Woodside Energy Ltd

Woodside Energy – Geotechnical Investigations

Clearing Permit Supporting Documentation

January 2020

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Abbreviations

BoM	Bureau of Meteorology
DPLH	Department of Planning, Lands and Heritage
EP Act	*Environmental Protection Act 1986*
ha	hectares
IBRA	Interim Biogeographic Regionalisation of Australia
km	kilometre
MAC	Murujuga Aboriginal Corporation
MSIA	Maitland Strategic Industrial Area
NAC	Ngarluma Aboriginal Corporation
NVCP	Native Vegetation Clearing Permit
PDWSA	Public Drinking Water Source Area
Pre-FEED	Pre Front End Engineering Design
RIWI Act	*Rights in Water and Irrigation Act 1914*
WA	Western Australia
Woodside	Woodside Energy Ltd

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1. Introduction

1.1 Project background

Woodside Energy Ltd (Woodside) has engaged GHD to conduct geotechnical investigations on the Maitland Strategic Industrial Area (MSIA), adjacent Industrial Buffer Area (Buffer Area) and along a land corridor leading to the Burrup Peninsula. The proposed geotechnical investigations will inform a hybrid renewable power plant concept that Woodside is currently examining.

Woodside propose to conduct a geotechnical investigation (the Investigation) to inform engineering design and construction planning for the hybrid renewable power plant. The Investigation will comprise completion of geotechnical boreholes and test pits conducted within an Application Area of 477.06 ha. The location of the Investigation Area is presented in Figure 1 (Appendix A).

The Investigation will require clearing of native vegetation to facilitate boreholes and test pits as well as access to the borehole/test pit sites. Clearing of native vegetation for the Investigation will require a native vegetation clearing permit (NVCP), under Part V of the *Environmental Protection Act 1986* (EP Act).

1.2 Scope and purpose of this document

This document has been prepared in support of an application for a NVCP under Section 51E of Part V of the EP Act, to clear up to 11.93 hectares (ha) of native vegetation within an Application Area of 477.06 ha for the purpose of conducting geotechnical investigations.

This supporting documentation includes:

- An overview of Investigation works and a description of clearing activities to be undertaken (Section 2.1)
- An overview of the existing environment (Section 3)
- Potential impacts identified (Section 4)
- Environmental management measures to be implemented to minimise clearing impacts (Section 5)
- An assessment against the Ten Clearing Principles, as defined in Schedule 5 of the EP Act (Section 6).

Flora and vegetation (VLA 2019) and terrestrial fauna (GHD 2019) surveys were undertaken for the Application Area and included a desktop review and field surveys in accordance with EPA guidelines. The data from the flora, vegetation and terrestrial fauna surveys have been utilised to assess the potential impacts of clearing for the Investigation.

1.3 Location and land ownership

Table 1-1 presents a summary of the tenure of the Application Area. The Application Area lies over Crown land including leases and reserves for pastoral and industrial land uses, road reserves and unallocated Crown land.

Table 1-1 Tenure of the Application Area

Investigation Areas	Location	Tenure
MSIA	MSIA	Crown Lease PL N-050300 Unallocated Crown Land
MSIA Buffer Area	MSIA Buffer Area	Crown Lease PL N-050300 Class C Crown Reserve 9701 Unallocated Crown Land
Land Corridor	Karratha Station pastoral lease Dampier-Bunbury Natural Gas Pipeline corridor Burrup Peninsula	Crown Leases PL N-050300, GE N-104744, GE N-104744 Class C Crown Reserves 9701, 41275, 49120, 49121 Road Reserve Unallocated Crown Land Crown Lease GE I-161020 Class C Crown Reserve 49121 Road Reserve

Woodside has obtained Licences to Occupy Crown Land (00342/2018_A10596493 and 00342/2018_A10631865) under Section 91 of the *Land Administration Act 1997* (WA), issued by Department of Planning, Lands and Heritage (DPLH) in July 2019. The Licences granted the permitted use:

"*Environmental, geological and cultural heritage surveys, geotechnical engineering investigation of ground conditions, assessment of construction materials and locate potential borrow pits and limited ground disturbing activities including access tracks clearing, boreholes, cone penetration tests, test pits and the temporary installation of water and meteorological monitoring equipment*".

Licence A10596493 covers the Application Area south of Burrup Peninsula and Licence A10631865 covers the Application Area on the Burrup Peninsula.

The Application Area is covered by Native Title, granted to the Ngarluma people and governed by the Ngarluma Aboriginal Corporation (NAC) established in 2005. Woodside has ongoing engagement with NAC regarding the Proposal and NAC is undertaking an Aboriginal heritage survey within the proposed Application Area. The Murujuga Aboriginal Corporation has been consulted in relation to activities on the Burrup Peninsula. Survey information has been utilised in planning for the works and no disturbance to any indigenous cultural site is predicted.

2. Description of clearing activities

2.1 Investigation works

The Investigation will comprise the following works:

- Borehole drilling to depths of up to 12 m, coring and sampling, using a rotary drill rig.
- Test pit excavation to a nominal 5 m depth using a tracked excavator.
- Access between existing roads/tracks to the borehole/test pit sites.

Table 2-1 presents a summary of the Investigation works. Boreholes will be undertaken along the land corridor from the MSIA to the Burrup Peninsula at intervals ranging from approximately 1000 - 1500 m. Test pits will be undertaken on a grid arrangement at approximately 200 - 400 m spacing within the MSIA Buffer Area.

Table 2-1 Summary of Investigation works

Investigation Areas	Bore Holes	Test Pits
MSIA	3	8
MSIA Buffer Area	0	16
Land Corridor	35	32
Totals	**38**	**56**

2.2 Native vegetation clearing

Investigation works will involve the following vegetation clearing:

- Borehole pads: 25 m x 25 m clearing
- Test pits: 15 m x 15 m clearing
- Access tracks: 6 m wide clearing within a 10-12 m wide corridor

To obtain access to each investigation site, access tracks are required. For the purpose of this application, tracks are assumed to require clearing of up to a 6 m wide strip of vegetation. Access tracks are from the nearest existing track directly to the investigation site, unless deviating to avoid sensitive vegetation (e.g. access via a longer track over grasslands to avoid transit through shrubs/trees/ephemeral vegetation etc). In preparing the application, the potential extent of clearing for access tracks has been estimated from on ground reconnaissance surreys and satellite imagery, but a small allowance is include for minor deviations to planned track routes.

Where access to an investigation site involves traversing over land not within the Application Area, permission has been sought from the relevant land owner and the amount of area to be cleared on each parcel for the purpose of accessing the land is not more than 5 ha per property and will not occur within environmentally sensitive areas or riparian vegetation. This access is being done in accordance with specified exemptions under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

Vegetation clearing on access tracks will involve vehicles and machinery (e.g. drill truck) driving over vegetation where the vegetation is low (e.g. grassland), with clearing of access tracks

limited to areas of taller vegetation (e.g. shrubland, tall grass) to prevent fires from engines and/or damage to vehicles and machinery. The vegetation will be cleared through slashing where practicable, to minimise soil disturbance and promote regrowth of vegetation. Given the nature of vegetation, only in a limited number of circumstances would clearing on access tracks be means other than slashing, i.e. using a Bobcat, Hilux Dozer or similar. Access tracks have been planned to minimise the extent of native vegetation clearing as far as is practicable (see Section 4.1).

Access tracks will be developed to avoid trees and tall shrubs as far as practicable.

3. Existing environment

3.1 Climate

The Application Area is located within the Pilbara bioregion, which experiences a hot, semi-arid climate, with a wet season from January to July and tropical cyclones common from November through to March. The average annual rainfall for Karratha (airport) is 297 mm. Average maximum temperatures in Karratha range from 26.4 C (July) to 36.2 C (March) and average minimum temperatures range from 13.8 C (July) to 26.8 C (January) (BoM 2019).

3.2 Land use

The Application Area occurs on Crown land within the City of Karratha and is subject to the City of Karratha Local Planning Scheme No. 8, with land zoned for strategic industry, rural (pastoral) and infrastructure land uses as presented in Table 3-1.

Table 3-1 Land Use of the Application Area

Investigation Area	Location	Zoning
MSIA	MSIA	Strategic Industry
MSIA Buffer Area	MSIA Buffer Area	Rural Industry Buffer Special Control Area Infrastructure
Land Corridor	Karratha Station pastoral lease Dampier-Bunbury Natural Gas Pipeline corridor Burrup Peninsula	Strategic Industry Infrastructure State and Regional Roads District Roads

3.3 Landforms and soils

The Application Area occurs within the Roebourne sub-region of the Pilbara Interim Biogeographic Regionalisation of Australia (IBRA) region, on the Roebourne Plains and Burrup Peninsula.

Land systems (Vreeswyk *et al* 2004) are presented in Table 3-2 and Figure 2. As presented, the Application Area predominantly comprises the Horseflat land system of the Roebourne Plains, which is mostly subject to pastoral land use (e.g. Karratha Station). The Granitic land system comprises the Burrup Peninsula, the southern portion of which is subject to industrial development. The Littoral land system is located within intertidal flats and is widespread along the Roebourne IBRA subregion. The Boolgeeda, Calrete and Cheerawarra land systems comprise small areas of the Application Area.

Table 3-2 Land systems mapped within the Application Area

Land systems	Description
Horseflat	Extensive level plains with clay soils and gilgai microrelief, also stony plains and very gently inclined slopes marginal to major rivers, both with non-gilgaied clay soils
Calcrete	Calcrete platforms, plains and narrow drainage tracts, shallow alkaline loamy soils.
Boolgeeda	Stony lower slopes, level stony plains and narrow sub-parallel drainage floors, relief up to 20 m.
Cheerawarra	Gently undulating sandplains, level sandy surfaced coastal plains and plains with saline clay soils.
Littoral	Bare coastal mudflats subject to occasional tidal inundation, minor samphire flats, sandy plains and islands, mangrove outer margins, coastal dunes and beaches.
Granitic	Hill tracts of granitic rocks with pockets of shallow gritty surfaced acidic soils, relief up to 100 m.

Acid sulfate soils (ASS) may be present within alluvial drainage lines dissecting the Horseflat and Granitic land systems, sandy plains of the Cheerawarra land system, and intertidal flats of the Littoral land system (DWER 2019).

3.4 Hydrology

3.4.1 Groundwater

South of Dampier Causeway, the Application Area is expected to lie over a superficial aquifer within the superficial Quaternary and Cainozoic sediments (Horseflat, Calcrete and Cheerawarra land systems), above granitoid rocks (GHD 2017).

North of Dampier Causeway, the Application Area is expected to lie over limited aquifers within rocky outcrops of Gidley Granophyre (Granitic land system), shallow unconfined aquifers within alluvial or colluvial deposits, and saline aquifers in inter-tidal flats (Littoral land system) (GHD 2017).

The Application Area occurs within the Ashburton Sub-area of the Pilbara Groundwater Area, proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act). The closest Public Drinking water Source Area is the Harding Dam Catchment Area, which is located 40 km south-east.

3.4.2 Surface water

South of Dampier Causeway, the Application Area lies over the Roebourne Plains which extend between the Karratha Hills to the south (Boolgeeda land system, see Figure 2) and Dampier Salt Ponds to the north. The Karratha Hills form a watershed between the catchments of the Maitland River and the Port Hedland Coast. The Roebourne Plains are drained by ephemeral creeklines, which flow in a north-westerly direction into the Dampier Salt Ponds.

The Dampier Salt Ponds are used for commercial salt production and involve impoundment of marine waters and pumping across embankments to facilitate progressive evaporation and crystallisation.

North of Dampier Causeway, the Application Area lies on the Burrup Peninsula. Surface runoff will occur over impermeable Gidley Granophyre outcrops via incised creeklines into the Dampier Salt Ponds, inter-tidal flats and/or marine coastal waters. Due to the topography, small

catchments and impermeable surface, surface water flows on the Burrup Peninsula are expected to be highly intermittent and of short duration during and following rainfall events.

The Application Area occurs within the Pilbara Surface Water Area and Irrigation District proclaimed under the RIWI Act.

No major watercourses or wetlands of national or international significance (Ramsar) or geomorphic wetlands are present within the Application Area (DWER 2018).

3.5 Flora and vegetation

3.5.1 Broad vegetation mapping and extent

Vegetation associations

Table 3-3 presents the broad scale (1:1,000,000) vegetation associations (Beard 1975) mapped over the Application Area. As presented, the vegetation associations are retained at well above 30% of pre-European extent, which reflects the limited agricultural and urban development of the Pilbara Bioregion. The hummock grassland association is reserved above the Commonwealth and State Government target of 15%, however the short bunch-grass savannah and tidal mudflats have a very low reservation.

Table 3-3 Vegetation associations mapped within the Application Area

Vegetation association	Description	Pre-European extent in subregion (ha)	Current extent in subregion (ha)	Proportion of pre-European extent remaining in subregion	Pre-European extent with formal protection in subregion
117	Hummock grassland, grass steppe; soft spinifex Triodia species	50,962	46,901	92.0%	32.5%
589	Short bunch-grass savanna / grass-steppe	675,392	671,327	99.4%	1.8%
127	Tidal mud flat	177,179	159,024	89.8%	0.01%

Regional vegetation is also interpreted in terms of land systems, which define the topographic, soil and drainage characteristics that influence vegetation communities. The Application Area lies over six land systems as presented in Section 3.3. All of the land systems have remnant vegetation well above 30% of pre-European extent, reflective of the limited development in the Pilbara region and Roebourne sub-region.

Table 3-4 Vegetation within land systems mapped within the Application Area

Land systems	Pilbara IBRA region			Roebourne IBRA subregion		
	Total area (ha)	Remnant vegetation (ha)	Proportion of pre-European extent (5)	Total area (ha)	Remnant vegetation (ha)	Proportion of pre-European extent (%)
Horseflat	328,124	326,062	99%	297,359	295,389	99%
Calcrete	134,899	134,825	100%	3,305	3,305	100%
Boolgeeda	961,637	955,011	99%	27,085	27,076	100%
Cheerawarra	49,211	48,404	98%	48,425	47,684	98%
Littoral	215,527	188,305	87%	212,305	185,368	87%
Granitic	408,842	407,625	100%	7,795	6,590	85%

[1] Native vegetation extent (DPIRD-005) datasets available from www.data.wa.gov.au.

3.5.2 Vegetation and flora survey

Vicky Long and Associates (VLA) undertook a reconnaissance flora and vegetation survey over the Application Area and its vicinity, in accordance with EPA Technical Guidance (2016a), including:

1. Desktop review of previous surveys, Commonwealth and State databases, aerial photography and mapping of vegetation, geology, land systems, hydrology, wetlands and reserves.
2. Field survey conducted over a northern survey area (Burrup Peninsula) in June 2019 and over a southern survey area (Roebourne Plains) in July 2019. The field survey comprised:
   - 47 releves on the Burrup Peninsula
   - 31 inspection sites on the Roebourne Plains
   - Vascular species identification, including weeds and priority flora
   - Foliar cover
   - Vegetation condition based on EPA (2016a) adapted from Trudgen (1988)
   - Habitat description and disturbance observations.

3.5.3 Vegetation types and condition

The reconnaissance flora and vegetation survey (VLA 2019) recorded 33 vegetation types across the Application Area (out of 48 vegetation types recorded across the wider survey area), as presented in Figure 3 and Table 3-5. Vegetation types 01-23 were recorded on the Burrup Peninsula and vegetation types 24-48 were recorded on the causeway and Roebourne Plain.

The survey (VLA 2019) included mapping of native vegetation condition, as summarised in Table 3-6 and presented in Figure 4. The Application Area contains native vegetation in predominantly Good condition (346.51 ha or 73% of total) and a large proportion in Excellent or Very Good condition (96.14 ha or 20% of total). A small proportion (34.42 ha or 7% of total) of the Application Area is in a Poor, Degraded or Cleared condition.

3.5.4 Conservation significant ecological communities

No Commonwealth or State listed threatened ecological communities (TECs) are known to occur within 10 km of the Application Area.

Field survey and desktop review of DBCA databases identified PECs as recorded, likely to occur or with potential to occur in the Application Area:

- Burrup Peninsula rock pile communities (Priority 1)
- Roebourne Plains coastal grassland with gilgai microrelief on deep cracking clays (Priority 1)
- Horseflat land system of the Roebourne plains (Priority 3).

Table 3-7 presents a description of the PECs and the vegetation types and areas within the Application Area in which they may occur. The areas presented in Table 3-7 are the total area of the VTs mapped in the Application Area in which the PECs may occur. The actual area of PECs are expected to comprise a small proportion portion of the total area of the VTs.

3.5.5 Flora diversity

The survey (VLA 2019) identified a total of 138 plant taxa from 40 families in the northern survey area (Burrup Peninsula) and 106 plant taxa from 26 families on the southern survey area (Roebourne Plain). At the time of survey (June and July 2019), most of the species were dormant and there was an absence of annual or ephemeral species. VLA (2019) noted a diverse range of species on the Burrup Peninsula, and that the survey on the Roebourne Plain was not a true representation of total species diversity with an expected growth of annual and ephemeral species in the wet season.

3.5.6 Conservation significant flora

No threatened flora listed under State or Commonwealth legislation are known to occur within 5 km of the Application Area or are expected to occur within the Application Area.

The survey (VLA 2019) identified ten priority flora species that may potentially occur in the Application Area, with three of these species recorded during the survey:

- *Trianthema* sp. Python Pool (Priority 2)
- *Atriplex lindleyi* subsp. Conduplicata (Priority 3)
- *Gmphrena cucullata* (Priority 3)
- *Gomphrena leptophylla* (Priority 3)
- *Gymnanthera cunninghamii* (Priority 3)
- *Oldenlandia* sp. Hamersley Station (Priority 3)
- *Stackhousia clementii* (Priority 3)
- *Terminalia supranitifolia* (Priority 3) – recorded within survey area
- *Vigna triodiophila* (Priority 3) – recorded within survey area
- *Rhynchosia bungarensis* (Priority 4) – recorded within survey area

Table 3-5 Vegetation types mapped within the Application Area

No.	Code	Description	Area within Application Area (ha)	Proportion of Application Area
1	AbCc	Acacia bivenosa tall open to shrubland over *Cenchrus ciliaris tussock grassland, closed tussock grassland, patchy Triodia angusta.	0.79	0.2%
2	AbTe	Acacia bivenosa, occasional Dichrostachys spicata, A. ancistrocarpa open tall shrubland over mixed Triodia epactia/T. angusta hummock and *Cenchrus ciliaris tussock grassland.	1.18	0.2%
5	AbAsTe	Acacia bivenosa with Dolichandrone heterophylla tall shrubland over A. stellaticeps open to shrubland over Diplopeltis eriocarpa low shrubland over Triodia angusta or T. epactia hummock grassland to closed hummock grassland with patchy Eriachne obtuse.	1.21	0.3%
7	GpTeBaTs	Grevillea pyramidalis scattered to open tall shrubland, sometimes scattered Hakea lorea subsp lorea, Ipomoea costata, Acacia inaequilatera over Triodia epactia hummock grassland, sometimes patchy T. angusta. Open low Indigofera monophylla shrubland. Scattered Brachychiton acuminatus, Terminalia supranitifolia, Dichrostachys spicata on small rock outcrops.	2.20	0.5%
10	GpAiTe	Grevillea pyramidalis, Acacia inaequilatera, Ehretia saligna, Santalum lanceolatum, tall shrubland over open mixed low shrubland, Scaevola spinescens, A. orthocarpa, Solanum phlomoides, Indigofera monophylla over Triodia epactia hummock grassland with patchy *Cenchrus ciliaris	1.47	0.3%
11	DsAiTe	Dichrostachys spicata, Acacia inaequilatera, A. coriacea tall shrubland over Scaevola spinescens, Alectryon oleifolius open low mixed shrubland over Triodia epactia / T. angusta hummock grassland. Scattered Eucalyptus victrix and Terminalia circumalata.	0.28	0.1%
14	EvAbTa	Eucalyptus victrix open to scattered low woodland with scattered Corymbia hamersleyana over Acacia bivenosa tall open shrubland over Adriana tomentosa / Indigofera monophylla open low shrubland over Triodia angusta / T. epactia open to hummock grassland.	0.82	0.2%
15	ChAbTe	Corymbia hamersleyana open to low woodland over Acacia bivenosa / A. coriacea/ DIchrostachys spicata tall shrubland, sometimes Adriana tomentosa/ Stemodia grossa low shrubland over open Triodia epactia / T. angusta hummock and sometimes *Cenchrus ciliaris tussock grassland.	0.06	0.0%
17	BaDslc	Brachychiton acuminatus mixed low woodland with Dichrostachys spicata over, Ipomoea costata, Acacia coriacea, Terminalia supranitifolia open shrubland over scattered Triodia epactia / Cymbopogon ambiguus/ *Cenchrus ciliaris grasses. Occasional Ficus brachypoda trees.	0.03	0.0%
18	BaEsErv	Brachychiton acuminatus mixed low woodland with Ehretia saligna, Erythrina vespertilio, Terminalia circumalata over Ipomoea costata, Acacia coriacea open shrubland over Triodia epactia hummock grassland. Scattered *Cenchrus ciliaris.	0.43	0.1%
21	Ta	Triodia angusta hummock grassland	0.15	0.0%

23	Tspp	Tecticornia halocnemoides subsp tenuis, T. pruinosa, T. indica subsp leiostachya,with Muellerolimon salicorniaceum open low shrubland with patchy Avicennia marina trees.	0.93	0.2%
24	AbTeEx	Acacia bivenosa, A. coriacea, A. synchronicia open or scattered shrubland over mosaic Triodia epactia hummock and Eragrostis xerophila tussock grassland.	8.03	1.7%
25	AbTw	Acacia bivenosa shrubland to open shrubland with scattered A. inaequilatera, A coriacea, A. ancistrocarpa, Eremophila longifolia, over Triodia wiseana hummock grassland. Patchy T. epactia and *Cenchrus ciliiaris on some scald areas.	23.79	5.0%
26	AbCc	Acacia bivenosa closed to shrubland over *Cenchrus ciliaris, *Cenchrus setiger tussock grassland. Patchy Eragrostis xerophila, Triodia wiseana, T. epactia	9.96	2.1%
27	AiTe	Acacia inaequilatera tall open shrubland with some Ehretia saligna, A. bivenosa over Triodia epactia hummock grassland, patchy Eragrostis xerophila.	1.00	0.2%
28	AiAc?Eb1	Acacia inaequilatera, A. coriacea tall shrubland, sometimes open shrubland over ?Eriachne benthamii, Chrysopogon fallax patchy *Cenchrus ciliaris tussock grassland.	1.93	0.4%
29	AiTw	Acacia inaequilatera tall open shrubland, or scattered shrubs occasional A. synchronicia, A. coriacea, Hakea lorea sometimes over A. bivenosa open shrubs over Triodia wiseana hummock grassland.	6.31	1.3%
30	AiAcTw	Acacia inaequilatera open shrubland, occasional A. coriacea over Triodia wiseana closed hummock grassland.	0.93	0.2%
31	TaTCc	*Tamarix aphylla (WONS Species) low open woodland over Tecticornia species open low shrubland with *Aerva javanica over open *Cenchrus ciliaris tussock grassland.	2.35	0.5%
32	T spp	Tecticornia haloocnemoides subsp tenuis, Tecticornia ? indica closed low shrubland.	3.43	0.7%
33	AcCc	Acacia coriacea tall shrubland to open tall shrubland over A. ampliceps or *Vachellia farnesiana shrubland sometimes over Stemodia grossa closed low shrubland over mixed *Cenchrus ciliaris tussock with Triodia epactia scattered grasses.	1.12	0.2%
34	AaAcC?v	Acacia ampliceps tall shrubland to closed shrubland with A. coriacea over Myoporum montanum shrubland with occasional Stemodia grossa over Cyperus sp and Typha sp (dead) sedgeland	0.85	0.2%
35	AcAi	Acacia coriacea / A.inaequilatera, tall mixed shrubland over *Vachellia farnesiana open shrubs over mixed open tussock grassland (too dead to id) and scattered Triodia wisena hummocks	0.75	0.2%
36	Ac?Tt	Acacia coriacea with tall shrubland over scattered Acacia inaequilatera, A. ancistrocarpa shrubs over ? Themeda triandra (dead / dormant) ? with some *Cenchrus ciliaris (dead)tussock grassland.	0.44	0.1%
39	ShEx	Senna hamersleyensis low shrubland (senescing?) over scattered Eragrostis xerophila tussocks	1.31	0.3%
42	Te	Triodia epactia hummock grassland. There can be very scattered Acacia bivenosa, A. coriacea, A. xiphophylla, Ehretia saligna.	1.93	0.4%

[1] A question mark before the species indicates that the species of grassland flora could not be confirmed due to the dry conditions on the Roebourne Plains during the survey.

