FLORA & VEGETATION ASSESSMENT

ARROWSMITH CENTRAL SURVEY AREA

Prepared By

Mattiske Consulting Pty Ltd

Prepared For

VRX Silica Limited

Date

April 2021




DOCUMENT STATUS				
DOCUMENT REFERENCE: VRX2101/004/21				
VERSION	**TYPE**	**AUTHOR/S**	**REVIEWER/S**	**DATE DISTRIBUTED**
V1	Internal review	S. Ruoss	E.M. Mattiske	-
V2	Draft for client	S. Ruoss	E.M. Mattiske	18/03/2019
V3	Revised report including updated survey area	J. Rogers /L. Taaffe/ S. Ruoss	E.M. Mattiske	31/01/2020
V4	Revised report	S. Ruoss	E.M. Mattiske	15/04/2021

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LIST OF ABBREVIATIONS

BAM Act:	*Biosecurity and Agriculture Management Act 2007* (WA)
BC Act:	*Biodiversity Conservation Act 2016* (WA)
BOM:	Bureau of Meteorology
DAWE:	Department of Agriculture, Water and Environment
DBCA:	Department of Biodiversity, Conservation and Attractions
DPIRD:	Department of Primary Industries and Regional Development
EP Act:	*Environmental Protection Act 1986* (WA)
EPA:	Environmental Protection Authority
EPBC Act:	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
IBRA:	Interim Biogeographical Regionalisation for Australia
Mattiske Consulting:	Mattiske Consulting Pty Ltd
NVIS:	National Vegetation Information System
PEC:	Priority Ecological Community
PRIMER:	Plymouth Routines in Multivariate Ecological Research
SIMPER:	Similarity percentages
SIMPROF:	Similarity profile
TEC:	Threatened Ecological Community
WAH:	Western Australian Herbarium (PERTH)
WAOL:	Western Australian Organism List

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd (Mattiske Consulting) was commissioned in October 2017 by Preston Consulting Pty Ltd on behalf of VRX Silica Ltd to undertake a flora and vegetation survey of the Arrowsmith Central Project survey area, this survey occurred during the months of October and November 2018. In August 2019 Mattiske Consulting was further commissioned by VRX Silica Ltd to undertake a flora and vegetation survey of the Arrowsmith Project survey area. The 2019 survey occurred during the months of October and November and included an extension to the Central survey areas within the Arrowsmith Project survey area. The Arrowsmith Central survey area occupies an area of approximately 1570 ha, and is located between the towns of Eneabba and Dongara, Western Australia. A total of 41 survey sites were established in the Arrowsmith Central survey area in 2018, and a further 77 survey sites were established in 2019. These 118 survey sites were selected to sample all vegetation types, with replication, within the survey area.

Rainfall in the three months preceding the October/November 2018 survey was above the long term average rainfall for the area, while in October/November 2019, rainfall in the 3 months preceding the survey was below average. Based on a range of factors including the proportion of potential flora recorded (estimated at 83.00 %), the proportion of annual taxa recorded (12.77 %), and vegetation quadrat distribution within the survey area, it can be concluded that the survey has not been constrained by factors which would adversely affect the survey outcomes and therefore not the conclusions derived from the data used to support vegetation analysis.

A total of 274 vascular plant taxa, representative of 126 genera and 50 families, were recorded within survey quadrats within the Arrowsmith Central survey area. The majority of taxa recorded were representative of the Myrtaceae (38 taxa), Proteaceae (35 taxa) and Fabaceae (24 taxa) families. Thirty-five annual plant species were recorded during the survey of the Arrowsmith Central survey area, representing 12.77 % of all taxa recorded, five of these represent introduced annual species. The majority of the taxa recorded were widespread both locally and more broadly within the associated biogeographical subregion.

No threatened flora pursuant to Part 2, Division 1, and Subdivision 2 of the *Biodiversity Conservation Act 2016* were recorded in the survey area. Seven priority flora species, as listed by the Western Australian Herbarium, were recorded in the survey area. These were *Grevillea leptopoda* P3 (1 record, 10 plants), *Hemiandra* sp. Eneabba (H. Demarz 3687) P3 (141 records, 190 plants), *Hopkinsia anoectocolea* P3 (2 records, 2 plants), *Hypocalymma gardneri* P3 (4 records, 17 plants), *Persoonia rudis* P3 (30 records, 34 plants), *Banksia elegans* P4 (5 records, 22 plants) and *Calytrix chrysantha* P4 (200 records, 19054).

A total of seven vegetation communities were recorded within the Arrowsmith Central survey area. None of these communities contained areas representative of Threatened Ecological Communities or Priority Ecological Communities. The vegetation communities present occurred primarily on grey to white sand plains. The survey area had very little topographic variation; however, small areas of lower lying depressions occurred in the southern corridor and within a small portion of land in the central west of the survey area, containing a winter wet depression associated with brown clay loam soils. The grey to white sand plains were most commonly associated with open woodland to isolated trees of *Eucalyptus todtiana* and *Xylomelum angustifolium* or *Banksia attenuata*, over a mixed mid storey often dominated by *Melaleuca leuropoma*, *Leptospermum oligandrum* and *Hakea polyanthema* over *Mesomelaena pseudostygia* and *Ecdeiocolea monostachya,* or occasionally dominated by *Banksia leptophylla* var. *melletica* and *Acacia blakelyi* over a mixed understory of Proteaceae and Myrtaceae species. The lower depressions were most commonly associated with thicket to scrub of *Allocasuarina campestris*, *Melaleuca concreta*, *Guichenotia macrantha* and *Calothamnus quadrifidus* subsp. *angustifolius*, over sparse *Leptosema aphyllum*.

Most of the vegetation communities are well represented at a local and regional scale, with the exception of one community type, S5, representing an open shrubland of *Calytrix chrysantha* (Priority 4), *Banksia leptophylla* var. *melletica* and *Eremaea beaufortioides* var. *beaufortioides*, over *Jacksonia hakeoides* and

Banksia nivea on white/grey sand plains. This community typically contains high numbers of the priority 4 species *Calytrix chrysantha*, with one quadrat containing up to 100 individuals.
The vegetation condition of the Arrowsmith Central survey area ranged from Pristine to Very Good. The majority of the Arrowsmith Central survey area was considered to be in Pristine condition due to the absence of disturbance, tracks and weeds. Small sections on the southern, eastern and western boundaries of the survey area were ranked as being in Excellent condition due to the presence of some non-aggressive weed species. A small portion on the boundary of the eastern corridor, adjacent to the Brand Highway, was ranked as Very Good due to the increased presence of weeds, evidence of grazing and litter.

Overall, the vegetation communities mapped and species recorded in the Arrowsmith Project survey area were consistent with the historical mapping of Beard (1976, 1990). The majority of the survey area is situated on sand plains supporting open woodland to isolated trees of *Eucalyptus todtiana* and *Xylomelum angustifolium* over mixed heath often consisting of *Melaleuca leuropoma* and *Hakea polyanthema*, over mixed understory of Proteaceae, Restionaceae and Myrtaceae species. Most of the vegetation communities are well represented at a local and regional scale, with the exception of one community type, S5, which contains high numbers of the priority species *Calytrix chrysantha* (P4). However, this community does not represent a TEC or PEC.

1. INTRODUCTION

Mattiske Consulting was commissioned in October 2017 by Preston Consulting Pty Ltd on behalf of VRX Silica Ltd to undertake a flora and vegetation survey of the Arrowsmith Project survey area, this survey occurred during the months of October and November 2018. In August 2019 Mattiske Consulting was again commissioned by Preston Consulting Pty Ltd on behalf of VRX Silica Ltd to undertake a flora and vegetation survey of the Arrowsmith Project survey area. The 2019 survey occurred during the months of October and November and included an extension to the Central survey area within the Arrowsmith Project survey area. VRX Silica Ltd are currently exploring their Arrowsmith Project tenements for construction sand and high quality silica sand.

1.1. Location and Scope of Project

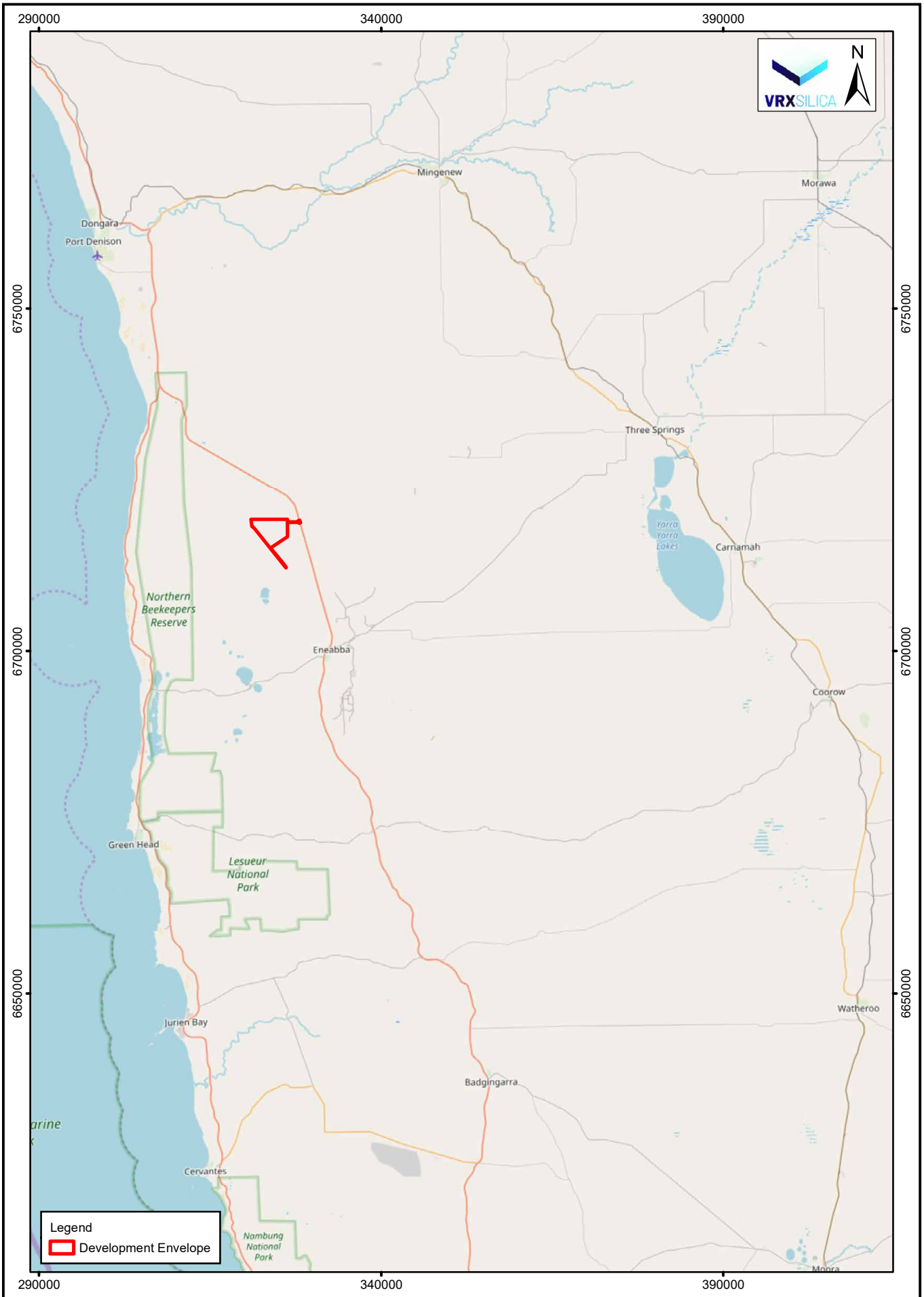
The Arrowsmith Central survey area lies within the Irwin Botanical District of the South-West Botanical Province (Beard 1990), between the towns of Eneabba and Dongara, Western Australia (Figure 1). The Arrowsmith Central survey area assessed in spring 2018 and 2019 consists of one polygon located in tenement E70/4987 (Table 1, Figure 2). This report outlines the methodology and results from a detailed flora and vegetation survey carried out in native vegetation in the Arrowsmith Central survey area.

Table 1: Location of Arrowsmith Central survey area

WAYPOINT	GDA94_50J	
	Easting mE	Northing mN
1	321000	6719200
2	326299	6719200
3	326300	6718862
4	327974	6718859
5	327932	6719005
6	328124	6719060
7	328234	6718678
8	328040	6718626
9	327998	6718773

Table 1: Location of Arrowsmith Central survey area (continued)

WAYPOINT	GDA94_50J	
	Easting mE	Northing mN
10	326303	6718772
11	326300	6716703
12	323868	6715055
13	326166	6712193
14	326066	6712191
15	321148	6718178



Imagery: OpenStreepMap

0 14 km

Scale: 1:750,000
MGA94 (Zone 50)

CAD Ref: a2602_f23_01

Date: April 2021 | Rev: A | A4

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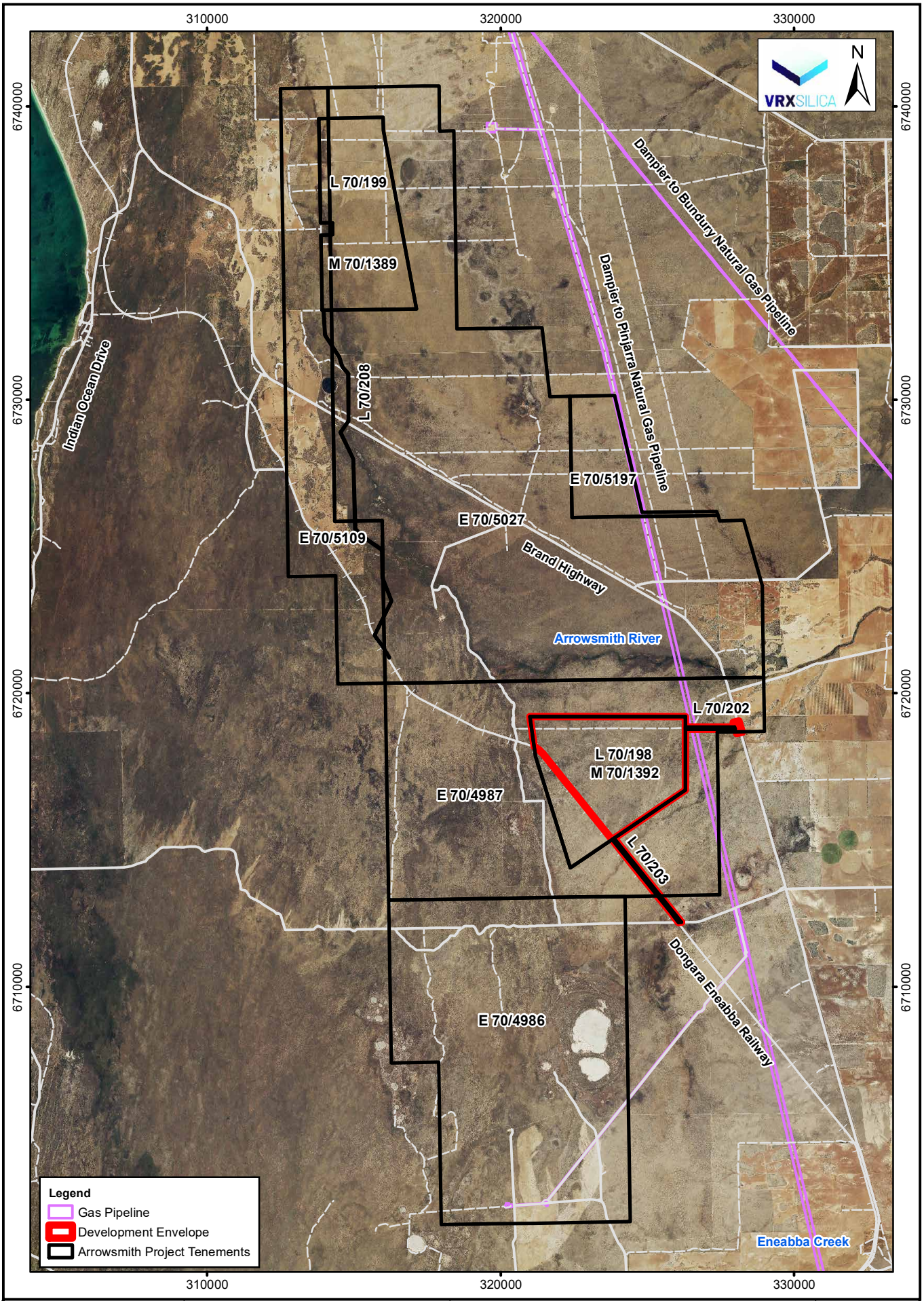
Arrowsmith Central Project

Locality

Figure: 1



Source: Aerial Photography: Landgate (Nov 2016), Tenements: DMIRS (24/06/2019)

0 4 km

Scale: 1:175,000
MGA94 (Zone 50)

CAD Ref: a2602_f23_02

Date: April 2021 | Rev: A | A4

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Arrowsmith Central Project Tenements

Figure: **2**

1.2. Environmental Legislation and Guidelines

The following key Commonwealth (federal) legislation relevant to this survey is the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The following key Western Australian (state) legislation relevant to this survey include the:

- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act);
- *Environmental Protection Act 1986* (EP Act); and

Furthermore, key Western Australian guidelines relevant to this survey are the:

- *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority [EPA] 2016a); and
- *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b).

Definitions of flora and vegetation terminology commonly used throughout this report are provided in Appendix A1-6.

2. OBJECTIVES

The objective of this survey was to undertake a flora and vegetation assessment of the Arrowsmith Central survey area including:

- Undertake a desktop study of the flora and vegetation of the Arrowsmith Central survey area, with an emphasis on threatened and priority flora, and threatened and priority ecological communities (TECs and PECs);
- Review the historical literature of the Arrowsmith Central survey area;
- Undertake a detailed survey of the Arrowsmith Central survey area, and collect and identify the vascular plant species present;
- Review the conservation status of the vascular plant species recorded by reference to current literature and listings by the Department of Biodiversity, Conservation and Attractions (DBCA) and plant collections held at the Western Australian State Herbarium (WAH), and listed by the Department of Agriculture, Water and the Environment (DAWE) under the EPBC Act;
- Define and map the vegetation communities in the Arrowsmith Central survey area;
- Define and map the location of any threatened and priority flora located within the Arrowsmith Central survey area;
- Define any management issues related to flora and vegetation values;
- Provide recommendations on the local and regional significance of the vegetation communities; and
- Prepare a report summarising the findings.

3. METHODS

3.1. Desktop Assessment

A desktop assessment was conducted using FloraBase (WAH 1998-), NatureMap (Department of Parks and Wildlife 2007-) and the EPBC Act *Protected Matters Search Tool* (DAWE 2013) databases, to identify the possible occurrence of threatened and priority flora and threatened and priority ecological communities within the Arrowsmith Project survey area.

The NatureMap search was conducted for the Central Arrowsmith lease area (E70/4987). Search parameters were 'by rectangle' and encompassed the Tenement using the following parameters:

Arrowsmith Central: 115° 5' 15" E, 115° 14' 20" E, - 29° 42' 37" S, - 29° 37' 29" S

The aforementioned coordinates were also used in the EPBC Act Protected Matters Search Tool (DAWE 2013).

In addition, historical documentation and vegetation mapping of the region, principally that of Beard (1976, 1990) and Desmond and Chant (2001), that provide extensive resource material for the floristics and vegetation of the Arrowsmith Central survey area, was reviewed.

3.2. Field Survey

A detailed field assessment of the flora and vegetation of the Arrowsmith Central survey area within tenement E70/4987 was undertaken by experienced botanists from Mattiske Consulting, from 29th October to 2nd November 2018 (4 botanists), 5th November to 9th November 2018 (2 botanists), 21st October to 25th October 2019 (4 botanists) and 11th November to 14th November 2019 (3 botanists), in accordance with methods outlined in *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b). All botanists held valid collection licences to collect flora for scientific purposes, issued under the BC Act.

The geographic co-ordinates defining the Arrowsmith Central survey area were supplied by VRX Silica Ltd. Aerial photographic maps of the proposed Arrowsmith survey area were prepared and supplied by CAD Resources. Survey sites for the Arrowsmith survey area were selected using aerial photographic maps and field observations. A total of 41 survey sites were established in the Arrowsmith Central survey area in 2018, and a further 77 survey sites were established in 2019. These 118 survey sites were selected to sample all vegetation types, with replication, within the survey area.

Survey sites consisted of pegged 10 x 10 metre quadrats. Flora and vegetation were described and sampled systematically at each survey site, and additional opportunistic collections were undertaken wherever previously unrecorded plants were observed. At each quadrat the following floristic and environmental parameters were recorded:

- GPS location (GDA94 datum, zone 50J);
- Local site topography;
- Soil type and colour;
- Outcropping rocks and their type;
- Percentage litter cover and percentage bare ground;
- Approximate time since fire;
- Vegetation condition (based on Keighery 1994); and

- For each vascular plant species, the average height and the percentage cover (of both alive and dead material) over the survey site.

The methodology for assessing threatened and priority flora consisted of extensive foot traverses within the Arrowsmith Central survey area. Botanists used handheld Garmin GPS units loaded with the survey polygons. Botanists walked in a zig-zag fashion between survey sites recording conservation significant species. If suspected or known conservation significant flora species were encountered, a specimen was collected and plant numbers were recorded for the population.

All plant specimens collected during the field surveys were dried and processed in accordance with the requirements of the WAH. The plant species were identified based on taxonomic literature and through comparison with pressed specimens housed at the WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

3.3. Survey Timing

According to Table 3 in the *Technical guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b), the primary survey timing for the Irwin Botanical Province is spring (September-November). As the current survey was conducted in October and November, it falls within this period. The survey was timed, where possible, to align with peak flowering periods of conservation significant flora with the potential to occur in the Arrowsmith Project survey area. Rainfall in the three months preceding the 2018 survey (July to September) was slightly above average, while rainfall preceding the 2019 survey (July to September) was well below average (Figure 3).

3.4. Analysis of Site Data

A species accumulation curve, based on accumulated species versus sites surveyed was prepared to provide an indication of the level of adequacy of the survey effort (*EstimateS* – Colwell 2013). As the number of survey sites increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The asymptotic value was determined using Michaelis-Menten modelling and provided an incidence based coverage estimator of species richness (Chao 2004). When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered to be adequate.

Plymouth Routines in Multivariate Ecological Research v7 (PRIMER) statistical analysis software was used to analyse species-by-site data and discriminate survey sites on the basis of their species composition (Clarke and Gorley 2015). To down-weight the relative contributions of quantitatively dominant species, a fourth root transformation was applied to the data set. Introduced species, annual species, species not identified to a species level and singletons (species recorded at a single quadrat and not forming a dominant structural component i.e. =>5 % cover) were excluded from the data set prior to analysis. Taxa which were identified to more than one subspecies or variety level were revised to the specific level to reduce the tendency to create further statistical variation in the analysis that was considered unwarranted. Computation of similarity matrices was based on the Bray-Curtis similarity measure. Hierarchical Clustering was used in conjunction with Similarity Profile, (SIMPROF), Similarity Percentages (SIMPER), quadrat descriptions, quadrat photos and aerial photographs; combining these methods increased the understanding of quadrat inter-relations and thus the ability to accurately delineate those quadrats based on species composition.

3.5. Vegetation Descriptions

Vegetation descriptions were based on Alpin's (1979) modification of the vegetation classification system of Specht (1970), to align with the National Vegetation Information System (NVIS) (see Appendix A5). Vegetation communities were described at the association level of the NVIS classification framework, as

defined by the Executive Steering Committee for Australian Vegetation Information (2003). Vegetation condition of each of the mapping sites was assessed as per the criteria developed by Keighery (1994) (see Appendix A6).

3.6. Survey Limitations

A general assessment was made of the current survey against a range of factors that may have limited the outcomes and conclusions of this report (Table 2). Based on this assessment, the present survey has not been subject to constraints which would affect the thoroughness of the survey, and the conclusions which have been formed.

Table 2: Potential limitations affecting the conclusions made in this report

POTENTIAL SURVEY LIMITATION	IMPACT ON CURRENT SURVEY
Availability of contextual information at a regional and local scale	**Not a limitation:** Reference resources such as Beard's mapping, together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint.** Adequate resources were made available by VRX silica to complete the survey.
Competency/experience of team carrying out survey; experience in the bioregion surveyed	**Not a limitation:** All botanists had extensive experience working in a range of botanical districts across the state. Majority of the plants observed in the field were collected for formal identification and were compared with specimens at the Western Australian State Herbarium where required. Any unknown or potential threatened or priority flora species were collected and identified, utilising resources available at the Western Australian Herbarium and consultation with expert taxonomists.
Proportion of flora collected and identification issues	**Potential limitation:** While many plants were in flower during the survey, a proportion of plants encountered during the survey were sterile and may impact the chance of identification of some specimens to species level. Orchid species may not emerge each year if conditions are not favourable. Although this may affect the completeness of the species list, it is not expected to have a significant effect on mapping reliability, nor on the identification of threatened and priority species in the area as the majority were perennial species.
Effort and extent of survey	**Potential limitation:** The survey area was thoroughly covered. Survey quadrats were initially selected from high resolution aerial maps, with additional quadrats selected in situ based on in field observations. Replication of some vegetation communities was unavoidable given their low occurrences within the survey area. The threatened and priority flora search undertaken by botanists by means of a comprehensive foot-traverse to between survey quadrate sites to ensure thorough coverage of the survey area. Flora that was unknown or resembled threatened or priority flora were collected, the location and habitat noted, and the number of plants estimated.
Mapping reliability	**Not a constraint.** Handheld GPS units were used for the survey, which for a majority of field conditions have an accuracy level of ± 5 m.
Access restrictions within survey area	**Not a limitation:** Vehicle access to the Arrowsmith Central survey area and foot traverses were sufficient to allow access to the entirety of the survey area.

Table 2: Potential limitations affecting the conclusions made in this report (continued)

POTENTIAL SURVEY LIMITATION	IMPACT ON CURRENT SURVEY
Survey timing, rainfall, season of survey	**Not a limitation:** The EPA (2016a) recommends that flora and vegetation surveys in the South – West Botanical Province be conducted in Spring (September-November). The current survey was conducted in October and November which falls within this period. Rainfall in the three months preceding the 2018 survey was slightly above average, while below average rainfall was received prior to the 2019 survey (Figure 3).
Disturbances (fire/flood/clearing)	**Not a limitation:** The Arrowsmith Central survey area exhibits minimal levels of disturbance, mainly from past fire events.
Data and statistical analysis	**Not a limitation:** Introduced species, annual species and singletons were excluded from the data set prior to analysis. Data collected was sufficient for delineation of vegetation communities based on statistical analysis.

4. DESKTOP ASSESSMENT RESULTS

4.1. Climate

The Irwin Botanical District has a typically dry, warm Mediterranean climate, with winter precipitation of 300-500 mm and 7-8 dry months per year (Beard 1990). Rainfall and temperature data for Eneabba is no longer available due to the closing of the Eneabba weather station, therefore rainfall data from Green Grove and long term temperature data from Carnamah (Bureau of Meteorology [BOM] 2021) are illustrated in Figure 3. Above average rainfall was received in the 3 months prior to the 2018 survey (July to September 2018; 200.5 mm cf. 212.6 mm) although September 2018 rainfall was 27 mm below average (Figure 3). In 2019, rainfall in the 3 months preceding the survey was well below average (July to September 2019; 200.5 mm cf. 88.6 mm)

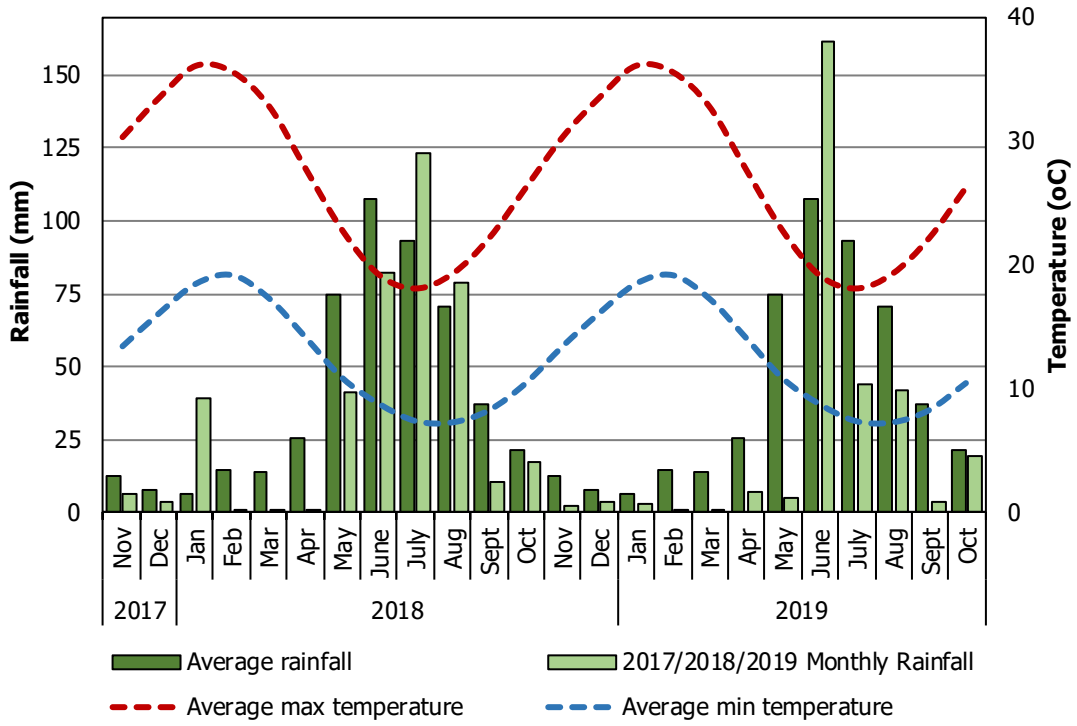


Figure 3: Rainfall and temperature data for Green Grove and Carnamah

Note: Long-term average monthly rainfall (1951-2019) and monthly rainfall data from Green Grove. Long-term average temperature data (1940-2019) from Carnamah (BOM 2021).

4.2. Managed Lands

There are a number of Nature Reserves in the area surrounding the Arrowsmith Central survey area, presented in Figure 4. The Beekeepers Nature Reserve (R 24496) is located to the west of the Arrowsmith Central survey area. The Yardanogo Nature Reserve (R 36203) and Nature Reserve R47436 are located north of the Arrowsmith Central survey area. The Lake Logue Nature Reserve (R 29073) and Nature Reserve R 39744 are located to the south of the Arrowsmith Central survey area. Nature Reserve R 25495 is located to the north-east of the Arrowsmith Central survey area (Figure 4).

4.3. Geology, Soils and Topography

The underlying geology of the area is predominantly Permian to Cretaceous sedimentary basins, with horsts of Proterozoic rocks (Beard 1990, Desmond and Chant 2001). The 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).

The Department of Primary Industries and Regional Development's (DPIRD) Land Systems present within the Arrowsmith Central survey area (Figure 5, Table 3) includes:

1. **Correy System (221Cy):** Broad sandy alluvial fan of the lower Arrowsmith River. Pale deep sands predominate, with grey shallow sandy duplexes, moderately deep sandy gravels and yellow deep sands less common. *Banksia* woodlands and heathlands.

