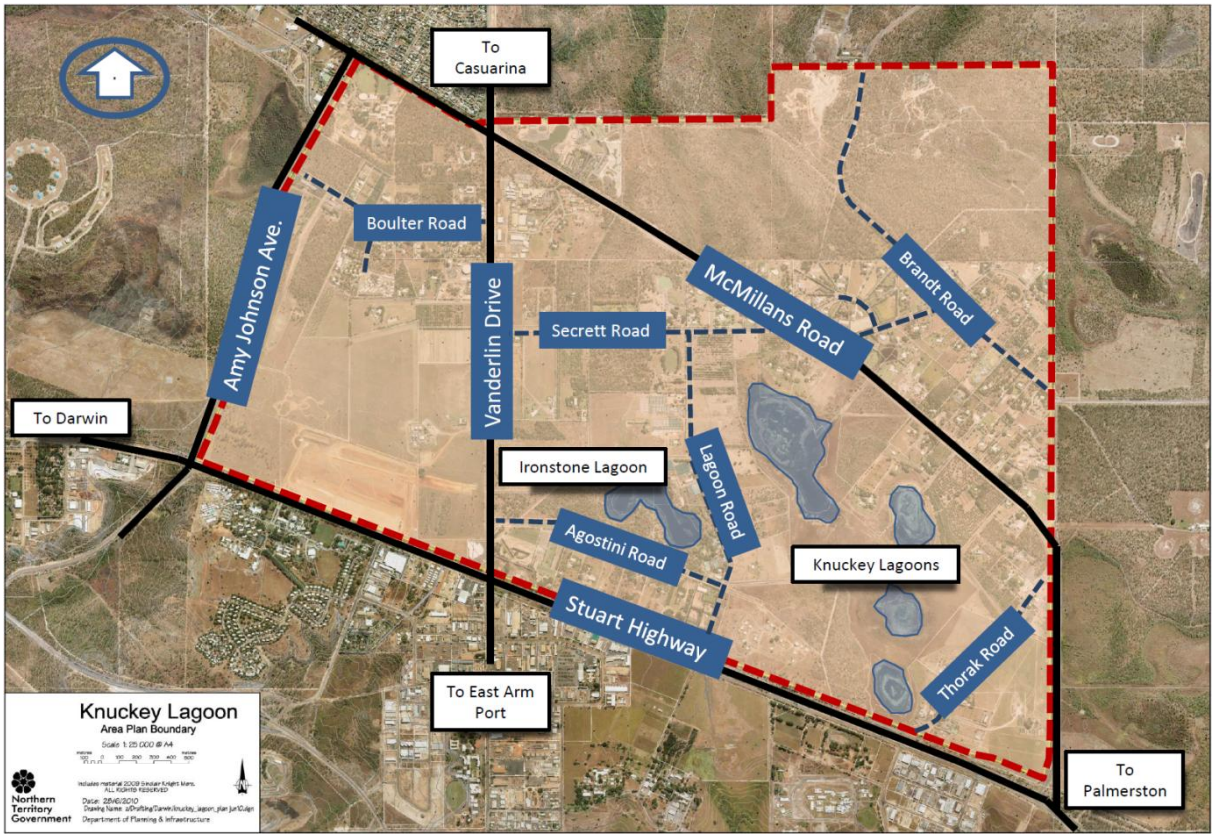


3.9 Infrastructure

Roads Infrastructure

The study area is bounded by major transport routes which provide excellent vehicular access to and from the area not only locally, but also from a sub-regional perspective. The Stuart Highway and McMillans Road respectively provide major east-west linkage to Darwin CBD, Palmerston and Casuarina and the northern suburbs, while Amy Johnson Avenue and Vanderlin Drive via Berrimah Road provide direct access to Tiger Brennan Drive and the East Arm Port.

Road Infrastructure



Head works Infrastructure

The existing water and sewerage head works infrastructure within the study area is limited and mostly utilised to full capacity.