43	Tw	Triodia wiseana hummock grassland. Sometimes scattered Acacia inaequilatera, A. coriacea, A pyrifolia, A. bivenosa.	28.08	5.9%
44	Eb?Cf	?Eriachne benthamii, ?Chrysopogon fallax tussock grassland with other annual grass species (all too dead/dormant to identify). Scattered *Vachellia farnesiana, Acacia coriacea shrubs	5.20	1.1%
45	Ex spp	Eragrostis xerophila tussock grassland. (apparent Sorghum plumosum, Panicum sp, Aristida sp) with intrusions of ?Eriachne benthamii on low areas.	27.45	5.8%
46	Ex	Eragrostis xerophila tussock grassland. Scattered *Vachellia farnesiana shrubs.	285.04	59.7%
47	Cc	*Cenchrus ciliaris tussock grassland with scattered shrubs of Acacia bivenosa, A. inaequilatera.	1.22	0.3%
48	TwEx	Triodia wiseana hummock and Eragrostis xerophila tussock mosaiced grassland.	30.45	6.4%
7/19		Mosaic of VT7 (GpTeBaTs) and VT19 (TslcTe)	0.56	0.1%
28/43		Mosaic of VT28 (AiAc?Eb) and VT43 (Tw)	10.17	2.1%
n/a	Cleared	Cleared land devoid of native vegetation	15.22	3.2%
		Total area (ha)	**477.06**	**100.0%**

Table 3-6 Vegetation condition mapped within the Application Area

Condition class	Area within Application Area (ha)	Proportion of Application Area
Excellent	54.54	11.4%
Very Good	41.60	8.7%
Good	346.51	72.6%
Poor	14.85	3.1%
Degraded	4.35	0.9%
Cleared	15.22	3.2%
Total	**477.06**	**100.0%**

Table 3-7 Priority Ecological Communities within the Application Area

Status	PEC	Description	Occurrence within Application Area (refer to Table 3-5 for VT descriptions)	Total area within Application Area in which PEC may occur (ha)
Priority 1	Burrup Peninsula rock pile communities	Pockets of vegetation in rock piles, rock pockets and outcrops. Comprises a mixture of Pilbara and Kimberley species, communities are different from those of the Hamersley and Chichester Ranges. Includes short-range endemic land snails. Threats: industrial development dust emissions, weed invasion (*Cenchrus ciliaris*, *Passiflora foetida*).	Recorded in: VT7: GpTeBaTs VT17: BaDslc VT18: BaEsErv	2.66
Priority 1	Roebourne Plains coastal grasslands with gilgai microrelief on deep cracking clays	Occurs on deep cracking clays that are self-mulching and emerge on depositional surfaces. Occur on microrelief of deep cracking clays, surrounded by clay plains/flats and sandy coastal and alluvial plains. Gilgai depressions support ephemeral and perennial tussock grasslands dominated by *Sorghum* sp. and *Eragrostis xerophila* along with other native species including *Astrebla pectinata*, *Eriachne benthamii*, *Chrysopogon fallax* and *Panicum decompositum*. Restricted to the Karratha area, this community differs from the surrounding clay flats of the Horseflat land system which are dominated by *Eragrostis xerophila* and other perennial tussock grass species (*Eragrostis* mostly). Threats: grazing, clearing for mining and infrastructure and urban development, weed invasion, basic raw material extraction.	Likely to occur in: VT45: Ex spp Potential to occur in: VT44: Eb?Cf?	32.65
Priority 3	Horseflat land system of the Roebourne plains	Extensive, weakly gilgaied clay plains dominated by tussock grasslands on mostly alluvial non-gilgaied, red clay loams or heavy clay loams. Perennial tussock grasses include *Eragrostis xerophila* and other *Eragrostis* spp., *Eriachne* spp. and *Dichanthium* spp. The community also supports a suite of annual grasses including *Sorghum* spp. and rare *Astrebela* spp. The community extends from Cape Preston to Balla Balla surrounding the towns of Karratha and Roebourne. Threats: grazing, weed invasion, fragmentation	Likely to occur in: VT46: Ex	285.04

3.5.7 Weeds

The survey (VLA 2019) recorded seven weed species on the Burrup Peninsula:

- *Aerva javanica (kapok)
- *Cenchrus ciliaris (buffel grass)
- *Cenchrus setiger (Birdwood grass)
- *Malvastrum americanum (Spiked malvastrum)
- *Passiflora foetida (stinking passion flower)
- *Vachellia farnesiana (mimosa bush)
- *Tamarix aphylla (tamarisk, athel pine), a Declared Pest and Weed of National Significance (WoNS).

3.6 Fauna

3.6.1 Fauna survey

GHD (2019) undertook a level 1 terrestrial fauna survey over the Application Area, in accordance with EPA Technical Guidance (EPA 2016b) and included:

- Desktop review of previous surveys, as summarised by AECOM (2013), Commonwealth and State databases, aerial photography and mapping of geology/hydrology/reserves.
- Field survey undertaken in June and July 2019, comprising:
  - Fauna habitat identification and mapping
  - Opportunistic fauna searches
  - Motion sensor camera trapping
  - Bat survey using ultrasonic recorders.

3.6.2 Fauna diversity

Desktop review (GHD 2019) identified 331 terrestrial vertebrate fauna species previously recorded within 20 km of the Application Area, including 194 birds, 37 mammals, 7 amphibians and 93 reptiles. Of the 331 fauna species recorded, 318 are native species and 13 species are considered introduced, including Cat, Fox, Goat, Sheep, Dog, Rabbit, House Mouse and Black Rat (GHD 2019).

The field survey identified 101 terrestrial vertebrate fauna species within the survey area, consisting of 68 birds, 17 reptiles and 16 mammals (GHD 2019). Of these species, four were introduced: Dog, Cat, Cattle and Black Rat.

3.6.3 Fauna habitat

The survey (GHD 2019) recorded nine fauna habitat types within the Application Area, as summarised in Table 3-8. Four of the habitat types are high value and provide habitat for listed threatened or migratory species, with the other habitats of moderate to high value and providing habitat for priority fauna species or opportunistic use for migratory species.

The Application Area is predominantly covered (368.22 ha or 77% of total) by Tussock Grasslands on Cracking Clays with intermittent coverage (34.74 ha or 7% of total) by the high value habitat Minor Drainage Lines. The majority of the Minor Drainage Lines (34.80 ha or 97% of total) lie over the Roebourne Plains and in the MSIA and Buffer Area, with a small area of Minor Drainage Lines (0.94 ha) is on the Burrup Peninsula. The other high value fauna habitats

comprise smaller areas, at approximately 1.86 ha (0.4% of total) for Rocky Hills with Exposed Boulder Piles and approximately 2.14 ha (0.4% of total) for Tidal Mudflats.

Table 3-8 Fauna habitats in Application Area

Fauna habitat type	Area within Application Area (ha)	Proportion of Application Area
Mudflat with Tidal Inundation, Mangroves and Scattered Samphire Habitat value: High Conservation significant species: Migratory birds, North-western Free-tailed Bat, Peregrine Falcon	2.14	0.4%
Rocky Hills with exposed boulder piles Habitat value: High Conservation significant species: Northern Quoll (Core habitat), Pilbara Olive Python (Core habitat), Peregrine Falcon	1.86	0.4%
Minor Drainage Lines Habitat value: High Conservation significant species: Burrup Peninsula: Northern Quoll, Pilbara Olive Python, Peregrine Falcon; Roebourne Plains: Northern Short-tailed Mouse, Lined Crevice Skink Fauna corridor	35.74 0.94 on Burrup Peninsula 34.80 on Roebourne Plains	7.5%
Hummock Grassland on Low Rocky Hills Habitat value: Moderate to High Conservation significant species: Northern Quoll, Pilbara Olive Python	1.75	0.4%
Hummock Grassland on Rocky Plain Habitat value: Moderate to High Conservation significant species: Northern Short-tailed Mouse, Lined Crevice Skink, Peregrine Falcon	30.44	6.4%
Hummock Grassland on Sandy Plain Habitat value: Moderate to High Conservation significant species: Northern Short-tailed Mouse, Lined Crevice Skink, Peregrine Falcon	10.84	2.3%
Tussock Grasslands on Cracking Clays Habitat value: Moderate Conservation significant species: Migratory birds (seasonal opportunistic), Northern Short-tailed Mouse, Lined Crevice Skink	368.22	77.2%
Low Chenopod Shrublands Habitat value: Moderate Conservation significant species: Northern Short-tailed Mouse, Lined Crevice Skink, Migratory birds (opportunistic)	6.54	1.4%

Fauna habitat type	Area within Application Area (ha)	Proportion of Application Area
Water Bodies Habitat value: Moderate Conservation significant species: Migratory birds (opportunistic)	0.47	0.1%
Disturbed Areas Habitat value: Low	19.07	4.0%
Total area	**477.06**	**100.0%**

3.6.4 Conservation significant fauna

The survey (GHD 2019) recorded five conservation significant species within the Application Area and identified 11 conservation significant species as likely to use the Application Area either as a resident, visitor or on an opportunistic basis. Table 3-9 summarises the recorded or likely conservation significant fauna, and the high value habitats identified in the Application Area.

Table 3-9 Conservation significant fauna recorded or likely in the Application Area

Species and Status	BC Act, DBCA	EPBC Act	Likelihood of Occurrence	High Value Habitats within Application Area
Northern Quoll (*Dasyurus hallucatus*)	Endangered	Endangered	Likely	Rocky Hills with exposed boulder piles, Minor (vegetated) Drainage Lines
Pilbara Olive Python (*Liasis olivaceus barroni*)	Vulnerable	Vulnerable	Likely	Rocky Hills with exposed boulder piles, Minor Drainage Lines
Peregrine Falcon (*Falco peregrinus*)	Other specially protected	n/a	Likely	Rocky Hills with exposed boulder piles, Minor Drainage Lines, Tidal Mudflat
North-western Free-tail Bat (*Mormopterus (Ozimops) cobourgianus*))	Priority 1	n/a	Recorded	Tidal Mudflat
Northern Short-tailed Mouse (*Leggadina lakedownensis*)	Priority 4	n/a	Likely	Minor Drainage Lines
Lined Soil-crevice Skink (*Notoscincus butleri*)	Priority 4	n/a	Likely	Minor Drainage Lines
Whimbrel (*Numenius phaeopus*)	Migratory	Migratory	Recorded	Tidal Mudflat
Gull-billed Tern (*Gelochelidon nilotica*)	Migratory	Migratory	Recorded	Tidal Mudflat
Caspian Tern (*Hydroprogne caspia*)	Migratory	Migratory	Recorded	Tidal Mudflat
Crested Tern (*Thalasseus bergii*)	Migratory	Migratory	Recorded	Tidal Mudflat
Bridled Tern (*Onychoprion anaethetus*)	Migratory	Migratory	Likely	Tidal Mudflat
Wood Sandpiper (*Tringa glareola*)	Migratory	Migratory	Likely	Tidal Mudflat
Common Greenshank (*Tringa nebularia*)	Migratory	Migratory	Likely	Tidal Mudflat
Oriental Pratincole (*Glareola maldivarum*)	Migratory	Migratory	Likely	Tidal Mudflat
Oriental Plover (*Charadrius veredus*)	Migratory	Migratory	Likely	Tidal Mudflat
Common Sandpiper (*Actitis hypoleucos*)	Migratory	Migratory	Likely	Tidal Mudflat

Field survey (GHD 2019) recorded evidence of past use by the Western Pebble-mound Mouse (*Pseudomys chapmani*) at one site within the Application Area. This Priority 4 species is considered locally extinct on the Burrup Peninsula and so is unlikely to occur within the Application Area.

As presented in Table 3-9, the survey (GHD 2019) indicated the likelihood of two threatened fauna species, ten migratory birds, three priority fauna species and one other specially protected species.

3.6.5 Northern Quoll

The Northern Quoll (Endangered) was not recorded during the survey (GHD 2019), however the species is likely to occur in the Application Area given the wide-ranging behaviour of the species and the availability of suitable habitat. The species is sparsely recorded on the Burrup Peninsula with five records located within 5 km of the Application Area and no regular records since 1990 (DBCA 2019a). The limited records for Northern Quoll on the Burrup Peninsula compared to Dolphin Island correlates with limited records of other native fauna (e.g. reptiles, Rothchild's Rock Wallaby) and a higher incidence of feral animals including Black Rat, Fox and Cat (DBCA 2019b).

Within the Application Area, the following habitat types on the Burrup Peninsula may contain pockets of potential habitat critical to survival of the species:

- Rocky Hills with Exposed Boulder Piles, where these contain sheltering rock piles
- Minor Drainage Lines, where these are in rocky areas and have trees.

The sheltering rock piles occur as pockets within the Rocky Hills with Exposed Boulder Pile habitat types presented on Table 3-8 and Figure 5. Similarly, the treed drainage lines in rocky areas comprise a small proportion of the Minor Drainage Lines presented in Table 3-8 and Figure 5, excluding those drainage lines on the Burrup Peninsula that are devoid of trees and the drainage lines on the Roebourne Plains grasslands.

The Roebourne Plains grasslands do not feature important habitat for the Northern Quoll, however the species may use Minor Drainage Lines to disperse from populations on the Karratha Hills (e.g. near Mount Regal), either for juvenile dispersal or active males searching for females during the breeding season (GHD 2019).

3.6.6 Pilbara Olive Python

The Pilbara Olive Python (Vulnerable) was not recorded during the survey (GHD 2019). Within the Application Area, the following habitat types on the Burrup Peninsula represent potential habitat for the species:

- Rocky Hills with Exposed Boulder Piles
- Minor Drainage Lines (Burrup Peninsula only)
- Hummock Grassland on Low Rocky Hills.

The Minor Drainage Lines on the Roebourne Plains are not expected to represent habitat for the Pilbara Olive Python, being located away from the rocky habitats preferred by the species.

3.6.7 Migratory Birds

The survey (GHD 2019) recorded four Commonwealth listed migratory species and identified a further six Commonwealth listed migratory species as likely to occur. The migratory bird species are expected to use the Tidal Mudflats that lie along the Burrup Peninsula, as well as opportunistic use of Tussock Grasslands on Cracking Clays and Water Bodies on the

Roebourne Plain. The migratory species may use the Tidal Mudflats for foraging as well as a flyway between habitat at King Bay and Hearson's Cove.

3.7 Fauna corridors

The fauna habitats of the Application Area are part of a contiguous largely intact area of remnant vegetation on the Burrup Peninsula, intertidal flats and Roebourne Plains, connected to a much larger area of habitats within the Roebourne IBRA subregion. Fauna are adapted to a semi-arid landscape devoid of fresh surface water except for infrequent and intermittent flow events following heavy rainfall. Accordingly, fauna of the Pilbara are less reliant on vegetated corridors and drainage lines compared to highly fragmented landscapes and higher rainfall regions such as the Swan Coastal Plain or Wheatbelt.

Minor Drainage Lines within the Roebourne Plains are expected to function as local fauna corridors linking coastal habitats (Littoral land system) to the Karratha Hills (Boolgeeda land system, see Figure 2). The Minor Drainage Lines contain scattered shrub and tree vegetation that may provide areas of relative shelter compared to the more exposed grasslands of the Horseflat land system. The Minor Drainage Lines are important habitats for the Priority 4 fauna species (Northern Short-tailed Mouse and Lined Soil-crevice Skink), and may be used opportunistically by Northern Quoll when dispersing from the Karratha Hills. The Minor Drainage Lines were observed during the survey being used by common species such as Red Kangaroo, Australian Bustard, White-breasted Sea-eagle and Whistling Kite (GHD 2019).

3.8 Conservation areas

The Application Area does not lie over conservation areas (see Figure 6).

The Application Area within the Burrup Peninsula lies, at its closest point, within 200 m of the Murujuga National Park (see Figure 6). The archipelago of islands north of Burrup Peninsula comprise conservation and recreation reserves vested in the Conservation and Parks Commission. No other conservation reserves or DBCA managed lands are located within a 10 km distance of the Application Area.

3.9 Environmentally Sensitive Areas

There are no Environmentally Sensitive Areas (ESAs) within the Application Area. The closest ESA are islands north of the Application Area, associated with the Dampier Archipelago Register of the National Estate site.

3.10 Aboriginal heritage

The Application Area on the Burrup Peninsula lies over the Dampier Archipelago (including Burrup Peninsula) National Heritage Place (ID 105727), which comprises portions of the Burrup Peninsula as well as the wider archipelago of islands. The National Heritage Place is most widely known for its large collection of Aboriginal rock art (in the form of petroglyphs) and contains the largest collection of petroglyphs in Australia. The National Heritage Place includes significant stone sites and those important to Aboriginal cultural heritage, such as standing stones, fish traps, stone pits, hunting hides, cairns, quarries, middens, rock shelters, ceremonial sites, artefact scatters, and grinding patches (DoEE 2007).

The Application Area lies within the administrative areas of Aboriginal heritage sites registered and lodged with the Registrar of Aboriginal Sites under the *Aboriginal Heritage Act 1972* (AH Act). The geotechnical investigation sites within the Application Area have been planned to avoid registered and lodged Aboriginal heritage sites, where the heritage site locations are well defined. A series of Aboriginal heritage surveys and desktop reviews has also been utilised to

determine the location of proposed investigation sites in a manner that avoids any disturbance to Aboriginal heritage sites.

Woodside has ongoing engagement with both MAC and NAC regarding the Proposal.

Woodside commits to zero impacts to Aboriginal heritage sites during the Investigation.

4. Potential impacts

4.1 Impact minimisation

The Investigation has been planned to minimise impacts on the environment. See Section 5 for the Environment Management Framework.

The following measures have been implemented:

- Limiting geotechnical investigation to the scope necessary to adequately inform design and construction planning
- Use of existing cleared access tracks, roads and other disturbed areas as far as practicable to access geotechnical sites
- Avoiding investigation or access through drainage lines as far as practicable
- Avoiding recorded Aboriginal heritage sites during planning of geotechnical investigation sites and access tracks.

The following will be implemented in the field during the conduct of the Investigation:

- Avoiding trees and tall shrubs in selection of access routes and borehole/test pit pads
- Driving over short vegetation (e.g. grasses) rather than clearing, where the vegetation does not pose a risk of fire or damage to vehicles and machinery
- Vehicles and machinery to use the same track/route (in convoy not parallel) across vegetation when accessing geotechnical investigation sites
- Utilisation of heritage monitors at defined locations at areas of potential cultural sensitivity.

4.2 Potential impacts to vegetation and flora

Based on a preliminary footprint for boreholes, test pits and access tracks and allowing a 15% contingency for variation in the field, the Investigation will comprise a disturbance area of 12.27 ha within the Application Area, and require clearing of 11.93 ha of native vegetation. An estimated 0.34 ha of the disturbance area comprises already cleared land.

Based on the preliminary footprint, the estimated 11.93 ha of native vegetation clearing will include:

- 0.39 ha that may contain Burrup Peninsula rock pile communities (Priority 1)
- 0.87 ha that may contain Roebourne Plains coastal grassland with gilgai microrelief on deep cracking clays (Priority 1)
- 6.58 ha that may contain Horseflat land system of the Roebourne plains (Priority 3).
- 8.35 ha that is habitat for Priority 2 flora species
- 8.21 ha that is habitat for Priority 3 flora species
- 0.63 ha that is habitat for Priority 4 flora species

The PECs and priority flora are expected to occur in pockets within the vegetation types mapped across the Application Area and therefore may potentially not be present within the Investigation clearing footprint.

Based on the preliminary footprint, the 11.93 ha of native vegetation to be cleared is:

- 1.9 ha (16% of total) in Excellent condition
- 1.1 ha (9%) in Very Good condition
- 7.6 ha (64%) in Good condition
- 0.6 ha (5%) in Poor condition
- 0.7 ha (6%) in Degraded condition

Native vegetation will be cleared for borehole or test pit pads, and will be driven over rather than cleared (where practical) for access tracks. The grassland vegetation is expected to be damaged or die off after being driven over, depending on ground conditions, but will not be physically removed or cleared. The shrubland and woodland vegetation is typically sparse and it is expected that almost all large shrubs and trees will be avoided during access.

The Investigation may result in indirect impacts to adjacent native vegetation through introduction and spread of weeds, fire outbreaks, and spills or leaks of hazardous materials or wastes. Potential indirect impacts will be managed through environmental provisions in the Project Execution Plan, as presented in Section 5.

4.3 Potential impacts to conservation areas

The Application Area does not lie within conservation areas and the Investigation will not cause direct impacts to conservation areas.

The Application Area on the Burrup Peninsula lies, at its closest point, within 200 m of Murujuga National Park and has potential to cause indirect impacts to the National Park through the introduction and spread of weeds, fire outbreaks and dust. The Application Area lies either downhill of the Murujuga National Park or is separated from the National Park by drainage lines, therefore the Investigation does not have potential to cause indirect impacts to the National Park from spills or leaks of hazardous materials.

The next closest conservation reserves lie at least 8 km from the Application Area, on offshore islands of the Dampier Archipelago, and will not be impacted by the Investigation.

Potential indirect impacts to Murujuga National Park will be managed through environmental provisions in the Project Execution Plan, as presented in Section 5.

As presented in Section 3.10, Woodside commits to eliminating any impacts to Aboriginal heritage sites during the Investigation.

4.4 Potential impacts to fauna and fauna habitat

The Investigation will involve clearing of native vegetation that is potential habitat for conservation significant fauna species, as summarised in Table 4-1.

Table 4-1 Clearing of conservation significant fauna habitat

Species (see Table 3-9 for details)	Status under BC Act, DBCA	Status under EPBC Act	Clearing to potential habitat (ha)
Northern Quoll	Endangered	Endangered	0.3 ha - High value 0.3 ha - Moderate to high value
Pilbara Olive Python	Vulnerable	Vulnerable	0.3 ha - High value 0.3 ha - Moderate to high value
Peregrine Falcon	Other specially protected	Not Relevant	1.0 ha - High value 0.3 ha - Moderate to high value
North-western Free-tail Bat	Priority 1	Not Relevant	0.2 ha - High value
Northern Short-tailed Mouse	Priority 4	Not Relevant	0.5 ha - High value 1.9 ha - Moderate to high value 8.0 ha - Moderate value
Lined Soil-crevice Skink	Priority 4	Not Relevant	0.5 ha - High value 1.9 ha - Moderate to high value 8.0 ha - Moderate value
Migratory birds	Migratory	Migratory	0.2 ha – High value 8.0 ha - Moderate value

The Investigation will involve clearing of native vegetation within Minor Drainage Line fauna habitat types, which comprise local fauna corridors within the Burrup Peninsula and Roebourne Plains. The clearing of native vegetation within Minor Drainage Lines will be for access tracks / routes only. The access tracks / routes will be either driven over if grassland / sparsely vegetated or otherwise will be cleared at a maximum width of 6 m and avoid trees and tall shrubs as far as practicable. The shrubland and woodland vegetation is typically sparse and larger shrubs and trees easily avoided.

The Investigation may result in direct injury or mortality of fauna through driving over or collision with vehicles and machinery (road kill). The Investigation will be undertaken during day time hours (06:00 to 18:00) for safety reasons, whereas native fauna are predominantly active at night, which will limit the potential for road kill of fauna. Boreholes and test pits will be backfilled on the day of drilling/excavation which will prevent fauna from becoming trapped or killed in excavations.

The Investigation may result in indirect impacts to fauna through inappropriate disposal or scavenging of food waste and attraction of feral animals.

Potential direct and indirect impacts to native fauna will be managed through environmental provisions in the Project Execution Plan, as presented in Section 5.

4.5 Land degradation, water quality and flooding

The Application Area on the Roebourne Plains predominantly lies over the Horseflat land system (see Figure 2), which comprises flat plains with predominantly clayey soils and stony mantles that are resistant to soil erosion, but may contain sandy areas prone to erosion once disturbed (Vreeswyk *et al.* 2004). Smaller portions of the Application Area lie over the Boolgeeda and Calcrete land systems (see Figure 2), which generally comprise stony areas

with loamy soils that are not susceptible to erosion (Vreeswyk *et al.* 2004). A small portion of the Application Area lies over the Cheerawarra land system, which comprise sandier soils that may be prone to erosion once disturbed.

The Application Area on the Burrup Peninsula lies on the Granitic land system, which predominantly comprises rocky soils that are not susceptible to erosion (Vreeswyk *et al.* 2004).

The Investigation will comprise small clearing areas (up to 25 m x 25 m, see Section 2.2) spaced at intervals of 1000-1500 m for boreholes and 200-400 m for test pits, with access tracks up to 6 m wide. Given the generally low vulnerability of landforms to erosion, the localised and highly distributed clearing areas are highly unlikely to cause erosion that causes land degradation or significant impacts to water quality.

The Investigation will not involve any on-site refuelling or maintenance of vehicles or machinery, which will occur at existing service stations or workshops in Karratha. The Investigation will involve temporary storage of minor quantities of hazardous materials or wastes, with all wastes disposed off-site at the end of each day. Drilling muds from boreholes will be disposed of to the borehole and test pits will be backfilled with the excavated material. Accordingly, the Investigation works are highly unlikely to cause spills or leaks of hazardous materials or wastes that result in land degradation or significant impacts to water quality.