2. **Eneabba Plain System (221En):** Level to gently undulating sandplain to the north-west and south-west of Eneabba. Pale deep sands, grey shallow to deep sandy duplexes, moderately deep sandy gravels and yellow deep sands common. *Banksia* woodlands and heathlands.

Table 3: Extent of Land Systems intersecting Arrowsmith Central survey area

LAND SYSTEM	MAPPING UNIT	TOTAL STATEWIDE EXTENT (ha)	AREA OF INTERSECTION WITH THE SURVEY AREA (ha)	PROPORTION OF CURRENT EXTENT (%)
Correy System	221Cy	28,142.42	1565.08	1.81
Eneabba Plain System	221En	3,8871.91	4.61	0.01

The Arrowsmith Project survey area in tenement E70/4987 consists mainly of the Correy System and a small segment of the Eneabba Plain System (221Cy, Figure 5). The proportion of the Correy System within the state-wide extent is 1.81 % and the proportion of the Eneabba Plain System is 0.01% (Table 3).

4.4. Regional Vegetation

Beard (1990) described the vegetation of the Irwin Botanical District as coastal scrub heath on sandplains, with *Acacia* and *Allocasuarina* thickets further inland, and hard-setting loams with *Acacia* scrub and scattered *Eucalyptus loxophleba*.

The Pre-European vegetation systems present within the Arrowsmith Central survey area (Figure 6, Table 4) include:

1. **Eridoon System:** 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 consists of scattered small trees with an open layer of tall shrubs over a closed layer of small heath-like shrubs, which experiences frequent fires.

    a. **Vegetation Association 378**: Shrublands; scrub-heath with scattered *Banksia* spp., *Eucalyptus todtiana* and *Xylomelum angustifolium* on deep sandy flats in the Geraldton Sandplain Region – Beard (1976) code x_5SZc

Table 4: Extent of pre-European vegetation associations intersecting the Arrowsmith Central survey area

VEGETATION ASSOCIATION	STATE-WIDE PRE-EUROPEAN EXTENT (ha)	STATE-WIDE CURRENT EXTENT (ha)	SURVEY AREA	
			AREA OF INTERSECTION (ha)	PROPORTION OF CURRENT EXTENT (%)
Vegetation Association 378 (Eridoon)	93,523.98	60,826.66	1569.70	2.58

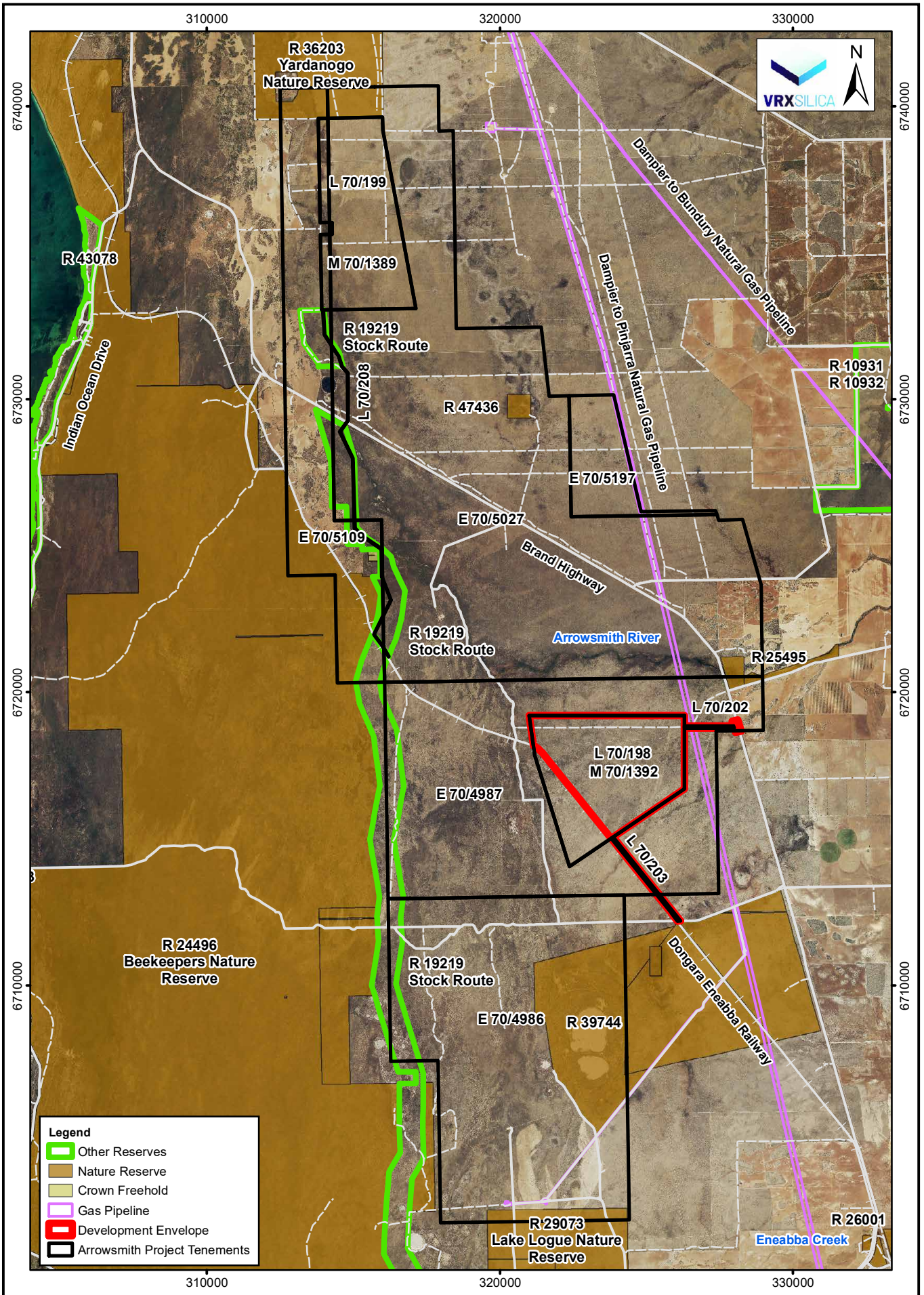
More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey falling within the Lesueur Sandplain subregion of the Geraldton Sandplain Region (Department of Agriculture, Water and the Environment [DAWE] 2021a). The Geraldton Sandplain 3 (GS3 – Lesueur Sandplain subregion) is described as having high floristic diversity and levels of endemism, with vegetation composed mainly of proteaceous scrub-heaths (Desmond and Chant 2001). Extensive York Gum (*Eucalyptus loxophleba*) and Jam (*Acacia acuminata*) woodlands occur on outwash plains associated with drainage (Desmond and Chant 2001).

4.5. Potential Flora

A total of 230 vascular plant taxa, representative of 104 genera and 46 families, have the potential to occur within the Arrowsmith Central survey area (based on NatureMap search results, included in Appendix B). The most commonly represented families were Myrtaceae (39 taxa), Proteaceae (38 taxa) and Fabaceae (21 taxa). The most commonly represented genera were *Stylidium* (12 taxa), *Banksia* (10 taxa), *Eucalyptus* (nine taxa) and *Hakea* (nine taxa).

4.6 Potential Threatened and Priority Flora

Thirteen threatened flora species, pursuant to Part 2, Division 1, and Subdivision 2 of the BC Act and as listed by the DBCA (2018a) have the possibility of occurring in the Arrowsmith Central survey area. All of these species, are pursuant to section 179 of the EPBC Act or listed by the DAWE (2021b) (Appendices B and C, Figure 7). A total of 18 priority flora species, including two priority one, two priority two, 10 priority three and four priority four flora species as listed by WAH (1998-) have the potential to occur within the Arrowsmith Central survey area (Appendices B and C, Figure 7).



Source: Aerial Photography: Landgate (Nov 2016), Tenements: DMIRS (24/06/2019), Gas Pipelines: DMIRS, Topography: Landgate (Nov 2016), Reserves: landgate (Nov 2016), Managed Lands: DBCA (09/07/2019)

0 4 km

Scale: 1:175,000
MGA94 (Zone 50)

CAD Ref: a2602_f23_03

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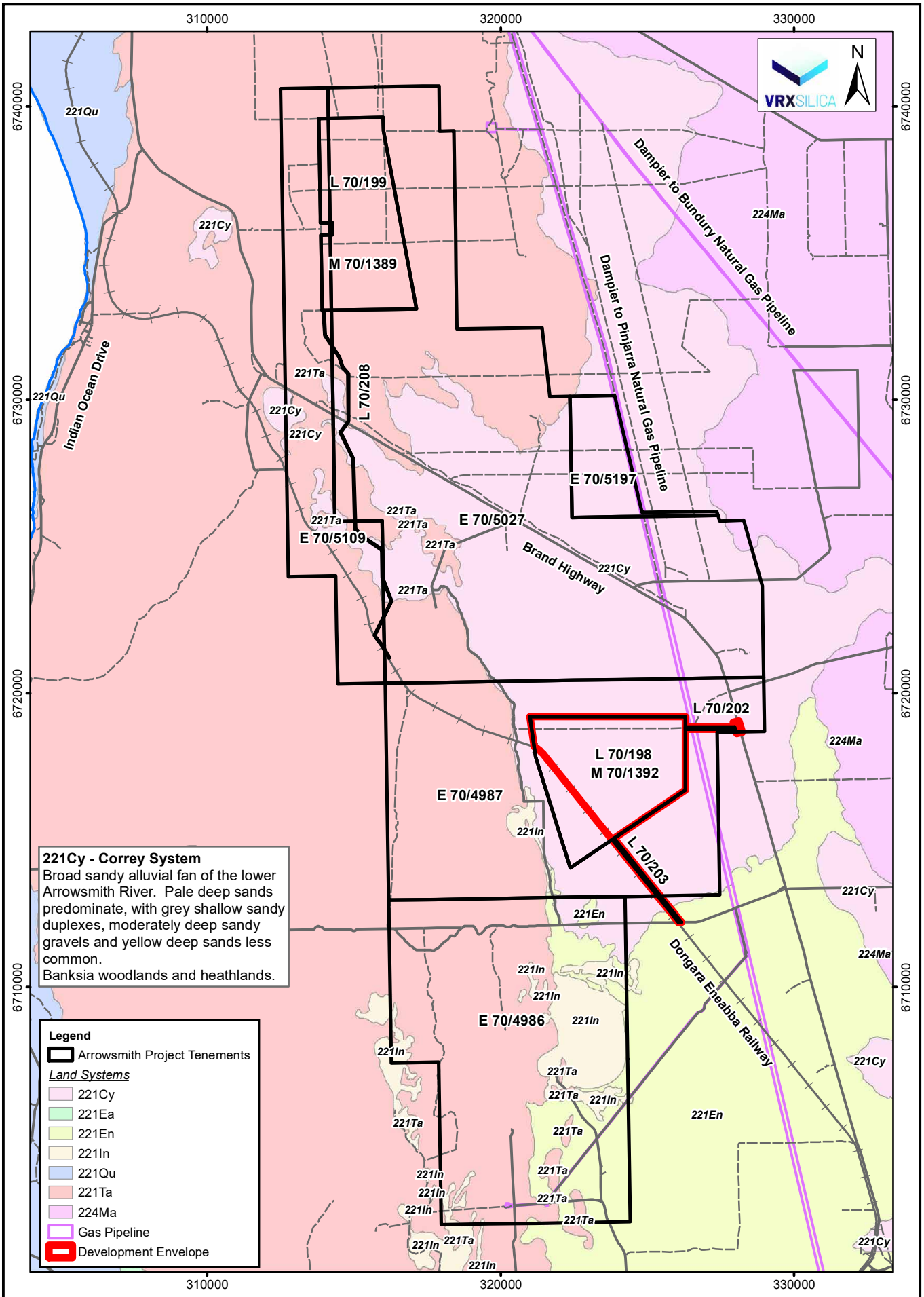
Arrowsmith Central Project
Managed Lands

Figure: **4**



Source: Aerial Photography: Landgate (Nov 2016), Tenements: DMIRS (24/06/2019), Gas Pipelines: DMIRS, Topography: Landgate (Nov 2016), Land Systems: DPIRD (05/11/2019)

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Scale: 1:175,000
MGA94 (Zone 50)

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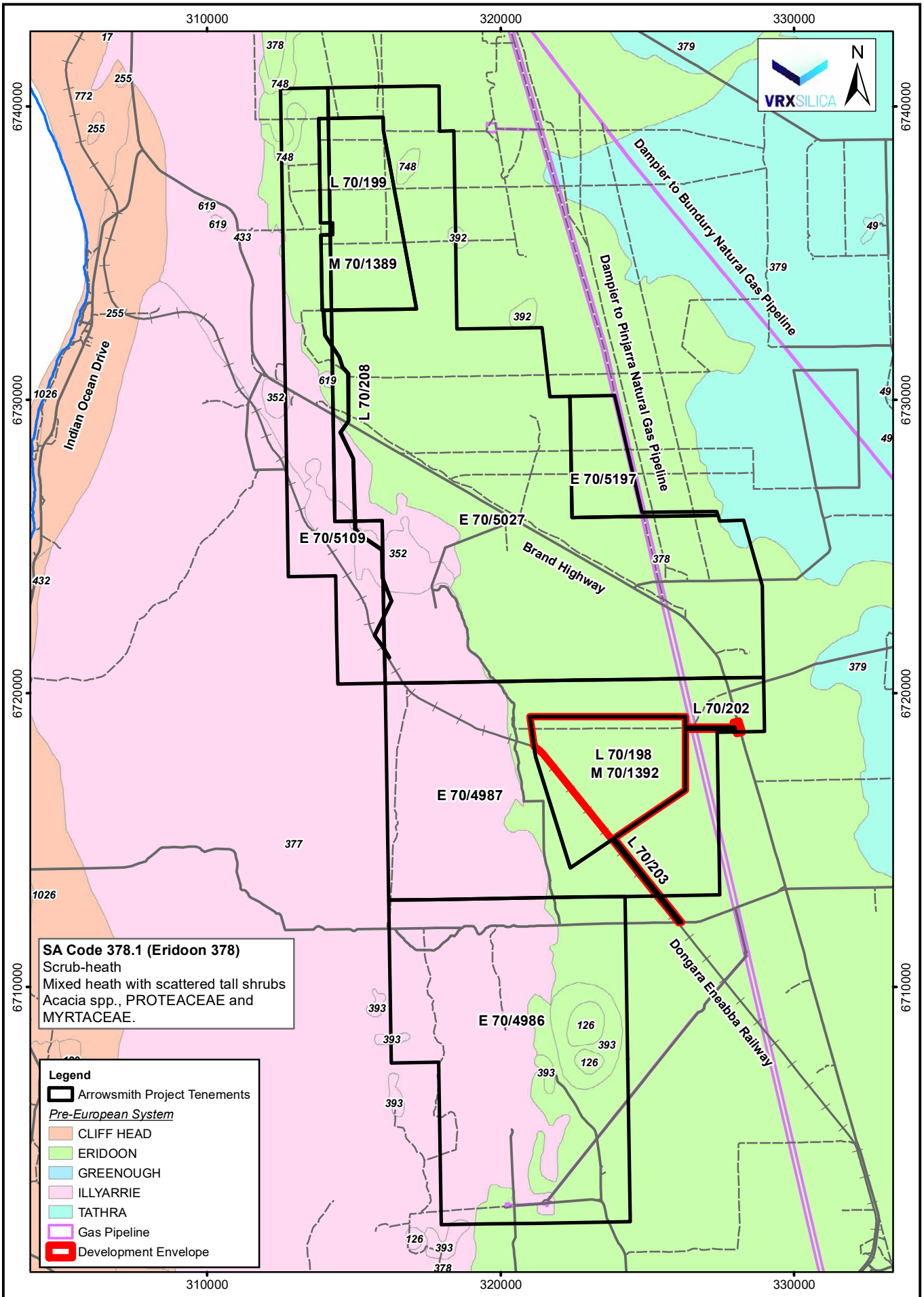
Arrowsmith Central Project
Land Systems

Figure: **5**



Source: Aerial Photography: Landgate (Nov 2016), Tenements: DMIRS (24/06/2019), Gas Pipelines: DMIRS, Topography: Landgate (Nov 2016), PEV: DPIRD (24/07/2019)

0 4 km
Scale: 1:175,000
MGA94 (Zone 50)

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Arrowsmith Central Project
Pre-European Vegetation

Figure: **6**

An assessment of the likelihood of recording any of the listed threatened and priority taxa within Arrowsmith Project tenements, based on factors including known soil type, topography and distribution, is set out in Appendix C. Based on this assessment, no threatened flora species had a high likelihood of occurring in the Arrowsmith Central survey area. Five threatened flora species had a moderate likelihood and eight had a low likelihood of occurring in the Arrowsmith Central survey area.

Six priority flora species had a low likelihood of occurring in the Arrowsmith Central survey area and nine had a moderate likelihood. Three priority species, *Poranthera asybosca* (P1), *Banksia elegans* (P4) and *Calytrix chrysantha* (P4) had a high likelihood of occurrence, mainly based on previous records in the area and suitable habitat.

4.7 Potential Introduced (Weed) Species and Declared Pest (Plant) Organisms

Seven introduced species have the potential to occur within the Arrowsmith tenements (based on NatureMap search results, included in Appendix B). Two of these species, **Asparagus asparagoides* and **Tamarix aphylla*, are declared pest organisms pursuant to section 22 of the BAM Act.

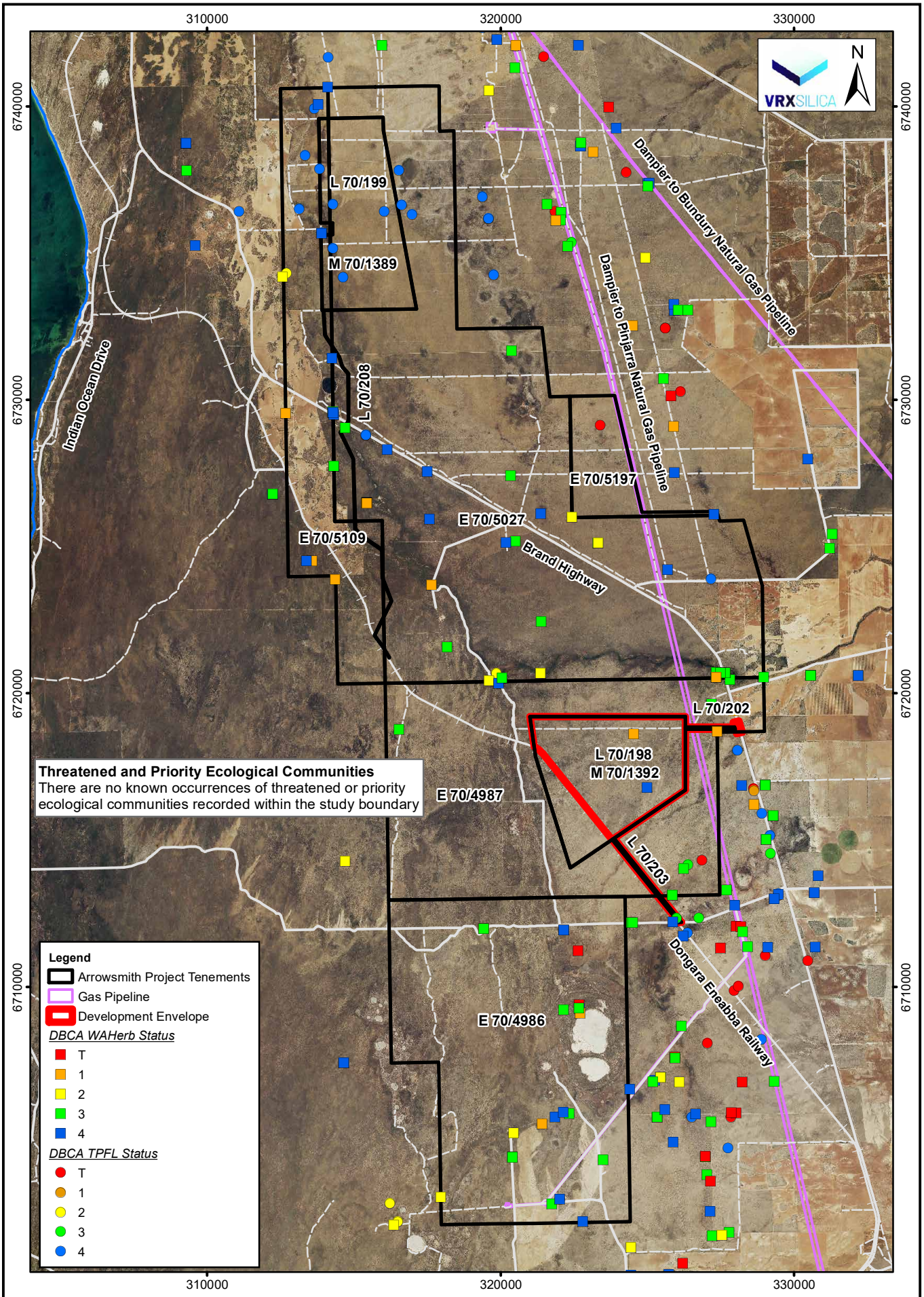
**Asparagus asparagoides* and **Tamarix aphylla* both have a declared pest organism keeping category of Exempt for the whole of Western Australia (DPIRD 2021). A declared pest category of Exempt requires no permits or conditions for keeping, although there may be other requirements under the *Biosecurity and Agriculture Management Act 2007*. Organisms in this category may also be regulated by legislation such as the *BC Act* administered by DBCA (DPIRD 2021).

4.8 Potential Threatened and Priority Ecological Communities

There are no threatened ecological communities (TECs) listed at Commonwealth level pursuant to sections 181 and 182 of the *EPBC Act* and listed by the DAWE (2021d) or at State level pursuant to Part 2 of the BC Act and as listed by DBCA (2018b) and no priority ecological communities (PECs) as listed at State level by DBCA (2021) that potentially occur within the Arrowsmith Central survey area.

4.9 Kwongan Region Vegetation

Kwongan vegetation occurs on the sandplains of south-western Australia and includes Proteaceae and Myrtaceae dominated scrub-heath and heath, *Banksia* woodlands, health-like scrub in temporary wet depressions and low scrub on coastal slopes (Mucina et al. 2014). The Arrowsmith Central survey area occurs within the Kwongan Region (Figures 8.1 & 8.2) which is recognized as supporting a diverse flora in these heath areas.



Source: Aerial Photography: Landgate (Nov 2016), Tenements: DMIRS (24/06/2019), Gas Pipelines: DMIRS, Topography: Landgate (Nov 2016), Flora: DBCA (10-0208, 16-0118FL, 08-0218EC)

0 4 km
Scale: 1:175,000
MGA94 (Zone 50)

CAD Ref: a2602_f23_06
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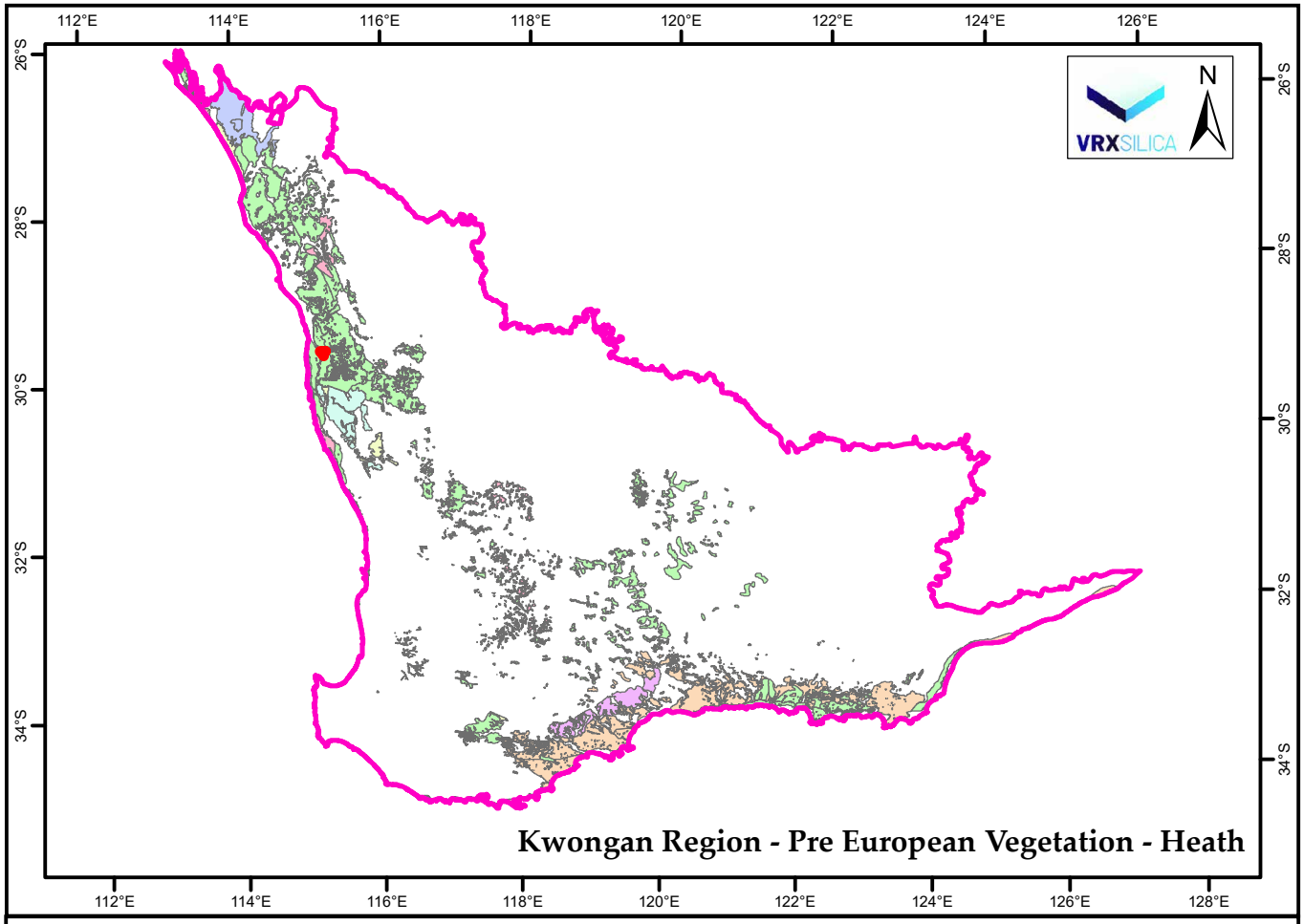
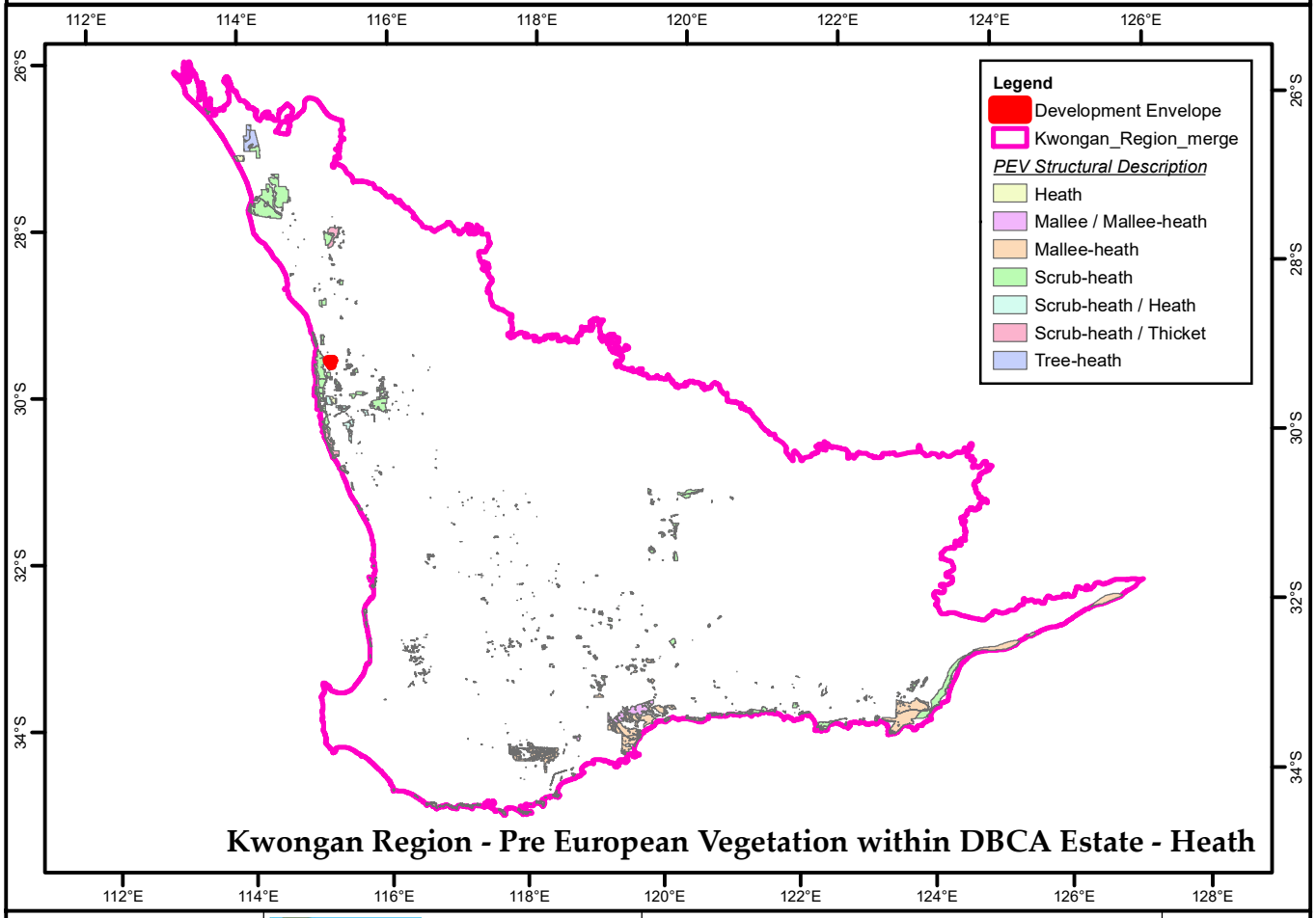
Arrowsmith Central Project
Threatened & Priority Species

Figure: **7**





Source: Kwongan Region: UWA, Pre European Vegetation: DPIRD, DBCA Estate: DBCA

0 204,000 m

Scale: 1:9,747,067
MGA94 (Zone 50)

