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DBP
Dampier Bunbury Pipeline

DBNGP Stage 4 Expansion Project Looping 1 - 9

Assessment of Referral Information (ARI) Summary

November 2005

Alinta

DBP has contracted Alinta Network Services to conduct the operation, maintenance and construction of the pipeline

Prepared for:
DBNGP (WA) Nominees Pty Limited

Level 7 GHD House
239 Adelaide Terrace
PERTH WA 6000

ph: (08) 92234300
fax: (08) 92234301

Alinta Network Services Pty Ltd (Project Managers)
ph; (08) 94923800
fax (08) 94923868

Prepared by:
Ecos Consulting (Aust) Pty Ltd
ABN 57 081 918 194

Suite 2, 11 Ventnor Avenue
WEST PERTH WA 6005

ph: (08) 9226 2577
fax: (08) 9226 2977
www.ecos.com.au

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ENV 657 – DBNGP Northern Looping ARI

Reference	Rev	Date	Prepared by	Reviewed by	Approved by	Comment
657-ARI	A	2Sep05	JB	MW	SOC	For Client Review
	0	28Sep05	JB	MW	SOC	Draft for EPA Service Unit – **NOT FOR PUBLIC RELEASE**
	1	26Oct05	ZB	Alinta	Alinta	Revised Draft for EPA Service Unit –**NOT FOR PUBLIC RELEASE**
	2	21Nov05	DH	SOC	Alinta	Revised Draft for EPA **-NOT FOR PUBLIC RELEASE**
	3	28Nov05	DH	SOC	Alinta	For Public Release

Preamble

DBNGP (WA) Nominees Pty Limited is proposing to construct a number of looping sections adjacent (and connected) to the existing underground gas transmission pipeline within the Dampier to Bunbury Natural Gas Pipeline (DBNGP) corridor. There are nine separate looping sections proposed from Compressor Station 1 (CS1) south of Karratha to Compressor Station 9 (CS9), north of Gingin, Western Australia (known as the "Northern Looping" project). The proposed pipeline looping sections will be 660 mm in diameter with a total length of approximately 194 km. Looping is best described as a process of duplicating an existing pipeline between compressor stations for a certain distance. Once the specified distance is reached it then ties back to the parallel pipeline. The consequence of this design results in an increase in the gas flow rate as well as increasing the volume of gas stored within the pipeline infrastructure.

The project was referred to the WA Environmental Protection Authority under section 38 of the Environmental Protection Act 1986. It is proposed that the Northern Looping project be assessed on the referral information as provided in this document. The structure of the document includes a description of the proposed project, environmental features and issues and an overview of the environmental management measures that will be implemented to minimise any impacts that the project is likely to have on the environment.

The Northern Looping project is of strategic economic importance to the State of Western Australia as it is designed to increase the supply of natural gas into the south-west of Western Australia to meet the increasing demand for gas by the both the household and commercial sectors.

Summary of Key Proposal Characteristics

Element	Description
Proponent	DBNGP (WA) Nominees Pty Limited
Location	There are nine loops. The first one starts at Compressor Station 1 (CS1) which is about 125km south of Karratha and the last one is located south of Compressor Station 9 (CS9) which is north of Gingin (see Appendix 1 for Location Map).
Proposed Action	Construct nine pipeline looping lengths of 660mm diameter buried adjacent to the existing DBNGP. These pipeline lengths will be looped to the existing DBNGP to increase flow of natural gas.
Total Length of Looping	194km
Proposed Tenure	The constructed pipeline will be wholly within the existing DBNGP easement which is gazetted under the *DBP Act* 1997.
Temporary Area of Disturbance (AoD)	Approximately 635 ha
Area of Temporary Vegetation Clearance	Approximately 466 ha
Construction Duration	10 months

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1 Introduction

1.1 Background

DBNGP (WA) Nominees Pty Limited is proposing to construct a number of looping sections adjacent (and connected) to the existing underground gas transmission pipeline within the Dampier to Bunbury Natural Gas Pipeline (DBNGP) corridor. There are nine separate looping sections proposed from Compressor Station 1 (CS1) south of Karratha to Compressor Station 9 (CS9), north of Gingin, Western Australia (known as the "Northern Looping" project) (see Appendix 1 for Location Map). Looping is best described as a process of duplicating an existing pipeline between compressor stations for a certain distance. Once the specified distance is reached it then ties back to the parallel pipeline. The consequence of this design results in an increase in the gas flow rate as well as increasing the volume of gas stored within the pipeline infrastructure.

Alinta Network Services Pty Ltd (ANS) is the Project Manager for the work.

The proposed 660 mm diameter pipeline loops will involve a total length of approximately 194 km. Standard pipeline construction practices will be adopted for the proposed Northern Looping pipeline. Construction techniques will be in accordance with the Australian Pipeline Industry Association (APIA) *Code of Environmental Practice*.

1.2 Proponent Details

DBNGP (WA) Nominees Pty Limited is the proponent for this project.

In October 2004 the Dampier Bunbury Natural Gas Pipeline was purchased by the current owners, a consortium comprised of Diversified Utility and Energy Trusts No. 1 and 2 (collectively referred to as DUET) who own 60%, and Alcoa and Alinta Limited (ALN) who own 20% each. Dampier Bunbury Pipeline (DBP) is the trading name of the DBNGP group of companies ultimately owned by the consortium. DBNGP (WA) Nominees Pty Limited is the holder of the pipeline licence for the DBNGP and is one of the companies forming the DBP Group.

DBNGP (WA) Nominees Pty Limited (DBP) was established to take responsibility for the management of the pipeline's commercial and regulatory interests and to ensure that no conflicts of interest exist. Day-to-day management of the pipeline is the responsibility of Alinta Network Services Pty Ltd (ANS) as the operator pursuant to an operating agreement between ANS and DBP.

Under the terms of the operating agreement, ANS is the asset manager of the pipeline. ANS provides operations, maintenance and construction services to DBP, as well as support functions such as Finance, Legal, Human Resources and IT support. ANS is one of Australia's leading managers and operators of both gas transmission pipelines and distribution networks, with operations in Queensland, New South Wales, Victoria, Tasmania and Western Australia. ANS is skilled in the planning, design and construction of pipelines and facilities. Maintenance work is carried out on behalf of ANS by National Power Services, also part of the Alinta group, focussed on the expert delivery of maintenance services to the utilities sector.

1.3 Purpose of this Document

The purpose of this document is to support the Assessment on Referral Information by summarising the main environmental issues associated with the project and outlining the environmental management measures that will be utilised to minimise any impacts on the environment.

1.4 Structure of this Document

This document provides an overview of the main environmental issues associated with the project and the proposed management measures to be implemented to minimise the identified potential impacts. The document is divided into a number of sections to address these issues:

Section 2 – Provides a description of the project

Section 3 – Provides a description of the environment in which the project will take place including ecological, social and economic factors

Section 4 – Provides a description of the environmental risk assessment process that will be undertaken for the project

Section 5 – Provides an overview of the potential environmental impacts associated with the project and the management measures that will be implemented to mitigate these impacts

Section 6 – Provides information of the stakeholder consultation that has been undertaken to date for the project

Section 7 – Provides an outline of the environmental management system and performance indicators that will be used to assess the level of compliance with the identified environmental management measures for the project.

1.5 Approval Process

The construction of gas pipelines in Western Australia is regulated under the *Petroleum Pipelines Act 1969* and an amendment to the existing DBNGP licence will be required for this proposal. Licence conditions require that both construction and operations Environmental Management Plans (CEMPs) be developed and implemented. Activities in the existing DBNGP Corridor are covered by the *Dampier to Bunbury Pipeline Act 1997.*

The proposal will also have to comply with the requirements of the *Environmental Protection Act 1986,* including the submission of a referral for the proposed pipeline to the Minister for the Environment under section 38 of the Act. The proposal will also comply with the requirements of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* if the project is not formally assessed and the *Wildlife Conservation Act 1950.*

Approvals are required from the following agencies prior to commencement. Northern Looping approvals include (but are not limited to):

Table 1-1: Relevant Approvals Processes

Phase	Legislation	Jrsdn	Agency	Approvals Process
Planning	*Environment Protection and Biodiversity Conservation Act 1999*	Cwth	DEH	EPBC Referral-submitted August 2005 Not a controlled activity
Planning	*Environmental Protection Act 1986*	WA	EPA	Part IV - S 38- submitted in August 2005
Planning	*Environmental Protection Act 1986*	WA	DoE	Permit/Licence to undertake dewatering
Planning	*Environmental Protection Act 1986* (In event that S 38 formal impact assessment is not triggered and proposal is not assessed formally)	WA	DoE	Vegetation Clearing Permit (S 51)
Planning	*Rights in Water and Irrigation Act 1914* (in event that open cut techniques are used) *Rights in Water and Irrigation Regulations 2000*	WA	DoE	Permit/Licence to modify banks (if such works undertaken).
Planning/ Construction	*Petroleum Pipelines Act 1969*	WA	DoE/ DoIR	Pipeline Licence, Construction EMP, Operation EMP
Planning	*Aboriginal Heritage Act 1972*	WA	DIA	S 18 Application
Planning	*Dampier Bunbury Pipeline Act 1997*	WA	DPI	S 34 Application (in place) S41 – approval for additional land within the DBP corridor
Planning	*Land Administration Act 1997*	WA	DPI	S91 – approval for additional land outside the DBP corridor
Planning	*Common law agreements*	WA	Individual land owner	Approval for additional land outside the DBP corridor (not Crown Land)
Planning	*Wildlife Conservation Act 1950* (in event that DRF or PF are in the ROW)	WA	CALM	If avoidance is not practicable then a Permit to take fauna, DRF/PF may be necessary

2 Project Description

2.1 Location

The loop locations and lengths are provided in Table 2.1 below. Location map is provided in Appendix 1.

Table 2-1: Locations and Length of Loops

Loop	Length (km)	Start		Finish	
		Longitude	Latitude	Longitude	Latitude
1	12.000	115.953	-21.449	115.883	-21.535
2	32.277	115.245	-22.470	115.104	-22.727
3	25.000	115.146	-23.647	115.172	-23.869
4	25.000	115.293	-24.842	115.281	-25.066
5	21.898	115.225	-26.084	115.215	-26.281
6	11.000	115.185	-27.348	115.184	-27.447
7	5.698	115.133	-28.619	115.136	-28.670
8	46.123	115.359	-29.887	115.443	-30.287
9	15.146	115.776	-31.105	115.823	-31.235

2.2 Land Tenure

DBP is the owner of the existing DBNGP. While some construction activity will take place outside the DBNGP Corridor the actual looping pipeline sections will be constructed within the DBNGP corridor. The corridor was established in the early 1980's and formally gazetted under the *Dampier to Bunbury Pipeline Act* 1997 (DBP Act).

In certain sections the construction activity will extend outside of the existing corridor (eg turnarounds, borrow pits and campsites). Where construction activities extend outside the existing corridor approvals to access the land will be sought under Section 91 of the *Land Administration Act* 1997 or Section 41 of the DBP Act of through agreements with landowners. The area impacted by the proposal is approximately 635 ha.

2.3 Construction Methodology

Pipeline construction will typically be carried out within a 30 m wide area for construction activity and the area that will be cleared and graded will be approximately 25 m wide. A number of specialised crews pass along the corridor, fabricating and installing the pipeline then backfilling and rehabilitating the corridor. The pipeline engineering and design features are contained in Table 2-2.

In areas where the topsoil is very shallow (e.g. northern loops) the requirement for topsoil storage will be less, therefore reducing the clear and grade width by one, two or three meters.

Table 2-2: Pipeline Engineering and Design Features

Design Element	Details
Length	Approximately 194km
Diameter (outside)	DN660
Wall Thickness	8.72 mm and 11.7 mm
Pipe quality	API 5L Grade X 70
Factory Coating	1.85mm trilaminate
Pipeline Content	Natural Gas
Operational Pressure	8.48 MPa
Maximum Allowable Operating Pressure	10.2 MPa
Hydrotest Pressure	12.75 MPa
Design capacity	127 TJ/day
Standard Construction / Operation Easement Width	30m
Minimum depth of cover	750mm
Corrosion Protection	Impressed current cathodic protection
Non-destructive Testing	100% UT
Buried marker tape	As specified by AS 2885 Risk Assessment
SCADA	SCADA communications to be Modbus RTU protocol

There are roads and other infrastructure along the proposed route that will be need to be crossed in accordance with local municipality requirements, together with the APIA *Code of Environmental Practice (1998)* and *AS 2885.1*.

Pipeline construction typically occurs as a sequence of activities commencing with survey, fencing, clear and grade, trenching etc. Northern Looping pipeline construction activities are summarised in Table 2-3. This table deals specifically with construction activities; environmental management measures are discussed in Section 5. The pipeline will be constructed and operated in accordance with the requirements of *AS2885 Pipelines — Gas and Liquid Petroleum*, the APIA *Code of Environmental Practice,* and the Construction and Operations EMPs.

The Ashburton, Minilya and Gascoyne Rivers will be crossed using horizontal directional drilling (HDD). All other watercourses will be crossed using open trench methods.

The construction workforce is expected to range from 150-200 people, including the project management and pipe supply/distribution personnel. Approximately 150 personnel will be present at any one time.

Table 2-3: Pipeline Construction Sequences

Activity	Description
Detailed Survey	Engineering, environmental and cultural heritage surveys are conducted for route selection and to determine if any special construction techniques or mitigation measures are required. Once the preferred pipeline route has been determined the centreline is surveyed and engineering aspects are finalised. Markers (pegs) are placed to identify pipeline alignment and Area of Disturbance (AoD).
Fencing	Severed fences are replaced with temporary construction gates for both property boundaries and internal fences on the AoD.

Activity	Description
Clear and Grade	Graders and bulldozers are used to clear the AoD to approximately 25 m wide of vegetation and topsoil ready for construction to commence. Topsoil will typically be graded to a depth of 50 to 100 mm over the entire AoD and boxed an additional 50 to 100mm in the trenched area
Trenching	A trench is dug for the pipeline either by a trenching machine or excavator. Trench spoil is stockpiled on the right-of-way, usually on the non-working side. Top soil from the trench, to a depth of 50mm to 100mm, will be stockpiled separately from the subsoil. (see above)
Stringing	Steel pipe is trucked to the construction site in sections, each approximately 18 metres long. These are then laid end-to-end next to the trench alignment. The sections are placed on sandbags that are raised on blocks or wood (timber skids), to protect the pipe from corrosion and coating damage.
Bending	Where required, pipe sections are bent to match changes either in elevation or direction of the alignment.
Welding	Pipe sections are welded together.
Weld Inspection	The pipes are inspected using ultra-sonic equipment as per AS 2885.2.
Joint Coating	The area around the weld is then grit blasted and coated, with a protective coating to prevent corrosion
Padding	Where required, padding machines are used to sift the excavated subsoil to remove coarse materials. To protect the pipe coating the remaining fine material is used to pad beneath and on top of the buried pipe. In some instances (e.g. very rocky soils) imported sand or foam pillows are used for bedding under the pipe.
Lowering-in	Sidebooms (bulldozers with cranes) or excavators are used to lower the welded pipe into the trench.
Backfilling	Trench spoil (subsoil) is returned to the trench and material compacted to minimise risk of subsidence of material over the pipe.
Pressure Testing	Pipeline integrity is verified using hydrostatic testing in accordance with AS 2885.5. During hydrostatic testing the pipeline is capped with test manifolds, filled with water and pressurised up to 125% of operating pressure for a minimum of two hours. A 24-hour leak test or a 3-hour combined strength and leak test then follows. Providing it meets water quality guidelines and has landholder approval, hydrotest water is discharged to the surrounding environment. If water fails to meet quality guidelines it will be treated prior to disposal eg. by chemical neutralisation. Hydrotest water is sometimes treated with chemicals such as a biocide, oxygen scavengers and corrosion inhibitors prior to testing. However, this may not be required for the planned works.
Restoration and Rehabilitation	The easement is recontoured to match surrounding landform and erosion controls constructed where appropriate. Separately stockpiled topsoil is then respread evenly across the easement and any cleared vegetation placed across the easement, to assist in soil retention and provision of seed stock. Operational safety dictates that vegetation must be managed to retain line of sight for safety signs.
Signage	Marker signs are erected along the easement as per AS 2885.1-1997.

2.3.1 Horizontal Directional Drilling

At the sites where horizontal directional drilling (HDD) is undertaken an area will be required to temporarily house the drill rig. The drill site area for the HDD from an operational and safety perspective is usually 50 meters x 50 meters in area and incorporates an area for the positioning of the drilling rig, an area for the management of the drill mud (ie. Sumps) and a safe truck turnaround/manoeuvring area. The sites where HDD will be undertaken are the Ashburton, Minilya and Gascoyne Rivers.

The HDD drilling mud disposal requirements include the construction of evaporation dams at the HDD entry and exit locations where the mud will be stored until such time as the mud is dry. At this point the mud will then be loaded into tip trucks and disposed of at a suitable approved land fill/waste disposal site. The HDD pad will be reinstated in accordance with the project CEMP commitments.

2.3.2 Pressure Testing

Pressure testing of the pipeline will require the sourcing and disposal of 'hydrotesting' water.

The following existing bore locations (Table 2-4) are currently being tested to determine suitability for the Hydrotest program. Once identified the final bore site details will provided to the relevant licensing and approval bodies to apply for a license to take groundwater, eg a 5C License.

Table 2-4: Potential Hydrotesting water source bores

Location	Easting	Northing
Loop 1		
BF 2/1	382479	7615609
BF 2/2	381929	7615609
CS1 B1	391547	7627558
CS1 FB1	390058	7627426
Loop 2		
BF 3/1	319538	7513889
BF 3/6	316008	7516084
Loop 3		
CS3 B1	315470	7384072
CS3 B2	315506	7383687
Loop 4		
BF 5/2	327456	7251328
BF 5/4	327426	7251277
BF 5/5	327291	7250350
Loop 5		
SB4 (CS 5/1)	324002	7110702
CS5 Bore	322712	7112714
Talisker Solar Bore 11	to be advised	to be advised
Yalardy Station Bore	to be advised	to be advised
Loop 6		
BF 7/3	321483	6973470
BF 7/6	312177	6954313
BF 7/7	313112	6954244
Loop 7		
Bore 12AA	317489	6832998
CS7AMB	314968	6824970
CS7CA1	318034	6831792

Location	Easting	Northing
CS7CHU	317677	6822205
Loop 8		
BF 10/1	341874	6691265
TP-2	347561	6646314
Loop 9		
BF 12/1	382995	6557909

The hydrotest water will be discharged into evaporation ponds, dams, turkey nests or areas of the AoD in accordance with the Construction Environment Management Plan (CEMP).

2.4 Construction Camp Sites and other Infrastructure Requirements

2.4.1 Construction Camps

Construction camps will be erected along or near the pipeline at various intervals. These camps will house around 150 to 250 people. The camps are demountable buildings with individual sleeping quarters, toilet/showers, laundry, food mess, wet mess (bar) and recreation rooms. Caterers are contracted to cook and clean for the construction personnel. Camps will be located on previously disturbed areas wherever practicable and will be selected to avoid impacts to important vegetation or wildlife habitats. Final site selection may be influenced by the results of the fauna and flora studies

Waste produced from the camp includes:

- Food scraps and general domestic waste;
- Recyclables, such as aluminium cans, bottles, steel, cooking oil;
- Wastewater – black and grey streams are generally combined.

Management of potential impacts associated with camp construction and operation are addressed in Section 5.

2.4.2 Boreholes

If suitable, water will be obtained from a number of existing bores located along the corridor.

2.4.3 Borrow Pits

Borrow pits are unlikely to be required.

2.5 Alternative Options Considered

The DBNGP Corridor was selected in the late 1970's following various route selection studies. At the time six alternative corridors were selected for more detailed review of topographic, geological and biological investigation for the regions between Dampier and Perth (Dames & Moore 1979).

The main factors influencing the locations of the alternative corridors were:

- Avoidance of built up areas
- Avoidance of national parks and conservation reserves, existing and proposed
- Possible advantages of paralleling existing service corridors, including the pipeline from Dongara to Perth
- Availability of existing access
- The potential for using the Dongara field as a gas storage reservoir.

The six alternative corridors were assessed within the context of an Environmental Review and Management Programme (Dames & Moore 1979). Based on a large number of environmental and engineering considerations the present corridor was finally selected.

The design for this looping project is to run the new pipeline sections parallel within the existing DBNGP and tie in at a various locations south of compressor section (CS1-CS9). The corridor is designed to contain more than one pipeline.

A number of conditions were set as part of the privatisation of the DBNGP in 1998. One of those was that the DBNGP corridor be widened to accommodate several pipeline operators so that the benefits of competition could flow down to end users.

The widening project began in 1998. In identifying a suitable alignment for future gas pipeline operators, environmental considerations were considered and these resulted in several deviations from the existing and original 30 m corridor.

In terms of WA State Energy policy it was always intended that the owners of the DBNGP (DBNGP WA Nominees Pty Ltd) would expand the pipeline capacity within the original 30 metre corridor. This was done for a number of reasons.

1. By restricting the current owner to the original corridor, the balance of the widened corridor (70 m) became available to other pipeline operators, thus supporting the principle of competition.

2. In terms of the engineering rationale for using the existing corridor, the Government was aware that the most likely methodology for increasing pipeline capacity in the short term to the South West of the State, was to loop the existing DBNGP. For this to occur, the new looped pipeline would need to be located adjacent to the existing DBNGP within the original 30 m corridor.

3. The original corridor had already been cleared during the original construction of the DBNGP.

On behalf of the Western Australian Government, the Department of Planning and Infrastructure (DPI), as the manager of the DBNGP corridor, has the responsibility to ensure the corridor and the space available is used efficiently with a view to the longer term requirements of the State. The DPI has therefore directed the DBNGP operator to construct the new looping sections within the original 30 m corridor.

The Northern Looping sections will be constructed within the DBNGP corridor established in the early 1980's and gazetted under the *Dampier to Bunbury Pipeline Act 1997* prior to the privatisation of the pipeline.

The Act provided for the DBNGP Land Access Minister to confer rights in respect of land in the Corridor for the purpose of:

I. having, constructing, or operating, on the DBNGP corridor any pipeline for transporting gas or

II. enhancing any pipeline referred to in subparagraph (i)

The Information Memorandum that was prepared by the State of Western Australia for the sale of DBNGP makes the following statements in relation to the corridor:

8.2.1.1 The responsible Minister will have access rights which allow for the operation, maintenance, and enhancement of the DBNGP, as well as access rights to construct additional pipelines within the DBNGP Corridor.

8.4.2.1 The Initial Access Licence will be issued to AlintaGas by the responsible Minister and assigned to the Acquirer by AlintaGas as part of the DBNGP Sale. The Initial Access Licence will grant access to the DBNGP Corridor as necessary to allow for the ownership, operation and maintenance of the DBNGP and its related facilities.

8.4.2.2 The responsible Minister will grant an Access Licence or Access Licences granting access to the DBNGP Corridor, which may in aggregate be over its full length, to allow for the enhancement of the DBNGP (which may initially be by AlintaGas or subsequently by the Acquirer) through looping and compression or the construction of an independent pipeline, each to be placed and constructed within the DBNGP Corridor in accordance with best gas industry practice so as to best utilise the available space.

3 Environmental Description

3.1 Regional Setting

The area from CS1 to CS9 covers five bioregions (Table 3.1 & 3.2). These include the Pilbara, Carnarvon, Gascoyne, Northern Sand Plains and the Swan Coastal Plain.

Table 3-1: Bioregions

	Start (km point DBNGP)	End (km point DBNGP)	Region
Loop 1	137.140	149.140	Pilbara
Loop 2	272.110	304.249	Carnarvon
Loop 3	409.235	434.235	Gascoyne
Loop 4	546.830	571.830	Carnarvon
Loop 5	684.730	706.475	Carnarvon
Loop 6	824.870	835.870	Carnarvon
Loop 7	966.510	971.510	Northern Sand plains
Loop 8	1,114.010	1,160.086	Northern Sand plains
Loop 9	1,256.790	1,271.790	Swan Coastal Plains

Table 3-2: Bioregion Description

Region	Geology and Soil	Vegetation
Pilbara	The pipeline corridor crosses three main structural units, the Pilbara Craton, Capricorn Orogen and Carnavon Basin. Between KP 100 and Ashburton River, soils are dominated by hard alkaline soils with cracking clays, ironstone gravels and loamy soils developed on calcrete. The presence of laterite, silcrete and calcrete is a common feature of the corridor in the Pilbara and occurs over igneous, metamorphic and sedimentary rocks.	Located within the Eremaean Botanical Province, and classified as the Fortescue Botanical District (Beard, 1975, cited in Dames & Moore 2000).
Carnarvon	Lies entirely within the Carnarvon Basin. Pipeline corridor crosses the Carnarvon Region, before entering the Gascoyne and into the Carnarvon Region again. The northern Carnarvon region, the surface is formed predominantly from unconsolidated Quaternary deposits, with granite outcrops.	Carnarvon Botanical District (Beard, 1975, cited in Dames & Moore 2000)

Region	Geology and Soil	Vegetation
Gascoyne	The Gascoyne has areas of extensive occurrences of Proterozoic sedimentary, metamorphic and granitic rocks. Compressor Station 3 (approximately KP 410) marks a boundary between the red and yellow earth soils to the north (underlain by laterite) and hard red duplex soils to the south, which sandy textures which set hard when dry.	Ashburton Botanical District (Beard 1975, cited in Dames & Moore 2000)
Northern Sand plains	Located within Perth Basin. Dominated by earthy sands commonly underlain by ironstone gravels, laterite or indurated mottled pallid zone. South of the Irwin River, soils are dominated by sandy acidic yellow mottled soils containing ironstone gravel and laterite.	Irwin Botanical District (Beard, 1975, cited in Dames & Moore 2000)
Swan Coastal Plain	A coastal plain, low lying. Soils mainly recent sands or swamp deposits. This is a southern extension of the geological Perth Basin in which the underlying cretaceous to permian sediments are covered by a variety of calcareous material.	Darling Botanical District (Beard 1975, cited in Dames & Moore 2000) Swan Coastal Plain subregion of the Drummond Botanical Subdistrict (Beard 1972 cited in Dames & Moore 2000)

3.2 Climate

Climatic patterns vary markedly along the proposed northern looping pipelines project, extending from the Pilbara region, to the Swan Coastal Plains a distance of some 1400 km. The Pilbara region is characterised by an 'Arid Tropical' climate receiving a majority of its rain in the summer months. Rainfall is low and erratic (250 – 300mm), with high evaporation rates. Temperatures are extreme in nature ranging from 9°C - >40°C, (Dames & Moore 2000). See Table 3-3 for Climate Summary information.

The Carnarvon region's climate is semi-arid, receiving both summer and winter rainfall (200-250 mm). The Gascoyne region's climate is considered arid with similar rainfall to Carnarvon's. The Northern Sandplains Region is characterised by a dry warm mediterranean climate, receiving predominantly winter rainfall (300-500 mm), being dry for the remaining 7- 8 months of the year. The Swan Coastal Plain has a warm mediteranean climate, also with predominant winter rainfall (600-1000mm), with 5 to 6 months of dry during summer, (Dames & Moore 2000).

Climate is an important consideration when managing pipeline construction, particularly extreme climatic conditions involving rainfall and high wind speed. In particular, very heavy or prolonged rainfall and wet conditions may lead to soil erosion and flooding of the AoD. These impacts and potential mitigation measures are dealt with in Section 5.

Table 3-3: Summary Climate Data for Northern Looping Project

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean daily Max Temp (°C) Loop 7-9 Loop 4-6 Loop 1-3	33.1 - 36.6	33.4 - 36.3	30.3 - 33.6	26.4 - 29.0	23.4 - 24.0 25.9 (5&6)	22.5 (8 only) 21.2 -23.6	20.8 - 22.9 25.4 (2&3)	24.6 (4 only) 27.2 (2&3)	30.5 (2&3)	33.8 (2&3)	36.8 - 38.6	39.9 (1)
Mean No. Days >= 30 °C Loop 7-9 Loop 4-6 Loop 1-3	17.2 - 23.7	20.4 - 23.0	14.8 - 20.5	5.6 - 10.8	1.8 - 2.3 4.7 (5&6)	0.0 (8) 0.0 - 0.4	- 0.1 1.1 (2&3)	2.1 (4) 6.4 (2&3)	16.6 (2&3)	25.3 (2&3)	24.6 - 25.6	29.5 (1)
Highest Max temp (°C) Loop 7-9 Loop 4-6 Loop 1-3	46.0 - 47.0	45.7 - 48.7	42.9 - 44.0	38.6 - 40.9	35.5 - 37.0 36.8 (5&6)	29.0 (8) 29.7 - 30.8	29.5 - 31.0 32.6 (2&3)	36.2 (4) 35.6 (2&3)	40.4 (2&3)	44.4 (2&3)	44.0 - 46.1	48.4 (1)
Mean daily Min temp (°C) Loop 7-9 Loop 4-6 Loop 1-3	17.0 - 18.7	17.8 - 19.6	15.9 - 18.1	13.9 - 15.3	11.1 - 12.3 11.3 (5&6)	10.1 (8) 7.8 - 10.4	6.2 - 9.2 11.1 (2&3)	10.1 (4) 12.1 (2&3)	13.9 (2&3)	16.4 (2&3)	19.2 - 21.6	22.4 (1)
Mean rainfall (mm) Loop 7-9 Loop 4-6 Loop 1-3	7.0 - 7.6	12.4 - 12.7	13.5 - 15.0	21.2 - 35.1	48.3 - 74.4 98.0 (5&6)	107.6 (8) 28.1 - 32.6	27.2 - 27.3 22.3 (2&3)	12.5 (4) 12.3 (2&3)	2.2 (2&3)	2.3 (2&3)	3.2 - 6.9	13.2 (1)
Mean No of rain days Loop 7-9 Loop 4-6 Loop 1-3	1.1 - 1.8	2.0 - 2.6	3.0 - 3.6	3.8 - 6.9	7.4 - 9.8 5.1 (5&6)	13.3 (8) 4.7 - 7.3	4.3 - 7.3 2.5 (2&3)	2.7 (4) 1.6 (2&3)	0.5 (2&3)	0.4 (2&3)	0.6 - 0.8	1.5 (1)

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Highest monthly rainfall (mm) Loop 7-9 Loop 4-6 Loop 1-3	57.2 - 108.6	72.6 - 97.0	86.2 - 137.2	105.4 - 113.7	220.6 – 214.4 98.0 (5&6)	280.2 (8) 77.9 - 155.2	88.0 - 158.3 249.4 (2&3)	51.3 (4) 148.6 (2&3)	23.4 (2&3)	38.2 (2&3)	37.6 - 53.6	106.3 (1)
Lowest monthly rainfall (mm) Loop 7-9 Loop 4-6 Loop 1-3	0.0	0.0	0.0 - 0.3	0.0 - 0.4	0.0 – 18.5 0.8 (5&6)	22.2 (8) 0.0 - 3.1	- 6.9 0.0 (2&3)	(4) 0.0 (2&3)	0.0 (2&3)	0.0 (2&3)	0.0	0.0 (1)

* Expected construction period:
Loop 9 - 28th Jan to 28th May 2006
Loop 8 - 25th Feb to 6th June 2006
Loop 7 - 9th May to 10th June 2006
Loop 6 - 21st May to 6th July 2006
Loop 5 - 3rd May to 30th June 2006
Loop 4 - 3rd June to 4th August 2006
Loop 3 - 8th July to 8th Sept 2006
Loop 2 - 12th August to 22nd October 2006
Loop 1 - 16th Jun to 3rd Aug 2006

3.3 Geology and Soils

The proposed Northern Looping pipeline corridor traverses a wide range of geological bioregions, going from the Pilbara region through to the Swan Coastal Plain. Geology and soil types are broadly described for the regions traversed by the project in Table 3.2.

More specific geological data for each of the nine loops is described in Table 3-4 below (Parsons Brinckerhoff, 2005).

The most common geological formation encountered is the Quaternary Sands. These are found primarily in loops 1– 6 and in sections, are interspersed with areas of sedimentary (both Mesozoic and Paleozoic) and Granitic Rock (Archean and Proterozoic). Loop's 7 and 9 are characterised by the Duricrust formations, with some Lateritic & Quaternary Sands sections. Loop 8 is primarily characterised by Lateritic formations, with Mesozoic Sedimentary Rock in several narrow sections.

3.3.1 Soils

Soils are generally characterised by Earthy Sands to Red/Yellow Earths. These are found along all looping sections with the exception of Loop 4, which is characterised by Hard Red Duplex Soils as highlighted in Table 3-4. Red and/ or Duplex Soils are also found in sections within Loop's 3 and 9.

3.3.2 Acid Sulphate Soils

Acid Sulphate Soils (ASS) are described as:

> 'naturally occurring soils containing iron sulphides laid down in geological recent marine and estuarine sediments by bacteria. These soils are normally waterlogged and benign but when they are exposed to air by excavation, dewatering or other disturbance, the iron sulphides can be oxidised to sulphates, causing a rapid drop of pH (rise in acidity) and leaching of acid groundwater and heavy metals from soils' (BBG 2004).

A desktop ASS assessment was undertaken to predict the acid generating potential of soils encountered along the Northern Looping project area (Appendix 2). The desktop assessment will be used as the scope for an infield ASS assessment which will in turn be used to develop the ASS Management Plan if any ASS is identified.

Results of the desktop assessment showed that depth of groundwater correlated with the risk of ASS occurring. As such only one section of Loop 9 displayed any high risk of ASS occurring. At this section (KP: 1264-1271) groundwater was at a depth of 1-5m, (Parsons Brinckerhoff 2005). See Table 3.4 for groundwater depth summaries.

Other small sections considered as a medium risk of ASS were found on Loops 1, 2 and 8.

Table 3-4: Summary of Geology and Soils

Loop (KP)	GEOLOGY	SOILS
Loop 1 137-149	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	EARTHY SANDS: often underlain by ironstone gravels, laterite or an indurated mottled or pallid zone
Loop2 272-304	QUATERNARY SANDS: as described above, with some SEDIMENTARY (Mesozoic) and GRANTIC ROCKS in places	RED AND YELLOW EARTHS: with fine earthy fabric, underlain by laterite in placed
Loop 3 409-34	QUATERNARY SANDS: as described above, interspersed with SEDIMENTARY ROCKS (both Mesozoic and Paleozoic), and GRANITIC ROCKS (Archean-Proterozoic)	Where Quaternary sands predominant:- RED AND YELLOW EARTHS: with fine earthy fabric, underlain by laterite in placed. Where Sedimentary and/ or Granitic Rocks predominant:- DUPLEX SOILS: hard, red, alkaline, underlain by a wide variety of materials including weathered rock, laterite, calcrete, silcrete and red-brown hardpan
Loop 4 547-71	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas, with some areas of SEDIMENTARY ROCKS (PALEOZOIC)	HARD RED DUPLEX SOILS (alkaline): sandy textures which set hard when dry. Underlain by a wide range of materials including weathered rock, laterite, clacrete, sliicrete, and red-brown hardpan
Loop 5 684-706	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	EARTHY SANDS: often underlain by ironstone gravels, laterite or an indurated mottled or pallid zone
Loop 6 824-35	QUATERNARY SANDS: as described above	EARTHY SANDS: as described above
Loop 7 966-71	DURICRUST and LATERITE covered by eolian and colluvial sand	EARTHY SANDS: as described above
Loop 8 1113-46	LATERITE: covered by eolian and colluvial sand, interspersed with SEDIMENTARY ROCKS (MESOZOIC)	EARTHY SANDS: as described above
Loop 9 1256-71	DURICRUST and QUATERNARY SANDS as described above	EARTHY SANDS: as described above associated with Duricrust formation, RED DUPLEX SOILS (alkaline): sandy textures which set hard when dry. Underlain by a wide range of materials including weathered rock, laterite, clacrete, sliicrete, and red-brown hardpan, associated with Quaternary Sands

3.4 Watercourses

3.4.1 Groundwater

Groundwater is generally deep for most the proposed Northern Looping sections ie 20 to 140 m below ground level (mBGL). Some areas were moderately deep; namely Loops 1, 3 and 9. Only one section of Loop 9 displayed shallow depth to ground water (1 – 5m). See Table 3.5 below.

Table 3-5: Groundwater Depths

Loop (KP)	Groundwater (mBGL)
Loop 1 137-49	5-10
Loop 2 272-304	>40
Loop 3 409-34	5-10
Loop 4 547-71	No information*
Loop 5 684-706	>50
Loop 6 824-35	>80
Loop 7 966-71	>20
Loop 8 1113-46	128 - 135
Loop 9 1256-71	5-30 (Earthy Sands) 1-5 (Red Duplex Soils)

* Although no bores were in the vicinity of the pipeline AoD of Loop 4, this Loop is at an elevation of 140 to 160 mAHD. The area is characterised by Middle Proterozoic sandstones and granites, therefore it is anticipated that groundwater will not be intersected.

3.4.2 Wetlands

The definition of a wetland that has been adopted in the Wetland Conservation Policy for Western Australia (DWECP 1997) is 'an area of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres'.

The classification system employed for wetland classification on the Swan Coastal Plain classifies wetlands based on landform and water permanence, the various types of which are presented in Table 3-6 below. There are three categories of wetlands depending on the level of management applied (Hill et al 1996) (Table 3-7).

Table 3-6: Classification of Wetland

Wetland Type	General Description
Basin Wetlands	Dampland= seasonally waterlogged basin Sumpland= seasonally inundated basin Lake= permanently inundated basin Artificial basins (eg dams, reservoirs)
Flat Wetlands	Floodplain= seasonally inundated flat Palusplain= seasonally waterlogged flat

Table 3-7: Wetland Management Categories

Management category	General Description	Management Objectives
C-Conservation	Wetlands support a high level of ecological attributes and functions	Highest priority wetlands Reservation in national parks, crown reserves and State owned land Protections under Environmental Protection Policies Wetland covenanting by landowners.
R- Resource Enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions	Priority wetlands. Ultimate objective is for management, restoration and protection towards improving their conservation value. These wetlands have the potential to be restored to conservation category. This can be achieved by restoring wetland structure, function and biodiversity. Protection is recommended through a number of mechanisms.
M- Multiple Use	Wetlands with few important ecological attributes and functions remaining	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through land care. Should be considered in strategic planning (eg drainage, town/land use planning.

Loop 9 is close to three Conservation Category Wetlands located to the west of the DBNGP corridor at the following distances:

- KP 10: 450m
- KP 13.7: 500m
- KP 15: 185m.

Loop 9 traverses one Resource Enhancement Wetland between KP12.5 and KP13.2. This is recognised as an area potential acid sulphate soils. This risk was identified during a desktop investigation of acid sulphate soils and an infield acid sulphate soils investigation will be conducted in this area to verify the risks and assist in the development of management measures (PB 2005).

The aerial photos together with the respective wetland classifications for Loop 9 are shown in Appendix 3. Wetlands are known to exist in the vicinity of other loops but as no other wetland datasets having been developed, no maps could be provided to depict these wetland locations. The mitigation measures for all wetlands encountered are contained in Section 5.2.2.2.

There are no wetlands listed for protection under the JAMBA and CAMBA agreements, Ramsar Convention or ANCA identified wetlands within 2km of the proposed pipeline AoD.

3.4.3 Watercourses

The Northern Looping project will involve the crossing of many water courses. The following watercourses are the major watercourses that will be crossed during construction:

- Loop 1- Peter Creek
- Loop 2- Ashburton River
- Loop 3- Minilya River (north)
- Loop 4- Gascoyne River
- Loop 4- Davis Creek

- Loop 8- Coomallo Creek (x2)

The catchments for the northern watercourses (Loops 1-4) lie in the tropical and sub-tropical semi-arid zone. Due to the low rainfall and high evapotranspiration, runoff is very low and for most of the time there is no flow in these rivers (Dames & Moore 2000). Furthermore, as rainfall is most unreliable, a situation of no flow may persist for long periods (Dames and Moore 2000). For example, records for the Gascoyne River show that during the period 1907 to 1978 there were 15 years when no flow occurred that reached Carnarvon.

3.5 Ecology

3.5.1 Bioregion and Vegetation Communities

The Northern Looping project traverses five bioregions as listed previously in Table 3.1.

Mattiske (2002) undertook a flora and vegetation survey in the immediate area containing the DBNGP corridor. Based on this information, the bioregions and vegetation characteristics have been summarised below in Table 3-8

Table 3-8: Bioregion and Vegetation Characteristics

Loop	Botanical District	Characteristics
1	Fortescue	Characterised by tree and shrub-steppe communities. Dominant genera of the area are *Eucalyptus, Acacia* and *Triodia*. Its southern boundary is a major biogeographic, the *Acacia-Trodia* line.
2, 4,5,6	Carnarvon	Dominant genera are *Acacia* and *Triodia* with occurrences of species from the *Chenopodiaceae* (Chenopods) family such as *Halosarcia*, *Atriplex* and *Maireana* on flats and claypans. The vegetation of the area is varied and is dominated by *Acacia* in the south and changes to *Triodia* dominated in the north.
3	Ashburton	Different forms of *Acacia aneura* (mulga) with other *Acacia sp.* as shrubs on hills and woodlands on flats (Beard, 1990, cited in Mattiske, 2002). Other dominant species include *Eremophila* and *Senna*. The mulga woodlands/shrublands may be continuous or interrupted with bare patches. Perennial grasses such as *Triodia* species (Spinifex) are usually confined to patches of sandy soil, where sands tend to occur in low, raised banks. Annual grasses and daisies are common in spring and late winter or occur opportunistically after significant rainfall events.
7,8	Irwin	Dominant plant families include Proteaceae (*Grevillea, Banksia*), Myrtaceae (*Eucalyptus, Melaleuca*), Mimosaceae (*Acacia*), Casuarinaceae (*Casuarina, Allocasuarina*), Asteraceae (daisies), Chenopodiaceae (salt bushes) and Poaceae (grasses). Scrub heath and *Acacia–Casuarina* thickets with occasional areas of *Acacia* scrub with scattered *Eucalyptus* trees are main characteristics.
9	Darling Swan Coastal Plain subregion of the Drummond Botanical Subdistrict	Characterised by *Banksia* low woodland on leached sands with Melaleuca swamps in less drained areas.

Source: Mattiske, 2002

3.5.2 Flora

Results of a search of the EPBC Act Protected Matters Interactive Search Tool (DEH 2005) indicated that a total of nineteen flora species listed under the EPBC Act as Endangered, or Vulnerable species might occur along the pipeline route (Table 3-9).

Table 3-9: EPBC Act Listed Plants

Species	Common Name	Category	Loop Section	Distance to Pipeline Corridor[1]
Caladenia hoffmanii Hopper & A.P. Brown ms.		E	7	Not shown in area
Chamelaucium sp. Gingin (N.G. Marchant s.n. 4/11/1988)	Gingin Wax	E	9	25km SSE
Conostylis dielsii subsp. teres	Irwin Conostylis	E	7	29km SSW
Dryandra serratuloides subsp. Perissa	Northern Serrate Dryandra	V	8	8.6km E
Dryandra serratuloides subsp. Serratuloides	Southern Serrate Dryandra	V	8	Not shown in area
Eremophila viscida	Varnish Bush	E	7	Not shown in area
Eucalyptus impensa	Paynes Fine Mallee	E	8	7km W
Eucalyptus johnsoniana	Johnson's Mallee	V	8	460m W
Eucalyptus lateritica	Laterite Mallee	V	8	1.3km W
Eucalyptus leprophloia	Scaly Butt Mallee	E	8	1.6km W
Eucalyptus pruiniramis	Midlands Gum	E	8	Not shown in area
Eucalyptus suberea	Cork Mallee	V	8	1.3km W
Grevillea curviloba subsp. Incurva	Narrow curved-leaf Grevillea	E	8,9	24km SSE(9); 6.1 km E(8)
Hakea megalosperma	Lesueur Hakea	E	8	2.6km W
Leucopogon marginatus	Thick-margined Leucopogon	E	7	29km SSW
Paracaleana dixonii Hopper & A.P Brown ms.		E	8	6.3km W
Spirogardnera rubescens	Spiral Bush	E	8	6.2km E
Thelymitra stellata	Star Sun-orchid	E	8, 9	4.7km SE (9); 2.5km E(8)
Verticordia albida	White Featherflower	E	8	9.4km E

Table Key:

E – Endangered; V – Vulnerable;

Table 3-10 provides a qualitative assessment of the potential for the EPBC Act listed flora and species and their associated habitats to be located along the pipeline AoD. The assessment has been based on comparing known habitat requirements for each species with the results of preliminary assessments of the pipeline route conducted during the Strategic Environmental Review process (see Dames & Moore 2000). The width of the pipeline AoD ensures that impact to any habitat for listed species present along the route is minimal.

[1] Based on examination of the WA CALM Threatened Flora Database.

Table 3-10: Assessment of Flora Impacts

Species	Looping	Recorded	Likelihood of being present
Caladenia hoffmanii Hopper & A.P. Brown ms.	7	Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies	The potential area of habitat on Looping 7 is extremely small and probably highly degraded. Despite the wide habitat preference for this species the likelihood of it being present on the pipeline route is VERY LOW.
Chamelaucium sp. Gingin (N.G. Marchant s.n. 4/11/1988) now *Chamelaucium lullfitzii*	9	White or yellow sand, leaf litter. Plains, hilltops, crests and lower slopes of scarp, rises, road verges	The potential area of habitat for this species on Looping 9 is small. Therefore, the likelihood of this species being present on the pipeline route is LOW.
Conostylis dielsii subsp. Teres	7	White, grey or yellow sand, gravel. Low open woodland	The potential area of habitat on Looping 7 is extremely small and probably highly degraded. Despite the wide habitat preference for this species the likelihood of it being present on the pipeline route is VERY LOW.
Dryandra serratuloides subsp. Perissa	8	Gravelly lateritic soils	This soil type is common along Looping 8, hosting a wide variety of plant communities. The likelihood of this species being present on the pipeline route is LOW.
Dryandra serratuloides subsp. Serratuloides	8	Loam or clay loam over laterite, sandy gravel	These soil types are present along Looping 8, in lower slope positions. The likelihood of this species being present on the pipeline route is LOW.
Eremophila viscida	7	Granitic soils, sandy loam. Stony gullies, sandplains	The potential area of habitat on Looping 7 is extremely small and probably highly degraded. Despite the wide habitat preference for this species the likelihood of it being present on the pipeline route is VERY LOW.
Eucalyptus impensa	8	Yellow sand. Lateritic hills	Mallee eucalypts in the kwongan areas typically occur as widespread clumps or individuals. Despite the wide habitat preference for this species the likelihood of it being present on the pipeline route is VERY LOW.
Eucalyptus johnsoniana	8	White/grey sand with lateritic gravel. Sandplains, lateritic breakaways	Mallee eucalypts in the kwongan areas typically occur as widespread clumps or individuals. Despite the wide habitat preference for this species the likelihood of it being present on the pipeline route is VERY LOW.
Eucalyptus lateritica	8	White or grey sand with gravel. Lateritic breakaways & mesas	Mallee eucalypts in the kwongan areas typically occur as widespread clumps or individuals. Despite the wide habitat preference for this species the likelihood of it being present on the pipeline route is VERY LOW.
Eucalyptus leprophloia	8	White or grey sand over laterite. Valley slopes	Mallee eucalypts in the kwongan areas typically occur as widespread clumps or individuals. Despite the wide habitat preference for this species the likelihood of it being present on the pipeline route is VERY LOW.
Eucalyptus pruiniramis	8	Skeletal soils over sandstone or laterite. Rocky hillslopes	Mallee eucalypts in the kwongan areas typically occur as widespread clumps or individuals. Despite the wide habitat preference for this species the likelihood of it being present on the pipeline route is VERY LOW.

Species	Looping	Recorded	Likelihood of being present
Eucalyptus suberea	8	Grey sand. Near or on lateritic breakaways	Mallee eucalypts in the kwongan areas typically occur as widespread clumps or individuals. Despite the wide habitat preference for this species the likelihood of it being present on the pipeline route is VERY LOW.
Grevillea curviloba subsp. Incurva	8,9	Sand, sandy loam. Winter-wet heath	The potential area of habitat for this species on Looping 8 and 9 is small. Therefore, the likelihood of this species being present on the pipeline route is LOW.
Hakea megalosperma	8	Grey sand, loam. Lateritic hills and rocks	It is present in the vicinity of Loop 8 and there is a MODERATE risk of the species being present based on the presence of its habitat through Coomallo Nature Reserve.
Leucopogon marginatus	7	Yellow & gravely lateric sand. Undulating plains	The potential area of habitat on Looping 7 is extremely small and probably highly degraded. The likelihood of it being present on the pipeline route is VERY LOW.
Paracaleana dixonii Hopper & A.P Brown ms.	8	Grey sand over granite	This soil type is present along looping 8, however this species tends to occur in small populations in restricted areas, with populations most visible following fire. The likelihood of it being present on the pipeline route is VERY LOW.
Spirogardnera rubescens	8	Laterite, sand over laterite, loam	These soil types are common along Looping 8, hosting a wide variety of plant communities. The likelihood of this species being present on the pipeline route is LOW.
Thelymitra stellata	8, 9	Sand, gravel, lateritic loam	These soil types are common along Looping 8, hosting a wide variety of plant communities. The likelihood of this species being present on the pipeline route is LOW.
Verticordia albida	8	Grey-yellow sand. Road verges	This soil type is common along Looping 8, hosting a wide variety of plant communities. This species has been searched for intensively in the vicinity of looping 8 and the likelihood of this species being present on the pipeline route is LOW.

Based on an examination of the Conservation and Land Management database, there are no recorded Declared Rare Flora (DRF) or Priority Species (PS) in the vicinity of Loops 1, 2, 3, 4, 5, and 6. Previous studies along the corridor (Mattiske 2002) identified a single Priority 3 species (*Grevillea stenostachya*) in the vicinity of Loop 5, with an additional 17 priority flora species located south of this area with the majority located within areas in or near Loops 7, 8 and 9. No known Threatened Ecological Communities (as defined under the EPBC Act) were identified during the initial field survey conducted by Mattiske (2002).

The following list of species are DRF or PF that have been identified from the Department of Conservation and Land Management database that occur within the vicinity of Loops 8 and 9.

- Acacia cummingiana (P4)
- Acacia drummondii ssp. affinis (P4)
- Acacia wilsonii (DRF)
- Acacia splendens (DRF)
- Calytrix chrysantha (P4)
- Calytrix eneabensis (DRF)
- Calytrix sylvana (P1)
- Conostephium minus (P4)

- Daviesia epiphyllum (P3)
- Daviesia chapmanii (P4)
- Dryandra echinata (P1)
- Dryandra lindleyana ssp. pollosta (P4)
- Eucalyptus johnsoniana (DRF)
- Eucalyptus pendens (P4)
- Eucalyptus suberea (DRF)
- Eucalyptus lateritica (DRF)
- Eucalyptus leprophloia (DRF)
- Grevillea saccata (P4)
- Haemodorum loratum (P3)
- Hakea megalosperma (DRF)
- Jacksonia sp. Badgingarra (P1)
- Pericaleana dixonii (DRF)
- Verticordia blepharophylla (P2)
- Verticordia rutilastra (P4)
- Verticordia paludosa (P1)

Further additional targeted flora and vegetation assessments have been undertaken on Loops 8 & 9 and will be undertaken for Loops 1 - 6 within the Northern Looping project area to address potential impacts to significant plant communities (Threatened Ecological Communities and regionally significant vegetation) and Declared Rare and Priority Flora. Loop 7 will not be surveyed as this small (5km) loop traverses completely cleared crop land. Details of the survey methodology that has been agreed upon by CALM and the DoE are provided in the *DBNGP Northern Looping Flora and Vegetation Studies Assessment Method* (provided in Appendix 4). Further management measures relating to vegetation are provided in Section 5.2.3.2.

3.5.3 Nature Reserves, Bush Forever and ESA's

All national parks, conservation parks, marine parks, nature reserves and marine nature reserves in Western Australia are vested in the Conservation Commission of WA, and managed by CALM.

There are no Bush Forever sites in the proposed project areas. Loop 9 is some 0.5km from the nearest boundary of the Moore River National Park. Loop 8 abuts on both sides the Coomallo Nature Reserve for 2.75km (DBNGP corridor has been excise from the Reserve) which is described below.

Coomallo Nature Reserve

The Coomallo Nature Reserve (Reserve No. 41933) is 8815 ha and was gazetted as a Class C reserve in 1991. It has been recommended that the classification be upgraded to a Class A reserve. The Reserve is divided by the Jurien Road and the Brand Highway. The majority of vegetation is low heath with small patches of woodlands on sands or clays usually in lower parts of the landscape (CALM 1995). The management of this reserve is carried out under a memorandum of understanding between the DPI and CALM.

The management plan for Coomaloo Nature Reserve identified that that the key issues for any future management were:

- *Phytophthora* Dieback- much of the regional flora is highly susceptible to the disease which is most commonly introduced and spread in infected soil, mud or moist gravel on the wheels and under bodies of vehicles. The loss of vegetation to dieback will seriously reduce the parks conservation and recreation values.
- Fire protection (CALM 1995).

Environmentally Sensitive Areas

Three Environmentally Sensitive Areas (ESA's) have been identified on Loops 8 & 9. They are:

- The first 5.5km of Loop 8 – DPI land - future Mining Lease
- Coomallo Nature Reserve (2.75km of Loop 8)
- Resource Enhancement Category Wetland in Loop 9 (see Appendix 3).

The three currently identified ESA's are depicted in Appendix 7. Other ESA's may also be identified from the results of vegetation surveys on all loops. Mitigation measures to minimise impact within other ESA's identified from vegetation surveys will be developed in consultation with CALM. Mitigation measures to reduce the impact of construction on ESA's is contained in Section 5.2.3.2

3.5.4 Fauna

It is expected that fauna and fauna habitat situated in the cleared pipeline corridor will potentially be impacted.

A search of the EPBC Act database identified 11 birds, 1 reptile and 3 mammals as listed species that potentially could be located in the project area (see Table 3-11).

Table 3-11: EPBC Listed Fauna

Species	Common Name	Category	Loop Section
Birds			
Acanthiza iredalei iredalei	Slender-Billed Thornbill (western)	V	5, 6
Adrea alba	Great Egret	L	1 – 9
Apus pacificus	Fork-tailed Swift	L	1 – 9
Ardea ibis	Cattle Egret	L	1 – 9
Calyptorhynchus latirostris	Caraby's Black-Cockatoo	E	7 – 9,
Charadrius veredus	Oriental Plover	M, L	1 – 4
Glareola maldivarum	Oriental Pratincole	M, L	1, 2
Haliaeetus leucogaster	White-bellied Sea-Eagle	M, L	1, 2, 7 – 9
Hirundo rustica	Barn Swallow	M, L	1, 2
Merops ornatus	Rainbow Bee-eater	L	1 – 9
Numenius minutes	Little Curlew	M, L	1, 2
Reptiles			
Egernia stokesii badia	Western Spiny-tailed Skink	E	6
Mammals			
Dasycercus cristicauda	Mulgara	V	2
Dasyurus geoffroii	Chuditch, Western Quoll	E	9
Rhinonicteris aurantius (Pilbara form)	Pilbara Leaf-nosed Bat	V	1

Table Key

E – Endangered; V – Vunerable; M – Migratory; L – Listed

Table 3-12 provides a qualitative assessment of the potential for the EPBC Act listed fauna species to be located along the pipeline loops. The assessment has been based on comparing known habitat requirements for each species with the results of preliminary assessments of the pipeline loops conducted during the Strategic Environmental Review

process. The width of the pipeline easement ensures that impact to any habitat for listed species present along the route is minimal.

Table 3-12: Likely Occurrence of Fauna

Species	Assessment
Slender-Billed Thornbill (western)	May occur in samphire areas. Potential habitat loss very low.
Great Egret	Waterbird vagrant in area. Impact very low
Fork-tailed Swift	Aerial species. No impact.
Cattle Egret	Vagrant waterbird. Impact not significant
Carnaby's Black-Cockatoo	In southern part of northing looping about as far north as Dongara. Foraging in Banksia woodland/heath and potential breeding in wandoo. The existing easement was cleared 20 years ago. Temporary disturbance in a minor portion of any area.
Oriental Plover	Vagrant to grasslands in north. No Significant impact
Oriental Pratincole	Vagrant to grasslands in north. No Significant impact
White-bellied Sea-Eagle	Seabird. No Significant impact
Barn Swallow	Aerial vagrant. No Significant impact
Rainbow Bee-eater	Regular migratory visitor. Nests in earth banks. Nesting habitat potentially present along pipeline corridor
Little Curlew	Vagrant to grasslands in north. No Significant impact
Western Spiny-tailed Skink	Wheat belt and southern Murchison. Colonies occur in old trees and rock outcrops. The existing pipeline was cleared 20 years ago. No Significant impact
Mulgara	Sandy soils, especially spinifex. Minor temporary habitat loss. Some disruption of movement if pipe lies on surface. A Fauna Management Plan will be in place that includes inspection of trenches and provision of shelter.
Chuditch	Extinct in area of northern looping although some vagrants on coastal plain north of Perth. Impact unlikely.
Pilbara Leaf-nosed Bat	Roosts only in deep caves in Pilbara. Impact unlikely.

A detailed review of the fauna species that may be encountered on each Loop was conducted by Bamford Consulting (2005) and is contained in Appendix 5. The fauna review was carried out with reference to guidance and position statements published by the WA Environmental Protection Authority (EPA) on fauna surveys and environmental protection, and Commonwealth Biodiversity Legislation (e.g. EPA 2002; EPA 2004). The report synthesises the results of a literature review and is classified as a Level 1 survey (desktop study) according to the EPA Position Statement No. 3 (EPA 2002).

A list of fauna that would be expected to occur in the areas of interest was generated by searching available databases and literature. These include:

- the Western Australian Museum's 'Fauna base'.
- Birds Australia's database for the second Atlas of Australian Birds.\
- the information and species distribution maps provided by Tyler *et al.* (2000), Storr *et al.* (1983; 1990; 1999), Wilson and Swan (2003), Cogger (2000), Johnstone and Storr (1998), Strahan (1995), Menkhorst and Knight (2004) and Churchill (1998).

Separate searches were made for each Loop. The two databases listed above were searched for the one degree grid block that surrounds each loop. For additional information and records on threatened species and threatened communities, threatened fauna databases

maintained by the Western Australian Department of Conservation and Land Management (CALM) and the federal Department for the Environment and Heritage (Environment Protection and Biodiversity Conservation, EPBC, database) were searched. The search areas for the CALM and EPBC databases were a 50 km buffer area around the line that connects the start and finish of each loop (Loops 1 to 8). The buffer was reduced to 20 km for Loop 9 due to the greater number of records in this area.

The fauna review provides an analysis of the conservation significance of the species identified and provides a description on the likelihood of encountering individuals of each species as well as a review of the likelihood of each loop traversing the habitats required for the conservation significant species.

During stakeholder consultation there was much debate over the potential impacts on the Carnaby's Cockatoo, *Calyptorhynchus latirostris,* known to breed in the Coomallo Creek area. According to the WA Museum's Handbook on birds of Western Australia, the species has a breeding season from early July (early egg-laying) until mid-January (very late nestlings leaving nest). On the basis of these periods, construction activity planned for February or March should take place when the species is not breeding in the area and most birds have dispersed to the south. Therefore, disturbance of breeding Carnaby's Cockatoo due to construction activity should not be a concern at Coomallo Creek (Bamford pers comms 2005).

3.6 Heritage

Australian Interaction Consultants (AIC) were engaged by Alinta to provide ethnographic and archaeological advice for the Northern Looping Project which was initially based on a desktop investigation. AIC (2005) reported that:

> "previous heritage evaluations performed on the DBNGP include the West Australian Museum's initial archaeological survey of the pipeline route (WAM,1979), the secondary archaeological survey of the original pipeline corridor (Pickering, 1982) and the archaeological survey of the corridor expansion (McDonald, Hales and Associates 2001a)."

Determinations under Section 18 of the *Aboriginal Heritage Act* 1972, have previously been made by the Minister on the sites likely to be impacted by the proposed looping (AIC, 2005). Advice from the Department of Indigenous Affairs (DIA) is pending on the validity of Section 18 applications previously made with respect to the current Northern Looping project within DBNGP corridor. A summary of AIC findings and recommendations on the need to conduct further surveys are provided in Table 3-13 below.

Table 3-13: Department of Indigenous Affairs and Registered Sites and Survey Status

Location	DIA register of Aboriginal Sites advice from AIC in relation to specific loops
Loop 1	Four registered sites and seven reports. Of the seven reports six were written in 1994 and 2001 by McDonald, Hales and Associates and of these three are closed reports. No new archaeological sites or material were located in a survey undertaken in August 2005. Further heritage survey is unnecessary.
Loop 2	Ten registered sites in or near the vicinity of looping 2 and five reports with one closed report Further heritage survey is unnecessary
Loop 3	Sixteen registered sites and nine reports with three closed reports Further heritage survey is unnecessary.
Loop 4	Twenty three registered sites and eight reports with three closed reports. All sites are archaeological in nature artefact scatters except the mythological Moondwundu Waterhole DIA 18084

Location	DIA register of Aboriginal Sites advice from AIC in relation to specific loops
	Further heritage survey is unnecessary
Loop 5	One registered site and two reports with one closed report. Further heritage survey is unnecessary
Loop 6	No registered sites Further heritage survey is unnecessary
Loop 7	No sites recorded Further heritage survey is unnecessary
Loop 8	No registered sites Further heritage survey is unnecessary
Loop 9	In an area bound by 10km by 5km 14 recorded sites and 27 associated reports with three closed reports and one restricted with access pending. Further heritage survey is unnecessary

3.7 Social and Economic

3.7.1 Local Government Areas

The Loops 1-9 traverses 11 local government areas. Details on each of these areas is summarised in Table 3-14 below.

Table 3-14: Local Government Area Traversed by the Pipeline Corridor

Local Government Area	Loop	Area (km^2)	Population	Issues of Significance	Major Industries
Roebourne	1	15,196	14,942	Major Towns include Karratha and Dampier, Ports include Cape Lambert and Dampier. Major export outlet, very large amounts of Iron Ore, Salt, & Natural Gas.	Iron ore, salt, gas, pastoral, fishing tourism,
Ashburton	2	105,647	7,300	Major town - Onslow. Onslow Salt P/L is a major salt producer (2.5 million tonnes per annum). The Ashburton River runs through the lower portion of the Shire.	Mining, pastoral, fishing, fish processing, oil, tourism, salt
Carnarvon	3	53,000	6,577	Major town – Carnarvon. Highlights include:- banana plantations, tropical fruits, fine seafood and popular tourist destination.	Fishing, horticulture, salt & gypsum, tourism, pastoralism
Upper Gascoyne	4	46,602	262	Major town – Gascoyne Junction, Sparely populated area. Major rivers include:- Upper Gascoyne & Murchison Rivers.	Mining, pastoral, tourism
Shark Bay	5	25,000	950	Major town – Denham, The world's best known colony of Stromatolites in Shark Bay world heritage area. Very Popular Tourist region.	Pastoral, fishing, salt, pearl culturing, shell grit mining, tourism
Northampton	6	13,513	3,022	Major towns -Northampton & Kalbarri.	Wheat, sheep,

Local Government Area	Loop	Area (km^2)	Population	Issues of Significance	Major Industries
				Tourism is a fast growing industry, with notable areas including; Kalbarri National Park	fishing, mineral sands mining, tourism
Mullewa	7	10,707	1,350	One of the largest agricultural municipalities in Western Australia, its central town, Mullewa, Area is noted for it's wildflowers, predominately sheep/wheat area	Grain, sheep, iron ore
Carnamah	8	2,835	1,003	Major town – Carnamah. The historically rich farming area of Carnamah has a growing emphasis on tourism.	Fishing, mineral sands, rock quarrying, agriculture, floriculture, gas production
Coorow	8	4,137	1,600	The Shire of Coorow consists of several town-sites including Leeman and Green Head, Coastal Town-sites. Farming, Wildflowers predominant inland and Crayfish and Tourism predominant along the coastal towns	Agriculture, fishing, wildflowers, tourism
Dandaragan	8	6,934	2,750	Major town - Jurien Bay. Popular tourist area in coastal areas. High historical and cultural significance, eg Pinnacles. Tourist attractions include: - National Parks, walk trails, wildflowers, lookouts, natural beaches and heritage buildings.	Agriculture, lobster processing, mining, wildflower picking, tourism
Gin Gin	9	3,325	3,800	Major town – Gin Gin. Agriculture predominates, with tourism along coastal areas, eg Lancelin. The Shire contains the lower reaches of the Moore River, a system of fresh water lakes, streams, and the Gingin Brook and its tributaries.	Fishing, agriculture, bee keeping, fruit growing, market gardening

* excerpt taken from Dames &Moore 2000

3.7.2 Land Use

Due to the length of the proposed Northern Looping Project the land uses within the project area are varied. Loops 1, 2, 3, 5 and 6 primarily traverse Crown pastoral leases. Loop 4 begins in Bidgemia Station before passing through the Davis Island Reserve (Public Purposes Reserve), from which the DBNGP easement is excised. Loop 4 also passes through two State owned stock routes before entering Jimba Jimba Station.

Loops 7, 8 and 9 traverse primarily freehold land which is primarily used for cropping and grazing; there are some smaller areas of crown reserve and other crown land.

Loop 8 abuts the Coomallo Nature Reserve for a length of 2.75km (the DBNGP easement is also excised from this reserve).

The land use in the vicinity of the individual loops are summarised below:

Table 3-15: Land use in the vicinity of Loops 1-9

Loop 1	Mardie Station and Yarraloola Station
Loop 2	Nanutarra Station, Yanrey Station and Uaroo Station
Loop 3	Lyndon Station and Moogooree / Williambury Station
Loop 4	Bidgemia Station, Davis Island Reserve, Stock Routes and Jimba Jimba Station
Loop 5	Yalardy Station and Talisker Station
Loop 6	Coolcalalaya Station
Loop 7	Freehold and Crown Reserve – all cropping land
Loop 8	5.8 km - Crown, Reserve for future mining leases etc. 2.7 km - Crown, Other (DBNGP easement abuts Coomallo Nature Reserve through this section) 38.1 km - Freehold land (remnant vegetation, sheep and cropping)
Loop 9	Freehold - Cropping and grazing. Some remnant vegetation but mostly land cleared for agriculture.

There are no residences near Loops 1 – 7.

Nearby residences on Loop 8 are:

KP 11.4	270 m east from pipeline
KP 30.8	150 m west of pipeline (Farmhouse - seasonal use)
KP 34.1	290 m east of pipeline
KP 42.1	780 m west of pipeline
End of loop	1km south-east of pipeline

Nearby residences on Loop 9 are:

KP 0	1.3 km north-east of CS 9
KP 0	1.7km east of CS 9
KP 1.1	490 m west of pipeline
KP 1.8	440 m west of pipeline
KP 6.1	180 m east of pipeline (casual residence)
KP 7.2	600 m west of pipeline
KP 9.8	280 m west of pipeline
KP 10.7	750 m east of pipeline

3.7.3 Regional Impact

The Northern Looping project will meet the increasing demand for energy in the South West of WA for electricity generation, industrial expansion and increasing domestic gas consumption. This will lead to further long-term investment in the region.

4 Environmental Risk Assessment

DBP is committed to continual improvement in performance, efficient use of natural resources and aspire to zero harm to the environment. A risk-based approach is applied in the management of construction and operations; the overall philosophy is to give priority to designing the pipeline and work activities in such a manner as to avoid the creation of hazards that may lead to the potential for environmental impact. Where this is not possible, the priority will be to minimise and mitigate potential environmental impact through design and/or the implementation of specific constructional processes and procedures. Where environmental hazards are inevitable, they are to be managed to ensure that the potential for environmental harm is reduced to As Low As Reasonably Practicable (ALARP). The results of an Environmental Risk Assessment workshop will be included in the Construction CEMP as per the DoIR guidelines.

At the risk workshop, each potential environmental impact was assessed to determine its consequence (Table 4-1) and likelihood (Table 4-2). The risk matrix (Table 4-3) combines the consequence and likelihood to determine the risk ranking which in turn assigned the correct level of management required (Table 4-4) to successfully reduce the environmental risk to ALARP.