The Application Area lies outside of major flood ways (e.g. Maitland River) and is drained by ephemeral drainage lines. The Investigation will involve small clearing areas that are highly distributed, which will comprise a negligible proportion of catchment areas and not modify hydrological regimes such that flooding is exacerbated. Similarly, the minor clearing will not modify groundwater regimes that results in oxidation of acid sulfate soils (if present) causing significant impacts to water quality.

5. Environmental management framework

The Investigation will be undertaken in accordance with an Environment Management Plan (included with the project execution plan), which will include the following environmental management provisions;

1. Minimisation of clearing
   - Use of existing cleared access tracks, roads and other disturbed areas as far as practicable to access investigation areas
   - Vegetation within access tracks to be driven over in preference to clearing, where this does not pose an unacceptable fire risk or damage to vehicles
   - Where vegetation on access tracks is to be cleared, vegetation is to be slashed where practicable, to minimise soil disturbance and allow vegetation to regenerate from rootstock
   - Where existing tracks can't be used, navigation paths will avoid vegetation where practicable
   - Access routes optimised to avoid requirements for earthworks or grading where practicable
   - Movement of vehicles and machinery in convoy along access tracks /routes
   - Avoiding trees and tall shrubs in selection of access routes and borehole/test pit pads
2. Weeds and rehabilitation
   - Potential weed management activities have been informed by consultation with a local experienced botanist (Vicki Long Associates, pers comm, 2019) are are outlined below
   - All vehicles and machinery to be cleaned of soil and vegetative matter at point of entry into native vegetation from existing access tracks/roads/disturbed areas, and at exit from weed infested areas
   - Treatment of Declared Pests, Weeds of National Significance (WoNS) and *Passiflora foetida*[2] present within each investigation site and access track, prior to commencement of Investigation works
   - Treatment of Declared Pests to be in accordance with guidance by Department of Primary Industries and Regional Development[3] and treatment of WoNS to be in accordance with Weeds Australia guidance[4]
   - Weed treatment by a qualified professional, in a manner that prevents spray drift or water quality impacts to adjacent/downstream areas
   - Inspection of all clearing areas following the first wet season and follow up treatment of any weed infestations occurring
   - Investigation works are to avoid removal of topsoil as far as practicable, otherwise topsoil to be stockpiled adjacent to the works area for respreading at the completion of works

[2] Species is a high threat weed identified by CSIRO
[3] https://www.agric.wa.gov.au/declared-plants/
[4] http://weeds.ala.org.au/

- All borehole and test pit pads and rutted access tracks to be re-contoured and respread with topsoil, if necessary, to promote reestablishment of native vegetation
- Inspection of all clearing areas following the first wet season and any areas observed to not be regrowing with vegetation to be seeded with native species representative of the cleared vegetation communities.

3. Fauna

   - Staff awareness on Pilbara Olive Python (threatened species, non-venomous), prohibition on killing native fauna, and procedures for interaction with native fauna including snakes
   - Fauna care procedure for any injured fauna, using contact details for appropriate fauna rescue organisation or individual which are maintained by the Investigation team
   - Reporting all injury or death of terrestrial fauna to DBCA/DoEE as relevant.

4. Hazardous materials and waste management

   - All wastes, including food and mechanically removed weeds, to be disposed off site at a licensed waste facility
   - No storage of hazardous materials within the Application Area
   - All vehicles to be refuelled and serviced off-site
   - All accidental spills or leaks to be immediately responded to, to minimise soil contamination and prevent water contamination
   - Any contaminated soil from spills or leaks to be disposed off-site at a licensed waste facility
   - All spills or leaks that result in suspected pollution to be reported as required

5. Aboriginal cultural heritage management

   - Consultation with relevant traditional owners to define all Aboriginal heritage sites, exclusion zones and management requirements within Application Area
   - No disturbance of any Aboriginal heritage sites as a result of the Investigation
   - Monitoring by heritage monitors during Investigation works at locations where there has been determined to be risk of disturbance to cultural heritage sites (i.e. as a detailed survey has not been conducted, or a survey has identified a nearby heritage site)
   - Stop work and reporting of all suspected Aboriginal heritage materials or sites in the event that unrecorded materials/sites are encountered during field work, and management of the materials / site.

6. Assessment against the Ten Clearing Principles

Schedule 5 of the EP Act defines Ten Clearing Principles for the clearing of native vegetation. These principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way. Table 6-1 presents an assessment against the Ten Clearing Principles, in accordance with the DWER's *A Guide to the Assessment of Applications to Clear Native Vegetation* (Department of Environment Regulation 2014), to determine whether the Investigation is at variance to the principles.

As presented in Table 6-1 the Investigation is expected to be at variance with principle f (clearing on watercourses) and likely to be at variance with principle a (clearing of high biodiversity). However, due to the very small and distributed clearing areas, the extensive areas of remnant vegetation of similar or better quality, and the proposed environmental management, the Investigation is unlikely to cause significant residual environmental impacts.

Table 6-1 Assessment of the Investigation against the Ten Clearing Principles

Principle		Assessment	Outcome
A	Native vegetation should not be cleared if it comprises a high level of biological diversity.	The Investigation will involve clearing of native vegetation comprising 19 vegetation types, with vegetation 16% in Excellent condition, 9% in Very Good condition, 64% in Good condition, 5% in Poor condition and 6% in Degraded condition. The Investigation will involve clearing of native vegetation that includes: • 0.39 ha that may contain Burrup Peninsula rock pile communities (Priority 1) • 0.87 ha that may contain Roebourne Plains coastal grassland with gilgai microrelief on deep cracking clays (Priority 1) • 6.58 ha that may contain Horseflat land system of the Roebourne plains (Priority 3). • 8.35 ha that is habitat for Priority 2 flora species • 8.21 ha that is habitat for Priority 3 flora species • 0.63 ha that is habitat for Priority 4 flora species Given the predominantly Excellent to Good quality vegetation and potential presence of PECs and priority flora habitat, the native vegetation is expected to comprise a high level of biological diversity and clearing is likely to be at variance to this principle. The clearing is estimated to represent approximately 0.0001% of remnant vegetation remaining on the Littoral land system, approximately 0.003% of remnant vegetation remaining on the Horseflat land system and approximately 0.03% of remnant vegetation remaining on the Granitic land system, within the Roebourne subregion. The extensive areas of remnant vegetation remaining in the Roebourne subregion are expected to comprise similar or better quality vegetation than the vegetation to be cleared (as the Application Area lies in proximity to existing disturbed areas) and contain similar habitat for priority flora and PECs. Given the extensive remnants of similar or better quality vegetation remaining in the Roebourne subregion, the clearing though at variance is not expected to cause a significant residual environmental impact.	Likely to be at variance to this principle
B	Native vegetation should not be cleared if it comprises the whole or a	The Investigation will involve clearing of native vegetation that is potential habitat for conservation significant fauna species, including up to: • 0.6 ha of habitat for Northern Quoll – Endangered under BC Act and EPBC Act	Unlikely to be variance to this principle

Principle		Assessment	Outcome
	part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia	• 0.6 ha of habitat for Pilbara Olive Python – Vulnerable under BC Act and EPBC Act • 1.3 ha of habitat for Peregrine Falcon – other specially protected fauna under BC Act • 0.2 ha of habitat for North-western Free-tail Bat – Priority 1 • 10.4 ha of habitat for Northern Short-tailed Mouse, Lined Soil-crevice Skink – Priority 4 • 8.2 ha of habitat for ten migratory bird species – Migratory under BC Act and EPBC Act The Investigation may cause impacts to habitat for Northern Quoll and Pilbara Olive Python that represents approximately 0.01% of remnant vegetation on the Burrup Peninsula (Granitic land system of Roebourne IBRA subregion). The Application Area lies close to existing industrial roads and facilities that represent a mortality risk through road kill, and lies away from areas with high recorded occupancy at Dolphin Island and Mount Regal. The Burrup Peninsula is sparsely recorded for the Northern Quoll, reflective of the activity by feral animals. The Application Area does not contain breeding habitat critical to the survival of the Peregrine Falcon, which comprises cliffs found elsewhere on the Burrup Peninsula. This species is expected to use the Application Area on a sporadic and opportunistic basis and is wide ranging. The species preys on other birds, with bird populations not expected to be significantly impacted by the Investigation. The North-western Free-tail Bat is expected to use the Application Area opportunistically for foraging or to overfly between mangroves at King Bay and Hearson's Cove. The Investigation will impact up to 0.5 ha of high value habitat (Minor Drainage Lines) on the Roebourne Plains that represent important vegetated corridors for the Northern Short-tailed Mouse and Lined Soil-crevice Skink. The Investigation will impact up to 7.8 ha of Tussock Grassland on Cracking Clays that are also habitat for the two Priority 4 species. The clearing represents approximately 0.004% of remnant vegetation within the Horseflat land system of the Roebourne IBRA subregion which provides similar grassland habitat dissected by ephemeral drainage lines.	

Principle		Assessment	Outcome
		The Investigation will impact 0.2 ha of high value habitat (Tidal Mudflats) for migratory birds, which is used opportunistically and for overflight between King Bay and Hearson's Cove. The impact area represents 0.0001% of the Littoral land system within the Roebourne IBRA subregion which provides similar intertidal habitat. The Investigation will impact up to 7.8 ha of Tussock Grassland on Cracking Clays that may be used on a seasonal, opportunistic basis by migratory species, which represents approximately 0.003% of the remnant vegetation within the Horseflat land system which provides similar grassland habitat. Due to the small, highly distributed clearing areas and the extensive areas of similar or better habitat remaining on the Burrup Peninsula and Roebourne Plains, the Investigation is unlikely to cause impacts to significant habitat or habitat necessary for the maintenance of native fauna. Accordingly, the Investigation is unlikely to be at variance to this principle.	
C	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No threatened flora listed under State or Commonwealth legislation are known to occur within 5 km of the Application Area or are expected to occur within the Application Area.	Not at variance to this principle
D	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for, the maintenance of a threatened ecological community.	No Commonwealth or State listed threatened ecological communities (TECs) are known to occur within 10 km of the Application Area.	Not at variance to this principle
E	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an	Broadscale (1:1,000,000) pre-European vegetation mapping (Beard 1975) over the Application Area (see Table 3-3) indicates that vegetation associations are retained at well above 30% of pre-European extent (i.e. more than 89% of pre-European extent), which reflects the limited agricultural and urban development of the Pilbara Bioregion.	Not at variance to this principle

Principle		Assessment	Outcome
	area that has been extensively cleared.	Considering native vegetation by land systems (see Table 3-4), all six land systems within the Application Area have remnant vegetation well above 30% of pre-European extent. Due to the high retention and lack of extensive clearing of native vegetation in the Pilbara region and Roebourne sub-region, the native vegetation to be cleared is not considered a significant remnant.	
F	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	The Investigation will impact an estimated 0.34 ha of vegetation growing in association with ephemeral drainage lines (VTs 11-15 and 44, see Table 3-5 and Figure 3) and intertidal flats (VT 23). The majority of this clearing (0.18 ha or 54% of total) is the intertidal flats, with 0.14 ha on the Burrup Peninsula and 0.02 ha on the Roebourne Plains. A small number of geotechnical investigation sites are required on drainage lines in order to characterise the geotechnical properties of the alluvial formations. Planning of the Investigation has minimised the proposed works on drainage lines as far as is practicable. The 0.02 ha of vegetation on drainage lines on the Roebourne Plains (VT 44) provides habitat for Priority 4 fauna species. The 0.14 ha of vegetation on drainage lines on the Burrup Peninsula (VTs 11-15) provide habitat for the Northern Quoll and Pilbara Olive Python. The drainage lines are expected to flow intermittently for periods of a few to several days during and following heavy rainfall events. Although at variance with this principle, due to the very small and distributed areas of clearing (predominantly access tracks up to 6 m wide) and the extensive areas of drainage line habitat elsewhere in the Roebourne subregion, the Investigation is not expected to cause significant residual environmental impacts.	At variance to this principle
G	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The Application Area predominantly lies over the Horseflat, Boolgeeda, Calcrete and Granitic land systems that are resistant to erosion. There may be sandy areas within the Horseflat land system and the Cheerawarra land system that are vulnerable to erosion once disturbed. The Investigation will comprise small clearing areas (up to 25x25 m, see Section 2.2) spaced at intervals of 1000-1500 m for boreholes and 250-400 m for test pits, with access tracks up to 6 m wide.	Not at variance to this principle

Principle		Assessment	Outcome
		Given the generally low vulnerability of landforms to erosion, the small and highly distributed clearing areas are highly unlikely to cause erosion that causes land degradation.	
H	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The Application Area does not lie within conservation areas and the Investigation will not cause direct impacts to conservation areas. The Application Area on the Burrup Peninsula lies within 200 m of Murujuga National Park and has potential to cause indirect impacts to the National Park through the introduction and spread of weeds and fire outbreaks. These potential indirect impacts will be managed as presented in Section 5, and given the small duration and footprint of works are highly unlikely to cause significant impacts to the National Park. The Application Area lies either downhill of the Murujuga National Park or is separated from the National Park by drainage lines, therefore the Investigation does not have potential to cause indirect impacts to the National Park from spills or leaks of hazardous materials or wastes.	Not at variance to this principle
I	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The Investigation will comprise small clearing areas spaced at intervals of 1000-1500 m for boreholes and 250-400 m for test pits, with access tracks up to 6 m wide. Given the generally low vulnerability of landforms to erosion, the localised and highly distributed clearing areas are highly unlikely to cause erosion that causes significant impacts to water quality. The Investigation will not involve any on-site refuelling or maintenance of vehicles or machinery. The Investigation will involve temporary storage of minor quantities of hazardous materials or wastes, with any hazardous wastes disposed off-site at the end of each day. The Investigation works are highly unlikely to cause spills or leaks of hazardous materials or wastes that result in land degradation or significant impacts to water quality. The small, highly distributed clearing areas will not modify groundwater regimes that result in oxidation of ASS (if present) causing significant impacts to water quality.	Not at variance to this principle
J	Native vegetation should not be cleared if clearing	The Application Area lies outside of major flood ways (e.g. Maitland River) and is drained by ephemeral drainage lines. The Investigation will involve small clearing areas that are	Not at variance to this principle

Principle		Assessment	Outcome
	the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	highly distributed, which will comprise a negligible proportion of catchment areas and not modify hydrological regimes such that flooding is exacerbated.	

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Appendices

Appendix A – Figures

Figure 1 Application area

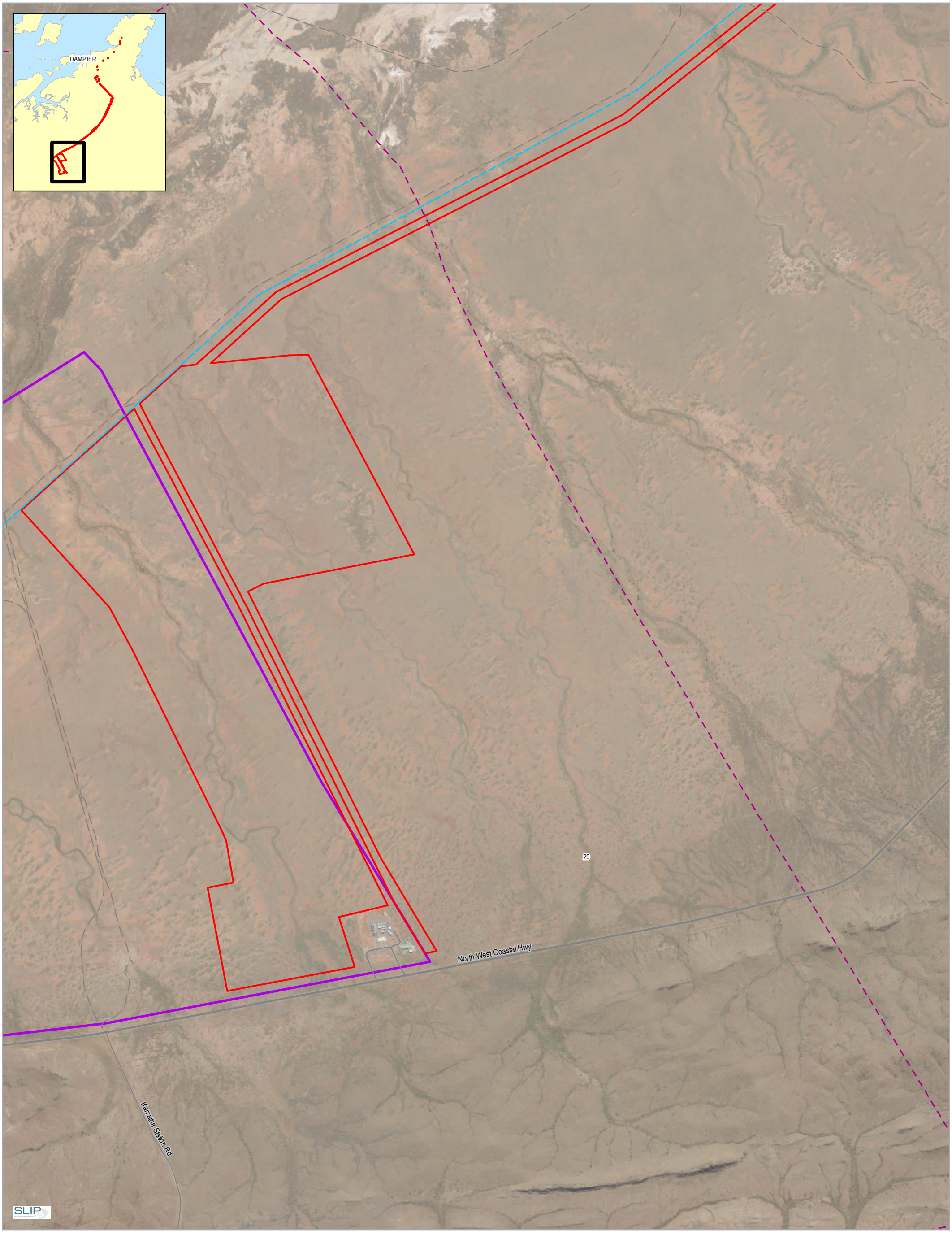
Figure 2 Land systems

Figure 3 Vegetation types

Figure 4 Vegetation condition

Figure 5 Fauna habitat types

Figure 6 Conservation areas



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- MSIA Buffer Area
- Maitland Strategic Industrial Area (MSIA)
- Application Area

Paper Size ISO A3

0 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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GHD

Woodside Energy Ltd
Geotechnical Investigation

Clearing Permit Application Area

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

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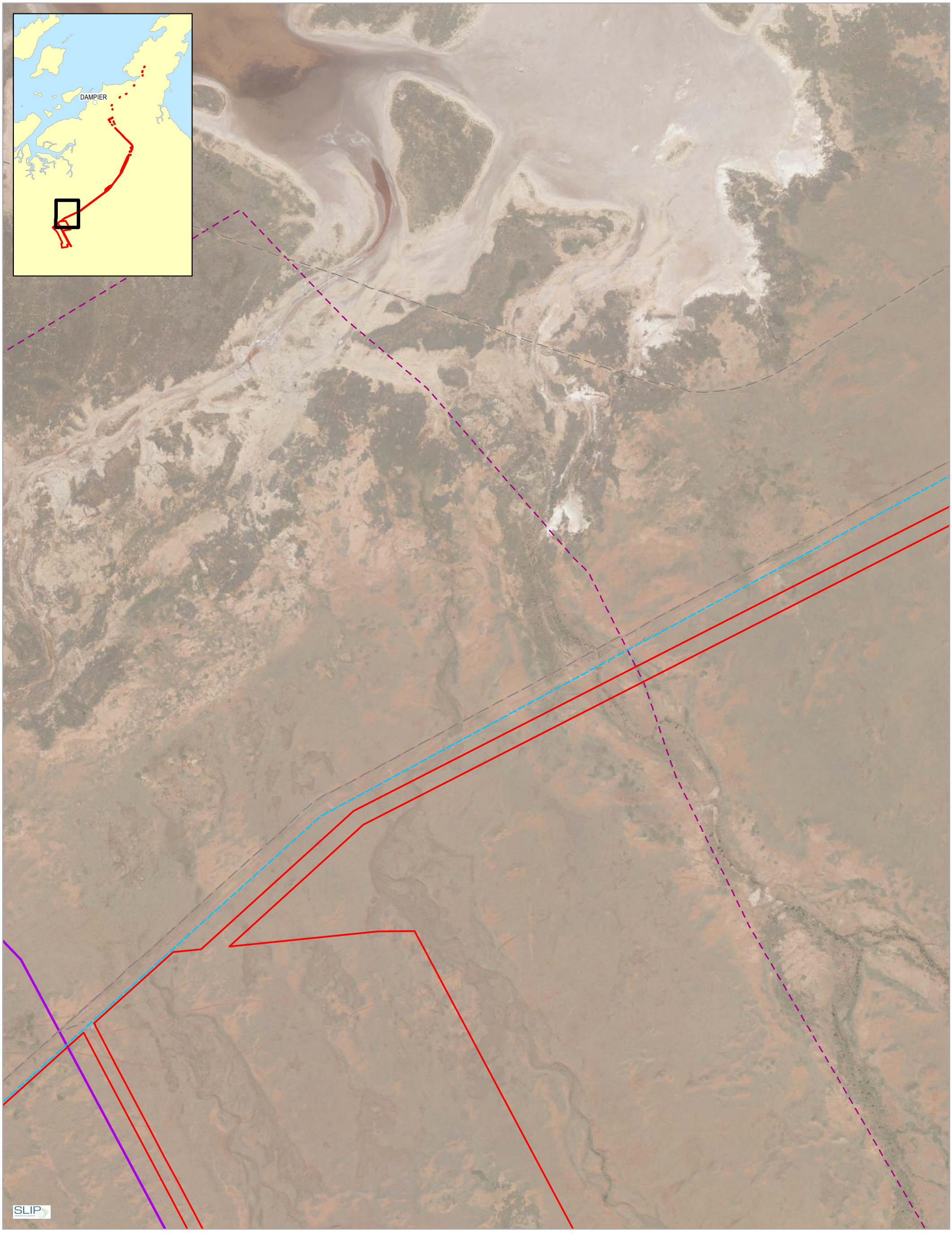

LEGEND

- Track
- Dampier to Bunbury Natural Gas Pipeline
- MSIA Buffer Area
- Maitland Strategic Industrial Area
- Application Area

Paper Size ISO A3

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Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Revision No. **0**
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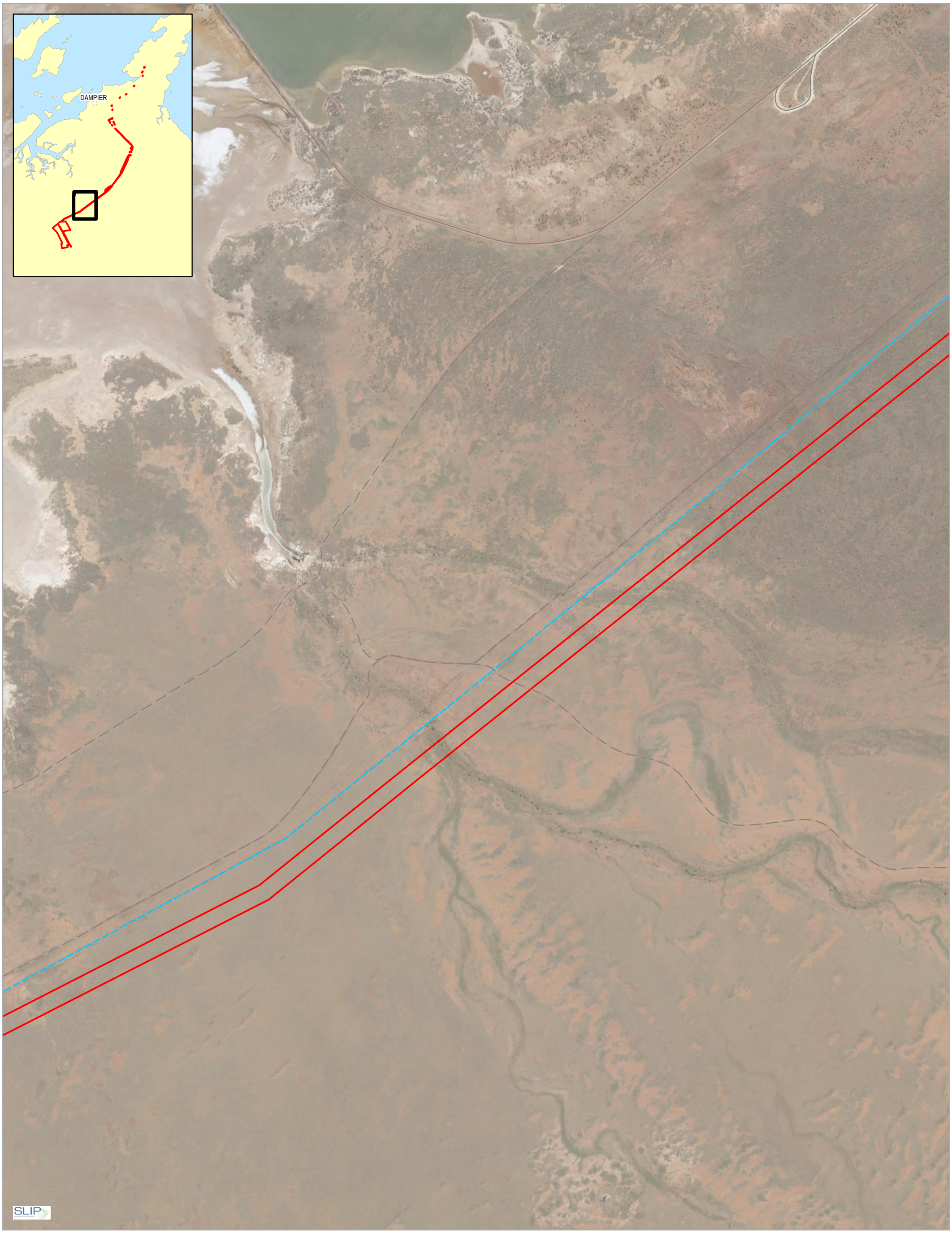

LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Woodside Energy Ltd
Geotechnical Investigation

Clearing Permit Application Area

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

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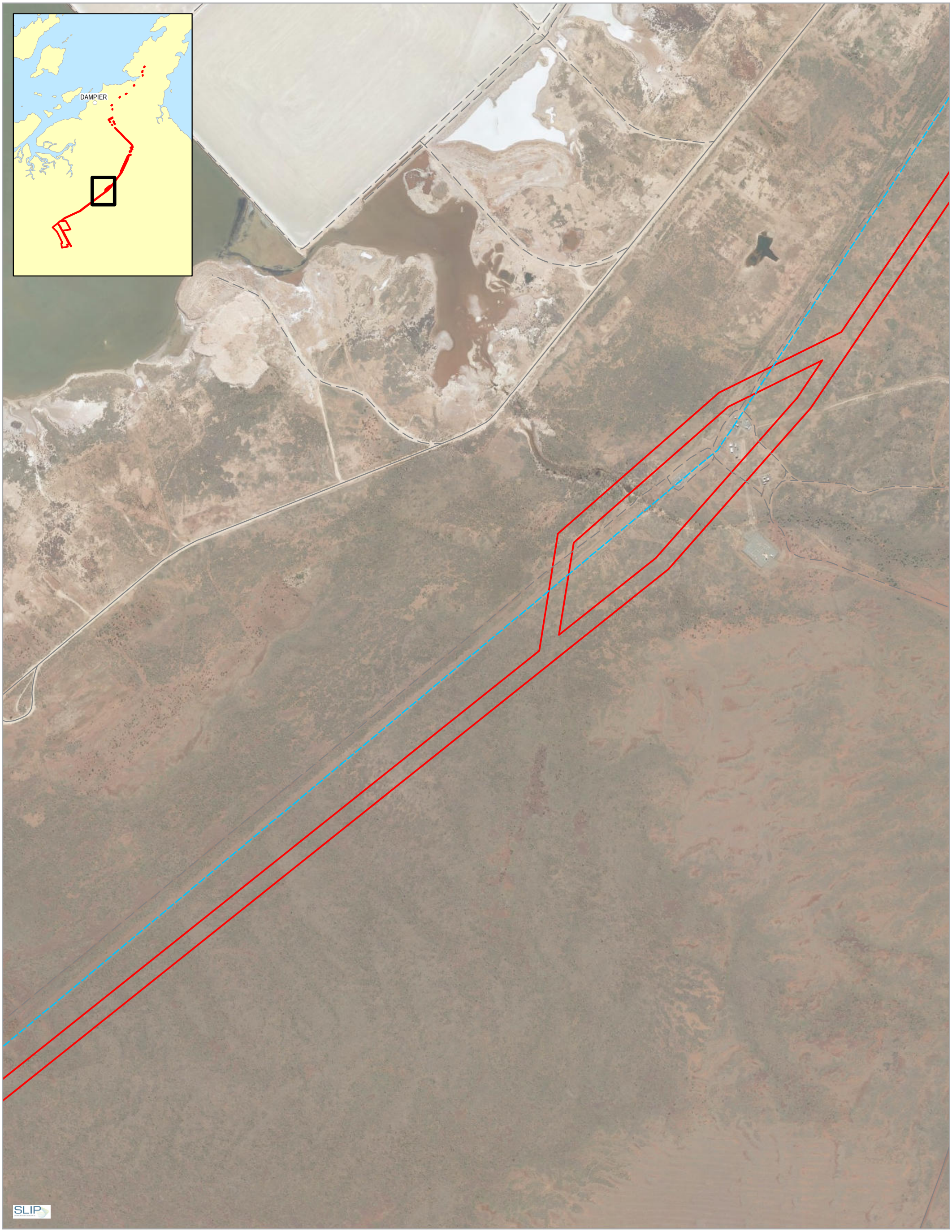

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- Track
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- Application Area

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
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Clearing Permit Application Area

Project No. **61-37808**
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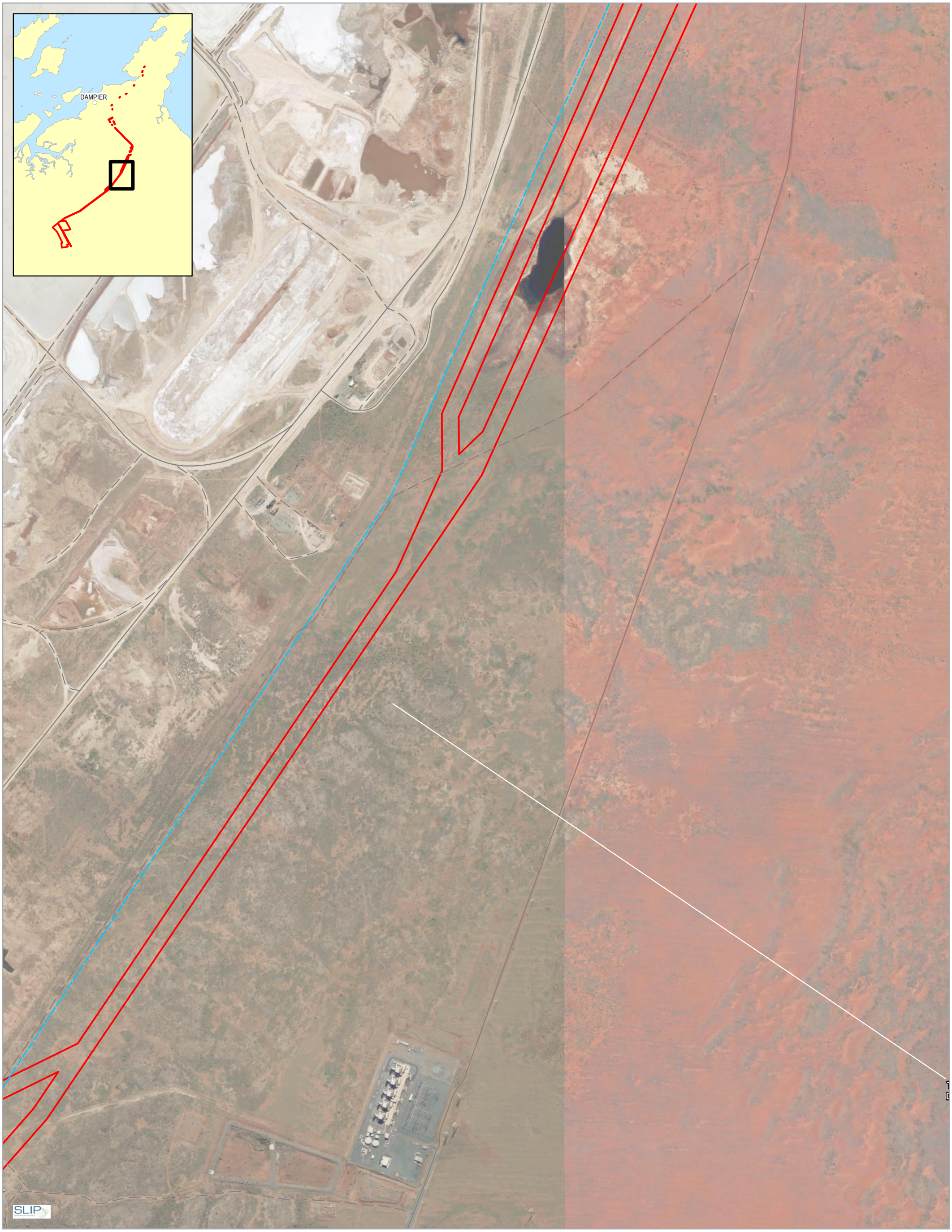

LEGEND

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- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

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Metres

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Grid: GDA 1994 MGA Zone 50

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Woodside Energy Ltd
Geotechnical Investigation

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LEGEND

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- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Paper Size ISO A3

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Metres

N

Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 50

Woodside Energy Ltd
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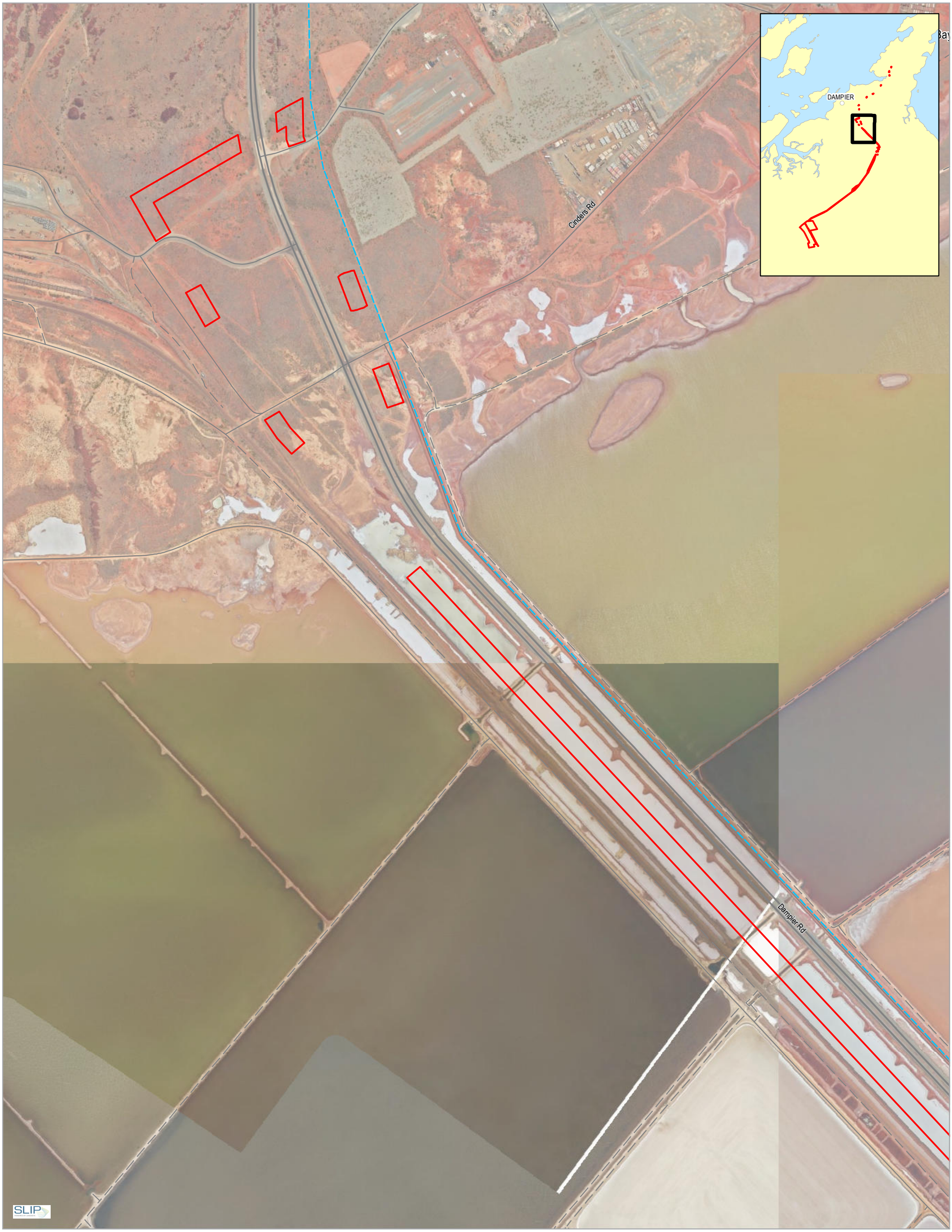

LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Paper Size ISO A3

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Metres

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Clearing Permit Application Area

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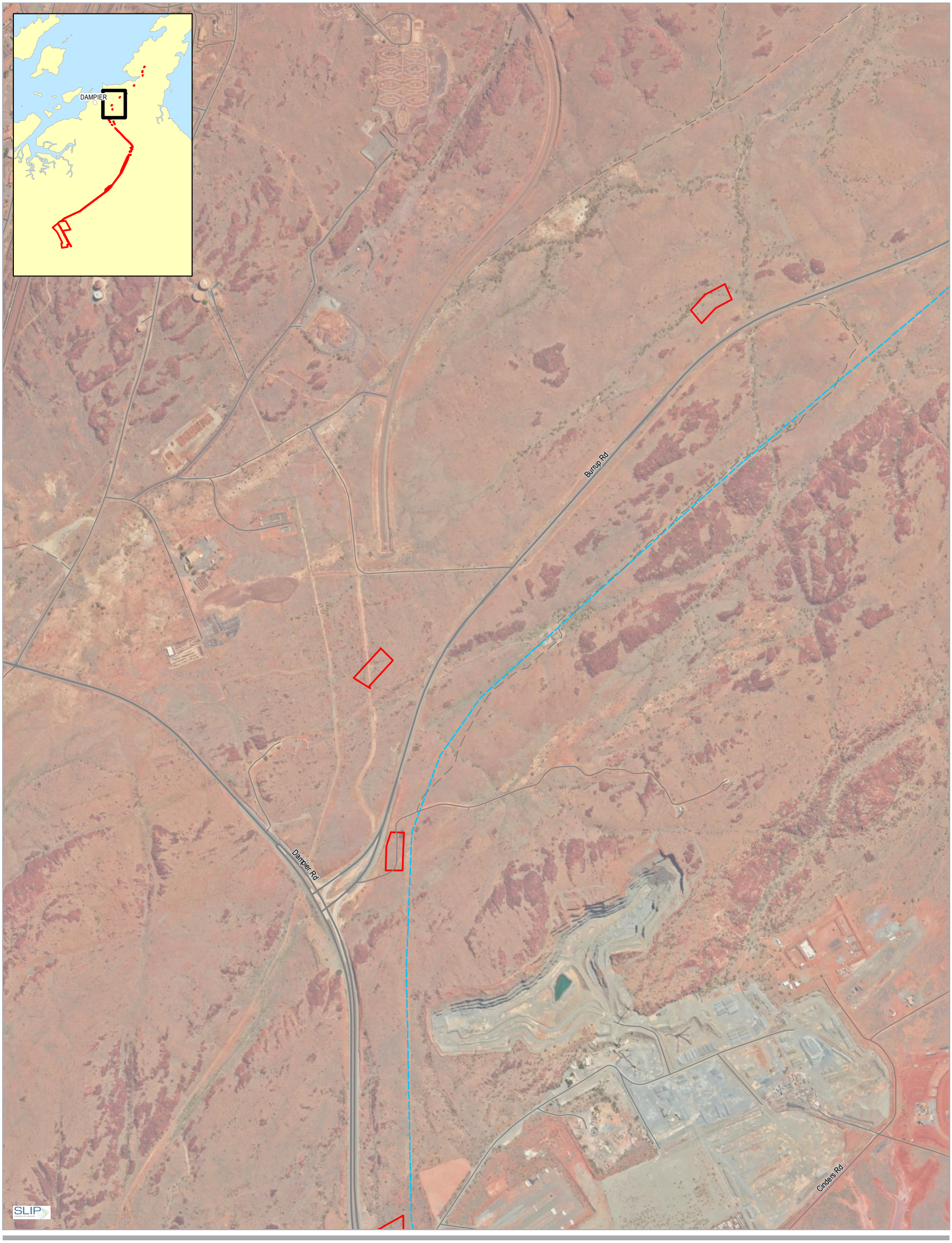

LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Paper Size ISO A3

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Metres

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Grid: GDA 1994 MGA Zone 50

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Clearing Permit Application Area

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LEGEND

- Major Road
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- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Woodside Energy Ltd
Geotechnical Investigation

Clearing Permit Application Area

Project No. **61-37808**
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LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 50

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Geotechnical Investigation

Clearing Permit Application Area

Project No. **61-37808**
Revision No. **0**
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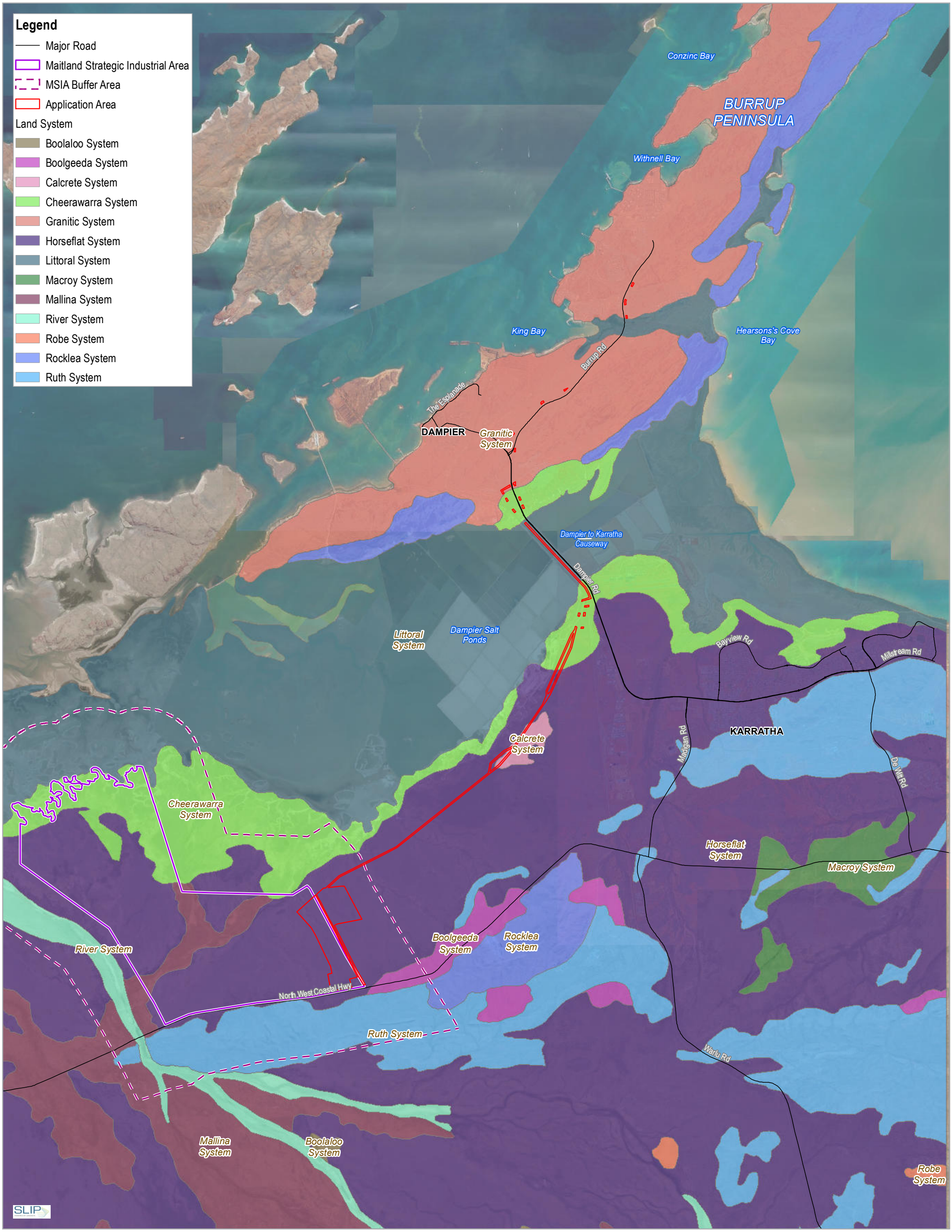

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Land Systems

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 2

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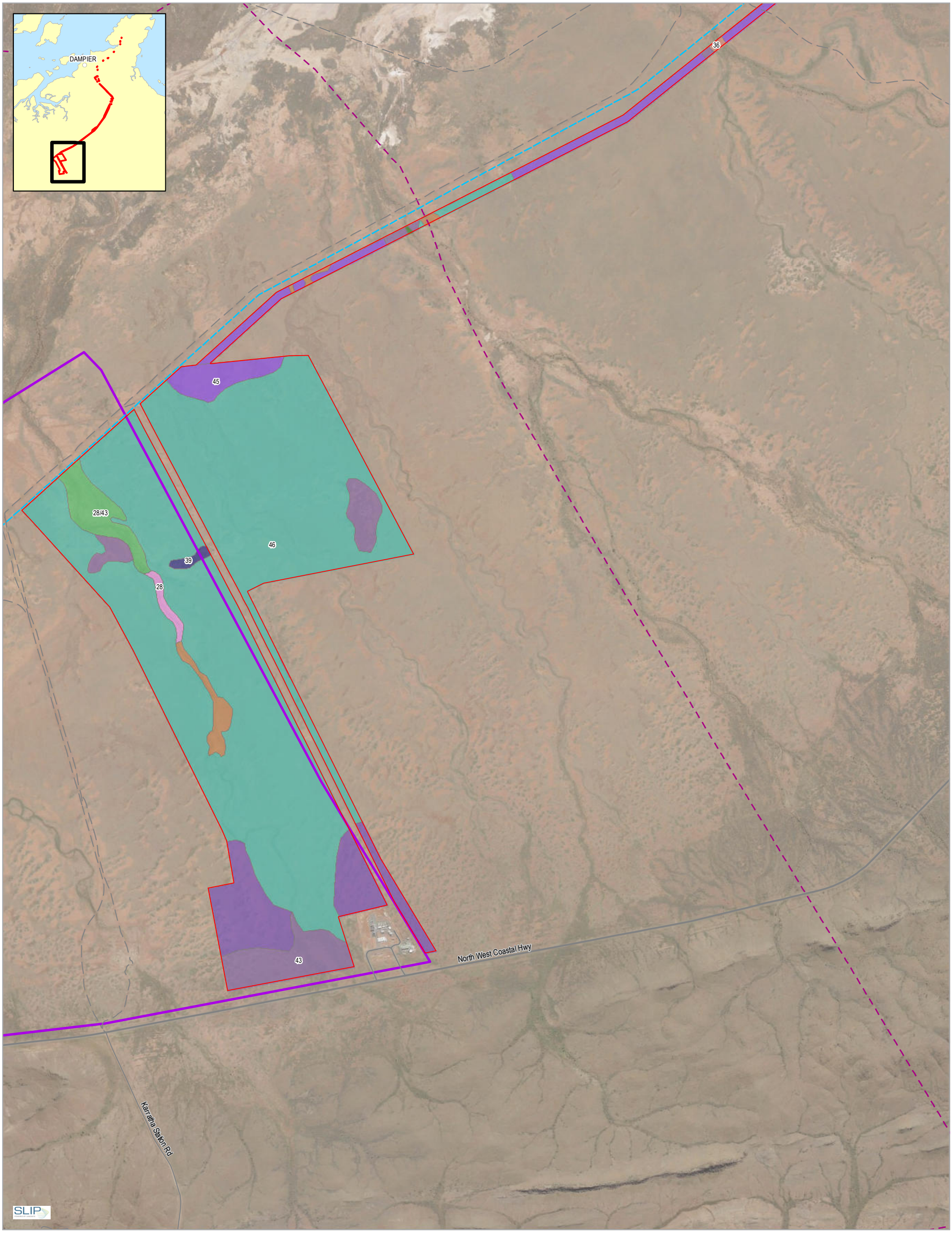

LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- MSIA Buffer Area
- Maitland Strategic Industrial Area (MSIA)
- Application Area

Vegetation Type

- VT28/43
- VT28 - AiAc?Eb
- VT30 - AiAcTw
- VT35 - AcAi
- VT36 - Ac?Tt
- VT39 - ShEx
- VT43 - Tw
- VT44 - Eb?Cf
- VT45 - Ex spp
- VT46 - Ex
- VT48 - AbTw