CAD Ref: a2602_f23_07_01

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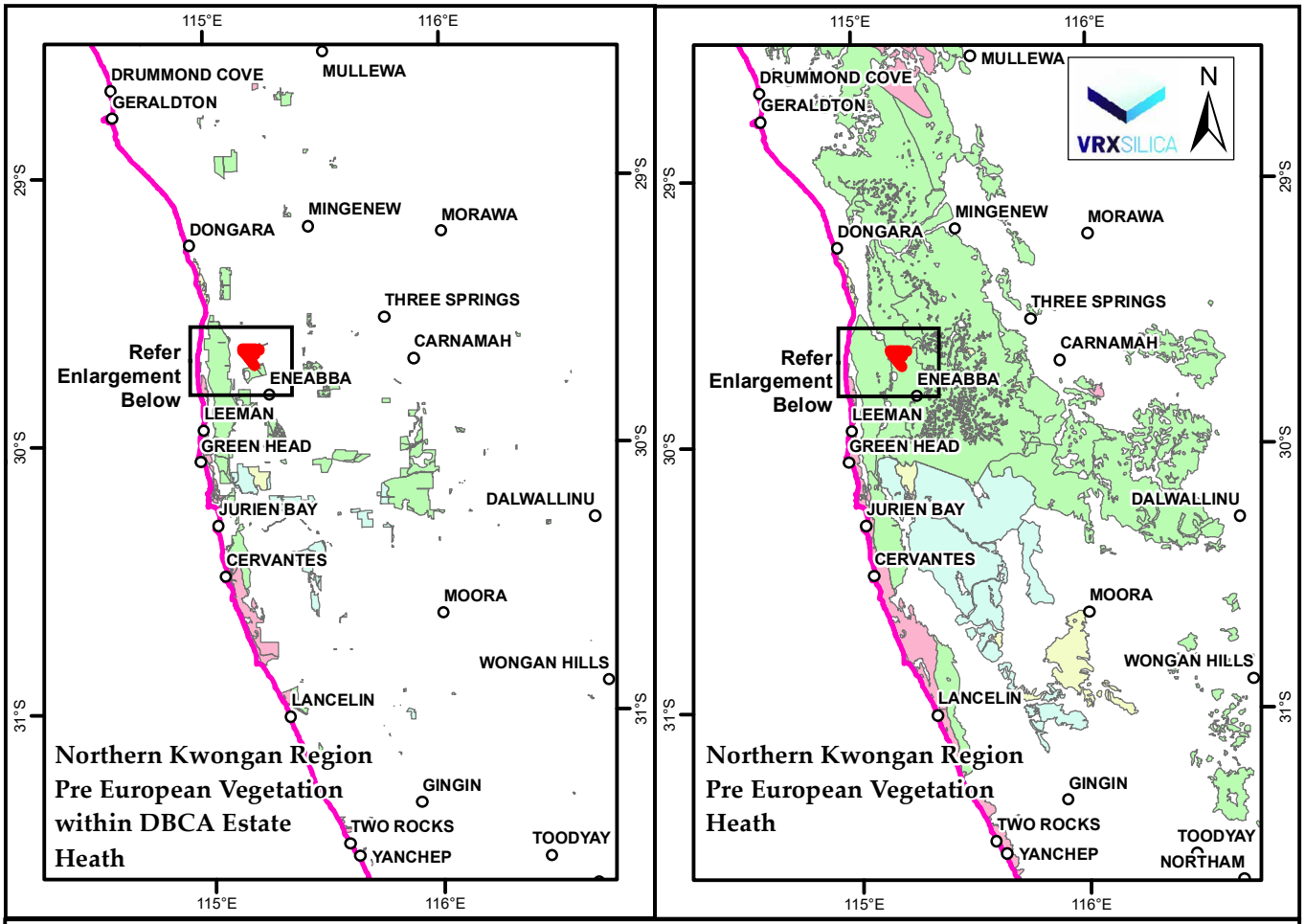
Arrowsmith Central Project

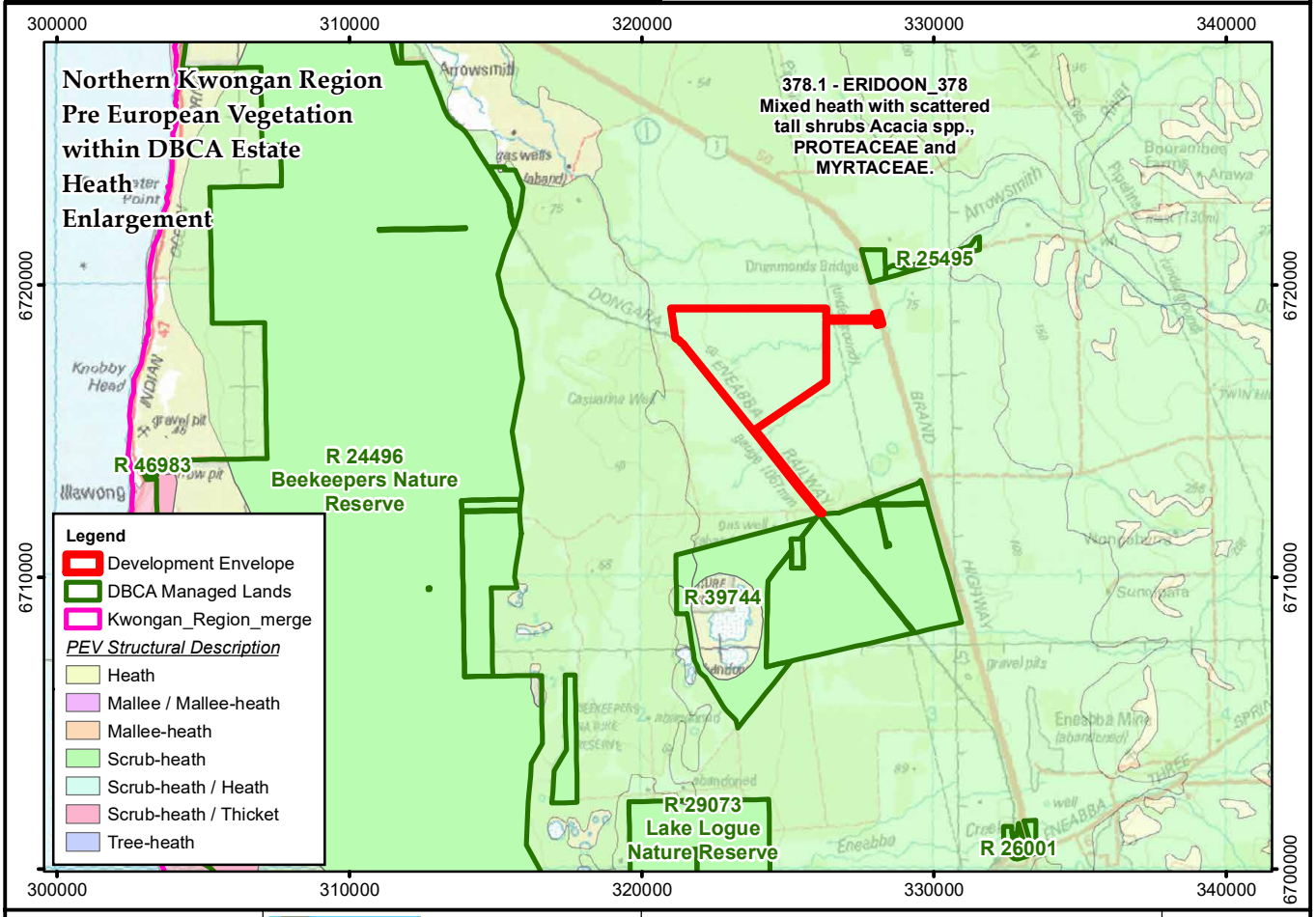
Kwongan Region

Pre European Vegetation - Heath

Figure:

8.1





Source: Background Image: GSA, Kwongan Region: UWA, Pre European Vegetation: DPIRD, DBCA Estate: DBCA

0 5,200 m
Scale: 1:250,000
MGA94 (Zone 50)

CAD Ref: a2602_f23_07_02
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Arrowsmith Central Project
Northern Kwongan Region
Pre European Vegetation - Heath

Figure: **8.2**

5 FIELD SURVEY RESULTS

A total of 118 survey quadrats were used to assess the flora and vegetation of the Arrowsmith Central survey area (Figure 10). Appendix D contains a list of the geographic locations for each of the survey quadrats. The taxa recorded during the survey are set out in Appendix E. A list of plant taxa recorded at each survey quadrat within the Arrowsmith Central survey area is set out in Appendix F.

5.6 Flora

A total of 274 vascular plant taxa, representative of 126 genera and 50 families, were recorded within survey quadrats within the Arrowsmith Central survey area. The majority of taxa recorded were representative of the Myrtaceae (38 taxa), Proteaceae (35 taxa) and Fabaceae (24 taxa) families (see Appendix E for a complete species list). Thirty-five annual plant species were recorded during the survey of the Arrowsmith Central survey area, representing 12.77 % of all taxa recorded; five of these are introduced annual species. A number of plant species collected could not be identified accurately to species level due to the absence of sufficient taxonomic characters to enable accurate identification. The principle reasons for not being able to fully identify some of the collected specimens to species level were:

1. Plant material was sterile or lacked sufficient taxonomic features to permit accurate identification to species level. In these cases the species is identified as, for example, *Thysanotus* sp. or *Drosera* sp.; and
2. The plant material collected could not be determined to a known taxon. For example, *Lepidosperma* species are currently undergoing taxonomic revision.

A species accumulation curve was used to evaluate the sampling adequacy and is presented in Figure 9. The incidence based coverage estimator of species richness was 329.46. Based on this value and the total of 274 species recorded (in vegetation mapping sites *only*), approximately 83 % of the flora species potentially present within the Arrowsmith Central survey area were recorded.

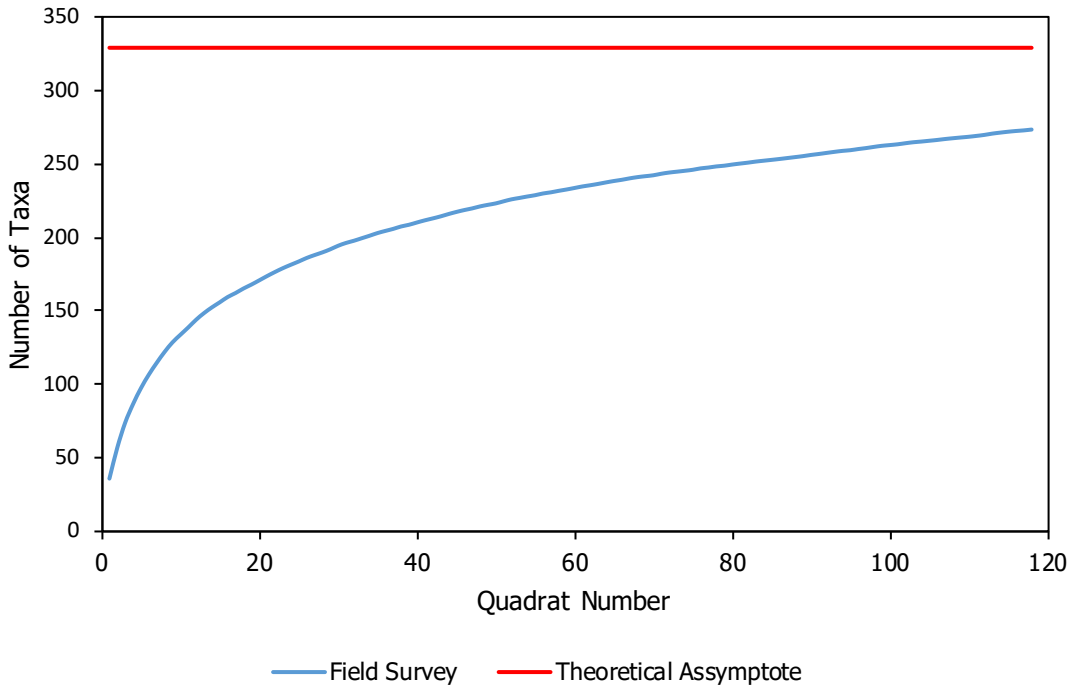
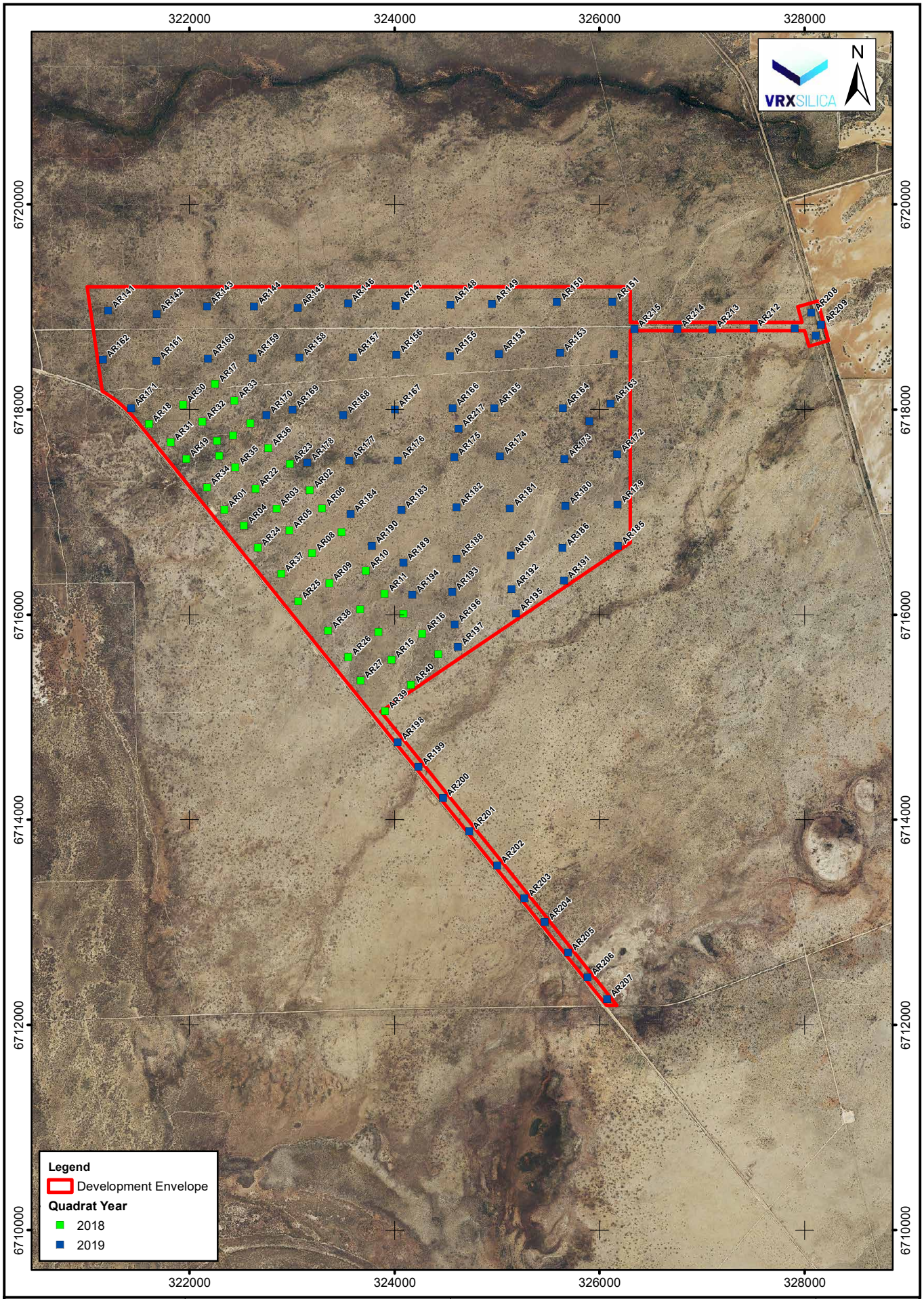


Figure 9: Average randomised species accumulation curve



0 1 km

Scale: 1:50,000
MGA94 (Zone 50)

CAD Ref: a2602_f36_01

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Arrowsmith Central Project
Quadrat Locations

Figure:
10

5.6.1 Threatened and Priority Flora

No threatened flora species pursuant to Part 2, Division 1, and Subdivision 2 of the BC Act and as listed by the DBCA (2018a), or pursuant to section 179 of the EPBC Act or listed by the DAWE (2021b), were recorded within the Arrowsmith Central survey area.

Seven priority flora species, *Grevillea leptopoda* (P3), *Hemiandra* sp. Eneabba (H. Demarz 3687) (P3), *Hopkinsia anoectocolea* (P3), *Hypocalymma gardneri* (P3), *Persoonia rudis* (P3), *Banksia elegans* (P4) and *Calytrix chrysantha* (P4), as listed by the WAH (1998-, DBCA 2018a), were recorded within the Arrowsmith Central survey area (Table 5). The geographic locations of priority flora species are presented in Figure 11 and Appendix G. A brief description of the priority species recorded is provided below:

- **PRIORITY 3:**

  Grevillea leptopoda **– PROTEACEAE –** Spreading to erect shrub, growing from 0.6 to 1.5 m high. White-cream flowers from August to September. Occurring on loam, lateritic gravel, sand and clay. WAH houses 31 records from the Shire of Carnamah, Shire Chapman Valley, Shire of Coorow, Shire of Dandaragan, Shire of Mingenew, Shire of Morawa, Shire of Northampton, Shire of Perenjori and Shire of Three Springs (WAH 1998-).

- **PRIORITY 3:**

  Hemiandra **sp. Eneabba (H. Demarz 3687) – LAMIACEAE –** Straggly, erect shrub, growing from 0.5 to 0.9 m high. Blue/violet/white flowers from September to February. Occurring on sand. WAH houses 35 records from the Shire of Carnamah, Shire of Coorow, Shire of Irwin and Shire of Three Springs (WAH 1998-).

- **PRIORITY 3:**

  Hopkinsia anoectocolea **– ANARTHIACEAE –** Rhizomatous, tufted perennial herb 0.5 to 1 m tall. Brown flowers from September to December. Occurs in white or grey sand, winter wet depressions, floodplains and salt lakes. WAH houses 49 records from the Shire of Carnamah, Shire of Cunderdin, Shire of Dandaragan, Shire of Irwin and Shire of Tammin (WAH 1998-).

- **PRIORITY 3:**

  Hypocalymma gardneri **– MYRTACEAE –** Shrub, growing to 0.3 m high. Yellow flowers from August to September. Occurring on grey-brown sand, laterite, sandplains and upper slopes. WAH houses 22 records from the Shire of Carnamah, Shire of Coorow, Shire of Dandaragan and Shire of Irwin (WAH 1998-).

- **PRIORITY 3:**

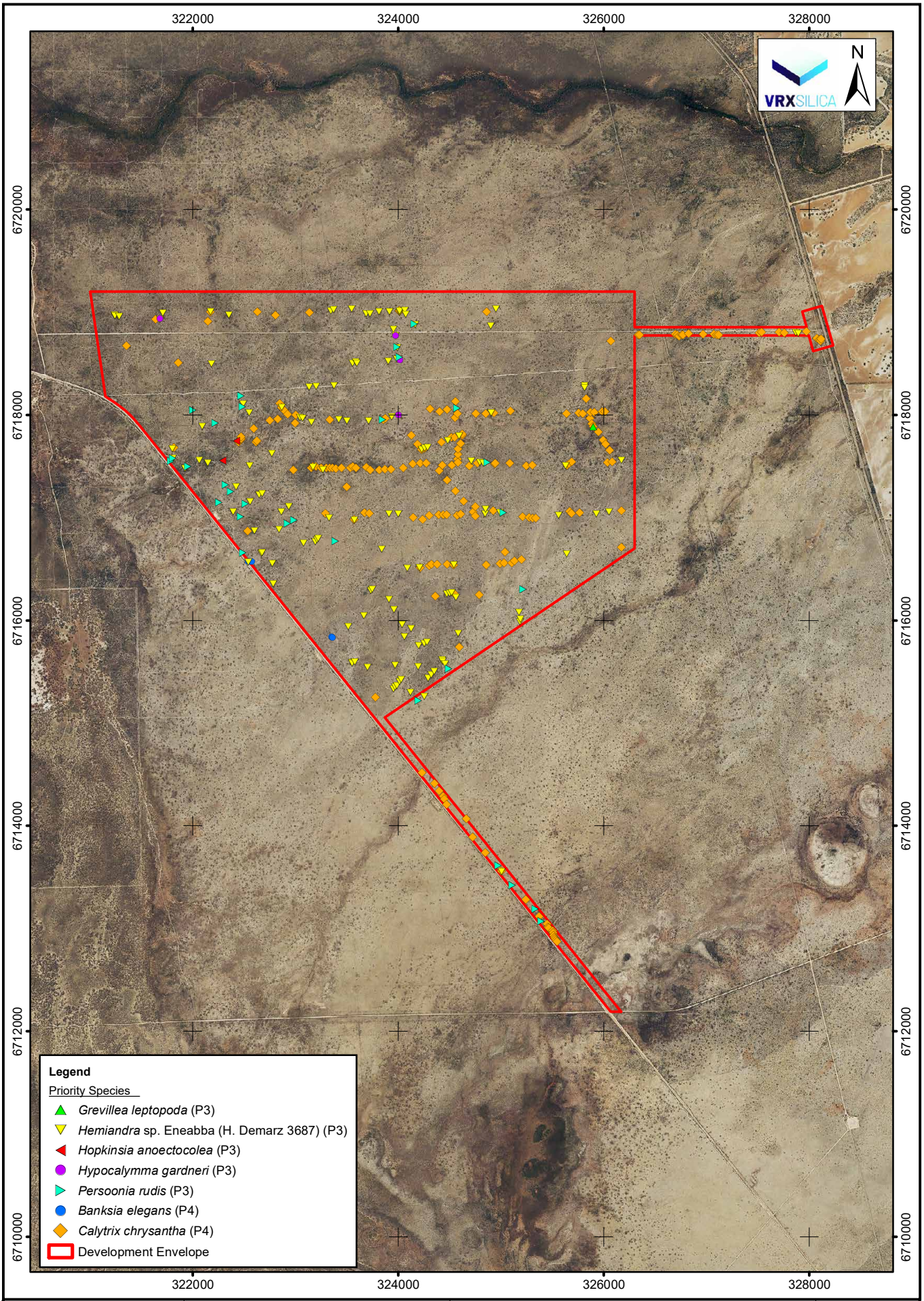
  Persoonia rudis **– PROTEACEAE –** Erect, often spreading shrub, 0.2 to 1 m high. Yellow flowers from September to December or January. Occurring on white, grey or yellow sand, often over laterite. WAH houses 41 records from the Shire of Carnamah, Shire of Coorow, Shire of Dandaragan, Shire of Gingin, Shire of Irwin, City of Swan, Shire of Three Springs and Shire of Victoria Plains (WAH 1998-).

- **PRIORITY 4:**

  Banksia elegans **– PROTEACEAE –** Shrub (with fire-tolerant rootstock, often suckering), growing from 1 to 4 m high. Yellow flowers from October to November. Occurring on yellow, white or red sandplains or low consolidated dunes. WAH houses 44 records from the Shire of Carnamah, Shire of Dandaragan, City of Greater Geraldton, Shire of Irwin and the Shire of Three Springs (WAH 1998-).

- **PRIORITY 4:**

  Calytrix chrysantha **– MRYTACEAE –** Shrub 0.3 to 1.3 m high. Yellow flowers from December to February. Occurs on white, grey or yellow/brown sand. WAH houses 38 records from the Shire of Carnamah, Shire of Coorow, City of Dandaragan, Shire of Irwin, Shire of Morawa and the Shire of Three Springs (WAH 1998-).



Source: Aerial Photography: Landgate (Nov 2016), Flora: MCPL (17/12/2019)

0 1,100 m

Scale: 1:50,000
MGA94 (Zone 50)

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Arrowsmith Central Project
Threatened & Priority Flora

Figure: **11**

Table 5: Priority flora species recorded within the Arrowsmith Central survey area

Conservation Code	Species	No. Records	No. Plants
P3	*Grevillea leptopoda*	1	10
	Hemiandra sp. Eneabba (H. Demarz 3687)	141	190
	Hopkinsia anoectocolea	2	2
	Hypocalymma gardneri	4	17
	Persoonia rudis	30	34
P4	*Banksia elegans*	5	22
	Calytrix chrysantha	200	19054

5.6.2 Flora Range Extensions

No species recorded at the Arrowsmith Central survey area represented extensions to their current known distributions.

5.6.3 Introduced (Weed) Species

A total of six introduced (weed) species were recorded within the Arrowsmith Central survey area (Table 6). None of these species, **Aira caryophyllea*, **Ehrharta calycina*, **Hypochaeris glabra*, **Lysimachia arvensis*, **Ursinia anthemoides* and **Wahlenbergia capensis* are declared pest organisms pursuant to section 22 of the BAM Act. None are listed as Weeds of National Significance (DAWE 2021c). All species recorded are listed in the Midwest region impact and invasiveness ratings (DPaW 2013). Three were listed as having high ecological impact and two were listed as being of low ecological impact. The remaining species, **Wahlenbergia capensis*, is listed as having unknown ecological impacts (DPaW 2013). All weed species recorded were described as having rapid invasiveness (DPaW 2013).

Table 6: Location of Introduced (Weed) Species within Arrowsmith Central survey area

Species	DPAW[1]		WAOL[2]	WONS[3]	GDA94_Z50	
	Ecological Impact	Invasiveness			Easting	Northing
**Aira caryophyllea*	H	R	Permitted - s11	No	321938 322250 322290 322428 323198 323559 325661 326073 326126 327503 327907 328068 328111	6718046 6718245 6717549 6717746 6716600 6717501 6717518 6712249 6719047 6718788 6718787 6718944 6718721
**Ehrharta calycina*	H	R	Permitted - s11	No	328163	6718825
**Hypochaeris glabra*	L	R	Permitted - s11	No	322290 322428 328068 328163	6717549 6717746 6718944 6718825
**Lysimachia arvensis*	L	R	Permitted - s11	No	322290 322428 326073	6717549 6717746 6712249
**Ursinia anthemoides*	H	R	Permitted - s11	No	321155 321605 321816 321968 322172 322290 322341 322428 322534 322596 323483 324090 324162 324976 325641 325661 326109 326175 327503 328111 328163	6718487 6717857 6717679 6717520 6717241 6717549 6717023 6717746 6716868 6717865 6716804 6716009 6715315 6718013 6718015 6717518 6718057 6717068 6718788 6718721 6718825

Note: [1] DPAW - Department of Parks and Wildlife 2013 weed ranking category for the Midwest region; [2] WAOL - Western Australian Organism List (BAM Act 2007; Department of Primary Industries and Regional Development 2019); Ecological Impact Rating: L - Low; M - Medium; H - High; U - Unknown. Invasiveness Rating: S - Slow; M - Moderate; R - Rapid; U - Unknown; [3] WONS - Weeds of National Significance (DAWE 2021c)

Table 6 (continued): Location of Introduced (Weed) Species within Arrowsmith Central survey area

Species	DPAW[1]		WAOL[2]	WONS[3]	GDA94_Z50	
	Ecological Impact	Invasiveness			Easting	Northing
* *Wahlenbergia capensis*	U	R	Permitted - s11	No	321968 322341 323177 324090 327907 328163	6717520 6717023 6717213 6716009 6718787 6718825

Note: [1] DPAW - Department of Parks and Wildlife 2013 weed ranking category for the Midwest region; [2] WAOL - Western Australian Organism List (BAM Act 2007; Department of Primary Industries and Regional Development 2019); Ecological Impact Rating: L - Low; M - Medium; H - High; U - Unknown. Invasiveness Rating: S - Slow; M - Moderate; R - Rapid; U - Unknown; [3] WONS - Weeds of National Significance (DAWE 2021c).

5.7 Vegetation

For the purpose of this report, vegetation was analysed, defined and mapped for the Arrowsmith Central survey area.

5.7.1 Statistical Analysis

SIMPROF analysis of the 118 survey quadrats identified 22 significantly associated groups of quadrats and five outlier quadrats. Where appropriate, outliers and small groupings were assigned to broader comparative vegetation units based on factors including species composition and quadrat descriptions. For the purposes of vegetation mapping (i.e. extrapolating quadrat data to generalise vegetation communities over broad areas), an inclusive rather than exclusive approach was adopted. Vegetation community S4 had only two representative quadrats surveyed; due to having a limited occurrence in the survey area. Some of the survey quadrats assigned to vegetation communities S5 and S1 were based on quadrat data and in field observations rather than SIMPROF analysis. This was due to the occurrence of quadrats located on ecotones.

Based on this approach, seven communities were delineated within the Arrowsmith Central survey area. The dendrogram representing the results of the cluster analysis, and the corresponding seven vegetation communities is illustrated in Figure 12.

5.7.2 Vegetation Communities

Based on statistical analysis (Section 5.2.1.), seven vegetation communities were defined and mapped across the Arrowsmith Central survey area. In addition to the statistical analysis, survey quadrat physical data and aerial photographic maps were used to delineate the boundaries of the vegetation communities in the Arrowsmith Central survey area. The vegetation mapped is presented in Figure 13. A list of species recorded within each vegetation community is set out in Appendix H. Vegetation community descriptions, topographic and edaphic information and representative photos are shown in Appendix I. A summary of the vegetation communities is presented below. The area of each of the vegetation communities in Arrowsmith Central survey area is presented in Table 7.

H3: Open heath of *Melaleuca leuropoma*, *Leptospermum oligandrum* and *Hakea polyanthema*, *Conospermum triplinervium*, *Beaufortia elegans* and *Pileanthus filifolius*, with isolated trees of *Banksia attenuata* and *Xylomelum angustifolium* over *Mesomelaena pseudostygia* and *Ecdeiocolea monostachya*.

H6: Heathland of *Banksia attenuata*, *Hakea polyanthema* and *Melaleuca leuropoma*, over isolated *Verticordia grandis* and *Styphelia xerophylla* on white to grey sand.

S1: Isolated trees of *Eucalyptus todtiana*, over shrubland of *Banksia leptophylla* var. *melletica*, *Acacia blakelyi* and *Melaleuca leuropoma* over mixed understory of Proteaceae and Myrtaceae species on white/grey sand.

S4: Open shrubland of *Calothamnus quadrifidus* subsp. *angustifolius*, *Melaleuca lateritia*, *Melaleuca rhaphiophylla* and *Melaleuca concreta* over isolated *Patersonia occidentalis* and *Conostylis candicans* subsp. *procumbens* on grey/white sands.

S5: Open shrubland of *Calytrix chrysantha* (P4), *Banksia leptophylla* var. *melletica* and *Eremaea beaufortioides* var. *beaufortioides*, over *Jacksonia hakeoides* and *Banksia nivea* on white/grey sand.