Table 4-1: Consequence

	Corporate	Loss	Environmental	Outrage
5 Catastrophic	Would threaten the survival of Alinta or one or more of its Business Units	> 20 m	Extinction to flora/ fauna species and irreparable damage to soil/water Impairment of ecosystem function. Long term effects to significant environment	Total outrage (eg. Longford, Auckland (attributable to Alinta))
4 Major	Would threaten the effective operation of Alinta for a period of up to a year or have a significant effect on how Alinta will operate in the future	10m-20m	Serious environmental effects with some impairment of ecosystem function eg. displacement of a species. Impairment of species of national significance	Major Alarm and anger – Impact supply to > 10% of customers for a day (electricity), several days (gas)
3 Severe	No threat to the effective operation of Alinta, but exposes Alinta to unacceptable cost consequences	2m-10m	Moderate damage to flora/ fauna and soil/ water. Impairment of species of regional significance	Widespread complaints and anger
2 Serious	No material impact on Alinta, issues are dealt with internally	200k-2m	Limited damage to flora/ fauna and soil/water Impairment of species of local significance	Limited complaints and anger
1 Minor	No material impact on Alinta, issues are routinely dealt with by operational areas	<200k	No damage to flora/ fauna and short term effects on soil/water and air. Local loss of species – flora and fauna well represented	Annoyance, concern and some complaints

Table 4-2: Likelihood

5 – Almost Certain	Event is expected to occur in most circumstances
4 – Likely	Event will probably occur in most circumstances
3 – Possible	Event should occur some time
2 – Unlikely	Event could occur at some time
1 – Rare	Event may occur only in exceptional circumstances

Table 4-3: Risk Matrix

Likelihood\Consequence	**1 Minor**	**2 Serious**	**3 Severe**	**4 Major**	**5 Catastrophic**
5 Almost Certain	Moderate	High	Extreme	Extreme	Extreme
4 Likely	Moderate	Significant	High	Extreme	Extreme
3 Possible	Moderate	Moderate	Significant	High	Extreme
2 Unlikely	Low	Low	Moderate	Significant	High
1 Rare	Low	Low	Moderate	Moderate	Significant

Table 4-4: Management Levels

Legend	
Extreme	Detailed research and management planning required at senior levels
High	Immediate senior management attention needed
Significant	Senior management attention needed
Moderate	Management responsibility must be specified
Low	Manage by routine procedures

5 Environmental Impacts and Management

5.1 Overview

Most aspects of pipeline construction can be managed by standard industry procedures, as detailed in the Australian Pipeline Industry Association (APIA) *Code of Environmental Practice*. However based on the risk assessment and in conjunction with feedback during the stakeholder consultation process, a number of issues require a higher level of management attention including:

- Vegetation clearance
- Rehabilitation
- Fauna entrapment
- Environmental hygiene (weeds and dieback).

This section provides an outline of the potential environmental impacts and the proposed management measures. The entire list of environmental management commitments will be detailed in the Construction Environmental Management Plan (CEMP) that will be developed in consultation with, and to the satisfaction of, regulators including CALM and will be submitted to the DoIR as required under the *Petroleum Pipelines Act 1969*.

This CEMP will also address any Ministerial Conditions that result as part of the ARI process.

In addition, ANS will produce an Environmental Line List, which in keeping with standard industry practice, is an internal working document that details management practices required for site specific environmental issues by chainage (KPs).

5.2 Potential Impacts and Mitigation Measures

5.2.1 Soils and Terrain

5.2.1.1 Potential Impacts

The following activities have the potential to affect the soils and terrain of the project area:

- construction camps
- clear-and-grade operations
- trenching
- backfilling
- reinstatement
- refuelling
- construction access.

Potential localised impacts to the soils and terrain of the project area include:

- erosion and sedimentation
- soil inversion
- soil compaction
- soil contamination
- acid sulphate soil formation.

In addition, the soils and terrain of the project area present potential constraints to pipeline construction and operation activities. These will be addressed in alignment selection, pipeline design and construction. In particular, they include:

- trench collapse during construction in sandy soils or wet soils
- subsidence of the trench.

These constraints are discussed further under 'Erosion and Sedimentation' below and in Section 5.2.1.2.

Erosion and Sedimentation

Erosion and sedimentation are key potential environmental impacts associated with pipeline construction projects. Pipeline construction primarily consists of earth moving activities, which remove surface cover and disturb soil profiles. Therefore, there is potential for sedimentation of the adjacent environments if adequate controls are not implemented.

During rainfall events the pipeline alignment may be subject to erosion by water and subsequent transportation and deposition of this sediment off the alignment (sedimentation). However, appropriate drainage controls, topsoil/spoil stockpile management and maintenance of erosion control devices will protect soils and surface water environments from significant erosion and sedimentation impacts.

Inadequate soil compaction over the trench line may also lead to trench subsidence and subsequent erosion. During periods of low rainfall, erosion (or aeolian scour) may result from wind action on soils where prolonged exposure occurs following initial clearing.

Soil Inversion

Without effective soil management, topsoil may be "lost" during the construction process by burial beneath (or mixing with) trench spoil during stockpiling, covering with sediment washed in from adjacent areas or returning trench spoil and topsoil to the trench in a sequence different to original profiles.

The loss of topsoil reduces the effectiveness of easement restoration and agricultural based land use activities by limiting the amount of available nutrients, biomass and productivity. However, topsoil is not expected to be "lost" due to the topsoil separation and management measures that will be implemented.

Soil Compaction

Pipeline construction requires compaction of the backfilled trench to prevent the disturbed soil from subsiding. However, vehicle traffic elsewhere on the construction easement can lead to soil compaction, in particular equipment and machinery laydown areas or areas of heavy vehicle traffic. Soil compaction may change local drainage patterns and prevent effective plant growth. Activities that may cause soil compaction will be restricted to approved areas (e.g. the right of way and access tracks) and will be temporary, as it will be rectified during rehabilitation by ripping or scarifying.

Soil Contamination

The potential also exists for construction related activities to result in localised soil contamination. The main potential sources of contamination are:

- minor spills of fuel or chemicals
- saline groundwater pumped out of trench during construction
- leachate from acid sulphate soils created by exposure to oxygen (oxidation) of soils during trenching
- discharged hydrotest water.

Pipeline projects involve relatively small quantities of chemicals and likely volumes of spills are extremely low. Pipeline construction equipment (such as graders, bulldozers and side-boom tractors) will be refuelled on the right-of-way from a standard fuel truck. Light vehicles will be refuelled off the right-of-way. Environmental controls and quality systems will be implemented as discussed below, including erosion and sediment controls and spill prevention and cleanup measures.

Acid Sulphate Soil

Acid sulphate soils form where exposure of sulphate rich soils to oxygen results in the production of acid (sulphuric acid), which can mobilise heavy metals in the soil. The creation

of acid sulphate soils can affect soil quality, water quality and land use. These sulphate rich soils may be present on the pipeline alignment.

5.2.1.2 Impact Mitigation

Mitigation measures outlined in the APIA *Code of Environmental Practice* will be implemented via the Construction Environmental Management Plan to minimise potential impacts.

To minimise potential impacts to soil and terrain, ANS will:

Erosion and sedimentation

- Where appropriate conduct geotechnical surveys to identify areas of potential subsidence or collapse and include the findings of these studies into pipeline design specifications and construction management plans
- limit ground disturbance and vegetation clearing to the minimum extent necessary for safe pipeline construction
- install and maintain erosion and sediment control structures in accordance with the Construction Environmental Management Plan (e.g. diversion berms and cross ditches to divert water off the right-of-way to adjacent stable ground)
- limit the period between clear-and-grade and restoration to the minimum practicable
- Install trench breakers to reduce in trench water movement and potential subsidence and related erosion
- compact the trench to a level consistent with surrounding soils
- implement appropriate physical and biological stabilisation (eg. installation of permanent erosion control berms, erosion matting, sowing of sterile grasses, etc.) site rehabilitation measures in accordance with the Construction Environmental Management Plan and the Rehabilitation Plan
- leave periodic breaks in any crown to prevent channelling of run-off along the right-of-way
- after construction is completed:
  - routinely inspect and maintain erosion and sediment control structures, particularly after heavy or prolonged rainfall
  - regularly inspect the easement during operations to identify areas of subsidence
- implement appropriate measures to permanently solve any recurring erosion or subsidence problems.

Soil inversion

- clearly identify the importance of stockpiling topsoil and trench spoil separately, and backfilling the trench in the appropriate soil horizon order in the Construction Environmental Management Plan and environmental inductions
- stockpile topsoil and trench spoil separately
- where practicable, return trench spoil in the appropriate horizon order
- at the completion of works, respread topsoil across the easement
- regularly inspect the easement to monitor rehabilitation.

Soil compaction

- identify access tracks and turn-around points for vehicles prior to construction
- minimise the number of planned tracks and use existing tracks as far as practicable
- restrict all vehicles and equipment movements to the construction easement or designated access tracks and roads
- rip or scarify compacted areas where necessary to facilitate vegetation growth
- regularly inspect the easement to monitor rehabilitation.

Soil contamination

- include a spill prevention, response and cleanup procedures in the Construction Environmental Management Plan, including refuelling techniques and chemical storage and handling requirements
- regularly inspect machinery for fuel and oil leaks and maintain in good working order
- use drip tray and spill mats for each coupling during refuelling truck operations

- use spill mats and spill containment equipment onsite where diesel pumps are required on the easement
- implement cleanup procedures if a spill occurs
- incorporate procedures for trench dewatering, hydrotest water disposal and management of contaminated water (for example highly saline groundwater, leachate from acid sulphate soils) into the Construction Environmental Management Plan. These may include measures to:
  - dispose of water on site after assessment/analysis, provided the water meets DoE criteria for the disposal site
  - contain and treat water on site
  - remove water off site
- obtain landholder approval and DoE approval if required for disposal of trench water outside easement or disposal of saline trench water

Acid sulphate soil (ASS) formation

- conduct a targeted assessment of the final alignment to determine if any areas of potential acid sulphate soils are present and include these locations on construction drawings and the Environmental Line List
- if acid sulphate soils are present, incorporate acid sulphate soil management plan into the Construction Environmental Management Plan. These may include measures to:
  - minimise the time that trench spoil is stockpiled
  - neutralise trench spoil with lime both after excavation and during backfill
  - contain runoff from stockpile areas in holding ponds or bunded areas
  - dispose of trench water only after analysis
- inspect the easement to monitor rehabilitation in any acid sulphate soil regions.

5.2.2 Water Resources

5.2.2.1 Potential Impacts

The following activities have the potential to affect the shallow groundwater and surface water resources within the project area:

- clear and grade operations
- trenching
- de-watering of the trench to aid construction
- the storage and handling of small quantities of fuel and chemicals (which have the potential to be spilt)
- the presence of the back-filled trench during operation.
- hydrostatic testing
- watercourse crossings.

Potential impacts of pipeline construction on groundwater and surface water resources include:

- alteration to groundwater and surface water flow regimes
- increased sediment load and turbidity
- contamination
- disruption to third party use
- disturbance to groundwater infrastructure.

The presence of shallow groundwater may also constrain standard construction activities.

Due to the nature of pipeline construction activities and operational conditions (particularly the shallow depth of trenching and the low risk of any surface contamination), no impacts to deep aquifers are likely to occur and these are not considered further.

No impacts to surface water or groundwater are expected during operation, following the successful restoration of surface contours and stability.

<u>Alteration to shallow groundwater and surface water flow regimes</u>

The intersection of shallow groundwater by the open trench has the potential to create localised disturbance to flow patterns, particularly in recharge or discharge zones. Due to the minor depth of the intrusion (approximately 1.5 m) and the short period for which the trench is open (generally less than two weeks), the resultant impact on groundwater flows is considered to be inconsequential.

To aid construction, it is common pipeline industry practice to pump accumulated water from the trench. 'Impacts are local and short term and not anticipated to have any measurable effect on groundwater resources.

Backfilling the trench after the pipeline has been laid aims to adequately compact returned trench spoil consistent with pre-existing conditions. If the backfilled trench is significantly less compacted than the surrounding soils, it may act as a horizontal conduit to water, altering the local hydrology. Alternatively, if sections of the trench are compacted more than pre-existing conditions, lateral flows of groundwater may be impeded, potentially resulting in accumulation of groundwater up gradient of compacted surfaces. However, this is unlikely to cause significant impacts due to the relatively shallow trenching depths.

Construction activities may result in physical disturbance to defined watercourses and to overland flow. Impacts to surface drainage patterns associated with overland flow away from watercourses are less noticeable. If they occur, impacts are most likely to be associated with the presence of temporary linear stockpiles of topsoil and trench spoil and modifications to surface contours during earthworks, which may impede or change natural overland flows.

Increased sediment load and turbidity

A temporary reduction in water quality caused by sediments entering streams and increasing turbidity is the most likely potential impact to occur during construction. The major source of sediment is erosion, transported by surface run-off, stream bank collapse and disposal of turbid trench water. The extent of sedimentation is determined by factors such as soil type, slope, run-off volume and velocity and vegetation cover. The timing of construction in predominantly dry conditions and the implementation of appropriate drainage controls, topsoil/spoil stockpile management and maintenance of erosion control devices will protect surface water environments from significant erosion and sedimentation impacts.

Contamination of surface water or groundwater

The potential exists for Project related activities to result in localised groundwater or surface water contamination. The main potential sources of contamination are:

- minor spills of fuel or chemicals
- saline groundwater pumped out of the trench during construction
- leachate from acid sulphate soils created by exposure (and oxidation) of soils during trenching, and
- discharged hydrotest water.

Pipeline projects involve relatively small quantities of chemicals and the risks to water resources associated with minor spills are extremely low. Pipeline construction equipment (such as graders, bulldozers and side-boom tractors) will be refuelled on the right-of-way from a standard fuel truck. These trucks hold up to 16000 litres, however it is highly unlikely that a storage tank on a fuel truck would be breached and the entire contents be spilt.

As discussed in Section 5.1, the pipeline corridor also traverses some areas with potential for occurrence of acid sulphate soils. Adequate planning and management is required to prevent or mitigate localised impacts to surface water.

Disturbance to Wetlands

During trenching and installation of the proposed pipeline dewatering measures may be required to provide a dry environment. This will result in the aquifers surrounding the excavated trench to be drawn down (GHD 2005). The radius of influence will depend on a number of factors including water table depth and length of open trench. The quality of groundwater discharges will also need to be compatible with water quality guidelines, and with any receptor waters.

Watercourse crossings

Either open cut or closed techniques can be used to cross watercourses. A summary of different watercourse crossing techniques to compare potential impacts is presented in Table 5-1.

The major watercourses in the project area are:

- Loop 1- Peter Creek
- Loop 2- Ashburton River
- Loop 3- Minilya River (north)
- Loop 4- Gascoyne River
- Loop 4- Davis Creek
- Loop 8- Coomallo Creek (x2).

The Ashburton, Minilya and Gascoyne Rivers will be crossed using the Horizontal Directional Drill (HDD) technique. The scheduling of construction for dry conditions and the proposed mitigation measures will ensure that impacts to watercourses are not significant or long-term.

Table 5-1: Summary of Potential Impacts of Different Watercourse Crossing Techniques

Technique	Potential Hazard	Potential Impact
Open Cut	Inadequate sedimentation controls	Potentially high sediment release during backfilling if controls are not adequately in place
Horizontal Directional Drill	Loss of circulation, collapsed hole, stuck drill stem, lost tools	Failure leads to subsequent attempts and possible additional land requirements
	Drill mud seepage directly into land and water course	Prolonged sediment load and deposition
	Washout of cavities and collapse of right-of-way	Sinkholes on right-of-way and under watercourse
	Deviation of drill alignment	Potential third party damage
	General	Large footprint required for drill pad Short-term visual impacts due to presence of equipment Noise impacts due to stationary workforce and continuous operation
Boring	Collapsed hole, stuck drill stem, lost tools	Failure leads to subsequent attempts and possible additional land requirements
	Washout of cavities and collapse of right-of-way	Sink holes on right of way and under water course
	Bellhole Dewatering	Discharge erosion, contamination
	General	Short term visual impacts due to presence of equipment Noise impacts due to stationary workforce and continuous operation

(Adapted from Canadian Pipeline Water Crossing Committee, 1999)

5.2.2.2 Impact Mitigation

Impacts to water resources are expected to be minor and temporary. Construction will be carried out during dry conditions. The risk of erosion is relatively low due to the topography and nature of the watercourses. Sediment and erosion control measures outlined in the APIA *Code of Environmental Practice* will be implemented via the Construction Environmental Management Plan (CEMP) to minimise potential impacts. The CEMP will include site specific requirements where appropriate.

ANS will implement the following specific measures to mitigate potential impacts to water resources:

- avoid large trees which provide habitats and assist bank stability
- compact the trench to a level approximately consistent with surrounding soils
- install trench breakers to prevent longitudinal water flow within the trench on slopes approaching watercourses
- include the locations of features such as groundwater discharge, and acid sulphate soils on Alignment Sheets
- reinstate surface contours as soon as reasonably practicable
- at watercourse crossings:
  - conduct subsequent grading and trenching immediately prior to pipe laying (that is, after the pipe is welded)
  - stockpile material in bunded areas away from the watercourse banks
  - contain pumps within lined, bunded areas
  - complete watercourse crossings within the shortest period practicable to minimise the period of open trench and subsequent environmental disturbance
  - avoid watercourse crossing works during periods of flood or heavy rainfall
  - ensure all equipment necessary for the stream crossing is on-site and in good working order prior to commencing work
  - obtain approvals for watercourse crossings from the Department of Environment
- where HDD is used for watercourse crossings
  - locate HDD drill entry and exit points away from watercourse banks, sensitive vegetation and any heritage sites
  - monitor drill entry and exit points for potential fracturing out of drilling mud
  - dispose of drilling mud (bentonite) and cuttings as per approval requirements
  - ensure HDD equipment is in good working order
  - reinstate HDD entry and exit sites (revegetation of the easement aims to re-establish local indigenous plant species where possible) in consultation with regulatory authorities
- remain vigilant for expected storm or flood warnings and develop a contingency plan for such events
- during periods of heavy rainfall, suspend all activities likely to result in erosion and sedimentation if their effects cannot be adequately controlled
- ensure adequate erosion and sediment controls are in place to protect water resources:
  - design erosion and sediment control measures that consider site conditions, slope, vegetation cover, proximity to sensitive environments, construction phase and climatic conditions
  - install diversion berms or drains along the top and at intermediate points down the slopes to the watercourse
  - install silt fences as necessary for interim on-site erosion control
  - monitor, maintain and repair erosion and sedimentation controls to ensure they remain effective, particularly after heavy rainfall events and during periods of prolonged rainfall
- handle and store chemicals in accordance with Material Safety Data Sheet requirements
- store fuels, lubricants and chemicals within containment areas (e.g. lined, bunded areas) in accordance with Australian Standard AS1940
- include a spill prevention, response and cleanup procedure into the Construction Environmental Management Plan (which will include refuelling techniques and chemical storage and handling requirements)
- ensure spill response and clean up equipment is on-site prior to commencing works

- prohibit vehicle refuelling within 50 m of a watercourse or on a slope leading to a watercourse
- regularly inspect machinery for fuel and oil leaks and maintain in good working order
- obtain hydrotest water from an appropriate source in consultation with relevant landowners and regulatory bodies, in accordance with statutory requirements
- incorporate procedures for trench dewatering, hydrotest water disposal and management of contaminated water (for example highly saline groundwater, leachate from acid sulphate soils) into the Construction Environmental Management Plan. These may include measures to:
  - dispose of water on site after assessment/analysis, provided the water meets DoE criteria for the disposal site
  - contain and treat water on site
  - remove water off site.

Wetlands Hydrogeology Management

Wetlands are known to exist in the vicinity of several loops, however wetland mapping is only available for Loop 9 (Appendix 3). Construction for Loop 9 is timed for the summer months whereby the water table will be at its lower limits and the seasonally inundated wetlands would be expected to be dry. Specific mitigation measures that ANS will apply to all wetlands will include:

- Open water bodies or other water bodies where groundwater may be close to the surface at the time of construction, within a 50 m radius of the trench, will have their water levels regularly monitored during the dewatering exercise. Should dewatering affect the water table then one of these four mitigation measures will be applied depending on site conditions:
  - reduce the length of the open trench such that lower dewatering rates can be applied
  - infiltration of abstracted trench dewatering water in proximity to the open water body
  - controlled dewatering inflow directly into the open water body depending on water compatibility and approval by DoE
  - stop work if severe impact on water body is likely to occur and develop other mitigation measures in consultation with the DoE.

- Abstracted groundwater will be monitored prior to the discharge of abstracted groundwater to ensure compatibility of dewatering water and receptor water particularly if ASS soils are encountered.

5.2.3 Vegetation

5.2.3.1 Potential Impacts

Approximately half of the pipeline corridor traverses areas where native vegetation has been previously cleared and has regenerated since the original pipeline was installed. The other half traverses cleared agricultural lands. Clearing of the re-growth native vegetation will be required.

Potential impacts of pipeline construction on vegetation include:

- clearing of vegetation from the DBNGP easement and other areas including turn around bays and construction camps (this entire area being collectively termed AoD).
- alteration to groundwater and surface water flow regimes
- introduction or spread of weeds and diseases (eg. Dieback)
- smothering (dust).

It is highly unlikely that dust suppression activities (water trucks and sprayers) will impact on 'in-tact' vegetation abutting the AoD due to the placement of soil and vegetation windrows at the edges of the AoD. Any overspray on the AoD will be intercepted by these soil and

vegetation windrows. Over watering is also unlikely it leads to the creation of unsafe conditions for vehicles and equipment travelling on the AoD and access tracks.

5.2.3.2 Impact Mitigation

Although no Declared Rare Flora (DRF) or Priority Flora species have previously been identified on the proposed route, additional surveys have been undertaken during spring 2005 for Loops 8 & 9 and Loops 1 – 6 will be surveyed in summer or autumn of 2006 prior to construction commencing (see Appendix 4).

Findings of the surveys will be forwarded to CALM and consultation undertaken on additional management measures that may be required.

The management measures to be implemented to minimise the impact of construction on DRF and PF include:

- locations of all DRF and PF identified on the AoD to be mapped and marked infield
- locations of all DRF and PF included on environmental line lists
- where practical and in consultation with CALM these plants will be protected from disturbance through the use of fencing and sign-posting on site
- construction personnel will be provided with information on these species and the management practises being implemented at inductions and toolbox on loops where the plants have been identified.

In the event that DRF or PF cannot be avoided and destruction of some plants is necessary to implement the project, the following management steps will be taken:

- plants that are required to be impacted will be individually marked in the field
- the impact of removal of the plants on the conservation status of the species will be assessed at a local and regional scale by a qualified botanical consultant in consultation with officers of CALM
- options for transplanting of individual plants or salvage of biological material for later propagation will be discussed with key government stakeholders
- an application to take DRF will be prepared and submitted to calm for approval by the Minister for the Environment in accordance with the Wildlife Conservation Act 1950.

Alinta is committed to minimising the disturbance to vegetation remaining on the AoD. Management measures to minimise vegetation disturbance that will be undertaken prior to the commencement of construction activities (i.e clear and grade), include:

- development of a set of drawing depicting the total area of disturbance for each loop. These drawings of the AoD will include the construction spread, campsites and access to the pits, truck turnaround bays, lay down areas, proposed water bores and access tracks to the bores, access tracks to the construction corridors and access tracks around or through creek crossings. All areas will be surveyed and flagged infield prior to construction
- development of construction drawings depicting the AoD in cross-section and identifying sections of the AoD where width reductions will occur
- implementing construction width reductions and/or other recognised mitigation measures in recognised environmentally sensitive areas in consultation with CALM
- on-ground inspection of the AoD by project environmental staff to identify areas requiring management (including flagging of vegetation)
- inclusion of site specific management measures on the Environmental Line List.

Management measures to minimise the impact of construction on the remaining vegetation include:

- flagging vegetation to be retained (AoD boundary) and large habitat trees
- trimming of overhanging branches instead of whole tree removal
- stockpiling of all vegetation including leaf litter and log debris for use during rehabilitation
- compliance with the Hygiene Management Protocol (Appendix 6) to ensure no weeds or disease are spread along the corridor due to construction activities

- implementing dust control activities as required
- reinstating surface contours as soon as reasonably practicable
- including the locations of features such as groundwater discharge, and acid sulphate soils on Environmental Line Lists
- ensuring no impacts occur to vegetation off the construction area.

The Rehabilitation Management Plan (Appendix 4) has been developed to ensure that all disturbed land will regenerate to the vegetation that existed prior to the disturbance. The plan has been developed on advice from the relevant specialist advisors and in consultation with CALM personnel as well as relevant stakeholders, including landholders. It contains clear objectives and performance criteria and also addresses monitoring and management requirements. The Rehabilitation Management Plan may be subject to CALM approved amendments where required.

The current locations of Environmentally Sensitive Areas (ESA's) on Loops 8 and 9 are contained in Section 3.5.3 and Appendix 7. Other ESA's may be identified on these loops as well as on all other loops as a result of additional vegetation surveys (Appendix 4).

To protect the ESA's, construction width will be reduced down to 20m and there will be no additional turn around locations areas within areas of CALM estate. The wetland management measures to be implemented for the protection of the Resource Enhancement Category wetland on Loop 9 as well as other wetlands identified as ESA's on other loops are contained in Section 5.2.2.2. Additionally, hygiene clean down boundaries will be located at the start of all identified ESA's.

5.2.4 Weeds and Dieback (Hygiene)

5.2.4.1 Potential Impacts

Construction activities have the potential to introduce or disperse weeds and to introduce dieback to uninfected areas. Dieback is considered an issue for Loops 8 & 9 only as other loops occur in a zone of <400mm rainfall and therefore dieback will not be an issue as it will not survive in these areas.

5.2.4.2 Impact Mitigation

Where appropriate a dieback and weeds survey will be conducted prior to any construction activity commencing.

The dieback survey will be conducted based on the requirement for the pathogen to have a minimum of 400mm annual rainfall with 600mm being the rainfall required for epidemic to occur. The survey will include the detection and mapping of *Phytophthora cinnamomi* to CALM standards and the sampling and subsequent analysis of soil and vegetation material from any dead or dying indicator plant species. Any disease boundaries found will be marked in the field using day-glo pink (*P. cinnamomi* infested) or white (uninterpretable) flagging tape.

Dieback will only present a hygiene issue on Loops 8 & 9. As construction on these Loops will occur in summer and autumn, predominantly dry seasons, the risk of spreading dieback will be minimal. Additionally, the Hygiene Protocol will be implemented to further reduce this risk.

The weed survey will include inspecting the area for the presence of environmental and Declared weed species, with particular emphasis placed on access routes and areas of previous disturbance and stream zones. The surveys will include investigations for the declared plants Mesquite and Parkinsonia known to occur the West Pilbara on flood plains and in riparian zones respectively. Environmental weed locations will also be included in the weed surveys in areas of remnant native vegetation. This will allow mapping of ephemeral weed species and those species that normally retreat to moist sites during summer months. The survey data will be utilised to prepare a map of weed cover for the survey areas that will be used to generate hygiene boundaries for each Loop.

Any locations and boundaries of *P. cinnamomi* or weed infestations will be illustrated on a map if recorded and included in the Environmental Line Lists for the respective Loops. The Hygiene Protocol (Appendix 6) will be implemented where weed and dieback boundaries are identified within remnant vegetation. The Hygiene Protocol is subject to CALM approved amendments where required.

The hygiene protocol has been developed (Appendix 6) and describes the steps that will be taken to minimise the risk of spreading dieback or weeds into dieback/weed free areas along the AoD. These include:

- cleandown prior to vehicles entering the AoD
- cleandown locations at the end of each weed/dieback infected area, to be utilised during the construction operation
- ensuring stockpiles of weed and weed-free and dieback and dieback free material are kept separate and only respread back to their point of origin.

The protocol has been developed on advice from the relevant specialist advisors and in consultation with CALM personnel as well as relevant stakeholders, including landholders. Weed monitoring and management requirements have been included into the Rehabilitation Management Plan (Appendix 4). The Rehabilitation Management Plan has been submitted to the relevant authorities for their approval. As part of the Rehabilitation Plan, the project footprint will be inspected for weed outbreaks approximately 4 weeks after the first significant rainfall event (>5mm). Active control of weed outbreaks into previously uninfected areas along the easement will be carried out if required.

Upon completion of weed surveys the Hygiene Management Protocol will be updated to include information, if required, on any weed species requiring eradication prior to the commencement of construction and weed hygiene boundaries. This information will also be incorporated into the Environmental Line Lists and marked in field prior to construction.

5.2.5 Fauna

5.2.5.1 Potential Impacts

The following activities have the potential to affect fauna that may be located in the project area:

- creation of construction access
- clear-and-grade operations (creation of AoD)
- trenching
- increase in food and water sources for scavengers and predators (rubbish, turkey nests etc)
- earthworks associated with creation of associated stockpiles, laydown or work areas and construction depots (if required).

Potential impacts of pipeline construction on fauna include:

- clearing of habitat possibly including fauna habitat and feed trees
- decrease in habitat health due to the generation of dust
- disturbance due to noise emissions
- short term restriction in east west movement of ground dwelling fauna
- provision of temporary artificial watering sites
- potential mortality from exposure due to entrapment in the trench.

The Coomallo Creek area is known as a breeding site for Carnaby's Cockatoo *Calyptorhynchus latirostris*. According to the WA Museum's Handbook on birds of Western Australia, the species has a breeding season from early July (early egg-laying) until mid-January (very late nestlings leaving nest). On the basis of these periods, construction activity planned for February or March should take place when the species is not breeding in the area and most birds have dispersed to the south. Therefore, disturbance of breeding Carnaby's Cockatoo due to construction activity should not be a concern at Coomallo Creek (Bamford pers comms 2005).

It is likely that some species of small mammals, reptiles and amphibians will fall into the trench and perish however the mitigation measures below will be employed to minimise the impact of the fauna populations in the region.

Rehabilitation of the corridor following the completion of looping construction will mitigate the effects of vegetation fragmentation. Changes to existing feral animal use of the corridor is unlikely as there has been a cleared track within the corridor since the original construction of the DBNGP in the early 1980's.

Open artificial water associated with construction activities will include water accumulating in the trench. Some temporary 'turkey nest' dams will also be constructed at water source points (ie bores). There is the potential for fauna to become trapped in these dams and as such they will be regularly inspected.

Water generated as a result of construction activities (ie dust suppression, trench-dewatering, hydrostatic testing water) will either be subject to evaporation or controlled rapid dispersal to land (ie infiltration) resulting in minimal impact on animal behaviour.

The impact on fauna from artificial light is not consider to be an issue as construction activities will be undertaken during daylight hours. A small amount of external lighting will be used at the temporary construction camps but any potential impact will be short term.

5.2.5.2 Impact Mitigation

Fauna management has been recognised by Alinta as an issue that requires a high level of management attention. Alinta further recognises that fauna will need to be managed effectively to ensure compliance with the *Wildlife Conservation Act 1950* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999.* A Fauna Interaction Protocol has been developed and is included in Appendix 5. This protocol is subject to CALM approved amendments where required. The aim of this protocol is to present mitigation measures that avoiding fauna injury or mortality. The mechanism that will cause the majority of fauna interactions will be trench excavation. Fauna clearing crews will check open trenches on a daily basis and remove trapped fauna.

The following mitigation measures (from the Fauna Interaction Protocol) that ANS will implement to minimise the impact on fauna include:

- mortality of animals that fall into trenches can to reduced by not undertaking projects in the period of highest environmental temperatures and the period when reptiles are most reproductively active (typically November to March). Note that this period will be avoided as far as practicable but on the Northern Looping Project, construction of Loops 8 & 9 will occur during Jan and Feb
- the EPA (2005) suggests open lengths of the trench of 20km in non-rocky areas with an additional 10km open in rocky areas
- trenches to be cleared of fauna at least once each day before 10am
- shelters (e.g. hessian bags, shade structures) should be installed in open trenches at 100m intervals
- trench plugs/exit ramps should be installed in trenches at no greater than 1.2 km intervals to facilitate the egress of fauna from the trench
- individual sections of trench shall be open for no greater than 14 consecutive days
- water in the trench should be pumped out on a daily basis.

Staff from the Department of Conservation and Land Management that have been involved in the clearing of fauna from trenches have supported many of the EPA recommendations and also offered additional advice. A fauna clearing crew:

- progresses at a maximum rate of approximately 3 km/h
- will consist of at least two persons operating together to reduce safety risks, stress on fauna and the time taken to capture fauna, and to ensure that the bottom 'corners' of the trench can be adequately inspected. At least one member will be appropriately trained/qualified in the identification and handling of vertebrate fauna (including

mammals, birds, reptiles and amphibians), and at least one member will be trained to interact with venomous snakes. At least one crew will be provided for each construction spread (i.e. each Loop)
- will be equipped with a hoop-bag for capturing animals
- will be equipped with a snake jigger.

The following management measures will also be undertaken to facilitate the exit of animals from the trench:

- the ends of each section of pipeline will be capped to prevent the entry of fauna, dust and other contaminants
- backfilling crews will inspect the trench to ensure any animals trapped in the trench are relocated prior to backfilling
- trench dewatering will occur as required, minimising the potential for trapped fauna to drown in the trench
- rubbish will be strictly controlled via standard waste management protocols and will include bins with lids to prevent scavengers from accessing waste including food scraps
- fauna handlers to check 'turkey nests' for trapped fauna
- exit ramps at trench plug points will be constructed on both sides of the trench and at an angle of less than 45°.

There are a few areas of high conservation value, notably in areas of native vegetation in Looping 8 (e.g. the Coomallo Creek area and the 5.5km immediately south of CS8) where additional efforts may be required. In such areas, depending upon the numbers of animals initially found in the trench, the trench may be cleared morning and evening, and effort may be required to minimise the length and time open on the trench.

Other measures to be implemented by ANS include:

- retain habitat trees where feasible. Fauna handlers will be present during the clear and grade operation to search for fauna on the AoD and where trees can not be retained, a fauna handler will inspect fallen trees for fauna requiring assistance
- sections of trench will be left open for as short a period as practicable. This will be no greater than two weeks (14 days)
- the feeding of animals, hunting, fire arms and pets on the construction site will be prohibited
- injured fauna will be transferred to listed wildlife carers where practicable
- details of fauna encountered in the trench or other activities will be recorded and identified
- construction will occur during daylight hours only to ensure that noise and light do not effect nocturnal fauna
- noise and dust emissions will be mitigated as described in Sections 5.2.7 (noise) and 5.2.8 (air emissions).

Habitat trees to be retained where feasible are those trees within the AoD that have a diameter of greater than 400mm and hollows that may be utilised by bird and other animals for nesting / shelter. Habitat trees to be retained will be identified during the pre construction field survey which occur the fortnight preceding the clear and grade operation. These location of these trees will also be included on the Environmental Line Lists.

5.2.6 Heritage

5.2.6.1 Potential Impacts

The proposed earthworks (particularly clear-and-grade operations) associated with pipeline construction have the potential to disturb archaeological material, should it be present. Impacts may include:

- damage to shallow artefact scatters
- damage to subsurface material
- damage to significant vegetation (for example scarred trees).

5.2.6.2 Impact Mitigation

ANS will implement the following measures to mitigate potential impacts to indigenous cultural heritage:

- install flagging, protective fencing or erosion control measures to protect any sites detected near the easement which will not be directly affected by construction
- in the unlikely case that new sites are detected on the alignment and cannot be avoided, obtain appropriate authorisation for unavoidable site disturbances necessary to permit the construction of the pipeline
- undertake on-site monitoring of clear and grade operations
- include Indigenous site identification and protection as part of the induction course
- in the event that site earthworks uncover potential Indigenous heritage material:
  - halt work at this location and establish a 100 m buffer around the site. Work may continue outside the buffer area.
  - site monitors and archaeologist should take immediate steps to evaluate the material. If monitors/ archaeologist are not present, work should stop immediately and contact made with the relevant heritage group
  - suspend works at the discovery site so that an evaluation of the nature of the discovery can be undertaken, along with an appropriate course of action.
  - the course of action may consist of recording the site location, removal of the cultural material or site protection as appropriate under the relevant legislation.

5.2.7 Noise Emissions

5.2.7.1 Potential Impacts

Pipeline construction activity will result in a temporary increase in noise levels within the immediate vicinity of the alignment, associated with the operation of vehicles and equipment such as excavators, graders, bulldozers and boring equipment. However, this impact is expected to be of short duration and intensity. It is not anticipated there will be any requirement for blasting to be carried out.

Public

There are no permanent residences near Loops 1-7; in Loops 8 and 9 there are no residences within 150 m and 180 m respectively from the project area.

Noise control measures are covered in Part 2, Regulation 7 of the *Environmental Protection (Noise) Regulations* 1997. These regulations outline the prescribed standards for noise emissions, and to exceed these standards is an offence. However, Part 2 Regulation 13 of the *Environmental Protection (Noise) Regulations* 1997 states:

> *13. Construction Sites*
>
> *"construction site" means premises or a public place on which the sole or principal activity is the carrying out of construction work*
>
> "construction work" means-
>
> *13.1(d) work in laying any pipe or work in lining pipe that is done at or adjacent to the place where the pip is laid or to be laid;*
>
> Part 2, Regulation 13.2 states;
>
> *Regulation 7 does not apply to noise emitted from a construction site as a result of construction work carried out between 0700 hours and 1900 hours on any day which is not a Sunday or a public holiday if the occupier of the premises or public place, shows that –*

(a) the construction work was carried out in accordance with control of environmental noise practices set out in section 6 of AS 2436-1981 Guide to Noise Control on Construction , Maintenance and Demolition Sites;

(b) the equipment used on the premises was the quietest reasonably available; and

(c) if the occupier was required to prepare a noise management plan under sub regulation (4) in respect of the construction site-

(i) the noise management plan was prepared and given in accordance with the requirement, and approved by the Chief Executive Officer; and

(ii) the construction work was carried out in accordance with the management plan.

As the construction of the Northern Looping project will be on a premises or public place on which the sole work activity is the construction of the pipe, the standards prescribed in Regulation 7 will not apply between the hours of 0700 and 1900 on any day that is not a Sunday or a public holiday.

Therefore, on Sundays and public holidays, work on the pipeline construction shall not exceed those standards prescribed in Regulation 7.

Fauna

The presence and activity of construction activity may result in temporary, short-term disturbances to fauna (e.g. noise may discourage critical lifecycle stages such as breeding or nesting). However the short duration of construction activities is not expected to have any significant impact on fauna. As discussed in Section 3.5.4, construction activities are not expected to have any prolonged impact on fauna.

5.2.7.2 Impact Mitigation

To mitigate potential noise impacts, ANS will:

- schedule normal construction near residences in accordance with respective WA DoE recommendations and as far as practicable, restrict noisy activities to normal working hours
- consult with local residents when unavoidable out-of-hours work is required
- if required, time construction to occur outside fauna breeding periods and/or implement appropriate management measures to limit noise impacts to highly sensitive fauna
- select appropriate equipment
- fit and maintain appropriate mufflers on earth-moving equipment and other vehicles on the site
- use drilling equipment with noise ratings suitable for use on public roads

5.2.8 Air Emissions

5.2.8.1 Potential Impacts

Atmospheric dust will be the main component of air emissions during the construction phase of the proposed development, principally from clearing and grading, trenching, backfill and reinstatement and vehicle movement. The impacts of dust generation will be short term.

Other minor sources of air emissions include exhaust fumes from earthmoving and transport equipment. However, these sources are likely to be negligible in the context of existing land use, transport and residential land uses of the Project area. No measurable impact is likely.

Impacts to air quality as a result of dust generation and atmospheric emissions are expected to be negligible, short term in duration and not have any impact upon personnel, the public or fauna.

5.2.8.2 Impact Mitigation

To minimise the impacts, the mitigation measures shall include the following:

- minimise the extent and period of exposed soil surfaces
- use of water trucks and sprayers to dampen down the soil during construction
- rehabilitate exposed surfaces as rapidly as practicable
- keep all construction vehicles and equipment well maintained and comply with vehicle emission standards
- monitor operations to ensure compliance with design requirements
- implement a program of regular monitoring, inspection and maintenance during operations to prevent pipeline rupture and reduce the occurrence of minor leaks from pipeline infrastructure.

5.2.9 Land Use

5.2.9.1 Potential Impacts

Pipeline construction has the potential to temporarily disrupt land use activities as a result of the disturbance of land on the right-of-way and the presence of vehicles and machinery. In particular the following construction activities have the potential to affect land use activities within the Project area:

- construction access
- earthworks
- welding
- materials transport and storage
- the storage and handling of small quantities of fuel and chemicals.

The potential impacts on land use as a result of pipeline construction activity include:

- temporary loss of land utilisation for agriculture or horticultural uses
- temporary loss of areas for the agistment of livestock
- reduction in long-term productivity due to soil compaction, inversion, contamination or erosion
- introduction, spread or colonisation of weeds, pathogens and/or agricultural diseases
- restriction in stock movement and possible stress to livestock
- impeded property access
- wildfire from welding activities
- increase in local traffic numbers and use of roads

These impacts can be successfully managed to avoid significant impact. These impacts are generally temporary in nature and cease once the construction phase of the Project has been completed and the easement has been rehabilitated. However, poor soil management or the introduction of weeds and diseases can impair long-term productivity.

The pipeline loops are generally to be installed in an existing pipeline easement, and as such there will be no change to the long-term impacts such as habitat fragmentation and ease of movement for feral animals.

The operation of the gas pipeline will generally not impact existing land use, as the pipeline will be buried and the construction corridor rehabilitated to as near as practicable to the pre-construction state. Existing land use activities will generally not be restricted over the pipeline except for those that will potentially cause harm to the pipeline or the public (for example, water bore installation, blasting, fence post installation, deep ripping in areas where it has not been specifically approved and planting of deep rooted plants).

Access along the easement will be consistent with existing practices, and as such no change in impact is anticipated. Access to the easement during construction will generally be along existing tracks. Any new tracks created will be rehabilitated following construction unless required by the landowner.

5.2.9.2 Impact Mitigation

The final pipeline route and construction methods for key areas (e.g. vehicle and stock access routes) will be selected in consultation with landowners, in order to minimise disturbance to any planned activities.

The Northern Looping Project Team has a responsibility and obligation to deliver the project with minimum disruption to the landowners affected by both pre-construction and construction activities.

A function of the Land Management Team is the initial (and ongoing) communication with landowners advising them of every aspect of the project that is likely to affect them. The importance of this responsibility is clearly recognised and is the basis of the Land Management Plan.

Land Management Processes

- Notify landowners of impending works and timeframes
- communicate accurate information to landowners and other stakeholders on a timely basis, and respond to concerns and issues as they arise;
- retain experienced resources to undertake the work;
- planning pre construction activities with input from all Project disciplines;
- checking with all Project disciplines on what commitments are achievable;
- ensuring all agreements are in writing ; and
- reporting progress outcomes and issues regularly.

Land Management Activities will include

- Understanding of land use current and future – what to design for – deep ripping, future irrigation levelling etc;
- Suitable work areas to allow prompt safe construction;
- Clear understanding of how to gain access to Easement – public roads, along easement, or private track;
- Understanding of when access is to be available, and specific approvals requirements; and
- Understanding of process for planning of Pre-construction activities – surveys, test holes site inspections etc.

More specifically ANS will:

- enter into formal easement agreements outlining the legal responsibilities of both ANS and the landowner
- work closely with landowners and managers to minimise conflict with existing land use activities
- where possible, avoid construction activities during key periods or, if not practicable, consult with landholders to coordinate activities.
- implement appropriate quarantine measures and weed, pest and disease control and management protocols during construction and operations, in consultation with landowners and relevant management authorities. These will include:
  - washdown / decontamination of vehicles and machinery before Project commencement
  - screening of imported material (e.g. padding) or extraction sites for weeds and pathogens
  - not grading topsoil over property boundaries

  - implementing hygiene procedures (e.g. washdown) at property boundaries if required
  - post-construction weed control if required
- rehabilitate the construction right-of-way in consultation with landholders
- implement appropriate erosion and sediment control measures
- develop and implement appropriate traffic management procedures
- ensure fire prevention and response equipment is present on-site for relevant activities (e.g. welding)
- consult with local Shires and obtain relevant permits to work on fire ban days

5.2.10 Third-party Infrastructure

Impacts to third party infrastructure can be mitigated through careful pre-construction planning and appropriate consultation with relevant regulatory authorities, public utility service companies and landholders. With adequate management the following impacts can be prevented:

- disruption or damage to road and other transport infrastructure or networks
- disruption or damage to utility services
- disruption or damage to private third party property.

5.2.10.1 Potential Impacts

Transport Networks

The following Project activities may disrupt or damage transport networks:

- use of roads during construction by extendable semi trailers delivering stockpiles of pipe to worksites
- use of roads by low loaders mobilising construction equipment between worksites
- transporting of construction personnel to worksites
- open cut crossings of unsealed roads
- pipeline surveillance and maintenance activities.

With adequate management the following potential impacts to the transport network can be avoided or adequately managed:

- loss of road integrity
- localised traffic congestion or disruptions.

It has been estimated that approximately 1500 deliveries will be required for the Northern Looping Pipeline, transported by extendable semi trailers. Impacts of pipe and equipment transportation during the construction period include slow moving traffic on roads and subsequent disturbance to local traffic and motorists.

It is anticipated that there may be some localised traffic disruptions associated with road crossings as standard open cut road-crossings can typically take up to six hours.

Heavy vehicle and equipment movement may result in localised damage to the integrity of the road pavement or surface (that is through wear-and-tear). Boring beneath sealed roads will not cause damage to road integrity.

Inspection of the easement will be required during pipeline operations. However, it is expected that inspections will be undertaken by four wheel drive vehicles and by aerial inspection. Impacts to roads or traffic conditions are considered negligible.

Public Utilities

The Northern Looping Pipeline will not result in significant impacts to public utility services. Utilities will be identified prior to construction and incorporated into construction line lists and appropriately flagged, earthed, protected and avoided during construction. Should the construction of the pipeline perforate, rupture or incise cables, pipes or other utility

infrastructure, short term disruptions to services such as electricity, water and telecommunication networks may occur.

Utility infrastructure may also pose safety risks to personnel during construction, in particular induced current and direct contact with 'live' wires arising from placement and movement of construction equipment and large metal objects in parallel and close proximity to power lines. Arcing between transmission lines and construction plant equipment and vehicles may also occur if required separation distances are violated.

Private Property

Impacts to private property will be necessary as part of the normal construction process, but will occur with the prior knowledge and approval of the landholder. Such impacts include cutting fences and installing temporary gates, and modifications to existing gates or driveways. Damage will be avoided where practicable and made good on Project completion if unavoidable.

5.2.10.2 Mitigation Measures

Transport

To reduce the effects of transport network disturbances, ANS will implement the following mitigation measures:

- plan equipment and material transport routes and storage areas in consultation with local and state authorities to minimise disruption to residents and industry
- deliver Project related equipment during daylight hours, where practicable
- implement a traffic safety management plan
- reinstate open cut roads to the satisfaction of the local authorities
- address any damage caused to roads or bridges caused by construction or associated activities
- where practicable, use shuttle buses to transport personnel to worksites
- install temporary gates across easements at all roads to reduce illegal entry.

Public Utilities

To reduce the effects of disturbances to public utilities, ANS will:

- maintain close liaison with utility companies to identify existing overhead and buried cables, lines, pipes and water mains
- obtain standard clearance for services from various authorities
- include utilities on construction line list
- use preventative flagging to mark the location of services and infrastructure
- appropriately earth equipment and pipe at established intervals
- where possible, cross transmission easements at or near 90 degrees and well away from structures.

Private Property

To reduce impacts to private property, ANS will:

- maintain close liaison with all affected landowners
- appropriately note agreed impacts or modifications on the line list
- obtain pre-construction agreement on the type and extent of impact to occur
- obtain pre-construction agreement regarding strategies and responsibilities for rectification of, or compensation for, damage.

5.2.11 Public Safety and Risk

Pipelines are recognised as a safe and efficient means of transporting natural gas. However, all developments present some level of risk.

A detailed risk assessment has been carried out in accordance with AS 2885.1 and will result in the application of a combination of physical and procedural measures to ensure that the pipeline design, construction, operation and maintenance and management meet appropriate safety standards.

The risk assessment involved the identification of all credible threats to the pipeline at all locations along its length. A credible threat to the pipeline can be assumed to include any element which can plausibly cause pipeline failure, including threats due to location (including crossing and land use segments) and general threats common to the entire system (for example, corrosion). The location analysis will consider land use related activities (for example, land usage) and crossing segments (for example, main sealed roads, rail crossings, utilities and waterways).

All identified threats presenting an unacceptable level of risk will be mitigated through the adoption of the requirements under AS2885.1. Mitigation considers threats due to external interference (deliberate and accidental) as well as threats due to unsatisfactory design, construction, materials and operations. Threats due to natural events such as erosion and lightning were also considered.

The protection methods available to ANS are broadly described in Table 5-2.

Table 5-2: Pipeline Protection Safety Measures

Methods	Measures	Description
Physical Measure	Burial	The entire pipeline will be buried at depth in accordance with AS2885.1.
	Barrier/Slab	Crash barriers and concrete slabs will be adopted where risks are not sufficiently mitigated (e.g. within railway easements).
	Exclusion	Fences will be installed where necessary to limit access by unauthorised personnel.
	Wall thickness	Wall thickness is increased where higher levels of risk to pipeline integrity exists or the consequences of rupture is considered unacceptable (e.g. populous centres).
	Barrier to Penetration	Other physical barriers may be used to protect the pipeline such as coating or encasing.
Procedural Measure	Liaison – Contractors	Organisations, such as councils, utility or major agriculture/community groups that may present a threat to the pipeline will be contacted.
	Marker Signs	Pipeline signs will be posted in accordance with AS 2885.1 (Clause 4.2.5.4. (a)(ii).
	Marker Tape	Buried marker tape will be installed above the pipe in accordance with the risk assessment under AS 2885.1.
	Liaison – Landholders	Landowners will be contacted on an ongoing basis throughout Project development, construction and operation.
	One-call	Pipeline incorporated in a one call network for efficient processing of public inquiries and enabling an effective pipeline reporting mechanism.
	Patrolling	Quarterly patrolling of the entire route throughout the life of the pipeline.

5.2.12 Waste Management

Relatively small amounts of domestic and industrial wastes will be generated during the construction and operation of the Northern Looping Project.

Specific mitigation and procedural measures to be adopted by ANS include:

- develop specific waste management strategies for each waste stream prior to the commencement of any waste producing activities, based on the principles of "Reduce, Reuse, Recycle" and appropriate disposal
- dispose of all hydrotest water in accordance with the Construction Environmental Management Plan
- place a high emphasis on housekeeping and cleanliness at the site . All work areas will be maintained in a neat and orderly manner
- domestic campsite wastes (e.g. sewage, kitchen/putrescible, grey water, packaging etc) will be disposed of in accordance with local authority requirements. Such wastes will be disposed of at appropriate facilities regardless of the location of the nearest facility
- collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations
- store and handle chemicals in accordance with Section 5.2.13
- remove all waste material from the easement on completion of each section of the pipeline.

5.2.13 Hazardous Storage, Spill and Emergency Response

A variety of chemicals may be required on-site during the construction of the Northern Looping project. These include fuel, lube oils, solvents, rust proofing agents and primer. Potential impacts include contamination to soils and water resources and other environmentally sensitive values. Such impacts have been detailed in Sections 5.2.1 and 5.2.2 respectively.

Mitigation measures undertaken by ANS to reduce the effects of hazardous substances and spill events to the environment and third parties will include:

- hazardous material will be securely stored and handled to ensure it cannot drain onto the ground or to watercourses or floodplains
- appropriate storage (e.g. bunding as per regulatory guidelines) of all fuels and hazardous materials used on-site
- materials and equipment required to respond to a hazardous spill will be readily available
- development of procedures for emergency response
- appropriate implementation of cleanup/spill response procedures if the event of a spill
- Material Safety Data Sheets will be kept for each chemical used on-site and at a location that is easily accessible 24 hrs per day
- all Project personnel on will be instructed on prevention, safety and response practices as a component of the environmental induction process.

6 Stakeholder Consultation

Consultation has been undertaken with various stakeholders including government agencies as listed in Table 6.1. Further consultation is planned during the development of the CEMP.

The Northern Looping Project Team has a responsibility and obligation to deliver the project with minimum disruption to the landowners affected by both pre-construction and Construction activities.

A key aspect is the initial (and ongoing) communication with landowners advising them of every aspect of the project that is likely to affect them. The importance of this responsibility is clearly recognised and is the basis of a Land Management Plan. The land management processes and activities include the following aspects.

Land Management:

- communicate accurate information to landowners and other stakeholders on a timely basis, and respond to concerns and issues as they arise;
- retain experienced resources to undertake the work;
- planning pre construction activities with input from all Project disciplines;
- checking with all Project disciplines on what commitments are achievable;
- ensuring all agreements are in writing;
- reporting progress outcomes and issues regularly.

Land Management Activities will include:

- Understanding of land use current and future – what to design for – deep ripping, future irrigation levelling etc;
- Suitable work areas to allow prompt safe construction;
- Clear understanding of how to gain access to Easement – public roads, along the easement or private tracks;
- Understanding of when access is to be available and specific approvals requirements; and
- Understanding of process for planning of Pre-construction activities – surveys, test hole site inspections etc.

It is the intention of ANS to undertake further consultation with key government agencies, Non- Government Organisations (NGO's), and land owners. Various groups have already attended the Environmental Risk Workshop.

Table 6-1: Stakeholder Consultation

Agency/Group	Topic/Legislation	How/Where actioned
Department of Environment and Heritage	EPBC Referral	Referred August 2005- Not a controlled action
Department of Conservation and Land Management	Flora Survey Methodology Rehabilitation Plan Fauna Studies and Fauna Handling Hygiene Environmentally Sensitive Areas Declared Rare and Priority Flora	Appendix 4 Appendix 4 Appendix 5 Appendix 6 Section 3.5.2 Section 3.5.2 and Appendix 4
Department of Industry and Resources	Pipeline Licence/ CEMP	CEMPs
Environmental Protection Authority Service Unit	S 38 EPA Referral Fauna Handling	This ARI Appendix 5
Department of Environment	Environmental Protection Act 1996 Acid Sulphate Soils Fauna Studies Flora Studies	Licences for groundwater extraction, dewatering, disturbance to watercourse bed and banks. Acid Sulphate Soils (see section 3.3.2) Appendix 5 Section 3.5.2 and Appendix 4
Department for Planning and Infrastructure	-	Access and rights within DBNGP Corridor

7 Environmental Management Framework

7.1 Environmental Management System

The feasibility, planning and assessment of the Northern Looping project has been undertaken under the ANS's Environment Management System (EMS) which comprises the following elements:

- A corporate policy stating commitment to conduct activities in an environmentally responsible manner
- Clearly stated objectives consistent with this commitment
- Practical procedures to achieve the objectives
- Clearly defined responsibilities for personnel to indicate their obligations regarding environmental management
- Appropriate induction and training of personnel
- Comprehensive monitoring and auditing programs to assess compliance with procedures and the achievement of objectives
- A system of reporting for recording of data and notification of relevant personnel
- Ongoing consultation to seek input from and inform all parties of relevant issues.

The EMS is based on the principles of ISO14001: Environmental Management Systems. In addition to the EMS, a number of project specific documents are being prepared including a Construction Environmental Management Plan which includes the training, induction and auditing program. Information on these components is provided in the following sections.

7.1.1 Responsibilities

Environmental management and compliance will be the responsibility of all personnel and a contractual obligation for all contractors involved with the Project.

The proposed organisation and responsibilities for personnel overseeing environmental management during construction are detailed in Table 7-1. Although it is not the current intention, one or more of these positions may be amalgamated or the responsibilities shared under a modified arrangement.

Table 7-1: Roles and Responsibilities for Pipeline Construction

Role	Responsibility
DBP Executive Management	▪ Licence holders. Therefore hold overall responsibility for Project and environmental management
ANS Project Director	▪ Responsible for overall implementation of EMS / CEMP ▪ Reports directly to DBNGP Nominees Executive Management
Project Manager	▪ Directly responsible for the management of the Project, including all environmental aspects ▪ Reports directly to ANS Project Director
Construction Manager	▪ Directly responsible for the overseeing and fulfilling of commitments contained in Construction Environmental Management Plan ▪ Assesses compliance with the CEMP through regular inspection ▪ Reports to the Project Manager and Project Director regarding the Project's environmental performance and due diligence
Lands Manager	▪ Field based employee responsible for landowner consultation ▪ Reports to the Construction Manager
Environment Manager	▪ Oversees CEMP implementation ▪ Monitors the activities of construction contractors and assesses compliance with the CEMP ▪ Coordinates Aboriginal heritage monitors ▪ Coordinates ANS's environmental supervision of clear-and-grade and other key activities ▪ Coordinates the monitoring and audit program ▪ Represents the Project on environmental matters with stakeholders ▪ Reports to the Project Manager and Project Director
Construction Contractors	▪ Responsible for ensuring that works comply with the contractual agreements, meet regulatory requirements and that all environmental objectives contained in the contracts are attained ▪ Will be required to have a designated and appropriately experienced/qualified environmental officer
Environmental Consultant(s)	▪ External auditors contracted periodically to audit the Project against the Pipeline Licence and the CEMP ▪ External consultants used in the field to provide specialist advice on specific issues on an "as needs" basis
Cultural Heritage Monitors	▪ To be present during earthwork activities

The overall responsibility for environmental compliance lies with ANS. ANS will maintain a high level of on-site supervision of the construction contractor and the environmental performance of potential contractors will be reviewed as part of construction tender evaluation. The construction contractor(s) and individuals will also be responsible and accountable through their conditions of employment or contract. The training of all personnel involved in the pipeline construction will ensure that each individual is aware of their environmental responsibility.

7.1.2 Induction

All personnel involved with the construction and operation of the Northern Looping project will be required to complete environmental induction prior to commencing work. The objective of the induction will be to provide project personnel with the necessary information to allow them to recognise and effectively manage the environmental aspects of the project.

The environmental induction program will involve the discussion of a variety of issues including:

- relevant legislation and legislative requirements
- roles and responsibilities
- environmental issues for the project, including:
  - management of sensitive areas
  - erosion and sediment control
  - protection of water quality
  - vegetation and habit management
  - interaction with fauna
  - weed and pathogen control
  - heritage management
  - protecting existing utilities, infrastructure and the amenity of landholders
  - traffic and access
  - waste management
  - fire management
  - emergency response
- Project documentation (including the CEMP, alignment sheets, technical drawings and other associated documents)
- incident reporting.

An environmental induction register will be maintained to ensure that all personnel are aware of requirements prior to access to the project right-of-way.

7.1.3 Environmental Inspection

During construction the pipeline alignment and construction activities will regularly be inspected and reported upon to ensure compliance with the Construction Environmental Management Plan and other environmental requirements. ANS will have a representative on site to supervise flagging of environmental features on the right-of-way (e.g. trees) and clear-and-grade operations, as well as other key activities.

7.1.4 Monitoring

Photographic environmental monitoring points will be installed at a number of locations along the Looping section. Photographs will be taken at each nominated site prior to the commencement of various stages of the construction cycle and after reinstatement, to provide a visual record of the progress of construction and compliance with environmental objectives.

7.1.5 Auditing

It is proposed that two environmental audits will be undertaken during the construction of each Northern Looping section.

The first audit will be undertaken during the first construction cycle in each Loop in order to check compliance with the CEMP. This will enable non-conformances to be identified and preventative action implemented to prevent repetition. The audit will include all work areas.

The second audit will be conducted prior to completion of reinstatement.

Regular audits will also be undertaken during the operation of the pipeline, with the first occurring 12 months after the completion of construction.

7.1.6 Records and Reporting

During all phases of the Project an appropriate and auditable record system will be maintained. Environmental reporting will be conducted in accordance with licence conditions.

Environmental records will include:

- non-conformance reports
- remedial actions taken following incident reports
- inspection reports
- training and induction attendance
- consultation records and meeting notes
- audit reports
- monitoring results.

Environmental incidents and identified instances of non-compliance will be recorded and reported on a non-conformance report proforma.

7.1.7 Preventative and Corrective Action

The purpose of the CEMP is to identify and manage environmental risks and impacts. This will be achieved through the elements described above. If unforeseen events or system failures occur, the CEMP will provide for prompt identification, review and response, to minimise impacts and prevent reoccurrence. Formal reporting and corrective action will include the use of non-conformance reports and corrective action requests.

7.2 Environmental Management Plans

7.2.1 Construction and Operation EMPs

Under the *Petroleum Pipelines Act* 1969, ANS is required to submit a Construction EMP (CEMP) prior to the commencement of construction and an Operational EMP (OEMP) prior to commissioning, to DoIR for approval.

The Construction Environmental Management Plan is being developed for the construction phase of the pipeline project. This CEMP will be consistent with the Australian Pipeline Industry Association (APIA) Code of Environmental Practice and will provide guidance on the environmental aspects and management of the environmental impacts of the Project. It will also provide a summary of legal and community requirements and the responsibilities of all levels of personnel involved with the Project.

The both the CEMP and OEMP will contain the following information:

- Project overview
- Environmental commitment & project EMS
- Statutory requirements and environmental legislation
- Environmental aspects and impacts
- Environmental Risk Assessment
- Environmental objectives
- Environmental responsibilities
- Training requirements
- Reporting
- Auditing
- Environmental Management Protocols.

7.2.2 Issue Specific Management Plans

As discussed in Section 5 above a number of issue specific management plans have been developed for this project:

- Rehabilitation plan
- Hygiene Management Protocol
- Fauna management protocol.

Rehabilitation of the Northern Looping Pipeline corridor will depend on the current land use eg pastoral land versus remnant native vegetation. The issues relevant to rehabilitation include:

- Weed management
- Priority and Rare Flora management
- Resource management (topsoil and vegetation material)
- Soil profile and final landform
- Establishment of native vegetation

The rehabilitation process will include the following key steps:

- Collection of viable seed (where required)
- Removal of existing invasive weeds on the easement where appropriate (see Section 5.2.4)
- Weed hygiene (see Section 5.2.4)
- Protection of existing Declared Rare and Priority flora on the easement where possible (see Section 5.2.3)
- Clearing and storing of native vegetation (see Section 5.2.3).
- Removal and storage of topsoil (see Section 5.2.1).
- Removal and storage of trench spoil (see Section 5.2.1).
- Reconstruction of the soil profile following pipe laying (see Section 5.2.1).
- Respreading of topsoil. (see Section 5.2.1)
- Respreading of stored vegetation material (see Section 5.2.3).
- Application of native seed (see Section 5.2.3).
- Ongoing weed management and monitoring (see Section 5.2.4).

Completion criteria are included in the Plan and will be audited.

The details of the Rehabilitation Plan was developed on advice from relevant specialist advisors and with input and advice from CALM. The plan is included in Appendix 4.

If the further studies and/or surveys determine that there are likely impacts on significant biodiversity values/assets, appropriate further mitigation and offset measures to the satisfaction of the Minister for Environment will be developed on advice from CALM.

8 Abbreviations

AIC	Australian Interaction Consultants
AASS	Actual Acid Sulphate Soil
AOD	Area of Disturbance
ASS	Acid Sulphate Soil
CALM	Department of Conservation and Land Management
CS	Compressor Station
DEH	Department for Environment and Heritage
DIA	Department of Indigenous Affairs
DoIR	Department of Industry and Resources
DoE	Department of Environment
DPI	Department of Planning and Infrastructure
DRF	Declared Rare Flora
ELL	Environmental Line List
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Authority
EPP	Environmental Protection Policy
KP	Kilometre point (unit of measurement along section of pipeline)
MLV	Main Line Valve
PASS	Potential Acid Sulphate Soil
PS	Priority Species
ROW	Right-of-way or construction corridor

9 References

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Appendix 1: Location Maps

Map 1: Northern Looping Pipeline Locality Plan – Broad Scale

Maps 2 – 10: Northern Looping Existing Environment Maps

Maps 11 – 19: Northern Looping Locality Plan Maps

Data sourced from: Alinta Ltd
MapInfo
CALM
Geoscience Australia

DBNGP

Compressor Station CS 1

KP 0

KP 1

KP 2

KP 3

KP 4

KP 5

KP 6

KP 7

KP 8

KP 9

KP 10

KP 11

Proposed Route
DBNGP Loop 1

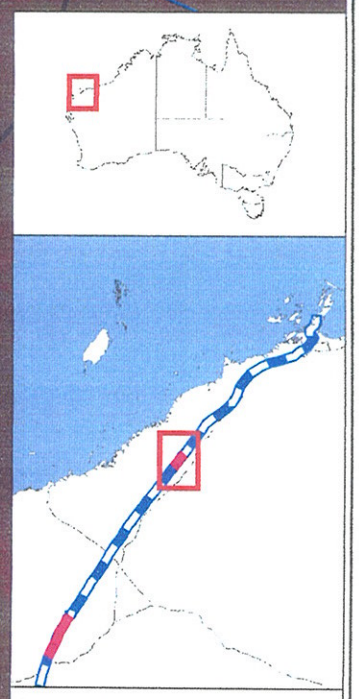
DBNGP

R.ROBE RIVER

ROBE RIVER

NORTH WEST COASTAL HWY

ROBE RIVER



Legend

- Priority Flora Species
- Rare and Threatened Flora
- Threatened Ecological Communities
- Rare and Threatened Fauna
- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Register of National Estate
- Register of Heritage Places
- Groundwater
- Environmentally Sensitive Areas
- PDWSA Groundwater

Note: While every effort was made to ensure the accuracy and currency of the information shown on this map, the project team does not accept any responsibility for errors or omissions that may have occurred.

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Alinta

Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 1
Site Plan - Existing Environment
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL01-C-100-01
Map Revision: 0
Project File: Northern Loop Site Plan - Existing Environment.mxd
Pipeline Route Rev A 10/06/2005

Date: 04 / 08 / 2005
Sheet: 1 of 1

GDA

Data sourced from: Alinta Ltd
MapInfo
CALM
Geoscience Australia

DBNGP

Compressor Station CS 2

KP 0

KP 1

KP 2

KP 3

KP 4

KP 5

KP 6

KP 7

KP 8

KP 9

KP 10

KP 11

KP 12

KP 13

KP 14

KP 15

KP 16

KP 17

KP 18

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KP 20

KP 21

KP 22

KP 23

KP 24

KP 25

KP 26

KP 27

KP 28

KP 29

KP 30

KP 31

Proposed Route
DBNGP Loop 2

ASHBURTON RIVER

DBNGP



Legend

- Priority Flora Species
- Rare and Threatened Flora
- Threatened Ecological Communities
- Rare and Threatened Fauna
- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Register of National Estate
- Register of Heritage Places
- Groundwater
- Environmentally Sensitive Areas
- PDWSA Groundwater

Note: While every effort was made to ensure the accuracy and currency of the information shown on this map, the project team does not accept any responsibility for errors or omissions that may have occurred.

