

ENCL: **ORDINARY COUNCIL MEETING/OPEN**  
 YES

AGENDA ITEM: **14.1.6**

**CREATION OF EASEMENT OVER SECTION 4295 (216) MCMILLANS ROAD, MARRARA**

REPORT No.: 17CO0015 DB:hd COMMON No.: 265213

DATE: 12/12/2017

**Presenter: Manager Design, Developments & Projects, Drosso Lelekis**

**Approved: General Manager City Operations, Luccio Cercarelli**

### **PURPOSE**

The purpose of this report is to seek Council's approval of the creation of an easement within Section 4295 (216) McMillans Road, Marrara for the purpose of providing access to sewerage infrastructure, in favour of Darwin International Airport (DIA).

### **LINK TO STRATEGIC PLAN**

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Evolving Darwin Towards 2020 Strategic Plan':-

#### **Goal**

1. Collaborative, Inclusive and Connected Community

#### **Outcome**

1.4 Improved relations with all levels of government and significant stakeholders

#### **Key Strategies**

1.4.1 Actively engage with all levels of government to coordinate efficiencies and develop opportunities

### **KEY ISSUES**

- Northern Territory Airports Pty Ltd have requested Council's approval of a 12 metre wide sewerage easement over existing and future sewerage infrastructure within Lot 4295 (216) McMillans Road, Marrara (**Attachment A**).
- There is an existing sewer rising main within Lot 4295 (216) McMillans Road, Marrara with no easement in place.
- Northern Territory Airports (NTA) are requesting the easement to install a secondary sewer main.
- An independent assessment (**Attachment D**) commissioned by City of Darwin assessed the application and identifies that a second main is not required for servicing purposes, however the NTA may be doing this for their own reasons.
- Power Water Corporation (PWC) have advised that they do not have an application for an additional connection.
- The current rezoning application of Lot 4295 (216) McMillans Road, Marrara from Public Open Space (PS) to Conservation Zone (CN) recognises the need for an

PAGE: 2  
 REPORT NUMBER: 17CO0015 DB:hd  
 SUBJECT: CREATION OF EASEMENT OVER LOT 4295 (216) MCMILLANS ROAD,  
 MARRARA

---

easement and the land in question has been left as Zone PS in the planning application.

- The size of the proposed easement was not determined at the time of lodging the rezoning application and if approved, advice on the width will be provided to the Department of Lands, Planning and Logistics.
- It is recommended that an eight metre wide sewer easement (rather than the 12m requested) is granted in favour of the upstream lot with conditions as outlined within the recommendations.

### **RECOMMENDATIONS**

- A. THAT Report Number 17CO0015 DB:hd entitled Creation of Easement over Lot 4295 (216) McMillans Road, Marrara, be received and noted.
- B. THAT Council approve the creation of an eight metre wide sewer easement over the existing sewerage infrastructure over Lot 4295 (216) McMillans Road, Marrara in favour of Section 5729 (40) Henry Wrigley Drive, Eaton subject to:
- (i) all costs associated with the creation of the sewer easement being met by Northern Territory Airports Pty Ltd or Darwin International Airports Pty Ltd;
  - (ii) the boundary of the easement be offset from the existing sewer rising main by 1.5 metres to allow space within the easement to accommodate a second sewer rising main.
  - (iii) THAT the following conditions be applied to LTO Form 52 "Creation of Easement":
    - i. Removal of any vegetation or trees requiring the approval of Council prior to commencement of works and subject to evidence of need to remove.
    - ii. Any vehicles entering the easement requiring approval of Council prior to accessing the easement.
    - iii. Any works within the easement requiring approval of Council prior to commencement of works.
    - iv. Construction of new infrastructure to be
- C. THAT pursuant to Section 26 (2) of the Local Government Act, Council authorises the affixing of the common seal to all documents associated with finalising the creation of a sewer easement over Section 5729 (40) Henry Wrigley Drive, Eaton in favour of the Darwin International Airport in accordance with Report Number 17CO0015 DB:hd entitled Creation of Easement over Lot 4295 (216) McMillans Road, Marrara, and that this be attested by the signatures of the Chief Executive Officer and the Lord Mayor.

PAGE: 3  
REPORT NUMBER: 17CO0015 DB:hd  
SUBJECT: CREATION OF EASEMENT OVER LOT 4295 (216) MCMILLANS ROAD, MARRARA

## **BACKGROUND**

There is an existing sewer rising main owned and maintained by Darwin International Airports (DIA) that runs through Lot 4295 (216) McMillans Road, Marrara. This sewer main is not currently within an easement and is connected to the Power and Water Corporation sewerage infrastructure within the existing Power and Water Corporation easement located along the northern allotment boundary.



Figure 01 - Excerpt from current title, approximate location of existing sewerage infrastructure

PAGE: 4  
 REPORT NUMBER: 17CO0015 DB:hd  
 SUBJECT: CREATION OF EASEMENT OVER LOT 4295 (216) MCMILLANS ROAD, MARRARA

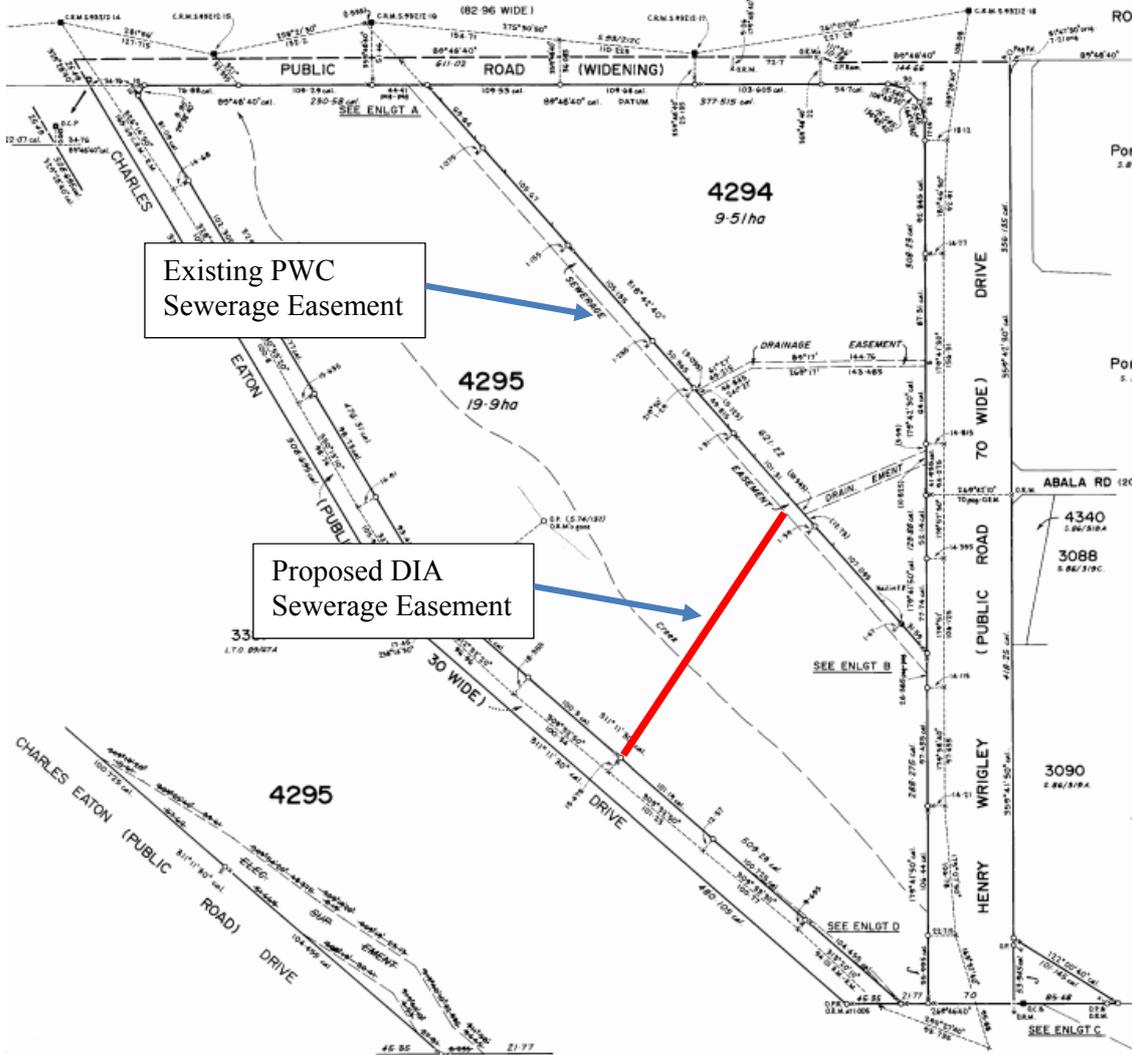


Figure 02 - Excerpt from current title, approximate location of existing sewerage infrastructure

**Planning Background**

Previous Report Number 14TS0229, entitled Rezone Section 5249 (35) Henry Wrigley Drive and Section 4295 (216) McMillans Road, Marrara to zone CN (Conservation), was prepared for Town Planning Committee meeting held on 7 October 2014.

