Horizon Power

Geotechnical Works Clearing Permit Application

December 2020

Abbreviations

ASS	Acid Sulfate Soil
BC Act	*Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DAWE	Department of Agriculture, Water and the Environment
DE	Development Envelope
DEC	Department of Environment and Conservation
DBCA	Department of Biodiversity, Conservation and Attractions
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESAs	Environmentally Sensitive Areas
GHD	GHD Pty Ltd
GoWA	Government of Western Australia
ha	Hectares
IBRA	Interim Biogeographic Regionalisation of Australia
km	Kilometre
km/hr	Kilometre per hour
kV	Kilovolts
m	Meters
NVCP	Native Vegetation Clearing Permit
PDWSA	Public Drinking Water Source Areas
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
RIWI Act	*Rights in Water and Irrigation Act 1914*
TEC	Threatened Ecological Community
WoNS	Weeds of National Significance

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1. Introduction

1.1 Proposal background

Horizon Power is proposing to develop new transmission lines and substation infrastructure to supply electricity from the Maitland Strategic Industrial Area to the Burrup Strategic Industrial Area, in the Pilbara region of Western Australia (the Project). The transmission line route extends from Dampier on the Burrup Peninsula, down to Karratha and further south onto the mainland and the Maitland Strategic Industrial Area within a Development Envelope (DE) (Figure 1, Appendix A).

As part of project development, Horizon Power require geotechnical investigations to be undertaken to assist in determining the locations of the proposed substation, transmission line and access road infrastructure. Horizon Power commissioned GHD Pty Ltd (GHD) to complete a Native Vegetation Clearing Permit (NVCP) application for the proposed geotechnical studies, targeting infrastructure locations to progress the Project.

1.1.1 Development Envelope and Geotech Corridor

The DE extends from the Burrup Peninsula, through Dampier and further south, and is located within the City of Karratha. The project will consist of up to 47 bores and 25 test pits within a Geotechnical Corridor, as well as numerous access tracks to be influenced by the topography on the site. The DE and Geotechnical Corridor have been applied to constrain the placement of boreholes/ test pits and access tracks, and to allow for flexibility in the exact placement of the test pits and access tracks during works (Figure 2, Appendix A).

Horizon Power propose to clear up to 15.53 hectares (ha) of native vegetation, with a 10 percent contingency of 1.55 ha, totalling 17.08 ha of native vegetation within a DE of 657.15 ha to conduct geotechnical investigations for the Project (Figure 2, Appendix A). The 10 percent contingency is required to accommodate potential additional clearing that may be required during works, i.e. if an additional borehole is required or the location of a test pit needs to be changed. This will also allow for uncertainty in the terrain and access requirements on the Burrup. For example, if minor additional vegetation must be cleared for an access track if the proposed access track for machinery was inaccessible due to steep or rocky terrain.

1.2 Purpose of this report

The purpose of this NVCP supporting document is to inform Horizon Power and Department of Water and Environmental Regulation (DWER) of the ten clearing principles assessment outcome for the geotechnical works, and potential impacts that may result from the proposed geotechnical works. This document has been prepared in support of an application for a NVCP (purpose) under Section 51E of Part V of the *Environmental Protection Act 1986* (WA) (EP Act).

This document includes:

- An overview of works required and description of clearing activities to be undertaken (Section 2)
- An overview of existing environment (Section 3)
- An assessment of potential impacts identified (Section 4)
- An assessment against the Ten Clearing Principles, as defined in Schedule 5 of the EP Act (Section 5)

- Environmental management measures to be implemented to minimise clearing impacts (Section 6)
- Identification of other environmental and heritage approvals applicable to the proposed works (Section 7)
- Offsets applicable to the proposed works (Section 8)

1.3 Limitations

This report has been prepared by GHD for Horizon Power and may only be used and relied on by Horizon Power for the purpose agreed between GHD and the Horizon Power as set out in section 1.1.1 of this report.

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

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

1.4 Assumptions

The assumptions and limitations outlined in GHD's flora and vegetation survey (GHD 2020a) and the 124-KRT-DMP 132 kV Line Upgrade Project Flora and Fauna Survey (GHD 2019) apply to this report. It is also assumed that Horizon Power will adopt the proposed indicative geotechnical locations and access track methodology when the geotechnical works goes to tender as prescribed in Section 2.

2. Description of clearing activities

The proposed geotechnical test pit and borehole locations in Figure 2 (Appendix A) are indicative. These locations are based on desktop information available at the time of producing this report, including aerial imagery, GHD knowledge of site conditions, previous survey effort for a nearby Horizon Power transmission line and biological survey information for the Burrup Expansion Project collated by GHD in July 2020.

The proposed locations are subject to change if there is an unforeseen constraining factor to allow flexibility in the placement of geotechnical investigations. A Geotechnical Corridor is identified on Figure 2 (Appendix A) to identify the area within which all borehole and test pit locations are constrained. The larger DE identifies the area within which access tracks will be constrained.

2.1 Access tracks

To conduct the geotechnical works, native vegetation is to be driven over but not completely cleared along access tracks within the DE. A truck mounted drill rig and light vehicles will manoeuvre to and from geotechnical test locations targeting the transmission tower locations and substations. A width of 20 meters (m) is proposed for each access track. Access tracks account for 11.65 ha (75 %) of the 15.53 ha of clearing proposed.

2.2 Boreholes and test pits

Up to 25 geotechnical test pits and 47 boreholes are proposed approximately every 500 – 700 m to target transmission pole locations within the DE (Figure 2, Appendix A). Of 15.53 ha of clearing proposed, 3.85 ha (25%) is boreholes and test pits.

For the boreholes, an area of 25 m by 25 m is required to accommodate the drilling of a borehole using a truck mounted auger, a laydown area for equipment, and drill spoil. This clearing area accommodates a 5 m margin of error using typical handheld GPS equipment. Bore hole locations south of the Burrup and along the Burrup are based on proposed tower locations from the Burrup Expansion 220 kilovolts (kV). BH65, BH67, BH69, BH71 in the northern portion of the DE are subject to change during the geotechnical fieldwork due to the rocky, elevated Burrup Peninsula terrain (Appendix A, Figure 2 – page 2 of 9).

For the test pits, a clearing area of 30 m by 25 m is required. Test pit locations target the proposed substations and an access road in the southern most portion of the geotechnical corridor (Appendix A, Figure 2 – page 8 and 9 of 9).

Additional test pit / borehole locations may be required where there is limited existing geotechnical information should the ground condition significantly vary between one geotechnical test location to another. A contingency of 10% has been applied to this clearing permit application to allow for flexibility when undertaking the works.

3. Existing environment

3.1 Climate

The Burrup Peninsula experiences a hot semi-arid climate, characterised by warm to hot temperatures all year round. The Bureau of Meteorology (BoM) Karratha Station (site number: 004083) is the nearest weather station to the DE with long-term data.

Temperature data from the Karratha weather station indicates the mean maximum temperature ranges from 36.3 ˚C in March to 26.4 ˚C in July, and the area has an annual mean temperature of 32.5 ˚C. The Burrup Peninsula receives little, sporadic rainfall which falls predominantly from December through to June and the area has a mean annual rainfall of around 292.4 mm (BoM, 2020). The northwest Australian coastline, which includes the Pilbara region, is a cyclone prone area having on average five cyclones over the tropical cyclone season (November to April) (BoM 2020). Tropical cyclones cause extreme rainfall events and can generate 25-34% of the total annual rainfall near the Burrup Peninsula. Runoff from these rainfall events may occur as sheetflow, as water forms a film over the landscape. In the Burrup Peninsula, sheetflow typically occurs in broad inter-drainage areas on alluvial plains, near the baselines of hills and ridges (BoM 2020).

Figure 3-1 presents the temperature and rainfall statistics from the Karratha weather station.

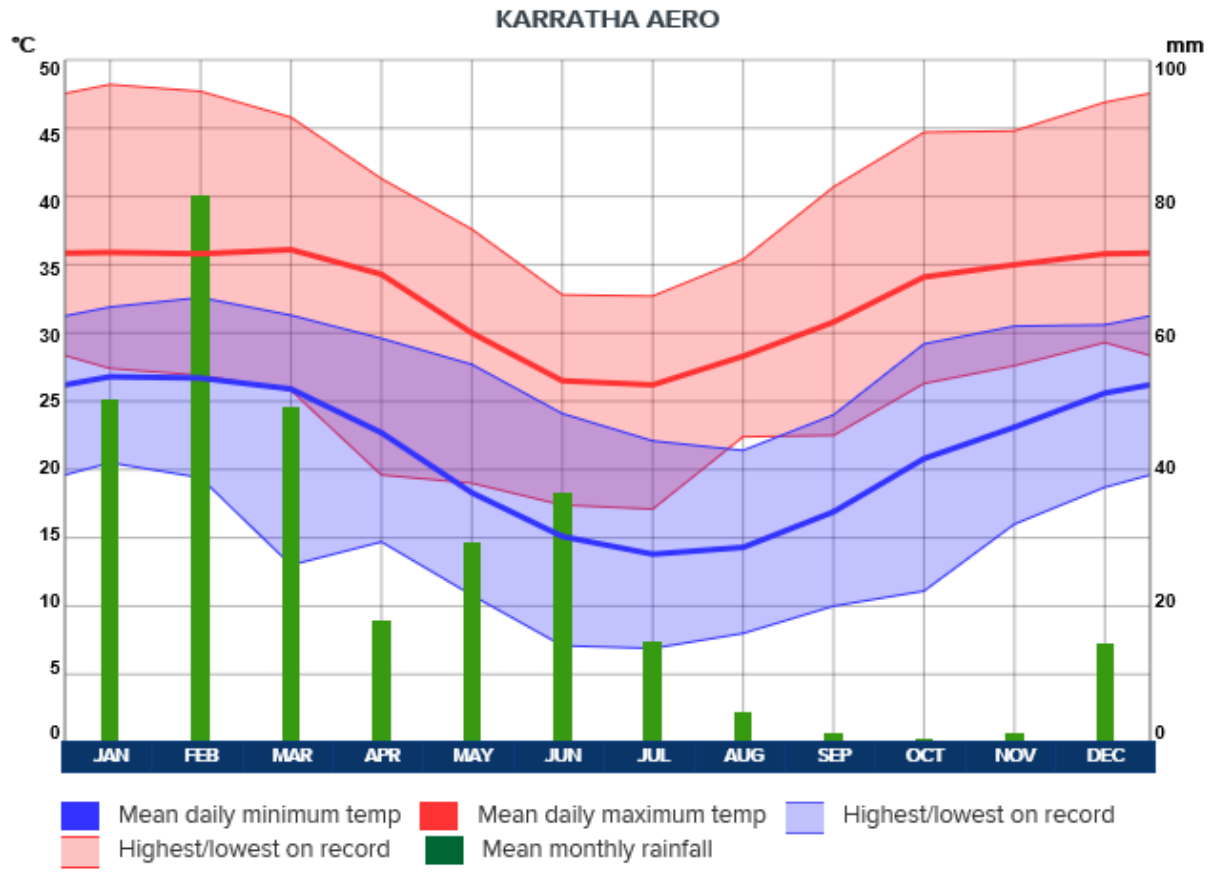


Figure 3-1 Karratha Aero (station no 004083) Climate Data (1972 - 2020)

The mean maximum morning (9 am) wind speed ranges from 17.3 kilometre per hour (km/hr) in April, prevailing predominately from the east to 21.4 km/hr in June, also predominately from the east. The mean afternoon (3 pm) wind speed reported ranges from 23 km/hr in June/July, prevailing predominantly from the north-east to 29.7 km/hr, predominantly from the west (BoM, 2020).

3.2 Land Use

The majority of the land surrounding the DE is rural with some strategic industrial areas (DPLH 2020). This land is primarily native vegetation and includes agriculture land uses, such as cattle pastures, railways, parks and recreation, light and general industry and rural small holdings.

3.3 Geology and soils

3.3.1 Regional geology

The DE is located within the Pilbara (PIL) Interim Biogeographic Regionalisation of Australia (IBRA) region and the Roebourne (PIL04) subregion. The geotechnical investigation is located in the Karratha Coast Zone of the Pilbara Province. The Pilbara Province lies over the Pilbara Craton, which consists of two different tectonic components. The two broad geologic sequences are the ancient Archaean granite-greenstone terrain and the younger volcano-sedimentary sequence of the Hamersley Basin (Tille 2006).

The Karratha Coast Zone is characterised by coastal mudflats with sandy coastal plains and some hills on marine deposits and sedimentary and volcanic rocks of the Pilbara Craton. Soils include tidal soils with calcareous loamy earths, salt lake soils and red/brown noncracking clays (Tille 2006).

3.3.2 Soils

The soil landscape within the DE changes from predominantly rugged, granitic hills which support spinifex grasslands in the north, through bare, coastal mud and samphire flats, dunes and beaches which support shrublands, to clay plains which support grasslands and snakewood shrublands (GoWA 2019a). The soils within the northern area of the DE comprise of tidal soils inter-dispersed with red, shallow sands and calcareous, loamy earths. Soils in the southern section of the DE are predominantly red/brown non-cracking clay with a small section of calcareous, shallow loam (GoWA 2019b).

3.3.3 Topography

Topography within the Pilbara region varies from elevated ranges, ridges and outcrops to deep gullies, drainage lines, flats and floodplains (ERIE 2020). Throughout the Burrup area of the DE (northern area) the terrain is rugged, with an elevation of approximately 60 m. Topography in the southern part of the DE (Dampier and Maitland) is flat and stable, with an elevation of approximately 10 m to 30 m. Topography of the DE and the surrounding area is presented in Figure 3a, Appendix A.

3.3.4 Acid sulfate soils

A review of the Acid Sulfate Soil (ASS) risk mapping indicates ASS has the potential to be present intermittently within the DE with a risk rating ‘high to moderate’ and ‘moderate to low’ risk of containing ASS within 3 m of the natural soil surface. The ‘moderate to low’ risk rating indicates the risk of ASS occurring within 3 m of natural soil surface and high to moderate risk of ASS deeper than 3 m of natural soil surface (CSIRO 2020) (Figure 3b, Appendix A).

3.4 Hydrology

Desktop searches of the Government of Western Australia’s (GoWA) data layers identified the water resources present in the DE. These are detailed below in Table 3-1.

Table 3-1 Water resources within the development envelope

Aspect	Details	Results
Groundwater Areas (GoWA 2018a)	Groundwater areas proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act)	Pilbara Groundwater Area
Surface Water Areas (GoWA 2018b, 2018c)	Surface water areas proclaimed under the RIWI Act	Pilbara Surface Water Area
Irrigation District	Irrigation Districts proclaimed under the RIWI Act	None present
Rivers	Rivers proclaimed under the Rights in RIWI Act	None present
Public Drinking Water Source Areas (PDWSA) (GoWA 2020a)	PDWSA is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the *Metropolitan Water Supply, Sewage and Drainage Act 1909* (WA) or the *Country Areas Water Supply Act 1947* (WA)	None present
Waterways Management Areas	Areas proclaimed under the *Waterway Conservation Act 1976* (WA). These are Albany waterways, Avon River, Wilson Inlet, Peel–Harvey estuaries and Leschenault Inlet.	None present

3.4.1 Groundwater

There are no PDWSAs within a 20 kilometre (km) radius of the DE.

The DE is situated on the Proclaimed Pilbara Groundwater Area under the RIWI Act (GoWA 2018a).

Groundwater in the Pilbara originates from direct infiltration by rainfall and surface water flows, such as rivers. The most significant aquifers in the region can be grouped into three types:

- Alluvial aquifers that are either unconsolidated sedimentary aquifers or chemically deposited aquifers
- Consolidated sedimentary (or sedimentary rock) aquifers
- Fractured rock aquifers

Groundwater in the Pilbara region is typically fresh, with low salinity levels (200-1500 mg/L). Salinity is higher in well sites than bores and mean TDS was found to increase toward the coast (Reeves et al. 2007).

3.4.2 Surface water and drainage

There are ten major rivers within the Pilbara region, however no rivers intercept or are within the vicinity of the DE. These rivers discharge over the coastal flats towards the Indian Ocean with discharge points being a combination of direct ocean outlets and dispersal through marshy flats. Rivers within the Pilbara region contribute significant recharges of these aquifers (GoWA 2010). There are no rivers or waterway management areas within a 20 km radius of the DE.

The DE is in proximity to the Indian Ocean (approximately 2.0 km to the north-west). Surface water in broader area is largely reliant on weather and surface water in waterways is generally only present or flowing for parts of the year, often in response to larger cyclonic, rainfall events. The City of Karratha Water Management Strategy (Essential Environment 2016) indicate that drainage issues arise from the high erosion tendencies of the red soils and the large volumes of stormwater that flow in the wet season. There are numerous minor drainage lines that intersect the DE. The majority of these drainage lines are orientated north to south, from high to low elevation. Drainage lines drain onto the coastal flats where they significantly recharge the aquifers within the Pilbara region. Drainage lines within the DE are presented on Figure 3b (Appendix A).

3.4.3 Wetlands

No Internationally (Ramsar) or nationally important wetlands are located within a 20 km radius of the DE.

3.5 Flora and vegetation

3.5.1 Survey effort

The Burrup Expansion Project Flora and Vegetation Survey (GHD 2020a) documents the methods and results of the desktop assessment and field survey for the proposed transmission lines that comprise Horizon Power's Burrup Expansion Project. The survey area was surveyed to delineate key flora and vegetation values and potential impacts. The DE for the geotechnical scope of works describes the current proposed transmission line to be constructed following the removal of Maitland to Karratha 132kV line options. While the survey area is larger than the DE, the outcomes of the biological survey provide information to support the NVCP application. The survey data for the Project has been extrapolated in some areas by Senior Botanist Joel Collins to indicate the likely vegetation occurrence within the DE where no survey data exists.

3.5.2 Regional biogeography

The Roebourne IBRA subregion is characterised by Quaternary alluvial and older colluvial coastal and subcoastal plains with a grass savannah of mixed bunch and hammock grasses, and a dwarf shrub steppe of *Acacia stellaticeps* or *A. pyrifolia* and *A. inaequilatera.* Uplands are dominated by *Triodia* hummock grasslands. Ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands. Samphire, *Sporobolus* and mangal occur on marine alluvial flats and river deltas. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite. Islands are either Quaternary sand accumulations, or composed of basalt or limestone, or combinations of any of these three (Kendrick and Stanley 2001).

3.5.3 Broad vegetation mapping and extents

Broad scale (1:250,000) pre-European vegetation mapping of the area was completed by Beard (1975) at an association level. Mapping indicates three vegetation associations are present within the DE:

- In the northern section of the DE are Hummock grasslands, grass steppe and soft spinifex (Vegetation Association No. 117)
- South of this section are bare areas and tidal mudflats (Vegetation Association No. 127)
- The vegetation association then changes to Mosaic with short-bunch savannah / grass plains (Pilbara) / Hummock grasslands, grass steppe and soft spinifex (Vegetation Association No. 589)

The pre-European mapping has been modified and digitised by Shepherd et al. (2002). The extent of vegetation associations has been determined by the state-wide vegetation remaining extent calculations maintained by DBCA (GoWA 2020b).

Table 3-2 details the extent of pre-European vegetation associations mapped within the DE.

Table 3-2 Extent of pre-European vegetation associations (Beard 1975, GoWA 2020b)

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	%current extent in all DBCA managed land (proportion of current extent)	Current extent within a 20 km radius of DE (ha)	Hectares with the DE	% of current extent within the DE
117	State: Western Australia	919,517.05	886,005.79	96.36	14.79	22,885	195.53	0.02%
	IBRA bioregion: Pilbara	82,705.78	78,096.64	94.43	22.54		195.53	0.25%
	IBRA subregion: Roebourne	50,962.94	46,901.57	92.03	37.53		195.53	0.42%
	LGA: City of Karratha	41,173.74	31,921.58	77.53	58.03		195.53	0.61%
127	State: Western Australia	737,724.05	697,871.38	94.60	12.30	10,233	43.70	0.006%
	IBRA bioregion: Pilbara	177,749.75	159,595.04	89.79	2.32		43.70	0.006%
	IBRA subregion: Roebourne	177,178.87	159,024.16	89.75	2.33		43.70	0.02%
	LGA: City of Karratha	96,204.40	83,703.29	87.01	4.37		43.70	0.05%
589	State: Western Australia	807,698.58	802,713.40	99.38	1.91	59,373	417.91	0.05%
	IBRA bioregion: Pilbara	728,768.20	724,695.82	99.44	2.11		417.91	0.05%
	IBRA subregion: Roebourne	675,391.80	671,327.48	99.40	2.14		417.91	0.06%
	LGA: City of Karratha	312,813.64	310,512.32	99.26	0.78		417.91	0.13%

3.5.4 Vegetation types and condition

Vegetation types

The vegetation within the Survey area is primarily Hummock grasslands of *Triodia epactia* and *T. wiseana* with scattered to open shrublands dominated by *Acacia, Hakea, Grevillea* and *Senna* species on rocky, sandy loam plain, and low undulating rocky rises and slopes. Minor drainage lines which dissect the plain and rocky slopes are lined by *Corymbia hamersleyana* and *Eucalyptus victrix*. The Survey area includes previously cleared land and disturbed areas which are adjacent to tracks, and the presence of *Cenchrus ciliaris* (Buffel grass) and *Tamarix aphylla* (Athel pine) resulted in areas of Degraded to Completely Degraded Condition.

Based on the vegetation and flora surveys, 14 vegetation types occur within the DE. The southern portion of the DE is less developed then the northern section which is adjacent to strategic and general industry. Vegetation types within the DE are listed below and presented spatially in Figure 3c, Appendix A:

1. VT01 – The 'Burrup Peninsula rock pile communities' are pockets of vegetation in the rock piles and outcrops. The rock piles are important for providing fire and revolutionary refuge for flora (Kendrick and Stanley 2001). The rock pocket communities vary from open *Cymbopogon ambiguus* assemblages with *Ptilotus obovatus* and few small forbs and grasses on otherwise bare calcrete, through to *Triodia* sub shrub communities, to dense shrub/tree communities with *Flueggea virosa* subsp. melanthesoides, *Phyllanthus ciccoides*, small spreading trees of *Ficus brachypoda, Brachychiton acuminatus*, *Pittosporum phylliraeoides* and *Terminalia supranitifolia* often as large trees and sometimes in numbers (DEC 2013).

2. VT02 – *Corymbia hamersleyiana* open woodland over *Acacia bivenosa, Grevillea pyramidalis* subsp. *Pyramidalis* and *Hakea lorea* subsp. *Lorea* scattered shrubs over *Triodia epactia* open hummock grassland with **Cenchrus ciliaris* scattered grasss over over *Hybanthus aurantiacus, Cleome viscosa* and *Trichodesma zeylanicum* var. *zeylanicum* open forbland on brown sandy loam on elevated rocky plain. Associated species include *Chrysopogon fallax, Bonamia erecta, Euphorbia tamnesis* subsp.

3. VT03 – Eucalyptus victrix open woodland over *Terminalia circumalata* low open woodland over *Triodia wiseana* open hummock grassland with **Cenchrus ciliaris* and *Eriachne benthamii* scattered tussock grasslands over *Hybanthus aurantiacus*,*Indigofera trita* and *Gossypium austral* scattered herbs on rocky sandy loam on minor drainage lines. Associated species include *Cyperus vaginatus*, *Rhynchosia minima* and *Boerhavia coccinea*.

4. VT04 – Tecticornia ? *indica subsp. Leiostachya* and *Tecticornia ?pterygosperma* low chenopod shrubland with scattered *Avicennia marina* on saline flats with tidal inundation.

5. VT05 – **Cenchrus ciliaris* open grassland over *Trianthema turgidifolia* and *Neobassia astrocarpa* open chenopod shrubland on disturbed edges of saline flats.

6. VT06 – *Grevillea pyramidalis subsp. pyramidalis* and **Vachellia farnesiana* scattered shrubs over *Ipomoea costata*, *Indigofera monophylla* and *Scaevola spinescens* open shrubland over *Triodia epactia* open hummock grassland over *Cleome viscosa*, *Rhynchosia minima* and *Hybanthus aurantiacus* scattered herbs on red/brown sandy loam on rocky slopes with frequent basalt outcropping. Associated species include Abutilon lepidum, *Gomphrena cunninghamii*, *Streptoglossa decurrens* and *Indigofera monophyla*.

7. VT07 – *Grevillea pyramidalis subsp. pyramidalis*, *Hakea lorea subsp. lorea*, *Acacia inaequilatera* and *Ehretia saligna var. saligna* open shrubland over *Solanum lasiophyllum*, *Diplopeltis eriocarpa* and *Solanum lasiophyllum* scattered shrubs over *Triodia epactia* sparse hummock grassland on flat sandy plains/dunes above saline flats. Associated species include Indigofera, monophylla, Triumfetta propinqua, Acacia orthocarpa, Trichodesma zeylanicum var. zeylanicum and Acacia ampliceps.

8. VT08 – *Acacia bivenosa, Acacia synchronicia* and *Acacia ancistrocarpa* (Fitzroy Wattle) open shrubland over *Triodia wiseana* open hummock grassland and **Cenchrus ciliaris* (Buffel Grass) sparse tussock grasses on disturbed sandy loam plains (GHD 2019).

9. VT11 – The Horseflat Land System of the Roebourne Plains are 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 *Astrebla spp* (DBCA 2019).

10. VT12 – Acacia inaequilatera and *Ehretia saligna var. saligna* open shrubland over *Solanum lasiophyllum*, Corchorus incanus subsp. incanus and *Hybanthus aurantiacus* low open shrubland over *Triodia epactia* and *Triodia wiseana* open hummock grassland with *Eragrostis xerophila* and *Chrysopogon fallax* scattered tussock grasses on brown sandy loam stony plain. Other associated species include Acacia bivenosa, Cleome viscosa, *Ptilotus calostachyus*, *Indigofera linifolia* and *Phyllanthus maderaspatensis*.

11. VT13 – *Acacia inaequilatera* and *Acacia bivenosa* open shrubland over *Solanum lasiophyllum*, *Scaevola spinescens* and *Indigofera monophylla* low open shrubland over *Triodia wiseana* open hummock grassland with **Cenchrus ciliaris* tussock grasses. Other species include *Acacia ancistrocarpa*, *Diplopeltis eriocarpa*, Tephrosia supina, Triumfetta clementii and *Senna artemisioides*.

12. VT14 – *Corymbia hamersleyana* and *Acacia coriacea subsp. coriacea* scattered trees over *Acacia inaequilatera* and *Hakea lorea subsp. lorea* over *Triodia wiseana* very open hummock grassland withu **Cenchrus ciliaris* tussock grasses on brown sandy loam on minor drainage lines. Other species include *Acacia xiphophylla* **Vachellia farnesiana*, *Chrysopogon fallax*, *Portulaca oleracea* and **Aerva javanica*.

13. VT18 – *Eucalyptus camaldulensis* (planted) scattered trees over **Cenchrus ciliaris* (Buffel Grass) tussock grasses on brown sandy loam on disturbed road verge.

14. VT19 – **Tamarix aphylla* scattered trees over *Sesbania cannibina herbland* on brown loamy clay surrounding wetland.

Vegetation condition

The vegetation condition throughout the clearing area varies from Completely Degraded to Very Good condition (see Table 4-1 below for vegetation extents and condition proposed to be cleared based on current test and track locations). The vegetation condition of the DE is shown in Figure 3d, Appendix A. There is evidence of historical clearing and development on the Burrup Peninsula and surrounds. Areas of Very Good condition vegetation is typically in the undisturbed areas scattered along the length of the DE.

3.5.5 Significant ecological communities

The Threatened Ecological Community (TEC)/ Priority Ecological Community (PEC) database did not identified any TECs occurring within the DE and two PECs within a 20 km radius of the DE. These are:

- Roebourne Plains gilgai grasslands – Roebourne Plains coastal grasslands with gilgai microrelief on deep cracking clays (Priority 1)
- Coastal dune native tussock grassland dominated by *Whiteochloa airoides* (Priority 3)

The flora and vegetation survey completed by GHD (2020a) identified two Priority Ecological Communities (PECs) within the DE.

- Burrup Peninsula rock pile communities (Priority 1) represented by vegetation type 1 (VT01).
- Horseflat land system of the Roebourne Plains (Priority 3) represented by vegetation type 11 (VT11).

3.5.6 Flora diversity

The *NatureMap* (BDCA 2007–) database identified 606 taxa previously recorded within a 20 km buffer of the Survey Area. This total comprised of 569 native taxa and 37 naturalised (introduced taxa). The most commonly recorded families were Fabaceae, Poaceae, Malvaceae and Chenopodiaceae.

The flora and vegetation survey completed by GHD (2020a) recorded 131 flora taxa (including subspecies and varieties) representing 35 families and 86 genera. This total comprised 126 native taxa and five introduced taxa, *Cenchrus ciliaris* (Buffel grass), *Aerva javanica* (Kapok), *Vachellia farnesiana* (Mimosa bush), *Passiflora foetida* (Passionflower) and *Tamarix aphylla* (Athel tree).

Buffel grass and Kapok have been rated as having 'high' potential ecological impact under the invasive plant prioritisation process. Buffel grass significantly alters environmental conditions when invading new habitats as it reduces soil fertility, increases soil erosion (which increases surface run-off) and creates unstable watersheds with degraded water quality. It also exudes chemicals that are toxic to other plants (DEC 2013). Buffel grass is most common in disturbed areas such as vehicle tracks, roadsides and other previously cleared areas.

Mimosa bush was present in the northern section of the Survey area along the existing pipeline on the rocky shores and drainage areas (GHD 2020a).

3.5.7 Conservation significant flora

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (PMST) (DAWE 2020) and *NatureMap* (BDCA 2007–) database identified the presence/potential presence of 12 conservation significant flora within a 20 km radius of the DE. This included:

- One Priority 2 taxon
- Ten Priority 3 taxa
- One Priority 4 taxon

The flora and vegetation survey (GHD 2020a) recorded no Threatened flora species listed under the EPBC Act and/or the *Biodiversity Conservation Act 2016* (BC Act) within the Survey area. However, four Priority species listed by the DBCA were recorded within the Survey area and DE during survey effort (Table 3-3). The location of Priority flora within the DE and wider Survey area are presented in Figure 3c, Appendix A.

Table 3-3 DBCA listed Priority flora recorded within DE

Priority Flora	Description
Rhynchosia bungarensis (Priority 4)	This species is listed as a Priority 4, and consists of a compact, prostrate shrub which can grow to 0.5 m in height with yellow flowers. According to NatureMap there are 110 records of this species, with a large number of records concentrated on the Burrup Peninsula. Within the Survey area, this species was recorded inside the rockpiles, particularly in the cracks of the incised boulders.

	Twenty individuals were recorded within the DE; however, 78 individuals were recorded within the Survey area, with some locations containing up to five plants. The maximum number of plants found in one area was 20.
Terminalia supranitifolia (Priority 3)	This species is listed as a Priority 3, and consists of a spreading, tangled shrub or tree which can grow to 5.5 - 3 m in height. *T. supranitifolia* has green-yellow flowers that appear in May, July, or September. This species was recorded inside the rockpiles on the Burrup Peninsula, and also occasionally on grassy and rocky slopes that lead to the rockpiles. 33 individuals were recorded within the DE. However, 11 individuals were recorded throughout the Survey area, with eight collected from just outside of the Survey area.
Vigna triodiophila (Priority 3)	This species is a fine-stemmed prostrate or scrambling vine with small, ovate elliptic leaves, and is known to flower and fruit between May and September. *V. triodiophila* is listed as a Priority 3 species. This species was recorded within rockpiles on the Burrup Peninsula and was not common, with only five individual occurring within the DE and 16 individuals being recorded from three locations of the Survey area.
Oldenlandia sp. Hamersley Station (A. A. Mitchell PRP 1479) (Priority 3)	This species is a spreading annual herb which can grow between 0.05 - 0.1 m in height. It has blue flowers that appear in March, and the species is listed as Priority 3 by the DBCA. This species was recorded in the far south-west corner of the Survey area in an area of Very Good to Excellent vegetation condition. One individual was recorded within the DE and a total of two individuals were recorded from two sites of the same general location within the Survey area.

Likelihood of occurrence

The vegetation and flora survey (GHD 2020a) did not identify any other Threatened or Priority flora likely to occur based on habitat preferences.

3.5.8 Weeds

The EPBC Act PMST (DAWE 2020) identified 20 Weeds of National Significance (WoNS) that may occur within a 20 km radius of the DE. All common weed species that would be expected in this region of the Pilbara, were recorded during the survey (GHD 2020a). One individual weed species (*Passiflora foetida*) was recorded within the DE in proximity to BHT83 in the northern point of the DE (Figure 3c, Appendix A).

3.6 Fauna

3.6.1 Survey effort

A level 1 fauna assessment was conducted for a northern section of the DE for the 124-KRT-DMP 132kV Line Upgrade Project (Fauna Survey Area) (GHD 2019). The fauna survey covered 11.92 ha or 1.8% of the DE. Results from this report are discussed in the sections below. Fauna

habitats within the DE were assigned by reviewing vegetation types by a Senior Ecologist (Section 3.5).

3.6.2 Fauna habitat

GHD (2019) identified six broad fauna habitat types during the GHD (2019) fauna survey for the 124-KRT-DMP 132kV Line Upgrade Project, including:

- Rocky plains and low rises
- Minor drainage lines
- Rock piles
- Saline flats
- Sand loam plains
- Gilgai grasslands.

3.6.1 Fauna diversity

The *NatureMap* database identified 694 fauna species previously recorded within a 20 km radius of the Fauna Survey Area (GHD 2019). This total comprised 207 birds, four amphibians, 104 reptiles, 212 invertebrates, 42 mammals and 125 fish. Of the 694 fauna species previously recorded, 682 were native species and 12 were naturalised (introduced) species.

The fauna survey identified 77 fauna species, including 50 birds, 13 mammals and 14 reptiles within the Survey area. All fauna species recorded during the survey are generally common and are known to occur in the area.

3.6.2 Conservation significant fauna

The EPBC Act PMST and *NatureMap* database identified the presence/potential presence of 52 conservation significance fauna within a 20 km buffer of the Fauna Survey Area. This total does not include those species that are exclusively marine as no marine habitat is present (GHD 2019). The desktop assessment identified:

- 18 species listed as Threatened under the EPBC Act and/or BC Act
- One species listed as Threatened under the EPBC Act and as Priority 3 by DBCA
- 27 species listed as Migratory under the EPBC Act and/or BC Act
- Five species listed as Priority by the DBCA
- One species listed as specially protected species under the BC Act

No threatened or priority fauna species or evidence of their presence were identified in the Survey area DE (GHD 2019).

Likelihood of occurrence

A likelihood of occurrence assessment was conducted post-field survey for the conservation significant fauna identified above in the desktop assessments. The likelihood of occurrence assessment concluded that six species are likely to occur, and the remaining species are unlikely or highly unlikely to occur within the survey area. Species likely to occur are listed in Table 3-4.