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Alinta

Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

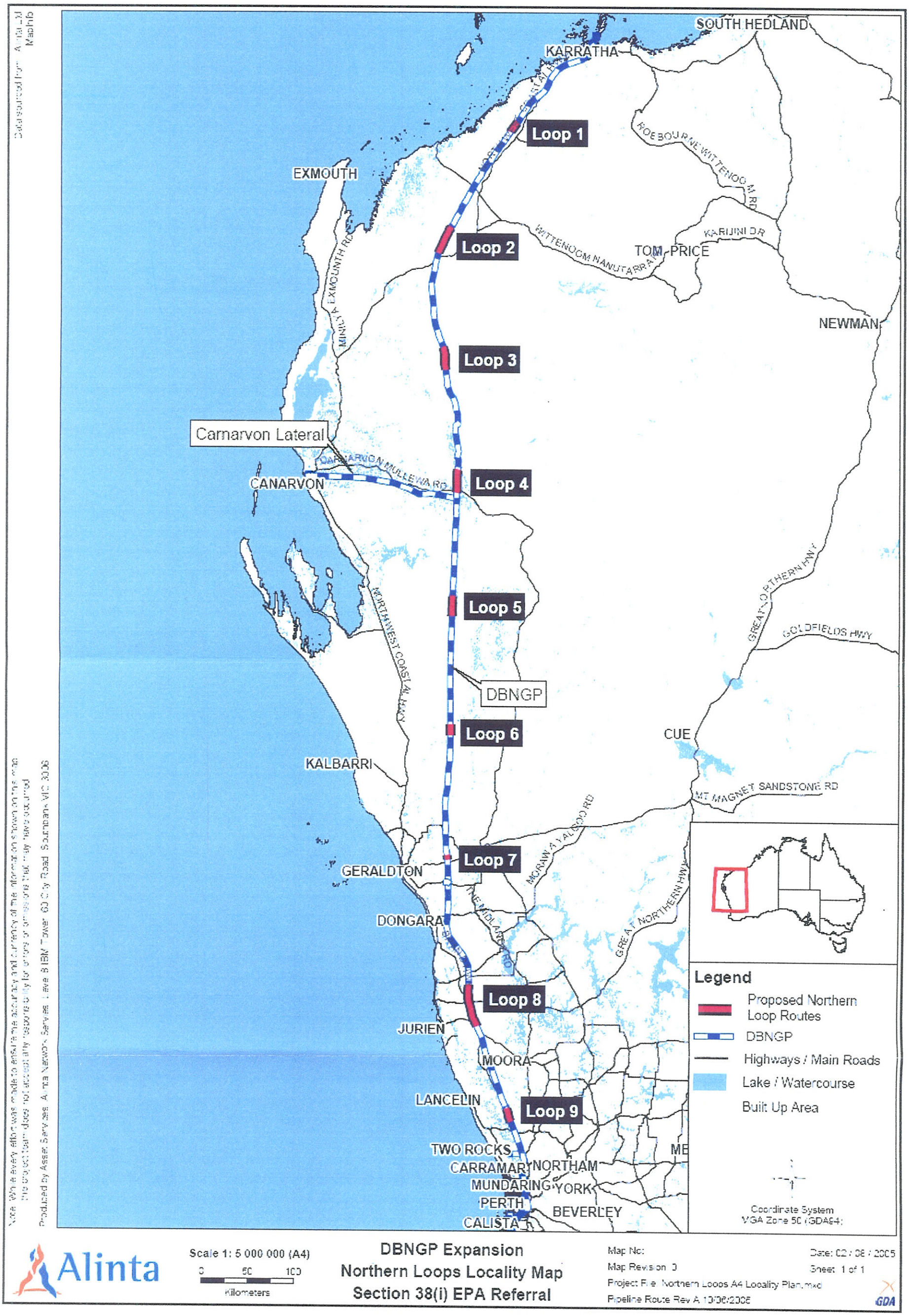
DBNGP Loop 2
Site Plan - Existing Environment
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL02-C-100-01
Map Revision: 0
Project File: Northern Loop Site Plan - Existing Environment.mxd
Pipeline Route Rev A 10/06/2005

Date: 04 / 08 / 2005
Sheet: 1 of 1

GDA


SOUTH HEDLAND
KARRATHA
Loop 1
EXMOUTH
ROEBOURNE WITTENOOM RD
Loop 2
WITTENOOM NANUTARRA RD
KARIJINI DR
TOM PRICE
NEWMAN
Loop 3
Carnarvon Lateral
CARNARVON MULLEWA RD
CANARVON
Loop 4
NORTHWEST COASTAL HWY
Loop 5
GREAT NORTHERN HWY
GOLDFIELDS HWY
DBNGP
Loop 6
CUE
KALBARRI
MT MAGNET SANDSTONE RD
Loop 7
GERALDTON
MORAWA YALGOO RD
THE MIDLANDS RD
DONGARA
GREAT NORTHERN HWY
Loop 8
JURIEN
MOORA
LANCELIN
Loop 9
TWO ROCKS
CARRAMAR
NORTHAM
MUNDARING
YORK
PERTH
BEVERLEY
CALISTA
Legend
Proposed Northern Loop Routes
DBNGP
Highways / Main Roads
Lake / Watercourse
Built Up Area
Coordinate System
MGA Zone 50 (GDA94)
Alinta
Scale 1: 5 000 000 (A4)
0 50 100
Kilometers
DBNGP Expansion
Northern Loops Locality Map
Section 38(i) EPA Referral
Map No:
Map Revision 0
Project File: Northern Loops A4 Locality Plan.mxd
Pipeline Route Rev A 13/06/2006
Date: 02 / 08 / 2006
Sheet 1 of 1
GDA

Data sourced from: Alinta Ltd
MapInfo
CALM
Geoscience Australia

DBNGP

Compressor Station CS 3

KP 0

KP 1

KP 2

KP 3

KP 4

KP 5

KP 6

KP 7

KP 8

KP 9

KP 10

KP 11

Proposed Route
DBNGP Loop 3

KP 12

KP 13

KP 14

KP 15

KP 16

KP 17

KP 18

KP 19

KP 20

KP 21

KP 22

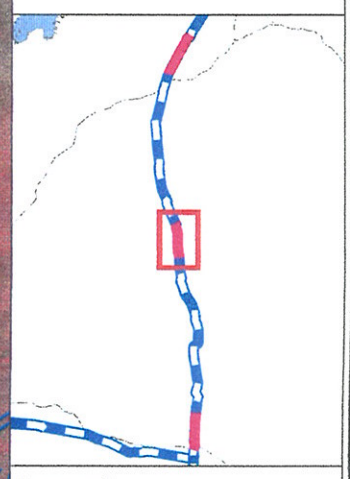
KP 23

KP 24

MINILYA RIVER

DBNGP





Legend

- Priority Flora Species
- Rare and Threatened Flora
- Threatened Ecological Communities
- Rare and Threatened Fauna
- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Register of National Estate
- Register of Heritage Places
- Groundwater
- Environmentally Sensitive Areas
- PDWSA Groundwater

Note: While every effort was made to ensure the accuracy and currency of the information shown on this map, the project team does not accept any responsibility for errors or omissions that may have occurred.

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Alinta

Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 3
Site Plan - Existing Environment
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL03-C-100-01
Map Revision: 0
Project File: Northern Loop Site Plan - Existing Environment.mxd
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GDA

Data sourced from: Alinta Ltd
MapInfo
CALM
Geoscience Australia

DBNGP

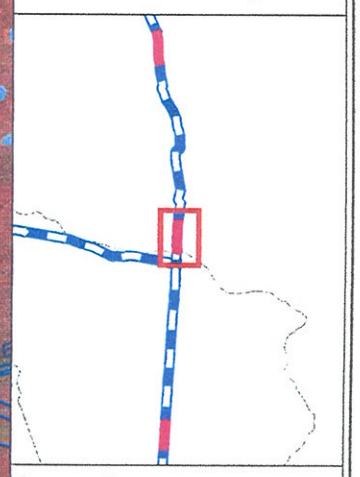
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KP 1
KP 2
KP 3
KP 4
KP 5
KP 7
KP 8
KP 9
KP 10
KP 11
KP 12
KP 13
KP 14
KP 15
KP 16
KP 17
KP 18
KP 19
KP 20
KP 21
KP 23
KP 24

Proposed Route
DBNGP Loop 4

LYONS RIVER
DAVIS CREEK
GASCOYNE RIVER
GASCOYNE JUNCTION
CARNARVON

DBNGP





Legend

- Priority Flora Species
- Rare and Threatened Flora
- Threatened Ecological Communities
- Rare and Threatened Fauna
- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Register of National Estate
- Register of Heritage Places
- Groundwater
- Environmentally Sensitive Areas
- PDWSA Groundwater

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Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 4
Site Plan - Existing Environment
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL04-C-100-01
Map Revision: 0
Project File: Northern Loop Site Plan - Existing Environment.mxd
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Data sourced from: Alinta Ltd
MapInfo
CALM
Geoscience Australia

DBNGP

Compressor Station CS 5

KP 0

KP 1

KP 2

KP 3

KP 4

KP 5

KP 6

KP 7

KP 8

KP 9

Proposed Route
DBNGP Loop 5

KP 10

KP 11

KP 12

KP 13

KP 14

KP 15

KP 16

KP 17

KP 18

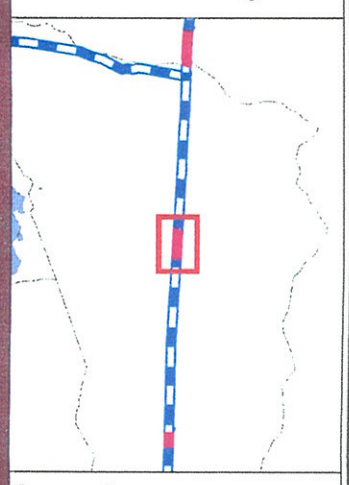
KP 19

KP 20

KP 21

DBNGP





Legend

- Priority Flora Species
- Rare and Threatened Flora
- Threatened Ecological Communities
- Rare and Threatened Fauna
- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Register of National Estate
- Register of Heritage Places
- Groundwater
- Environmentally Sensitive Areas
- PDWSA Groundwater

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Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 5
Site Plan - Existing Environment
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL05-C-100-01
Map Revision: 0
Project File: Northern Loop Site Plan - Existing Environment.mxd
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Geoscience Australia

DBNGP

Compressor Station CS 6

KP 0

KP 1

KP 2

KP 3

KP 4

KP 5

KP 6

KP 7

KP 8

KP 9

KP 10

Proposed Route
DBNGP Loop 6

DBNGP

COOLCALALAYA

MURCHISON RIVER

MURCHISON RIVER

MURCHIS

MURCHISON RIVER

YALG

Legend

- Priority Flora Species
- Rare and Threatened Flora
- Threatened Ecological Communities
- Rare and Threatened Fauna
- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Register of National Estate
- Register of Heritage Places
- Groundwater
- Environmentally Sensitive Areas
- PDWSA Groundwater

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Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 6
Site Plan - Existing Environment
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL06-C-100-01
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GDA

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Geoscience Australia

DBNGP

GREENOUGH RIVER

YUNA TENINDEWA RD

VALENTINE

NORTH ERADU

GREENOUGH RIVER

GREENOUGH RIVER

Compressor Station CS 7

KP 0

KP 1

KP 2

KP 3

KP 4

Proposed Route
DBNGP Loop 7

GREENOUGH RIVER

ERADU

GERALDTON

GREENOUGH RIVER

GREENOUGH RIVER

GREENOUGH RIVER

DBNGP

ERADU SOUTH

Legend

- Priority Flora Species
- Rare and Threatened Flora
- Threatened Ecological Communities
- Rare and Threatened Fauna
- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Register of National Estate
- Register of Heritage Places
- Groundwater
- Environmentally Sensitive Areas
- PDWSA Groundwater

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Alinta

Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 7
Site Plan - Existing Environment
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL07-C-100-01
Map Revision: 0
Project File: Northern Loop Site Plan - Existing Environment.mxd
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GDA

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MapInfo
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Geoscience Australia

DBNGP

BRAND HWY

Compressor Station CS 8

KP 0
KP 1
KP 2
KP 3
KP 4
KP 5
KP 6
KP 7
KP 8
KP 9
KP 10
KP 11
KP 12
KP 13
KP 14
KP 15
KP 16
KP 17
KP 18
KP 19

WARRADARGE

Proposed Route
DBNGP Loop 8

KP 22
KP 23
KP 24
KP 25
KP 26
KP 27
KP 28
KP 29
KP 30
KP 31
KP 32
KP 33
KP 34
KP 35
KP 36
KP 37
KP 38
KP 39
KP 40
KP 41
KP 42
KP 43
KP 44
KP 45

HILL RIVER

DBNGP

Legend

- Priority Flora Species
- Rare and Threatened Flora
- Threatened Ecological Communities
- Rare and Threatened Fauna
- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Register of National Estate
- Register of Heritage Places
- Groundwater
- Environmentally Sensitive Areas
- PDWSA Groundwater

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Alinta

Scale 1: 150 000 (A3)
0 1,000 2,000 4,000 6,000
Meters

DBNGP Loop 8
Site Plan - Existing Environment
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL08-C-100-01
Map Revision: 0
Project File: Northern Loop Site Plan - Existing Environment.mxd
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GDA

Data sourced from: Alinta Ltd
MapInfo
CALM
Geoscience Australia

DBNGP

Proposed Route
DBNGP Loop 9

DBNGP

RED GULLY

MOORE RIVER

MOORE RIVER NATIONAL PARK

Compressor Station CS 9

KP 0
KP 1
KP 2
KP 3
KP 5
KP 6
KP 7
KP 8
KP 9
KP 10
KP 11
KP 12
KP 13
KP 14

BEERMULLAH

GINGIN BROOK

GINGIN BROOK RD

MUCKENBURRA

GRANVILLE

BRAND HWY

DEWARS

Legend

- Priority Flora Species
- Rare and Threatened Flora
- Threatened Ecological Communities
- Rare and Threatened Fauna
- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Register of National Estate
- Register of Heritage Places
- Groundwater
- Environmentally Sensitive Areas
- PDWSA Groundwater

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Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 9
Site Plan - Existing Environment
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL09-C-100-01
Map Revision: 0
Project File: Northern Loop Site Plan - Existing Environment.mxd
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GDA

Data sourced from: Alinta Ltd
MapInfo
Geoscience Australia

4
3
2
Creek
Pindooral Camp
Trevarton
Dukes Well
Coxes Well
25
50
DBNGP
Creek
WEST
Boundary Well
Bradley Well
Myanore
RIVER
Nine Mile Well
Compressor Station CS 1
mast
KP 0
Shepherds Well
KP 1
KP 2
KP 3
KP 4
KP 5
KP 6
KP 7
KP 8
KP 9
KP 10
KP 11
38
NORTH
Creek
waterholes
Proposed Route
DBNGP Loop 1
Peter
Princess Well
WH
68
Jennys Bore
Yarraloola
racecourse
DBNGP
mast (77m)
numerous waterholes
PEEDAN HILL
119
King Well
mast
Macks Bore
Warramboo Outstation
waterhole
ECHO BLUFF

Legend
- Compressor Station
- Proposed Loop Route
- DBNGP
- Lot Boundaries

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Scale 1: 100 000 (A3)
0 1,000 2,000 4,000
Meters

DBNGP Loop 1
Site Plan - Proposal Details
Section 38(i) EPA Referral

Coordinate System
MGA Zone 50 (GDA94)

Map No: DBPL01-C-101-01
Map Revision: 0
Project File: Northern Loop Site Plan - Proposal Details.mxd
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GDA

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MapInfo
Geoscience Australia

NANYINGEE HILL
waterhole
DBNGP
Compressor Station CS2
mast (134m)
KP 0
KP 1
KP 2
KP 3
KP 4
KP 5
KP 6
KP 7
KP 8
KP 9
KP 10
KP 11
KP 12
KP 13
KP 14
KP 15
KP 16
KP 17
KP 18
KP 19
KP 20
KP 21
KP 22
KP 23
KP 24
KP 25
KP 26
KP 27
KP 28
KP 29
KP 30
KP 31
Bennett Well
Cheetara No 2 Well
Four Mile Well
CHEETARA ROCK
Whiskey Pool
waterhole
position
Myallie Well
Proposed Route
DBNGP Loop 2
Pipeline
Gas
Bunbury
Dampier
GLOBE HILL
Shallow Well
Woodhouse Well
mast
gravel pits
Deep Well
(abandoned)
gravel pit

Legend
- Compressor Station
- Proposed Loop Route
- DBNGP
- Lot Boundaries

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Alinta

Scale 1: 100 000 (A3)
0 1,000 2,000 4,000
Meters

DBNGP Loop 2
Site Plan - Proposal Details
Section 38(i) EPA Referral

Coordinate System
MGA Zone 50 (GDA94)

Map No: DBPL02-C-101-01
Map Revision: 0
Project File: Northern Loop Site Plan - Proposal Details.mxd
Pipeline Route Rev A 10/06/2005

Date: 04 / 08 / 2005
Sheet: 1 of 1

GDA

Data sourced from: Alinta Ltd
MapInfo
Geoscience Australia

River
Choadingmanna
DBNGP
221
212
bore
Lyndon
LYNDON
MINN
tower
(134m)
Compressor Station CS 3
197
200
KP 0
KP 1
KP 2
KP 3
KP 4
KP 5
KP 6
KP 7
KP 8
KP 9
KP 10
KP 11
KP 12
KP 13
KP 14
KP 15
KP 16
KP 17
KP 18
KP 19
KP 20
KP 21
KP 22
KP 23
KP 24
Bloodwood Well
bore
Beroi Dam
257
250
Proposed Route
DBNGP Loop 3
(Tobe Laid)
28
209
253
200
254
K47
225
ROAD
Williambury
Williambury Pool
waterhole
Minilya River
bore
waterhole
225
DBNGP
200
Dampier to Bunbury
tower
256
250
Gneudna Bore
9
8
7
1
2

Legend
- Compressor Station
- Proposed Loop Route
- DBNGP
- Lot Boundaries

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Scale 1: 100 000 (A3)
0 1,000 2,000 4,000
Meters

DBNGP Loop 3
Site Plan - Proposal Details
Section 38(i) EPA Referral

Coordinate System
MGA Zone 50 (GDA94)

Map No: DBPL03-C-101-01
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GDA

Data sourced from: Alinta Ltd MapInfo Geoscience Australia

DBNGP

Compressor Station CS4

KP 0

KP 1

KP 2

KP 3

KP 4

KP 5

KP 6

KP 7

KP 8

KP 9

KP 10

KP 11

KP 12

KP 13

KP 14

KP 15

KP 16

KP 17

KP 18

KP 19

KP 20

KP 21

KP 22

KP 23

KP 24

Proposed Route
DBNGP Loop 4

Wigemburna

Coomantha

Doordwoordoo

Coyerbooroo

Coonatha Well

Black Girl Well

Karrabooka Well

No 26 Well

Priathanna

Davis Island

Kylietharra Outcamp

WALBARUNE PEAK

Coongarracoodoo

Black Hill Well

bore

Salt Well

Coomel Well

LYONS RIVER ROAD

ULLAWARRA

GASCOYNE RIVER

Bidgemia

Piddendoora Pool

Bigina

GASCOYNE JUNCTION

Robbers Bore

Plake Bore

Gully Gas Pipeline (underground)

DBNGP

tower (72m)

Wingercarrier Well

Bitter Bore

Legend

- Compressor Station
- Proposed Loop Route
- DBNGP
- Lot Boundaries

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Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 4
Site Plan - Proposal Details
Section 38(i) EPA Referral

Coordinate System
MGA Zone 50 (GDA94)

Map No: DBPL04-C-101-01
Map Revision: 0
Project File: Northern Loop Site Plan - Proposal Details.mxd
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GDA

Data sourced from: Alinta Ltd
MapInfo
Geoscience Australia

DBNGP
No 1 Bore
35
2
ROAD
10
GILROYD
ROAD
217
200
198
No 8 Bore
New No 8 Bore
206
mast
(110m)
Compressor Station CS 5
No 4
Bore
No 3 Bore
8
pipeline facility
KP 0
No 2 Bore
East Tank
No 9
Tank
SEC Bore
KP 1
No 7
Bore
Yalardy
WOODLEIGH
KP 2
No 1 Tank
KP 3
(underground)
1
KP 4
gravel pit
203
20
207
KP 5
KP 6
No 2 Tank
Pipeline
KP 7
Green Tank
No 6 Tank
KP 8
200
2
Gas
3
soak
KP 9
No 7 Bore
Proposed Route
DBNGP Loop 5
KP 10
Bunbury
KP 11
20
KP 12
No 1 Bore
215
to
KP 13
209
KP 14
Dampier
KP 15
KP 16
KP 17
KP 18
KP 19
ROAD
200
Talisker
No 3
Bore
KP 20
No 5 Bore
No 2 Bore
210
194
pipeline
facility
KP 21
28
tower
No 6 Tank
DBNGP
No 11 Bore
226

Legend
- Compressor Station
- Proposed Loop Route
- DBNGP
- Lot Boundaries

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Alinta

Scale 1: 100 000 (A3)
0 1,000 2,000 4,000
Meters

DBNGP Loop 5
Site Plan - Proposal Details
Section 38(i) EPA Referral

Coordinate System
MGA Zone 50 (GDA94)

Map No: DBPL05-C-101-01
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GDA

Data sourced from: Alinta Ltd
MapInfo
Geoscience Australia

1
2
3
Dampier
DBNGP
• 236
• 241
numerous small claypar
BOMPAS HILL
numerous small claypans
waterhole
• 237
waterhole
Compressor Station CS 6
tower
KP 0
KP 1
KP 2
KP 3
KP 4
KP 5
KP 6
KP 7
KP 8
KP 9
KP 10
Proposed Route
DBNGP Loop 6
WILELY
The Elbow
• 206
• 263
claypan
231
waterhole
258
Mungarra Pool
237 •
209 •
• 214
DBNGP
Drages
claypan
claypans
claypan
COOLCALALAYA
alaya
claypans
• 264

Legend
Compressor Station
Proposed Loop Route
DBNGP
Lot Boundaries

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Alinta

Scale 1: 100 000 (A3)
0 1,000 2,000 4,000
Meters

DBNGP Loop 6
Site Plan - Proposal Details
Section 38(i) EPA Referral

Coordinate System
MGA Zone 50 (GDA94)

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GDA

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Geoscience Australia

28° 30'

waterhole

BINDOO HILL NATURE

BINDOO HILL

293

DBNGP

Goyarra

Abbawardoo Pool

Kockatea

Gully

YUNA

ROAD

Alluna

NORTH ERADU

VALENTINE

RIVER

Lamda

266

208

Compressor Station CS 7

mast (80m)

KP 0

KP 1

KP 2

KP 3

KP 4

256

235

THURNOONGGNOO BLUFF

260

Proposed Route
DBNGP Loop 7

Chaddesley

GREENOUGH

THE FORTY FOUR MILE NATURE RESERVE

RAIL

ERADU

Ambania

NORTHAM

GERALDTON

quarry

abandoned

90

MAGNET

MOUNT

ERADU HILL

Eradu

abandj

Eureka

Eradu Pool

Wicherina

Wicherina Dam

Woodcote

Dampier to Bunbury Gas Pipeli

Kareelah

Yelturtoo

DBNGP

268

quarry

CASURINAS

Wicherina Downs

Fresh Water Pool

ERADU SOUTH

WICHERINA SOUTH

Beetalyinna Pool

wh

1

2

Legend

- Compressor Station
- Proposed Loop Route
- DBNGP
- Lot Boundaries

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Alinta

Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 7
Site Plan - Proposal Details
Section 38(i) EPA Referral

Coordinate System
MGA Zone 50 (GDA94)

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Map Revision: 0
Project File: Northern Loop Site Plan - Proposal Details.mxd
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GDA

Data sourced from: Alinta Ltd MapInfo Geoscience Australia

Ellengail
golf course
Eneabba North Mine
DBNGP
Alandale
gravel pit
Eneabba West Mine
RGC North
Compressor Station CS 8
mast
KP 0 (0m)
KP 1
KP 2
KP 3
KP 4
KP 5
KP 6
KP 7
KP 8
KP 9
KP 10
KP 11
KP 12
KP 13
KP 14
KP 15
KP 16
KP 17
KP 18
KP 19
Boolaroo
Eneabba South Mine (abandoned)
RGC South Mine
gas well (abandoned)
Judeen
SOUTH ENEABBA NATURE RESERVE
MIDLAND INDIGENOUS RESERVE
waterhole
gravel pit
LSR 5
LSR 4
WARRADARGE
WARRADARGE HILL
GREEN HEAD ROAD
ALEXANDER MORRISON NATIONAL PARK
Proposed Route DBNGP Loop 8
LSR 2
KP 22
KP 23
KP 24
KP 25
KP 26
KP 27
KP 28
KP 29
KP 30
KP 31
KP 32
KP 33
KP 34
KP 35
KP 36
KP 37 (61m)
KP 38
KP 39
KP 40
KP 41
KP 42
KP 43
KP 44
KP 45
Coomallo Hill Tower
COOMALLO HILL
Bitter Pool North
GAIRDNER RANGE
MT CESUEUR
JURIEN ROAD
MT BENIA PROHIBITED AREA
CATAMOURI HILL
HILL RIVER
MINTAJA HILLS
ERAGILGA HILLS
Nylagarda Hill
NATURE RESERVE
Badgingarra Mine
TABLE HILL
DBNGP
Gavenoo Flat
COWALLA PEAK
TIMBER RESERVE
Coomallo Creek
HERSCHELL RANGE
BRAND HWY
Bolgendara Ck
ALEXANDER MORRISON NATIONAL PARK
ALEXANDER MORRISON NATIONAL PARK
BADGINGARRA AG RESEARCH STATION SCIENTIFIC

Legend
- Compressor Station
- Proposed Loop Route
- DBNGP
- Lot Boundaries

Note: While every effort was made to ensure the accuracy and currency of the information shown on this map, the project team does not accept any responsibility for errors or omissions that may have occurred.

Produced by Asset Services, Alinta Network Servies. Level 8 IBM Tower, 60 City Road, Southbank VIC 3006

Alinta

Scale 1: 150 000 (A3)
0 1,000 2,000 4,000 6,000
Meters

DBNGP Loop 8
Site Plan - Proposal Details
Section 38(i) EPA Referral

Coordinate System
MGA Zone 50 (GDA94)

Map No: DBPL08-C-101-01
Map Revision: 0
Project File: Northern Loop Site Plan - Proposal Details.mxd
Pipeline Route Rev A 10/06/2005

Date: 04 / 08 / 2005
Sheet: 1 of 1

GDA

Data sourced from: Alinta Ltd MapInfo Geoscience Australia

Compressor Station CS 9
KP 0
KP 1
KP 2
KP 3
KP 5
KP 6
KP 7
KP 8
KP 9
KP 10
KP 11
KP 12
KP 13
KP 14
Proposed Route DBNGP Loop 9
DBNGP
DBNGP
RED GULLY
MINDARRA
MOORE RIVER NATIONAL PARK
BEERMULLAH
MUCKENBURRA
GRANVILLE
BOONANARRING
Moore
Six Mile Swamp
Dampier to Bunbury gas pipeline
Red Gully Creek
Padbury Gully
Whitfield
Gingin Brook
Mungala Bk
Little Bootine Swamp
Big Bootine Swamp
Beermullah Lake
White Lake
Culcadarra Lake
Boonalarup Lake
Yeereatup Lake
Wallering
Lake Muckenburra
BEERMULLAH PLAIN
BRAND HWY
GINGIN BROOK ROAD
quarry
gravel pit
tower (posn approx)
mast
golf course
piggery
quarries
Boonanarrin
Legend
Compressor Station
Proposed Loop Route
DBNGP
Lot Boundaries

Note: While every effort was made to ensure the accuracy and currency of the information shown on this map, the project team does not accept any responsibility for errors or omissions that may have occurred.

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Alinta

Scale 1: 100 000 (A3)
0 1,000 2,000 4,000
Meters

DBNGP Loop 9
Site Plan - Proposal Details
Section 38(i) EPA Referral

Coordinate System
MGA Zone 50 (GDA94)

Map No: DBPL09-C-101-01
Map Revision: 0
Project File: Northern Loop Site Plan - Proposal Details.mxd
Pipeline Route Rev A 10/06/2005

Date: 04 / 08 / 2005
Sheet: 1 of 1

GDA

Appendix 2: Acid Sulphate Soils Desktop Study

Parsons Brinckerhoff Australia Pty Ltd (2005) *Dampier to Bunbury Natural Gas Pipeline – Northern Looping Acid Sulphate Soil Desktop Study* prepared for Ecos Consulting (Aust) Pty Ltd July, 2005.

Dampier to Bunbury Natural Gas Pipeline – Northern Looping Acid Sulphate Soil Desktop Study

July 2005

ECOS Consulting

PARSONS BRINCKERHOFF

Parsons Brinckerhoff Australia Pty Limited ACN 078 004 798 and
Parsons Brinckerhoff International (Australia) Pty Limited ACN 006 475 056
trading as Parsons Brinckerhoff ABN 84 797 323 433

1 Alvan Street
Subiaco WA 6008
PO Box 1232
Subiaco WA 6904
Australia
Telephone +61 8 9489 9700
Facsimile +61 8 9380 4060
Email perth@pb.com.au

ABN 84 797 323 433
NCSI Certified Quality System ISO 9001

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Author:	Julie Palich
Reviewer:	Michael Lambert
Approved by:	Michael Lambert
Signed:	
Date:	
Distribution:	ECOS (3), PB (3)

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Appendix B Regional Topography and Depth to Groundwater Maps
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Appendix D Groundwater Monitor Bore Information

1. Introduction

Parsons Brinckerhoff (PB) was engaged by ECOS Consulting (ECOS) to undertake a desktop assessment to predict the acid generating potential of soils encountered along the DBNGP (WA) Nominees Pty Ltd proposed DBNGP Northern Loop Pipeline project, to assist with obtaining government approvals for the expansion. The Northern Loop expansion encompass a total of 192 km extending from Pannawonica in the Pilbara to Gingin in the Northern Sand Plains (Figure 1).

Although this preliminary desktop investigation will allow areas of acid sulphate soils to be identified to a relatively high level of confidence, field sampling and validation are likely to be required by the Department of Environment (DoE) to meet current guidelines in areas that are classified as having a medium to high risk of being characterised acid sulphate soils.

The following data sources were used as part of the desktop investigation:

- Geotechnical Characteristics of the Pipeline Corridor (Dames & Moore, 1999) including flight observations, broad soil types and geology
- Department of Environment WIN Database for depth to groundwater
- Department of Environment Statewide River Water Quality Assessment (2004) for surface water quality
- Shuttle Radar Topography Mission (SRTM) for Digital Elevation Model (DEM) and water bodies
- AGSO National Geoscience Dataset for regional regolith mapping
- Integrated dataset of Agricultural Land Cover Change (ALCC95), Forests of Australia 2003, 1996/97 Land Use of Australia, and the National Vegetation Information System 2000 (NVIS00) for regional vegetation cover.

2. Assessment Methodology

Data from each of the aforementioned sources was mapped along the line of the Northern Loop route. A risk ranking of potential for acid sulphate soil occurrence was assigned based on geological/lithological units (Appendix A), wetland classifications, vegetation (Appendix C), and depth to water/topography (Appendix B). The risk classifications are summarised in Table 2.1 on the following page.

A level of intrusive investigation was then assigned based on the risk of acid sulphate soils being present along the pipeline route. Due to the geomorphological setting of most of the Loop segments, risk rankings of medium or higher based on geological information required supporting information from a secondary source (wetland, vegetation, water table) to result in a medium or high ranking. The level of intrusive investigation, based on the acid sulphate soil risk classification, for the preliminary acid sulphate soil investigation is defined as follows:

LOW: Site walkover at time of development. Where ground truthing indicates a deviation from the predicted occurrence, a soil bore will be installed at a frequency up to 1 soil bore per 500 m. Field analysis of pH_F and pH_{FOX} (pH after oxidation) at 0.25 m intervals will be undertaken where soil bores are installed. Laboratory analysis will only be undertaken if pH_F or pH_{FOX} <5 or $\Delta pH_{F,FOX}$>1.

MEDIUM: Soil bores will be installed at a frequency of 1 soil bore per 200 m. Field analysis of pH_F and pH_{FOX} (pH after oxidation) at 0.25 m intervals will be undertaken. The highest risk soil sample from each bore will be sent for laboratory analysis by the Chromium Reducible Sulphur Suite (S_{CR}) and 1 in every 10 bores will be laboratory analysed for S_{CR} at 0.5 m intervals through the bore profile

HIGH: Soil bores will be installed at a frequency of 1 soil bore per 100 m or one bore per area, whichever is greater. Field analysis of pH_F and pH_{FOX} (pH after oxidation) at 0.25 m intervals will be undertaken. The highest risk soil sample from each bore will be sent for laboratory analysis for S_{CR} and 1 bore per area will be laboratory analysed for S_{CR} at 0.5 m intervals through the bore profile.

Table 2.1 Acid Sulphate Soil Risk Classification Criteria

ASS RISK RANKING	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL
LOW	MODERATELY WEATHERED BEDROCK	DURICRUST (CALCRETE/ SILICRETE/ UNDIFFERENTIATED) SEDIMENTARY ROCKS (MESOZOIC) SEDIMENTARY ROCKS (PALEOZOIC) GRANITIC ROCKS (ARCHEAN-PROTEROZOIC)	DUPLEX SOILS RED AND YELLOW EARTHS	SHALLOW ROCK ROCK FROM WITHIN TRENCH LATERITE	NATIVE GRASSLANDS NATIVE SHRUBS AND HEATHS CROPS NATIVE FORESTS AND WOODLANDS	NONE CREEKS – fresh RIVERS – fresh	>10
MEDIUM	TERRESTRIAL SEDIMENTS AEOLIAN SANDS	QUATERNARY DEPOSITS DURICRUST (FERRUGINOUS)	EARTHY SANDS LEACHED SANDS	SOIL COVER	MALALEUCAS, EUCALYTUS	RIVERS – brackish to saline WATER BODIES – brackish to saline	5 – 10
HIGH	LACUSTRINE SEDIMENTS	QUATERNARY DEPOSITS in low-lying, wetland areas	LEACHED SANDS in low lying areas			WETLANDS	1 – 5

3. Loop 1

3.1 ASS Classification

Loop 1 comprises a distance of 12 km between Peter Creek and Yarralool in the Pilbara. The site is located at an elevation of 41 – 60 mAHD at the edge of a historical floodplain. Regionally the area comprises a basement of Archaen granite and volcaincs overlain by massive deposits of Proterozoic sediments. Most of the surface is covered by alluvium and colluvium sands.

Peter Creek intersects the northern extent of Loop 1 and the Robe River passes immediately to the south of Loop 1. The Robe River is classified as fresh to brackish. These can both be considered sensitive receptors to any impacts resulting from the disturbance of acid sulphate soils.

Information pertaining to the depth to groundwater in the area has been derived from data from 8 groundwater monitor bores located predominantly within 1 km to the west of the line. An additional 2 groundwater monitor bores are also located in the area, however information on depth to groundwater at those sites was not available. Information available from the groundwater monitor bores are tabulated in Appendix D.

Table 3.1 summarises the occurrence of the geological, wetland, vegetation and water table characteristics encountered along the Loop 1 pipeline route.

Table 3.1 Loop 1 Acid Sulphate Soil Risk Classification Map

LOOP 1 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
136	TERRESTRIAL SEDIMENTS sandy soils on bedrock	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	EARTHY SANDS often underlain by ironstone gravels, laterite or an indurated mottled or pallid zone	SOIL COVER	NATIVE GRASSLAND and minimally modified pastures	CREEK - fresh	5 – 10	MEDIUM
137						NONE		LOW
138								
139								
140								
141								
142								
143								
144								
145								
146								
147								
148						RIVER – fresh to brackish		MEDIUM

3.2 Preliminary ASS Investigation

Table 3.2 summarises the preliminary acid sulphate soil sample and analysis plan for Loop 1. A soil bore depth of 3 m has been assumed for all bores, however, soil bores will need to be installed to 1 m below the proposed depth of pipeline excavation.

Table 3.2 Summary Sampling and Analysis Plan

ASS Risk Ranking	No. Kilometers	No. Proposed Soil Bores	No. Proposed Field Tests	No. Proposed S_{CR} Analysis
LOW	10	0	0	0
MEDIUM	2	10	130	20
HIGH	0	0	0	0

1. Soil bores are assumed to be installed to 3 metres below ground level

It is noted that the preliminary intrusive acid sulphate soil investigation is a screening program only to verify the presence or absence of acid sulphate soils. Where acid sulphate soils are identified a detailed site investigation will likely be required by the DoE as part of the acid sulphate soil management plan development.

4. Loop 2

4.1 ASS Classification

Loop 2 is located approximately 30 km west of Nanutarra and comprises a distance of 32 km between the Ashburton River and the North West Coastal Highway located in the Pilbara. The site is located at an elevation of 41 – 60 mAHD at the edge of a historical floodplain. Regionally the area comprises a basement of Archaen granite and volcanics overlain by massive deposits of Proterozoic sediments. Most of the surface is covered by alluvium and colluvium sands.

The Ashburton River intersects the northern extent of Loop 2. The Yannarie River is located approximately 20 to 30 km to the west of the line south of Cheetara Rock. These water bodies are classified as being brackish and can both be considered sensitive receptors to any impacts resulting from the disturbance of acid sulphate soils.

Information pertaining to the depth to groundwater in the area has been derived from data from 12 groundwater monitor bores located predominantly within 1 km to the northwest of the line. An additional 17 groundwater monitor bores are also located in the area along the length of the line, however information on depth to groundwater at those sites was not available. Information available from the groundwater monitor bores are tabulated in Appendix D.

Table 4.1 summarises the occurrence of the geological, wetland, vegetation and water table characteristics encountered along the Loop 2 pipeline route.

Table 4.1 Loop 2 Acid Sulphate Soil Risk Classification Map

LOOP 2 DISTANCE	GEOLOGY/LITHOLOGY				WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
272	TERRESTRIAL SEDIMENTS sandy soils on bedrock	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	RED AND YELLOW EARTHS with fine earthy fabric, underlain by laterite in placed	SOIL COVER	NATIVE SHRUBS AND HEATHS	NONE	>40	LOW
273								
274						RIVER - brackish		MEDIUM
275						NONE	No Information	LOW
276								
277								
278		SEDIMENTARY ROCKS (MESOZOIC)						
279		QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas		SHALLOW ROCK				
280								
281								
282								
283								
284					NATIVE GRASSLAND and minimally modified pastures			
285								
286								
287				HARD ROCK EXPOSURE				

LOOP 2 DISTANCE	GEOLOGY/LITHOLOGY				WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
288	TERRESTRIAL SEDIMENTS sandy soils on bedrock	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	RED AND YELLOW EARTHS with fine earthy fabric, underlain by laterite in placed	SHALLOW ROCK	NATIVE GRASSLAND and minimally modified pastures	NONE	No Information	LOW
289								
290								
291								
292		SEDIMENTARY ROCKS (MESOZOIC)		HARD ROCK EXPOSURE				
293								
294		GRANITIC ROCKS						
295		QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas		SHALLOW ROCK				
296								
297								
298								
299								
300								
301								
302								
303								
304								

4.2 Preliminary ASS Investigation

Table 4.2 summarises the preliminary acid sulphate soil sample and analysis plan for Loop 2. A soil bore depth of 3 m has been assumed for all bores, however, soil bores will need to be installed to 1 m below the proposed depth of pipeline excavation.

Table 4.2 Summary Sampling and Analysis Plan

ASS Risk Ranking	No. Kilometers	No. Proposed Soil Bores	No. Proposed Field Tests	No. Proposed S_{CR} Analysis
LOW	31	0	0	0
MEDIUM	1	5	65	10
HIGH	0	0	0	0

1. Soil bores are assumed to be installed to 3 metres below ground level

It is noted that the preliminary intrusive acid sulphate soil investigation is a screening program only to verify the presence or absence of acid sulphate soils. Where acid sulphate soils are identified a detailed site investigation will likely be required by the DoE as part of the acid sulphate soil management plan development.

5. Loop 3

5.1 ASS Classification

Loop 3 is located approximately 10 km west of Lyndon and comprises a distance of 25 km between the Lyndon and Minilya South Rivers located in the Carnarvon Basin. The site is located at an elevation of 140 - 200 mAHD. Regionally the site is located within a sedimentary basin with locally exposed rocks of Permian to recent age.

The Lyndon River passes to the north of Loop 3 and the Minilya River South passes through the southern extent of the line extending to the west, south and east. These water bodies are classified as being fresh to brackish and can both be considered sensitive receptors to any impacts resulting from the disturbance of acid sulphate soils.

Information pertaining to the depth to groundwater in the area has been derived from data from 2 groundwater monitor bores located within 1 km of the line. An additional 10 groundwater monitor bores are also located in the area along the length of the line, however information on depth to groundwater at those sites was not available. Information available from the groundwater monitor bores are tabulated in Appendix D.

Table 5.1 summarises the occurrence of the geological, wetland, vegetation and water table characteristics encountered along the Loop 3 pipeline route.

Table 5.1 Loop 3 Acid Sulphate Soil Risk Classification Map

LOOP 3 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
409	TERRESTRIAL SEDIMENTS sandy soils on bedrock	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	RED AND YELLOW EARTHS with fine earthy fabric, underlain by laterite in placed	SHALLOW ROCK	NATIVE GRASSLAND and minimally modified pastures	NONE	5 – 10	LOW
410		SEDIMENTARY ROCKS (MESOZOIC)	DUPLEX SOILS: hard, red, alkaline, underlain by a wide variety of materials including weathered rock, laterite, calcrete, silcrete and red-brown hardpan					
		QUATERNARY SANDS						
411		GRANITIC ROCKS (ARCHEAN-PROTEROZOIC)						
412								
413								
414						CREEK - fresh		
415		SEDIMENTARY ROCKS (MESOZOIC)				NONE		
416								
417								
418							No Information	
419								
420		QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts						
421								
422	TERRESTRIAL		DUPLEX SOILS: hard,	SHALLOW ROCKS	NATIVE	NONE	No Information	LOW

LOOP 3 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
423	SEDIMENTS sandy soil on bedrock	and clays. Lacustrine and peaty deposits occur in wetland areas	red, alkaline, underlain by a wide variety of materials including weathered rock, laterite, calcrete, silcrete and red0brown hardpan		GRASSLAND and minimally modified pastures			
424								
425	MODERATELY WEATHERED BEDROCK alkaline red soils	SEDIMENTARY ROCKS (PALEOZOIC)						
426								
427					NATIVE SHRUBS AND HEATHS			
428								
429								
430								
431								
432								
433		QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas			NATIVE GRASSLAND and minimally modified pastures	RIVER – fresh to brackish		
434						NONE		

5.2 Preliminary ASS Investigation

All indicators along Loop 3 indicate that soils in this area are of low risk of being acid generating. As such an acid sulphate soil investigation should not be required.

6. Loop 4

6.1 ASS Classification

Loop 4 covers a distance of 25 km commencing 8 km to the east of Gascoyne Junction and extending north. The site is located in the Gascoyne at an elevation of 140 - 160 mAHD. Regionally the site is characterised by Middle Proterozoic sandstones and granites.

The Gascoyne River passes through the southern extent of the line and Davis Creek passes through the line in the north. The Lyons River runs north south to the west of the line at a distance ranging from 2 to 20 km. These water bodies are classified as being fresh and can be considered sensitive receptors to any impacts resulting from the disturbance of acid sulphate soils.

There are no registered groundwater monitor bores located within 1 km of Loop 4, therefore it was not possible to determine depth to groundwater in this area.

Table 6.1 summarises the occurrence of the geological, wetland, vegetation and water table characteristics encountered along the Loop 4 pipeline route.

Table 6.1 Loop 4 Acid Sulphate Soil Risk Classification Map

LOOP 4 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
546	MODERATELY WEATHERED BEDROCK alkaline red soils	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	HARD RED DUPLEX SOILS (alkaline) sandy textures which set hard when dry. Underlain by a wide range of materials including weathered rock, laterite, calcrete, silicrete, and red-brown hardpan	SOIL COVER	NATIVE GRASSLAND and minimally modified pastures	NONE	No information	LOW
547		SEDIMENTARY ROCKS (PALEOZOIC)						
548								
549								
550		QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas						
551						CREEK-fresh		
552						NONE		
553								
554								
555					NATIVE SHRUBS AND HEATHS			
556						WATERHOLE		
557						NONE		
558								
559								
560								

LOOP 4 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
561	MODERATELY WEATHERED BEDROCK alkaline red soils	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	HARD RED DUPLEX SOILS (alkaline) sandy textures which set hard when dry. Underlain by a wide range of materials including weathered rock, laterite, calcrete, silicrete, and red-brown hardpan	ROCK FROM WITHIN TRENCH	NATIVE SHRUBS AND HEATHS	NONE	No information	LOW
562		SEDIMENTARY ROCKS (PALEOZOIC)			NATIVE GRASSLAND and minimally modified pastures	WATERHOLE		
563		QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas				NONE		
564								
565								
566								
567				SOIL COVER		WATERHOLE		
568						NONE		
569								
570				SHALLOW ROCK	PERMANENT WATER FEATURE	RIVER - fresh		
571					NATIVE GRASSLAND and minimally modified pastures	NONE		

6.2 Preliminary ASS Investigation

All indicators along Loop 4 indicate that soils in this area are of low risk of being acid generating. As such an acid sulphate soil investigation should not be required.

7. Loop 5

7.1 ASS Classification

Loop 5 is located approximately 2 km west of Yalardy and comprises a distance of 22 km between the Yalardy and Talisker located. The site is located in the Gascoyne at an elevation of 180 - 220 mAHD. Regionally the site is characterised by Middle Proterozoic sandstones and granites.

There are no nearby surface watercourses, with only some ephemeral waterholes located in the vicinity of Loop 5.

Information pertaining to the depth to groundwater in the area has been derived from data from 1 groundwater monitor bore located within 0.5 km of the line. An additional 3 groundwater monitor bores are also located in the area along the length of the line, however information on depth to groundwater at those sites was not available. Information available from the groundwater monitor bores are tabulated in Appendix D.

Table 7.1 summarises the occurrence of the geological, wetland, vegetation and water table characteristics encountered along the Loop 5 pipeline route.

Table 7.1 Loop 5 Acid Sulphate Soil Risk Classification Map

LOOP 5 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
684	TERRESTRIAL SEDIMENTS sandy soil on bedrock	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	EARTHY SANDS often underlain by ironstone gravels, laterite or an inundurated mottled or pallid zone	SOIL COVER	NATIVE SHRUBS AND HEATHS	WATERHOLES 0.1 to 3 km to the east	No Information	LOW
685								
686								
687					NATIVE GRASSLAND and minimally modified pastures	NONE		
688								
689								
690								
691								
692								
693								
694								
695								
696								
697								
698								
699								
700								
701								
702								

LOOP 5 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
703	TERRESTRIAL SEDIMENTS sandy soil on bedrock	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	EARTHY SANDS often underlain by ironstone gravels, laterite or an inundurated mottled or pallid zone	ROCK FROM WITHIN TRENCH	NATIVE SHRUBS AND HEATHS	NONE	>50 m	LOW
704							No Information	
705								
706								

7.2 Preliminary ASS Investigation

All indicators along Loop 5 indicate that soils in this area are of low risk of being acid generating. As such an acid sulphate soil investigation should not be required.

8. Loop 6

8.1 ASS Classification

Loop 6 is located 5 km north of the Murchison River near Coolcalalaya and comprises 11 km. The site is located in the Gascoyne at an elevation of 240 - 300 mAHD. Regionally the site is characterised by Middle Proterozoic sandstones and granites.

The Murchison River passes 5 km to the south of Loop 5 and wetlands have been identified immediately north of the river to a distance of 2 km south of Loop 5. These water bodies are classified as being fresh and can both be considered sensitive receptors to any impacts resulting from the disturbance of acid sulphate soils.

Information pertaining to the depth to groundwater in the area has been derived from data from 2 groundwater monitor bores located at the northern end of the line. Information available from the groundwater monitor bores are tabulated in Appendix D.

Table 8.1 summarises the occurrence of the geological, wetland, vegetation and water table characteristics encountered along the Loop 6 pipeline route.

Table 8.1 Loop 6 Acid Sulphate Soil Risk Classification Map

LOOP 6 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Waterbodies	mBGL	
824	TERRESTRIAL SEDIMENTS sandy soil on bedrock	QUATERNARY SANDS undifferentiated alluvial, colluvial eluvial and eolian sands, silts and clays. Lacustrine and peaty deposits occur in wetland areas	EARTHY SANDS often underlain by ironstone gravels, laterite or an inundurated mottled or pallid zone	SOIL COVER	NATIVE SHRUBS AND HEATHS	NONE	>80 m	LOW
825					NATIVE FORESTS AND WOODLANDS		No Information	
826								
827								
828								
829								
830								
831								
832								
833								
834								
835								

8.2 Preliminary ASS Investigation

All indicators along Loop 6 indicate that soils in this area are of low risk of being acid generating. As such an acid sulphate soil investigation should not be required.

9. Loop 7

9.1 ASS Classification

Loop 7 is located approximately 2 km north of the Geraldton Highway and comprises a distance of 5 km south of Eradu Rd North. The site is located immediately to the east of the Northern Sand Plains at an elevation of 260 - 300 mAHD. Regionally the site comprises gently undulating red sand dunes.

The Greenough River passes approximately 5 km to the west of Loop 7. This water body is classified as being saline and can be considered a sensitive receptor to any impacts resulting from the disturbance of acid sulphate soils.

Information pertaining to the depth to groundwater in the area has been derived from data from 5 groundwater monitor bores located within 5 km of the line. An additional 9 groundwater monitor bores are also located in the area, however information on depth to groundwater at those sites was not available. Information available from the groundwater monitor bores are tabulated in Appendix D.

Table 9.1 summarises the occurrence of the geological, wetland, vegetation and water table characteristics encountered along the Loop 7 pipeline route.

Table 9.1 Loop 7 Acid Sulphate Soil Risk Classification Map

LOOP 7 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
966	AEOLIAN SAND duplex soils	DURICRUST	EARTHY SANDS often underlain by ironstone gravels, laterite or an inundurated mottled or pallid zone	LATERITE	CROPS and highly modified pastures	RIVER 5 km to west (saline)	>20	LOW
967								
968								
969		LATERITE covered by eolian and colluvial sand						
970								
971								

9.2 Preliminary ASS Investigation

All indicators along Loop 7 indicate that soils in this area are of low risk of being acid generating. As such an acid sulphate soil investigation should not be required.

10. Loop 8

10.1 ASS Classification

Loop 8 comprised 47 km located east of the Brand Highway laterally between Eneabba and Jurien Bay on the Dandaragan Plateau. The majority of the line is located at an elevation of 160 – 240 mAHD, except for a 2 km section where the Hill River historically cut through the plateau and the elevation is 140 – 160 mAHD.

The Hill River and Coomallow Creek passes approximately 5 km to the west of Loop 8 over the southern half of the line. These water bodies are classified as being saline and can both be considered sensitive receptors to any impacts resulting from the disturbance of acid sulphate soils.

Information pertaining to the depth to groundwater in the area has been derived from data from several groundwater bores registered to Iluka Resources Eneabba Operations. Information pertaining to these bores is not publicly available.

Table 10.1 summarises the occurrence of the geological, wetland, vegetation and water table characteristics encountered along the Loop 3 pipeline route.

Table 10.1 Loop 8 Acid Sulphate Soil Risk Classification Map

LOOP 8 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
1113	AEOLIAN SANDS	LATERITE covered by eolian and colluvial sand	EARTHY SANDS often underlain by ironstone gravels, laterite or indurated mottled or pallid zone	LATERITE	UNKNOWN / NOT REPORTABLE	NONE	128	LOW
1114								
1115								
1116		SEDIMENTARY ROCKS (MESOZOIC)						
		LATERITE covered by eolian and colluvial sand						
1117								
1118								
1119					CROPS and highly modified pastures			
1120								
		SEDIMENTARY ROCKS (MESOZOIC)						
1121		LATERITE covered by eolian and colluvial sand						
1122								
1123								
1124								
1125								
1126								
1127								
1128								

LOOP 8 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
1129	AEOLIAN SANDS bleached sands, sands with pans, leached sands	LATERITE covered by eolian and colluvial sand	EARTHY SANDS often underlain by ironstone gravels, laterite or indurated mottled or pallid zone	LATERITE	ANNUAL CROPS AND HIGHLY MODIFIED PASTURES	NONE	135	LOW
1130								
1131								
1132								
1133								
1134								
1135								
1136								
1137					NATIVE SHRUBLANDS AND HEATHLANDS			
1138		SEDIMENTARY ROCKS (MESOZOIC)						
		LATERITE covered by eolian and colluvial sand						
1139					ANNUAL CROPS AND HIGHLY MODIFIED PASTURES	RIVER 6 km to west (saline)		
		SEDIMENTARY ROCKS (MESOZOIC)						
1140		LATERITE covered by eolian and colluvial sand						
1141								
1142								
1143								
1144								
1145								
1146								

LOOP 8 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
1147	AEOLIAN SANDS bleached sands, sands with pans, leached sands	LATERITE covered by eolian and colluvial sand	EARTHY SANDS often underlain by ironstone gravels, laterite or indurated mottled or pallid zone	LATERITE	ANNUAL CROPS AND HIGHLY MODIFIED PASTURES	RIVER 6 km to west (saline)	135	LOW
1148					NATIVE SHRUBLANDS AND HEATHLANDS		130	
1149								
1150		SEDIMENTARY ROCKS (MESOZOIC)						
1151		LATERITE covered by eolian and colluvial sand			EUCALYPTUS			MEDIUM
1152								
1153					ANNUAL CROPS AND HIGHLY MODIFIED PASTURES	RIVER 2 km to west (saline)		LOW
1154		LATERITE AND UNDIFFERENTIATED ROCK TYPES						
1155								
1156								
1157								
1158								
1159								

10.2 Preliminary ASS Investigation

Table 10.2 summarises the preliminary acid sulphate soil sample and analysis plan for Loop 1. A soil bore depth of 3 m has been assumed for all bores, however, soil bores will need to be installed to 1 m below the proposed depth of pipeline excavation.

Table 10.2 Summary Sampling and Analysis Plan

ASS Risk Ranking	No. Kilometers	No. Proposed Soil Bores	No. Proposed Field Tests	No. Proposed S_{CR} Analysis
LOW	45	0	0	0
MEDIUM	2	10	130	20
HIGH	0	0	0	0

1. Soil bores are assumed to be installed to 3 metres below ground level

It is noted that the preliminary intrusive acid sulphate soil investigation is a screening program only to verify the presence or absence of acid sulphate soils. Where acid sulphate soils are identified a detailed site investigation will likely be required by the DoE as part of the acid sulphate soil management plan development.

11. Loop 9

11.1 ASS Classification

Loop 9 is located along the Brand Highway commencing approximately 10 km north of Gingin and extending north for 15 km. The site is located on the edge of the Gingin Scarp at an elevation of 160 – 180 mAHD in the north and dropping to an elevation of 61 – 80 mAHD to the south.

Red Gully Creek South and passes 0.5 m to the east and Winnifield Brooks passes 2 km to the west of Loop 9 over the northern portion of the line. Wetlands are located to the west and immediately adjacent to the line in the south. These water bodies are likely to be fresh to brackish and are be considered sensitive receptors to any impacts resulting from the disturbance of acid sulphate soils.

Information pertaining to the depth to groundwater in the area has been derived from data from 15 groundwater monitor bores located within 1 km of the line. Several additional groundwater monitor bores are also located in the area along the length of the line, however information on depth to groundwater at those sites was not available. Information available from the groundwater monitor bores are tabulated in Appendix D.

Table 11.1 summarises the occurrence of the geological, wetland, vegetation and water table characteristics encountered along the Loop 3 pipeline route.

Table 11.1 Loop 9 Acid Sulphate Soil Risk Classification Map

LOOP 9 DISTANCE	GEOLOGY/LITHOLOGY				VEGETATION, WETLANDS AND WATER BODIES		DEPTH TO GROUNDWATER	ASS RISK RANKING
	Regolith	Geology	Soil Types	Flight Observations	Vegetation	Water Bodies	mBGL	
1256	TERRESTRIAL SEDIMENTS	DURICRUST	EARTHY SANDS often underlain by ironstone gravels, laterite or an indurated mottled or pallid zone	SEDIMENTARY ROCKS (PALEOZOIC)	CROPS and highly modified pastures	NONE	>30	LOW
1257								
1258								
1259								
1260				SOIL COVER			5 – 30	MEDIUM
1261								
1262								
1263								
1264						STANDING WATER AND WETLANDS within1 km to west. Wetland crosses line at 1268 km	1 – 5	HIGH
1265								
1266								
1267		QUATERNARY SANDS undifferentiated alluvial, colluvial, eluvial and eolian sands, gravels, silts and clays. Lacustrine and peaty deposits occur in wetland areas	RED DUPLEX SOILS (alkaline) sandy textures that set hard when dry. Underlain by a wide range of materials including weathered rock, laterite, calcrete, silicrete and red-brown hardpan					
1268					NATIVE GRASSLANDS and minimally modified pastures	NONE		
1269								
1270					CROPS and highly modified pastures			
1271								

11.2 Preliminary ASS Investigation

Table 11.2 summarises the preliminary acid sulphate soil sample and analysis plan for Loop 1. A soil bore depth of 3 m has been assumed for all bores, however, soil bores will need to be installed to 1 m below the proposed depth of pipeline excavation.

Table 11.2 Summary Sampling and Analysis Plan

ASS Risk Ranking	No. Kilometers	No. Proposed Soil Bores	No. Proposed Field Tests	No. Proposed S_{CR} Analysis
LOW	4	0	0	0
MEDIUM	4	20	260	40
HIGH	7	70	455	105

1. Soil bores are assumed to be installed to 3 metres below ground level

It is noted that the preliminary intrusive acid sulphate soil investigation is a screening program only to verify the presence or absence of acid sulphate soils. Where acid sulphate soils are identified a detailed site investigation will likely be required by the DoE as part of the acid sulphate soil management plan development.

12. Conclusions

Based on the results of the desktop investigation, and within the limitations detailed in Section 13, the following conclusions have been drawn regarding the acid generating potential of near surface soils along the Loop 1 – 9 expansions:

- LOOP 1: Two, 1 km segments have been classified as medium risk around Peter Creek and the Robe River. All other areas along the line have been classified as low risk
- LOOP 2: A 1 km segment has been classified as medium risk around Ashburton River. All other areas along the line have been classified as low risk.
- LOOP 3 – LOOP 7: Soils along these Loops have all been classified as low risk.
- LOOP 8: A 2 km segment has been classified as medium risk around the former intersection of the Hill River. All other areas along the line have been classified as low risk.
- LOOP 9: The southernmost 11 km of Loop 9 have been classified as medium or high risk (4 km medium risk, 7 km high risk) due to the presence of high water tables and wetlands on or adjacent to the line. All other areas along the line have been classified as low risk.

13. Statement of Limitations

Scope of Services

This environmental site assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Parsons Brinckerhoff (PB) ("scope of services"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on Data

In preparing the report, PB has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, PB has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. PB will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to PB.

Environmental Conclusions

In accordance with the scope of services, PB has relied upon the data and has not conducted any environmental field monitoring or testing in the preparation of the report. The conclusions are based upon the data and visual observations and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions.