At the Ordinary Council Meeting on Tuesday, 25 November 2014, Council resolved as follows:

PAGE: 5  
 REPORT NUMBER: 17CO0015 DB:hd  
 SUBJECT: CREATION OF EASEMENT OVER LOT 4295 (216) MCMILLANS ROAD,  
 MARRARA

---

DECISION NO.21\2843 (25/11/14)

**Rezoning Rapid Creek Sections 4295 and 5249 from PS (Public Open Space) and OR (Organised Recreation) Zones to CN (Conservation) Zone**

Common No. 265213

*THAT Council apply to the Lands Department for the rezoning of Rapid Creek Sections 4295 and 5249 from PS (Public Open Space) and OG (organised Recreation) Zones to CN (Conservation) Zone.*

A Planning Scheme Amendment was lodged on 28 June 2015. On 2 July 2015 the Northern Territory Government requested that the City of Darwin put the application on hold pending research into the Rapid Creek Flood Mitigation works.

At the Ordinary Council Meeting on Tuesday, 28 July 2015, Council resolved as follows:

DECISION NO.21/357 (28/07/15)

**Conservation rezoning application for Section 5249 (35) Henry Wrigley Drive and Section 4295 (216) McMillans Road, Marrara - Update**

Report No. 15TS0131 NS:dj (28/07/15) Common No. 265213

*THAT Council request that the exhibition of the Rezoning Application PA2015/0400 be delayed until all information is at hand and a coordinated approach can be taken by all stakeholders as outlined in Report Number 15TS0131 NS:dj entitled Conservation rezoning application for Section 5249 (35) Henry Wrigley Drive and Section 4295 (216) McMillans Road, Marrara - Update.*

The Development Consent Authority report outlined that “if officers believe that there will be no major issues, they will proceed with the Rezoning Application.”

On 22 June 2016 the Northern Territory Government requested that the City of Darwin exclude areas that will be used for flood mitigation works from the proposed rezoning to zone CN (Conservation). This included a ‘Proposed Sewerage Easement 12m wide – DIA’. The areas are shown as drainage easements on the attached map (**Attachment B**).

On 22 February 2017 NTG, Rapid Creek Landcare Group and internal environmental staff were advised of the intention to lodge the application with the amendments requested by the Northern Territory Government. No comments or issues were raised.

The rezoning application was re-lodged on 22 February 2017. The Planning Scheme Amendment was placed on exhibition between 16/06/2017 and 14/07/2017. Submissions were received from Power and Water, Darwin International Airport, Rapid Creek Landcare Group, Department of Infrastructure, Planning and Logistics and Department of Defence. An update from the Department of Infrastructure,

PAGE: 6  
 REPORT NUMBER: 17CO0015 DB:hd  
 SUBJECT: CREATION OF EASEMENT OVER LOT 4295 (216) MCMILLANS ROAD, MARRARA

Planning and Logistics, dated 12/10/2017, indicated that “the Chairman of the NT Planning Commission has decided not to hold a hearing on this proposed rezoning given that none of the submissions received objected to the proposal and the Rapid Creek Landcare Group, as the only public submitter, was comfortable that there was no need to hold a hearing.”



Figure 03 - Excerpt from current Planning Application to rezone a portion of Section 4295 (216) McMillans Road, Marrara

This report assesses the proposed easement for the Darwin International Airport over an existing sewer rising main, the proposed duplication of the main and the impacts this may have with consideration of the current Planning Scheme Amendment Application PA2015/0400.

PAGE: 7  
REPORT NUMBER: 17CO0015 DB:hd  
SUBJECT: CREATION OF EASEMENT OVER LOT 4295 (216) MCMILLANS ROAD,  
MARRARA

---

## **DISCUSSION**

Northern Territory Airports Pty. Ltd has approached City of Darwin to create a 12 metre wide easement over Council owned Section 4295 (216) McMillans Road, Marrara. They consider this easement width necessary to allow for the existing sewer rising main, including access for maintenance purposes and to provide enough width to accommodate a future proposed duplication of the sewer rising main. The duplication is intended to provide redundancy and allow inspection of the integrity of the existing sewer main.

The assessment of this request has been broken into two sections:

1. Assessment of the existing sewer and provision for an easement over it; and
2. The future proposed sewer rising main and its location

### **Existing Sewer Rising Main**

It is considered essential that the existing sewer rising main have an easement placed over it to allow ongoing maintenance of the infrastructure, however Council is able to approve an easement with conditions.

Due to the sensitivity of Rapid Creek and the potential impact to the Riparian vegetation as detailed within the Vegetation Assessment section of the application made (**Attachment A**), it is considered that a condition should be placed over any easement granted that permission be required to remove any vegetation, access with a vehicle or construct new infrastructure within the easement.

It has been identified by Northern Territory Airports and in the Vegetation Assessment within their application that a number of large trees are growing over the existing sewer and that this has the potential to cause damage to the pipe infrastructure leading to contamination of Rapid Creek. Northern Territory Airports have advised that they are unable to undertake an assessment of the infrastructure at this point as the pipe cannot be in use whilst a camera inspection is being performed.

An independent assessment (**Attachment D**) commissioned by City of Darwin identified that building a redundant pipe for inspection purposes is not strictly necessary and that inspection of the pipe could be completed through various other methods to determine any issues.

Northern Territory Airports have identified within their application that the easement should be 12 metres wide to accommodate both the existing and proposed sewer rising mains.

The independent assessment determined that a minimum of a seven metre wide easement would be sufficient to accommodate the existing and future pipes. In considering the request and the assessment, City of Darwin officers consider that an eight metre wide easement would be appropriate.

PAGE: 8  
 REPORT NUMBER: 17CO0015 DB:hd  
 SUBJECT: CREATION OF EASEMENT OVER LOT 4295 (216) MCMILLANS ROAD,  
 MARRARA

---

The clearing of vegetation is of particular concern as there are significant trees within the area. This may impact the function of the Riparian Zone, and would allow for unauthorised vehicles to access the Creek as a result of loss of this natural barrier.

An easement provides certainty of location of infrastructure for future reference.

### **Proposed Sewer Rising Main Duplication**

The intent of the 12 metre wide easement is to allow for the duplication of the existing sewer along the preferred route Northern Territory Airports are pursuing.

Power and Water Corporation (PWC) have advised that Northern Territory Airports are restricted on the flow rate they may discharge into the PWC system and that no new or additional connection application has being made.

Within the application for the easement, Northern Territory Airports have identified that two alternative routes were assessed and determined by them to not be preferred.

The new main would be approximately 270 metres long and would traverse through the proposed easement and under the Creek. Northern Territory Airports consider this to be the route of lowest risk due to the lower storage volume within the pipe due to its reduced length, as is discussed further below. No risk assessment was provided for this option by NTA. However, the independent review undertaken included this.

The independent assessment has identified that, if approved, a good proportion of the new rising main could be constructed along the proposed easement via boring. This would significantly reduce any impact on flora, on the surface of the creek and the surrounding habitat will remained untouched.

It is not intended that the creation of the easement would imply approval of the new rising main and that PWC approval and other technical requirements would have to be met prior to its construction approval within the easement.

This recommendation is to doesn't approve the duplication of the existing sewer rising main and grants an eight metre wide easement in favour of the upstream lot with conditions restricting tree removal, access and construction.

Currently the existing sewer rising main has not been assessed, but the independent assessment has identified that this can be undertaken without duplicating the main. There is a risk that the existing pipe may rupture and leak sewage into the creek, however the risk would only be slightly reduced with a new, duplicated main.

The provision of an easement may is consistent with the rezoning application, however the easement width will inform the location and width of the Public Space to remain. Once the area is rezoned to Conservation it will make any further changes to

PAGE: 9  
 REPORT NUMBER: 17CO0015 DB:hd  
 SUBJECT: CREATION OF EASEMENT OVER LOT 4295 (216) MCMILLANS ROAD,  
 MARRARA

---

the easement challenging. It is therefore recommended that if an eight metres be approved to allow for future consideration of expansion of the infrastructure.

Approval of a new sewer rising main within this easement would be subject to it meeting the following conditions;

- Removal of any trees requires the approval of Council prior to commencement of works and subject to evidence of need to remove.
- Any vehicles entering the easement require approval of Council prior to accessing the easement.
- New construction within the easement requires approval of Council prior to commencement of works.
- All costs associated with the creation of the sewer easement being met by Northern Territory Airports Pty Ltd or Darwin International Airports Pty Ltd.
- It is located within the approved eight metre easement.
- PWC approval of the connection for the rising main is provided.

### **CONSULTATION PROCESS**

In preparing this report, the following City of Darwin officers were consulted:

- Town Planner
- Team Leader Development
- Manager Climate Change and Environment

In preparing this report, the following External Parties were consulted:

- Project Manager, Northern Territory Airports
- Planner, Department of Lands, Planning and Infrastructure
- Power and Water Corporation
- Rapid Creek Landcare Group

### **POLICY IMPLICATIONS**

None identified.

### **BUDGET AND RESOURCE IMPLICATIONS**

All costs associated with the creation of the easement would be paid for by the DIA.

The value of the land over which this easement would be created has not been established.

### **RISK/LEGAL/LEGISLATIVE IMPLICATIONS**

To facilitate the creation of an easement a Section 91 Creation of Easement in Gross and section 44(1) Request to Issue Certificate as to Title forms require authorisation by Council under the common seal.

PAGE: 10  
 REPORT NUMBER: 17CO0015 DB:hd  
 SUBJECT: CREATION OF EASEMENT OVER LOT 4295 (216) MCMILLANS ROAD,  
 MARRARA

---

Section 26 (2) of the Local Government Act requires that the affixing of the common seal to a document must be authorised or ratified by resolution of the Council; and must be attested by the signatures of the Chief Executive Officer and at least one member of the Council.