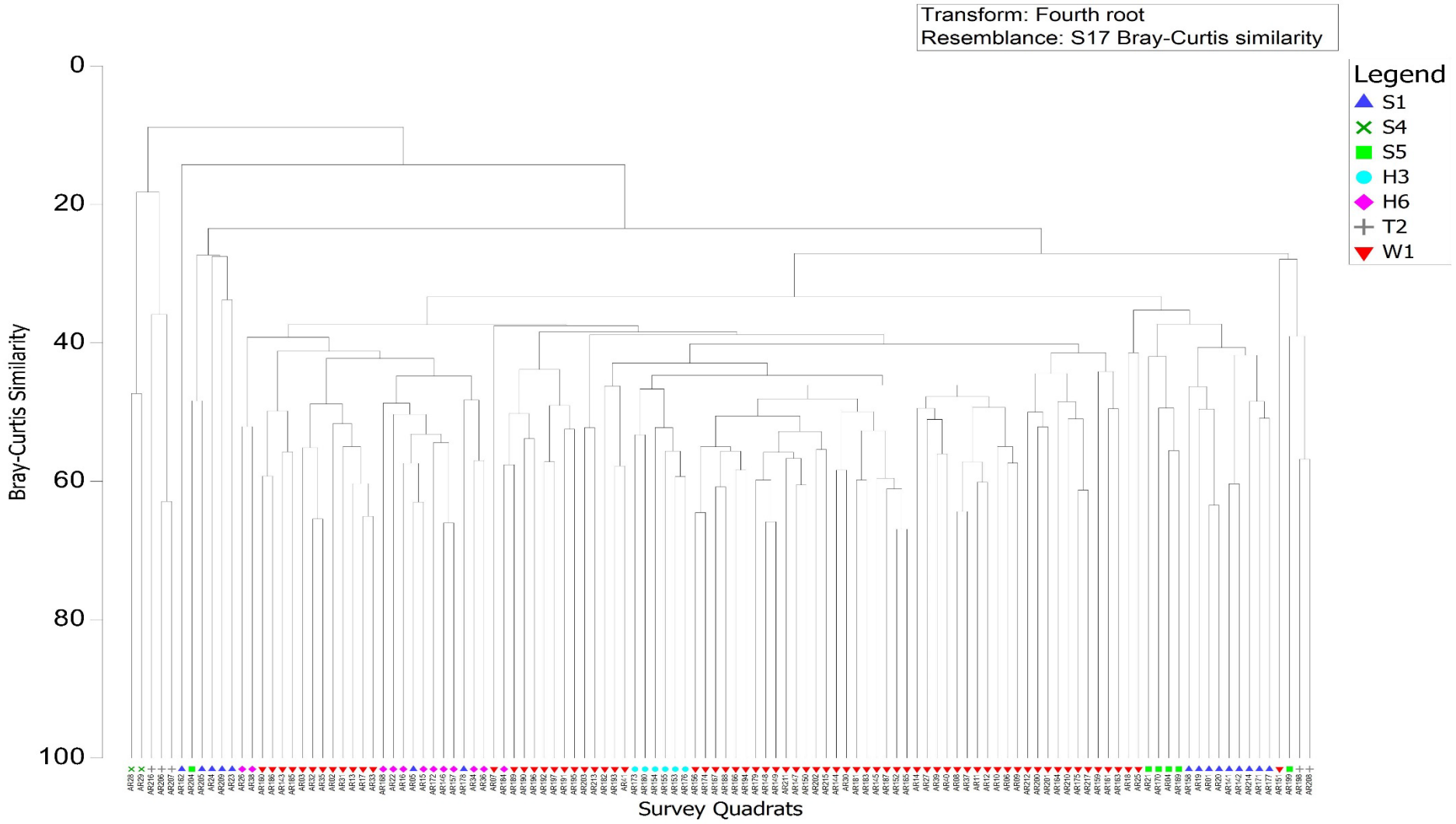
T2: Thicket to scrub of *Allocasuarina campestris*, *Melaleuca concreta*, *Guichenotia macrantha* and *Calothamnus quadrifidus* subsp. *angustifolius*, over sparse *Leptosema aphyllum* on white sand over grey to brown clay/loam.

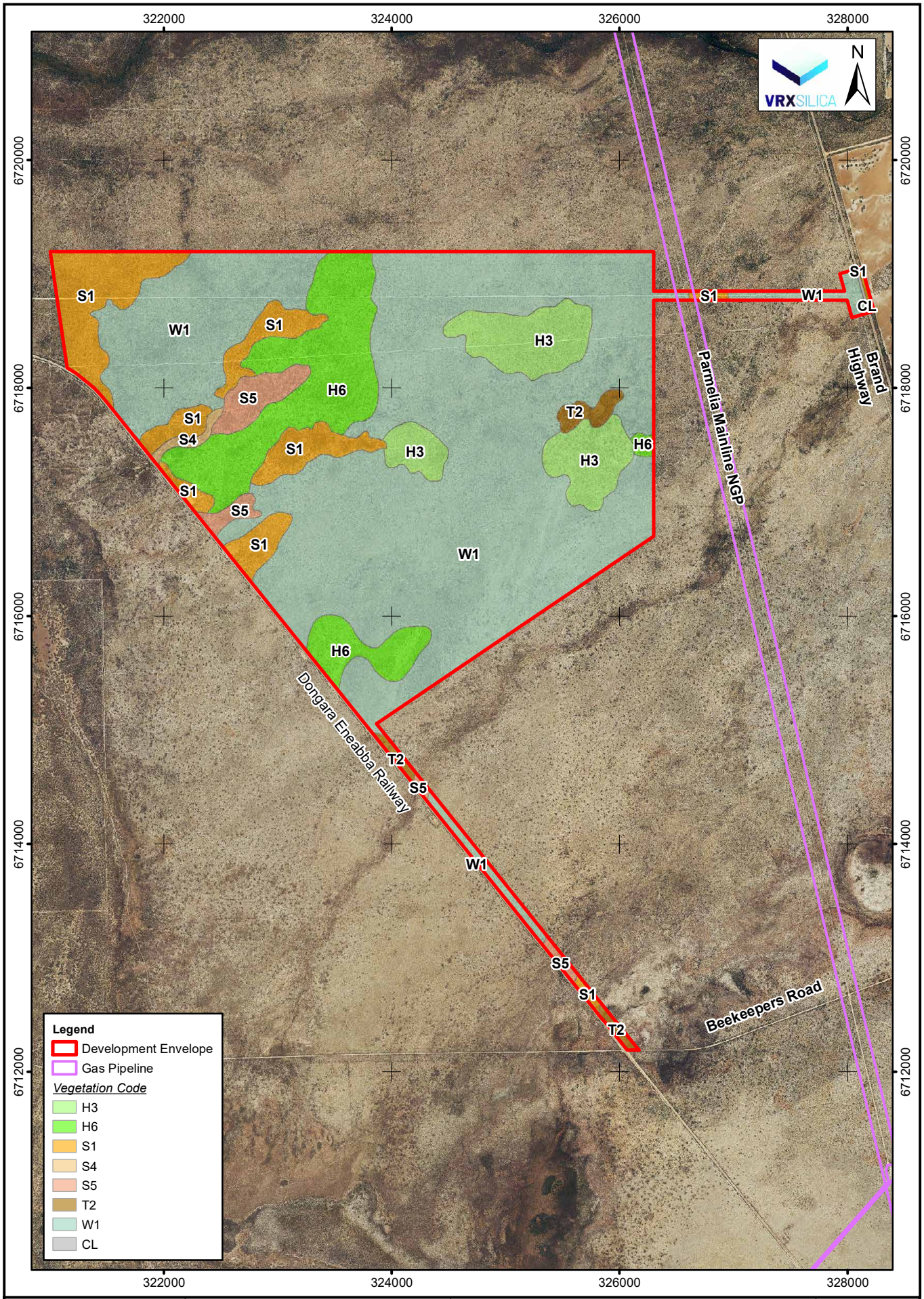
W1: Open woodland to isolated trees of *Eucalyptus todtiana* and *Xylomelum angustifolium*, over open shrubland of *Melaleuca leuropoma* and *Hakea polyanthema*, over isolated *Mesomelaena pseudostygia* and *Ecdeiocolea monostachya* on cream sand.

Table 7: Area of Vegetation Communities within Arrowsmith Central survey area

Vegetation Community	Arrowsmith Central survey area (ha)	Arrowsmith Central survey area (%)	Number of Quadrats
H3	121.51	7.74	6
H6	192.81	12.28	12
S1	160.90	10.25	16
S4	6.24	0.40	2
S5	37.94	2.42	6
T2	18.55	1.18	5
W1	1030.82	65.67	71
Cleared	0.92	0.06	-
Total	**1569.70**	**100**	**118**

Figure 12: Dendrogram of survey quadrats established across Arrowsmith Central survey area





Source: Aerial Photography: Landgate (Nov 2016), Vegetation Condition: MCPL (28/01/2020)

0 1,000 m

Scale: 1:45,000
MGA94 (Zone 50)

CAD Ref: a2602_f23_09

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Arrowsmith Central Project
Vegetation

Figure: **13**

5.7.3 Threatened and Priority Ecological Communities

No TECs pursuant to Part 2, Division 2, and Subdivision 1 of the BC Act and as listed by the DBCA (2018b) or DAWE (2021d) were recorded within the Arrowsmith Central survey area. No PECs as listed by the DBCA (2021) were recorded within the Arrowsmith Central survey area.

5.7.4 Vegetation Condition

The condition of the vegetation within the Arrowsmith Central survey area ranged from Pristine to Very Good (Table 8); the majority of the area was considered Pristine according to the Keighery (1994; Appendix A5) scale. Figure 14 shows the vegetation condition of the Arrowsmith Central survey area. Within the Arrowsmith Central survey area these areas can be delineated as follows:

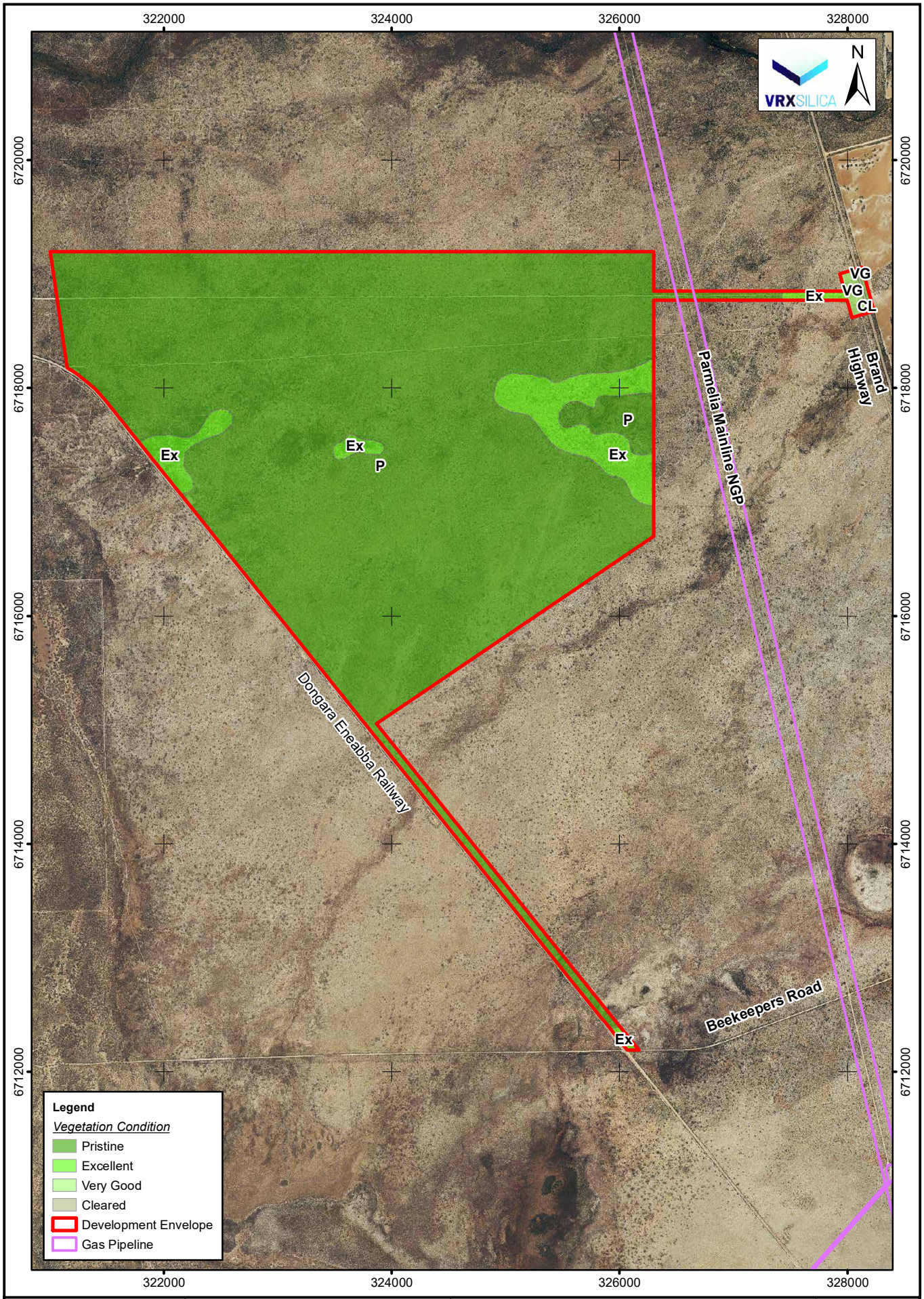
Pristine: Majority of the current development envelope, aside from small fragments on the south eastern and western borders. No disturbance present.

Excellent: Small fragments of the survey area to the south, east and west. These areas contained some weed species, often in very low numbers.

Very Good: One small area on the edge of the eastern border of the development envelope. This area occurred adjacent to Brand Highway and contained weeds, evidence of grazing and litter.

Table 8: Condition rating of areas within Arrowsmith Central survey area

Condition	Within Arrowsmith Central (ha)	Within Arrowsmith Central (%)
Pristine	1458.97	92.95
Excellent	102.68	6.54
Very Good	8.04	0.51
Good	0.00	0.00
Degraded	0.00	0.00
Completely Degraded	0.00	0.00
Total	**1569.70**	**100**



Source: Aerial Photography: Landgate (Nov 2016), Vegetation Condition: MCPL (28/01/2020)

0 1,000 m

Scale: 1:45,000
MGA94 (Zone 50)

CAD Ref: a2602_f23_10

Date: April 2021 | Rev: A | A4

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Arrowsmith Central Project
Vegetation Condition

Figure: **14**

6 DISCUSSION

6.1 General

Mattiske Consulting was commissioned in October 2017 by Preston Consulting Pty Ltd on behalf of VRX Silica Ltd to undertake a flora and vegetation survey of the Arrowsmith Project survey area, this survey occurred during the months of October and November 2018. In August 2019 Mattiske Consulting was again commissioned by VRX Silica Ltd to undertake a flora and vegetation survey of the Arrowsmith Project survey area. The 2019 survey occurred during the months of October and November and included an extension to the Central survey area within the Arrowsmith Project survey area. The Arrowsmith Central survey area occupies an area of approximately 1570 ha, and is located between the towns of Eneabba and Dongara, Western Australia. A total of 118 vegetation survey quadrats were established to sample all the apparent vegetation community types which were located within the survey area.

Rainfall in the three months preceding the October/November 2018 survey was above the long term average rainfall for the area, and that for the three months preceding the October/November 2019 survey was below the long term average rainfall for the area, based on Bureau of Meteorology data for Green Grove. Overall, based on a range of factors including the proportion of potential flora recorded (estimated at 83 %), and vegetation quadrat distribution within the survey area, the survey has not been constrained by factors which would adversely affect the survey outcomes nor the conclusions derived from the data used to support vegetation analysis (Table 2).

6.2 Flora

A total of 274 vascular plant taxa, representative of 126 genera and 50 families, were recorded within the Arrowsmith Central survey area. The majority of taxa recorded were representative of the Myrtaceae (38 taxa), Proteaceae (35 taxa) and Fabaceae (24 taxa) families (Appendix E). The majority of the taxa recorded were widespread both locally and more broadly within the associated biogeographical subregion. The 274 taxa recorded during the survey compares to 438 taxa recorded as being potentially present within the desktop assessment. This larger number of potential taxa can be attributed to the larger and more diverse tenement area in which was searched. This area covers a greater number of landscape features and hence vegetation communities.

Conservation significant taxa

Of the 13 threatened flora species and 18 priority taxa identified during the desktop survey, seven priority flora taxa were recorded in the Arrowsmith Central survey area. The larger number of threatened and priority species identified as having the potential to occur within the survey area can be attributed to the larger and more diverse tenement area in which was searched. Many of these species are restricted to specific landscape features, such as lateritic hills and outcrops that do not occur in the Arrowsmith Central survey area.

No threatened flora pursuant to Part 2, Division 1, and Subdivision 2 of the BC Act and as listed by the DBCA (2018a) were recorded in the survey area. Seven priority taxa, as listed by the WAH (1998-, DBCA 2018a) were recorded in the survey area. These were *Grevillea leptopoda* (P3), *Hemiandra* sp. Eneabba (H. Demarz 3687) (P3), *Hopkinsia anoectocolea* (P3), *Hypocalymma gardneri* (P3), *Persoonia rudis* (P3), *Banksia elegans* (P4) and *Calytrix chrysantha* (P4). It should be noted that a large number (<19000) of *Calytrix chrysantha* (P4) was recorded in the area.

The following is a summary of the seven priority flora species recorded within the Arrowsmith Central survey area:

Grevillea leptopoda (P3) was recorded in the north-eastern part of the Arrowsmith Central survey area (Figure 11) from 1 location totalling 10 plants. The 31 records held at the WAH indicate *Grevillea leptopoda* (P3) ranges from Badgingarra to Northampton. *Grevillea leptopoda* (P3) occurs on a wide range of habitat from loam and lateritic gravel to sand and clay. This species was only recorded once within the T2 vegetation community.

Hemiandra sp. Eneabba (H. Demarz 3687) (P3) was recorded scattered throughout the Arrowsmith Central survey area (Figure 11) from 141 locations totalling 190 plants. The 35 records held at the WAH indicates *Hemiandra* sp. Eneabba (H. Demarz 3687) (P3) ranges from Eneabba to the Yardanogo Nature Reserve near Dongara with a preference for sandplain habitat. This species is not restricted to a unique set of ecological conditions and is present in various vegetation communities within the survey area.

Hopkinsia anoectocolea (P3) was recorded in the north-western part of the Arrowsmith Central survey area (Figure 11) from 2 locations totalling 2 plants. The 49 records held at the WAH indicate *Hopkinsia anoectocolea* (P3) ranges from York to Carnamah. *Hopkinsia anoectocolea* (P3) occurs on white or grey sand in seasonally wet depressions, floodplains and salt lakes. This species has only been recorded within the S4 community and is most likely restricted to winter wet depressions.

Hypocalymma gardneri (P3) was recorded scattered in the northern part of the Arrowsmith Central survey area (Figure 11) from 4 locations totalling 17 plants. The 22 records held at the WAH indicate *Hypocalymma gardneri* (P3) ranges from Dandaragan to Dongara. *Hypocalymma gardneri* (P3) 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 within the survey area.

Persoonia rudis (P3) was recorded scattered throughout the Arrowsmith Central survey area (Figure 11) from 30 locations totalling 34 plants. The 41 records held at the WAH indicate *Persoonia rudis* (P3) is a wide ranging species which occurs from the Bullsbrook Nature Reserve to Three Springs. *Persoonia rudis* (P3) occurs on a wide range of habitat from white, grey or yellow sand often over laterite. This species is not restricted to a unique set of ecological conditions and is present in various vegetation communities within the survey area.

Banksia elegans (P4) was recorded in the south western portion of the Arrowsmith Central survey area (Figure 11) from 5 locations totalling 22 plants. The 44 records held at the WAH indicate *Banksia elegans* (P4) ranges from Moore River to Geraldton. *Banksia elegans* (P4) 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 within the survey area.

Calytrix chrysantha (P4) was recorded throughout the Arrowsmith Central survey area (Figure 11) from 200 locations totalling 19054 plants. The 38 records held at the WAH indicate *Calytrix chrysantha* (P4) occurs from the Coomallo Nature Reserve to Dongara. *Calytrix chrysantha* (P4) occurs on a wide range of habitat from white, grey or yellow/brown sand. This species is not restricted to a unique set of ecological conditions and is present in various vegetation communities within the survey area.

Introduced taxa

Six introduced species were recorded within the Arrowsmith Central survey area: **Aira caryophyllea*, **Ehrharta calycina*, **Hypochaeris glabra*, **Lysimachia arvensis*, **Ursinia anthemoides* and **Wahlenbergia capensis*. None of these species are declared pest organisms pursuant to section 22 of the BAM Act (all are permitted under section 11 of the BAM Act) and none are Weeds of National Significance (DAWE 2021c). All recorded introduced species are well known in the area and are within known distributions.

Taxa representing range extensions

No species recorded at the Arrowsmith Central survey area represented extensions to their current known distributions.

6.3 Vegetation

A total of seven vegetation communities were recorded within the Arrowsmith Central survey area. None of these communities contained areas representative of TECs or PECs. The vegetation communities present occurred primarily on grey to white sand plains. The survey area had very little topographic variation, however small areas of lower lying depressions occurred in the southern corridor and within a small portion of land to the central west of the survey area, containing a winter wet depression associated with brown clay loam soils. The grey to white sand plains were most commonly associated with open woodland to isolated trees of *Eucalyptus todtiana* and *Xylomelum angustifolium* or *Banksia attenuata*, over a mixed understorey often dominated by *Melaleuca leuropoma*, *Leptospermum oligandrum* and *Hakea polyanthema* over *Mesomelaena pseudostygia* and *Ecdeiocolea monostachya,* or occasionally dominated by *Banksia leptophylla* var. *melletica* and *Acacia blakelyi* over a mixed understory of Proteaceae and Myrtaceae species. The lower depressions were most commonly associated with thicket to scrub of *Allocasuarina campestris*, *Melaleuca concreta*, *Guichenotia macrantha* and *Calothamnus quadrifidus* subsp. *angustifolius*, over sparse *Leptosema aphyllum*.

Most of the vegetation communities are well represented at a local and regional scale, with the exception of one community type, S5, representing an open shrubland of *Calytrix chrysantha* (P4), *Banksia leptophylla* var. *melletica* and *Eremaea beaufortioides* var. *beaufortioides*, over *Jacksonia hakeoides* and *Banksia nivea* on white/grey sand plains. This community typically contains high numbers of the priority 4 species *Calytrix chrysantha*, with one quadrat containing up to 100 individuals.

The vegetation of the Arrowsmith Central survey area ranged from Pristine to Very Good. The majority of the Arrowsmith Central survey area was considered to be in Pristine condition due to the absence of disturbance, tracks and weeds. Small sections on the southern, eastern and western boundaries of the survey area were ranked as being in Excellent condition due to the presence of some non-aggressive weed species. A small portion on the boundary of the eastern corridor, adjacent to the Brand Highway was ranked as Very Good due to the increased presence of weeds, evidence of grazing and litter.

7 CONCLUSION

Overall, the vegetation communities mapped and species recorded in the Arrowsmith Project survey area were consistent with the historical mapping of Beard (1976, 1990). The majority of the survey area is situated on sand plains supporting open woodland to isolated trees of *Eucalyptus todtiana* and *Xylomelum angustifolium* over mixed heath often consisting of *Melaleuca leuropoma* and *Hakea polyanthema*, over mixed understory of Proteaceae, Restionaceae and Myrtaceae species. Most of the vegetation communities are well represented at a local and regional scale, with the exception of one community type, S5, which contains high numbers of the priority species *Calytrix chrysantha* (P4). However, this community does not represent a TEC or PEC.

8 ACKNOWLEDGEMENTS

The authors would also like to thank taxonomists from the Western Australian Herbarium for their plant identification support and VRX Silica personnel for their assistance during the project.

9 PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

NAME	POSITION	PROJECT INVOLVEMENT	FLORA COLLECTION PERMITS
Dr EM Mattiske	Managing Director & Principal Ecologist	Planning, managing, reporting	N/A
Dr S Ruoss	Senior Ecologist & Project Leader	Planning, fieldwork, data analysis, reporting	FB62000031; DRF TFL 17-1819
Ms L Taaffe	Botanist	Fieldwork, data analysis, reporting	FB62000021
Ms J Rogers	Botanist	Fieldwork, data collation, reporting	FB62000032
Mr A Pereira	Botanist	Fieldwork	FB62000145
Mr B Ellery	Taxonomist	Plant identification	N/A

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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of Threatened Flora Species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable**	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent**	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Biodiversity Conservation Act 2016* (BC Act) provides for (amongst other things) the protection of flora that is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future in Western Australia under Part 10 (Division 2).

Threatened flora are listed in the *Wildlife Conservation (Rare Flora) Notice 2018* (under Part 2, Division 1, Subdivision 2 of the BC Act; Department of Biodiversity, Conservation and Attractions 2018a) and are categorised under Schedules 1-3**.** A flora species is defined as **threatened** if it is facing an extremely high risk of extinction in the wild in the immediate, near or medium-term future, pursuant to sections 20, 21 and 22 of the BC Act (Department of Biodiversity, Conservation and Attractions 2019). Threatened species are categorised as critically endangered, endangered, and vulnerable (Table A1.2).

Table A1.2 State definition of Threatened Flora Species

Note: Adapted from Department of Biodiversity, Conservation and Attractions (2019a).

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2018*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the *Wildlife Conservation (Rare Flora) Notice 2018*).

Priority flora species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient" or species that are "adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list" for other than taxonomic reasons" (Department of Biodiversity, Conservation and Attractions 2019). Priority species are not afforded additional protection under state or federal legislation, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a). The Department of Biodiversity, Conservation and Attractions categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of Priority Flora Species

Note: Adapted from Department of Biodiversity, Conservation and Attractions (2019).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** Rare, Near Threatened, and other species in need of monitoring	**a) Rare -** Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. **b) Near Threatened -** Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. **c) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of Threatened Ecological Communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

The *Biodiversity Conservation Act 2016* (BC Act) provides for (amongst other things) some protection of ecological communities at risk of collapse in Western Australia under Part 3 (Division 2).

Threatened ecological communities (TECs) are listed in the *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment (28 June 2018)* (under Part 2, Division 2, Subdivision 1 of the BC Act; Department of Biodiversity, Conservation and Attractions 2018b). An ecological community is defined as **threatened** if it is facing an extremely high risk of collapse in the immediate, near or medium-term future, pursuant to sections 28, 29 and 30 of the BC Act. Threatened ecological communities are categorised as critically endangered, endangered, and vulnerable (Table A2.2). Some of these TECs are also endorsed by the Federal Minister as threatened, and some of these are listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of Threatened Ecological Communities

Note: Adapted from Department of Environment and Conservation (2013).

CODE	CATEGORY	DEFINITION
CR	**Critically Endangered**	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	**Vulnerable**	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet **any one or more of** the following criteria: **1.** The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; **2.** The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or **3.** The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the Department of Biodiversity, Conservation and Attractions (2021) in the *Priority Ecological Communities for Western Australia – Version 31 (20 March 2021)*. Similarly to priority flora, PECs are not afforded legislative protection, however are considered significant under the Environmental Protection Authority's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of Priority Ecological Communities

Note: Adapted from Department of Environment and Conservation (2013).

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	**Priority 3** (Poorly known ecological communities)	**1.** Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation; **2.** Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or **3.** Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Priority 4** (Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring)	**1.** Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. **2.** Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. **3.** Communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2021).

Table A3.1 Categories and Control Measures of Declared Pest (Plant) Organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to: **(i)** alleviate the harmful impact of the declared pest in the area; or **(ii)** reduce the number or distribution of the declared pest in the area; or **(iii)** prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to: **(a)** alleviate the harmful impact of the declared pest in the area for which it is declared; or **(b)** reduce the number or distribution of the declared pest in the area for which it is declared; or **(c)** prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: DEFINITION OF VEGETATION CONDITION SCALE FOR THE SOUTH WEST AND INTERZONE BOTANICAL PROVINCES

Vegetation condition ratings relate to vegetation structure, level of disturbance at each structural layer and the ability of the vegetation unit to regenerate (Table A5.1). Vegetation condition provides complementary information for assessing the significance of potential impacts.

Table A5.1 Definition of Vegetation Condition Categories

Note: Adapted from Keighery (1994).

CATEGORY	DEFINITION
Pristine	Pristine or nearly so, no obvious sign of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX A6: NVIS STRUCTURAL FORMATION TERMINOLOGY

Note: Adapted from ESCAVI (2003).

COVER CHARACTERISTICS							
Foliage cover*	70-100	30-70	10-30	<10	≈0	0-5	unknown
Crown cover**	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
% cover***	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
Cover code	d	c	i	r	bi	bc	unknown

GROWTH FORM	HEIGHT RANGES (m)	STRUCTURAL FORMATION CLASSES						
tree, palm	<10, 10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, tree-fern	<1, 1-2, >2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	<1, 1-2, >2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	<1, 1-2, >2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs
samphire shrub	<0.5, >0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	spare samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	<2, >2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses
tussock grass	<0.5, >0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grassland	isolated clumps of tussock grasses	tussock grasses
other grass	<0.5, >0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
sedge	<0.5, >0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	<0.5, >0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
forb	<0.5, >0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forbs
fern	<1, 1-2, >2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	ferns
bryophyte	<0.5	closed bryophyteland	bryophyteland	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	<10, 10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines
aquatic	0-0.5, <1	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics	aquatics
seagrass	0-0.5, <1	closed seagrass bed	seagrass bed	open seagrass bed	sparse seagrasses	isolated seagrasses	isolated clumps of seagrasses	seagrasses

APPENDIX B: VASCULAR PLANT SPECIES WITH THE POTENTIAL TO OCCUR WITHIN THE ARROWSMITH CENTRAL PROJECT SURVEY AREA

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (DBCA 2019). SCC= State conservation code; FCC = Federal conservation code; CE = Critically Endangered; E = Endangered; V = Vulnerable.