Within the limitations imposed by the scope of services, the assessment of the site and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. PB assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of PB or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

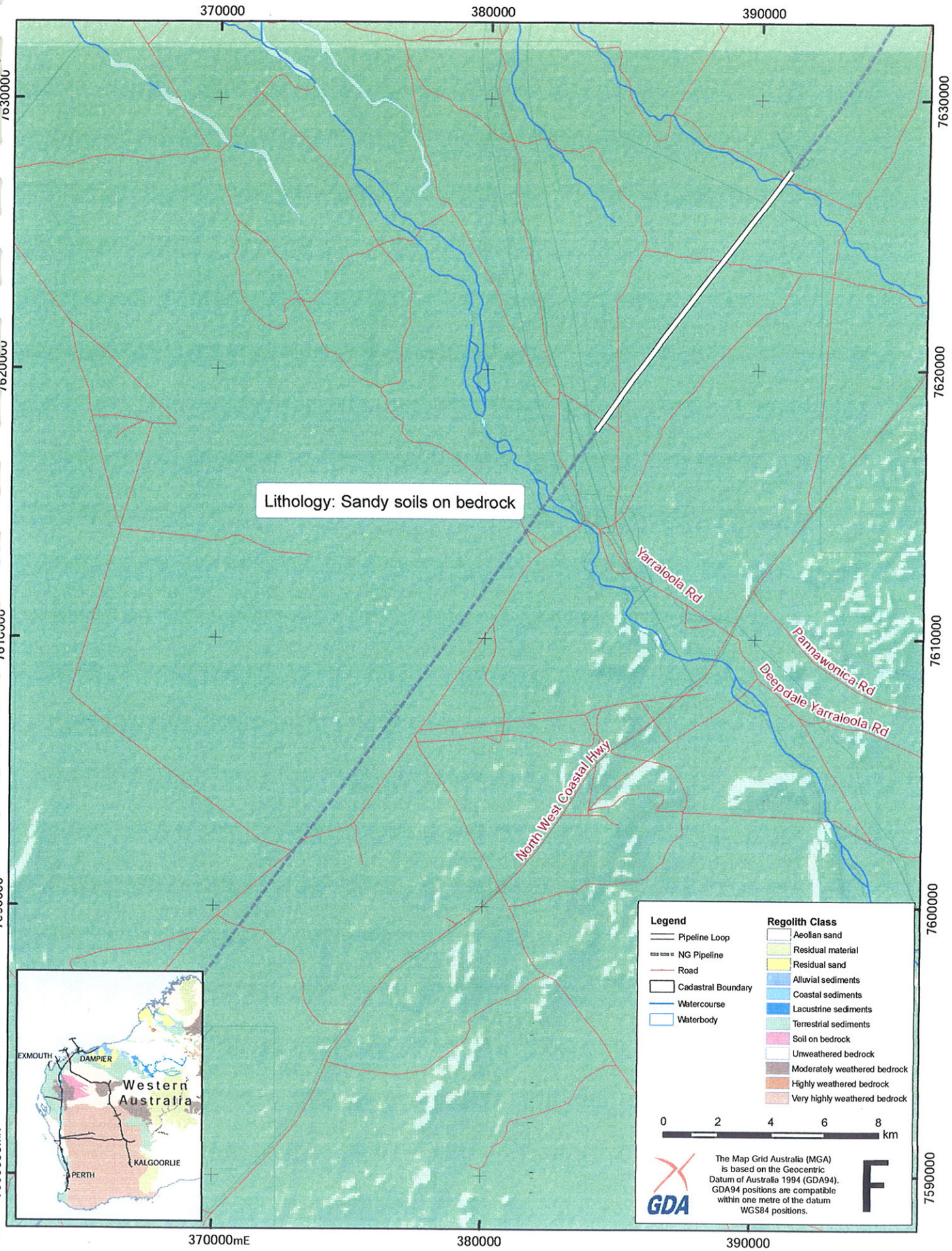
Other Limitations

PB will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

Appendix A

Regional Regolith and Lithology Maps



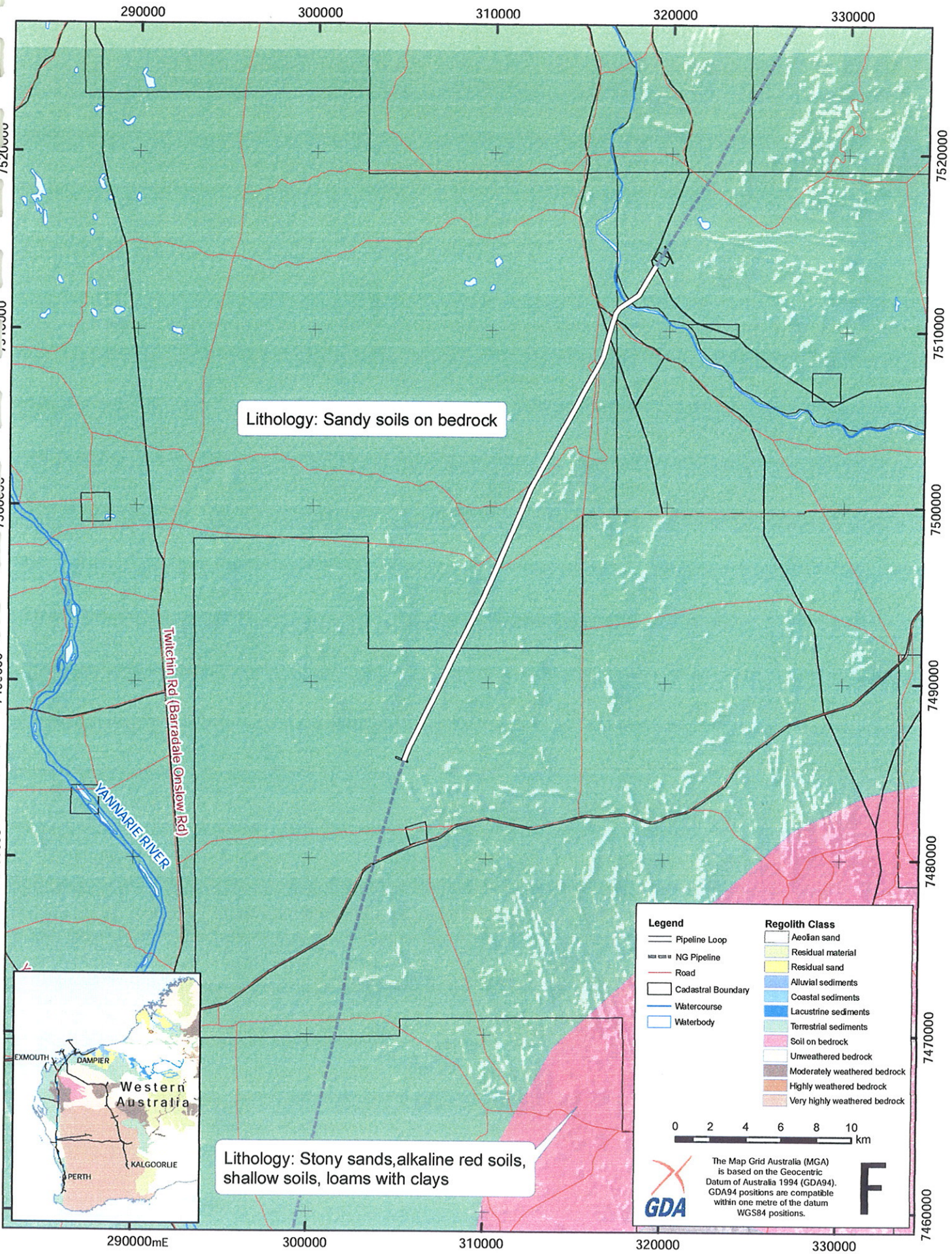
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 1 - REGOLITH AND LITHOLOGY

FIGURE A1

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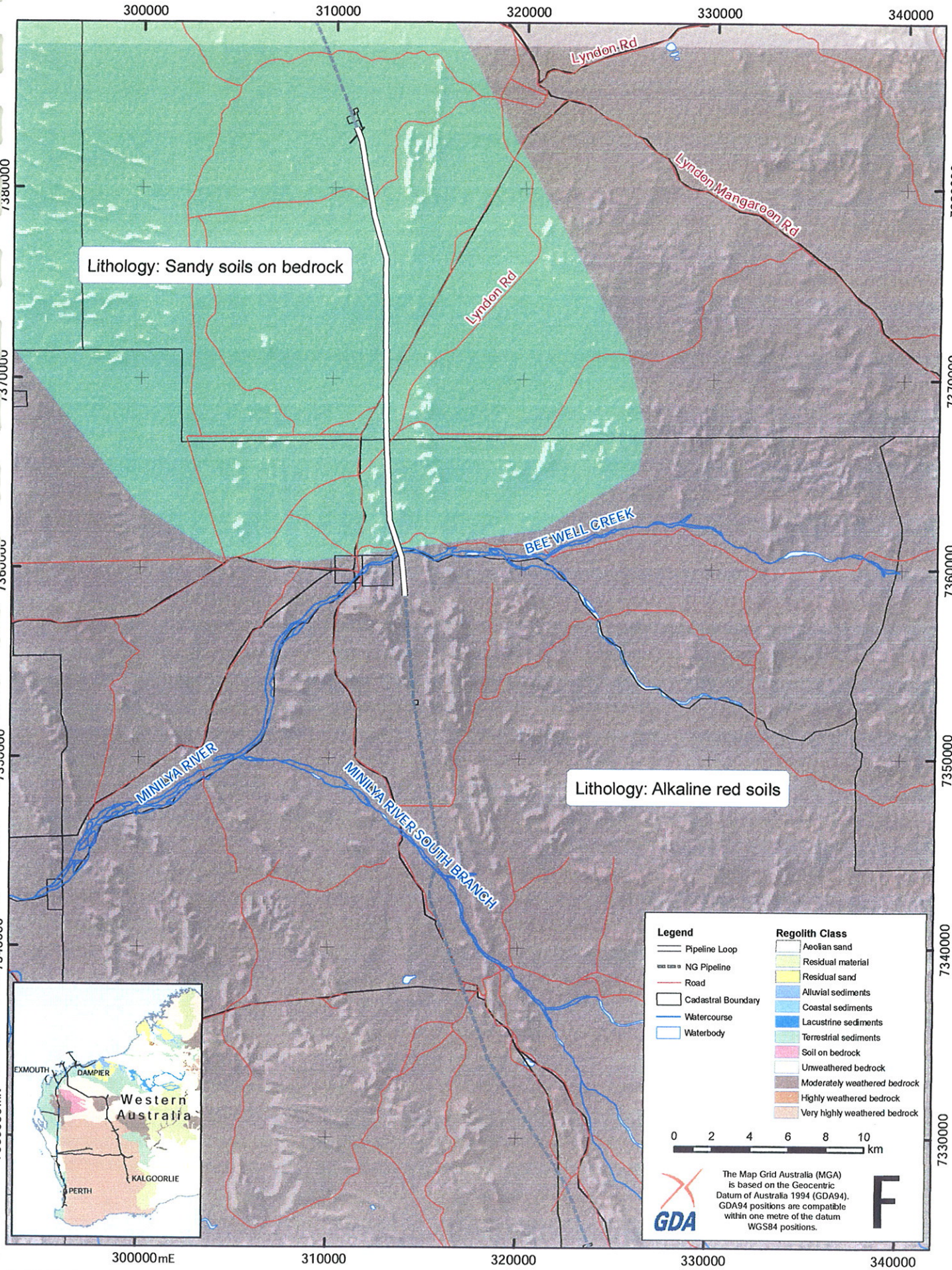
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 2 - REGOLITH AND LITHOLOGY

FIGURE A2

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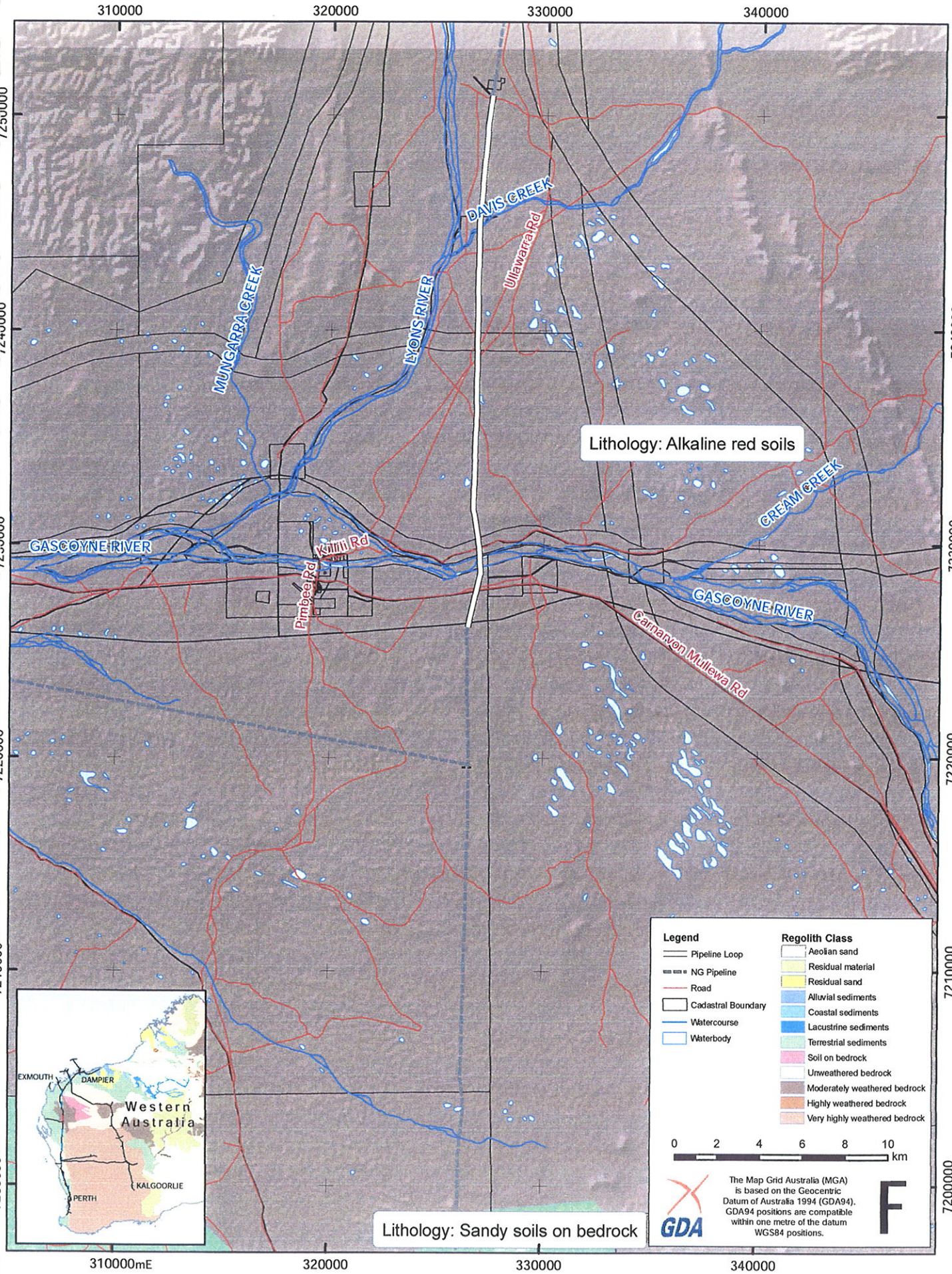
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DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 3 - REGOLITH AND LITHOLOGY

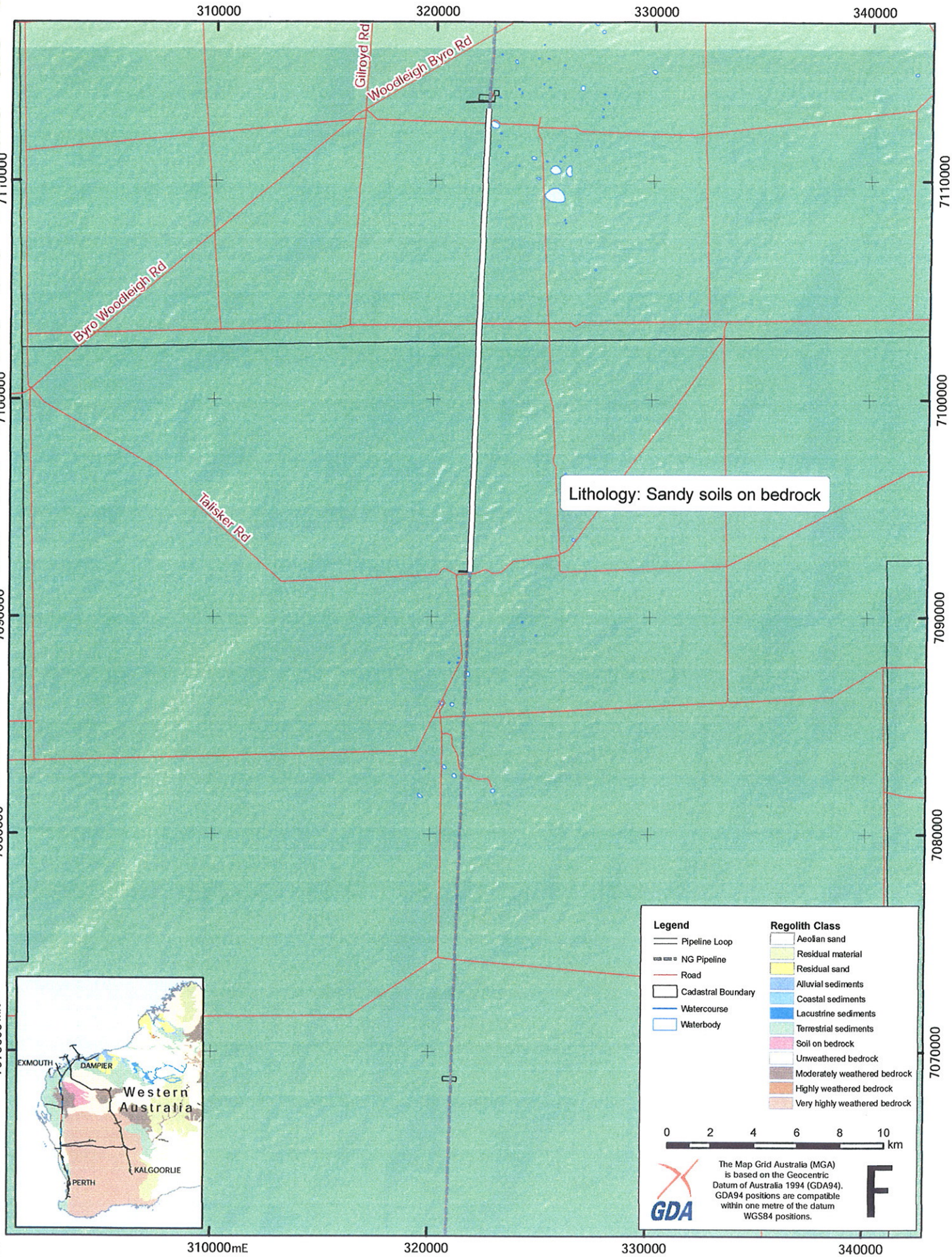
FIGURE A3



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 4 - REGOLITH AND LITHOLOGY

FIGURE A4



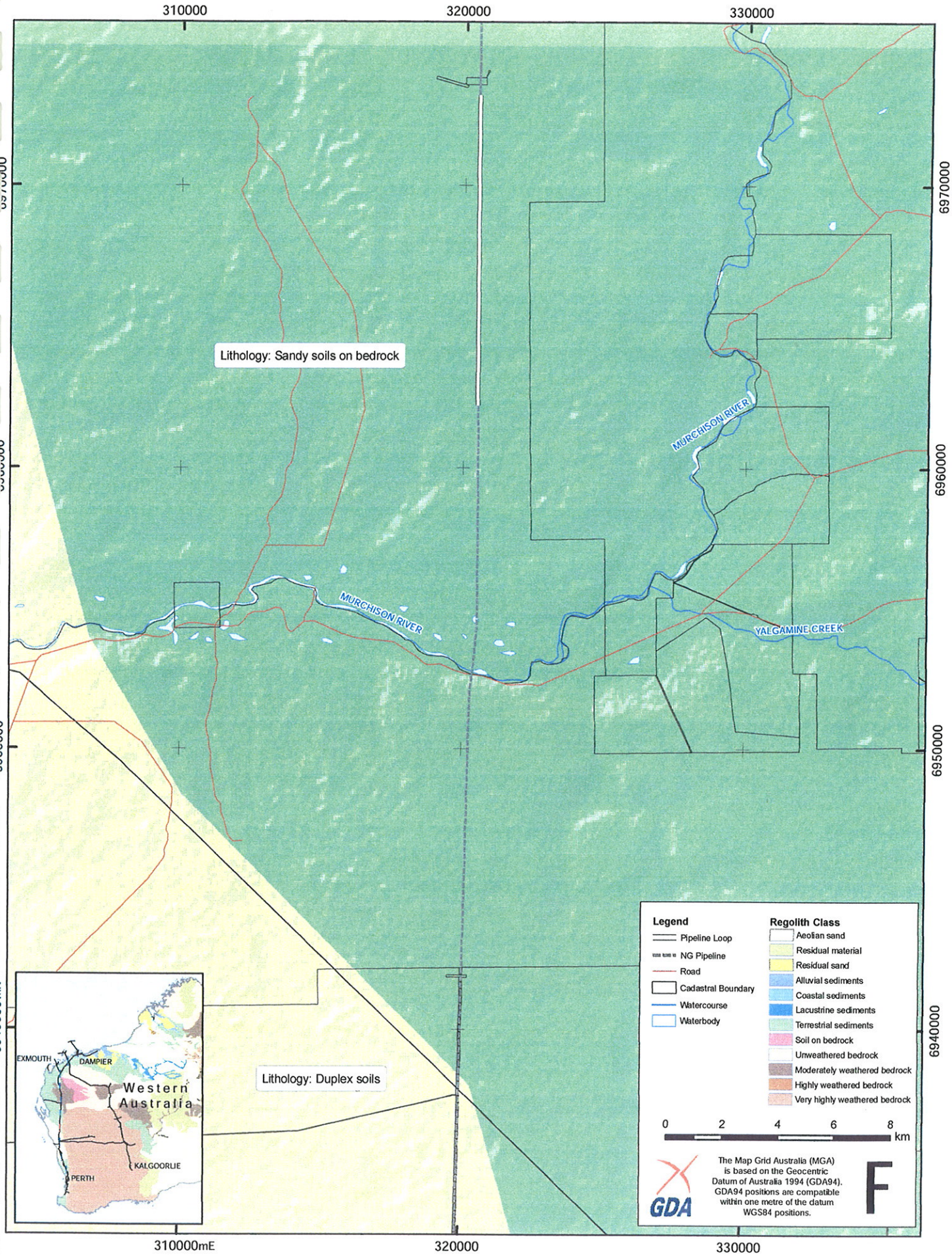
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 5 - REGOLITH AND LITHOLOGY

FIGURE A5

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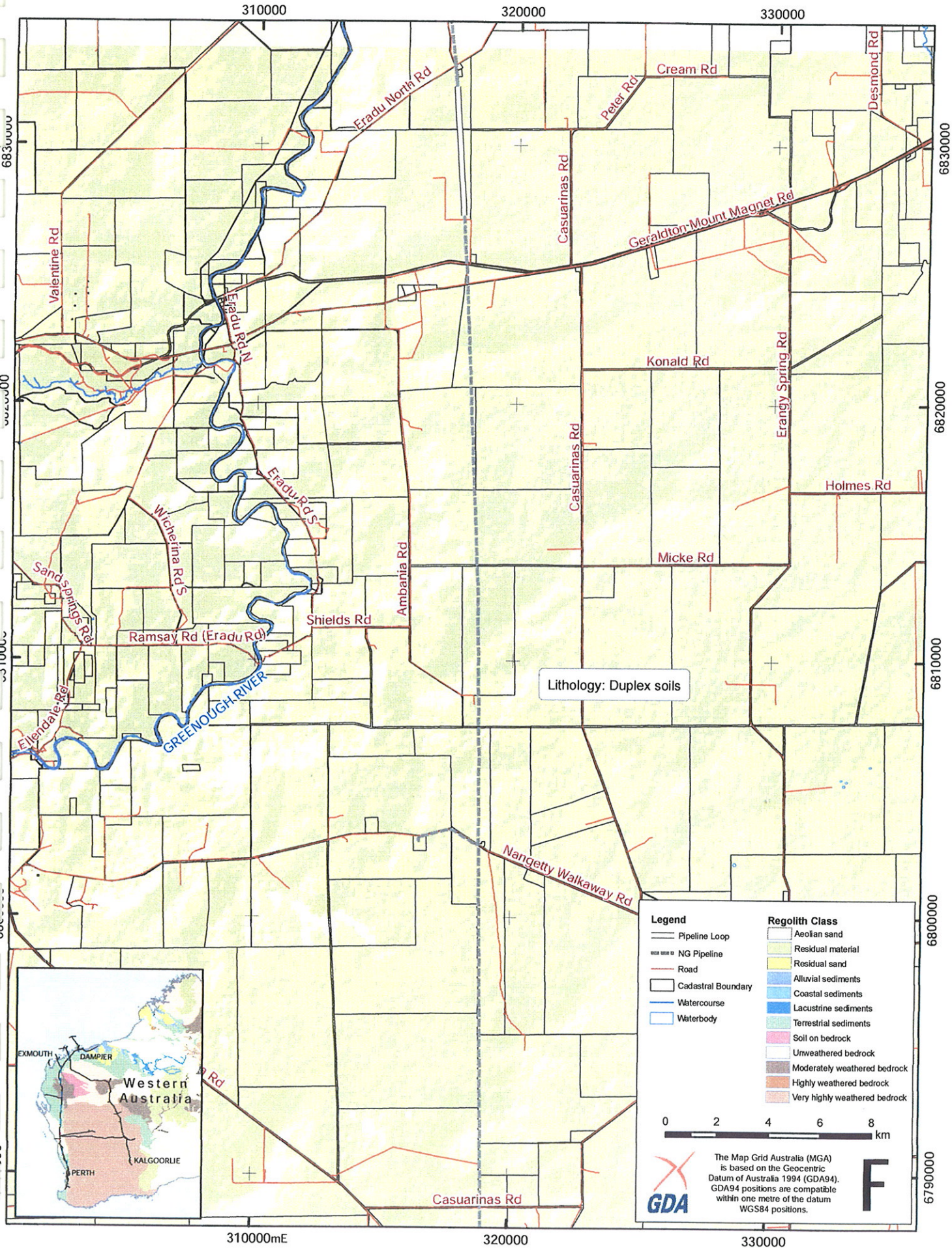
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DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 6 - REGOLITH AND LITHOLOGY

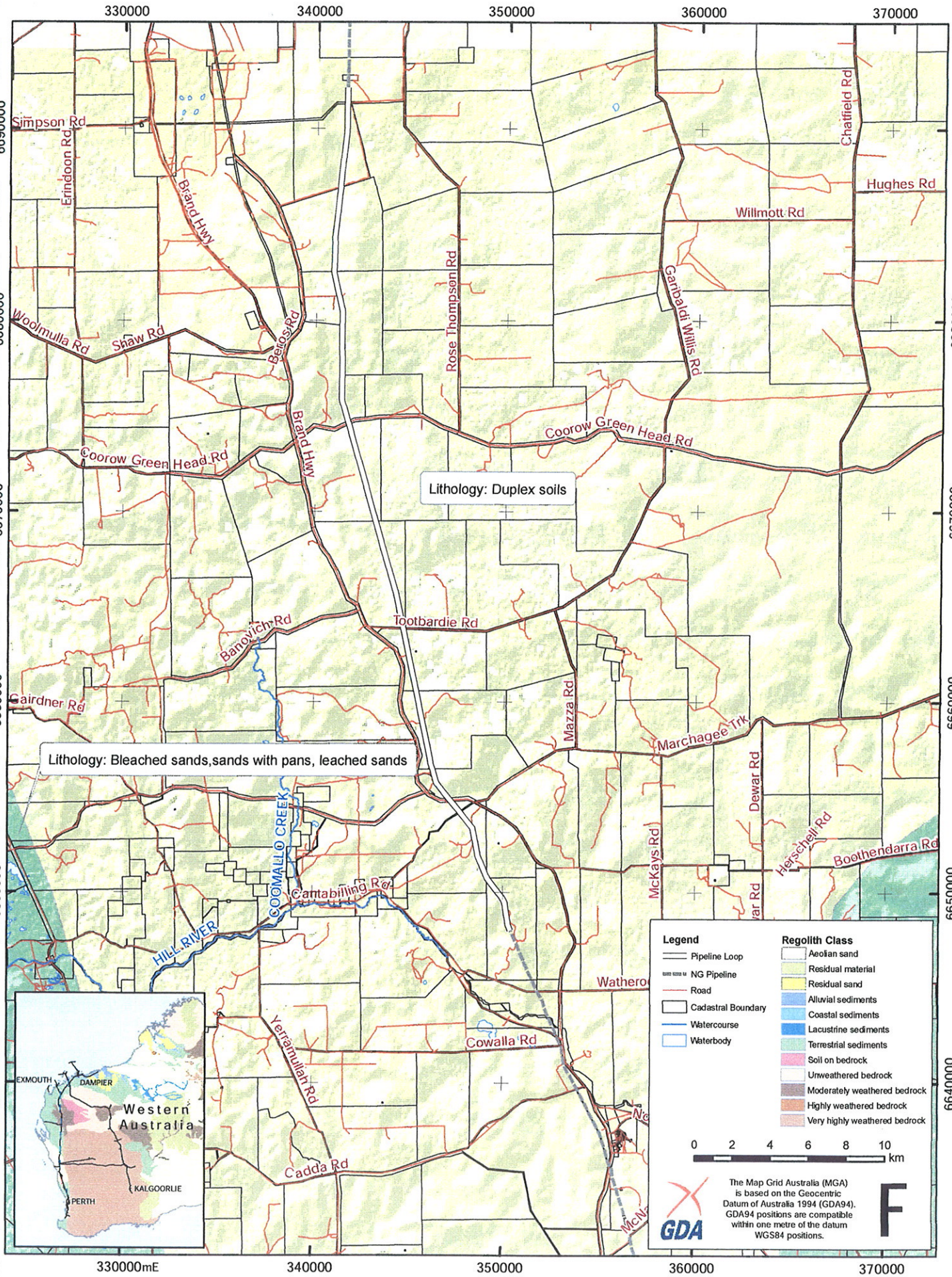
FIGURE A6



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 7 - REGOLITH AND LITHOLOGY

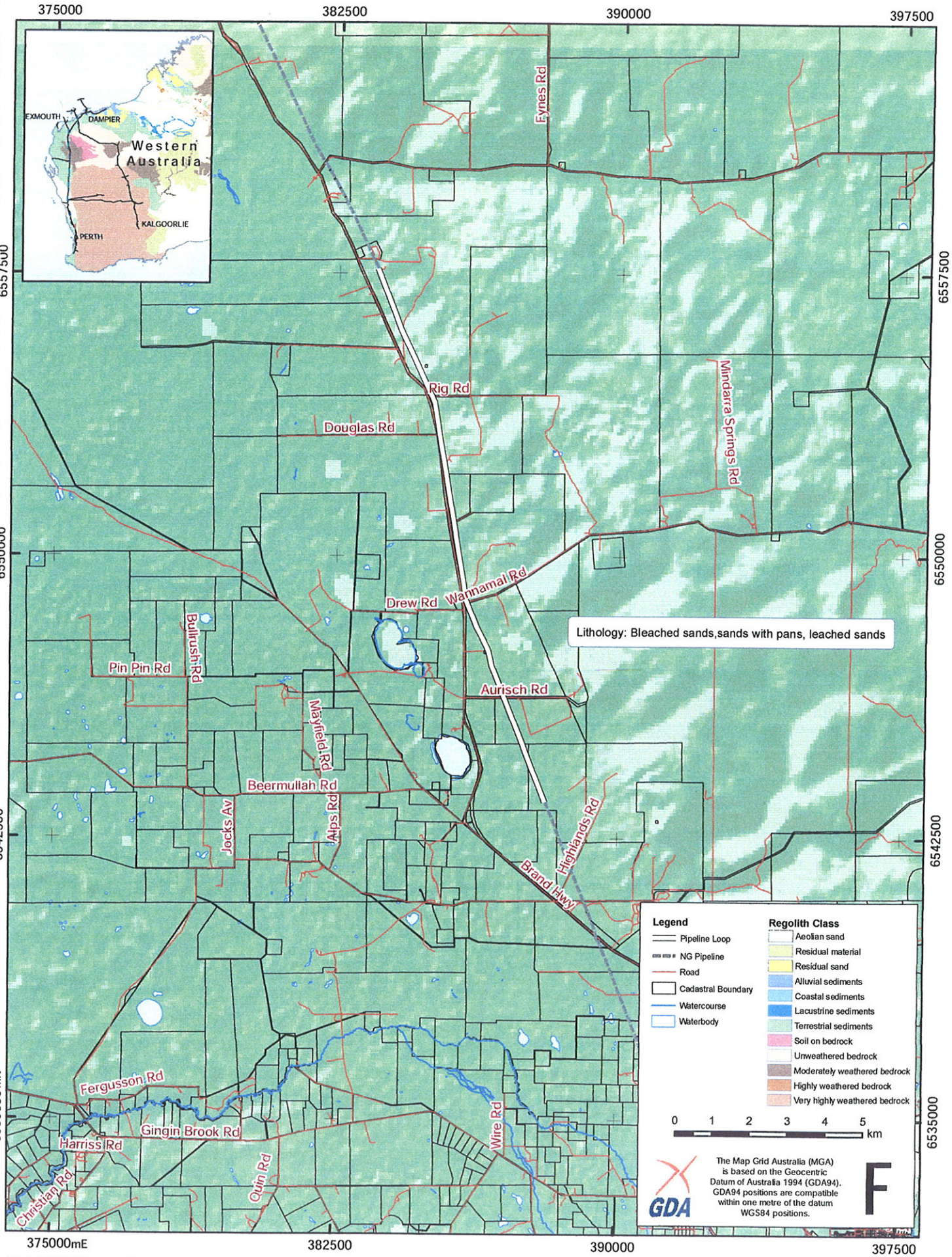
FIGURE A7



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 8 - REGOLITH AND LITHOLOGY

FIGURE A8



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 9 - REGOLITH AND LITHOLOGY

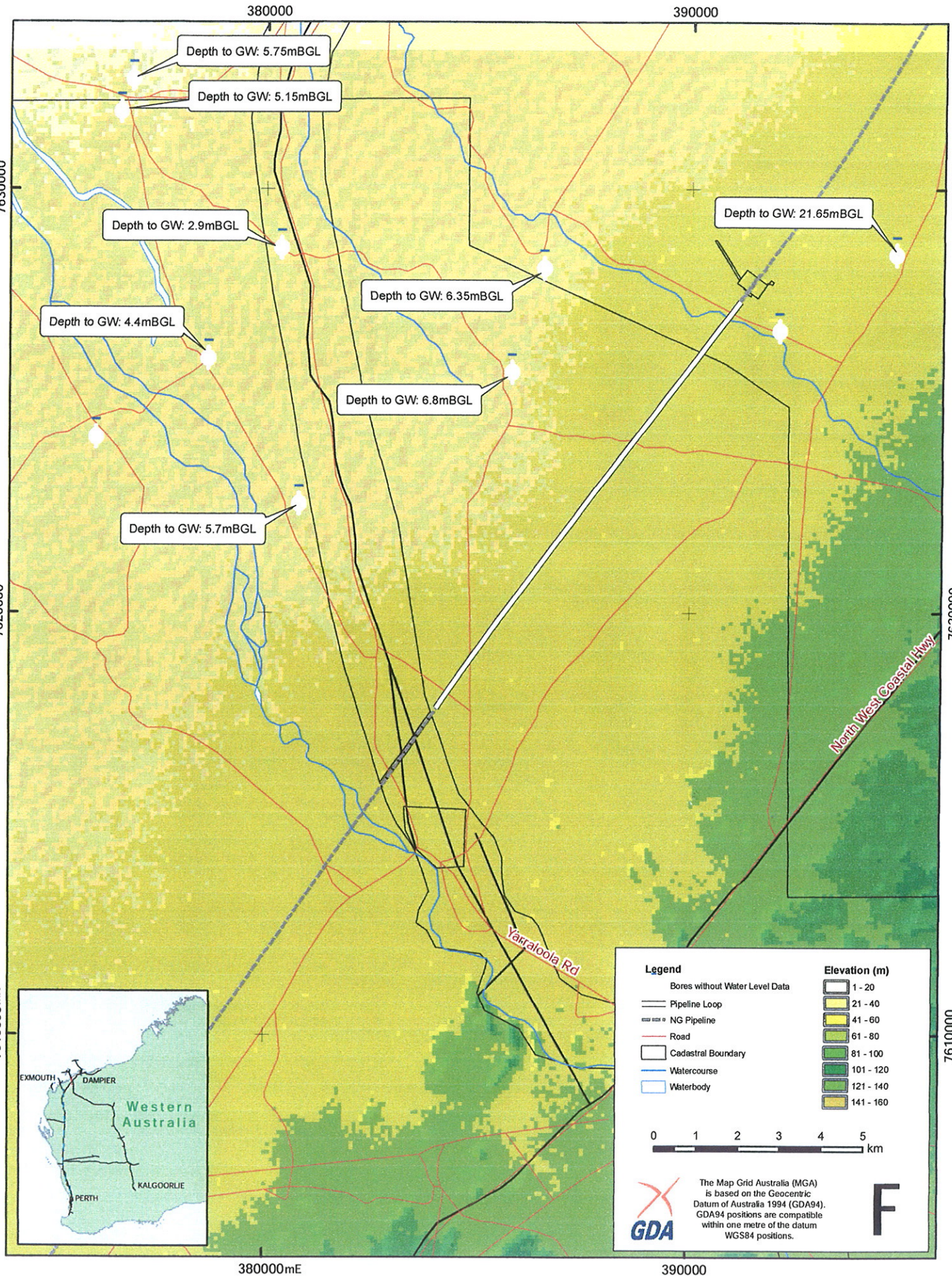
FIGURE A9

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Appendix B

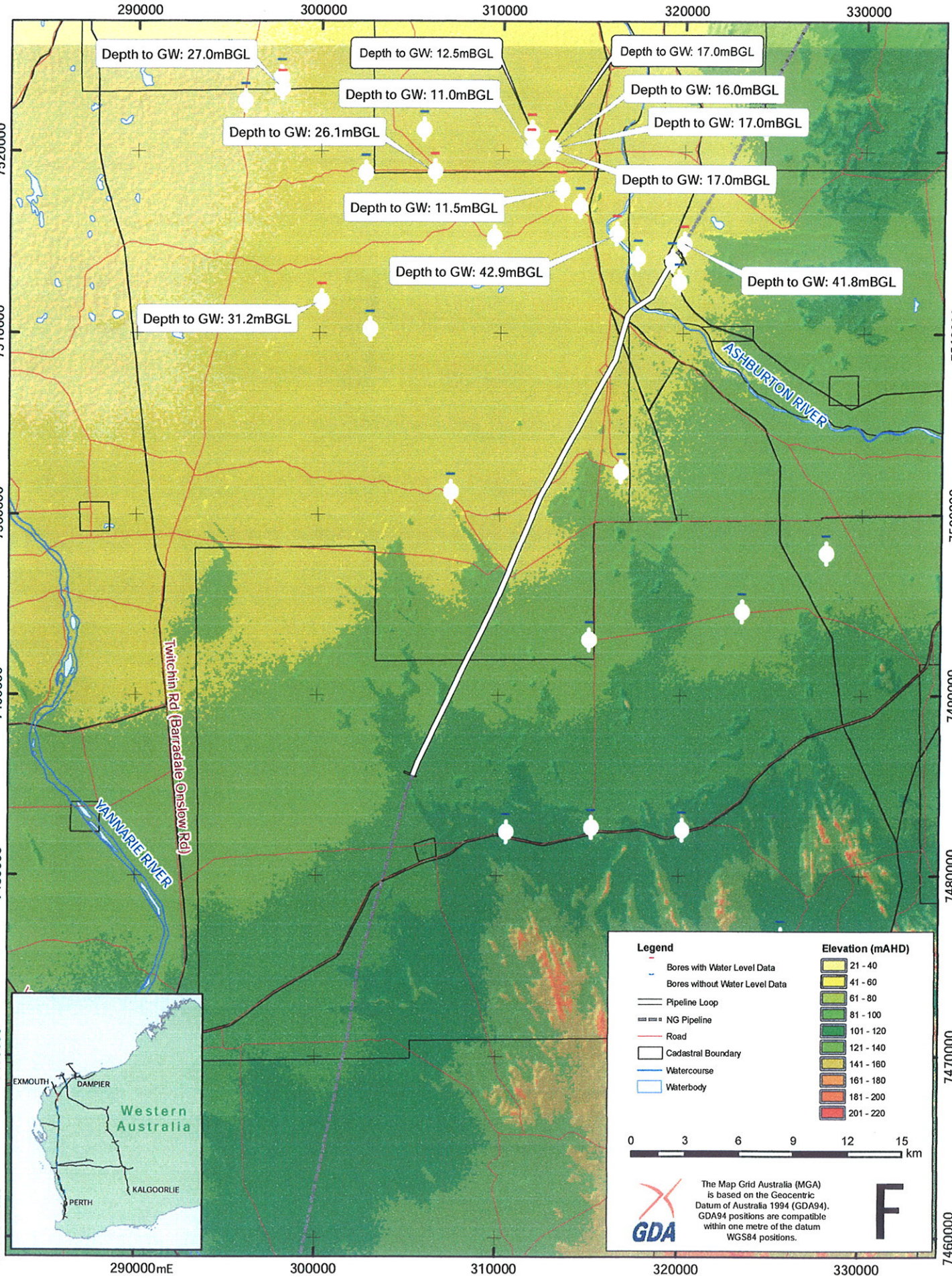
Regional Topography and Depth to Groundwater Maps



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 1 - TERRAIN AND DEPTH TO GROUNDWATER

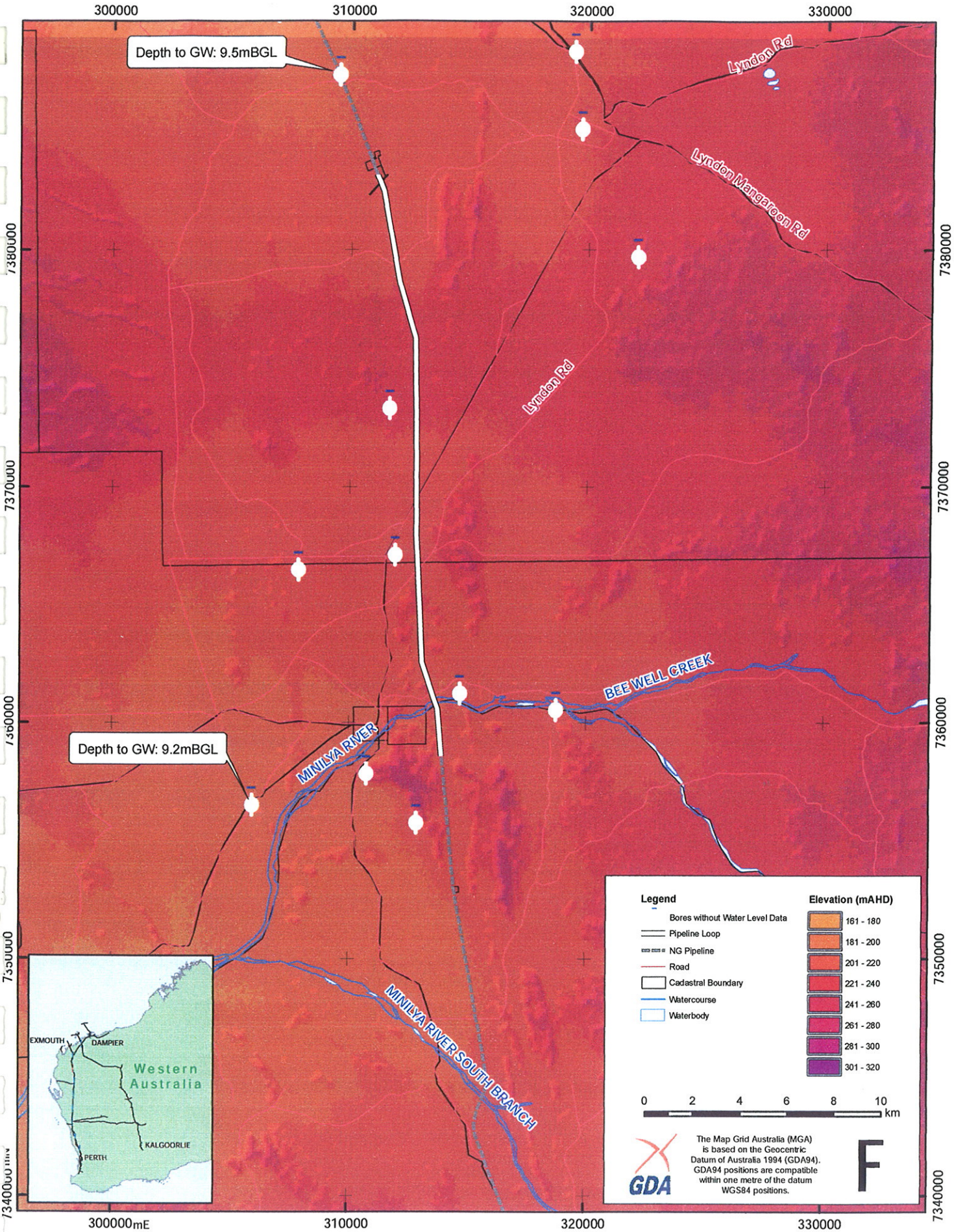
FIGURE B1



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 2 - TERRAIN AND DEPTH TO GROUNDWATER

FIGURE B2



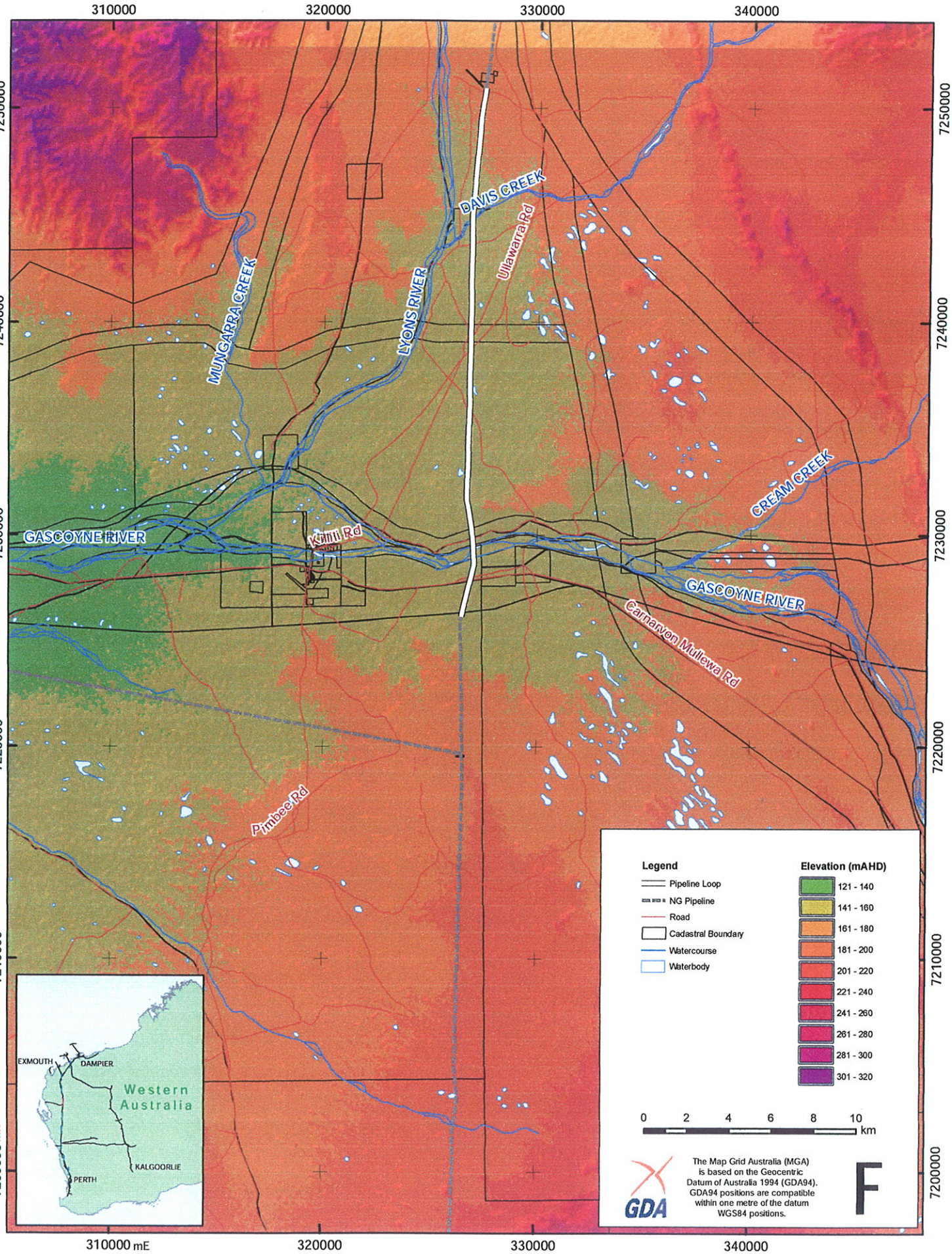
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 3 - TERRAIN AND DEPTH TO GROUNDWATER

FIGURE B3

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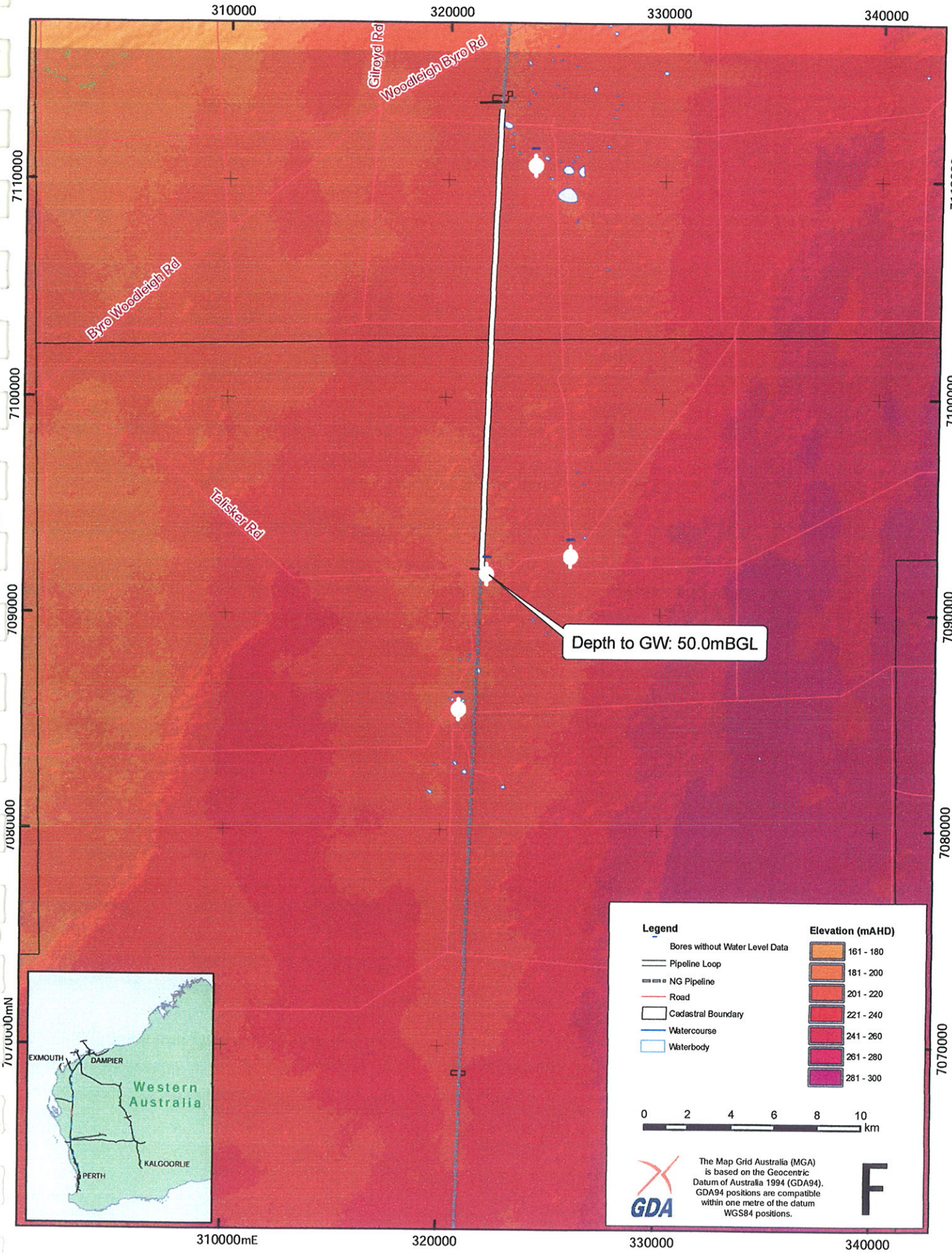
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DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 4 - TERRAIN AND DEPTH TO GROUNDWATER

FIGURE B4



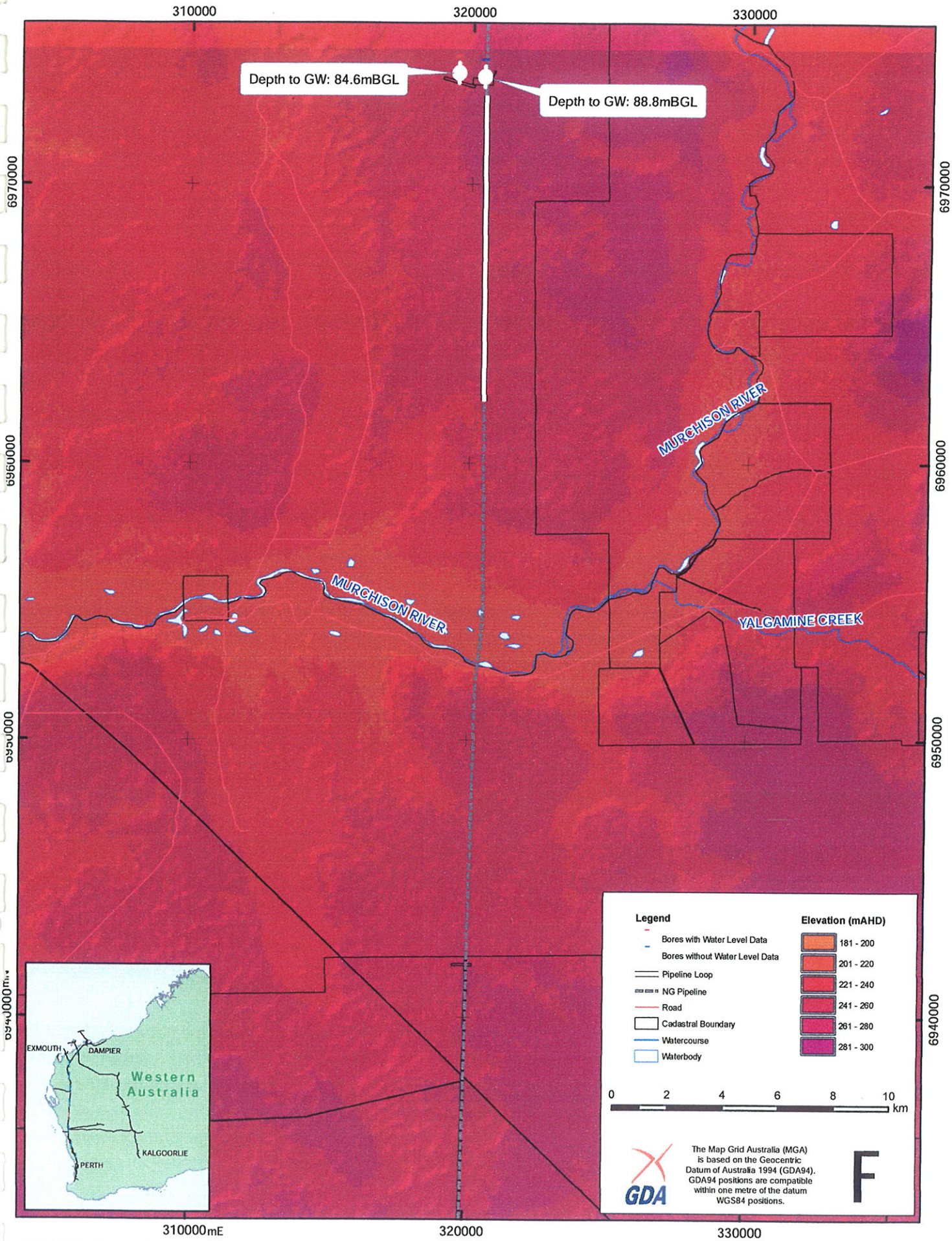
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 5 - TERRAIN AND DEPTH TO GROUNDWATER

FIGURE B5

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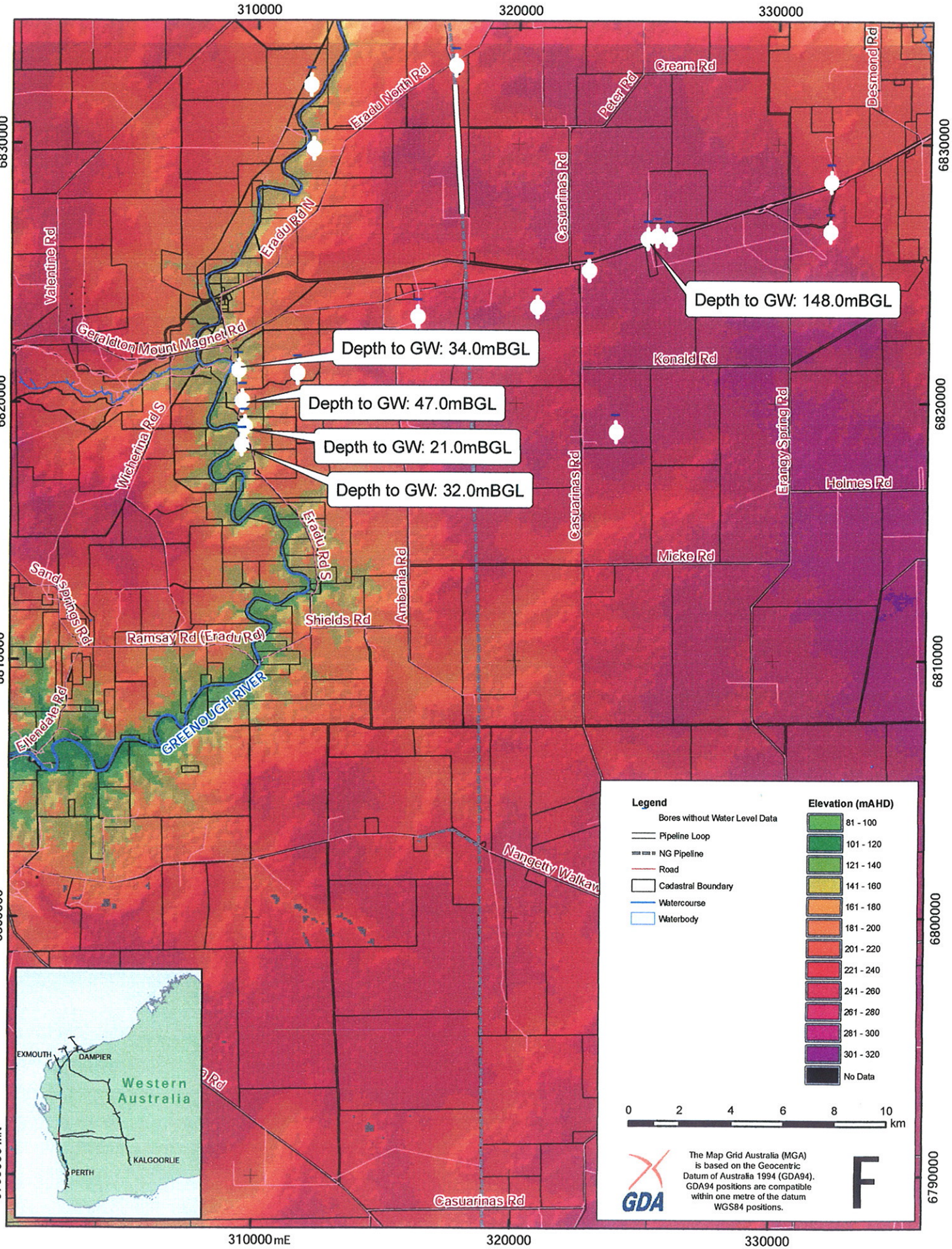
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 6 - TERRAIN AND DEPTH TO GROUNDWATER

FIGURE B6

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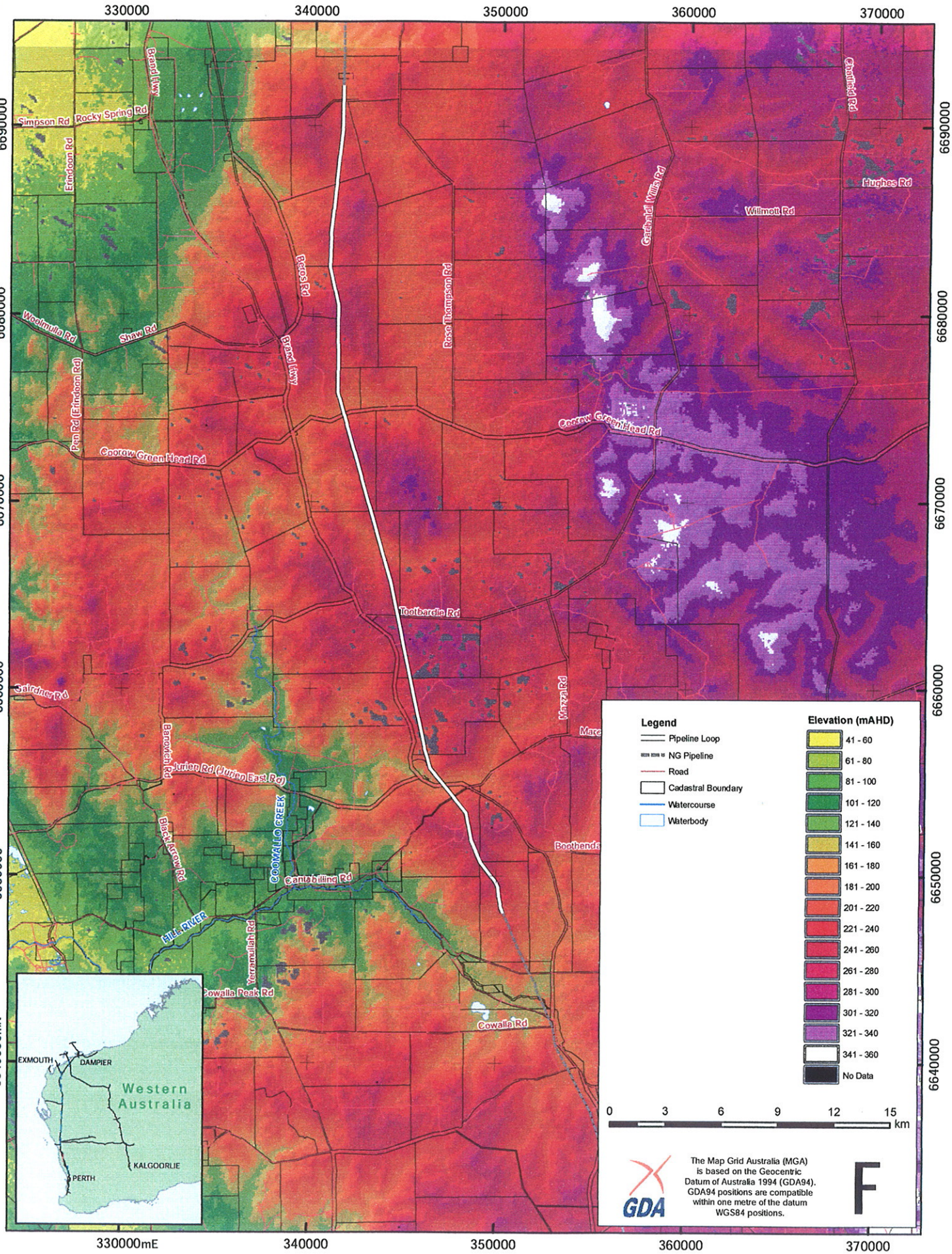
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 7 - TERRAIN AND DEPTH TO GROUNDWATER

FIGURE B7

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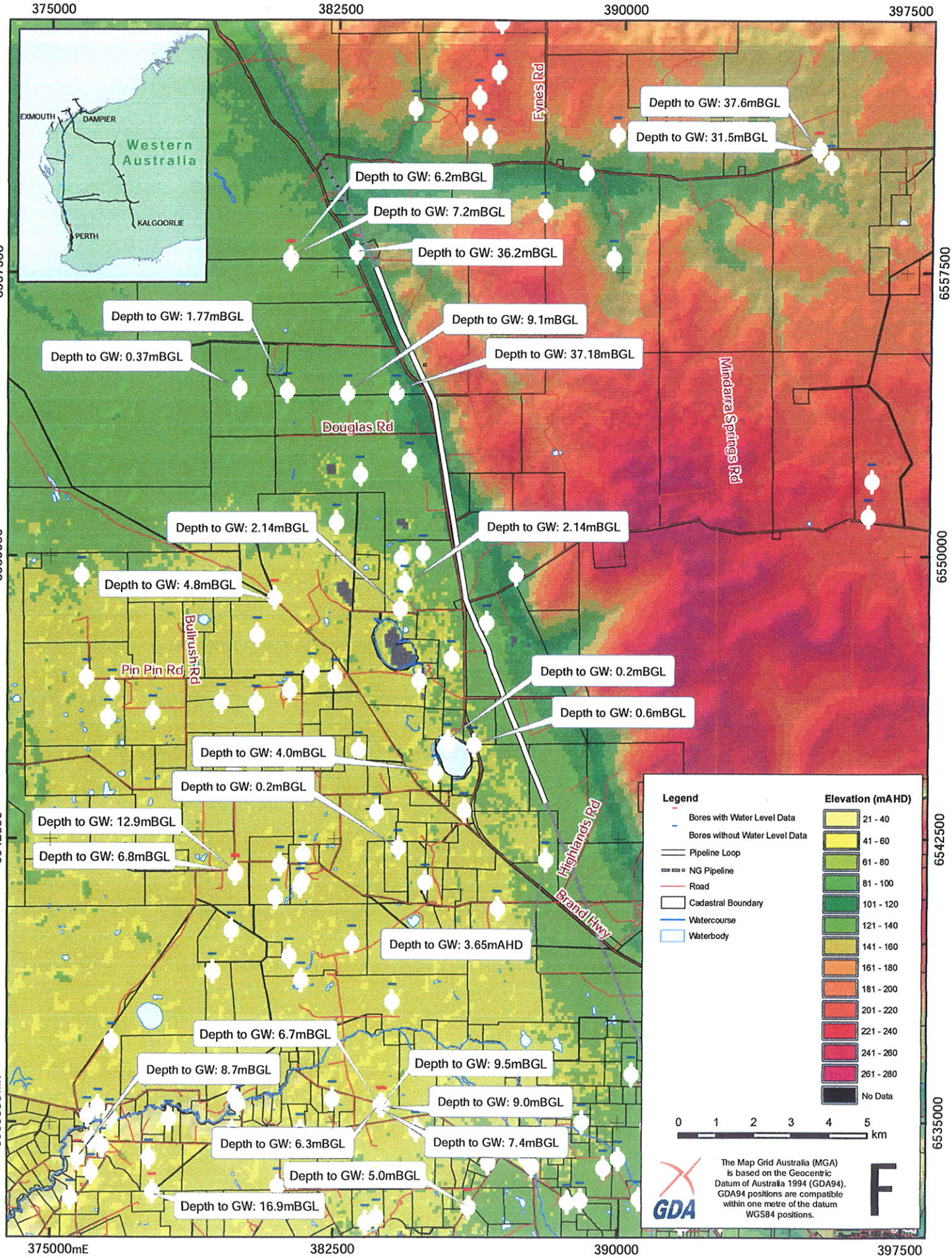
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 8 - TERRAIN AND DEPTH TO GROUNDWATER

FIGURE B8

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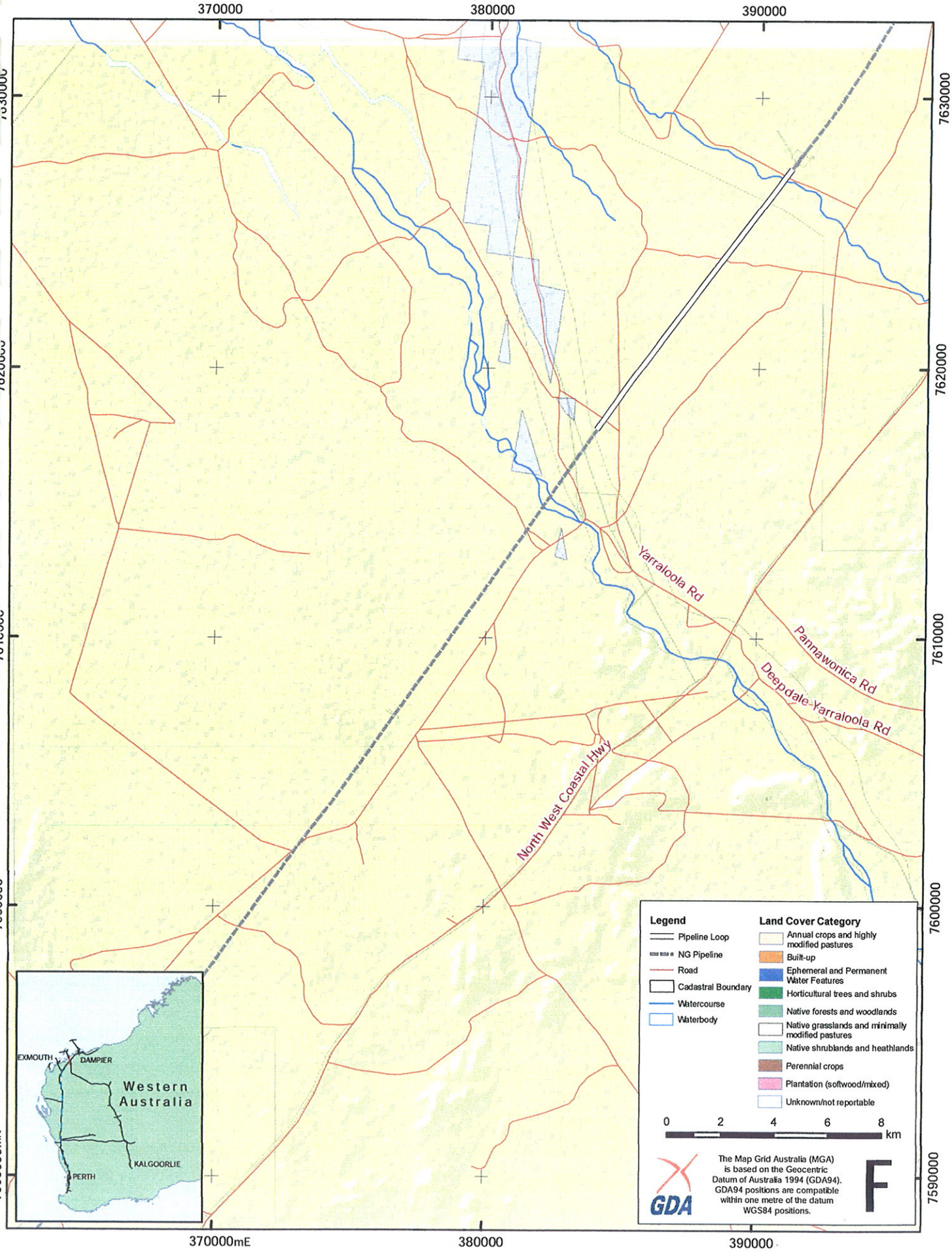
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 9 - TERRAIN AND DEPTH TO GROUNDWATER

FIGURE B9

Appendix C

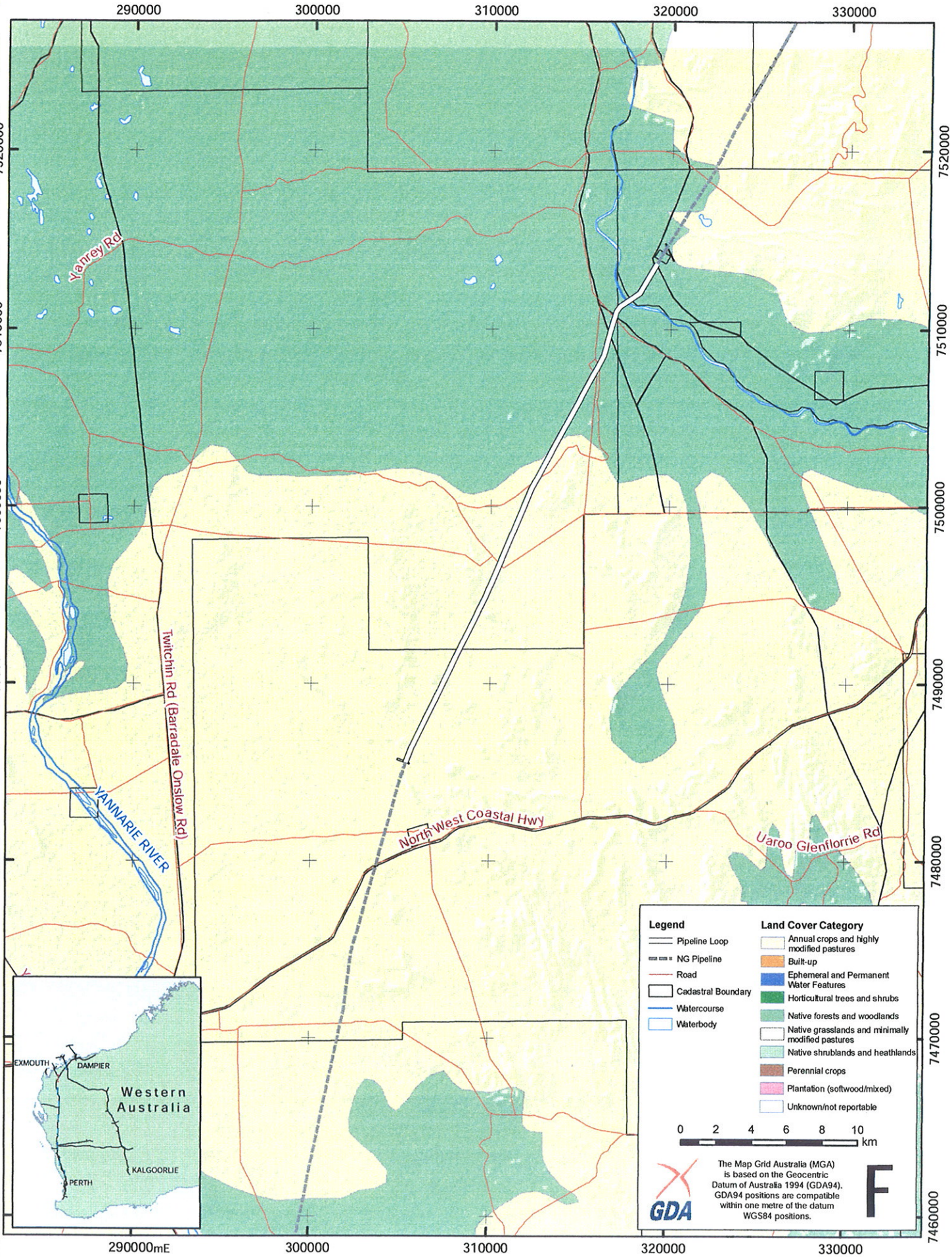
Regional Vegetation Mapping



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 1 - LAND COVER

FIGURE C1



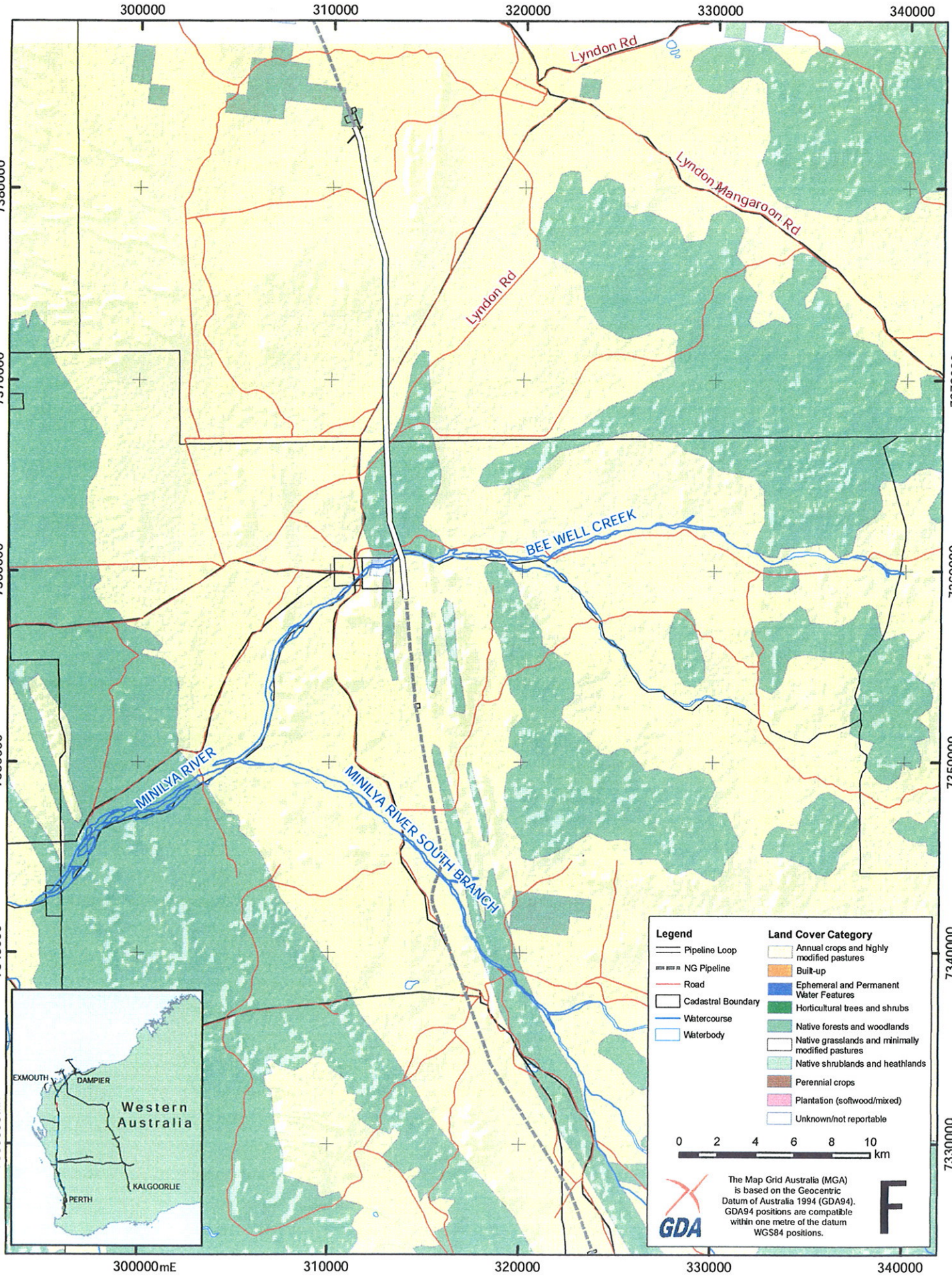
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 2 - LAND COVER