The independent assessment undertaken of the proposals included identification of risks associated with each option (**Attachment D**)

### **ENVIRONMENTAL IMPLICATIONS**

Although the creation of an easement itself will have little to no impact on the area, the provision for an easement without the conditions as stated above could lead to increased loss of vegetation, vehicle access along the easement and close to the creek by unauthorised vehicles and construction disturbing the area.

Some loss of vegetation is likely, which would be associated with undertaking works on the infrastructure within the easement. This can be mitigated through the use of boring rather than trenching.

If there is a break to the existing or new pipe, effluent could flow into the creek system. Although an assessment was not been provided by NTA to compare the potential impacts of Alternative Route 1 and Alternative Route 2 compared to the preferred route, this was included in the independent assessment undertaken.

### **COUNCIL OFFICER CONFLICT OF INTEREST DECLARATION**

We the Author and Approving Officers declare that we do not have a Conflict of Interest in relation to this matter.

**DROSSO LELEKIS**  
**MANAGER DESIGN,**  
**DEVELOPMENT & PROJECTS**

**LUCCIO CERCARELLI**  
**GENERAL MANAGER**  
**CITY OPERATIONS**

For enquiries, please contact James Whyte on 8930 0413 or email:  
[j.whyte@darwin.nt.gov.au](mailto:j.whyte@darwin.nt.gov.au).

#### **Attachments:**

- Attachment A:** Sewer Easement Information provided by Darwin International Airport  
**Attachment B:** Proposed Easement  
**Attachment C:** Northern Territory Government Proposed works and easements  
**Attachment D:** Independent Assessment – DIA – New Sewer Rising Main

ATTACHMENT A



# Sewer Infrastructure

SEWER EASEMENT INFORMATION



# Contents

---

**1.0 Executive Summary ..... 1**

**2.0 Easement Details ..... 2**

    Fig.1 Easement & Existing SPS ..... 3

**Appendix 1 Easement Set Out ..... 5**

**Appendix 2 Alternative Route Plan ..... 6**

**Appendix 3 ECOZ Report..... 7**



## 1.0 Executive Summary

---

DIA have been conducting a full review of their assets which includes the sewer infrastructure that is critical to the operations of the airport. In doing so it has been determined that a second outlet is required to provide redundancy and allow for the overlap to enable change out of ageing infrastructure in and around the Airport.

The current outlet for the sewer infrastructure has been in place for 20+ years and will require a detailed condition report. The report will be scheduled for when the second outlet has been installed and commissioned allowing for the changeover and any subsequent works that may result from the findings, if required.

DIA are requesting a 12m easement in line with the DCC proposal (22<sup>nd</sup> February 2017) to rezone Lot 4295 that will provide security and access to its current and planned Sewer Rising Mains (SRM). DIA would also require regular access to the easement to carry out periodic maintenance activities that will provide ongoing assurances of the infrastructure.

DIA have been discussing the requirements of the second outlet connection and the easement with the relevant Authorities; Darwin City Council (DCC) - property owners of lot 4295 and Power Water Corporation (PWC) – owners of the main sewer infrastructure DIA will connect to. This report has been compiled in support of the requirements of DIA and DCC to provide the Council with a more detailed understanding for its consideration.

DIA have engaged with specialists, *Active Tree Services – Arborist and ECOZ Environmental Consultants*, to provide an impartial assessment of the easement area that have set out the initial findings and mitigations that can be implemented by DIA to offset all works required through the area of the 12m easement.

## 2.0 Easement Details

---

DIA are requesting that a 12m easement is granted to provide access for the current and new planned installation of a second sewer rising main (SRM). This will allow for redundancy a maintenance inspections of the Airport assets. Such inspection would include but not limited to;

- Access for required for regular maintenance;
  - Monthly – visual inspection of pipeline easement and pits
  - Quarterly – site conditions and maintenance
  - Annually – pipe inspection (shut down drain and camera)

This is a critical piece of the Airports infrastructure that is vital to the daily operations. The request for a 12m easement has been advice sought through Jacobs Engineering as to an adequate and safe area that will enable the installation of the second outlet. The spacing would be (3m-6m-3m) 3m from each boundary of the easement would be the centreline of the outlet pipes with a 6m clearance between the two.

DIA have assessed alternative routes but maintain that the direct route (270m) alongside the current outlet is the best outcome for the preservation of the soon to be conservation zone and DIA. The positioning alongside the current SRM will allow for ease of maintenance providing a direct line of sight from the pump station situated on Murphy Road along the easement. Furthermore the reduction of environmental risk is considerable given the overall length and capacity/volume is at least 2.5 time less than any of the alternatives.

### Alternative Route 1

Was to utilise the installed infrastructure along Charles Eaton and go towards McMillans Road. The flow of the sewer is directed towards Murphy Road collection point and has been designed to cater for any and all future development. There would also be the increased risk to encapsulating the soon to be conservation area in more sewer pipe than necessary.

Alternative Route 2

Was to install the second pipe along Charles Eaton in the road reserve and along Henry Wrigley Drive road reserve. This was ruled out also as it is 2.5 times longer (670m) and again would encapsulate a much larger portion of the soon to be conservation area. The capacity/volume of such infrastructure would hold a greater risk to the surrounding area.

**Fig.1 Easement & Existing SPS**



Currently lot 4295 is zoned PS (Public Open Space) which has been identified by DCC as the classification to remain for the DIA and other easements. DIA support that the area of the easement is granted (see Fig.1) and is able to be maintained as detailed within the DCC proposal to rezone the majority of lot 4295 on the 22<sup>nd</sup> February 2017.

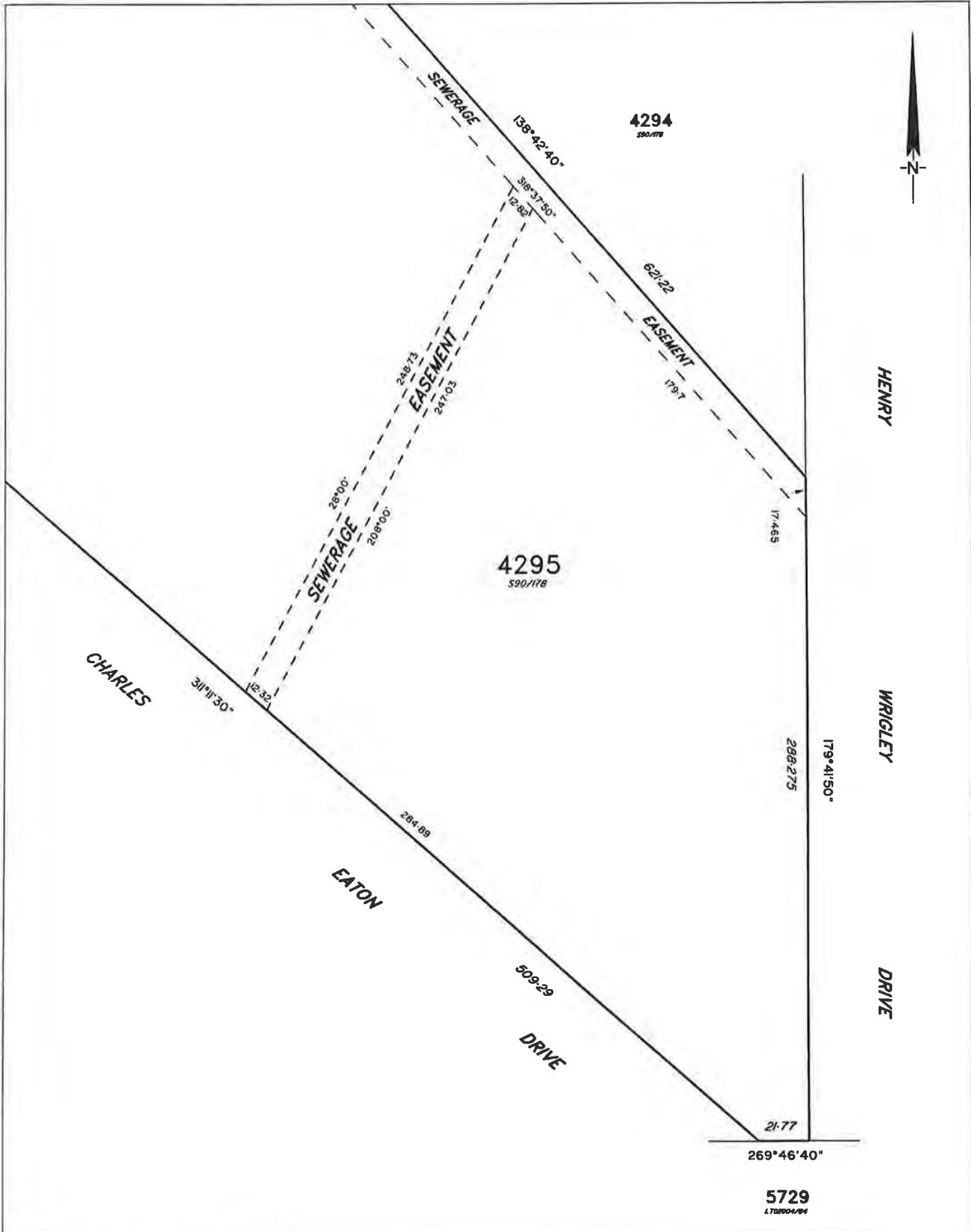
Through the consultation with specialist environmental and arborist consultants DIA has been provided advice that the removal of vegetation in DCC proposed easement will represent a small loss of overall. The tree species recorded within the proposed easement are all common in the Darwin region and none listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* and/or the *Territory Parks and Wildlife Conservation Act (NT)*. Areas of the proposed easement are already highly disturbed, vegetation is open and dominated by exotic species. The loss of habitat is not considered to be of a scale that would significantly impact any species in this area. Within the attached report by ECOZ the species and number of trees have been identified that can be off-set to another area within the newly zoned CN area under the instruction of DCC. (ECOZ report attached Appendix 1)

DIA have engaged BMD Urban Pty Ltd to construct the upgrade to the SPS on Murphy Road that will ultimately be connected to the existing and new duplication SRM. These works as mentioned have been identified within the asset condition review for upgrade works and we had intended to construct both portions of work at the same time. We have amended our contract to separate these portions of work to enable consultation with DCC and the relevant stakeholders given that no easement had been previously registered to ensure a clear informative approach is taken.

