



Appendix 2: Turner River Consolidated Flora and Vegetation Assessment



Detailed Flora and Vegetation Assessment

Turner River Consolidated

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Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Fortescue Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

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Executive Summary

Fortescue Ltd commissioned SLR Consulting Australia Pty Ltd to undertake three detailed flora and vegetation surveys over three consecutive years (2022-2024), in three adjacent Survey Areas. This report represents the consolidated results of all three surveys, known as the Turner River Consolidated Project Area. The three surveys were all conducted by SLR Consulting (in 2022 referred to as 360 Environmental part of SLR Consulting), with consistent personnel.

The Turner River Consolidated Project Area covers approximately 11,057ha and is located approximately 120 km south of Port Hedland in the Pilbara bioregion of Western Australia.

The purpose of the surveys was to identify key flora and vegetation values within the Project Area and to inform the Environmental Impact Assessment process for the defined area. This report presents the consolidated results of the flora and vegetation surveys undertaken to support the above objectives.

The desktop assessment identified 25 conservation significant flora taxa occurring within 50 km of the Project Area. A pre-survey likelihood of occurrence assessment was undertaken and determined six conservation significant flora taxa already recorded within the area, nine taxa as having a high likelihood of occurrence, three taxa as having a medium likelihood of occurrence, and seven taxa as having a low likelihood of occurrence. It also identified a single Priority Ecological Community, the Gregory Land System, which is identified by linear sand dunes which were not present in the Project Area.

The three consolidated detailed flora and vegetation surveys recorded the floristic composition and vegetation types from 177 flora sites (96 quadrats, 81 relevés), mapping notes and opportunistic observations. A total of 463 flora taxa were recorded from 175 genera across 60 families.

No Threatened flora species pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* and/or gazetted as Threatened pursuant to the *Biodiversity and Conservation Act 2016* were recorded during the survey.

Twelve Priority flora were recorded within the Project Area:

- *Neptunia longipila* (P2) – 201 individuals
- *Euphorbia clementii* (P3) – 1,904 individuals
- *Euploca mutica* (P3) – 695 individuals
- *Goodenia obscurata* (P3) – 1 individual
- *Gymnanthera cunninghamii* (P3) – 58 individuals
- *Nicotiana umbratica* (P3) – 209 individuals
- *Phyllanthus hebecarpus* (P3) – 189 individuals
- *Rothia indica* subsp. *australis* (P3) – 2 individuals
- *Triodia basitricha* (P3) – 2,115 individuals
- *Triodia chichesterensis* (P3) – ~121,416 individuals
- *Bulbostylis burbridgeae* (P4) – 633 individuals
- *Ptilotus mollis* (P4) – 15 individuals.

Two of these (*N. longipila*, and *G. obscurata*) were not identified in the database searches as they have only recently been described (following the surveys they were recorded in) and were identified following a review of literature and specimens.



Six taxa recorded were considered to be potentially novel taxa based on anomalous features:

- *Amaranthus* aff. *interruptus*
- *Bonamia pilbarensis* (tight indumentum form)
- *Eriachne* sp. Coongan Station (A.A. Mitchell PRP1566)
- *Polymeria* sp. stoloniferous
- *Solanum* aff. *cleistogamum*
- *Trianthema* aff. *oxycalyptum*

Of these, SLR believes that *Amaranthus* aff. *interruptus* and *Eriachne* sp. Coongan Station (A.A. Mitchell PRP1566) have the potential to be considered conservation significant.

Eleven introduced flora taxa were recorded during the surveys. Of these, **Opuntia ?stricta* (Common Prickly pear) is listed as a Weed of National Significance and a Declared Pest and **Calotropis procera* (Calotrope) is listed as a Declared Pest. The remaining nine weed taxa are relatively common across the Pilbara. Weed density was highest among the major drainages, facilitated by cattle.

Twenty three vegetation types were described and mapped across five broad landforms (clay, drainage, hills, outcroppings, and plains) within the Project Area. Vegetation in the Project Area was dominated by open sandy plains, with small expressions of granite boulders, and intersected by minor to major drainage. A fire in January 2022 affected ~41.55% of the Project Area, which affected vegetation mapping reliability. The area was sampled with flora quadrats in unburnt areas and mapped with regrowing juvenile individuals where possible.

No vegetations types mapped within the Project Area were considered analogous to any state or federally listed TECs or PECs.

Three vegetation types (MaAcpCi, EcAtTe, and EcMgTlo) were dominated by *Melaleuca argentea*, and/or *Eucalyptus camaldulensis* subsp. *refulgens*, and were considered to be Groundwater Dependent Vegetation. One further vegetation type (EvAtTlo) was dominated by *E. victrix*, and considered to be Potentially Groundwater Dependent Vegetation.

Seven vegetation types were considered to be locally significant due to either supporting numerous significant flora (ChAaTc, ChAspTe, TcAtpTla, GwAaTs, AsyAISf, and AspTba), or having a limited distribution in the Project Area (ChAaTs), or both.

Vegetation condition within the Project Area ranged from Excellent to Degraded (excluding cleared areas) with the majority considered to be in Excellent condition. Evidence of disturbance included weeds, cattle, and existing roads and infrastructure.



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Acronyms and Abbreviations

BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
°C	Degree Celsius
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DBCA	Department of Biodiversity, Conservation and Attractions
DoE	Department of Environment
DP	Declared Pest
DWER	Department of Water and Environmental Regulation
EIA	Environmental Impact Assessment
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection Biodiversity and Conservation Act 1999</i>
ESA	Environmentally Sensitive Area
Fortescue	Fortescue Limited
GDV	Groundwater Dependent Vegetation
GIS	Geographic Information System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessments
km	Kilometres
m	Metres
mm	Millimetres
MNES	Matters of National Environmental Significance
NVIS	National Vegetation Information System
P	Priority
PEC	Priority Ecological Community
PGDV	Potentially Groundwater Dependent Vegetation
PMST	Protected Matters Search Tool
Project Area	The Consolidation of the three Survey Areas (TR, TRW, TRA)
SLR	SLR Consulting Australia Pty Ltd
Survey Area	One detailed two season flora survey
T	Threatened
TEC	Threatened Ecological Community
TPFL	Threatened and Priority Flora Database
TPFRF	Threatened and Priority Flora Report Forms



TR	Turner River (Previously North Star)
TRW	Turner River West (Previously North Star Junction West)
TRA	Turner River Additional (Previously North Star Additional)
TRC	Turner River Consolidated
WA	Western Australia
WAH	Western Australian Herbarium
WoNS	Weeds of National Significance



1.0 Introduction

1.1 The Project

Fortescue Ltd (Fortescue) commissioned SLR Consulting Australia Pty Ltd (SLR) to undertake a detailed flora and vegetation survey for a potential solar farm development at Turner River (The Project). The Project consisted of three surveys conducted over three years, each surveyed over two phases (Table 1). In 2022 the original Turner River (TR) survey was undertaken (then called North Star), in 2023 the Turner River West (TRW) survey was undertaken (then called North Star West), and in 2024 the Turner River Additional (TRA) survey was undertaken. The three surveys have been combined and consolidated to achieve floristic alignment and are collectively referred to as the Turner River Consolidated (TRC) Project Area.

The Project Area is located approximately 25 km west of Iron Bridge and 120 km south of Port Hedland (Figure 1), and covers a total of 11,057 ha.

Table 1: Summary of the Project Area

Survey Area	Year of Survey	Total Area (ha)	Percentage of Consolidated Total
Turner River	2022	4,757.00	43.02 %
Turner River West	2023	4,532.89	40.99 %
Turner River Additional	2024	1,767.73	15.99 %
Turner River Consolidated	-	11,057.62	-

1.2 Objectives and Scope

The purpose of the survey was to identify key flora and vegetation values within the Project Area and to inform the Environmental Impact Assessment (EIA) process for the Project Area.

The scope of works was the same for each survey, to:

- Undertake a Desktop Assessment including relevant database searches and a literature review to compile and summarise existing records of flora and vegetation in the vicinity of the Survey Area
- Undertake a two-phase detailed flora and vegetation survey to identify and describe the vegetation and flora occurring within the Survey Area
- Undertake targeted searching for flora of conservation significance within the Survey Area
- Produce a flora and vegetation technical report
- Supply a geospatial data package prepared in accordance with Fortescue and Index of Biodiversity Surveys for Assessments (IBSA) requirements.

This report presents the outcomes of the flora and vegetation surveys undertaken to support the objectives outlined above.



2.0 Background

2.1 Protection of Flora and Vegetation

Western Australian (WA) flora and vegetation is formally protected by the following legislative measures:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). (Commonwealth of Australia, 1999)
- *Biodiversity Conservation Act 2016* (WA) (BC Act) (Government of Western Australia, 2016)
- *Environmental Protection Act 1986* (WA) (EP Act) (Government of Western Australia, 1986)
- *Biosecurity and Agriculture Management Act 2007* (WA) (BAM Act) (Government of Western Australia, 2007).

In addition to these legislative measures, the WA Department of Biodiversity, Conservation and Attractions (DBCA) priority flora list provides a non-legislative list of possibly threatened, rare but not threatened or near threatened taxa.

In addition to these protection mechanisms, the Environmental Impact Assessment process is supported by various guidance documents published by the Environmental Protection Authority (EPA), DBCA and the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

Western Australia:

- Environmental Factor Guideline – Flora and Vegetation (EPA, 2016a)
- Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b).

Commonwealth:

- Matters of National Environmental Significance – Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (Department of the Environment, 2013).

2.2 Climate

The closest long-term Bureau of Meteorology (BoM) weather station to the Project Area with a complete temperature and rainfall dataset is Port Hedland Airport (004032), located approximately 80 km north of the Project Area.

Climate statistics were calculated utilising data from the most current climate normal, which is defined as a 30-year interval (BoM, 2007), where possible. A climate normal is a period long enough to include year-to-year variations while avoiding the influence of longer-term changes in climate (BoM, 2007).

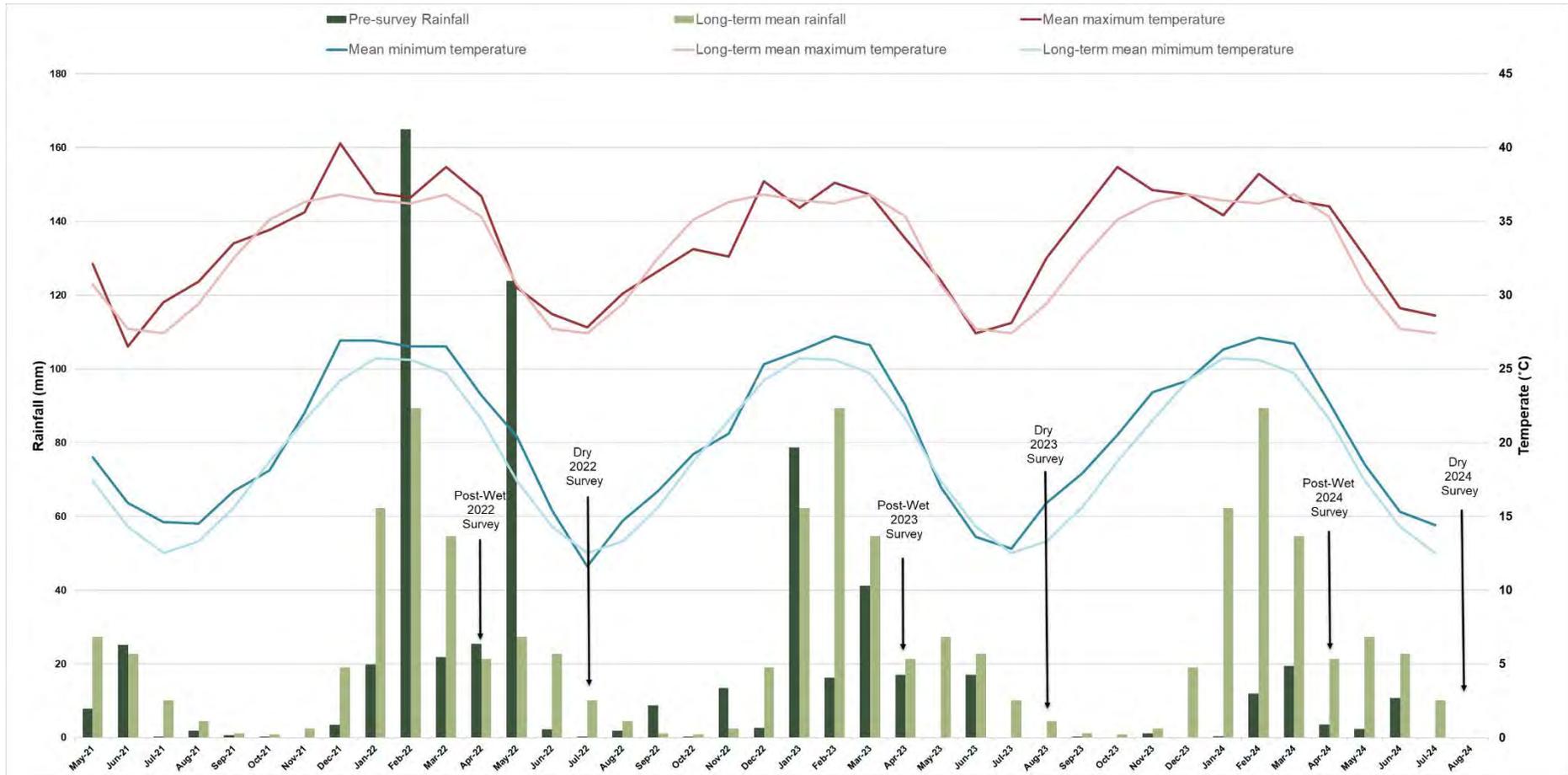
The long-term mean minimum temperature for Port Hedland Airport ranges from 13.1°C (July) to 26.0°C (January) (1991 to 2020) and the long-term mean maximum temperature ranges from 28.0°C (June and July) to 37.0°C (March) (Graph 1, Table 2) (BoM, 2024).



Long term and pre-survey rainfall and temperature data relevant to each of the six surveys is summarised below in Table 2. Rainfall – with the exception of the 3- and 12-month periods prior to the TRW Dry 2023 survey – fell short of the long-term averages across much of the 2 year survey period. This was particularly evident for the 2024 TRA surveys, where 3- and 12-month rainfall totals prior to the two surveys were up to 269 mm below the long-term average (Table 2). Average minimum and maximum temperatures were largely above average.

Higher than average temperatures and lower than average rainfall totals prior to the respective surveys is likely to have had some impact on the presence of some flora. In particular, low rainfall prior to the TRA post wet survey in April 2024 is likely to have impacted the suite of flora recorded during that survey.