FIGURE C2

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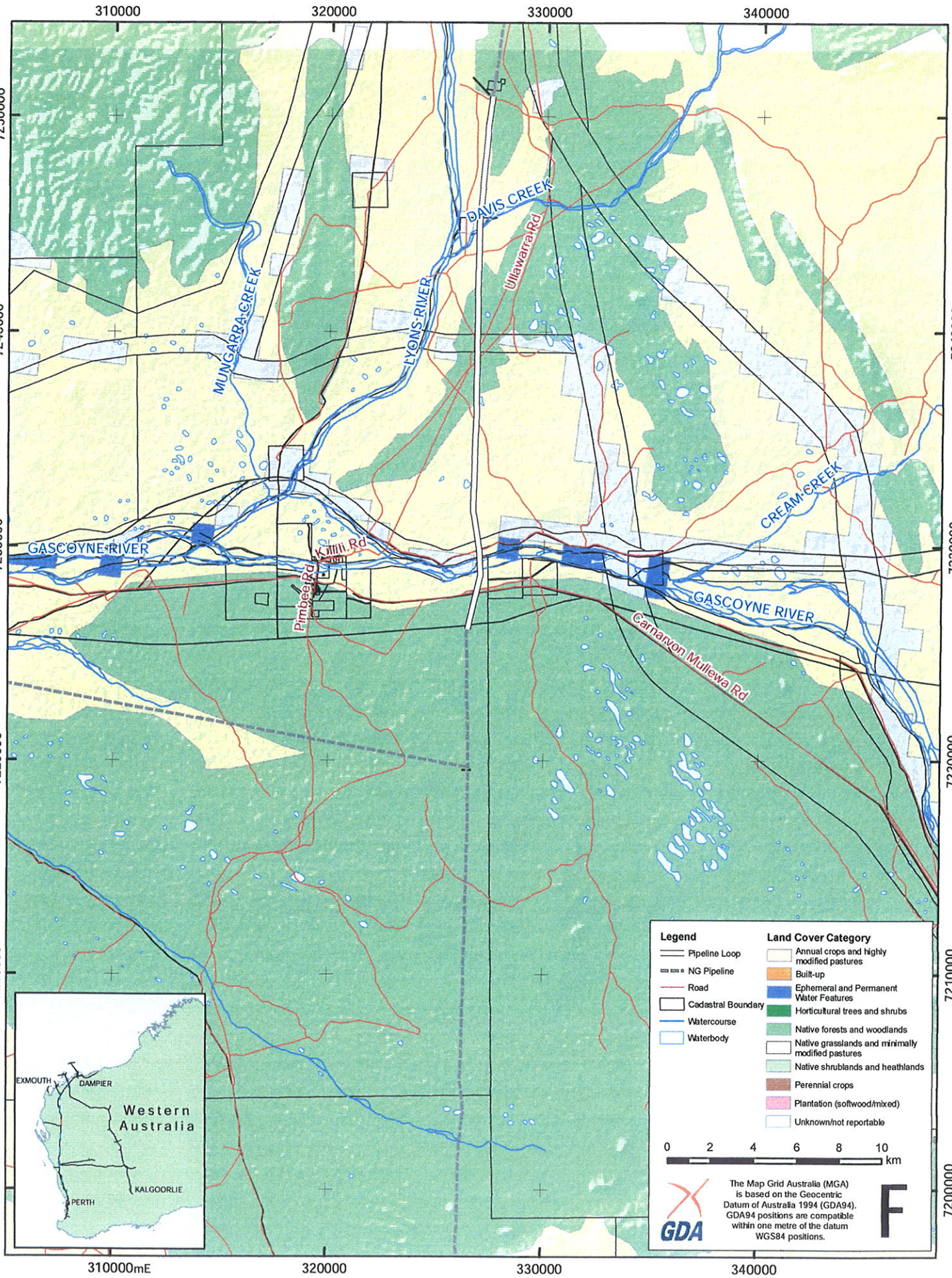
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 3 - LAND COVER

FIGURE C3

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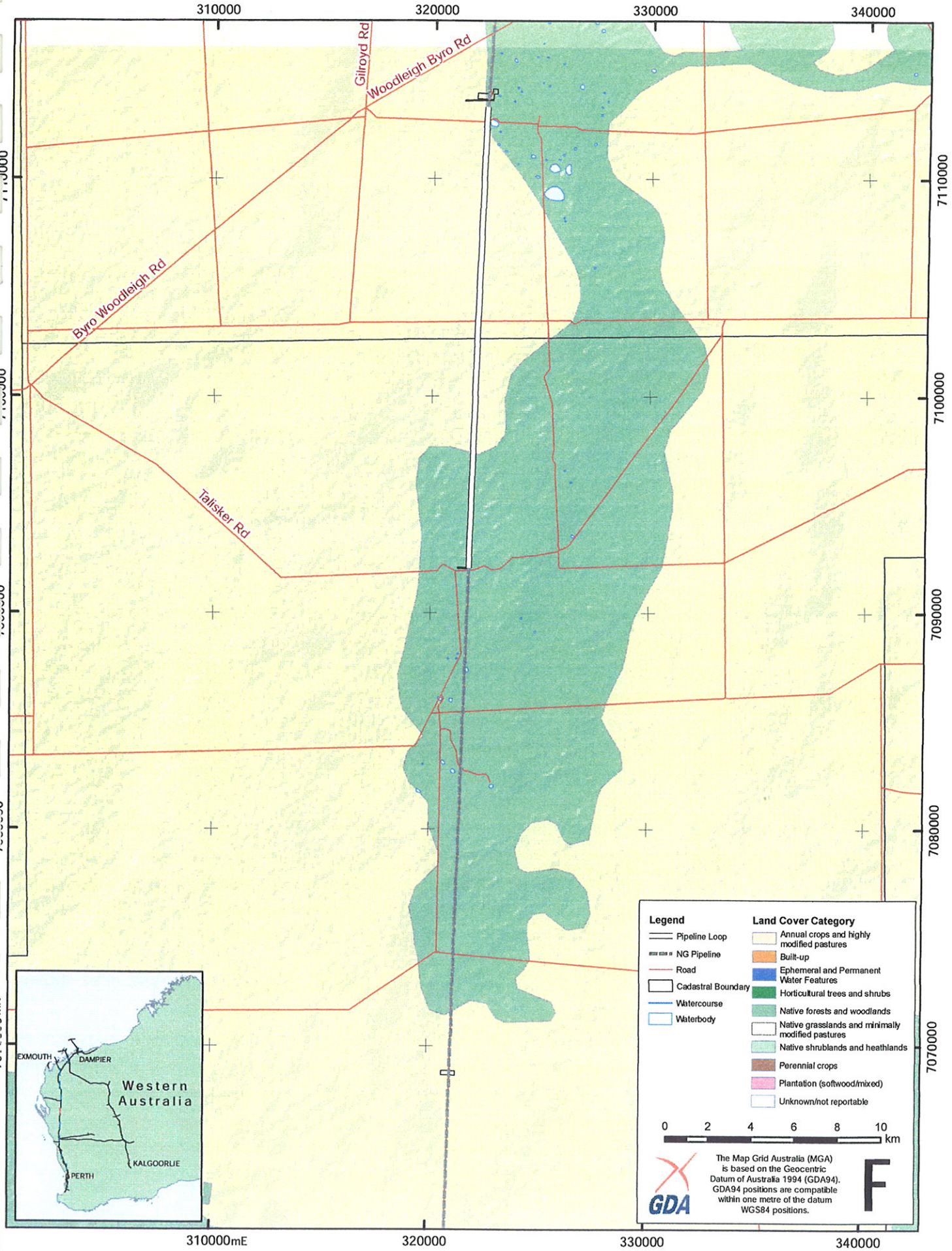
Date: 25/07/2005 • Scale 1:255 000 @ A4 • PLAN No: 5167A-C3



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 4 - LAND COVER

FIGURE C4



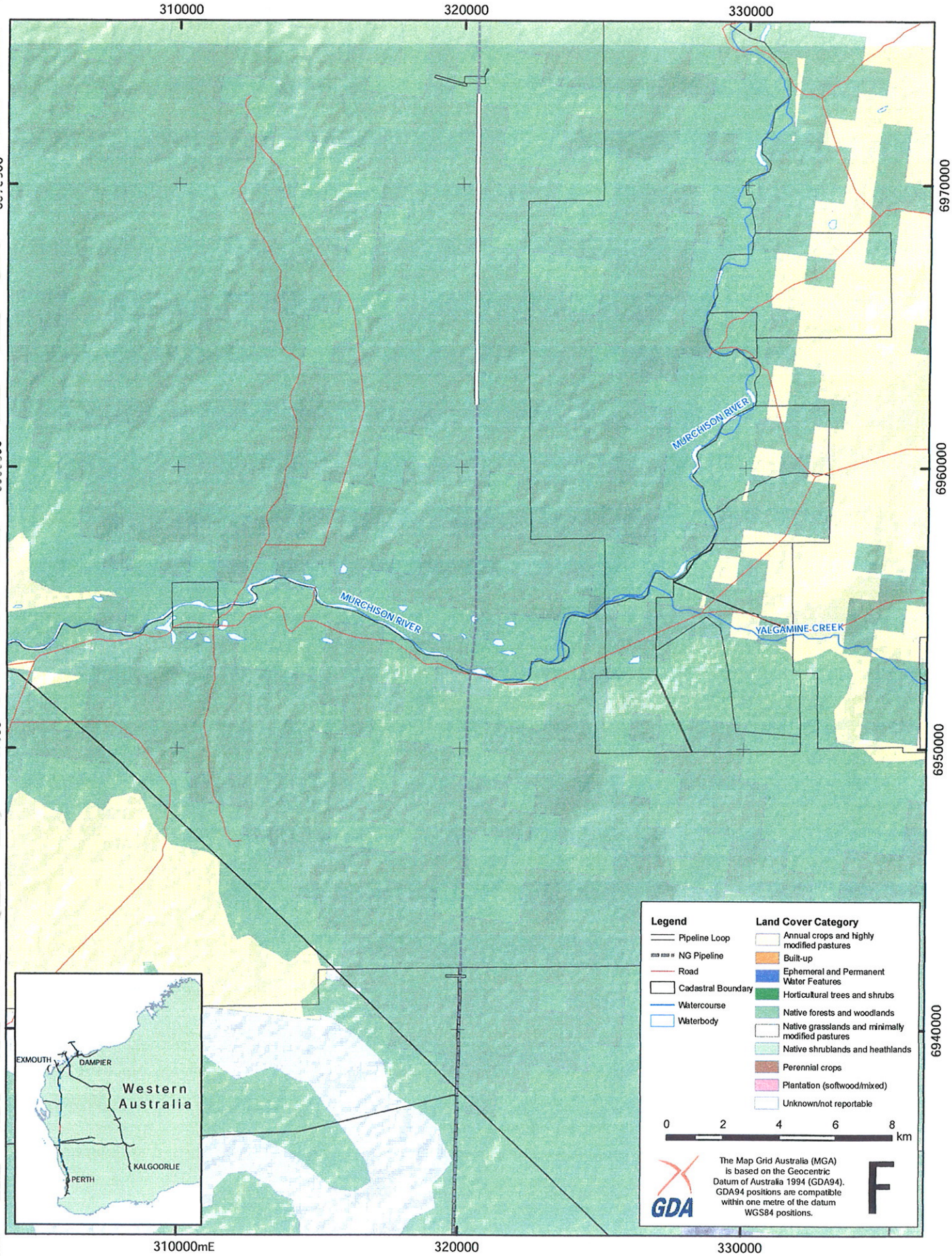
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 5 - LAND COVER

FIGURE C5

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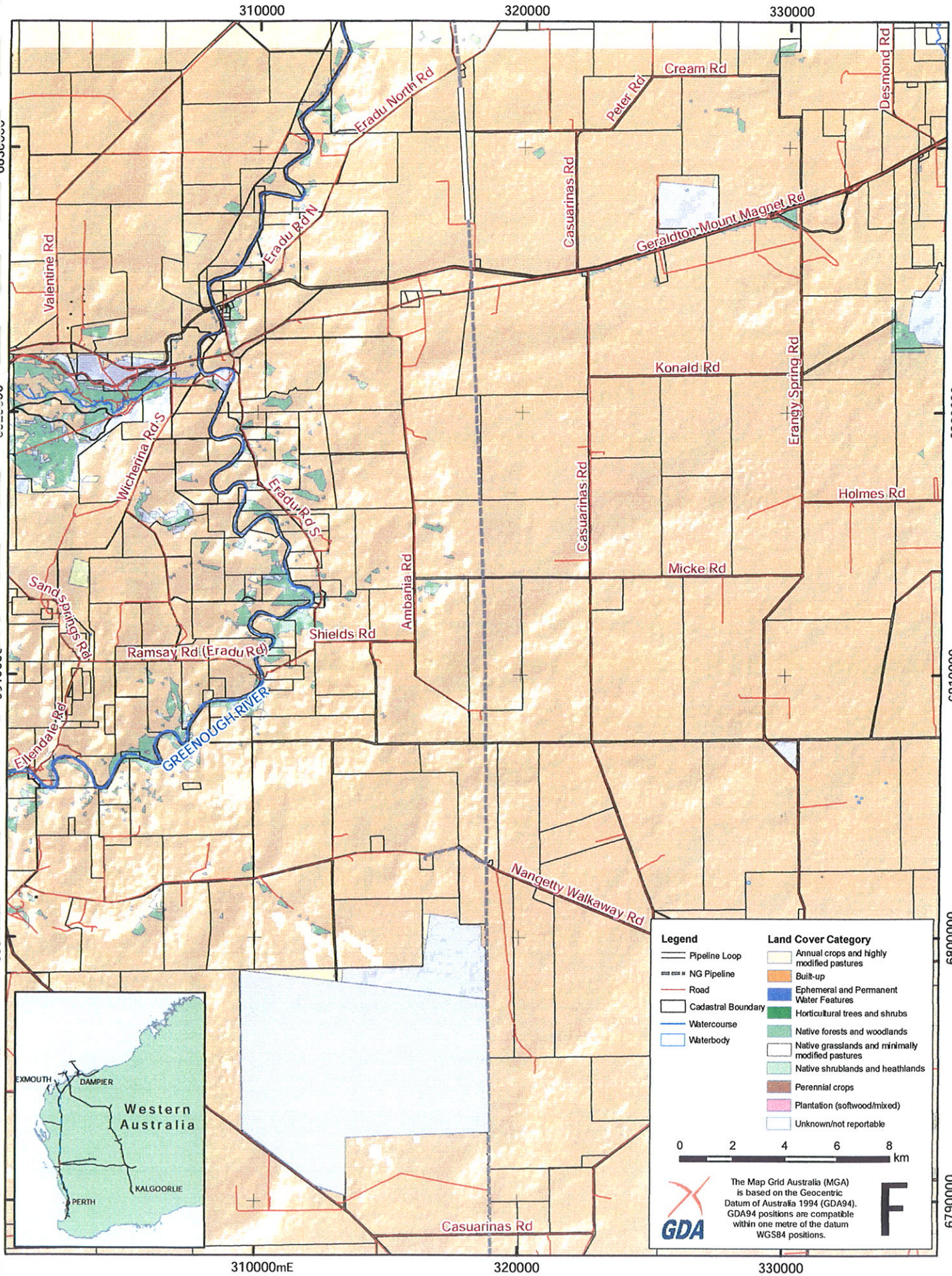
DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 6 - LAND COVER

FIGURE C6

PARSONS BRINCKERHOFF • Email: perth@pb.com.au

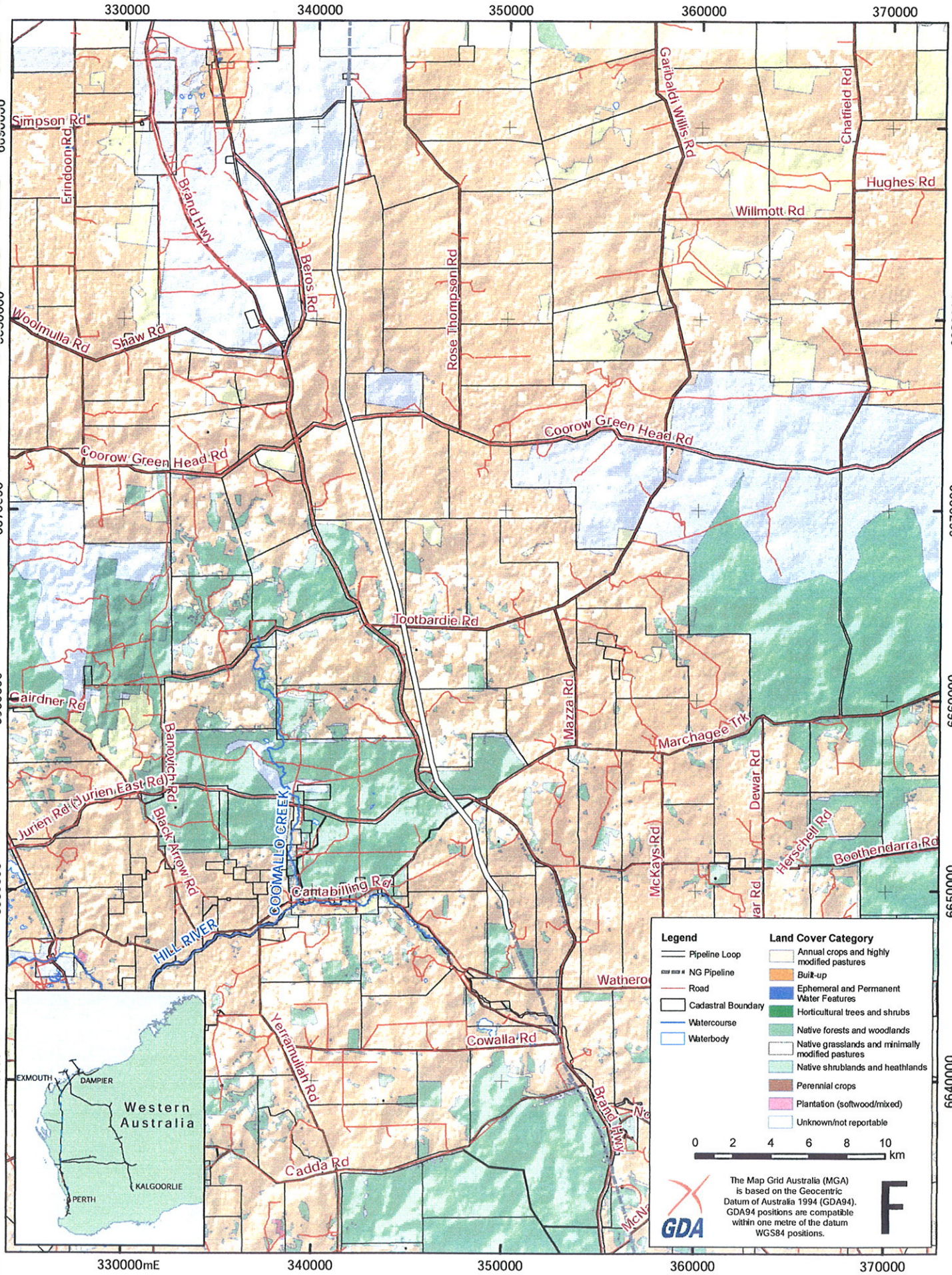
Date: 25/07/2005 • Scale 1:170 000 @ A4 • PLAN No: 5167A-C6



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 7 - LAND COVER

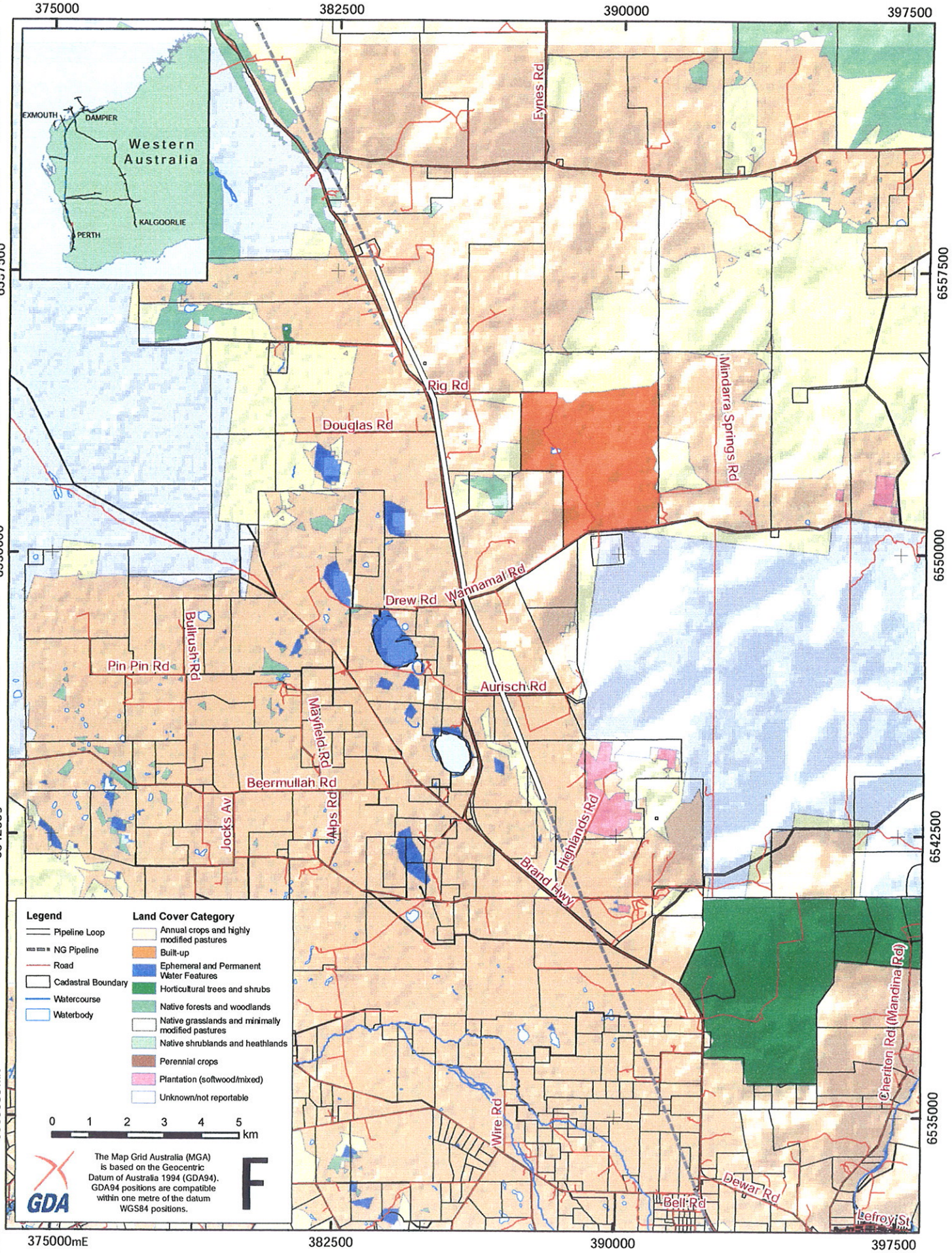
FIGURE C7



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 8 - LAND COVER

FIGURE C8



DAMPIER - BUNBURY NATURAL GAS PIPELINE; ACID SULPHATE SOIL PRELIMINARY INVESTIGATION

LOOP 9 - LAND COVER

FIGURE C9

Appendix D

Groundwater Monitor Bore Information

Table D.1: Groundwater Monitor Bore Information

WIN SITE ID	EASTING	NORTHING	ELEVATION (mAHD)	DRILLED DEPTH (mBGL)	TOPMOST SCREEN (mBGL)	BOTTOMMOST SCREEN (mBGL)	SAMPLE DATE	STATIC WATER LEVEL mBGL
LOOPING 1								
20036242	386541	7628146	NA	15.45	NA	NA	4/11/1996	6.35
20036243	394830	7628476	NA	30.48	NA	NA	15/06/1974	21.65
20036245	385807	7625708	NA	9.05	NA	NA	30/10/1996	6.80 - 7.00
20036247	380845	7634936	NA	14.63	NA	NA	15/06/1994	10.15
20036248	376863	7632586	NA	9.75	NA	NA	31/10/1996	5.25
20036249	376582	7631835	NA	10.67	NA	NA	30/10/1996	5.15
20036250	380356	7628623	NA	6.4	NA	NA	15/06/1974	2.90
20036251	378657	7626033	NA	10.67	NA	NA	30/10/1996	4.40
20036252	376019	7624181	NA	13.72	NA	NA	23/12/1964	NA
20036253	380794	7622596	NA	10.67	NA	NA	15/06/1974	5.70
LOOPING 2								
12083999	306241	7518905	NA	44	38	44	19/11/1997	26.1
12084007	297887	7523444	NA	54	35	41	19/11/1997	27
12084165	300098	7511781	NA	54	36	42	19/11/1997	31.2
20009568	328010	7497889	NA	15	NA	NA	NA	NA
20009572	323394	7494683	NA	NA	NA	NA	NA	NA
20009582	325683	7476520	NA	NA	NA	NA	NA	NA
20009589	315167	7482692	NA	NA	NA	NA	NA	NA
20009590	320142	7482563	NA	NA	NA	NA	NA	NA
20009591	310494	7482448	NA	21.4	NA	NA	NA	NA
20009606	316620	7502401	NA	NA	NA	NA	NA	NA
20009608	307293	7501287	NA	23.7	NA	NA	NA	NA
20009609	302754	7510253	NA	NA	NA	NA	NA	NA
20009610	314983	7493093	NA	11.8	NA	NA	NA	NA
20009647	324481	7521283	NA	14.3	NA	NA	NA	NA
20009663	314274	7517004	NA	NA	NA	NA	NA	NA
20009665	312765	7520141	49	110	73.6	102.3	15/11/1981	17
20009666	312765	7520135	49	110	76.3	101.3	22/11/1981	17
20009667	312765	7520135	49	110	74.3	102.4	24/11/1981	16
20009668	312765	7520135	NA	40	26.8	29.9	20/11/1981	17
20009669	313294	7517906	50	124.5	76	96	15/11/1981	11.5
20009670	311601	7521049	49	152	78	98	8/11/1981	12.5
20009671	311583	7520242	49	115	80	100	7/11/1981	11
20009672	312797	7520141	50	102	71	98.6	NA	NA
20009674	319360	7514023	NA	60.5	NA	NA	NA	NA
20009675	319736	7512842	NA	30	NA	NA	NA	NA
20009676	320007	7514939	54.73	85	10	30	11/11/1981	41.8
20009677	317460	7514155	NA	50	NA	NA	14/11/1981	NA
20009678	316289	7515507	51.69	85	30	67.5	16/12/1981	42.9
20009680	297832	7524059	NA	27.6	NA	NA	15/09/1975	25.8

Table D.1: Groundwater Monitor Bore Information

WIN SITE ID	EASTING	NORTHING	ELEVATION (mAHD)	DRILLED DEPTH (mBGL)	TOPMOST SCREEN (mBGL)	BOTTOMMOST SCREEN (mBGL)	SAMPLE DATE	STATIC WATER LEVEL mBGL
20009680	297832	7524059	NA	27.6	NA	NA	15/09/1975	25.8
20009681	302427	7518810	NA	32	NA	NA	NA	NA
20009682	305615	7521201	NA	NA	NA	NA	NA	NA
20009683	295881	7522735	NA	NA	NA	NA	NA	NA
LOOPING 3								
20009450	318725	7360554	NA	6.4	NA	NA	23/05/1978	NA
20009456	314700	7361241	NA	11.7	NA	NA	NA	NA
20009457	311929	7367122	NA	84	45	77	11/09/1981	NA
20009466	307877	7366489	NA	33	NA	NA	NA	NA
20009471	312874	7355762	NA	24.38	NA	NA	3/07/1978	NA
20009473	310764	7357845	NA	15	NA	NA	30/06/1958	NA
20009477	305945	7356509	NA	18.9	NA	NA	28/05/1978	9.2
20009483	319373	7388333	NA	7.6	NA	NA	NA	NA
20009486	309474	7387361	NA	18.7	NA	NA	NA	9.5
20009497	311670	7373320	NA	28.7	NA	NA	NA	NA
20009498	319686	7385071	NA	25	8	22	30/09/1981	NA
LOOPING 5								
20009219	325848	7092678	NA	NA	NA	NA	30/06/1963	NA
20009220	325848	7092678	NA	NA	NA	NA	30/06/1971	NA
20009222	320792	7085582	NA	97.54	NA	NA	15/05/1977	NA
20009223	321998	7091872	NA	NA	NA	NA	30/06/1965	50
20009224	321998	7091872	NA	NA	NA	NA	0/01/1900	NA
20009235	324002	7110702	NA	188	97.2	145.9	8/04/1982	NA
LOOPING 6								
20009205	319478	6973984	170.35	219	140	201.3	21/10/1981	84.6
20009207	320420	6973862	NA	207.8	165	207.8	19/11/1981	88.8
LOOPING 7								
6808	325016	6826335	NA	167.34	NA	NA	30/06/1960	148
20008533	332072	6828550	NA	10.67	NA	NA	NA	NA
20008543	332057	6826629	NA	21.34	NA	NA	NA	NA
20008544	332057	6826628	NA	30.48	NA	NA	NA	NA
20008545	332057	6826628	NA	21.34	NA	NA	NA	NA
20008806	317572	6832994	NA	204.00	NA	NA	30/06/1981	NA
20008813	312029	6832245	NA	60.50	NA	NA	30/06/1984	NA
20008817	325879	6826323	NA	153.92	NA	NA	NA	NA
20008818	325405	6826447	NA	167.34	NA	NA	30/06/1960	NA
20008819	320795	6823709	NA	143.87	NA	NA	NA	NA
20008820	323843	6818881	NA	162.46	NA	NA	30/06/1960	NA
20008821	322752	6825125	NA	183.00	NA	NA	30/06/1982	NA
20008902	309362	6821266	NA	53.04	NA	NA	30/06/1958	34
20008903	309494	6820080	NA	70.71	NA	NA	30/06/1958	47

Table D.1: Groundwater Monitor Bore Information

WIN SITE ID	EASTING	NORTHING	ELEVATION (mAHD)	DRILLED DEPTH (mBGL)	TOPMOST SCREEN (mBGL)	BOTTOMMOST SCREEN (mBGL)	SAMPLE DATE	STATIC WATER LEVEL mBGL
20008904	309609	6819070	NA	44.81	NA	NA	30/06/1958	21
20008905	309488	6818367	NA	53.65	NA	NA	30/06/1958	32
20008906	316208	6823324	NA	91.44	NA	NA	NA	NA
20008907	311599	6821149	NA	58.22	NA	NA	NA	NA
LOOPING 9								
6320	375739	6534049	32.28	23.05	8	22	8/10/2004	8.7
6325	377725	6533178	37.01	23.1	9	23	15/10/2004	16.9
6336	383799	6535448	45.533	78.3	57.3	75.3	2/05/2005	6.3 - 9.5
6337	383829	6535438	44.973	73.2	12.2	73.2	2/05/2005	5
6339	386104	6532765	56.98	4	0	4	15/10/2004	NA
6379	383815	6535442	47.28	304.2	246	252	6/04/2000	NA
6380	383765	6535457	43.45	550	434	440	2/05/2005	NA
6485	382483	6535611	NA	78.39	57.15	75.15	15/10/1979	NA
6598	381279	6557868	67.773	72	18	24	7/04/2005	7.2
6599	381268	6557839	67.766	25	17.78	24.06	7/04/2005	6.2
6604	380899	6548894	49.169	60	6	36	7/04/2005	4.8
6609	379896	6541610	44.19	54	27	39	7/04/2005	6.8
6610	379900	6541582	44.056	41	26.75	39.12	7/04/2005	12.9
20031217	395471	6560388	NA	3.66	NA	NA	NA	NA
20031223	386643	6564334	NA	100.58	NA	NA	NA	NA
20031225	384515	6561781	NA	54.86	NA	NA	NA	NA
20031227	386204	6562087	NA	53.34	NA	NA	NA	NA
20031232	389023	6560111	NA	3.66	NA	NA	NA	NA
20031233	389757	6557859	NA	3.66	NA	NA	NA	NA
20031234	389828	6561105	NA	37.8	NA	NA	30/06/1965	NA
20031235	385976	6561145	NA	15.85	NA	NA	1/11/1993	NA
20031236	386477	6561055	NA	10.97	NA	NA	NA	NA
20031239	386773	6564076	NA	109.73	NA	NA	30/06/1964	NA
20031241	385207	6564894	NA	100.58	NA	NA	NA	NA
20031242	387958	6559119	NA	3.05	NA	NA	NA	NA
20031243	385368	6565815	NA	103.63	89.76	91.28	NA	NA
20031249	383000	6558004	70.73	152	61	146.4	7/06/1981	36.2
20031264	382518	6550879	NA	20.12	NA	NA	30/06/1965	NA
20031265	384733	6546691	NA	2.44	NA	NA	NA	NA
20031266	385582	6547283	NA	2.44	NA	NA	NA	NA
20031267	387266	6549517	NA	9.14	NA	NA	NA	NA
20031268	382508	6546789	NA	4.88	NA	NA	NA	NA
20031269	381895	6546943	NA	3.96	NA	NA	NA	NA
20031270	384216	6548587	NA	18.29	NA	NA	17/04/1980	2.14
20031271	386503	6548230	NA	12.8	NA	NA	NA	NA
20031272	384231	6549938	NA	9.75	NA	NA	17/04/1980	NA

Table D.1: Groundwater Monitor Bore Information

WIN SITE ID	EASTING	NORTHING	ELEVATION (mAHD)	DRILLED DEPTH (mBGL)	TOPMOST SCREEN (mBGL)	BOTTOMMOST SCREEN (mBGL)	SAMPLE DATE	STATIC WATER LEVEL mBGL
20031273	384199	6542257	NA	2.13	NA	NA	NA	0.2
20031274	384199	6542257	NA	2.13	NA	NA	NA	NA
20031275	383618	6543217	NA	2.13	NA	NA	NA	NA
20031276	386193	6544993	NA	91.44	NA	NA	NA	0.6
20031277	385505	6545078	NA	4.57	NA	NA	NA	0.2
20031278	385181	6544251	NA	8.23	NA	NA	30/06/1960	4
20031279	381314	6546440	NA	6.4	NA	NA	NA	NA
20031280	381686	6542097	NA	2.74	NA	NA	NA	NA
20031284	384816	6550072	NA	2.4	NA	NA	NA	NA
20031285	384076	6554305	NA	251	107.56	195.35	11/07/1985	37.18
20031286	382784	6554300	NA	251	63	148.85	3/08/1985	9.1
20031287	381207	6554371	NA	245	53.9	211.47	18/08/1985	1.77
20031288	383139	6544849	NA	41.45	NA	NA	13/03/1997	0.37
20031289	385939	6543249	NA	37	30	36	15/02/1997	NA
20031290	383139	6544849	NA	49	24	48	27/03/1997	NA
20031291	383139	6552149	NA	43	27	39	21/04/1997	NA
20031309	394123	6534838	NA	9.14	NA	NA	30/06/1963	NA
20031310	394118	6534515	NA	2.44	NA	NA	NA	NA
20031312	395099	6539868	NA	25.91	17.68	22.56	30/06/1969	NA
20031315	393257	6537919	NA	33.53	NA	NA	NA	NA
20031325	396238	6536208	NA	8.53	NA	NA	30/06/1957	NA
20031348	396282	6534035	NA	46	40	46	27/08/1993	NA
20031361	391577	6533111	NA	3.66	NA	NA	30/06/1912	NA
20031364	390368	6536271	NA	48.77	NA	NA	30/06/1970	NA
20031365	391290	6532772	NA	6.1	NA	NA	30/06/1956	NA
20031366	391088	6532680	NA	3.66	NA	NA	NA	NA
20031367	386627	6533936	NA	670.56	NA	NA	30/06/1967	NA
20031368	391560	6533111	NA	28.35	NA	NA	30/06/1969	NA
20031369	392223	6535188	NA	30.48	NA	NA	30/06/1961	NA
20031370	390808	6534885	NA	7.62	NA	NA	NA	NA
20031371	390015	6534037	NA	14.33	NA	NA	30/06/1957	NA
20031372	389026	6532954	NA	3.05	NA	NA	30/06/1953	NA
20031373	391065	6533190	NA	3.66	NA	NA	30/06/1948	NA
20031374	391042	6533057	NA	4.88	NA	NA	30/06/1950	NA
20031375	389062	6535006	NA	3.66	NA	NA	30/06/1907	NA
20031378	387761	6533855	NA	24.99	NA	NA	NA	NA
20031379	383662	6532488	NA	11.58	NA	NA	30/06/1961	NA
20031381	392221	6533068	NA	6.1	NA	NA	NA	NA
20031382	392197	6534342	NA	24.99	NA	NA	30/06/1969	NA
20031383	388683	6532897	NA	4.88	NA	NA	NA	NA
20031384	384714	6534799	NA	7.32	NA	NA	30/06/1953	NA

Table D.1: Groundwater Monitor Bore Information

WIN SITE ID	EASTING	NORTHING	ELEVATION (mAHD)	DRILLED DEPTH (mBGL)	TOPMOST SCREEN (mBGL)	BOTTOMMOST SCREEN (mBGL)	SAMPLE DATE	STATIC WATER LEVEL mBGL
20031389	392404	6533628	NA	12.19	NA	NA	30/06/1971	NA
20031390	392810	6534238	NA	18.59	NA	NA	NA	NA
20031391	392518	6537078	NA	6.4	NA	NA	30/06/1970	NA
20031394	386840	6540650	NA	9.14	NA	NA	30/06/1971	NA
20031395	392215	6535913	NA	25.6	NA	NA	30/06/1972	NA
20031396	381668	6541390	NA	3.05	NA	NA	NA	NA
20031397	392852	6534298	NA	2.13	NA	NA	NA	NA
20031398	392826	6534600	NA	6.1	NA	NA	NA	NA
20031399	384927	6541338	NA	3.66	NA	NA	NA	NA
20031402	382985	6539729	NA	3.05	NA	NA	NA	NA
20031403	381333	6539388	NA	4.88	NA	NA	NA	NA
20031404	381645	6538746	NA	4.88	NA	NA	NA	NA
20031405	384067	6538180	NA	3.66	NA	NA	NA	NA
20031407	391234	6536222	NA	3.05	NA	NA	NA	NA
20031408	392654	6535994	NA	2.74	NA	NA	30/06/1963	NA
20031410	392469	6538151	NA	24.69	NA	NA	30/06/1959	NA
20031411	390564	6532983	NA	3.66	NA	NA	NA	NA
20031412	389635	6533800	NA	2.74	NA	NA	NA	NA
20031413	392242	6532796	NA	4.57	NA	NA	NA	NA
20031414	392858	6532729	NA	8.23	NA	NA	NA	NA
20031415	392534	6533972	NA	15.24	NA	NA	30/06/1962	NA
20031416	392404	6534140	NA	2.44	NA	NA	NA	NA
20031424	381608	6541249	NA	4.2	NA	NA	NA	NA
20031427	392520	6537255	NA	51.81	21.33	44.19	15/04/1983	NA
20031428	392521	6537255	NA	39.47	16.76	35.02	15/10/1983	NA
20031430	392521	6537255	NA	9.14	NA	NA	NA	NA
20031432	388088	6541950	NA	146	40	95.5	17/01/1989	NA
20031433	387616	6534061	NA	40	20	40	27/01/1986	NA
20031434	383374	6532348	NA	136	81	131	29/09/1988	NA
20031436	391686	6532351	NA	42	20	32	16/08/1989	NA
20031438	392760	6532445	NA	27.1	23.5	27.1	1/06/1990	NA
20031440	391832	6532457	NA	42	20	32	16/08/1989	NA
20031442	392596	6533890	NA	42.67	34.75	41.15	15/12/1990	NA
20031449	381639	6534749	NA	22.2	19.2	22.2	21/03/1998	NA
20031540	381078	6541816	NA	19.51	13.16	19.51	30/06/1970	NA
20031541	379987	6535493	NA	4.88	NA	NA	30/06/1948	NA
20031542	379887	6535680	NA	3.81	NA	NA	NA	NA
20031543	379834	6534751	NA	6.1	NA	NA	NA	NA
20031545	376273	6535405	NA	3.66	NA	NA	NA	NA
20031546	376636	6537136	NA	1.22	NA	NA	30/06/1962	NA
20031554	381043	6533321	NA	2.74	NA	NA	NA	NA

Table D.1: Groundwater Monitor Bore Information

WIN SITE ID	EASTING	NORTHING	ELEVATION (mAHD)	DRILLED DEPTH (mBGL)	TOPMOST SCREEN (mBGL)	BOTTOMMOST SCREEN (mBGL)	SAMPLE DATE	STATIC WATER LEVEL mBGL
20031557	379308	6538991	NA	12.8	NA	NA	30/06/1969	NA
20031559	379809	6540070	NA	11.28	NA	NA	NA	NA
20031566	380962	6540947	NA	3.05	NA	NA	NA	NA
20031567	377630	6534077	NA	9.14	NA	NA	30/06/1962	NA
20031568	376603	6535123	NA	3.66	NA	NA	30/06/1962	NA
20031569	376109	6534542	NA	4.72	NA	NA	30/06/1957	NA
20031572	375995	6535180	NA	15.39	13.72	15.39	30/06/1976	NA
20031582	376097	6533684	NA	33.52	28.65	33.52	15/05/1979	NA
20031583	376384	6534373	NA	21.33	15.24	21.33	30/06/1982	NA
20031586	378168	6535096	NA	40.8	33.25	39.5	19/10/1993	NA
20031955	375539	6560249	NA	54	42	54	28/02/1997	NA
20031992	380454	6547901	NA	2.44	NA	NA	NA	NA
20031993	377707	6545827	NA	10	NA	NA	NA	NA
20031994	376636	6546510	NA	5.1	NA	NA	1/08/1980	NA
20031995	375954	6546784	NA	4.88	NA	NA	NA	NA
20031996	376526	6545722	NA	6.1	NA	NA	15/10/1980	NA
20031997	380430	6546097	NA	9.45	NA	NA	30/06/1961	NA
20031998	379518	6546123	NA	10.06	NA	NA	30/06/1961	NA
20031999	379841	6544312	NA	11.28	NA	NA	30/06/1961	NA
20032005	375815	6549490	NA	4.5	NA	NA	NA	NA
20032011	379939	6554444	NA	252	47.8	144.46	17/09/1985	NA
20084351	384431	6552516	NA	71	58	70	19/05/1999	NA
20084354	386709	6562754	NA	42	27	39	23/08/1999	NA
20084477	395175	6560737	113.32	426	414	420	8/04/2005	37.6
20084478	395155	6560717	119.45	95.7	83.7	89.7	8/04/2005	31.5
23000200	383794	6535450	46.68	188.31	181	185	2/05/2005	NA

Appendix 3: Geomorphic Wetlands

Figures 1 & 2: Aerial Photos and Geomorphic Wetland Locations

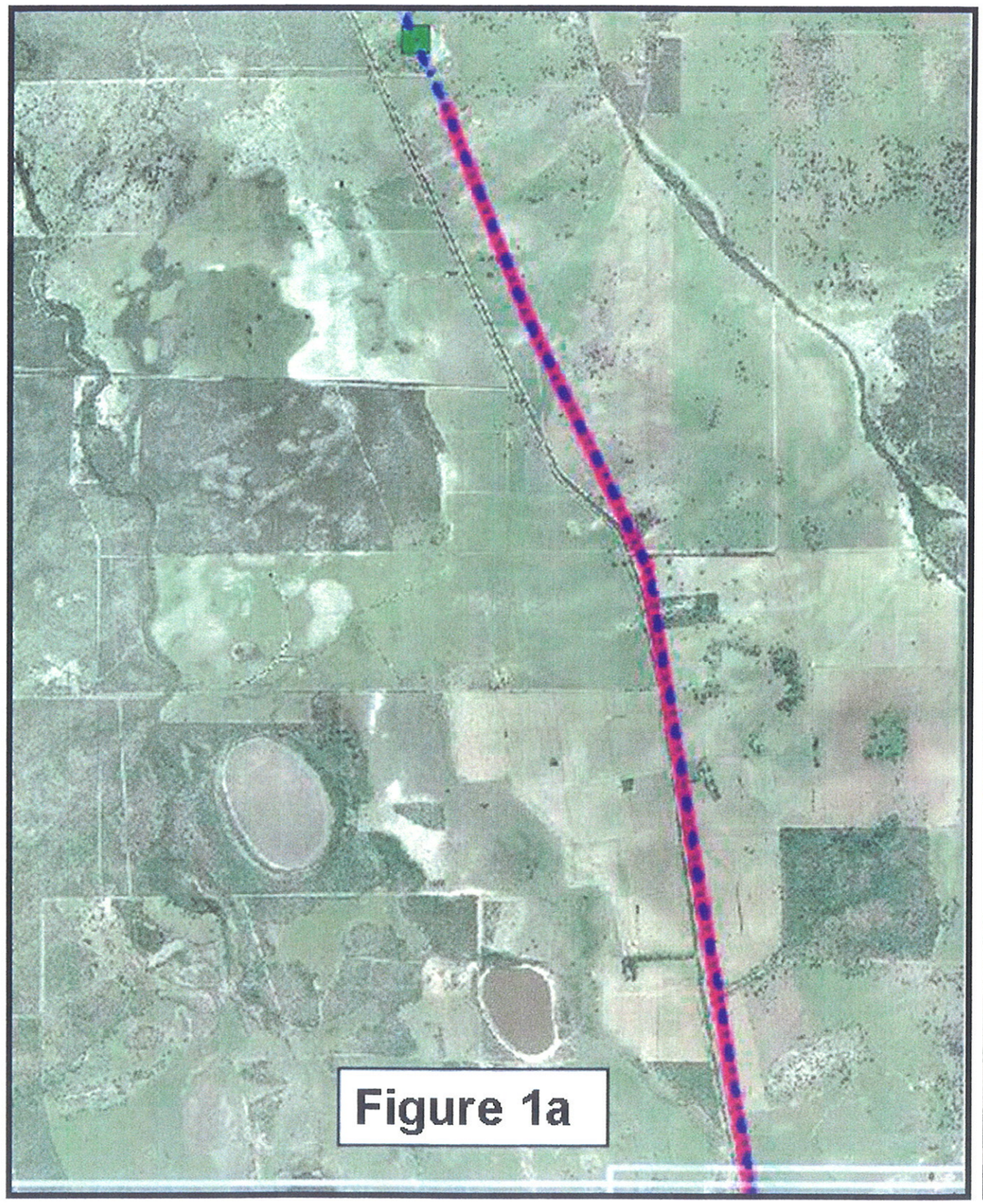


Figure 1a

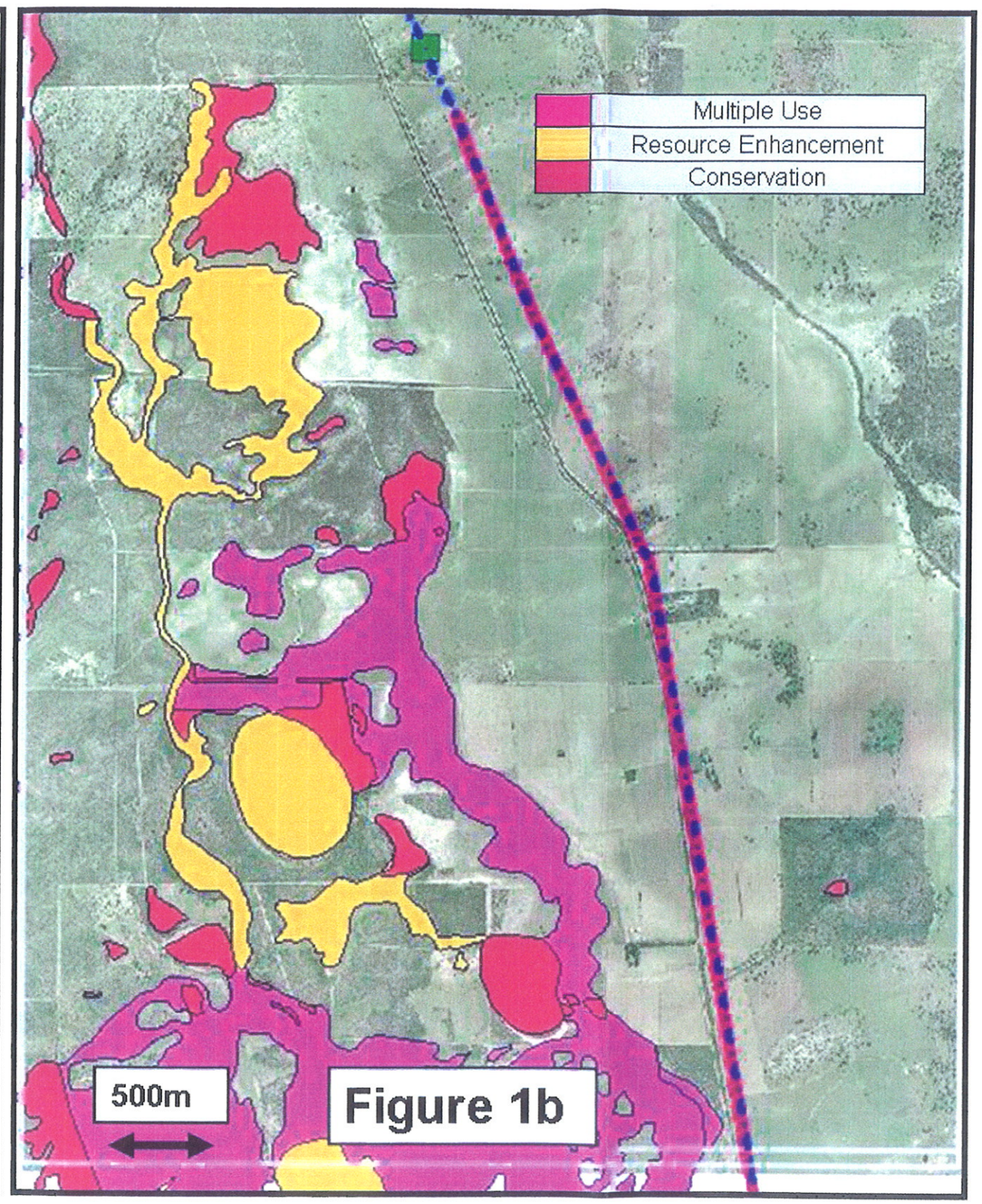


Figure 1b

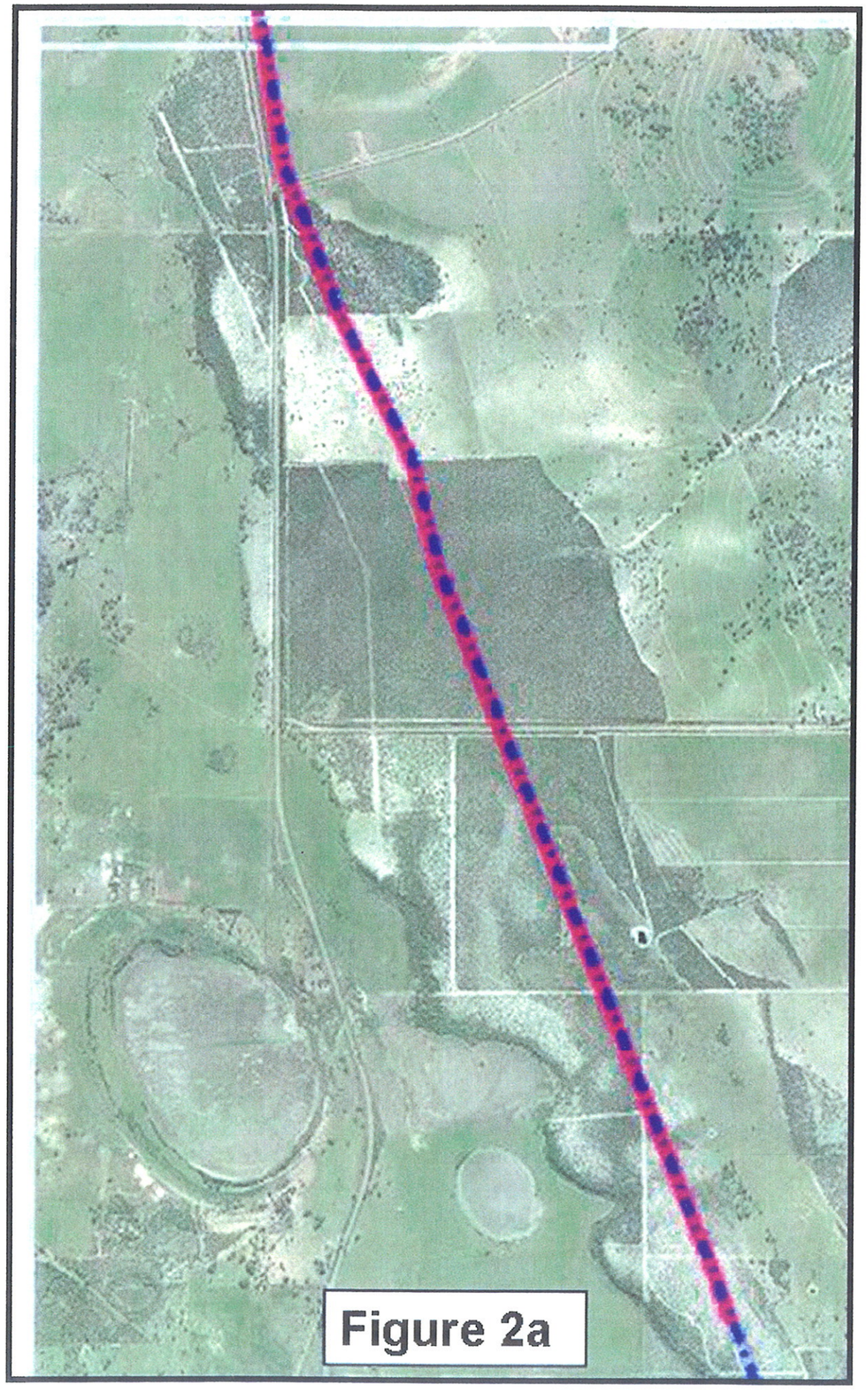


Figure 2a



Figure 2b

Appendix 4: Flora Survey Methodology & Rehabilitation Management Plan

Woodman Environmental Consulting Pty Ltd (2005) Draft *DBNGP Northern Looping Flora and Vegetation Studies Assessment Method, August 2005. RevB*

Note: The attached Flora and Vegetation Studies Assessment Method has been revised following discussions between CALM and Woodman Consulting. However the Proponents wish to further discuss with CALM the risk management benefits of the additional studies to those originally proposed.

Ecos Consulting (Aust) Pty Ltd (2005) *Alinta DBNGP Stage 4 Expansion Project Looping 1 – 9 Rehabilitation Management Plan,* November 2005. RevA

ALINTA

DBNGP NORTHERN LOOPING

FLORA AND VEGETATION STUDIES

ASSESSMENT METHOD

August 2005

WOODMAN ENVIRONMENTAL CONSULTING PTY LTD
A.C.N. 088 055 90

DOCUMENT REVISION HISTORY

Revision	Description	Originator	Reviewed	Date
A	Released for client review	GW	DW	3-08-05
B	Government and Client input	GW	CALM/DoE	12-10-05

Reference: ECOS 05-11

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DESCRIPTION OF PROJECT AND PROJECT AREA

Alinta on behalf of DBNGP (WA) Nominees Pty Limited propose to install additional gas pipeline lengths (loops) within the existing DBNGP corridor south of each compressor station (one to nine) between Karratha and Perth. The proposed pipelines will be 650 mm in diameter with a total length of approximately 192 kms.

A strategic environmental review of a proposed widening of the Dampier to Bunbury Natural Gas Pipeline Corridor was completed by Dames & Moore, 2000 for the Western Australian Gas Pipeline Sale Steering Committee. The review provides detailed information on the potential environmental and social impacts of the proposed pipeline corridor, and concludes that construction within this corridor could be accomplished in an environmentally responsible manner and with minimal social impacts.

The area from CS 1-9 covers five regions. These include the Pilbara, Carnarvon, Gascoyne, Northern Sandplains and the Swan Coastal Plain.

	Start[1] (km point)	End (km point)	Region
Loop 1	137.67	149.67	Pilbara
Loop 2	272.64	304.25	Carnarvon
Loop 3	409.77	434.77	Gascoyne
Loop 4	547.36	572.36	Carnarvon
Loop 5	685.26	706.48	Carnarvon
Loop 6	825.40	836.40	Carnarvon
Loop 7	967.05	972.05	Northern Sandplains
Loop 8	1,114.44	1,160.52	Northern Sandplains
Loop 9	1,257.08	1,272.08	Swan Coastal Plain

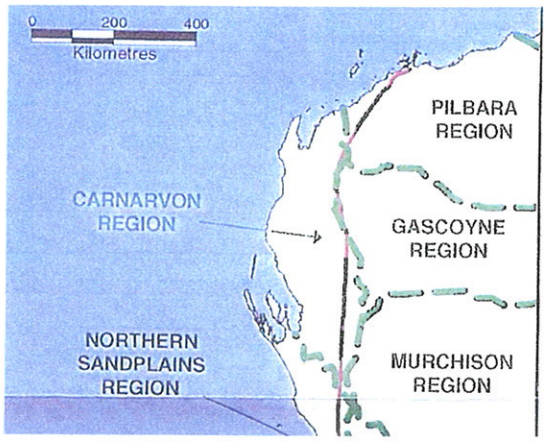


Table 1 presents the soil and vegetation characteristics of the project areas.

[1] KP= Kilometre Point starting at 0km for the DBNGP near Karratha

Table 1: Soil and vegetation characteristics (Rare and priority flora data from CALM Threatened Flora database)

Region	Geology and Soil	Vegetation
Pilbara Loop 1only)	- The pipeline corridor crosses three main structural units, the Pilbara Craton capricon Orogen and Carnavon Basin - Between KP 100 and Ashburton River, soils are dominated by hard alkaline soils with cracking clays, ironstone gravels and loamy soils developed on calcrete. - The presence of laterite, silcrete and calcrete is a common feature of the corridor in the Pilbara and occurs over igneous, metamorphic and sedimentary rocks.	- Located within the Eremaean Botanical Province, and classified as the Fortescue Botanical District (Beard, 1975). - No recorded DRF or PS in the vicinity of Loop 1.
Carnarvon (loops 2, 4, 5, 6)	- Lies entirely within the Carnarvon Basin. - Pipeline corridor crosses the Carnarvon Region, before entering the Gascoyne and into the Carnarvon Region again. The northern Carnarvon region, the surface is formed predominantly from unconsolidated Quaternarary deposits, with granite outcrops	- Carnarvon Botanical District (Beard, 1975) . - No recorded DRF or PS in the vicinity of Loop 2, 4, 5 and 6.
Gascoyne (Loop 3 only)	- The Gascoyne has areas of extensive occurrences of Proterozoic sedimentary, metamorphic and granitic rocks. - Compressor Station 3 (approximately KP 410) marks a boundary between the red and yellow earth soils to the north (underlain by laterite) and hard red duplex soils to the south, which sandy textures which set hard when dry.	- Ashburton Botanical District (Beard 1975). - Most vegetation in Gascoyne Region are well represented throughout the region. - The banks of the Gascoyne supports dense stands of *Eucalyptus camaldulensis*, which provide valuable fauna habitat. - A number of ephemeral wetlands to the north and south of Minilya River support species such as claypan grasses, fringed with acacia and cassia shrubs. - No recorded DRF or PS in the vicinity of Loop 3.

Northern Sandplains (Loops 7 & 8)	- Located within Perth Basin. - Dominated by earthy sands commonly underlain by ironstone gravels, laterite or indurated mottled pallid zone. - South of the Irwin River, soils are dominated by sandy acidic yellow mottled soils containing ironstone gravel and laterite.	- Irwin Botanical District (Beard, 1975) - Kwongan vegetation – sclerophyllous shrubland that dominate the area. - Large number of DRF and PF present - Loop 7 – Priority Species Recorded to the south of Loop 9, but none recorded in the vicinity of Loop 7 which is predominantly cleared. Loop 8 – Traverses an easement previously excised through Coomallo Nature Reserve. This region has numerous recorded DRF Species and Priority Species.
Swan Coastal Plains (Loop 9 only)		Darling Botanical District (Beard 1972) Swan Coastal Plain subregion of the Drummond Botanical Subdistrict (Beard 1972) Is situated in close proximity to various DRF and PF species. TECs are present in the area that Looping 9 traverses

Previous studies along the corridor have been conducted in 2000 and between August and September 2001 (Strategic Environmental Review for the proposed corridor widening of the DBNGP) by Mattiske Consulting Pty Ltd. These studies included mapping of vegetation types. In addition, Declared Rare Flora or Priority Listed Flora were noted at recording sites. This work identified a single Priority 3 species (*Grevillea stenostachya*) in the vicinity of Looping 5, with an additional 17 priority flora species located south of this area with the majority located within areas in or near Loops 7, 8 and 9.

Preliminary discussions with the Department of Conservation and Land Management (CALM), Department of Environment (DoE) and Department of Industry and Resources (DOIR) have indicated that the project will require additional targeted flora and vegetation assessments to address potential impacts to significant plant communities (TECs and regionally significant vegetation) and Declared Rare and Priority Flora. Feedback from Government agencies have indicated the previous surveys conducted by Mattiske Consulting are not considered to be satisfactory to identify and manage issues related to flora and vegetation for Loops 1 to 7. Therefore additional searching for Rare and priority listed flora is required for Loops 1 - 7, and full plant community mapping and searching for Rare and priority listed flora is required for Loops 8 and 9 as they traverse highly significant communities that contain known TECs and Declared Rare Flora species. CALM requested that Alinta develop an assessment method that will be

submitted for review and discussion prior to commencement of studies. This document fulfils that request.

Review of Existing Information

A review of all available existing information on the DBNGP Northern Looping survey areas will be carried out at the commencement of the project. This review will involve obtaining copies of reports of previous surveys carried out, a search of the Library and Information Service of Western Australia (encompassing the state and university libraries) and discussion with local Department of Conservation and Land Management personnel. In particular, Mattiske Consulting's Vegetation and Flora surveys will be reviewed. All information obtained will be reviewed and summarised. A search of the Department of Conservation and Land Management (CALM) Rare and Priority flora and Threatened Ecological Community (TEC) databases will also be carried out. This search will provide an up to date list of all Rare and Priority flora taxa and TECs known to occur within the project area.

Legislative and Policy Setting

The DBNGP Looping 9 survey area is within the Swan Coastal Plain, System 6 area and as such any environmental assessment for the project will be subject to the Environmental Protection Authority (EPA) document "Guidance for the Assessment of Environmental Factors No. 10" – Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1 Region (EPA 2003a).

PROPOSED METHODS

Flora and Vegetation assessments have been conducted for the survey area in the past, however additional work is required to bring the previous works in accordance with the Environmental Protection Authority (EPA) document "Guidance for the Assessment of Environmental Factors No. 51" – Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia (EPA 2004). Due to the location of the different Looping survey areas, the presence of regionally significant bushland and the potential presence of DRF species along Loops 8 and 9, the appropriate level of investigation should be Level 2 for these Loops, however Loop 7 contains no remnant vegetation and will not be surveyed. Loops 1 to 6 are not located within regions containing significant vegetation and previous investigations in the corridor and immediately adjacent to the corridor have been conducted at a Level 1 survey intensity which is appropriate for the areas. The previously recorded presence of priority flora in the vicinity of Loops 5 and 6 indicate that searching for significant species and assessments of impact of the proposal to the conservation status of species is warranted for these areas. In addition, searching for the presence of significant (DRF and Priority Flora) will be conducted on loops 1 to 4.

Vegetation Mapping

The vegetation mapping conducted previously by Mattiske Consulting will be re-visited for Loops 8 and 9 to identify and describe plant communities. Mapping will extend beyond the existing 30m easement to account for any edge impacts or potential extensions of working areas. Plant communities mapped in the Loop 9 area will be aligned with FCTs according to Gibson *et al.* 1994 where possible to provide an indication of the regional conservation significance of communities. Communities that resemble listed Threatened Ecological Communities (TECs) will be visited in the field with CALM personnel for verification purposes. Currently, no plot based floristic analysis is proposed for this project due to the previously cleared nature of the corridor. No mapping of vegetation communities will be replicated for loops 1 to 6.

Vegetation Condition Map Production

Where native vegetation is present in the Loop 8 and 9 survey areas a separate map showing vegetation condition will be developed in accordance with the methods described in the Bush Forever documents (Government of Western Australia 2000). This information will be used to facilitate the determination of conservation significance of the plant communities mapped.

Flora

Flora Species

Flora studies for the DBNGP Northern Looping survey will focus on additional searching for the Declared Rare Flora and Priority Flora species known to occur in the vicinity of the corridor (30m easement and additional 20m to west to account for edge effects or enlarged working areas) for all loops. However the plant community mapping to be conducted in loops 8 and 9 will identify as many species in each community as possible. Surveys in loops 8 and 9 will be conducted during September and October 2005. Surveys to be conducted on loops 1 to 6 will be conducted following significant rain events in summer and autumn 2006. Discussions with botanists stationed in the Pilbara have indicated that ephemeral natives and weeds have been dry for several weeks (V. Long pers. comm.) and that surveys 4 to 6 weeks following summer rainfall events would provide more data.

Weed Mapping

The Loop 8 and 9 survey areas will be inspected for the presence of environmental and Declared weed species, with particular emphasis placed on access routes and areas of previous disturbance and streamzones during spring 2005. Loops 1 to 6 will be surveyed following significant rain events in summer or autumn 2006. This will allow mapping of ephemeral weed species and those species that normally retreat to moist sites during summer months. In addition, the weed distribution data will be current at the time of hygiene plan development and thus provide the most accurate data to guide the operations. This data will be utilised to prepare a map of weed cover for the survey areas that will be used to generate weed hygiene plans and procedures for the proposed installation of the pipeline.

Phytophthora cinnamomi

The Loop 8 and 9 survey areas will be traversed in a vehicle by personnel experienced and accredited for the detection and mapping of *Phytophthora cinnamomi* to CALM standards. High risk plant communities and landscapes will be inspected on foot for symptoms of the plant pathogen's presence. Samples of soil and vegetation material from any dead or dying indicator plant species will be collected and analysed for the presence of *P. cinnamomi* by Dr Elaine Davison at Curtin University. Samples will be double baited to increase the chances of recovering the pathogen from samples. Any disease boundaries found will be marked in the field using day-glo pink (*P. cinnamomi* infested) or white (uninterpretable) flagging tape. Any locations and boundaries of *P. cinnamomi* will be illustrated on a map if recorded and a hygiene plan (prepared to CALM standards) and management plan will be produced to effectively manage this issue.