DIA can provide any additional information that may be required as a result of a request that may arise on the 28<sup>th</sup> November 2017 at the Council meeting.

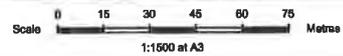
## Appendix 1 Easement Set Out

---



Survey Plan	S 90/178
Title Details	Volume 804 - Folio 393
Datum	Grid Bearings
Scale	1:1500 at A3

NOTE: PROPOSED EASEMENT IS IN FAVOUR OF SECTION 6729 HUNDRED OF BAGOT



**JACOBS**

A.C.N. 105 201 998  
 370 Stirling Place, Sturtville QLD 4057  
 Telephone (07) 5500 4000 Facsimile (07) 5500 4040

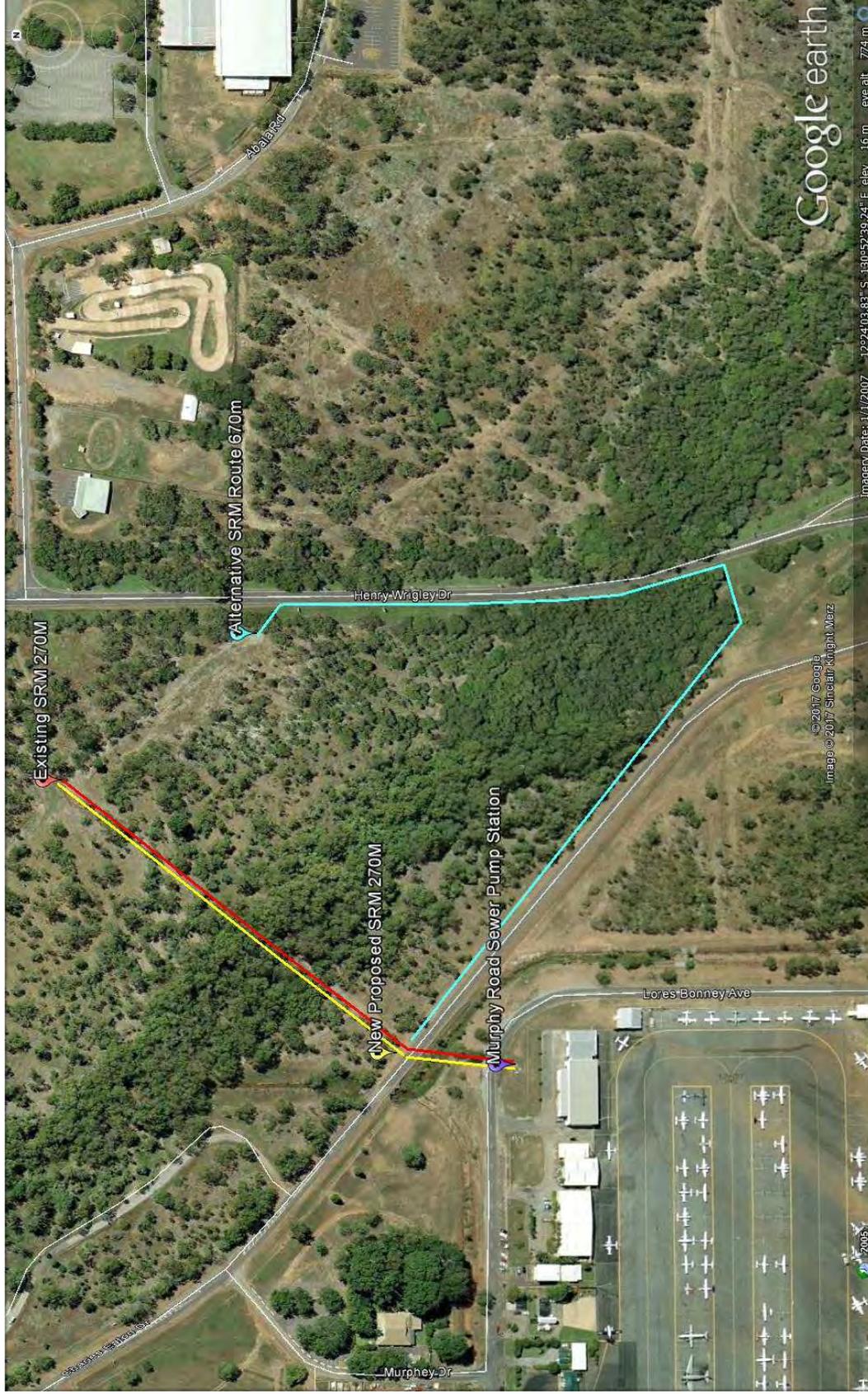
*Alan Thorpe*  
 Alan William Thorpe  
 Licensed Surveyor

06/07/2017  
 Date

**PROPOSED SEWERAGE EASEMENT  
 SECTION 4295 HUNDRED OF BAGOT**

## Appendix 2 Alternative Route Plan

---



## Appendix 3 ECOZ Report

---



# Vegetation Assessment Proposed Sewer Easement Northern Territory Airports



# DOCUMENT CONTROL RECORD

<b>Job</b>	EZ17302
<b>Document ID</b>	160376-1-23
<b>Project manager</b>	Helen Dwyer
<b>Author(s)</b>	Chris Brady

Revision	Date	Document history	Approver
0-14	10 Nov 2017	Sent to client for review	H. Dwyer
1	13 Nov 2017	Final sent to client	H. Dwyer

Recipients are responsible for eliminating all superseded documents in their possession.

EcOz Pty Ltd.  
 ABN: 81 143 989 039  
 Winlow House, 3<sup>rd</sup> Floor  
 75 Woods Street  
 DARWIN NT 0800  
 GPO Box 381, Darwin NT 0800

Telephone: +61 8 8981 1100  
 Facsimile: +61 8 8981 1102  
 Email: [ecoz@ecoz.com.au](mailto:ecoz@ecoz.com.au)  
 Internet: [www.ecoz.com.au](http://www.ecoz.com.au)



### RELIANCE, USES and LIMITATIONS

This report is copyright and is to be used only for its intended purpose by the intended recipient, and is not to be copied or used in any other way. The report may be relied upon for its intended purpose within the limits of the following disclaimer.

This study, report and analyses have been based on the information available to EcOz Environmental Consultants at the time of preparation. EcOz Environmental Consultants accepts responsibility for the report and its conclusions to the extent that the information was sufficient and accurate at the time of preparation. EcOz Environmental Consultants does not take responsibility for errors and omissions due to incorrect information or information not available to EcOz Environmental Consultants at the time of preparation of the study, report or analyses.

# TABLE OF CONTENTS

---

1	INTRODUCTION .....	1
2	METHODS.....	1
3	RESULTS.....	3
4	DISCUSSION .....	5
5	REFERENCES .....	6

## Tables

Table 1.	Plant species and approximate number of individuals (>1 m tall) recorded within the proposed easement .....	3
----------	---	---

## Figures

Figure 1.	Map showing location of proposed easement .....	2
Figure 2.	Photographs of vegetation growing within the proposed easement from south-west to north-east ..	4