Graph 1: Climate Summary of all Surveys



Table 2: Rainfall and Temperature Comparisons to Long-Term Data for TR, TRW and TRA

Survey & Season	Range	Mean Rainfall (mm)		Rainfall difference (mm)	Mean Maximum Temperature (°C)		Mean Minimum Temperature (°C)	
		Long-Term	Recent		Long-Term	Recent	Long-Term	Recent
TR Post-Wet (Apr 2022)	12 mths	337.1	331.4	-5.7	33.5	33.3	19.7	20.7
	3 mths	165.2	74.4	-90.8	36.1	36.1	24.0	25.4
TR Dry (Jun 2022)	12 mths	320.3	196.8	-123.5	33.1	32.9	19.1	19.9
	3 mths	37.4	17.0	-20.4	28.2	29.3	13.4	14.1
TRW Post-Wet (April 2023)	12 mths	334.3	271.2	-63.1	33.7	34.2	20.0	20.6
	3 mths	223.3	206.6	-16.7	36.6	37.4	25.6	26.6
TRW Dry (Aug 2023)	12 mths	334.6	387.2	52.6	36.6	34.2	21.8	22.7
	3 mths	117.8	171.0	53.2	34.7	35.3	21.6	23.4
TRA Post-Wet (Apr 2024)	12 mths	330.9	78.8	-252.1	33.8	34.3	20.1	20.7
	3 mths	227.3	31.8	-195.5	36.6	36.7	25.8	26.7
TRA Dry (Aug 2024)	12 mths	331.4	61.6	-269.8	33.8	34.8	20.2	21.1
	3 mths	58.6	13.2	-45.4	29.2	30.1	15.2	16.1



2.3 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on major biological, geographical, and geological attributes. These bioregions are subdivided into 419 subregions as part of a refinement of the IBRA framework (Department of the Environment and Energy, 2016). The Project Area occurs within the Pilbara bioregion and the Chichester (PIL01) subregion.

The Chichester (PIL01) subregion comprises the northern section of the Pilbara Craton and is characterised by undulating Archaean granite and basalt plains include significant areas of basaltic ranges. The subregion is represented by plains supporting a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, and ranges supporting *Eucalyptus leucophloia* tree steppes. The climate is Semi-desert-tropical and receives 300 mm of rainfall annually, with drainage occurring to the north via numerous rivers (e.g. De Grey, Oakover, Nullagine, Shaw, Yule, Sherlock) (Kendrick & McKenzie, 2001).

2.4 Soil Landscapes and Land Systems

Soil landscapes and land system mapping of WA describes broad soil and landscape characteristics from regional to local scales, ranging from 1:20,000 to 1:250,000 (DPIRD, 2018). The Project Area occurs across nine land systems (Table 3; Figure 2).

Table 3: Land Systems within the Project Area

Land System		Description	Extent within Project Area (ha) and Percent Coverage
Name	Code		
Turner River			
Boolaloo System	283Bo	Granite hills, domes, tor fields and sandy plains supporting spinifex grasslands with scattered shrubs.	26.8 (0.6%)
Macroy System	280/283Mc	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex shrubby grasslands.	1257.0 (26.4%)
River System	280Ri	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	15.6 (0.3%)
Robe System	280Ro	Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands	89.2 (1.9%)
Platform System	280PI	Dissected slopes and raised plains supporting shrubby hard spinifex grasslands	51.3 (1.1%)
Uaroo System	283Ua	Broad sandy plains, pebbly plains and drainage tracts supporting hard and soft spinifex hummock grasslands with scattered acacia shrubs	1317.9 (27.7%)
Boolgeeda System	280Bg	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or Mulga shrublands	1952.05 (41.0%)



Land System		Description	Extent within Project Area (ha) and Percent Coverage
Name	Code		
Capricorn System	280Cp	Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs	47.2 (1.0%)
Turner River West			
Macroy System	280/283Mc	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex shrubby grasslands.	2748.1 (60.6%)
River System	280Ri	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	1.3 (0.01%)
Boolaloo System	283Bo	Granite hills, domes, tor fields and sandy plains supporting spinifex grasslands with scattered shrubs.	1783.5 (39.3%)
Turner River Additional			
Boolgeeda System	280Bg	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or Mulga shrublands	16.3 (0.9%)
Macroy System	280/283Mc	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex shrubby grasslands.	1289.5 (72.9%)
River System	280/283Ri	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	248.5 (14.1%)
Talga System	280Ti	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands	107.7 (6.1%)
Uaroo System	283Ua	Broad sandy plains, pebbly plains and drainage tracts supporting hard and soft spinifex hummock grasslands with scattered acacia shrubs	105.8 (6.0%)

2.5 Hydrography

Hydrographic features intersecting and in the vicinity of the Project Area are described in Table 4 and shown in Figure 2 (DWER, 2018).

Table 4: Hydrographical Features in the Vicinity of the Project Area

Hydrographical Feature	Description
Turner River West	A major tributary located just West of TRW, flowing towards the north towards Port Hedland.



Hydrographical Feature	Description
Turner River	A minor river which flows from TRA north towards Port Hedland.
Significant Stream	A significant stream intersecting the Turner River and the southern portion of the TR Survey Area.
Gillam Creek	A minor, non-perennial tributary, intersecting the TR Survey Area.

2.6 Broad Vegetation Associations

Mapping of pre-European vegetation in WA was completed on a broad scale (1:1,000,000) by Beard (1976). These vegetation associations were later refined by Shepherd et al. (2002) resulting in 819 associations.

Four broad vegetation system association occurs over the Project Area (Figure 3):

- **Abydos Plain - Chichester 93:** Hummock grassland with scattered shrubs or mallee *Triodia* spp., *Acacia* spp., *Grevillea* spp. *Eucalyptus* spp
- **Abydos Plain - Chichester 619:** Medium woodland; river gum (*Eucalyptus camaldulensis*)
- **Abydos Plain - Chichester 626:** Hummock grasslands, shrub steppe; kanji over soft spinifex and *Triodia brizoides*
- **George Ranges 82:** Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*

Representation of the association at a local, regional, and state level is shown in Table 5.

Table 5: Broad Vegetation Associations within the Turner River Consolidated Project Areas and their Representation at the State, Regional and Local Levels
(Government of Western Australia, 2019)

Vegetation Association	Extent			
	Pre-European (ha)	Current (ha)	Remaining (%)	Managed in DBCA Lands (%)
Representation across Western Australia				
Abydos Plain 93	3,044,309.52	3,040,640.98	99.88	1.96
Abydos Plain 619	119,373.78	118,205.01	99.02	0.20
Abydos Plain 626	117,724.44	117,198.13	99.55	15.66
George Ranges 82	2,565,901.28	2,553,206.19	99.51	11.57
Representation across the Pilbara Bioregion				
Abydos Plain 93	3,042,114.27	3,038,471.67	99.88	1.96
Abydos Plain 619	118,920.31	118,116.78	99.32	0.20
Abydos Plain 626	117,724.44	117,198.13	99.55	15.66
George Ranges 82	2,563,583.23	2,550,888.14	99.50	11.58
Representation across the Chichester (PIL01) Subregion				
Abydos Plain 93	2,940,348.04	2,936,731.54	99.88	-
Abydos Plain 619	85,543.15	85,520.95	99.97	0.28



Vegetation Association	Extent			
	Pre-European (ha)	Current (ha)	Remaining (%)	Managed in DBCA Lands (%)
Abydos Plain 626	117,724.44	117,198.13	99.55	15.66
George Ranges 82	360,666.90	360,322.69	99.90	-
Representation across the Shire of East Pilbara				
Abydos Plain 93	1,709,522.24	1,706,780.57	99.84	2.70
Abydos Plain 619	52,765.30	52,763.69	100.00	0.00
George Ranges 82	927,709.76	919,072.17	99.07	0.50

*as a portion of the current extent

2.7 Environmentally Sensitive and Conservation Areas

Environmentally Sensitive Areas (ESAs) are declared by the Department of Water and Environmental Regulation (DWER) to prevent the degradation of important environmental values such as Threatened flora, Threatened Ecological Communities (TECs) or significant wetlands.

The Project Area is not identified within an ESA or Conservation Area and the nearest ESA/conservation area is shown in Figure 4 and listed below:

- Mungaroona Range Nature Reserve, located 50 km southwest of the Project Area and is vested under the Conservation Commission of Western Australia (DBCA, 2021).



3.0 Methods

The detailed flora and vegetation surveys documented by this report was undertaken in accordance with relevant EPA and DAWE guidelines (see section 2.1).

3.1 Desktop Assessment

3.1.1 Literature Review

Background information on the Project Area and surrounds was compiled prior to each field survey, and consolidated in this report. Historical vegetation mapping (Beard, 1976; Shepherd, Beeston, and Hopkins, 2002), land systems mapping (DPIRD, 2018), and the IBRA classification system (Kendrick & McKenzie, 2001) were consulted to provide broad contextual knowledge of the vegetation units and habitat likely to be encountered within the Project Area.

The literature review also considered a selection of biological reports detailing assessments undertaken in the region (Figure 5), that were either publicly available or provided by Fortescue:

- North Star Detailed Flora and Vegetation Survey (360 Environmental part of SLR Consulting, 2022) – Consolidated in this report as Turner River (2022)
- North Star Junction West Detailed Flora and Vegetation Survey (SLR Consulting, 2023) – Consolidated in this report as Turner River West (2023)
- Glacier Valley Extension Flora and Vegetation Survey, North Star Project (Ecoscape, 2018a)
- North Star Junction Flora and Fauna Assessments (Ecoscape, 2021)
- North Star Slurry and Infrastructure Corridors Conservation Significant Flora and Vegetation Assessment (Ecologia, 2015)
- North Star Vegetation and Flora Assessment (Ecologia, 2012)
- Pilbara Transmission Project Flora and Vegetation Desktop Assessment (Ecoscape, 2018b)
- Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor (Biota Environmental Services, 2004)

3.1.2 Database Searches

Database searches were undertaken to compile a list of potential flora and identify potential significant ecological communities within or surrounding the Project Area (Table 6). In addition, an EPBC Protected Matters Search Tool (PMST) was undertaken to identify the potential for Matters of National Environmental Significance (MNES) to occur within or surrounding the Project Area (DAWE, 2020). All three surveys were conducted in such close proximity that a single set of database searches was used for all of them.



Table 6: Database Searches of the Project Area

Database Name	Date Received and Search Reference	Search Target	Buffer around the Project Area
Threatened and Priority Ecological Communities database search (Department of Biodiversity Conservation and Attractions, 2022)	5 April 2022 04_0322EC	TECs and PECs	50 km radial search buffer around a central point
Threatened and Priority Flora (TPFL) database search (DBCA, 2022b)	14 February 2022 19-0222FL_TPFL	Threatened and Priority flora	70 km radial search buffer around a central point
Western Australian Herbarium flora database search (DBCA, 2022c)	14 February 2022 19-0222FL_WAHerb	Threatened and Priority flora	70 km radial search buffer around a central point
NatureMap (DBCA, 2022a)	16 February 2022	Threatened and Priority flora	40 km radial search buffer around a central point
Protected Matters Search Tool (DAWE, 2022)	27 Mar 2023	Commonwealth listed flora and TECs	100 km radial search buffer around a central point

Currently listed Priority and Threatened Ecological Communities (PECs and TECs) that occur within the Pilbara bioregion were also examined to determine if any corresponded with the Project Area (DBCA, 2020; Department of Biodiversity Conservation and Attractions, 2018).

3.1.3 Likelihood of Occurrence

Significant flora species identified from the desktop assessment were assessed to determine the likelihood of their occurrence within the Project Area, both prior to and post field survey. The assessment was completed based on the likelihood of occurrence criteria presented in Table 7.

Only species either recorded within the Project Area or considered as having a high or medium likelihood of occurrence are discussed in detail. Species classified as having a low likelihood of occurrence based on the above criteria are not discussed unless a justification for this classification is required.



Table 7: Likelihood of Occurrence Criteria

Rank	Criteria
Previously Recorded	The species has been previously recorded in the Project Area
High (Likely to occur)	<ul style="list-style-type: none"> • There are existing records of the species in close proximity to the Project Area (within 20 km) • The species is strongly linked to a specific habitat, which is present in the Project Area; or • The species has more general habitat preferences, and suitable habitat is present.
Medium (May occur)	<ul style="list-style-type: none"> • There are existing records of the species from the locality (within 40 km), however <ul style="list-style-type: none"> ○ The species is strongly linked to a specific habitat, of which only a small amount is present in the Project Area; or ○ The species has more general habitat preferences, but only some suitable habitat is present. • There is suitable habitat in the Project Area, but the species is recorded infrequently in the locality.
Low (Unlikely to occur)	<ul style="list-style-type: none"> • The species is linked to a specific habitat, which is absent from the Project Area; or • Suitable habitat is present, however there are no existing records of the species from the locality despite reasonable previous search effort in suitable habitat; or • There is some suitable habitat in the Project Area, however the species is very infrequently recorded in the locality.

3.2 Field Survey

3.2.1 Survey Timing

The biological surveys were undertaken across two field trips to collect data from the Project Area (Table 8). Survey effort is demonstrated in Figure 6.

Table 8: Field Trips

Trip	Survey	Scope	Date	Person Field Days
1	Turner River	Detailed flora and vegetation survey phase 1 – Post-wet season	1 – 7 Apr 2022	28
2	Turner River	Detailed flora and vegetation survey phase 2 – Dry season	20 – 29 Jun 2022	36
3	Turner River West	Detailed flora and vegetation survey phase 1 – Post-wet season	29 Mar – 4 Apr 2023	14
4	Turner River West	Detailed flora and vegetation survey phase 2 – Dry season	18 – 24 Aug 2023	14
5	Turner River Additional	Detailed flora and vegetation survey phase 1 – Post-wet season	22 Apr – 28 Apr 2024	14
6	Turner River Additional	Detailed flora and vegetation survey phase 2 – Dry season	5 – 10 Aug 2024	12



3.2.2 Field Personnel

Field personnel and their roles for each of the trips are detailed in Table 9. The detailed flora and vegetation surveys were led by Principal Botanist Simon Colwill with 14 years' of experience conducting surveys of similar scope throughout Western Australia.

Table 9: Field Personnel

Personnel	Collection License	Role	Years Experience	Trips
Simon Colwill	FB62000037-2	Principal Botanist, Project Manager	14	1,2,3,4,5,6
Grant Buller	FB62000321-2	Senior Ecologist	5	1,2
Jack Hardie	FB62000389-2	Botanist	3	2,3,4,5,6
Megan Young	FB62000388	Botanist	3	1,2
Bridget Duncan	FB62000370	Botanist	2	1

3.2.3 Establishment of Flora Sites

Indicative flora sites were identified prior to the surveys using aerial photography, and adjacent available vegetation mapping, to estimate broad vegetation patterns within the Project Area. The location and number of flora sites completed were adjusted on site to achieve sites most representative of the vegetation present.