Table 3-4 Conservation significant fauna likely to occur in the clearing area

Species	EPBC Act	BC Act/ DBCA	Description	Likelihood of occurrence
Peregrine Falcon (*Falco peregrinus*)		OS	The Peregrine Falcon is found on and near cliffs, gorges, timbered watercourses, riverine environments, wetlands, plains, open woodlands, and pylons and spires of buildings, though less frequently in desert regions (Morcombe 2004). They are not common but can be found almost anywhere throughout WA and in the southwest, including particularly at Fitzgerald River, Stirling Range, Porongurup National Parks, Kondinin, and Peak Charles, with many more locations north of Perth (Nevill 2013).	Likely – The habitats present within the survey area represents suitable foraging habitat, however, lacks suitable breeding habitat. Therefore, likely to occur at least on an occasional basis within all fauna habitats.
Osprey (*Pandion haliaetus*)	Mi	Mi	Ospreys have a wide distribution because they are able to live almost anywhere where there are safe nest sites and shallow water with abundant fish. Nests are generally found within 3 to 5 km of a water body such as a salt marsh, mangrove (*Rhizophora*) swamp, cypress (*Taxodium)* swamp, lake, bog, reservoir or river. The frequency with which each of these habitat types is used varies by geographic region.	Likely – The survey area is situated near the coastline. This species is likely to fly over, and opportunistically utilise portions of all fauna habitat.
Northern Quoll (*Dasyurus hallucatus*)	En	En	The Northern Quoll have suffered range restrictions throughout its distribution and now exists in several geographically disjunct populations spread across the northern parts of Australia. Populations include far North Queensland, the Northern Territory, Kimberley region and the Pilbara region in Western Australia. The population of Northern Quolls in the Pilbara Region of Western Australia are considered isolated from other populations. Importantly the Pilbara Quolls are not suffering from the precipitous decline facing the species in other regions; this decline is, at least in part, attributed to the toxic Cane Toad (*Bufo marinus*) (Hill and Ward 2010).	Likely – Known to occur locally. The rocky areas provide suitable habitat. However, no evidence of their presence was observed during the fauna survey. Rock plains and low rises and rock piles are likely habitat.
Water-rat (*Hydromys chrysogaster*)		P4	The Water-rat has a widespread distribution near permanent water bodies of Australia, New Guinea and offshore Islands. In Western Australia, species distribution ranges from the south-west to the Pilbara region and across to the north-west of the state. *Hydromys chrysogaster* individuals live mainly near permanent fresh water. They live on land but depend on the water for food. Also present along the coastline, *H. chrysogaster* do not need completely fresh water. They can also survive in areas where rivers and streams have become polluted or are brackish. (Watts and Aslin, 1981).	Likely – Known to occur on the Burrup Peninsula, however, not on the mainland. The habitat within the Fauna Survey Area is considered marginally suitable, whilst the northern portion of the

Species	EPBC Act	BC Act/ DBCA	Description	Likelihood of occurrence
				DE (the Burrup Peninsula) is suitable.
Pilbara Olive Python (*Liasis olivaceus* subsp. *barroni*)	Vu	Vu	The Pilbara Olive Python's range is restricted to the Pilbara region, north Western Australia, and including the Dampier Archipelago (Tutt et al 2002). Habitat consists of rocky escarpments, gorges and waterholes. The preferred microhabitats for this species are under rock piles, on top of rocks, and under spinifex as well as in man-made features such as overburden heaps, railway embankments and sewerage treatment ponds. The species breeding season occurs from June to August, with males moving long distances in search of breeding females (Wilson and Swan 2017).	Likely - Species known to occur locally. rocky habitat within the fauna survey area is considered suitable habitat, however, no permanent natural pools within the fauna survey area or within the DE.
Lined soil-crevice skink (Dampier) (*Notoscincus butleri*)		P4	The Lined soil crevice skink occurs is endemic to Western Australia and is restricted to the arid NorthWest, in a pocket of the Pilbara region of Western Australia. This small skink species has been recorded associated with spinifex-dominated areas near creek and river margins (Wilson and Swan 2008).	Likely – Species known to occur locally (West Intercourse Island and less than 2 km south of Karratha). The rocky habitat within the survey area is considered suitable habitat, however, there are no major creeks or rivers within the fauna survey area or the DE.

3.7 Conservation Areas

The DE does not intercept any DBCA managed land or water areas. The closest DBCA managed land area is the Murujuga National Park, which is located on the Burrup Peninsula and directly adjacent to the DE (GoWA 2020c) (Figure 3e, Appendix A).

3.8 Environmentally sensitive areas

No Environmentally Sensitive Areas (ESAs) intersect or are adjacent to the DE. The closest ESA is the Dampier Archipelago and its offshore islands, which are located approximately 8 km northwest of the DE.

4. Assessment of impacts

4.1 Potential impacts to vegetation and flora

Vegetation

Potential impacts to vegetation include:

- Driving over approximately 11.65 ha of vegetation to access geotechnical locations
- Removal of approximately 3.85 ha of vegetation for geotechnical boreholes and test pits
- Introduction or spread of weeds on site
- Dust impacts to adjacent vegetation
- Clearing of approximately 5.94 ha of Priority 3 PEC, which is aligned with VT11 – Horseflat land system of the Roebourne Plains

The vegetation types and associated condition for each type proposed to be cleared for the works is detailed in Table 4-1.

15.53 ha of clearing is proposed for the works. An additional 10% contingency is proposed to be added to the purpose permit to allow for flexibility when on site, totalling 17.03 ha. It is noted that the proposed clearing for access tracks, which accounts for approximately 75% of clearing, involves driving over native vegetation, rather than removal of vegetation. The project will impact on approximately 5.94 ha (0.03%) of approximately 19,045 ha of VT11 (PEC) within 20 km of the DE (Van Vreeswyk et al. 2004). Although 2.02 ha of VT11 was extrapolated based on aerial imagery, providing a degree of uncertainty on the extent of this vegetation type. The 5.94 ha of VT11 Priority 3 PEC vegetation proposed to be cleared is in Very Good to Degraded condition. Due to the nature of the proposed clearing, the impact on vegetation is expected to be minimal, with vegetation able to revegetate naturally.

Flora

No priority flora is proposed to be cleared within the DE. The DE was designed to ensure significant flora species in the clearing area were avoided. For all Priority flora within the DE, at least a 50 m buffer has been applied to ensure priority flora are a sufficient distance from clearing areas, except for TPMS03 (see Appendix A, Figure 3c – page 8 of 9) where a 20 m buffer has been applied around a Priority 3 species (*Oldenlandia sp. Hamersley*) due to this test pit locations being constrained to target the proposed substation design footprint.

4.2 Potential impacts to fauna and fauna habitat

Potential impacts to fauna and fauna habitat include:

- Removal of approximately 15.53 ha of fauna habitat (total)
- Removal of approximately 15.53 ha of habitat suitable for the Osprey and the Peregrine Falcon – all vegetation types with the DE
- Removal of approximately 5.07 ha (rocky plains and low rises and rock piles – VT01, VT02, VT03, VT04, VT06 and VT16) of habitat suitable for the Northern Quoll, Water-rat, Pilbara Olive Python and the Lined soil crevice skink
- Vehicle strike
- Decline in fauna habitat due to introduction and/or spread of weeds

There is potential for fauna diversity and fauna habitat to be impacted by clearing activities. However, clearing 15.53 ha amounts to 0.01% of the 154,357 ha of native vegetation within a 20 km radius of the DE being cleared (GoWA 2020d).The fauna habitat types within the DE will remain well connected and part of a larger contiguous landscape of similar habitats within the local area and surrounding region.

Table 4-2 describes the fauna habitat types within the clearing area.

Table 4-1 Vegetation types and condition within clearing area (GHD 2020)

Vegetation Type (VT)	Vegetation Condition (ha)					Total Clearing Area (ha)
	Very Good	Good	Poor	Degraded	Completely Degraded	
VT02	0.59		0.04			0.63
VT02 (extrapolated)	0.04					0.04
VT03	0.07					0.07
VT04	0.68					0.68
VT04 (extrapolated)	0.04					0.04
VT05	0.02	0.12	0.27			0.41
VT06	0.50	0.56	0.30		0.22	1.58
VT06 (extrapolated)	1.92	0.11				2.03
VT07	0.08				0.11	0.19
VT08			0.13			0.13
VT11 (PEC)	3.29	0.39	0.10	0.15		3.93
VT11 (extrapolated) (PEC)	2.02					2.02
VT12			0.14			0.14
VT12 (extrapolated)			0.16			0.16
VT13	1.42	0.22	0.11	0.20		1.95
VT13 (extrapolated)	0.92		0.02	0.16		1.10
VT18					0.15	0.15
VT19			0.16		0.01	0.17
VT19 (extrapolated)				0.08		0.08

Vegetation Condition Total	11.59	1.4	1.43	0.6	0.5	
Vegetation Condition Percentage of Total NVCP area	76%	9%	9%	3%	3.%	
TOTAL						**15.53**
TOTAL PLUS CONTINGENCY (inc. 10% contingency across all vegetation types)						**17.08**

Table 4-2 Fauna habitat types within the clearing area (GHD 2019)

Fauna habitat	Description	Area (ha)
Rocky plains and low rises	This habitat type is associated with stony/rocky plains and low undulating rises and consists of scattered shrubs of *Acacia*, *Grevillea*, *Hakea* and *Senna* species over a *Triodia* hummock grassland. The hummock grasslands provides refuge for reptiles (such as snakes, skinks, goannas and dragons) and small mammals and ground dwelling birds. The open shrublands provide refuge and a food source for native birds. Rocky outcrops contain small crevices which provide refuge for reptile species and small mammals. The majority of the habitat was well connected with some minor clearing as a result of access tracks and existing powerlines. This habitat type aligns with VT01, VT02, VT03, VT04 and VT16.	1.45
Minor drainage lines	The minor drainage lines are dominated by open woodlands of *Corymbia hamersleyana* and the occasional *Eucalyptus camaldulensis*. Mixed *Acacia* shrublands dominated the mid layer over an open hummock and tussock grassland of *Triodia* species and **Cenchrus ciliaris*. The drainage areas within the survey area on the Burrup Peninsula are very broad and not well defined. Creeklines are considered to be important ecological corridors to other broader habitats within the local area and provide a source of water during periods of heavy rainfall. Trees and shrubs provide shelter and food resources to a number of native fauna species, in particular birds. This habitat type aligns with VT05, VT14 and VT17.	0.41
Rock piles	The rock pile habitat is found on hill tops on the Burrup Peninsula. The rock crevices and over hangs provide shelter for fauna species in particular the Pilbara olive python (Vulnerable), Northern Quoll (Endangered) and rock-wallabies. The scattered trees (*Brachychiton* and *Terminalia* species) provide food resources and refuge for a number of fauna species, particularly birds. This habitat type aligns with VT06.	3.62
Saline flats	The saline flats consists of the salt pans and the adjacent low chenopod shrubland/low open hummock grassland on sandy clay flats. The vegetation is low and sparse with large bare areas of sandy clay and rocky outcrops. This habitat type may provide suitable foraging habitat for a range of migratory waders. The causeway and adjacent salt works link the mainland to the Burrup Peninsula. The salt ponds along the causeway are manmade and do not support native vegetation. This habitat type aligns with VT07.	0.19

Fauna habitat	Description	Area (ha)
Sandy loam plains	This habitat type occurs on the mainland adjacent to Dampier Highway. The vegetation is dominated by open shrublands of *Acacia* species over a sparse hummock and tussock grassland of *Triodia wiseana* and **Cenchrus ciliaris*. This habitat type has been disturbed and generally in poor condition as a result of adjacent land uses and previous clearing. The ground cover is generally sparse and provides limited habitat for reptiles and small mammals. The *Acacia* shrublands provide suitable habitat for a number of bird species. This habitat type aligns with VT08, VT12, VT13 and VT15.	3.48
Gilgaied clay plains	The gilgai grassland habitat type consists of a low open tussock grassland of *Eragrostis xerophila* grassland with isolated patches of *Triodia epactia* on deep cracking gilgai clay plains. The area has been subject to varying degrees of degradation from historical clearing in adjacent areas and weed invasion. The gilgai grassland provides suitable habitat for the Short-tailed mouse (Priority 4) who favours cracking clay and adjacent habitats. This habitat type aligns with VT11.	5.94
Highly disturbed	Planted and/or weedy isolated shrubs. This habitat contains isolated (planted and/or weedy) shrubs over tussock grassland of **Cenchrus ciliaris*. This habitat type has been disturbed and generally in poor condition as a result of adjacent land uses and previous clearing. The ground cover may provide limited habitat for reptiles and small mammals. In one location this habitat is located adjacent to a wetland (man-made drainage depression). This contained water at the time of survey and may provide suitable foraging habitat for a range of migratory waders. This habitat type aligns with VT18 and VT19.	0.41
TOTAL	**15.53**	
TOTAL PLUS CONTINGENCY (inc. 10% contingency across all vegetation types)	**17.08**	

4.3 Potential impacts to erosion, flooding and salinity

There is potential for erosion, flooding and salinity impacts during the geotechnical works. The clearing area comprises of 15.53 ha within a DE of 657.15 ha, which amounts to 2.3% clearing footprint within the DE. Approximately 154,357 ha of native vegetation is present within a 20 km radius of the DE. Clearing 15.53 ha amounts to 0.01% of the 154,357 ha of native vegetation within a 20 km radius of the DE being cleared (GoWA 2020d).

Given the relatively small amount of hectares to be cleared, there is an insignificant impact to erosion, flooding and salinity within the broader area, particularly given that access tracks (accounting for 75% of the proposed impact) will not be excavated and vegetation is being driven over and will regrow over time.

Riparian vegetation identified during the flora and vegetation survey included VT03 within minor drainage lines and VT19 surrounding a wetland (GHD 2020a). No drainage lines will be significantly impacted as drainage lines will only be intersected by access tracks where it cannot be avoided. A maximum of approximately 0.236 ha of riparian vegetation (0.07 ha of VT03 and 0.16 ha of VT19) within the clearing area will be driven over for access tracks.

VT03 comprises *Eucalyptus victrix* open woodland over *Terminalia circumalata* low open woodland over *Triodia wiseana* open hummock grassland with **Cenchrus ciliaris* and *Eriachne benthamii* scattered tussock grasslands over *Hybanthus aurantiacus*, *Indigofera trita* and *Gossypium australe* scattered herbs on rocky sandy loam on minor drainage lines.

VT09 comprises **Tamarix aphylla* scattered trees over *Sesbania cannibina* herbland on brown loamy clay surrounding wetland.

The current surface water hydrology regime is expected to be maintained. No increased incidence of flooding increase salinity or erosion along drainage lines is likely to occur as a result of the proposed clearing due to the limited clearing extents over the length of the DE.

5. Assessment against 10 clearing principles

The clearing of vegetation in Western Australia is regulated by DWER and requires a permit under Part V of the EP Act, except when a project is assessed under Schedule 6 of the Act or is prescribed by regulation in the Environmental Protection (Clearing Native Vegetation) Regulations 2004.

In making a decision about a clearing permit application under section 51O of the EP Act, the CEO of DWER must consider the clearing principles contained in Schedule 5 of the EP Act so far as they are relevant to the matter under consideration. The ten clearing principles aims to ensure that potential impacts resulting from removal of native vegetation can be assessed holistically.

To support the NVCP application for the Burrup expansion project, an assessment of the proposed clearing against the ten clearing principles outlined in Schedule 5 of the EP Act has been undertaken and presented in Table 5-1.

The assessment was undertaken with reference to DWER guideline *A guide to the assessment of applications to clear native vegetation under Part V Division 2 of the Environmental Protection Act 1986* (DWER 2014).

This assessment concluded the proposed clearing associated with the geotechnical investigative works may be at variance to principle (f) and is unlikely to be or not at variance to the remaining clearing principles.

Table 5-1 Assessment of the proposed clearing footprint against the ten clearing principles

Principle	Assessment	Outcome	References
(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	The vegetation within the DE is primarily Hummock grasslands of Triodia epactia and T. wiseana with scattered to open shrublands dominated by Acacia, Hakea, Grevillea and Senna species on rocky, sandy loam plain, and low undulating rocky rises and slopes. Minor drainage lines which dissect the plain and rocky slopes are lined by Corymbia hamersleyana and Eucalyptus victrix. The DE includes previously cleared land and disturbed areas which are adjacent to tracks, and the presence of Cenchrus ciliaris (Buffel grass) and Tamarix aphylla (Athel pine) resulted in areas of Degraded to Completely Degraded Condition. The *NatureMap* database identified 606 taxa previously recorded within a 20 km buffer of the DE. This total comprised of 569 native taxa and 37 naturalised (introduced taxa). The flora and vegetation survey completed by GHD (2020a) recorded 131 flora taxa (including subspecies and varieties) representing 35 families and 86 genera. This total comprised 126 native taxa and five introduced taxa, Cenchrus ciliaris (Buffel grass), Aerva javanica (Kapok), Vachellia farnesiana (Mimosa bush), Passiflora foetida (Passionflower) and Tamarix aphylla (Athel tree). 14 vegetation types occur within the DE and are well represented in the surrounding region. Conservation significant vegetation (VT01) and priority flora have been avoided through the selection process of borehole and test pit clearing locations. A total of 5.94 ha of VT11 could not be avoided due to site constraints and clearing is proposed, noting that 2.02 ha of VT11 was extrapolated. The actual total hectares of VT11 cleared, therefore, may be less than 5.94 ha. 5.94 ha of VT11 clearing amounts to 0.03% of approximately 19,045 ha of VT11 within a 20 km radius of the DE (Van Vreeswyk et al. 2004). Of the 15.53 ha to be cleared, approximately 76% of the vegetation is in Very Good condition, with the remaining vegetation ranging from Good to Completely Degraded. A 10% contingency has been applied to the total clearing area, therefore, the NVCP application is to a total of 17.08 ha. It is unknown where the additional 10% clearing may occur. Although, geotechnical locations will be, where practicable constrained to avoid area of high biological diversity, i.e. Priority flora and PEC. The EPBC Act PMST and *NatureMap* database identified the presence/potential presence of 12 conservation significant flora within a 20 km radius of the Survey area. This included: • One Priority 2 taxon • Ten Priority 3 taxa • One Priority 4 taxon The flora and vegetation survey (GHD 2020a) recorded no threatened flora species listed under the EPBC Act and/or the BC Act within the Survey area. However, four priority species listed by the DBCA were recorded within the DE and wider Survey area (GHD 2020a). No Priority flora will be cleared as part of the geotechnical investigation as the DE has been developed to avoid clearing Priority flora. Priority flora also have at least a 50 m buffer away from clearing areas, except for TPMS03 where a 20 m buffer has been applied due to the test pit location being constrained within the substation design footprint. There will be no impact to priority flora as none will be cleared for the project. The flora and vegetation survey completed by GHD (2020) identified two Priority Ecological Communities (PECs) within the DE: • Burrup Peninsula rock pile communities (Priority 1) represented by vegetation type 1 (VT01) • Horseflat land system of the Roebourne Plains (Priority 3) represented by vegetation type 11 (VT11) The native vegetation to be cleared is comprised of vegetation types and taxa typical to the region. Whilst the native vegetation is not considered to comprise a high level of biological diversity compared to the surrounding area, 5.94 ha of PEC in predominantly Very Good condition will be removed. Considering the vegetation is anticipated to regrow in these areas and 75% of the proposed clearing in the PEC is vehicles driving over the vegetation, it is considered that the clearing is unlikely to be at variance with this principle.	The proposed clearing is unlikely to be at variance to this principle.	Beard (1976) GHD (2020a) DBCA (2007–) DAWE (2020)
(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for	The NatureMap database identified 694 fauna species previously recorded within a 20 km radius of the Fauna Survey Area (GHD 2019). This total comprised 207 birds, four amphibians, 104 reptiles, 212 invertebrates, 42 mammals and 125 fish. The fauna survey identified 77 fauna species, including 50 birds, 13 mammals and 14 reptiles within the Survey area. All fauna species recorded during the survey are generally common and are known to occur in the area.	The proposed clearing is unlikely to be at variance to this principle.	DBCA (2007–) DAWE (2020) GHD (2019)

Principle	Assessment	Outcome	References
fauna indigenous to Western Australia.	The EPBC Act PMST and *NatureMap* database identified the presence/potential presence of 52 conservation significant fauna within a 20 km buffer of the Survey area. The desktop assessment identified: • 18 species listed as Threatened under the EPBC Act and/or BC Act • One species listed as Threatened under the EPBC Act and as Priority 3 by DBCA • 27 species listed as Migratory under the EPBC Act and/or BC Act • Five species listed as Priority by the DBCA • One species listed as specially protected species under the BC Act. No Threatened or Priority fauna species or evidence of their presence was recorded in the Survey area during the field assessment. A likelihood of occurrence assessment was conducted post-field survey for all conservation significant fauna species identified in the desktop assessment which concluded six species are likely to occur within the Survey area: • Pelegrine Falcon (*Falco peregrinus*) • Osprey (*Pandion haliaetus*) • Northern Quoll (*Dasyurus hallucatus*) • Water-rat (*Hydromys chysogaster*) • Pilbara Olvie Python (*Liasis olivaceus* subsp. *barroni*) • Lined soil-crevice skink (Dampier) (*Notoscincus butleri*) No evidence of the above species presence was observed during the survey. There is potential for fauna diversity and fauna habitat to be impacted by clearing activities. Removal of approximately 15.53 ha of habitat suitable for the Osprey and the Peregrine Falcon (all vegetation types with the DE) and approximately 5.07 ha of rocky plains and low rises and rock piles suitable for the Northern Quoll, Water-rat, Pilbara Olive Python and the Lined soil crevice skink is proposed. There is also a risk of fauna strikes by machinery and a decline habitat due to introduction and/or spread of weeds. However, clearing 15.53 ha amounts to 0.01% of the 154,357 ha of native vegetation within a 20 km radius of the DE being cleared (GoWA 2020d). The fauna habitat types within the DE will remain well connected and part of a larger contiguous landscape of similar habitats within the local area and surrounding region. The DE is unlikely to support fauna habitat that is in better condition than the surrounding available habitat. Furthermore, the clearing area is not likely to comprise significant locally or regionally unique habitat for indigenous fauna dependent on the habitats present in within the DE. It is likely these habitats are well represented in the local and regional area given the extent of native vegetation adjacent to the DE footprint, and in nearby conservation areas. The clearing footprint is within a large contiguous tract of native vegetation that extends north to the Burrup Peninsula. The proposed clearing is unlikely to have significant impact on the fauna habitat for conservation significant fauna. The proposed clearing is unlikely to be at variance with this principle.		GoWA (2020d)
(c) Native vegetation should not be cleared if it includes or is necessary for the continued existence of rare flora.	No EPBC Act and/or BC Act listed Threatened flora have been identified within 20 km of the DE. The proposed clearing is not likely to include or be necessary for the continued existence of rare/threatened flora. The vegetation and flora survey (GHD 2020) did not identify any other Threatened or Priority flora likely to occur based on habitat preferences. No threatened flora is considered likely to occur within the DE based on the likelihood of occurrence assessment. It is considered that the proposed clearing is unlikely to be at variance to this principle.	The proposed clearing is unlikely to be at variance to this principle.	DBCA TPFL and WAHERB databases DBCA (2007–)
(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance	The EPBC Act PMST and DBCA TEC databases did not identify any TECs within 20 km of the Survey area. No TECs were identified during the flora and vegetation surveys in the DE. The proposed clearing is unlikely to be at variance to this principle.	The proposed clearing is unlikely to be at variance to this principle.	DBCA TEC database (2020) GHD (2020a)

Principle	Assessment	Outcome	References
of, a threatened ecological community.			
(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	The DE contains three vegetation associations (Section 3.5.4), all of which have above 77% remaining on state, regional and local government levels. Approximately 154,357 ha of native vegetation is present within a 20 km radius of the DE. Clearing 15.53 ha amounts to 0.01% of the 154,357 ha of native vegetation within a 20 km radius of the DE being cleared (GoWA 2020). After native vegetation clearing has been undertaken, sufficient pre-European vegetation remain in the region. The proposed clearing will not impact the maintenance of ecological values in the landscape. Further, the proposed clearing includes 11.65 ha of clearing for tracks (75% of the total clearing area), which will involve driving over vegetation rather than vegetation removal and is therefore not expected to significantly impact native vegetation. The proposed clearing is not at variance to this principle.	The proposed clearing is not at variance to this principle.	Beard (1976) GoWA (2020b) Shepherd et al. (2002) Commonwealth of Australia (2001)
(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	No significant watercourses or Internationally (Ramsar) or Nationally Important Wetlands intersect the DE. The DE does not intersect any significant drainage lines. The proposed geotechnical test locations were selected to avoid minor intermittent surface water drainage lines where riparian vegetation is present. However, the DE area intersects several minor/broad ephemeral drainage lines. These drainage lines are likely to be associated with infrequent surface water caused by sporadic weather events like seasonal cyclones. Clearing in these minor watercourses is limited to vehicles creating access tracks by driving over native vegetation, rather than removal of native vegetation. Riparian vegetation identified during the flora and vegetation survey included VT03 within minor drainage lines and VT19 surrounding a wetland (GHD 2020a). A maximum of approximately 0.236 ha of riparian vegetation (0.07 ha of VT03 and 0.16 ha of VT19) within the clearing area will be driven over for access tracks. The proposed clearing may be at variance to this principle however does not significantly impact riparian vegetation.	The proposed clearing may be at variance to this principle.	DAWE (2020) Landgate (2020)
(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The soil landscape within the DE changes from predominantly rugged, granitic hills which support spinifex grasslands in the north, through bare, coastal mud and samphire flats, dunes and beaches which support shrublands, to clay plains which support grasslands and snakewood shrublands (GoWA 2019a). The soils within the northern area of the DE comprise of tidal soils inter-dispersed with red, shallow sands and calcareous, loamy earths. Soils in the southern section of the DE are predominantly red/brown non-cracking clay with a small section of calcareous, shallow loam (GoWA 2019b). Runoff from rainfall events may occur as sheetflow, as water forms a film over the landscape. In the Burrup Peninsula, sheetflow typically occurs in broad inter-drainage areas on alluvial plains, near the baselines of hills and ridges (BoM 2020). Sheetflow is likely to occur within the DE due to the presence of non-cracking clays. The surrounding area of the DE is remnant vegetation, so the risk of soil erosion during rainfall events is minimal within the borehole and test pit locations. Salinity is unlikely to increase in the surrounding area of the DE due to clearing of native vegetation. Clearing 15.53 ha amounts to 0.01% of the 154,357 ha of native vegetation within a 20 km radius of the DE being cleared (GoWA 2020d). Soils will be minimally exposed as a result of clearing causing a small, localised impact within the surrounding landscape. Vegetation will be driven over to create access tracks to boreholes and test pit locations, however, upon completion of the Project, this vegetation will be replaced to revegetate. Throughout the Burrup area of the DE (northern area) the terrain is rugged, with an elevation of approximately 60 m. Topography in the southern part of the DE (Dampier and Maitland) is flat and stable, with an elevation of approximately 10 m to 30 m. Elevated, rugged landscapes will be avoided by the works as they present difficulties to access and operate of machinery. The northern area of the DE (the Burrup region, where the rock pile communities occur) is rocky and therefore less likely to be subjected to erosion. A review of the Acid Sulfate Soil (ASS) risk mapping indicates ASS is present intermittently within the DE with a risk rating ‘high to moderate’ and ‘moderate to low’ risk of containing ASS within 3 m of the natural soil surface (Figure 3b, Appendix A). Some boreholes minimally disturb ASS, reducing the risk of acidification. The overall risk of land degradation within the DE is low. The proposed clearing is unlikely degrade the landscape due to soil erosion, salinity and ASS. The proposed clearing is unlikely to be at variance to this principle.	The proposed clearing is unlikely to be at variance to this principle.	ASRIS (2017) GoWA (2019a) GoWA (2019b) GoWA (2020d) BoM (2020)

Principle	Assessment	Outcome	References
(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 DE does not intersect Murujuga National Park adjacent to the DE on the Burrup Peninsula. No clearing will be undertaken within National Park. The proposed clearing is unlikely to impact the environmental values of the Murujuga National Park. The proposed clearing is not at variance to this principle.	The proposed clearing is not at variance to this principle.	DAWE (2020) GoWA (2020c)
(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.	No Internationally (Ramsar) or Nationally Important Wetlands intersect the Survey area. The Survey area is located within the proclaimed Pilbara Groundwater Area and Pilbara Surface Water Area. It is considered unlikely any clearing will significantly disturb or interrupt natural drainage and surface run-off patterns. However, during heavy localised rainfall events, erosion may occur in cleared areas resulting in localised, short-term soil erosion and/or sedimentation. It is unlikely clearing will have an impact on groundwater levels or quality. The proposed activity associated with the clearing will not alter the current hydrological regime within the DE due to the relatively minimal clearing proposed within an area causing minimal sheetflow over a short time scale, with adequate surrounding native vegetation allow water to infiltrate. The proposed clearing is unlikely to cause deterioration in surface water and ground water quality.	The proposed clearing is unlikely to be at variance to this principle.	DAWE (2020) GoWA (2020a)
(j) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	The Survey area comprises tidal soils with some calcareous loamy earths, salt lake soils and red/brown non-cracking clays. The Karratha area has a mean annual rainfall of around 292.4 mm (BoM, 2020). Removal of vegetation in areas with clay soils can exacerbate the incidence or intensity of flooding or localised waterlogging. However, the total clearing area is relatively small considering the amount of remaining native vegetation in the surrounding area. The surrounding areas are predominantly undeveloped, particularly in the southern portion of the DE, allowing for infiltration into natural soils. Vegetation along access tracks will be driven over and regrow over time. Cleared vegetation is also to be place back into the cleared areas to aid regrowth. Therefore, it is unlikely clearing will increase the incidence of flooding and compaction of soils. Driving over vegetation is not likely to increase flooding or compaction of soils. In addition, the removal of vegetation for testing and replacement of this vegetation is not likely to result in compaction and flooding. The proposed clearing is unlikely exacerbate the incidence of intensity of flooding.	The proposed clearing is unlikely to be at variance to this principle.	BoM (2018) GoWA (2019) Tille (2006)

6. Environmental Avoidance and Management

Horizon Power will utilise the hierarchy of avoid, minimise, reduce and rehabilitate to mitigate the environmental impacts of the geotechnical works. Potential impacts to the following environmental factors have been considered during avoidance, mitigation and establishing appropriate management efforts:

- Vegetation and flora
  - Clearing of PEC (VT01 and VT11). Clearing of VT01 was avoided and 5.94 ha of VT11 is proposed to be cleared as avoidance is not practicable.
  - Clearing of significant flora was avoided through the placement of test locations and tracks. No clearing of the 59 known Priority flora will occur as a result of the project. The Priority flora species within the DE are protected by 50 m radius buffer, except TPMS03 which was given 20 m due to project constraints.
- Fauna habitat
  - Clearing of 1.45 ha of rocky plains and low rises
  - Clearing of 0.41 ha of minor drainage lines
  - Clearing of 3.62 ha of rock piles
  - Clearing of 0.19 ha saline flats
  - Clearing of 3.48 ha sand loam plains
  - Clearing of 5.94 ha gilgaied clay pans.

In addition, the selection process undertaken to avoid impacts during geotechnical works included other, non-environmental, constraints. Geotechnical test pits and borehole locations and associated access tracks where clearing is proposed to be undertaken were constrained by the Dampier to Bunbury Natural Gas Pipeline corridor, overhead power lines, existing tracks, topography and rocky terrain (particularly on the Burrup Peninsula), geological conditions, flora and vegetation conservation significance or density, Aboriginal heritage sites and watercourses.

Impact avoidance, mitigation and management measures are detailed in Section 6.1.1 to Section 6.2.1.

6.1 Impact avoidance and minimisation through design

6.1.1 Flora and Vegetation

Flora and vegetation loss was avoided through design of the geotechnical locations and access tracks within the development envelope by avoiding vegetation clearing where possible, particularly the two PEC vegetation types; the horseflat land system of the Roebourne Plains (P3) (VT11) and the Burrup Peninsula rock pile communities (P1) (VT01). When considering placement of the geotechnical tests, a site by site assessment with designers, geotechnicians and the environmental team occurred, to identify constraints and the most practicable location of the geotechnical sites, utilising existing access tracks and existing cleared areas wherever possible.

The following borehole and test pit locations intersect VT11 and cannot be avoided as the transmission line intersects areas where VT11 is the dominant ecological community within the landscape:

- BHRT02 is with within VT11 due to overhead powerlines constraining the area for the borehole and VT11 surrounding BHRT02. An existing access track will be followed, and vegetation will be driven over to access this borehole location to minimise clearing. The same track will be used upon return to the main access road
- BHT2, 4, 6, 8, 11, 13, 15, TPM01 – 04, and BHPS01 – 03 are within VT11. Impacts to VT11 in these areas cannot be avoided by moving borehole locations.

No proposed borehole and test pit locations or access tracks intersect VT01. BHT65, 67 and 69 are subject to change and are located near VT01, however given VT01 is sporadic, VT01 is likely to be completely avoided by selecting an access track and borehole location in VT03 or VT06.

Impacts to flora and vegetation will be minimised by selecting existing access tracks and sparely vegetated or bare soil access tracks and borehole/ test pit locations where possible during geotechnical works.

Conservation significant areas to be avoided will be provided to the geotechnical team in hard copy and digital format to ensure sites of environmental significance are avoided in the field when deciding the location of boreholes, test pits and access tracks within the geotechnical corridor.

Priority flora have at least a 50 m buffer away from clearing areas, except for TPMS03 where a 20 m buffer has been applied due to the test pit location being constrained within the substation design footprint.

6.2 Impact avoidance and management measures applied on site

6.2.1 Loss of flora, vegetation and fauna habitat

The following avoidance strategies will be adopted onsite during the geotechnical investigation:

- The geotechnical team will utilise existing tracks and roads where possible, only veering off existing tracks and roads at approximately 500 - 700 m intervals with an access track width of approximately 20 meters to allow for the drill rig and light vehicle access to borehole locations. Vegetation will be driven over and not removed, where practicable.
- Preference will be given to Degraded or already cleared vegetation in proximity to access tracks when selecting borehole locations, while avoiding heritage sites and PEC as required.
- Geotechnical teams will avoid flora and vegetation communities (and heritage sites) by referring to GPS data that delineates “no-go’” zones. These include conservation significant vegetation (VT01 and VT11) and buffer zones around priority flora.
- Boreholes are to be capped and the cleared drill pad area will have topsoil reinstated to facilitate natural regrowth.
- Upon the conclusion of drilling each borehole, the same access track will be used to return to the main road. Preference will be given to Degraded or already cleared vegetation when selecting access tracks where terrain allows.
- A Weed Management Plan will be developed prior to the works and will be implemented to mitigate the risk of weeds entering the site or spreading.

7. Other approvals

7.1 Aboriginal Heritage

Aboriginal heritage sites have been identified from an assessment of public data bases and in consultation with the traditional owners (Murujuga and Ngarluma) during two heritage surveys, which have been undertaken for the purposes of this project. During the surveys, sites additional to those registered in the area were identified. Please note that for confidentiality reasons, these locations have not been included in the figures presented. During the geotechnical investigation, identified heritage sites will be avoided and traditional owners will be engaged as monitors to further ensure site avoidance. As such, site disturbance approvals under the Aboriginal Heritage Act 1972 are not considered necessary by Horizon.

Horizon Power will engage Murujuga heritage monitors for the entirety of the works on the Burrup, and Ngarluma heritage monitors for the entirety of the works south of the Burrup. The project area is considered low risk for geotechnical purposes, as it is a previously disturbed area, however, geotechnical investigation positions may change as a result of the heritage monitors' input at the time of the works.

7.2 Referral to the Department of Agriculture, Water and Environment

The decision whether to refer the geotechnical works to DAWE is based upon whether it may have a significant impact upon Matter of National Environmental Significance (MNES), which are protected EPBC Act. These include; World Heritage properties, National Heritage places, wetlands of international importance (listed under the Ramsar convention), Commonwealth land or marine areas, migratory species protected under international agreements, nuclear actions, nationally threatened species and ecological communities and water resources.

GHD conducted an assessment of significant impacts on MNES for the works, combining the results from the desktop assessment and biological surveys. Based on this assessment there are no obvious triggers to suggest referral of the project to DAWE (GHD 2020b). The geotechnical works will not have a significant impact on MNES or impact Commonwealth land and therefore referral is not required.

7.3 Referral to the Environmental Protection Authority

The geotechnical works does not trigger a Part IV referral under s 38 of the EP Act, as environmental impacts can be adequately managed under Part V of the EP Act via a clearing permit.

8. Offsets

Environmental offsets are conservation actions that provide environmental benefits intended to counterbalance significant residual environmental impacts associated with a proposal (GoWA 2014).

Horizon Power have considered requirements to counterbalance the residual impacts through environmental offsets for geotechnical works. Consideration has been given to requirements of the Western Australian Government's Environmental Offset Policy (GoWA 2011) and the Western Australian Offsets Guidelines (GoWA 2014).

Horizon Power operates on a hierarchy of avoid, minimize, reduce, rehabilitate and offset environmental impacts. This hierarchy is achieved primarily through changes in scope and design, development and implementation of the environmental management plans or strategies and finally, if required, development of an offset proposal. Application of the management hierarchy has been documented throughout this document.

