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# **ARROWSMITH NORTH REHABILITATION TRIAL**

**NATIVE VEGETATION CLEARING PERMIT APPLICATION  
SUPPORTING INFORMATION**

VRX-ARN-VCP-01

07 February 2022

**PREPARED FOR VRX SILICA LIMITED**

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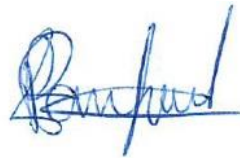

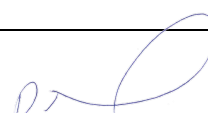
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# 1 INTRODUCTION

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## 1.1 PROJECT BACKGROUND

VRX Silica Limited (VRX), an Australian Stock Exchange listed company, is seeking to develop the Arrowsmith North Silica Sand Project (the Proposal), a high grade silica sand mine in the Mid-West region of Western Australia (WA). The Proposal is located within the Geraldton Sandplains bioregion, approximately 270 kilometres (km) north of Perth (Figure 1).

The Proposal will produce a high grade silica sand via extraction and mechanical upgrading which will be transferred to Geraldton via the Eneabba-Geraldton rail for export. The Proposal includes mining silica sand from the upper 8 – 15 metre (m) of the soil profile. Mining will be performed in sections by removing blocks (typically 150 m x 150 m), with an estimated five blocks being mined per year. Mining infrastructure will be comprised of a mine feed plant, moveable surface conveyor and pipeline, processing plant, freshwater supply bore, access corridor, gas fired power station, workshop and supported by ancillary infrastructure.

Mining will be progressively rehabilitated by Vegetation Direct Transfer (VDT). The VDT methodology uses a front end loader with a modified bucket to remove a 3 m x 3 m x 0.4 m sod from the top of the soil profile (vegetation and topsoil remain in situ). The sod is translocated from the mining face and are placed in a previously mined area. There are numerous advantages to utilising VDT as a rehabilitation technique, such as: recycling of plant and soil materials; faster re-vegetative process; restoration of the whole ecosystem; and erosion control (Ross et al. 2000).

The Proposal has been referred to the Environmental Protection Authority (EPA) for assessment under Section 38 of the *Environmental Protection Act 1986* and the level of assessment has been set at 'Public Environmental Review'.

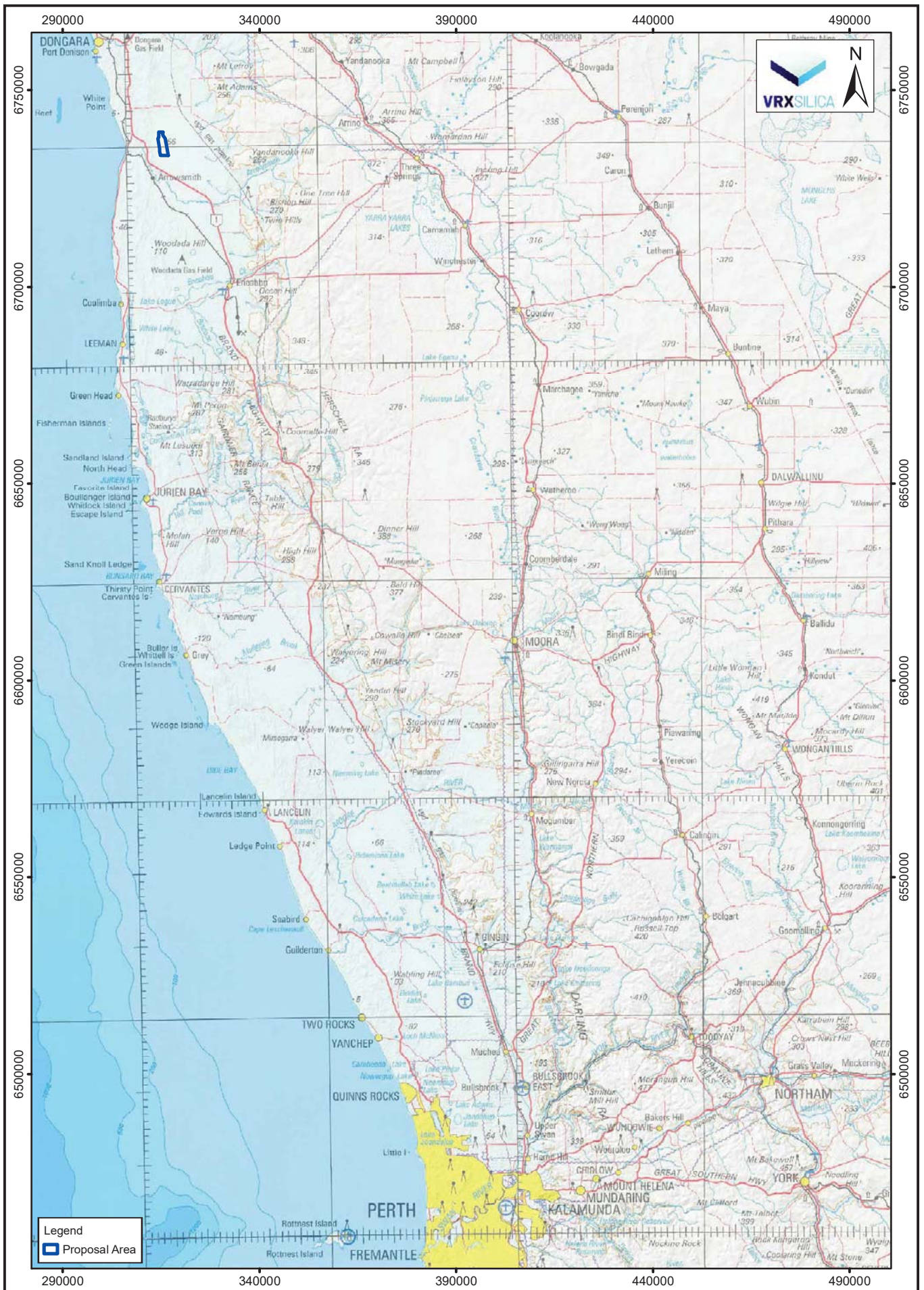
To inform the assessment of the Proposal, VRX proposes to undertake a trial of the VDT rehabilitation methodology (VDT Trial). The VDT Trial will allow VRX to assess the performance of the modified bucket attachment and help to refine the sod placement technique to ensure better rehabilitation outcomes. VDT Trials will involve the removal, translocation and placement of a small number of sods using the VDT methodology (described further in Section 3). The VDT Trials will occur within a 0.75 hectare (ha) plot (Trial Area; Figure 2) which lies entirely within the Mine Development Envelope (Figure 2) that has been extensively surveyed for the assessment of the Proposal.

## 1.2 PURPOSE

The purpose of this Native Vegetation Clearing Permit (NVCP) application is to authorise the clearing of 0.75 ha of native vegetation to enable VRX to undertake VDT Trials within tenement M70/1389.







Legend  
 Proposal Area

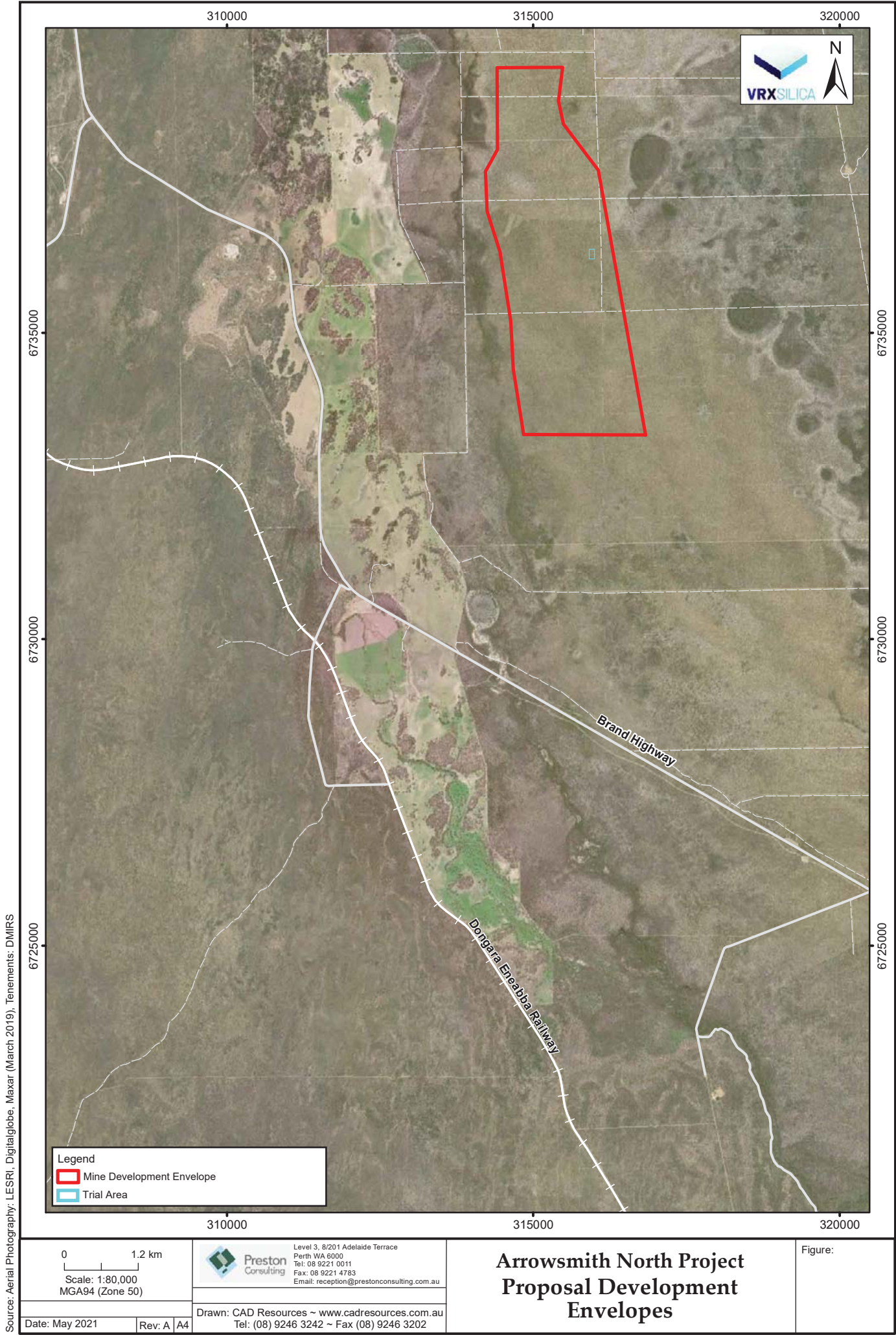
0 20 km  
 Scale: 1:1,300,000  
 MGA94 (Zone 50)  
 CAD Ref: a2602\_f31\_01  
 Date: August 2020

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## Arrowsmith North Project Regional Location of the Proposal

Figure 1: Regional Location of the Proposal





Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS

**Legend**  
 Mine Development Envelope  
 Trial Area

0 1.2 km  
 Scale: 1:80,000  
 MGA94 (Zone 50)

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## Arrowsmith North Project Proposal Development Envelopes

Figure:

**Figure 2: Trial Area in the context of the Development Envelope**



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## 2 TRIAL AREA

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### 2.1 BOUNDARY

All vegetation clearing required to undertake the VDT Trials will occur within the Trial Area defined in Figure 2.

### 2.2 TENURE AND LAND ACCESS

All vegetation disturbance addressed in this NVCP application will occur within granted tenements M70/1389 (owned by Ventnor Resources Pty Ltd, a wholly owned subsidiary of VRX). The Trial Area is comprised of 0.75 ha of native vegetation and is on vacant crown land that has been subject to minor exploration for mineral sands and seismic surveys for gas.

Access to the site is via Brand Highway and existing access tracks.

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## 3 VEGETATION DIRECT TRANSFER

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The rehabilitation technique VDT, or community translocation, is the practice of salvaging and replacing intact sods of vegetation with the underlying soil intact (Figure 3, Ross et al., 2000). Examples of utilising VDT in rehabilitation have shown rapid recovery of indigenous vegetation cover and conservation of the habitat. There are numerous advantages to utilising VDT as a rehabilitation technique, such as: recycling of plant and soil materials; faster re-vegetative process; restoration of the whole ecosystem; and erosion control (Ross et al. 2000). Rehabilitation using this method allows for the retention of root stock, seed banks and soil micro-organisms. These factors are particularly favourable when rehabilitating vegetation assemblages that have recalcitrant species, such as those found in the Mine Development Envelope (Rodgers et al. 2011).

VDT is noted to be the best available rehabilitation method for the Proposal, given the shallow root structure of the majority of the vegetation, and the progressive mining method proposed. VDT offers the following advantages over conventional topsoil stripping, stockpiling and replacement for mine rehabilitation:

- Rootstock is mostly preserved allowing re-sprouting species survival (many recalcitrant);
- Seed bank preserved;
- Soil microbiology preserved;
- Soil compaction absent;
- Soil structure preserved; and
- Surface stability achieved.