At least three flora sites were sampled in each vegetation type observed within the Project Area, where possible. Some vegetation types that were not large enough to accommodate three flora sites had only one or two sites sampled.

The flora sites comprised either quadrats or relevés. Quadrats were 50 x 50 m typically with corners aligned to northwest, northeast, southeast and southwest, and accurately measured using measuring tapes. As a minimum, the northwest corner of each quadrat was demarcated with an aluminium fence dropper and where possible a fence dropper was also installed in the southeast corner. Fence droppers were removed following completion of the quadrat as per Fortescue request. Relevés comprised unbounded sites of approximately 50 x 50 m where possible, or alternate configurations approximately equating to 2500 m² (as required in areas such as drainage lines, gullies, and narrow ridge lines). A comprehensive record of the flora present at the time of sampling was recorded for both quadrat and relevés sites, the primary difference between the site types being that relevés were not measured and bounded using tapes.

Flora site location was recorded using a handheld Unistrong UTM GPS tablet, with points recorded at each corner of a quadrat, the start and finish point of linear relevés, and the central point of circular relevés. At each flora site, the following was recorded using a Fulcrum mobile data collection device:

- Site code
- Date and personnel
- Landform and soil description
- Relevant site descriptors including slope, aspect, and estimated fire age
- Inventory of vascular flora including the approximate average height and percentage foliar cover for each taxon recorded



- Vegetation description in accordance with the National Vegetation Information System (NVIS), Level 5 'association', whereby the dominant growth form, height, cover and species (three species) for the three traditional strata (upper, mid, and ground) are described
- Vegetation condition in accordance with the Eremaean Botanical Provinces vegetation condition scale (EPA, 2016b), and evidence of disturbance (for example clearing, rubbish, feral animals, and weed incursion) where present
- Photograph of the vegetation occurring within the site.

A total of 177 flora sites (comprising 96 quadrats and 81 relevés) were established within the Project Area. An additional 1,131 combined mapping notes were completed to aid vegetation mapping delineation.

3.2.4 Opportunistic Flora

Additional flora taxa observed opportunistically around flora sites or while traversing on foot within the Project Area were also recorded. Where populations of significant flora taxa, Declared Pests (DPs) or Weeds of National Significance (WoNS) were encountered, a GPS location and a count of the individuals present was recorded.

3.2.5 Targeted Searching

Prior to undertaking the survey, a list of significant flora with the likelihood or potential to occur within the Project Area was compiled (see section 4.2.3). Field personnel familiarised themselves with photographs, reference samples and descriptions of these taxa before conducting the survey.

The entire Project Area was not systematically searched. Rather, targeted searching focussed on habitat suitable for Threatened and Priority flora. Furthermore, potential habitat within the proposed footprint was prioritised for targeted searching over areas outside the proposed footprint.

Personnel also actively searched for significant flora species in and around flora sites, while traversing on foot within the Project Area and in known locations or preferred habitat encountered in the Project Area.

Where Threatened or Priority flora were encountered in the field a GPS location was taken and a count of individuals was recorded, followed by a search in the local vicinity to determine if any other individuals were present nearby and delineate population boundaries where relevant. Specimens of any potential significant flora that could not be identified in the field were collected for identification and lodgement at the Western Australian Herbarium (WAH).

3.2.6 Taxonomy and Nomenclature

Where field identification of plant taxa was not possible, specimens were collected for identification using resources of the WAH. Identification of flora collections was completed by experienced Pilbara taxonomists Pierre-Louis de Kock and Simon Colwill.

The finalised species list was checked against FloraBase (DBCA, 2024) to determine the conservation status and known distribution of each taxon. Introduced species were compared against the current BAM Act Declared Plants list and the WoNS list to determine their control status (DCCEEW, 2024; DPIRD, 2024).



Any significant flora taxa, including potential Threatened and Priority species, range extensions and potential new taxa were submitted to the WAH for verification and lodgement. Where relevant, Threatened and Priority Flora Report Forms (TPFRFs) were submitted to DBCA flora branch following each survey, and provided to Fortescue.

3.2.7 Vegetation Unit and Condition Mapping

Broad vegetation and condition mapping was conducted in the field, with boundaries delineated over aerial photography, at a scale of 1:5,000. Broad vegetation units were refined based on taxonomic identification of flora collections, statistical analysis of data collected from the quadrats and relevés, and mapping notes taken during the field survey. Vegetation condition mapping was refined based on site data and mapping notes. Finalised polygons were digitised and produced as electronic mapping data using GIS software.

3.3 Statistical Analysis

Statistical analysis of quadrat data was undertaken in accordance with EPA guidelines for a detailed flora and vegetation survey.

3.3.1 Multivariate Analysis

The vegetation composition of each quadrat was compared using cover class values for each species recorded and analysed using multivariate analysis tools in Primer v7. Cover values were tested for similarity using the Bray-Curtis coefficient. Vegetation units were defined based on approximately 40-80% similarity and distinguished visually in a dendrogram cluster analysis. The analysis was undertaken on a data matrix comprising 362 vascular flora taxa and 169 flora sites. Relevés were included in the analysis as they were undertaken with a high level of accuracy for this survey, the only difference from the quadrats being that they were not marked with the traditional four cardinal corners.

Singletons (flora taxa recorded at only one site) were excluded from the analysis because, due to the properties of the Bray-Curtis coefficient, they act as "indicators" for grouping and can therefore bias the results. However, if singletons were a dominant taxon within the site they were retained. Introduced taxa were removed as their presence is typically associated with a disturbance rather than representative of a vegetation unit. Unidentified or partially identified flora taxa were removed based on their ambiguity; exceptions were made for taxa that could not be identified but were confirmed to be the same across a number of sites.

Annual and ephemeral taxa were excluded in the analysis, and eight sites (NSQ88, NSR68, NSR69, NSR71, NSR73, NSR77, NSR81, NSR83) were excluded from the analysis due to recent fires.

3.3.2 Species Accumulation Curve

Species accumulation curves were plotted using Primer v7 to determine the adequacy of the surveys. The treatments comprised Sobs (Mao Tao), to reflect the number of species observed (based on a given total of species recorded), and richness estimators Chao 1, Chao 2, Jackknife 1, Bootstrap and Michaelis-Menton to predict the total number of flora taxa that could potentially be recorded. Species accumulation curves for this survey were calculated using data collected from the flora sites within the Project Area. All flora taxa, both annual and perennial, within each flora site were used in generating the species accumulation curve, except for unknown flora taxa that could only be tentatively identified.



4.0 Results

4.1 Limitations

Limitations and constraints of the flora and vegetation surveys are detailed below in Table 10.

Table 10: Limitations and Constraints Associated with the Survey

Variable	Degree of Limitation	Potential Constraints on Survey Outcomes
Availability of data and information	No	All data required to complete the scope of works including regional and local contextual information was available.
Competency and experience	No	<p>The flora and vegetation field surveys were undertaken by teams with extensive experience in undertaking similar scopes within the bioregion.</p> <ul style="list-style-type: none"> Principal Botanist Simon Colwill – 14 years' experience Senior Ecologist Grant Buller – 5 years' experience Botanist Jack Hardie – 3 years' experience. <p>Flora identification was undertaken by Pilbara taxonomists Pierre-Louis de Kock, and Simon Colwill.</p>
Survey scope	No	<p>The detailed flora and vegetation survey was undertaken in accordance with (Environmental Protection Authority, 2016) and was considered appropriate to inform approvals applications. Two phases of survey were undertaken in a post-wet, and dry season for each of the three surveys.</p> <p>Targeted searching for flora of conservation significance was undertaken, however as per standard practice in the Pilbara systematic searches were not feasible. Rather, targeted searching focussed on habitat suitable for Threatened and Priority flora within the proposed development footprint.</p>
Access	No	The entire Project Area was accessed by helicopter, vehicle and on foot.
Adequacy of survey intensity	No	<p>177 flora sites (comprising 96 quadrats and 81 relevés) were sampled across the Project Area. An additional 290 mapping notes were undertaken to aid vegetation mapping and delineation.</p> <p>The survey effort was considered adequate to assess the flora and vegetation values of the Project Area and provide information required to inform approvals applications. The greatest survey intensity was focussed on unburnt areas, with survey effort reduced in burnt areas due to lack of surveyable flora. Burnt areas were still assessed visually from the air with the use of a helicopter, and the consolidation of results from the three surveys allowed for appropriate survey intensity despite fire impacts.</p> <p>Additional flora species, and populations of significant flora species and weed species would likely be recorded with additional survey effort, particularly in burnt areas once regenerated.</p>



Variable	Degree of Limitation	Potential Constraints on Survey Outcomes
Timing, weather, season	No	The flora surveys were conducted within the recommended timing for the region and many annual flora taxa were recorded.
Life forms sampled	No	<p>The Project Area was traversed by helicopter, car, and on foot and representative sites of all remnant vegetation was sampled. All flora species encountered within the Project Area were recorded.</p> <p>A total of 463 vascular flora taxa were recorded from the Project Area, comprising ~98% native flora taxa and 2% introduced flora taxa.</p> <p>Of the 463 flora taxa recorded, 43 taxa (~9%), could not be identified to taxonomic finality because they were sterile at the time of the surveys. A further nine taxa were considered hybrids of two recorded parent taxa. This was not considered a constraint as it represented a very small portion of the flora sampled.</p> <p>None of the unknown flora taxa collected were analogous to Threatened or Priority flora taxa identified by the database searches as likely to occur within the Project Area, nor were they representative of flora of other significance.</p>
Mapping reliability	Partial	<p>Vegetation types were described and mapped based on quadrat and relevé data and additional mapping notes taken during the field surveys.</p> <p>Vegetation types were consolidated between each survey for aligned vegetation and condition mapping across all three surveys.</p> <p>The greatest effort was expended ground truthing vegetation boundaries in unburnt areas, with reduced effort in mapping on areas that were recently affected by fire. Where fires were noted, vegetation was significantly impacted, with only sparse remnant species, or difficult to identify juvenile regrowth. Many fire ephemeral taxa were present that were not reliable to map vegetation from. Where vegetation was burnt it was considered to be mapped to a low reliability, which represented approximately 41.55% of the Project Area.</p>
Disturbances (fire, flood etc.)	Partial	<p>There were recent fires through the southern extent of the TRW Survey Area, and other small, assorted sections of the Project Area. Vegetation was affected in these areas, leading to a decrease in mapping reliability. Recent fire is also likely to have caused an increase in ephemeral fire-response taxa, including significant taxa such as <i>Euphorbia clementii</i> (P3), which was only present in burnt areas.</p> <p>Areas of disturbance associated with cattle grazing and trampling, cleared tracks and drill pads, infrastructure, weeds, fire scars, and railway tracks were present within the Project Area but were not a constraint on the results of the survey.</p>
Problems with data and analysis	No	Flora sites considered to be affected by fire were excluded from the analysis. Floristic groupings were rigorous and mostly aligned with in field observations. There were no limitations to the analysis.



Variable	Degree of Limitation	Potential Constraints on Survey Outcomes
Completeness	No	The surveys were considered complete for a detailed flora and vegetation survey, all vegetation types were surveyed and delineated within the Project Area and a minimum of three quadrats was surveyed for each vegetation type where possible. Three of the 23 vegetation types were sampled with fewer than three sites, due to restricted distribution of the vegetation and landforms. This is not considered a limitation.

4.2 Desktop Assessment

4.2.1 Literature Review

The key findings of the flora and vegetation reports reviewed are summarised in Appendix B.

4.2.2 Database Searches

Database searches identified 24¹ significant flora species occurring within 50 km of the Project Area (Appendix C), comprising:

- One Threatened taxa
- Four Priority 1 taxa
- One Priority 2 taxon
- Sixteen Priority 3 taxa
- Two Priority 4 taxa

No State or Commonwealth listed TECs were identified within the Project Area by the database searches. One State listed PEC occurs within 50 km of the Project Area, the Gregory Land System (P3) (Figure 7). Six instances of this PEC are located within 50 km of the Project Area, the closest being located approximately 15 km west of the Project Area. The Gregory Land System is described as 'Linear dunes and restricted sandplains supporting shrubby hard spinifex (and occasionally soft spinifex) grasslands'.

4.2.3 Likelihood of Occurrence

The pre-survey likelihood of occurrence assessment identified that of the 25 significant flora species identified by the desktop assessment:

- 6 had previously been recorded within the Project Area
- 8 were considered to have a high likelihood of occurrence
- 3 were considered to have a medium likelihood of occurrence
- 7 were considered to have a low likelihood of occurrence.

Following the survey, the likelihood of occurrence assessment identified that:

- 10 taxa identified by the database searches were recorded within the Project Area
- 2 Additional taxa not identified by the database searches were recorded within the Project Area due to recent taxonomic reviews

¹ At the time of the database searches *Eragrostis crateriformis* (P3) was a listed priority species, which has since been delisted and is no longer mentioned as significant in the report.



- No taxa were considered to have a high likelihood of occurrence
- 3 taxa were considered to have a medium likelihood of occurrence
- 11 taxa were considered to have a low likelihood of occurrence.

The likelihood of occurrence assessment is provided in Appendix D.

4.3 Field Survey

4.3.1 Flora Composition

The consolidated surveys recorded a total of 463 taxa from 175 genera across 60 families (Appendix E). The dominant families were Fabaceae (81 taxa), Poaceae (77 taxa) and Malvaceae (51 taxa). The most dominant genera were *Acacia* (30 species), *Cyperus* (13 species), and *Eriachne* (12 species). Species diversity was considered higher than average for the region and size of the Project Area, due to recent burns and an increase in fire-responding annual taxa during the Turner River (2022) survey.

4.3.2 Flora of Significance

No Threatened flora species pursuant to the EPBC Act 1999 and/or gazetted as Threatened pursuant to the BC Act 2016 were recorded during the survey. Twelve DBCA listed Priority taxa were recorded within the Project Area (Table 11, Figure 8).

An additional 18 taxa were considered significant for other reasons, as detailed in Table 11. Flora may be considered of other significance if it is a:

- Range extension, population extension, or represents the extent of a species range
- Novel taxon or displays unusual characteristics warranting further taxonomic investigation
- Hybrid of other species within the Project Area, or
- Species that plays a keystone role in a community, has relic status or is locally endemic

During access walks to and from the Project Area, significant flora were recorded opportunistically outside the Project Area boundaries, these records were not included in the total counts, and all species recorded outside were also recorded within the Project Area. Additional information for each taxon is provided below Table 11. Hybrid species are listed in Table 11, and not discussed further.

Threatened and Priority Flora Report forms were submitted to the DBCA and Fortescue following the survey.



Table 11: Summary of Significant Flora in the Project Area.