The assessment against the ten clearing principles concluded the proposed clearing is not at variance with any of the ten clearing principles. Therefore, offsets are not proposed to compensate for the residual impacts associated with the proposed clearing.

9. References

Beard, JS 1975, Vegetation Survey of Western Australia: Pilbara, map and explanatory memoir 1:1,000,000 series, Nedlands, University of Western Australia Press.

Bureau of Meteorology (BoM) 2020, Climate Data Online. Retrieved December 2020, from http://www.bom.gov.au/climate/data

Commonwealth Scientific and Industrial Research (CSIRO) (2020), Australian Soil Resource Information System. Retrieved December 2020 from https://www.asris.csiro.au/themes/AcidSulfateSoils.html

Department of Agriculture Water and the Environment (DAWE) (2020), *Environmental Protection and Biodiversity Conservation Act 1999 Protected Matters Search Tool Results*, retrieved February 2019, from http://www.environment.gov.au/epbc/pmst/index.html

Department of Biodiversity, Conservation and Attractions (DBCA) 2007–, NatureMap: Mapping Western Australia's Biodiversity, retrieved March 2020, from http://naturemap.dpaw.wa.gov.au/default.aspx/

Department of Biodiversity, Conservation and Attractions (DBCA) (2019), Priority Ecological Communities for Western Australia Version 28. Species and Communities Program, DBCA, 17 January 2019.

Department of Environment and Conservation (DEC) 2013, Murujuga National Park Management Plan 78, Department of Environment and Conservation, Perth.

Department of Planning, Lands and Heritage (2020), City of Karratha, Local Planning Scheme No.8. Retrieved December 2020, from https://www.dplh.wa.gov.au/getmedia/b8676bd0-e711-43b9-bbb1-720d14e98c14/Map-05_Karratha_Dampier-Townsite-Surrounds.

Department of Water and Environmental Regulation (2014), *A guide to the assessment of applications to clear native vegetation under Part V Division 2 of the Environmental Protection Act 1986*.

Ecosystem Restoration & Intervention Ecology (ERIE) Research Group (2020), Pilbara. Retrieved December 2020, from https://erie-research.org/pilbara/

Essential Environment (2016), City of Karratha Water Management Plan. Unpublished report prepared for the City of Karratha.

GHD (2019) 124-KRT-DMP- 132 kV Line Upgrade Project – Flora and Fauna Survey, August 2019.

GHD (2020a) Horizon Power Burrup Expansion Project Flora and Vegetation Survey, July 2020.

GHD (2020b) Horizon Power Burrup Expansion Project – Matters of National Environmental Significance, August 2020.

Government of Western Australia (GoWA) (2010), Pilbara Regional Water Plan 2010 – 2030, Department of Water, May 2010.

Government of Western Australia (GoWA) (2011) WA Environmental Offsets Policy. Government of Western Australia.

Government of Western Australia (GoWA) (2014), WA Environmental Offsets Guidelines, August 2014.

Government of Western Australia (GoWA) (2018a), RIWI Act, Groundwater Areas (DWER-034), Department of Water and Environmental Regulation. Retrieved December 2020, from https://catalogue.data.wa.gov.au/dataset/riwi-act-groundwater-areas

Government of Western Australia (GoWA) (2018b), Surface Water Management Areas (DWER-041), Department of Water and Environmental Regulation. Retrieved December 2020, from https://catalogue.data.wa.gov.au/dataset/surface-water-management-areas

Government of Western Australia (GoWA) (2018c), RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037), Department of Water and Environmental Regulation. Retrieved December 2020, from https://catalogue.data.wa.gov.au/dataset/riwi-act-surface-water-areas-and-irrigation-districts.

Government of Western Australia (GoWA) (2019a), Soil Landscape Mapping – Best Available (DPIRD-027), Department of Primary Industries and Regional Development. Retrieved December 2020, from https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-best-available

Government of Western Australia (GoWA) (2019b), Soil Landscape Mapping – Western Australia attributed by WA Soil Group (DPIRD-076), Department of Primary Industries and Regional Development. Retrieved December 2020, from https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-western-australia-attributed-by-wa-soil-group

Government of Western Australia (GoWA) (2020a), Public Drinking Water Source Areas (DWER-033), Department of Water and Environmental Regulation. Retrieved December 2020, from https://catalogue.data.wa.gov.au/dataset/surface-water-management-areas

Government of Western Australia (GoWA) 2020b, 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full report), Current as of April 2019, Perth, Australia, Department of Biodiversity, Conservation and Attractions, retrieved May 2020, from https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

Government of Western Australia (GoWA) (2020c), DBCA – Legislated Lands and Waters (DBCA-011), Department of Biodiversity, Conservation and Attractions. Retrieved December 2020, from https://catalogue.data.wa.gov.au/dataset/dbca-legislated-lands-and-waters

Government of Western Australia (GoWA) (2020d) Native Vegetation Extent. Government of Western Australia.

Government of Western Australia (GoWA) (2020e), Clearing Regulations – Environmentally Sensitive Areas (DWER-046), Department of Water and Environmental Regulation. Retrieved December 2020, from https://catalogue.data.wa.gov.au/dataset/clearing-regulations-environmentally-sensitive-areas-dwer-046.

Kendrick, P. & Stanley, F. (2001), Pilbara 4 (PIL4 – Roebourne synopsis), A biodiversity Audit of Western Australia's 53 Biogeographic Subregions in 2002. Keighery, B. J. 1994, Bushland Plant Survey: A Guide to Plant Community Survey for the Community, Nedlands. Australia, Wildflower Society of Western Australia (Inc.).

Landgate (2020), Medium Scale Topo Water (Line) 29 November 2020.

Reeves, J. M., De Deckker, P. & Halse, S. A. (2007), Groundwater Ostracods from the arid Pilbara region of northwestern Australia: distribution and water chemistry. Hydrobiologia 585:99-118.

Shepherd, DP, Beeston, GR, and Hopkins, AJM (2002), Native Vegetation in Western Australia – Extent, Type and Status, Resource Management Technical Report 249, Department of Agriculture, Western Australia.

Tille, P. J. (2006), Soil-landscapes of Western Australia's rangelands and arid interior, Department of Agriculture and Food, Western Australia, Perth. Report 313.

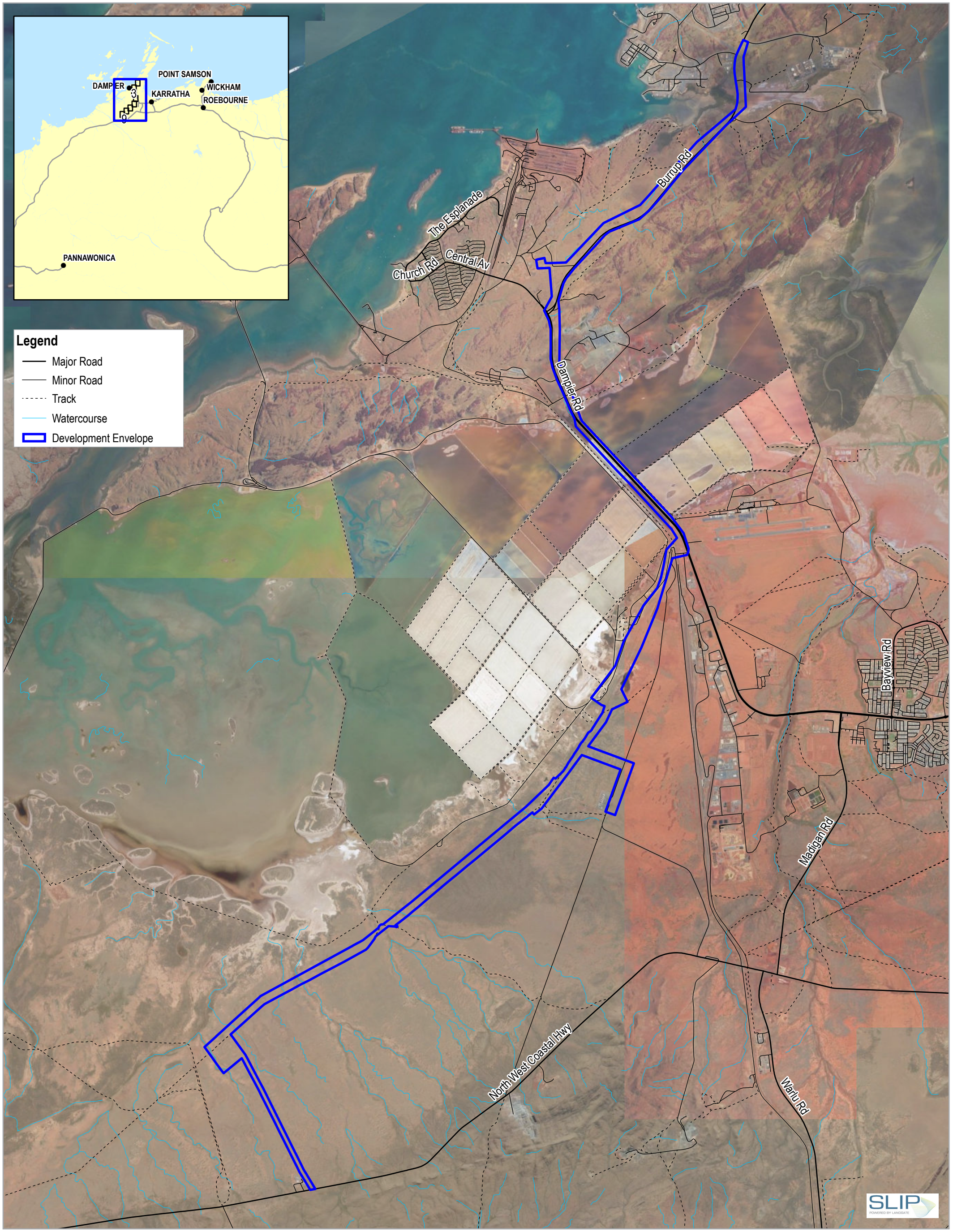
Wilson, S. and G. Swan (2008). A complete guide to reptiles of Australia, 2nd edition. New Holland Publishers, Australia.

Wilson, S and Swan, G (2017), A Complete Guide to Reptiles of Australia, Fifth edition, Sydney, Australia, New Holland Press.

Van Vreeswyk, A M et al (2004) An inventory and condition survey of the Pilbara region, Western Australia.

Appendices

Appendix A – Figures



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Horizon Power
Geotechnical Works
Clearing Permit Application

Project Location

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Revision No. **0**
Date **9/12/2020**

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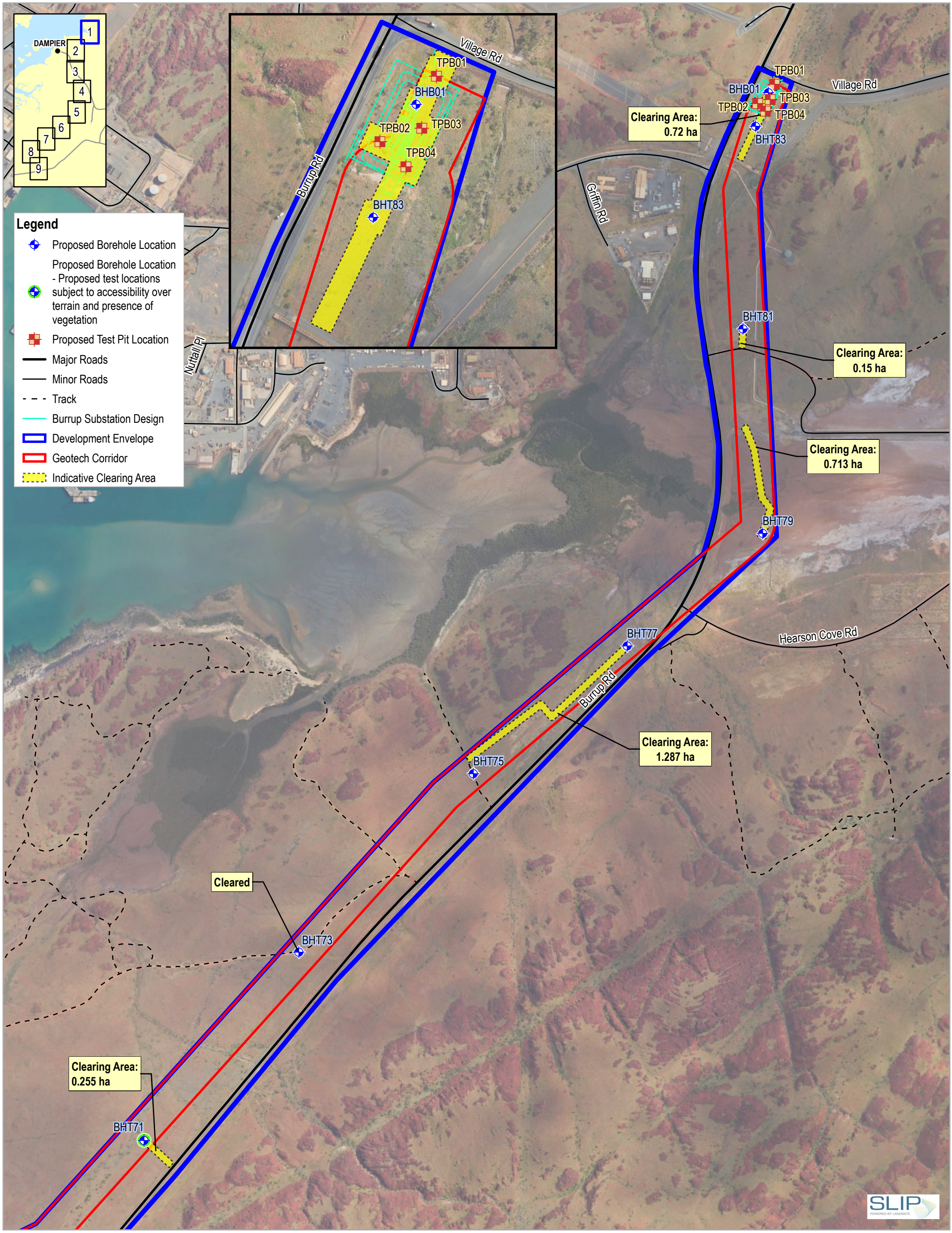

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Horizon Power
Geotechnical Works
Clearing Permit Application

Project No. **12542051**
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Date **21/12/2020**

Geotech Investigation Locations

FIGURE 2

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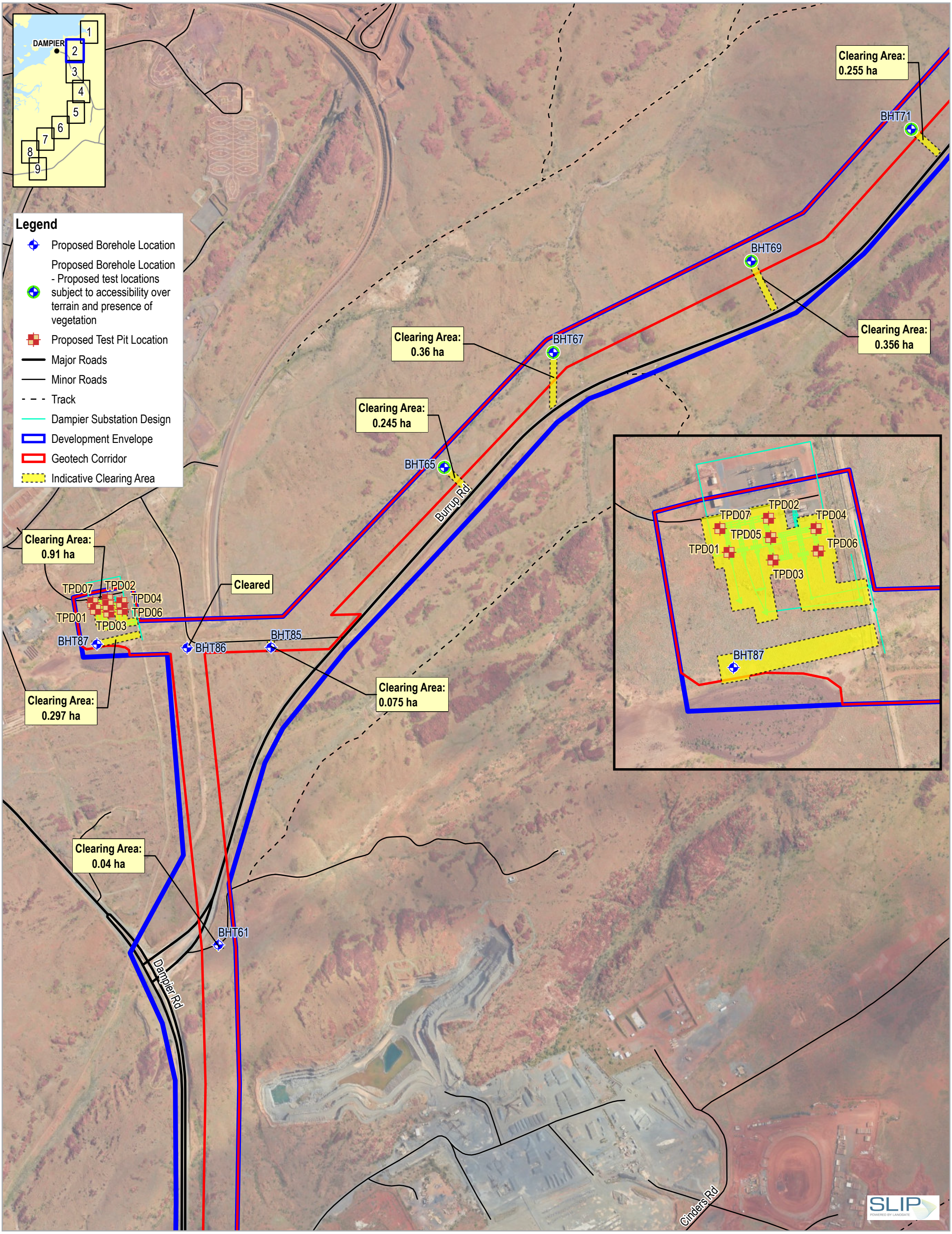

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Geotech Investigation Locations

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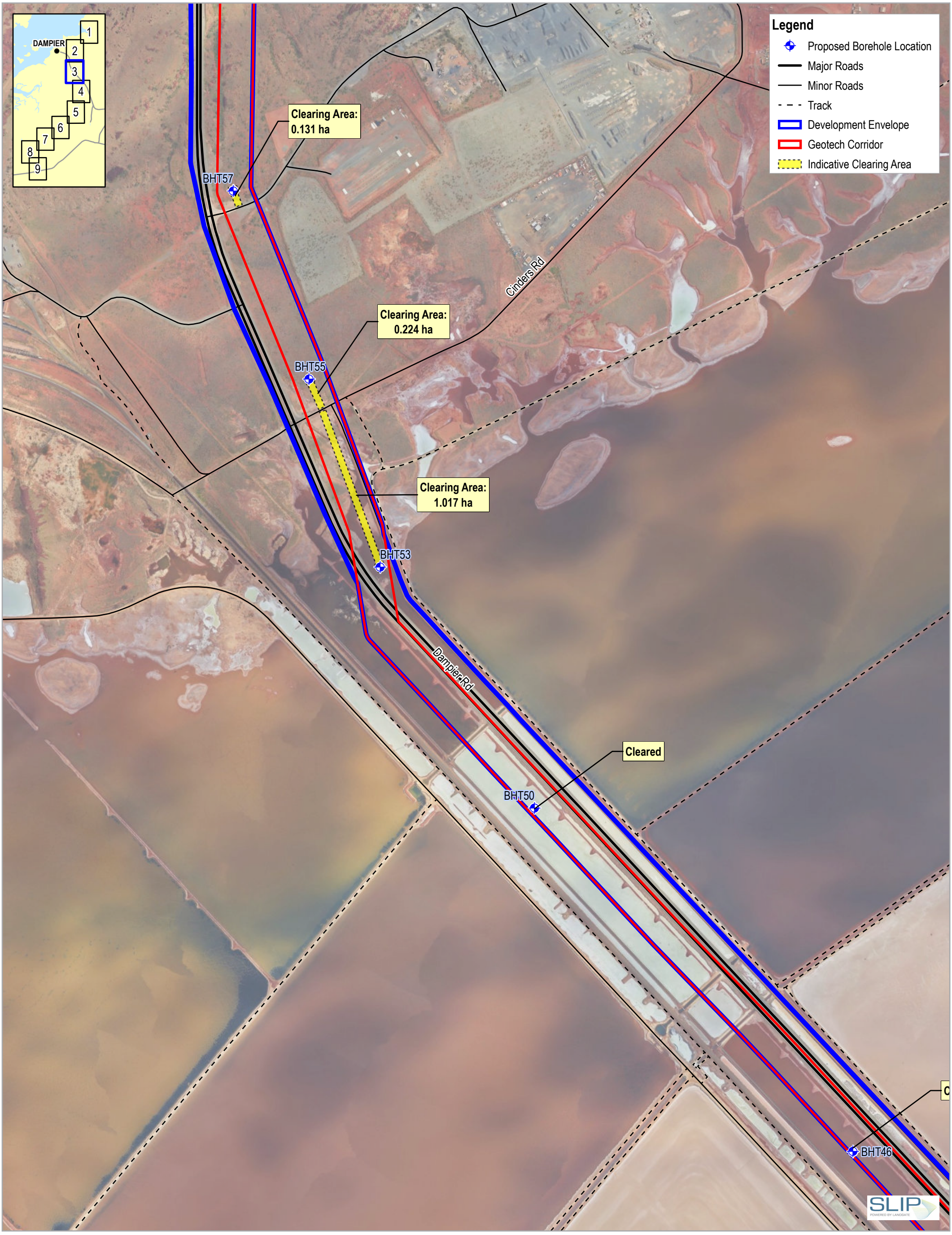

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Geotech Investigation Locations

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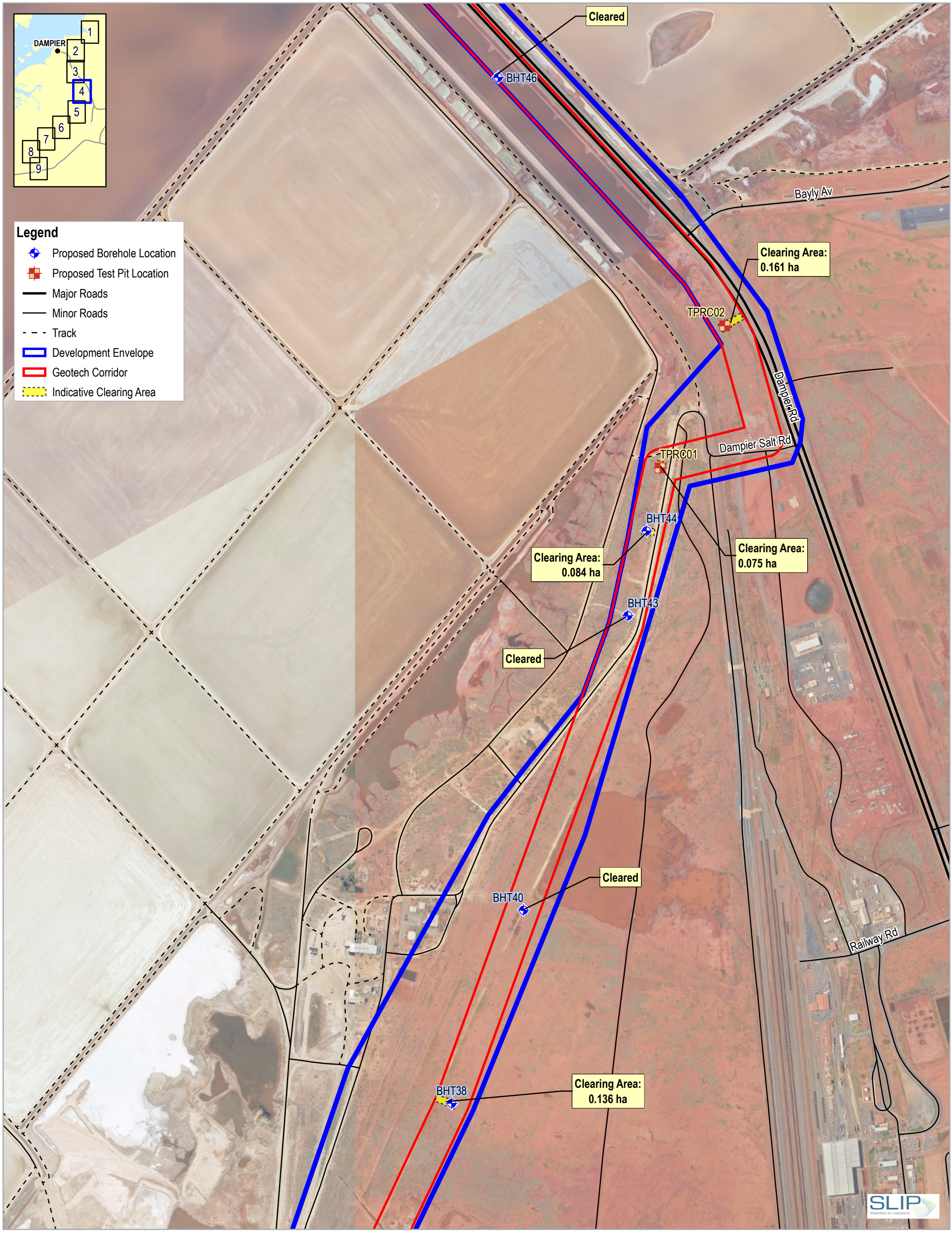

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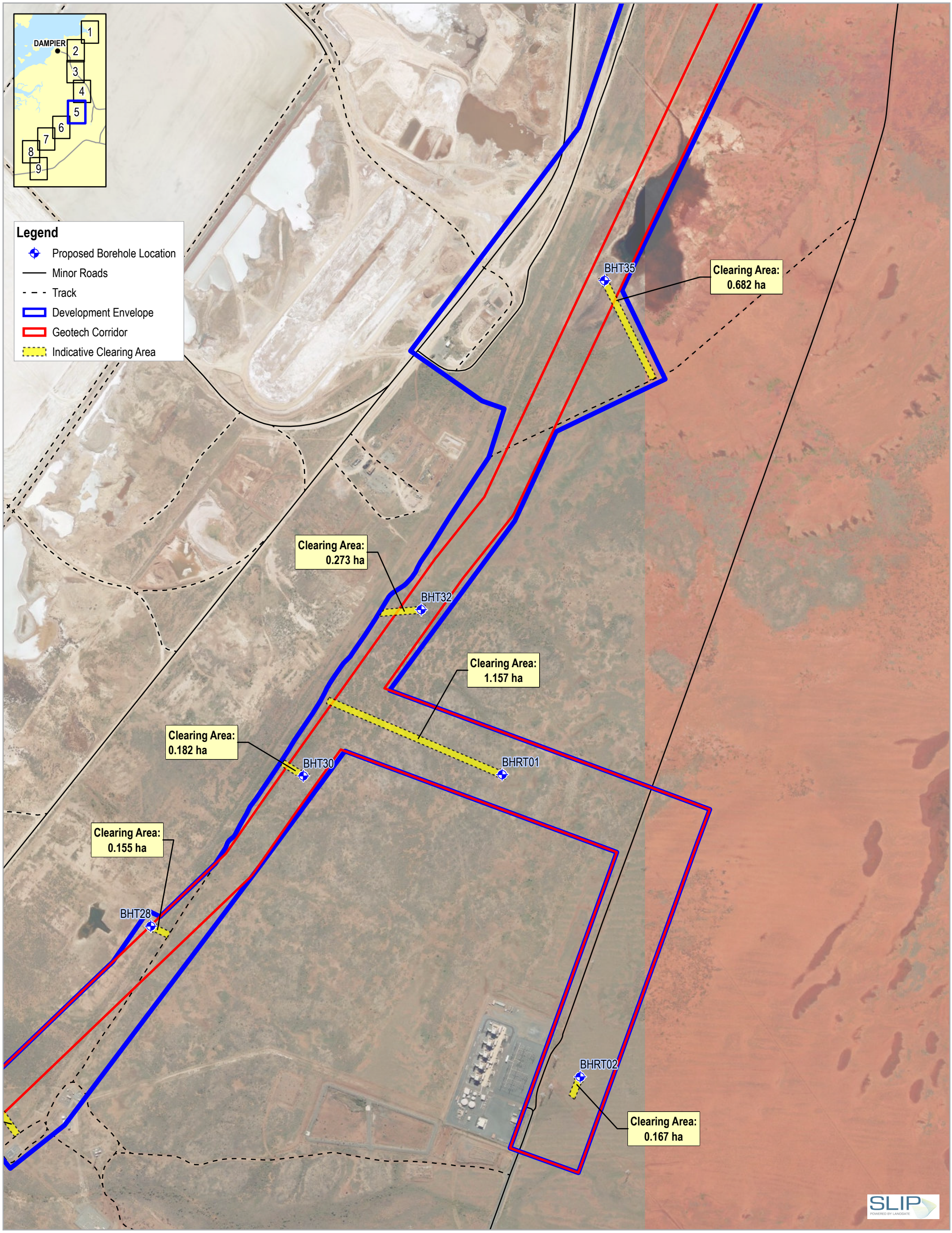

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Geotech Investigation Locations

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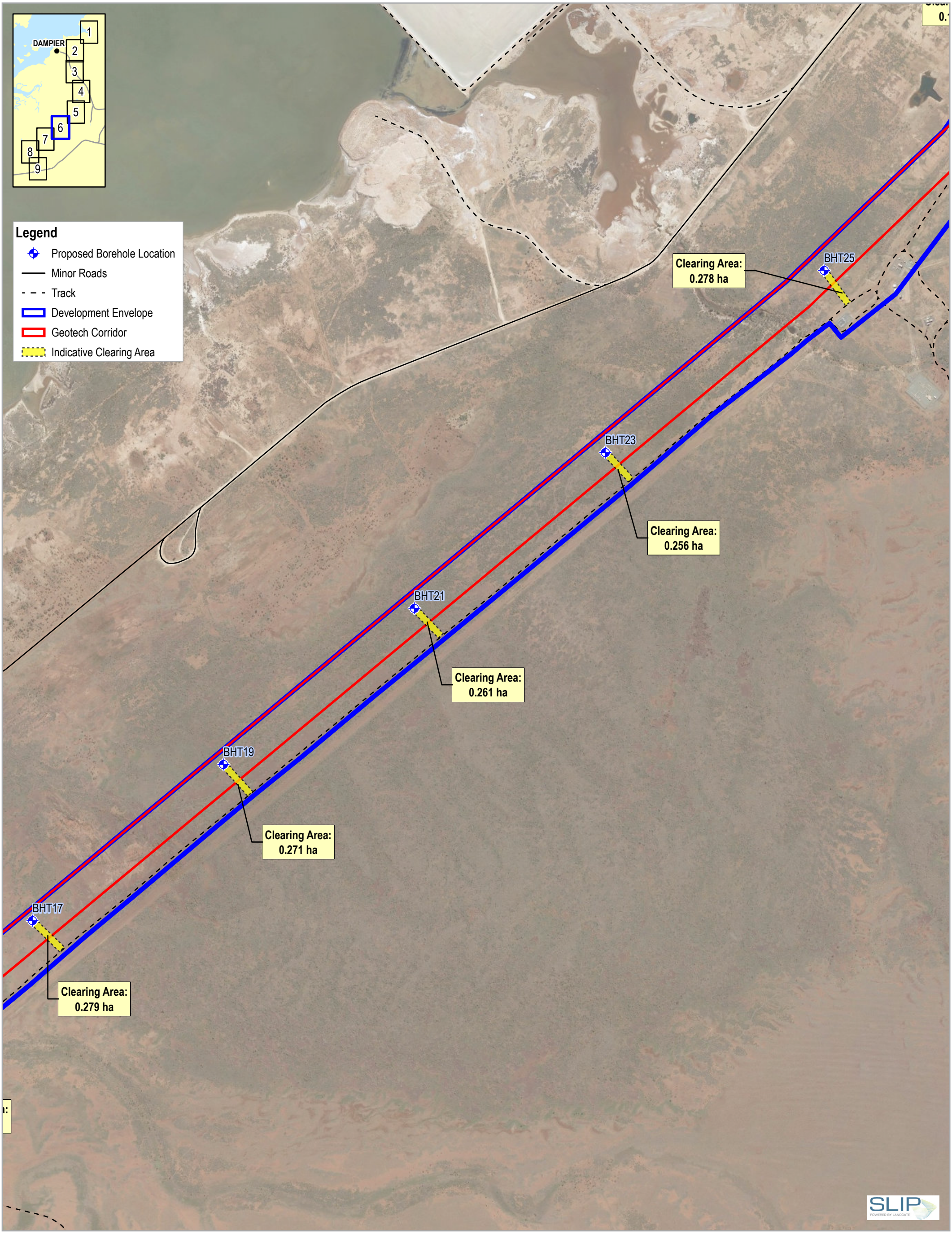

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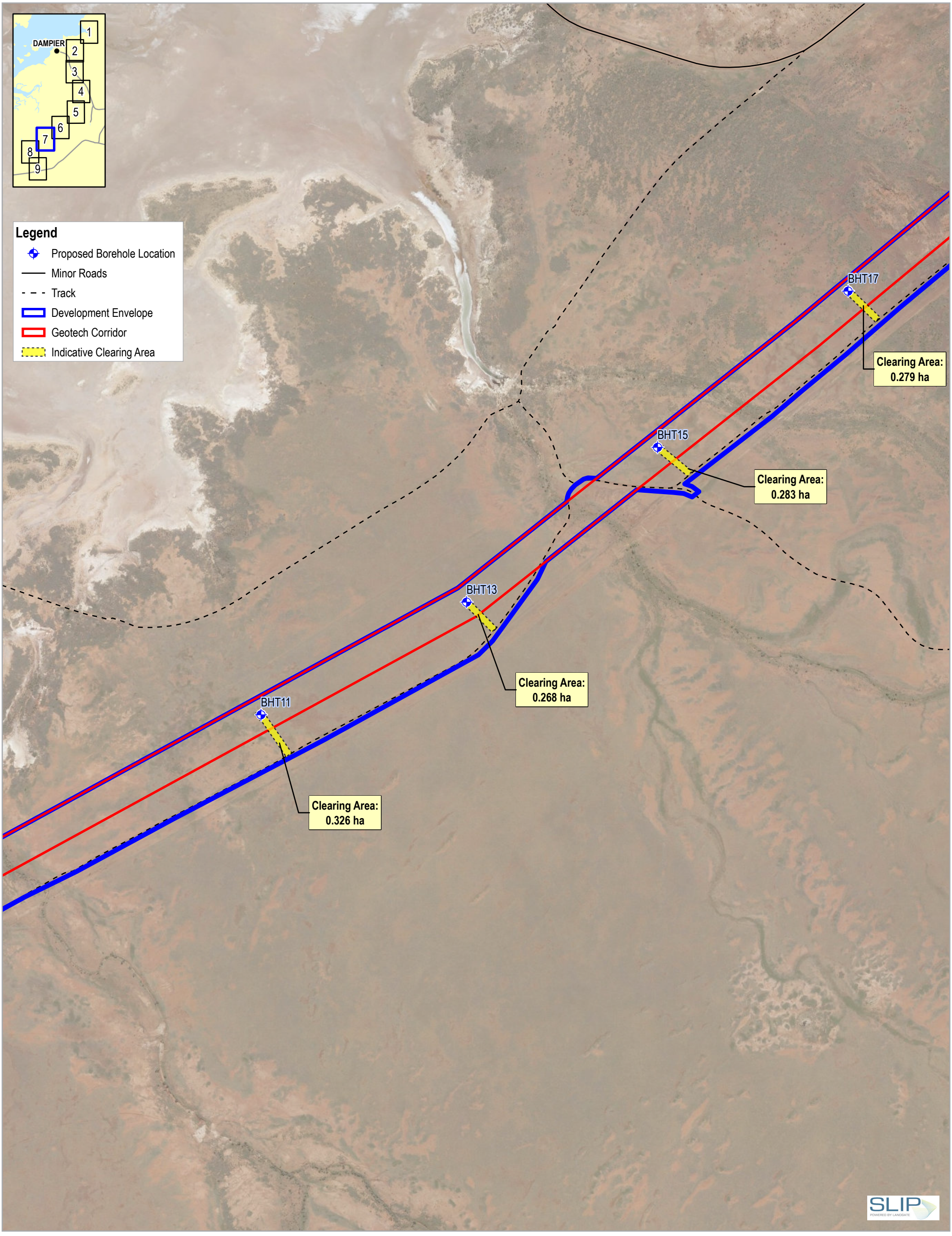