There is limited town water supply and servicing of new developments along Boulter Road require upgrades. Major water network upgrades will be required to service any future development intended for Berrimah Farm. These upgrades could be the catalyst to initiate supply to the study area. In the absence of development of Berrimah Farm significant development will be needed to establish the economic viability of required infrastructure upgrades.

Power and Water have plans to develop a new water supply zone at East Arm to serve the port. This work, together with minor upgrading in the Casuarina zone might create sufficient storage capacity within the Karama zone to serve the study area.

The existing watershed which bisects the study area in an east-west direction requires any future major trunk sewer upgrades to be connected to either the Leanyer treatment ponds to the north, or the Berrimah treatment ponds to the south.

Future planned extensions to the Berrimah treatment ponds are likely to have sufficient capacity to serve future development at East Arm and Berrimah Farm. Again significant development will be required to justify the costs related to the extension of the existing sewage treatment facilities.

- ***Can the lack of services be addressed in order for identified development potential to be realised?***
- ***Could land use densification make reticulated services a viable option? And how much densification would be needed for cost effective infrastructure?***
- ***What degree of densification would be acceptable on the existing rural character of the area?***

- ***Should the study area remain a low density rural residential area? – preservation of the existing character with development limited to the planned areas west of Vanderlin Drive…***
- ***Should low intensity development be allowed throughout the study area?***
- ***Should the optimum development potential of the area be investigated?***

4. LAND USE OPTIONS

4.1 Approach

It is clear that the study area has its fair share of challenges. These challenges can be collated into three distinctive categories:

Proximity to the Darwin International Airport, the significance of the natural environment and the location of the study area in relation to existing and planned urban development creates a volatile situation in terms of the direction of future land use and development.

Some within the community are passionate about the lifestyle and amenity of the locality but the pressure to allow for various more intense land uses is increasing.

Parameters to guide consideration of the options for future land use and development are summarised below:

Parameters	Acceptable Outcomes
Lagoons and associated drainage areas	
Maintain the natural values of the lagoon system and associated fauna and flora.	Appropriate design to minimise potential environmental impacts on the lagoons and associated fauna and flora.
Surface Water and Drainage	
Maintain the flood peak and attenuation provided by the lagoon system.	Continued low intensity development; or Engineering design to maintain quantity and timing of runoff.
Minimise potential for contamination or siltation from erosion resulting from runoff.	Stormwater drainage design sensitive to potential hydrological and ecological impacts.
Groundwater	
Maintain groundwater flows which are vital to continued health of Holmes Jungle	Continued low intensity development; or Engineering design to maintain the discharge from the aquifer to Holmes Jungle.
Maintain groundwater quality	Appropriate design and maintenance of onsite waste disposal; or Provision of reticulated sewerage; and Management of surface runoff via surface water and drainage methods mentioned above.
Protect diffuse aquifer recharge.	Control of runoff from continued low intensity development; or Appropriate design to limit the impacts of increased runoff normally associated with more intense development.
Environmental Sensitivity	
Protect the natural, historic and aesthetic values of the Knuckey Lagoons Conservation Reserve and its links to Holmes Jungle.	Parks and Wildlife review of prioritisation and management; or Implementation of contributions schemes in association with development to assist funding.
Improve passive recreation opportunities and access to the lagoon for fire and weed management.	Increased informal passive surveillance associated with increase in population; and Buffers between lot boundaries and the lagoons.
Proximity to Darwin International Airport	
Minimise impacts of noise on residents and of development on future operation of the Airport.	Development in accordance with Australian Standards.
Biting Insects	
Minimise exposure to biting insects.	Limitations on more intense development; or Subject to the outcomes of further investigation - remediation works to reduce exposure.
Existing Land Use	
Minimise impacts on the rural amenity valued by residents and the community	Protection of those factors valued by the community; and Retaining the rural amenity of the locality

	whilst achieving a balance between various aspirations in relation to future development
Infrastructure	
Limited existing water and sewerage headworks infrastructure and capacity.	Continued utilisation of groundwater and onsite effluent disposal; or Establish thresholds necessary to establish the economic viability of infrastructure to serve development options.