Taxon	Turner River (2022)		Turner River West (2023)		Turner River Additional (2024)		Consolidated Total		Outside	
	Count	Locations	Count	Locations	Count	Locations	Count	Locations	Count	Locations
Priority 2 (DBCA)										
<i>Neptunia longipila</i>	201	3	-	-	-	-	201	3	1	1
Priority 3 (DBCA)										
<i>Euphorbia clementii</i>	1,512	32	1	1	391	32	1,904	65	71	9
<i>Euploca mutica</i>	87	15	583	50	25	6	695	71	2	2
<i>Goodenia obscurata</i>	-	-	1	1	-	-	1	1	-	-
<i>Gymnanthera cunninghamii</i>	8	4	43	8	7	6	58	18	29	7
<i>Nicotiana umbratica</i>	-	-	164	9	45	3	209	12	5	1
<i>Phyllanthus hebecarpus</i>	-	-	189	11	-	-	189	11	2	1
<i>Rothia indica</i> subsp. <i>australis</i>	-	-	2	1	-	-	2	1	-	-
<i>Triodia basitricha</i>	2,115	5	-	-	-	-	2,115	5	7,200	6
<i>Triodia chichesterensis</i>	95,704	45	21,092	25	4,620	25	121,416	95	37,480	13
Priority 4 (DBCA)										
<i>Bulbostylis burbidgeae</i>	-	-	633	21	-	-	633	21	1,410	14
<i>Ptilotus mollis</i>	15	1	-	-	-	-	15	1	-	-



Taxon	Turner River (2022)		Turner River West (2023)		Turner River Additional (2024)		Consolidated Total		Outside	
	Count	Locations	Count	Locations	Count	Locations	Count	Locations	Count	Locations
Anomalous features, potentially new species										
<i>Amaranthus</i> aff. <i>interruptus</i>	-	-	36	6	21	2	57	8	119	15
<i>Bonamia pilbarensis</i> (tight indumentum form)	-	-	-	-	4	4	4	4	-	-
<i>Eriachne</i> sp. Coongan Station (A.A. Mitchell PRP1566)					4	4	4	4		
<i>Polymeria</i> sp. stoloniferous	182	15	15	1	3	3	200	19	4	1
<i>Solanum</i> aff. <i>cleistogamum</i>	1	1	-	-	-	-	1	1	57	6
<i>Trianthema</i> aff. <i>oxycalyptum</i>	3	3	145	12	-	-	148	15	8	7
Range Extension										
<i>Polygala galeocephala</i>	1	1	3	3	2	2	6	6	-	-
<i>Portulaca digyna</i>	1,523	5	108	6	-	-	1,631	11	5	1
<i>Zornia muelleriana</i> subsp. <i>congesta</i>	-	-	2	2	1	1	3	3	-	-
Hybrids										
<i>Acacia ampliceps</i> x <i>bivenosa</i>	2	2	-	-	-	-	2	2	-	-
<i>Acacia ancistrocarpa</i> x <i>orthocarpa</i>	1	1	-	-	-	-	1	1	1	1
<i>Acacia ancistrocarpa</i> x <i>trachycarpa</i>	1	1	-	-	-	-	1	1	-	-
<i>Acacia ancistrocarpa</i> x unknown hybrid	1	1	-	-	-	-	1	1	-	-
<i>Acacia eriopoda</i> x <i>stellaticeps</i>	-	-	1	1	-	-	1	1	-	-



Taxon	Turner River (2022)		Turner River West (2023)		Turner River Additional (2024)		Consolidated Total		Outside	
	Count	Locations	Count	Locations	Count	Locations	Count	Locations	Count	Locations
<i>Acacia orthocarpa</i> x <i>stellaticeps</i>	-	-	1	1	-	-	1	1	-	-
<i>Acacia trachycarpa</i> x unknown hybrid	2	1	-	-	-	-	2	1	-	-
<i>Acacia tumida</i> var. <i>pilbarensis</i> x unknown hybrid	-	-	1	1	-	-	1	1	-	-
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	-	-	1	1	1	1	2	2	-	-



4.3.2.1 Flora of Significance

***Neptunia longipila* (P2)**

Neptunia longipila (P2) is an annual herb growing on cracking clay or semi-clay soils within the TR Survey Area. This species was only recently described (Bean, 2022) as part of a revision of the genus, requiring fruit to confirm the identification. This species was recorded primarily in vegetation type AsyAISf on cracking clay landform, which is common for *Neptunia* species. Other opportunistic individuals were recorded in nearby drainages with ecotonal semi-clay soils (ChAspTe), however this was not considered the main habitat of the species. These records represent a range extension of approximately 100 kms. The WAH has 16 records of the species, with most records occurring within 20 km of the Project Area (DBCA, 2024). Within the Project Area 201 individuals were recorded, with an additional single record just outside the TR Survey Area.

***Euphorbia clementii* (P3)**

Euphorbia clementii (P3) is an annual herb which typically grows to 0.6 m tall in clay-loam open flood plains and germinates actively in response to fire. It has prominent brightly coloured red and yellow stems, a white inflorescence, and flowering time ranging from April to July (Plate 1). The WAH has 31 records of the species, with most records occurring within 20 km of the Project Area (DBCA, 2024).

During the surveys 1,904 individuals were recorded across the Project Area, predominantly from the TR Survey Area in locations most recently affected by fire. This taxon was not restricted to any distinct vegetation type, occurring in hills, plains, and drainages wherever fire had recently occurred. A further 71 individuals were recorded outside the Project Area opportunistically.

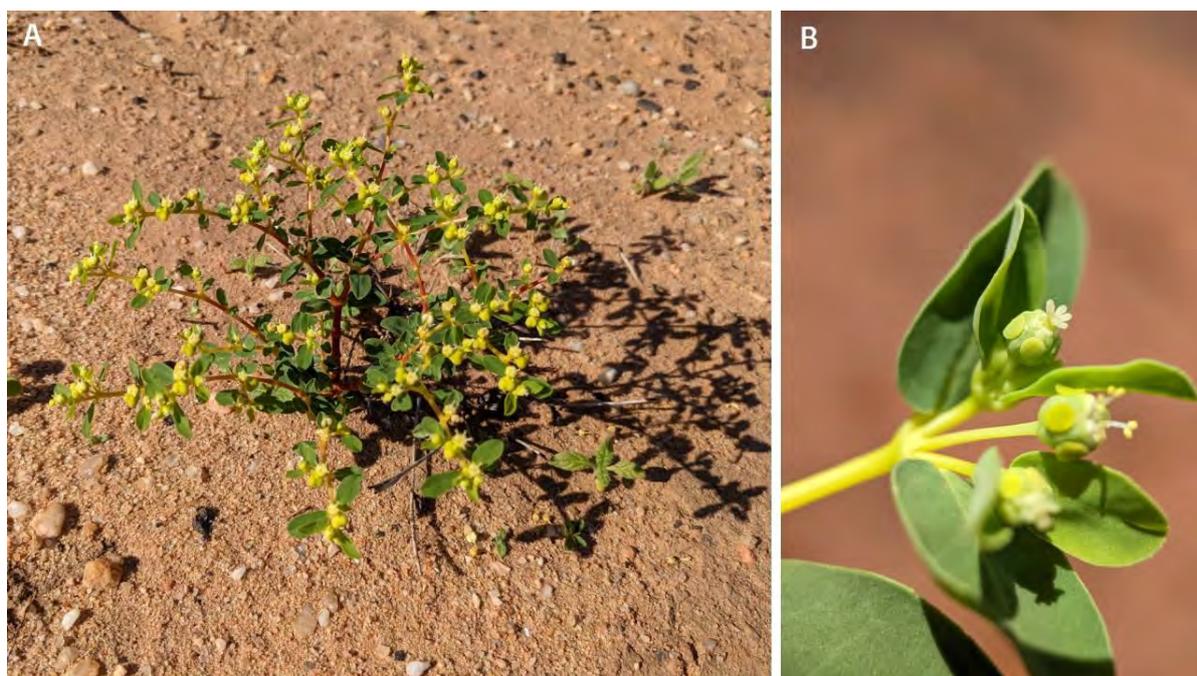


Plate 1: *Euphorbia clementii* (P3) from the Project Area A) Habit among burnt plains, and B) flowers (SLR Consulting Australia, 2023)



***Euploca mutica* (P3)**

Euploca mutica (P3) (formerly known as *Heliotropium muticum*) is a slender low shrub or herb, occurring sparsely among the open plains of the Project Area (Plate 2) (DBCA, 2024). This taxon was identified by the database searches and would be expected to occur sparsely across similar vegetation in the Project Area.

During the surveys 695 individuals were recorded from 71 locations, predominantly among vegetation type AoTe that had been recently burnt. Individuals were cryptic among the spinifex of the open plains, with few individuals occurring at each location. Many were in poor condition with notable browning on most plants, senescing in the late season. An additional 2 individuals were recorded opportunistically outside the Project Area.

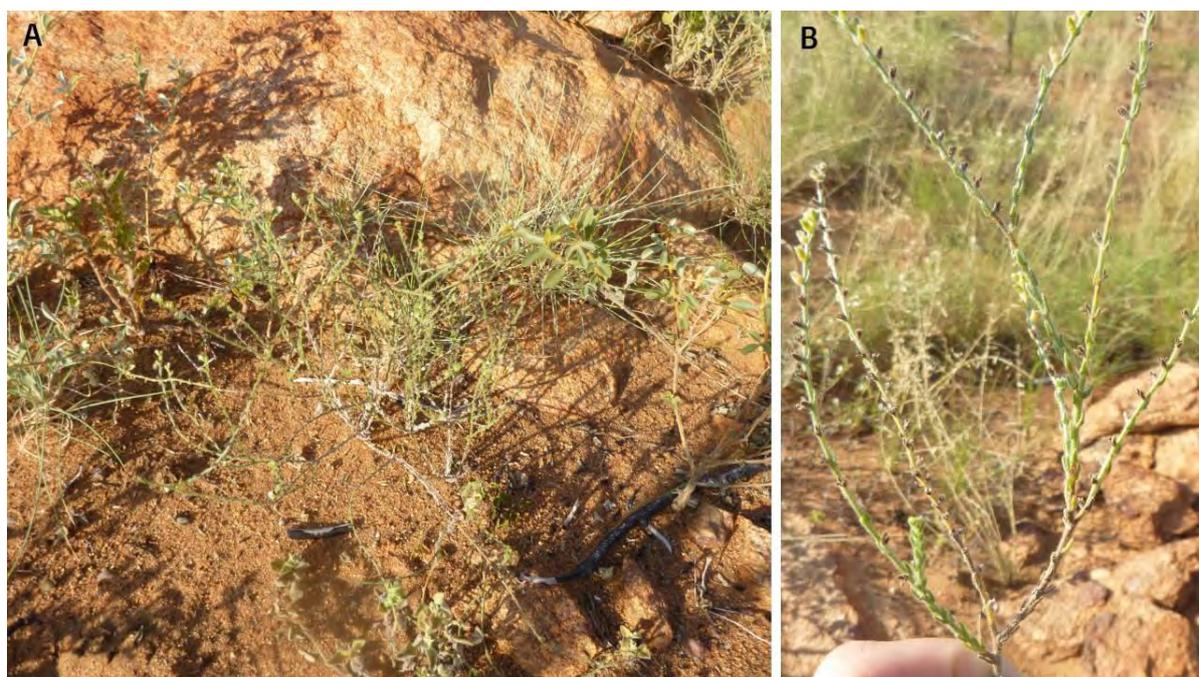


Plate 2: *Euploca mutica* (P3) from the Project Area A) Habit and habitat, and B) branch



***Goodenia obscurata* (P3)**

Goodenia obscurata (P3) is a low shrub in the connate bract group of *Goodenia*, and only recently separated from *G. connata* (Shepherd, et al, 2023). The WAH has 28 records of this species ranging from ~450km west of the Project Area in the Carnarvon bioregion, with this record representing its most north eastern known range (DBCA, 2024). Only a single record of this taxon was located opportunistically within the TRW Survey Area in vegetation type AoTe. This taxon was not photographed as it was not known to be of significance during the surveys.

***Gymnanthera cunninghamii* (P3)**

Gymnanthera cunninghamii (P3) is an erect shrub which typically grows 1.5 to 2 m tall and is commonly found in major drainage lines growing in sandy soils associated with taxa such as *Eucalyptus camaldulensis*, *Eucalyptus victrix* and *Melaleuca* (DBCA, 2024)(Plate 3). Flowering time extends from January to December and colours range from cream, yellow and green. The WAH has 40 records of the species, mostly recorded inland of Port Hedland.

During the survey 58 individuals were recorded sparsely from 18 locations in major and minor drainage lines through the Project Area. *Gymnanthera cunninghamii* was recorded in each Survey Area, as well as a further 29 individuals recorded opportunistically outside the Project Area. Few individuals occurred at each location, with most in good condition.



Plate 3: *Gymnanthera cunninghamii* (P3) A) in drainage habitat and B) Branch



***Nicotiana umbratica* (P3)**

Nicotiana umbratica is a low annual herb with long white flowers (Plate 4), growing in the shade of large granite boulders (DBCA, 2024). During the surveys 209 individuals were recorded from 12 locations among larger granite boulder outcroppings, generally restricted to within the largest outcropping expressions with vegetation type TcAtpT1a, although also recorded in some smaller outcroppings. It was recorded in the TRW and TRA Survey Areas, with a further 5 individuals recorded opportunistically outside the TR Survey Area.

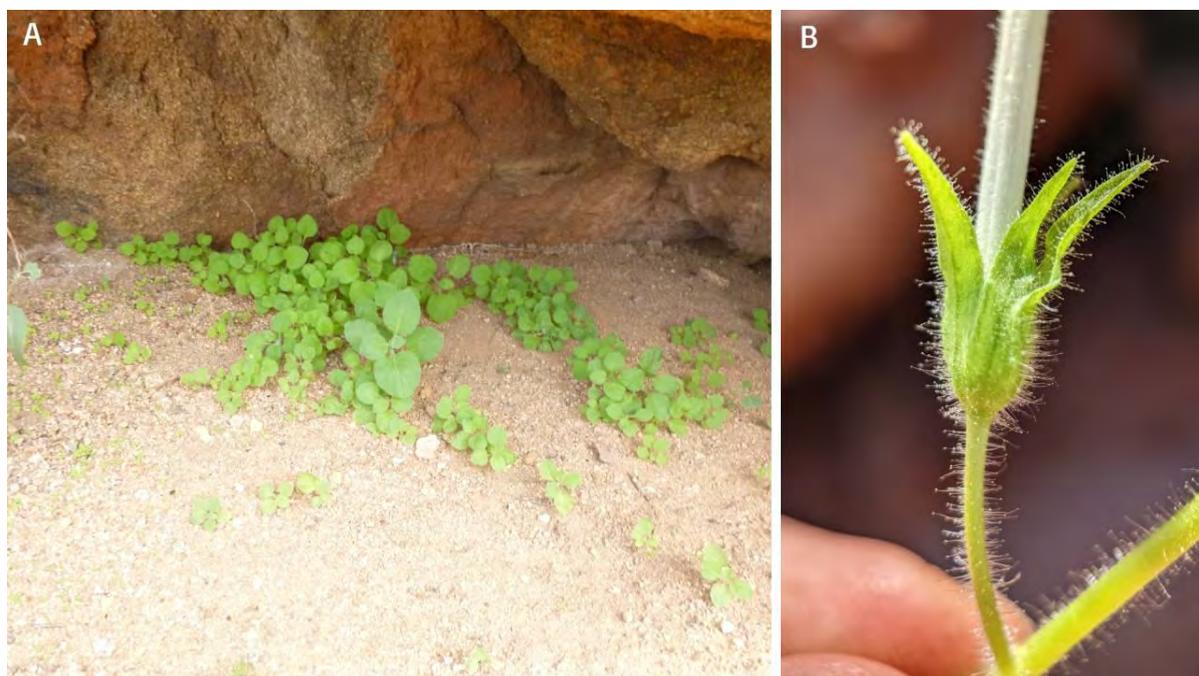


Plate 4: *Nicotiana umbratica* (P3) within the Project Area A) habit and habitat, and B) flower and calyx (SLR Consulting Australia, 2023)



***Phyllanthus hebecarpus* (P3)**

Phyllanthus hebecarpus is a low shrub with small dense hairs on all surfaces (Plate 5), growing in the cracks and shade of large boulders (DBCA, 2024). During the survey 189 individuals were recorded from 11 locations among larger granite boulder outcroppings of the TRA Survey Area, generally restricted to within vegetation type TcAtpTla. An additional 2 individuals were recorded opportunistically outside the Project Area.