# 1 INTRODUCTION

---

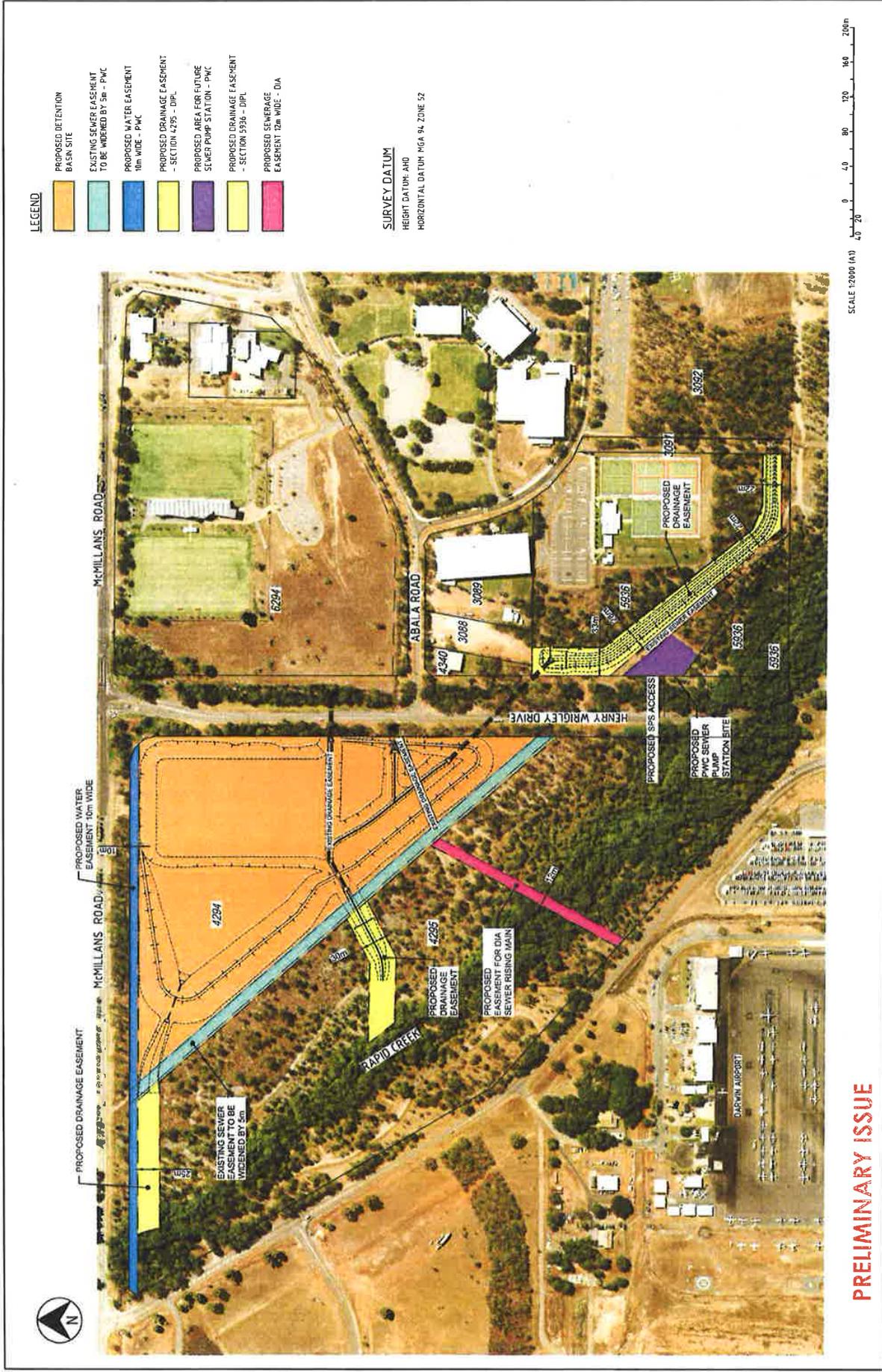
Northern Territory Airports have contracted EcOz Environmental Consultants (EcOz) to undertake an assessment of the vegetation within a corridor approximately 250 m long and 12 m wide, that has been proposed as a sewer easement in the vicinity of Darwin International Airport. The proposed easement runs atop an existing sewer line from Charles Eaton Drive to the north-east, where it will adjoin an existing sewer easement (Figure 1). The proposed easement crosses Rapid Creek.

There is some concern that a few large trees currently atop the sewer line could impact the integrity of the pipe. Given the nature of the material within the pipe and its vicinity to the watercourse any breach of the pipe is likely to negatively impact water quality in Rapid Creek.

# 2 METHODS

---

A site inspection was undertaken by an ecologist familiar with the vegetation of the Northern Territory on the 3<sup>rd</sup> of November 2107. The ecologist walked the proposed easement and recorded tree species within the ~250 m x 12 m corridor. Introduced species were also recorded.



- LEGEND**
- PROPOSED DETENTION BASIN SITE
  - EXISTING SEWER EASEMENT TO BE WIDENED BY 5m - PWC
  - PROPOSED WATER EASEMENT 10m WIDE - PWC
  - PROPOSED DRAINAGE EASEMENT - SECTION 4295 - DIPL
  - PROPOSED AREA FOR FUTURE SEWER PUMP STATION - PWC
  - PROPOSED DRAINAGE EASEMENT - SECTION 5936 - DIPL
  - PROPOSED SEWERAGE EASEMENT 12m WIDE - DIA

**SURVEY DATUM**  
 HEIGHT DATUM: AHD  
 HORIZONTAL DATUM: MGA 94, ZONE 52

SCALE 1:2000 (A1) 0 20 40 80 120 160 200m

**PRELIMINARY ISSUE**

REV	DESCRIPTION	DATE	BY	CHECKED BY
1	PRELIMINARY ISSUE	05/01/17	JK	JACOBS
2	PRELIMINARY ISSUE	17/03/16	PS	JACOBS
3	PRELIMINARY ISSUE	14/01/16	CP	JACOBS
4	INITIAL ISSUE	17/03/16	CP	JACOBS

**Northern Territory Government**

**JACOBS**

A/CN/001/026/2006  
 Level 2, 25-251 Fwy Rd  
 Darwin NT 0800 AUSTRALIA

Project No: 101/1000  
 Tel: 08 8961 4000  
 Fax: 08 8961 4000  
 Main Survey Station

DARWIN  
 BARBARA  
 RAPID CREEK FLOOD MITIGATION  
 EXISTING AND PROPOSED EASEMENT PLAN

PROPOSED TO: [ ]  
 USED FOR: [ ]  
 SHEET OF: 1 of 1  
 PROJECT NO: SK-0030  
 REVISION: E A1

Figure 1. Map showing location of proposed easement

### 3 RESULTS

Eleven tree species were recorded growing within the corridor of the proposed easement, with approximately 43 individuals taller than one metre (Table 1). There are several large trees including Paperbarks (*Melaleuca* sp.) and Black Wattle (*Acacia auriculiformis*). The vegetation adjacent to Rapid Creek is dense, with a closed canopy (Figure 2). The stream bank is dominated by species common along permanent water courses in the Darwin region (e.g. *Carallia brachiata*, *Barringtonia acutangula*, *Acacia auriculiformis*). Further from the creek the vegetation is more sparse, with that on the Charles Eaton Drive side dominated by species typical of transition between woodland and open forest (e.g. *Acacia auriculiformis* and *Planchonia careya*).

On the north-east end of the proposed easement the vegetation is very open and dominated by species typically associated with seasonally inundated areas (e.g. *Pandanus spiralis*, *Lophostemon lactifluus* and *Barringtonia acutangula*). The ground layer is dominated by introduced species, including Humidicola (*Urochloa humidicola*), Rat's Tail Grass (*Sporobolus* sp.), and the Class B weeds declared under the *Weed Management Act*; Spiny head Sida (*Sida acuta*) and Snakeweed (*Stachytarpheta* spp.).

**Table 1. Plant species and approximate number of individuals (>1 m tall) recorded within the proposed easement**

Family	Species	Number
Caesalpiniaceae	<i>Peltophorum pterocarpum</i>	1
Combretaceae	<i>Terminalia microcarpa</i>	1
Lecythidaceae	<i>Barringtonia acutangula</i>	10
Lecythidaceae	<i>Planchonia careya</i>	2
Mimosaceae	<i>Acacia auriculiformis</i>	4
Myrtaceae	<i>Corymbia ptychocarpa</i>	2
Myrtaceae	<i>Lophostemon lactifluus</i>	4
Myrtaceae	<i>Melaleuca argentea</i>	2
Pandanaceae	<i>Pandanus spiralis</i>	5
Rhamnaceae	<i>Alphitonia excelsa</i>	1
Rhizophoraceae	<i>Carallia brachiata</i>	11



Figure 2. Photographs of vegetation growing within the proposed easement from south-west to north-east

## 4 DISCUSSION

---

Trees that develop vast and invasive root systems are not appropriate to plant over or near underground infrastructure such as sewer lines, as they can crack and break pipes, causing burst water mains, blocked sewers or damage to conduits (PWC 2009). The proposed easement may be cleared of vegetation to provide access to the sewer line and reduce the potential for damage to pipes from tree roots or damage from falling trees.

Given the proximity of sewer line to Rapid Creek, the current vegetation within the proposed easement poses a potential risk to Rapid Creek, should damage to the pipes result in the escape of sewerage. Sewage contains many potential contaminants, including nutrients, suspended and dissolved solids, and disease-causing micro-organisms which, if released to Rapid Creek, would impact on water quality in Rapid Creek (ANZECC and ARMCANZ 1997). The resulting reduction in water quality could cause eutrophication, whereby algal blooms reduce dissolved oxygen and light availability, impacting aquatic life (e.g. fish kills). The introduction of a number of potential pathogens and disease-causing micro-organisms would also reduce recreational opportunities in Rapid Creek, and may impact downstream use of the creek. As such, the management of the easement (i.e. removal of vegetation) is required to minimise risks to Rapid Creek.

The *Northern Territory Planning Scheme* (NTPS) stipulates how land is managed and developed in the Northern Territory, and permits certain activities within various zoned and unzoned lands. Clause 1.3 (Section 2(b)i) states that (unless specified) the NTPS does not prevent the construction, alteration, repair or maintenance of facilities for the reticulation of water, sewerage, gas or electricity. Additionally, the proposed easement is located within land zoned PS (Public Open Space). Clause 10.2 of the NTPS provides requirements for clearing of native vegetation within certain zones, but does not apply to PS.

There is a proposal to zone the land in the vicinity of the proposed easement CN (Conservation). Whilst this would not prevent clearing of vegetation to protect the integrity of the sewer pipes, it may increase regulatory requirements, with a permit required each time maintenance vegetation clearing is undertaken. Given the requirement to maintain the corridor such that there are no large trees that could damage or prevent access to the sewer pipes, consideration may be given to a zoning more appropriate for sewer easements, such as U (Utilities).

The tree species recorded within the proposed easement are all common in the Darwin region. None of the plant species recorded are listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and/or the *Territory Parks and Wildlife Conservation Act* (NT).