Rehabilitation

A rehabilitation plan will be developed for the project Environmental Management Plan (EMP) that will address reuse of vegetation material and topsoil resources on the corridor to maximise the success of rehabilitation works.

Vegetation monitoring plots will be established in adjacent undisturbed vegetation to collect plant presence and density and foliage cover data to be used for any active rehabilitation processes as well as developing completion criteria for monitoring of success of the rehabilitation post pipeline installation. Plots will also be established on the disturbed ROW for long term rehabilitation success monitoring. Final rehabilitation procedures, native plot and monitoring parameters and completion criteria will be agreed with CALM and DoE. These will then be incorporated into the (EMP) that will be approved by the Department of Industry and Resources (DoIR). It is envisaged that plots will be established during 2006.

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ALINTA DBNGP STAGE 4 EXPANSION PROJECT LOOPING 1 - 9

Rehabilitation Management Plan

November 2005

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1 Introduction

DBNGP (WA) Nominees Pty Limited is proposing to construct a number of looping sections adjacent (and connected) to the existing underground gas transmission pipeline within the Dampier to Bunbury Natural Gas Pipeline (DBNGP) corridor. There are nine separate looping sections proposed from Compressor Station 1 (CS1) south of Karratha to Compressor Station 9 (CS9), north of Gingin, Western Australia (known as the "Northern Looping" project). The proposed pipeline looping sections will be 660 mm in diameter with a total length of approximately 194 km.

2 Vegetation and Weed Surveys

Vegetation and weed surveys for the Northern Looping Project have been and will be conducted by Greg Woodman of Woodman Environmental Consulting Pty Ltd. Loops 8 & 9 of the project area were inspected in spring 2005 with surveys aimed at identifying Declared Rare Flora (DRF), Priority Flora (PF) and weed infestations. No vegetation or weed surveys will be conducted on Loop 7 as there is no remnant vegetation remaining in this area. Loops 6 – 1 will be inspected 4 – 6 weeks after significant rainfall events (>5mm) for the presence of DRF, PF and weeds.

2.1 Vegetation Surveys

The results of the DRF and PF surveys for Loops 8 & 9 are not yet available. A taxonomist is currently identifying plant specimens collected during the surveys. Specimen identification should be completed by early December 2005. DRF and PF surveys will be conducted later in 2006 following significant rainfall events. The management measures to be undertaken if any DRF and PF are identified within the AoD are detailed in Section 4.3 and are also contained in the Northern Looping CEMP.

2.2 Weed Surveys

Weed surveys were conducted on Loops 8 & 9 during spring, 2005. A weed survey will not be conducted on Loop 7 as there is no remnant vegetation remaining on this loop. Loops 6 – 1 will have weed surveys conducted concurrently with DRF and PF surveys following significant rainfall in the summer or autumn of 2006.

Once the results of the weed surveys are collated and maps are produced by Woodman Consulting, this information will be incorporated into the Environmental Line Lists (ELLs) and maps will be used to delineate hygiene boundaries on the Area of Disturbance (AoD) prior to construction commencing.

3 Rehabilitation Objectives

The objectives of the rehabilitation plan are:

- to re-establish the vegetation on the AoD to the condition that it was in prior to construction
- to protect the integrity of populations of DRF and PF where practicable
- to stop the spread of weeds along the AoD.

4 Rehabilitation Strategy

The rehabilitation strategy for the Northern Looping Project focuses on the timely reinstatement of areas of clearing on the AoD. Where possible, significant trees on the AoD that do not pose a threat to the integrity of the pipe, will be retained. In sensitive areas such as the Gascoyne and Ashburton Rivers, Horizontal Direct Drilling will be used to prevent erosion of the riparian zone. The Construction Environmental Management Plan for the project presents management measures designed to minimise impacts of the pipeline construction (Ecos Consulting (Aust) Pty Ltd 2005).

4.1 Rehabilitation Methods

Native vegetation will be established on the AoD utilising seed stock from the topsoil seedbank (geospores) and from plant stored seed (bradyspores).

The following mitigation measures will be implemented to promote the successful re-establishment of native vegetation on the AoD:

- flagging vegetation to be retained including large trees, DRF and PF
- trimming of overhanging branches instead of whole tree removal
- stockpiling of all vegetation and topsoil for use during rehabilitation
- following the Hygiene Protocol to ensure no weeds or disease are spread along the corridor due to construction activities
- implementing dust control activities as required
- reinstating surface contours as soon as reasonably practicable
- including the locations of features such as groundwater discharge, and acid sulphate soils on alignment sheets
- ensuring no impacts occur to vegetation off the construction area
- shallow ripping of AoD to alleviate compaction
- respread of topsoil and vegetation
- Monitoring of rehabilitation in areas of remnant vegetation (quadrats and photo-points).

Weed species richness and cover will be included in rehabilitation monitoring to facilitate management of weed issues following completion of the rehabilitation. Annual monitoring results will be used to develop weed management programs in consultation with CALM and ongoing weed control is expected in the early years of rehabilitation to promote native species cover development.

Weed hygiene will be implemented during all operations in accordance with the Hygiene Protocol (Ecos Consulting (Aust) Pty Ltd 2005).

4.2 Resource Management

Native vegetation on the AoD is a valuable resource for the rehabilitation process in that it provides seed, carbon material, stabilises the soil surface, cools the soil surface, provides habitat for fauna and provides micro habitats for capturing additional seed dispersing from adjacent vegetation. In addition, where trees can be retained on the AoD they will provide habitat, cover and structure.

Vegetation will be cleared and stored in a windrow adjacent to the AoD immediately adjacent to where it was cleared from. This will ensure that respread vegetation will be located in the appropriate vegetation type and position in the landscape to make best use of any remaining seed stored on the stems.

Topsoil is an essential component of a successful rehabilitation program as it contains the majority of the naturally stored seed for the existing vegetation that propagate using seed as their prime strategy. Topsoil will be removed using a grader that will cut the top 50mm to 100mm of soil and store it in a windrow on the AoD edge immediately adjacent to where it was removed from. Similarly to vegetation, this will ensure that topsoil is respread within the appropriate position in the landscape and vegetation type. Topsoil will not be picked up and moved along the AoD. Topsoil will not be used for padding in the pipe trench. Topsoil will not be driven on or disturbed in any way prior to being respread on the AoD.

4.3 Priority and Declared Rare Flora Management

Management of significant species along the AoD will involve a comprehensive approach consisting of the following steps:

- locations of all DRF and pf identified on the AoD will be mapped and marked in the field.
- locations of all DRF and pf included on environmental line lists.
- where practical and in consultation with calm these plants will be protected from disturbance through the use of fencing and sign-posting on site.
- construction personnel will be provided with information on these species and the management practises being implemented at inductions and toolbox meetings.

In the event that DRF or PF cannot be avoided and destruction of some plants is necessary to implement the project, the following management steps will be taken:

- plants that are required to be impacted will be individually marked in the field.
- the impact of removal of the plants on the conservation status of the species will be assessed at a local and regional scale by a qualified botanical consultant in consultation with officers of CALM
- options for transplanting of individual plants or salvage of biological material for later propagation will be discussed with key government stakeholders
- an application to take DRF will be prepared and submitted to calm for approval by the Minister for the Environment in accordance with the Wildlife Conservation Act 1950.

4.4 Soil Profile and Landform

Trench spoil will be removed and stored in a windrow adjacent to the trench. Following installation of the pipe, the trench will be backfilled and compacted. The surface of the AoD will then be graded to original surface contours and lightly ripped to a depth of 40cm to alleviate any compaction from vehicle and machinery movement. Ripping on contour will not be possible due to the constrained width of the AoD, however shallow ripping with narrow tines should not result in the generation of deep furrows and a light drag bar will be utilised behind the machine to smooth the final surface.

Topsoil will be graded evenly back over the AoD following ripping, ensuring that topsoil is not transported along the easement.

5 Completion Criteria

Table 1 presents the completion criteria for the entire Northern Looping AoD including the rehabilitation specific criteria. Specific vegetation and weed criteria relate to the large sections of remnant vegetation remaining on Loop 8; Coomallo Nature Reserve and the 5km of remnant vegetation within the DPI Mining Lease at the start of Loop 8.

Photo-point monitoring will be conducted on Loops to monitor the success of rehabilitation. Two photos will be taken, one shot facing up and one shot facing down the AoD from each photo-point. On Loops 1 – 7 there will be a minimum of two photo-points per loop with spacing of no greater than 5km between photo-points. On Loop 9 and 8 there are several small pockets of remnant vegetation remaining. In these areas of remnant vegetation, photo-monitoring points will be spaced at a distance of no greater than 200 metres. All photo-points will be recorded on the Environmental Line Lists. Aerial photography and land owner consultations have shown that many areas of remnant vegetation through which the DBNGP easement traverses are currently used by land owners as fire breaks, stock routes and vehicle access tracks. Hence, the quality of regrowth on the DBNGP easement in many of these areas of remnant vegetation is poor. Vegetation will be re-established on the AoD to the condition that it was in prior to construction.

Table 1: Completion Criteria for the Northern Looping Pipeline Project

Aspect	Objective	Criteria	Assessment method
Construction	To ensure that the key commitments that will influence recovery of the pipeline easement are implemented during construction	100% compliance with the weed hygiene protocol.	Audit during the operation
		100% compliance with the dieback hygiene protocol (Loops 8 & 9 only)	Audit during the operation
		Vegetation and topsoil is cleared and stored in accordance with the CEMP.	Audit during the operation
		Significant plant species are protected in accordance with the CEMP.	Audit during the operation
Decommissioning	To ensure that all visual disturbances are removed by immediate remedial action to the greatest extent practicable	All equipment, materials and litter are removed from the AoD	Visual inspection of AoD
Landform	To reinstate the land to provide suitable conditions for natural recolonisation of native vegetation and support natural surface water movement	Natural contours should be re-instated to pre-disturbance conditions	Visual inspection of AoD
		There should be no active erosion rills in excess of the surrounding land *	GPS record and physical measurement of any points of erosion

Aspect	Objective	Criteria	Assessment method
Vegetation and Weeds – Coomallo Nature Reserve and Mining Lease at start of Loop 8	To facilitate the re-establishment of indigenous plant species within each vegetation type on the AoD	There should be no bare patches longer than 10m after 12 & 24 months where inconsistent with the original condition	Visual assessment, with particular emphasis in erosion prone areas
		The foliage cover of declared and environmental weeds on the AoD should be similar to regrowth vegetation remaining on the AoD after construction at 12 & 24 months	Assessment by photographic and visual survey
		A minimum of 1 native plant per square metre when averaged over the entire area rehabilitated at 12 months and 2 native plants per square metre when averaged over the entire area rehabilitated at 24 months.	Assessment of a representative number quadrats within each vegetation type comparing the rehabilitated area to the regrowth vegetation remaining on the AoD after construction
		Percentage foliage cover of native species indigenous to each plant community is greater than or equal to 40% of foliage cover in regrowth vegetation remaining on the AoD after construction at 24 months (excluding pipeline access track)*	Assessment of a representative number quadrats within each vegetation type comparing the rehabilitated area to the regrowth vegetation remaining on the AoD after construction
		Species richness greater or equal to 50% of richness in regrowth vegetation remaining on the AoD after construction at 24 months	Assessment of a representative number quadrats within each vegetation type comparing the rehabilitated area to the regrowth vegetation remaining on the AoD after construction
Vegetation and Weeds – Small pockets of remnant vegetation on private property	To facilitate the establishment of indigenous plant species within each vegetation type on the AoD	There should be no bare patches longer than 10m after 12 & 24 months when inconsistent with the original condition	Visual assessment, with particular emphasis in erosion prone areas
		The foliage cover of declared and environmental weeds on the AoD should be similar to regrowth vegetation remaining on the AoD after construction at 24 months.	Assessment by photographic and visual survey

If the monitoring occasions note areas that do not meet these criteria then discussions will be held with CALM regarding recommended remedial action. It is expected that failed areas will be actively reinstated with planting of appropriate species in failed areas during autumn 2007 in consultation with an appropriately qualified botanical consultant and CALM. Any areas of high weed cover will be treated with an appropriate program in consultation with CALM.

Monitoring will be conducted annually in spring for loops 8 & 9 and after significant rainfall events for loops 6 - 1 until the rehabilitated areas have regenerated to a stable condition, to the satisfaction of CALM and DoE.

* While best endeavors will be made to achieve these Completion Criteria there may be some exclusions in the event that uncharacteristic seasonal weather conditions prevail. This shall be taken into consideration in relation to the Completion Criteria. In this event where areas are not meeting Completion Criteria, joint site reviews will be undertaken to determine appropriate remedial action, if required, to DoE and CALM requirements.

Appendix 5: Fauna Review & Fauna Interaction Protocol

M. Bamford and W. Bancroft, Bamford Consulting Ecologists (2005) *Fauna values of the Northern Loopings (Loops 1 to 9) of the Dampier to Bunbury Natural Gas Pipeline (DBNGP)* prepared for Ecos Consulting (Aust) Pty Ltd, Nov 2005.

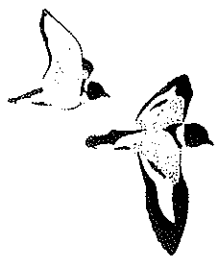
Ecos Consulting (Aust) Pty Ltd (2005) *Protocols For Interaction With Fauna During The Construction Of Stage 4 Expansion, Loops 1-9 Of The DBNGP Pipeline.* Draft prepared by M. Bamford and W. Bancroft, Bamford Consulting Ecologists, Nov 2005.

Fauna values of the Northern Loopings (Loops 1 to 9) of the Dampier to Bunbury Natural Gas Pipeline (DBNGP)

Prepared for: Ecos Consulting (Aust) Pty Ltd

Prepared by: **Wes Bancroft and Mike Bamford**

M.J. & A.R. BAMFORD
CONSULTING ECOLOGISTS
23 Plover Way,
Kingsley, WA, 6026.



November 2005

EXECUTIVE SUMMARY

INTRODUCTION

DBNGP (WA) Nominees Pty Limited is proposing to expand their underground gas transmission pipeline within the pre-existing Dampier to Bunbury Natural Gas Pipeline (DPNGP) corridor. The 'Northern Looping' component of the expansion will comprise nine separate expansion loops that range in length from 5 km to 47 km and that will be located between Compressor Station 1 (CS1) south of Karratha to Compressor Station 9, north of Gingin.

The proposed expansion will require clearing, earthworks and pipe-laying adjacent to the existing pipeline. Associated with looping construction there will be at least some camps and water storage facilities (turkey nests). Looping construction will inevitably affect fauna in a number of ways, including:

- Death/injury of fauna during clearing, grading and impacts with vehicles;
- Loss of habitat (temporary except in the case of habitat trees);
- Fragmentation of habitat (temporary);
- Spread of weeds and feral fauna along cleared line;
- Increase in feral fauna due to provision of water in turkey nests (temporary);
- Entrapment in trenches that are excavated to receive the pipeline;
- Disturbance of fauna in nearby areas from light, noise and even personnel feeding selected species.

Bamford Consulting Ecologists was commissioned to conduct a literature review to assess the potential impact of the Northern Loopings expansion project on terrestrial fauna and to propose mitigation or amelioration measures that may be employed to minimise these impacts.

METHODS

The fauna assessment and report preparation were carried out with reference to guidance and position statements published by the WA Environmental Protection Authority (EPA) on fauna surveys and environmental protection, and Commonwealth Biodiversity Legislation (e.g. EPA 2002; EPA 2004). The report synthesises the results of a literature review and is classified as a Level 1 survey (desktop study) according to the EPA Position Statement No. 3 (EPA 2002).

Personnel

The following personnel were involved in the preparation of this report:

- Dr Mike Bamford *BSc(Biol.), Hons(Biol.), PhD(Biol.)*
- Dr Wes Bancroft *BSc(Zool./Microbiol.), Hons(Zool.), PhD(Zool.)*

Licences and permits

No licences or permits were required for preparation of the current (desktop) report.

Literature search

The nine areas of interest for this report are those bounding Loops 1 to 9 of the Dampier to Bunbury Natural Gas Pipeline (DBNGP). The co-ordinates of the start and finish points, and the length of each of the loops are as follows:

Loop	Start	Finish	Length (km)
1	21.45278 S, 115.949416 E	21.530318 S, 115.887168 E	12
2	22.473778 S, 115.24254 E	22.72623 S, 115.104422 E	32
3	23.651526 S, 115.147778 E	23.864889 S, 115.171977 E	25
4	24.846901 S, 115.292097 E	25.054874 S, 115.283605 E	25
5	26.088712 S, 115.224569 E	26.279986 S, 115.214937 E	22
6	27.352876 S, 115.185087 E	27.413866 S, 115.184381 E	11
7	28.623925 S, 115.133441 E	28.655597 S, 115.135303 E	5
8	29.891507 S, 115.358941 E	30.28704 S, 115.443019 E	47
9	31.109649 S, 115.778575 E	31.234758 S, 115.823493 E	15

A list of fauna that would be expected to occur in the areas of interest was generated by searching available databases and literature. These include:

- the Western Australian Museum's 'Faunabase'.
- Birds Australia's database for the second Atlas of Australian Birds.
- the information and species distribution maps provided by Tyler *et al.* (2000), Storr *et al.* (1983; 1990; 1999), Wilson and Swan (2003), Cogger (2000), Johnstone and Storr (1998), Strahan (1995), Menkhorst and Knight (2004) and Churchill (1998).

Separate searches were made for each Loop. The two databases listed above were searched for the one degree grid block that surrounds each loop. For additional information and records on threatened species and threatened communities, threatened fauna databases maintained by the Western Australian Department of Conservation and Land Management (CALM) and the federal Department for the Environment and Heritage (Environment Protection and Biodiversity Conservation, EPBC, database) were searched. The search areas for the CALM and EPBC databases were a 50 km buffer area around the line that connects the start and finish of each loop (Loops 1 to 8). The buffer was reduced to 20 km for Loop 9 due to the greater number of records in this area.

Because none of the work for the Northern Looping will be conducted in marine systems the obligate marine animals were excluded from the results presented here. Similarly, some species that were returned by one or more of the data searches have been excluded because their ecology, or the habitat types within the areas of interest, meant that it is highly unlikely that these species would be present. A list of these excluded species is presented in Appendix 2.

Many species presented here comprise one or more subspecies, morphs or geographically recognised groups. Animals are listed only to the species level in the results tables but where subspecies are relevant (e.g. conservations significant species) this is highlighted in the Results/Discussion.

Nomenclature and taxonomy

As per the recommendations of EPA (2004), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's *Checklist of the Vertebrates of Western Australia*. The authorities used for each vertebrate group are: amphibians and reptiles (Aplin and Smith 2001), birds (Christidis and Boles 1994; Johnstone 2001), and mammals (How *et al.* 2001).

Assessment of conservation significance

The conservation status of fauna species is assessed under Commonwealth and State Acts such as the *Commonwealth Environment Protection and Biodiversity Conservation Act* (EPBC Act) 1999 and the *Western Australian Wildlife Conservation Act* 1950. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN 2001). The *WA Wildlife Conservation Act* 1950 uses a set of Schedules but also classifies species using some of the IUCN categories. These categories and Schedules are described in Appendix 1.

The EPBC Act also has lists of migratory species that are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals). The list of migratory species under the EPBC Act has been revised to include species only, thus excluding family listings (DEH, pers. comm.). Those species listed in JAMBA are also protected under Schedule 3 of the *WA Wildlife Conservation Act*. There is a separate list of marine species under the EPBC Act, but this only applies to land and waters under Commonwealth management. Therefore, marine listings are not included in this report.

The Department of the Environment and Heritage (DEH, formerly Environment Australia) has also supported the publication of reports on the conservation status of most vertebrate fauna species: reptiles (Cogger *et al.* 1993), birds (Garnett and Crowley 2000), monotremes and marsupials (Maxwell *et al.* 1996), rodents (Lee 1995) and bats (Duncan *et al.* 1999). The Threatened Species and Communities Section of Environment Australia has also produced a list of Threatened Australian Fauna (Environment Australia 1999), although this list is effectively a precursor to the list produced under the EPBC Act. These publications also use the IUCN categories, although those used by Cogger *et al.* (1993) differ in some respects because this report pre-dates categories reviewed by Mace and Stuart (1994) and revisited since by IUCN (2001).

In Western Australia, the Department of Conservation and Land Management (CALM) has produced a supplementary list of Priority Fauna, being species that are not considered Threatened under the WA Act but for which the Department feels there is cause for concern. Some Priority species, however, are also assigned to the IUCN Conservation Dependent category. Levels of Priority are described in Appendix 1(Christidis and Boles 1994; Johnstone 2001). Assessments in this report are based on the most recent version of the CALM priority list (March 2005).

Fauna species included under conservation acts and/or agreements are formally recognised as of conservation significance under state or federal legislation. Species listed only as Priority by CALM, or that are included in publications such as Garnett

and Crowley (2000) and Cogger *et al.* (1993), but not in State or Commonwealth Acts, are also of recognised conservation significance. In addition, species that are at the limit of their distribution, those that have a very restricted range and those that occur in breeding colonies, such as some waterbirds, can be considered of conservation significance, although this level of significance has no legislative or published recognition and is based on interpretation of distribution information. The WA Department of Environment (formerly the Department of Environmental Protection, DEP) used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of Perth Bushplan (DEP 2000).

On the basis of the above comments, three levels of conservation significance are recognised in this report:

- *Conservation Significance (CS) 1*: Species listed under State or Commonwealth Acts.
- *Conservation Significance (CS) 2*: Species not listed under State or Commonwealth Acts, but listed in publications on threatened fauna or as Priority species by CALM.
- *Conservation Significance (CS) 3*: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

RESULTS and DISCUSSION

OVERVIEW

The literature review identified 497 terrestrial vertebrate species that could potentially occur in one or more of the northern looping sections. The number of species in each of the vertebrate classes was:

Amphibia (Frogs)	23
Reptilia (Reptiles)	174
Aves (Birds)	230
Mammalia (Mammals)	70

Tables 1 to 4 present the species and indicate as to which looping section(s) they would be expected to occur. The results of the CALM and EBPC database searches (for species of conservation significance) are presented as stand-alone tables (Tables 5 and 6), but the information provided by these has also been collated in Tables 1 to 4, and the Species of Conservation Significance section below.

SPECIES OF CONSERVATION SIGNIFICANCE

Of the 497 terrestrial vertebrate species, 59 were assessed as having a conservation significance status of CS1 or CS2 (see Methods). Thirty-four of these were CS1 and 25 were CS2. The number of species of conservation significance in each of the vertebrate classes was:

Amphibia (Frogs)	0
Reptilia (Reptiles)	12 (4 CS1, 8 CS2)

Aves (Birds)	32 (23 CS1, 9 CS2)
Mammalia (Mammals)	15 (7 CS1, 8 CS2)

The following accounts provide basic information on these species that includes their conservation status, the reason for their significance, aspects of their ecology, and potential threatening processes. Information presented has been collated from a number of references: Storr *et al.* (1983; 1990; 1999; 2002), Marchant and Higgins (1990; 1993), Cogger *et al.* (1993), Lee (1995), Strahan (1995), Higgins and Davies (1996), Maxwell *et al.* (1996), Pizzey and Knight (1997), Churchill (1998), Duncan *et al.* (1999), Higgins (1999), Cogger (2000), Garnett and Crowley (2000), Barrett *et al.* (2003), Wilson and Swann (2003), Burbidge (2004) and Menkhorst and Knight (2004).

Reptiles

Species :	*Aclys concinna major*	Conservation status:	**CS2**
Common name:	Javelin Legless Lizard		
Habitat:	Heath on dune and sand plains.		
Notes:	Listed as Priority 1 by CALM, and is of concern because this subspecies is restricted to an area between Shark Bay and Kalbarri. A second subspecies, *A. c. concinna*, occurs between Leeman and Perth and is not currently listed as a threatened or priority species.		
Species :	*Pletholax gracilis edelensis*	Conservation status:	**CS2**
Common name:	Keeled Legless Lizard		
Habitat:	Sand dunes with *Spinifex longifolius*.		
Notes:	Listed as Priority 3 by CALM, and is of concern because this subspecies is restricted to the Edel Land Peninsula, Shark Bay. A second subspecies, *P. g. gracilis*, occurs on sand plains with heath and *Banksia* spp. between Geraldton and Perth and is not currently listed as a threatened or priority species.		
Species :	*Ctenotus gemmula* (Swan Coastal Plain)	Conservation status:	**CS2**
Common name:	Jewelled Ctenotus (Swan Coastal Plain)		
Habitat:	Pale sands with heath and *Banksia* spp. or mallee woodlands.		
Notes:	Listed as Priority 3 by CALM. This species has two disjunct populations: on the Swan Coastal Plain, where it is scarce and of concern; and on the Lower-west Coastal Plain (Albany to Esperance), where it is not currently listed as a threatened or priority species.		
Species :	*Cyclodomorphus branchialis*	Conservation status:	**CS1**
Common name:	Gilled Slender Blue-tongue		
Habitat:	Semi-arid shrublands on heavy red soils.		
Notes:	Listed as Vulnerable under the WA Wildlife Conservation Act, and is of concern because it is known only from are area between Murchison River and Irwin River, and east to Yalgoo. *C. branchialis* is a ground-dwelling and largely nocturnal skink which shelters in spinifex, leaf litter and under fallen timber.		
Species :	*Egernia stokesii badia*	Conservation status:	**CS1**
Common name:	Western Spiny-tailed Skink		
Habitat:	Dry to semi-arid habitats where the species shelters in rock crevices and hollow logs.		
Notes:	Listed as Endangered under the EPBC Act and as Vulnerable under the		

	WA Wildlife Conservation Act. This subspecies has declined significantly because of clearing for agriculture, and continues to be threatened by fox predation. At least two other subspecies are recognised: *E. s. stokesii* (Houtman Abrolhos), CS2; and *E. s. aethiops* (Baudin Island, Shark Bay), CS1.	
Species :	*Lerista lineata*	Conservation status: **CS2**
Common name:	None.	
Habitat:	Coastal heath on sand, shrubland.	
Notes:	Listed as Priority 3 by CALM, and is of concern because this species has three, small, disjunct populations: near Busselton; between Perth and Mandurah (including Garden Island); and at Woodleigh Station near Shark Bay.	
Species :	*Lerista planiventralis maryani*	Conservation status: **CS2**
Common name:	None.	
Habitat:	Lightly and sparsely vegetated sands.	
Notes:	Listed as Priority 1 by CALM, and is of concern because this subspecies is restricted to an area between Onslow and Barridale and is known from a small number of records. The *L. planiventralis* group (which also includes the *decora* and *planiventralis* subspecies) forage diurnally for small invertebrates.	
Species :	*Lerista yuna*	Conservation status: **CS2**
Common name:	None.	
Habitat:	Pale sands.	
Notes:	Listed as Priority 3 by CALM, and is of concern because this species is known only from the Yuna region, north-east of Geraldton. Shelters in soft soil under leaf litter at the base of shrubs.	
Species :	*Aspidites ramsayi* (south-west population)	Conservation status: **CS1**
Common name:	Woma (south-west population)	
Habitat:	Woodlands, heathlands and spinifex.	
Notes:	Listed as Specially Protected under the WA Wildlife Conservation Act and as Priority 1 by CALM. This species occurs in two disjunct populations: central, arid Australia; and south-western Western Australia. The latter population has dramatically declined in response to land clearing and, possibly, predation by cats and foxes.	
Species :	*Liasis olivaceus barroni*	Conservation status: **CS1**
Common name:	Pilbara Olive Python	
Habitat:	Moist or rocky areas (e.g. gorges, river courses) and surrounding hills.	
Notes:	Listed as Vulnerable under the EPBC Act and WA Wildlife Conservation Acts. Habitat clearing, predation by foxes and cats, wildfires and deliberate killing by humans are the key threatening processes. Research supports full species status, but no formal recognition has yet been made.	
Species :	*Morelia spilota imbricata*	Conservation status: **CS2**
Common name:	Carpet Python (south-west population)	
Habitat:	Undisturbed bushland and rocky outcrops.	
Notes:	Listed as Priority 4 by CALM and is of concern because this subspecies has declined dramatically in the face of urban development and land clearing. *M. spilota* occurs in the south-west of WA, south of a line that runs from approximately Geraldton in the north-west to Eyre in the south-east. It is often arboreal and preys on birds, other reptiles and small to medium size mammals. At least six other subspecies of *M. spilota* are	

	recognised around Australia.		
Species :	*Neelaps calonotos*	Conservation status:	**CS2**
Common name:	Black-striped Snake		
Habitat:	Dunes and sand plains with heath or eucalypt or banksia woodlands.		
Notes:	Listed as Priority 3 by CALM, and is of concern because this species is restricted to an area between Lancelin and Perth. It is threatened by encroaching land development.		

Birds

Species :	*Leipoa ocellata*	Conservation status:	**CS1**
Common name:	Malleefowl		
Habitat:	Semi-arid areas, and remnant vegetation within the agricultural zone		
Notes:	Listed as Vulnerable under the EPBC Act and WA Wildlife Conservation Acts. Land clearing, predation by cats and foxes, and altered fire regimes have reduced the population, and continue to threaten existing animals. *L. ocellata* build large nesting mounds.		
Species :	*Ardea alba*	Conservation status:	**CS1**
Common name:	Great Egret		
Habitat:	Estuaries, tidal flats, rivers, freshwater lakes, sewage ponds and dams.		
Notes:	Listed as Migratory under the EPBC Act. Common and widespread throughout Australia (except deserts). *A. alba* forages in aquatic habitats for fish, amphibians, and invertebrates.		
Species :	*Ardea ibis*	Conservation status:	**CS1**
Common name:	Cattle Egret.		
Habitat:	Paddocks, pastures, wetlands, and tidal mudflats.		
Notes:	Listed as Migratory under the EPBC Act. Colonised Australia (from Indonesia) in the 1940s and is now widespread throughout tropical and temperate Australia.		
Species :	*Plegadis falcinellus*	Conservation status:	**CS1**
Common name:	Glossy Ibis		
Habitat:	Well-vegetated wetlands, wet paddocks and pasture, floodplains and occasionally saline wetlands and mudflats.		
Notes:	Listed as Migratory under the EPBC Act. *P. falcinellus* moves somewhat erratically in response to rains, but is most abundant in northern and eastern Australia.		
Species :	*Haliaeetus leucogaster*	Conservation status:	**CS1**
Common name:	White-bellied Sea-Eagle		
Habitat:	Islands, coasts, estuaries, large rivers and large inland lakes.		
Notes:	Listed as Migratory under the EPBC Act. Moderately common to common in coastal, riverine and wetland habitat around Australia. *H. leucogaster* is an aerial hunter that forages for fish, snakes, birds and medium-sized mammals.		
Species :	*Falco hypoleucos*	Conservation status:	**CS2**
Common name:	Grey Falcon		
Habitat:	Lightly treed plains, timbered watercourses, open woodland or margins with cleared land.		
Notes:	Listed as Priority 4 by CALM, and is of concern because this species is uncommonly encountered.		

Species :	*Falco peregrinus*	Conservation status:	**CS1**
Common name:	Peregrine Falcon		
Habitat:	Cliffs, gorges, timbered watercourses, and tall man-made infrastructure.		
Notes:	Listed as Specially Protected under the WA Wildlife Conservation Act. *F. peregrinus* is cosmopolitan but uncommon throughout Australia and prefers sites with tall perches (such as gorges, trees or power poles).		
Species :	*Ardeotis australis*	Conservation status:	**CS2**
Common name:	Australian Bustard		
Habitat:	Grasslands, spinifex, open scrublands and pastoral lands.		
Notes:	Listed as Priority 4 by CALM, and is of concern because this species has declined in abundance in recent times as a result of land clearing, grazing, illegal shooting and the introduction of feral predators, and requires continued monitoring. *A. australis* is a nomad of northern, western and inland Australia and is common in areas away from human settlement. They forage terrestrially for fruits, seeds and invertebrates.		
Species :	*Tringa nebularia*	Conservation status:	**CS1**
Common name:	Common Greenshank		
Habitat:	Estuaries, tidal flats, mangroves, rivers, wetlands, sewage ponds and saltfields.		
Notes:	Listed as Migratory under the EPBC Act. *T. nebularia* breeds from Scotland to Siberia and migrates to arrive in Australia from August to October , returning to the breeding grounds by April or May. *T. nebularia* occurs in association with wetland or aquatic habitats throughout Australia (except in the central deserts) where it feeds predominantly on aquatic insects.		
Species :	*Tringa glareola*	Conservation status:	**CS1**
Common name:	Wood Sandpiper		
Habitat:	Muddy margins of wetlands, mudflats, mangroves, salt marshes and sewage ponds.		
Notes:	Listed as Migratory under the EPBC Act. *T. glareola* breeds from northern Eurasia to Siberia and migrates to arrive in by September , returning to the breeding grounds by May. This species is an uncommon but regular migrant to Australia.		
Species :	*Actitis hypoleucos*	Conservation status:	**CS1**
Common name:	Common Sandpiper		
Habitat:	Estuaries, tidal flats, mangroves, rivers, wetlands, sewage ponds and saltflats.		
Notes:	Listed as Migratory under the EPBC Act. *A. hypoleucos* breeds from British Isles to Siberia and migrates to arrive in Australia from July, returning to the breeding grounds by April. *A. hypoleucos* prefers stony or pebbly substrates associated with water bodies and is uncommon, though widespread, throughout Australia (except in the central deserts). *A. hypoleucos* may congregate in groups but is most commonly observed singly.		
Species :	*Calidris ruficollis*	Conservation status:	**CS1**
Common name:	Red-necked Stint		
Habitat:	Tidal flats, estuaries, salt marshes, beaches, wetlands and sewage ponds.		
Notes:	Listed as Migratory under the EPBC Act. *C. ruficollis* breeds in Arctic Siberia and northern Alaska and migrates to arrive in Australia by August, returning to the breeding grounds by May. *C. ruficollis* is one of the most		

	abundant migrant waders to Australia, where it is common in suitable habitat throughout the country (excluding deserts). *C. ruficollis* usually forages and roosts in small to very large flocks.	
Species :	*Calidris acuminata*	Conservation status: **CS1**
Common name:	Sharp-tailed Sandpiper	
Habitat:	Tidal flats, estuaries, salt marshes, beaches, wetlands and sewage ponds.	
Notes:	Listed as Migratory under the EPBC Act. *C. acuminata* breeds in Arctic Siberia and migrates to arrive in Australia by August, returning to the breeding grounds by May. *C. acuminata* prefers freshwater environments. It has been recorded from coastal and inland wetlands throughout Australia but is more abundant in the south.	
Species :	*Calidris ferruginea*	Conservation status: **CS1**
Common name:	Curlew Sandpiper	
Habitat:	Tidal flats, estuaries, salt marshes, beaches, wetlands and sewage ponds.	
Notes:	Listed as Migratory under the EPBC Act. *C. ferruginea* breeds in north-eastern Siberia and migrates to arrive in Australia by August, returning to the breeding grounds by May. *C. ferruginea* is abundant in Australia during the non-breeding season and occurs at coastal and inland sites throughout the country (excluding deserts). *C. ferruginea* probes for marine invertebrates in benthic substrates.	
Species :	*Burhinus grallarius*	Conservation status: **CS2**
Common name:	Bush Stone-curlew	
Habitat:	Woodland, often adjacent to watercourss in the Pilbara.	
Notes:	Listed as Priority 4 by CALM because it is adversely affected by foxes. *B. grallarius* is also sometimes struck on roads.	
Species :	*Thinornis rubricollis*	Conservation status: **CS2**
Common name:	Hooded Plover	
Habitat:	Oceanic beaches and salt lakes.	
Notes:	Listed as Priority 4 by CALM because *T. rubricollis* nests are highly susceptible to disturbance by beach traffic (e.g. vehicles, horses, pedestrians) and birds are threatened by fox and cat predation.	
Species :	*Sterna caspia*	Conservation status: **CS1**
Common name:	Caspian Tern	
Habitat:	Coastal waters, beaches, tidal flats, larger rivers, lakes and wetlands.	
Notes:	Listed as Migratory under the EPBC Act. *S. caspia* occurs commonly throughout much of Australia (except desert regions). *S. caspia* feeds on small and medium sized fish.	
Species :	*Chlidonias leucopterus*	Conservation status: **CS1**
Common name:	White-winged Black Tern	
Habitat:	Coastal waters, estuaries, large wetlands and sewage ponds.	
Notes:	Listed as Migratory under the EPBC Act. *C. leucopterus* breeds in Eurasia, and migrates to arrive in Australia by October, returning to the breeding grounds by May or June. In Australia *C. leucopterus* occurs along the western, northern and eastern coasts, but also utilises inland, aquatic habitats.	
Species :	*Calyptorhynchus latirostris*	Conservation status: **CS1**
Common name:	Carnaby`s Cockatoo	
Habitat:	Open forests and woodlands, Kwongan heath, sand plains, suburban vegetation and pine plantations.	
Notes:	Listed as Endangered under the EPBC and WA Wildlife Conservation	

	Acts. Land clearing and degradation has reduced avialbale breding sites (tree hollows) and fragmented breeding an dfeeding sites. Feral bees, galahs and corellas out-compete *C. latirostris* for nesting hollows. Illegal trapping and smuggling also threatens this species.		
Species :	*Calyptorhynchus baudinii*	Conservation status:	**CS1**
Common name:	Baudin`s Cockatoo		
Habitat:	Jarrah, Marri and Karri forests, woodlands, coastal scrub.		
Notes:	Listed as Vulnerable under the EPBC Act and as Endangered under the WA Wildlife Conservation Act. Clearing for agriculture and logging has removed nesting and feeding trees for this species.		
Species :	*Cacatua leadbeateri*	Conservation status:	**CS1**
Common name:	Major Mitchell's Cockatoo		
Habitat:	Timbered watercourses, grasslands, mulga, and gibber.		
Notes:	Listed as Specially Protected under the WA Wildlife Conservation Act. The population of *C. leadbeateri* in Western Australia has declined significantly in response to large scale agricultural clearing.		
Species :	*Pezoporus occidentalis*	Conservation status:	**CS1**
Common name:	Night Parrot		
Habitat:	Spinifex and hummock grasslands, chenopod shrublands, especially surrounding salt lakes.		
Notes:	Listed as Endangered and Migratory under the EPBC Act and as Critically Endangered under the WA Wildlife Conservation Act. There have been no confirmed sightings of a live *P. occidentalis* since the 1930s, but prior to this it was recorded from inland desert and pastoral areas. Not surprisingly the ecology of this species is poorly understood, but it is thought to forage nocturnally for seeds and herbage. The major threatening processes to this species are predation (especially by foxes and cats), altered fire regimes and grazing.		
Species :	*Ninox connivens connivens*	Conservation status:	**CS2**
Common name:	Barking Owl (south-west population)		
Habitat:	Open forests, woodlands, dense scrub and timbered watercourses.		
Notes:	Listed as Priority 2 by CALM and is of concern because the population of this subspecies has declined dramatically as a result of habitat clearing and logging. The northern subspecies, *N. c. peninsularis*, occurs in the Pilbara and Northern Territory and is not currently listed as a threatened or priority species.		
Species :	*Apus pacificus*	Conservation status:	**CS1**
Common name:	Fork-tailed Swift		
Habitat:	Aerial habitats throughout Australia.		
Notes:	Listed as Migratory under the EPBC Act. *A. pacificus* breeds in Siberia and the Himalayas and migrates to arrive in Australia in October, returning to the breeding grounds by May or June. Movements within Australia are in response to weather patterns, with this species often following thunderstorms. It is a highly aerial species that rarely comes to ground.		
Species :	*Merops ornatus*	Conservation status:	**CS1**
Common name:	Rainbow Bee-eater		
Habitat:	Open woodlands, sand ridges, sand pits, riverbanks, beaches, dunes, cliffs, mangroves and man-made grassed fields.		
Notes:	Listed as Migratory under the EPBC Act. *M. ornatus* occurs year-around		

in the tropics and with a southward migration, to both south-eastern and south-western Australia, in early spring. Southern birds return north in autumn. When present, *M. ornatus* is common and prominent in natural and altered environments.

Species :	*Amytornis textilis textilis*	Conservation status:	**CS1**
Common name:	Thick-billed Grasswren (western population)		
Habitat:	Sandy lowlands with dense, low shrubs, low *Acacia* spp. over grasses.		
Notes:	Listed as Vulnerable under the EPBC Act and as Priority 4 by CALM. Current status: *A. t. textilis* is restricted to the Shark Bay region and is mainly threatened by vegetation changes induced by introduced herbivores, and predation by feral cats and foxes.		
Species :	*Hylacota cauta whitlocki*	Conservation status:	**CS2**
Common name:	Shy Heathwren (south-west population)		
Habitat:	Mallee, native pine, heath with *Banksia* or *Leptospermum* spp.		
Notes:	Listed as Priority 4 by CALM and is of concern because agricultural clearing has removed large tracts of suitable habitat. Degraedation (by stock) and fragmentation are threatening persisting remnants. *H. c. whitlocki* lives in dense shrubs and feeds close to the ground for invertebrates. *H. c. whitlocki* occurs in the south-west and south-east of Western Australia.		
Species :	*Calamanthus campestris montanellus*	Conservation status:	**CS2**
Common name:	Rufous Fieldwren (western wheatbelt population)		
Habitat:	Saltbush, bluebush, spinifex, roly-poly bush and low shrubs.		
Notes:	Listed as Priority 4 by CALM and is of concern because agricultural clearing has removed large tracts of suitable habitat. Habitat degradation by stock and weeds continues to threaten this species. *C. c. montanellus* occurs in the south-west and wheatbelt regions of Western Australia.		
Species :	*Acanthiza iridalei iredalei*	Conservation status:	**CS1**
Common name:	Slender-billed Thornbill (western population)		
Habitat:	Treeless chenopod shrubland, samphire, low heath, mulga and mangroves.		
Notes:	Listed as Vulnerable under the EPBC Act and is of concern because its favoured habitats have been badly degraded by grazing stock (particularly sheep).		
Species :	*Pomatostomus superciliosus ashbyi*	Conservation status:	**CS2**
Common name:	White-browed Babbler (western wheatbelt population)		
Habitat:	Dry, scrubby woodland, mulga, mallee, native pine and shrubby areas.		
Notes:	Listed as Priority 4 by CALM and is of concern because agricultural clearing has removed most of the suitable habitat for this species in this region. *P. s. ashbyi* occurs in the south-west of Western Australia, south of a line between approximately Jurien Bay and Hopetown.		
Species :	*Oreoica gutturalis gutturalis*	Conservation status:	**CS2**
Common name:	Crested Bellbird (southern population)		
Habitat:	Arid scrublands, saltbush, mallee, spinifex, and woodlands.		
Notes:	Listed as Priority 4 by CALM and is of concern because land clearing has removed most of the suitable habitat for this species and it is particularly sensitive to habitat fragmentation. *O. g. gutturalis* occurs in a strip from near Geraldton on the west coast, through the wheatbelt to the southern coast of Western Australia, east of Esperance.		
Species :	*Neochmia ruficauda subclarescens*	Conservation status:	**CS1**

Common name:	Star Finch (western population)
Habitat:	Near water in grass flats, bushes, reeds, rushes near water and irrigated fields.
Notes:	The westernmost race (*subclarescens*) of *N. ruficauda* is listed as Endangered under the EPBC Act and as Priority 4 by CALM. *N. r. subclarescens* occurs from north-western Western Australia to the eastern Northern Territory border. This species prefers eucalypt woodland and grassland in close proximity to fresh water where it feeds on seeds. *N. r. subclarescens* occurs at low densities in the Pilbara but has large populations in some areas of the Kimberley (e.g. the irrigated grasslands around Kununurra). The major threatening process to this species is the over-grazing of grasslands near water.

Mammals

Species :	*Dasycercus cristicauda*	Conservation status:	**CS1**
Common name:	Mulgara		
Habitat:	Spinifex hummock grassland and sandy desert.		
Notes:	Listed as Vulnerable under both the EPBC and WA Wildlife Conservation Acts. Formerly distributed through the inland deserts of Western Australia and the Northern Territory, *D. cristicauda* now occurs patchily within this range. *D. cristicauda* feeds on small vertebrates and large invertebrates and populations fluctuate greatly according to the quality of the seasons. Fox and cat predation in conjunction with altered fire regimes are the major processes threatening *D. cristicauda*.		
Species :	*Dasyurus geoffroii*	Conservation status:	**CS1**
Common name:	Chuditch		
Habitat:	Wet and dry sclerophyll forest, mallee.		
Notes:	Listed as Vulnerable under the EPBC and WA Wildlife Conservation Acts. A ten year recovery plan was published in 1991 and has since been successfully implemented. Habitat alteration through clearing, grazing and changed fire regimes, competition with foxes and cats for food, predation by foxes, hunting, and poisoning all threaten *D. geoffroii*. This species occupies large home ranges, is highly mobile and appears able to utilise bush remnants and corridors.		
Species :	*Dasyurus hallucatus*	Conservation status:	**CS1**
Common name:	Northern Quoll		
Habitat:	Rocky eucalypt woodland and other vegetation/soil associations within approximately 200 km of the coast.		
Notes:	Listed as Endangered under the EPBC Act and is of concern because populations have been in decline and this ahs been accelerated by the invasion and spread of the poisonous Cane Toad (which is regularly eaten by *D. hallucatus*).		
Species :	*Phascogale tapoatafa*	Conservation status:	**CS2**
Common name:	Brush-tailed Phascogale		
Habitat:	Dry sclerophyll forest.		
Notes:	Listed as Priority 3 by CALM and is of concern because it is threatened by habitat clearing and alteration, a reduction in hollow-bearing trees (particularly as a result of clearing and logging), and predation by cats and		

foxes. *P. tapoatafa* is sparsely distributed in the south-west of Western Australia.

Species :	*Isoodon obesulus fusciventer*	Conservation status:	**CS2**
Common name:	Southern Brown Bandicoot, Quenda		
Habitat:	Sandy soils with low ground cover. Prefer areas that are regularly burnt. Highest densities occur in association with wetlands and damplands.		
Notes:	Listed as Priority 5 by CALM and is of concern because habitat clearing and fragmentation, fire, and predation by foxes, cats and domestic dogs threaten this species.		

Species :	*Macrotis lagotis*	Conservation status:	**CS1**
Common name:	Bilby, Greater Bilby		
Habitat:	Acacia shrubland and hummock grasslands.		
Notes:	Listed as Vulnerable under both the EPBC and WA Wildlife Conservation Acts. The species is of concern because it was once common, but is now rare and declining, and its distribution has undergone a dramatic contraction. Predation by foxes appears to be the greatest threat to *M. lagotis*, however, habitat clearing has also contributed to their decline, particularly in the southern parts of their range. This species shelters in burrows.		

Species :	*Lagorchestes conspicillatus leichardti*	Conservation status:	**CS2**
Common name:	Spectacled Hare-wallaby (mainland)		
Habitat:	Tussock or hummock grassland with moderate to sparse tree cover.		
Notes:	Listed as Priority 3 by CALM and is of concern because this species has declined in many parts of its range and is vulnerable to cat and fox predation. It also suffers from the impacts of frequent fires.		

Species :	*Macropus irma*	Conservation status:	**CS2**
Common name:	Western Brush Wallaby, Kwoora		
Habitat:	Open dry sclerophyll forests with open, seasonal wet flats with low grasses and open scrub.		
Notes:	Listed as Priority 5 by CALM and is of concern because it is threatened by habitat clearing and fragmentation, predation by foxes and illegal hunting.		

Species :	*Petrogale lateralis lateralis*	Conservation status:	**CS1**
Common name:	Black-flanked Rock Wallaby.		
Habitat:	Rock piles and scree slopes.		
Notes:	Listed as Vulnerable under both the EPBC and WA Wildlife Conservation Acts and is of concern because its distribution and abundance have been greatly reduced, most likely by fox predation and habitat clearing. *P. l. lateralis* now occurs in isolated populations on Cape Range, the southern edge of the Pilbara, on Calvert Range (near Lake Disappointment) and in the wheatbelt, near Kelleberrin. There are at least three other subspecies of *P. lateralis*, all of which have been listed as Vulnerable under the EPBC and WA Wildlife Conservation Acts.		

Species :	*Macroderma gigas*	Conservation status:	**CS2**
Common name:	Ghost Bat		
Habitat:	Arid spinifex hills, blacksoil grasslands, forests, and open woodland.		
Notes:	Listed as Priority 4 by CALM and is of concern because the population is in decline. Disturbance of roosting sites by mining, tourism and natural degradation (particularly mineshafts) has contributed to the decline. Competition for prey with cats and foxes may also threaten this species.		

Species :	*Rhinonicterus aurantius* (Pilbara poulation)	Conservation status:	**CS1**
Common name:	Orange Leaf-nosed Bat (Pilbara poulation)		
Habitat:	Deep, moist caves and mine adits.		
Notes:	The Pilbara form of *R. aurantius* is listed as Vulnerable under both the EPBC and WA Wildlife Conservation Acts. This form is known from a scattered number of localities in the Pilbara and Gascoyne regions and is geographically separated from the much more common Kimberley/Northern Territory form. *R. aurantius* shelters in caves or underground mines by day, and forages nocturnally in surrounding grasslands and woodlands. The disturbance and collapse of roost sites are the major threats to Pilbara *R. aurantius*.		
Species :	*Hydromys chrysogaster*	Conservation status:	**CS2**
Common name:	Water Rat		
Habitat:	Permanent bodies of fresh or brackish water.		
Notes:	Listed as Priority 4 by CALM and is of concern because the species' population is in decline, particularly along rivers affected by salting or degradation.		
Species :	*Leggadina lakedownensis*	Conservation status:	**CS2**
Common name:	Lakeland Downs Mouse or Kerakenga		
Habitat:	Moist tussock grassland, tropical savannah and stony hummock grassland.		
Notes:	Listed as Priority 4 by CALM. *L. lakedownensis* populations rise and fall dramatically, probably in response to climatic fluctuations and availability of seeds.		
Species :	*Pseudomys chapmani*	Conservation status:	**CS2**
Common name:	Pilbara Pebble-mound Mouse, Western Pebble-mound Mouse		
Habitat:	Stony hillsides with hummock grassland.		
Notes:	Listed as Priority 4 by CALM and is of concern because it is insufficiently known, and the species may be in decline as a result of cat and fox predation. *P. chapmani* populations rise and fall dramatically, probably in response to climatic fluctuations and availability of seeds.		
Species :	*Pseudomys shortridgei*	Conservation status:	**CS1**
Common name:	Heath Mouse		
Habitat:	Tall heath and mallee that has not been burnt for more than 15 years.		
Notes:	Listed as Vulnerable under both the EPBC and WA Wildlife Conservation Acts and is of concern because cats, foxes and inappropriate fire regimes have caused populations to contract and decline. In Western Australia *P. shortridgei* are known from Lake Magenta and Dragon Rocks Nature Reserves, the Ravensthorpe Range and Fitzgerald River National Park, all in the south-west of the state.		

POTENTIAL IMPACTS ON FAUNA

The procedures and processes required to construct the northern loops may impact on fauna in a number of ways. The majority of these impacts are applicable to all northern loops and are dealt with in this section in a general manner (i.e. not loop-specific).

Direct interaction with fauna during the Northern Loopings project will be unavoidable and a separate investigation of fauna interactions was warranted. A

detailed Fauna Interaction Protocol for interacting with fauna has been previously prepared (Bamford 2005[1]) and it is anticipated that this document will be used to guide fauna interactions throughout the construction of the Northern Loopings. In addition, a number of less direct impacts may need to be managed:

- Death/injury of fauna during clearing, grading and impacts with vehicles.
- Loss of habitat (temporary except in the case of habitat trees);
- Fragmentation of habitat (temporary).
- Spread of weeds and feral fauna along cleared line;
- Increase in feral fauna due to provision of water in turkey nests (temporary);
- Entrapment in trenches that are excavated to receive the pipeline;
- Disturbance of fauna in nearby areas from light, noise and even personnel feeding selected species.

LOOP-SPECIFIC INFORMATION

A summary of the species of conservation significance and any loop-specific concerns or information are presented here.

Loop 1

Loop 1 will run for *c.* 12 km in a south-westerly direction from Compressor Station 1 (CS1). CS1 is located *c.* 25 km south-west of the Fortescue River Roadhouse (on the North West Coastal Highway). Loop 1 will cross Peter Creek at its northern end, but will not cross the Robe River to the south and west of its southern terminus. The vegetation and soil association intercepted by Loop 1 is predominantly open shrublands of *Melaleuca glomerata* with occasionally emergent *Eucalyptus* sp. on sand/gravel/loam flats.

The literature search identified 5 frog, 79 reptile, 155 bird, and 42 mammal species that may potentially occur in the vicinity of Loop 1. There are 20 CS1 and 8 CS2 species within this set:

CS1 Species	CS2 Species
Pilbara Olive Python	*L. planiventralis maryani*
Great Egret	Grey Falcon
Glossy Ibis	Australian Bustard
White-bellied Sea-Eagle	Bush Stone-curlew
Peregrine Falcon	Spectacled Hare-wallaby
Common Greenshank	Ghost Bat

[1] Bamford & Bancroft (2005) *Protocols For Interaction With Fauna During The Construction Of Stage 4 Expansion, Loops 1-9 Of The DBNGP Pipeline.* Prepared for Ecos Consulting (Aust) Pty Ltd, Nov 2005.

Wood Sandpiper	Short-tailed Mouse
Common Sandpiper	Western Pebble-mound Mouse
Red-necked Stint	
Sharp-tailed Sandpiper	
Curlew Sandpiper	
Caspian Tern	
White-winged Black Tern	
Night Parrot	
Fork-tailed Swift	
Rainbow Bee-eater	
Star Finch	
Northern Quoll	
Black-footed Rock-wallaby	
Orange Leaf-nosed Bat	

The egret, ibis, sea-eagle, sandpipers and terns are unlikely to occur along the path of Loop 1 because these species are dependent on standing bodies of water or tidal mudflats. The python, quoll, rock-wallaby, leaf-nosed bat and pebble-mound mouse are generally dependent on rocky hills or gorges that are present in the vicinity, but not along the path of Loop 1. Although the falcons may forage in the general vicinity of Loop 1, they prefer to roost or nest along cliff lines or in large trees that are not present along its path. The Australian Bustard is an arid-zone nomad that may pass through the Loop 1 area but is unlikely to be significantly impacted by construction. Although relatively sedentary, Bush Stone-curlews forage across wide areas (up to 20 km) and are unlikely to be permanently displaced by construction along Loop 1. The Night Parrot is a very rarely encountered and poorly known species that may prefer spinifex/samphire margins (not present in Loop 1). Bee-eaters forage widely across any suitable habitat and may migrate through the Loop 1 region. The Fork-tailed Swift is a highly aerial vagrant species that is unlikely to be affected by the proposed works. The Star Finch is usually restricted to areas that are near fresh water sources and the lack of these sources along the Loop 1 path suggests that this species is unlikely to be a permanent resident.
Ghost Bats may potentially forage along the Loop 1 path but are dependent on caves or mine shafts (that are not present along Loop 1) as roosting sites. The ecology of the Short-tailed Mouse is poorly understood and it may occur in the path of Loop 1.

Loop 2

Loop 2 will run for *c.* 32 km in a south/south-westerly direction from CS2. CS2 is located *c.* 30 km east of the Nanutarra Roadhouse (on the North West Coastal Highway). Loop 2 will cross the Ashburton River at its northern end. The vegetation and soil associations intercepted by Loop 2 include:

- hummock grassland (spinifex) with *Acacia* spp. over *Pluchea tetranthera* with occasionally emergent *Eucalyptus* sp. in silty soils;
- open scrub of *Acacia* spp., *Aristida* sp., *Senna artemisioides*, and *Cullen leucanthum* over native and introduced grasses in degraded silty soils; and
- low open woodland of *Corymbia zygophylla* over spinifex, native grasses and *Acacia ancistrocarpa* with *Eremophila ramiflora* over mixed shrub species in red silty soils with quartz pebbles.

The literature search identified 6 frog, 87 reptile, 155 bird, and 37 mammal species that may potentially occur in the vicinity of Loop 2. There are 17 CS1 and 6 CS2 species within this set:

CS1 Species	CS2 Species
Pilbara Olive Python	Grey Falcon
Great Egret	Australian Bustard
Glossy Ibis	Bush Stone-curlew
White-bellied Sea-Eagle	Ghost Bat
Peregrine Falcon	Short-tailed Mouse
Common Greenshank	Western Pebble-mound Mouse
Wood Sandpiper	
Common Sandpiper	
Red-necked Stint	
Sharp-tailed Sandpiper	
Curlew Sandpiper	
White-winged Black Tern	
Night Parrot	
Fork-tailed Swift	
Rainbow Bee-eater	
Star Finch	
Northern Quoll	

The egret, ibis, sea-eagle, sandpipers and tern are dependent on standing bodies of water or tidal mudflats and, if present along the Loop 2 path, are most likely to occur along in the vicinity on the Fortescue River crossing. The python, quoll and pebble-mound mouse are generally dependent on rocky hills or gorges that are present in the vicinity, but not along the path of Loop 2. Although the falcons may forage in the general vicinity of Loop 2, they prefer to roost or nest along cliff lines or in large trees that are not present along its path. The Australian Bustard is an arid-zone nomad that may pass through the Loop 2 area but is unlikely to be significantly impacted by construction. Although relatively sedentary, Bush Stone-curlews forage across wide areas (up to 20 km) and are unlikely to be permanently displaced by construction along Loop 2. The Night Parrot is a very rarely encountered and poorly known species that may prefer spinifex/samphire margins (spinifex is present in Loop 2). Bee-eaters forage widely across any suitable habitat and may migrate through the Loop 2 region. The Fork-tailed Swift is a highly aerial vagrant species that is unlikely to be affected by the proposed works. The Star Finch is usually restricted to areas that are near fresh water sources and, in the case of Loop 2, these areas would be near the Fortescue River crossing and are unlikely to be significantly disturbed (due to horizontal drilling). Ghost Bats may potentially forage along the Loop 2 path but are dependent on caves or mine shafts (that are not present along Loop 2) as roosting sites. The ecology of the Short-tailed Mouse is poorly understood and it may occur in the path of Loop 2.

Loop 3

Loop 3 will run for *c.* 25 km in a southerly direction from CS3. CS3 is located *c.* 100 km east of the Minilya Roadhouse (on the North West Coastal Highway), east of the

Gooch Range. Loop 3 will cross the upper reaches of the Minilya River at its southern end. The vegetation and soil associations intercepted by Loop 3 include:

- Low shrubland of *Acacia ancistrocarpa* with *Corchorus lasiocarpus*, *Pterocaulon sphacelatum*, *Cullen martinii* over spinifex with occasionally emergent *Corymbia deserticola* and *Acacia acradenia* in red sandy clay soils;
- Tall open shrubland of *Acacia acradenia* over *Acacia synchronicia*, *Eremophila cuneifolia* and *Senna artemisioides* over dead Poaceae spp. in red sandy clay soils;
- Tall open shrubland of *Acacia* spp. and *Hakea preissii* over *Eremophila cuneifolia*, *Senna artemisioides* and *Streptoglossa decurrens* in red sandy clay soils; and
- Tall open shrubland of *Acacia cuspidifolia* over *Scaevola spinescens* over dead Poaceae spp. in sandy soils with mixed pebbles.

The literature search identified 4 frog, 75 reptile, 152 bird, and 33 mammal species that may potentially occur in the vicinity of Loop 3. There are 16 CS1 and 5 CS2 species within this set:

CS1 Species	CS2 Species
Great Egret	Grey Falcon
Glossy Ibis	Australian Bustard
White-bellied Sea-Eagle	Bush Stone-curlew
Peregrine Falcon	Ghost Bat
Common Greenshank	Western Pebble-mound Mouse
Wood Sandpiper	
Common Sandpiper	
Red-necked Stint	
Sharp-tailed Sandpiper	
Curlew Sandpiper	
White-winged Black Tern	
Fork-tailed Swift	
Rainbow Bee-eater	
Star Finch	
Mulgara	
Bilby	

The egret, ibis, sea-eagle, sandpipers and terns are unlikely to occur along the path of Loop 3 because these species are dependent on standing bodies of water or tidal mudflats. The pebble-mound mouse is generally dependent on rocky hills or gorges that are present in the vicinity, but not along the path of Loop 3. Although the falcons may forage in the general vicinity of Loop 3, they prefer to roost or nest along cliff lines or in large trees that are not present along its path. The Australian Bustard is an arid-zone nomad that may pass through the Loop 3 area but is unlikely to be significantly impacted by construction. Although relatively sedentary, Bush Stone-curlews forage across wide areas (up to 20 km) and are unlikely to be permanently displaced by construction along Loop 3. Bee-eaters forage widely across any suitable habitat and may migrate through the Loop 3 region. The Fork-tailed Swift is a highly aerial vagrant species that is unlikely to be affected by the proposed works. The Star Finch is usually restricted to areas that are near fresh water sources and the lack of these sources along the Loop 3 path suggests that this species is unlikely to be a permanent resident. The Mulgara inhabits sandy areas, where it generally burrows in

the flats between dunes, and therefore may be present along the path of Loop 3. The Bilby inhabits a range of soil types, including sands and clays, where it constructs burrows for shelter during the day. Although the soils along the Loop 3 path would be suitable for bilbies, the presence of these animals along Loop 3 would represent a reasonable westerly extension of their known current range and is therefore unlikely. Ghost Bats may potentially forage along the Loop 3 path but are dependent on caves or mine shafts (that are not present along Loop 3) as roosting sites.

Loop 4

Loop 4 will run for *c.* 25 km in a southerly direction from CS4. CS4 is located *c.* 20 km north-east of the town of Gascoyne Junction and east of the Kennedy Range National Park. Loop 4 will cross Davis Creek (a tributary of the Lyons River) and the Gascoyne River at its southern end. The vegetation and soil associations intercepted by Loop 4 include:

- Tall open shrubland of *Acacia* spp. over *Eremophila cuneifolia*, *Acacia* sp., *Senna artemisioides* over *Sclerolaena cuneata* and *Cenchrus* sp. in red sandy clay soils with quartz pebbles;
- Tall open shrubland of *Acacia acradenia* and *Hakea preissii* over *Ptilotus polakii*, *Frankenia cordata*, *Solanum lasiophyllum* and *Acacia* sp. in sandy soils with quartz pebbles; and
- Tall open shrubland of *Acacia sclerosperma* and *Hakea preissii* over *Ptilotus obovatus* and *Cenchrus* sp. with occasionally emergent *Eucalyptus* sp. in sandy soils.

The literature search identified 5 frog, 71 reptile, 157 bird, and 27 mammal species that may potentially occur in the vicinity of Loop 4. There are 16 CS1 and 3 CS2 species within this set:

CS1 Species	CS2 Species
Great Egret	Grey Falcon
Glossy Ibis	Australian Bustard
White-bellied Sea-Eagle	Bush Stone-curlew
Peregrine Falcon	
Common Greenshank	
Wood Sandpiper	
Common Sandpiper	
Red-necked Stint	
Sharp-tailed Sandpiper	
Curlew Sandpiper	
White-winged Black Tern	
Fork-tailed Swift	
Rainbow Bee-eater	
Slender-billed Thornbill	
Star Finch	
Mulgara	

The egret, ibis, sea-eagle, sandpipers and tern are dependent on standing bodies of water or tidal mudflats and, if present along the Loop 4 path, are most likely to occur along in the vicinity on the Gascoyne River crossing. Although the falcons may

forage in the general vicinity of Loop 4, they prefer to roost or nest along cliff lines or in large trees that may be present along the Gascoyne River. The Australian Bustard is an arid-zone nomad that may pass through the Loop 4 area but is unlikely to be significantly impacted by construction. Although relatively sedentary, Bush Stone-curlews forage across wide areas (up to 20 km) and are unlikely to be permanently displaced by construction along Loop 4. Bee-eaters forage widely across any suitable habitat and may migrate through the Loop 4 region. The Fork-tailed Swift is a highly aerial vagrant species that is unlikely to be affected by the proposed works. Habitat along the Loop 4 path is probably unsuitable for Slender-billed Thornbills because they favour vegetation surrounding salt-lakes or treeless plains. The Star Finch is usually restricted to areas that are near fresh water sources and the lack of these sources along the Loop 4 path suggests that this species is unlikely to be a permanent resident. The Mulgara inhabits sandy areas, where it generally burrows in the flats between dunes, and therefore may be present along the path of Loop 4.

Loop 5

Loop 5 will run for *c.* 22 km in a southerly direction from CS5. CS5 is located *c.* 90 km east-north-east of the Overlander Roadhouse (on the North West Coastal Highway). Loop 5 will not cross any main drainage lines. The vegetation and soil associations intercepted by Loop 5 include:

- Low open woodland of *Eucalyptus camaldulensis* over *Acacia beauverdiana*, *Callitris glaucophylla*, *Thryptomene decussata*, *Grevillea paradoxa* and *Dianella revoluta* over *Monachather paradoxus* on pale red sandy soils; and
- Open scrub of *Acacia* spp. over *Eremophila clarkei*, *Senna cardiosperma*, *Grevillea paradoxa* over *Sida cardiophylla* and *Eriachne* sp. on red sand.

The literature search identified 5 frog, 63 reptile, 165 bird, and 20 mammal species that may potentially occur in the vicinity of Loop 5. There are 16 CS1 and 3 CS2 species within this set:

CS1 Species	CS2 Species
Great Egret	Grey Falcon
Glossy Ibis	Australian Bustard
White-bellied Sea-Eagle	Bush Stone-curlew
Peregrine Falcon	
Common Greenshank	
Wood Sandpiper	
Common Sandpiper	
Red-necked Stint	
Sharp-tailed Sandpiper	
Curlew Sandpiper	
Caspian Tern	
White-winged Black Tern	
Fork-tailed Swift	
Rainbow Bee-eater	
Thick-billed Grasswren	
Slender-billed Thornbill	

The egret, ibis, sea-eagle, sandpipers and terns are unlikely to occur along the path of Loop 5 because these species are dependent on standing bodies of water or tidal mudflats. The falcons may forage in the general vicinity of Loop 5 and may nest in larger trees present along the Loop 5 path. The Australian Bustard is an arid-zone nomad that may pass through the Loop 5 area but is unlikely to be significantly impacted by construction. Although relatively sedentary, Bush Stone-curlews forage across wide areas (up to 20 km) and are unlikely to be permanently displaced by construction along Loop 5. Bee-eaters forage widely across any suitable habitat and may migrate through the Loop 5 region. The Fork-tailed Swift is a highly aerial vagrant species that is unlikely to be affected by the proposed works. Thick-billed Grasswrens are sedentary and prefer habitats with dense, low shrubs that may be present along the Loop 5 path. Habitat along the Loop 5 path is probably unsuitable for Slender-billed Thornbills because they favour vegetation surrounding salt-lakes or treeless plains.

Loop 6

Loop 6 will run for *c.* 11 km in a southerly direction from CS6. CS6 is located *c.* 75 km north-east of Kalbarri. Loop 6 will not cross any main drainage lines. The vegetation and soil associations intercepted by Loop 6 is predominantly low open woodland of *Eucalyptus camaldulensis* over *Acacia beauverdiana, Callitris glaucophylla, Thryptomene decussata, Grevillea paradoxa* and *Dianella revoluta* over *Monachather paradoxus* on pale red sandy soils.