The preferred framework for future development will be one which gives priority to protection or enhancement of the natural landscape and creates a place where people enjoy a strong sense of community and live in balance with that landscape.

Successful implementation of the preferred option will depend on:

- effective management of the natural environment; and
- in the event the preferred option involves more intense development, the financial feasibility of providing the infrastructure necessary to fulfill the aspirations of land owners.

This context suggests two alternative approaches. The first is the continuation of the existing low intensity of development with some potential minor variations depending on the capacity of service infrastructure to support individual proposals.

The second alternative is to investigate growth scenarios with consideration of the viability of infrastructure necessary to support the level of development and the measures required to appropriately protect the natural environment.

4.2 Growth Scenarios

The following scenarios identify what various levels of development may look like. The options include low, medium and high growth scenarios and include a summary of the implications and outcomes associated with each. Future development will not necessarily reflect any one of these scenarios but may incorporate components from each. The intention of presenting these three possible responses to the issues requiring consideration is to stimulate informed discussion of the potential future directions for land use and development.

4.3 Low Growth Scenario

The low growth scenario assumes that trunk services will not be provided with the result that opportunities for significant infill development even in the medium to long term will be strictly limited. This is basically a 'status quo' option with limited potential for some infill in areas proximate to existing service infrastructure with available capacity.

Components of this low growth scenario may include:

A – Continued development of the area covered by the Berrimah North Area Plan for urban residential and community uses subject to consideration of an appropriate local road network and availability of required service infrastructure capacity.

B –Planned expansion of the Peter McAulay Centre to the east of the existing complex on Portion 2708.

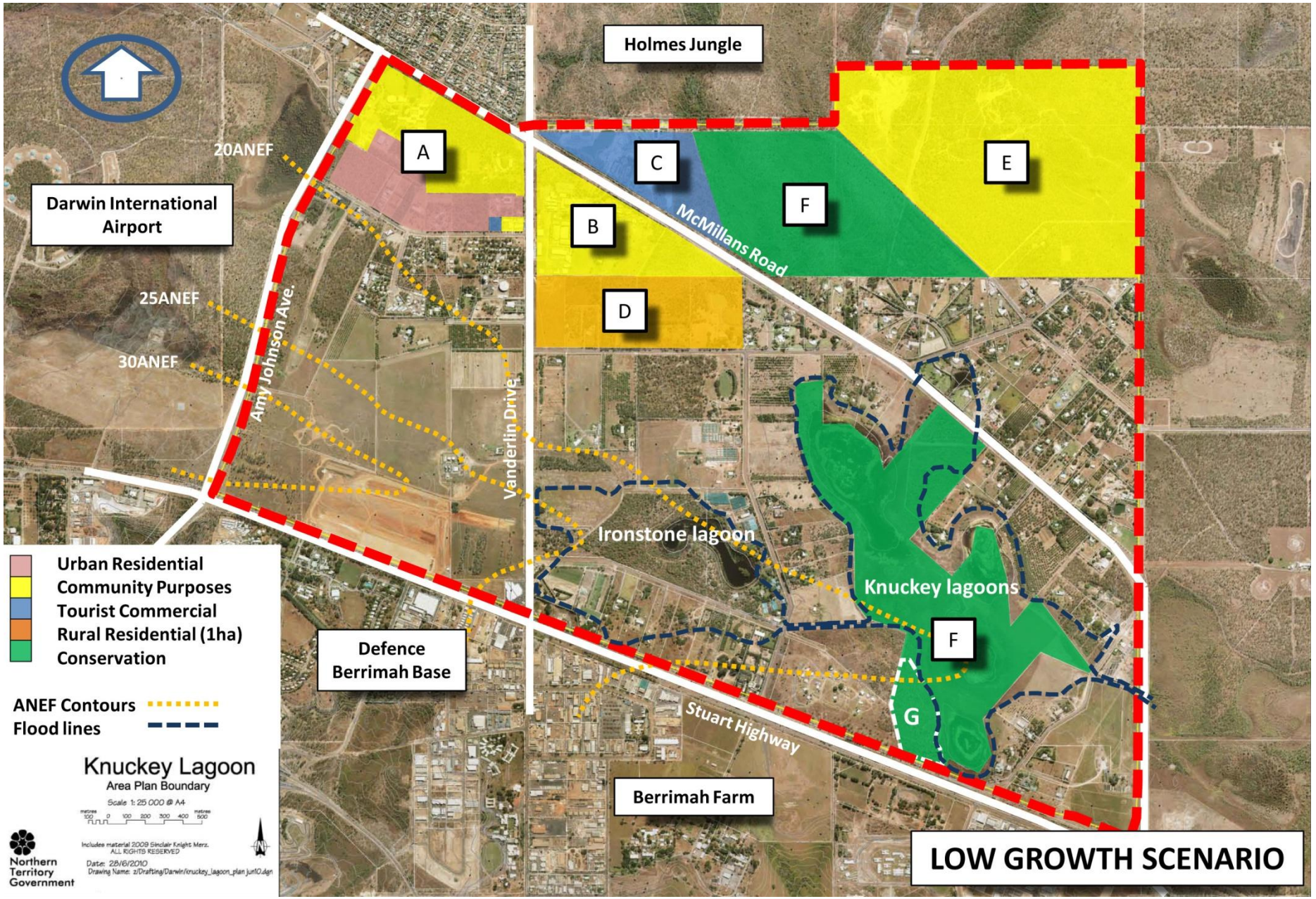
C – Planned expansion of Crocodylus Park.