Paper Size ISO A3

0 50 100 150 200

Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

Horizon Power
Geotechnical Works
Clearing Permit Application

Geotech Investigation Locations

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 2

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_002_GeotechInvestigationFP_Rev0
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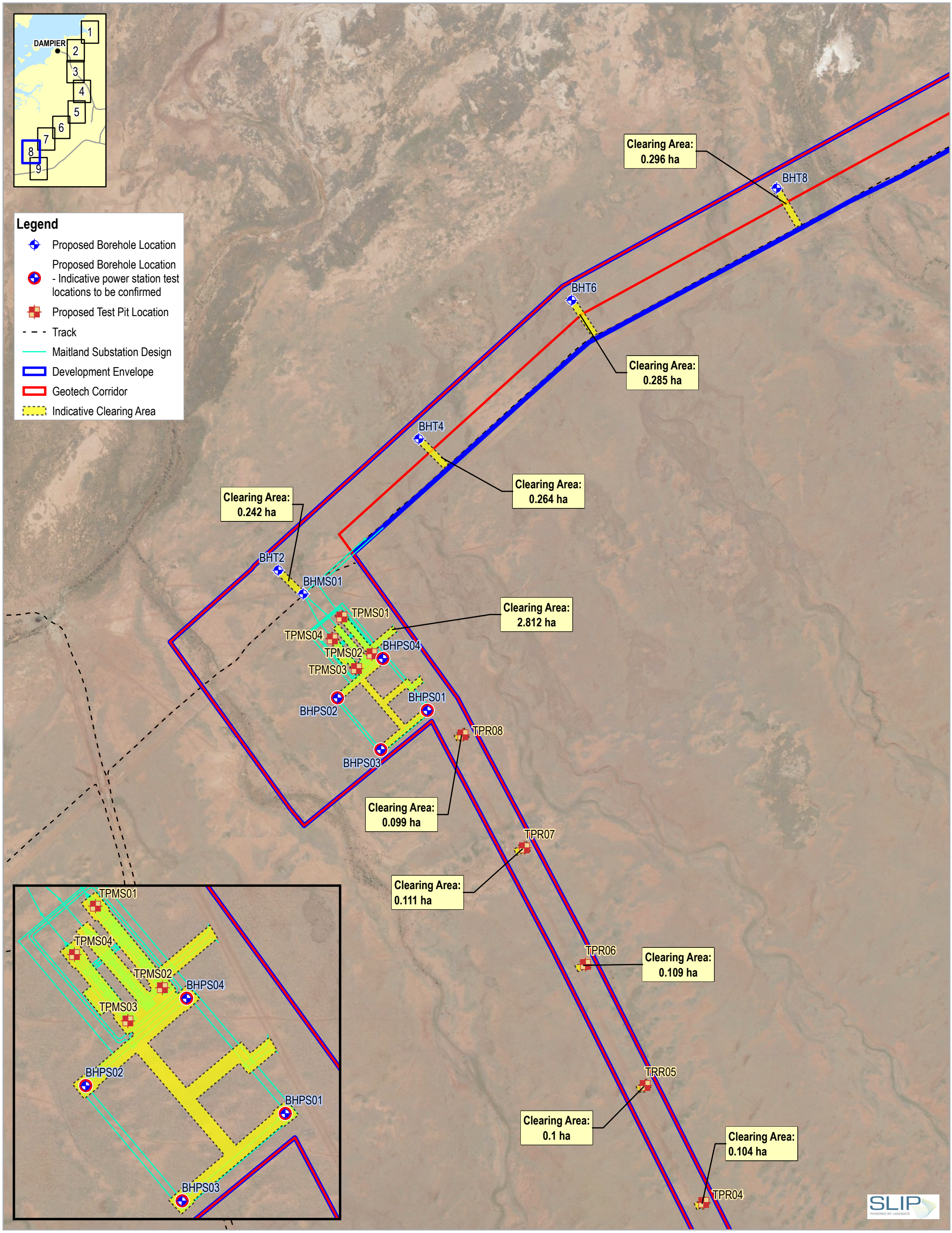

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

Geotech Investigation Locations

FIGURE 2

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_002_GeotechInvestigationFP_Rev0
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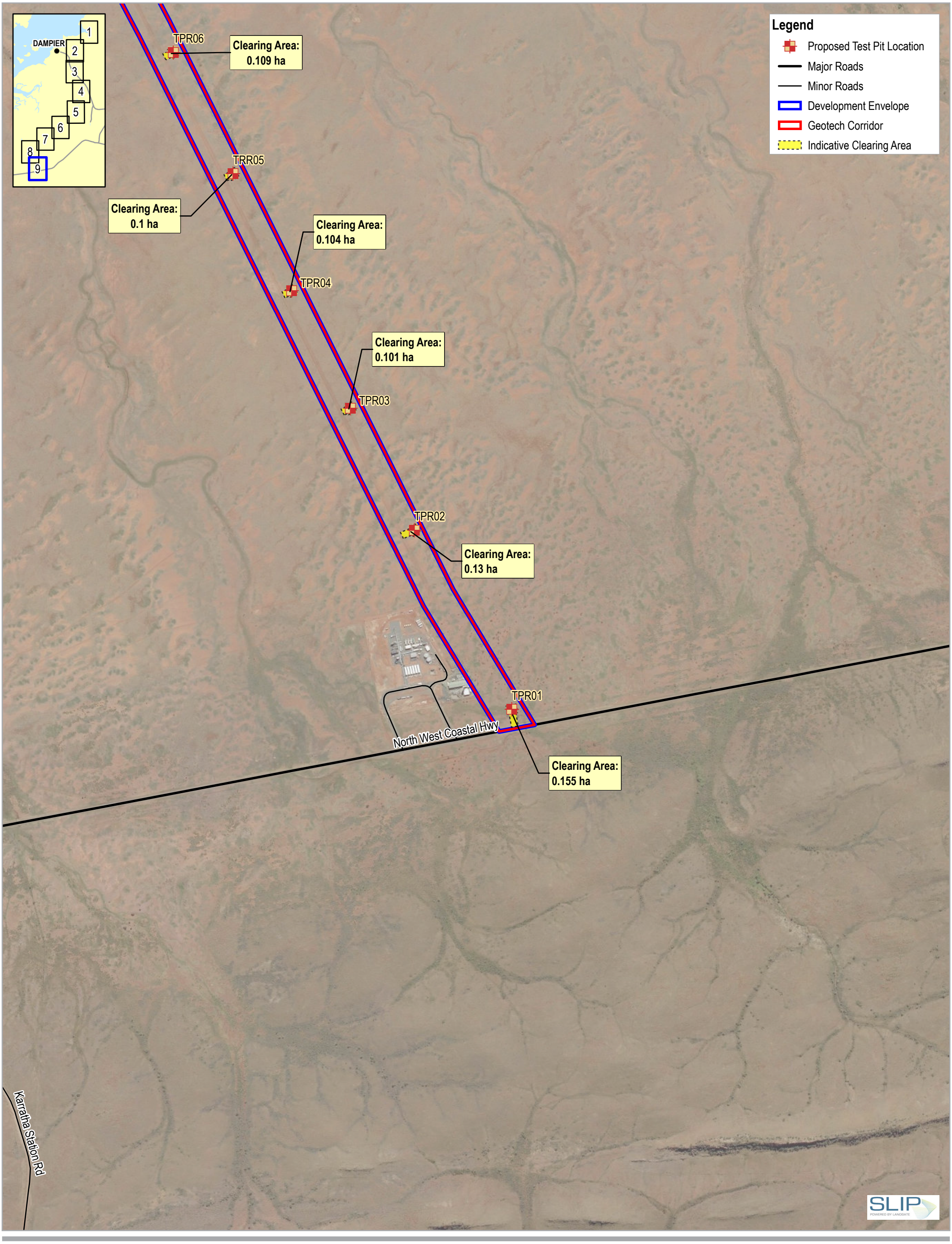

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

Geotech Investigation Locations

FIGURE 2

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_002_GeotechInvestigationFP_Rev0
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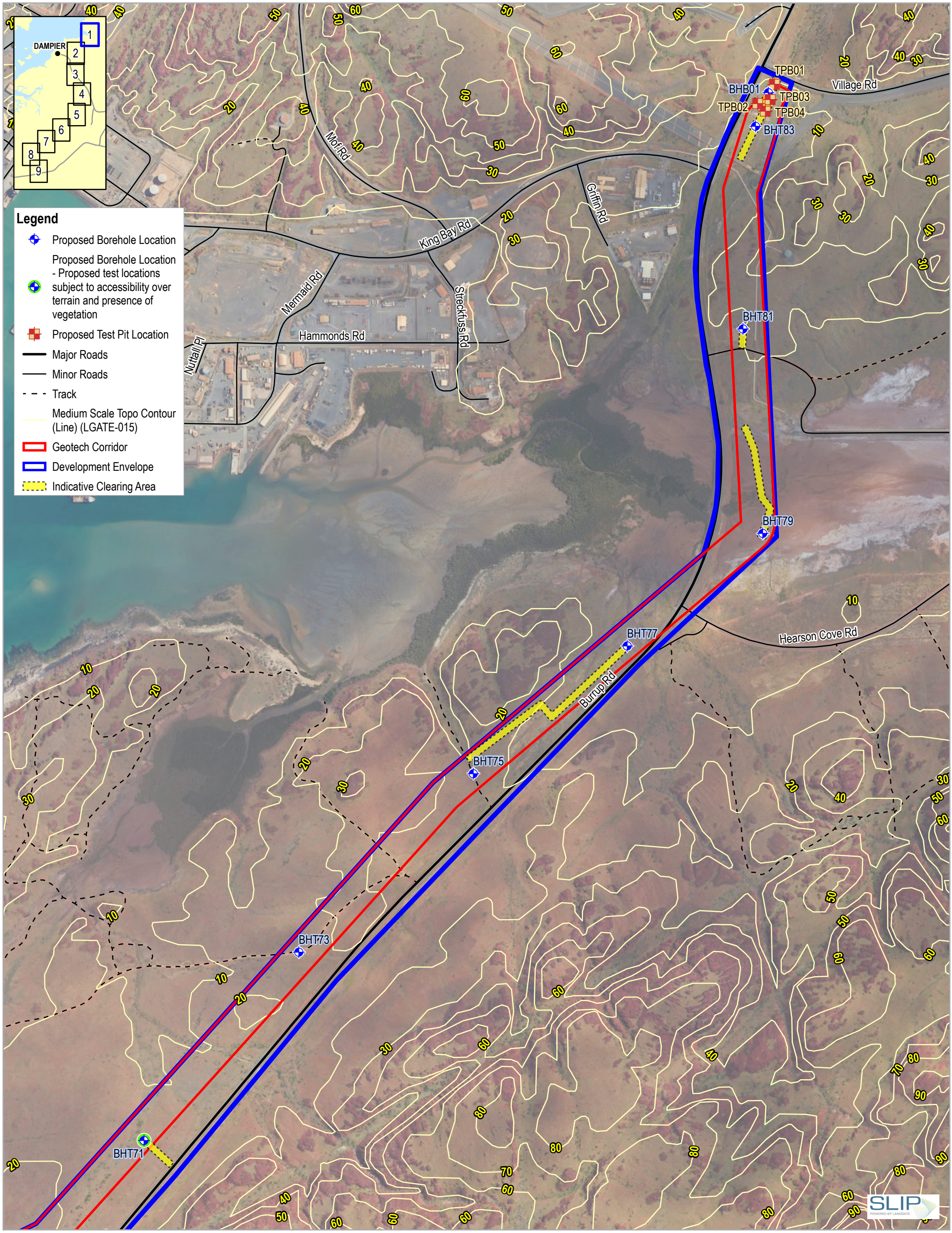

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Topography

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3a

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003a_Topography_Rev0
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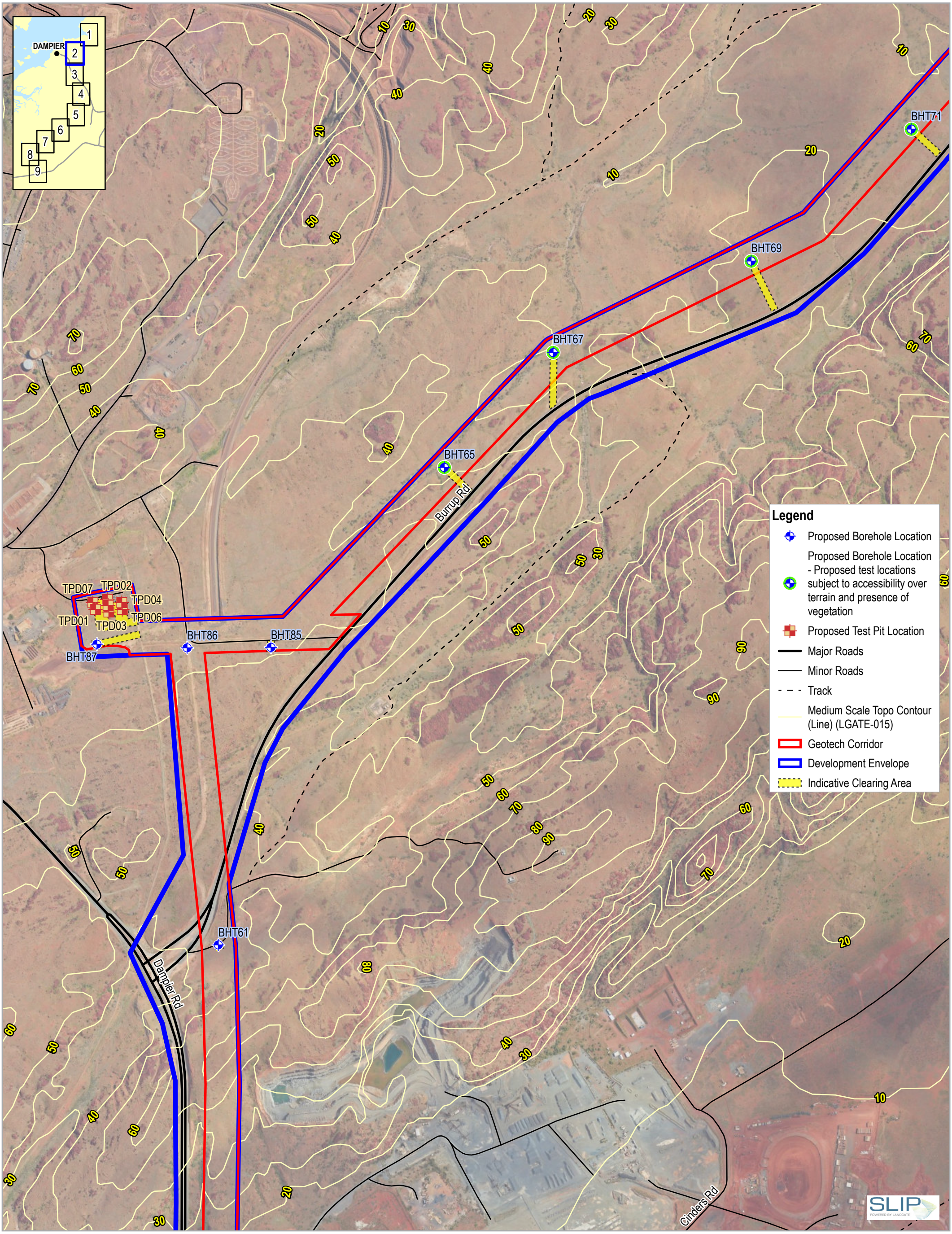

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Topography

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3a

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003a_Topography_Rev0
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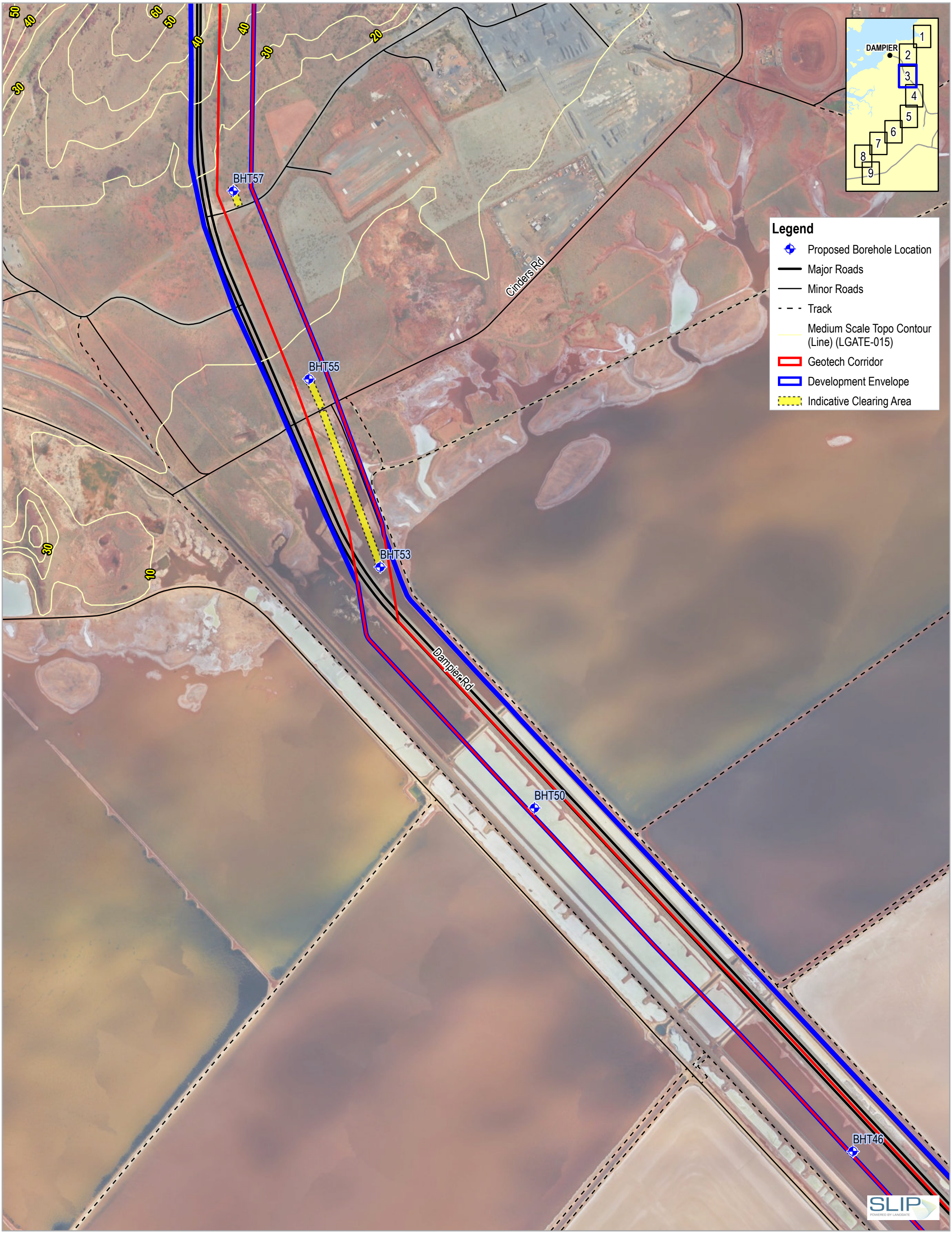

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Topography

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3a

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003a_Topography_Rev0
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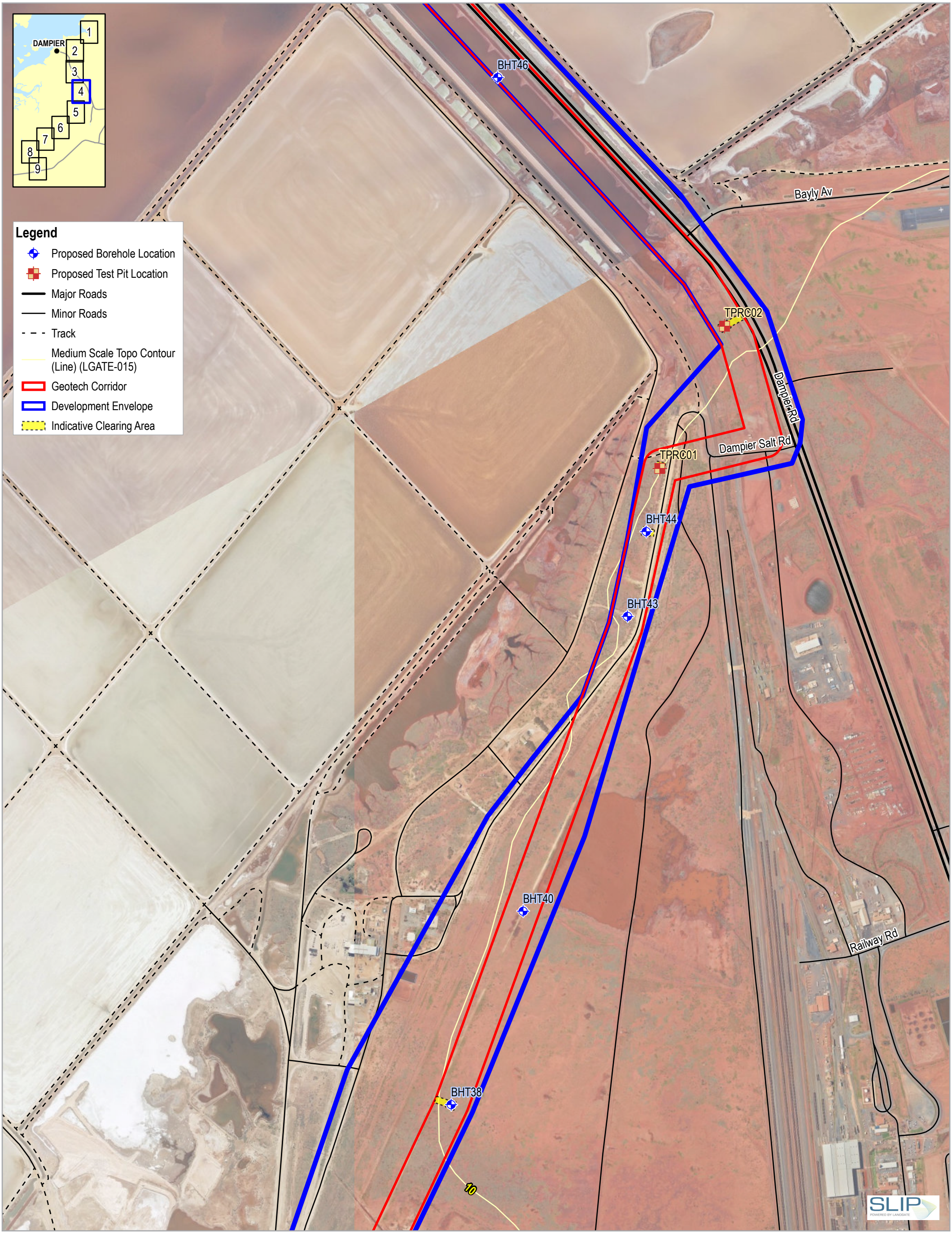

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Topography

Project No. **12542051**
Revision No. **0**
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FIGURE 3a

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003a_Topography_Rev0
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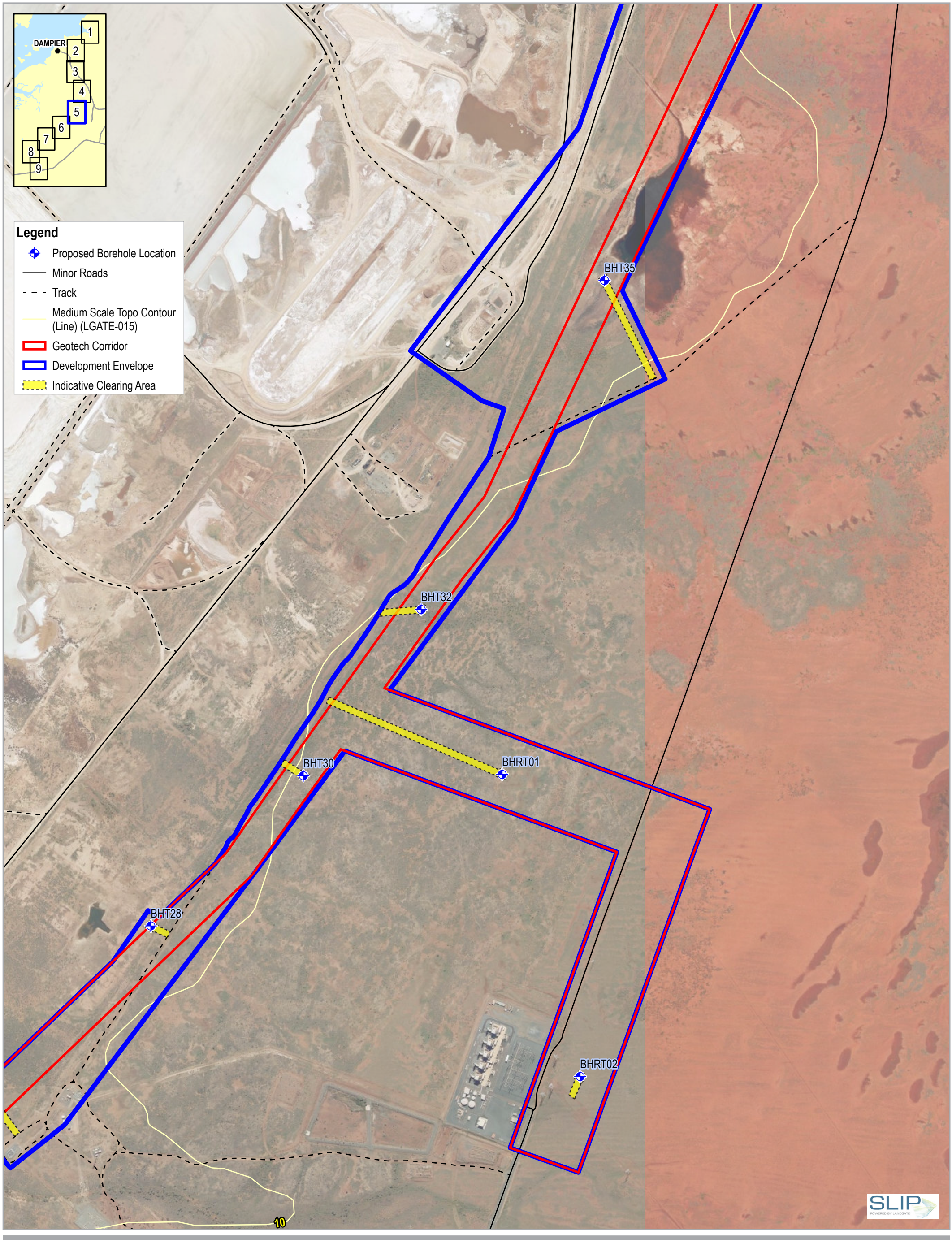

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Topography

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3a

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003a_Topography_Rev0
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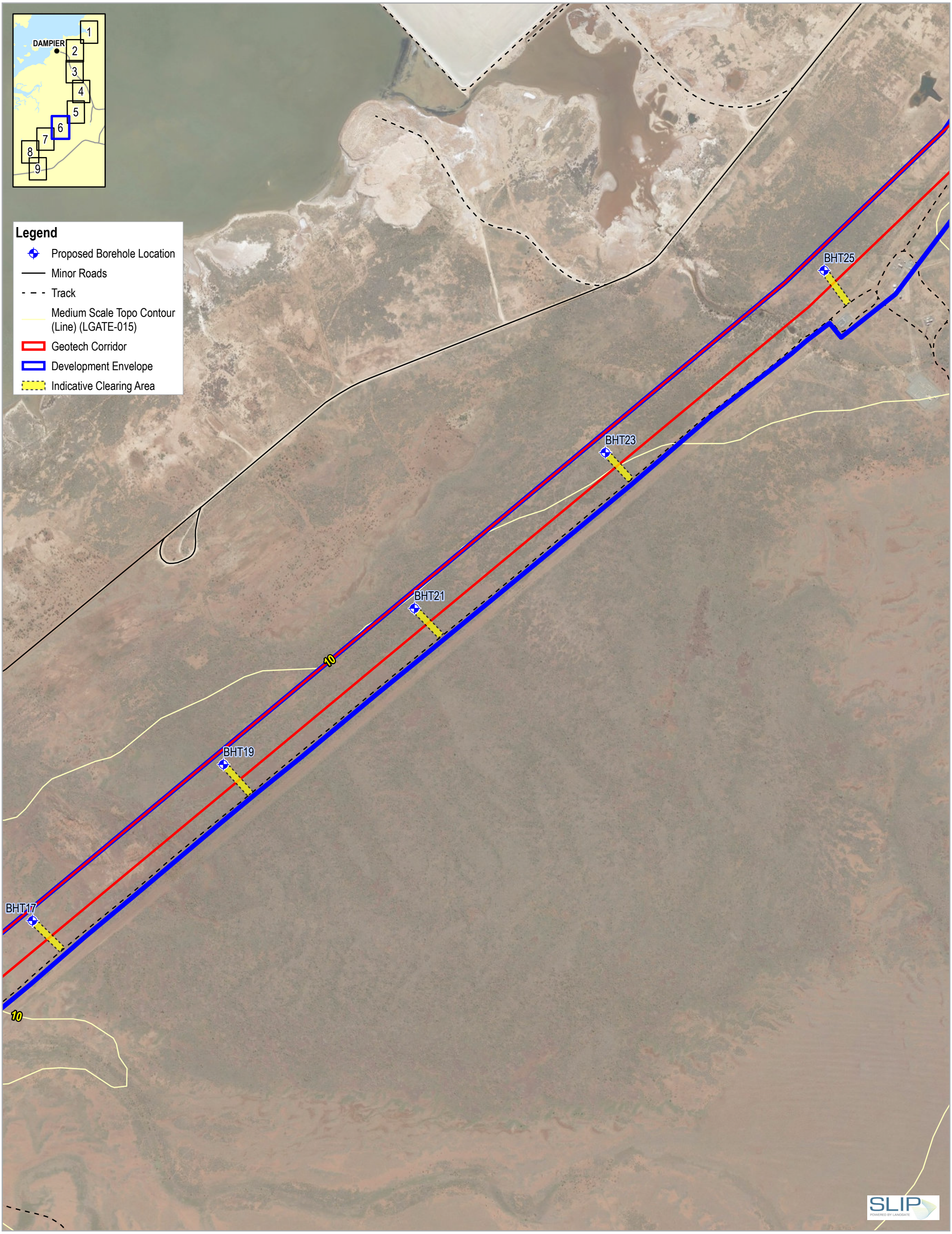

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Topography

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3a

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003a_Topography_Rev0
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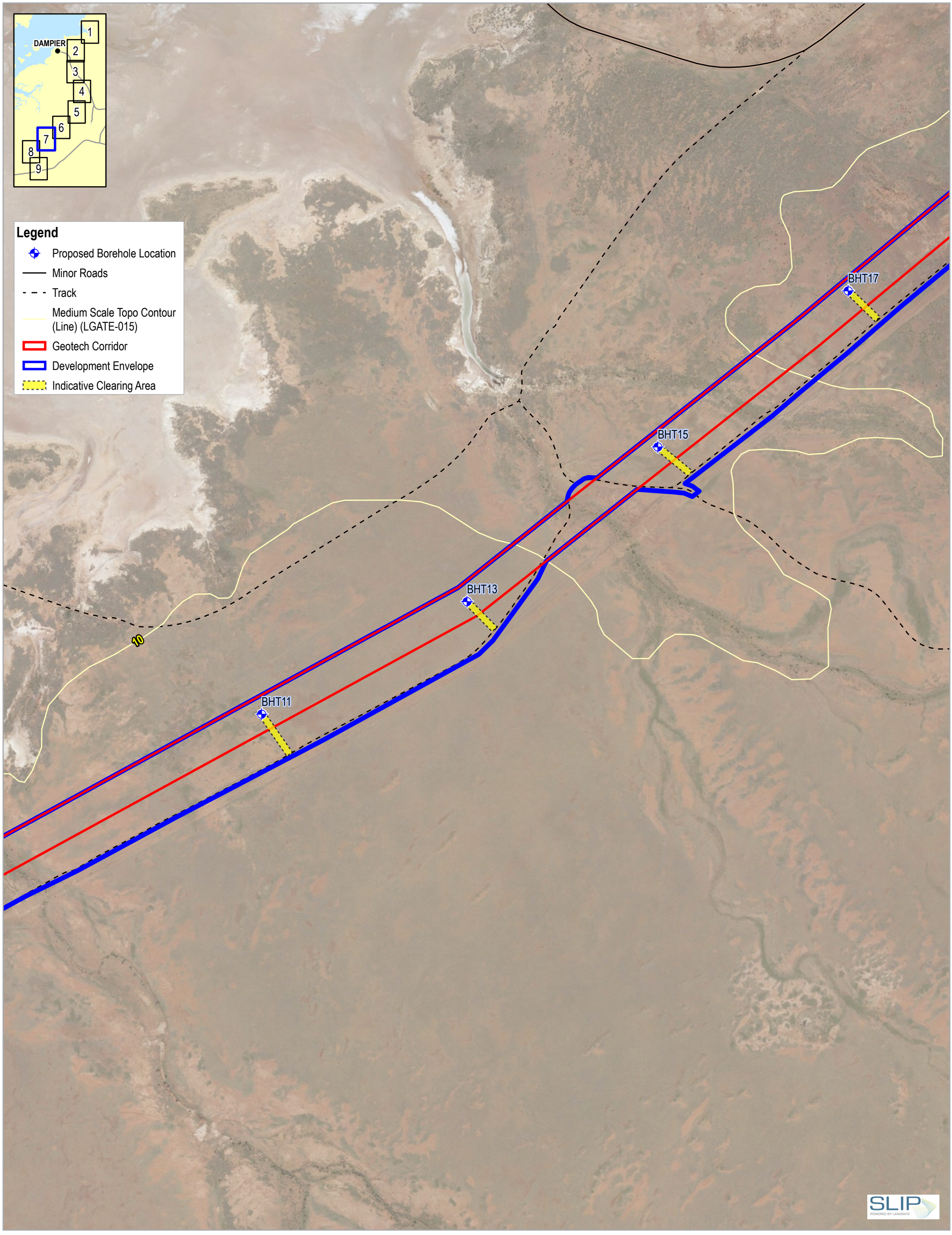