Paper Size ISO A3

0 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Geotechnical Investigation

Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

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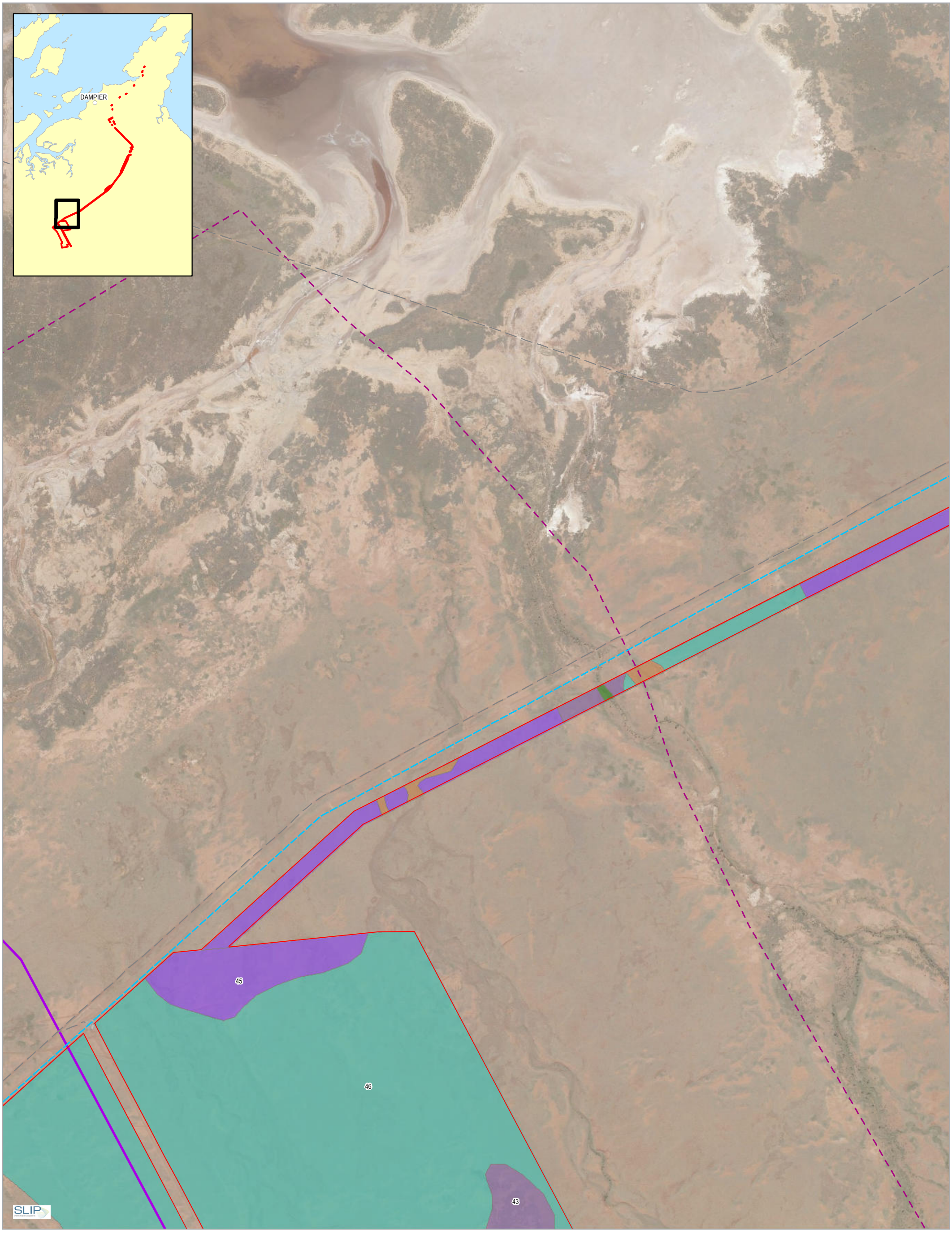

LEGEND

- Track
- Dampier to Bunbury Natural Gas Pipeline
- MSIA Buffer Area
- Maitland Strategic Industrial Area
- Application Area

Vegetation Type

- VT35 - AcAi
- VT43 - Tw
- VT44 - Eb?Cf
- VT45 - Ex spp
- VT46 - Ex

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

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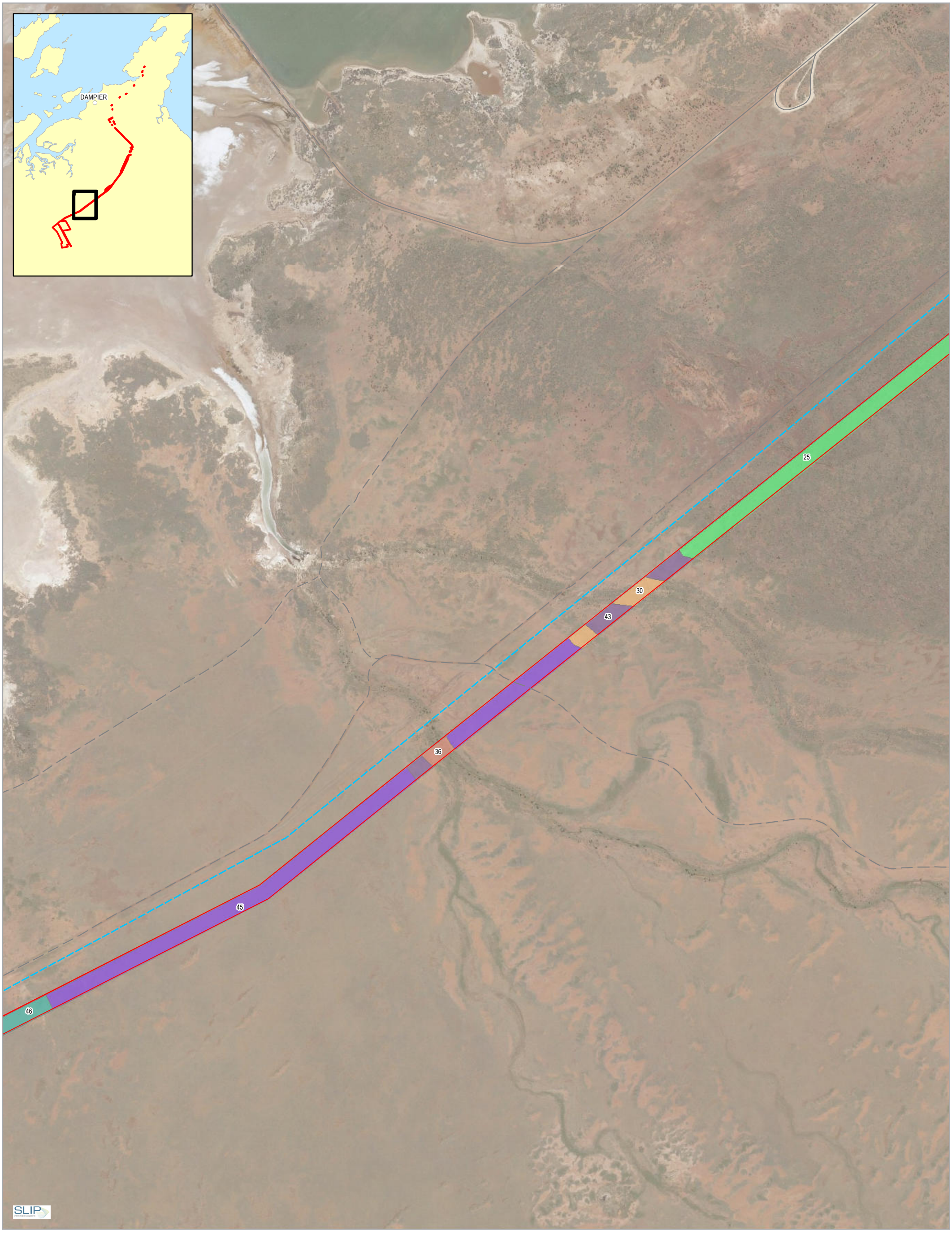

LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Type

- VT25 - AbTw
- VT30 - AiAcTw
- VT36 - Ac?Tt
- VT43 - Tw
- VT45 - Ex spp
- VT46 - Ex

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

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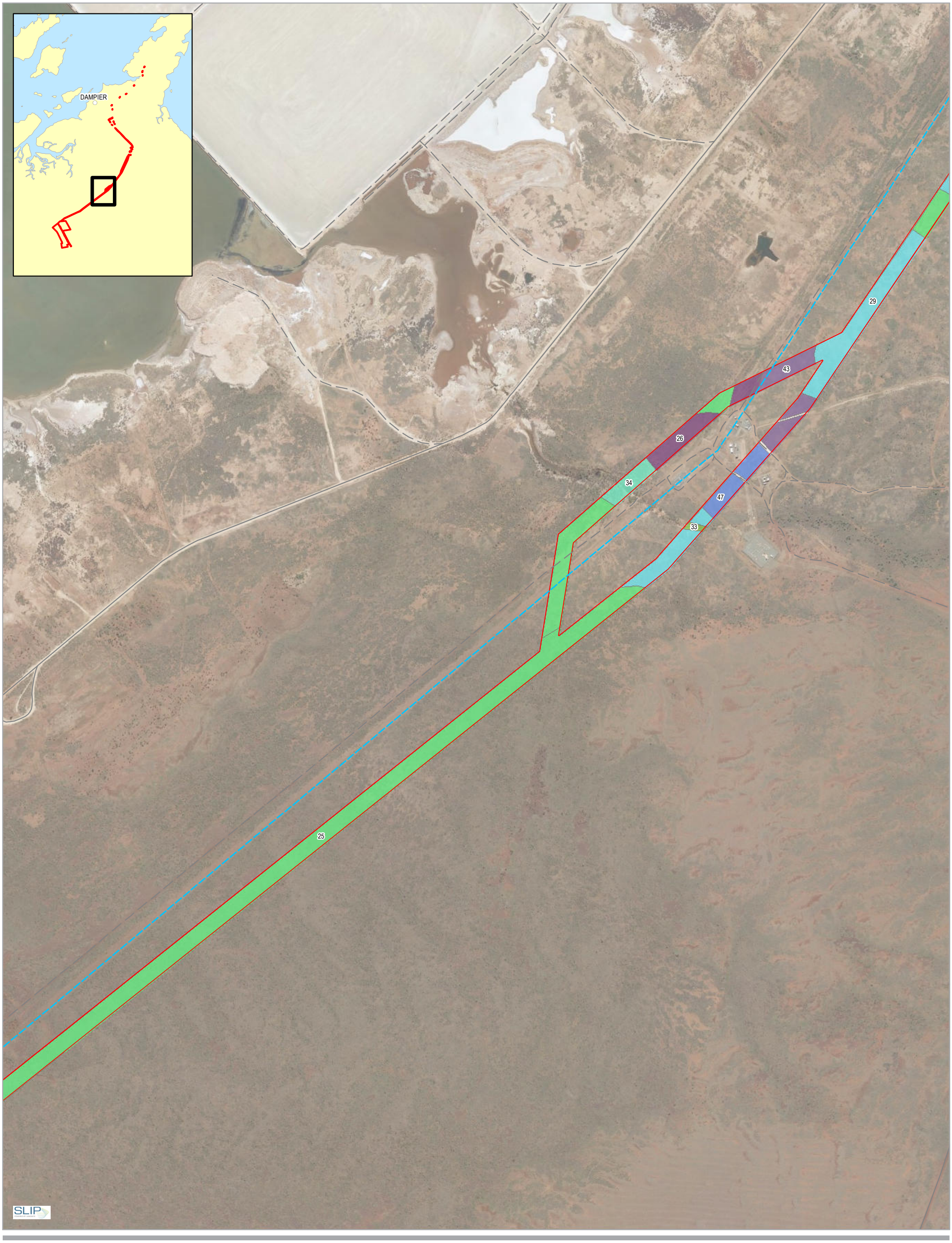
Print date: 23 Jan 2020 - 09:11

Data source: GHD: Application area - 20191217, Vegetation types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Type

- VT25 - AbTw
- VT26 - AbCc
- VT29 - AiTw
- VT33 - AcCc
- VT34 - AaAcC?v
- VT43 - Tw
- VT47 - Cc
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

Woodside Energy Ltd
Geotechnical Investigation

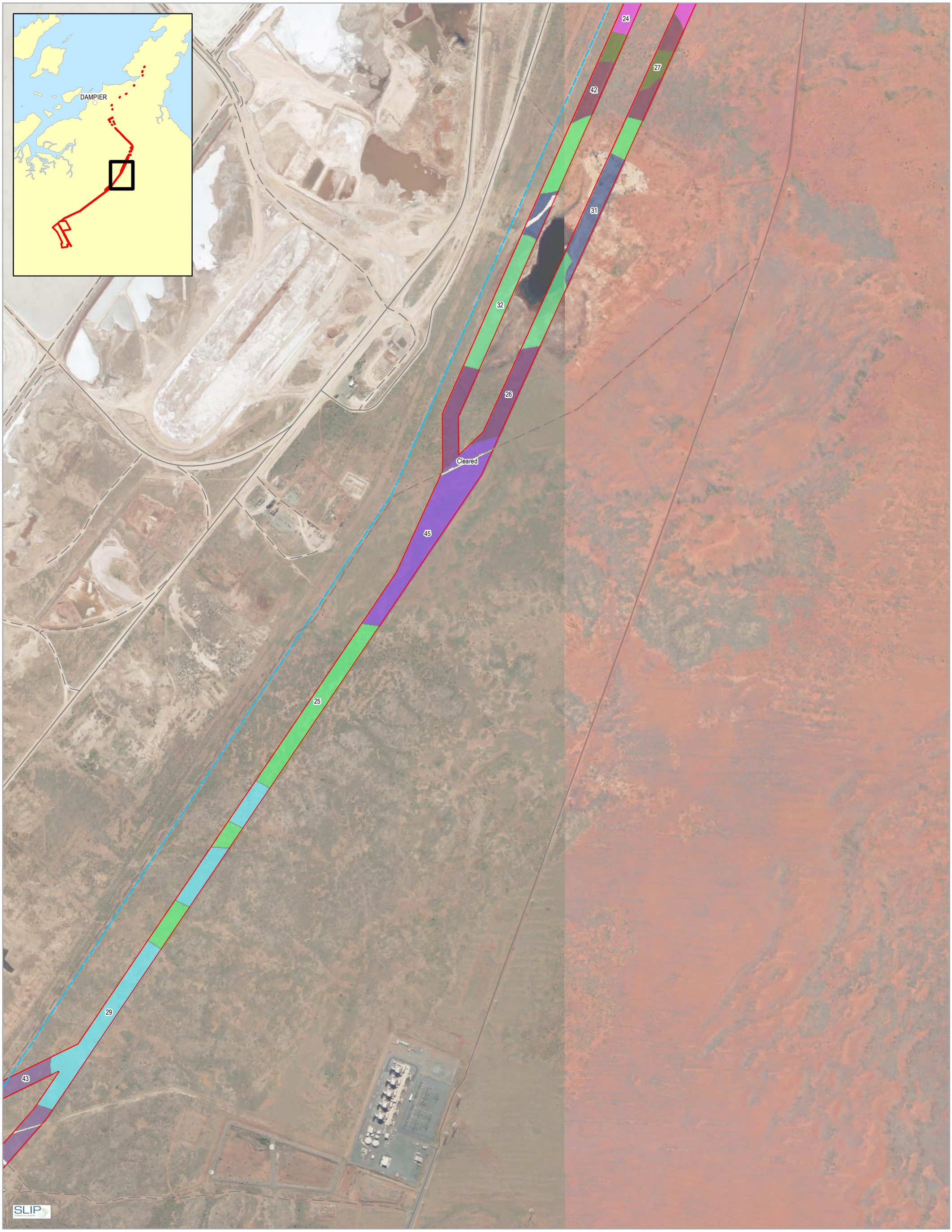
Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_003_VegetationTypes_Rev0.mxd
Print date: 23 Jan 2020 - 09:11

Data source: GHD: Application area - 20191217, Vegetation types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Type

- VT24 - AbTeEx
- VT25 - AbTw
- VT26 - AbCc
- VT27 - AiTe
- VT29 - AiTw
- VT31 - TaTCc
- VT32 - T supp
- VT42 - Te
- VT43 - Tw
- VT45 - Ex spp
- VT47 - Cc
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

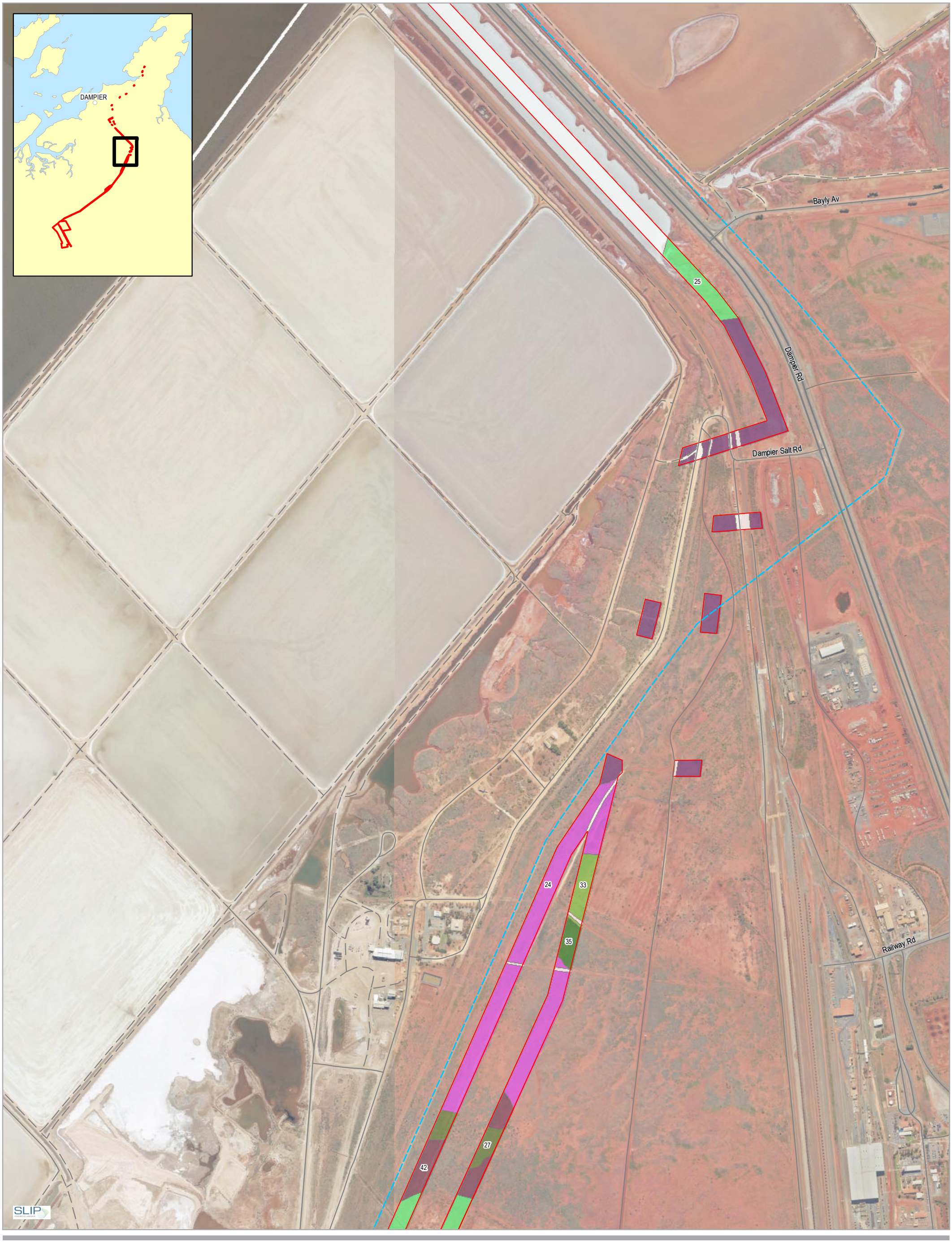
Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\61137808_003_VegetationTypes_Rev0.mxd
Print date: 23 Jan 2020 - 09:11

Data source: GHD: Application area - 20191217, Vegetation types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Type

- VT24 - AbTeEx
- VT25 - AbTw
- VT26 - AbCc
- VT27 - AiTe
- VT31 - TaTCc
- VT33 - AcCc
- VT35 - AcAi
- VT42 - Te
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Woodside Energy Ltd
Geotechnical Investigation

Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\61378 08_003_VegetationTypes_Rev0.mxd
Print date: 23 Jan 2020 - 09:11

Data source: GHD: Application area - 20191217, Vegetation types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa

LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Type

- VT01 - AbCc
- VT02 - AbTe
- VT05 - AbAsTe
- VT10 - GpAiTe
- VT15 - ChAbTe
- VT21 - Ta
- VT23 - Tspp
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

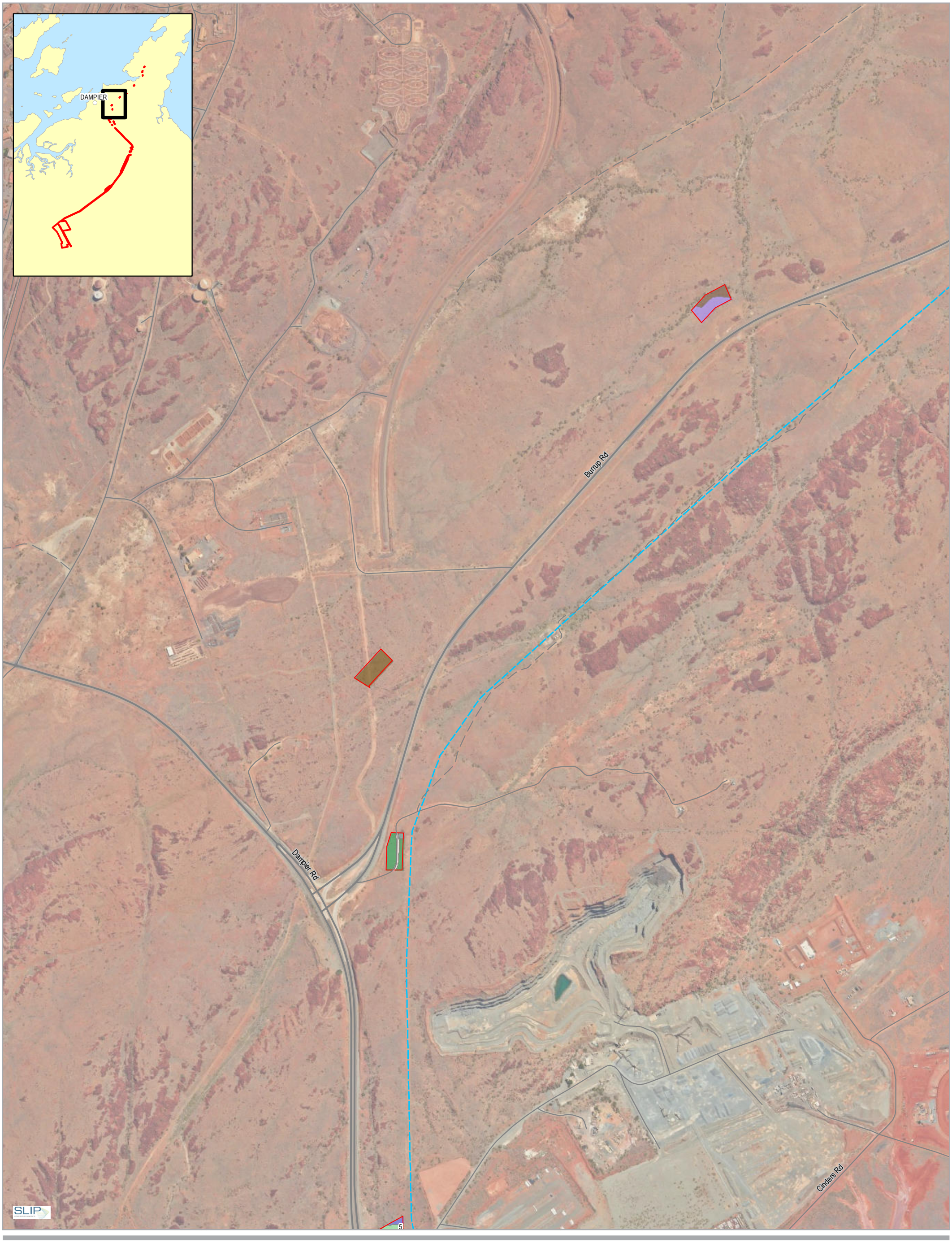
Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_003_VegetationTypes_Rev0.mxd
Print date: 23 Jan 2020 - 09:11

Data source: GHD: Application area - 20191217, Vegetation types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Type

- VT01 - AbCc
- VT05 - AbAsTe
- VT07 - GpTeBaTs
- VT07/19
- VT10 - GpAiTe
- VT11 - DsAiTe
- VT15 - ChAbTe
- VT17 - BaDs
- VT18 - BaEsErv
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Woodside Energy Ltd
Geotechnical Investigation