VDT provides a rehabilitation surface that is far less susceptible to erosion by wind or water, having a stable cover layer transferred from the harvested area. This significantly reduces the risk of rehabilitation failure due to sandblasting or poor establishment conditions. The transferred plants together with residual organic matter do not degrade in stockpile and provide an excellent retention of nutrients, soil mycorrhiza and micro flora and fauna (Mattiske, 2019).



## 3.1 VDT EXCAVATION

Historically, excavators with conventional bucket attachments have been used for VDT. This machinery has the potential to fragment the sod, exposing roots to the air and therefore requires a high degree of operator skill to ensure the structural integrity of sods are maintained. VRX is instead intending to utilise a purpose-built wide-mouth front end loader attachment (measuring 3 m x 3 m x 0.4 m), as depicted in Figure 3. This is expected to reduce the scope of operator error and provide better control to increase the likelihood of successful VDT rehabilitation.



Figure 3: VDT Excavation (sod removal method)

## 3.2 ESTIMATED VEGETATION DISTURBANCE REQUIREMENTS

The VDT Trial will result in the disturbance of up to 0.75 ha of native vegetation.

## 3.3 METHOD OF VEGETATION DISTURBANCE

Disturbance will be limited to VDT trials only. VDT is performed by a trained operator in a front end loader equipped with a modified bucket attachment. A sod measuring 3 m x 3 m x 0.4 m will be removed from the top of the soil profile and directly transferred to a cleared area for placement. Access to the VDT Trial area will be via existing tracks.

## 3.4 INDICATIVE TIMELINE

VDT Trials are proposed to commence as soon as appropriate approvals are received and are anticipated to last two weeks.



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## **4 ENVIRONMENTAL CHARACTERISTICS**

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The following sections detail the environmental characteristics of the Trial Area that are relevant to this NVCP. Several biological assessments have been conducted on the Mine and Access and Processing Survey Areas (Figure 4) to meet the relevant EPA guidance for an Environmental Impact Assessment of the Proposal. Mattiske Consulting Pty Ltd (Mattiske) was commissioned to conduct a desktop and field assessment of the Flora and Vegetation of the Mine Survey Area. Bamford Consulting Ecologists (BCE) was commissioned to conduct a Level 1 (now 'Basic') fauna assessment of the Mine and Access and Processing Survey Area.

For simplification, this NVCP will only discuss and assess the clearing of the proposed activities against the environmental characteristics the of the Mine Survey Area and will be referred to as the Survey Area (Survey Area).





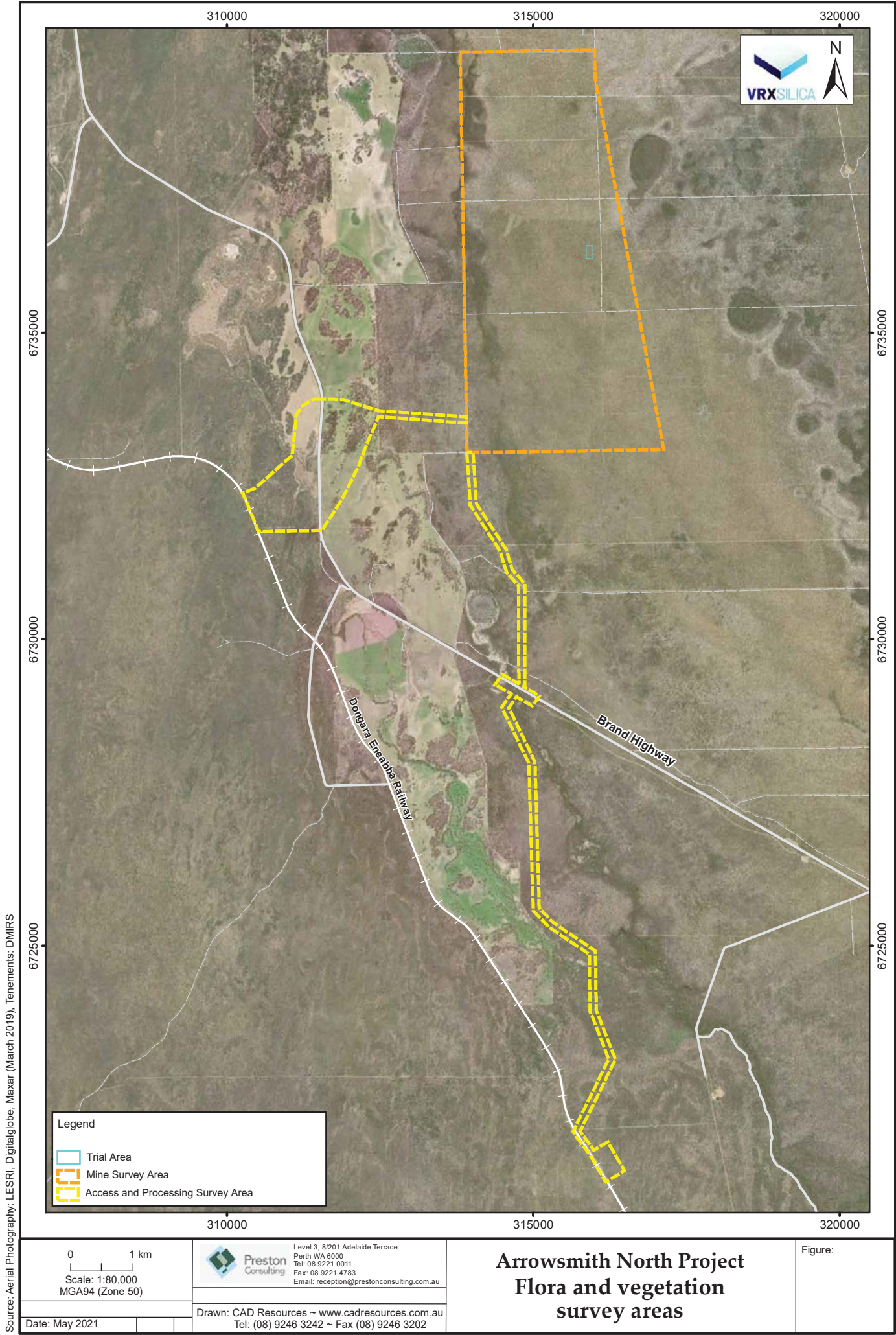


Figure 4: Flora and vegetation Survey Areas

## **4.1 BIOGEOGRAPHIC REGIONS**

The Interim Biogeographic Regionalisation for Australia (IBRA) has identified 26 bioregions in WA which are further divided into subregions. The Trial Area lies within the Lesueur Sandplain subregion (GES02), comprising coastal Aeolian and limestones of the central Perth basin overlain with shrub-heaths and rich in endemics (BCE, 2020). The broader Geraldton Sandplains (GES) Bioregion is composed mainly of proteaceous scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, lateritic sandplain. Extensive York Gum and Jam woodlands occur on outwash plains associated drainage (Thackway and Cresswell, 1995). The dominant land uses in this bioregion are agriculture, conservation reserves and crown reserves (BCE, 2020). The area exhibits extremely high floristic endemism, with over 250 species of sandplain flora endemic to the subregion. The area is known Australia-wide and internationally as having particularly high floristic diversity and levels of endemism (Desmond and Chant, 2001).

## **4.2 LAND SYSTEMS AND SOILS**

The Department of Primary Industries and Regional Development (DPIRD) identifies the land system within the Trial Area as the Tamala South System (221 Ta; Figure 5).

The Tamala South System has a state-wide extent of approximately 154,103 ha and is comprised of rises and low hills with relict dunes and some limestone outcrops on coastal limestone north of Jurien Bay. Yellow deep sands are common, with yellow/brown shallow sands and calcareous shallow and deep sands.

The underlying geology of the Trial Area is predominantly Permian to Cretaceous sedimentary basins, with horsts of Proterozoic rocks. The Trial Area is characterised by undulating lateritic sandplains with leached sandy soils over laterite in coastal areas; earthy, yellow sands over laterite further inland; and hard-setting loams with red clay subsoils (Beard, 1990; Desmond and Chant, 2001).



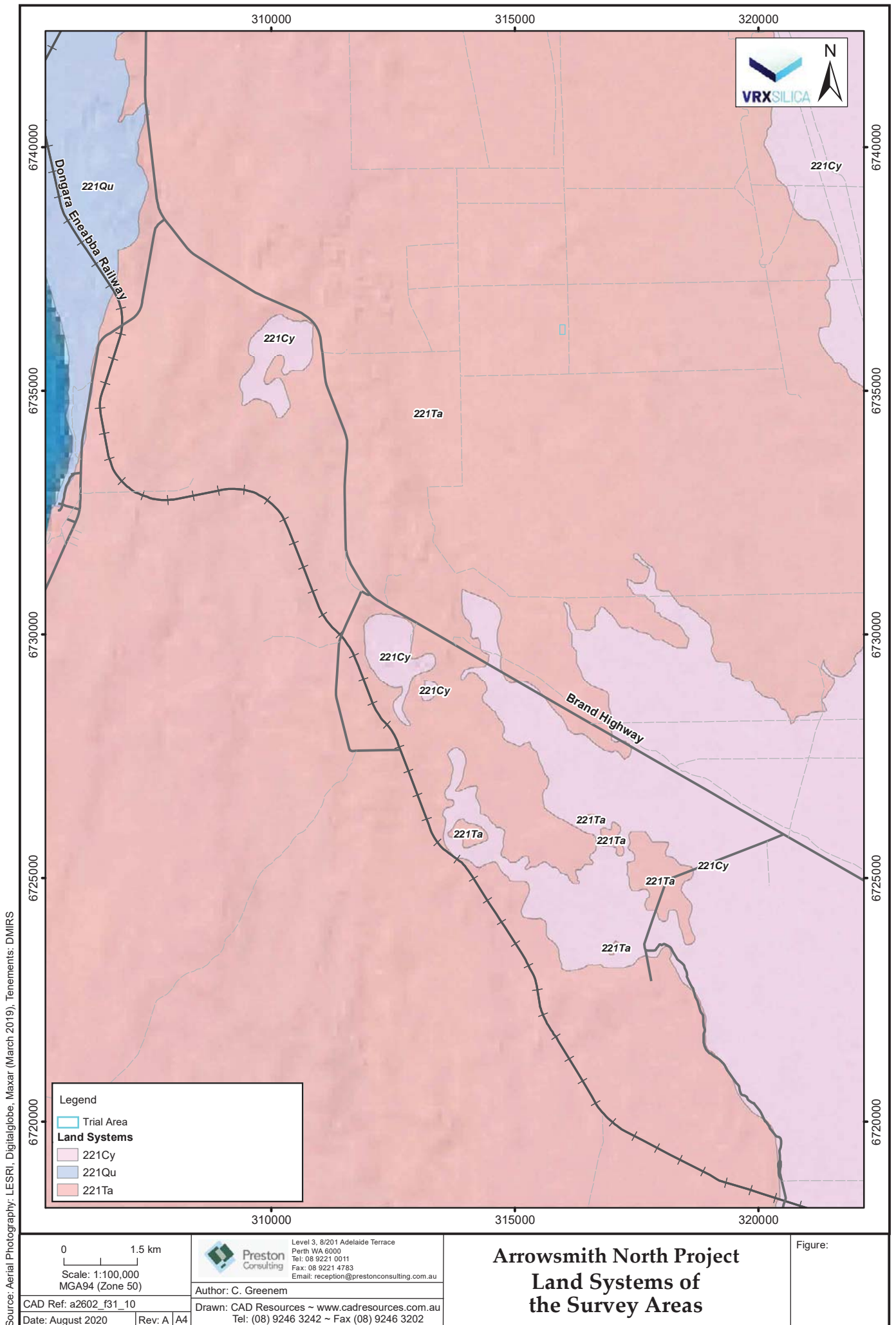


Figure 5: Land Systems of the Trial Area



## 4.3 FLORA AND VEGETATION

### 4.3.1 SURVEY EFFORT

Mattiske was commissioned to conduct a detailed desktop study of the flora and vegetation of the Survey Area. Extensive reconnaissance and detailed field surveys were conducted to verify and build on the desktop assessment. Mattiske’s report provided mapping and descriptions of vegetation types and the condition of flora within the Survey Area.

The information contained within the following sections is from Mattiske (2021) unless otherwise referenced.

### 4.3.2 CONSERVATION SIGNIFICANT FLORA

#### *Potential Conservation Significant Flora*

Thirteen threatened flora species listed by the Department of Biodiversity, Conservation and Attractions (DBCA, 2018) and Department of Agriculture, Water and the Environment (DAWE, 2020), and 45 Priority flora listed by Western Australian Herbarium (WAH, 1998) have the potential to occur within the Trial Area. Mattiske (2021) assessed the likelihood of recording any listed threatened and Priority taxa within the broader Mine Survey Area, based on factors including known soil type, topography and distribution. No Threatened flora species had a high likelihood of occurring in the Survey Area. Six Threatened flora species had a moderate likelihood and nine had a low likelihood of occurring in the Survey Area.

Fifteen Priority flora species had a low likelihood of occurring in the Survey Area and 16 had a moderate likelihood. Nine Priority species had a high likelihood of occurrence, mainly due to previous records in the area and suitable habitat.