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Topography

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3a

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003a_Topography_Rev0
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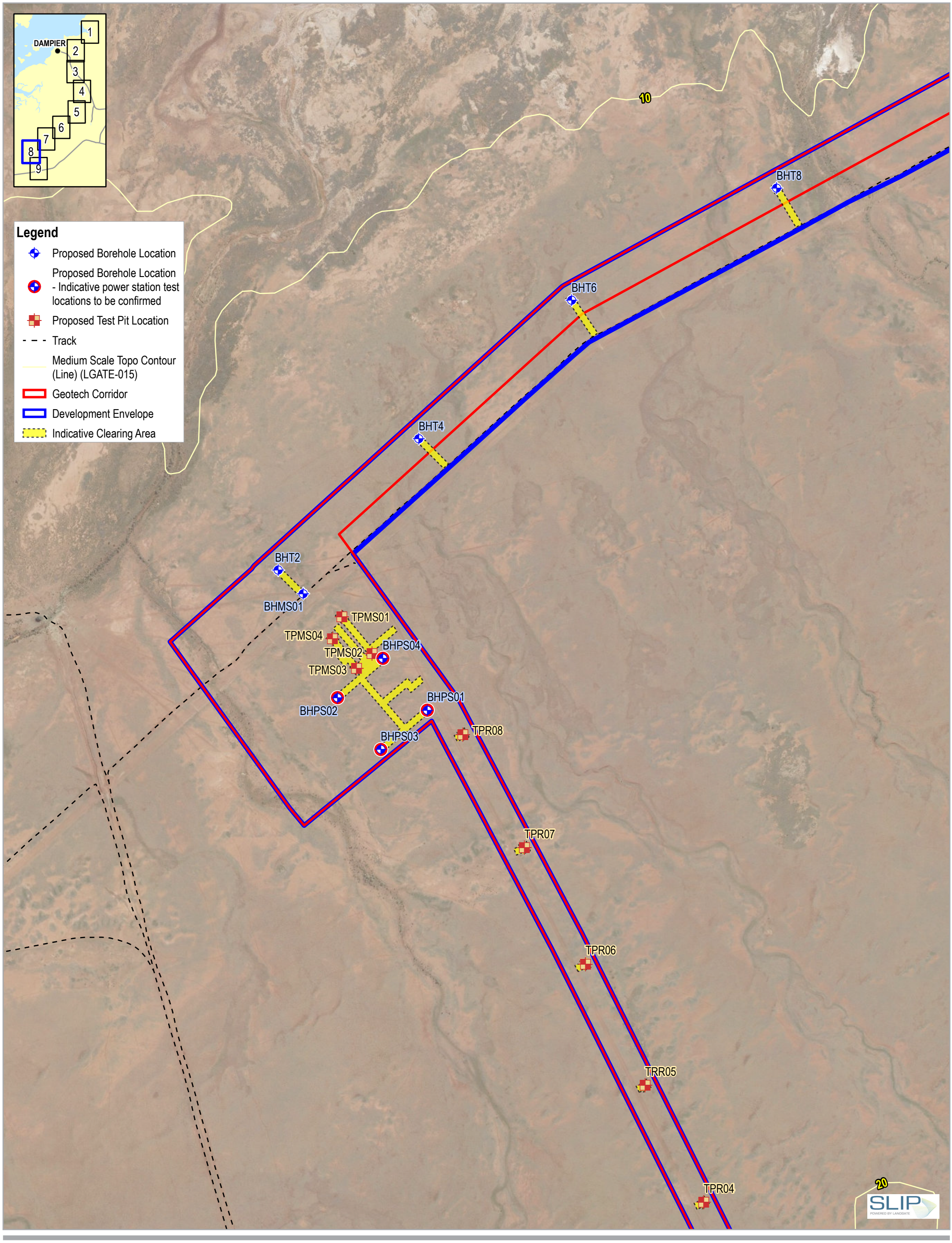

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Topography

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3a

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003a_Topography_Rev0
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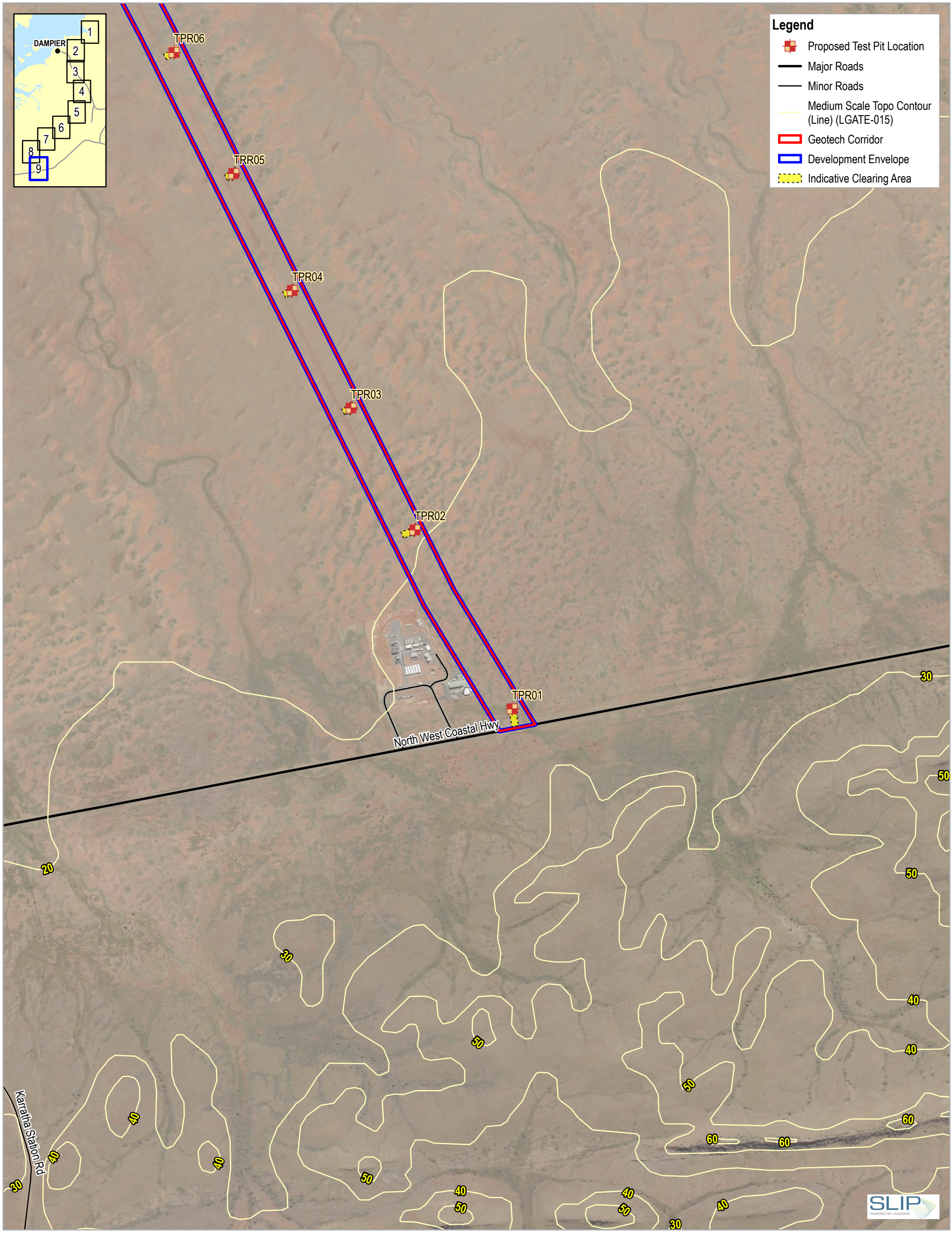

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Map Projection: Transverse Mercator
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Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Topography

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3a

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003a_Topography_Rev0
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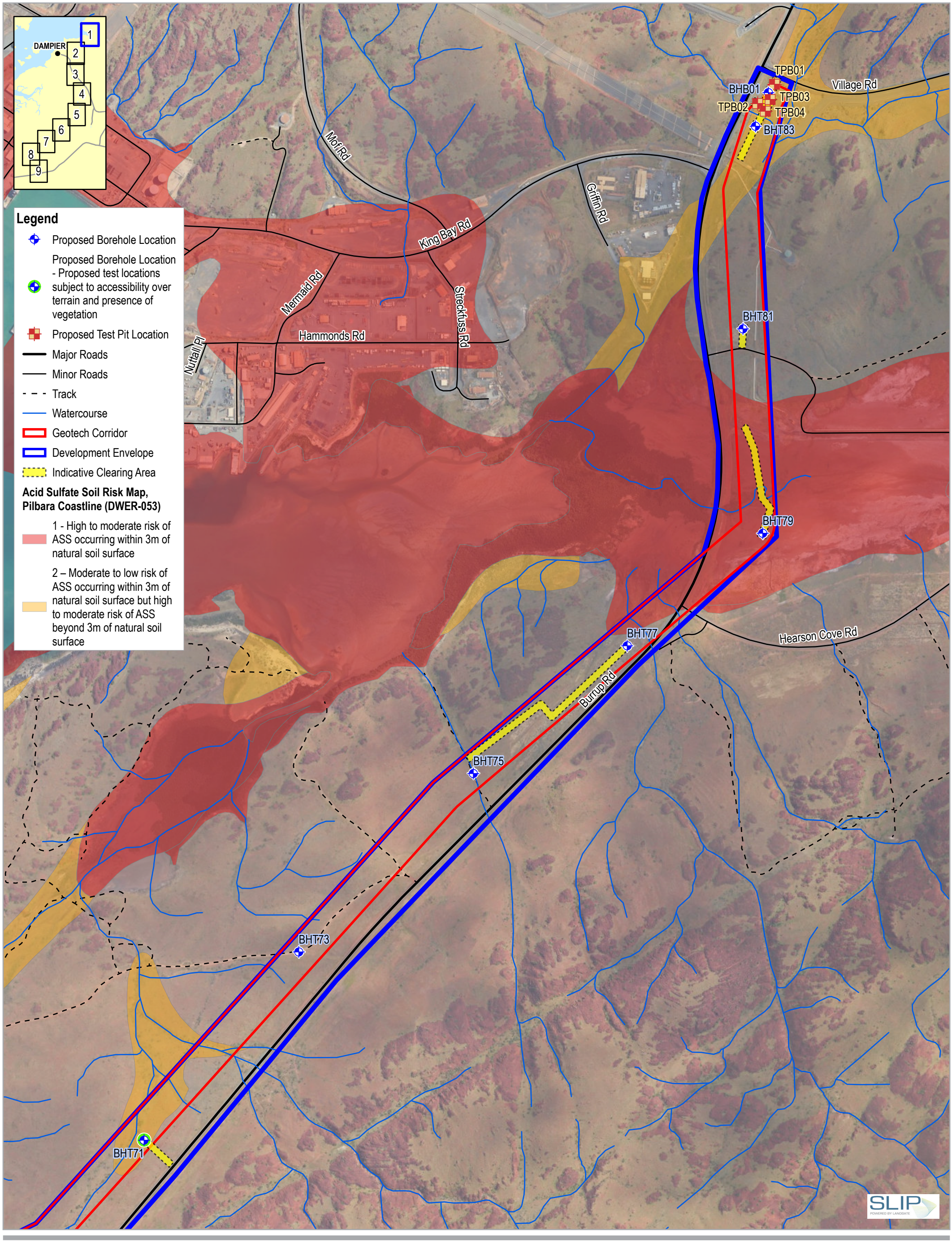

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Acid Sulfate Soil Risk and Drainage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3b

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003b_ASS_Rev0
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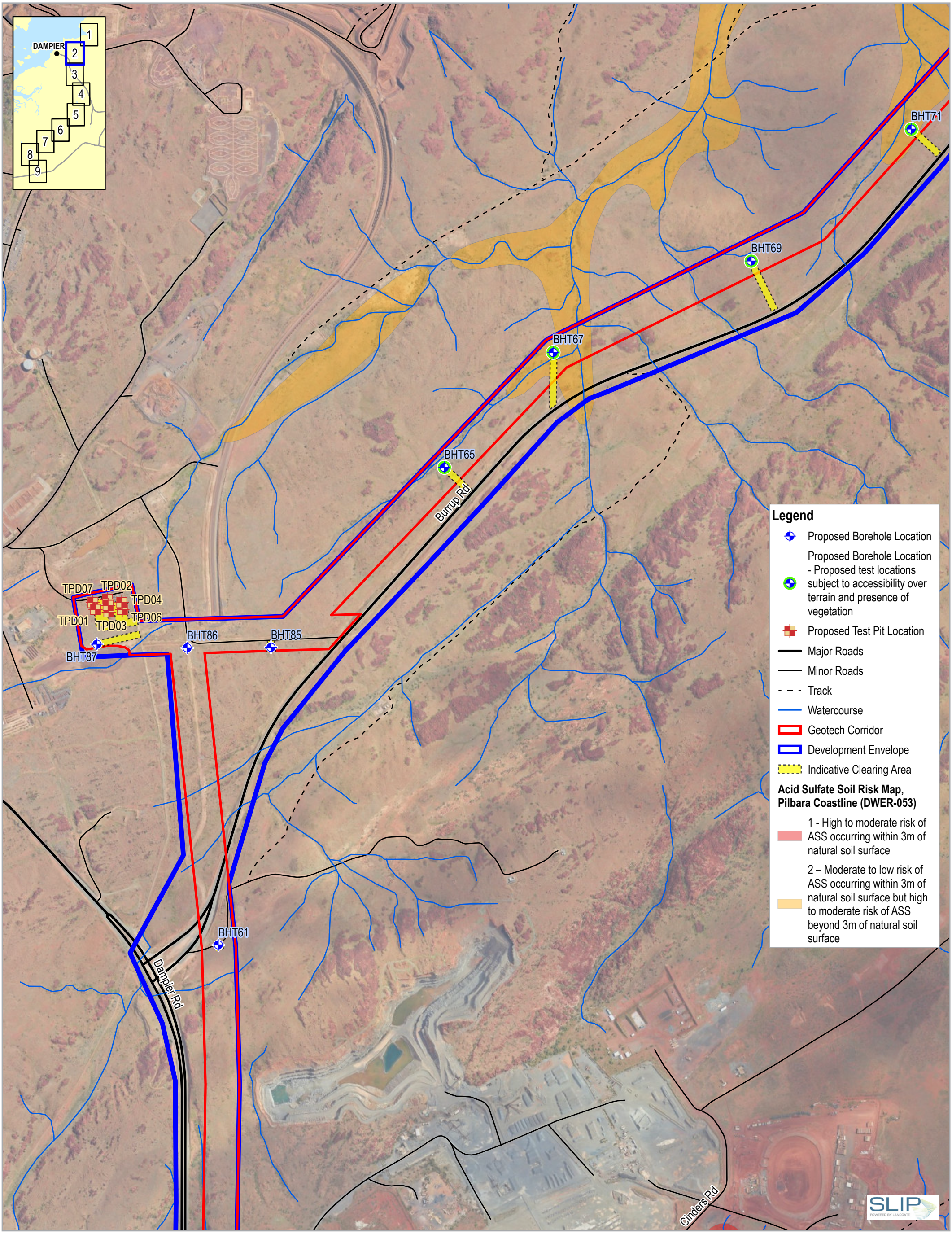

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Acid Sulfate Soil Risk and Drainage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3b

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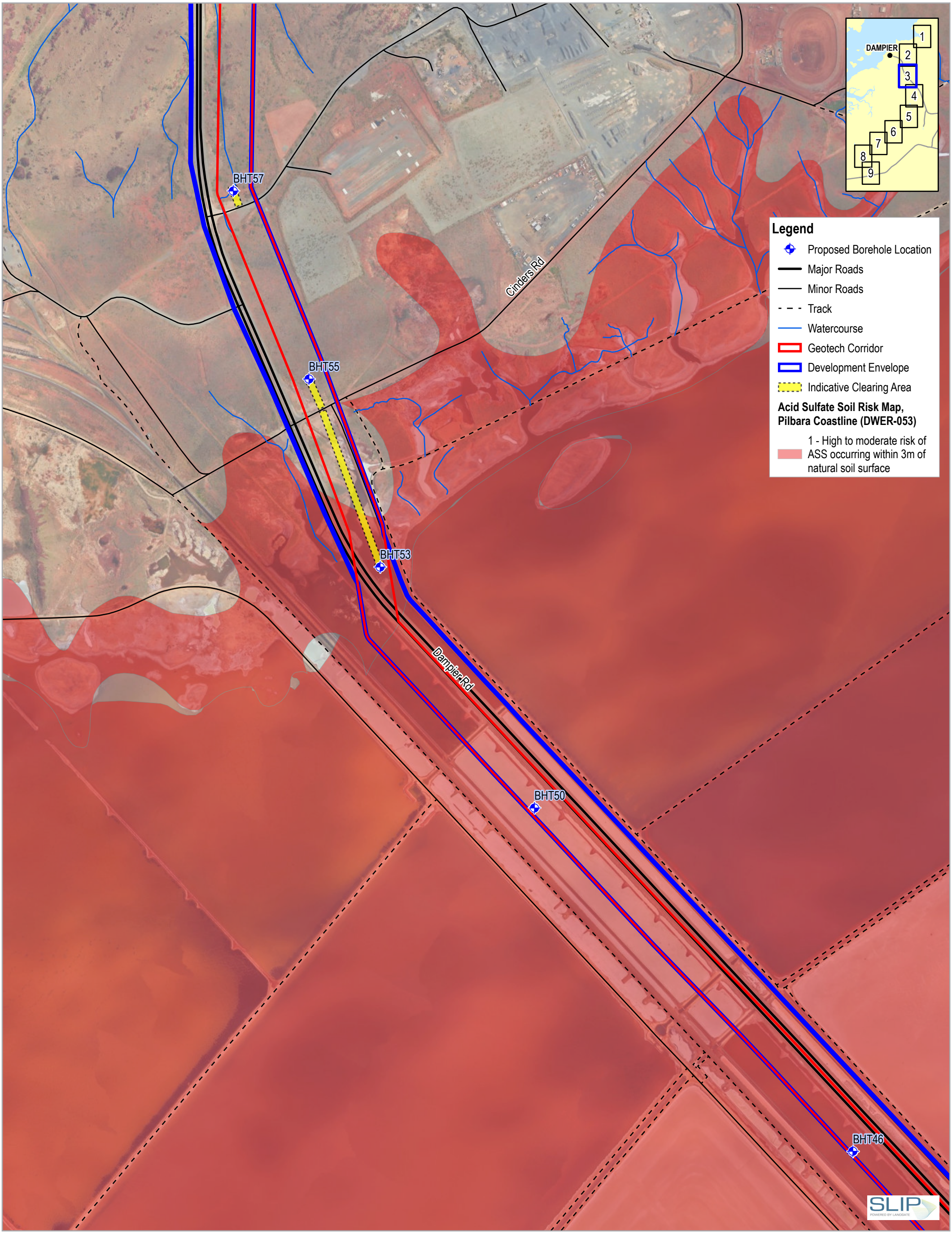

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Acid Sulfate Soil Risk and Drainage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3b

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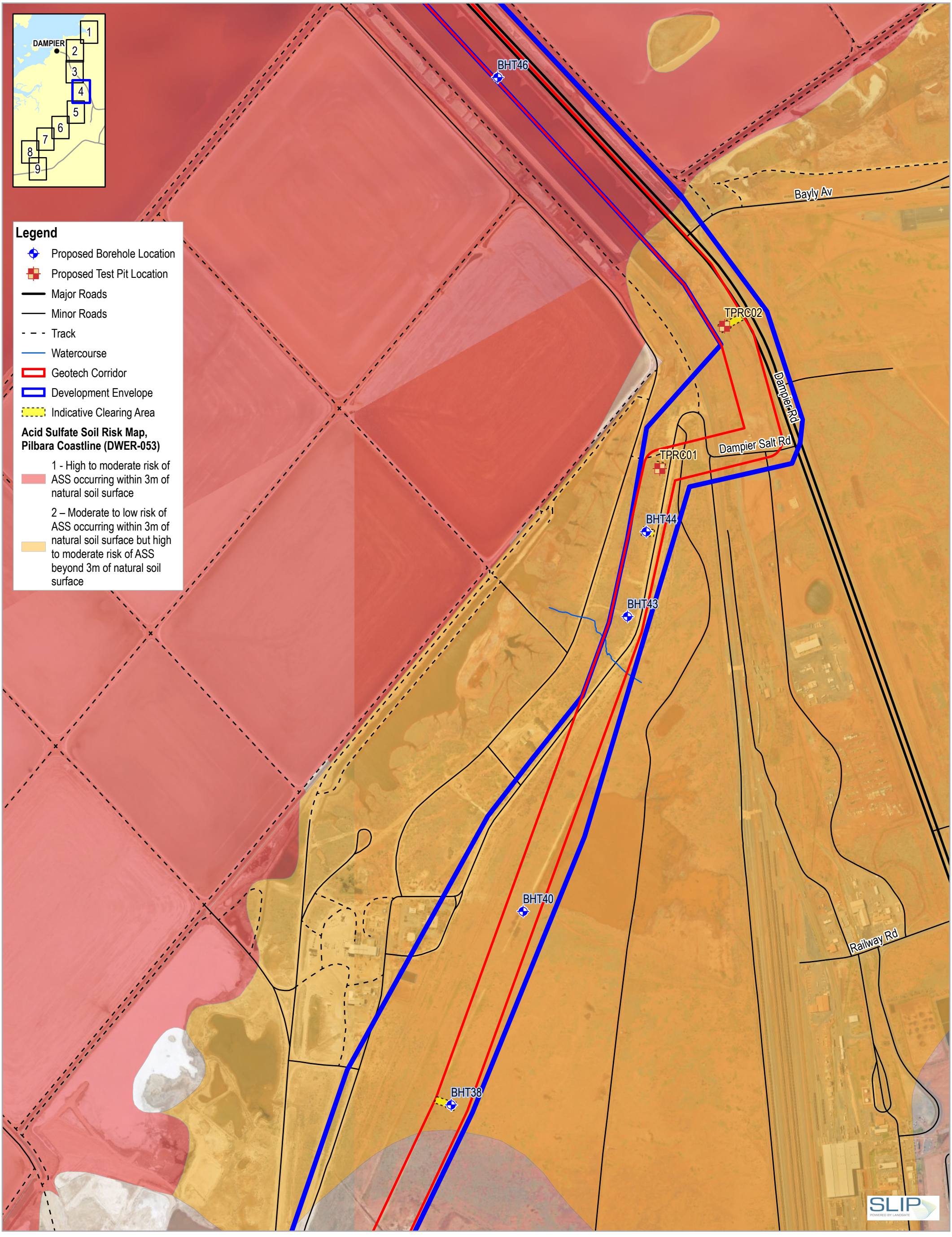

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Acid Sulfate Soil Risk and Drainage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3b

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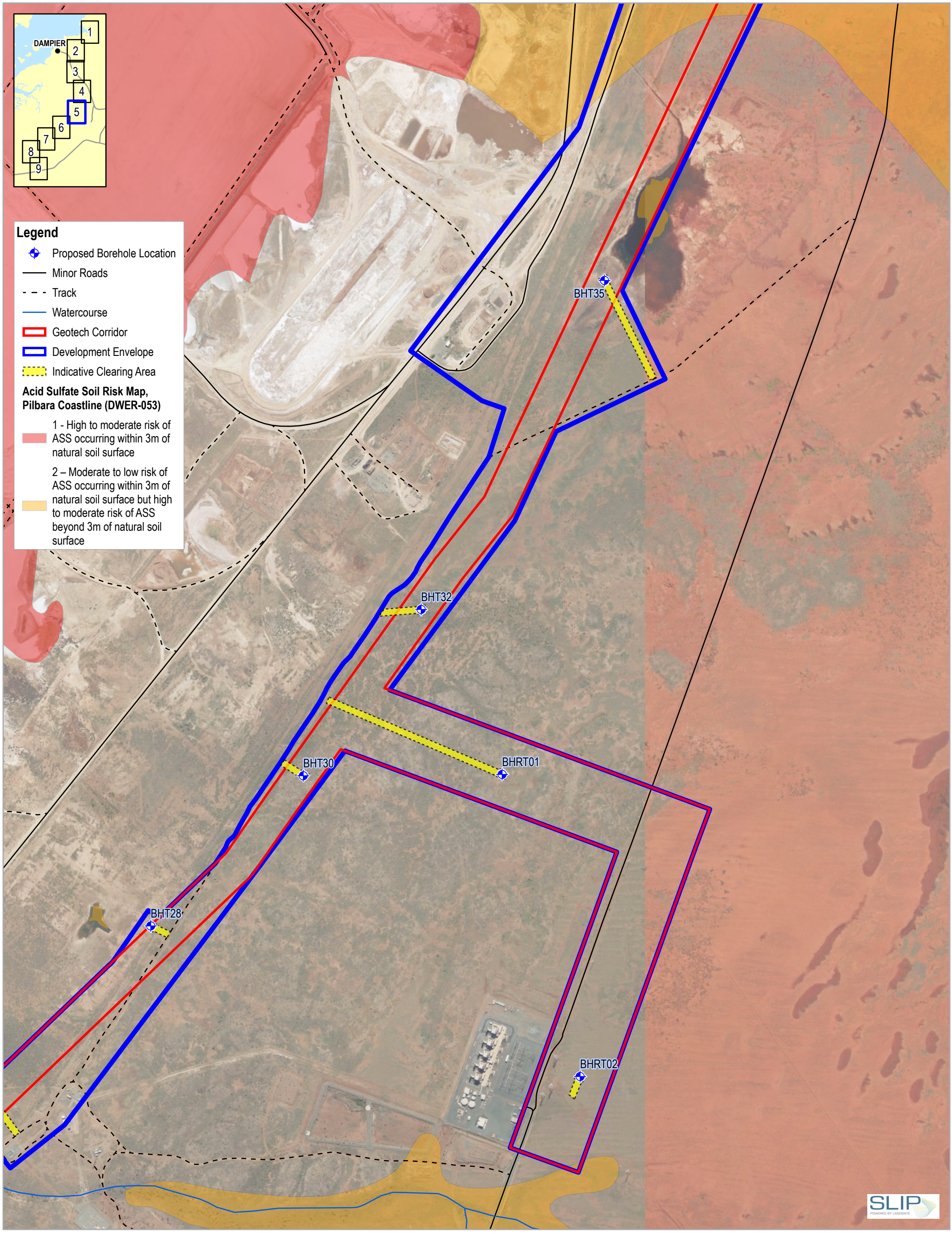

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Acid Sulfate Soil Risk and Drainage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3b

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003b_ASS_Rev0
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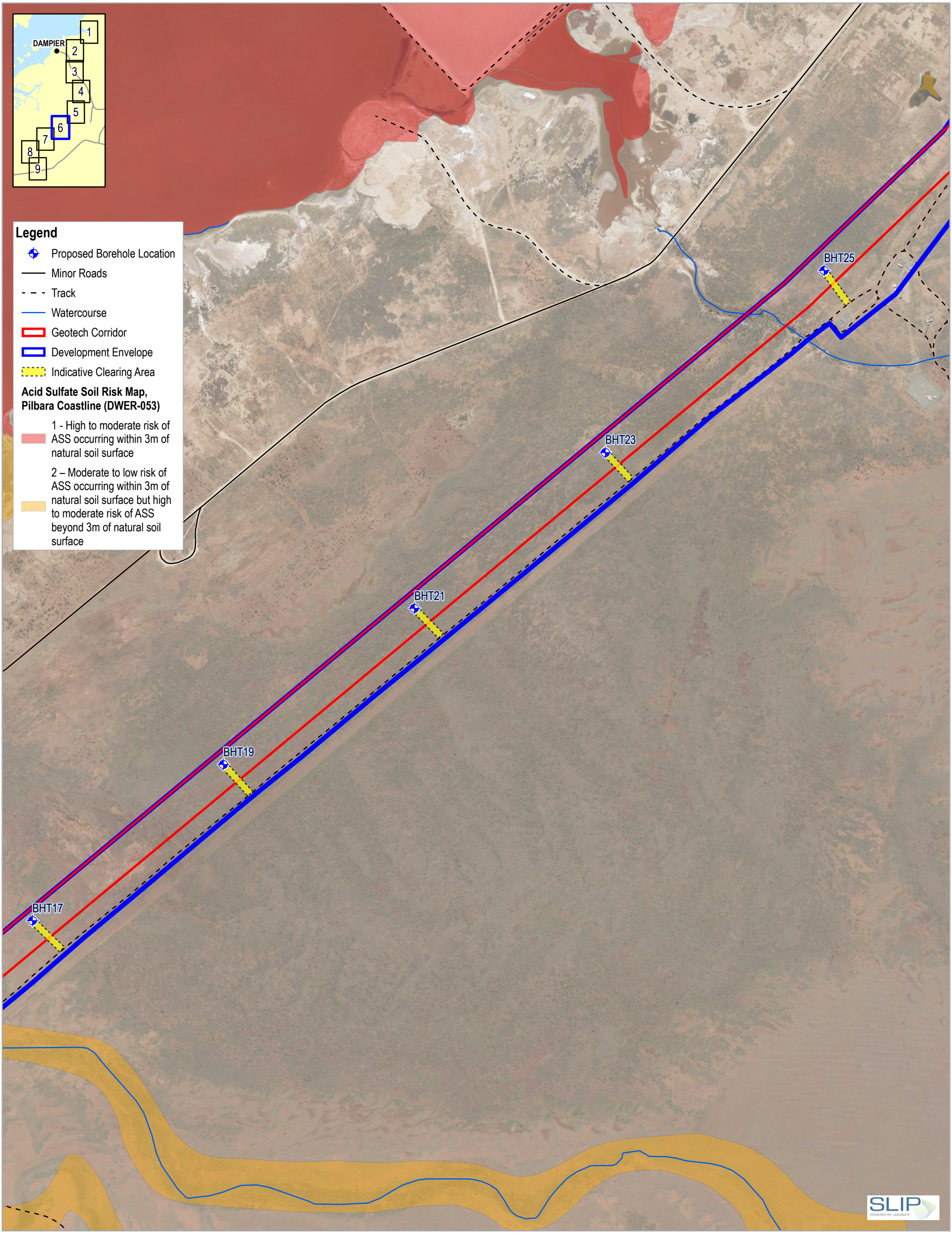

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Map Projection: Transverse Mercator
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Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Acid Sulfate Soil Risk and Drainage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3b

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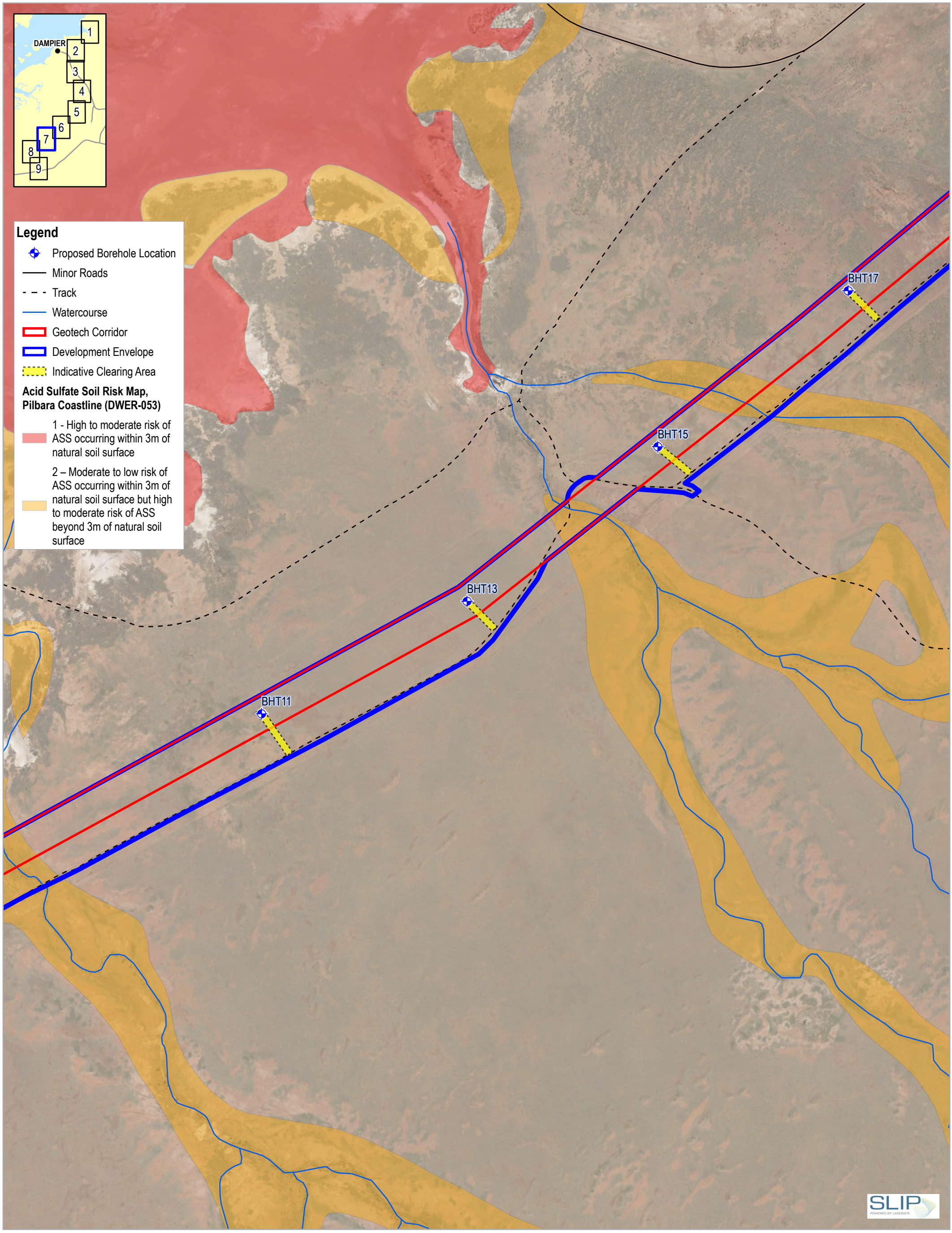

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Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Acid Sulfate Soil Risk and Drainage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3b

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003b_ASS_Rev0
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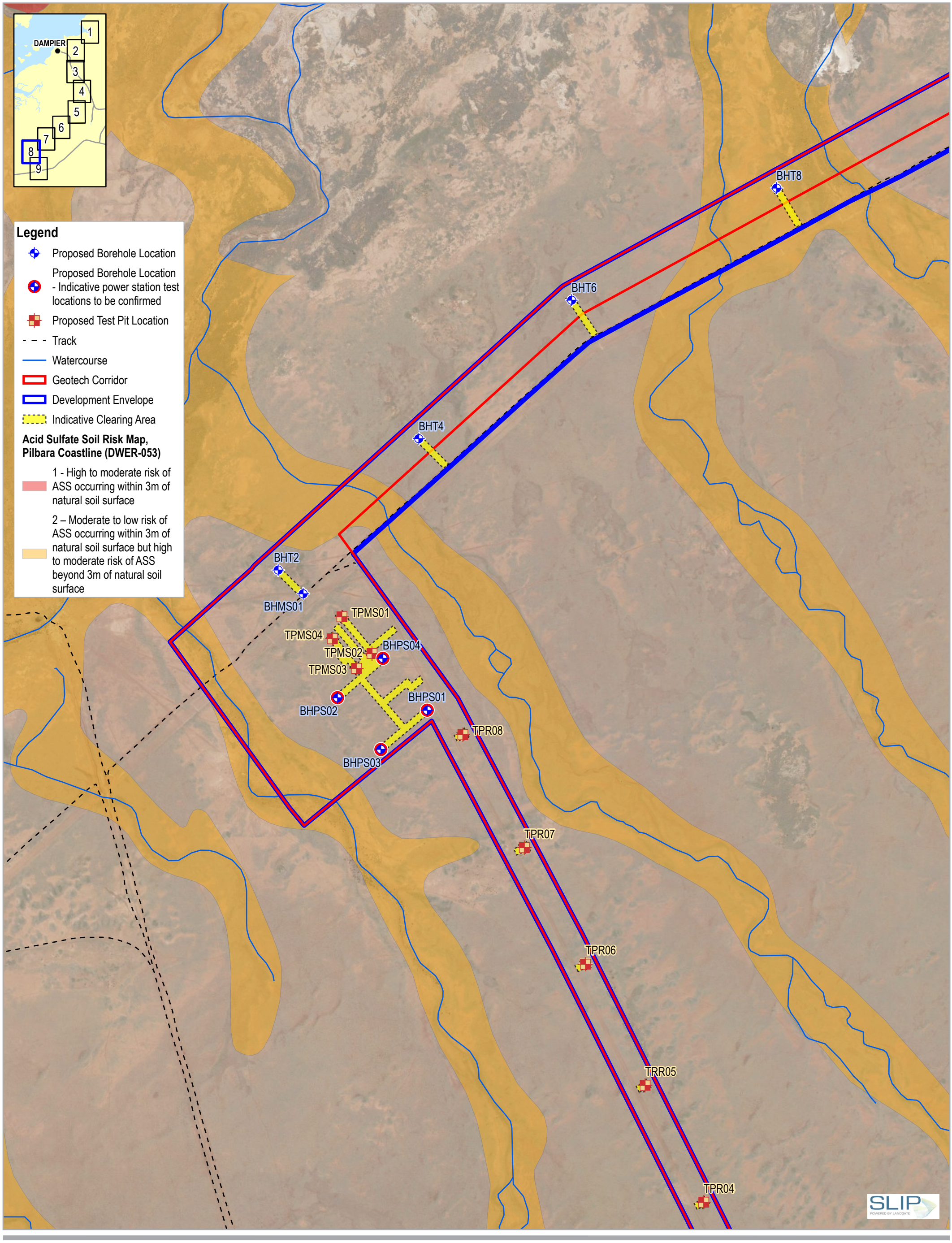