D – Infill rural residential (1 ha) development between Secrett Road and the Peter McAulay Centre utilising capacity potentially available when reticulated water and power are provided to serve development in accordance with the Berrimah North Area Plan.

E – Development of the area between the Mickett Creek Shooting Range and the Knuckey Lagoons Recreation Reserve for a range of community uses.

F – Continued management of the Knuckey Lagoon Conservation Reserve and extension of the Holmes Jungle Nature Park to incorporate drainage lines to the east of Crocodylus Park to ensure the long term sustainability of the natural environment.

G – Enhanced opportunities for passive recreational activities focused on the natural amenity of the lagoons through formalisation of a recreation area on unconstrained land adjacent to the southernmost lagoon north of Stuart Highway within the Knuckey Lagoons Conservation Reserve. The provision of public access along the lagoon edges will be considered within the context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McMillans Road
Amy Johnson Ave.
Vanderlin Drive
Ironstone lagoon
Knuckey lagoons
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G
Defence Berrimah Base
Stuart Highway
Berrimah Farm
Urban Residential
Community Purposes
Tourist Commercial
Rural Residential (1ha)
Conservation
ANEF Contours
Flood lines
Knuckey Lagoon
Area Plan Boundary
Scale 1: 25 000 @ A4
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LOW GROWTH SCENARIO

of protection of sensitive fauna and flora habitats and the privacy and amenity value of abutting properties.

Parameters / outcomes

The parameters and outcomes particularly relevant to this scenario include:

- the lack of reticulated water and sewerage will limit the potential for subdivision of existing rural and rural living lots and result in continued ad hoc consideration of individual development proposals;
- the lack of reticulate urban services may impact on the economic viability of services required to support other potential developments in the locality including Berrimah North and Berrimah Farm;
- the potential impacts on the natural ground and surface water resources associated with continued extraction ground water for domestic uses and utilisation of on-site effluent disposal;
- limited potential to respond to passive recreation opportunities provided by the natural environment or improve management of Reserves; and
- limited opportunities for improvements in stormwater drainage to minimise potential impacts on the natural values of the lagoons system.