Family	Species	SCC	FCC	EPBC	Nature map
Amaranthaceae	*Ptilotus manglesii*				x
	Ptilotus stirlingii subsp. *stirlingii*				x
Anarthriaceae	*Hopkinsia anoectocolea*	P3			x
	Lyginia imberbis				x
Apiaceae	*Eryngium pinnatifidum*				x
	Eryngium pinnatifidum subsp. *pinnatifidum*				x
Araliaceae	*Trachymene coerulea* subsp. *leucopetala*				x
	Trachymene pilosa				x
Asparagaceae	* *Asparagus asparagoides*			x	
	Laxmannia sessiliflora subsp. *drummondii*				x
	Thysanotus asper				x
	Thysanotus rectantherus				x
	Thysanotus spiniger				x
Asphodelaceae	*Bulbine semibarbata*				x
Asteraceae	*Gnephosis angianthoides*				x
	Gnephosis tenuissima				x
	Myriocephalus occidentalis				x
	Myriocephalus oldfieldii				x
Boryaceae	*Borya sphaerocephala*				x
Campanulaceae	*Lobelia rhytidosperma*				x
Casuarinaceae	*Allocasuarina humilis*				x
Centrolepidaceae	*Centrolepis alepyroides*				x
	Centrolepis milleri	P3			x
	Centrolepis polygyna				x
Colchicaceae	*Wurmbea tubulosa*	T	E	x	
Convolvulaceae	*Convolvulus remotus*				x
Cyperaceae	*Lepidosperma scabrum*				x
	Lepidosperma sp.				x
Cyperaceae	*Chaetospora curvifolia*				x

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Family	Species	SCC	FCC	EPBC	Nature map
Cyperaceae (Continued)	*Mesomelaena pseudostygia*				x
	Schoenus grandiflorus				x
	Schoenus odontocarpus				x
	Schoenus pleiostemoneus				x
Cyperaceae	*Tetraria microcarpa*				x
Dilleniaceae	*Hibbertia acerosa*				x
	Hibbertia hypericoides subsp. *hypericoides*				x
	Hibbertia racemosa				x
	Hibbertia robur				x
Droseraceae	*Drosera drummondii*				x
	Drosera eneabba				x
	Drosera hirsuta				x
	Drosera magna				x
	Drosera spilos				x
Elaeocarpaceae	*Tetratheca nephelioides*	T	CE	x	
Ericaceae	*Andersonia heterophylla*				x
	Brachyloma preissii				x
	Leucopogon inflexus				x
	Leucopogon prolatus				x
	Leucopogon sp. Northern ciliate (R. Davis 3393)				x
	Styphelia insularis				x
	Styphelia filifolia	P3			x
	Styphelia microdonta				x
	Styphelia obtecta	T	E	x	x
	Styphelia planifolia				x
	Styphelia xerophylla				x
	Styphelia sp. Eneabba (N. Marchant s.n. PERTH 012917				x
Euphorbiaceae	*Beyeria gardneri*	P3			x
	Monotaxis bracteata				x
	Stachystemon axillaris				x
Fabaceae	*Acacia auronitens*				x
	Acacia blakelyi				x
	Acacia fagonioides				x
	Acacia lasiocarpa var. *lasiocarpa*				x
	Acacia latipes subsp. *latipes*				x
	Acacia latipes subsp. *licina*	P3			x

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Family	Species	SCC	FCC	EPBC	Nature map
Fabaceae (Continued)	*Acacia saligna* subsp. Wheatbelt (B.R. Maslin 8602)				x
	Acacia xanthina				x
	Cristonia stenophylla				x
	Daviesia divaricata subsp. *divaricata*				x
	Daviesia incrassata subsp. *teres*				x
	Daviesia nudiflora subsp. *hirtella*				x
	Daviesia podophylla				x
	Daviesia speciosa	T	E	x	
	Gastrolobium polystachyum				x
	Gompholobium tomentosum				x
	Jacksonia lehmannii				x
	Kennedia prostrata				x
	Leptosema aphyllum				x
	Mirbelia trichocalyx				x
Gentianaceae	* *Cicendia filiformis*				x
Goodeniaceae	*Dampiera spicigera*				x
	Dampiera tephrea	P2			x
	Goodenia corynocarpa				x
	Goodenia reinwardtii				x
	Lechenaultia floribunda				x
	Scaevola sericophylla				x
Gyrostemonaceae	*Gyrostemon ramulosus*				x
	Gyrostemon subnudus				x
	Tersonia cyathiflora				x
Haemodoraceae	*Anigozanthos pulcherrimus*				x
	Conostylis aculeata subsp. *breviflora*				x
	Conostylis aurea				x
	Conostylis candicans subsp. *candicans*				x
	Conostylis canteriata				x
	Conostylis crassinerva subsp. *absens*				x
	Conostylis dielsii subsp. *teres*	T	E	x	
	Conostylis micrantha	T	E	x	
	Conostylis tomentosa				x
	Haemodorum spicatum				x
	Phlebocarya filifolia				x
Hemerocallidaceae	*Johnsonia pubescens* subsp. *pubescens*				x
	Tricoryne humilis				x
Hypericaceae	*Hypericum japonicum*				x

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Family	Species	SCC	FCC	EPBC	Nature map
Juncaginaceae	*Triglochin protuberans*	P3			x
	Triglochin sp. A Flora of Australia (G.J. Keighery 2477)				x
Lamiaceae	*Hemiandra gardneri*	T	E	x	
	Quoya verbascina				x
Loganiaceae	*Orianthera spermacocea*				x
	Nuytsia floribunda				x
Malvaceae	*Guichenotia intermedia*				x
	Guichenotia ledifolia				x
	Guichenotia macrantha				x
	Guichenotia micrantha				x
	Guichenotia quasicalva	P2			x
	Lasiopetalum sp. Coorow (E. Ried 101)				x
	Seringia hermanniifolia				x
	Sida hookeriana				x
Montiaceae	*Calandrinia baccata*				x
	Calandrinia calyptrata				x
	Calandrinia corrigioloides				x
	Calandrinia granulifera				x
Myrtaceae	*Beaufortia elegans*				x
	Calothamnus longissimus				x
	Calothamnus sanguineus				x
	Calothamnus torulosus				x
	Calytrix chrysantha	P4			x
	Calytrix cravenii				x
	Calytrix depressa				x
	Calytrix eneabbensis	P4			x
	Calytrix sapphirina				x
	Calytrix strigosa				x
	Eremaea asterocarpa subsp. *histoclada*				x
	Eremaea beaufortioides var. *microphylla*				x
	Eremaea violacea subsp. *raphiophylla*				x
	Eremaea x *phoenicea*				x
	Eucalyptus crispata	T	V	x	
	Eucalyptus decipiens				x
	Eucalyptus erythrocorys				x
	Eucalyptus flocktoniae				x
	Eucalyptus impensa	T	E	x	
	Eucalyptus leprophloia	T	E	x	

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Family	Species	SCC	FCC	EPBC	Nature map
Myrtaceae	*Eucalyptus rudis*				x
(Continued)	*Eucalyptus todtiana*				x
	Eucalyptus x *balanites*	T	E	x	
	Hypocalymma xanthopetalum				x
	Melaleuca concreta				x
	Melaleuca leuropoma				x
	Melaleuca ryeae				x
	Melaleuca systena				x
	Scholtzia laxiflora				x
	Scholtzia trilocularis				x
	Thryptomene hyporhytis				x
	Verticordia blepharophylla				x
	Verticordia densiflora var. *cespitosa*				x
	Verticordia densiflora var. *densiflora*				x
	Verticordia fragrans	P3			x
	Verticordia grandis				x
	Verticordia luteola var. *rosea*	P1			x
	Verticordia ovalifolia				x
	Verticordia pennigera				x
Orchidaceae	*Caladenia crebra*				x
	Paracaleana dixonii	T	E	x	x
	Thelymitra stellata	T	E	x	
Phyllanthaceae	*Poranthera asybosca*	P1			x
Pittosporaceae	*Billardiera coriacea*				x
	Marianthus erubescens				x
Plantaginaceae	* *Plantago coronopus* subsp. *commutata*				x
Poaceae	* *Cenchrus ciliaris*			x	
	* *Vulpia myuros*				x
Polygalaceae	*Muehlenbeckia adpressa*				x
Proteaceae	*Adenanthos cygnorum* subsp. *cygnorum*				x
	Banksia dallanneyi				x
	Banksia dallanneyi subsp. *media*				x
	Banksia elegans	P4			x
	Banksia hewardiana				x
	Banksia hookeriana				x
	Banksia incana				x
	Banksia leptophylla				x

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Family	Species	SCC	FCC	EPBC	Nature map
Proteaceae (Continued)	*Banksia leptophylla* var. *melletica*				x
	Banksia menziesii				x
	Banksia tridentata				x
	Conospermum crassinervium				x
	Conospermum incurvum				x
	Conospermum unilaterale				x
	Conospermum wycherleyi subsp. *glabrum*				x
	Conospermum wycherleyi subsp. *wycherleyi*				x
	Conostephium preissii				x
	Grevillea biternata				x
	Grevillea candelabroides				x
	Grevillea erinacea	P3			x
	Grevillea exposita				x
	Grevillea shuttleworthiana subsp. *canarina*				x
	Grevillea umbellulata				x
	Hakea candolleana				x
	Hakea costata				x
	Hakea cygna subsp. *cygna*				x
	Hakea eneabba				x
	Hakea incrassata				x
	Hakea lissocarpha				x
	Hakea marginata				x
	Hakea polyanthema				x
	Hakea ruscifolia				x
	Petrophile brevifolia				x
	Petrophile drummondii				x
	Petrophile macrostachya				x
	Petrophile scabriuscula				x
	Stirlingia latifolia				x
	Synaphea oulopha	P3			x
Restionaceae	*Chordifex sinuosus*				x
	Desmocladus semiplanus				x
	Lepidobolus preissianus subsp. *preissianus*				x
Selaginellaceae	*Selaginella gracillima*				x
Solanaceae	*Anthocercis littorea*				x
	* *Lycium ferocissimum*			x	
Stylidiaceae	*Levenhookia octomaculata*				x
	Stylidium adpressum				x
	Stylidium crossocephalum				x
	Stylidium despectum				x

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Family	Species	SCC	FCC	EPBC	Nature map
Stylidiaceae (Continued)	*Stylidium dichotomum*				x
	Stylidium ecorne				x
	Stylidium flagellum				x
	Stylidium longitubum	P4			x
	Stylidium purpureum				x
	Stylidium repens				x
	Stylidium sp.				x
	Stylidium torticarpum	P3			x
	Stylidium udusicola				x
Thymelaeaceae	*Pimelea angustifolia*				x
	Pimelea rosea				x
Xanthorrhoeaceae	*Xanthorrhoea drummondii*				x

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Conostylis dielsii subsp. *teres*	Haemodoraceae	T	Endangered	Habit: Shortly rhizomatous, tufted perennial, grass-like or herb, 0.13-0.33 m high, leaves terete. Flower colour: cream-yellow Flowering period (indicated in green): J F M A M J **J** **A** S O N D ▲ ▲ Survey (▲) Soils: White, grey or yellow sand, gravel. Low open woodland. IBRA Distribution: GES Florabase records: 24	Moderate
Conostylis micrantha	Haemodoraceae	T	Endangered	Habit: Rhizomatous, tufted perennial, grass-like or herb, 0.13-0.24 m high. Flower colour: yellow-cream/red Flowering period (indicated in green): J F M A M J **J** **A** S O N D ▲ ▲ Survey (▲) Soils: White or grey sand. Sandplains. IBRA Distribution: AVW, GES Florabase records: 22	Moderate
Daviesia speciosa	Fabaceae	T	Endangered	Habit: Many-stemmed shrub, 0.3-0.8 m high. Flower colour: red Flowering period (indicated in green): J F M **A** **M** J J A S O N D ▲ ▲ Survey (▲) Soils: Gravelly lateritic soils. Undulating plains, rises. IBRA Distribution: AVW, GES Florabase records: 19	Low

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Eucalyptus crispata	Myrtaceae	T	Vulnerable	Habit: (Mallee), 3-7 m high, bark rough on the trunk, in partly decorticated curls. Flower colour: yellow-cream Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Sand, loam with lateritic gravel. Lateritic breakaways. IBRA Distribution: GES Florabase records: 25	Low
Eucalyptus impensa	Myrtaceae	T	Endangered	Habit: (Straggly mallee), to 1.5 m high, bark smooth. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Yellow sand. Lateritic hills. IBRA Distribution: GES Florabase records: 13	Low
Eucalyptus leprophloia	Myrtaceae	T	Endangered	Habit: (Mallee), 2-5(-8) m high, bark rough loose & flaky to 1 m. Flower colour: cream-white Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: White or grey sand over laterite. Valley slopes. IBRA Distribution: AVW, GES Florabase records: 22	Low

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Eucalyptus x *balanites*	Myrtaceae	T	Endangered	Habit: (Mallee), to 5 m high, bark rough, flaky. Flower colour: white Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Sandy soils with lateritic gravel. IBRA Distribution: GES, SWA Florabase records: 11	Low
Hemiandra gardneri	Lamiaceae	T	Endangered	Habit: Prostrate, pungent shrub, 0.1-0.2 m high, to 1 m wide. Flower colour: red/pink-red Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Grey or yellow sand, clayey sand. Sandplains. IBRA Distribution: AVW, GES Florabase records: 21	Moderate
Styphelia obtecta	Ericaceae	T	Endangered	Habit: Erect shrub, 0.5-1.7 m high. Flower colour: cream-yellow Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Grey sand. IBRA Distribution: GES Florabase records: 19	Low

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Paracaleana dixonii	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.09-0.2 m high. Flower colour: yellow-brown Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Grey sand over granite IBRA Distribution: GES, SWA Florabase records: 20	Moderate
Tetratheca nephelioides	Elaeocarpaceae	T	Critically Endangered	Habit: Caespitose, dwarf shrub, to 0.3 m high. Flower colour: purple Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: White-grey sand, yellow-brown clayey sand, gravel, laterite. Outcrops, undulating hills, ridges. IBRA Distribution: AVW, GES Florabase records: 17	Moderate
Thelymitra stellata	Orchidaceae	T	Endangered	Habit: Tuberous, perennial, herb, 0.15-0.25 m high. Flower colour: yellow & brown Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Sand, gravel, lateritic loam. IBRA Distribution: GES, JAF, SWA Florabase records: 20	Low

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Wurmbea tubulosa	Colchicaceae	T	Endangered	Habit: Cormous, perennial, herb, 0.01-0.03 m high Flower colour: white-pink Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Clay, loam. River banks, seasonally-wet places. IBRA Distribution: AVW, GES Florabase records: 19	Low
Poranthera asybosca	Phyllanthaceae	P1	-	Habit: Erect herb, 0.2-0.45 m high. Flower colour: pink-green Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: White sand over laterite. IBRA Distribution: GES Florabase records: 1	High
Verticordia luteola var. *rosea*	Myrtaceae	P1	-	Habit: Slender shrub,0.3-2 m high. Flower colour: pink/green-cream-brown Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: White sand. Flats. IBRA Distribution: GES Florabase records: 17	Moderate

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Dampiera tephrea	Goodeniaceae	P2	-	Habit: Ascending to erect perennial, herb or shrub, 0.3-0.6 m high. Flower colour: blue Flowering period (indicated in green): J F M A M J **J** A S O N D ▲ ▲ Survey (▲) Soils: Sand, gravelly loam. IBRA Distribution: GES, SWA Florabase records: 28	Low
Guichenotia quasicalva	Malvaceae	P2	-	Habit: Erect, compact shrub, to 0.5 m high. Flower colour: blue-purple Flowering period (indicated in green): J F M A M J J A **S** **O** N D ▲ ▲ Survey (▲) Soils: Sandy clay over laterite. Drainage line. IBRA Distribution: AVW, GES Florabase records: 20	Moderate
Acacia latipes subsp. *licina*	Fabaceae	P3	-	Habit: Pungent shrub, 0.4-1.2 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M **J** **J** **A** **S** O N D ▲ ▲ Survey (▲) Soils: White sand, granitic soils. Limestone hills, sandplains. IBRA Distribution: AVW, GES Florabase records: 21	Moderate

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Beyeria gardneri	Euphorbiaceae	P3	-	Habit: Shrub, 0.25-0.5 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J **A S** O N D ▲ ▲ Survey (▲) Soils: Yellow sand. IBRA Distribution: AVW, GES, SWA, YAL Florabase records: 37	Moderate
Centrolepis milleri	Centrolepidaceae	P3	-	Habit: Annual, to 6 cm tall Flower colour: - Flowering period: - Flowering period (indicated in green): *Flowering period unknown J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Sand, sandy clay. Sandplain. IBRA Distribution: ESP, GES Florabase records: 7	Moderate
Grevillea erinacea	Proteaceae	P3	-	Habit: Spindly, prickly, sparingly branched shrub, (0.3-) 0.6-1.8 m high. Flower colour: green-white-cream Flowering period (indicated in green): J F M A M J **J A S O N D** ▲ ▲ Survey (▲) Soils: White, grey or yellow sand, often with lateritic gravel. IBRA Distribution: AVW, GES Florabase records: 36	Moderate

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Hopkinsia anoectocolea	Anarthriaceae	P3	-	Habit: Rhizomatous, tufted perennial, herb, 0.5-1 m high, to 1 m in diameter. Flower colour: brown Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: White or grey sand, often saline. Winter-wet depressions, floodplains, salt-lakes. IBRA Distribution: AVW, GES, SWA Florabase records: 49	Moderate
Stylidium torticarpum	Stylidiaceae	P3	-	Habit: Caespitose perennial, herb, 0.12-0.27 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Sandy clay and clay loam over laterite. Adjacent to creeklines, depressions, and beneath breakaways. IBRA Distribution: AVW, GES, SWA Florabase records: 49	Low

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Styphelia filifolia	Ericaceae	P3	-	Habit: Shrub, to 0.7 m high, to 0.9 m wide. Flower colour: white, cream Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Sand, sandy soil. Swamp, seasonally wet area, drainage line, flat, slopes. IBRA Distribution: GES, SWA Florabase records: 36	Low
Synaphea oulopha	Proteaceae	P3	-	Habit: Compact shrub, ca 0.2 m high. Flower colour: yellow Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Grey sand, gravelly loam, clay. Lateritic breakaways & rises. IBRA Distribution: GES Florabase records: 16	Low

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Triglochin protuberans	Juncaginaceae	P3	-	Habit: Annual, herb, 0.03-0.13 m high. Flower colour: - Flowering period (indicated in green): J F M A M J J A S **O** **N** D ▲ ▲ Survey (▲) Soils: Red loam, grey mud over clay. Winter-wet sites, claypans, near salt lakes, margins of pools. IBRA Distribution: AVW, GES, MUR, YAL Florabase records: 10	Low
Verticordia fragrans	Myrtaceae	P3	-	Habit: Openly branched shrub, 1-3 m high. Flower colour: pink-white Flowering period (indicated in green): J F M A M J J A **S** **O** **N** D ▲ ▲ Survey (▲) Soils: White, grey or yellow sand, clay loam. Low-lying areas, sandplains. IBRA Distribution: GES Florabase records: 29	Moderate

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

Note: Refer to Appendix A for State (SCC; Department of Biodiversity, Conservation and Attractions 2017a) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; CAR – Carnarvon; ESP – Esperance Plains; GAS – Gascoyne; GES – Geraldton Sandplains; JAF – Jarrah Forest; MAL – Mallee; MUR – Murchison; SWA – Swan Coastal Plain; YAL – Yalgoo. Likelihood of occurrence in survey area is based on a Low, Moderate or High ranking.

Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Banksia elegans	Proteaceae	P4	-	Habit: Shrub (with fire-tolerant rootstock, often suckering), 1-4 m high. Flower colour: yellow/green-yellow Flowering period (indicated in green): J F M A M J J A S **O N** D ▲ ▲ Survey (▲) Soils: Yellow, white or red sand. Sandplains, low consolidated dunes. IBRA Distribution: AVW, GES Florabase records: 44	High
Calytrix chrysantha	Myrtaceae	P4	-	Habit: Shrub, 0.3-1.3 m high. Flower colour: yellow Flowering period (indicated in green): **J F** M A M J J A S O N **D** ▲ ▲ Survey (▲) Soils: White, grey or yellow/brown sand. Flats. IBRA Distribution: AVW, GES Florabase records: 38	High
Calytrix eneabbensis	Myrtaceae	P4	-	Habit: Shrub, 0.3-1 m high. Flower colour: purple & pink & yellow Flowering period (indicated in green): J F M A M J **J A S** O N D ▲ ▲ Survey (▲) Soils: White, grey or yellow sand over laterite. Sandplains. IBRA Distribution: GES Florabase records: 31	Moderate

APPENDIX C: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE ARROWSMITH CENTRAL SURVEY AREA

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Species	Family	SCC	FCC	Description and Habitat	Likelihood of Occurrence
Stylidium longitubum	Stylidiaceae	P4	-	Habit: Erect annual (ephemeral), herb, 0.05-0.12 m high. Flower colour: pink Flowering period (indicated in green): J F M A M J J A S O N D ▲ ▲ Survey (▲) Soils: Sandy clay, clay. Seasonal wetlands IBRA Distribution: GES, JAF, SWA Florabase records: 46	Low

APPENDIX D: LOCATION OF VEGETATION SURVEY QUADRATS ESTABLISHED IN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

QUADRAT	LOCATION (GDA94, Zone 50)	
	EASTING (mE)	NORTHING (mN)
AR01	322341	6717023
AR02	323177	6717213
AR03	322848	6717034
AR04	322534	6716868
AR05	322976	6716821
AR06	323295	6717038
AR07	323483	6716804
AR08	323198	6716600
AR09	323366	6716306
AR10	323722	6716428
AR11	323905	6716202
AR12	323667	6716048
AR13	324090	6716009
AR14	323846	6715830
AR15	323971	6715560
AR16	324273	6715814
AR17	322250	6718245
AR18	321605	6717857
AR19	321968	6717520
AR20	322272	6717692
AR21	322596	6717865
AR22	322646	6717225
AR23	322979	6717467
AR24	322668	6716652
AR25	323060	6716131
AR26	323550	6715585
AR27	323671	6715356
AR28	322290	6717549
AR29	322428	6717746
AR30	321938	6718046
AR31	321816	6717679
AR32	322127	6717881
AR33	322440	6718084
AR34	322172	6717241
AR35	322448	6717436
AR36	322770	6717623
AR37	322895	6716397
AR38	323354	6715842
AR39	323906	6715060
AR40	324162	6715315
AR41	324427	6715616
AR141	321209	6718968
AR142	321681	6718934
AR143	322172	6719006
AR144	322631	6719004
AR145	323059	6718990
AR146	323547	6719034
AR147	324014	6719013
AR148	324545	6719020
AR149	324952	6719029
AR150	325584	6719046
AR151	326126	6719047

APPENDIX D: LOCATION OF VEGETATION SURVEY QUADRATS ESTABLISHED IN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

QUADRAT	LOCATION (GDA94, Zone 50)	
	EASTING (mE)	NORTHING (mN)
AR152	326143	6718537
AR153	325617	6718552
AR154	325020	6718542
AR155	324543	6718516
AR156	324016	6718536
AR157	323596	6718507
AR158	323076	6718505
AR159	322619	6718499
AR160	322182	6718498
AR161	321676	6718474
AR162	321155	6718487
AR163	326109	6718057
AR164	325641	6718015
AR165	324976	6718013
AR166	324567	6718014
AR167	324005	6717999
AR168	323502	6717944
AR169	323005	6717997
AR170	322752	6717947
AR171	321431	6718014
AR172	326174	6717564
AR173	325661	6717518
AR174	325031	6717546
AR175	324585	6717536
AR176	324035	6717500
AR177	323559	6717501
AR178	323152	6717481
AR179	326175	6717068
AR180	325669	6717058
AR181	325128	6717038
AR182	324606	6717043
AR183	324068	6717018
AR184	323573	6716980
AR185	326182	6716668
AR186	325640	6716645
AR187	325133	6716575
AR188	324607	6716547
AR189	324089	6716505
AR190	323780	6716670
AR191	325654	6716333
AR192	325145	6716247
AR193	324563	6716220
AR194	324176	6716193
AR195	325188	6716011
AR196	324589	6715904
AR197	324617	6715683
AR198	324032	6714753
AR199	324234	6714515
AR200	324473	6714207
AR201	324727	6713888
AR202	325006	6713555
AR203	325267	6713232

APPENDIX D: LOCATION OF VEGETATION SURVEY QUADRATS ESTABLISHED IN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

QUADRAT	LOCATION (GDA94, Zone 50)	
	EASTING (mE)	NORTHING (mN)
AR204	325466	6713000
AR205	325693	6712704
AR206	325885	6712461
AR207	326073	6712249
AR208	328068	6718944
AR209	328163	6718825
AR210	328111	6718721
AR211	327907	6718787
AR212	327503	6718788
AR213	327104	6718779
AR214	326761	6718782
AR215	326341	6718782
AR216	325901	6717885
AR217	324626	6717812

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED FROM THE FIELD SURVEY WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (DBCA 2019)

Family	Species
Aizoaceae	*Carpobrotus* sp.
Amaranthaceae	*Ptilotus manglesii* *Ptilotus stirlingii* subsp. *stirlingii*
Anarthriaceae	*Hopkinsia anoectocolea* (P3) *Lyginia imberbis*
Apiaceae	*Actinotus leucocephalus* *Xanthosia fruticulosa* *Xanthosia huegelii*
Araliaceae	*Trachymene pilosa*
Asparagaceae	*Laxmannia sessiliflora* subsp. *drummondii* *Lomandra hastilis* *Lomandra* sp. *Thysanotus rectantherus* *Thysanotus* sp. *Thysanotus* sp. (Climbing) *Thysanotus spiniger*
Asteraceae	*Blennospora drummondii* *Gnephosis drummondii* *Gnephosis tenuissima* *Hyalosperma cotula* * *Hypochaeris glabra* *Podolepis capillaris* *Podolepis lessonii* *Podotheca angustifolia* *Podotheca gnaphalioides* *Pogonolepis stricta* *Pterochaeta paniculata* *Siloxerus humifusus* * *Ursinia anthemoides* *Waitzia acuminata* var. *acuminata* *Waitzia acuminata* var. *albicans*
Boryaceae	*Borya* sp.
Campanulaceae	*Isotoma hypocrateriformis* *Isotoma* sp. *Lobelia rhytidosperma* * *Wahlenbergia capensis* *Wahlenbergia gracilenta*
Casuarinaceae	*Allocasuarina campestris* *Allocasuarina humilis* *Allocasuarina microstachya* *Allocasuarina* sp.
Celastraceae	*Stackhousia monogyna*

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED FROM THE FIELD SURVEY WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (DBCA 2019)

Family	Species
Celastraceae (cont.)	*Tripterococcus brunonis*
Centrolepidaceae	*Centrolepis pilosa* *Centrolepis polygyna*
Colchicaceae	*Burchardia congesta*
Crassulaceae	*Crassula colorata*
Cyperaceae	*Caustis dioica* *Lepidosperma apricola* sens. lat. *Lepidosperma scabrum* sens. lat. *Lepidosperma squamatum* sens. lat. *Lepidosperma tenue* sens. lat. *Lepidosperma* sp. *Mesomelaena pseudostygia* *Mesomelaena tetragona* *Schoenus brevisetis* *Schoenus clandestinus* *Schoenus grandiflorus* *Schoenus latitans* *Schoenus nanus* *Schoenus pleiostemoneus* *Schoenus* sp.
Dilleniaceae	*Hibbertia acerosa* *Hibbertia aurea* *Hibbertia crassifolia* *Hibbertia hypericoides* subsp. *hypericoides* *Hibbertia spicata* *Hibbertia subvaginata* *Hibbertia* sp.
Droseraceae	*Drosera eneabba* *Drosera erythrorhiza* *Drosera* sp. *Drosera* sp. (climbing)
Ecdeiocoleaceae	*Ecdeiocolea monostachya* *Georgeantha hexandra*
Ericaceae	*Andersonia heterophylla* *Conostephium preissii* *Leucopogon inflexus* *Leucopogon oldfieldii* *Leucopogon* sp. *Leucopogon* sp. Northern ciliate (R. Davis 3393) *Lysinema pentapetalum* *Styphelia microdonta* *Styphelia planifolia* *Styphelia xerophylla* *Styphelia* sp.

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED FROM THE FIELD SURVEY WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (DBCA 2019)

Family	Species
Ericaceae (cont.)	Ericaceae sp.
Euphorbiaceae	*Monotaxis bracteata* *Monotaxis grandiflora*
Fabaceae	*Acacia blakelyi* *Acacia dilatata* *Acacia lasiocarpa* *Acacia latipes* subsp. *latipes* *Acacia pulchella* *Acacia saligna* *Acacia spathulifolia* *Acacia stenoptera* *Acacia* sp. *Daviesia divaricata* subsp. *divaricata* *Daviesia* ?*hakeoides* *Daviesia nudiflora* *Daviesia pedunculata* *Daviesia podophylla* *Daviesia triflora* *Gompholobium tomentosum* *Isotropis cuneifolia* *Isotropis* sp. *Jacksonia floribunda* *Jacksonia* ?*nutans* *Jacksonia hakeoides* *Jacksonia* sp. *Leptosema aphyllum* Fabaceae sp.
Goodeniaceae	*Dampiera carinata* *Dampiera lindleyi* *Dampiera oligophylla* *Dampiera spicigera* *Dampiera* sp. *Goodenia coerulea* *Goodenia pulchella* subsp. Coastal Plain A (M. Hislop 634) *Goodenia reinwardtii* *Lechenaultia linarioides* *Scaevola canescens* *Scaevola phlebopetala* *Scaevola repens* subsp. Northern Sandplains (R.J. Cranfield & P.J. Spencer 8445)
Gyrostemonaceae	*Gyrostemon* ?*subnudus*
Haemodoraceae	*Anigozanthos humilis* *Conostylis aculeata* *Conostylis aculeata* subsp. *bromelioides* *Conostylis aurea* *Conostylis candicans* subsp. *calcicola* *Conostylis candicans* subsp. *candicans*

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED FROM THE FIELD SURVEY WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (DBCA 2019)

Family	Species
Haemodoraceae (cont.)	*Conostylis candicans* subsp. *procumbens* *Conostylis canteriata* *Conostylis resinosa* *Conostylis* sp.
Haloragaceae	*Gonocarpus pithyoides*
Hemerocallidaceae	*Arnocrinum preissii* *Corynotheca micrantha* var. *micrantha* *Dianella revoluta* *Johnsonia pubescens* subsp. *pubescens* *Tricoryne* ?*humilis* *Tricoryne* sp.
Iridaceae	*Patersonia occidentalis*
Lamiaceae	*Hemiandra* sp. Eneabba (H. Demarz 3687) (P3) *Quoya verbascina*
Lauraceae	*Cassytha flava* *Cassytha glabella forma bicallosa* *Cassytha pomiformis* *Cassytha* sp.
Loganiaceae	*Orianthera spermacocea* *Phyllangium divergens*
Loranthaceae	*Nuytsia floribunda*
Malvaceae	*Guichenotia macrantha* *Guichenotia* sp. *Lasiopetalum* sp. Coorow (E. Ried 101)
Montiaceae	*Calandrinia* sp.
Myrtaceae	*Babingtonia camphorosmae* *Babingtonia grandiflora* *Beaufortia elegans* *Calothamnus quadrifidus* subsp. *angustifolius* *Calothamnus sanguineus* *Calytrix chrysantha* (P4) *Calytrix depressa* *Calytrix sapphirina* *Calytrix strigosa* *Calytrix* sp. *Darwinia sanguinea* *Darwinia speciosa* *Eremaea asterocarpa* *Eremaea beaufortioides* var. *beaufortioides* *Eremaea beaufortioides* var. *lachnosanthe* *Eremaea ectadioclada* *Eremaea fimbriata*

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED FROM THE FIELD SURVEY WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (DBCA 2019)

Family	Species
Myrtaceae (cont.)	*Eremaea violacea* subsp. *violacea* *Eremaea* sp. *Eucalyptus todtiana* *Hypocalymma gardneri* (P3) *Leptospermum oligandrum* *Leptospermum spinescens* *Melaleuca acutifolia* *Melaleuca concreta* *Melaleuca lateritia* *Melaleuca leuropoma* *Melaleuca rhaphiophylla* *Melaleuca ryeae* *Melaleuca trichophylla* *Melaleuca* sp. *Pileanthus filifolius* *Scholtzia laxiflora* *Verticordia densiflora* var. *densiflora* *Verticordia grandis* *Verticordia nobilis* *Verticordia ovalifolia* *Verticordia* sp.
Olacaceae	*Olax benthamiana*
Orchidaceae	Orchidaceae sp.
Phyllanthaceae	*Poranthera microphylla*
Poaceae	* *Aira caryophyllea* *Amphipogon turbinatus* *Austrostipa* ?*crinita* *Austrostipa elegantissima* *Austrostipa hemipogon* *Austrostipa macalpinei* *Austrostipa* sp. * *Ehrharta calycina* *Neurachne alopecuroidea* Poaceae sp.
Primulaceae	* *Lysimachia arvensis*
Proteaceae	*Adenanthos cygnorum* *Banksia attenuata* *Banksia candolleana* *Banksia elegans* (P4) *Banksia hookeriana* *Banksia leptophylla* var. *melletica* *Banksia menziesii* *Banksia nivea* *Banksia prionotes* *Banksia sessilis* *Banksia shuttleworthiana*