The literature search identified 2 frog, 60 reptile, 167 bird, and 19 mammal species that may potentially occur in the vicinity of Loop 6. There are 16 CS1 and 2 CS2 species within this set:

CS1 Species	CS2 Species
Great Egret	Australian Bustard
Glossy Ibis	Bush Stone-curlew
White-bellied Sea-Eagle	
Peregrine Falcon	
Common Greenshank	
Wood Sandpiper	
Common Sandpiper	
Red-necked Stint	
Sharp-tailed Sandpiper	
Curlew Sandpiper	
Caspian Tern	
White-winged Black Tern	
Major Mitchell's Cockatoo	
Fork-tailed Swift	
Rainbow Bee-eater	
Slender-billed Thornbill	

The egret, ibis, sea-eagle, sandpipers and terns are unlikely to occur along the path of Loop 6 because these species are dependent on standing bodies of water or tidal mudflats. The Peregrine Falcon may forage in the general vicinity of Loop 6 and may perch in larger trees present along the Loop 6 path. The Australian Bustard is an arid-

zone nomad that may pass through the Loop 6 area but is unlikely to be significantly impacted by construction. Although relatively sedentary, Bush Stone-curlews forage across wide areas (up to 20 km) and are unlikely to be permanently displaced by construction along Loop 6. Bee-eaters forage widely across any suitable habitat and may migrate through the Loop 6 region. Major Mitchell's Cockatoo forage in small flocks and prefer seeds of *Callitris* and *Acacia* spp. and may therefore forage along the Loop 6 path. The Fork-tailed Swift is a highly aerial vagrant species that is unlikely to be affected by the proposed works. Habitat along the Loop 6 path is probably unsuitable for Slender-billed Thornbills because they favour vegetation surrounding salt-lakes or treeless plains.

Loop 7

Loop 7 will run for *c.* 5 km in a southerly direction from CS7. CS7 is located *c.* 50 km north-north-east of Geraldton. Loop 7 will not cross any main drainage lines. The vegetation and soil associations intercepted by Loop 7 is predominantly low disturbed remnant shrubland of *Melaleuca uncinata* and *Acacia aestivalis* over *Baeckea* sp. over *Lepidosperma leptostachyum* and pastoral weeds on pale sands with sub-surface sandstone in association with watercourses.

The literature search identified 11 frog, 96 reptile, 184 bird, and 25 mammal species that may potentially occur in the vicinity of Loop 7. There are 20 CS1 and 8 CS2 species within this set:

CS1 Species	CS2 Species
Gilled Slender Blue-tongue	*Lerista yuna*
Western Spiny-tailed Skink	Carpet Python
Woma	Australian Bustard
Great Egret	Bush Stone-curlew
Glossy Ibis	Barking Owl
White-bellied Sea-Eagle	Rufous Fieldwren
Peregrine Falcon	White-browed Babbler
Common Greenshank	Crested Bellbird
Wood Sandpiper	
Common Sandpiper	
Red-necked Stint	
Sharp-tailed Sandpiper	
Curlew Sandpiper	
Caspian Tern	
White-winged Black Tern	
Major Mitchell's Cockatoo	
Fork-tailed Swift	
Rainbow Bee-eater	
Slender-billed Thornbill	
Black-footed Rock-wallaby	

The blue-tongue and *Lerista* shelter under shrubs and leaf litter that may be present along the Loop 7 path, however land degradation by stock may have rendered habitat unsuitable for these species. The spiny-tailed skink and rock-wallaby are generally

dependent on rocky habitats or gorges that are not present along the Loop 7 path. The Woma prefers woodlands, heathlands and spinifex but is susceptible to land disturbance and is therefore unlikely to occur along the Loop 7 path. The Carpet Python inhabits undisturbed bushland and rocky outcrops that are not present along Loop 7 path. The egret, ibis, sea-eagle, sandpipers and terns are unlikely to occur along the path of Loop 7 because these species are dependent on standing bodies of water or tidal mudflats. The Peregrine Falcon may forage in the general vicinity of Loop 7 and may perch in larger trees present along the Loop 7 path. The Australian Bustard is an arid-zone nomad that may pass through the Loop 7 area but is unlikely to be significantly impacted by construction. Although relatively sedentary, Bush Stone-curlews forage across wide areas (up to 20 km) and are unlikely to be permanently displaced by construction along Loop 7. Major Mitchell's Cockatoo forage in small flocks and prefer seeds of *Callitris* and *Acacia* spp. and may therefore forage along the Loop 7 path. Although the Barking Owl may forage in the vicinity of Loop 7 it prefers woodlands in which it can roost during the day (not present along the Loop 7 path). Bee-eaters forage widely across any suitable habitat and may migrate through the Loop 7 region. The Fork-tailed Swift is a highly aerial vagrant species that is unlikely to be affected by the proposed works. The babbler and bellbird inhabit a range of shrublands but are both sensitive to habitat clearing and disturbance that may preclude their occurrence along the Loop 7 path. Rufous Fieldwren inhabit low, dry shrublands and may be present along the Loop 7 path. Habitat along the Loop 7 path is probably unsuitable for Slender-billed Thornbills because they favour vegetation surrounding salt-lakes or treeless plains.

Loop 8

Loop 8 will run for *c.* 47 km in a south-south-easterly direction from CS8. CS8 is located *c.* 12 km south-east of Eneabba. Loop 8 will cross the Coomallo Creek (in the Coomallo Creek Nature Reserve) approximately mid-way along its length. The vegetation and soil associations intercepted by Loop 8 include:

- Low woodland of *Eucalyptus todtiana* and *Allocasuarina campestris* over low shrubs and sedges on sand;
- Heath of mixed shrubs on sand;
- Low woodland of *Eucalyptus wandoo* over sparse shrubs;
- Low woodland of *Eucalyptus todtiana* over shrubs;
- Heath dominated by Proteaceous shrubs;
- Open mallee;
- Heath on laterite;
- Heath dominated by Dryandra spp. on laterite; and
- Low woodland of Banksia spp. over shrubs on sand.

The literature search identified 11 frog, 74 reptile, 187 bird, and 25 mammal species that may potentially occur in the vicinity of Loop 8. There are 19 CS1 and 11 CS2 species within this set:

CS1 Species	CS2 Species
Western Spiny-tailed Skink	Jewelled Ctenotus
Woma	Carpet Python
Malleefowl	Australian Bustard
Great Egret	Bush Stone-curlew

Glossy Ibis	Hooded Plover
White-bellied Sea-Eagle	Barking Owl
Peregrine Falcon	Shy Heathwren
Common Greenshank	Rufous Fieldwren
Wood Sandpiper	White-browed Babbler
Common Sandpiper	Crested Bellbird
Red-necked Stint	Brush Wallaby
Sharp-tailed Sandpiper	
Curlew Sandpiper	
Caspian Tern	
White-winged Black Tern	
Carnaby`s Cockatoo	
Major Mitchell's Cockatoo	
Fork-tailed Swift	
Rainbow Bee-eater	

The spiny-tailed skink is generally dependent on rocky habitats and may be present along the Loop 8 path. The pythons prefer undisturbed woodlands or heathlands, like those that are present along the Loop 8 path (e.g. the Coomallo Creek Nature Reserve), and there is a reasonable likelihood of these species occurring along the Loop 8 path. The Jewelled Ctenotus prefers heath on sand is likely to occur along the path of Loop 8. Malleefowl range over a territory of 40-70 ha and construct large nest mounds; these mounds, if present along the Loop 8 path, should be avoided. The egret, ibis, sea-eagle, sandpipers and terns are unlikely to occur along the path of Loop 8 because these species are dependent on standing bodies of water or tidal mudflats. The Peregrine Falcon may forage in the Loop 8 vicinity and may perch or nest in larger trees along the Loop 8 path. The Australian Bustard is an arid-zone nomad that may pass through the Loop 8 area but is unlikely to be significantly impacted by construction. If Hooded Plover were present in the Loop 8 area they would be dependent on salt lakes. Although relatively sedentary, Bush Stone-curlews forage across wide areas (up to 20 km) and are unlikely to be permanently displaced by construction along Loop 8. Carnaby's Cockatoo feeds on seeds of Proteaceous plants (present in the Loop 8 vicinity) and nests in tree hollows and is known to nest in the Coomallo Creek Nature Reserve, along the Loop 8 path. Major Mitchell's Cockatoo forage in small flocks and prefer seeds of *Callitris* and *Acacia* spp. and may therefore forage along the Loop 8 path. The Barking Owl may forage and roost in woodlands along the Loop 8 path. Bee-eaters forage widely across any suitable habitat and may migrate through the Loop 8 region (they may also dig nesting burrows in sandy areas). The Fork-tailed Swift is a highly aerial vagrant species that is unlikely to be affected by the proposed works. The babbler and bellbird inhabit a range of shrublands and are likely to occur in good quality, undisturbed habitat along the Loop 8 path. The heathwren and fieldwren inhabit low, dense shrublands and may be present along the Loop 8 path. The Brush Wallaby is likely to inhabit open woodlands in the vicinity of Loop 8, but is also likely to move in response to disturbance.

Loop 9

Loop 9 will run for *c.* 15 km in a south-south-easterly direction from CS9. CS9 is located *c.* 30 km north-west of Gingin. Loop 9 will not cross any main drainage lines. The vegetation and soil associations intercepted by Loop 9 include:

- Low woodland of *Banksia* spp. over dense shrubs on sand;
- Heath of *Regelia ciliata*;
- Sedgeland of *Juncus pallidus*;
- Swamp dominated by *Regelia ciliata* with emergent *Melaleuca preissiana* and *Corymbia calophylla*; and
- Low woodland of *Eucalyptus todtiana* and *Allocasuarina campestris* over low shrubs and sedges.

The literature search identified 12 frog, 64 reptile, 188 bird, and 34 mammal species that may potentially occur in the vicinity of Loop 9. There are 21 CS1 and 15 CS2 species within this set:

CS1 Species	CS2 Species
Woma	Jewelled Ctenotus
Great Egret	*Lersita lineata*
Cattle Egret	Carpet Python
Glossy Ibis	Black-striped Snake
White-bellied Sea-Eagle	Australian Bustard
Peregrine Falcon	Bush Stone-curlew
Common Greenshank	Hooded Plover
Wood Sandpiper	Barking Owl
Common Sandpiper	Rufous Fieldwren
Red-necked Stint	White-browed Babbler
Sharp-tailed Sandpiper	Crested Bellbird
Curlew Sandpiper	Brush-tailed Phascogale
Caspian Tern	Quenda
White-winged Black Tern	Brush Wallaby
Carnaby's Cockatoo	Water-rat
Baudin's Cockatoo	
Major Mitchell's Cockatoo	
Fork-tailed Swift	
Rainbow Bee-eater	
Chuditch	
Heath Mouse	

The pythons prefer undisturbed woodlands or heathlands, like those that are present along the Loop 9 path, and there is a reasonable likelihood of these species occurring in this area. The Jewelled Ctenotus prefers heath on sand is likely to occur along the path of Loop 9. *Lerista lineata* is known from three areas; Perth to Mandurah (including Garden Island), Busselton and Woodleigh Station (Shark Bay) and has not been recorded from the Loop 9 area. The Black-striped Snake is likely to occur in the banksia woodland in the path of Loop 9. The egret, ibis, sea-eagle, sandpipers and terns are unlikely to occur along the path of Loop 9 because these species are dependent on standing bodies of water or tidal mudflats. The Peregrine Falcon may forage in the Loop 9 vicinity and may perch or nest in larger trees along the Loop 9 path. The Australian Bustard is an arid-zone nomad that may pass through the Loop 9

area but is unlikely to be significantly impacted by construction. If Hooded Plover were present in the Loop 9 area they would be dependent on salt lakes. Although relatively sedentary, Bush Stone-curlews forage across wide areas (up to 20 km) and are unlikely to be permanently displaced by construction along Loop 9. Carnaby's Cockatoo feeds on seeds of Proteaceous plants (present in the Loop 9 vicinity) and nests in tree hollows and is known to nest in the Coomallo Creek Nature Reserve, along the Loop 8 path. Baudin's Cockatoo may occur, but Loop 9 is located at the very northern limit of this species' range. Major Mitchell's Cockatoo forage in small flocks and prefer seeds of *Callitris* and *Acacia* spp. and may therefore forage along the Loop 9 path. The Barking Owl may forage and roost in woodlands along the Loop 9 path. Bee-eaters forage widely across any suitable habitat and may migrate through the Loop 9 region (they may also dig nesting burrows in sandy areas). The Fork-tailed Swift is a highly aerial vagrant species that is unlikely to be affected by the proposed works. The babbler and bellbird inhabit a range of shrublands and are likely to occur in good quality, undisturbed habitat along the Loop 9 path. The fieldwren inhabits low, dense shrublands and may be present along the Loop 9 path. Chuditch are wide ranging and are likely to move away from areas of disturbance during Loop 9 construction.

The distribution of Brush-tailed Phascogale is patchy and it may occur, in low numbers, in the vicinity of Loop 9 but is unlikely to be greatly impacted by construction. Quenda and water-rats are likely to be present along the Loop 9 path, particularly in the vicinity of wetland areas. The Brush Wallaby is likely to inhabit open woodlands in the vicinity of Loop 9, but is also likely to move in response to disturbance. While the habitat of Loop 9 may be suitable for the Heath Mouse the records in the Loop 9 vicinity probably represent the former range of the species and it is unlikely to currently occur in the area.

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Table 1. Amphibians that may occur in the vicinity of the northern loopings. Status is assigned as described in Methods.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Hylidae											
Cyclorana maini	Main`s Frog	1	1	1	1	1					
Cyclorana platycephala	Water-holding Frog		1	1	1	1					
Litoria adelaidensis	Slender Tree Frog									1	
Litoria moorei	Motorbike Frog							1	1	1	
Litoria rubella	Desert Tree Frog	1	1	1	1	1	1				
Myobatrachidae											
Heleioporus albopunctatus	Western Spotted Frog							1	1	1	
Heleioporus eyrei	Moaning Frog							1	1	1	
Heleioporus psammophilus	Sand Frog								1	1	
Limnodynastes dorsalis	Banjo Frog, Pobblebonk							1	1	1	
Limnodynastes spenceri	Spencer`s Frog	1	1	1	1						
Neobatrachus aquilonius	Northern Burrowing Frog	1	1								
Neobatrachus kunapalari	Kunapalari Frog							1	1		
Neobatrachus pelobatoides	Humming Frog							1	1	1	
Neobatrachus sutor	Shoemaker Frog							1	1		
Neobatrachus wilsmorei	Wilsmore`s Frog				1	1	1	1			
Notaden nichollsi	Desert Spadefoot	1	1								
Crinia georgiana	Quacking Frog									1	
Crinia glauerti	Glauert`s Froglet									1	
Crinia insignifera	Squelching Froglet									1	
Crinia pseudinsignifera	Bleating Froglet							1	1		
Myobatrachus gouldii	Turtle Frog							1	1	1	
Pseudophryne guentheri	Günther`s Toadlet							1	1	1	
Pseudophryne occidentalis	Western Toadlet					1					

Table 2. Reptiles that may occur in the vicinity of the northern loopings. Status is assigned as described in Methods.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Cheluidae											
Chelodina oblonga	Oblong Turtle									1	
Chelodina steindachneri	Steindachner's Turtle	1	1	1	1	1	1	1	1		
Agamidae											
Caimanops amphiboluroides	Mulga Dragon			1			1				
Ctenophorus caudicinctus	Ring-tailed Dragon	1	1	1	1	1					
Ctenophorus femoralis		1	1	1	1						
Ctenophorus isolepis	Central Military Dragon	1	1	1							
Ctenophorus maculatus	Spotted Military Dragon					1	1	1	1		
Ctenophorus nuchalis	Central Netted Dragon	1	1	1	1	1	1	1	1		
Ctenophorus reticulatus	Western Netted Dragon	1	1	1	1	1	1	1	1		
Ctenophorus rubens		1	1	1	1	1					
Ctenophorus scutulatus	Lozenge-marked Dragon			1	1	1	1	1	1		
Diporiphora winneckei	Blue-lined Dragon	1	1		1						
Lophognathus gilberti	Gilbert's Dragon	1									
Lophognathus longirostris	Long-nosed Dragon	1	1	1	1	1	1	1			
Moloch horridus	Thorny Devil		1	1	1	1	1	1	1	1	
Pogona minor	Western Bearded Dragon	1	1	1	1	1	1	1	1	1	
Rankinia adelaidensis	Western Heath Dragon							1	1	1	
Tympanocryptis cephala	Pebble Dragon	1	1	1							
Gekkonidae											
Crenadactylus ocellatus	Clawless Gecko	1	1	1			1	1	1	1	
Diplodactylus alboguttatus	White-spotted Ground Gecko							1	1	1	
Diplodactylus conspicillatus	Fat-tailed Gecko	1	1	1	1	1					
Diplodactylus granariensis	Western Stone Gecko							1	1	1	
Diplodactylus klugei						1					
Diplodactylus ornatus								1	1		
Diplodactylus polyophthalmus	Spotted Stone Gecko								1	1	
Diplodactylus pulcher				1	1	1	1	1	1		
Diplodactylus savagei		1		1							
Diplodactylus squarrosus						1	1	1			
Diplodactylus stenodactylus	Sand-plain Gecko	1	1	1	1						
Nephrurus levis	Smooth Knob-tailed Gecko	1	1		1	1	1	1			
Nephrurus wheeleri	Banded Knob-tailed Gecko	1	1								
Oedura marmorata	Marbled Velvet Gecko		1		1			1			
Rhynchoedura ornata	Beaked Gecko		1			1		1			
Strophurus elderi	Jewelled Gecko		1	1							
Strophurus jeanae		1	1								
Strophurus michaelseni								1			
Strophurus spinigerus	Soft Spiny-tailed Gecko							1	1	1	
Strophurus strophurus	Western Spiny-tailed Gecko	1	1	1	1	1		1			
Underwoodisaurus milii	Barking Gecko							1	1	1	

Table 2. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Christinus marmoratus	Marbled Gecko									1	
Gehyra pilbara		1	1								
Gehyra punctata		1	1	1	1	1	1	1			
Gehyra variegata		1	1	1	1	1	1	1	1	1	
Heteronotia binoei	Bynoe's Gecko	1	1	1	1	1	1	1			
Heteronotia spelea	Desert Cave Gecko	1	1	1	1						
Pygopodidae											
Aclys concinna	Javelin Legless Lizard								1	1	CS2
Aprasia pulchella										1	
Aprasia repens								1	1	1	
Aprasia smithi								1			
Delma australis						1	1	1			
Delma butleri				1	1	1	1	1			
Delma fraseri								1	1	1	
Delma grayii								1	1	1	
Delma haroldi		1	1								
Delma nasuta		1	1	1							
Delma pax		1	1								
Delma tincta		1	1	1	1	1	1	1	1		
Lialis burtonis		1	1	1	1	1	1	1	1	1	
Pletholax gracilis	Keeled Legless Lizard							1	1	1	CS2
Pygopus lepidopodus							1	1	1	1	
Pygopus nigriceps		1	1	1	1	1	1	1	1		
Scincidae											
Acritoscincus trilineatum										1	
Carlia munda		1	1								
Cryptoblepharus carnabyi			1				1	1	1	1	
Cryptoblepharus plagiocephalus		1	1	1	1	1	1	1	1		
Ctenotus alleni								1			
Ctenotus australis									1	1	
Ctenotus calurus					1						
Ctenotus duricola		1	1	1							
Ctenotus fallens							1	1	1	1	
Ctenotus gemmula	Jewelled Ctenotus								1	1	CS2
Ctenotus grandis		1	1								
Ctenotus hanloni		1	1	1	1						
Ctenotus helenae		1	1	1	1						
Ctenotus iapetus		1	1	1	1						
Ctenotus impar								1	1	1	
Ctenotus leonhardii						1	1	1			
Ctenotus maryani		1	1	1	1	1					
Ctenotus mimetes								1	1		
Ctenotus pantherinus		1	1	1	1	1		1	1		
Ctenotus rufescens		1	1		1						

Table 2. Continued

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Ctenotus saxatilis		1	1	1							
Ctenotus schomburgkii				1	1	1	1	1	1	1	
Ctenotus severus					1	1	1	1			
Ctenotus uber			1	1	1	1	1	1	1		
Cyclodomorphus branchialis	Gilled Slender Blue-tongue							1			CS1
Cyclodomorphus celatus								1	1	1	
Cyclodomorphus melanops		1	1	1	1						
Egernia depressa		1	1	1	1	1	1	1	1		
Egernia formosa			1								
Egernia inornata								1			
Egernia kingii										1	
Egernia multiscutata									1	1	
Egernia napoleonis										1	
Egernia stokesii	Western Spiny-tailed Skink							1	1		CS1
Eremiascincus fasciolatus		1	1	1	1	1					
Eremiascincus richardsonii					1	1	1	1	1	1	
Glaphyromorphus isolepis		1	1								
Hemiergis quadrilineata										1	
Lerista bipes		1	1	1							
Lerista christinae									1	1	
Lerista connivens					1	1	1	1			
Lerista distinguenda								1	1	1	
Lerista elegans		1	1	1	1	1	1	1	1	1	
Lerista flammicauda				1							
Lerista gascoynensis					1						
Lerista gerrardii								1	1		
Lerista kennedyensis					1						
Lerista lineata										1	CS2
Lerista lineopunctulata								1	1	1	
Lerista macropisthopus			1	1	1	1	1	1			
Lerista muelleri		1	1	1	1	1	1	1	1		
Lerista nichollsi						1	1				
Lerista onsloviana		1									
Lerista petersoni			1	1	1						
Lerista planiventralis		1			1			1	1		CS2
Lerista praepedita								1	1	1	
Lerista uniduo			1	1	1	1	1	1			
Lerista yuna								1			CS2
Menetia greyii		1	1	1	1	1	1	1	1	1	
Menetia surda				1	1	1	1	1			
Morethia butleri						1	1	1			
Morethia lineoocellata								1	1	1	
Morethia obscura						1	1	1	1	1	

Table 2. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Morethia ruficauda		1	1	1	1						
Notoscincus ornatus			1	1	1						
Proablepharus reginae			1								
Tiliqua multifasciata		1	1								
Tiliqua occipitalis						1	1	1	1	1	
Tiliqua rugosa	Bobtail							1	1	1	
Varanidae											
Varanus acanthurus	Spiny-tailed Monitor	1	1	1							
Varanus brevicauda	Short-tailed Pygmy Monitor	1	1	1	1						
Varanus caudolineatus	Stripe-tailed Monitor		1	1	1	1	1	1			
Varanus eremius	Pygmy Desert Monitor	1	1	1	1	1	1	1			
Varanus giganteus	Perentie	1	1	1	1						
Varanus gouldii	Sand Goanna	1	1	1	1	1	1	1	1	1	
Varanus panoptes	Yellow-spotted Monitor	1	1	1	1	1	1				
Varanus tristis	Black-headed Monitor	1	1	1	1	1	1	1	1	1	
Typhlopidae											
Ramphotyphlops ammodytes		1	1	1							
Ramphotyphlops australis								1	1	1	
Ramphotyphlops grypus		1	1	1							
Ramphotyphlops hamatus		1	1	1	1	1	1	1	1		
Ramphotyphlops leptosoma						1	1	1			
Ramphotyphlops waitii								1	1	1	
Boidae											
Antaresia perthensis	Pygmy Python	1	1	1	1	1	1				
Antaresia stimsoni	Stimson's Python	1	1	1	1	1	1	1	1	1	
Aspidites melanocephalus	Black-headed Python	1									
Aspidites ramsayi	Woma or Ramsay's Python							1	1	1	CS1
Liasis olivaceus		1	1								CS1
Morelia spilota	Carpet Python							1	1	1	CS2
Elapidae											
Acanthophis pyrrhus	Desert Death-adder		1	1	1	1	1	1			
Acanthophis wellsi		1	1								
Brachyurophis approximans	Northwestern Shovel-nosed Snake	1	1	1	1	1					
Brachyurophis fasciolata								1	1	1	
Brachyurophis semifasciata	Southern Shovel-nosed Snake							1	1	1	
Demansia psammophis	Yellow-faced Whipsnake	1	1	1	1	1	1	1	1	1	
Demansia rufescens	Rufous Whipsnake	1	1								
Echiopsis curta	Bardick							1	1	1	
Furina ornata	Moon Snake	1	1	1							
Neelaps bimaculatus	Black-naped Snake								1	1	
Neelaps calonotos	Black-striped Snake									1	CS2
Notechis scutatus	Tiger Snake									1	
Parasuta gouldii	Gould's Snake						1	1	1	1	

Table 2. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Parasuta monachus	Monk Snake						1	1	1		
Pseudechis australis	Mulga Snake	1	1	1	1	1	1	1	1	1	
Pseudechis butleri	Spotted Mulga Snake							1			
Pseudonaja affinis	Dugite									1	
Pseudonaja modesta	Ringed Brown Snake	1	1	1	1	1	1	1	1	1	
Pseudonaja nuchalis	Gwardar	1	1	1	1	1	1	1	1	1	
Simoselaps anomalus	Desert Banded Snake	1									
Simoselaps bertholdi	Jan`s Banded Snake			1	1	1	1	1	1	1	
Simoselaps littoralis	West Coast Banded Snake							1	1		
Suta fasciata	Rosen`s Snake	1	1	1	1	1	1	1			
Suta punctata	Spotted Snake	1	1								

Table 3. Birds that may occur in the vicinity of the northern loopings. Status is assigned as described in Methods.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Casuariidae											
Dromaius novaehollandiae	Emu	1	1	1	1	1	1	1	1	1	
Megapodiidae											
Leipoa ocellata	Malleefowl								1		CS1
Phasianidae											
Coturnix pectoralis	Stubble Quail	1	1	1	1	1	1	1	1	1	
Coturnix ypsilophora	Brown Quail	1	1							1	
Anatidae											
Oxyura australis	Blue-billed Duck	1	1	1	1	1	1	1	1	1	
Biziura lobata	Musk Duck					1	1	1	1	1	
Stictonetta naevosa	Freckled Duck									1	
Cygnus atratus	Black Swan	1	1	1	1	1	1	1	1	1	
Tadorna tadornoides	Australian Shelduck					1	1	1	1	1	
Chenonetta jubata	Australian Wood Duck	1	1	1	1	1	1	1	1	1	
Anas superciliosa	Pacific Black Duck	1	1	1	1	1	1	1	1	1	
Anas rhynchotis	Australasian Shoveler					1	1	1	1	1	
Anas gracilis	Grey Teal	1	1	1	1	1	1	1	1	1	
Anas castanea	Chestnut Teal						1	1	1	1	
Malacorhynchus membranaceus	Pink-eared Duck					1	1	1	1	1	
Aythya australis	Hardhead	1	1	1	1	1	1	1	1	1	
Podicipedidae											
Tachybaptus novaehollandiae	Australasian Grebe	1	1	1	1	1	1	1	1	1	
Poliocephalus poliocephalus	Hoary-headed Grebe	1	1	1	1	1	1	1	1	1	
Podiceps cristatus	Great Crested Grebe	1	1	1	1	1	1	1	1	1	
Anhingidae											
Anhinga melanogaster	Darter	1	1	1	1	1	1	1	1	1	
Phalacrocoracidae											
Phalacrocorax melanoleucos	Little Pied Cormorant	1	1	1	1	1	1	1	1	1	
Phalacrocorax varius	Pied Cormorant	1	1	1	1	1	1	1	1	1	
Phalacrocorax sulcirostris	Little Black Cormorant	1	1	1	1	1	1	1	1	1	
Phalacrocorax carbo	Great Cormorant	1	1	1	1	1	1	1	1	1	
Pelecanidae											
Pelecanus conspicillatus	Australian Pelican	1	1	1	1	1	1	1	1	1	
Ardeidae											
Egretta novaehollandiae	White-faced Heron	1	1	1	1	1	1	1	1	1	
Egretta garzetta	Little Egret	1	1	1	1	1	1	1	1	1	
Ardea pacifica	White-necked Heron	1	1	1	1	1	1	1	1	1	
Ardea alba	Great Egret	1	1	1	1	1	1	1	1	1	CS1
Ardea ibis	Cattle Egret									1	CS1
Nycticorax caledonicus	Nankeen Night Heron	1	1	1	1	1	1	1	1	1	
Threskiornithidae											
Plegadis falcinellus	Glossy Ibis	1	1	1	1	1	1	1	1	1	CS1

Table 3. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Threskiornis molucca	Australian White Ibis	1	1	1	1	1	1	1	1	1	
Threskiornis spinicollis	Straw-necked Ibis	1	1	1	1	1	1	1	1	1	
Platalea regia	Royal Spoonbill	1	1	1	1	1	1	1	1	1	
Platalea flavipes	Yellow-billed Spoonbill	1	1	1	1	1	1	1	1	1	
Accipitridae											
Elanus axillaris	Black-shouldered Kite	1	1	1	1	1	1	1	1	1	
Hamirostra melanosternon	Black-breasted Buzzard	1	1	1	1	1	1				
Milvus migrans	Black Kite	1	1	1	1	1	1	1	1	1	
Haliastur sphenurus	Whistling Kite	1	1	1	1	1	1	1	1	1	
Haliaeetus leucogaster	White-bellied Sea-eagle	1	1	1	1	1	1	1	1	1	CS1
Circus assimilis	Spotted Harrier	1	1	1	1	1	1	1	1	1	
Circus approximans	Swamp Harrier	1	1	1	1	1	1	1	1	1	
Accipiter fasciatus	Brown Goshawk	1	1	1	1	1	1	1	1	1	
Accipiter cirrhocephalus	Collared Sparrowhawk	1	1	1	1	1	1	1	1	1	
Aquila audax	Wedge-tailed Eagle	1	1	1	1	1	1	1	1	1	
Hieraaetus morphnoides	Little Eagle	1	1	1	1	1	1	1	1	1	
Falconidae											
Falco berigora	Brown Falcon	1	1	1	1	1	1	1	1	1	
Falco longipennis	Australian Hobby	1	1	1	1	1	1	1	1	1	
Falco hypoleucos	Grey Falcon	1	1	1	1	1					CS2
Falco peregrinus	Peregrine Falcon	1	1	1	1	1	1	1	1	1	CS1
Falco cenchroides	Nankeen Kestrel	1	1	1	1	1	1	1	1	1	
Rallidae											
Gallirallus philippensis	Buff-banded Rail	1	1	1	1	1	1	1	1	1	
Porzana pusilla	Baillon's Crake	1	1	1	1	1	1	1	1	1	
Porzana fluminea	Australian Spotted Crake	1	1	1	1	1	1	1	1	1	
Porzana tabuensis	Spotless Crake	1	1	1	1	1	1	1	1	1	
Porphyrio porphyrio	Purple Swamphen									1	
Gallinula tenebrosa	Dusky Moorhen									1	
Gallinula ventralis	Black-tailed Native-hen	1	1	1	1	1	1	1	1	1	
Fulica atra	Eurasian Coot	1	1	1	1	1	1	1	1	1	
Otididae											
Ardeotis australis	Australian Bustard	1	1	1	1	1	1	1	1	1	CS2
Turnicidae											
Turnix velox	Little Button-quail	1	1	1	1	1	1	1	1	1	
Turnix varia	Painted Button-quail							1	1	1	
Scolopacidae											
Tringa nebularia	Common Greenshank	1	1	1	1	1	1	1	1	1	CS1
Tringa glareola	Wood Sandpiper	1	1	1	1	1	1	1	1	1	CS1
Actitis hypoleucos	Common Sandpiper	1	1	1	1	1	1	1	1	1	CS1
Calidris ruficollis	Red-necked Stint	1	1	1	1	1	1	1	1	1	CS1
Calidris acuminata	Sharp-tailed Sandpiper	1	1	1	1	1	1	1	1	1	CS1
Calidris ferruginea	Curlew Sandpiper	1	1	1	1	1	1	1	1	1	CS1

Table 3. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Burhinidae											
Burhinus grallarius	Bush Stone-curlew	1	1	1	1	1	1	1	1	1	CS2
Recurvirostridae											
Himantopus himantopus	Black-winged Stilt	1	1	1	1	1	1	1	1	1	
Cladorhynchus leucocephalus	Banded Stilt	1	1	1	1	1	1	1	1	1	
Recurvirostra novaehollandiae	Red-necked Avocet	1	1	1	1	1	1	1	1	1	
Charadriidae											
Charadrius ruficapillus	Red-capped Plover	1	1	1	1	1	1	1	1	1	
Charadrius australis	Inland Dotterel				1	1	1	1	1	1	
Elseyornis melanops	Black-fronted Dotterel	1	1	1	1	1	1	1	1	1	
Thinornis rubricollis	Hooded Plover								1	1	CS2
Erythrogonys cinctus	Red-kneed Dotterel	1	1	1	1	1	1	1	1	1	
Vanellus tricolor	Banded Lapwing	1	1	1	1	1	1	1	1	1	
Laridae											
Larus novaehollandiae	Silver Gull	1	1	1	1	1	1	1	1	1	
Sterna nilotica	Gull-billed Tern	1	1	1	1	1	1	1	1	1	
Sterna caspia	Caspian Tern	1				1	1	1	1	1	CS1
Chlidonias hybridus	Whiskered Tern	1	1	1	1	1	1	1	1	1	
Chlidonias leucopterus	White-winged Black Tern	1	1	1	1	1	1	1	1	1	CS1
Columbidae											
Columba livia	Rock Dove	1	1	1	1	1	1	1	1	1	
Streptopelia senegalensis	Laughing Turtle-Dove							1	1	1	
Phaps chalcoptera	Common Bronzewing	1	1	1	1	1	1	1	1	1	
Phaps elegans	Brush Bronzewing									1	
Ocyphaps lophotes	Crested Pigeon	1	1	1	1	1	1	1	1	1	
Geophaps plumifera	Spinifex Pigeon	1	1	1	1						
Geopelia cuneata	Diamond Dove	1	1	1	1	1	1	1	1		
Geopelia striata	Peaceful Dove	1	1	1	1	1					
Geopelia humeralis	Bar-shouldered Dove	1	1								
Cacatuidae											
Calyptorhynchus latirostris	Carnaby's Cockatoo								1	1	CS1
Calyptorhynchus baudinii	Baudin's Cockatoo									1	CS1
Eolophus roseicapilla	Galah	1	1	1	1	1	1	1	1	1	
Cacatua tenuirostris	Long-billed Corella									1	
Cacatua pastinator	Western Corella							1	1	1	
Cacatua sanguinea	Little Corella	1	1	1	1	1	1	1	1	1	
Cacatua leadbeateri	Major Mitchell's Cockatoo						1	1	1	1	CS1
Nymphicus hollandicus	Cockatiel	1	1	1	1	1	1	1	1	1	
Psittacidae											
Glossopsitta porphyrocephala	Purple-crowned Lorikeet									1	
Polytelis anthopeplus	Regent Parrot							1	1	1	
Platycercus icterotis	Western Rosella								1	1	
Barnardius zonarius	Australian Ringneck	1	1	1	1	1	1	1	1	1	

Table 3. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Purpureicephalus spurius	Red-capped Parrot							1	1	1	
Psephotus varius	Mulga Parrot				1	1	1	1	1	1	
Melopsittacus undulatus	Budgerigar	1	1	1	1	1	1	1	1	1	
Neosephotus bourkii	Bourke's Parrot					1	1	1			
Neophema elegans	Elegant Parrot						1	1	1	1	
Pezoporus occidentalis	Night Parrot	1	1								CS1
Cuculidae											
Cuculus pallidus	Pallid Cuckoo	1	1	1	1	1	1	1	1	1	
Cacomantis flabelliformis	Fan-tailed Cuckoo							1	1	1	
Chrysococcyx osculans	Black-eared Cuckoo	1	1	1	1	1	1	1	1	1	
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo	1	1	1	1	1	1	1	1	1	
Chrysococcyx lucidus	Shining Bronze-Cuckoo						1	1	1	1	
Strigidae											
Ninox connivens	Barking Owl	1	1	1	1	1	1	1	1	1	CS2
Ninox novaeseelandiae	Southern Boobook	1	1	1	1	1	1	1	1	1	
Tytonidae											
Tyto alba	Barn Owl	1	1	1	1	1	1	1	1	1	
Podargidae											
Podargus strigoides	Tawny Frogmouth	1	1	1	1	1	1	1	1	1	
Caprimulgidae											
Eurostopodus argus	Spotted Nightjar	1	1	1	1	1	1	1	1	1	
Aegothelidae											
Aegotheles cristatus	Australian Owlet-nightjar	1	1	1	1	1	1	1	1	1	
Apodidae											
Apus pacificus	Fork-tailed Swift	1	1	1	1	1	1	1	1	1	CS1
Halcyonidae											
Dacelo novaeguineae	Laughing Kookaburra							1	1	1	
Dacelo leachii	Blue-winged Kookaburra	1	1	1	1						
Todiramphus pyrrhopygia	Red-backed Kingfisher	1	1	1	1	1	1	1	1		
Todiramphus sanctus	Sacred Kingfisher	1	1	1	1	1	1	1	1	1	
Meropidae											
Merops ornatus	Rainbow Bee-eater	1	1	1	1	1	1	1	1	1	CS1
Climacteridae											
Climacteris melanura	Black-tailed Treecreeper	1	1								
Climacteris rufa	Rufous Treecreeper							1	1	1	
Maluridae											
Malurus splendens	Splendid Fairy-wren					1	1	1	1	1	
Malurus lamberti	Variegated Fairy-wren	1	1	1	1	1	1	1	1	1	
Malurus pulcherrimus	Blue-breasted Fairy-wren							1	1	1	
Malurus leucopterus	White-winged Fairy-wren	1	1	1	1	1	1	1	1	1	
Stipiturus malachurus	Southern Emu-wren								1	1	
Stipiturus ruficeps	Rufous-crowned Emu-wren	1	1	1							
Amytornis striatus	Striated Grasswren	1	1	1	1	1					
Amytornis textilis	Thick-billed Grasswren					1					CS1

Table 3. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Pardalotidae											
Pardalotus punctatus	Spotted Pardalote									1	
Pardalotus rubricatus	Red-browed Pardalote	1	1	1	1						
Pardalotus striatus	Striated Pardalote	1	1	1	1	1	1	1	1	1	
Sericornis frontalis	White-browed Scrubwren							1	1	1	
Hylacota cauta	Shy Heathwren								1		CS2
Calamanthus campestris	Rufous Fieldwren							1	1	1	CS2
Pyrrholaemus brunneus	Redthroat				1	1	1	1	1		
Smicrornis brevirostris	Weebill	1	1	1	1	1	1	1	1	1	
Gerygone fusca	Western Gerygone	1	1	1	1	1	1	1	1	1	
Acanthiza apicalis	Inland Thornbill			1	1	1	1	1	1	1	
Acanthiza uropygialis	Chestnut-rumped Thornbill				1	1	1	1	1	1	
Acanthiza robustirostris	Slaty-backed Thornbill				1	1	1	1			
Acanthiza iredalei	Slender-billed Thornbill				1	1	1	1			CS1
Acanthiza inornata	Western Thornbill								1	1	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	1	1	1	1	1	1	1	1	1	
Aphelocephala leucopsis	Southern Whiteface				1	1	1	1	1		
Meliphagidae											
Anthochaera carunculata	Red Wattlebird							1	1	1	
Anthochaera lunulata	Western Wattlebird								1	1	
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	1	1	1	1	1	1	1	1	1	
Manorina flavigula	Yellow-throated Miner	1	1	1	1	1	1	1	1	1	
Lichenostomus virescens	Singing Honeyeater	1	1	1	1	1	1	1	1	1	
Lichenostomus leucotis	White-eared Honeyeater							1			
Lichenostomus keartlandi	Grey-headed Honeyeater	1	1								
Lichenostomus ornatus	Yellow-plumed Honeyeater								1	1	
Lichenostomus plumulus	Grey-fronted Honeyeater	1	1	1	1	1	1				
Lichenostomus penicillatus	White-plumed Honeyeater	1	1	1	1	1	1	1	1	1	
Melithreptus brevirostris	Brown-headed Honeyeater							1	1	1	
Melithreptus lunatus	White-naped Honeyeater									1	
Lichmera indistincta	Brown Honeyeater	1	1	1	1	1	1	1	1	1	
Phylidonyris novaehollandiae	New Holland Honeyeater							1	1	1	
Phylidonyris nigra	White-cheeked Honeyeater							1	1	1	
Phylidonyris albifrons	White-fronted Honeyeater					1	1	1	1	1	
Phylidonyris melanops	Tawny-crowned Honeyeater							1	1	1	
Acanthorhynchus superciliosus	Western Spinebill								1	1	
Certhionyx niger	Black Honeyeater	1	1	1	1	1	1	1	1		
Certhionyx variegatus	Pied Honeyeater	1	1	1	1	1	1	1	1		
Epthianura tricolor	Crimson Chat	1	1	1	1	1	1	1	1		
Epthianura aurifrons	Orange Chat	1	1	1	1	1	1	1			
Epthianura albifrons	White-fronted Chat					1	1	1	1	1	
Petroicidae											
Microeca leucophaea	Jacky Winter					1	1	1	1	1	

Table 3. Contined.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Petroica multicolour	Scarlet Robin									1	
Petroica goodenovii	Red-capped Robin			1	1	1	1	1	1	1	
Melanodryas cucullata	Hooded Robin	1	1	1	1	1	1	1	1	1	
Eopsaltria griseogularis	Western Yellow Robin							1	1	1	
Eopsaltria georgiana	White-breasted Robin								1	1	
Drymodes brunneopygia	Southern Scrub-robin							1	1		
Pomatostomidae											
Pomatostomus temporalis	Grey-crowned Babbler	1	1	1	1	1	1	1			
Pomatostomus superciliosus	White-browed Babbler			1	1	1	1	1	1	1	CS2
Cinclosomatidae											
Psophodes occidentalis	Chiming Wedgebill	1	1	1	1	1	1	1	1		
Cinclosoma castanotum	Chestnut Quail-thrush						1	1			
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush		1	1	1	1	1	1			
Neosittidae											
Daphoenositta chrysoptera	Varied Sittella	1	1	1	1	1	1	1	1	1	
Pachycephalidae											
Oreoica gutturalis	Crested Bellbird	1	1	1	1	1	1	1	1	1	CS2
Pachycephala pectoralis	Golden Whistler							1	1	1	
Pachycephala rufiventris	Rufous Whistler	1	1	1	1	1	1	1	1	1	
Colluricincla harmonica	Grey Shrike-thrush	1	1	1	1	1	1	1	1	1	
Dicruridae											
Myiagra inquieta	Restless Flycatcher								1	1	
Grallina cyanoleuca	Magpie-lark	1	1	1	1	1	1	1	1	1	
Rhipidura fuliginosa	Grey Fantail	1	1	1	1	1	1	1	1	1	
Rhipidura leucophrys	Willie Wagtail	1	1	1	1	1	1	1	1	1	
Campephagidae											
Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	1	1	1	1	1	1	
Coracina maxima	Ground Cuckoo-Shrike					1	1	1			
Lalage sueurii	White-winged Triller	1	1	1	1	1	1	1	1	1	
Artamidae											
Artamus leucorhynchus	White-breasted Woodswallow	1	1								
Artamus personatus	Masked Woodswallow	1	1	1	1	1	1	1	1	1	
Artamus cinereus	Black-faced Woodswallow	1	1	1	1	1	1	1	1	1	
Artamus cyanopterus	Dusky Woodswallow								1	1	
Artamus minor	Little Woodswallow	1	1	1	1	1	1	1			
Cracticus torquatus	Grey Butcherbird	1	1	1	1	1	1	1	1	1	
Cracticus nigrogularis	Pied Butcherbird	1	1	1	1	1	1	1	1	1	
Gymnorhina tibicen	Australian Magpie	1	1	1	1	1	1	1	1	1	
Strepera versicolor	Grey Currawong							1	1	1	
Corvidae											
Corvus coronoides	Australian Raven						1	1	1	1	
Corvus bennetti	Little Crow	1	1	1	1	1	1	1	1	1	
Corvus orru	Torresian Crow	1	1	1	1	1	1				

Table 3. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Ptilonorhynchidae											
Chlamydera guttata	Western Bowerbird	1	1	1	1	1	1				
Alaudidae											
Mirafra javanica	Singing Bushlark	1	1	1	1						
Motacilidae											
Anthus novaeseelandiae	Richard's Pipit	1	1	1	1	1	1	1	1	1	
Passeridae											
Taeniopygia guttata	Zebra Finch	1	1	1	1	1	1	1	1	1	
Neochmia ruficauda	Star Finch	1	1	1	1						CS1
Emblema picta	Painted Finch	1	1	1							
Dicaeidae											
Dicaeum hirundinaceum	Mistletoebird	1	1	1		1	1	1	1	1	
Hirundinidae											
Cheramoeca leucosternum	White-backed Swallow	1	1	1	1	1	1	1	1	1	
Hirundo neoxena	Welcome Swallow	1	1	1	1	1	1	1	1	1	
Hirundo nigricans	Tree Martin	1	1	1	1	1	1	1	1	1	
Hirundo ariel	Fairy Martin	1	1	1	1	1	1	1	1	1	
Sylviidae											
Acrocephalus stentoreus	Clamorous Reed-Warbler	1	1	1	1	1	1	1	1	1	
Megalurus gramineus	Little Grassbird					1	1	1	1	1	
Eremiornis carteri	Spinifexbird	1	1	1	1						
Cinclorhamphus mathewsi	Rufous Songlark	1	1	1	1	1	1	1	1	1	
Cinclorhamphus cruralis	Brown Songlark	1	1	1	1	1	1	1	1	1	
Zosteropidae											
Zosterops lateralis	Silvereye				1	1	1	1	1	1	

Table 4. Mammals that may occur in the vicinity of the northern loopings. Status is assigned as described in Methods.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Tachyglossidae											
Tachyglossus aculeatus	Echidna	1	1	1	1	1	1	1	1	1	
Dasyuridae											
Antechinus flavipes	Yellow-footed Antechinus, Mardo									1	
Dasycercus cristicauda	Mulgara			1	1						CS1
Dasykaluta rosamondae	Little Red Kaluta	1	1	1	1						
Dasyurus geoffroii	Chuditch									1	CS1
Dasyurus hallucatus	Northern Quoll	1	1								CS1
Ningaui timealeyi	Pilbara Ningaui	1	1	1							
Phascogale tapoatafa	Brush-tailed Phascogale									1	CS2
Planigale ingrami	Long-tailed Planigale		1								
Planigale maculate	Common Planigale	1									
Planigale sp	Planigale	1	1	1							
Pseudantechinus woolleyae	Woolley`s Pseudantechinus	1	1	1							
Sminthopsis crassicaudata	Fat-tailed Dunnart					1	1	1	1	1	
Sminthopsis dolichura	Little Long-tailed Dunnart					1	1	1	1	1	
Sminthopsis granulipes	White-tailed Dunnart								1		
Sminthopsis griseoventer	Grey-bellied Dunnart								1	1	
Sminthopsis macroura	Stripe-faced Dunnart	1	1	1	1	1					
Sminthopsis youngsoni	Lesser Hairy-footed Dunnart	1	1		1						
Peramelidae											
Isoodon obesulus	Southern Brown Bandicoot, Quenda									1	CS2
Thylacomyidae											
Macrotis lagotis	Bilby, Dalgyte			1							CS1
Macropodidae											
Lagorchestes conspicillatus	Spectacled Hare-wallaby	1									CS2
Macropus fuliginosus	Western Grey Kangaroo							1	1	1	
Macropus irma	Brush Wallaby								1	1	CS2
Macropus robustus	Euro, Biggada	1	1	1	1	1	1	1	1	1	
Macropus rufus	Red Kangaroo, Marlu	1	1	1	1						
Petrogale lateralis	Black-footed Rock-wallaby	1						1			CS1
Petrogale rothschildi	Rothschild`s Rock-wallaby		1	1							
Phalangeridae											
Trichosurus vulpecula	Brushtail Possum	1	1							1	
Burramyidae											
Cercartetus concinnus	Western Pygmy-possum									1	
Tarsipedidae											
Tarsipes rostratus	Honey Possum, Noolbenger						1	1	1	1	
Emballonuridae											
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	1	1	1	1						
Taphozous georgianus	Common Sheathtail-bat	1	1	1	1						
Taphozous hilli	Hill`s Sheathtail-bat							1			

Table 4. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Megadermatidae											
Macroderma gigas	Ghost Bat	1	1	1							CS2
Hipposideridae											
Rhinonicteris aurantius	Orange Leaf-nosed Bat	1									CS1
Vespertilionidae											
Chalinolobus gouldii	Gould's Wattled Bat	1	1	1	1	1	1	1	1	1	
Chalinolobus morio	Chocolate Wattled Bat							1	1	1	
Nyctophilus arnhemensis	Northern Long-eared Bat	1									
Nyctophilus geoffroyi	Lesser Long-eared Bat	1	1	1	1	1	1	1	1	1	
Nyctophilus gouldi	Gould's Long-eared Bat									1	
Scotorepens balstoni	Inland Broad-nosed Bat				1	1	1	1			
Scotorepens greyii	Little Broad-nosed Bat	1	1	1	1						
Vespadelus finlaysoni	Finlayson's Cave Bat	1	1	1	1	1					
Vespadelus regulus	Southern Forest Bat								1	1	
Molossidae											
Chaerephon jobensis	Northern Freetail-bat	1	1	1	1						
Mormopterus beccarii	Beccari's Freetail-bat	1	1	1	1						
Mormopterus planiceps	Southern Freetail-bat								1	1	
Tadarida australis	White-striped Freetail-bat	1	1	1	1	1	1	1	1	1	
Muridae											
Hydromys chrysogaster	Water-rat									1	CS2
Leggadina lakedownensis	Short-tailed Mouse	1	1								CS2
Mus musculus	House Mouse	1	1	1	1	1	1	1	1	1	
Notomys alexis	Spinifex Hopping-mouse	1	1	1	1	1	1	1	1		
Pseudomys albocinereus	Ash-grey Mouse							1	1	1	
Pseudomys chapmani	Western Pebble-mound Mouse	1	1	1							CS2
Pseudomys delicatulus	Delicate Mouse	1	1								
Pseudomys hermannsburgensis	Sandy Inland Mouse	1	1	1	1	1	1	1			
Pseudomys shortridgei	Heath Mouse									1	CS1
Rattus fuscipes	Western Bush Rat								1	1	
Rattus norvegicus	Brown Rat									1	
Rattus rattus	Black Rat	1						1	1	1	
Rattus tunneyi	Pale Field-rat	1									
Zyzomys argurus	Common Rock-rat	1	1	1							
Leporidae											
Oryctolagus cuniculus	Rabbit	1	1	1	1	1	1	1	1	1	Int
Canidae											
Canis lupus	Dog	1	1	1	1	1	1	1	1	1	Int
Vulpes vulpes	Red Fox	1	1	1	1	1	1	1	1	1	Int
Felidae											
Felis catus	Cat	1	1	1	1	1	1	1	1	1	Int
Suidae											
Sus scrofa	Pig									1	Int

Table 4. Continued.

Species		Loop									Status
		1	2	3	4	5	6	7	8	9	
Bovidae											
Bos taurus	European Cattle	1	1	1	1	1	1	1			Int
Capra hircus	Goat	1	1	1	1	1	1	1			Int
Ovis aries	Sheep	1	1	1	1	1	1	1	1	1	Int

Table 5. Results of the CALM Threatened Species Database search. The number of records of each species within the search area around each of the northern loops is shown. CALM categories are explained in Appendix 1.

Species	Loop								
	1	2	3	4	5	6	7	8	9
Schedule 1									
Idiosoma nigrum Shield-backed Trapdoor Spider						3	3	1	
Bothriembryon whitleyi Snail							1		
Cyclodomorphus branchialis Skink								1	
Egernia stokesii badia Western Spiny-tailed Skink					1		2	1	
Liasis olivaceus barroni Pilbara Olive Python		1							
Leipoa ocellata Malleefowl					1	4		2	
Calyptorhynchus sp. White-tailed Black Cockatoo								1	
Pezoporus occidentalis Night Parrot	1	1							
Dasycercus cristicauda Mulgara				1					
Dasyurus geoffroii Chuditch									3
Macrotis lagotis Bilby			1						
Pseudocheirus occidentalis Western Ringtail Possum									1
Pseudomys shortridgei Heath Mouse (Dayang)									1
Rhinonicteris aurantius Orange Leaf-nosed Bat	1								
Schedule 2									
Cacatua leadbeateri Major Mitchell's Cockatoo							1		
Schedule 4									
*Morelia spilota imbricata** Carpet Python								1	
Falco peregrinus Peregrine Falcon		1					4		
Prioirty 1									
Austromerope poultoni Scorpion Fly								1	
Branchinella wellardi Gastropod				1					
Lerista planiventralis maryani Skink		1							
Psacadonotus seriatus Cricket							1		
Ramphotyphlops ganei Blind snake	1								
Prioirty 2									
Phasmodes jeeba Stick Insect								1	
Hypseleotris aurea Golden Gudgeon						1			
Prioirty 3									
Austrosaga spinifer Cricket								2	
Hemisaga vepreculae Cricket								3	
Hylaeus globuliferus Native Bee								4	1
Leioproctus contrarius Native Bee						1			2
Lerista yuna Skink							1		
Lagorchestes conspicillatus leichardti Spectacled Hare-wallaby (mainland)	1								
Priority 4									
Throscodectes xederoides Mogumber Bush Cricket									1
Galaxiella munda Western Mud Minnow									1
Ardeotis australis Australian Bustard	1		1				1	1	1
Burhinus grallarius Bush Stonecurlew	1				1				

Table 5. Continued.

Species	Loop								
	1	2	3	4	5	6	7	8	9
Charadrius rubricollis Hooded Plover									1
Falco hypoleucos Grey Falcon		1						1	
Calamanthus campestris montanellus Rufous Fieldwren (western wheatbelt)								3	
Pomatostomus superciliosus ashbyi White-browed Babbler (western wheatbelt)							8		
Oreoica gutteralis gutteralis Crested Bellbird (southern)							1	2	3
Neochima ruficauda subclarescens Star Finch (western)	1								
Isoodon obesulus fusciventer Quenda									2
Macropus irma Brush Wallaby							1	3	6
Leggadina lakedownensis Lakeland Downs Mouse (Kerakenga)	3								
Pseudomys chapmani Western Pebble-mound Mouse (Ngadji)	4	1		1					
Macroderma gigas Ghost Bat								1	
Calyptorhynchus latirostris Carnaby's Black-Cockatoo								16	8

* also listed as a Priority 4 species

Table 6. Results of the EPBC Threatened Species Database search.

Species		Loop								
		1	2	3	4	5	6	7	8	9
Endangered										
Egernia stokesii badia	Western Spiny-tailed Skink					1	1	1	1	
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo						1	1	1	1
Dasyurus hallucatus	Northern Quoll	1	1							
Vulnerable										
Morelia olivacea barroni	Olive Python (Pilbara subspecies)	1	1							
*Leipoa ocellata**	Malleefowl					1	1	1	1	1
Calyptorhynchus baudinii	Baudin's Black-Cockatoo									1
Amytornis textilis textilis	Thick-billed Grasswren (western)					1				
Acanthiza iredalei iredalei	Slender-billed Thornbill (western)				1	1	1	1		
Dasycercus cristicauda	Mulgara	1	1	1						
Dasyurus geoffroii	Chuditch								1	1
Petrogale lateralis lateralis	Black-flanked Rock-wallaby	1								
Rhinonicteris aurantius (Pilbara form)	Pilbara Leaf-nosed Bat	1	1							
Migratory										
Haliaeetus leucogaster	White-bellied Sea-Eagle	1	1	1			1	1	1	1
Numenius minutus	Little Curlew	1	1	1						
Charadrius veredus	Oriental Plover	1	1	1	1	1				
Glareola maldivarum	Oriental Pratincole	1	1							
Sterna caspia	Caspian Tern								1	
Hirundo rustica	Barn Swallow	1	1							

* also listed as migratory.

Appendix 1. Categories used in the assessment of conservation status.

IUCN categories (based on review by Mace and Stuart 1994) as used for the Environmental Protection and Biodiversity Conservation (EPBC) Act and the WA Wildlife Conservation Act.

Extinct. Taxa not definitely located in the wild during the past 50 years.

Extinct in the Wild. Taxa known to survive only in captivity.

Critically Endangered. Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered. Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.

Near Threatened. Taxa that risk becoming Vulnerable in the wild.

Conservation Dependent. Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.

Data Deficient (Insufficiently Known). Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.

Least Concern. Taxa that are not Threatened.

Schedules used in the WA Wildlife Conservation Act.

Schedule 1. Rare and Likely to become Extinct.
Schedule 2. Extinct.
Schedule 3. Migratory species listed under international treaties.
Schedule 4. Other Specially Protected Fauna.

WA Department of Conservation and Land Management Priority species
(species not listed under the Conservation Act, but for which there is some concern).

Priority 1. Taxa with few, poorly known populations on threatened lands.

Priority 2. Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 2. Species returned by one or more of the database searches that have been omitted from the expected species lists (Tables 1 to 4) because of habitat or range limitations (see Methods).

Species		Loop								
		1	2	3	4	5	6	7	8	9
Heleioporus inornatus	Whooping Frog									1
Pseudophryne douglasi	Douglas' Toadlet		1	1						
Pseudemydura umbrina	Western Swamp Tortoise									1
Ctenophorus clayi	Black-collared Dragon				1					
Ctenophorus ornatus	Ornate Dragon									1
Diplodactylus maini								1	1	
Diplodactylus wombeyi			1	1						
Gehyra purpurascens			1							
Hemidactylus frenatus	Asian House Gecko									1
Ctenotus labillardieri										1
Ctenotus rubicundus				1						
Ctenotus rutilans				1						
Egernia luctuosa										1
Hemiergis initialis										1
Hemiergis peronii										1
Varanus rosenbergi	Heath Monitor									1
Ramphotyphlops braminus										1
Ramphotyphlops pinguis										1
Parasuta nigriceps	Black-backed Snake									1
Tadorna radjah	Radjah Shelduck									1
Anas platyrhynchos	Mallard									1
Ixobrychus minutes	Little Bittern									1
Pandion haliaetus	Osprey	1								1
Haliastur indus	Brahminy Kite	1								
Limosa limosa	Black-tailed Godwit									1
Limosa lapponica	Bar-tailed Godwit	1								1
Numenius phaeopus	Whimbrel	1								1
Numenius madagascariensis	Eastern Curlew	1								
Tringa stagnatilis	Marsh Sandpiper									1
Xenus cinereus	Terek Sandpiper									1
Heteroscelus brevipes	Grey-tailed Tattler	1								1
Arenaria interpres	Ruddy Turnstone	1								1
Calidris tenuirostris	Great Knot									1
Calidris canutus	Red Knot									1
Calidris alba	Sanderling									1
Philomachus pugnax	Ruff									1
Phalaropus lobatus	Red-necked Phalarope	1								1
Rostratula benghalensis	Painted Snipe									1
Esacus neglectus	Beach Stone-curlew	1								
Haematopus longirostris	Pied Oystercatcher	1								1
Haematopus fuliginosus	Sooty Oystercatcher	1								1

Species		Loop								
		1	2	3	4	5	6	7	8	9
Pluvialis squatarola	Grey Plover	1								1
Charadrius dubius	Little Ringed Plover									1
Charadrius mongolus	Lesser Sand Plover	1								1
Charadrius leschenaultia	Greater Sand Plover									1
Sterna bengalensis	Lesser Crested Tern	1				1				
Sterna bergii	Crested Tern	1								1
Sterna dougallii	Roseate Tern	1								1
Sterna albifrons	Little Tern	1								1
Sterna nereis	Fairy Tern	1								1
Sterna anaethetus	Bridled Tern	1								1
Anous stolidus	Common Noddy									1
Streptopelia chinensis	Spotted Turtle-Dove									1
Cacatua galerita	Sulphur-crested Cockatoo									1
Trichoglossus haematodus	Rainbow Lorikeet									1
Neophema petrophila	Rock Parrot									1
Centropus phasianinus	Pheasant Coucal		1							
Todiramphus chloris	Collared Kingfisher	1								
Climacteris affinis	White-browed Treecreeper					1				
Malurus elegans	Red-winged Fairy-wren									1
Lonchura castaneothorax	Chestnut-breasted Mannikin									1
Carduelis carduelis	European Goldfinch									1
Zosterops lutea	Yellow White-eye	1								
Myrmecobius fasciatus	Numbat									1
Macropus eugenii	Tammar								1	
Setonix brachyurus	Quokka									1
Chalinolobus nigrogriseus	Hoary Wattled Bat									1
Notomys mitchellii	Mitchell's Hopping-mouse							1		
Mustela putorius	Ferret									1
Equus caballus	Horse									1
Camelus dromedarius	Dromedary, Camel						1			

Protocols For Interaction With Fauna During The Construction Of Stage 4 Expansion, Loops 1-9 Of The DBNGP Pipeline

Original draft prepared by: M. Bamford and W. Bancroft, Bamford Consulting Ecologists

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1 Introduction

Construction of Stage 4 Northern Looping of the Dampier to Bunbury Natural Gas Pipeline (DBNGP) is scheduled to occur between January and October 2006 and requires clearing, earthworks and pipe-laying activities to be undertaken adjacent to the existing pipeline in nine looped sections (Loopings 1 to 9) that range in length from 5 km to 47 km. Associated with looping construction there will be a requirement for some camps and water storage facilities (turkey nests). Looping construction will potentially affect fauna in a number of ways, including:

- Death/injury of fauna during clearing, grading and impacts with vehicles;
- Loss of habitat (generally temporary, however the necessary removal of large habitat trees may result in permanent habitat loss. The existing cleared line over the pipeline will also be maintained);
- Fragmentation of habitat (temporary except for the impact of a cleared permanent access track above the pipeline);
- Spread of weeds and feral fauna along cleared line;
- Increase in feral fauna due to provision of water in 'turkey nests' (temporary);
- Entrapment in trenches that are excavated to receive the pipeline;
- Disturbance of fauna in nearby areas from light, noise and even personnel feeding selected species.

The purpose of this document is to establish a set of protocols for the management of interactions between people/machinery and fauna so that effects on fauna are minimised. The range of actions available under these protocols are summarised as follows:

- No direct action possible;
- No direct action required;
- Capture, translocation and release;
- Capture and transfer to wildlife care for rehabilitation;
- Euthanasia.

The appropriate action(s) will depend on the species involved and the context in which they are encountered.

2 Types of actions

2.1 Species and contexts for which no direct action is possible

During clearing and grading, some fauna will inevitably be killed through the movement of machinery. Reptile densities in Banksia woodland north of Perth (parts of Loopings 8 and 9) are in the order of 400-500 individuals/ha (Bamford, in prep.), and most of these are small lizards that cannot escape moving machinery. The only action undertaken to minimise numbers of deaths will be the minimisation of the footprint of clear and grading activities.

2.2 Species and contexts for which no direct interaction will be required

During clearing and grading, some animals, including birds and large mammals, will be able to move away from the source of disturbance. However, the majority of animals are likely to be small ground-dwelling species that will be unable to rapidly move away from vehicles and equipment. Nestling birds will also not be able to escape.

2.3 Species and contexts for which capture, translocation and release will be required

During clearing and grading, there may be some instances where animals are observed and can be moved out of harm's way. For example, an Echidna observed in the path of a grader can easily be moved to one side. However, such instances are likely to be rare, as most wildlife is cryptic. Project Environmental Officers or fauna handlers may be called upon to assist construction crew with the relocation of fauna.

Entrapment in the trench can affect large numbers of animals and is discussed in detail below. Animals encountered during clearing/grading, or trapped in the trench, can be immediately translocated if they are uninjured or have sustained only minor injuries.

Where animals need to be captured for immediate translocation, this should be done so as to minimise stress and risk of injury to both the animal and the handler. Translocation should be immediate to suitable habitat at a suitable distance from the disturbance. There may be a trade-off between distance from disturbance (and, therefore, chance of re-encounter) and habitat or species requirements (and, therefore, species' survival). For small species, species with small home ranges, or species that have reasonably specific habitat requirements, this may mean that the optimum release point is near the point of disturbance. For example, species from rocky habitats need to be released in rocky habitats even if these lie only 20-30m from the pipeline route. For large species, species with broad home ranges, or species that have broad/general habitat requirements, the release point could be over 100m from the pipeline route. In uniform habitat, practicality may determine the appropriate release distance. A suitably experienced zoologist with a sound working knowledge of fauna ecology and requirements will be responsible for the management of this process. They will also be responsible for deciding if an injured animal should be released or dealt with in another way (see below).

2.4 Species and contexts for which capture and transfer to a wildlife carer for rehabilitation will be required

In some instances, animals may be found during clearing/grading, or in the trench, that have sustained injuries. They may also be struck by vehicles transporting materials for the project. The potential for animals to be struck by vehicles will be reduced by the enforcement of a speed limit of 60km/h on the AoD.

If the injuries to an animal are so serious that it is decided that the animal will not survive if released, transfer to a wildlife carer may be appropriate in some cases. The same situation would apply with nestling birds and orphaned marsupial joeys. The alternative to caring for such fauna would be euthanasia (see below).

Transfer of injured or orphaned fauna to a wildlife carer will be dependent upon a number of factors, including:

- Location. In remote areas (Loopings 1 to 6), there is unlikely to be access to a wildlife carer. Where there is no ready access to a wildlife carer, euthanasia may be the only option. In contrast, in agricultural areas, there may be ready access to a wildlife carer.
- Species. Devoting resources to rehabilitating an individual of a common species may be difficult to justify. For rare species, however, the expense may be justified. For example the Woma *Aspidites ramsayi*, a rare python, could occur in Looping 8 and an injured specimen would be worth rehabilitating. Decisions to rehabilitate or not rehabilitate wildlife will need to be made by a suitably experienced/trained zoologist, possibly in consultation with CALM.
- Introduced species. As a policy, introduced species should not be rehabilitated.

A directory of recognised CALM wildlife carers will be distributed to relevant project construction personnel.

2.5 Species and contexts for which euthanasia will be required

If rehabilitation is not considered to be an option for an injured or orphaned animal because it is an introduced species or because access to a carer is not possible or justified, then euthanasia is the only option. Injured animals should not be left to suffer. Euthanasia will be carried out by a suitably experienced person and will be consistent with animal welfare legislation and CALM guidelines (e.g. Chapman *et al.* 2005).

Note: There is an extensive literature on euthanasia techniques. For most of the loopings, euthanasia *in situ* is recommended with reference made to Chapman *et al.* (2005) to determine the appropriate method(s) for the species concerned.

Transferring injured animals to a veterinarian is unlikely to be a viable option in most cases, unless the animal is located in close proximity to a veterinary clinic, as an animal is likely to suffer during such transportation. Euthanasia of injured fauna will be the duty of the zoologist. Appropriate experience and/or training of the zoologist will be undertaken where required.

3 Trench clearing

The mechanism that will cause the majority of fauna interactions will be trench excavation.

Fauna clearing crews will check open trenches on a daily basis and remove trapped fauna. The following recommendations, from a recent report by the Environmental Protection Authority (EPA 2005), will be followed:

- The mortality of animals that fall into trenches can be reduced by not undertaking projects in the period of highest environmental temperatures and the period when reptiles are most reproductively active (typically November to March). Note that this period will be avoided as far as practicable but on the southern loopings (Loopings 8 and 9) work will start towards the end of this period.
- Trench length. The EPA (2005) suggests open lengths of the trench of 20km in non-rocky areas with an additional 10km open in rocky areas.
- Trenches to be cleared of fauna at least once each day before 10am.
- Shelters (e.g. hessian bags, cardboard boxes) should be installed in open trenches at 100m intervals.
- Trench plugs/exit ramps should be installed in trenches at no greater than 1.2 km intervals to facilitate the egress of fauna from the trench.
- Water in the trench should be pumped out on a daily basis.

The critical time of day for trench clearance may change as a result of climatic conditions. If during construction it is noted that the critical timing for trench clearance is not 10am, discussions will be held with CALM to select the most appropriate time of day to conduct trench clearance to maximise fauna survival.

Staff from the Department of Conservation and Land Management that have been involved in the clearing of fauna from trenches have supported many of the EPA recommendations and also offered additional advice. A fauna clearing crew:

- Progresses at a maximum rate of approximately 3 km/h.
- Will consist of at least two persons operating together to reduce safety risks, stress on fauna and the time taken to capture fauna, and to ensure that the bottom 'corners' of the trench can be adequately inspected. At least one member will be appropriately trained/qualified in the identification and handling of vertebrate fauna (including mammals, birds, reptiles and amphibians), and at least one member will be trained to interact with venomous snakes. At least one crew will be provided for each construction spread (i.e. each Loop).
- Will be equipped with a hoop-bag for capturing animals.
- Will be equipped with a snake jigger.