4.4 Medium Growth Scenario

The medium growth scenario assumes that strategic development initiatives near the study area (e.g. Berrimah Farm and East Arm Port) and the associated upgrading to trunk services have potential to create opportunity for service delivery within the study area. This scenario also takes into account that many existing land owners may prefer to retain the rural / natural character of the area.

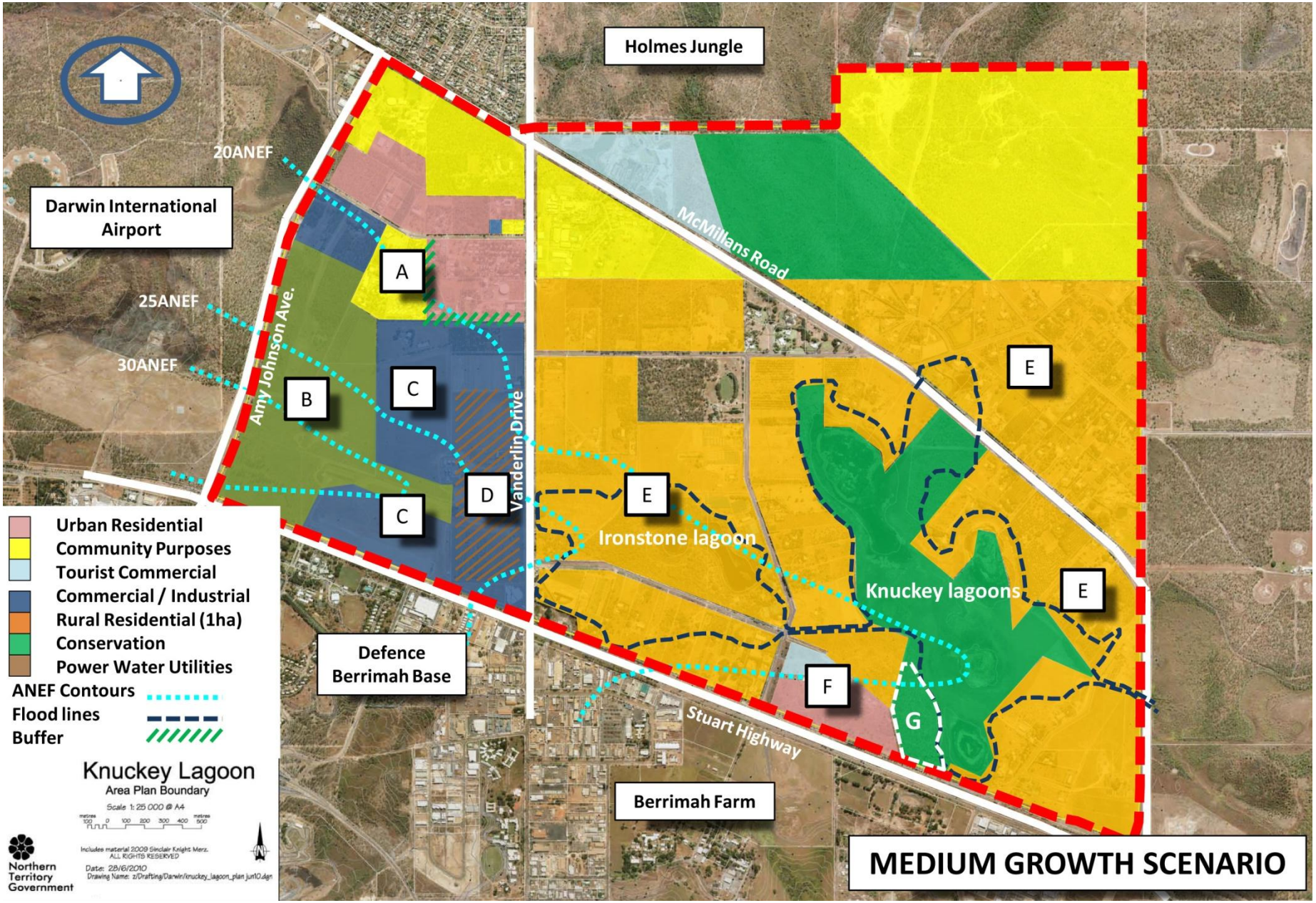
As well as the components identified in low growth scenario this medium growth scenario may include:

A –Land immediately to the south of Boulter Road is constrained by the ANEF 20 contour but in compliance with the Building Site Acceptability Table (see Paragraph 3.3 above) may have potential for commercial, tourist commercial or light industrial uses. Land on the corner of Boulter Road and Vanderlin Drive and outside the ANEF 20 contour could be considered for urban residential use as an extension of the area identified on the Berrimah North Area Plan. Development for residential purposes will require consideration of a buffer from adjoining community purpose and industrial development.

B – The existing Zone RD (Restricted Development) to the south of the Precinct A recognises constraints associated with the position of this land under the flight path and proximity to the main runway of the Darwin International Airport. Although the intention is to limit the number of people who work and reside in the area the land may provide opportunities for low intensity recreational related activities. The existing Flight Path Golf Facility currently established on Vanderlin Drive is such a use, and consideration may be given to the relocation and expansion of this facility which is currently constrained by planned upgrading of Power and Water infrastructure.

C – Recent amendments to zoning of areas not directly under the flight path recognise the potential for specific industrial uses that minimise potential for exposure to aircraft noise and do not inhibit the operation for the airport.

D – Depending on the land required to accommodate future Power and Water infrastructure their existing site to the west of Vanderlin Drive may provide opportunities for extension of recent commercial and industrial in this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MEDIUM GROWTH SCENARIO

locality. Industrial and commercial development would make optimal use of this strategically located land.

E – Redevelopment of rural and rural living lots to provide rural residential lots (1ha) as prescribed in the NT Planning Scheme for rural residential lots within Litchfield Shire.

F - Infill urban style residential development of that part of the existing Indigenous Corporation village on the corner of Stuart Highway and Lagoon Road that is outside the ANEF 20 noise contour. The portion of the site within the ANEF 20 contour has potential to accommodate a culture / visitors / environmental education centre where tourists could be introduced to the arts and crafts of the indigenous people as well as environmental, heritage and cultural aspects of the Knuckey Lagoons.

Parameters / outcomes

The parameters and outcomes particularly relevant to this scenario include:

- a response to the strategic location of the locality within the regional context while providing a degree of protection for the rural amenity and natural character of the area;
- implementation of this scenario will be depend on determination of the economic viability of infrastructure necessary to support development and the opportunities further development may create to provide funding;
- increased intensity of land uses with appropriate infrastructure could assist in:
    - the introduction and implementation of more stringent environmental protection guidelines and policies;
    - increased passive recreation opportunities;
    - establish the viability of improved stormwater drainage regime; and
    - reduce the potential impacts of continued use of groundwater and on site waste disposal on the water resources and the environment.