Plate 5: *Phyllanthus hebecarpus* (P3) within the TRW Survey Area A) habit and habitat, and B) flower and calyx (SLR Consulting Australia, 2023)



***Rothia indica* subsp. *australis* (P3)**

Rothia indica subsp. *australis* is a low herb with trifoliate leaves and small yellow flowers (Plate 6), growing in the cracks and shade of large granite boulders (DBCA, 2024). During the survey only two individuals were recorded from a single location within vegetation type T1o in the TRW Survey Area, near a disused dirt track.



Plate 6: *Rothia indica* subsp. *australis* (P3) within the TRW Survey Area



***Triodia basitricha* (P3)**

Triodia Basitricha (P3) is a soft, non-resinous hummock grass which commonly grows on rocky and gravelly slopes of low hills or mountains (Plate 7). It grows up to 50 cm tall and has a distinctive curling foliage near the base of the plant. The WAH has 34 records with some occurring inland of Port Hedland and most occurring north of Tom Price in the Chichester region (DBCA, 2024).

During the survey 2,115 individuals were recorded in the TR Survey Area from five locations, and a further estimated 7,200 individuals from six locations outside the TR Survey Area. This taxon occurred as a dominant or co-dominant spinifex (with *T. epactia*) in vegetation type AspTba, and also was present in ChAspTe and GwAaTs.



Plate 7: *Triodia basitricha* (P3) A) Leaves and B) Hummock form within the TR Survey Area.



***Triodia chichesterensis* (P3)**

Triodia chichesterensis (P3) is a hard hummock grass which commonly grows on brown clay-loam soils typically with ironstone pebbles and surface quartzite present (Plate 8). It grows up to 35 cm tall and is typically found growing in association with *T. wiseana* and *T. lanigera* (DBCA, 2024). The WAH has 42 records of the species mostly inland of Port Hedland.

During the survey 121,416 estimated individuals were recorded in the Project Area. This species was present mostly as a dominant (or co-dominant with *T. wiseana*) in vegetation type ChAaTc which covered 877.19 ha of the Project Area. A further 37,480 individuals were recorded opportunistically outside the Project Area

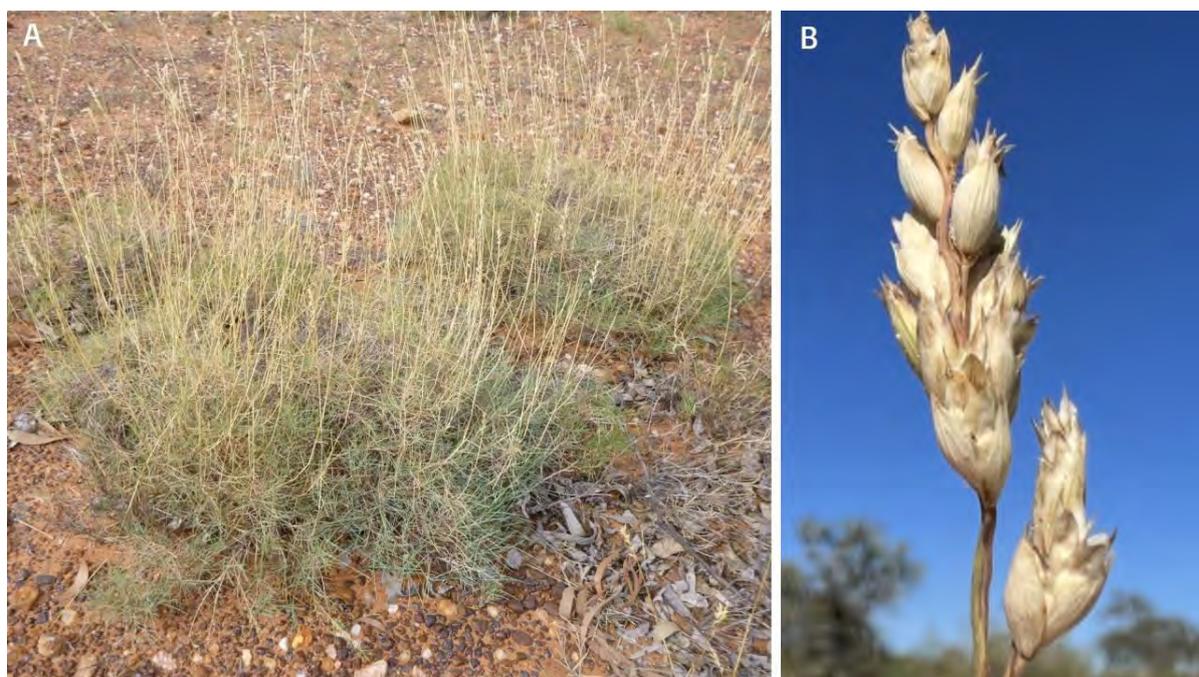


Plate 8: *Triodia chichesterensis* (P3) within the Project Area A) habit and habitat, and B) spikelets



***Bulbostylis burbidgeae* (P4)**

Bulbostylis burbidgeae (P4) is a low tufted grass-like annual herb or sedge (Plate 9) (DBCA, 2024). It grows in a relatively widespread area across the Chichester bioregion, among the shade of large granite boulders and cliff bases.

During the surveys 633 individuals were recorded from 21 locations, primarily within the TRW Survey Area in vegetation type TcAtpTla. A further 1,410 individuals were recorded opportunistically outside the Project Area. Many individuals that were recorded in the post-wet season survey were senescing or no longer present during the dry-season survey.



Plate 9: *Bulbostylis burbidgeae* (P4) within the TRW Survey Area A) habit and habitat, and B) spikelets



***Ptilotus mollis* (P4)**

Ptilotus mollis (P4) is a compact perennial shrub with soft grey coloured foliage which commonly grows to 50 cm tall and is found on rocky scree slopes and outcroppings (Plate 10). It flowers in May and September with white / pink inflorescence (DBCA, 2024). The WAH has 43 records of the species mostly found inland of Karratha and Port Hedland (DBCA, 2024).

During the survey 15 individuals of *P. mollis* were recorded from relevé NSR20 on low rocky hills in vegetation type AiTw. The individuals were in relatively poor condition.



Plate 10: *Ptilotus mollis* (P4) within the TR Survey Area



4.3.2.2 Potentially novel taxa

Amaranthus aff. interruptus

This taxon was present among the large granite boulder outcrops of the TRW and TRA Survey Areas. It primarily grew in the larger outcroppings in vegetation type TcAtpTla, with some additional records in AtpTe. Only 57 individuals were recorded from the Project Area, with an additional 119 recorded opportunistically outside the Project Area. While it bears similarity to *A. interruptus* in its inflorescence and fruiting characteristics, the tepals do not have any lobes and are rather almost linear terete, to sharp-pointed (Plate 11).

***Bonamia pilbarensis* (tight indumentum form)**

This unusual form of the common species *B. pilbarensis* was recorded from the low rolling rocky plains with ironstone, quartz, or calcrete. It was spread across the Project Area although not recorded separately from *B. pilbarensis* at all times. It is a known form of *B. pilbarensis*, occurring just south of Port Hedland, with a “denser indumentum of white hairs giving the plant a silver appearance” (Johnson, 2014) (Plate 12).

***Eriachne* sp. Coongan (A.A. Mitchell PRP 1566)**

A potentially novel species that is undergoing review for addition to the WA Census (Pers. Comm P.L. de Kock, 2024). This taxon is difficult to distinguish from *E. obtusa* and was likely confused with *E. obtusa* over the three surveys as it was not distinguished as a potentially novel taxon until 2024, as such it is almost certainly present in all three survey areas. It can be distinguished by the hairs on the lemma occurring in two distinct patches (a base patch and apex fringe) (Plate 13). Preferred habitat appears to be sandy plains, bordering sheet flow minor drainages.

***Polymeria* sp. (stoloniferous)**

This taxon was sparsely noted among the burnt plains of the of the Project Area, possibly responding to recent burns. The species is known to be widespread in the Pilbara however is not currently recognized (pers. comm., M. Hislop, 2022). It can be distinguished by its low, spreading stoloniferous habit, with prominently veined abaxial leaf surface (Plate 14). It referred to as *P. sp. (stoloniferous)* due to its prostrate stoloniferous growth form, and to avoid confusion with other *Polymeria* sp. recorded during the surveys. This taxon did not appear to have a defined vegetation type and rather was spread sparsely across the burnt plains, and was present in all three surveys, with 200 individuals recorded.

Solanum aff. cleistogamum

This taxon was recorded predominantly from drainages outside the Project Area during the TR survey and was noted as of potential taxonomic interest . It can be distinguished from typical *S. cleistogamum* by its upright low shrub form, dense orange prickles on the stem, and longer leaf (Plate 15).

Trianthema aff. oxycalyptum

This taxon bears similarities to *T. oxycalyptum* and *T. glossostigmum* (Plate 16). It can be differentiated from *T. oxycalyptum* by its broader elliptic leaf, rounded petals, and obviously separating sepals. It can be differentiated from *T. glossostigmum* by the floral whorl characteristics, and seed. Further investigation would be required into the genus as a whole to fully understand where this taxon lies (pers. comm. M. Hislop 2022). This taxon was recorded from the sandy plains of the TR and TRW Survey Areas (generally among vegetation types AoTe and AeTe) often occurring in close proximity (20-50m) from low granite outcroppings.



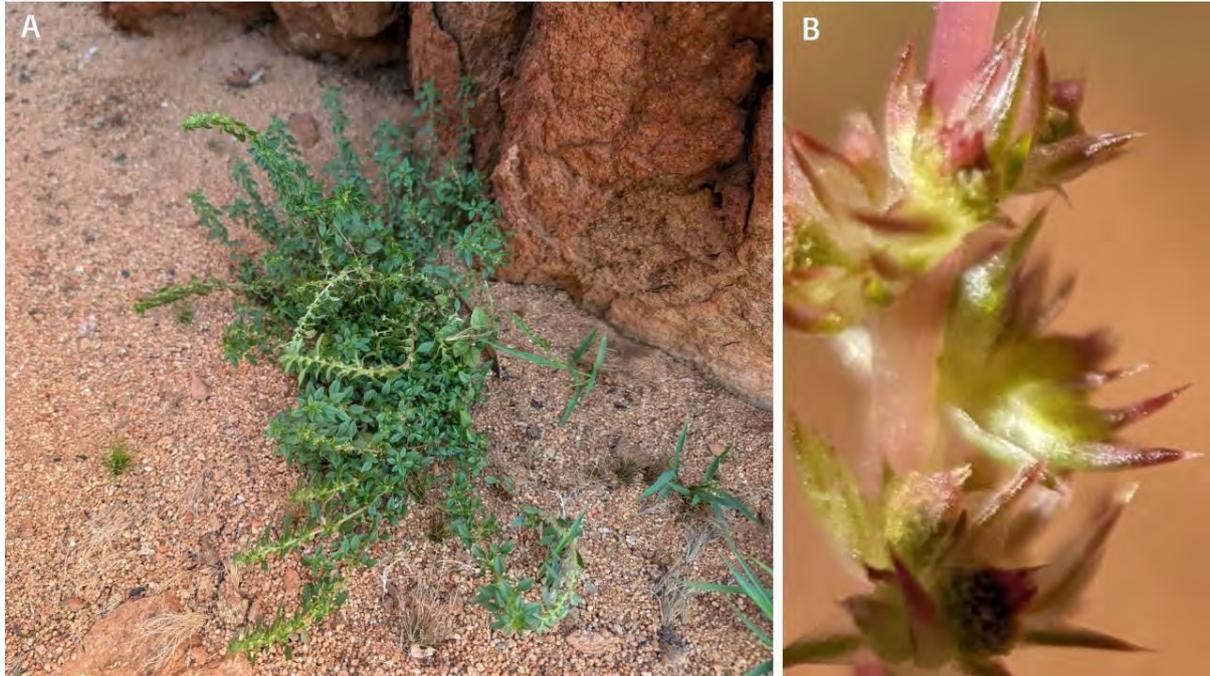


Plate 11: *Amaranthus* aff. *interruptus* A) Shaded habitat and B) Tepals from the Project Area



Plate 12: *Bonamia pilbarensis* (tight indumentum form) from the Project Area





Plate 13: *Eriachne* sp. Coongan station (A.A. Mitchell PRP 1566) Spikelet from the Project Area

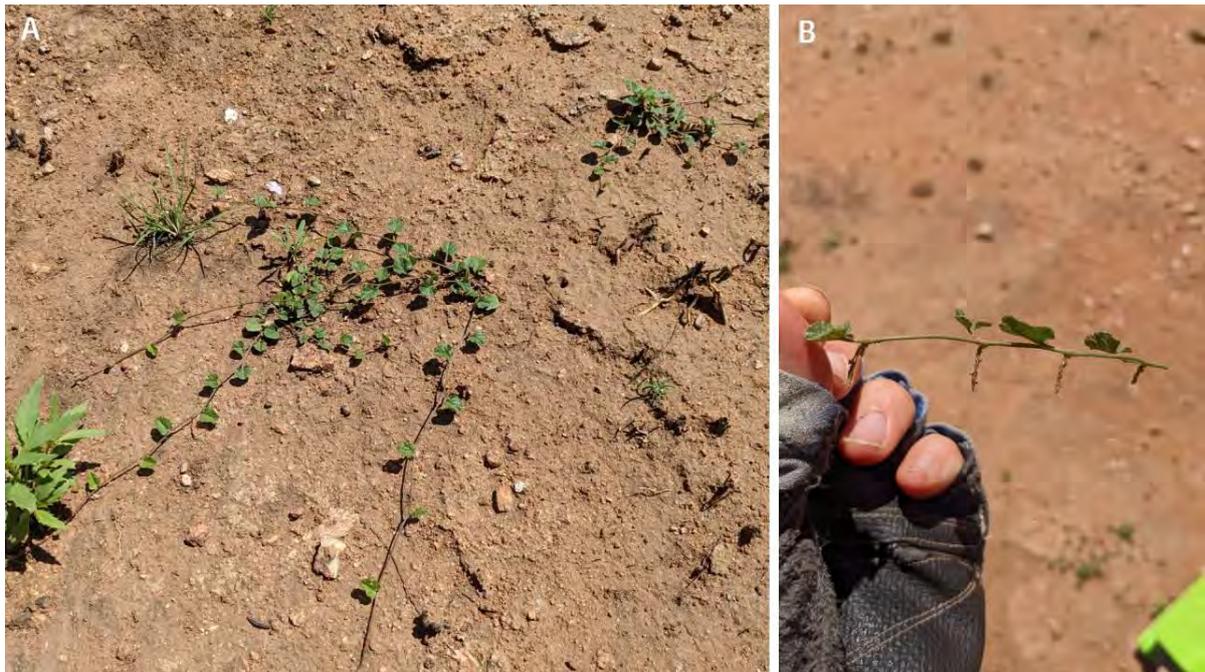


Plate 14: *Polymeria* sp. (stoloniferous) within the Project Area A) growing on freshly burnt ground, and B) stoloniferous habit





Plate 15: *Solanum* aff. *cleistogamum* A) Fruiting calyx, and B) shrub habit in drainage habitat.