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Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

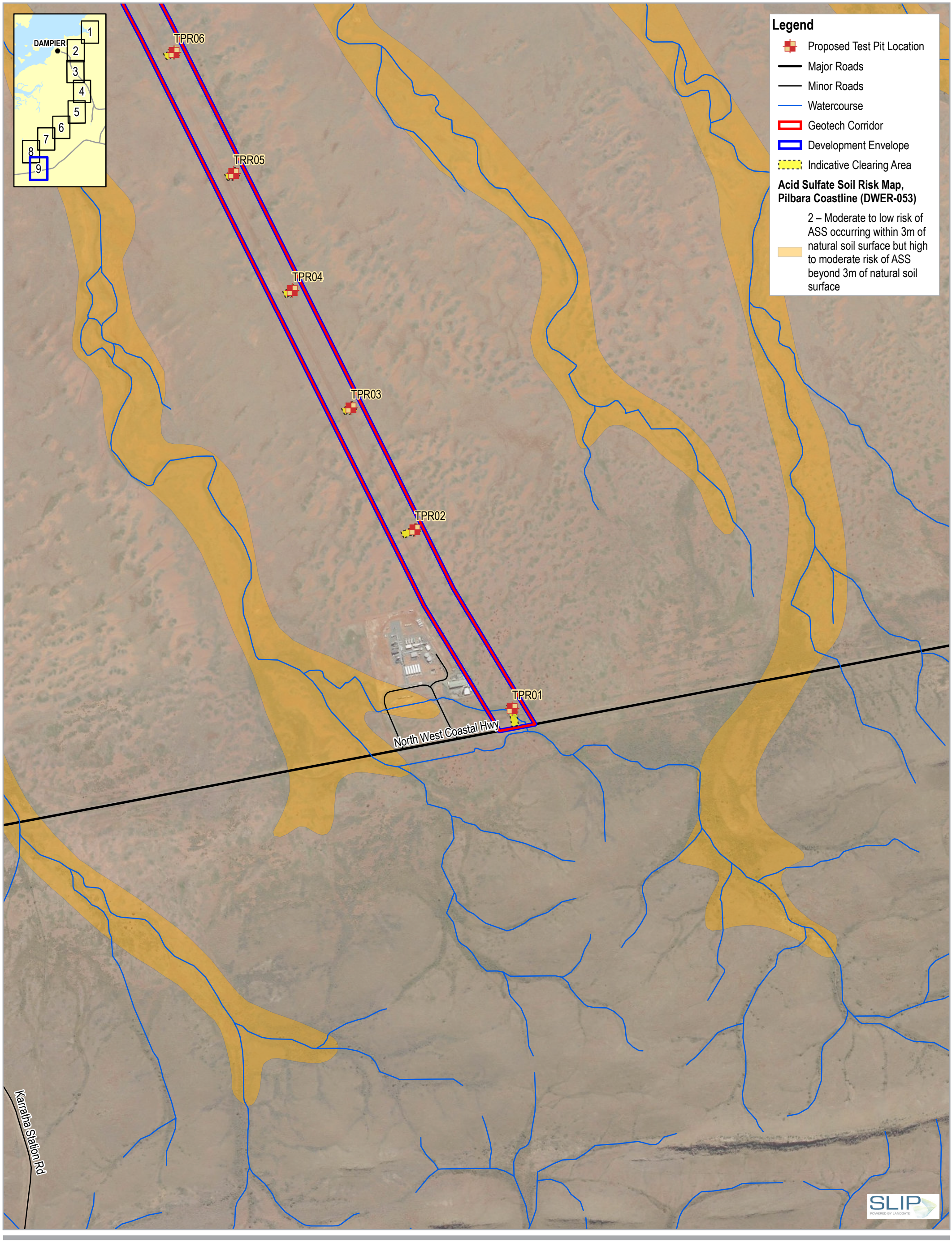
Environmental Constraints – Acid Sulfate Soil Risk and Drainage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3b

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003b_ASS_Rev0
Print date: 21 Dec 2020 - 14:29

Data source: GHD: Indicative Geotechnical Test Locations, Indicative Access Tracks, Geotech Corridor, Development Envelope - 202011; DWER: Acid Sulfate Soil Risk Map - Pilbara Coastline (DWER-053); LGATE: Roads (LGATE-012), Imagery accessed on 20201221. Created by: slei



Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

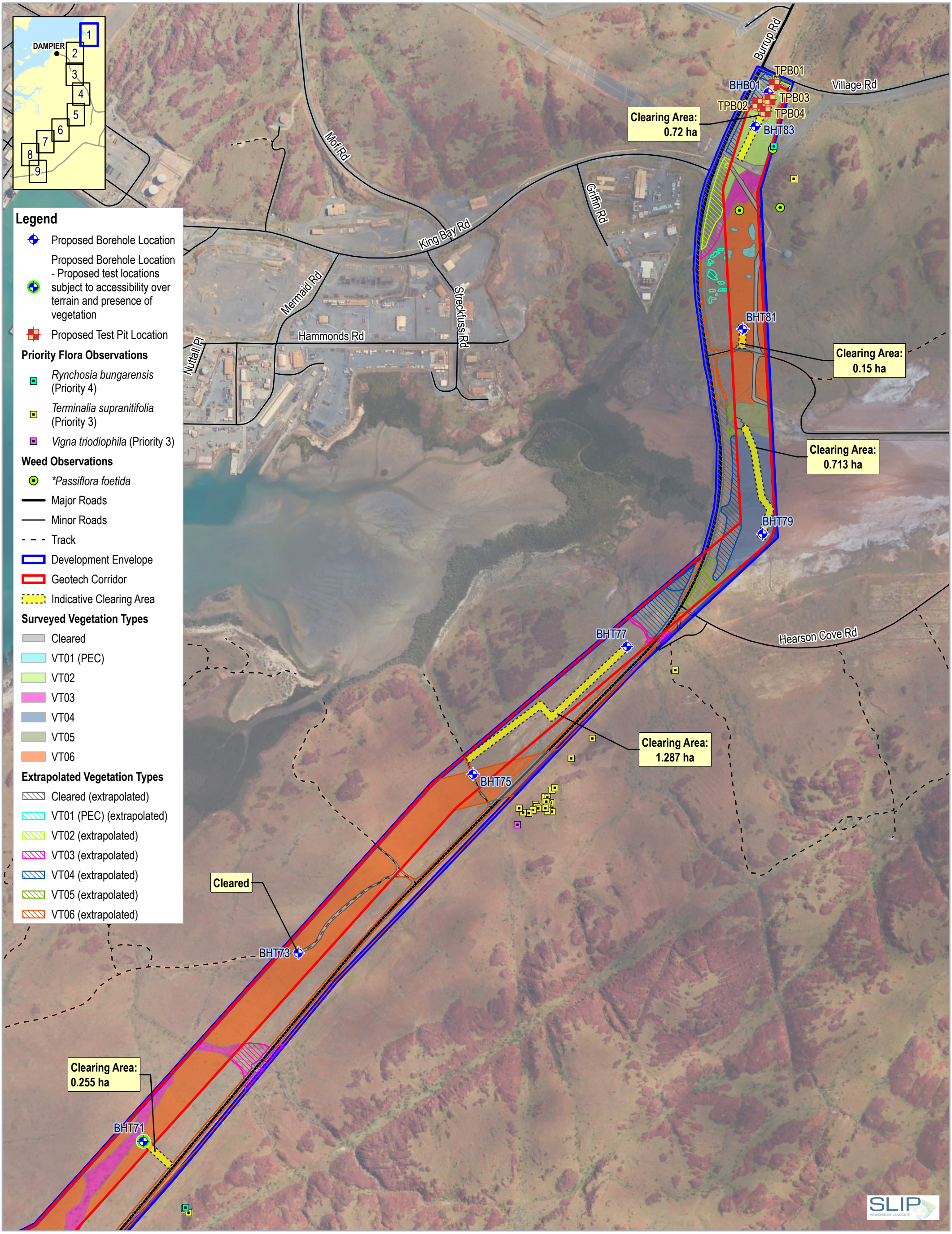
Environmental Constraints – Acid Sulfate Soil Risk and Drainage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3b

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003b_ASS_Rev0
Print date: 21 Dec 2020 - 14:29

Data source: GHD: Indicative Geotechnical Test Locations, Indicative Access Tracks, Geotech Corridor, Development Envelope - 202011; DWER: Acid Sulfate Soil Risk Map - Pilbara Coastline (DWER-053); LGATE: Roads (LGATE-012), Imagery accessed on 20201221. Created by: slei



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

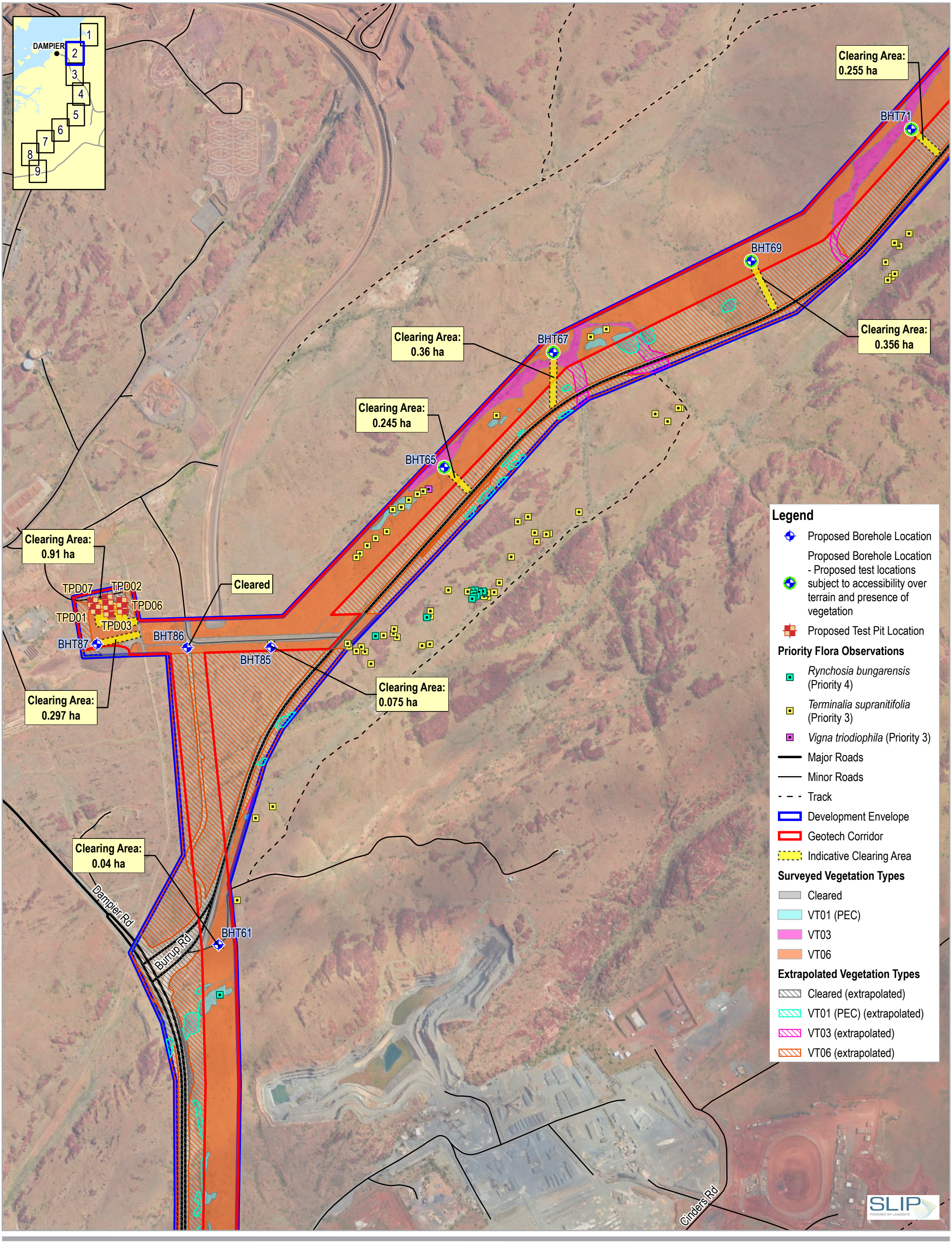
Environmental Constraints – Vegetation Communities Types and Priority Flora

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3c

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003c_VegetationTypes_Rev0
Print date: 21 Dec 2020 - 15:36

Data source: GHD: Indicative Geotechnical Test Locations, Indicative Access Tracks, Geotech Corridor, Development Envelope - 202012; LGATE: Roads (LGATE-012), Imagery accessed on 20201221. Created by: slei



Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Types and Priority Flora

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3c

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003c_VegetationTypes_Rev0
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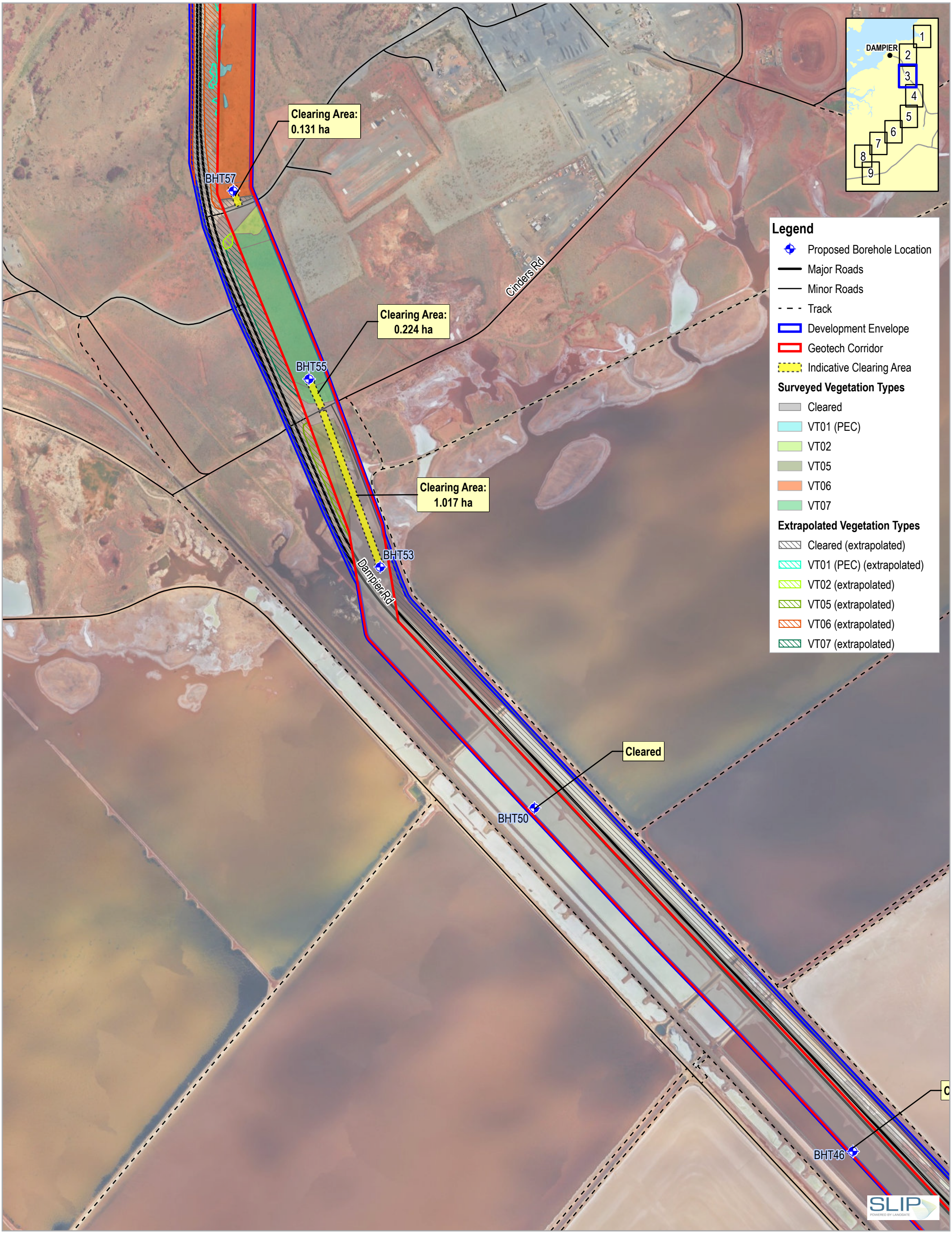
Data source: GHD: Indicative Geotechnical Test Locations, Indicative Access Tracks, Geotech Corridor, Development Envelope - 202012; LGATE: Roads (LGATE-012), Imagery accessed on 20201221. Created by: slei



Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

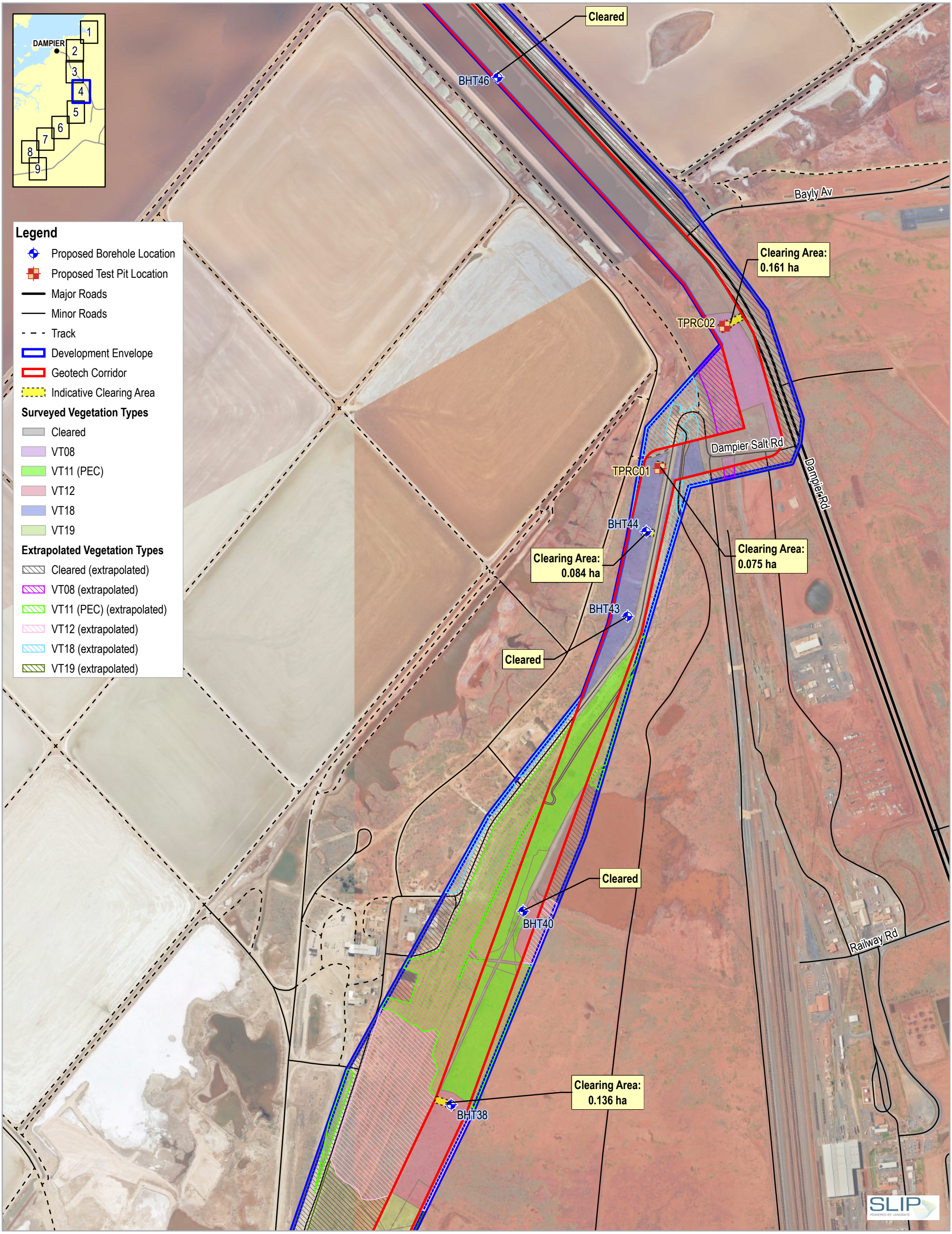
Environmental Constraints – Vegetation Communities Types and Priority Flora

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3c

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003c_VegetationTypes_Rev0
Print date: 21 Dec 2020 - 15:38

Data source: GHD: Indicative Geotechnical Test Locations, Indicative Access Tracks, Geotech Corridor, Development Envelope - 202012; LGATE: Roads (LGATE-012), Imagery accessed on 20201221. Created by: slei



Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Types and Priority Flora

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3c

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003c_VegetationTypes_Rev0
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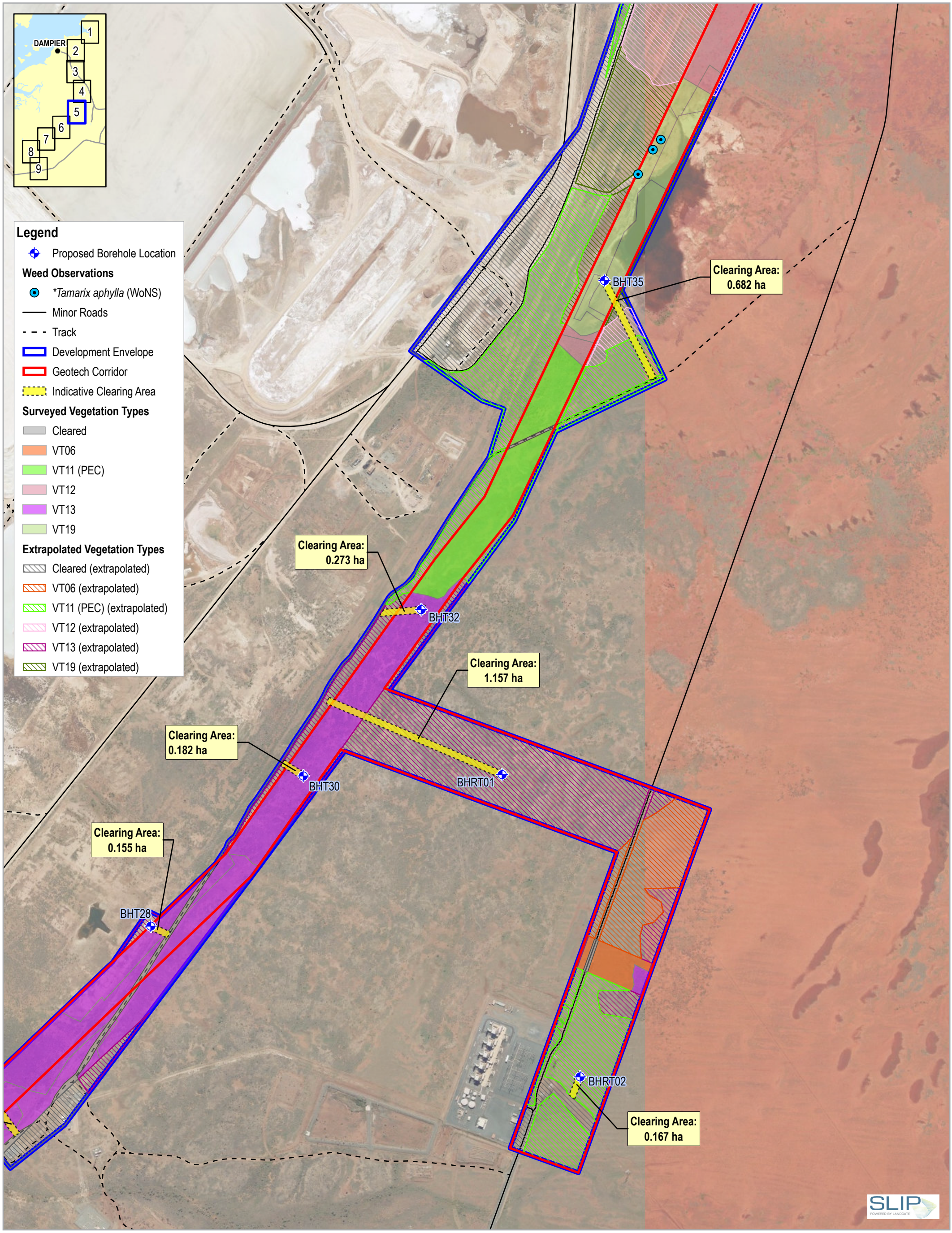
Data source: GHD: Indicative Geotechnical Test Locations, Indicative Access Tracks, Geotech Corridor, Development Envelope - 202012; LGATE: Roads (LGATE-012), Imagery accessed on 20201221. Created by: slei



Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Types and Priority Flora

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3c

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003c_VegetationTypes_Rev0
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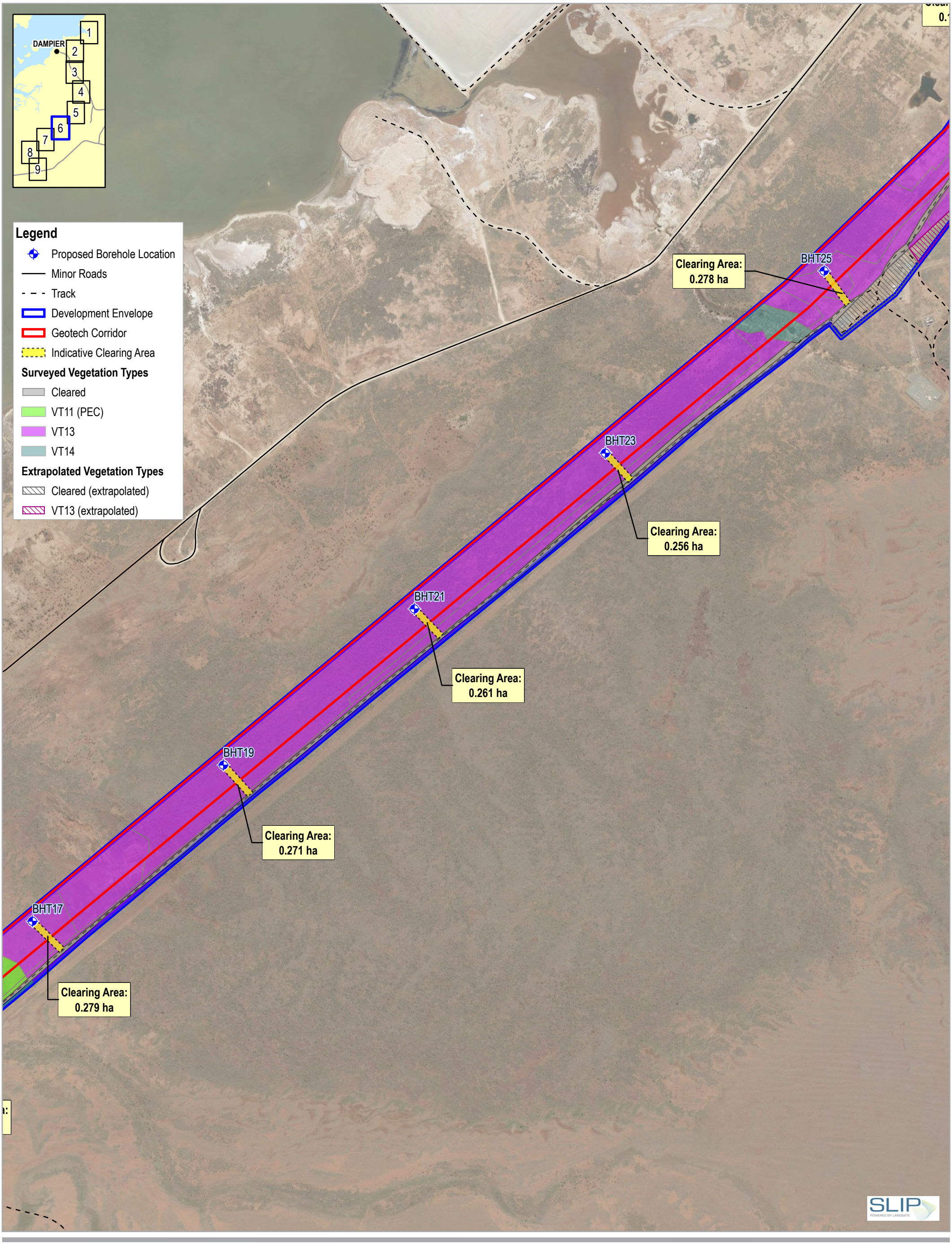

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Types and Priority Flora

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3c

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003c_VegetationTypes_Rev0
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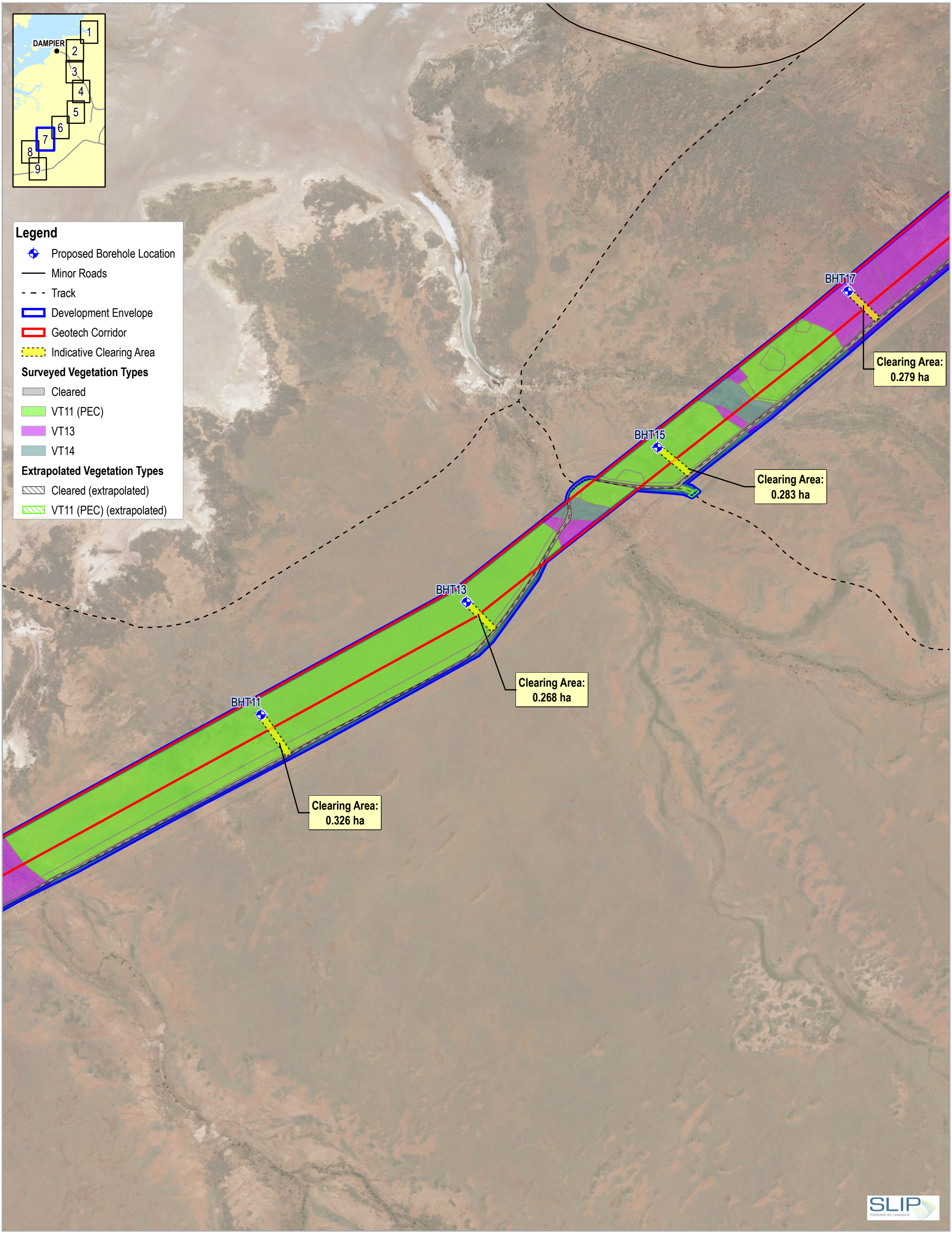

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Types and Priority Flora

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3c

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003c_VegetationTypes_Rev0
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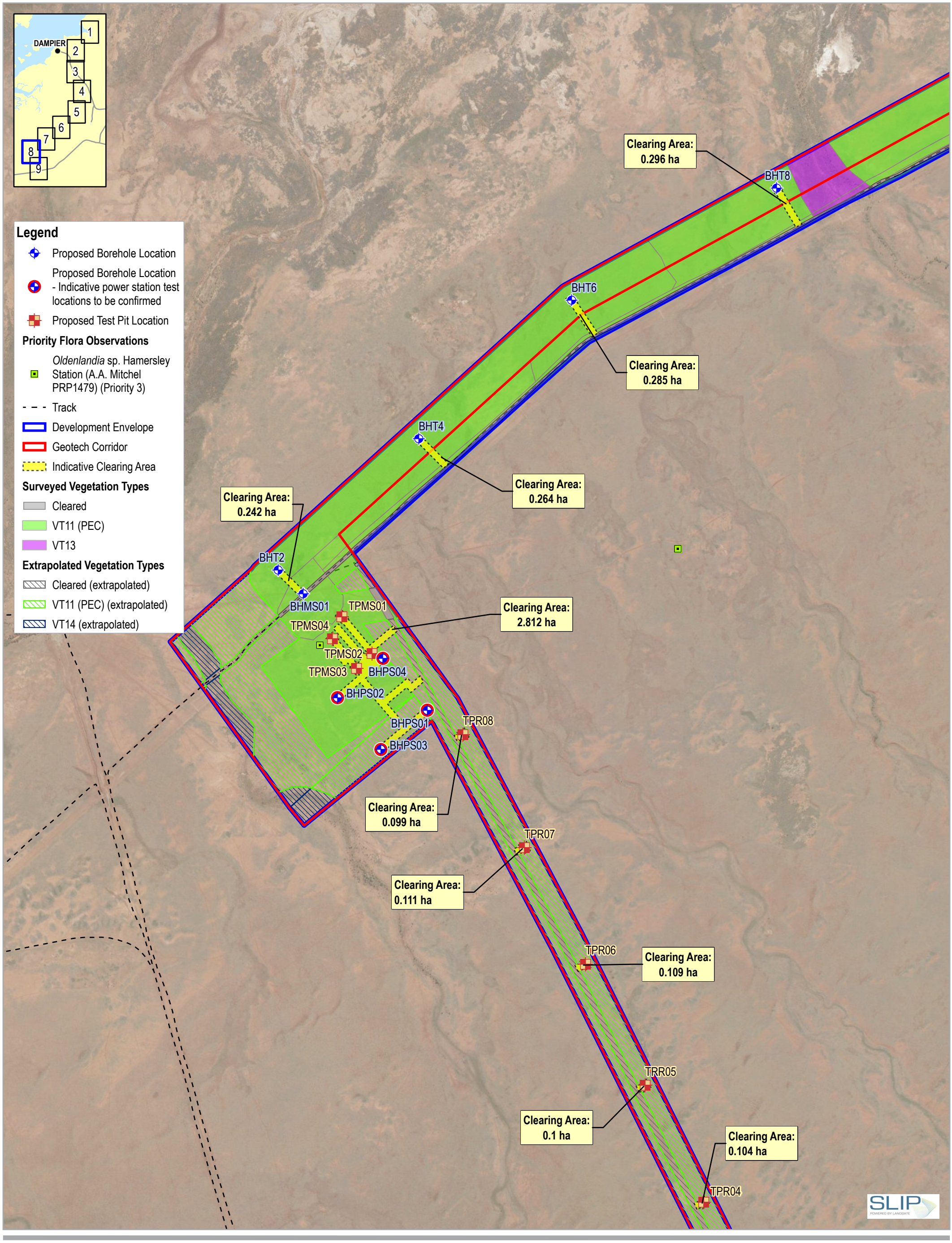