4.5 High Growth Scenario

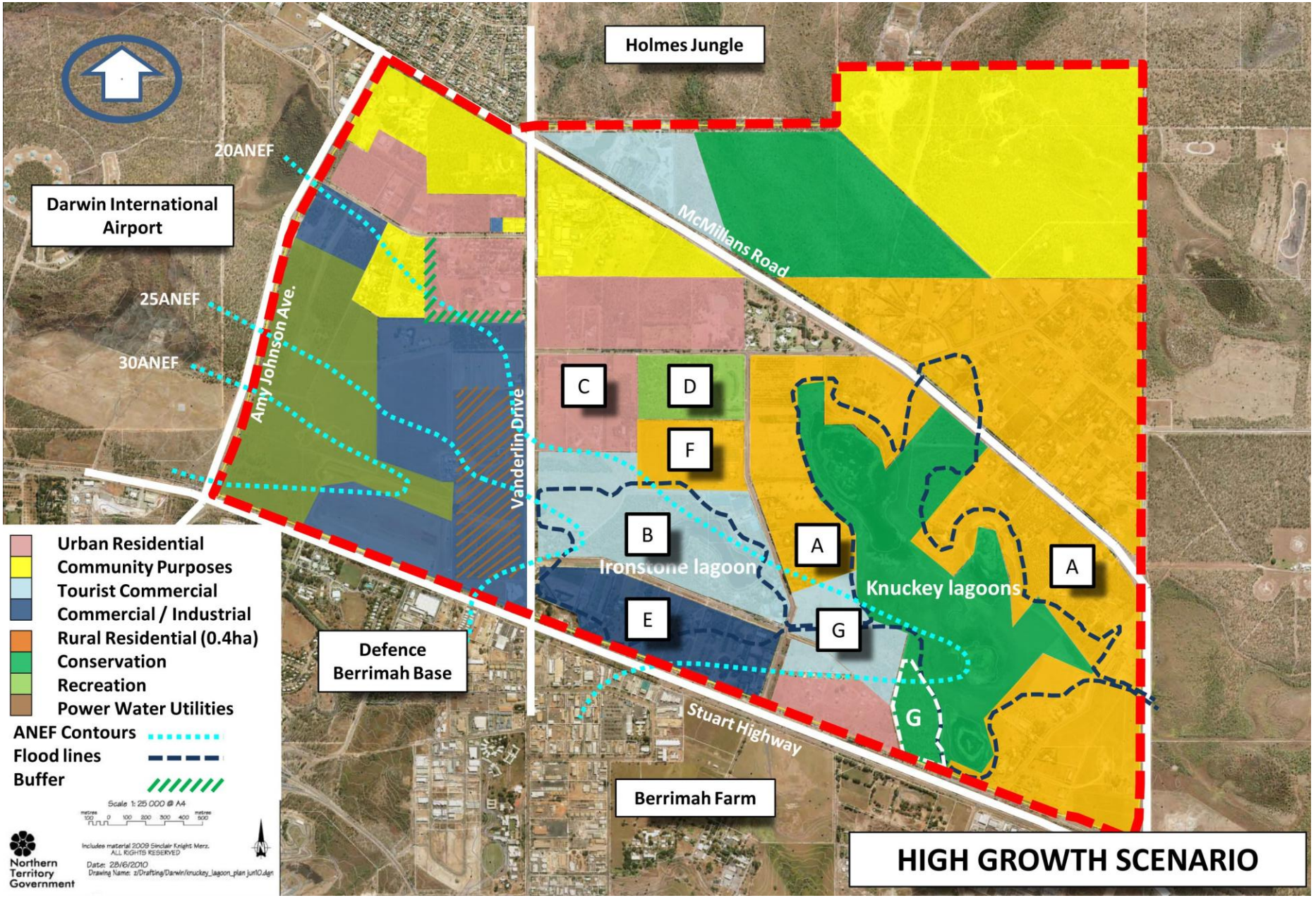
The high growth scenario assumes that the strategic location of the study area, within the regional context, and the potential for development in adjoining localities will result in continuous pressure on this area to evolve into a peri-urban environment as an interface between the urban and rural areas.

Ultimately the intensity of development which can be accommodated will depend on effective management of potential impacts on the natural environment and the financial feasibility of the providing the infrastructure necessary to support such development.