The proposed sewer easement intersects the riparian vegetation bordering Rapid Creek. Riparian vegetation is considered a Sensitive Vegetation Community in the Northern Territory. It is considered significant as it shades streams, moderating temperature and creating suitable conditions for breeding for many aquatic species, maintains dissolved oxygen levels, and restricts the occurrence of algal blooms (NTG undated). Riparian vegetation can also protect stream banks from erosion and filters any sediment or nutrients in overland flow before the flow enters the stream, thus reducing sedimentation of aquatic habitats and reducing nutrient induced algal blooms (NTG undated).

The proposed easement is relatively narrow in extent (12 m); it could be expected that the canopy of trees growing adjacent to the corridor could shade the majority (or all) the watercourse within the corridor. A site specific Erosion and Sediment Control Plan should be developed and implemented to protect the stream bank.

The loss of trees will represent a small loss of habitat for fauna species. Rapid Creek is known to support numerous species relatively restricted to this habitat, such as Azure Kingfisher, Shinning Flycatcher and Mitchell's Water Monitor. The loss of habitat is not considered to be of a scale that would significantly impact any of these species.

Adjacent to the proposed easement on the north-east end runs a drainage line that is highly disturbed. The vegetation is open and dominated by exotic species. In agreement with the land owner, there may be an

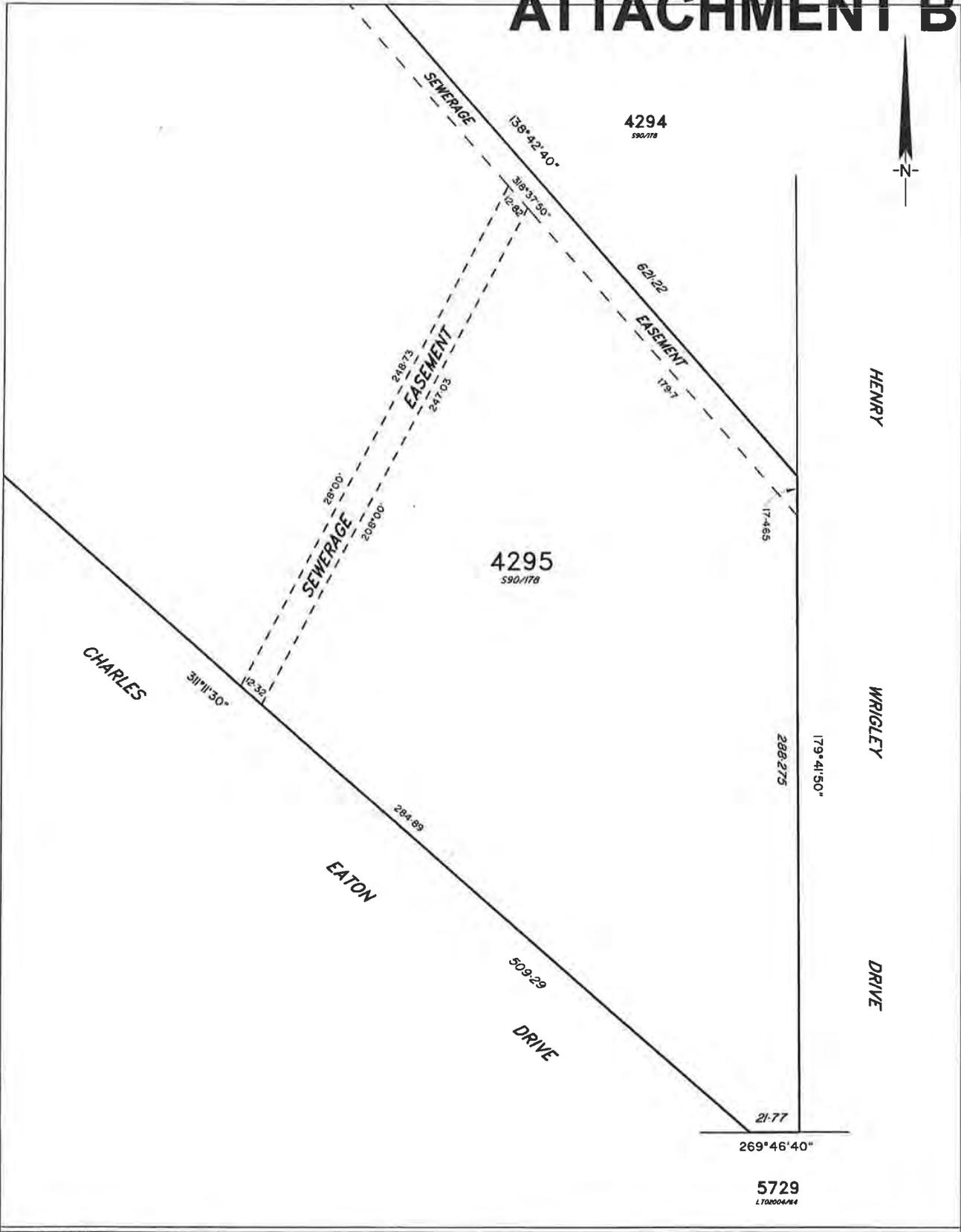
opportunity to plant a similar number (or more) local providence trees associated with riparian vegetation to offset loss of trees resulting from any clearing of the proposed easement. A reference list of suitable species has been compiled by the Rapid Creek Landcare Group. This would add to the substantial revegetation effort in the Rapid Creek corridor. Revegetation of this area would increase the amount of habitat for fauna associated with riparian vegetation and have benefits for the quality of water entering Rapid Creek.

## 5 REFERENCES

---

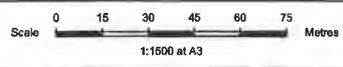
- Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ). (1997). *Australian Guidelines for Sewage Systems; Effluent Management*, National Water Quality Management Strategy, Canberra.
- Northern Territory Government. (undated). *Sensitive Vegetation in the Northern Territory*.  
[https://nt.gov.au/\\_\\_data/assets/pdf\\_file/0014/204206/riparian-vegetation-factsheet-english.pdf](https://nt.gov.au/__data/assets/pdf_file/0014/204206/riparian-vegetation-factsheet-english.pdf)
- Power and Water Corporation. (2009). *Living with Power and Water Easements*.  
[https://www.powerwater.com.au/\\_\\_data/assets/pdf\\_file/0011/14213/Easements\\_-\\_August\\_2009.pdf](https://www.powerwater.com.au/__data/assets/pdf_file/0011/14213/Easements_-_August_2009.pdf)

# ATTACHMENT B



Survey Plan	S 90/178
Title Details	Volume 804 - Folio 393
Datum	Gnd Bearings
Scale	1:1500 at A3

NOTE: PROPOSED EASEMENT IS IN FAVOUR OF SECTION 5729 HUNDRED OF BAGOT



**JACOBS**

A.D.A. 001 154 888  
 870 Box 1148 Pong, Northern Territory 0804  
 Telephone (08) 2528 4422 Facsimile (08) 2528 4440