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED FROM THE FIELD SURVEY WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (DBCA 2019)

Family	Species
Proteaceae (cont.)	*Banksia* sp. *Conospermum triplinervium* *Conospermum unilaterale* *Grevillea eriostachya* *Grevillea leptopoda* (P3) *Grevillea* ?*umbellulata* *Hakea candolleana* *Hakea costata* *Hakea eneabba* *Hakea incrassata* *Hakea lissocarpha* *Hakea polyanthema* *Hakea prostrata* *Hakea psilorrhyncha* *Hakea ruscifolia* *Hakea trifurcata* *Petrophile brevifolia* *Petrophile drummondii* *Petrophile macrostachya* *Petrophile scabriuscula* *Stirlingia latifolia* *Synaphea spinulosa* subsp. *spinulosa* *Synaphea* sp. *Xylomelum angustifolium*
Restionaceae	*Alexgeorgea nitens* *Chordifex sinuosus* *Desmocladus parthenicus* *Desmocladus semiplanus* *Lepidobolus preissianus* subsp. *preissianus* *Lepidobolus* sp. Restionaceae sp.
Rhamnaceae	*Cryptandra myriantha* *Cryptandra* sp. *Stenanthemum notiale* subsp. *notiale*
Rubiaceae	*Opercularia vaginata*
Rutaceae	*Boronia ramosa* subsp. *anethifolia*
Santalaceae	*Santalum acuminatum*
Sapindaceae	*Dodonaea pinifolia*
Stylidiaceae	*Levenhookia pusilla* *Levenhookia stipitata* *Stylidium adpressum* *Stylidium burbidgeanum* *Stylidium crossocephalum* *Stylidium diuroides* subsp. *paucifoliatum* *Stylidium kalbarriense*

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED FROM THE FIELD SURVEY WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

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Family	Species
Stylidiaceae (cont.)	*Stylidium maitlandianum* *Stylidium purpureum* *Stylidium repens* *Stylidium* sp.
Thymelaeaceae	*Pimelea angustifolia* *Pimelea leucantha* *Pimelea* sp.
Xanthorrhoeaceae	*Xanthorrhoea drummondii*
Zamiaceae	*Macrozamia fraseri*

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

SPECIES	AR01	AR02	AR03	AR04	AR05	AR06	AR07	AR08	AR09	AR10	AR11	AR12	AR13	AR14	AR17	AR18	AR19	AR20	AR21	AR22	AR23	AR24	AR25	AR26	AR27	AR28	AR29	AR30	AR31	AR32	AR33	AR34	AR35	AR36	AR37	AR38	AR39	AR40	AR41	AR141
Acacia blakelyi	X		X	X									X				X	X	X	X	X		X	X					X	X	X	X	X	X				X		X
Acacia dilatata			X																X																	X				
Acacia lasiocarpa																																								
Acacia latipes subsp. *latipes*			X	X				X		X	X	X	X	X	X	X				X					X	X		X	X		X				X		X		X	X
Acacia pulchella														X									X	X	X													X	X	
Acacia saligna																										X														
Acacia spathulifolia			X																																				
Acacia stenoptera																																								
Acacia sp.																																								
Actinotus leucocephalus	X																	X	X							X	X												
Adenanthos cygnorum																																X								
* *Aira caryophyllea*								X							X											X	X	X												
Alexgeorgea nitens		X	X		X	X				X				X					X	X		X		X						X			X				X		X	
Allocasuarina campestris		X	X	X	X					X	X				X	X			X						X											X			X	
Allocasuarina humilis		X	X	X	X								X		X		X			X	X			X					X		X								X
Allocasuarina microstachya								X			X	X																							X					
Allocasuarina sp.																																								
Amphipogon turbinatus		X			X	X											X			X				X															
Andersonia heterophylla																																								
Anigozanthos humilis	X		X	X	X		X		X						X	X	X						X	X							X	X						X		
Arnocrinum preissii																																	X							
Austrostipa ?*crinita*																																								
Austrostipa elegantissima													X																											
Austrostipa hemipogon																																								
Austrostipa macalpinei		X		X			X				X	X					X	X	X			X		X			X	X			X					X	X	X
Austrostipa sp.		X	X	X			X	X	X	X	X	X	X		X	X				X	X			X		X		X	X	X		X	X	X	X		X	X	X	
Babingtonia camphorosmae																																								
Babingtonia grandiflora																									X															
Banksia attenuata		X			X	X				X			X		X					X	X			X	X			X	X	X	X	X	X	X		X			
Banksia candolleana			X				X		X																						X								
Banksia elegans (P4)																																				X				
Banksia hookeriana														X																										
Banksia leptophylla var. *melletica*	X		X	X	X											X	X	X	X		X	X	X							X	X	X	X		X			X	X
Banksia menziesii										X																						X		X		X				
Banksia nivea	X			X	X	X			X	X		X		X		X			X				X		X										X		X		X	
Banksia prionotes																									X			X	X	X			X						
Banksia sessilis																																								
Banksia shuttleworthiana																									X												X			
Banksia sp.																																								
Beaufortia elegans											X			X		X	X												X			X					X			X
Blennospora drummondii																X																								
Boronia ramosa subsp. *anethifolia*	X	X		X			X	X					X		X		X	X		X				X											X		X		X
Borya sp.																																								
Burchardia congesta		X						X	X	X		X		X		X							X	X			X	X		X	X		X		X				
Calandrinia sp.																										X														
Calothamnus quadrifidus subsp. *angustifolius*			X					X		X	X	X		X							X				X	X	X	X		X			X		X		X	X	
Calothamnus sanguineus	X	X		X					X	X		X		X	X								X						X							X	X	X	X
Calytrix chrysantha (P4)				X		X													X		X								X										
Calytrix depressa							X														X							X	X						X					
Calytrix sapphirina					X															X		X	X										X			X		X	
Calytrix strigosa	X	X	X		X							X			X			X		X			X					X	X	X	X		X				X		
Calytrix sp.																																								
Carpobrotus sp.																																								
Cassytha flava	X	X	X		X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X		X	X										X	X	X	X		
Cassytha glabella forma bicallosa																																								

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

	SPECIES	AR01	AR02	AR03	AR04	AR05	AR06	AR07	AR08	AR09	AR10	AR11	AR12	AR13	AR14	AR17	AR18	AR19	AR20	AR21	AR22	AR23	AR24	AR25	AR26	AR27	AR28	AR29	AR30	AR31	AR32	AR33	AR34	AR35	AR36	AR37	AR38	AR39	AR40	AR41	AR141
	Cassytha pomiformis																																								X
	Cassytha sp.				X											X	X											X	X	X	X	X	X	X	X						
	Caustis dioica				X					X		X																X													
	Centrolepis pilosa	X	X					X	X					X		X	X			X	X		X			X	X			X		X	X	X					X		
	Centrolepis polygyna															X				X																					
	Chordifex sinuosus					X	X					X			X						X					X								X		X			X		
	Conospermum triplinervium	X	X	X	X		X	X	X	X	X			X	X	X	X		X	X	X					X			X	X	X	X		X		X		X	X	
	Conospermum unilaterale																								X														X	X	
	Conostephium preissii																																								
	Conostylis aculeata																																								
	Conostylis aculeata subsp. *bromelioides*																			X																					
	Conostylis aurea	X				X	X			X				X	X						X	X	X		X	X															
	Conostylis candicans subsp. *calcicola*		X		X	X																		X					X	X		X	X	X	X						
	Conostylis candicans subsp. *candicans*																																								X
	Conostylis candicans subsp. *procumbens*	X					X									X		X	X		X						X														
	Conostylis canteriata																																								
	Conostylis resinosa			X				X	X			X				X	X												X	X	X	X	X	X		X			X		
	Conostylis sp.																																								
	Corynotheca micrantha var. *micrantha*																																								
	Crassula colorata		X															X							X		X	X					X							
	Cryptandra myriantha																																								
	Cryptandra sp.																					X																			
	Dampiera carinata																																								X
	Dampiera lindleyi														X																										
	Dampiera oligophylla										X																														
	Dampiera spicigera					X	X		X		X																		X							X				
	Dampiera sp.																		X	X			X																	
	Darwinia sanguinea																																								
	Darwinia speciosa																																								
	Daviesia divaricata subsp. *divaricata*		X			X	X		X			X				X							X						X	X	X	X				X		X		X	
	Daviesia ?*hakeoides*																																								X
	Daviesia nudiflora						X			X	X	X	X			X					X															X		X	X	X	
	Daviesia pedunculata																																								
	Daviesia podophylla									X	X		X												X											X			X		
	Daviesia triflora		X	X		X	X		X					X	X	X					X				X	X					X	X	X	X	X		X			
	Desmocladus parthenicus																							X																
	Desmocladus semiplanus					X														X					X															
	Dianella revoluta											X				X																								
	Dodonaea pinifolia																											X												
	Drosera eneabba	X	X			X	X			X	X					X			X					X		X			X	X	X			X		X				
	Drosera erythrorhiza						X								X							X																		
	Drosera sp.	X														X																							X		
	Drosera sp. (climbing)										X					X						X				X															
	Ecdeiocolea monostachya	X	X	X			X		X	X		X	X		X											X			X		X		X	X		X		X			
*	*Ehrharta calycina*																																								
	Eremaea asterocarpa																	X																							
	Eremaea beaufortioides var. *beaufortioides*		X	X	X	X		X		X		X		X		X		X	X	X	X		X	X	X	X			X	X	X	X	X	X		X	X	X	X		
	Eremaea beaufortioides var. *lachnosanthe*																																						X		
	Eremaea ectadioclada		X			X					X			X		X					X				X							X	X		X		X		X		X
	Eremaea fimbriata																																								
	Eremaea sp.																																								
	Eremaea violacea subsp. *violacea*	X		X			X	X	X	X		X				X					X				X	X			X	X				X	X		X	X	X	
	Ericaceae sp.																																								
	Eucalyptus todtiana	X	X				X	X	X	X		X		X		X		X		X			X		X	X			X		X	X				X		X		X
	Fabaceae sp.																			X																					

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

	SPECIES	AR01	AR02	AR03	AR04	AR05	AR06	AR07	AR08	AR09	AR10	AR11	AR12	AR13	AR14	AR17	AR18	AR19	AR20	AR21	AR22	AR23	AR24	AR25	AR26	AR27	AR28	AR29	AR30	AR31	AR32	AR33	AR34	AR35	AR36	AR37	AR38	AR39	AR40	AR41	AR141
	Georgeantha hexandra																																								
	Gnephosis drummondii																																								
	Gnephosis tenuissima						X	X					X				X											X							X						
	Gompholobium tomentosum										X			X		X						X	X		X	X														
	Gonocarpus pithyoides							X	X														X																		
	Goodenia coerulea																										X	X													
	Goodenia pulchella subsp. *Coastal Plain A* (M. Hislop 634)																X		X			X		X				X			X									
	Goodenia reinwardtii																											X												
	Grevillea ?umbellulata																																								
	Grevillea eriostachya						X																																		
	Grevillea leptopoda (P3)																																								
	Guichenotia macrantha																																								
	Guichenotia sp.																																								
	Gyrostemon ?subnudus									X																															
	Hakea candolleana						X					X										X												X				X			
	Hakea costata																					X				X														
	Hakea eneabba																									X														
	Hakea incrassata								X				X																								X				
	Hakea lissocarpha												X																												
	Hakea polyanthema	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X			X		X			X		X		X	X		X	X	X	X	X	X
	Hakea prostrata																																					X			
	Hakea psilorrhyncha																						X			X				X										
	Hakea ruscifolia																																								
	Hakea trifurcata																																								
	Hemiandra sp. Eneabba (H. Demarz 3687) (P3)																				X		X		X											X				X	
	Hibbertia acerosa				X			X														X		X																
	Hibbertia aurea																																								
	Hibbertia crassifolia			X		X	X			X	X				X	X								X	X				X						X			X	X	
	Hibbertia hypericoides subsp. *hypericoides*		X				X	X	X	X	X	X	X	X	X	X	X	X						X		X			X	X		X	X		X	X		X	X	X	X
	Hibbertia sp.																																								
	Hibbertia spicata	X									X						X					X		X																
	Hibbertia subvaginata																	X			X		X		X										X					
	Hopkinsia anoectocolea (P3)																										X	X												
	Hyalosperma cotula						X			X									X			X		X																
	Hypocalymma gardneri (P3)																																								
*	*Hypochaeris glabra*																										X	X													
	Isotoma hypocrateriformis			X			X	X	X	X			X			X	X					X		X			X	X	X	X			X		X		X		X		
	Isotoma sp.																																								
	Isotropis cuneifolia	X		X	X		X			X		X		X		X	X		X	X		X	X	X	X	X			X		X				X	X	X	X		
	Isotropis sp.																																								
	Jacksonia floribunda																																								
	Jacksonia hakeoides	X	X	X	X		X		X	X	X	X			X		X	X	X	X	X				X		X	X		X	X	X	X	X	X	X	X		X	X	X
	Jacksonia ?nutans									X														X		X															
	Jacksonia sp.																																								
	Johnsonia pubescens subsp. *pubescens*					X																X																		
	Lasiopetalum sp. Coorow (E. Ried 101)																																								
	Laxmannia sessiliflora subsp. *drummondii*	X						X		X	X						X		X	X		X		X							X	X	X			X				
	Lechenaultia linarioides																																								
	Lepidobolus preissianus subsp. *preissianus*	X					X	X		X		X	X			X	X		X		X	X		X		X			X							X	X	X		X
	Lepidobolus sp.		X	X	X				X																						X	X		X						
	Lepidosperma apricola sens. lat.																																								
	Lepidosperma scabrum sens. lat.														X																										
	Lepidosperma sp.											X		X																											
	Lepidosperma squamatum sens. lat.																																								
	Lepidosperma tenue sens. lat.			X										X		X											X			X		X									

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

SPECIES	AR01	AR02	AR03	AR04	AR05	AR06	AR07	AR08	AR09	AR10	AR11	AR12	AR13	AR14	AR17	AR18	AR19	AR20	AR21	AR22	AR23	AR24	AR25	AR26	AR27	AR28	AR29	AR30	AR31	AR32	AR33	AR34	AR35	AR36	AR37	AR38	AR39	AR40	AR41	AR141
Leptosema aphyllum																																								
Leptospermum oligandrum		X	X		X	X		X	X	X	X	X		X											X		X			X			X	X	X	X	X	X	
Leptospermum spinescens		X	X		X	X						X		X								X		X	X					X		X				X	X	X	
Leucopogon inflexus					X		X				X				X								X	X	X					X						X	X	X	
Leucopogon oldfieldii																																								
Leucopogon sp.						X			X													X																		
Leucopogon sp. Northern ciliate (R. Davis 3393)	X				X	X											X			X			X		X														
Levenhookia pusilla		X				X		X		X					X						X		X		X			X												
Levenhookia stipitata	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X		X		X		X		X	X			X		X		X		X	X		
Lobelia rhytidosperma			X			X	X	X	X		X				X				X				X					X				X			X					
Lomandra hastilis		X			X								X									X		X																
Lomandra sp.																																								
Lyginia imberbis		X			X			X	X	X									X												X		X		X				
* *Lysimachia arvensis*																										X	X													
Lysinema pentapetalum															X								X		X									X				X		
Macrozamia fraseri	X		X														X												X	X		X							
Melaleuca acutifolia																																								
Melaleuca concreta																											X													
Melaleuca lateritia																										X	X													
Melaleuca leuropoma	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X
Melaleuca rhaphiophylla																										X														
Melaleuca ryeae																																								
Melaleuca trichophylla														X									X																	
Melaleuca sp.																																								
Mesomelaena pseudostygia	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X	X		X	X	X			X	X	X	X	X	X	X	X	X		X	X	X
Mesomelaena tetragona																																								
Monotaxis bracteata																																								
Monotaxis grandiflora		X				X			X		X	X													X				X		X									
Neurachne alopecuroidea	X		X	X	X	X	X			X			X	X	X	X	X	X	X	X	X	X			X			X	X	X	X	X			X	X	X		
Nuytsia floribunda																																								
Olax benthamiana																																								
Opercularia vaginata						X				X	X	X	X											X			X													
Orchidaceae sp.														X																										
Orianthera spermacocea											X			X																										
Patersonia occidentalis																										X	X													
Petrophile brevifolia		X	X			X	X	X	X	X	X	X		X	X				X			X		X			X		X		X	X			X		X	X		
Petrophile drummondii					X															X																		X		
Petrophile macrostachya	X	X	X		X	X		X	X	X	X		X		X	X		X		X		X	X		X				X	X	X	X		X	X		X		X
Petrophile scabriuscula																X							X															X		
Phyllangium divergens					X								X									X	X	X			X													
Pileanthus filifolius	X	X	X		X	X	X		X	X	X	X	X		X			X		X		X	X	X				X	X	X	X	X			X	X		X	X	
Pimelea angustifolia			X		X			X		X	X	X	X		X									X	X										X				X	
Pimelea leucantha																																								
Pimelea sp.																																								
Poaceae sp.																																								
Podolepis capillaris																										X	X													
Podolepis lessonii	X						X												X							X													
Podotheca angustifolia																																								
Podotheca gnaphalioides	X						X				X	X	X		X	X	X		X	X		X				X		X	X		X	X							
Pogonolepis stricta																																								
Poranthera microphylla		X	X								X		X		X			X	X	X	X							X	X	X									
Pterochaeta paniculata								X				X			X				X									X	X			X		X					
Ptilotus manglesii																			X								X													
Ptilotus stirlingii subsp. *stirlingii*																																								
Quoya verbascina																																								

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

	SPECIES	AR01	AR02	AR03	AR04	AR05	AR06	AR07	AR08	AR09	AR10	AR11	AR12	AR13	AR14	AR17	AR18	AR19	AR20	AR21	AR22	AR23	AR24	AR25	AR26	AR27	AR28	AR29	AR30	AR31	AR32	AR33	AR34	AR35	AR36	AR37	AR38	AR39	AR40	AR41	AR141
	Restionaceae sp.																											X													
	Santalum acuminatum																																								
	Scaevola canescens						X			X	X				X								X			X															X
	Scaevola phlebopetala																														X			X				X			
	Scaevola repens subsp. *Northern Sandplains* (R.J. Cranfield & P.J. Spencer 8445)		X	X					X			X	X			X	X				X								X	X	X	X	X		X		X			
	Schoenus brevisetis							X	X																											X				X	
	Schoenus clandestinus	X					X			X				X	X		X					X		X		X						X		X						
	Schoenus grandiflorus																																								
	Schoenus latitans		X	X				X	X			X	X																							X				X	
	Schoenus nanus	X		X	X		X	X			X	X	X	X	X	X	X	X	X	X		X		X		X			X	X		X				X		X			
	Schoenus pleiostemoneus									X	X					X				X	X	X		X		X									X						
	Schoenus sp.																														X										
	Scholtzia laxiflora	X	X	X	X	X	X	X			X		X	X	X	X			X						X	X					X	X	X	X		X		X		X	X
	Siloxerus humifusus																			X																				
	Stackhousia monogyna				X			X																																	
	Stenanthemum notiale subsp. *notiale*						X	X			X	X		X		X													X	X	X	X				X					
	Stirlingia latifolia		X			X	X	X			X								X					X	X				X		X		X		X			X			
	Stylidium adpressum	X	X	X			X	X	X		X					X			X		X								X		X						X			
	Stylidium burbidgeanum																																								
	Stylidium crossocephalum						X				X			X	X											X						X			X				X	X	
	Stylidium diuroides subsp. *paucifoliatum*																																								
	Stylidium kalbarriense		X	X			X					X	X			X	X		X					X	X	X				X	X			X			X		X		
	Stylidium maitlandianum														X																										
	Stylidium purpureum	X	X				X	X		X						X						X		X	X				X	X		X		X	X	X				
	Stylidium repens				X	X	X	X		X	X	X	X		X	X	X	X	X			X	X	X	X	X			X	X	X		X		X	X	X	X	X		
	Stylidium sp.																																								
	Styphelia microdonta			X						X	X																									X				X	
	Styphelia planifolia																																					X			
	Styphelia xerophylla					X								X		X		X	X		X		X		X	X				X		X	X		X	X	X			
	Styphelia sp.																																								
	Synaphea sp.																																								
	Synaphea spinulosa subsp. *spinulosa*			X		X	X																	X					X	X		X		X						
	Thysanotus rectantherus						X							X	X	X					X								X	X	X	X		X	X				X	
	Thysanotus sp.																												X	X										
	Thysanotus sp. (Climbing)															X				X								X												
	Thysanotus spiniger						X	X	X	X	X	X	X																							X					
	Trachymene pilosa	X	X	X	X					X			X	X		X	X	X	X	X	X		X	X	X		X	X	X	X			X			X			X	
	Tricoryne ?humilis					X																														X				
	Tricoryne sp.																																								
	Tripterococcus brunonis																																								
*	*Ursinia anthemoides*	X			X			X						X			X	X		X						X	X			X			X					X		
	Verticordia densiflora var. *densiflora*	X		X		X				X	X	X	X	X	X	X	X		X	X			X		X	X		X	X	X	X	X	X		X			X	X	X
	Verticordia grandis		X			X	X		X	X	X			X		X				X					X			X		X	X	X		X				X		
	Verticordia nobilis																							X																	
	Verticordia ovalifolia																								X												X				
	Verticordia sp.																																								
*	*Wahlenbergia capensis*	X	X											X				X																							
	Wahlenbergia gracilenta		X		X																				X							X								
	Waitzia acuminata var. *acuminata*																																								
	Waitzia acuminata var. *albicans*		X		X			X	X			X	X				X	X						X				X		X					X			X		
	Xanthorrhoea drummondii		X	X					X				X			X		X								X				X		X	X							
	Xanthosia fruticulosa				X							X	X																												
	Xanthosia huegelii					X		X																		X		X											X		
	Xylomelum angustifolium							X									X									X	X								X				X	X	

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

SPECIES	AR142	AR143	AR144	AR145	AR146	AR147	AR148	AR149	AR15	AR150	AR151	AR152	AR153	AR154	AR155	AR156	AR157	AR158	AR159	AR16	AR160	AR161	AR162	AR163	AR164	AR165	AR166	AR167	AR168	AR169	AR170	AR171	AR172	AR173	AR174	AR175	AR176	AR177	AR178
Acacia blakelyi	X														X			X				X		X	X	X					X		X		X			X	X
Acacia dilatata																															X								
Acacia lasiocarpa						X							X			X																							
Acacia latipes subsp. *latipes*	X		X	X						X	X	X			X				X					X	X	X		X											
Acacia pulchella				X								X														X			X		X	X	X						
Acacia saligna																									X														
Acacia spathulifolia																																							
Acacia stenoptera																																							
Acacia sp.																																							
Actinotus leucocephalus																																							
Adenanthos cygnorum																							X																
* *Aira caryophyllea*											X																							X				X	
Alexgeorgea nitens					X	X			X							X	X			X									X					X			X	
Allocasuarina campestris				X											X					X																		
Allocasuarina humilis	X	X		X	X	X		X	X	X		X	X	X		X	X				X					X		X		X			X	X		X		X	X
Allocasuarina microstachya																																							
Allocasuarina sp.													X																										
Amphipogon turbinatus																				X								X										
Andersonia heterophylla									X																														
Anigozanthos humilis									X																														
Arnocrinum preissii																																							
Austrostipa ?*crinita*																		X					X															
Austrostipa elegantissima																																							
Austrostipa hemipogon																																							
Austrostipa macalpinei			X	X			X			X																						X					X	
Austrostipa sp.																																							
Babingtonia camphorosmae											X																												
Babingtonia grandiflora																															X								
Banksia attenuata	X	X	X		X				X				X					X		X	X			X									X			X			X
Banksia candolleana													X	X	X					X					X		X								X	X			
Banksia elegans (P4)																																							
Banksia hookeriana			X																																				
Banksia leptophylla var. *melletica*		X			X				X	X							X	X				X	X						X	X	X	X	X				X	X
Banksia menziesii		X			X												X																					
Banksia nivea		X		X			X	X		X		X			X	X		X		X						X	X	X	X	X	X	X			X				
Banksia prionotes	X								X															X		X								X				X	
Banksia sessilis																																							
Banksia shuttleworthiana						X	X	X						X	X												X	X	X										
Banksia sp.																																							
Beaufortia elegans			X					X		X		X				X	X			X			X				X	X				X			X				
Blennospora drummondii																																							
Boronia ramosa subsp. *anethifolia*																																		X					
Borya sp.																																							
Burchardia congesta			X	X			X				X																		X		X	X					X	
Calandrinia sp.																																							
Calothamnus quadrifidus subsp. *angustifolius*		X										X							X			X											X					
Calothamnus sanguineus	X				X	X	X				X	X	X	X	X	X											X			X			X	X	X	X		X
Calytrix chrysantha (P4)		X	X			X																			X					X	X		X		X		X	X
Calytrix depressa																											X			X	X								
Calytrix sapphirina	X				X																										X		X					X
Calytrix strigosa			X								X							X	X							X						X				X		
Calytrix sp.																X																							
Carpobrotus sp.																					X																		
Cassytha flava									X																														
Cassytha glabella forma bicallosa	X	X	X	X		X				X		X	X	X	X	X	X	X			X				X	X		X	X		X	X	X	X	X		X		X

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

	SPECIES	AR142	AR143	AR144	AR145	AR146	AR147	AR148	AR149	AR15	AR150	AR151	AR152	AR153	AR154	AR155	AR156	AR157	AR158	AR159	AR16	AR160	AR161	AR162	AR163	AR164	AR165	AR166	AR167	AR168	AR169	AR170	AR171	AR172	AR173	AR174	AR175	AR176	AR177	AR178
	Cassytha pomiformis	X	X			X																						X			X									
	Cassytha sp.						X		X		X			X	X	X	X																							
	Caustis dioica																															X								
	Centrolepis pilosa							X				X																												
	Centrolepis polygyna																																							
	Chordifex sinuosus				X	X	X		X	X							X	X											X				X		X		X			X
	Conospermum triplinervium		X	X		X	X	X	X				X	X	X	X	X	X	X		X	X	X		X	X		X	X		X		X	X		X	X	X	X	
	Conospermum unilaterale																																							
	Conostephium preissii																				X																			
	Conostylis aculeata						X																									X								
	Conostylis aculeata subsp. *bromelioides*																																							
	Conostylis aurea				X	X				X			X		X		X	X			X					X	X	X		X				X			X			
	Conostylis candicans subsp. *calcicola*		X				X			X								X																						
	Conostylis candicans subsp. *candicans*	X				X				X	X			X		X	X		X			X							X	X					X	X				X
	Conostylis candicans subsp. *procumbens*																																							
	Conostylis canteriata													X																										
	Conostylis resinosa																																							
	Conostylis sp.																																							
	Corynotheca micrantha var. *micrantha*																																							
	Crassula colorata					X																																		
	Cryptandra myriantha																																							
	Cryptandra sp.																																							
	Dampiera carinata								X																				X											
	Dampiera lindleyi																																							
	Dampiera oligophylla																																							
	Dampiera spicigera											X																	X											
	Dampiera sp.													X																										
	Darwinia sanguinea																																			X				
	Darwinia speciosa																	X																						
	Daviesia divaricata subsp. *divaricata*		X	X						X						X		X		X	X	X	X				X						X				X	X	
	Daviesia ?*hakeoides*	X				X												X		X	X		X					X	X	X					X				
	Daviesia nudiflora		X		X	X	X	X	X	X	X	X	X		X	X	X	X		X	X							X		X					X		X		
	Daviesia pedunculata						X		X		X								X																					
	Daviesia podophylla									X																				X	X									
	Daviesia triflora						X			X	X						X				X		X																	
	Desmocladus parthenicus																							X																
	Desmocladus semiplanus					X				X							X				X																			
	Dianella revoluta																																				X			
	Dodonaea pinifolia																																							
	Drosera eneabba					X				X			X					X			X		X						X					X		X		X	X	
	Drosera erythrorhiza																				X																			
	Drosera sp.						X				X																													
	Drosera sp. (climbing)															X															X									
	Ecdeiocolea monostachya			X	X		X	X	X		X	X	X	X	X	X				X			X		X	X	X		X					X	X		X	X		
*	*Ehrharta calycina*																																							
	Eremaea asterocarpa																																							
	Eremaea beaufortioides var. *beaufortioides*	X				X	X			X							X	X	X	X	X	X								X	X		X		X		X	X	
	Eremaea beaufortioides var. *lachnosanthe*																																X							
	Eremaea ectadioclada	X				X	X			X	X						X				X							X	X	X				X	X	X		X	
	Eremaea fimbriata																																					X		
	Eremaea sp.																																							
	Eremaea violacea subsp. *violacea*	X	X	X	X		X	X	X	X		X	X		X	X	X	X	X		X	X	X			X	X	X	X				X	X			X		
	Ericaceae sp.																																							
	Eucalyptus todtiana							X			X			X		X	X		X			X	X			X							X	X	X	X		X	X	X
	Fabaceae sp.																																							

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

	SPECIES	AR142	AR143	AR144	AR145	AR146	AR147	AR148	AR149	AR15	AR150	AR151	AR152	AR153	AR154	AR155	AR156	AR157	AR158	AR159	AR16	AR160	AR161	AR162	AR163	AR164	AR165	AR166	AR167	AR168	AR169	AR170	AR171	AR172	AR173	AR174	AR175	AR176	AR177	AR178
	Georgeantha hexandra																																							
	Gnephosis drummondii																																							
	Gnephosis tenuissima											X																												
	Gompholobium tomentosum			X		X											X					X												X	X					
	Gonocarpus pithyoides																																							
	Goodenia coerulea				X																																			
	Goodenia pulchella subsp. *Coastal Plain A* (M. Hislop 634)																																							
	Goodenia reinwardtii																							X									X							
	Grevillea ?umbellulata																																							
	Grevillea eriostachya																																			X				
	Grevillea leptopoda (P3)																																							
	Guichenotia macrantha																																							
	Guichenotia sp.																																							
	Gyrostemon ?subnudus																																							
	Hakea candolleana								X			X																												
	Hakea costata				X																			X								X	X	X					X	
	Hakea eneabba																									X						X								
	Hakea incrassata																																							
	Hakea lissocarpha																										X													
	Hakea polyanthema	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Hakea prostrata																																							
	Hakea psilorrhyncha																X		X		X																				
	Hakea ruscifolia																													X										
	Hakea trifurcata																																						X	
	Hemiandra sp. Eneabba (H. Demarz 3687) (P3)	X	X			X	X		X	X								X				X								X									
	Hibbertia acerosa																																						X	
	Hibbertia aurea																																							
	Hibbertia crassifolia		X	X					X	X			X	X	X			X			X	X	X						X	X	X					X			X
	Hibbertia hypericoides subsp. *hypericoides*	X		X	X		X	X	X	X	X		X				X			X	X					X	X	X	X	X		X	X	X	X	X	X	X	X
	Hibbertia sp.																																							
	Hibbertia spicata																																							
	Hibbertia subvaginata															X								X																X
	Hopkinsia anoectocolea (P3)																																							
	Hyalosperma cotula				X			X	X		X	X	X							X			X		X	X	X								X		X			
	Hypocalymma gardneri (P3)	X															X											X												
*	*Hypochaeris glabra*																																							
	Isotoma hypocrateriformis											X																												
	Isotoma sp.																																							
	Isotropis cuneifolia																														X									X
	Isotropis sp.																																							
	Jacksonia floribunda																																	X						
	Jacksonia hakeoides		X	X	X		X			X	X		X		X		X		X	X	X		X		X	X	X	X	X		X	X	X		X				X
	Jacksonia ?nutans																																							
	Jacksonia sp.								X																															
	Johnsonia pubescens subsp. *pubescens*									X																														
	Lasiopetalum sp. Coorow (E. Ried 101)																																							
	Laxmannia sessiliflora subsp. *drummondii*			X	X	X															X											X							
	Lechenaultia linarioides																					X	X		X															
	Lepidobolus preissianus subsp. *preissianus*	X		X	X						X		X					X							X		X	X	X						X		X	X		
	Lepidobolus sp.		X					X	X			X		X	X	X			X	X							X									X				
	Lepidosperma apricola sens. lat.											X		X	X	X																								
	Lepidosperma scabrum sens. lat.																																							
	Lepidosperma sp.		X																																					
	Lepidosperma squamatum sens. lat.																																			X				
	Lepidosperma tenue sens. lat.																																							