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Types and Priority Flora

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3c

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003c_VegetationTypes_Rev0
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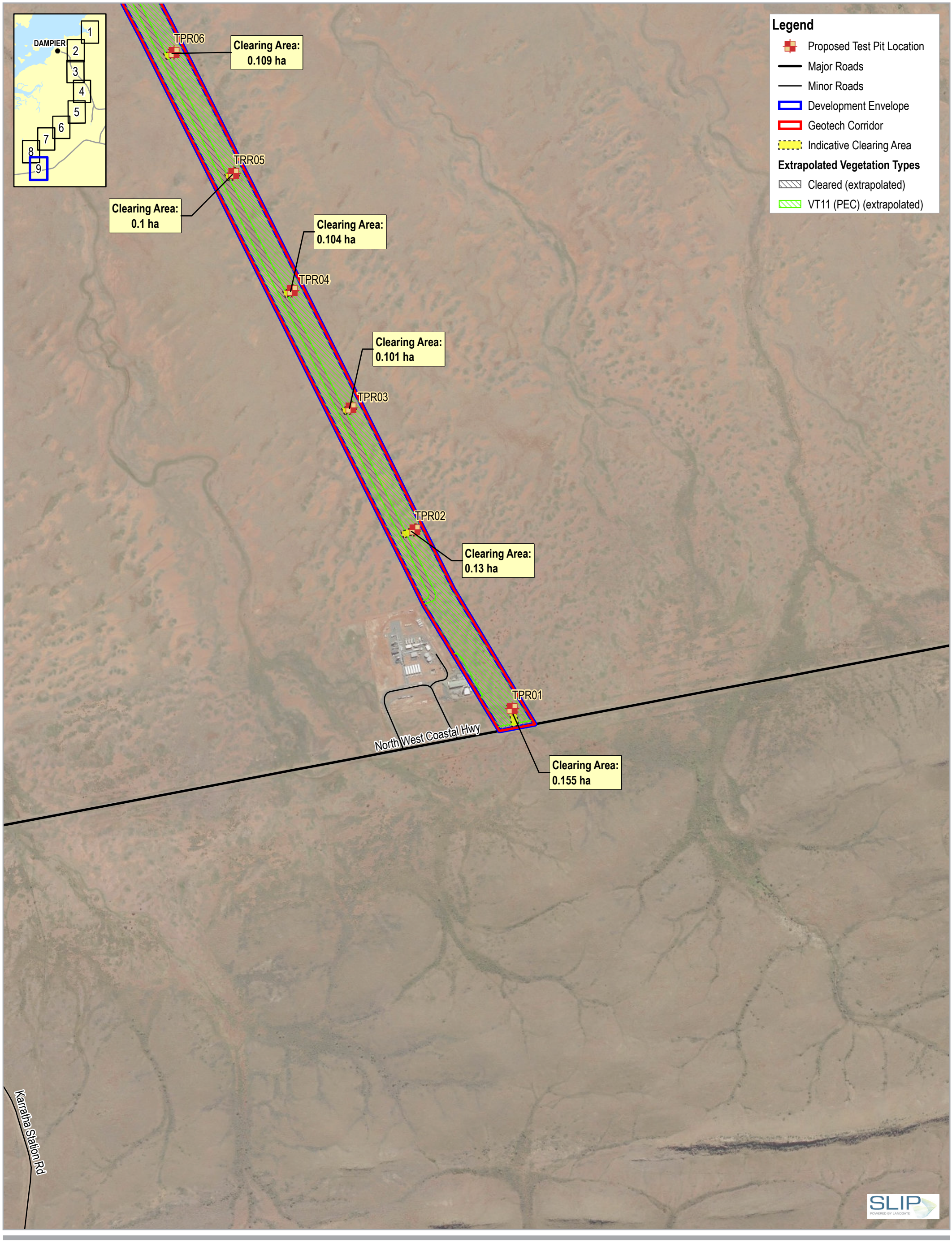

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Types and Priority Flora

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3c

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003c_VegetationTypes_Rev0
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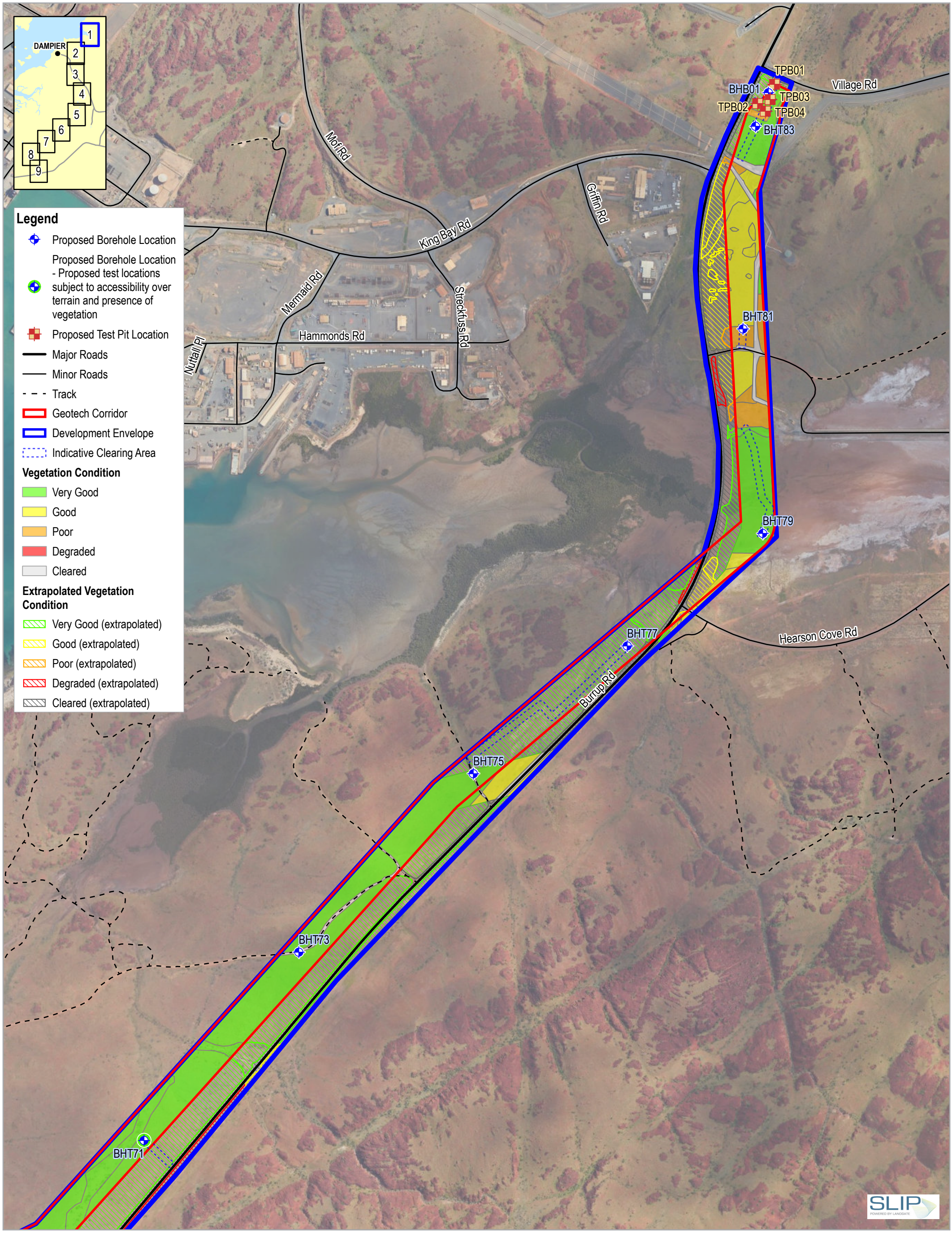

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Condition

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3d

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003d_VegetationCondition_Rev0
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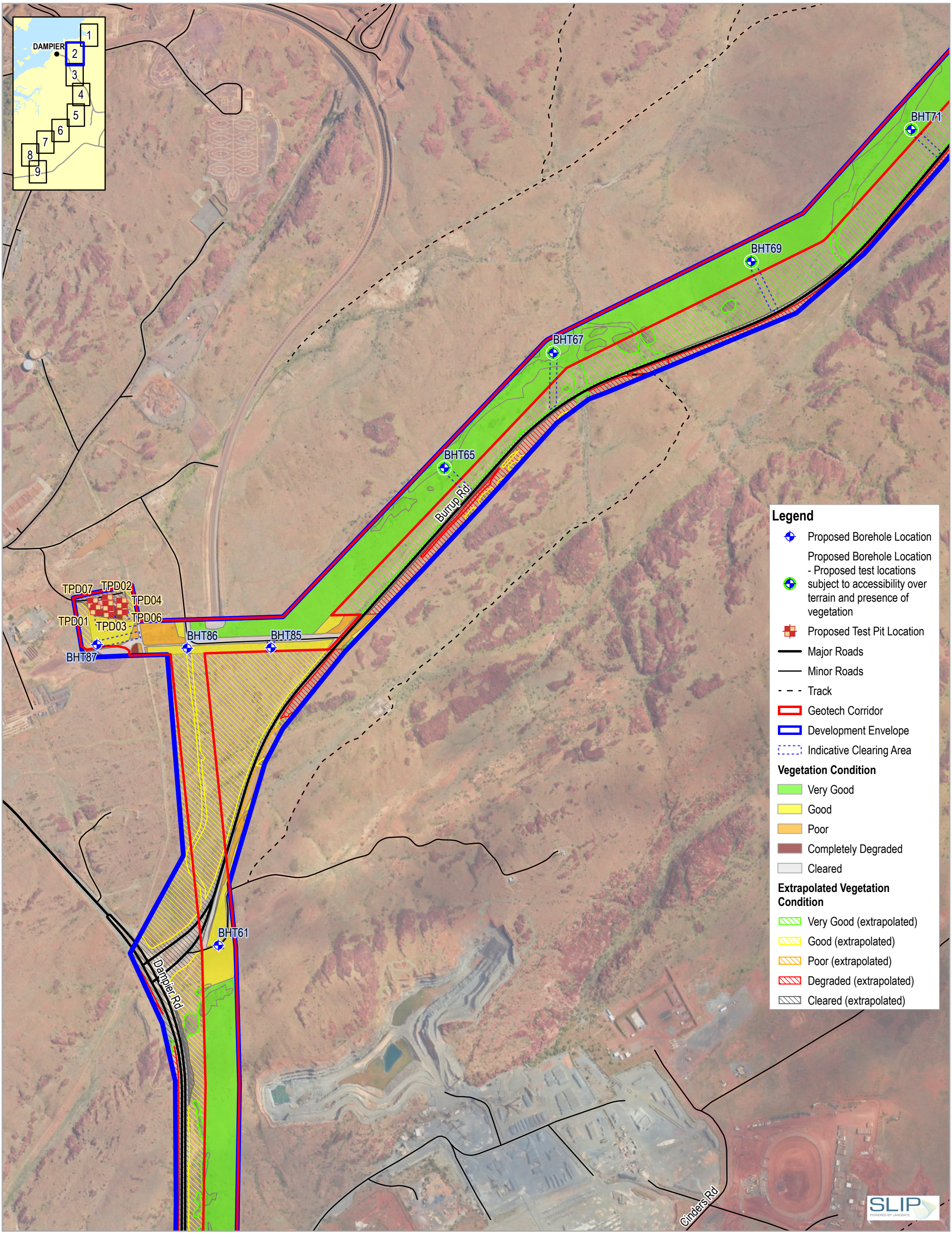

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Condition

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3d

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003d_VegetationCondition_Rev0
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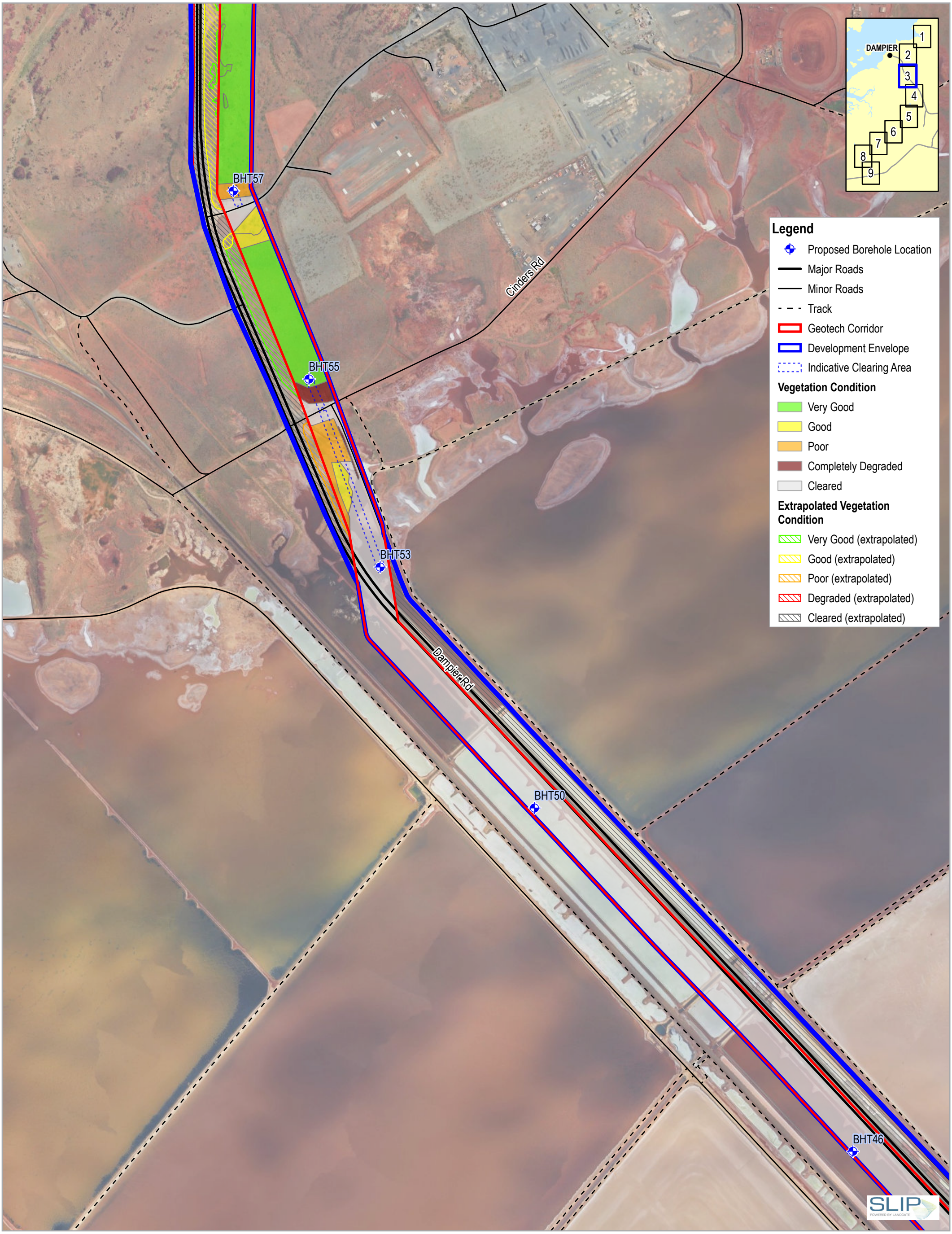

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Condition

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3d

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003d_VegetationCondition_Rev0
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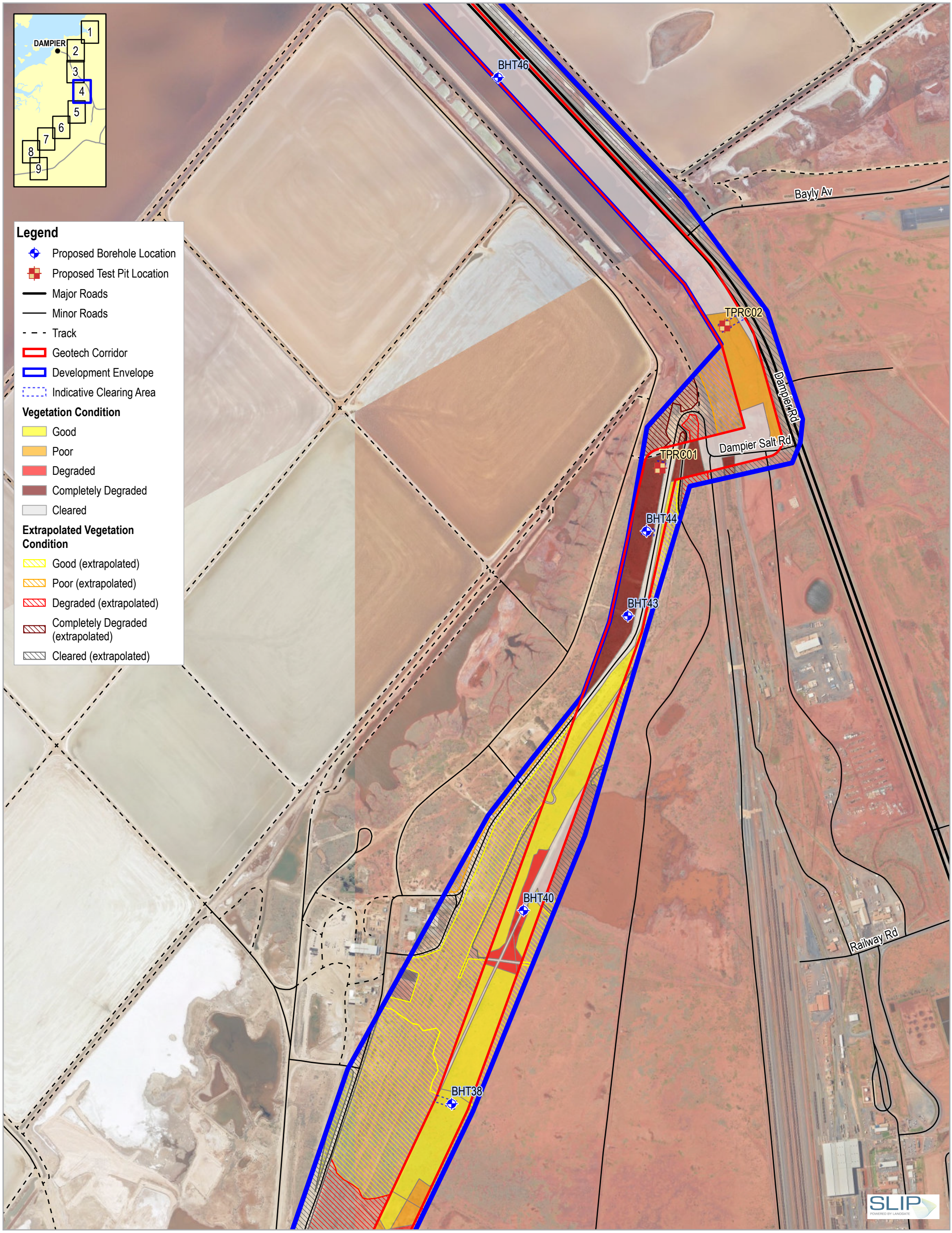

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Condition

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3d

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003d_VegetationCondition_Rev0
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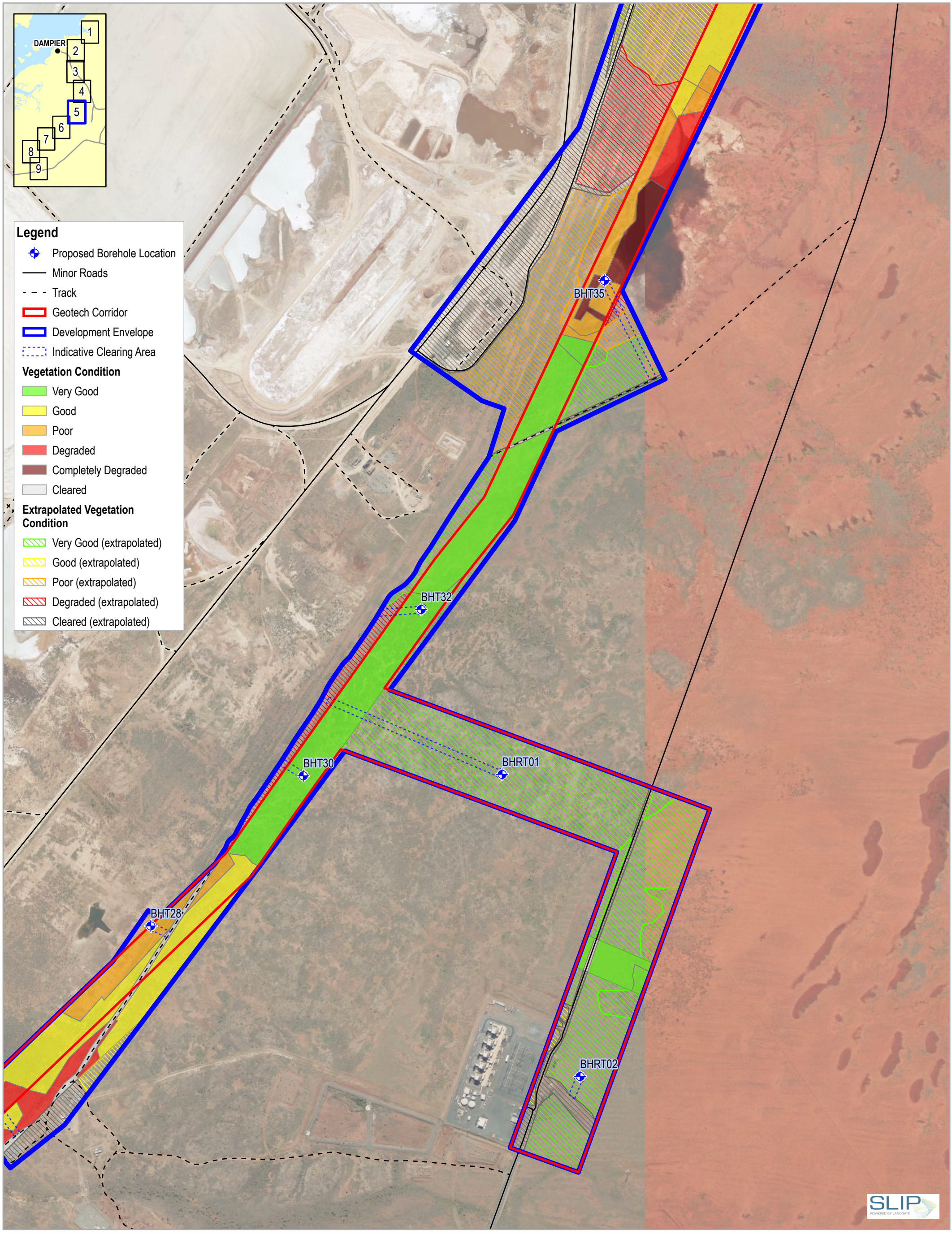

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Condition

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3d

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003d_VegetationCondition_Rev0
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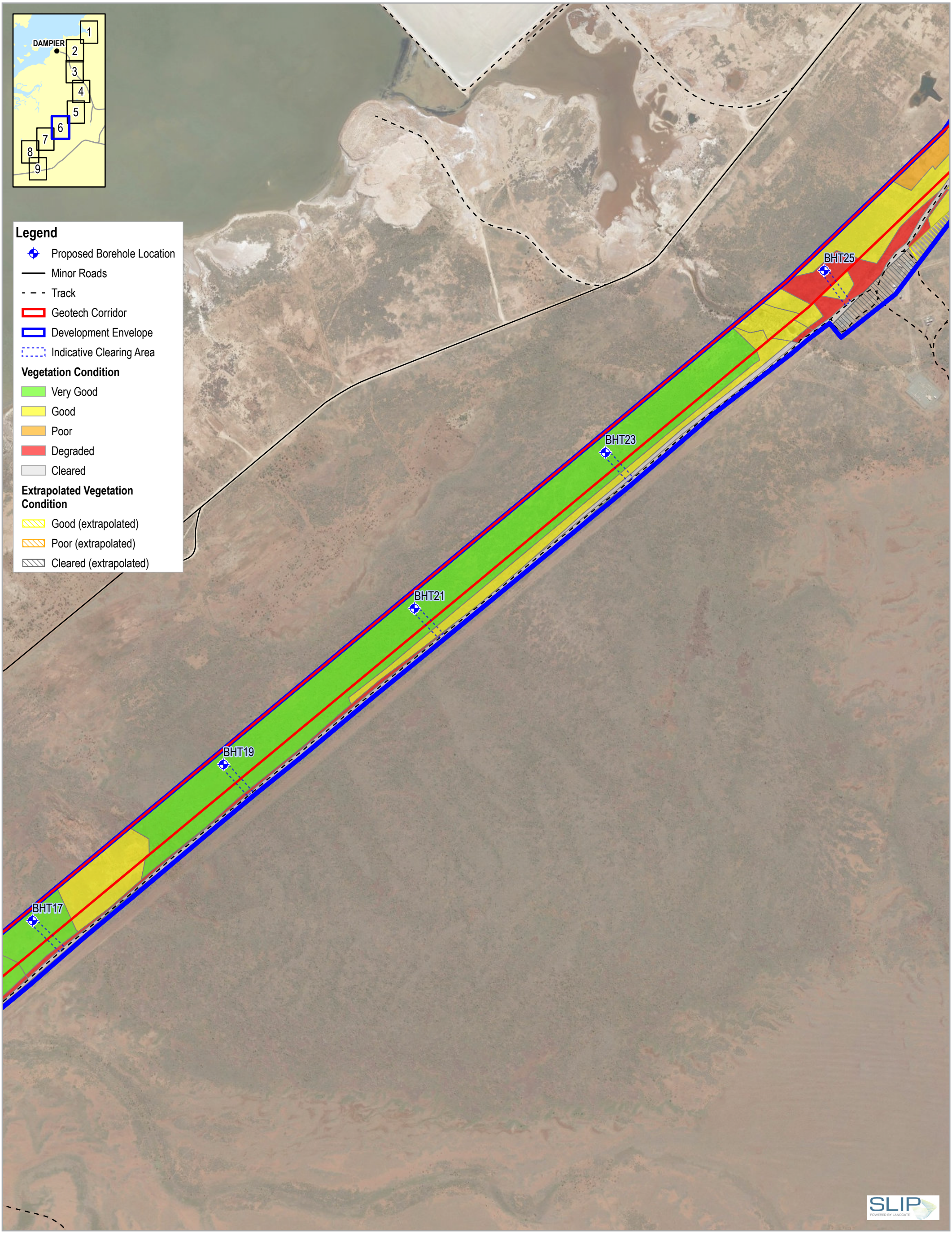

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Condition

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3d

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003d_VegetationCondition_Rev0
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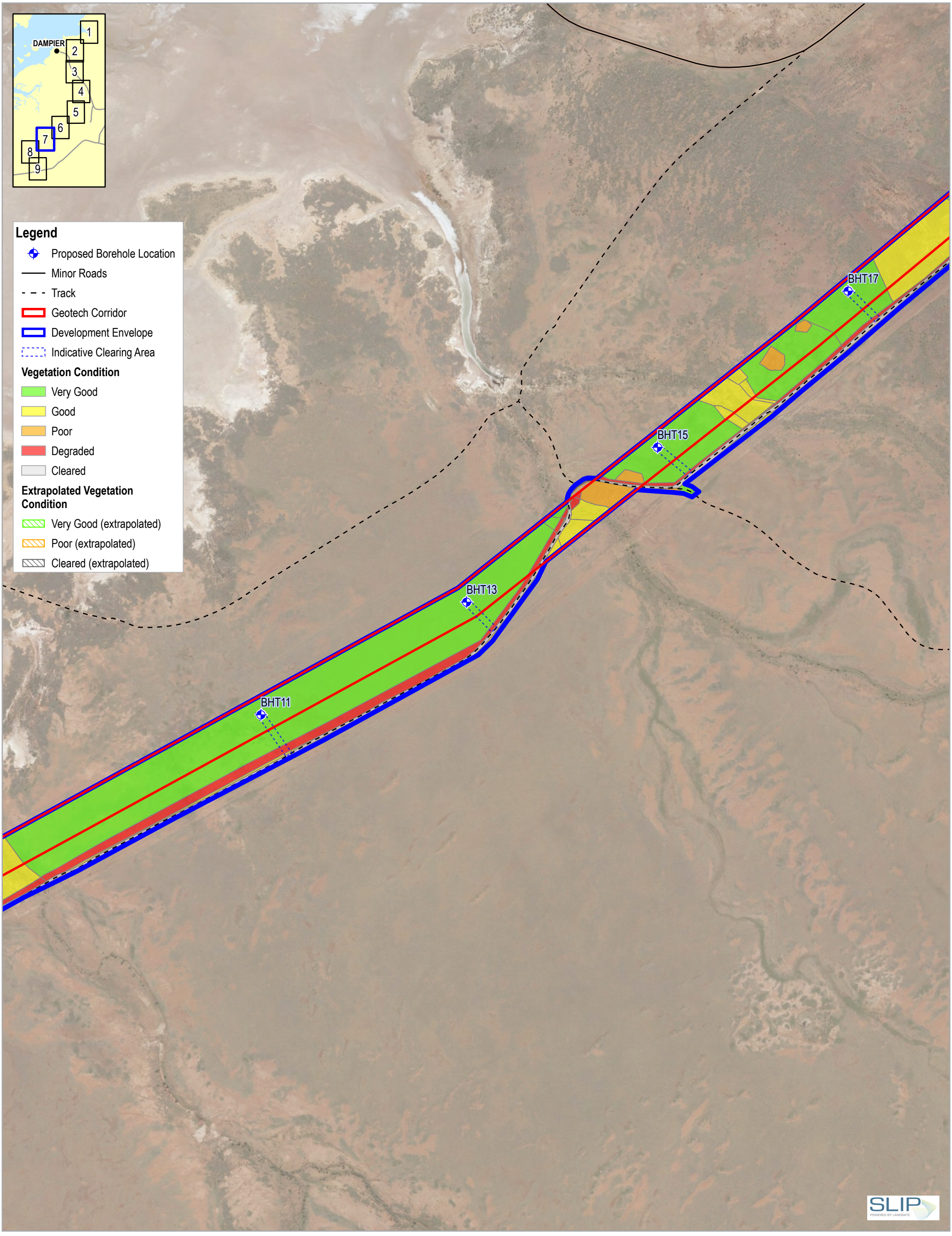

Paper Size ISO A3

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Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Condition

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3d

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003d_VegetationCondition_Rev0
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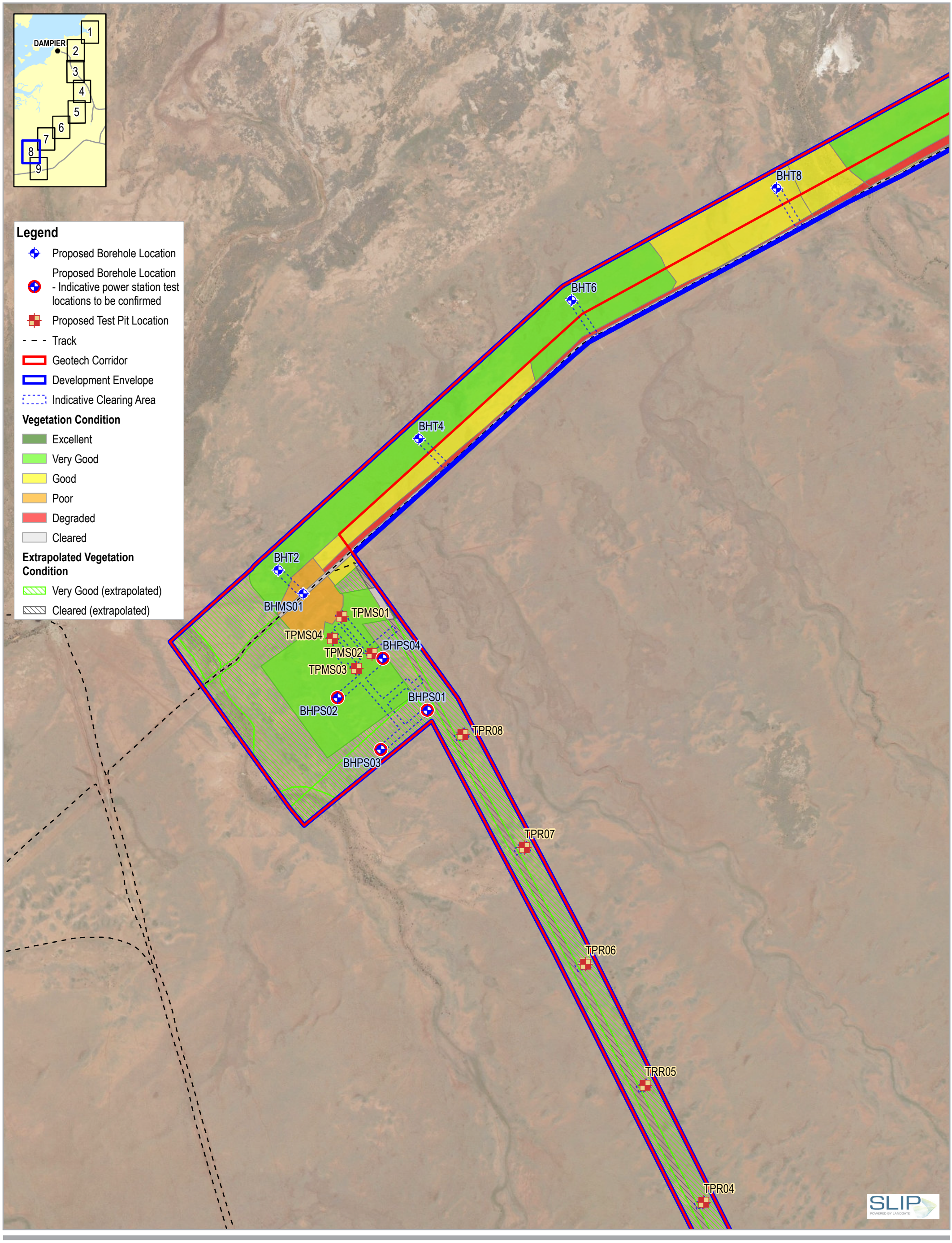

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Condition

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3d

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003d_VegetationCondition_Rev0
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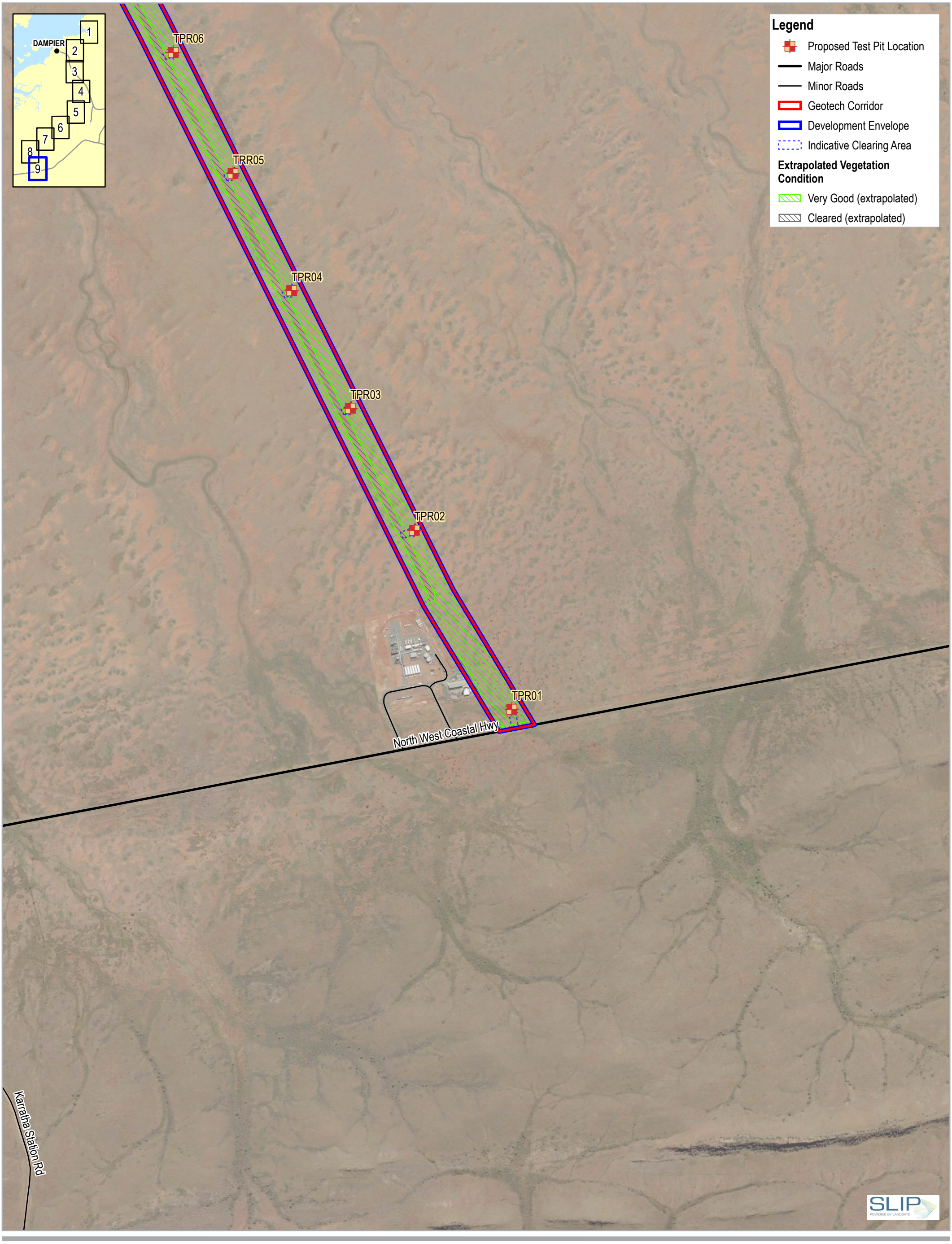