*Alan Thorpe*  
 Alan William Thorpe  
 Licensed Surveyor

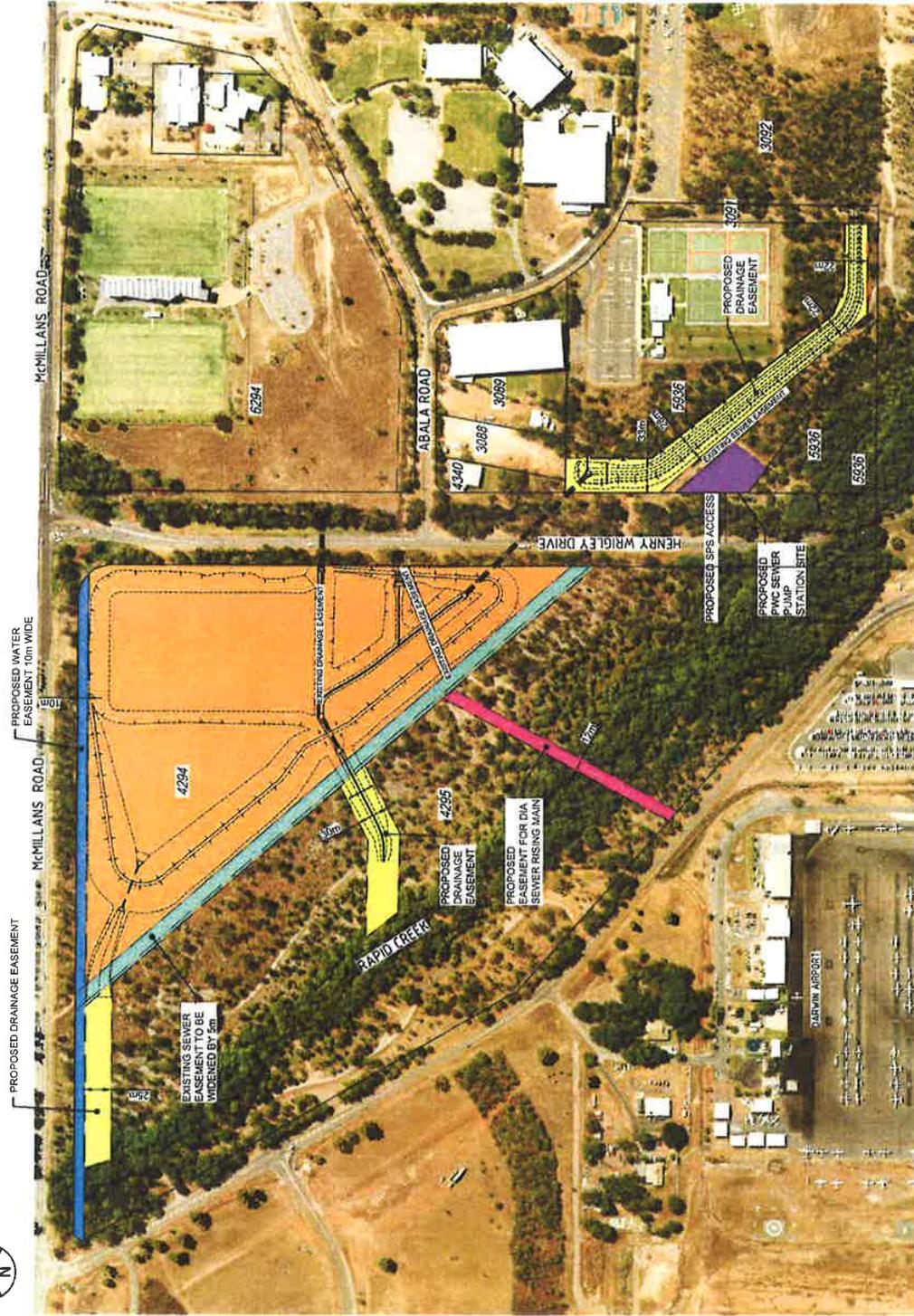
06/07/2017  
 Date

**PROPOSED SEWERAGE EASEMENT  
 SECTION 4295 HUNDRED OF BAGOT**

IW114400\_SU01\_A.dwg

- LEGEND**
- PROPOSED DETENTION BASIN SITE
  - EXISTING SEWER EASEMENT TO BE WIDENED BY 5m - PWC
  - PROPOSED WATER EASEMENT 10m WIDE - PWC
  - PROPOSED DRAINAGE EASEMENT - SECTION 4295 - DPL
  - PROPOSED AREA FOR FUTURE SEWER PUMP STATION - PWC
  - PROPOSED DRAINAGE EASEMENT - SECTION 9598 - DPL
  - PROPOSED SEWERAGE EASEMENT 10m WIDE - DIA

**SURVEY DATUM**  
 HEIGHT DATUM: AHD  
 HORIZONTAL DATUM: MGA 94, ZONE 52



SCALE: 1:2000 (A1)



PRELIMINARY ISSUE

<p><b>JACOBS</b></p> <p>A.C.N. 120 156 628                  Jacobs Group (Australia) Pty. Ltd                  Level 20, 100 Park Street                  NT 0800 AUSTRALIA</p>		<p><b>Northern Territory Government</b></p>		<p>DARWIN MARRARA RAPID CREEK FLOOD MITIGATION EXISTING AND PROPOSED EASEMENT PLAN</p>	
<p>1. PRELIMINARY ISSUE</p> <p>2. PRELIMINARY ISSUE</p> <p>3. PRELIMINARY ISSUE</p> <p>4. PRELIMINARY ISSUE</p>	<p>DATE: 22/01/21</p> <p>DATE: 17/08/20</p> <p>DATE: 24/03/20</p> <p>DATE: 17/02/20</p>	<p>DATE: 22/01/21</p> <p>DATE: 17/08/20</p> <p>DATE: 24/03/20</p> <p>DATE: 17/02/20</p>	<p>DATE: 22/01/21</p> <p>DATE: 17/08/20</p> <p>DATE: 24/03/20</p> <p>DATE: 17/02/20</p>	<p>DATE: 22/01/21</p> <p>DATE: 17/08/20</p> <p>DATE: 24/03/20</p> <p>DATE: 17/02/20</p>	<p>DATE: 22/01/21</p> <p>DATE: 17/08/20</p> <p>DATE: 24/03/20</p> <p>DATE: 17/02/20</p>
<p>PROJECT NO: 100110000</p> <p>PROJECT NAME: Rapid Creek Flood Mitigation</p> <p>PROJECT LOCATION: Darwin MARRARA</p> <p>PROJECT NUMBER: 1 of 1</p> <p>PROJECT CODE: SK-0030</p> <p>PROJECT TYPE: E</p>		<p>PROJECT NO: 100110000</p> <p>PROJECT NAME: Rapid Creek Flood Mitigation</p> <p>PROJECT LOCATION: Darwin MARRARA</p> <p>PROJECT NUMBER: 1 of 1</p> <p>PROJECT CODE: SK-0030</p> <p>PROJECT TYPE: E</p>		<p>PROJECT NO: 100110000</p> <p>PROJECT NAME: Rapid Creek Flood Mitigation</p> <p>PROJECT LOCATION: Darwin MARRARA</p> <p>PROJECT NUMBER: 1 of 1</p> <p>PROJECT CODE: SK-0030</p> <p>PROJECT TYPE: E</p>	



**Darwin City Council**

DIA - New Sewage Rising Main  
Review of Proposed Works

December 2017

## Table of contents

1.	Introduction.....	1
2.	Need for the Main.....	2
2.1	Easement Requirement.....	2
3.	Inspection and Testing Options .....	4
4.	Route Options .....	5
4.1	Preferred Route A.....	5
4.2	Alignment Option B.....	8
5.	Summary.....	9
6.	Scope and limitations .....	10

## Figure index

Figure 4-1	AC 1/17 and northern pipe alignment.....	5
Figure 4-2	Northern bank chamber and tree over pipe alignment .....	5
Figure 4-3	Creek Crossing .....	6
Figure 4-4	Main in sleeve exposed in northern drain .....	6
Figure 4-5	Southern creek bank chamber.....	7
Figure 4-6	Assumed existing pipe corridor.....	7
Figure 4-7	Verge of Henry Wrigley Dr.....	8

# 1. Introduction

Darwin International Airport (DIA) has indicated an intent to construct a new duplicate sewer rising main from their existing pump station at Murphy Road to the discharge point into the Marrara Trunk Sewer on the Northern side of Rapid Creek. The option preferred by DIA is to run parallel to the existing rising main in a straight line from the pump station to the existing discharge point, crossing Council Land comprising the Rapid Creek Conservation Zone and the Rapid Creek watercourse. A non-preferred option identified would run the main along Charles Eaton Dr to Henry Wrigley Dr then along Henry Wrigley Dr to a new discharge point on the trunk sewer adjacent to Henry Wrigley Dr. The latter option is longer and would include a crossing of Rapid Creek attached to the existing road culvert endwall or buried in the road formation cover fill over the culvert.

This report provides some commentary on the proposal as presented in the DIA option study to assist Council in consideration of the DIA proposal.

## 2. Need for the Main

While there is no identified problem with the existing rising main in regard to capacity or condition, and it is not particularly old (approximately 25 years out of a probably life of 50 years) the regrowth of trees along the route of the existing main is seen by DIA as a potential threat to the integrity of the pipe. The DIA suggest that a second new main is desirable as a duplication of the existing main to reduce risk and improve security by providing a standby main and to permit the existing main to be put off line for inspection and possible rehabilitation if a fault is identified.

Design details for the existing main are not provided however, given the conservative standards adopted by the authority responsible for construction of airport facilities at the time, the main is likely to be rubber ring jointed ductile iron cement lined (DICL) with polythene wrap and hence relatively resistant to physical damage by roots. Joints remain vulnerable to root intrusion however this would be ameliorated by the wrapping system generally adopted. If more normal standards were adopted then the main would most likely be rubber ring jointed PVC pressure pipe which is unlikely to admit root intrusion and remains reasonably durable against physical damage unless trees are uprooted by wind with root entangled pipes.

In the Darwin environment, growth of trees over water and sewer pipelines is an extremely common occurrence and unless the main is a particularly vulnerable pipe type, has prior damage allowing root entry or the trees are of a particularly aggressive type then the chances of adverse consequences for the pipe are fairly low. The provision of duplicate redundant rising mains in such circumstances has not previously been considered necessary for any other sewage stations and rising mains in the region.

While the Rapid Creek environment is a sensitive issue for contamination from the Airport precinct and DIA has the right to be particularly risk averse in this regard, the priority for provision of the second main is nevertheless considered fairly low. To build a second main in order to test the first main to find out if the second main is required is considered unnecessary.

### 2.1 Easement Requirement

As the existing DIA owned main passes through property not owned by DIA it is necessary to establish an easement over the main in favour of DIA to permit legal access to the main for maintenance and to provide legal protection against disruption to the main as well as alleviate the current trespass situation. The rights of the property owner to compensation for the prior trespass and the future restriction on use of the land must also be addressed and conditions may reasonably be attached to any easement granted.

The appropriate width of the easement required will depend on the size and number of mains, and the depth of construction. PWC easement guidelines for sewer rising mains up to DN150 dictates a minimum width of 3m, and 6m width for mains larger than DN150. The existing main size is not stated but from observation on site is likely to be DN200 hence a 6m easement would normally apply if it was a PWC asset. While central installation within the easement is preferred by PWC, installation of mains to within 1.5m of the easement boundary is acceptable hence a second main at normal spacing of 1.5 to 2m would generally be permitted within this same 6m easement width however some small additional width to say 7m would be a more conservative option.

From the above it can be seen that the proposed pipe spacing of 6m and easement width of 12m is extremely conservative for trenched construction. If the second main is installed by direction drill, an increase in pipe spacing to say 3m within an easement of 7m may be prudent to minimise risk of clashing if the alignment of the drill head is not well controlled. Hence even

for bored construction, the easement width of 12m requested would be very conservative and would be difficult to justify unless further additional use of the easement is intended by DIA in future.

Selective removal of large trees over or near the main or the installation of root barriers may be deemed necessary if a clear risk to the integrity of the existing main is established, however general clearing of the width of easement proposed would be an extreme measure. The priority for any tree removal would depend on species and size of the trees involved as well as the type of pipe and joint system used and the proximity to the main. Welded or solvent joint systems are less vulnerable to root intrusion than rubber ring joints however most modern systems have reasonable resistance and the threat of physical threat to the pipe barrel is low. It is unlikely that more than 5 or 6 trees would be in sufficient proximity to the main to constitute even a minor threat.