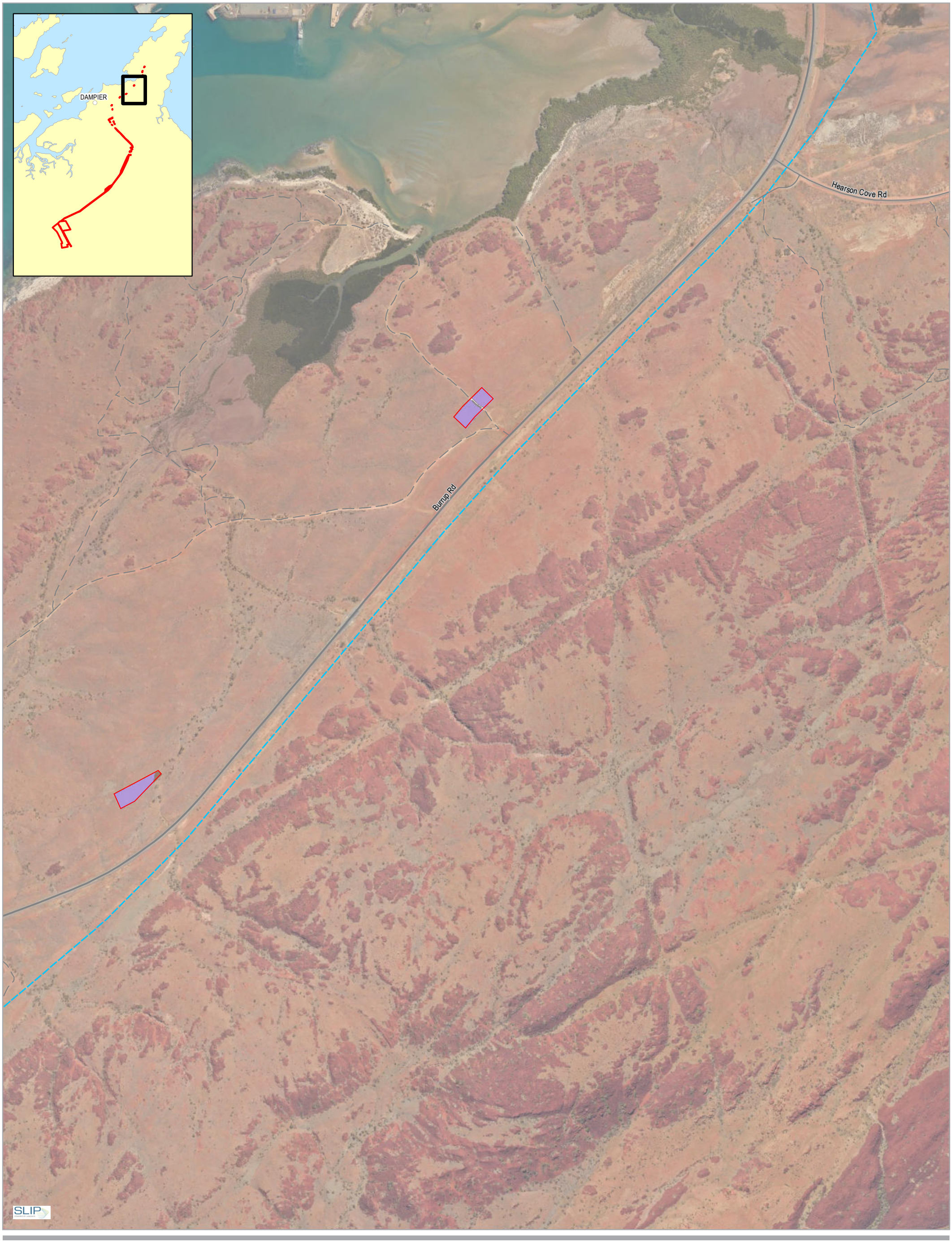
Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\61137808_003_VegetationTypes_Rev0.mxd
Print date: 23 Jan 2020 - 09:11

Data source: GHD: Application area - 20191217, Vegetation types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Type

- VT07 - GpTeBaTs
- VT11 - DsAiTe
- VT23 - Tspp
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

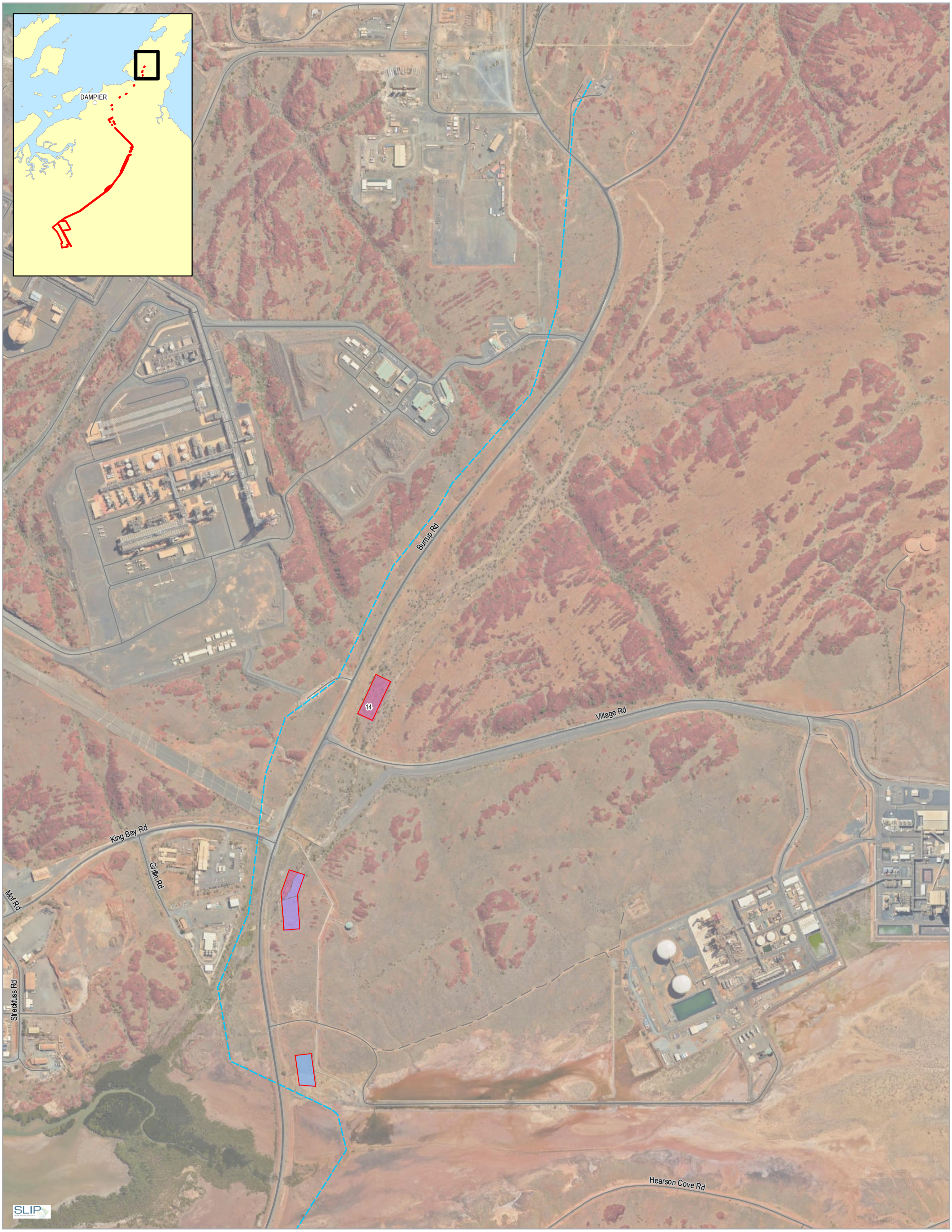
Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_003_VegetationTypes_Rev0.mxd
Print date: 23 Jan 2020 - 09:11

Data source: GHD: Application area - 20191217, Vegetation types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Type

- VT07 - GpTeBaTs
- VT14 - EvAbTa
- VT23 - Tspp

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

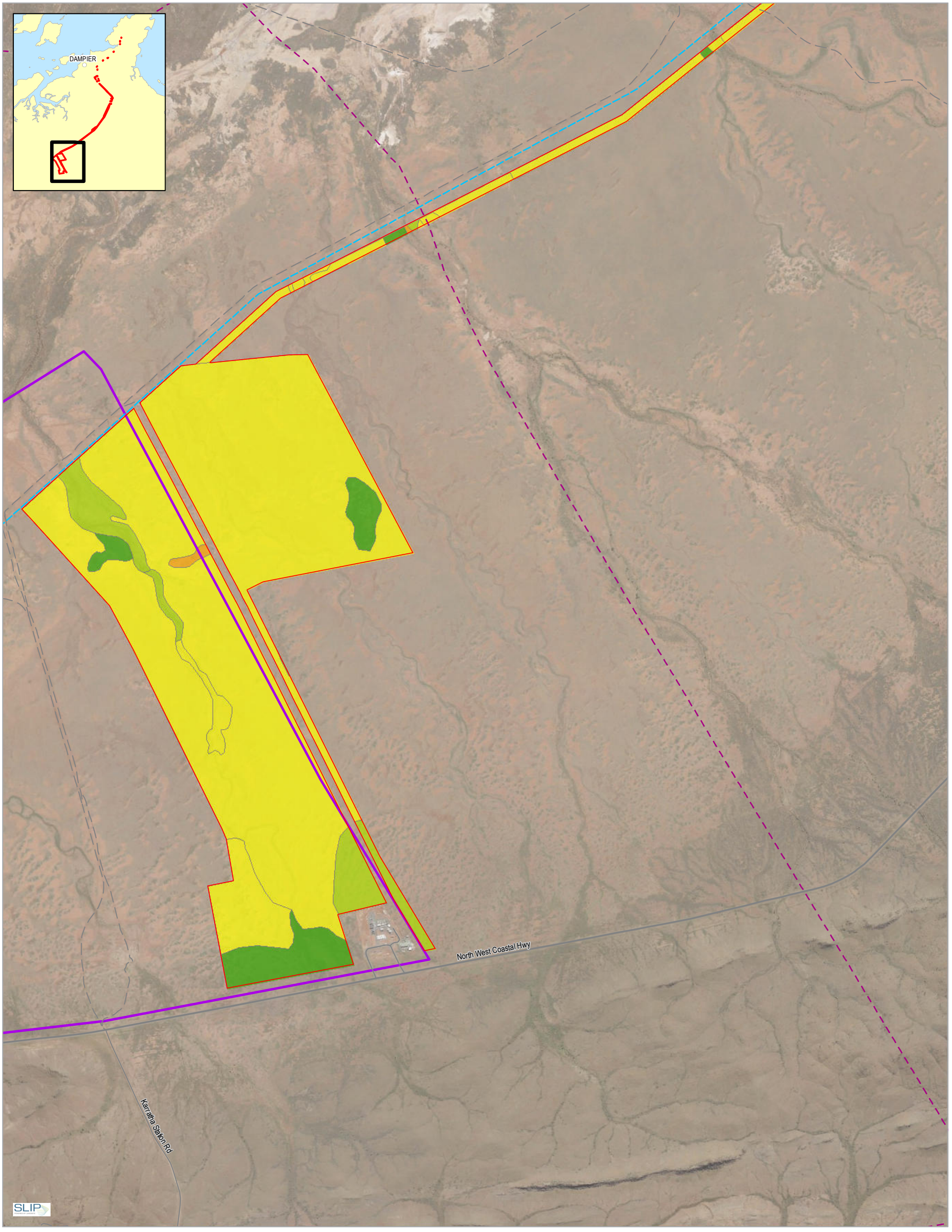
Vegetation Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 3

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_003_VegetationTypes_Rev0.mxd
Print date: 23 Jan 2020 - 09:11

Data source: GHD: Application area - 20191217, Vegetation types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- MSIA Buffer Area
- Maitland Strategic Industrial Area
- Application Area

Vegetation Condition

- Excellent
- Very good
- Good
- Poor

Paper Size ISO A3

0 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

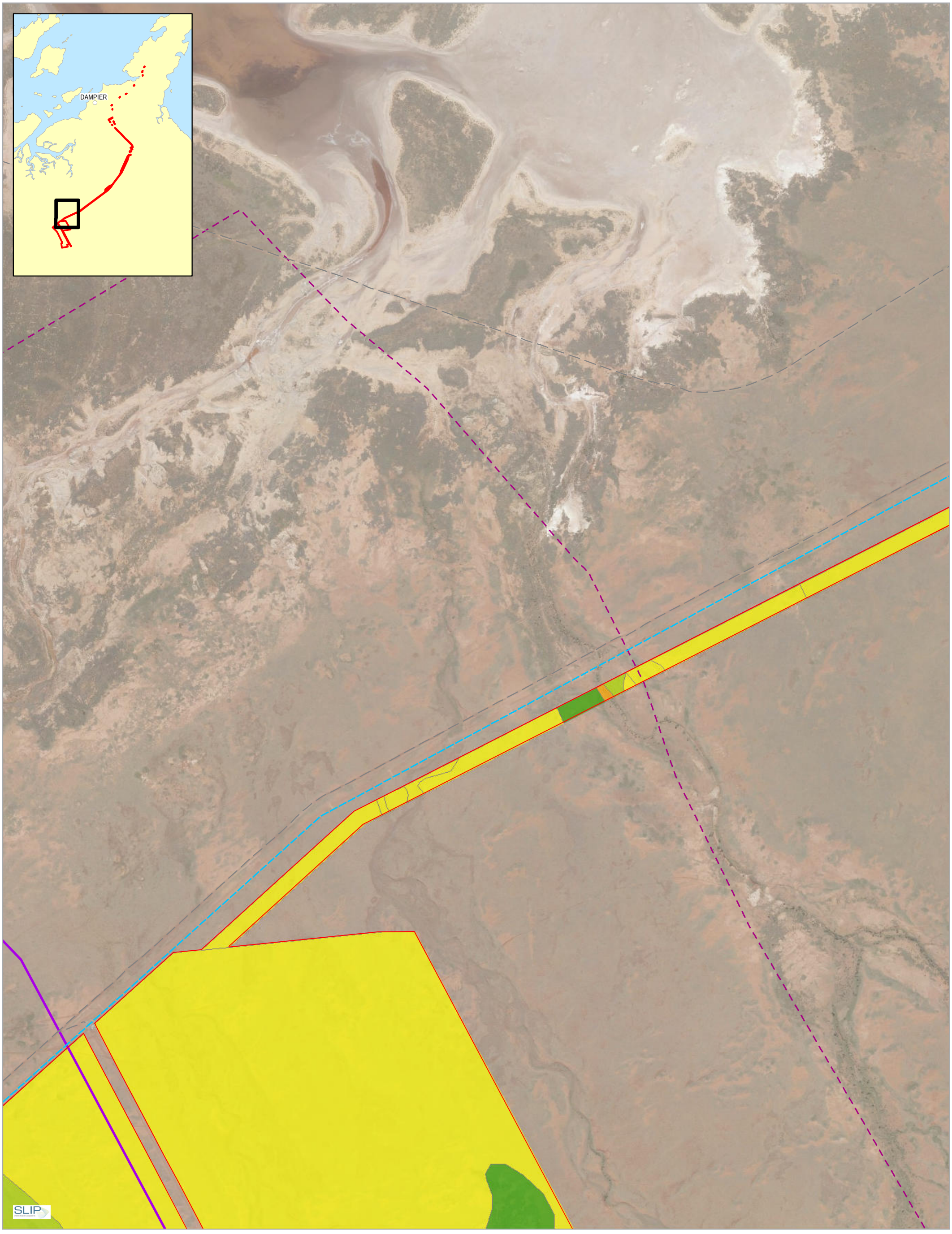
Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Page1_Rev0.mxd
Print date: 23 Jan 2020 - 09:18

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703); GA: Dampier to Bunbury natural gas pipeline; DPLH: MSIA boundary. Created by: cgverzosa



LEGEND

- Track
- Dampier to Bunbury Natural Gas Pipeline
- MSIA Buffer Area
- Maitland Strategic Industrial Area
- Application Area

Vegetation Condition

- Excellent
- Very good
- Good
- Poor

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

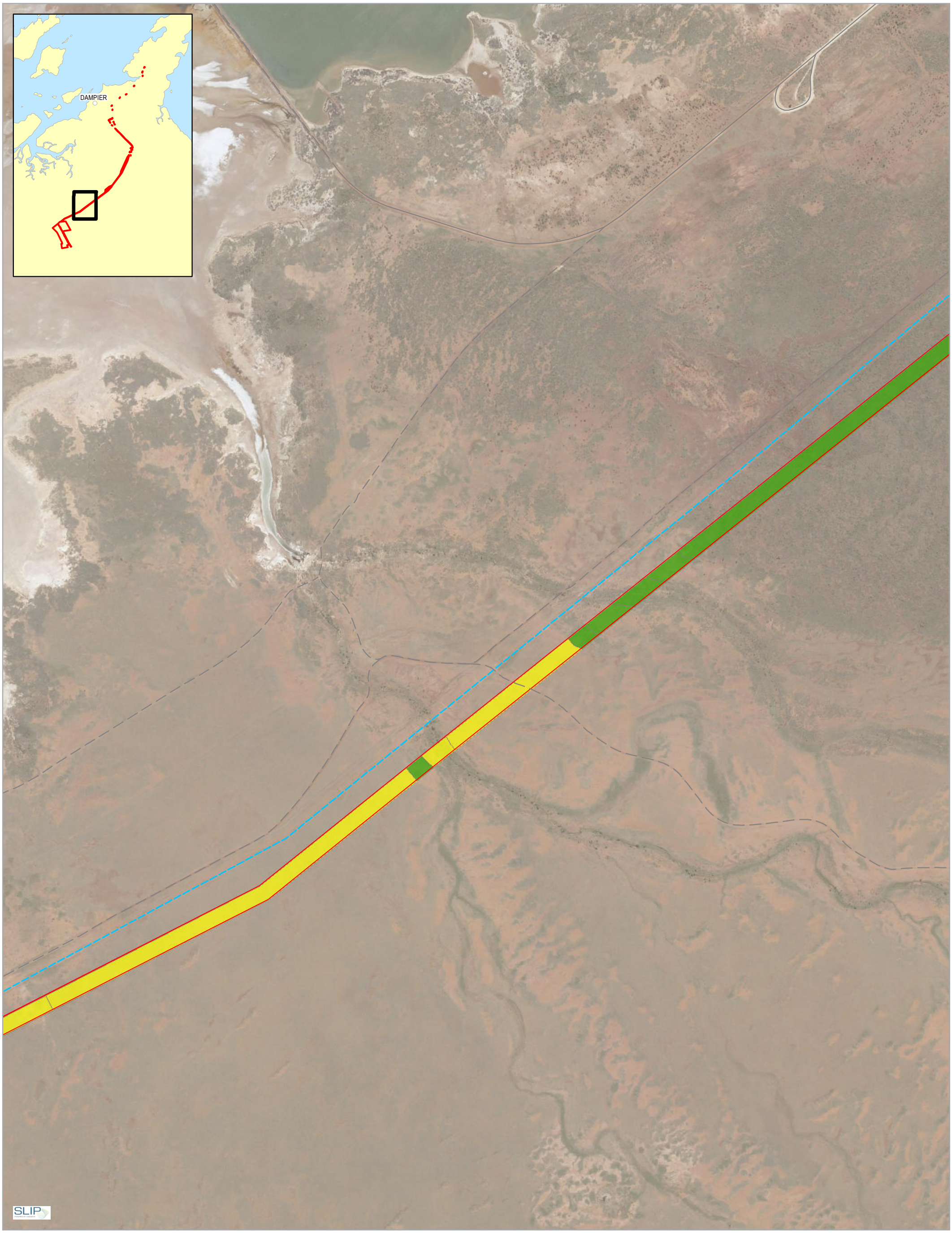
Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Rev0.mxd
Print date: 23 Jan 2020 - 09:21

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Condition

- Excellent
- Good

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Rev0.mxd
Print date: 23 Jan 2020 - 09:21

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa

LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Condition

- Excellent
- Very good
- Poor
- Degraded
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Woodside Energy Ltd
Geotechnical Investigation

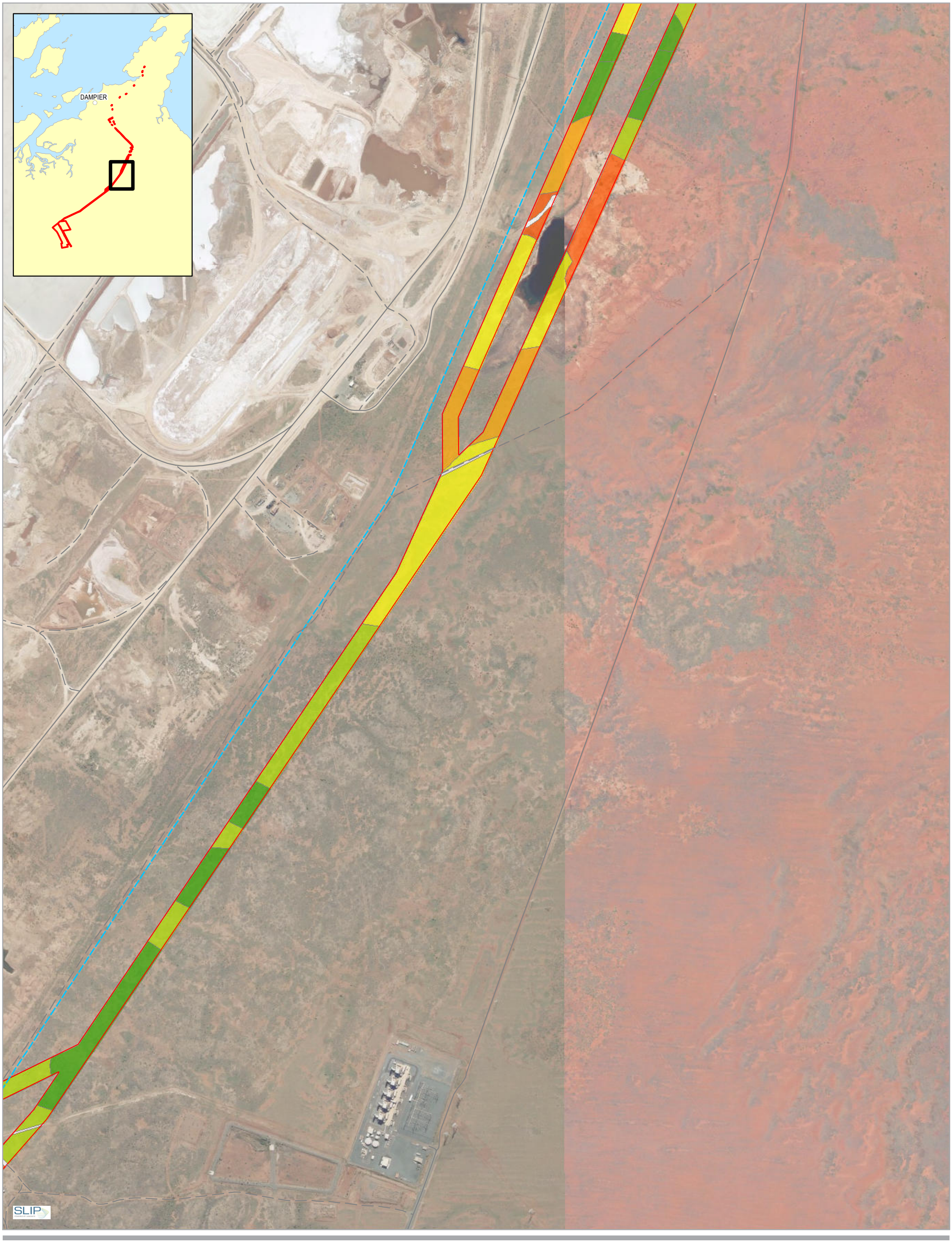
Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Rev0.mxd
Print date: 23 Jan 2020 - 09:21

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Condition
- Excellent
- Very good
- Good
- Poor
- Degraded
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