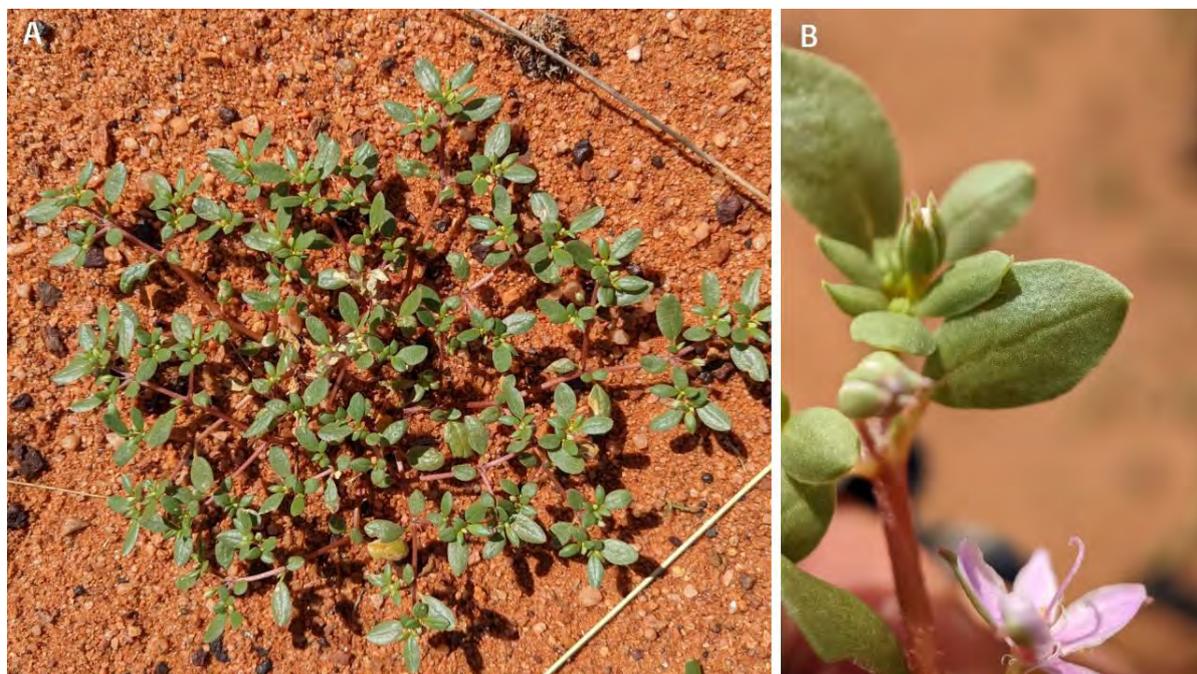


Plate 16: *Trianthema* aff. *oxycalyptum* A) habit, and B) leaves, flower, and bud from the Project Area

4.3.2.3 Range Extensions and Population Extensions

The three flora considered range extensions (Table 11) are pictured below. Both *Polygala galeocephala* (Plate 17) and *Zornia muelleriana* subsp. *congesta* (Plate 18) are range extensions of approximately 80-100 km south of the known range which is primarily around



the townships of Port Hedland and Karratha. *Portulaca digyna* is a larger range extension of approximately 550 km southwest of its known range of the Dampierland and Kimberley bioregions (Plate 19).

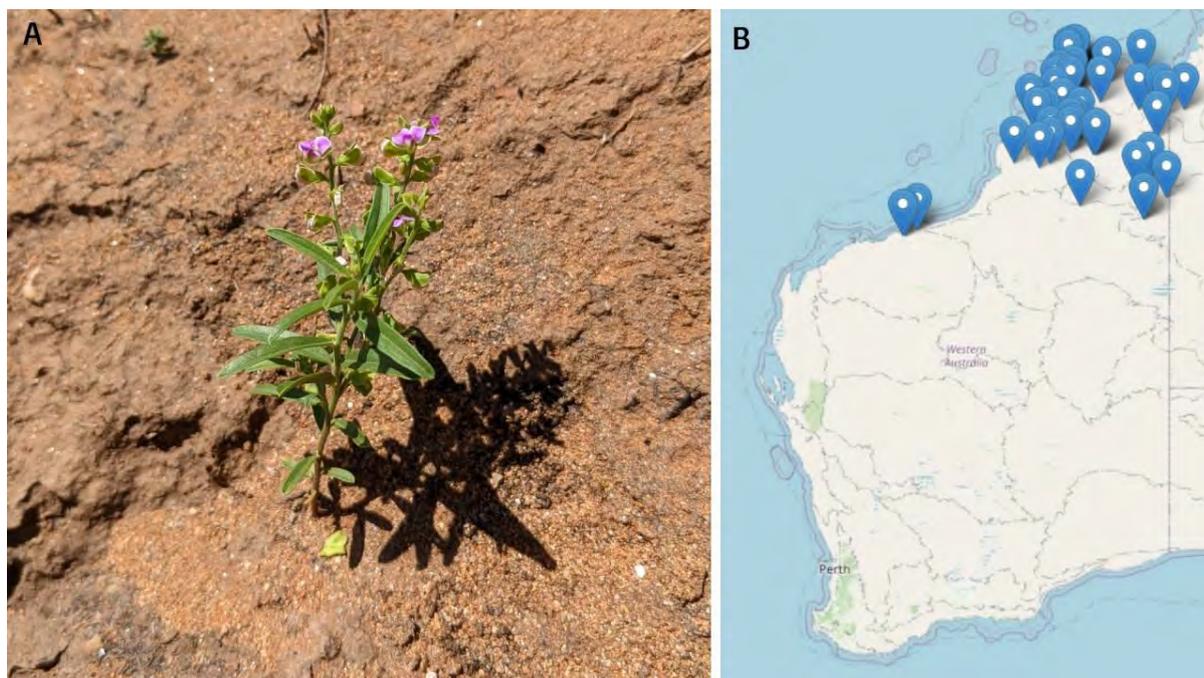


Plate 17: *Polygala galeocephala* from the Project Area A) Habit and B) State distribution

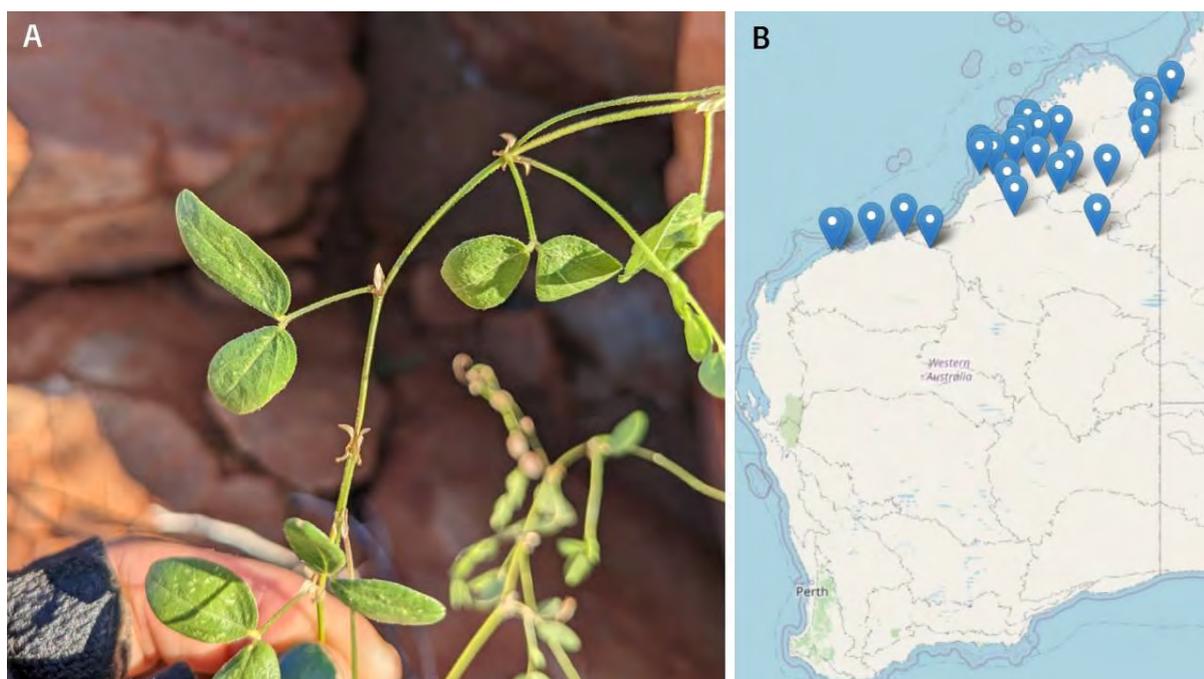


Plate 18: *Zornia muelleriana* subsp. *congesta* from the Project Area A) Leaf and B) State distribution





Plate 19: *Portulaca digyna* from the Project Area A) Inflorescence and B) State distribution

4.3.3 Introduced Flora

A total of eleven introduced species were recorded within the Project Area, representing approximately 2% of the total taxa recorded (Table 12). Of these, **Opuntia ?stricta* (Common Prickly pear) is listed as a Weed of National Significance (WoNS) (DAWE, 2021), and a Declared Pest (DP), and **Calotropis procera* (Calotrope) is listed as a DP under the BAM Act (DPIRD, 2021). **Opuntia ?stricta* was only recorded in the TRA Survey Area in the major drainage channels (Figure 10), while **Calotropis procera* was recorded within each Survey Area, also along drainage lines. Weed spread among the Project Area was relatively minimal, concentrated in drainage channels in conjunction with cattle movement. **Cenchrus ciliaris* recorded regularly, most commonly from drainage and disturbed areas around existing tracks and existing infrastructure.



Table 12: Introduced Flora Species within the Project Area

Taxon	Turner River (2022)		Turner River West (2023)		Turner River Additional (2024)		Consolidated Total		Outside	
	Count	Locations	Count	Locations	Count	Locations	Count	Locations	Count	Locations
<i>Aerva javanica</i>	96	9	5	1	154	10	312	23	57	3
<i>Bidens bipinnata</i>	13	2	10	1	-	-	23	3	-	-
<i>Calotropis procera</i> (DP)	7	4	1	1	263	18	271	23	-	-
<i>Cenchrus ciliaris</i>	32,548	31	2,149	14	9,552	27	45,569	77	1,320	5
<i>Cenchrus setiger</i>	360	6	22	3	3,492	11	4,874	21	1,000	1
<i>Chloris pumilio</i>	5	1	-	-	-	-	5	1	-	-
<i>Flaveria trinervia</i>	50	3	4	2	-	-	55	6	1	1
<i>Malvastrum americanum</i>	-	-	-	-	-	-	1	1	1	1
<i>Opuntia ?stricta</i> (WoNS, DP)	-	-	-	-	24	18	24	18	-	-
<i>Pseudognaphalium luteoalbum</i>	-	-	-	-	-	-	1	1	1	1
<i>Sonchus oleraceus</i>	-	-	-	-	1	1	1	1	-	-



4.3.4 Unconfirmed Flora

Forty three specimens (approximately 9% of the taxa recorded) could not be identified to taxonomic finality (Appendix E). Of these, 28 were identified to genus, and a further 15 tentatively identified to species or subspecies, but could not be confirmed due to insufficient material. Of the nine taxa identified to be hybrids (listed in Table 11), three taxa only had one identifiable parent species. None of the unconfirmed flora taxa were analogous to significant flora taxa identified by the database searches. Some of the unconfirmed flora taxa may represent duplicates of taxa that were already confirmed within the Project Area.

4.3.5 Vegetation Types

Twenty three vegetation types were described and mapped across five broad landforms within the Project Area (Summarised in Table 13, detailed in Table 14, illustrated in Figure 8):

- Clay – A single vegetation type occurred on a small patch of cracking clay, covering 3.18 ha.
- Drainage – represented by four vegetation types and covering 797.57 ha (7.21% of the Project Area), including groundwater dependent, and potentially groundwater dependent vegetation.
- Hills – Hill landforms in the Project Area were predominantly low, undulating expressions, with occasional small higher expressions. The hills were represented by three vegetation types covering 390.70 ha (3.53% of the Project Area).
- Outcroppings - represented by three vegetation types occurring on large-scale granite outcroppings and boulders, as well as smaller expressions with some sand/clay/loam areas. Outcropping landforms covered 189.98 ha (1.72% of the Project Area).
- Plains – The most dominant landform of the Project Area, open sandy plains was represented by 10 vegetation types and covering 10,101.70 ha (91.36% of the Project Area).

The Project Area also included 797.57 ha (7.21% of the Project Area) of cleared land including roads, rail, and infrastructure.

Detailed site sheets for each quadrat are provided in Appendix F.