Should construction by open cut methodology along this route be adopted or significant repair be required to the existing main then some clearing will be required for access by construction plant. However as discussed in Section 4.1 of the report, consideration should be given to less intrusive directional boring methodology for installation of any new pipework should the duplication in fact be deemed necessary.

### 3. Inspection and Testing Options

Taking the existing main off line for internal inspection can be accomplished by using sucker trucks to remove waste from the wet well, or diverting the pump discharge to tanker trucks for the period required to empty and inspect the pipe with cameras. Overflow storage at the pump station should also be available to accommodate several hours of this flow. The catchment is entirely non-residential although there is significant late night activity in the terminal area associated with the midnight flights. However if the outage is timed for minimum flow periods the volume of waste to be removed is unlikely to be impractical to handle.

There are access chambers over surface exposures of the main on each side of the creek channel from which it is assumed to be possible to drain the bulk of the main and/or to pump out the low point under the creek invert by an inserted vacuum line. Purging could also be accomplished by introducing a high velocity air flow at the pump station. This would aerate and remove liquid even from the creek invert although the airflow introduced to the receiving sewer could affect odour control and would need approval of PWC. It is assumed that the pits adjacent to the creek would also house fittings that can be removed to allow camera insertion and hence inspection of the most at-risk length of main under the creek.

The presence of any significant leaks can readily be determined by pressure testing of the main without draining it and with minimal offline period. This would require installation of a temporary plug at the discharge and possibly installation of spades at the pump station and adapters to enable connection of a testing pump and gauges.

Any leak detected may be locatable using acoustic scanning.

The construction of a second main simply to enable the inspection and testing is thus fairly redundant and it is strongly recommended that this inspection be done prior to any serious consideration of construction of a second main and that the second main be considered only if serious and widespread faults are detected in the existing main. Any duplication could comprise just short sections of new main, for example at the creek crossing, installed (possibly by line boring) to by-pass and replace any section found faulty leaving the bulk of perfectly good existing main intact.

## 4. Route Options

### 4.1 Preferred Route A

The preferred route A runs parallel to the existing main, directly across Rapid Creek to chamber 1/17 on the Marrara Trunk Sewer where there is a monitoring device of some sort. This is obviously the shortest and hence lowest cost option. There appears to be the residual of a clear corridor over what is assumed to be the existing main alignment however this has not been confirmed. It is unclear which side of the existing main, the second main would be located however it is likely that any offset more than 2m would push the second main into areas of more dense existing vegetation growth.



**Figure 4-1 AC 1/17 and northern pipe alignment**



**Figure 4-2 Northern bank chamber and tree over pipe alignment**

It is noted that the pipe alignment shown on the Google image route map in the report is a little different to the alignment of the easement used for the ECOZ vegetation study. From observation on site, the latter probably more correctly represents the alignment of the existing main and represents a fairly clear line through the existing vegetation. It was not possible to check the correctness of the surveyed easement plan with respect to the existing main location. It is assumed that this would be established based on a field verified location of the existing main. However if this is not the case then confirmation of the existing alignment by ground

penetrating radar (GPR) and/or potholing may be prudent before the easement plan and design alignment for any new main is finalised.

The existing route on the southern side has only a few trees in the actual apparent vicinity of the existing main however a significant offset alignment for a new main may clash with additional trees and overhanging branches may impact construction. The existing main may be in the root zone of several medium size trees. There are several larger trees on or adjacent to the alignment immediately adjacent to the creek channel, particularly on the northern side, refer Figure 4-3. These trees appear to be somewhat older than the main and were presumably protected and preserved during the original construction but have since increased in size. The balance of the alignment on the northern side is generally free of trees immediately over or near the assumed location of the main although the main may be in the root zone of several trees in the vicinity.



**Figure 4-3 Creek Crossing**

The main is exposed in the bottom of a drainage channel on the northern side, however it appears to be protected by a steel sleeve, refer Figure 4-4.



**Figure 4-4 Main in sleeve exposed in northern drain**



**Figure 4-5 Southern creek bank chamber**



**Figure 4-6 Assumed existing pipe corridor**

The current proposal infers widespread clearing of the proposed 12m easement and construction by conventional open cut method which would result in significant impact to the environment along the route particularly in the immediate vicinity of the creek. The visual continuity of the vegetated creek line would be broken with some significant loss of visual amenity and reduced flow calming and erosion protection during floods.

If construction along this route is confirmed, then consideration should be given to construction of the creek crossing and some distance either side by directional drilling with a pulled in polyethylene (PE) main. This could be run at some depth below the surface, thus avoiding interference with tree roots and the like, however the subsurface geology below around 1.5m depth seems to be ironstone or other medium rock and this may provide additional protection without the need for deep installation. Notwithstanding, the drilled hole will require sufficient cover for stability and mud retention. Establishment tends to be a major cost component of any directional drill construction hence it may prove economic to extend the line bore to include the bulk of the reserve area.

Based on recent advice from drillers a 500m length for a directional drill is considered relatively easily achievable. Therefore considering the proposed length required through the conservation zone is approximately 200m this is a valid construction methodology to consider. This would however need to be confirmed with consideration given to undertaking a detailed geotechnical investigation.

## 4.2 Alignment Option B

The optional alignment along Charles Eaton Dr and down Henry Wrigley Dr would be possible within cleared areas and road verges (pending determination of what other services may already be located in the road verge) and could avoid any significant disturbance to vegetation within the existing conservation zone. The main would need to be located close to the existing road kerb of Henry Wrigley Dr to get separation from trees and some pruning of overhanging branches would be required to facilitate machine use along the verge near the culvert. This would create some significant interference with traffic use of the northbound lane of Henry Wrigley Dr and would cost significantly more due to the additional length and traffic control requirements as well as costs associated with meeting PWCs current connection requirement to a new chamber on the trunk sewer. The additional length and static lift would also effect pump performance and potentially necessitate new pumps and upgraded switchboards at the existing pump station.



**Figure 4-7 Verge of Henry Wrigley Dr**

It is noted that the DIA report incorrectly describes the creek crossing as a bridge where it is a culvert through a fill embankment with 600 to 800mm of fill over the culvert.

Attachment to the existing culvert endwall would enable crossing of the watercourse with minimal impact. Attachment would be to the downstream side and hence relatively protected from debris impact during flooding. It may also be possible to lay the new main within the fill over the culvert and avoid any exposure. Use of DICL or MSCL pipe where exposed or if cover is reduced in fill would improve impact resistance and reduce potential for vandalism. Additional physical protection can be provided to any exposed pipe if necessary.

## 5. Summary

The need for a second main is fairly tenuous and the reduction in a relatively trivial risk would not normally justify the cost and environmental impact however the slight reduction in risk could be seen as a PR requirement worth the cost to DIA. A shorter section of new bored main through only the higher risk area at the creek crossing would seem to be more cost effective as would some selective tree removal.

Options and methods to inspect and test the existing main are available without constructing a second main and should be carried out before committing to constructing the possibly redundant second main.

The normal standard easement for a single DN200 main is 6m and an extra metre is more than sufficient to allow for parallel mains at acceptable spacing. The 6m separation proposed and the 12m easement width sought is not considered justifiable.

Risks associated with the respective alignments include:

- There is a real but small risk of damage to the existing main resulting from tree growth which may be reduced further by killing and/or removal of several selected trees. The ECOZ report identifies various tree species in the proposed easement but makes no assessment of the relative threat the particular species represents to the main.
- Removal of large trees is a risk activity and will require careful work to protect workers and other vegetation.
- Destabilisation of the creek channel with consequent wet season erosion could result from new main installation ( Route A open cut option).
- Solidification of settle solids in redundant mains left idle for some time. This could be cumulative if use is cyclic (low).
- Drill hole collapse or root interference for boring options ( low).
- Spillage of waste into the creek during draining of the mains for inspection (low).
- Traffic hazard associated with work adjacent to roads ( most of Route B but only part of Route A).

If construction of a new main proceeds then use of line boring is considered feasible and recommended for the waterway crossing and adjacent vegetated areas and should be extended through as much of the reserve area as economically feasible. It would be necessary to locate the new main at a depth of several metres to avoid most tree roots and locate in sound material. A heavy duty welded PE main would be used and would have no RRJ joints for root penetration etc.

For Route B the risks associated with attaching the main to the existing culvert headwall are minimal and the main can most likely be buried in the fill embankment in any case. This does not represent any impediment to Route B. The primary difficulties with Route B are the cost associated with a longer length and the alignment resulting in traffic disruptions.

## 6. Scope and limitations

This report is based on information about the proposal presented in the DIA report and a brief site inspection. No detailed survey or other data collection has been carried out and all opinions and comments provided are limited by the extent and accuracy of information provided in that report.

*This report: has been prepared by GHD for Darwin City Council and may only be used and relied on by Darwin City Council for the purpose agreed between GHD and the Darwin City Council as set out in section 1 of this report.*

*GHD otherwise disclaims responsibility to any person other than Darwin City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

*GHD has prepared this report on the basis of information provided by Darwin City Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or*

GHD

Level 7

24 Mitchell Street

T: 61 8 8982 0100 F: 61 8 8981 1075 E: drwmail@ghd.com

© GHD 2017

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

#### Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	L Monteith	C Sherry		L Monteith		06.12.17