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

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Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – Vegetation Communities Condition

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3d

\\ghdnet.internal\ghd\AU\Perth\Projects\61\12542051\GIS\Maps\Working\12542051_Atlas_ProjectMap\12542051_Figures.aprx\12542051_003d_VegetationCondition_Rev0
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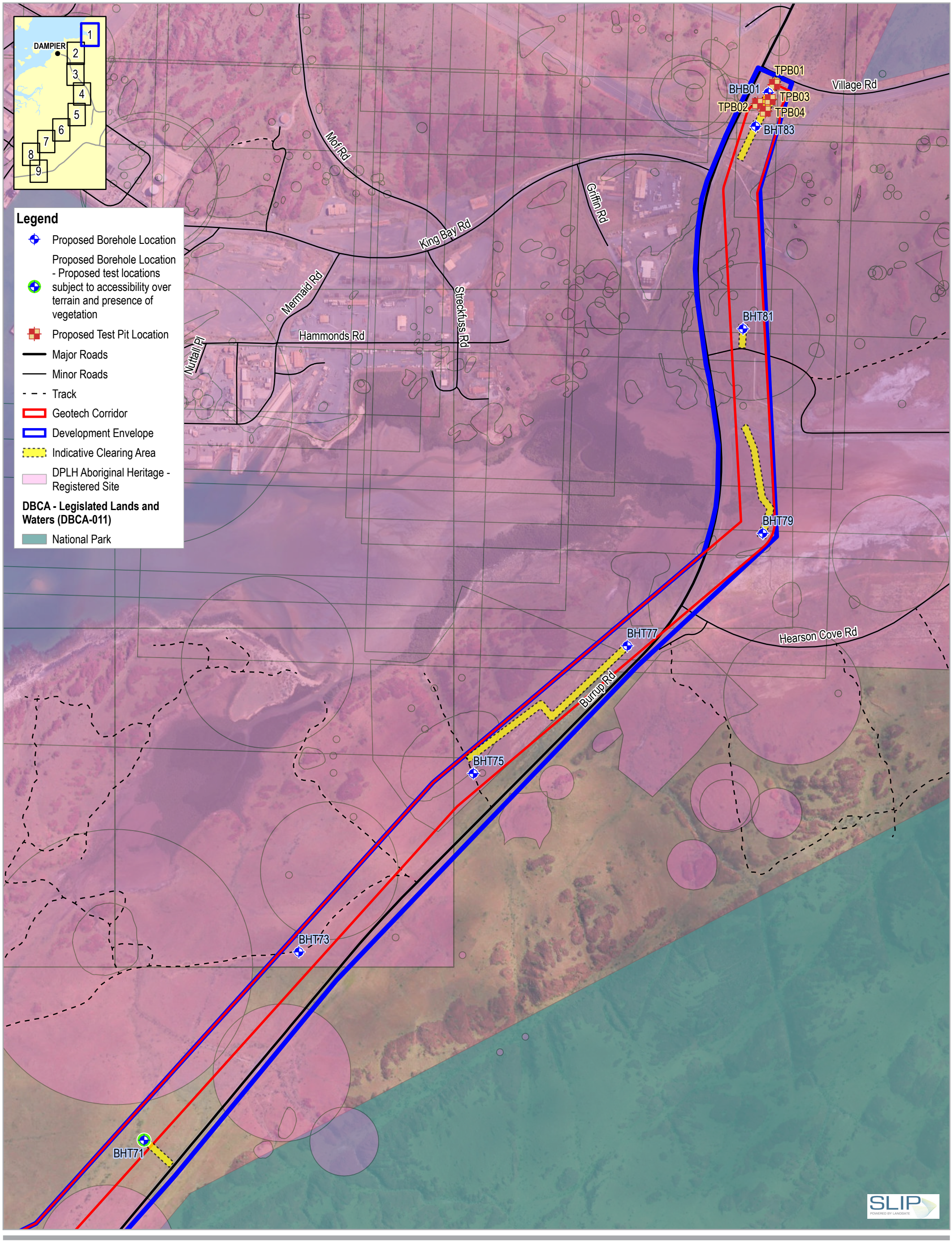

Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 50

N

GHD

Horizon Power
Geotechnical Works
Clearing Permit Application

Environmental Constraints – National Park and Heritage

Project No. **12542051**
Revision No. **0**
Date **21/12/2020**

FIGURE 3e

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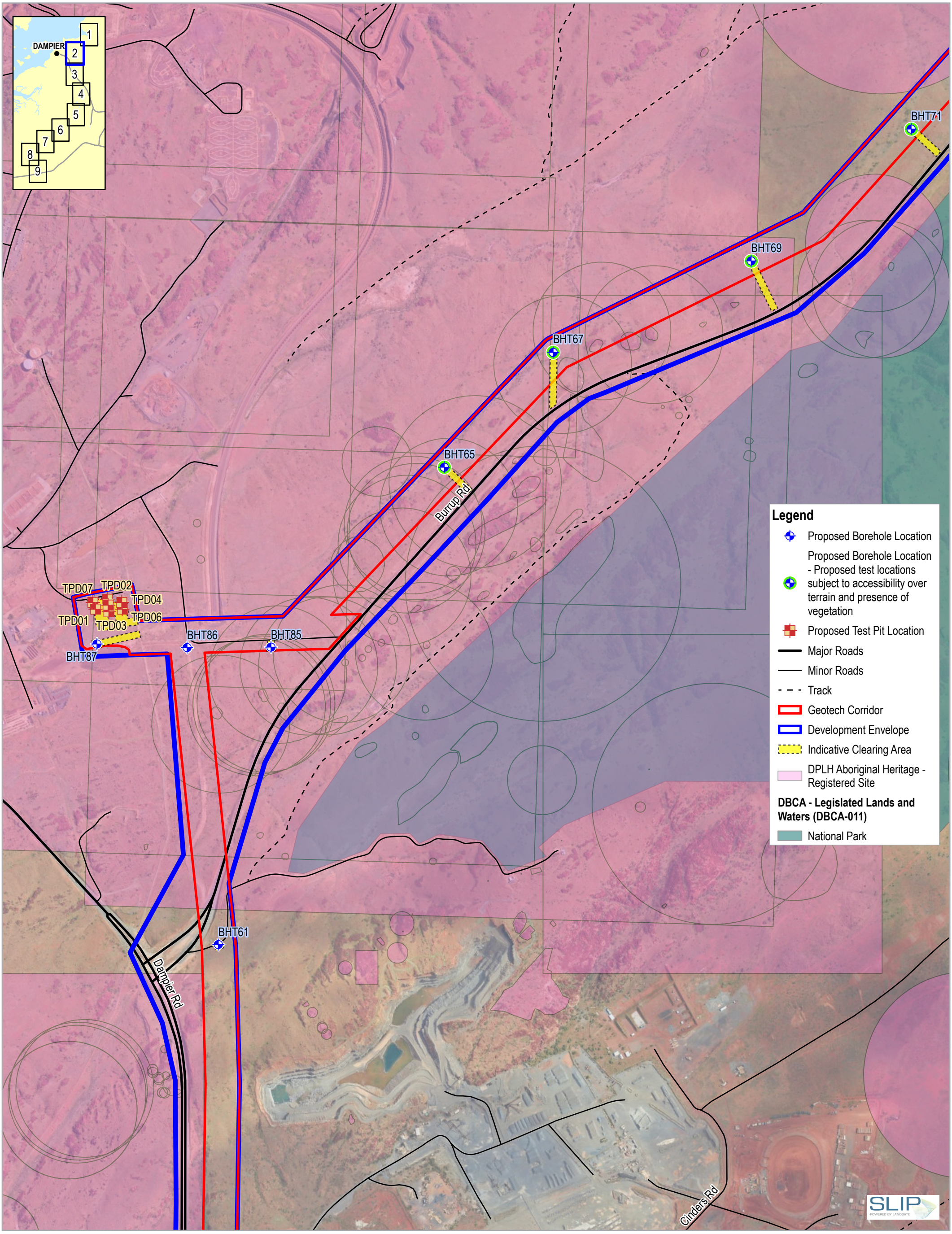

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Horizon Power
Geotechnical Works
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Project No. **12542051**
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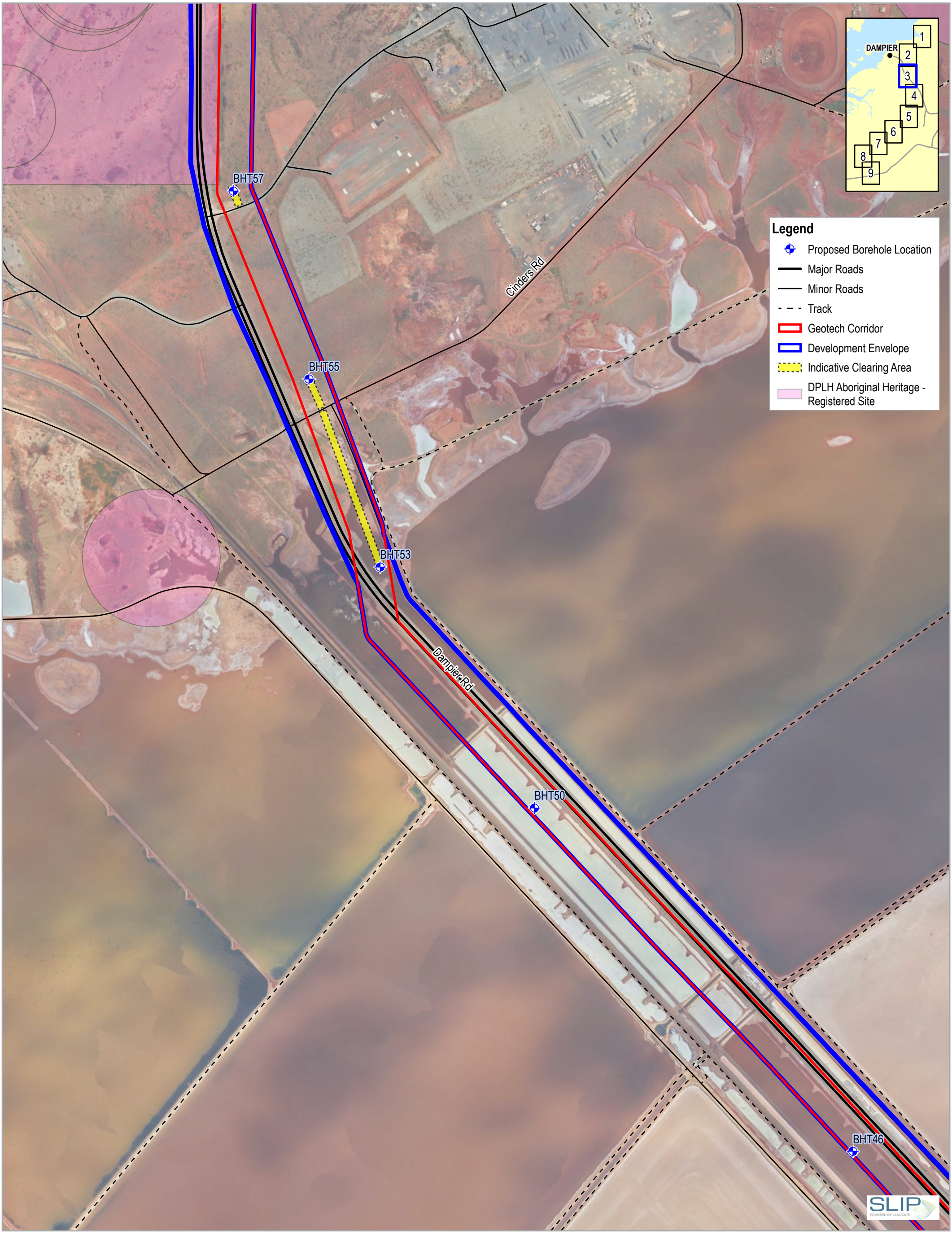

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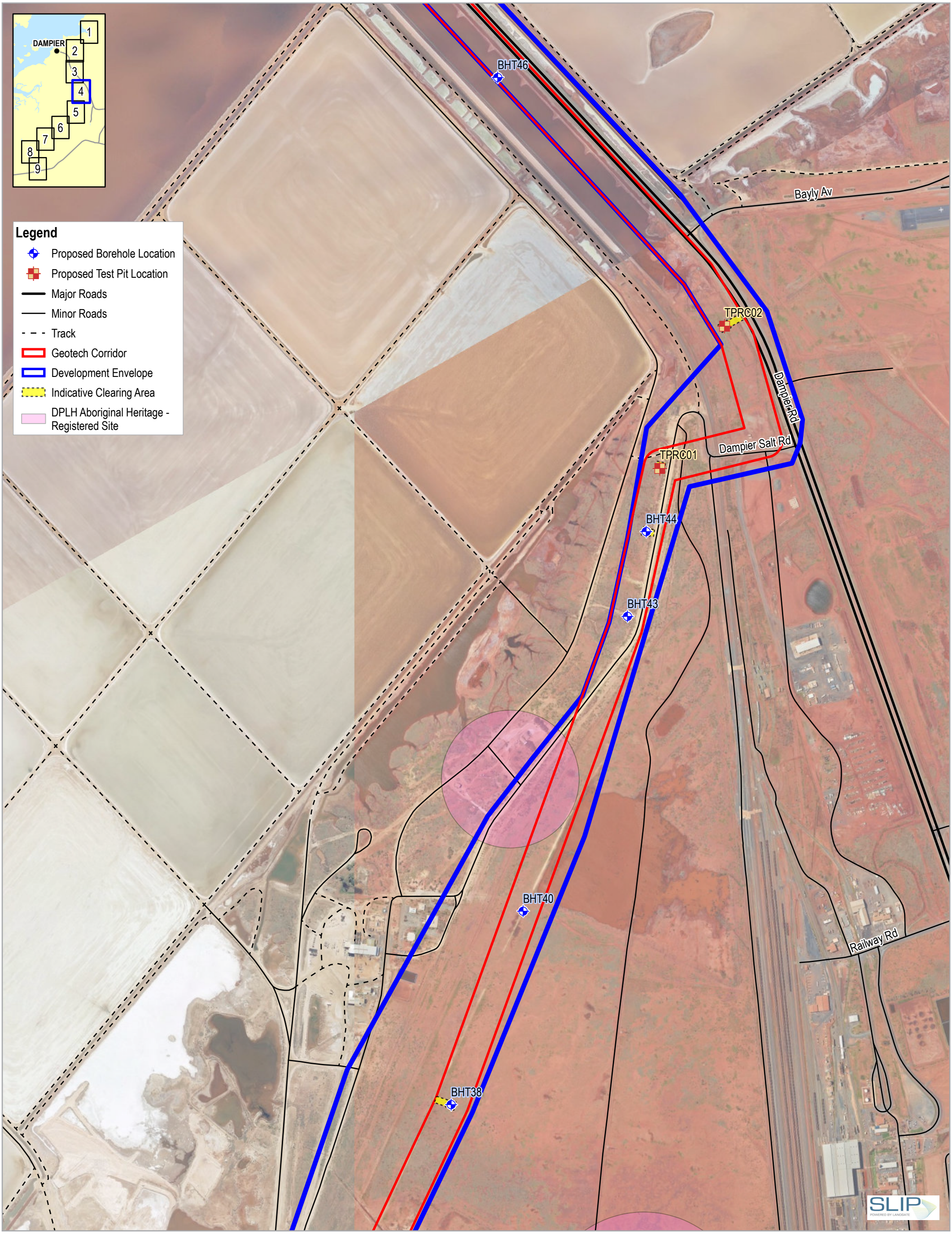

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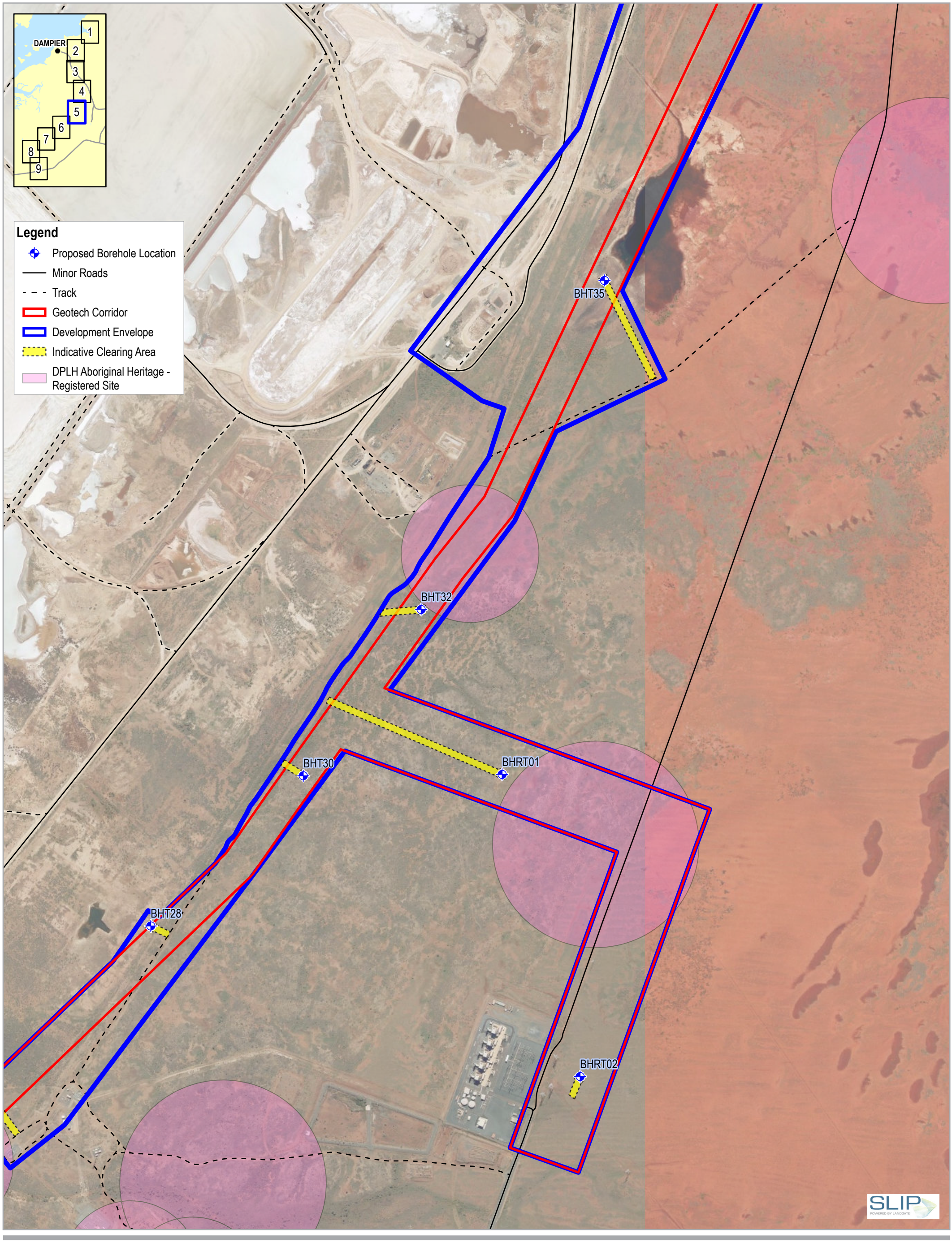

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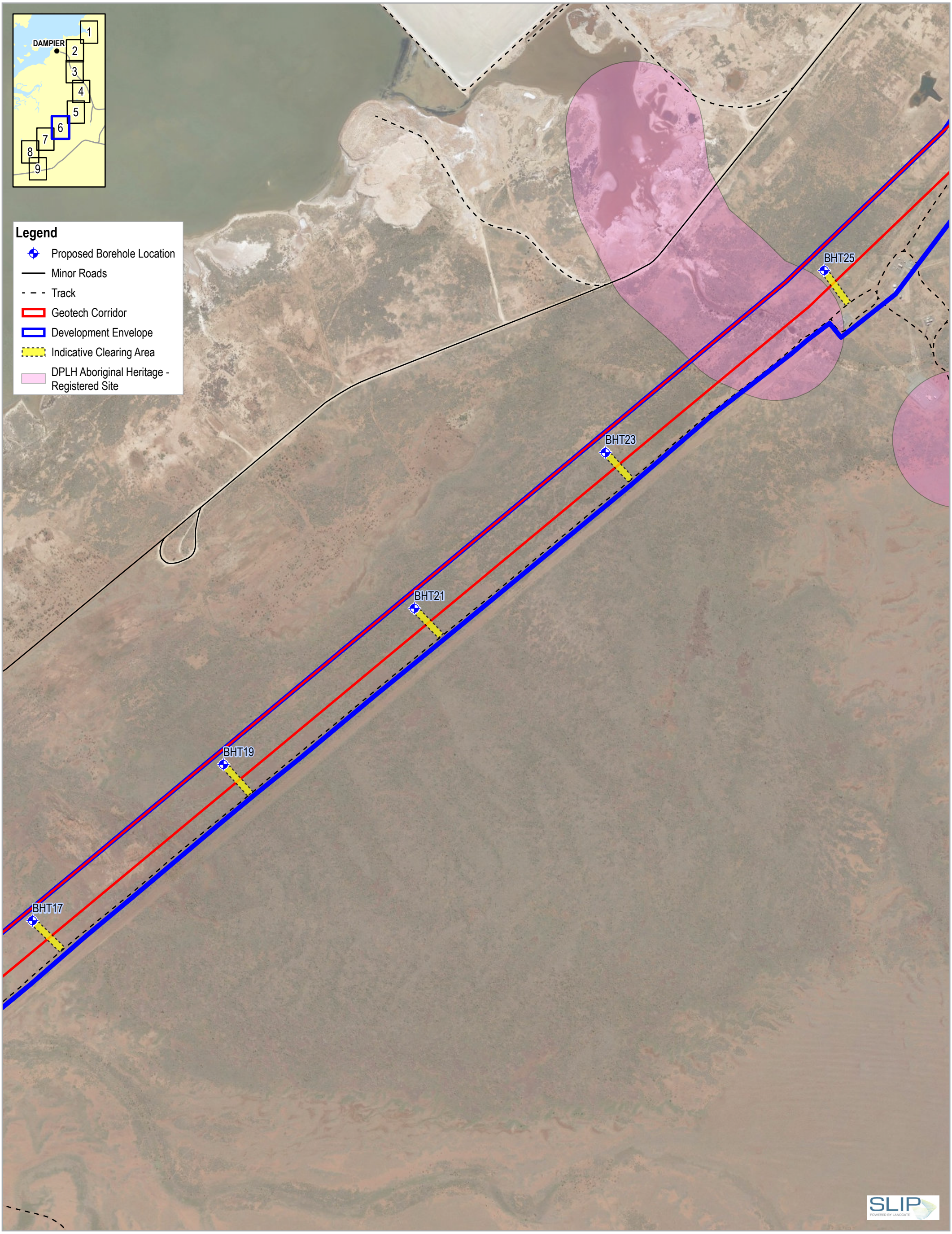

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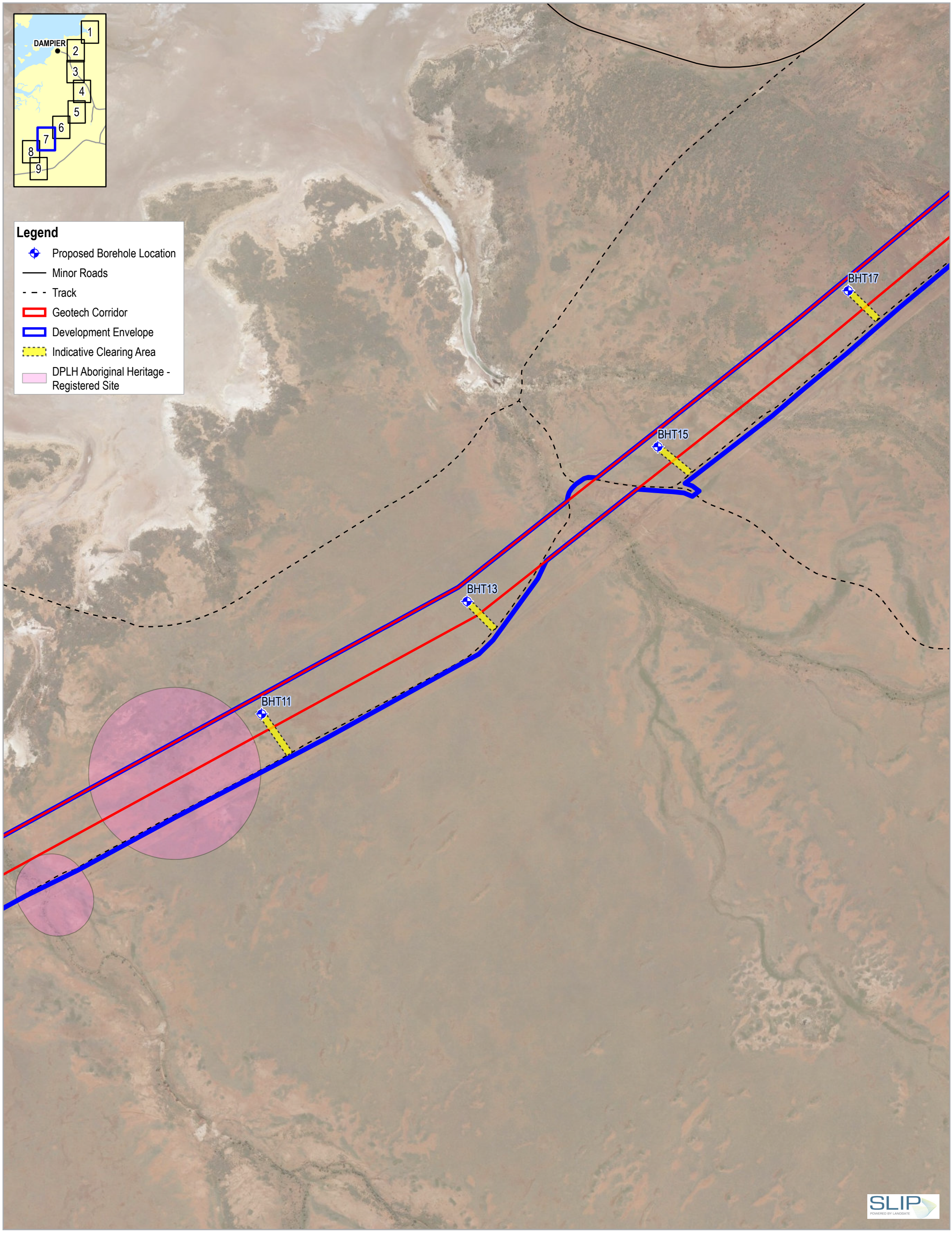

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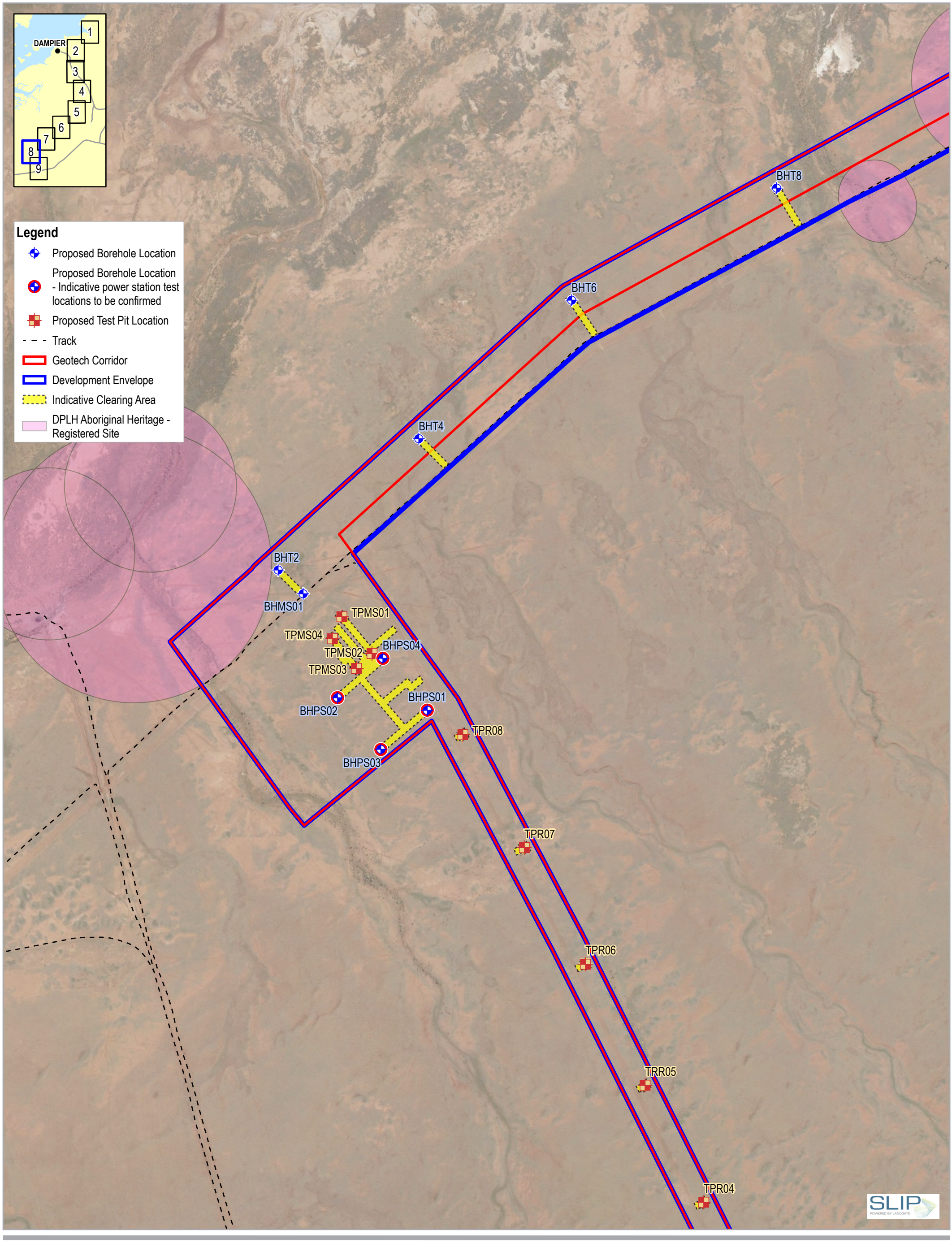

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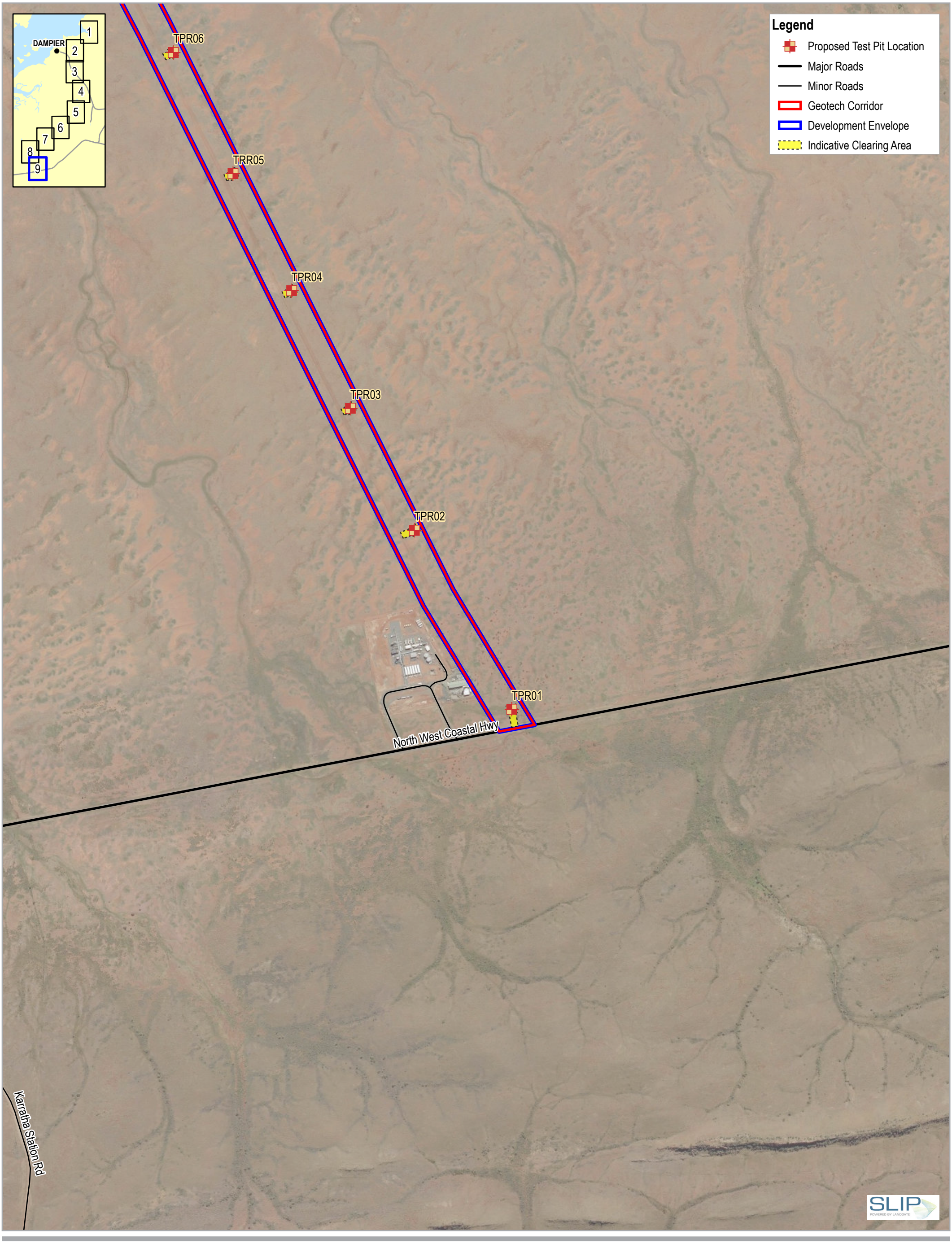

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12542051-25846-3/https://projectsportal.ghd.com/sites/pp18_02/geotechnicalworkscle/ProjectDocs/12542051_Horizon Power Burrup Expansion Project Geotechnical Works Clearing Permit Application.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	S. Ascott R Lupton	R. Lupton		D Farrar		21/12/2020

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