The conservation significant taxa with the potential of occurring within the Survey Area are detailed in Table 1.

**Table 1: Threatened and Priority Flora potentially occurring within the Survey Area during desktop assessment**

Species	Conservation Status	Likelihood of Occurrence
<b>Threatened Species</b>		
<i>Conostylis dielsii</i> subsp. <i>Teres</i>	Endangered	Moderate
<i>Conostylis micrantha</i>	Endangered	Moderate
<i>Daviesia speciosa</i>	Endangered	Low
<i>Eucalyptus crispata</i>	Endangered	Low
<i>Eucalyptus impensa</i>	Endangered	Low
<i>Eucalyptus leprophloia</i>	Endangered	Low
<i>Eucalyptus x balanites</i>	Endangered	Low
<i>Hemiandra gardneri</i>	Endangered	Moderate
<i>Leucopogon obtectus</i>	Endangered	Low
<i>Paracaleana dixonii</i>	Endangered	Low
<i>Tetratheca nephelioides</i>	Critically Endangered	Moderate



Species	Conservation Status	Likelihood of Occurrence
<i>Thelymitra stellata</i>	Endangered	Low
<i>Wurmbea tubulosa</i>	Endangered	Low
<b>Priority Species</b>		
<i>Acacia latipes</i> subsp. <i>licina</i>	Priority 3	Moderate
<i>Acacia vittata</i>	Priority 2	Low
<i>Banksia elegans</i>	Priority 4	High
<i>Banksia fraseri</i> var. <i>crebra</i>	Priority 3	Moderate
<i>Banksia scabrella</i>	Priority 4	High
<i>Beyeria gardneri</i>	Priority 3	Moderate
<i>Caladenia denticulate</i> subsp. <i>albicans</i>	Priority 1	Low
<i>Calectasia palustris</i>	Priority 2	Low
<i>Calytrix chrysantha</i>	Priority 4	High
<i>Calytrix eneabensis</i>	Priority 4	High
<i>Calytrix superba</i>	Priority 4	Moderate
<i>Centrolepis milleri</i>	Priority 3	Low
<i>Comesperma griffinii</i>	Priority 2	Moderate
<i>Dampiera tephrea</i>	Priority 2	Low
<i>Eucalyptus macrocarpa</i> subsp. <i>elachantha</i>	Priority 4	Moderate
<i>Eucalyptus macrocarpa</i> x <i>pyriformis</i>	Priority 3	Low
<i>Grevillea erinacea</i>	Priority 3	Moderate
<i>Guichenotia alba</i>	Priority 3	Moderate
<i>Guichenotia quascalva</i>	Priority 2	Moderate
<i>Hemiandra</i> sp. Eneabba (H. Demarz 3687)	Priority 3	High
<i>Hopkinsia anoectocolea</i>	Priority 3	Moderate
<i>Hypocalymma tetrapterum</i>	Priority 3	Moderate
<i>Lasiopetalum ogilvieanum</i>	Priority 1	Moderate
<i>Persoonia chapmaniana</i>	Priority 3	Low
<i>Persoonia filiformis</i>	Priority 3	Moderate
<i>Persoonia rudis</i>	Priority 3	High
<i>Poranthera asybosca</i>	Priority 1	Moderate
<i>Schoenus griffinianus</i>	Priority 4	High
<i>Schoenus</i> sp. Eneabba (F. Obbens & C. Godden 1154)	Priority 2	Moderate
<i>Scholtzia calcicola</i>	Priority 2	Moderate
<i>Stawellia dimorphantha</i>	Priority 4	High
<i>Stylidium carnosum</i> subsp. Narrow leaves (J.A. Wege 490)	Priority 1	Low
<i>Stylidium longitubum</i>	Priority 4	Low
<i>Stylidium pseudocaespitosum</i>	Priority 2	Low
<i>Stylidium torticarpum</i>	Priority 3	Low
<i>Styphelia filifolia</i>	Priority 3	Low



Species	Conservation Status	Likelihood of Occurrence
<i>Synaphea oulopha</i>	Priority 3	Low
<i>Triglochin protuberans</i>	Priority 3	Low
<i>Verticordia argentea</i>	Priority 2	Moderate
<i>Verticordia dasystylis</i> subsp. <i>oestopoia</i>	Priority 1	Low
<i>Verticordia fragrans</i>	Priority 3	High
<i>Verticordia luteola</i> var. <i>rosea</i>	Priority 1	Moderate

### **Recorded Conservation Significant Flora**

No Threatened Flora listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Biodiversity Conservation Act 2016* (BC Act) were recorded in the Mine Survey Area. Eleven Priority flora were recorded, two of which were recorded within the Trial Area. Priority Flora recorded within the Trial Area are summarised in Table 2 and their locations are shown in Figure 6.

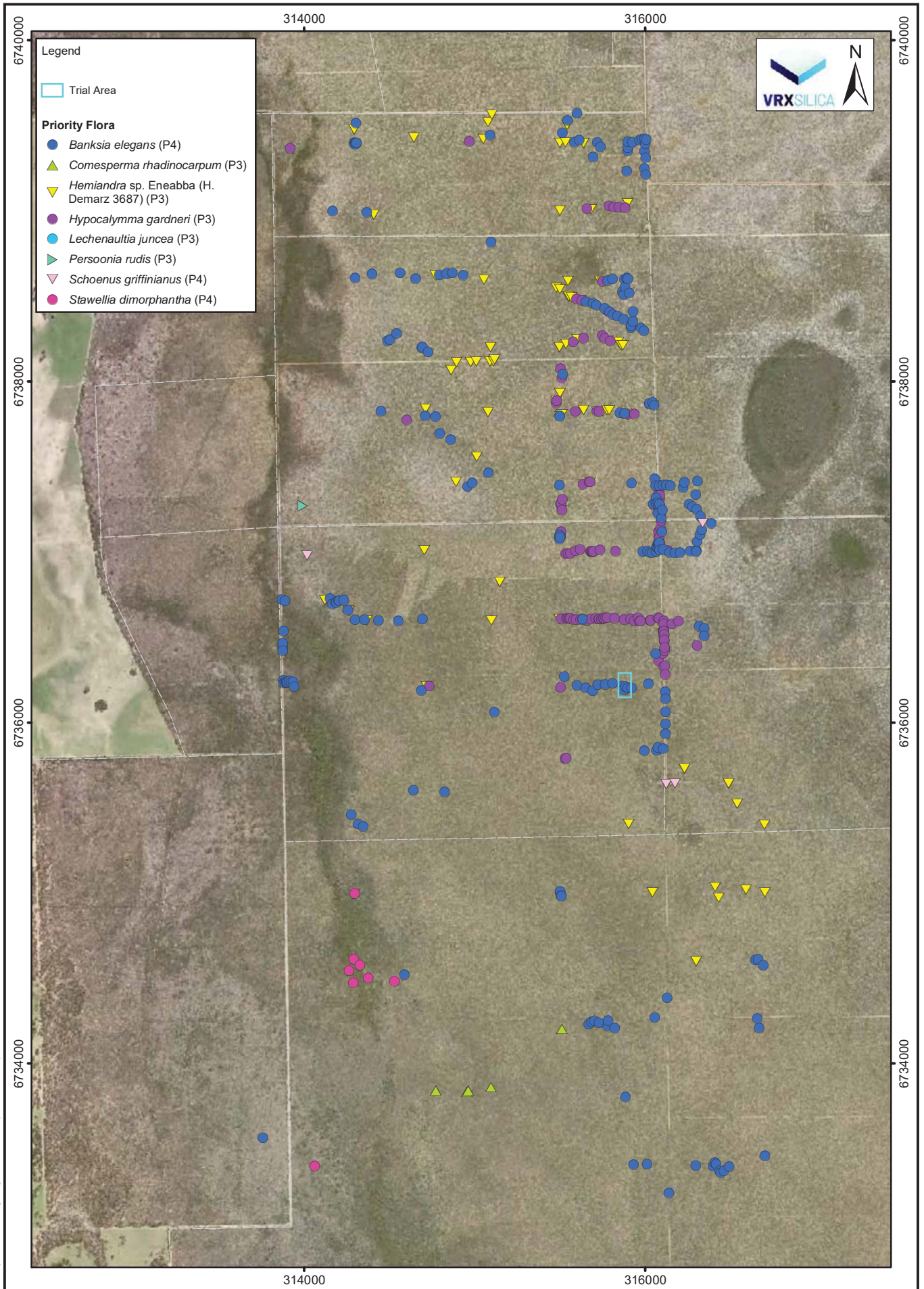
The larger number of Threatened and Priority flora species identified as having the potential to occur within the Survey Area can be attributed to the larger and more diverse desktop search area (Table 1). Many of these species are restricted to specific landscape features such as lateritic hills and outcrops that do not occur in the Mine Survey Area.

**Table 2: Priority flora recorded within the Trial Area**

Species and conservation status	Survey Area Record	Extent within Trial Area
<i>Banksia elegans</i> (P4)	Mine, Targeted and Access and Processing	Recorded throughout the Trial Area totalling 68 plants. 1546 plants were recorded within the remainder of the survey areas. The 44 records held at the WAH indicates <i>Banksia elegans</i> ranges from Moore River to Geraldton. <i>Banksia elegans</i> occurs on white or red sands, on sandplains and low dunes. This species is not restricted to a unique set of ecological conditions and is present in various vegetation communities.
<i>Hypocalymma gardneri</i> (P3)	Mine	Recorded one plant. 217 plants were recorded within the remainder of the Mine Survey Areas. The 22 records held at the WAH indicates this species ranges from Dandaragan to Dongara. This species occurs on a wide range of habitat from grey to brown sand, often over laterite. This species is not restricted to a unique set of ecological conditions and is present in various vegetation communities.







Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS

<p>0 400 m Scale: 1:30,000 MGA94 (Zone 50)</p>	<p><b>Preston Consulting</b> Level 3, 8/201 Adelaide Terrace Perth WA 6000 Tel: 08 9221 0011 Fax: 08 9221 4783 Email: reception@prestonconsulting.com.au</p>	<p><b>Arrowsmith North Project</b> <b>Priority Flora recorded within</b> <b>the Mine Survey Area</b></p>	<p>Figure:</p>
<p>Date: May 2021</p>	<p>Rev: A   A4 Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax (08) 9246 3202</p>		

Figure 6: Priority flora recorded within the Trial Area and Mine Survey Area

### 4.3.3 INTRODUCED FLORA SPECIES

The following eight introduced (weed) species were recorded within the Survey Area:

- *Aira caryophyllea*;
- *Brassicaceae* sp.;
- *Briza maxima*;
- *Hypochaeris glabra*;
- *Lysimachia arvensis*;
- *Trifolium arvense* var. *arvense*;
- *Ursinia anthemoides*; and
- *Wahlenbergia capensis*.

None of these species are listed as Weeds of National Significance (DotEE, 2019). All species recorded are listed in the Midwest region impact and invasiveness ratings (DPaW, 2013). Two were listed as having a high ecological impact (*Aira caryophyllea* and *Ursinia anthemoides*), one was listed as having a moderate ecological impact (*Brassicaceae* sp.) and two were listed as having a low ecological impact (*Lysimachia arvensis* and *Hypochaeris glabra*). The three remaining species (*Briza maxima*, *Trifolium arvense* var. *arvense* and *Wahlenbergia capensis*) are listed as having an unknown ecological impact (DPaW, 2013). All weed species recorded were described as having rapid invasiveness, with the exception of *Trifolium arvense* var. *arvense*, which has moderate invasiveness (DPaW, 2013).

### 4.3.4 VEGETATION

The Trial Area is located within the Irwin Botanical District, which is described as coastal scrub heath on sandplains, with *Acacia* and *Allocasuarina* thickets further inland, and hard-setting loams with *Acacia* scrub and scattered *Eucalyptus loxophleba* (Beard, 1990).

The Trial Area is comprised of the Erindoon pre-European vegetation systems (Figure 8). The Erindoon system is defined as a flat coastal plain with various small rivers and creeks with numerous small lakes and swamps and some limited alluvial flats of heavier soil on the lower Arrowsmith River. Vegetation within this system is comprised of scattered small trees with an open layer of tall shrubs over a closed layer of small heath-like shrubs, which experiences frequent fires.

More recently, the vegetation of WA has been assigned to bioregions and subregions under the IBRA, with the Survey Area falling within the Lesueur Sandplain subregion of the Geraldton Sandplain Region (DAWE, 2020). The Geraldton Sandplain 3 (GES02 – Lesueur Sandplain subregion) is described as having high floristic diversity and levels of endemism, with vegetation comprised mainly of proteaceous scrub heaths. Extensive York Gum (*Eucalyptus loxophleba*) and Jam (*Acacia acuminata*) woodlands occur on outwash plains associated with drainage (Desmond and Chant, 2001).

#### ***Regional Native Vegetation Extent***

Native vegetation within 10, 15 and 20 km of the Survey Area was mapped using DPIRD's Native Vegetation Dataset and is shown in Figure 7. The extent of native vegetation surrounding the Survey Area is summarised in Table 3.