Table 13: Summary of Vegetation in the Project Area

Vegetation Type	Turner River (2022)		Turner River West (2023)		Turner River Additional (2024)		Consolidated Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Clay								
AsyAlSf	3.18	0.07	-	-	-	-	3.18	0.03
Drainage								
ChAspTe	109.89	2.31	-	-	68.00	3.85	177.89	1.61
ChAspTrc	243.88	5.13	57.94	1.28	8.03	0.45	309.86	2.80
EcAtTe	-	-	39.55	0.87	-	-	39.55	0.36
EcMgTlo	25.58	0.54	-	-	136.48	7.72	162.06	1.47
EvAtTlo	44.15	0.93	-	-	-	-	44.15	0.40
MaAcpCi	12.47	0.26	-	-	51.60	2.92	64.07	0.58
Hills								
AiTww	113.44	2.38	-	-	6.38	0.36	119.82	1.08
AspTba	67.37	1.42	-	-	-	-	67.37	0.61
GwAaTs	2.79	0.06	-	-	-	-	2.79	0.03
Outcroppings								
AeTe	-	-	128.19	2.83	1.24	0.07	129.43	1.17
AtpTe	-	-	102.03	2.25	15.00	0.85	117.02	1.06
TcAtpTla	9.30	0.20	33.63	0.74	-	-	42.93	0.39
Plains								
AanTl	-	-	163.32	3.60	-	-	163.32	1.48
AiAbTww	271.51	5.71	4.00	0.09	47.47	2.69	322.98	2.92
AoTe	422.23	8.88	3,273.75	72.22	450.70	25.50	4,146.67	37.50
AspTbr	189.43	3.98	-	-	11.29	0.64	200.72	1.82
AsTla	10.88	0.23	234.73	5.18	105.12	5.95	350.73	3.17
ChAaTc	282.72	5.94	273.24	6.03	321.23	18.17	877.19	7.93
ChAaTs	32.45	0.68	27.76	0.61	10.60	0.60	70.81	0.64
ChAspTla	1,055.54	22.19	4.71	0.10	466.49	26.39	1,526.73	13.81
ChAspTla2	1,528.71	32.14	-	-	-	-	1,528.71	13.82
PfTlo	274.37	5.77	54.50	1.20	30.89	1.75	359.75	3.25
Cleared	57.11	1.20	135.56	2.99	37.22	2.11	229.89	2.08



Table 14: Vegetation Types Occurring within the Project Area

Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
Clays				
<p>AsyAISf: <i>Acacia synchronicia</i> mid isolated shrubs over <i>Aristida latifolia</i> low tussock grassland over <i>Triodia epactia</i> low open hummock grassland over <i>Sida fibulifera</i> and <i>Neptunia longipila</i> (P2) low open shrubland</p>	Cracking clays	NSQ76	Very Good	
Drainage				
<p>ChAspTe: <i>Corymbia hamersleyana</i> low isolated trees over mixed <i>Acacia</i> spp. mid to tall shrubland over *<i>Cenchrus ciliaris</i> (<i>Chrysopogon fallax</i>) low isolated tussock grassland over <i>Triodia epactia</i> low open hummock grassland</p>	Broad open drainage plain between low hills. Somewhat ecotonal in landform and vegetation	NSAQ04, NSAR24, NSAQ38, NSAR39, NSAQ40, NSAR41, NSQ18, NSQ22, NSR49, NSR59 (burnt), NSR60, NSQ63, NSR75, NSR80, NSR81, NSQ90	Degraded to Excellent	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>ChAspTrc: <i>Corymbia hamersleyana</i> low isolated trees over <i>Acacia eriopoda</i>, <i>A. trachycarpa</i>, and <i>A. colei</i> var. <i>colei</i> tall open shrubland over <i>Tephrosia rosea</i> var. <i>clementii</i>, <i>Triumfetta ramosa</i>, and <i>A. stellaticeps</i> mid to low open shrubland over <i>Themeda triandra</i> (*<i>Cenchrus ciliaris</i>) low tussock grassland over <i>Triodia epactia</i> low open hummock grassland</p>	<p>Minor drainage</p>	<p>NSR03, NSR08, NSR25, NSR48, NSW19, NSW30, NSAR16, NSAR22, NSAR27</p>	<p>Very Good</p>	
<p>EcAtTe: <i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i> low open woodland over <i>Acacia trachycarpa</i> and <i>A. tumida</i> var. <i>pilbarensis</i> tall shrubland over <i>Triodia epactia</i> and <i>T. longiceps</i> low open hummock grassland</p>	<p>Major drainage</p>	<p>NSWQ02 (burnt), NSW11, NSW32</p>	<p>Excellent</p>	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>EcMgTlo: <i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i> and <i>E. victrix</i> mid open woodland over <i>Melaleuca glomerata</i> and <i>M. linophylla</i> tall open shrubland over <i>Cyperus vaginatus</i> low sparse sedges over <i>Triodia longiceps</i> (<i>T. epactia</i>) low sparse hummock grasses</p>	Major drainage	NSR02, NSR24, NSQ45, NSR58, NSR82, NSR89, NSAQ11, NSAQ13, NSAQ21	Degraded to Excellent	
<p>EvAtTlo: <i>Eucalyptus victrix</i> and <i>Corymbia hamersleyana</i> low isolated trees over <i>Acacia trachycarpa</i> (<i>Atalaya hemiglauca</i>, <i>A. pyrifolia</i>, <i>Cullen leucanthum</i>) tall shrubland over <i>Triumfetta propinqua</i> mid isolated shrubs over <i>Triodia epactia</i> and <i>T. longiceps</i> low hummock grassland over <i>Cenchrus ciliaris</i> low open tussock grassland</p>	Major sandy drainage among granite plains	NSQ04, NSQ26, NSR51, NSR72	Very Good to Good	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>MaAcpCi: <i>Melaleuca argentea</i> (<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>, <i>E. victrix</i>) low open woodland over <i>Acacia coriacea</i> subsp. <i>pendens</i>, and <i>A. trachycarpa</i> (<i>A. ampliceps</i>) tall isolated shrubs over <i>Cyperus vaginatus</i>, and <i>C. ixiocarpus</i> mid sparse sedges over <i>Eulalia aurea</i> and *<i>Cenchrus ciliaris</i> low open tussock grassland</p>	Major Drainage	NSR50, NSQ52, NSR56, NSAQ10, NSAQ12, NSAQ34	Good to Very Good	
Hills				
<p>AiT_w: <i>Acacia inaequilatera</i> (<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>) tall isolated shrubs over <i>Triodia wiseana</i> low open hummock grassland</p>	Hilltop	NSAR01, NSAR03, NSAR30, NSR17, NSR19, NSR20	Very Good to Excellent	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>AspTba: <i>Acacia ancistrocarpa</i>, <i>A. tumida</i> var. <i>pilbarensis</i> (<i>A. acradenia</i>, <i>Petalostylis labicheoides</i>) over <i>Triodia basitricha</i> (<i>T. wiseana</i>) low hummock grassland</p>	Low rise	NSQ05, NSQ09, NSQ14	VG EX	
<p>GwAaTs: <i>Grevillea wickhamii</i> subsp. <i>hispida</i> tall sparse shrubs over <i>Acacia ancistrocarpa</i> mid shrubland over <i>Triodia ?schinzii</i> low hummock grassland</p>	Upper slope	NSR11	Very Good	
Outcropping				



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>AeTe: <i>Acacia eriopoda</i> and <i>A. tumida</i> var. <i>pilbarensis</i> tall sparse shrubland over <i>Triodia epactia</i> and <i>T. lanigera</i> low open hummock grassland</p>	<p>Minor granite outcroppings</p>	<p>NSAR29, NSWR01, NSWQ21, NSWQ22</p>	<p>Excellent</p>	
<p>AtpTe: <i>Acacia tumida</i> var. <i>pilbarensis</i> (<i>A. eriopoda</i>) tall open shrubland over <i>Triodia epactia</i> low open to sparse hummock grassland</p>	<p>Minor granite outcroppings</p>	<p>NSAR09, NSAQ20, NSAR23, NSWQ15, NSWR18, NSWR33</p>	<p>Excellent</p>	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>TcAtpTla: <i>Terminalia circumalata</i> low isolated trees over <i>Acacia tumida</i> var. <i>pilbarensis</i> tall sparse shrubland over <i>A. retivenea</i> subsp. <i>clandestina</i> mid sparse shrubland over <i>Triodia lanigera</i> low open hummock grassland</p>	Granite outcrop	NSR74, NSW16, NSW27 (burnt), NSW28 (burnt)	Very good to Excellent	
Plains				
<p>AanTl: <i>Acacia ancistrocarpa</i> (<i>A. orthocarpa</i>, <i>A. tumida</i> var. <i>pilbarensis</i>) mid to tall shrubland over <i>Triodia lanigera</i> (<i>T. epactia</i>) low open hummock grassland</p>	Plains	NSWQ10, NSWQ39	Excellent	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>AiAbTw: <i>Acacia inaequilatera</i> tall isolated shrubs over <i>A. acradenia</i> and <i>A. bivenosa</i> mid open shrubland over <i>Triodia wiseana</i> low open hummock grassland</p>	<p>Low rise</p>	<p>NSAR43, NSQ27, NSQ28, NSR41, NSR61, NSR68, NSR70, NSR73, NSR77, NSR79, NSWQ36, NSWR37</p>	<p>Very Good to Excellent</p>	
<p>AoTe: <i>Acacia orthocarpa</i> (<i>A. ancistrocarpa</i>) mid to tall open shrubland over <i>Triodia epactia</i> and <i>T. lanigera</i> low open hummock grassland</p>	<p>Plains</p>	<p>NSAQ14, NSAQ36, NSAQ37, NSQ36, NSQ62, NSR06, NSR29, NSR33, NSR35, NSR39, NSR83 (BURNT), NSR86, NSWQ03, NSWQ12, NSWQ13, NSWQ25, NSWQ29, NSWQ34</p>	<p>Very Good to Excellent</p>	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>AspTbr: <i>Acacia</i> spp. tall open shrubland over <i>Triodia brizoides</i> (<i>T. wiseana</i>, <i>T. lanigera</i>) low hummock grassland</p>	<p>Undulating plain/low hills</p>	<p>NSAR28, NSAQ46, NSQ78, NSR87, NSQ93, NSR95</p>	<p>Excellent</p>	
<p>AsTla: <i>Acacia stellaticeps</i> and <i>Pluchea ferdinandi-muelleri</i> low open shrubland over <i>Triodia lanigera</i> (<i>T. epactia</i>) low hummock grassland</p>	<p>Plains</p>	<p>NSAQ07, NSAQ31, NSAQ32, NSAQ33, NSAQ35, NSR67, NSR69 (Burnt), NSR71, NSQ84, NSQ88, NSWQ17, NSWQ20, NSWQ24, NSWQ38</p>	<p>Very good to Excellent</p>	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>ChAaTc: <i>Corymbia hamersleyana</i> low isolated trees over <i>Acacia acradenia</i>, <i>Petalostylis labicheoides</i>, and <i>Grevillea wickhamii</i> (<i>A. inaequilatera</i>) tall sparse shrubland over <i>Triodia chichesterensis</i> and <i>Triodia wiseana</i> low hummock grassland</p>	<p>Undulating plains/low hills</p>	<p>NSAQ15, NSAQ17, NSAQ19, NSAQ42, NSQ01, NSQ07, NSR12, NSQ47, NSQ66, NSWQ08, NSWQ14, NSWQ26, NSWQ31</p>	<p>Very Good to Excellent</p>	
<p>ChAaTs: <i>Corymbia hamersleyana</i> low isolated trees over <i>Acacia acradenia</i> tall, isolated shrubs over <i>Triodia schinzii</i> low hummock grassland</p>	<p>Plains</p>	<p>NSAQ02, NSAQ05, NSAQ08, NSR64, NSWQ07, NSWQ09 (burnt), NSWQ35</p>	<p>Very Good to Excellent</p>	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>ChAspT1a: <i>Corymbia hamersleyana</i> low isolated trees over <i>Acacia inaequilatera</i> (<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>) tall isolated shrubs over a mosaic of <i>Acacia ancistrocarpa</i>, <i>A. acradenia</i>, and <i>Petalostylis labicheoides</i> mid open shrubland over <i>Triodia lanigera</i> and <i>Triodia epactia</i> (<i>T. longiceps</i>, <i>T. wiseana</i>) low hummock grassland</p>	Plains	NSAQ06, NSAQ18, NSAQ25, NSAQ26, NSAQ44, NSAQ45, NSQ18, NSR23, NSQ30, NSR34, NSQ38, NSR40, NSQ43, NSR44, NSQ55, NSWQ06	Very Good to Excellent	
<p>ChAspT1a2: <i>Corymbia hamersleyana</i> low isolated trees over a mosaic of <i>Acacia ancistrocarpa</i>, <i>A. acradenia</i>, and <i>Grevillea wickhamii</i> mid open shrubland over <i>Triodia lanigera</i> low hummock grassland. Isolated intersecting minor drainage channels within this vegetation consist of <i>Acacia tumida</i> var <i>pilbarensis</i> (<i>A. ancistrocarpa</i>) mid shrubland over <i>Triodia lanigera</i> and <i>T. epactia</i> low open hummock grassland</p>	Plain	NSQ10, NSQ13, NSQ15, NSQ16, NSQ21, NSQ54, NSQ85	Excellent	



Vegetation Unit and Description*	Local Landform	Sites	Vegetation Condition	Photograph
<p>PfTlo: <i>Pluchea ferdinandi-muelleri</i> (<i>Acacia stellaticeps</i>) low open shrubland over <i>Triodia longiceps</i> (<i>T. epactia</i>) low open hummock grassland</p>	<p>Plains with minor sheet flow</p>	<p>NSQ31, NSR32, NSR37, NSR42, NSR46, NSR53, NSQ57, NSQ65 (Burnt), NSWQ04, NSWQ05, NSW23</p>	<p>Very Good to Excellent</p>	
<p>Cleared</p>	<p>Existing rail, roads, and infrastructure</p>	<p>Not sampled</p>	<p>Completely degraded</p>	<p>-</p>

*Brackets indicate species that may or may not be present, but were observed as dominant at some of the sites that make up the vegetation type



4.3.6 Vegetation Condition

Vegetation condition within the Project Area ranged from Excellent to Degraded Table 15, Figure 10), comprising:

Table 15: Vegetation Condition within the Project Area

Condition	Turner River (2022)		Turner River West (2023)		Turner River Additional (2024)		Consolidated Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Excellent	4,060.41	85.36	4,333.51	95.60	921.59	52.13	9,315.51	84.25
Very Good	591.95	12.44	58.18	1.28	641.44	36.29	1291.56	11.68
Good	34.14	0.72	6.98	0.15	29.65	1.68	70.77	0.64
Poor	17.84	0.37			137.92	7.80	155.76	1.41
Completely Degraded (Cleared)	52.66	1.11	134.22	2.96	37.14	2.10	224.02	2.03

Although the vegetation was primarily in excellent condition (84.25%), burnt vegetation could not be properly assessed as weed presence may not have been apparent.