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

SPECIES	AR142	AR143	AR144	AR145	AR146	AR147	AR148	AR149	AR15	AR150	AR151	AR152	AR153	AR154	AR155	AR156	AR157	AR158	AR159	AR16	AR160	AR161	AR162	AR163	AR164	AR165	AR166	AR167	AR168	AR169	AR170	AR171	AR172	AR173	AR174	AR175	AR176	AR177	AR178
Leptosema aphyllum																																							
Leptospermum oligandrum				X			X	X	X	X		X	X	X	X	X	X		X	X	X	X		X			X		X	X			X	X	X	X	X	X	X
Leptospermum spinescens	X		X			X		X	X	X			X	X		X						X	X					X					X			X			
Leucopogon inflexus	X			X		X	X						X	X						X								X				X		X				
Leucopogon oldfieldii												X		X																	X								
Leucopogon sp.																																							
Leucopogon sp. Northern ciliate (R. Davis 3393)																				X																			
Levenhookia pusilla																								X													X		
Levenhookia stipitata				X			X								X									X										X			X		
Lobelia rhytidosperma																																							
Lomandra hastilis															X	X																			X				
Lomandra sp.																																							
Lyginia imberbis																																							
* *Lysimachia arvensis*																																							
Lysinema pentapetalum					X				X			X		X		X	X			X									X				X		X				X
Macrozamia fraseri					X													X			X											X							
Melaleuca acutifolia																																							
Melaleuca concreta																																							
Melaleuca lateritia																																							
Melaleuca leuropoma	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Melaleuca rhaphiophylla																																							
Melaleuca ryeae																																							
Melaleuca trichophylla																																							
Melaleuca sp.																																							
Mesomelaena pseudostygia	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X			X	X	X	X	X	X		X	X	X	X	X		X	X	X
Mesomelaena tetragona													X																										
Monotaxis bracteata																																							
Monotaxis grandiflora																											X												
Neurachne alopecuroidea						X		X							X	X		X	X	X					X		X		X		X	X	X		X			X	X
Nuytsia floribunda																							X																X
Olax benthamiana																																							
Opercularia vaginata							X			X	X													X															X
Orchidaceae sp.																																							
Orianthera spermacocea			X																																				
Patersonia occidentalis																													X	X									
Petrophile brevifolia		X		X			X	X	X	X		X	X	X		X		X		X	X	X		X	X	X	X	X	X		X			X	X				
Petrophile drummondii					X	X			X									X										X	X	X			X						
Petrophile macrostachya	X	X	X		X	X	X	X	X	X		X	X			X	X	X		X	X					X	X	X	X						X		X		
Petrophile scabriuscula												X		X									X				X								X				
Phyllangium divergens																																							
Pileanthus filifolius	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X					X		X	X			X	X	X				
Pimelea angustifolia		X		X										X																									
Pimelea leucantha																																							
Pimelea sp.		X																							X														
Poaceae sp.													X										X																
Podolepis capillaris																																							
Podolepis lessonii																																							
Podotheca angustifolia																																							
Podotheca gnaphalioides																										X								X					
Pogonolepis stricta																																							
Poranthera microphylla																																							
Pterochaeta paniculata			X										X												X														
Ptilotus manglesii																																							
Ptilotus stirlingii subsp. *stirlingii*																																							
Quoya verbascina										X																													

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH CENTRAL SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

	SPECIES	AR142	AR143	AR144	AR145	AR146	AR147	AR148	AR149	AR15	AR150	AR151	AR152	AR153	AR154	AR155	AR156	AR157	AR158	AR159	AR16	AR160	AR161	AR162	AR163	AR164	AR165	AR166	AR167	AR168	AR169	AR170	AR171	AR172	AR173	AR174	AR175	AR176	AR177	AR178
	Restionaceae sp.																																							
	Santalum acuminatum																																							
	Scaevola canescens		X	X	X					X			X									X	X			X	X	X					X				X			
	Scaevola phlebopetala																																							
	Scaevola repens subsp. *Northern Sandplains* (R.J. Cranfield & P.J. Spencer 8445)						X	X			X			X	X		X		X	X																		X			
	Schoenus brevisetis																																							
	Schoenus clandestinus										X																														
	Schoenus grandiflorus																																							
	Schoenus latitans			X	X													X											X											
	Schoenus nanus										X																													
	Schoenus pleiostemoneus																																							
	Schoenus sp.						X																																	X
	Scholtzia laxiflora	X		X	X	X	X		X	X	X			X		X		X		X	X	X	X		X						X	X			X	X		X		
	Siloxerus humifusus																																							
	Stackhousia monogyna																																							
	Stenanthemum notiale subsp. *notiale*		X	X										X	X																									
	Stirlingia latifolia		X			X				X											X			X																
	Stylidium adpressum			X			X		X																														X		
	Stylidium burbidgeanum																																							
	Stylidium crossocephalum					X	X			X					X		X	X										X		X										
	Stylidium diuroides subsp. *paucifoliatum*																																							
	Stylidium kalbarriense				X							X						X							X															X
	Stylidium maitlandianum																																							
	Stylidium purpureum			X			X						X			X	X												X	X		X					X		X
	Stylidium repens	X		X	X	X	X	X	X	X	X	X	X		X		X	X			X	X				X	X	X	X		X	X		X		X	X	X		X
	Stylidium sp.													X		X	X																							
	Styphelia microdonta																																							
	Styphelia planifolia																																							
	Styphelia xerophylla					X				X	X						X	X				X		X				X					X							X
	Styphelia sp.							X																																
	Synaphea sp.																															X								
	Synaphea spinulosa subsp. *spinulosa*																X	X				X						X		X										X
	Thysanotus rectantherus			X																	X								X										
	Thysanotus sp.						X																			X														
	Thysanotus sp. (Climbing)												X												X								X							
	Thysanotus spiniger																																							
	Trachymene pilosa							X																		X							X		X				X	
	Tricoryne ?*humilis*																																							
	Tricoryne sp.																																							
	Tripterococcus brunonis																															X								
*	*Ursinia anthemoides*																							X	X	X	X								X					
	Verticordia densiflora var. *densiflora*	X	X	X	X		X	X		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X		X	
	Verticordia grandis		X	X		X	X		X	X	X					X	X	X			X	X	X		X	X		X	X	X				X		X		X	X
	Verticordia nobilis																																							
	Verticordia ovalifolia																																							
	Verticordia sp.																																							
*	*Wahlenbergia capensis*																																							
	Wahlenbergia gracilenta																																							
	Waitzia acuminata var. *acuminata*																																							
	Waitzia acuminata var. *albicans*																																X							
	Xanthorrhoea drummondii				X									X		X						X				X									X		X	X	X	
	Xanthosia fruticulosa																																							
	Xanthosia huegelii																																							
	Xylomelum angustifolium		X							X	X			X						X	X			X	X	X	X					X	X	X		X	X			

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH PROJECT SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

SPECIES	AR179	AR180	AR181	AR182	AR183	AR184	AR185	AR186	AR187	AR188	AR189	AR190	AR191	AR192	AR193	AR194	AR195	AR196	AR197	AR198	AR199	AR200	AR201	AR202	AR203	AR204	AR205	AR206	AR207	AR208	AR209	AR210	AR211	AR212	AR213	AR214	AR215	AR216	AR217
Acacia blakelyi				X		X	X	X		X		X	X						X	X	X	X			X	X	X	X			X	X			X			X
Acacia dilatata																																							
Acacia lasiocarpa																																			X		X		
Acacia latipes subsp. *latipes*		X	X					X	X											X		X	X	X	X					X		X		X		X		X	X
Acacia pulchella				X				X				X	X	X	X														X										
Acacia saligna																																							
Acacia spathulifolia																										X	X												
Acacia stenoptera													X																										
Acacia sp.									X																					X									
Actinotus leucocephalus																											X												
Adenanthos cygnorum																																							
* *Aira caryophyllea*															X		X				X								X	X		X	X	X					
Alexgeorgea nitens				X																X																		
Allocasuarina campestris		X	X				X	X			X	X		X		X	X	X	X	X	X			X		X	X	X	X	X		X			X		X	
Allocasuarina humilis																																							
Allocasuarina microstachya																									X		X												
Allocasuarina sp.											X			X			X	X																					
Amphipogon turbinatus																										X													
Andersonia heterophylla																																							
Anigozanthos humilis																										X				X	X							
Arnocrinum preissii																																							
Austrostipa ?*crinita*																																							
Austrostipa elegantissima																																							
Austrostipa hemipogon																				X																			
Austrostipa macalpinei	X		X						X																						X		X	X		X	X		
Austrostipa sp.																																							
Babingtonia camphorosmae																																							
Babingtonia grandiflora																																							
Banksia attenuata						X		X			X	X					X	X					X													X			X
Banksia candolleana	X					X																										X	X			X			
Banksia elegans (P4)																																							
Banksia hookeriana																																							
Banksia leptophylla var. *melletica*															X												X				X					X			
Banksia menziesii								X																															
Banksia nivea	X	X		X	X	X	X		X	X	X		X		X				X	X					X	X							X		X				
Banksia prionotes						X													X																				
Banksia sessilis																											X												
Banksia shuttleworthiana																				X	X	X																	
Banksia sp.																					X																		
Beaufortia elegans	X	X								X		X			X	X				X		X	X	X	X	X									X	X			
Blennospora drummondii																																							
Boronia ramosa subsp. *anethifolia*		X						X				X		X												X	X												
Borya sp.																																					X		
Burchardia congesta										X						X			X												X		X				X	
Calandrinia sp.																																							
Calothamnus quadrifidus subsp. *angustifolius*									X				X		X	X				X	X	X			X	X		X	X	X	X		X		X		X		
Calothamnus sanguineus	X	X	X	X	X	X				X	X	X	X		X			X	X							X									X			X	X
Calytrix chrysantha (P4)	X	X				X			X												X	X	X	X		X							X			X	X	X	X	X
Calytrix depressa																																						X	
Calytrix sapphirina					X									X	X		X		X																				
Calytrix strigosa									X												X	X				X													
Calytrix sp.																																							
Carpobrotus sp.																																							
Cassytha flava																																							
Cassytha glabella forma bicallosa	X	X	X	X	X				X	X	X		X	X	X			X	X		X											X	X	X					

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH PROJECT SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

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	SPECIES	AR179	AR180	AR181	AR182	AR183	AR184	AR185	AR186	AR187	AR188	AR189	AR190	AR191	AR192	AR193	AR194	AR195	AR196	AR197	AR198	AR199	AR200	AR201	AR202	AR203	AR204	AR205	AR206	AR207	AR208	AR209	AR210	AR211	AR212	AR213	AR214	AR215	AR216	AR217
	Cassytha pomiformis						X	X					X					X			X	X			X									X				X
	Cassytha sp.																X																						
	Caustis dioica																																	X		X		X		
	Centrolepis pilosa																																	X						
	Centrolepis polygyna																																							
	Chordifex sinuosus			X								X			X		X																						
	Conospermum triplinervium	X	X	X		X	X	X		X	X	X	X	X		X	X	X	X		X	X	X	X	X	X							X	X	X		X		X
	Conospermum unilaterale											X		X	X			X		X																			
	Conostephium preissii																X							X															
	Conostylis aculeata																								X														
	Conostylis aculeata subsp. *bromelioides*																																							
	Conostylis aurea			X	X	X	X			X		X	X		X			X	X	X			X	X				X				X	X	X					
	Conostylis candicans subsp. *calcicola*																																							
	Conostylis candicans subsp. *candicans*				X				X					X								X																X		
	Conostylis candicans subsp. *procumbens*																																							
	Conostylis canteriata																																			X				
	Conostylis resinosa																																							
	Conostylis sp.																																	X						
	Corynotheca micrantha var. *micrantha*																					X																	
	Crassula colorata																												X										
	Cryptandra myriantha																						X	X										X	X				
	Cryptandra sp.																																							
	Dampiera carinata				X							X																												
	Dampiera lindleyi																																							
	Dampiera oligophylla																																							
	Dampiera spicigera																				X		X								X							X		
	Dampiera sp.																					X			X		X			X			X							
	Darwinia sanguinea																																							
	Darwinia speciosa																																					X		
	Daviesia divaricata subsp. *divaricata*	X		X		X		X	X	X				X					X	X																			
	Daviesia ?hakeoides				X		X					X	X		X			X																					X	
	Daviesia nudiflora	X	X	X		X	X				X	X				X			X		X													X		X	X			
	Daviesia pedunculata																																							
	Daviesia podophylla		X					X						X	X	X																								
	Daviesia triflora																								X														
	Desmocladus parthenicus							X																																
	Desmocladus semiplanus											X																												
	Dianella revoluta																															X								
	Dodonaea pinifolia																																							
	Drosera eneabba						X										X		X																					
	Drosera erythrorhiza																																							
	Drosera sp.																									X										X		X		
	Drosera sp. (climbing)									X																							X			X		X		X	
	Ecdeiocolea monostachya	X		X			X			X			X			X					X	X	X	X	X	X				X	X	X	X	X		X	X	X	
*	*Ehrharta calycina*																															X								
	Eremaea asterocarpa																																							
	Eremaea beaufortioides var. *beaufortioides*			X		X			X	X					X	X				X			X	X	X	X							X			X			X
	Eremaea beaufortioides var. *lachnosanthe*									X																														
	Eremaea ectadioclada				X		X				X				X							X																		
	Eremaea fimbriata																																							
	Eremaea sp.																											X												
	Eremaea violacea subsp. *violacea*	X		X	X	X				X	X			X		X	X								X									X	X		X	X		
	Ericaceae sp.																							X	X		X													
	Eucalyptus todtiana		X	X					X				X						X		X		X				X	X				X			X	X				
	Fabaceae sp.																																							

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	SPECIES	AR179	AR180	AR181	AR182	AR183	AR184	AR185	AR186	AR187	AR188	AR189	AR190	AR191	AR192	AR193	AR194	AR195	AR196	AR197	AR198	AR199	AR200	AR201	AR202	AR203	AR204	AR205	AR206	AR207	AR208	AR209	AR210	AR211	AR212	AR213	AR214	AR215	AR216	AR217
	Georgeantha hexandra																						X	X										X	X					
	Gnephosis drummondii																																						X	
	Gnephosis tenuissima																						X							X	X			X	X					
	Gompholobium tomentosum		X						X			X		X	X			X		X				X			X	X							X					
	Gonocarpus pithyoides																																							
	Goodenia coerulea																																							
	Goodenia pulchella subsp. *Coastal Plain A* (M. Hislop 634)																																							
	Goodenia reinwardtii																											X												
	Grevillea ?umbellulata																																							
	Grevillea eriostachya																								X															
	Grevillea leptopoda (P3)																																						X	
	Guichenotia macrantha																										X	X	X	X										
	Guichenotia sp.																										X													
	Gyrostemon ?subnudus																																							
	Hakea candolleana																							X									X		X					
	Hakea costata																			X				X	X	X											X			
	Hakea eneabba										X						X		X																		X			
	Hakea incrassata		X																				X																	
	Hakea lissocarpha																									X						X			X				X	
	Hakea polyanthema		X		X	X	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X			X						X	X	X	X	X		X
	Hakea prostrata																										X													
	Hakea psilorrhyncha																																							
	Hakea ruscifolia																																							
	Hakea trifurcata																												X											
	Hemiandra sp. Eneabba (H. Demarz 3687) (P3)						X					X				X		X							X															
	Hibbertia acerosa																																							
	Hibbertia aurea																																	X						
	Hibbertia crassifolia			X	X		X	X	X		X	X	X		X	X	X	X		X			X			X	X									X				
	Hibbertia hypericoides subsp. *hypericoides*	X	X	X	X	X	X			X	X		X	X	X	X	X		X	X			X				X					X		X	X		X	X		X
	Hibbertia sp.															X																								
	Hibbertia spicata																																							
	Hibbertia subvaginata													X				X		X								X	X											
	Hopkinsia anoectocolea (P3)																																							
	Hyalosperma cotula			X					X	X												X	X			X					X							X		X
	Hypocalymma gardneri (P3)																																							
*	*Hypochaeris glabra*																															X	X							
	Isotoma hypocrateriformis									X																						X		X						
	Isotoma sp.				X																																			
	Isotropis cuneifolia						X								X					X															X				X	
	Isotropis sp.											X	X																												
	Jacksonia floribunda	X							X																															
	Jacksonia hakeoides		X		X		X			X	X	X				X	X	X		X		X	X	X	X	X		X				X		X	X	X		X		X
	Jacksonia ?nutans																																							
	Jacksonia sp.																																							
	Johnsonia pubescens subsp. *pubescens*																																						X	
	Lasiopetalum sp. Coorow (E. Ried 101)																											X												
	Laxmannia sessiliflora subsp. *drummondii*						X	X						X				X		X		X					X													
	Lechenaultia linarioides																															X								
	Lepidobolus preissianus subsp. *preissianus*			X		X	X			X					X					X				X		X							X		X			X		
	Lepidobolus sp.											X						X	X			X	X		X		X							X	X	X	X	X		X
	Lepidosperma apricola sens. lat.																										X													
	Lepidosperma scabrum sens. lat.																																							
	Lepidosperma sp.																																							
	Lepidosperma squamatum sens. lat.																																							
	Lepidosperma tenue sens. lat.																																							

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH PROJECT SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

SPECIES	AR179	AR180	AR181	AR182	AR183	AR184	AR185	AR186	AR187	AR188	AR189	AR190	AR191	AR192	AR193	AR194	AR195	AR196	AR197	AR198	AR199	AR200	AR201	AR202	AR203	AR204	AR205	AR206	AR207	AR208	AR209	AR210	AR211	AR212	AR213	AR214	AR215	AR216	AR217
Leptosema aphyllum																												X	X									X	
Leptospermum oligandrum	X	X	X	X	X	X	X		X	X	X	X	X	X		X				X			X	X	X			X	X					X	X	X	X		X
Leptospermum spinescens	X					X				X	X	X	X	X	X		X	X	X						X								X		X				
Leucopogon inflexus			X		X	X				X	X	X	X	X		X	X	X	X				X	X	X									X	X				
Leucopogon oldfieldii																																							
Leucopogon sp.																																							
Leucopogon sp. Northern ciliate (R. Davis 3393)																																							
Levenhookia pusilla												X																											
Levenhookia stipitata			X						X			X									X	X		X					X					X			X		
Lobelia rhytidosperma				X	X																																	
Lomandra hastilis								X				X						X								X	X										X		
Lomandra sp.				X									X																										
Lyginia imberbis																																							
* *Lysimachia arvensis*																													X										
Lysinema pentapetalum													X		X	X	X	X																	X				
Macrozamia fraseri								X													X					X	X												
Melaleuca acutifolia																													X										
Melaleuca concreta																												X	X								X	
Melaleuca lateritia																																							
Melaleuca leuropoma	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X
Melaleuca rhaphiophylla																																							
Melaleuca ryeae																										X	X	X												
Melaleuca trichophylla																																							
Melaleuca sp.																													X			X							
Mesomelaena pseudostygia	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X						X	X	X	X	X	X	X		X
Mesomelaena tetragona																																							
Monotaxis bracteata																																					X		
Monotaxis grandiflora					X	X						X					X							X															
Neurachne alopecuroidea	X			X	X						X	X				X			X			X		X		X					X		X	X				
Nuytsia floribunda																																				X			
Olax benthamiana																																	X						
Opercularia vaginata			X		X				X							X			X						X	X							X	X					
Orchidaceae sp.																																							
Orianthera spermacocea	X								X													X																	
Patersonia occidentalis																																							
Petrophile brevifolia	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X	X	X	X				X	X		X		X		X
Petrophile drummondii						X		X		X		X	X				X																						
Petrophile macrostachya	X	X			X	X		X			X		X	X	X	X	X		X			X		X								X	X			X		X
Petrophile scabriuscula												X			X	X			X							X											X		
Phyllangium divergens																																							
Pileanthus filifolius	X	X	X	X	X	X	X	X	X	X		X		X	X	X			X	X			X	X										X			X		
Pimelea angustifolia		X		X		X	X			X		X		X									X		X														
Pimelea leucantha																											X												
Pimelea sp.																																							
Poaceae sp.																													X	X	X	X							
Podolepis capillaris																																							
Podolepis lessonii																																							
Podotheca angustifolia																									X					X									
Podotheca gnaphalioides																					X								X										
Pogonolepis stricta																													X										
Poranthera microphylla																																							
Pterochaeta paniculata		X			X				X													X				X													
Ptilotus manglesii																																							
Ptilotus stirlingii subsp. *stirlingii*													X																											
Quoya verbascina																																							

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES RECORDED IN EACH SURVEY QUADRAT IN THE ARROWSMITH PROJECT SURVEY AREA OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMVER 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora (DBCA 2019)

	SPECIES	AR179	AR180	AR181	AR182	AR183	AR184	AR185	AR186	AR187	AR188	AR189	AR190	AR191	AR192	AR193	AR194	AR195	AR196	AR197	AR198	AR199	AR200	AR201	AR202	AR203	AR204	AR205	AR206	AR207	AR208	AR209	AR210	AR211	AR212	AR213	AR214	AR215	AR216	AR217
	Restionaceae sp.																																							
	Santalum acuminatum																													X										
	Scaevola canescens	X	X			X		X									X																							
	Scaevola phlebopetala																																							
	Scaevola repens subsp. *Northern Sandplains* (R.J. Cranfield & P.J. Spencer 8445)																						X	X	X		X	X					X	X	X	X		X		
	Schoenus brevisetis																																							
	Schoenus clandestinus																																	X						
	Schoenus grandiflorus																											X												
	Schoenus latitans	X			X		X				X						X																							
	Schoenus nanus																										X		X					X					X		
	Schoenus pleiostemoneus					X																																		
	Schoenus sp.											X										X	X			X						X					X		X	
	Scholtzia laxiflora	X		X										X	X	X		X	X		X		X	X	X						X			X			X		X	
	Siloxerus humifusus																																							
	Stackhousia monogyna																																							
	Stenanthemum notiale subsp. *notiale*																X						X	X											X	X				
	Stirlingia latifolia				X		X	X	X						X			X	X	X																				
	Stylidium adpressum			X		X						X	X						X							X			X									X		
	Stylidium burbidgeanum																												X											
	Stylidium crossocephalum						X				X			X	X	X	X	X						X												X				
	Stylidium diuroides subsp. *paucifoliatum*																																	X						
	Stylidium kalbarriense			X						X										X	X	X									X			X						
	Stylidium maitlandianum																																							
	Stylidium purpureum			X	X								X			X	X	X							X															
	Stylidium repens	X			X	X	X					X	X		X	X	X		X	X			X	X	X	X	X					X	X	X	X	X	X			
	Stylidium sp.																																							
	Styphelia microdonta				X											X																								
	Styphelia planifolia																																							
	Styphelia xerophylla								X					X	X		X	X	X																					
	Styphelia sp.																																							
	Synaphea sp.																																							
	Synaphea spinulosa subsp. *spinulosa*																X			X			X	X	X															
	Thysanotus rectantherus			X																																				
	Thysanotus sp.																											X			X						X			
	Thysanotus sp. (Climbing)																X		X															X						
	Thysanotus spiniger						X					X																													
	Trachymene pilosa																									X	X		X		X	X								X
	Tricoryne ?humilis																																							
	Tricoryne sp.																																							X
	Tripterococcus brunonis														X														X											
*	*Ursinia anthemoides*	X																														X			X					
	Verticordia densiflora var. *densiflora*	X		X	X	X		X	X	X	X			X		X	X						X		X	X							X	X	X		X	X	X
	Verticordia grandis	X				X	X	X	X		X	X		X			X		X			X	X												X	X	X		X		
	Verticordia nobilis						X					X														X														
	Verticordia ovalifolia																																							
	Verticordia sp.																				X		X																	
*	*Wahlenbergia capensis*																															X		X						
	Wahlenbergia gracilenta																													X										
	Waitzia acuminata var. *acuminata*				X			X																							X									
	Waitzia acuminata var. *albicans*																			X																				
	Xanthorrhoea drummondii												X						X							X	X							X	X	X			X	
	Xanthosia fruticulosa																																							
	Xanthosia huegelii														X					X																				
	Xylomelum angustifolium		X		X		X	X	X					X	X			X	X	X			X		X										X					

APPENDIX G: LOCATION OF PRIORITY FLORA RECORDED WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Conservation Code	Species	GDA94_Z50		No. Plants
		Easting (mE)	Northing (mN)	
P3	*Grevillea leptopoda*	325901	6717885	10
	Hemiandra sp. Eneabba (H. Demarz 3687)	321237	6718973	1
		321242	6718967	1
		321285	6718960	1
		321681	6718934	1
		321708	6718991	2
		321801	6717667	1
		321803	6717573	1
		321921	6717476	1
		322062	6717560	1
		322092	6717887	1
		322147	6717534	1
		322172	6719006	3
		322182	6718498	1
		322349	6718973	1
		322393	6717054	1
		322420	6717298	1
		322489	6718104	1
		322542	6716566	1
		322548	6718021	1
		322555	6717507	1
		322559	6717157	1
		322598	6716874	1
		322646	6717225	1
		322668	6716652	1
		322674	6716655	1
		322674	6717238	2
		322770	6717623	1
		322774	6716553	1
		322782	6716355	1
		322839	6716886	2
		322860	6717058	1
		322866	6718074	1
		322932	6717110	1
		323045	6717974	1
		323068	6717969	1
		323076	6716752	1
		323133	6718274	4
		323153	6717927	1
		323170	6717496	2
		323190	6716766	1
		323200	6718276	1
		323208	6716790	1
		323221	6716799	1
		323269	6717464	2
		323328	6716996	1
		323344	6719012	1
		323369	6719027	2
		323375	6718283	1
		323422	6717955	3
		323502	6717944	1
		323512	6715944	1
		323547	6719034	5
		323550	6715585	1
		323551	6715584	1
		323555	6718503	1
		323573	6716980	1
		323576	6715594	1
		323586	6718516	3
		323596	6718507	1
		323667	6716048	1
		323687	6718990	1
		323698	6715544	1

APPENDIX G: LOCATION OF PRIORITY FLORA RECORDED WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Conservation Code	Species	GDA94_Z50		No. Plants
		Easting (mE)	Northing (mN)	
P3	*Hemiandra* sp. Eneabba (H. Demarz 3687)	323711	6717938	1
		323725	6718986	1
		323734	6716288	1
		323746	6716302	1
		323813	6719007	1
		323838	6716697	1
		323903	6718522	1
		323909	6716203	1
		323913	6717034	2
		323916	6719005	1
		323937	6717980	1
		323954	6715332	1
		323954	6718832	4
		323957	6716101	1
		323970	6715349	1
		323971	6715560	2
		323973	6718772	1
		323986	6715366	1
		323986	6718541	2
		323992	6718653	1
		323998	6717036	1
		324011	6715405	1
		324014	6719001	1
		324014	6719013	2
		324028	6715422	1
		324036	6715961	1
		324060	6715842	1
		324062	6719018	4
		324073	6718975	1
		324089	6716505	1
		324120	6715297	1
		324126	6715921	1
		324165	6718876	2
		324196	6715554	1
		324200	6715753	2
		324207	6716514	1
		324230	6717665	2
		324252	6715776	1
		324254	6715260	1
		324256	6717676	1
		324280	6715789	1
		324289	6717684	1
		324293	6715437	3
		324322	6715473	2
		324352	6715503	4
		324427	6715616	4
		324430	6715604	1
		324457	6715580	1
		324474	6716254	2
		324482	6717751	2
		324499	6716262	2
		324520	6716266	1
		324540	6716539	1
		324563	6716220	2
		324583	6715870	1
		324594	6717795	1
		324712	6717548	1
		324797	6717537	2
		324831	6717529	1
		324848	6717034	1
		324849	6717082	1
		324901	6718867	1
		324905	6718025	1

APPENDIX G: LOCATION OF PRIORITY FLORA RECORDED WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Conservation Code	Species	GDA94_Z50		No. Plants
		Easting (mE)	Northing (mN)	
P3	*Hemiandra* sp. Eneabba (H. Demarz 3687)	324952	6719029	1
		324989	6717047	1
		325006	6713555	1
		325174	6716076	1
		325185	6715985	2
		325188	6716011	1
		325560	6717019	1
		325628	6717502	1
		325641	6716647	2
		325813	6718282	2
		325816	6718263	1
		325931	6717033	1
		326051	6717059	1
		326173	6717560	1
		327871	6718798	1
		327895	6718793	1
	Hopkinsia anoectocolea	322290	6717549	1
		322428	6717746	1
	Hypocalymma gardneri	321681	6718934	1
		323973	6718772	1
		324005	6717999	6
		324016	6718536	9
	Persoonia rudis	321781	6717556	1
		321804	6717575	1
		321951	6717499	1
		321999	6718050	1
		322217	6717923	1
		322253	6717147	1
		322315	6717323	1
		322367	6717254	1
		322465	6717014	1
		322469	6718190	1
		322479	6718083	1
		322485	6716657	1
		322510	6717133	1
		322920	6716940	1
		322983	6716976	3
		323387	6716770	1
		323846	6717952	1
		323987	6718663	1
		324012	6718561	1
		324156	6718886	1
		324196	6715217	1
		324492	6715527	1
		324570	6718067	1
		324867	6717539	1
		324974	6713617	1
		325025	6717048	1
		325108	6713426	2
		325213	6716300	2
		325333	6713186	1
		325390	6713073	1
P4	*Banksia elegans*	322541	6716568	1
		322555	6716573	1
		322575	6716573	18
		323354	6715842	1
		323361	6715827	1
	Calytrix chrysantha	321354	6718675	12
		321638	6718929	55
		321816	6717679	1
		321858	6718504	50
		322145	6718910	1
		322172	6719006	1