**Table 3: Native vegetation surrounding the Proposal**

Radius (km)	Area (ha)	% of native vegetation remaining
Survey Area	1,297.4	88.14
10	27,134	90.45
15	57,388.5	91.17
20	86,122.9	82.85

### ***Vegetation Associations***

The Trial Area occurs within one vegetation association which is summarised in Table 5 and shown in Figure 8.

**Table 4: Vegetation associations of the Survey Area**

Pre-European System	Vegetation Association	Description	State-wide Pre-European Extent (ha)	Extent remaining (ha)	Survey Area	
					Area of Intersection (ha)	Proportion of Current Extent (%)
Eridoon	378.1	Mixed heath with scattered tall shrubs <i>Acacia</i> spp., <i>Proteaceae</i> and <i>Myrtaceae</i>	124,192.7	80,734.1 (65.0%)	0.75	<0.001%





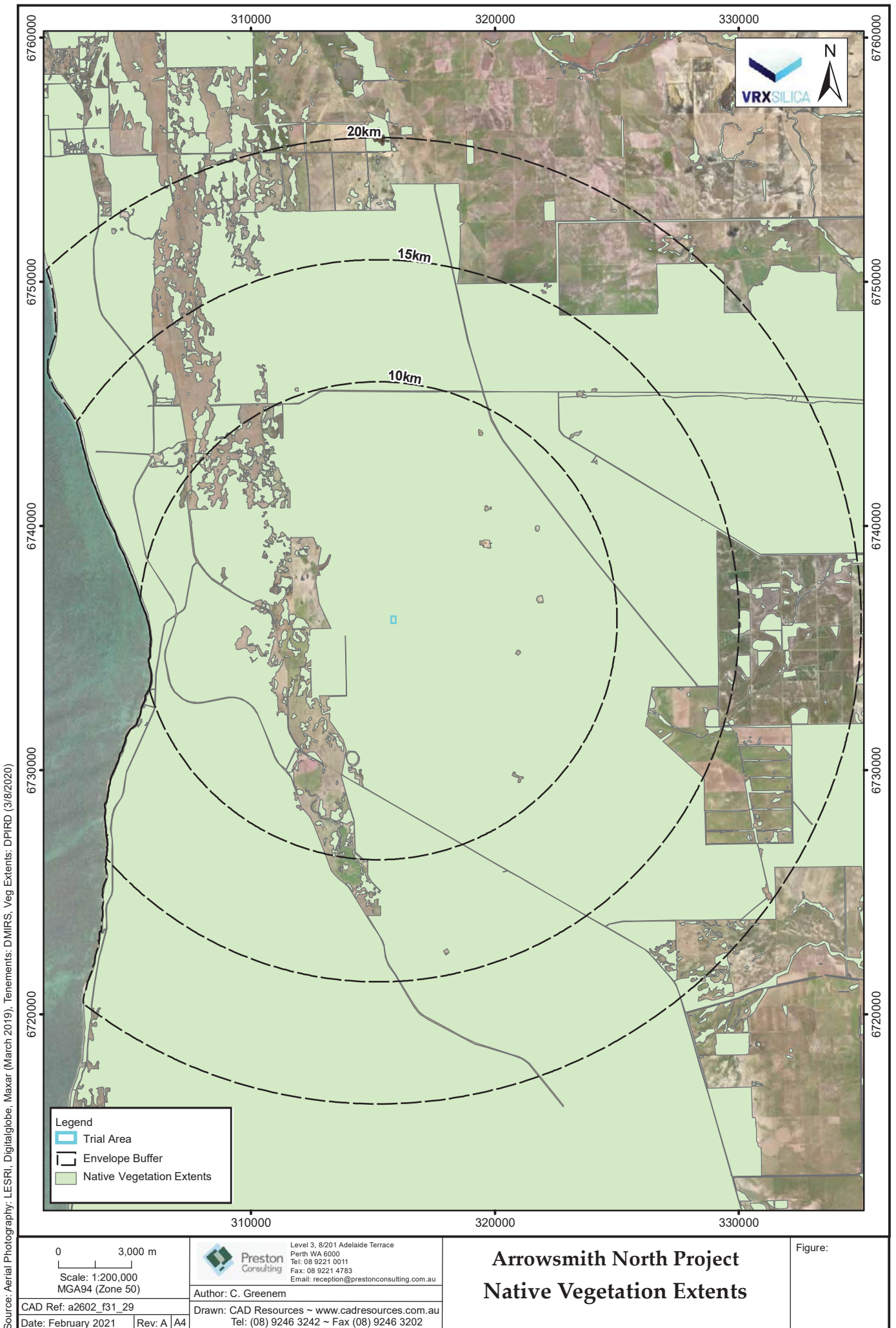


Figure 7: Extent of native vegetation within 20 km of the Survey Area

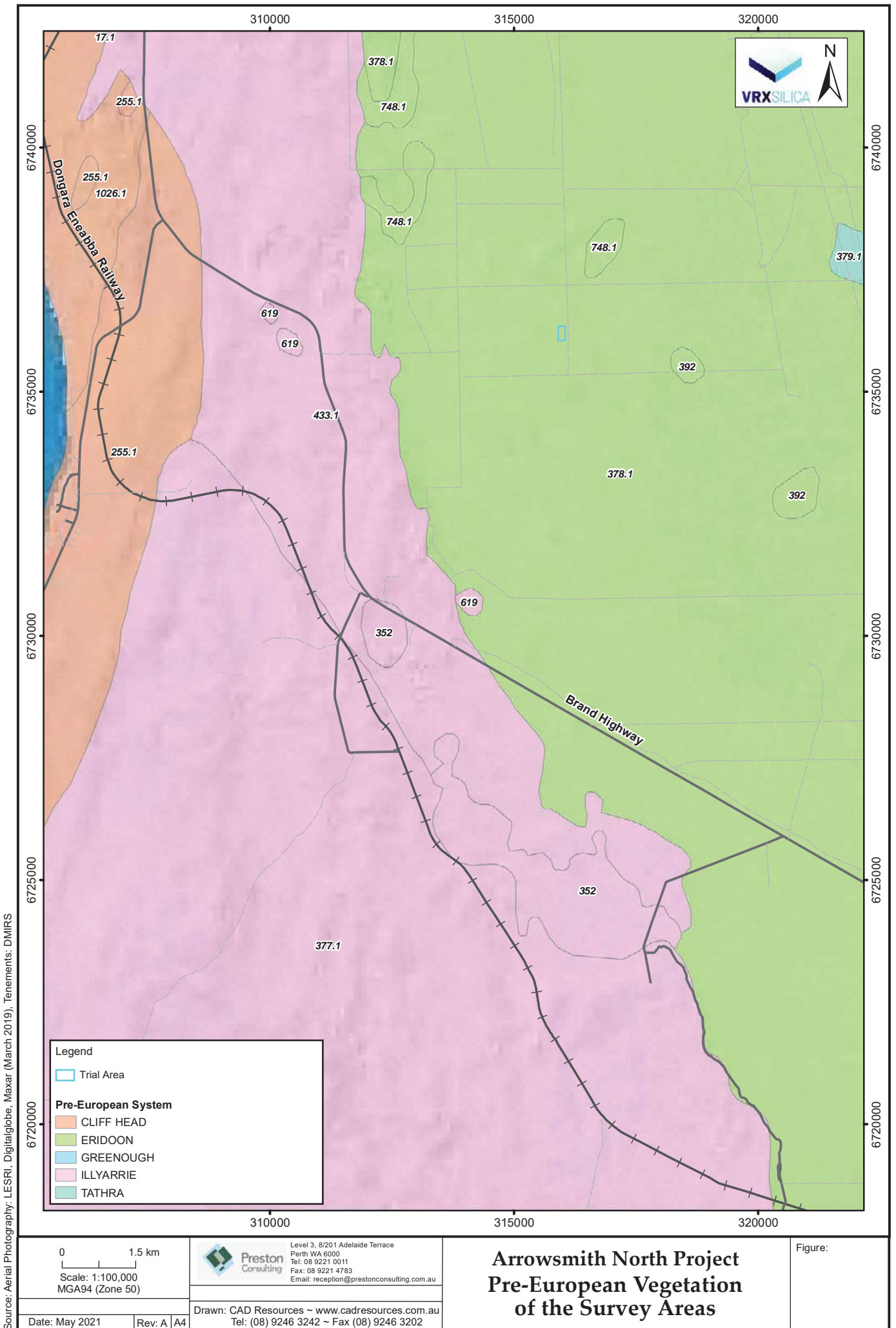


Figure 8: Pre-European vegetation of the Trial Area

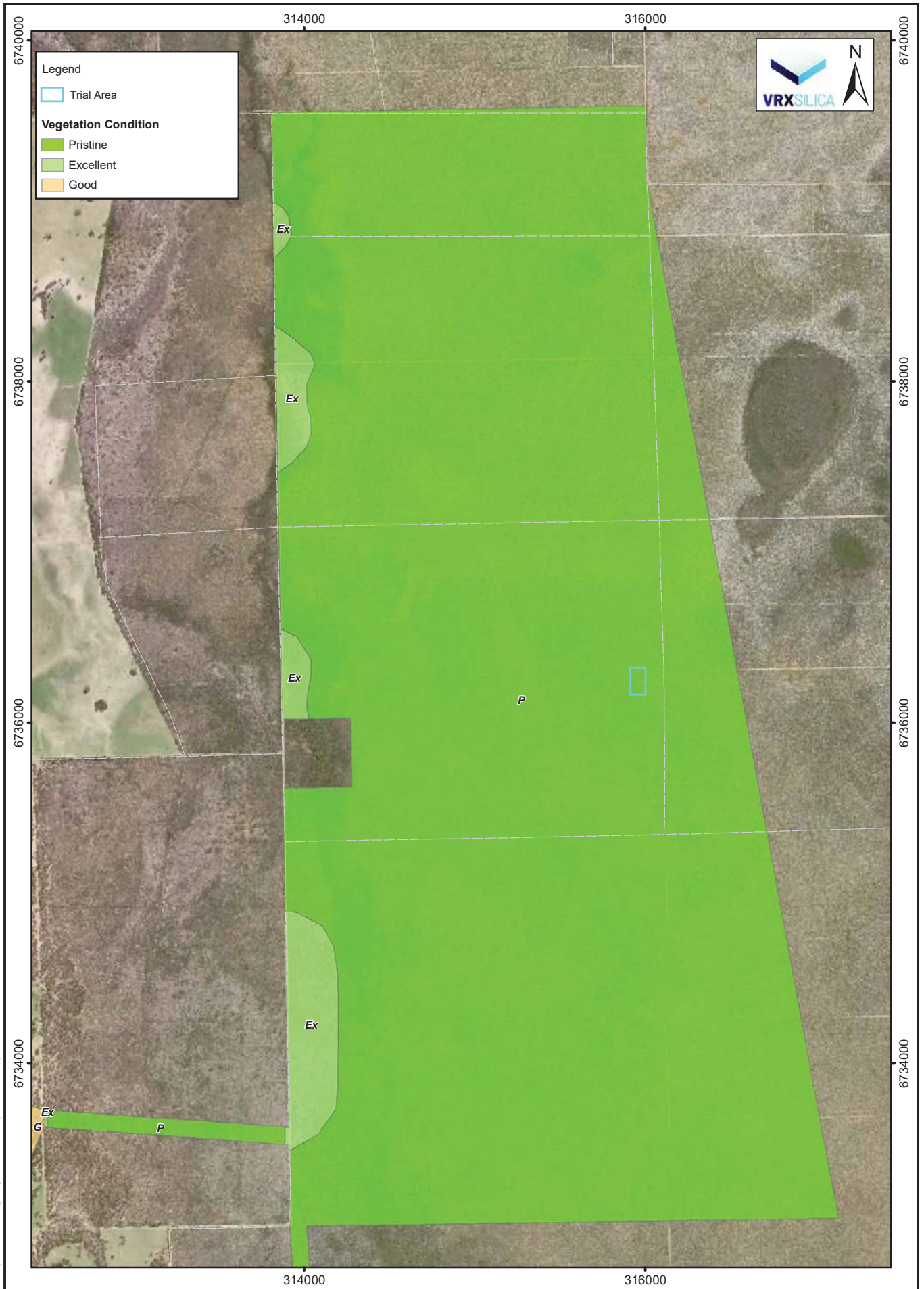
### ***Vegetation Condition***

The condition of vegetation within the Survey Area ranges from Pristine to Excellent, with the majority of the area considered Pristine according to the Keighery (1994) scale. The condition of the vegetation within the Trial Area is mapped as Pristine (Figure 9).

The Eridoon system experiences frequent bushfires. The northern extent of the Survey Area was subject to bushfire in 2012 and the southern extent in 2007. The extent and timing of fires within 20 km of the Proposal are mapped in Figure 10.