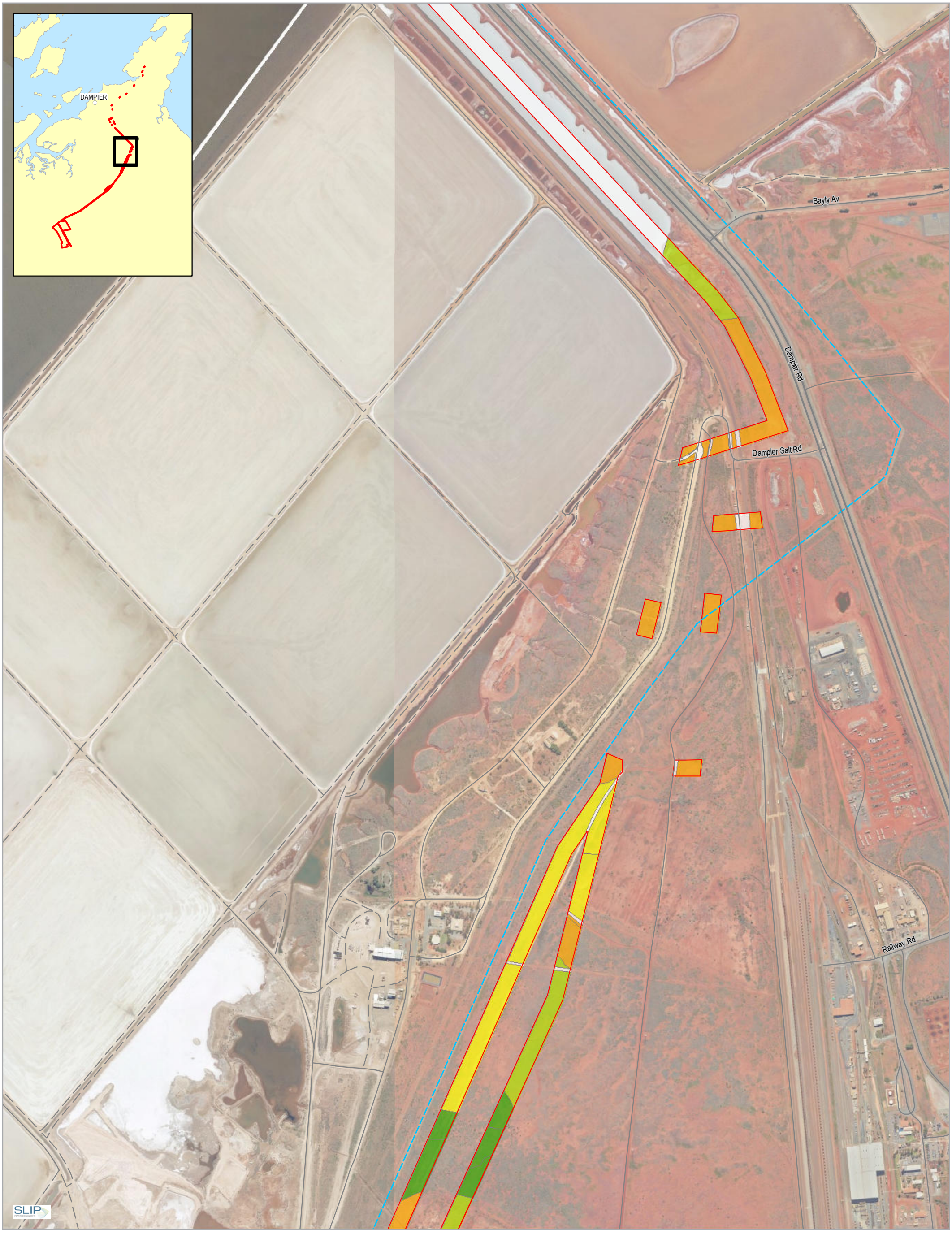
Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Rev0.mxd
Print date: 23 Jan 2020 - 09:22

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Condition

- Excellent
- Very good
- Good
- Poor
- Degraded
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Woodside Energy Ltd
Geotechnical Investigation

Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Rev0.mxd
Print date: 23 Jan 2020 - 09:22

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa

LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Condition

- Excellent
- Very good
- Good
- Poor
- Degraded
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Woodside Energy Ltd
Geotechnical Investigation

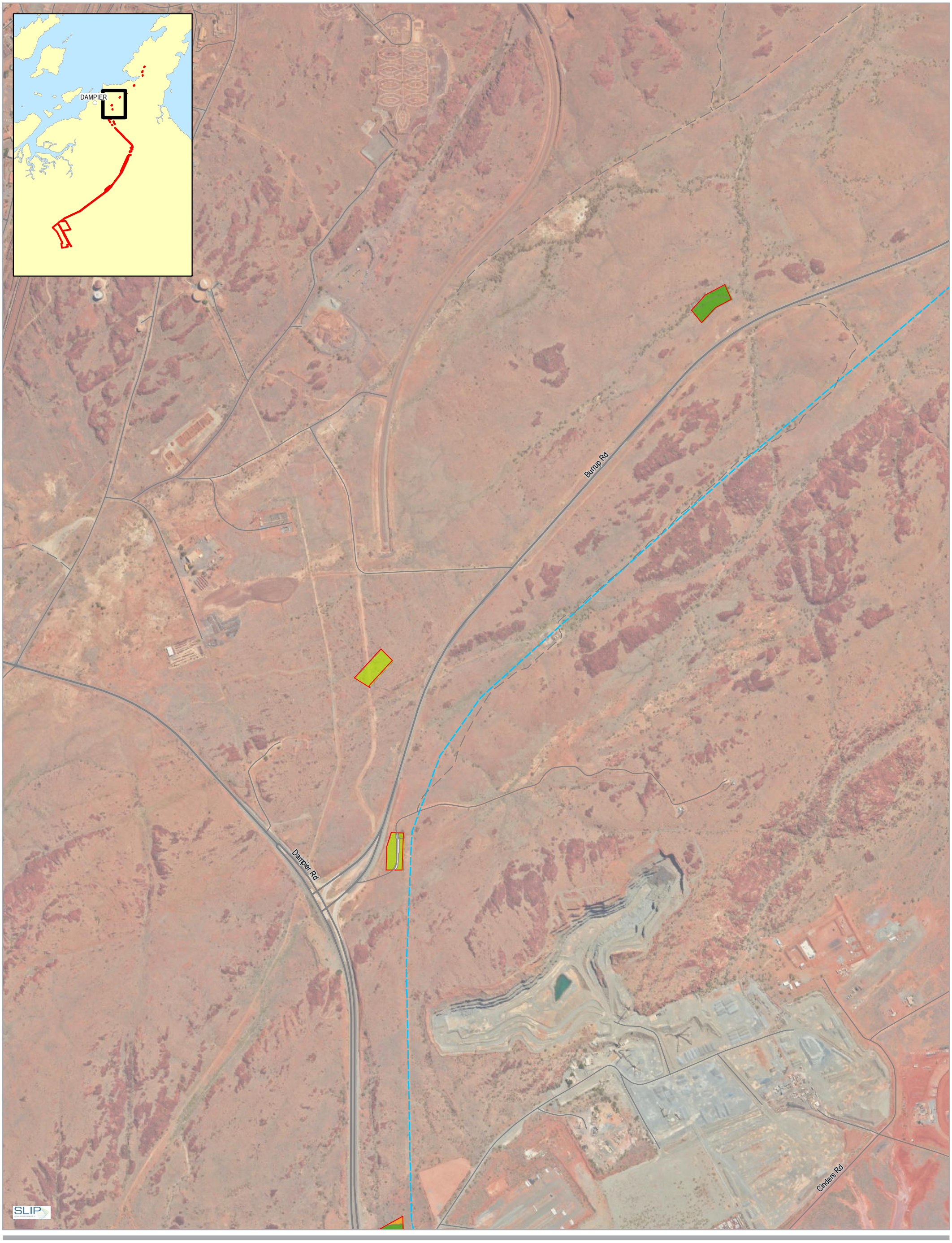
Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Rev0.mxd
Print date: 23 Jan 2020 - 09:20

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Condition

- Excellent
- Very good
- Poor
- Degraded
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Woodside Energy Ltd
Geotechnical Investigation

Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Rev0.mxd
Print date: 23 Jan 2020 - 09:22

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa

LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Condition
- Excellent
- Good
- Cleared

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Woodside Energy Ltd
Geotechnical Investigation

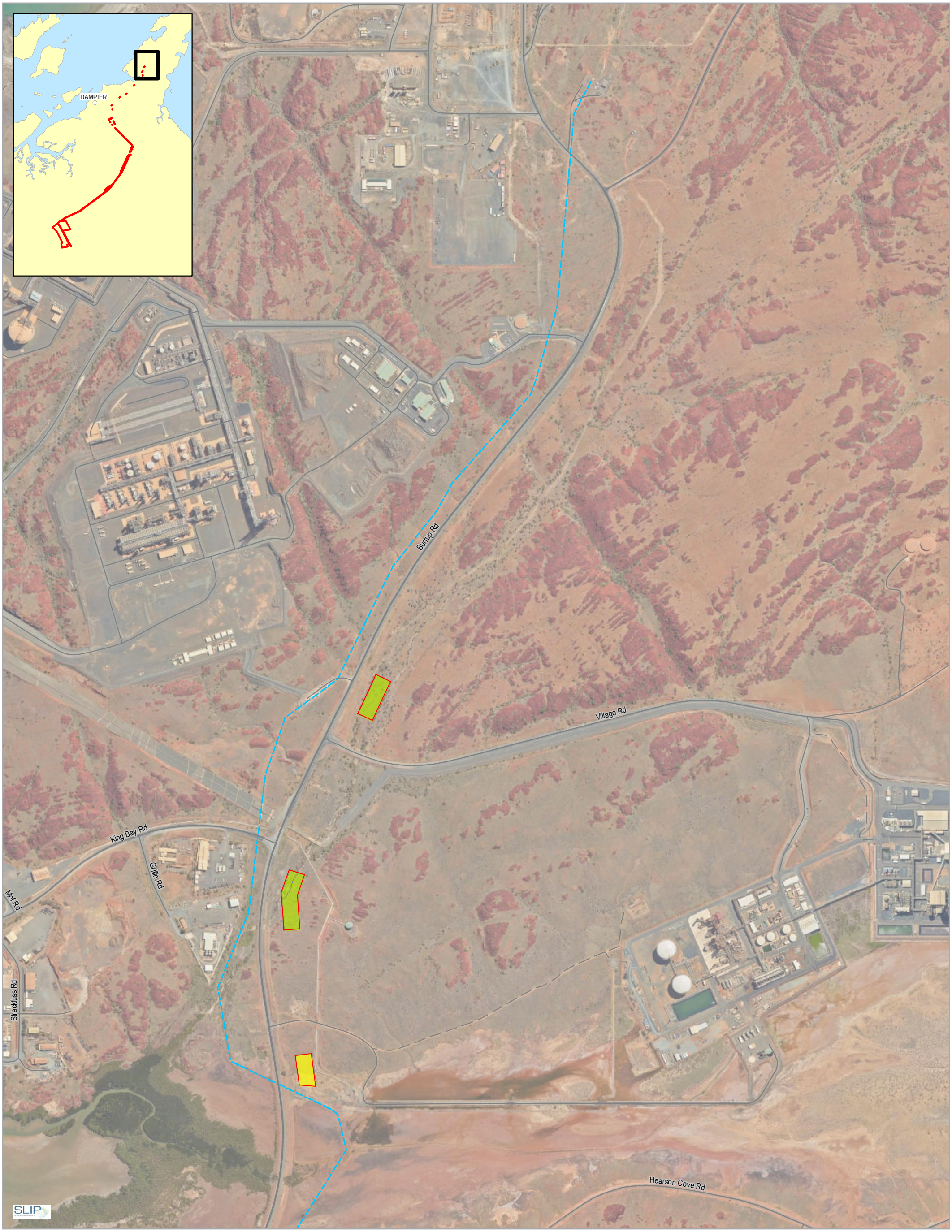
Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Rev0.mxd
Print date: 23 Jan 2020 - 09:22

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Vegetation Condition

- Very good
- Good

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

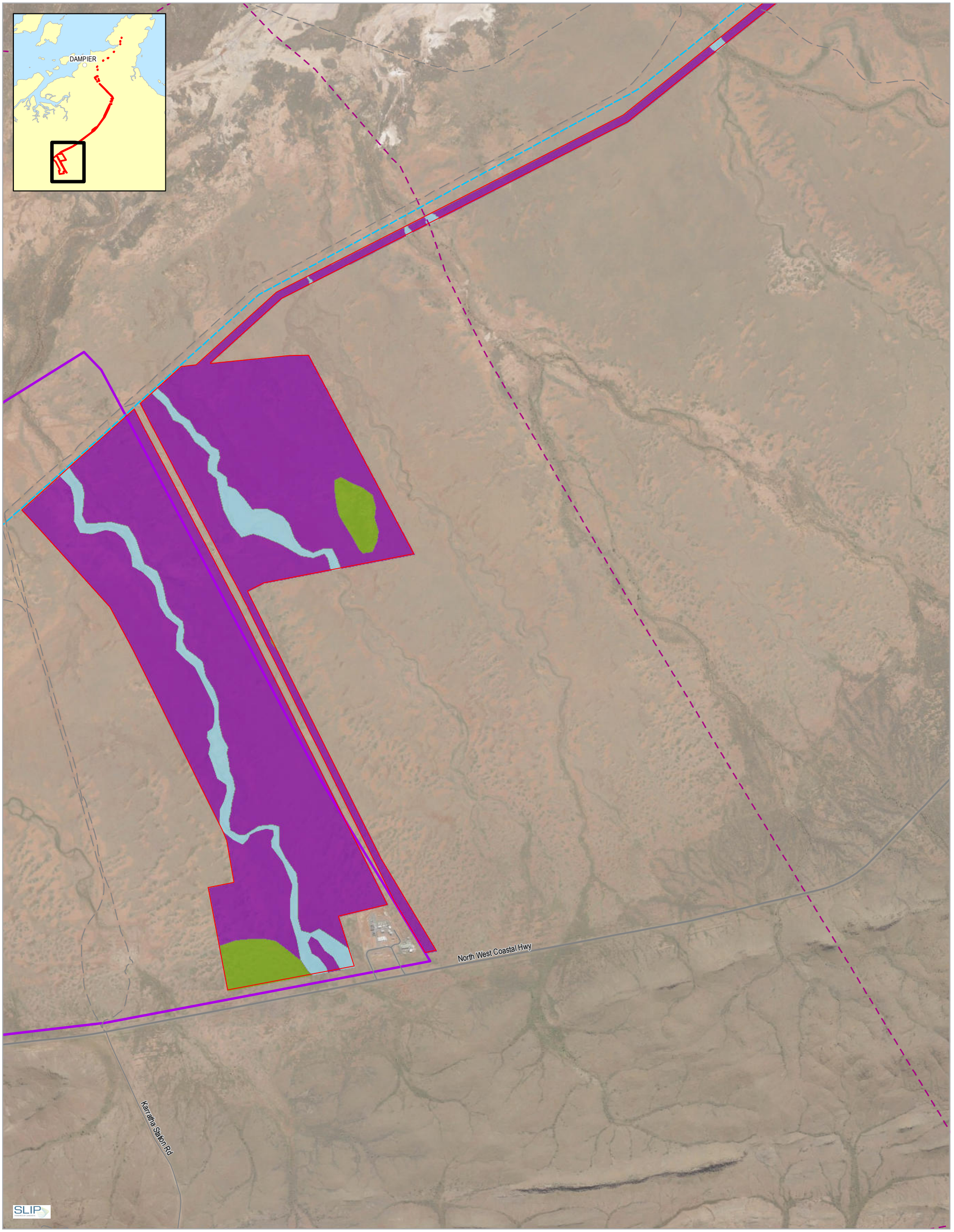
Vegetation Condition

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 4

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_004_VegetationCondition_Rev0.mxd
Print date: 23 Jan 2020 - 09:22

Data source: GHD: Application area - 20200117, Vegetation condition - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- MSIA Buffer Area
- Maitland Strategic Industrial Area (MSIA)
- Application Area

Fauna Habitat

- Minor drainage
- Triodia on stony soils
- Tussock grasslands on cracking clays

Paper Size ISO A3

0 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

Woodside Energy Ltd
Geotechnical Investigation

Fauna Habitat Types

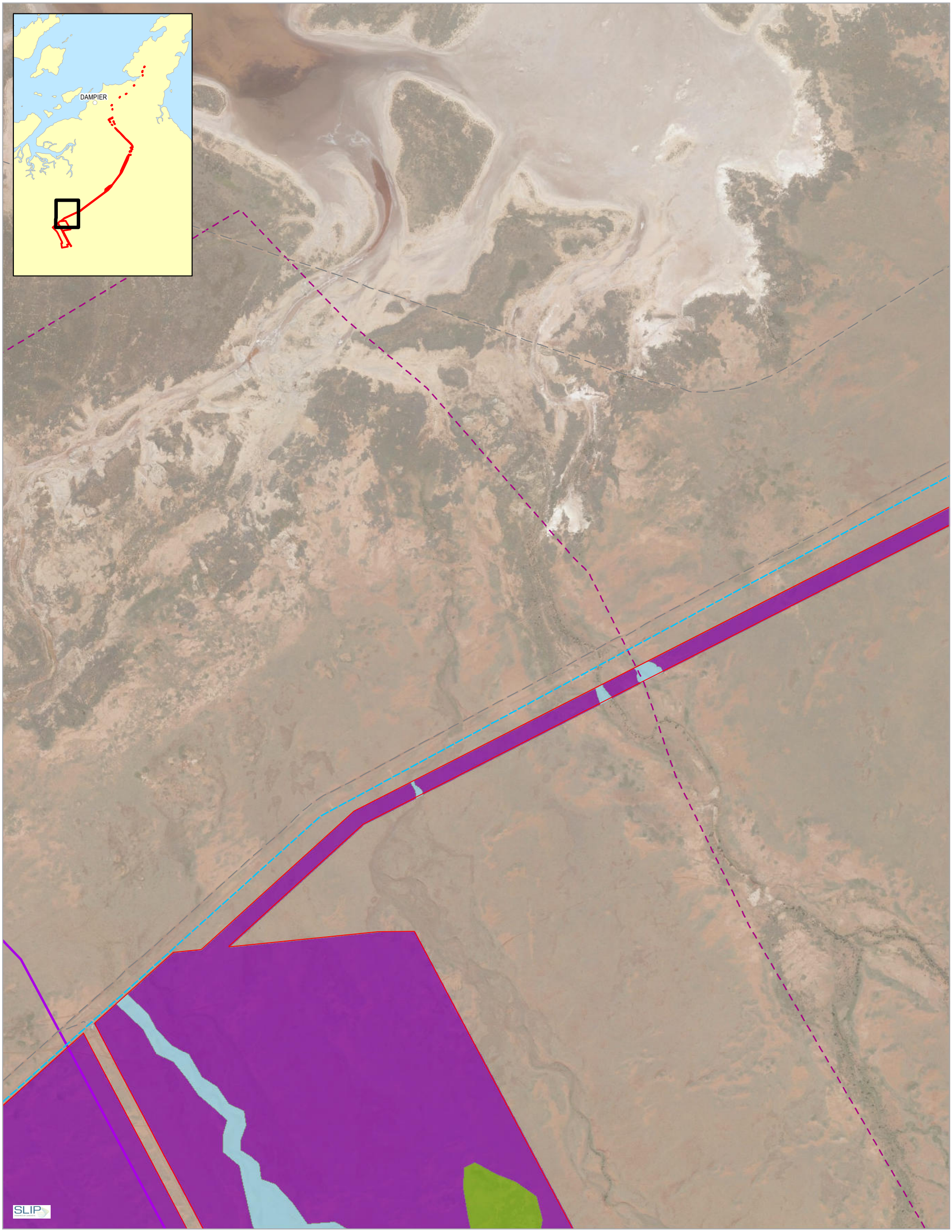
Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

Page 1 of 10

FIGURE 5

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_005_FaunaHabitatTypes_Page1_Rev0.mxd
Print date: 23 Jan 2020 - 09:27

Data source: GHD: Application area - 20200117, Fauna habitat types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703); GA: Dampier to Bunbury natural gas pipeline; DPLH: MSIA boundary. Created by: cgverzosa



LEGEND

- Track
- Dampier to Bunbury Natural Gas Pipeline
- MSIA Buffer Area
- Maitland Strategic Industrial Area
- Application Area

Fauna Habitat

- Minor drainage
- Triodia on stony soils
- Tussock grasslands on cracking clays

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

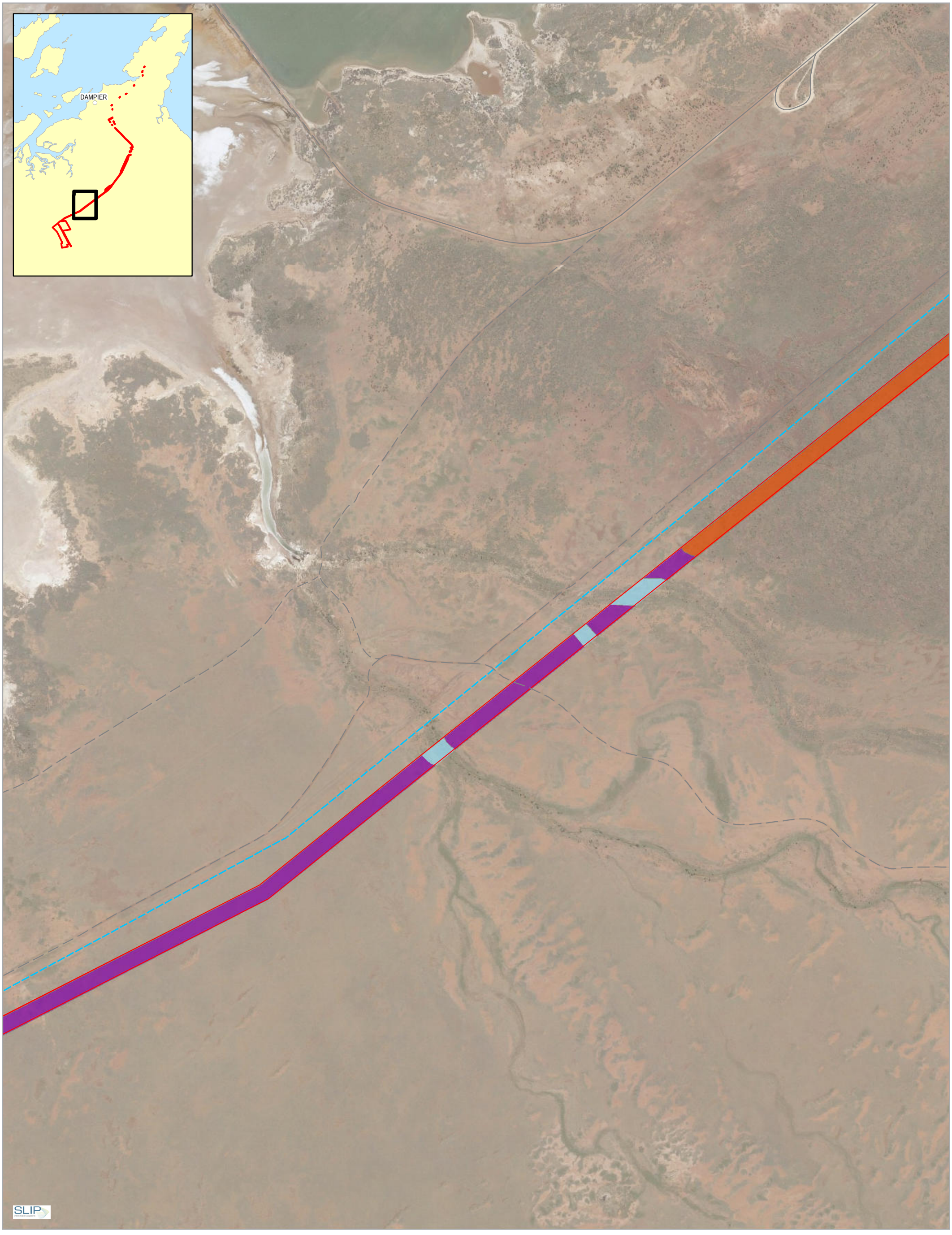
Fauna Habitat Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 5

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_005_FaunaHabitatTypes_Rev0.mxd
Print date: 23 Jan 2020 - 09:31

Data source: GHD: Application area - 20200117, Fauna habitat types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Fauna Habitat

- Hummock grassland on rocky plain
- Minor drainage
- Tussock grasslands on cracking clays

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Woodside Energy Ltd
Geotechnical Investigation

Fauna Habitat Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 5

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_005_FaunaHabitatTypes_Rev0.mxd
Print date: 23 Jan 2020 - 09:31

Data source: GHD: Application area - 20200117, Fauna habitat types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa

LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Fauna Habitat

- Disturbed
- Hummock grassland on rocky plain
- Minor drainage
- Water body

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Woodside Energy Ltd
Geotechnical Investigation