The following management measures will also be undertaken to facilitate the exit of animals from the trench:

- The ends of each section of pipeline will be capped to prevent the entry of fauna, dust and other contaminants.
- Backfilling crews will inspect the trench to ensure any animals trapped in the trench are relocated prior to backfilling.
- Trench dewatering will occur as required, minimising the potential for trapped fauna to drown in the trench.
- Rubbish will be strictly controlled via standard waste management protocols and will include bins with lids to prevent scavengers from accessing waste including food scraps.
- Fauna handlers to check water storage 'turkey nests' for trapped fauna.
- Exit ramps at trench plug points will be constructed on both sides of the trench and at an angle of less than 45°.

There are a few areas of high conservation value, notably in areas of native vegetation in Looping 8 (e.g. the Coomallo Creek area and the 5.5km immediately south of CS8) where additional efforts may be required. In such areas, depending upon the numbers of animals initially found in the trench, the trench may be cleared morning and evening, and effort may be required to minimise the length and time open on the trench.

4 Recording and fate of dead animals

Records will be kept of all animals encountered during fauna management operations. Opportunistic listings of fauna (native and introduced) will also be kept, including bird lists, and detailed records will be made of animals handled. Records to be kept will include (where practicable) date, location, looping number, UTM, datum (WGS84 or similar), species, vegetation and landform, and any notes such as the form of encounter.

In most cases, dead animals, either found during operations or euthanased, will be removed from the immediate vicinity of activity to prevent carrion-feeding species being attracted to areas where they may, in turn, be injured.

The WA Museum will be contacted prior to operations commencing at each Loop to determine if there are any species of which specimens may be required. The Museum will also be able to advise on how specimens should be preserved, but usually frozen material is acceptable. A GPS will be used to note the collection location of museum-bound specimens.

5 References

Bamford, M. J. (in prep.). A comparison of measures of abundance of reptiles in Kwongan vegetation of the South-West of Australia, determined through systematic searching and pitfall trapping.

Chapman, T., Sims, C. and Mawson, P. (2005). Minimising Disease Risk in Wildlife Management: Standard operating procedures for fauna translocation, monitoring and euthanasia in the field. Department of Conservation and Land Management, Kensington, Western Australia.

EPA. (2005). EPA Bulletin No. 1164. Gas Pipeline To Nifty Copper Operations. Environmental Protection Authority, Perth, Western Australia.

Appendix 6: Hygiene Protocol

Ecos Consulting (Aust) Pty Ltd (2005) *Northern Looping Hygiene Protocol*

Northern Looping Hygiene Protocol

1 OVERVIEW

Woodman Environmental Consulting Pty Ltd was contracted by Ecos Consulting (Aust) Pty Ltd in 2005 to conduct a flora, vegetation and *Phytophthora cinnamomi* assessment along the areas of the existing DBNGP pipeline easement that will be accessed as part of Alinta's Looping 10 Project.

The declared plants Mesquite and Parkinsonia have been identified by CALM as potentially occurring within the Area of Disturbance (AoD) in the western Pilbara. These and all other declared plants and invasive introduced species will be identified during weed surveys carried out in the appropriate seasons as stated in the vegetation survey methodology for the Northern Looping Project (Woodman 2005).

Declared plants and other invasive species will be controlled with herbicide or where possible removed by hand to ensure underground corms are eradicated during rehabilitation monitoring after construction.

Disturbed areas along the pipeline route are likely to be infested with environmental weeds and hygiene operations will be required to reduce the risk of spreading weeds into undisturbed areas of the Northern Looping Projects Area of Disturbance (AoD).

2 MANAGEMENT

2.1 Objectives

- Prevent the introduction of weeds and dieback to the easement from external sources;
- To minimise the risk of spreading existing weeds and dieback infections along the easement and to external areas; and
- Rehabilitate the AoD to minimise the potential for weed colonisation and dieback spread.

2.2 Scope

A front end loader, grader and excavator will be used for the clear, grade and rehabilitation operations.

The front end loader and an excavator will be used to fell all vegetation on the AoD except where it is feasible to leave large habitat trees *in situ*. The front end loader will most likely be fitted with a rake blade and the excavator fitted with a rake bucket to assist in the segregation of woody debris and ground shrubs from topsoil. All vegetation will be stockpiled in windrows to one side of the AoD.

The grader will then blade all topsoil to a minimum depth of 50mm (generally, 50mm to 100mm deep) from the AoD, into a windrow on the eastern side of the easement next to the vegetation windrow. The topsoil underneath the vegetation windrow however, will be left *in situ*. All large habitat trees that can be avoided will be flagged to ensure they are not cleared. Where existing fauna runs, large trees or trench plugs occur, there will be breaks in the vegetation and topsoil stockpiles.

During rehabilitation the heavy machinery will be used to respread the topsoil and vegetation back across the AoD.

3 Risks

3.1 Overview

The highest risk of weed and dieback spread will be during the clear and grade operation and rehabilitation operation where the vegetation and topsoil will be cleared, graded and respread (rehabilitation) using the machinery described above. Dieback will only be of concern for Loops 8 & 9 as all other loops are in areas where there is not sufficient rainfall for the dieback disease to survive. Topsoil in the identified disturbed and cleared areas is potentially infested with environmental weed seeds. The machinery involved in the clear and grade and rehabilitation operations will need to be cleaned down to remove all soil / organic matter when moving from disturbed / cleared areas into undisturbed areas, thus minimise the risk of spreading weed seeds and disease into those undisturbed areas.

Once the clear and grade operation has removed the topsoil and associated weed seed bank from the AoD, there should be a very low risk of weed spread due to other vehicle and machinery movement along the AoD. However, caution will be required when respreading the topsoil during rehabilitation to ensure that weeds are not spread to weed free areas.

All vehicles that cross dieback hygiene boundaries will require Cleandown even after the topsoil has been removed and stockpiled as the dieback disease can be spread by the movement of all layers of the soil profile.

Potential also exists to spread weeds from offsite onto the AoD or from the AoD to offsite locations. Therefore, the hygiene operations commence prior to bringing any vehicles / machines on site and before any vehicles / machines leave site.

3.2 Strategy

- Hygiene training at induction for all personnel
- GPS location of all weed and dieback areas
- Identification of weed and dieback infection areas on construction maps
- Yellow survey tape used infield to identify the weed and dieback area boundaries
- Boundary flagging to be maintained until the clear and grade operation has removed all topsoil from the AoD
- Ensure all vehicles and machinery that will access the AOD are free from soil / organic matter prior arrival on site (recorded as part of the mobilisation procedure)
- Vehicles that move off the AoD but remain on bitumen roads do not require clean down
- Identified entry and exit points to the AoD at which hygiene protocols become effective
- Clean down of machinery when moving from disturbed areas to undisturbed areas during clear, grade and rehabilitation.

Clean down operation operations will involve:

- lay timber skids across boundary
- use of air blower or high pressure water to clean rake bucket and rake blade and undercarriage of machines inside the boundary of the disturbed / undisturbed areas
- drive machinery from disturbed area onto timber skids
- wash tracks / wheels of machinery as the machine drives along the timber skids into the undisturbed area
- machinery hygiene inspections shall be logged in machine daily log books
- audit of vehicle hygiene operations in the field
- conduct a clean down of all vehicles that accessed the AoD prior to them leaving site
- investigation and reporting of breaches of hygiene program to Alinta and CALM within 24 hours of any breach.

4 Roles and Responsibilities:

4.1 Environmental Officer

- identify entry and exit points where hygiene protocol will commence
- ensure hygiene is adequately covered in site induction program
- ensure hygiene boundaries are marked on construction maps
- ensure that hygiene boundaries are flagged infield prior to commencement of clear and grade operation and remove after rehabilitation phase complete
- conduct infield checks to ensure hygiene boundary flagging is in place at all times
- conduct infield checks to ensure washdown procedures are carried out correctly.

4.2 Machine Operator

- conduct machine clean down and inspection prior to crossing hygiene boundary
- after ensuring machine is clean, sign that clean down was complete in machine daily log.

4.3 Spread Boss

- Ensure timber skids and washdown units will be present at hygiene boundaries during all hygiene sensitive operations (clear, grade & rehabilitation).

5 Timing

- field marking of hygiene boundaries will occur prior to the construction phase
- clear and grade operation is the first phase of construction
- rehabilitation is the final phase of construction
- conduct infield checks to ensure compliance with the Hygiene Protocol during construction
- boundary flagging shall remain intact throughout the operation only to be removed after the rehabilitation phase is complete.

6 References

Woodman Environmental Consulting Pty Ltd (2005) *DBNGP Northern Looping Flora And Vegetation Studies Assessment Method.* Prepared for Ecos Consulting (Aust) Pty Ltd, August 2005.

Appendix 7: Environmentally Sensitive Areas

Data sourced from: Alinta Ltd
MapInfo
CALM
Geoscience Australia

DBNGP

BRAND HWY

Compressor Station CS 8 KP 0

KP 1

KP 2

KP 3

KP 4

KP 5

KP 6

KP 7

KP 8

KP 9

KP 10

KP 11

KP 12

KP 13

KP 14

KP 15

KP 16

KP 17

KP 18

KP 19

KP 20

KP 21

KP 22

KP 23

KP 24

KP 25

KP 26

KP 27

KP 28

KP 29

KP 30

KP 31

KP 32

KP 33

KP 34

KP 35

KP 36

KP 37

KP 38

KP 39

KP 40

KP 41

KP 42

KP 43

KP 44

KP 45

KP 46

ESA DPI
Mining Reserve

WARRADARGE

COOROW GREEN HEAD RD

COOROW GREEN HEAD RD

Proposed Route
DBNGP Loop 8

BRAND HWY

NU4

ESA Coomallo Reserve

JURIEN RD

HILL RIVER

HILL RIVER

DBNGP

Legend

- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 8
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Environmentally Sensitive Area (Registered)
- Environmentally Sensitive Area (Unregistered)

Note: While every effort was made to ensure the accuracy and currency of the information shown on this map, the project team does not accept any responsibility for errors or omissions that may have occurred.

Produced by Asset Services, Alinta Network Servies, Level 8 IBM Tower, 60 City Road, Southbank VIC 3006

Alinta

Scale 1: 150 000 (A3)

0 1,000 2,000 4,000 6,000

Meters

DBNGP Loop 8
Site Plan - Environmentally Sensitive Areas
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL08-C-102-01
Map Revision: 0
Project File: Northern Loop Site Plan - ESA.mxd
Pipeline Route Rev B 12/10/2005

Date: 24 / 11 / 2005
Sheet: 1 of 1

GDA

Data sourced from: Alinta Ltd
MapInfo
CALM
Geoscience Australia

DBNGP

RED GULLY

MOORE RIVER

Compressor Station CS 9

KP 0

KP 1

KP 2

KP 3

KP 4

KP 5

KP 6

KP 7

KP 8

KP 9

KP 10

KP 11

KP 12

KP 13

KP 14

KP 15

MOORE RIVER NATIONAL PARK

Proposed Route
DBNGP Loop 9

BEERMULLAH LAKE

BEERMULLAH

ESA Geomorphic Wetland

BRAND HWY

DBNGP

GINGIN BROOK

GINGIN BROOK RD

QUIN BROOK

GINGIN BROOK RD

MUCKENBURRA

GRANVILLE

DEW

Legend

- Compressor Station
- Rivers
- Railway
- Proposed Route Loop 9
- Highways / Main Roads
- Other Roads
- DBNGP
- Lake / Watercourse
- Built Up Area
- Environmentally Sensitive Area (Registered)
- Environmentally Sensitive Area (Unregistered)

Note: While every effort was made to ensure the accuracy and currency of the information shown on this map, the project team does not accept any responsibility for errors or omissions that may have occurred.

Produced by Asset Services, Alinta Network Services. Level 8 IBM Tower, 60 City Road, Southbank VIC 3006

Alinta

Scale 1: 100 000 (A3)

0 1,000 2,000 4,000

Meters

DBNGP Loop 9
Site Plan - Environmentally Sensitive Areas
Section 38(i) EPA Referral

Coordinate System
GDA94

Map No: DBPL09-C-102-01
Map Revision: 0
Project File: Northern Loop Site Plan - ESA.mxd
Pipeline Route Rev B 12/10/2005

Date: 24 / 11 / 2005
Sheet: 1 of 1

GDA

Appendix 8: Alinta Responses to CALM Comments on Draft ARI

Alinta Response to CALM Comments on Oct ARI

Comments Received from Regulators

No	Regulator Comments	Alinta Response
1	**Comments from Ross Doherty** <u>Horizontal Directional Drilling (HDD)</u> Environmentally, HDD is the most ideal method of installing conduit beneath waterways because it minimises bank disturbance and eliminates the potential for erosion. I anticipate however that there may be operational problems associated with using this method at the Ashburton River given the rocky nature of the bed in the vicinity of the proposed alignment. I understand that the feasibility of using HDD at Ashburton is currently being assessed. I believe there should be some discussion of a contingency plan (trenching) in the event that HDD is impractical. If open trenching is employed at Ashburton River then significant environmental impact may result.	Geotechnical studies and advice support HDD being practical. Methods of management of environmental impacts if an alternative method has to be adopted are well known and will be implemented in the event that alternative methods are needed.
2	<u>Weed Mapping</u> There are infestations of the declared plants Mesquite and Parkinsonia in the West Pilbara. Mesquite usually occurs within the flood plains of significant waterways and Parkinsonia is confined to riparian zones. Both are actively targeted for control in the project area. In the weed mapping exercise the existence of these plants should be specifically investigated as the spread of seeds during earthworks could be detrimental to existing weed management programs.	Weed mapping will occur on all loops of the Northern Looping project at the appropriate times of the year as per the Vegetation Methodology previously agreed upon between Woodman Environmental Consulting, DoE and CALM. Declared weed locations will be recorded and managed through Environmental Line Lists, the Rehabilitation Management Plan (including weed monitoring during rehabilitation) and also through the Hygiene Plan to ensure there is no further spread of weeds along the AoD. Relevant sections of the ARI have been updated

Alinta Response to CALM Comments on Oct ARI

No	Regulator Comments	Alinta Response
		(eg Section 5.2.4.2).
3	Waste Management Section 5.2.12 states that domestic campsite wastes will be disposed of to local licensed facilities where available. The intention is unclear. It needs to be confirmed that all domestic waste is to be disposed of at appropriate facilities regardless of the location of the nearest facility.	The ARI has been updated to reflect this request in Section 5.2.12.
4	Groundwater Use For any planned purpose the proponent is required to apply for a '5C licence to take groundwater' prior to accessing water from existing bores.	Noted with thanks. The ARI has been updated (Section 2.3.2) to include this comment.
5	**Comments from Mark Brundrett / John Dell (DoE)** The statement that no wetlands are present in the vicinity of loops 1-8 is incorrect (Page 17). The alignment passes next to lakes and there are many river and creek crossings. Conservation category wetland mapping is not available for the regions where loops 1-8 occur, but many wetlands in these regions are of high ecological importance.	Noted with thanks. The ARI has been updated to note that there are other wetlands, however mapping is not yet available.

Alinta Response to CALM Comments on Oct ARI

No	Regulator Comments	Alinta Response
6	Maps showing vegetation types, vegetation condition, and dieback infected areas in the pipeline corridor and adjacent vegetation should be provided. It is not possible to accurately assess the significance of vegetation to be disturbed from the information provided.	Maps of vegetation types and vegetation condition reports will be developed upon the identification of vegetation on Loops 8 & 9 from the results of the spring surveys that were conducted in October 2005. This report and associated maps will be available in late December.
7	The list of rare flora likely to occur in close proximity to the pipeline (Table 3-10) is very incomplete. Approximately 20 species of rare or priority taxa are omitted from Table 3-10. This list does not seem to not include any priority taxa. A partial list of these species is provided in Table 1 below.	Table 3-10, as stated in the ARI only includes species that were identified during the EPBC search tool on the DEH website. Section 3.5.2 has been updated to include the additional information that has been provided from the CALM database.
8	Several taxa listed in Table 3-10, but stated to have very low likelihood of being present, are in fact shown to be located close to the pipeline corridor on the CALM rare flora GIS dataset (e.g. Eucalyptus suberea, E. lateritica, Paracaleana dixonii). These taxa are indicated with an asterisk in the list below, which is not a complete list.	The spring survey have been conducted by Woodman consulting and will identify DRF and PF on the AoD. Vegetation samples are currently undergoing taxonomix identification by specialists and if any DRF or PF are identified they will be managed in accordance with relevant legislative requirements. See the Rehabilitation Management Plan for further information and Section 5.2.3.2 of the ARI.
9	Note that most records for rare flora in this area are close to roads and/or in nature reserves. This indicates that there has been limited sampling in other remnant vegetation.	Noted with thanks. See response to comment 8.
10	It is essential that any rare flora surveys look for all rare	The methodology for the vegetation and weed

Alinta Response to CALM Comments on Oct ARI

No	Regulator Comments	Alinta Response
	and priority taxa, not just those included in a particular list. Further advice form CALM should be sought in this regard.	surveys was agreed upon by CALM and the DoE prior to the commencement of the spring surveys on Loops 8 and 9. (See page 3 of Woodman, Northern Looping Veg Survey Methodology). All DRF and PF will be searched for during the surveys.
11	There is an extremely high degree of plant species richness and endemism, especially near loops 8 and 9. It is likely that additional rare and priority taxa not included in the list below would be located in the pipeline corridor by additional surveys.	Noted with thanks. See response to comments 8 and 11.
12	The timing of flora surveys is important, as some species listed below cannot be identified when they are not flowering.	Noted with thanks.
13	A commitment to minimise disturbance of native vegetation whenever possible should be provided.	Alinta's environmental policy commits to minimising all forms of environmental harm. The mitigation measures in Section 5.2.3.2 and the statement of Alinta's commitment to minimise harm to the vegetation has been added to this section.
14	A management plan for rare and priority flora located along the pipeline is required. Will these species be avoided, or has a translocation plan been developed?	The management of DRF and PF identified will be conducted on a case by case basis. This is described in Section 5.2.3.2 of the ARI and is also included in the Rehabilitation Management Plan.

Alinta Response to CALM Comments on Oct ARI

No	Regulator Comments	Alinta Response
15	Effective management of weeds is a key issue, especially since this area has been disturbed before, so weed recruitment from the soil seed bank may be greater than anticipated.	Noted with thanks. The Hygiene Protocol shall be followed to ensure weeds are managed effectively.
16	It is likely that dieback occurs in the area and an effective dieback management plan is required concerning: 1. Identifying any existing areas of infection. 2. Identifying areas of highly susceptible vegetation, especially in nature reserves. Avoiding spread of dieback to new areas.	Dieback mapping has been completed and the results will be incorporated into the Hygiene Protocol when they become available. The Hygiene Protocol has also been included in the ARI.
17	Completion criteria targets that address the recovery of plant diversity and cover as well as effective weed management are required for the pipeline corridor.	Completion criteria are contained in the Rehabilitation Management Plan which has been included in the ARI and is currently undergoing CALM review.
18	What contingency plans are in place if there are insufficient dispersal and seed bank recruitment to reach targets? In particular, problems with weeds should be expected and contingency plans put in place.	Section 5 of the Rehabilitation Management Plan states *"If the monitoring occasions note areas that do not meet these criteria then discussions will be held with CALM regarding recommended remedial action. It is expected that failed areas will be actively reinstated with planting of appropriate species in failed areas during autumn 2007 in consultation with an appropriately qualified botanical consultant and CALM. Any areas of high weed cover will be treated with an appropriate program in consultation with CALM."*

Alinta Response to CALM Comments on Oct ARI

No	Regulator Comments	Alinta Response
19	Table 1. Preliminary list of some rare and priority taxa likely to occur on or near the pipeline, most of which were not included in Table 3-10. *Taxa with multiple records in close proximity to the corridor. Acacia cummingiana (P4) Acacia drummondii ssp. affinis (P4)* Acacia wilsonii (DRF) Acacia splendens (DRF) Calytrix chrysantha (P4) Calytrix eneabensis (DRF) Calytrix sylvana (P1?) Conostephium minus (=magnum?)(P4)* Daviesia epiphyllum (P3) Daviesia chapmanii (P4) Dryandra echinata (P1)* Dryandra lindleyana ssp. pollosta (P4) Eucalyptus johnsoniana (DRF)* Eucalyptus pendens (P4)* Eucalyptus suberea (DRF)* Eucalyptus lateritica (DRF)* Eucalyptus leprophloia (DRF) Grevillea saccata (P4)* Haemodorum loratum (P3)* Hakea megalosperma (DRF) Jacksonia sp. Badgingarra (P1) Pericaleana dixonii (DRF)* Verticordia blepharophylla (P2)* Verticordia rutilastra (P4)* Verticordia paludosa (P1)	This list of species has been added to the ARI in Section 3.5.2 to provide a more comprehensive coverage of the DRF and PF that may be encountered along the AoD. The spring surveys will ensure that all DRF and PF that do occur on the AoD have been identified and the appropriate mitigation measures to manage this issue are outlined in Section 5.2.3.2.

Alinta Response to CALM Comments on Oct ARI

No	Regulator Comments	Alinta Response
20	There are a number of typographical errors and inconsistencies including misspelt faunal names and inconsistencies between name usages between the various tables.	Noted with thanks and amended.
21	Baudins Black Cockatoo does not occur in areas covered by this proposal and it should be deleted from Tables 3-11and 3-12. Some species are included in Table 3-12 but not in Table 3-11. This is inexplicable when these Tables are meant to include the same species. These Tables also fail to include some EPBC listed species known from the project area and which are included in the Scheduled Listed Fauna in Table 3-15.	Baudins Black Cockatoo has been removed from Tables 3-11 and 3-12. All species in Table 3-12 are also contained in Table 3-11. Significant taxa have been identified in the fauna review conducted by Bamford Consulting and is contained in the ARI as Appendix 5.
22	The report uses the out of date 1998 Wildlife Conservation (Specially Protected Fauna) Notice instead of the current 2003 Notice. Accordingly several of the categories used and the species listed need considerable revision to use current status listings. Because of changes between the old and the new Notice some species also need to be moved to CALM's Priority Fauna list.	This section of the ARI has been updated and the fauna review conducted by Bamford Consulting has been added to the ARI to address these concerns. The fauna review was very comprehensive reviewing many databases and other information sources. It includes a ranking of significance of species based on CALM and DEH listings. The review also describes the habitat requirements and discusses likelihood of significant species being impacted upon.
23	The caption preceding Table 3-14 refers to five categories of Priority Fauna but only four Priority categories are listed in Table 3-14 and the descriptions	See response to comment 22.

Alinta Response to CALM Comments on Oct ARI

No	Regulator Comments	Alinta Response
	are different from those used in CALM's current listing (20.05.2005).	
24	Table 3-15 does not include all Scheduled listed fauna known from the project area and fails to include some species that are included in Table 3-11. At least six names are misspelt in this table.	See response to comment 22.
25	There is no Table of Priority listed fauna.	See response to comment 22.
26	The statement that "nesting habitat is not present along pipeline corridor" for Rainbow Bee-eater (Table 3-12) is not correct. This species is likely to breed along the entire length of the pipeline corridor.	Table 3-12 had been updated to reflect this concern.
27	The statement on page 26 "All of the identified fauna species would be transitory through the area" is not correct. Many of the species listed are sedentary and some are exceedingly habitat specific.	See response to comment 22.
28	The statement that "The risk of fauna mortality due to machinery operation or entrapment in the trench is considered low" (page 43) is not a true reflection of unmanaged impacts. The reason for developing a fauna management plan is because of this likely impact. Additionally a large number of small poorly mobile species especially reptiles will be direct casualties of clearing and other machinery operation.	The risk assessment was conducted and risk levels ranked according to residual risk, hence, this is the risk once mitigation measures have been employed. However, this statement has been updated in the revised ARI to address this concern.
29	The statement "Retain habitat trees where feasible" is	Section 5.2.3.2 now describes the process by

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No	Regulator Comments	Alinta Response
	supported but no assessment has been conducted especially in environmentally sensitive areas to determine location of habitat trees. Additionally no criteria have been provided to define habitat trees.	which habitat trees to be retained on the AoD will be selected including habitat tree identification criteria.
30	Section 5.2.5.1 has not been updated to include the recommended protocols for interaction with fauna in the report by Bamford Consulting Ecologists which included additional advice from CALM. The criteria on amount of open trench lefty open at any one time period (on page 4) of the Bamford report is not appropriate in environmentally sensitive areas of this project. The EPA (2005) report quoted is not appropriate for this project. It should be noted that in a more recent bulletin (EPA 2005) the EPA has set the following criteria "up to 800m of the trench would be open during the day time. Up to 36m of trench would be left open during night time to allow for pipe joining." Accordingly criteria for this project need to be considered in consultation with CALM and the DoE.	Section 5.2.5.2 has been updated to include the recommendations of the Bamford Fauna Interaction Protocol. The 800m length of trench open during operation and 36m of trench open overnight are Kemerton Lateral Pipeline specific criteria. At Kemerton, 800m of trench will be opened and closed within a day due to the sandy soils in the area rapidly collapsing the trench. This is an engineering constraint, not a fauna mitigation measure, although it will effectively reduce the number of fauna trapped in the trench due to it's reduced length. Fauna will be managed by having sufficient numbers of appropriately trained personnel inspecting the trench at the appropriate times of the day to relocate trapped fauna.
31	It is noted that detailed fauna management plans are not part of this current ARI draft document and need to be provided.	The Fauna Review and Fauna Interaction Protocol are now included as Appendix 5 of the ARI.

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32	**Comments from CALM** <u>General Comments</u> Because of the potentially high conservation values of areas affected by the project the EPA should consider the requirement for a bond for rehabilitation performance, particularly for the portion of the alignment that traverses CALM managed estate with CALM to sign off when rehabilitation completion criteria are met.	This question of bond was discussed with both CALM and the EPA Services Unit and it has been decided that a bond is not applicable for the project.
33	Due to the amount of time required from agency staff to provide advice and undertake on-ground monitoring and management in relation to rehabilitation, CALM requests that the proponent provide for cost recovery of staff time during the implementation phase of this project. The proponent has indicated a desire to discuss this issue specifically in relation to formal rehabilitation monitoring, if CALM identifies that it has the regional resources to undertake this activity. Alternatively CALM would consider engaging a consultant to represent CALM at Alinta's cost.	Alinta has noted that during rehabilitation there may be opportunity within the overall rehabilitation budget to cover some of the operational costs for CALM representatives to conduct occasional monitoring visits to these sites. This will be discussed between CALM and Alinta prior to this monitoring occurring.
34	Right of Way (ROW) – the proponent needs to define within the ARI whether the ROW refers to the total area of disturbance (within and outside of the existing easement) or just the existing easement. It appears from the cross-section maps that the 'construction ROW' refers to the area of disturbance inside and outside of the easement, but does this also include	The ROW refers to the total area of disturbance including turn around locations and construction camps. As such, the ARI has been amended to that all references to the ROW are now referred to as the AoD to avoid confusion. This has been described in Section 5.3.2.1. and in the table within the Preamble.

	turn-around bays, laydown areas etc?	
35	The responses from Alinta to the government department's comments on the September 2005 version of the draft ARI are not necessarily included in the October 2005 version of the draft ARI (eg CALM comment 11, 13, 19, 22, 29, 38, 40, 44, 48, EPA comment 22 etc). As this information is important in understanding the entire proposal, the proponent should relate the detail from the 'summary of regulator comment to draft ARI' table into the relevant parts of the draft ARI document itself. At a minimum, it must be noted within the documentation that both documents comprise the final ARI.	The ARI has been updated to address these comments in their relevant sections.
36	The draft ARI only provides a general list of potential impacts and mitigation measures which makes it difficult to predict whether the impacts of the proposal on significant flora and fauna will be adequately assessed and managed at the detailed level. Adequate assessment of potential impacts requires additional survey information from experienced qualified consultants. Survey information can then be used for the development of detailed management or mitigation plans to manage or offset potential impacts, in consultation with CALM. Therefore, CALM advises that implementation of the proposal as outlined in the ARI should be subject to further agreement with CALM for relevant components of the construction and operational EMPs (ie these management plans and protocols form part of CALM's sign-off/ endorsement). The CEMP (listing all environmental commitments) and any other specific management plans should be developed in consultation with, and to the satisfaction	Additional surveys are being carried out and CALM 's and other relevant regulators agreement to the specific measures within the Construction Environment Management Plan and associated documents will be obtained. The Rehabilitation Management Plan, Hygiene Protocol, Fauna Review and Fauna Interaction Protocol have also been added to the revised ARI.

	of, the relevant regulators. The proponent needs to identify which regulators will be consulted for each major component of the CEMP and other management plans.	
37	Due to the fact that on-ground surveys along the loops will be staged from spring 2005 to autumn 2006, the proponent should commit to developing loop-specific CEMP and management plans (ie hygiene management protocol, rehabilitation plan) as information becomes available and prior to construction activities commencing in relevant loops.	The CEMP is supported by an Environmental Line Lists (ELL). The ELLs contains a meter by meter description of the environmental issues and associated management methods to be adopted at any point on the AoD. There will only be one CEMP for the project.
38	Although there is a commitment for further consultation with CALM regarding the results of the additional flora studies and additional management measures (p.41), the proponent should include an overall commitment that, if further studies and/or surveys determine that there are likely impacts on significant biodiversity values/assets, they will support the provision of appropriate further mitigation and offset measures to the satisfaction of the Minister for Environment on advice from CALM.	Accepted. Section 7.7.2 of the ARI and Section 5 of the Rehabilitation Management Plan include this commitment.
39	The final disturbance footprint of campsites, borrow pits and access to pits, truck turnarounds bays, lay down areas etc. can only be selected once the proposed field vegetation surveys/studies and the final fauna study have been completed. At that time it will be possible to select areas in a way that minimises environmental impact, through consideration of identified values and areas of lower impact or risk (and in conjunction with the on-site inspection for bare-ground, appropriate soils etc). The finalised area of disturbance must be	Noted with thanks.

	considered in the development of the hygiene and rehabilitation plans.	
40	Alinta made an oral commitment at the Environmental Risk Assessment workshop that, 'environmentally sensitive areas' would be identified in consultation with CALM, and that these would be treated in a different manner to minimise environmental impacts. It is unclear from the ARI document how Alinta proposed to identify these 'environmentally sensitive areas' and how they will be treated differently as there appears to be no direct reference to 'environmentally sensitive areas'. The definition of these areas and the methods and criteria for their identification and management should be properly described in the draft ARI and EMPs. It is understood that two areas, Coomallo NR and the 5.5km strip of remnant vegetation south of CS8, have already been identified as environmentally sensitive areas from the Environmental Risk Assessment workshop. CALM remains willing to assist in nominating other 'environmentally sensitive areas' and has already further identified Toolonga Nature Reserve as a potential environmentally sensitive area. Other such areas may include sites of significant flora (eg DRF or priority flora), significant vegetation (i.e. TECs), significant fauna habitat (Carnaby's cockatoo feed or nest trees), the wetland in loop 9 etc. Some environmentally sensitive areas, however, may not be identifiable until field surveys have been completed. Prior to their finalisation, the ARI should identify generic management actions or options for these sites (ie all environmentally sensitive areas should be marked on-	Section 3.5.3 of the ARI now describes the known ESA's and states that additional ESA's will be identified upon receipt of results of vegetation surveys. There are specific measures such as no turn around areas, reduced working widths, clean downs at entry etc in these areas described in the ARI in Section 3.5.3. Toolonga Nature Reserve is south of Loop 5 and will not be impacted upon by this project.

	ground, no activity outside of the existing easement, no disposal of hydrotest water, mandatory washdown prior to entrance, consideration of realignment of pipeline within corridor etc), keeping in mind that specifics for some sites may be developed in consultation with CALM and DoE once on-ground surveys have been completed to identify the specific values.	
41	All commitments made in the environmental risk assessment workshop spreadsheet need to be included in either the ARI or CEMP as appropriate eg additional management measure from 2.02, 2.05, 3.03 to include environmental weeds, 3.07 etc (these are examples only and not a complete list).	Noted with thanks.
42	Specific Comments Table 1-1 (p.3) – it is noted that an EPBC referral was submitted in August 2005 for the project, but there is no discussion of the status of this referral or whether the referral was declared a controlled act or not	ARI amended to note that the project is not a controlled activity. Refer Table 1-1.
43	2.3 Construction methodology (p.4) 'the area that will be cleared and graded will be approximately 25m wide' which is indicated on the cross-section maps provided to be both within and outside of the existing easement – this does not reflect the commitment Alinta made at the risk assessment workshop and in previous draft ARI that no clearing and grading activity would be undertaken outside of the existing 30m easement.	Noted with thanks. Some unavoidable clearing will occur outside the existing 30m easement.

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44	(p.5) 'environmental management measures are discussed in Table 2-3' – This reference is an error as this table deals specifically with construction activities	Noted with thanks. Reference corrected
45	Table 2-3 (p.6) clear and grade - 'graders and bulldozers are used to clear the ROW to 25m wide of vegetation and topsoil' o this does not reflect that 25m is the maximum width and that in some areas (areas of shallow topsoils ie northern loops) the clearing and grading pathway may be up to 3m less than 25m o reference to ROW – it is not clear whether this is just within the existing easement or may occur outside of the existing easement (and refer to above point of the proponent's commitment of no clearing and grading outside of existing easement)	Table wording adjusted. The point is discussed within the text. The ambiguity has been removed by using the term AoD.
46	Table 2-3 (p.6) Pressure testing – CALM discourages the discharge of hydrotest water near any environmentally sensitive areas and is unlikely to give approval for the discharge of hydrotest water into the conservation estate as not enough information is provided regarding the quantity and quality of water and it is uncertain what the potential impacts may be. In environmentally sensitive areas, CALM's and DoE's advice should be sought on the best method of disposing of hydrotest water. In addition, discharge of	Advice noted with thanks.

	hydrotest water near DRF would possibly require a permit to take.	
47	Table 2-3 (p.6) Restoration and rehabilitation – there is no mention of the requirement to maintain a line cleared of vegetation directly over the pipelines to allow visual identification of marker signs	Table 2.3 revised.
48	2.4.1 Construction camps 'camps will be located on previously disturbed areas wherever practicable and will be selected to avoid impacts to important vegetation and wildlife habitats' – final site selection may be influenced by the results of the fauna and flora studies	Additional text added to Table.
49	Table 3-3 CALM has advised that October to April construction must be avoided in the Pilbara as these are times of high reptile movement and risk of cyclones flooding the trenches. Alinta has advised that the expected construction period for loop 1 is 4 Nov - 28 Dec and for loop 2 is 5 Sept – 28 Nov and that 'the construction schedule is such that the construction timing for these loops can not be altered'. Alinta commits to following the fauna management protocol (which state that 'construction of trenches in the Pilbara will be scheduled to avoid the majority of the summer months') and that 'additional resources will allocated if seasonal or habitat conditions are likely to affect the efficient recovery of animals from the trench'. Please see further notes under 5.2.5.1 and 5.2.5.3 and the fauna handling protocol sections.	The construction schedule has been tightened to ensure that all work will be completed by the end of October 2006. This should avoid peak reptile activity periods in the Pilbara.

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50	3.5.4 Fauna There is no reference to the final report on the desktop fauna study being undertaken by Bamford Consulting and expected in the week ending 11 Nov and incorporation of these results.	This report has been included in the ARI as Appendix 5.
51	The Pilbara Olive Python is also listed under the EPBC Act and should be included in table 3-11 and assessed in table 3-12.	An EPBC search was conducted utilising the DEH interactive search tool for the project area. This species was not identified during the search conducted for the Northern Looping Project and as such, this species was not included in Tables 3-11 and 3-12. It should be noted however that this species was included in the ARI Rev1 as a Schedule 1 species and is also included in the Fauna Review appended to the current ARI.
52	The proponent needs to clarify within the ARI that the EPBC Act protects habitat of listed species as well as the listed species themselves.	Clarification has been made in the ARI.
53	It appears that no on-ground fauna survey has been undertaken for this project making it difficult to verify the adequacy of the desktop work. There may still be an opportunity for the proponent to undertake a fauna habitat survey as part of the pipeline construction operation, thereby increasing capacity to manage the risks to significant fauna.	Risk is managed by the Fauna Handling Protocol. Habitat requirements for significant fauna species are discussed in the fauna review.
54	4 Environmental Risk Assessment CALM would like to confirm that the risk assessment workshop referred to on p. 32 is not the workshop that was held on Thursday 29 September, as this work was	The risk workshop is the one identified and the commitment to carry out the work that will be undertaken in the future once all studies and surveys have been completed to identify key

	not undertaken on that day. It needs to be clear that this section refers to work that will be undertaken in the future once all studies and surveys have been completed to identify key biodiversity values, and that results will be included in the CEMP. The purpose of undertaking a risk assessment is to determine the management level required, and therefore the specific management measures proposed for each level and type of risk must also be outlined.	biodiversity values is given in the CEMP.
55	5.1 Overview (p.34) 'based on the risk assessment' – a formal risk assessment should be undertaken once all studies and surveys have been completed; if a preliminary risk assessment has been undertaken, the results should be presented in the draft ARI	See response to comment 54. Results of the risk assessment are included in the CEMP.
56	'the entire list of environmental management commitments will be detailed in the CEMP' in consultation with, and to the satisfaction of, regulators including CALM	Point noted in ARI.
57	5.2.1.1 Soils and terrain impact mitigation Mattiske (2002) identified two sites in the Pilbara (4k, 8a) which should be particularly targeted for erosion protection. The proponent should consider this advice and investigate the erosion potential and any need for additional erosion protection at these sites.	Section 5.2.1.1 describes the range of mitigation measures that Alinta will use to control erosion on the entire project. These measures will be implemented at all sites where erosion may be an issue regardless of whether the specific area has been identified to be at risk from previous reports. The Rehabilitation Management Plan also includes Completion Criteria that relate to land form including erosion.
58	5.2.2.1 Water Resources Potential Impacts	Noted with thanks.

	(p.38) the trench will be open for 'generally less than two weeks' – EPA approach to previous Nifty proposal was that that 'no part of the trench shall r main open for more than seven days, except in 'rocky terrain' where the trench shall not remain open for more than 15 days'	
59	(p.38) 'timing of construction in predominantly dry conditions' – the timings presented in table 3-3 suggest that this is not the case	Operation constraints may prevent avoidance of all risk of wet conditions.
60	(p.39) the scheduling of construction for dry conditions…will ensure that impacts to watercourses are not significant or long-term' – from table 3-3 it appears that construction for particularly loops 3 and 4 will encounter wet conditions	See response to comment 59
61	(p.39) the scheduling of construction for dry conditions…will ensure that impacts to watercourses are not significant or long-term' – from table 3-3 it appears that construction for particularly loops 3 and 4 will encounter wet conditions	See response to comment 59.
62	5.2.3.1 Vegetation Potential Impacts • (p.41) 'clearing of native vegetation, including re-growth, will be required' – it was understood from the environmental risk assessment workshop that the entire length of the 30m easement was cleared and graded in the early 1980's; so it would be presumed that if no clearing and grading is to occur outside of the original easement, then the only clearing	Turn-around bays and construction camps will also be cleared. This has been stated in Section 5.2.3.1 of the ARI. Construction camps will be constructed on previously cleared areas where practicable however turn around bays may clear small sections of vegetation that have not been cleared in the past.

	required would be of re-growth.	
63	5.2.3.2 Vegetation Impact Mitigation Mis-named as 5.2.3.1	Reference changed in ARI.
64	(p.41) 'additional surveys will be undertaken during Spring 2005 and summer and autumn 2006'	Section 5.2.3.2 has been updated.
65	(p.41) 'findings of the surveys will be forwarded to CALM and consultation undertaken on additional management measures that may be required. Finalisation of all management measures should be to the requirements of CALM'. In addition, further generic information must be provided by the proponent up-front in the ARI on the potential scope and nature of additional management measures. For example, is there scope for the pipeline to be moved within the easement in order to avoid conservation significant species? Relocation?	The reference to CALM approval has been changed. There is no scope for relocation of the pipeline but there is limited scope to change some aspects of construction to manage specific issues. These will be detailed in the CEMP and the ELL. Additional management measures have been included through the addition of the Rehabilitation Management Plan, Fauna Interaction Protocol and Hygiene Protocol into the ARI.
66	(p.42) an additional management measure is to mark on-ground the area to be cleared and graded as well as the total area of disturbance	Section 5.2.3.2 has been updated in the ARI to include this mitigation measure.
67	It is proposed to flag vegetation to be retained, such as large trees. Information should be provided by the proponent on criteria that will be used to determine the vegetation to be retained (e.g. DRF, priority flora, habitat and food trees etc.)	These criteria have been included in the ARI in Section 5.2.5.2 and in the Rehabilitation Management Plan.
68	(p.42) 'stockpiling of all vegetation (including log debris	Section 5.2.3.2 of the ARI has been updated to

	and leaf litter) for use during rehabilitation'	include this text.
69	(p.42) some proposed management measures require more detail, for example: ○ 'implementing dust control activities as required' – will this be monitored to determine when they are required; needs to refer to section 5.2.8.2; will dust suppressants be utilised? What is the proposed water source for water trucks and sprayers (ie saline or freshwater)? ○ 'ensuring no impacts occur to vegetation off the construction area' – does this refer to no direct clearing of vegetation, or also consider no indirect impacts ie hydrological changes; will this be monitored to ensure delivery?	These will be addressed in the sections of the CEMP that will require the agreement of CALM.
70	(p.42) Aerial photography of the time period since clearing in the early 1980's may assist in the development of the rehabilitation plan and completion criteria as it may give an indication of regrowth rates.	Aerial photography as well as land owner consultation has been used to understand the regrowth on the DBNGP easement. This is stated Section 5 of the Rehabilitation Management Plan.
71	5.2.4.1 Weeds and dieback potential impacts (p.42) – 'dieback is considered an issue for loops 5 to 9' while Appendix 4 (p.6) indicates that only loops 8 and 9 will be assessed for Phytophthora cinnamomi. It is CALM's understanding that loops 5, 6 and 7 all occur in a zone of <400mm rainfall and therefore Phytophthora cinnamomi will not be an issue as it will not survive in these areas.	This section has been amended to include Loops 8 & 9 only.

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72	Where Phytophthora cinnamomi infestations are identified and mapped, in addition to following the hygiene plan (to be developed), access and operations should be undertaken under standard dry soil conditions.	The only risk of dieback spread is in loops 8 & 9. Construction of these loops is predominantly during the dry season. The ARI has been updated to state this in Section 5.2.4.2.
73	5.2.4.2 Weeds and dieback impact mitigation Surveying and mapping of declared and environmental weed species in the loopings is strongly supported.	Noted with thanks. This mitigation measure will be implemented and was already part of the Vegetation Survey Methodology presented in Appendix 4 of the October draft ARI.
74	Maps of each loop with an overlay of weed infestation areas should be provided as baseline data to relevant agencies.	Once weed mapping is completed, as per the Vegetation Survey Methodology presented in Appendix 4 of the October draft ARI, maps and other relevant information will be presented to relevant agencies prior to construction commencing on these loops. A commitment to undertake additional mitigation measures to control additional weed infestations on the AoD as a result of the construction activity has been included in the Rehabilitation Management Plan.
75	Weed hygiene and management measures during construction, rehabilitation and on-going maintenance work must be considered.	These mitigation measures are included in the Hygiene Protocol and in Section 5.2.4.2 of the ARI.
76	In addition to the proposed weed hygiene measures, the proponent must also commit to eradicating any declared or environmental weeds that are introduced or spread as a result of the project, and report such outbreaks and treatment undertaken to the appropriate agencies.	Section 5 of the Rehabilitation Plan includes completion criteria that state that foliage cover of declared and environmental weeds on the AoD should be similar to regrowth vegetation remaining on the AoD after construction at 24 months. Weed cover will be monitored and where compliance criteria are not met and areas

		of high weed cover are identified, these areas will be treated with an appropriate program in consultation with CALM.
77	(p.43) 'As part of the Rehabilitation Plan, the project footprint will be inspected for weed outbreaks approximately 4 weeks after the first significant rainfall event (>5mm)'. In order to detect any new weed infestations it is uncertain if this is sufficient and CALM suggests that monitoring for weeds should be over a more extended period (annual inspections together with monitoring for rehabilitation completion criteria) particularly for identified environmentally sensitive areas.	The Rehabilitation Management Plan includes annual monitoring programs for both revegetation and weed infestation Completion Criteria.
78	The proponent should commit to leaving the area less weed infested than prior to pipeline construction.	Alinta is committed to rehabilitating the AoD to the condition that is was in prior to construction.
79	Construction in loops 8 and 9 will occur at least partly in the wetter months (ie loop 8 from 11 Feb – 24 May and loop 9 from 14 Jan – 5 May), and even though the proponent has noted that they expect reinstatement activities (ie completion of major earthworks) to be completed by mid-Feb for loop 9 and mid-April for loop 8 there is still a higher risk of hygiene issues over this time due to ongoing works and access.	Noted with thanks. The Hygiene Protocol that will be approved by CALM will be implemented during all construction operations to minimise the risk of weed and disease spread.
80	5.2.5.1 Fauna potential impacts (p.43) additional potential impact is 'restrictions in east-west movement'	Section 5.2.5.1 has been updated to include this additional potential impact

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81	(p.43) The draft ARI recognises that it is "possible" that fauna may fall into the trench and perish. However, in the previous example at Telfer thousands of animals died as a result of trench entrapment and even in the recent example at Nifty, where strict fauna management procedures were employed during trenching to prevent fauna mortalities, a small number of animals were killed as a result of trenching activities. Therefore, it should be recognised by the proponent that the likelihood of this event is "almost certain" and in accordance to the risk assessment matrix in table 4-3, this 'the risk of fauna mortality due to machinery operation or entrapment in the trench' can not possibly then be 'considered low due to the nature of the planned operations'.	Section 5.2.5.1 has been updated to reflect this and fauna entrapment has been identified in Section 5.1 as an impact that will require a high level of management attention.
82	The proponent should acknowledge that they have commitments under the Animal Welfare Act 2002 to protect animals as well as other more specific legislation ie Wildlife Conservation Act 1950, Environmental Protection and Biodiversity Conservation Act	Section 5.2.5.2 has been updated stating that Alinta recognises these legislative requirements.
83	There is no reference to the final report on the desktop fauna study being undertaken by Bamford Consulting and expected in the week ending 11 Nov and how the results on this report will be incorporated in the CEMP or fauna interaction protocols.	The Fauna Review has been included with the ARI in Appendix 5.
84	5.2.5.2 Fauna impact mitigation The proponent needs to consider the following additional potential impacts to fauna within the ARI and	The additional impact on feral animals has been noted in the ARI in the relevant fauna sections. The Coomallo Creek area is known as a

	identify appropriate management measures: ○ there may be an increase in feral animal activity due to the provision of artificial water in turkey nests; ○ there is likely to be potential impacts on Carnaby's cockatoo around loop 8 as they known to nest in areas adjacent to the project area, especially in the Coomallo NR but also in remnant vegetation in farmland; the project area intersects their flight path from known nesting hollows to the feeding area further east in Big Soak Plains area; animals are expected to be fledging around February within the vicinity of loop 8 which overlaps with the construction period at this site.	breeding site for Carnaby's Cockatoo *Calyptorhynchus latirostris.* According to the WA Museum's Handbook on birds of Western Australia, the species has a breeding season from early July (early egg-laying) until mid-January (very late nestlings leaving nest). On the basis of these periods, construction activity planned for February or March should take place when the species is not breeding in the area and most birds have dispersed to the south. Therefore, disturbance of breeding Carnaby's Cockatoo due to construction activity should not be a concern at Coomallo Creek (Bamford pers comms 2005).
85	(p.44) Need to include commitment for contractors to visually inspect trench prior to backfilling for fauna and arrange appropriate removal if sighted.	This mitigation measure has been added to Section 5.2.5.2
86	(p.44) 'retain habitat trees where feasible' – the proponent needs to clarify within the ARI that the EPBC Act protects habitat of listed species as well as the listed species themselves, which is particularly relevant to the Carnaby's cockatoo and the retention of habitat and feed trees.	This proposal was referred to the DEH and was deemed to be an uncontrolled action. Additionally, it should be noted that construction will occur within a previously cleared easement and as such, large habitat trees with hollows, that take many years to develop would be highly unlikely to exist within the AoD. Also, where practicable, Alinta has committed to retaining habitat trees. See Section 5.2.5.2 for the methodology to be employed for selection of

		trees to be retained. See response to comment 84 in regards to Carnaby's Cockatoo.
87	5.2.7.2 Noise emission impact mitigation (p.46) regarding noise emissions 'the short duration of construction activities is not expected to have any significant impact on fauna' – the noise impacts on fauna are little studied, making it difficult to make and justify this claim.	Noted with thanks.
88	Given that it is known that Carnaby's cockatoos are nesting adjacent to the project area, the proponent needs to further consider the potential impacts of and appropriate management measures for noise impacts on this species in particular as 'critical life stages such as breeding or nesting' are likely to be interrupted. Particularly in loop 8, it is preferable if construction did not occur during February when it is expected that the young will be fledging.	See response to comment 84.
89	(p.46) 'time construction to occur outside fauna breeding periods…' – is this a possible management measure given that in the table of 'summary of regulator comment to draft ARI' it is noted for points 10 and 11 that 'the construction schedule is such that the construction timing for these loops can not be altered', and also given that construction will occur over a 12-month period and that different animals breed at different times of the year	This mitigation measure has been deleted from the ARI.
90	It is understood from the response to CALM's preliminary informal comment that all construction	Section 5.2.5.2 has been updated to include this commitment.

	activities will be limited to daylight hours. The proponent needs to commit to this in order to avoid impacts of noise (and artificial light) on nocturnal fauna (e.g. bats and other mammals).	
91	5.2.9.1 Land Use potential impacts (p.47) 'access along the easement will be consistent with existing practices, and as such no change in impacts is anticipated' – what are the existing practices? If permanent clearing is required directly over the pipeline for visual identification of gas pipeline signage, will there not now be a requirement for a wider area of permanent clearing? What are the existing arrangements to prevent third party/illegal use and are there any implications of illegal vehicle access directly over the pipeline? Will any changes to the 'existing practices' be monitored? This may be particularly important at the identified environmentally sensitive areas.	Refer to Alinta's Operational EMP (ref risk workshop)
92	5.2.9.2 Land Use Impact Mitigation (p.48) The proponent needs to further consider the risk of accidental wildfire as a result of operations during pipe installation (including welding, machinery and cigarettes) and appropriate management actions (including vehicles to be clean of debris due to fire hazard, and the use of diesel rather than petrol vehicles), to minimise this risk particularly to the conservation estate such as Coomallo Nature Reserve and Moore River National Park. The development of a fire management plan as part of the construction EMP would be appropriate.	Fire management is contained within the CEMP that will be forwarded to CALM for review prior to construction.

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93	The proponent should also consider whether there are likely impacts to the pipeline construction from wildfire as well as to the pipeline once buried ie heat intensity at depth.	Noted with thanks.
94	6 Stakeholder consultation Table 6-1 consultation was also undertaken on Sept 2005 version of draft ARI	Table 6-1 outlines the main issues that have been discussed with stakeholders, not the timing of discussions.
95	Additional clearing and location maps and drawings provided on CD The proponent should note that these are preliminary maps as the final area of disturbance can only be determined once on-ground flora survey and the final fauna study are completed, and in conjunction with the on-site inspection for bare-ground, appropriate soils etc., in order that environmental impacts can be minimised. What is the process for finalising the area of disturbance? These maps need to be overlaid with flora/vegetation survey results in order for CALM to be able to provide further advice on an appropriate final area of disturbance and environmentally sensitive areas.	The AOD maps have been presented and explained to CALM.
96	There is no discussion in the draft ARI of crossing of numerous minor creeks	The impacts of various crossing techniques was discussed in Table 5-1 of the draft ARI.
97	Loop1 o Will the additional approx 1.5m of land for topsoil dumping outside of existing 30m easement require clearing and grading? o The proponent makes a commitment	Point 1 - Yes the additional 1.5m of land for topsoil dumping will require clearing outside the easement but is considered to be part of the total AoD of the Project. Point 2 – Sedimentation and erosion control is

	(p.40) to 'stockpile material in bunded areas away from the watercourse banks'. It is therefore presumed that excavated watercourse material will be stored well away from the water crossing, that the storage design of waste/spoil material from trenching will account for surface hydrology and the placement of any spoil material will manage any impacts to surface water flows or increased sedimentation of flows. The potential impacts of this water crossing activity may depend on whether the creek bed is wet or dry as a result of summer storm events.	discussed in Section 5.2.2.2.
98	Loop 2 Will the additional approx 1.5m of land for topsoil dumping outside of existing 30m easement require clearing and grading?	Yes
99	Loop 3 o Will the additional approx 1.5m of land for topsoil dumping outside of existing 30m easement require clearing and grading?	Yes
100	Loop 4 o Will the additional approx 1.5m of land for topsoil dumping outside of existing 30m easement require clearing and grading? o There is no discussion of crossing of Davis Creek in draft ARI. Regarding the	Yes Creek crossings (including Davis Creek) are discussed in Section 5.2.2.1

	storage of excavated watercourse material at Davis Creek, please see second dot point under loop 1. The potential impacts of this activity may depend on whether the creek bed is wet or dry at the time of construction as a result of summer storm events. o It appears that this loop traverses adjacent to several and through one lakes/watercourses, however there is no discussion in the draft ARI of management measures. This may require the implementation of management measures, depending on whether the lakes/ watercourses are wet or dry.	
101	Loop 5 o Will the additional approx 1.5m of land for topsoil dumping outside of existing 30m easement require clearing and grading?	Yes
102	Loop 6 Will the additional approx 1.5m of land for topsoil dumping outside of existing 30m easement require clearing and grading?	Yes
103	Loop 7 o Regarding the approx 5m of topsoil dumping and traffic lane outside of existing 30m easement, it appears that there will be little clearing required in this	Yes, the extra 5m will require clearing. Additionally, it should be noted that Loop 7 is entirely within cleared crop land.

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	area, however, will this additional 5m require clearing and grading?	
104	Loop 8 ○ Do the varying widths required outside the existing 30m easement ie 1.5 m or 5m, require clearing and grading?	Yes
105	Loop 9 ○ Do the varying widths required outside the existing 30m easement ie 1.5 m or 5m, require clearing and grading? The resource enhancement wetland does not appear on this map	The resource enhancement wetland is included in Appendix 3 of the ARI. The Geomorphic Wetland data set was not included with these maps as this data set would cloud other relevant data due to the entirely filled polygons which comprise the dataset.
106	Projected schedule for specialist environmental studies There is no mention of the field flora surveys for loops 1 to 6 to be undertaken following significant rainfall events in summer and autumn 2006, as per Appendix 4?	This has been amended within the ARI in Section 5.2.3.2
107	There is no mention of field weed surveys for loops 4 to 7 (in addition to loops 1 to 3 which is discussed) although Appendix 4 indicates that weed mapping will occur for loops 1 to 6 following significant rain events in summer or autumn 2006?	This has been addressed within the ARI in Section 5.2.4.2
108	The final report (incorporating vegetation, weeds and dieback) expected from Woodman Consulting in the week ending 23 Dec will only cover loops 8 and 9. It is expected that a second final report incorporating	This is correct.

	vegetation and weeds for all of the remaining loops will be developed after the on-ground work has been completed and prior to construction activities commencing.	
109	It is expected that the rehabilitation plan expected from Woodman Consulting in the week ending December 23 (following the completion of the vegetation field survey) will only be for loops 8 and 9. It is expected that an additional rehabilitation plan will be developed for all of the remaining loops (ie loops 1 to 7) once on-ground surveys have been completed in summer or autumn 2006. It is anticipated that the rehabilitation plans will incorporate the results from the final fauna study report.	The Rehabilitation Management Plan has been incorporated into the ARI. This plan includes completion criteria and monitoring requirements for all loops. Additional information gained from the surveys will be added to the Rehabilitation Management Plan if required.
110	It is expected that the fauna interaction protocols will be updated as required to reflect the results of the final fauna study report.	The Fauna Review conducted by Bamford Consulting has been included in the ARI as has the Fauna Interaction Protocol.
111	PLEASE NOTE: The Woodman Report and Management Plans for loops 8 and 9 are due in the week ending Dec 23. The proponent needs to consider the timing of the release of these documents in the context of public holidays and summer operational requirements (ie fire for CALM) and ensure that there is adequate timing for agency review of these documents.	Noted with thanks.
112	Appendix 4 Flora and vegetation studies assessment method General Comments: It is understood that loops 8 and 9 flora surveys will be conducted Sept/Oct 2005 while surveys in loops 1-6	Alinta, through Woodman Environmental Consulting, developed the vegetation survey methodology in August 2005. This methodology was developed in consultation with CALM and the DoE. Both of these agencies have reviewed

	will occur during summer/autumn2006, after significant rainfall events. However, CALM advised that 'depending on the likely species of priority or DRF (either found in Mattiske's survey or occurring in similar habitat in the general vicinity), additional seasonal targeted searches may be required in order to capture all of these species', there is no consideration of this point in the revised draft.	the methodology and raised no significant issues with it. Please refer to the Document Revision History and page 3 of this document for further clarification (Appendix 4 of the ARI).
113	Specific comments: Proposed methods (p.4) It appears that there is no remnant vegetation impacted by loop 7. However, CALM would like confirmation of the statement in the October draft ARI that loop 7 'contains no remnant vegetation' and therefore that no further surveying is required, particularly as the previous version of this document said 'little remnant vegetation' and that p.3 of the Flora and vegetation studies assessment method document notes that 'additional searching for rare and priority listed flora is required for loops 1 to 7'.	This original comment was derived from the vegetation survey methodology (Appendix 4). Loop 7 construction will occur within entirely cleared crop land. In the Flora and Vegetation Studies method, CALM, DoE and DoIR have indicated that *"additional searching for Rare and priority listed flora is required for Loops 5, 6 and 7".* As Loop 7 is entirely within crop land, no surveys will be conducted in this area.
114	CALM requested that in addition to the desktop reviews that have been undertaken, targeted surveys for significant flora (eg priority flora, declared rare flora, range extensions, disjunct populations), significant vegetation (eg TECs, regionally significant vegetation) and significant fauna habitat (eg Carnaby's Cockatoo habitat or feed species) for all impact areas of the entire northern loopings alignment should be undertaken prior to clearing (flora/ vegetation surveys must be undertaken for the entire extent of proposed	See response to comment 112.

	disturbance (whether it is inside or outside the easement), including infrastructure such as campsites, all access routes etc). It is unsure whether all of these aspects will be covered by the proposed flora and vegetation survey and requires clarification.	
115	The proponent has committed to undertaking searches for significant (DRF and priority) flora for loops 1 to 4 (p.4). Details should be provided on the proposed methodology for such searching, and how it will differ to the "full plant community mapping and searching for rare and priority listed flora" (p. 3) that is proposed for loops 8-9. The proponent has also identified that searching for 'significant species and assessments of impact of the proposal to the conservation status of species is warranted' in the vicinity of loops 5 and 6 (p.4). However, it is not stated the type of survey, or the proposed methodology for surveys, within these loops that will be undertaken. The assumption in the draft ARI that full flora/vegetation surveys are not required for loops 1-6 as they are 'not located within regions containing significant vegetation' must be justified by the proponent with adequate data demonstrating that the level of survey is appropriate and that there is an acceptable understanding of the floristic values at risk of the development. Without a full survey it may not be possible to know whether significant values occur within these loops and therefore whether appropriate mitigation or management protocols are required. If previous work can be used to demonstrate that the proponent has an adequate level and scale of understanding, this should be reflected in the draft ARI. Otherwise there is a need	See response to comment 112.

	for the proponent to undertake further on-ground survey work in order to obtain this understanding (this also relates to the comment on the cover of the hardcopy of Appendix 4 – 'the proponents wish to further discuss with CALM the risk management benefits of the additional studies to those originally proposed').	
116	(p.5) It is understood that the actual survey for loopings 8 and 9 was primarily undertaken in October, which should be noted as a little late in the season for surveying in this area.	See response to comment 112
117	(p.5) 'mapping will extend beyond the 30m easement to account for any edge effects or potential extensions of working areas' – how far out of the easement will vegetation mapping extend for in loopings 8 and 9?	See response to comment 112
118	(p.5) It is understood that the specific searching for DRF and priority flora in loops 1 to 4 will occur within the '30m easement and additional 20m to west to account for edge effects or enlarged working areas'. Will this also be the case for the additional surveys in loops 5 and 6?	See response to comment 112
119	(p.5) 'surveys to be conducted on loops 1 to 6 will be conducted following significant rain events in summer and autumn 2006'. The proponent needs to consider the possibility that there may be no significant rain in some areas for a long time and not prior to construction due to commence.	See response to comment 112.

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120	Weed mapping (p.5) Will weed mapping be undertaken for loop 7? This is mostly an issue to ensure that weeds are not transferred to other areas within the project footprint.	Loop 7 is contained within an individual property. All vehicles will be cleaned down prior to entering each new loop as per the Hygiene Protocol.
121	Will weed/dieback mapping be undertaken for the entire area of disturbance, to include those areas outside of the existing 30m easement?	See response to comment 112.
122	The weed survey of loops 1 to 6 will be undertaken following 'significant rain events in summer or autumn 2006'. The proponent needs to consider the possibility that there may be no significant rain in some areas for a long time.	See response to comment 112.
123	Rehabilitation (p.6) Vegetation monitoring plots (disturbed and control) should be established in all vegetation types and in consultation with CALM.	The Rehabilitation Management Plan included as an Appendix in the ARI has been reviewed by CALM (Norm Caporn) and CALM has also reserved the right to alter this in discussion with Alinta where required.
124	Fauna handling protocol Specific Comments: Species and contexts for which no direct interaction will be required (p.2) • 'majority of animals...will be unable to rapidly move away from vehicles and equipment' – is there any proposed management for this issue? • Project is timetabled for Jan to June 2006 – this appears to be incorrect as the expected construction period stretches from January to December 2006	• Due care will be taken and machinery operators would do their best to not injure fauna if they can. • This comment has been deleted from the Fauna Interaction Protocol. • Noted with thanks.

	• 'timeframe falls within a period when most birds will not be nesting…and minimise impacts to nesting birds' – this is incorrect as Carnaby's cockatoos are expected to be fledging around February in the vicinity of loop 8, which overlaps with the proposed construction period. In addition, given that construction will be occurring over a 12-month period it seems unlikely that 'the timeframe falls within a period when most birds will not be nesting'.	
125	Species and contexts for which capture, translocation and release will be required (p.2) • Is there a commitment to actively search for animals during clearing and grading and remove them, or is this ad hoc? • Prior to clearing, a person experienced/qualified in reptile handling should inspect the alignment and remove and relocate any Pilbara Olive Pythons that are found.	This commitment has been added to the ARI in Section 5.2.5.2
126	General comments regarding trench clearing: The recent construction of the pipeline at Nifty set a standard in fauna management during trenching activities that is currently best practice. It is imperative that the DBNGP trenching adopt, as a minimum, the same standards that were applied for the Nifty project as anything less is unacceptable. In summary these are: • maximum length of trench 20km in sandy terrain, with an additional 10km allowed in rocky terrain (although this may not apply to all	Recent discussions held with Norm Caporn and Grant Lamb decided upon the following mitigation measures Timing – generically, trench will be cleared before 10am, however if a better time is noted due to climatic conditions, CALM will be consulted and site specific trench clearance timings may be altered Trench plugs installed at no greater than 1.2km intervals

	loopings in this project due to the short looping distances)
	• works restricted to daylight hours
	• no part of the trench to remain open for more than 7 days, except for in rocky terrain where 15 days is allowed (this differs to the 2 weeks proposed in the draft ARI and should be amended)
	  • trench plugs at intervals of maximum 1km, which should be ramped up to allow larger fauna to escape the trench shade shelters installed at a maximum distance of 100m apart
	  • An environmental officer present on site for the duration of the project to ensure that trenches are inspected regularly for fauna. In addition to the environmental officer, experienced and suitably qualified personnel are present to conduct trench inspection. Personnel must have fauna handling qualifications/skills, and have knowledge in fauna identification.
	  • trench inspections conducted every day before 10am, and live specimens relocated to an area of suitable habitat away from construction activity.
	  • dead fauna are removed and correctly stored in a manner for vouchering with the WA museum
	  • Records must be kept of all fauna specimens removed from the trench. This
		Shade shelters at a max of 100m separation
		Records to be kept of species relocated or removed from trench
		Backfill crew to inspect trench for animals and if any found – fauna handlers to remove prior to backfill.
		Trench section will not remain open for more than 14 days.
		The fauna interaction protocol containing these commitments and many others is currently being reviewed by Norm Caporn.
		It should also be noted that the EPA recognises the sensitivity of this issue and will set Ministerial Conditions accordingly taking into account all relevant factors.

	will require an experienced and suitably qualified zoologist able to identify and record fauna. All records of fauna collected (dead and alive) must be provided to CALM. ◦ If species of conservation significance are observed during construction, CALM must be notified within 24 hours. ◦ Trench work must be undertaken for loops 1-2 between April-October in order to minimise fauna deaths during construction. ◦ Water should be pumped out of the trench on a daily basis. • open trenching was NOT permitted after 31 October and there was a commitment to undertaking 'closed trenching' after October, where the length of trench was filled in at the end of each day (following a visible fauna inspection) so that no open trench was left overnight. • A final fauna management plan detailing how the proponent will implement the above commitments should be prepared to the satisfaction of CALM.	
127	Specific comments regarding Trench clearing (p.4) ◦ 'Nov-March will be avoided as far as practicable' – however, loops 1, 2, 8 and 9 overlap with this period so it appears that this EPA recommendation will not be followed. ◦ Trench length – Alinta has suggested that	See response to comment 126.

	trenches will generally be open for <5km at one time • Time over which trench is open – the cover letter from Alinta indicates that this dot-point was left in the document by error and should be removed – however, there needs to be some commitment as to time over which the trench will be open using the EPA's current standard as well as project specific details • 'staff from CALM…also offered additional advice' – the proponent needs to commit that this advice will be followed • 'At least one crew will be provided for each construction spread' – the number of crews required depends on the length of trench open and the number of daylight hours prior to 10am • 'Construction in Pilbara will be scheduled to avoid the majority of the summer months'. This timing is particularly critical for loops 1 and 2 in order to minimise fauna deaths, however, loops 1 and 2 are planned to coincide at least partly with the summer months. CALM's preference is that construction does not occur during the height of the summer period (November to March). If there is absolutely no flexibility in altering the construction timings further protocols to manage these real risks must be developed to the satisfaction of CALM. For example, as per the Nifty example, if trenching is to be undertaken between November and March, closed trenching procedures must be adopted, with the open trench filled in at the end of each	

	day (following a visible inspection for fauna) so that no open trench remains overnight. • 'There are a few areas of high conservation value that have already been identified...' Additional areas of high conservation value/environmentally sensitive areas may be determined after survey work has been completed and in consultation with CALM, where these additional protocols to minimise potential impacts will also apply. • The Environment Officer should regularly liaise with local CALM staff and if unforeseen fauna deaths are encountered during pipeline construction, the proponent should commit to urgently reviewing these protocols in consultation with CALM.	
128	This document should also incorporate commitments outlined in the Northern Looping Environmental Risk Assessment spreadsheet, including: • 5.02 Where the removal of potential nesting trees cannot be avoided, fauna handlers will be present during tree felling operation to relocate all healthy fauna and appropriately assess injured fauna. In addition, as the EPBC Act protects habitat of listed species as well as the listed species themselves, this is particularly relevant to the Carnaby's cockatoo and the retention of habitat and feed trees. • 5.04 Provision of crossing points at suitable locations along the spread throughout the	See response to comment 126.

	construction period to minimise the risk of animals becoming trapped in the trenches. • 5.06 All contractors will avoid, where possible, direct contact with fauna. • 5.07 Prohibition of feeding, hunting, firearms and domestic pets from construction areas. • 15.01 Contractors to visually inspect trench whilst backfilling. If fauna are sighted, contact Environmental Officer to arrange for approved fauna handler to remove fauna from the trench. (The details of this process need further refinement in consultation with CALM within the construction EMP as there will be time issues, availability will hinder practicability, heat stress on animals etc.)	