**Legend**

□ Trial Area

**Vegetation Condition**

- Pristine
- Excellent
- Good



Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS

0 400 m	
Scale: 1:30,000	
MGA94 (Zone 50)	
Date: May 2021	Rev: A   A4

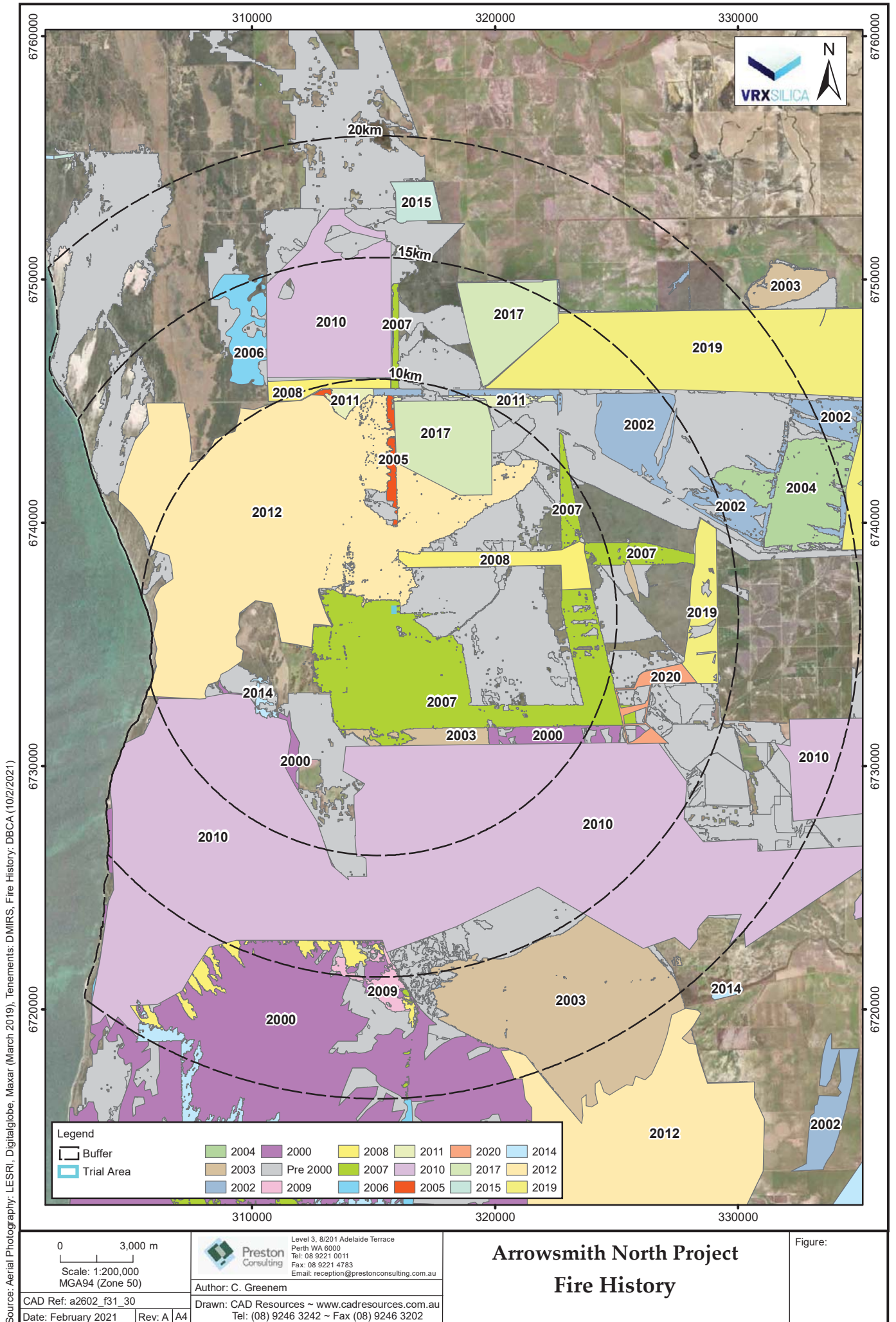
 **Preston Consulting**  
 Level 3, 8/201 Adelaide Terrace  
 Perth WA 6000  
 Tel: 08 9221 0011  
 Fax: 08 9221 4783  
 Email: reception@prestonconsulting.com.au

Drawn: CAD Resources ~ www.cadresources.com.au  
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## Arrowsmith North Project Vegetation condition of the Mine Survey Area

Figure:

**Figure 9: Vegetation condition of the Survey Area**



Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS, Fire History: DBCA (10/2/2021)

Figure 10: Extent of bushfires within 20km of the Survey Area

### ***Vegetation Communities***

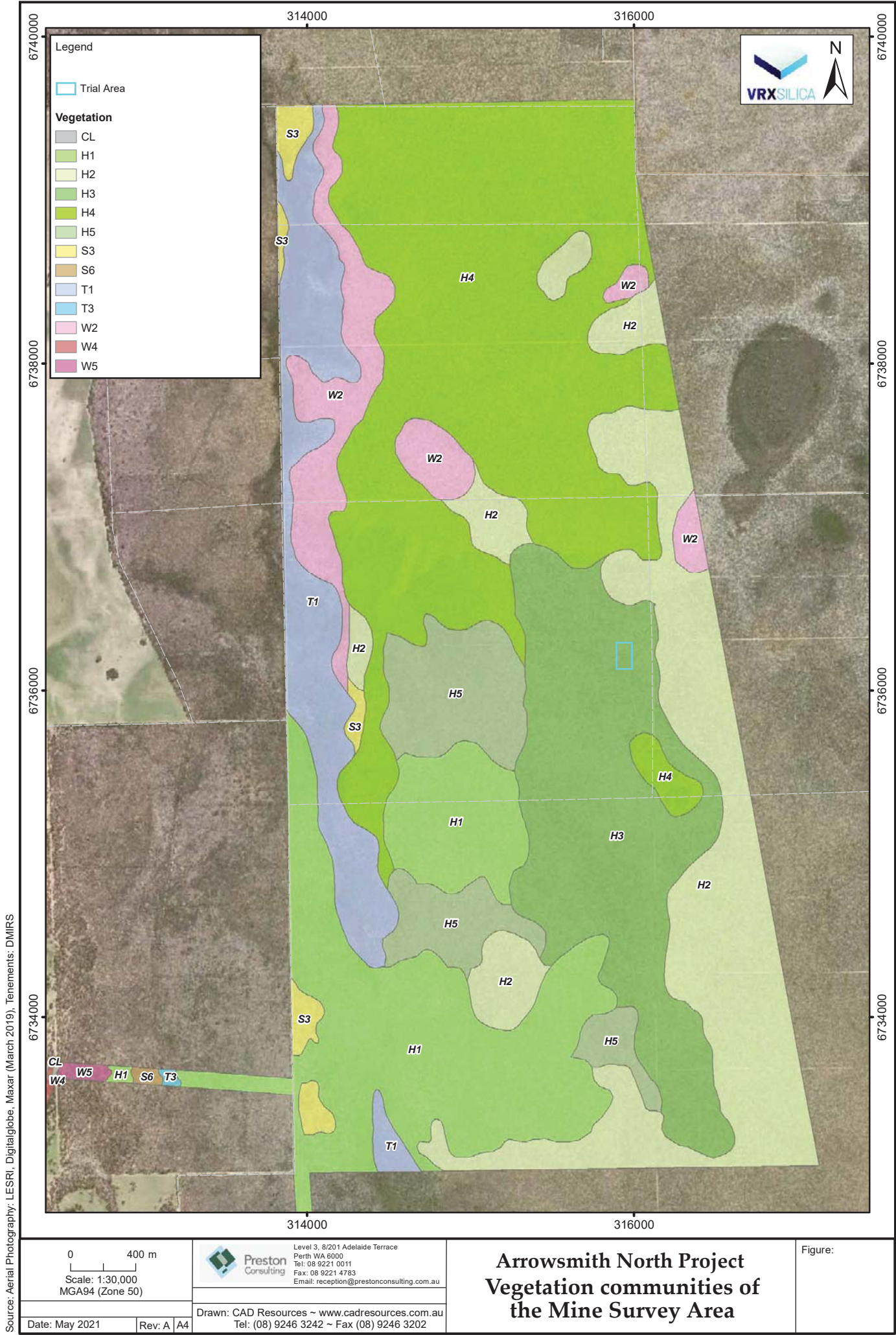
Seventeen vegetation communities were defined and mapped across the Survey Area. Survey quadrat physical data and aerial photographic maps were used to delineate the boundaries of the vegetation communities. The vegetation communities of the Survey Area, mapped by Mattiske (2021), are presented in Figure 11. Vegetation community descriptions and their extent within the survey areas is presented in detail in Mattiske (2021; Appendix 1). The Trial Area only intersects with the H3 vegetation community described in Table 5.

**Table 5: Vegetation community within the Trial Area**

Name	Vegetation Community Description	Extent	
		Survey Area (ha)	% Within the Trial Area
H3	Open Heath of <i>Melaleuca leuropoma</i> , <i>Leptospermum oligandrum</i> , <i>Hakea polyanthema</i> , <i>Conospermum triplinervium</i> , <i>Beaufortia elegans</i> and <i>Pileanthus filifolius</i> , with isolated trees of <i>Banksia attenuata</i> and <i>Xylomelum angustifolium</i> over <i>Mesomelaena pseudostygia</i> and <i>Ecdeiocola monostachya</i> on cream/grey sand on plains.	258.15	0.3







Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS

Figure 11: Vegetation communities of the Survey and Trial Area

### **4.3.5 SIGNIFICANT VEGETATION COMMUNITIES**

No Threatened Ecological Communities (TECs), pursuant to Part 2, Division 1, Subdivision 1 of the BC Act and as listed by the DBCA (2018) or DAWE (2020), or Priority Ecological Communities (PECs) as listed by DBCA (2020) were recorded within the survey areas.

None of the vegetation communities recorded within the Trial Area were considered locally or regionally unique and all are well represented in the wider area (Mattiske, 2021).

### **4.3.6 DIEBACK ASSESSMENT**

Assessments have been conducted by Glevan Consulting within and surrounding the Survey Area since 2006. In that period, 56 sites displaying suspicious deaths have been sampled to determine if *Phytophthora* was the cause of the vegetation decline. Twenty-six sites have shown the presence of *P. Arenaria*; no other *Phytophthora* species has been recorded. Significantly, *P. cinnamomi* has not been recovered from the greater area. Due to the period and repetition of assessments in the area, and the spatial distribution of *Phytophthora* recoveries, it is considered highly unlikely that *P. cinnamomi* will present in the undisturbed vegetation.

## **4.4 FAUNA**

### **4.4.1 SURVEY EFFORT**

A Level 1 fauna assessment and targeted surveys for conservation significant fauna were conducted by BCE in November 2018, September 2019 and October 2019 in the Survey Area. A desktop assessment was conducted by Bennelongia in December 2020 to determine the likelihood of significant Short-Range Endemic (SRE) invertebrate fauna occurring within the Survey Area. All information contained within the following sections is from BCE (2021) and Bennelongia (2021) unless otherwise referenced.

### **4.4.2 FAUNA HABITAT**

#### ***General Fauna***


The Survey Area reflects major components of the Lesueur Sandplain Subregion. They provide habitat values for species which utilise low dense shrubland and open woodland. There are several narrow natural drainage lines in some low-lying areas (excluded from the development envelopes) which may provide a limited amount of habitat for wetland species. These may be taken advantage of by wetland species visiting several wetland features in the surrounding landscape such as the system to the east and lakes to the south. It is unlikely that the drainage systems and wetlands in the Survey Area are ever directly linked to Ejarno Spring, or to the Arrowsmith River system to the south.

Vegetation and Substrate Associations (VSAs) combine broad vegetation types, the soils or other substrates with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. Three VSAs were identified in the Survey Area during the field survey; their locations are shown in Figure 12. The descriptions and extents of the VSAs within the Survey Area are detailed in BCE (2021; Appendix 2).