Fauna Habitat Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 5

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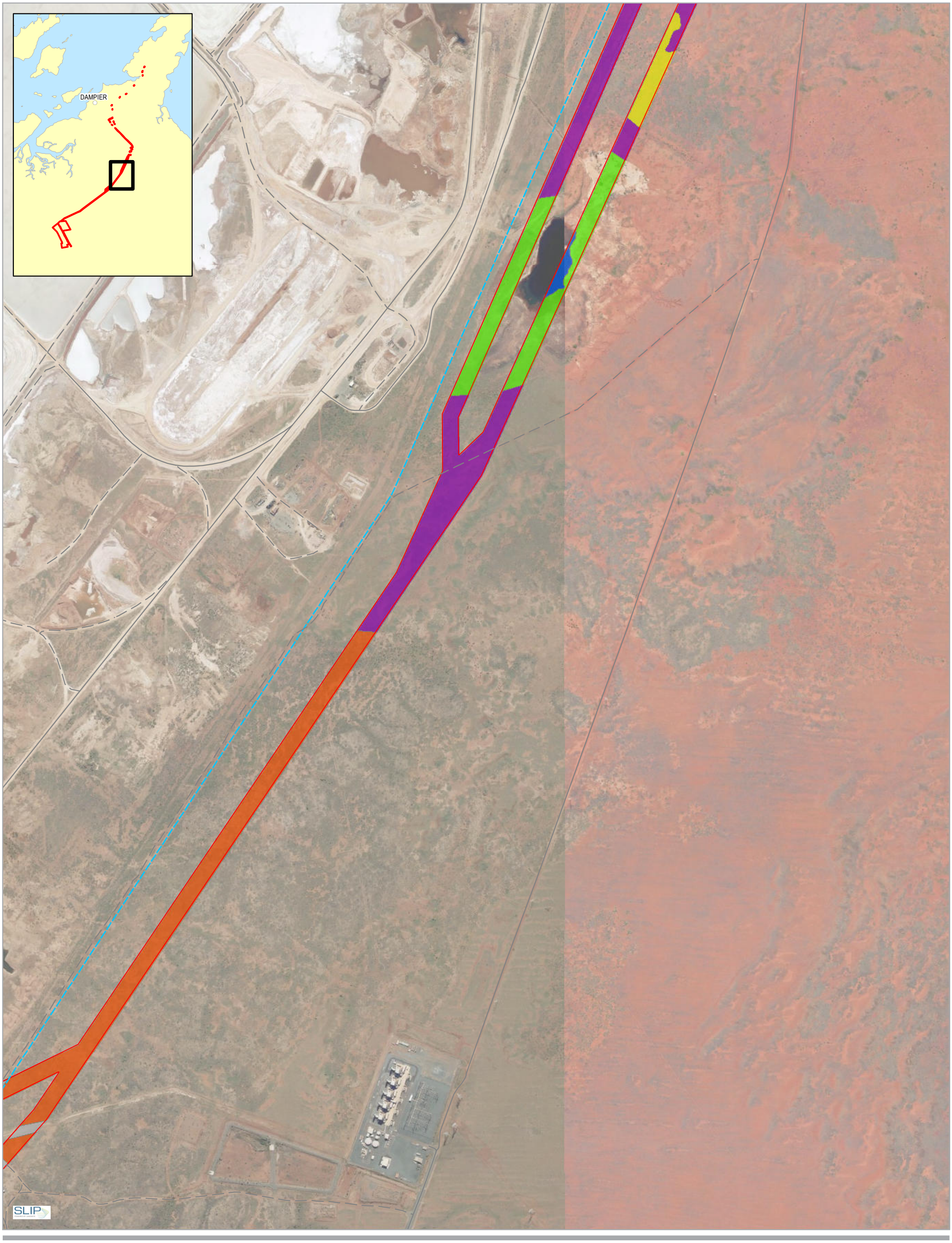
Print date: 23 Jan 2020 - 09:31

Data source: GHD: Application area - 20200117, Fauna habitat types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Fauna Habitat

- Disturbed
- Hummock grassland on rocky plain
- Hummock grassland on sandy plain
- Low chenopod shrublands
- Tussock grasslands on cracking clays
- Water body

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Woodside Energy Ltd
Geotechnical Investigation

Fauna Habitat Types

Project No. **61-37808**
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FIGURE 5

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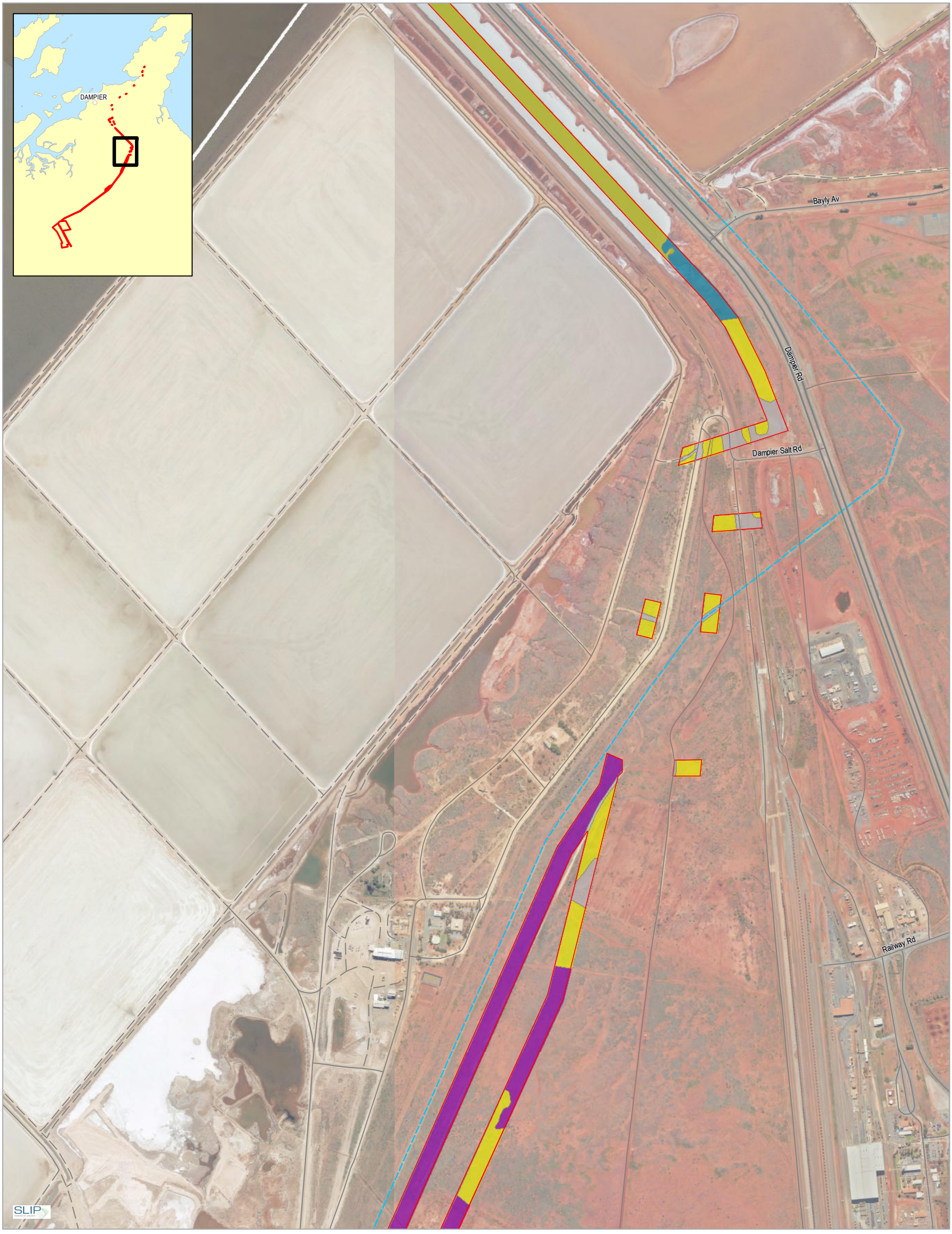
Print date: 23 Jan 2020 - 09:32

Data source: GHD: Application area - 20200117, Fauna habitat types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Fauna Habitat

- Disturbed
- Hummock grassland on sandy plain
- Low chenopod shrublands
- Salt works
- Tidal mud flats
- Tussock grasslands on cracking clays

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Woodside Energy Ltd
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Fauna Habitat Types

Project No. **61-37808**
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Print date: 23 Jan 2020 - 09:32

Data source: GHD: Application area - 20200117, Fauna habitat types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa

LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Fauna Habitat

- Disturbed
- Plain
- Rocky hills with exposed boulder piles
- Salt works
- Sand plain
- Tidal mud flats

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Woodside Energy Ltd
Geotechnical Investigation

Fauna Habitat Types

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 5

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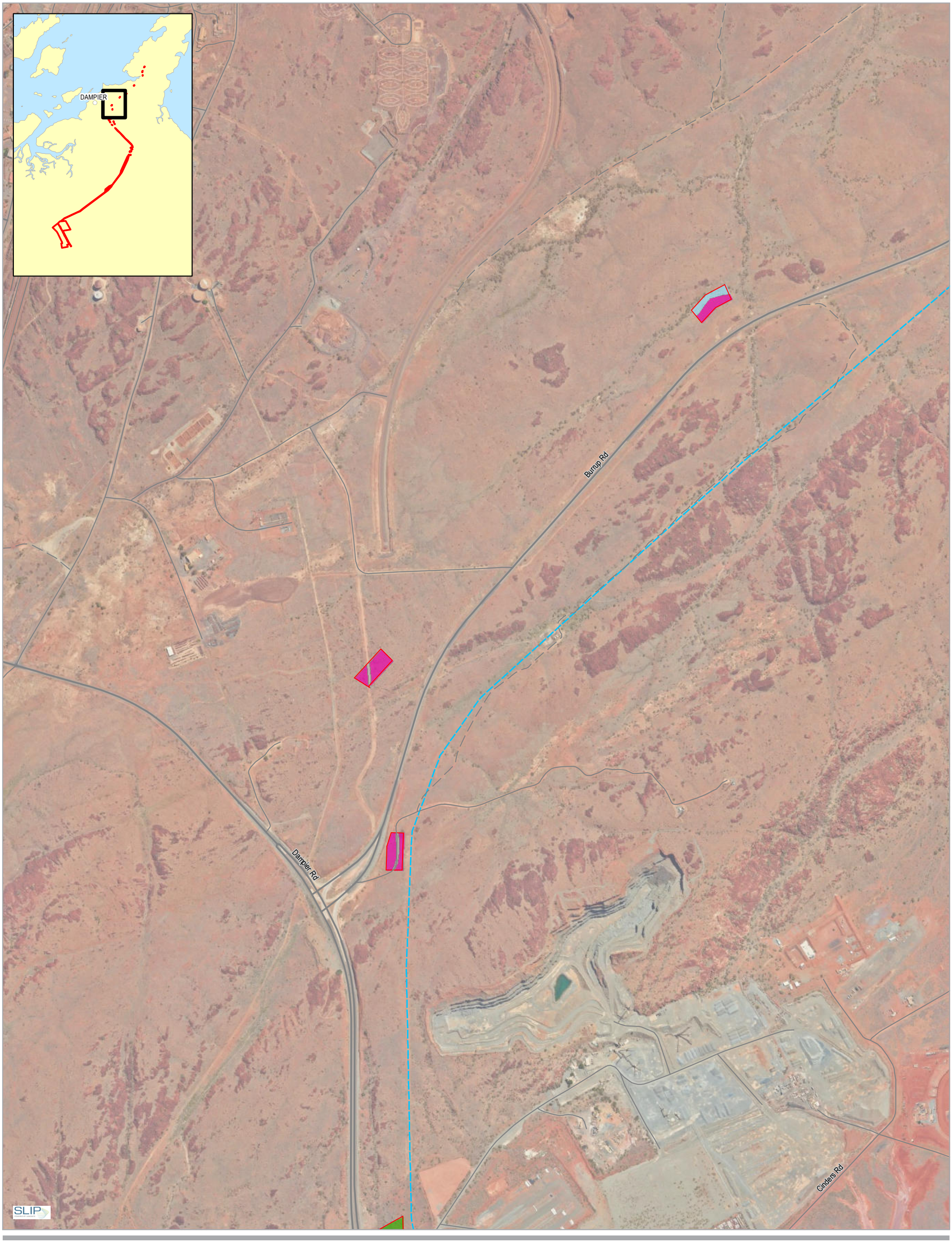

LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Fauna Habitat

- Disturbed
- Minor drainage
- Rocky hills with exposed boulder piles
- Sand plain

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Fauna Habitat Types

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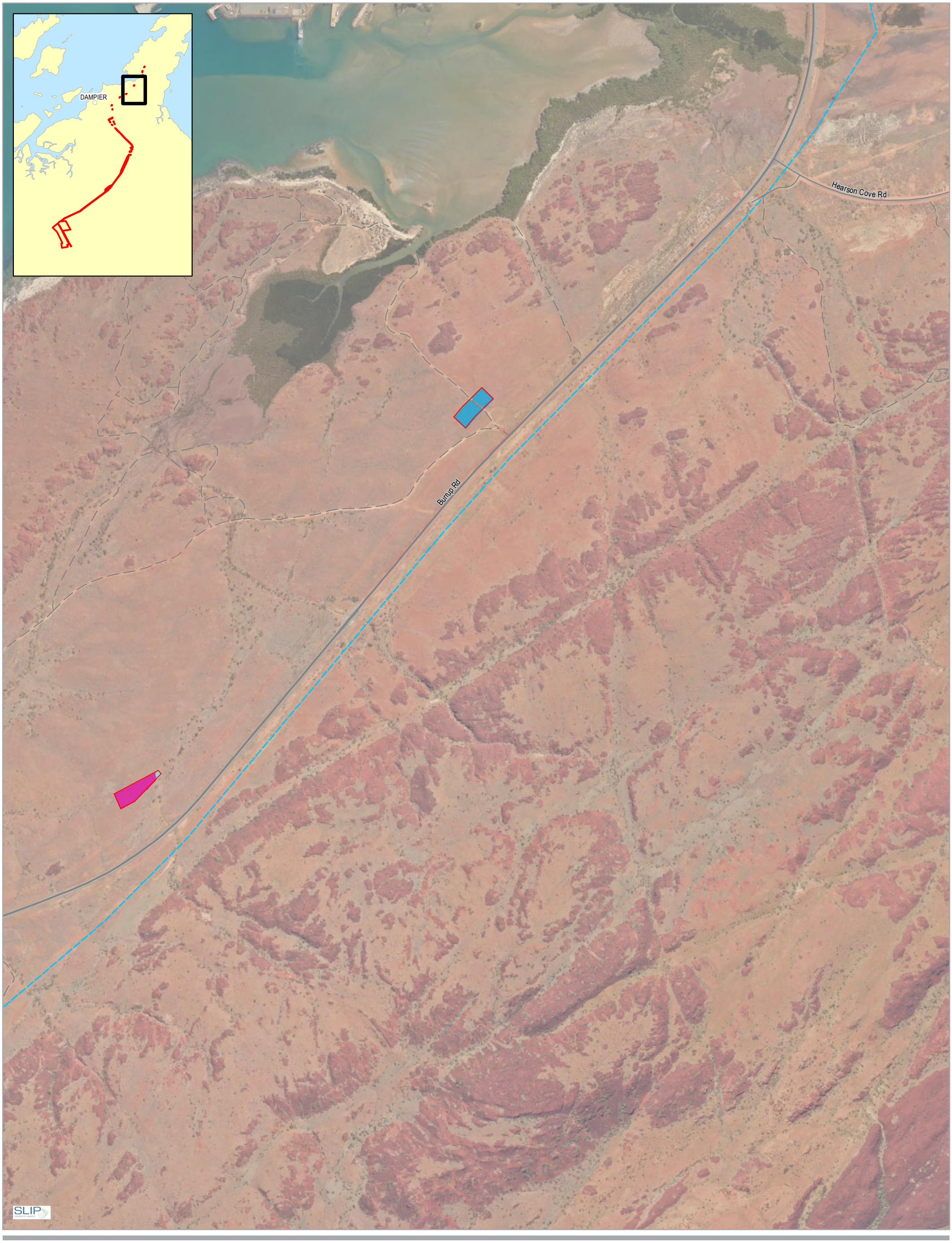
Print date: 23 Jan 2020 - 09:32

Data source: GHD: Application area - 20200117, Fauna habitat types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Fauna Habitat

- Disturbed
- Low rocky hills
- Minor drainage
- Rocky hills
- Rocky hills with exposed boulder piles

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Fauna Habitat Types

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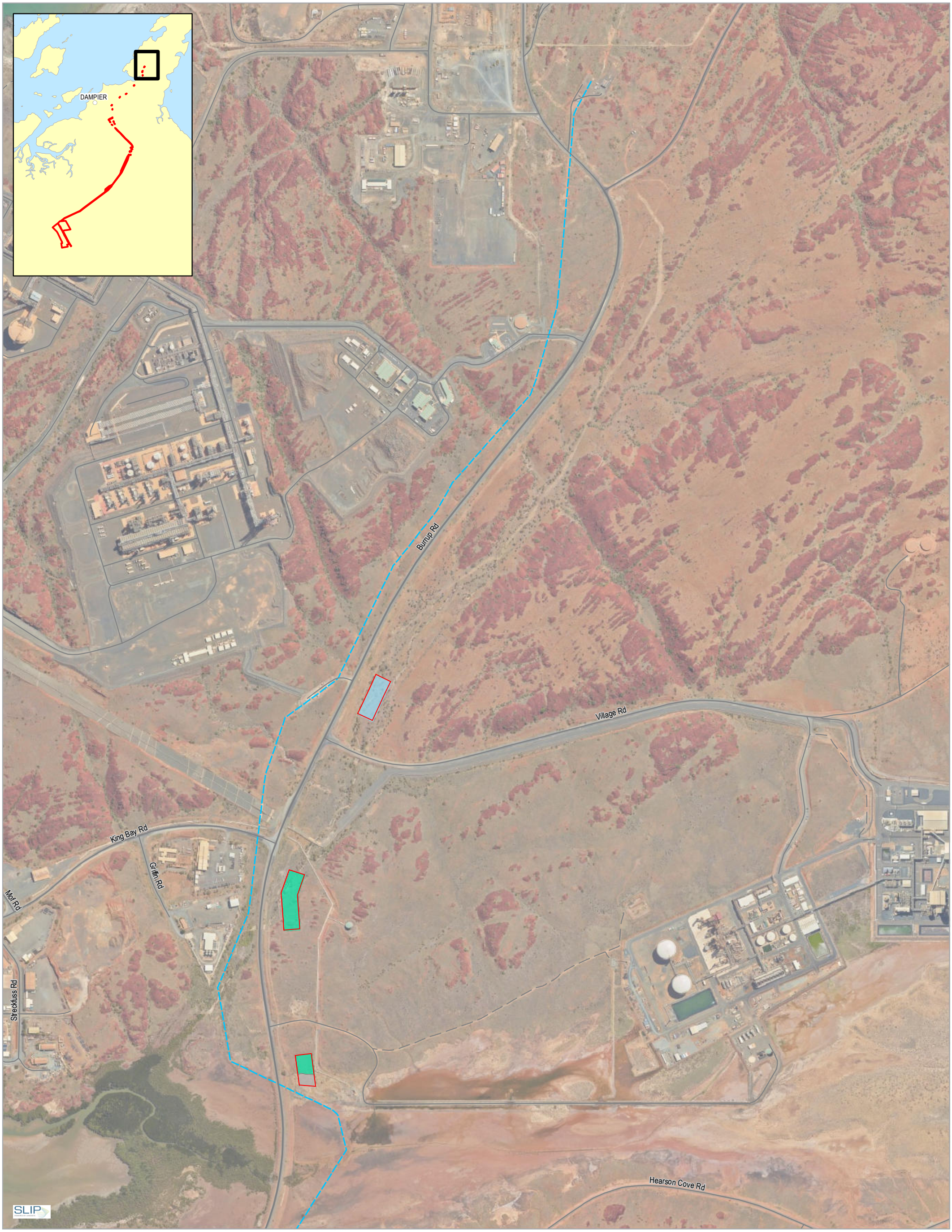
Print date: 23 Jan 2020 - 09:32

Data source: GHD: Application area - 20200117, Fauna habitat types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



LEGEND

- Major Road
- Minor Road
- Track
- Dampier to Bunbury Natural Gas Pipeline
- Application Area

Fauna Habitat

- Disturbed
- Minor drainage
- Rocky hills

Paper Size ISO A3

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Geotechnical Investigation

Fauna Habitat Types

Project No. **61-37808**
Revision No. **0**
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FIGURE 5

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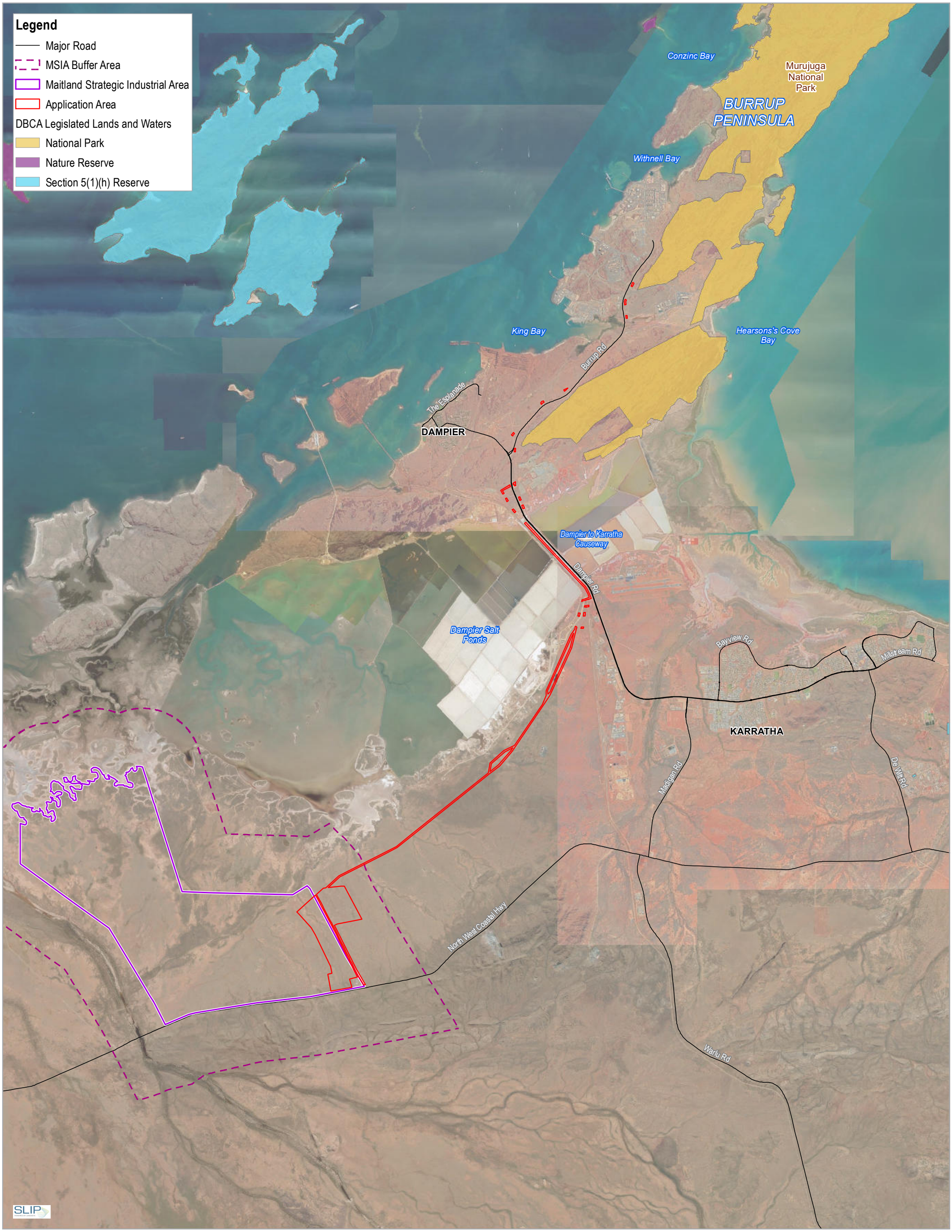
Print date: 23 Jan 2020 - 09:33

Data source: GHD: Application area - 20200117, Fauna habitat types - 20190917; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa



Paper Size ISO A3

0 1 2 3 4

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Geotechnical Investigation

Conservation Areas

Project No. **61-37808**
Revision No. **0**
Date **23 Jan 2020**

FIGURE 6

G:\61\37808\GIS\Maps\Working\Geotechnical Investigation - Clearing Permit\6137808_006_ConservationAreas_Rev0.mxd
Print date: 23 Jan 2020 - 09:37

Data source: GHD: Application area - 20200117; DBCA: Legislated lands and waters - 20181127; Landgate: Roads - 20190128, Imagery - 20180408 (accessed: 20190703). Created by: cgverzosa

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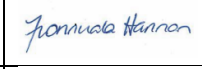
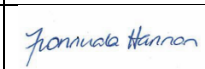
6137808-98155/https://projects.ghd.com/oc/WesternAustralia2/woodsideheppplant/Delivery/Documents/Woodside Power - Geotechnical Investigations - Clearing Permit Supporting Document - (Rev 1).docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	H Morgan	F Hannon		F Hannon		20/12/2019
1	H Morgan	F Hannon		F Hannon		22/01/2020

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