APPENDIX G: LOCATION OF PRIORITY FLORA RECORDED WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Conservation Code	Species	GDA94_Z50		No. Plants
		Easting (mE)	Northing (mN)	
P4	*Calytrix chrysantha*	322448	6717737	2
		322469	6717760	1
		322469	6717763	8
		322470	6717769	60
		322473	6717766	12
		322473	6717788	100
		322534	6716868	1
		322596	6717865	1
		322618	6717732	40
		322627	6717750	40
		322631	6719004	3
		322752	6717947	100
		322807	6718972	85
		322827	6717959	200
		322850	6718106	115
		322866	6718074	1
		322897	6718040	1500
		322926	6718002	1500
		322979	6717467	1
		322997	6717924	1500
		323005	6717997	75
		323136	6718996	40
		323152	6717481	53
		323170	6717496	23
		323202	6717501	26
		323249	6717488	50
		323295	6717038	1
		323303	6717487	55
		323335	6717485	45
		323335	6717956	1
		323362	6717481	45
		323394	6717478	85
		323450	6717484	90
		323500	6717301	2000
		323536	6717487	48
		323559	6717501	14
		323573	6716980	53
		323588	6717487	150
		323676	6717045	55
		323690	6717491	220
		323720	6717041	160
		323729	6717464	150
		323780	6715252	50
		323818	6717465	200
		323856	6717951	250
		323874	6717472	100
		323879	6717968	250
		323933	6717475	60
		324012	6719008	11
		324014	6719013	1
		324050	6717485	40
		324130	6717798	100
		324145	6717519	200
		324148	6716998	10
		324191	6717716	100
		324216	6717527	40
		324217	6716515	85
		324230	6717665	16
		324234	6714515	47
		324241	6716982	30
		324256	6717676	22
		324276	6717531	70
		324303	6716531	100

APPENDIX G: LOCATION OF PRIORITY FLORA RECORDED WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Conservation Code	Species	GDA94_Z50		No. Plants
		Easting (mE)	Northing (mN)	
P4	*Calytrix chrysantha*	324303	6717021	35
		324312	6718056	30
		324324	6716541	5
		324356	6714411	30
		324365	6716235	28
		324380	6716545	57
		324396	6717031	70
		324400	6717456	300
		324401	6714339	40
		324404	6718031	150
		324422	6717730	16
		324433	6717508	150
		324438	6714283	20
		324438	6717030	50
		324451	6714260	15
		324473	6714207	16
		324473	6717028	50
		324477	6717363	150
		324479	6716543	1
		324479	6718049	30
		324519	6717778	14
		324525	6717509	120
		324540	6716539	15
		324547	6716265	250
		324548	6717782	75
		324552	6717974	11
		324559	6717256	40
		324560	6718131	15
		324577	6717022	30
		324578	6717566	90
		324579	6718012	6
		324582	6717614	40
		324582	6717667	35
		324585	6717536	6
		324595	6715739	110
		324609	6717033	16
		324609	6717719	450
		324625	6717799	128
		324626	6717812	23
		324638	6717160	200
		324666	6714067	45
		324695	6717502	35
		324727	6713888	10
		324733	6717056	18
		324752	6717107	140
		324753	6717011	50
		324757	6718013	500
		324773	6717530	60
		324789	6716248	1
		324849	6713739	3
		324855	6718016	150
		324859	6716538	4
		324862	6719003	40
		324928	6717068	48
		324933	6718021	55
		324945	6717526	20
		324949	6717530	1
		324993	6716553	150
		325006	6713555	4
		325034	6716554	50
		325040	6716666	250
		325088	6717528	70
		325094	6718038	70

APPENDIX G: LOCATION OF PRIORITY FLORA RECORDED WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Conservation Code	Species	GDA94_Z50		No. Plants
		Easting (mE)	Northing (mN)	
P4	*Calytrix chrysantha*	325107	6716559	70
		325133	6716575	1
		325200	6716588	1
		325214	6717008	2
		325244	6713279	150
		325249	6717503	35
		325278	6717000	120
		325309	6717511	2
		325312	6716992	250
		325343	6716990	130
		325376	6713117	150
		325451	6713045	150
		325461	6713011	150
		325466	6713000	60
		325504	6712977	17
		325512	6712961	45
		325516	6712932	12
		325523	6712913	35
		325530	6712897	37
		325538	6712882	45
		325550	6712876	35
		325641	6718015	6
		325646	6717510	55
		325661	6717518	2
		325669	6717058	2
		325688	6717043	8
		325692	6717542	100
		325760	6718021	36
		325770	6717045	1
		325798	6718012	40
		325831	6718157	6
		325869	6717968	350
		325876	6718029	8
		325887	6717912	300
		325901	6717885	4
		325912	6718025	13
		325951	6717833	150
		325989	6718031	16
		325997	6717758	30
		326015	6718034	120
		326020	6717716	2
		326037	6717539	250
		326061	6717657	85
		326072	6718720	60
		326087	6717544	45
		326175	6717068	5
		326176	6716708	2
		326341	6718782	2
		326353	6718778	37
		326698	6718783	20
		326722	6718777	50
		326736	6718769	6
		326761	6718782	24
		326777	6718782	27
		326829	6718789	11
		326968	6718785	10
		327077	6718784	40
		327104	6718779	13
		327120	6718775	45
		327516	6718797	1
		327541	6718802	200
		327712	6718802	10
		327761	6718798	5

APPENDIX G: LOCATION OF PRIORITY FLORA RECORDED WITHIN THE ARROWSMITH CENTRAL SURVEY AREA, OCTOBER/NOVEMBER 2018 AND OCTOBER/NOVEMBER 2019

Conservation Code	Species	GDA94_Z50		No. Plants
		Easting (mE)	Northing (mN)	
P4	*Calytrix chrysantha*	327978	6718809	4
		328079	6718749	5
		328102	6718729	15
		328111	6718721	23
		328119	6718738	11

APPENDIX H: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (see Appendix A for definitions).

	SPECIES	VEGETATION COMMUNITY						
		S1	S4	S5	T2	H3	H6	W1
	Acacia blakelyi	x		x	x	x	x	x
	Acacia dilatata			x			x	x
	Acacia lasiocarpa					x		x
	Acacia latipes subsp. latipes	x	x	x	x	x	x	x
	Acacia pulchella	x		x			x	x
	Acacia saligna		x		x			x
	Acacia spathulifolia							x
	Acacia stenoptera	x		x				
	Acacia sp.							x
	Actinotus leucocephalus	x	x	x	x			x
	Adenanthos cygnorum	x					x	
*	*Aira caryophyllea*	x	x		x	x		x
	Alexgeorgea nitens	x		x			x	x
	Allocasuarina campestris	x		x	x	x	x	x
	Allocasuarina humilis	x		x		x	x	x
	Allocasuarina microstachya							x
	Allocasuarina sp.	x				x		x
	Amphipogon turbinatus	x					x	x
	Andersonia heterophylla						x	x
	Anigozanthos humilis	x		x			x	x
	Arnocrinum preissii							x
	Austrostipa ?crinita	x		x	x			
	Austrostipa elegantissima	x						x
	Austrostipa hemipogon				x			
	Austrostipa macalpinei	x	x	x				x
	Austrostipa sp.	x	x	x			x	x
	Babingtonia camphorosmae							x
	Babingtonia grandiflora			x				x
	Banksia attenuata	x				x	x	x
	Banksia candolleana	x				x	x	x
	Banksia elegans						x	
	Banksia hookeriana	x						x
	Banksia leptophylla var. *melletica*	x		x			x	x
	Banksia menziesii						x	x
	Banksia nivea	x		x	x	x	x	x
	Banksia prionotes	x				x	x	x
	Banksia sessilis	x						
	Banksia shuttleworthiana			x	x	x	x	x
	Banksia sp.			x				
	Beaufortia elegans	x		x	x	x	x	x
	Blennospora drummondii							x
	Boronia ramosa subsp. *anethifolia*	x		x		x	x	x
	Borya sp.				x			
	Burchardia congesta	x	x	x			x	x
	Calandrinia sp.		x					

APPENDIX H: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (see Appendix A for definitions).

SPECIES	VEGETATION COMMUNITY						
	S1	S4	S5	T2	H3	H6	W1
Calothamnus quadrifidus subsp. *angustifolius*	x	x	x	x	x		x
Calothamnus sanguineus	x		x		x	x	x
Calytrix chrysantha	x		x	x	x	x	x
Calytrix depressa	x		x	x			x
Calytrix sapphirina	x		x			x	x
Calytrix strigosa	x		x			x	x
Calytrix sp.							x
Carpobrotus sp.							x
Cassytha flava	x		x			x	x
Cassytha glabella forma bicallosa	x		x		x	x	x
Cassytha pomiformis	x		x			x	x
Cassytha sp.		x	x	x	x	x	x
Caustis dioica		x	x				x
Centrolepis pilosa	x	x	x			x	x
Centrolepis polygyna			x				x
Chordifex sinuosus	x					x	x
Conospermum triplinervium	x		x	x	x	x	x
Conospermum unilaterale						x	x
Conostephium preissii						x	x
Conostylis aculeata			x				x
Conostylis aculeata subsp. *bromelioides*			x				
Conostylis aurea	x				x	x	x
Conostylis candicans subsp. *calcicola*	x		x			x	x
Conostylis candicans subsp. *candicans*	x		x		x	x	x
Conostylis candicans subsp. *procumbens*	x	x				x	x
Conostylis canteriata					x		x
Conostylis resinosa						x	x
Conostylis sp.							x
Corynotheca micrantha var. *micrantha*			x				
Crassula colorata	x	x		x		x	x
Cryptandra myriantha							x
Cryptandra sp.	x						
Dampiera carinata	x						x
Dampiera lindleyi							x
Dampiera oligophylla							x
Dampiera spicigera	x			x			x
Dampiera sp.	x		x		x		x
Darwinia sanguinea							x
Darwinia speciosa						x	x
Daviesia ?hakeoides	x					x	x
Daviesia divaricata subsp. *divaricata*	x				x	x	x
Daviesia nudiflora	x			x	x	x	x
Daviesia pedunculata							x
Daviesia podophylla	x		x		x	x	x
Daviesia triflora	x					x	x

APPENDIX H: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (see Appendix A for definitions).

	SPECIES	VEGETATION COMMUNITY						
		S1	S4	S5	T2	H3	H6	W1
	Desmocladus parthenicus	x						x
	Desmocladus semiplanus	x		x			x	x
	Dianella revoluta	x						x
	Dodonaea pinifolia		x					
	Drosera eneabba	x					x	x
	Drosera erythrorhiza	x					x	x
	Drosera sp.	x						x
	Drosera sp. (climbing)	x		x	x	x		x
	Ecdeiocolea monostachya	x		x	x	x	x	x
*	*Ehrharta calycina*	x						
	Eremaea asterocarpa	x						
	Eremaea beaufortioides var. *beaufortioides*	x		x		x	x	x
	Eremaea beaufortioides var. *lachnosanthe*	x						x
	Eremaea ectadioclada	x		x		x	x	x
	Eremaea fimbriata					x		
	Eremaea violacea subsp. violacea	x				x	x	x
	Eremaea sp.	x						
	Ericaceae sp.			x				x
	Eucalyptus todtiana	x		x	x	x	x	x
	Fabaceae sp.			x				
	Georgeantha hexandra							x
	Gnephosis drummondii				x			
	Gnephosis tenuissima		x		x			x
	Gompholobium tomentosum	x		x		x	x	x
	Gonocarpus pithyoides	x						
	Goodenia coerulea							x
	Goodenia pulchella subsp. Coastal Plain A (M. Hislop 634)		x					
	Goodenia reinwardtii	x						x
	Grevillea ?umbellulata		x					
	Grevillea eriostachya							x
	Grevillea leptopoda				x			
	Guichenotia macrantha	x		x	x			
	Guichenotia sp.			x				
	Gyrostemon ?subnudus							x
	Hakea candolleana							x
	Hakea costata	x		x			x	x
	Hakea eneabba			x				x
	Hakea incrassata					x		x
	Hakea lissocarpha	x			x			x
	Hakea polyanthema	x		x	x	x	x	x
	Hakea prostrata			x				x
	Hakea psilorrhyncha	x					x	x
	Hakea ruscifolia						x	
	Hakea trifurcata	x			x			
	Hemiandra sp. Eneabba (H. Demarz 3687)	x					x	x

APPENDIX H: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (see Appendix A for definitions).

	SPECIES	VEGETATION COMMUNITY						
		S1	S4	S5	T2	H3	H6	W1
	Hibbertia acerosa	x		x				x
	Hibbertia aurea							x
	Hibbertia crassifolia	x		x		x	x	x
	Hibbertia hypericoides subsp. *hypericoides*	x		x		x	x	x
	Hibbertia sp.							x
	Hibbertia spicata	x						x
	Hibbertia subvaginata	x			x	x	x	x
	Hopkinsia anoectocolea		x					
	Hyalosperma cotula	x		x	x			x
	Hypocalymma gardneri	x						x
*	*Hypochaeris glabra*	x	x		x			
	Isotoma hypocrateriformis	x	x		x			x
	Isotoma sp.							x
	Isotropis cuneifolia	x		x			x	x
	Isotropis sp.							x
	Jacksonia ?nutans							x
	Jacksonia floribunda						x	x
	Jacksonia hakeoides	x	x	x	x	x	x	x
	Jacksonia sp.							x
	Johnsonia pubescens subsp. *pubescens*	x					x	x
	Lasiopetalum sp. Coorow (E. Ried X0X)	x						
	Laxmannia sessiliflora subsp. *drummondii*	x		x			x	x
	Lechenaultia linarioides	x						x
	Lepidobolus preissianus subsp. *preissianus*	x			x	x	x	x
	Lepidobolus sp.	x		x		x		x
	Lepidosperma apricola sens. lat.			x		x		x
	Lepidosperma scabrum sens. lat.							x
	Lepidosperma squamatum sens. lat.							x
	Lepidosperma tenue sens. lat.		x					x
	Lepidosperma sp.							x
	Leptosema aphyllum				x			
	Leptospermum oligandrum	x	x	x	x	x	x	x
	Leptospermum spinescens	x				x	x	x
	Leucopogon inflexus	x				x	x	x
	Leucopogon oldfieldii	x				x		x
	Leucopogon sp.	x						x
	Leucopogon sp. Northern ciliate (R. Davis 3393)	x					x	x
	Levenhookia pusilla	x						x
	Levenhookia stipitata	x	x	x		x		x
	Lobelia rhytidosperma			x				x
	Lomandra hastilis	x		x		x	x	x
	Lomandra sp.							x
	Lyginia imberbis	x		x				x
*	*Lysimachia arvensis*		x		x			
	Lysinema pentapetalum	x				x	x	x

APPENDIX H: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (see Appendix A for definitions).

SPECIES	VEGETATION COMMUNITY						
	S1	S4	S5	T2	H3	H6	W1
Macrozamia fraseri	x		x			x	x
Melaleuca acutifolia				x			
Melaleuca concreta		x		x			
Melaleuca lateritia		x					
Melaleuca leuropoma	x		x	x	x	x	x
Melaleuca rhaphiophylla		x					
Melaleuca ryeae	x		x	x			
Melaleuca sp.				x			x
Melaleuca trichophylla							x
Mesomelaena pseudostygia	x		x		x	x	x
Mesomelaena tetragona					x		
Monotaxis bracteata	x						
Monotaxis grandiflora						x	x
Neurachne alopecuroidea	x		x		x	x	x
Nuytsia floribunda	x						
Olax benthamiana							x
Opercularia vaginata	x	x				x	x
Orchidaceae sp.							x
Orianthera spermacocea							x
Patersonia occidentalis		x	x			x	
Petrophile brevifolia	x		x	x	x	x	x
Petrophile drummondii	x		x			x	x
Petrophile macrostachya	x				x	x	x
Petrophile scabriuscula	x		x		x		x
Phyllangium divergens	x	x				x	x
Pileanthus filifolius	x			x	x	x	x
Pimelea angustifolia	x				x	x	x
Pimelea leucantha	x						
Pimelea sp.							x
Poaceae sp.	x			x	x		x
Podolepis capillaris		x					
Podolepis lessonii	x	x	x				x
Podotheca angustifolia				x			x
Podotheca gnaphalioides	x	x	x	x	x	x	x
Pogonolepis stricta				x			
Poranthera microphylla	x		x			x	x
Pterochaeta paniculata			x		x		x
Ptilotus manglesii		x	x				
Ptilotus stirlingii subsp. *stirlingii*							x
Quoya verbascina							x
Restionaceae sp.		x					
Santalum acuminatum				x			
Scaevola canescens	x				x	x	x
Scaevola phlebopetala							x
Scaevola repens subsp. Northern Sandplains (R.J. Cranfield & P.J. Spencer 8	x		x		x	x	

APPENDIX H: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (see Appendix A for definitions).

	SPECIES	VEGETATION COMMUNITY						
		S1	S4	S5	T2	H3	H6	W1
	Schoenus brevisetis							x
	Schoenus clandestinus	x						x
	Schoenus grandiflorus	x						
	Schoenus latitans						x	x
	Schoenus nanus	x		x	x			x
	Schoenus pleiostemoneus	x		x			x	x
	Schoenus sp.	x		x				x
	Scholtzia laxiflora	x		x	x	x	x	x
	Siloxerus humifusus			x				
	Stackhousia monogyna			x				x
	Stenanthemum notiale subsp. *notiale*					x		x
	Stirlingia latifolia	x					x	x
	Stylidium adpressum	x					x	x
	Stylidium burbidgeanum				x			
	Stylidium crossocephalum					x	x	x
	Stylidium diuroides subsp. *paucifoliatum*							x
	Stylidium kalbarriense	x		x	x		x	x
	Stylidium maitlandianum							x
	Stylidium purpureum	x		x		x	x	x
	Stylidium repens	x		x		x	x	x
	Stylidium sp.					x		x
	Styphelia microdonta							x
	Styphelia planifolia							x
	Styphelia xerophylla	x					x	x
	Styphelia sp.							x
	Synaphea sp.			x				
	Synaphea spinulosa subsp. *spinulosa*	x					x	x
	Thysanotus rectantherus						x	x
	Thysanotus sp.	x			x			x
	Thysanotus sp. (Climbing)	x	x	x				x
	Thysanotus spiniger						x	x
	Trachymene pilosa	x	x	x	x	x	x	x
	Tricoryne ?humilis	x						x
	Tricoryne sp.							x
	Tripterococcus brunonis			x	x			x
*	*Ursinia anthemoides*	x	x	x		x	x	x
	Verticordia densiflora var. *densiflora*	x		x	x	x	x	x
	Verticordia grandis	x		x		x	x	x
	Verticordia nobilis						x	x
	Verticordia ovalifolia						x	
	Verticordia sp.				x			x
*	*Wahlenbergia capensis*	x						x
	Wahlenbergia gracilenta			x	x		x	x
	Waitzia acuminata var. *acuminata*				x			x
	Waitzia acuminata var. *albicans*	x	x	x				x

APPENDIX H: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (see Appendix A for definitions).

SPECIES	VEGETATION COMMUNITY						
	S1	S4	S5	T2	H3	H6	W1
Xanthorrhoea drummondii	x		x	x	x	x	x
Xanthosia fruticulosa			x				x
Xanthosia huegelii	x	x				x	x
Xylomelum angustifolium	x				x	x	x

APPENDIX I: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Vegetation Community Description

Vegetation map code: W1

Structural

Open woodland to isolated trees of *Eucalyptus todtiana* and *Xylomelum angustifolium*, over open shrubland of *Melaleuca leuropoma* and *Hakea polyanthema*, over isolated *Mesomelaena pseudostygia* and *Ecdeiocolea monostachya.*

Associated species

Pileanthus filifolius, *Petrophile macrostachya, Hibbertia hypericoides* subsp. *hypericoides, Jacksonia hakeoides*

Soils and Landforms: Flats, cream sandy soil

Outcropping: Absent

Condition: Pristine to very good

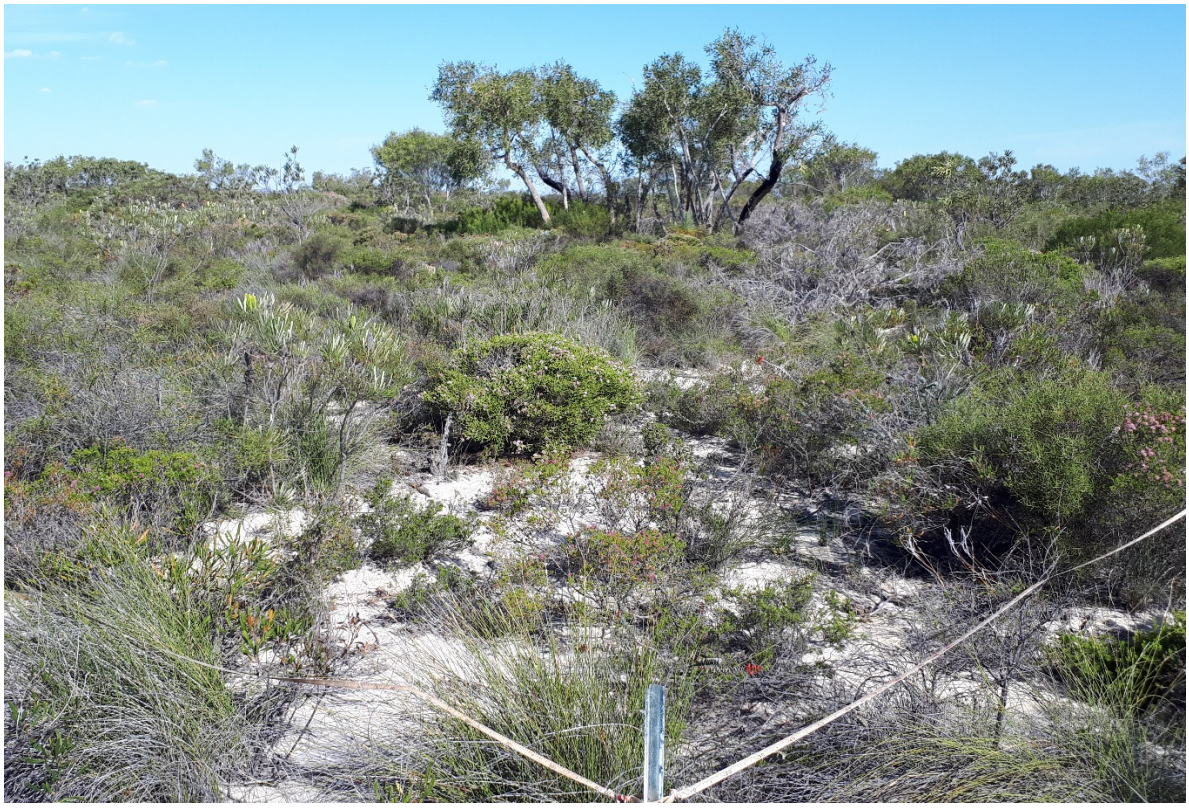
Area: 1030.8 ha

Proportion of survey area: 65.7 %

Number of Quadrats: 71

Species richness: 38.2 ± 1.1 (SE)

Representative Photographs



Site AR033

APPENDIX I: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Vegetation Community Description
Vegetation map code: S1 **Structural** Isolated trees of *Eucalyptus todtiana*, over shrubland of *Banksia leptophylla* var. *melletica*, *Acacia blakelyi* and *Melaleuca leuropoma* over mixed understory of Proteaceae and Myrtaceae species. **Associated species** *Jacksonia hakeoides*, *Conostylis candicans*, *Hakea polyanthema*, *Hibbertia hypericoides* subsp. *hypericoides* **Soils and Landforms:** Flats, grey and white sandy soil **Outcropping:** Absent **Condition:** Very good to pristine **Area:** 160.9 ha **Proportion of survey area:** 10.3 % **Number of Quadrats:** 16 **Species richness:** 30.6 ± 1.9 (SE)
Representative Photograph
 **Site AR178**

APPENDIX I: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Vegetation Community Description
Vegetation map code: S4 **Structural** Open shrubland of *Calothamnus quadrifidus* subsp. *angustifolius*, *Melaleuca lateritia*, *Melaleuca rhaphiophylla* and *Melaleuca concreta* over isolated *Patersonia occidentalis* and *Conostylis candicans* subsp. *procumbens.* **Associated species** *Jacksonia hakeoides*, *Acacia latipes* subsp. *latipes*, *Hopkinsia anoectocolea* **Soils and Landforms:** White/grey sand plains **Outcropping:** Absent **Condition:** Excellent **Area:** 6.2 ha **Proportion of survey area:** 0.4 % **Number of Quadrats:** 2 **Species richness:** 28.5 ± 2.5 (SE)
Representative Photographs
 **Site AR029**

APPENDIX I: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Vegetation Community Description
Vegetation map code: S5 **Structural** Open shrubland of *Calytrix chrysantha* (P4), *Banksia leptophylla* var. *melletica* and *Eremaea beaufortioides* var. *beaufortioides*, over *Jacksonia hakeoides* and *Banksia nivea.* **Associated species** *Melaleuca leuropoma*, *Conospermum triplinervium*, *Hakea polyanthema* **Soils and Landforms:** White/grey sand plains **Outcropping:** Absent **Condition:** Pristine **Area:** 37.9 ha **Proportion of survey area:** 2.4 % **Number of Quadrats:** 6 **Species richness:** 31.5 ± 2.5 (SE)
Representative Photograph
 **Site AR169**

APPENDIX I: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Vegetation Community Description

Vegetation map code: T2

Structural

Thicket to scrub of *Allocasuarina campestris, Melaleuca concreta, Guichenotia macrantha* and *Calothamnus quadrifidus* subsp. *angustifolius*, over sparse *Leptosema aphyllum*.

Associated species

Acacia latipes subsp. *latipes*, *Ecdeiocolea monostachya*, *Acacia blakelyi*

Soils and Landforms: White sand over grey to brown clay/loam

Outcropping: Absent

Condition: Excellent to pristine

Area: 18.6 ha

Proportion of survey area: 1.2 %

Number of Quadrats: 5

Species richness: 18.4 ± 1.3 (SE)

Representative Photograph

Site AR207

APPENDIX I: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Vegetation Community Description

Vegetation map code: H3

Structural

Open heath of *Melaleuca leuropoma, Leptospermum oligandrum* and *Hakea polyanthema, Conospermum triplinervium, Beaufortia elegans* and *Pileanthus filifolius*, with isolated trees of *Banksia attenuata* and *Xylomelum angustifolium* over *Mesomelaena pseudostygia* and *Ecdeiocolea monostachya*.

Associated species

Eucalyptus todtiana, *Calothamnus sanguineus*, *Cassytha glabella* forma *bicallosa*

Soils and Landforms: White/grey sand plains

Outcropping: Absent

Condition: Excellent to pristine

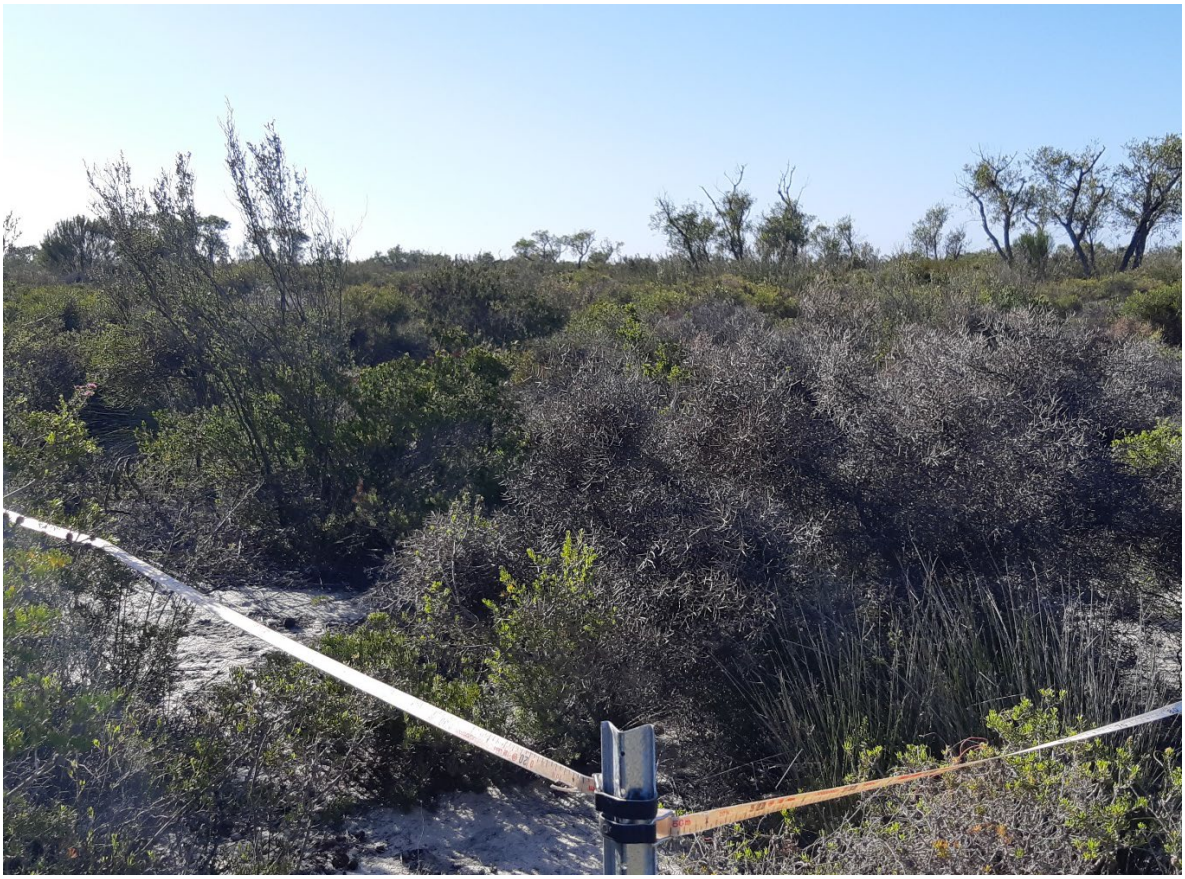
Area: 121.5 ha

Proportion of survey area: 7.7 %

Number of Quadrats: 6

Species richness: 31.5 ± 2.1 (SE)

Representative Photograph



Site AR154

APPENDIX I: SUMMARY OF VEGETATION COMMUNITIES RECORDED IN ARROWSMITH CENTRAL SURVEY AREA, 2018 AND 2019

Vegetation Community Description
Vegetation map code: H6 **Structural** Heathland of *Banksia attenuata, Hakea polyanthema* and *Melaleuca leuropoma,* over isolated *Verticordia grandis* and *Styphelia xerophylla* on white to grey sand. **Associated species** *Mesomelaena pseudostygia*, *Eremaea ectadioclada*, *Petrophile macrostachya*, *Eremaea beaufortioides* var. *beaufortioides*, *Jacksonia hakeoides*, *Stirlingia latifolia* **Soils and Landforms:** White/grey sand plains **Outcropping:** Absent **Condition:** Excellent to pristine **Area:** 192.8 ha **Proportion of survey area:** 12.3 % **Number of Quadrats:** 12 **Species richness:** 37.8 ± 1.8 (SE)
Representative Photograph
 **Site AR038**