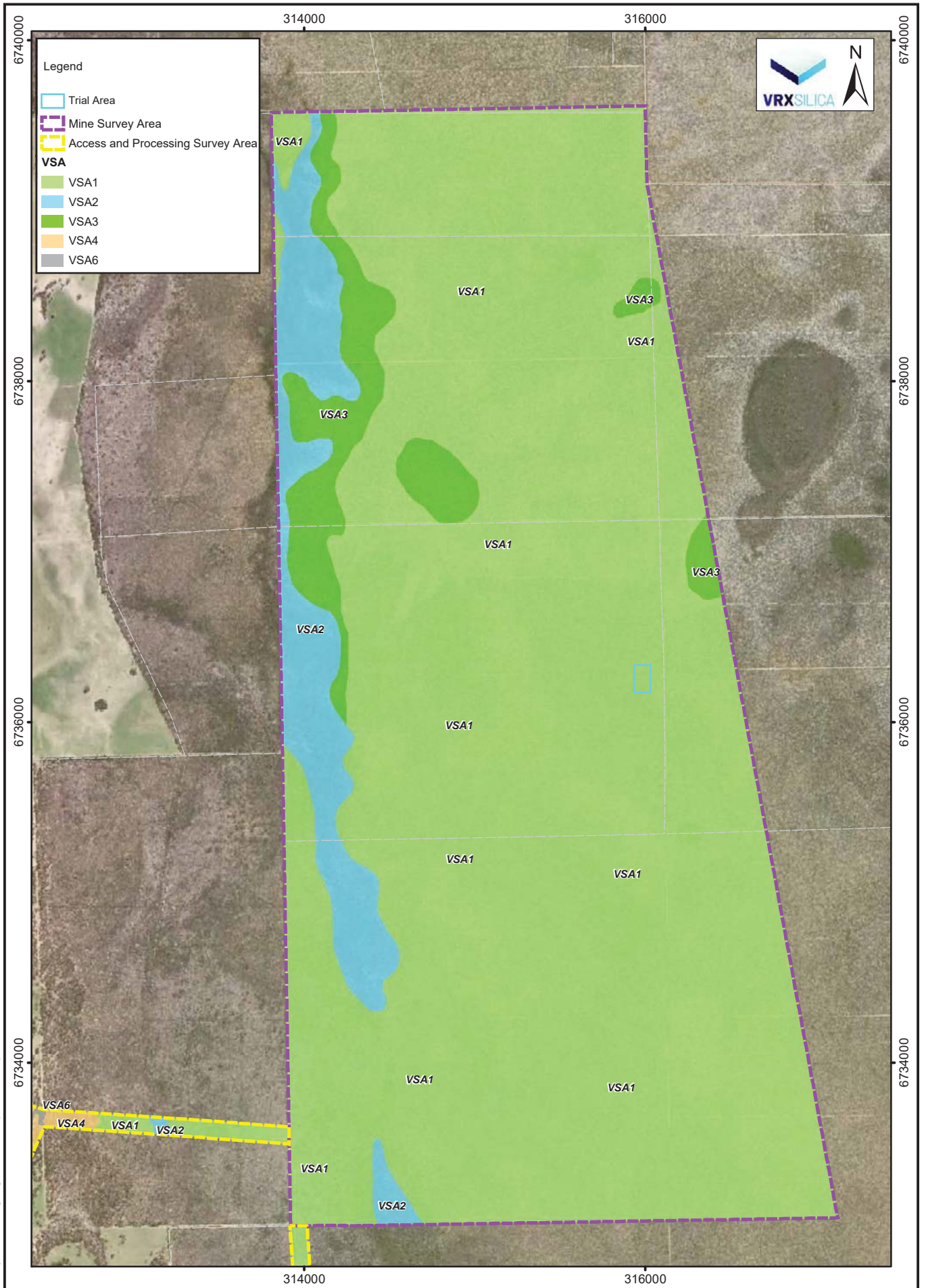
Only one of the three VSA's was identified in the Trial Area (Table 6; Figure 12).

**Table 6: VSA within the Trial Area**

VSA	Description	Extent within the Survey Area (ha)
<p><b>VSA1</b> Kwongan Heath</p>	 <p>Low, dense, proteaceous/myrtaceous shrubland on yellow and pale sands. This VSA contained several <i>Banksia</i> species that were in flower during September 2019. Occurs across majority of the project area and varies with landscape position from high to low on stabilised dunes. Vegetation types H1, H2, H3, H4, H5 and S3 (Mattiske, 2021)</p> <p>Occurs across majority of the Survey Area and varies with landscape position from high to low on stabilised dunes.</p> <p>Occurs along the eastern end of the western corridor and along much of the southern corridor.</p>	<p>1,254</p>







Source: Aerial Photography: LESRI, Digitalglobe, Maxar (March 2019), Tenements: DMIRS

0 380 m  
Scale: 1:30,000  
MGA94 (Zone 50)



Level 3, 8/201 Adelaide Terrace  
Perth WA 6000  
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## Arrowsmith North Project VSAs within the Mine Survey Area

Figure:

Date: May 2021 | Rev: A | A4

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Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Figure 12: VSA within the Trial Area

## ***Invertebrate Fauna***

The vegetation communities within the Survey Area have the potential to harbour SRE species, particularly in microhabitats that have higher local moisture content than surrounding areas, such as bark, leaf litter beds, soil humus, large debris and south-facing slopes. Such microhabitats within remnant vegetation on the Geraldton Sandplains are likely to have provided refuges for many relictual invertebrate taxa, as the region has undergone long-term aridification and historical clearing for pastoral land use (Ecologia, 2010). It is possible that the taller and/or thicker vegetation communities, such as woodlands, shrubs and closed heaths, are likely to contain a higher proportion of prospective microhabitats than more open communities within the Survey Area. However, such microhabitats could be found within any of the vegetation communities identified within the Survey Area. Despite a lack of dedicated sampling effort in the Geraldton Sandplains, species from numerous SRE Groups have been recorded from habitats in the bioregion that resemble the Proposal, including mygalomorph spiders, scorpions, pseudoscorpions, isopods, millipedes and snails (Harvey et al., 2000; Ecologia, 2010). Mygalomorph spiders are particularly well-known to inhabit coastal sandplains of the bioregion; for example, many species of the family Idiopidae are endemic to the Geraldton Sandplains (Rix et al., 2018a; Rix et al., 2018b; Rix et al., 2019).

### **4.4.3 GENERAL FAUNA**

The desktop survey (BCE, 2021) identified 209 vertebrate fauna species as potentially occurring in the survey areas including ten frogs, 50 reptiles, 122 birds and 24 mammals. The assemblage includes 14 listed vertebrate species, these species discussed further in Section 4.4.5. It is expected that at least 13 mammals and one bird identified in the desktop survey have become locally extinct.

### **4.4.4 SIGNIFICANT FAUNA**

For the purposes of this assessment the term ‘significant fauna’ refers to fauna listed under the EPBC Act or BC Act, DBCA Priority Fauna, or species that have declined extensively across the region, and some species that occur at the edge of their range. The potential fauna assemblage of the Survey Area includes 15 significant fauna species (Table 7). BCE (2021) contains a description of each of these species.

**Table 7: Significant fauna potentially occurring within the Survey Area**

<b>Species</b>	<b>Conservation listing</b>	<b>Presence within Survey Area</b>	<b>Expected Status</b>
<b>Invertebrates</b>			
Millipede ( <i>Antichiropus Eneabba 1</i> )*	Locally Significant	Unconfirmed	Uncertain Records within 12 km of the survey area
Bothriembryontid Land Snail ( <i>Bothriembryon perobesus</i> )	Priority 1	Unconfirmed	Uncertain Records within 50 km of survey area
Kwongan Heath Shield-Backed Trapdoor Spider ( <i>Idiosoma kwongan</i> )	Priority 1	Unconfirmed	Uncertain Records within 12 km of survey area



Species	Conservation listing	Presence within Survey Area	Expected Status
Springtime Corroboree Stick Katydid (Eneabba) ( <i>Phasmodes jeeba</i> )	Priority 3	Unconfirmed	Uncertain Records within 50 km of survey area
Thorny Bush Katydid (Moora) ( <i>Hemisaga vepreculae</i> )	Priority 2	Unconfirmed	Resident
Woollybush Bee ( <i>Hylaeus globuliferus</i> )	Priority 3	Unconfirmed	Resident
<b>Reptiles</b>			
Carpet Python ( <i>Morelia spilota imbricate</i> )	Locally Significant	Unconfirmed	Resident
Black-striped Snake ( <i>Neelaps calonotos</i> )	Priority 3	Confirmed	Resident
<b>Birds</b>			
Malleefowl ( <i>Leipoa ocellata</i> )	Vulnerable – EPBC and BC Act	Unconfirmed	Irregular visitor
Fork-Tailed Swift ( <i>Apus pacificus</i> )	Migratory – EPBC and BC Act	Unconfirmed	Regular migrant
Peregrine Falcon ( <i>Falco peregrinus</i> )	Other Specially Protected Fauna - BC Act	Unconfirmed	Irregular visitor
Rainbow Bee-eater ( <i>Merops ornatus</i> )	Locally Significant	Confirmed	Regular migrant
Carnaby's Black-Cockatoo ( <i>Calyptorhynchus latirostris</i> )	Endangered – EPBC and BC Act	Confirmed	Regular migrant
Rufous Fieldwren ( <i>Calamanthus campestris</i> )	Locally Significant	Unconfirmed	Resident
Shy Heathwren ( <i>Calamanthus cautus</i> )	Locally Significant	Unconfirmed	Irregular visitor
White-browed Babbler ( <i>Pomatostomus superciliosus</i> )	Locally Significant	Unconfirmed	Irregular visitor
<b>Mammals</b>			
Western Brush Wallaby ( <i>Notamacropus Irma</i> )	Priority 4	Confirmed	Resident
Rakali ( <i>Hydromys chrysogaster</i> )	Priority 4	Unconfirmed	Irregular visitor







### ***Carnaby's Black-Cockatoo***

Carnaby's Black-Cockatoo has been confirmed in the general area. The other two significant black-cockatoos in the South-West, Baudin's and the Forest Red-tailed, do not occur on the northern Swan Coastal Plain. Carnaby's Black-Cockatoo may forage on proteaceous and myrtaceous vegetation in the survey areas and roost in large trees near water courses. Foraging and roosting by Carnaby's Black-Cockatoos have been confirmed adjacent to the survey areas and is discussed below. Locations of foraging signs and sightings of Carnaby's Black-Cockatoo collected in September 2019 are shown in Figure 14. Breeding nearby is also a possibility.

#### *Breeding habitat*

The survey areas are unlikely to support breeding by Carnaby's Black-Cockatoos due to a lack of suitable nesting sites (no large trees of sufficient size to provide nesting hollows). However, there are large trees (River Gums) along the drainage system to the east of the Survey Area. It is possible these are suitable for roosting and could contain hollows of suitable size for nesting by the Black-Cockatoos.

#### *Roosting habitat*

Two Carnaby's Black-Cockatoo roost sites have been confirmed within proximity of the Survey Area. Bamford and Chuk (2015 - 2017) recorded a flock of 300+ individuals roosting 10 km south of the Survey Area, 2 km east of the southern alignment along the Arrowsmith River (Figure 14) In April 2015, Bamford (pers. comm) recorded a roost of 500+ individuals approximately 13 km north, near the north-eastern boundary of Yandanogo Nature Reserve. Two groups of Carnaby's Black-Cockatoos of ten or so individuals were seen flying very directionally and at speed across the Brand Highway (one group flying west, the other east) approximately 5 km south of the Survey Area on 23 September 2019 just after dusk. This timing and flight pattern suggest they were travelling to roost sites. Additionally, approximately 45 minutes before sunrise on 24 and 25 September 2019, Carnaby's Black-Cockatoos could be heard calling from the Western Flora Caravan Park where the surveyors were staying; this lies just over 18 km south-west of the survey areas. Static calls at this time of the day strongly suggest the presence of a roost. Data retrieved from the Great Cocky Count coordinator, Adam Peck (pers. comm) confirmed the absence of any other known Carnaby's Black Cockatoo roosts within 12 km of the Survey Area.

While there are no large trees within the survey areas that are likely to be used for roosting, there are large trees nearby, particularly along drainage lines that may be suitable. The presence of the roosts 10 km south and 13 km north to the south means that the survey areas may regularly be visited by foraging Carnaby's Black-Cockatoos.

A search of the wider landscape for suitable roosting and breeding trees was conducted in September 2019. This identified several locations with trees of possibly suitable stature along the Arrowsmith River and around wetlands to the south and east of the Survey Area, although the trees themselves were not inspected.

#### *Foraging habitat*

Banksias, hakeas, eucalypt trees, acacias and Woody Pears (*Xylomelum*) provide foraging habitat for Carnaby's Black-Cockatoos, Acacias and Banksias in particular are widespread throughout the survey areas. Furthermore, a large number of scattered and chewed Banksia inflorescences



consistent with Carnaby's were found across the Survey Area in September 2019. Two flocks (one of 50 individuals) were also spotted flying over the Survey Area in the mid-afternoon during the September 2019 survey. Flocks have occasionally been recorded in the general area, foraging in Kwongan heath and Banksia low woodland, including approximately 500 individuals north of Yardanogo Nature Reserve (April 2015; Bamford *et al.* 2015) and flocks of over 300 individuals near the Arrowsmith River west of Brand Highway (Bamford and Chuk 2015-2017).

BCE (2021) assigned a foraging value score to the VSAs in the survey areas for Carnaby's Black-Cockatoo. The Kwongan heath (VSA1) has the highest foraging value for the species (7 out of 10). This is on the basis of having high proportions of key food plants, notably Banksias.