As well as the components identified in the medium growth scenario, components of a high growth scenario may include:

A – Development of land directly abutting and surrounding the lagoons is rural residential development to create lots of 0.4 ha. The increased density has the potential to establish the economic viability of protection of the natural environment. The attractiveness of such lots to conservation conscious residents has the potential to generate active and ongoing interest in the management of both their land and the recreation reserve to limit any potential impacts on the environment. Development for non residential uses on land directly abutting Knuckey Lagoons, which would attract visitors, will require careful consideration to counteract any potential impacts of a reduced commitment to the environmental values of the locality. A framework to achieve a coordinated approach to development will be required to minimise potential impacts on the environment.

B - A possible alternative location for the provision of non residential land uses may be on land adjacent to Ironstone Lagoon. This area is in pristine condition and its reasonably undisturbed state provides an ideal opportunity for development of an 'eco-resort'. The amenity value of the undisturbed vegetation and the lagoon combined with the single ownership of all land surrounding the lagoon would maximise the potential for a coordinated development that could be managed to minimise potential impacts on the environment. Extension of this tourist related development to Vanderlin Drive also has the potential to minimise the impacts of associated traffic on the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HIGH GROWTH SCENARIO

rural amenity. The lower intensity tourist related activities would provide a transition from the higher intensity commercial / industrial uses to the west of Vanderlin Drive to the more rural uses around Knuckey Lagoons.

C - The area to the north of the proposed tourist commercial area and outside the ANEF 20 contour has potential for further extension of urban related land uses in the Boulter Road area though the rural living area to the north of Secrett Road.

D – The Darwin Pony Club facility on the corner of Lagoon and Secrett Roads could be further developed to provide a focus for equestrian activities in the locality. The current Pony Club activities appear to be limited to the eastern portion of the site which suggests potential to relocate the current stabling facilities on Vanderlin Drive to this site. This consolidation of equestrian activities has the potential to ensure the long term sustainability of the pony club facility while allowing for land use intensification along Vanderlin Drive. The surrounding potential urban and rural residential properties could form part of an equestrian themed development serviced by the centrally located equestrian facilities. Such an approach would allow ready access for urban residents to rural activities in a managed way to reduce potential environmental impacts.

E – Properties between the Stuart Highway and Agostini Road are severely impacted by wet season inundation. Redevelopment for more intense use may create opportunities for implementation of appropriate engineering solutions to address this problem. Accessibility and exposure from the Stuart Highway could see this area transform into a highway commercial precinct similar to those currently being developed in other locations along the Stuart Highway which are similarly impacted by noise from the airport.

F - The existing crocodile farm on Lagoon Road has the potential to develop as an expansion of tourist related activities in the locality or to be redeveloped for rural residential purposes as part of the 'equestrian estate'.

G – Land immediately north of the Indigenous village impacted by the ANEF 20 contour has the potential to accommodate tourist related facilities. Such facilities could link with the possible culture / visitors / environmental

education associated with the Indigenous village. Given the location adjacent to the less sensitive zone of the Knuckey Lagoons Conservation Reserve there may also be potential for a low intensity tourist accommodation.

Possible Implications / outcomes

The parameters and outcomes particularly relevant to this scenario include:

- development of a range of land uses in response to the strategic location of the locality;
- potential enhanced protection of the natural environment through appropriate design and implementation of controls focused on minimising the impacts of development;
- an outcome with potential to balance land use intensification with formal services provision within the context of enhanced environmental protection; and
- the creation of a community with a unique identify and strong sense of place.

5. CONCLUSION

The Knuckey and Ironstone Lagoons, the associated wetlands and the links to Holmes Jungle contribute to the significance of the natural environment in this locality. It is also a key strategic land asset within the Darwin region.

This document is not advocating any particular approach to the future directions for use and development in the locality but provides the contextual background and identifies possible responses.

The intention is to inform community discussion of the various opportunities including growing existing and establishing new businesses, providing possible local employment, increasing property values, providing alternative and a variation in housing, within the overarching objectives of protection or enhancement of the natural landscape and creating a place where people live in balance with that landscape.

The outcomes of the community discussion may inform preparation of a draft Area Plan for consideration for inclusion as policy within the NT Planning Scheme.