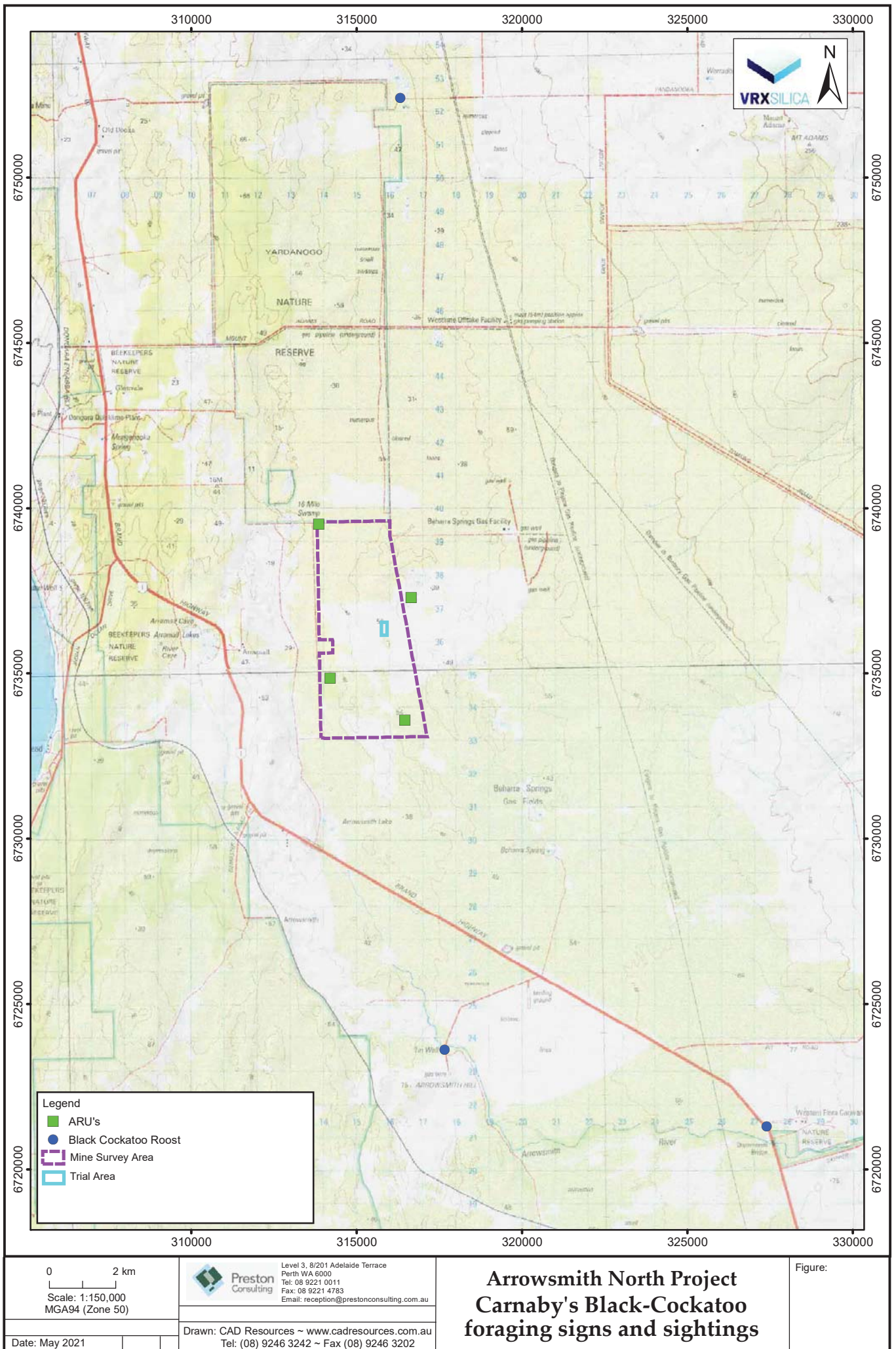


Figure 14: Carnaby's Black-Cockatoo roosts, sightings and Audio Recording Unit locations

## **4.5 SURFACE WATER DRAINAGE**

### **4.5.1 REGIONAL**

At a regional scale, surface water drains west and to the sea, notably in a dryland Arrowsmith River, and into Arrowsmith Lake. The Trial Area lies within a low, slightly undulating sandplain landscape with maximum terrain slopes in the order of 4%. The land elevations over the Survey Area vary from about 30 - 50 m RL.

The Trial Area is not subject to external concentrated flows from water courses or creeks due to it having a higher elevation than the surrounding terrain, and the high infiltration rate of the sandy landscape around the area. Similarly, runoff from the area is limited by the sandy substrate. Due to the high infiltration characteristics of the sandy soils and lack of water courses in the area, runoff, within and from the site, has low potential and is only anticipated to occur in short intense rain bursts.

### **4.5.2 LOCAL**

The closest significant surface water features are the Arrowsmith River, approximately 10 km south of the Trial Area, and Arrowsmith Lake which lies approximately 5.7 km south west of the Trial Area.

The Arrowsmith River traverses the landscape westward from the small town of Arrino for approximately 85 km then heads north for 10 km before splitting into two arms, one of which terminates at Arrowsmith Lake, the other continues in a north westerly direction. This arm is ephemeral and is likely to only flow in extreme rain events such as when Arrowsmith Lake overflows. Arrowsmith Lake is a permanent pool approximately 850 m long and 30 ha in size. Arrowsmith Lake is one of the few permanent water bodies in the wider area, but has no recreational use.

## **4.6 CURRENT LAND USE**

The dominant land use within the Lesueur Sandplain subregion is dry-land agriculture (69.34%), with lesser areas of conservation and unallocated crown land and crown reserves (Desmond & Chant, 2001).

The current land use within the Trial Area is Leases and Licences issued under the *Mining Act 1978*.



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## **5 STAKEHOLDER CONSULTATION**

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Stakeholder consultation specific to the VDT Trials has not been undertaken however, extensive consultation has been undertaken for the broader Proposal. The VDT Trials occur entirely within the Proposal Development Envelopes and the proposed activities for the VDT Trial comprise part of the Proposal therefore, VRX considers the stakeholder consultation undertaken for the Proposal is relevant for the VDT Trials. The stakeholder consultation conducted for the Proposal is summarised in the Proposal's EPA Referral Supplementary Report found at <https://www.epa.wa.gov.au/proposals/arrowsmith-north-silica-sand-project>.

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## **6 ASSESSMENT OF CLEARING AGAINST THE TEN CLEARING PRINCIPLES**

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The proposed vegetation clearing has been assessed against the ten clearing principles described within *A Guide to the Assessment of Applications to Clear Native Vegetation* (DER, 2014). The assessment is summarised in Table 8.





Table 8: Assessment of proposed vegetation clearing against the ten clearing principles.

Relevant information	Assessment of potential impacts	Proposed control measures	Outcome - Assessment of variance with clearing principle
<b>1. Native vegetation should not be cleared if it comprises a high level of biological diversity</b>			
<p>The Trial Area and surrounding environment has been subject to numerous desktop, and field flora and vegetation surveys.</p> <p>No Threatened Flora were recorded in the Trial Area.</p> <p>Two Priority Flora species (<i>Banksia elegans</i> (P4) and <i>Hypocalymma gardneri</i>(P3)) were recorded in the Trial Area. These species were also represented throughout the remainder of the Survey Areas.</p> <p>The Trial Area is comprised entirely of VSA1 fauna habitat which represents high value foraging habitat for the threatened Carnaby's Black-Cockatoo (<i>Calyptorhynchus latirostris</i>). No suitable Carnaby's Black-Cockatoo breeding or roosting habitat was recorded within the Survey Area.</p> <p>Malleefowl (<i>Leiopa ocellata</i>) was identified as potentially occurring within the Survey Area, however no sightings or evidence of its presence was observed during VRXs exploration activities, Aboriginal Heritage, fauna or flora and vegetation surveys (including foot traverses and targeted surveys).</p>	<p>No clearing of Threatened flora is expected to occur as a result of the VDT Trials.</p> <p>The proposed clearing will result in the removal and progressive rehabilitation of 0.75 ha of native vegetation, including:</p> <ul style="list-style-type: none"> <li>68 known <i>Banksia elegans</i> individuals (3.5% of the individuals recorded within the Survey Area); and</li> <li>One known <i>Hypocalymma gardneri</i> individual (0.04% of the individuals recorded in the Survey Area).</li> </ul> <p>The extent of clearing of native vegetation is limited to 0.75 ha which represents:</p> <ul style="list-style-type: none"> <li>0.04% of all native vegetation within the Survey Area</li> <li>Less than 0.01% of the VSA1 within the Survey Area; and</li> <li>0.29% of the H3 vegetation community within the Survey Area.</li> </ul>	<p>The proposed Trial Area has been located close to an existing access track to minimise the extent of clearing required for the VDT Trials.</p> <p>To minimise the impact of the VDT Trials on the environment, VRX proposes the following control measures:</p> <ul style="list-style-type: none"> <li>The extent of vegetation clearance is limited to 0.75 ha;</li> <li>The method of vegetation clearing is limited to VDT Trials only;</li> <li>Disturbed areas will be rehabilitated progressively as a result of VDT;</li> <li>The extent of vegetation clearing will be managed through internal ground disturbance procedures;</li> <li>The Trial Area will be identified using GPS coordinates and demarcated using tape and pickets;</li> <li>Mapped boundaries will be provided to the VDT operator to restrict clearing to within the Trial Area only;</li> <li>All rubbish will be managed appropriately and taken off site for disposal;</li> <li>Materials used for demarcation will be removed once the VDT Trials are complete;</li> <li>Access to the Trial Area will be via existing tracks only; and</li> <li>All vehicles, equipment and personnel will be inspected and cleaned as required to prevent the incidental spread of weeds and dieback.</li> </ul>	<p>The VDT Trial will include clearing of native vegetation known as Kwongan Heath and occurs within the Geraldton Sand Plains Bioregion which is known for its high level of biological diversity hence the proposed clearing may be at variance with this principle.</p>
<b>2. Native vegetation should not be cleared if it comprises the whole, or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA</b>			
<p>The Trial Area is comprised entirely of VSA1 which represents high value foraging habitat for the threatened Carnaby's Black-Cockatoo. No Carnaby's Black-Cockatoo breeding or roosting habitat was recorded within the Survey Area.</p> <p>Malleefowl were identified as potentially occurring within the Survey Area however, no sightings or evidence of its presence was observed during VRXs exploration activities, Aboriginal Heritage, fauna and flora and vegetation surveys (including foot traverses and targeted surveys).</p> <p>Three invertebrate species that are or may be of conservation significance with the potential to occur within the Survey Area, these species include:</p> <ul style="list-style-type: none"> <li>A Bothriembryontid Land Snail (<i>Bothriembryon perobesus</i>);</li> <li>Woollybush Bee (<i>Hylaeus globuliferus</i>); and</li> <li>Kwongan Heath Shield-Backed Trapdoor Spider (<i>Idiosoma kwongan</i>).</li> </ul> <p>No conservation significant invertebrates were recorded within the Survey Area.</p>	<p>Any fauna encountered during the VDT Trial are expected to be able to be completely avoided (refer to control measures).</p> <p>The conservation significant fauna species relevant to the VDT Trial include:</p> <ul style="list-style-type: none"> <li>Carnaby's-Black Cockatoo (<i>Calyptorhynchus latirostris</i> - listed as Endangered under the EPBC and BC Act); and</li> <li>Malleefowl (<i>Leiopa ocellata</i> - listed as vulnerable under the EPBC Act and BC Act);</li> </ul> <p>The proposed clearing will result in the removal and progressive rehabilitation of 0.75 ha of VSA1 representative of high value Carnaby's Black-Cockatoo foraging habitat (0.01% of the extent of VSA1 within the Survey Area).</p> <p>The proposed clearing will result in a very small part of a significant fauna habitat. The proposed clearing will not prevent access to an area necessary for maintaining a significant fauna habitat.</p>	<p>Implement measures described above.</p> <p>Any fauna injuries or fatalities will be reported to the VRX environment team.</p>	<p>The proposed clearing may be at variance with this principle however the area of impact is small (&lt;0.75 ha) and represents only a small percentage of the available habitat in the local area.</p>
<b>3. Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora</b>			
<p>The Trial Area and surrounding environment has been subject to numerous desktop, and field flora and vegetation surveys.</p> <p>No Threatened Flora were recorded in the Trial Area.</p> <p>Eleven Priority Flora were recorded in the Survey Area however, only two species (<i>Banksia elegans</i> (P4) and <i>Hypocalymma gardneri</i>(P3)) were recorded in the Trial Area.</p>	<p>No clearing of Threatened flora is expected to occur as a result of the VDT Trials.</p> <p>The proposed clearing will result in the removal and progressive rehabilitation of 0.75 ha of native vegetation and includes direct impacts to:</p> <ul style="list-style-type: none"> <li>68 known <i>Banksia elegans</i> individuals (3.5% of the individuals recorded within the Survey Area); and</li> <li>One known <i>Hypocalymma gardneri</i> individual (0.04% of the individuals recorded in the Survey Area).</li> </ul> <p>The extent of clearing of native vegetation is limited to 0.75 ha which represents:</p> <ul style="list-style-type: none"> <li>0.04% of all native vegetation within the Survey Area</li> <li>less than 0.01% of the VSA1 within the Survey Area; and</li> </ul>	<p>Implement control measures described above.</p>	<p>The proposed clearing does not include any Threatened Flora therefore it is not at variance with this principle. Impacts to Priority Flora a minor in a local context.</p>



Relevant information	Assessment of potential impacts	Proposed control measures	Outcome - Assessment of variance with clearing principle
	<ul style="list-style-type: none"> <li>0.29% of the H3 vegetation community within the Survey Area.</li> </ul>		
<b>4. Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a Threatened Ecological Community</b>			
No TEC's or PEC's were recorded in the Survey Area. The Trial Area is not necessary for the maintenance of a TEC or PEC.	Not Applicable	Not Applicable	The proposed clearing is not at variance with this principle.
<b>5. Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared</b>			
The vegetation within the Trial Area lies within a much broader area of native vegetation. The condition of vegetation within the Survey Area ranges from Pristine to Excellent, with the majority of the area considered Pristine according to the Keighery (1994) scale. The condition of the vegetation within the Trial Area is mapped as Pristine No other proposals are located in close proximity to the Proposal, however local vegetation has been impacted by agriculture, the resource industry and road infrastructure.	The proposed clearing will result in the removal and progressive rehabilitation of 0.75 ha of Pristine native vegetation within the Trial Area. This clearing represents only 0.05% of the vegetation mapped as Pristine within the Survey Area.	Implement the control measures listed above.	The proposed clearing is not at variance with this principle.
<b>6. Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland</b>			
The Trial Area occurs within the Arrowsmith Hydrological Zone and is not in a proclaimed surface water area. No wetlands are contained within or are in close proximity to the Trial Area.	Not Applicable	Not Applicable	The proposed clearing is not at variance with this principle
<b>7. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation</b>			
The vegetation within the Trial Area lies within a much broader area of native vegetation. The northern extent of the Survey Area was subject to bushfire in 2012 and the southern extent in 2007. Vegetation surrounding the Survey Area has been impacted by agriculture, the resource industry and road infrastructure. The condition of vegetation within the Survey Area ranges from Pristine to Excellent, with the majority of the area considered Pristine according to the Keighery (1994) scale. The condition of the vegetation within the Trial Area is mapped as Pristine.	The proposed clearing will result in the removal and progressive rehabilitation of 0.75 ha of Pristine native vegetation within the Trial Area. This clearing represents 0.05% of the vegetation mapped as Pristine within the Survey Area and does not include any activities that would lead to appreciable land degradation	Implement the control measures listed above.	The proposed clearing is not at variance with this principle.
<b>8. 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</b>			
The Trial Area does not occur within or adjacent to any conservation areas	Not Applicable	Not Applicable	The proposed clearing is not at variance with this principle.
<b>9. Native vegetation should not be cleared if the clearing is likely to cause deterioration in the quality of surface or underground water</b>			
The Trial Area occurs within the Arrowsmith Hydrological Zone and is not in a proclaimed surface water area. No wetlands lie within or are in close proximity to the Trial Area.	The proposed vegetation clearing is not expected to cause, or exacerbate, the incidence or intensity of flooding within the Trial Area or surrounding landscape.	Implement the control measures listed above.	The proposed clearing is not at variance with this principle.
<b>10. Native vegetation should not be cleared if the clearing is likely to cause, or exacerbate, the incidence or intensity of flooding</b>			
The soils of the Trial Area are characterised as having a high infiltration rate that is slightly reduced by a humus surface layer. If surface runoff is generated, it is anticipated that it will infiltrate the sandplain relatively quickly. Runoff from the site is only anticipated in short intense rain bursts (RPS, 2020).	The proposed vegetation clearing is not expected to cause, or exacerbate, the incidence or intensity of flooding within the Trial Area or surrounding landscape.	Implement the control measures listed above.	The proposed clearing is not at variance with this principle.



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## 7 SUMMARY AND CONCLUSIONS

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The purpose of this NVCP Application is to allow the clearing of up to 0.75 ha of native vegetation within the Trial Area to enable VRX to undertake VDT Trials as described in Section 3.

The following key points are noted:

- Minimal vegetation clearing is proposed with only 0.75 ha of vegetation clearing within the Trial Area;
  - Clearing is limited to mulching, removal, translocating and placement of sods as required for the VDT methodology;
  - The VDT Trial will result in the cleared areas being immediately rehabilitated;
- The area surrounding the Trial Area has been extensively surveyed for the Proposal, and the results of these surveys have been used to assess the impacts of the VDT Trial;
- The proposed clearing will not result in significant impacts to the following:
  - Significant Flora;
  - Threatened or Priority Ecological Communities;
  - Wetlands / surface water;
  - Remnant vegetation;
  - Land that has been subject to considerable degradation;
  - Groundwater; or
  - Conservation areas.

In summary, VRX has undergone extensive planning to identify control measures that will minimise the impacts of the VDT Trials on the environment. These control measures include the following:

- The extent of vegetation clearance is limited to 0.75 ha;
- The method of vegetation clearing is limited to VDT;
- Disturbed areas will be rehabilitated progressively as a result of VDT;
- The extent of vegetation clearing will be managed through internal ground disturbance procedures;
- The Trial Area will be identified using GPS coordinates and demarcated using tape and pickets;
- Mapped boundaries will be provided to dozer operator to restrict clearing to within the Trial Area only;
- All rubbish will be managed appropriately and taken off site for disposal;
- Materials used for demarcation will be removed once the VDT Trials are complete;
- Access to the Trial Area will be via existing tracks only;
- All vehicles, equipment and personnel will be inspected and cleaned as required to prevent the incidental spread of weeds and dieback; and
- Any fauna injuries or fatalities will be reported to the VRX environment team.

This NVCP application assessed the proposed vegetation clearing against the ten clearing principles described in *A Guide to the Assessment of Applications to Clear Native Vegetation* (DER, 2014). The clearing may be at variance with two of the principles and is not at variance with eight of the principles.





## 8 GLOSSARY

Term	Meaning
BC Act	Biodiversity Conservation Act 2016 (WA)
BCE	Bamford Consulting Ecologists
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DEC	Department of Environmental Conservation (now DBCA)
DMIRS	Department of Mines, Industry Regulation and Safety (WA)
DPaW	Department of Parks and Wildlife (WA)
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority (WA)
EP Act	Environmental Protection Act 1986 (WA)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
Glevan	Glevan Consulting Pty Ltd
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometres
m	Metre
Mattiske	Mattiske Consulting Pty Ltd
NVCP	Native Vegetation Clearing Permit
PEC	Priority Ecological Communities – plant communities listed as being potentially threatened under the Biodiversity Conservation Act 2016
Proposal	Arrowsmith North Silica Sand Project
SRE	Short-range Endemic
Survey Area	Mine Survey Area
TEC	Threatened Ecological Community
Trial Area	Trial Area (Figure 2)
VDT	Vegetation Direct Transfer
VDT Trial	Trial of the VDT rehabilitation methodology
VRX	VRX Silica Limited
VSA	Vegetation and Substrate Association
WA	Western Australia
WAH	Western Australian Herbarium



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## APPENDIX 1


### *Vegetation Community Descriptions (Mattiske, 2021)*

Name	Vegetation Community Description	Survey Area (ha)	% of Survey Area
H1	Open Heath to Closed Heath of <i>Hakea polyanthema</i> , <i>Calothamnus blepharospermus</i> , <i>Conospermum triplinervium</i> , <i>Petrophile macrostachya</i> and <i>Melaleuca leuropoma</i> with emergent <i>Banksia attenuata</i> over <i>Acanthocarpus preissii</i> and <i>Ecdeiocolea monostachya</i> on cream and white surface sands.	284.70	16.48
H2	Open Heath to Closed Heath of <i>Banksia hookeriana</i> , <i>Banksia attenuata</i> with occasional <i>Banksia menziesii</i> over <i>Melaleuca leuropoma</i> , <i>Eremaea beaufortoides</i> var. <i>beaufortoides</i> , <i>Scholtzia laxiflora</i> , <i>Conospermum triplinervium</i> , <i>Eremaea violacea</i> subsp. <i>violacea</i> over <i>Mesomelaena pseudostygia</i> on white sands on plains.	314.13	18.19
H3	Open Heath of <i>Melaleuca leuropoma</i> , <i>Leptospermum oligandrum</i> , <i>Hakea polyanthema</i> , <i>Conospermum triplinervium</i> , <i>Beaufortia elegans</i> and <i>Pileanthus filifolius</i> , with isolated trees of <i>Banksia attenuata</i> and <i>Xylomelum angustifolium</i> over <i>Mesomelaena pseudostygia</i> and <i>Ecdeiocolea monostachya</i> on cream/grey sand on plains.	258.15	14.95
H4	Open Heath of <i>Conospermum triplinervium</i> , <i>Banksia attenuata</i> , <i>Banksia hookeriana</i> , <i>Melaleuca leuropoma</i> , <i>Daviesia divaricata</i> subsp. <i>divaricata</i> and <i>Eremaea beaufortoides</i> var. <i>beaufortoides</i> over <i>Mesomelaena pseudostygia</i> and <i>Dampiera spicigera</i> on yellow-cream/white sand on flats.	518.10	30.00
H5	Open Heath to Closed Heath of <i>Banksia shuttleworthiana</i> , <i>Banksia attenuata</i> with occasional <i>Banksia menziesii</i> over <i>Melaleuca leuropoma</i> , <i>Eremaea beaufortoides</i> var. <i>beaufortoides</i> , <i>Conospermum triplinervium</i> , <i>Scholtzia laxiflora</i> and <i>Verticordia grandis</i> over <i>Mesomelaena pseudostygia</i> , <i>Ecdeiocolea monostachya</i> and <i>Lepidobolus preissianus</i> subsp. <i>preissianus</i> on pale yellow sandy flats.	112.44	6.51
S3	Scrub of <i>Banksia attenuata</i> , <i>Banksia leptophylla</i> var. <i>melletica</i> , <i>Hakea polyanthema</i> and <i>Melaleuca leuropoma</i> over <i>Scholtzia laxiflora</i> , <i>Petrophila macrostachya</i> , <i>Petrophile drummondii</i> , <i>Allocasuarina humilis</i> , <i>Hakea costata</i> and <i>Acacia spathulifolia</i> over <i>Scaevola repens</i> subsp. Northern Sandplains (R.J. Cranfield & P.J. Spencer 8445) and <i>Mesomelaena pseudostygia</i> on white-yellow sand on flats and slopes.	24.76	1.43
T1	Thicket to Scrub of <i>Allocasuarina campestris</i> , <i>Grevillea leucopteris</i> , <i>Guichenotia ledifolia</i> , <i>Acacia lineolata</i> , <i>Calothamnus quadrifidus</i> subsp. <i>quadrifidus</i> with occasional <i>Eucalyptus todtiana</i> and <i>Banksia attenuata</i> over <i>Dianella revoluta</i> and <i>Ecdeiocolea monostachya</i> on grey/cream/orange/red sand on flats and slopes.	119.46	6.92
W2	Low Open Woodland of <i>Banksia attenuata</i> and <i>Banksia menziesii</i> over open shrubland of <i>Melaleuca leuropoma</i> , <i>Eremaea beaufortoides</i> var. <i>beaufortoides</i> , <i>Daviesia triflora</i> , <i>Styphelia xerophylla</i> , <i>Pileanthus filifolius</i> and <i>Stirlingia latifolia</i> over <i>Alexgeorgea nitens</i> , <i>Lyginia imberbis</i> and <i>Stylidium crossocephalum</i> on cream to white sands on plains.	95.39	5.52
<b>Total</b>		<b>1,727.14</b>	<b>100</b>





## APPENDIX 2

### *Vegetation Substrate Associations (BCE, 2020)*

VSA	Description	Extent within Mine portion of Survey Area (ha)
<p><b>VSA1</b> Kwongan Heath</p>	 <p>Low, dense, proteaceous/myrtaceous shrubland on yellow and pale sands. This VSA contained several <i>Banksia</i> species that were in flower during September 2019. Occurs across majority of the project area and varies with landscape position from high to low on stabilised dunes. Vegetation types H1, H2, H3, H4, H5, H7, S3 and S6 (Matiske, 2021) Occurs across majority of the Mine Survey Area and varies with landscape position from high to low on stabilised dunes. Occurs along the eastern end of the western corridor and along much of the southern corridor.</p>	<p>1,254</p>



VSA	Description	Extent within Mine portion of Survey Area (ha)
<p><b>VSA2</b> Dense Riparian Thickets (and seasonal watercourse and swamps)</p>	 <p>Dense thickets mostly of <i>Acacia</i>, in some areas <i>Allocasuarina campestris</i>, growing on peaty-sand low in the landscape but extending onto slopes. These thickets are limited in the survey area to a small drainage line in the west, but are extensive along the southern transport corridor where this passes close to and across the Arrowsmith River. There are large wetlands lying east (outside) of the survey area that include tall woodland of eucalypts. While outside the project area, they may be relevant to some fauna using the survey area. There is also a wetland (Arrowsmith Lake) just west of the southern option of the Access and Processing corridor. This contained water at the time of the September 2019 site inspection.</p> <p>Occurs in the west of the western corridor, near damplands, and along the southern corridor where this crosses damplands and the upper reaches of the Arrowsmith River.</p> <p>Vegetation types T1, T3, T4, T5 and T6 (Mattiske, 2021).</p>	<p>377</p>
<p><b>VSA3</b> Open Woodland</p>	 <p>Open, low woodland of <i>Banksia</i> sp. with scattered <i>Eucalyptus tottiana</i> and <i>Xylomelum angustifolium</i> over shrubs on sand.</p> <p>Vegetation type W2 (Mattiske, 2021).</p> <p>Present in small patches in the mining lease but tends to merge with VSA 1.</p>	<p>95.0</p>