Evidence of disturbance included recent and historical clearing for infrastructure, introduced fauna tracks and scats, and weeds. Recently burnt areas were not considered of reduced condition and were retained as excellent unless other disturbance could be noted (i.e. weed regrowth and cattle tracks). Some areas of native vegetation surveyed during earlier surveys (2022) were cleared in the following years, and vegetation has been updated with the most recent consolidated surveys.

4.3.7 Fire History

Two fires have affected the Project Area across the three years of survey (Table 16), affecting a total of 4,593.92 ha (41.55% of the Project Area) over two years of burns (2022 and 2024) (NAFI, 2024) (Plate 20 and Plate 21). Fire scar data is an estimate due to the method of satellite detection and is considered to only be broadly accurate to large polygon blocks, the real fire scar is likely to be less than estimated. This estimate also does not include small patches of unburnt vegetation within the broader fire scar. The 2022 fire affected a large extent of the Turner river (2022) survey as it was burnt very shortly before survey and no regrowth was present. This same fire affected the Turner River West (2023) Survey, with more than 80% of the Survey Area burnt the year prior. Vegetation in this area had only recovered minimally, with many dominant *Acacia* and *Triodia* species still not obvious. Mapping in these areas was done based on dominant species that could be seen to be resprouting, however is not mapped with total confidence.



Table 16: Project Area Burn History

Fire History	Turner River (2022)	Turner River West (2023)	Turner River Additional (2024)	Total Burnt Extent
2022 Burn Extent (ha)	785.10	3,589.17	3.60	4,377.86
2024 Burn Extent (ha)	42.91	157.71	15.43	216.06
Total Burn Extent (ha)	828.011	3,746.88	19.03	4,593.92
Percentage of Survey Area Burnt	17.41 %	82.66 %	1.08 %	-
Percentage of Consolidated Project Area Burnt	7.49 %	33.89 %	0.17 %	41.55 %



Plate 20: Recently burnt vegetation in the TR Survey Area



Plate 21: Recently burnt vegetation in the TRW Survey Area



4.3.8 Vegetation of Significance

4.3.8.1 Threatened and Priority Ecological Communities

No vegetation types considered representative of any TECs, or PECs were recorded within the Project Area.

4.3.8.2 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) were classified by the presence of either obligate² or facultative³ phreatophyte taxa (Argus, 2018). Six vegetation types were present within drainage landforms in the Project Area. Of these, MaAcpCi was dominated by the obligate phreatophyte *Melaleuca argentea*, and was considered to be Groundwater Dependent Vegetation (GDV). Two vegetation types were dominated by the facultative phreatophyte *Eucalyptus camaldulensis* subsp. *refulgens* (EcAtTe, and EcMgTlo) and were also considered to be GDV. One further vegetation type (EvAtTlo) was dominated by *E. victrix*, and was considered to be Potentially Groundwater Dependent Vegetation (PGDV). *Eucalyptus victrix* is also considered a facultative phreatophyte but with a very limited capacity to survive inundation for extended periods of time (Argus, 2018).

4.3.8.3 Vegetation of Other Significance

Vegetation may be of significance for a range of reasons, other than a listing as a TEC, PEC (Environmental Protection Authority, 2016a), or GDE. Including:

- Vegetation extent being below a threshold level
- Scarcity
- Novel combinations of species
- A role as a refuge: Fortescue defines a refuge as “a vegetation type with distribution limited to restricted biotic or abiotic conditions within the survey area (that is restricted regionally). Such conditions are likely to be reflected in restricted landforms (e.g. mesa, high mountain top, sheltered gorge etc.) or unusual soil or surface geological conditions.”
- A role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species
- Being representative of the range of a unit (particularly a good local and/or regional example of a unit in ‘prime’ habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- A restricted distribution (<1% of the Survey Area).

Seven vegetation types in the Project Area are considered to be of other significance significant for the reasons detailed below (Table 17). Where vegetation was already considered significant for reasons listed above (ie: GDV) and was also locally restricted, it was not listed again.

² Vegetation that utilises groundwater sources all year round and is reliant upon access to groundwater for survival.

³ Vegetation that utilises groundwater in an opportunistic fashion or during times of limited water supply and/or drought.



Table 17: Locally Significant Vegetation Units in the Project Area

Vegetation Type	Survey Area Coverage		Reason for potential significance
	ha	%	
ChAaTc	877.19	7.93	Supports very large numbers of <i>Triodia chichesterensis</i> (P3) (dominant spinifex). Recorded numbers are only a fraction of the taxon's true extent through the Project Area. This vegetation type should be considered for state significance.
TcAtpTla	42.93	0.39	Locally and regionally restricted, supports <i>Nicotiana umbratica</i> (P3), <i>Phyllanthus hebecarpus</i> (P3), and <i>Bulbostylis burbidgeae</i> (P4) as well as the species of interest <i>Amaranthus</i> aff. <i>interruptus</i> . Also likely to be a fauna refuge due to large granite shelter landform.
GwAaTs	2.79	0.03	Locally restricted. However, dominated by species that are not restricted. A small patch of <i>Triodia basitricha</i> (P3) was recorded from this vegetation type but was considered ecotonal from nearby AspTba supporting landform (pisolitic ironstone).
AsyAISf	3.18	0.03	Locally and regionally restricted cracking clay landform supporting <i>Neptunia longipila</i> (P2).
ChAspTe	177.89	1.61	Locally significant due to occasional populations of <i>Neptunia longipila</i> (P2) on ecotonal clay boundaries. Dominant species not restricted.
AspTba	67.37	0.61	Locally and regionally restricted. Co-dominated by <i>Triodia basitricha</i> (P3).
ChAaTs	70.81	0.64	Locally restricted. However, dominated by species that are not restricted.

4.4 Statistical Analysis

4.4.1 Floristics

The following observations were made from the analysis:

- Sites that were considered to be recently or partially burnt when surveyed (e.g.; NSQ88, NSR68, NSR69, NSR71, NSR73, NSR77, NSR81, and NSR83) were excluded from the analysis.
- Sites in major drainage units (MaAcpCi and EcMgTlo) grouped together, while more variable minor drainage (ChAspTe and ChAspTrc) units did not group as strongly, due to the inclusion of many surround species from plains vegetation within sites.
- Units Pftlo, AspTbr, ChAaTc, ChAaTs, AoTe, AsTla all formed rigorous groups within the analysis.
- Vegetation units AiAbTw, AiTw, and some sites with ChAspTla formed a larger group due to the similarities of dominant *Acacia* and *Triodia* species. These units were mostly separated based on species density and landform, with AiTw growing on sparse rocky hills, rather than low undulating hills and plains.
- Vegetation units ChAspTla and ChAspTla2 formed a larger grouping in the analysis, due to similarity in species profile. The units were retained as separate units based on differences in landform (ChAspTla is a consolidated plain, while ChAspTla2 was



present on the foothills of the larger range to the east, with small incised channels between bare hills.

- NSQ76 formed a distinct grouping as vegetation AsyAISf.
- Sites within TcAtpTla formed a group with AtpTe due to the similarity in granite outcrop landform and similar species complex.
- Sites from the different surveys were spread across the analysis, suggesting no distinct differences between results of any survey.

Selected inputs and outputs of the floristic analysis are presented in Appendix G.

4.4.2 Survey Adequacy

Across the three surveys 177 flora sites were sampled (Table 18) across the Project Area, across 23 vegetation types. Two vegetation types (AsyAISf and GwAaTs) were sampled with a single site, and one vegetation type (AanTI) was sampled with only two sites due restricted distribution within the Project Area. All other vegetation types were able to be sampled with three or more sites when vegetation was consolidated across the three surveys.

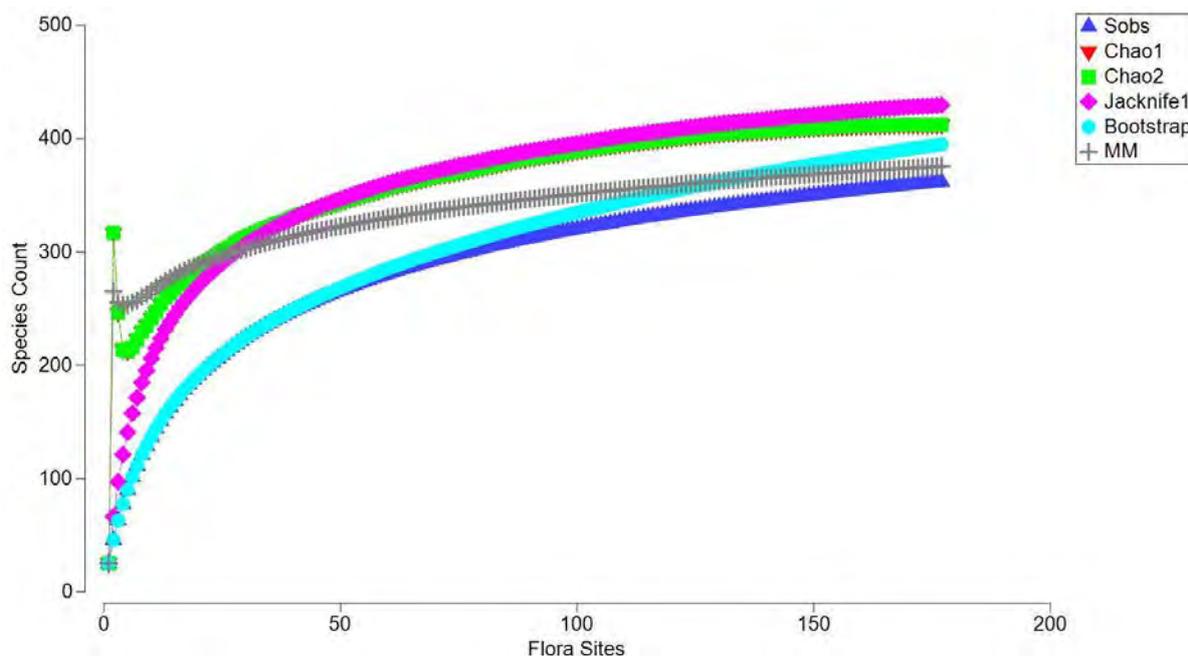
Table 18: Count of Flora Sites in the Project Area

Site Type	Turner River (2022)	Turner River West (2023)	Turner River Additional (2024)	Consolidated Total
Quadrat	38	26	33	97
Relevé	54	13	13	80
Total Sites	92	39	46	177

Eight sites (NSQ88, NSR68, NSR69, NSR71, NSR73, NSR77, NSR81, NSR83) were excluded from the analysis due to impact by fire, all of which were established during the Turner River (2022) Survey. Sites considered partially impacted by fire were included in the analysis as they grouped with other sites in the same vegetation type.

The species accumulation curve for the Project Area produced a smooth Sobs curve steadily increasing towards asymptote (Graph 2). The dataset for the species accumulation curve includes sites that were recently burnt.





Graph 2: Flora Species Accumulation Curve

Estimated species richness for the Project Area ranged from 376 to 412, with an observed value of 362 taxa (Table 19). Richness estimators indicated that the survey was approximately 84.26% to 96.39% adequate in recording the full complement of vascular flora taxa within the Survey Area (Table 19).

Table 19: Species Richness Indicators

Treatment	Expected Species Richness	Percentage Adequate
Chao 1	412	87.81%
Chao 2	412	87.81%
Jackknife 1	430	84.26%
Bootstrap	395	91.68%
Michaelis-Menton	376	96.39%

The data used to produce the species accumulation curve was conservative because opportunistic species (which are not associated with a site), and unconfirmed flora were not included. With opportunistic and unconfirmed flora included, the number of flora taxa recorded during the survey was 463, which is 107.77% of the highest expected species richness, and 123.29% of the lowest expected species richness.



5.0 Discussion

5.1 Flora Composition

The suite of flora taxa recorded during the surveys is considered typical for the respective areas (Beard 1976) and aligns with the database search results obtained. All three surveys recorded relatively high diversity. Recent burns in the TR Survey Area (2022) stimulated the growth of additional taxa, including fire opportunists such as *Euphorbia clementii* (P3), *Euploca mutica* (P3), and *Calandrinia* spp., which may not typically occur in more established vegetation. The overall Project Area was not especially diverse in landform, with the majority comprising of rolling sandy plains with mosaicking dominants, with only small pockets of concentrated diversity in drainages, granite boulders, and cracking clay.

Floristic diversity of annual species was considered average, with annual taxa present in the post-wet season surveys, as well as some fire-ephemeral taxa present into the dry seasons. However, many of these were in poor or deteriorating health. A significant positive impact on the floristic diversity was that of recent burns, affecting almost 42% of the Project Area. The fire of greatest impact occurred in January 2022 and burnt the majority of the Turner River West Survey Area. Although some of the dominant species were regenerating in these areas, it was not always apparent which vegetation type the plains or granite outcrops would be best represented by. The entirety of vegetation type EcAtTe was affected by the fires.

Within the burnt areas minimal discernible stratum dominant taxa remained. Many herbs and annual taxa were clearly responding well post fire (such as *Euploca mutica* (P3), and *Euphorbia clementii* (P3)), which many not usually be present. As such the fires were considered to be limiting to overall reliability of vegetation mapping but may have contributed beneficially to recording additional (and priority) taxa locations.

5.2 Flora of Conservation Significance

No Threatened flora species pursuant to the EPBC Act 1999 and/or gazetted as Threatened Flora pursuant to the BC Act 2016 were recorded within the Project Area. Only one threatened taxon was identified by the database searches, *Quoya zonalis*, which would not be expected to grow in the Project Area considering the geology present.

All 12 of the priority flora recorded within the Project Area were identified by the database searches and were considered medium to high likelihood of occurrence prior to the surveys. Descriptions of all priority taxa recorded in the Project Area are provided in Section 4.3.2.

Neptunia longipila (P2) was only described following the surveys in the Turner River Survey Area and as such was originally identified as *Neptunia dimorphantha*. Following a review of specimens this taxon was redetermined to the significant species for the purposes of the consolidated report. This taxon was predominantly recorded from the cracking clay landforms of vegetation type AsyAISf, with some additional errant locations from drainages nearby, which were somewhat ecotonal in nature with semi-clay soils. Given the limited distribution of the cracking clays, it is unlikely that this taxon is widely distributed in the locality.

Euphorbia clementii (P3) was primarily recorded during the TR Survey, due to the taxon responding prolifically following the recent fire. Fewer individuals were present in 2023 during the TRW Survey, with another increase in individuals present in small burnt patches in the TRA Survey Area following the 2024 fire. It is considered likely that this taxon is very widespread in the Project Area and the locality following natural fire events.

Euploca mutica (P3) (previously known as *Heliotropium muticum*) was recorded sparsely across the entire Project Area, generally occurring in populations of only a small number of individuals. *Euploca mutica* is a relatively small inconspicuous upright shrub, with spindly



stems and small green-brown leaves. Given its size and cryptic nature, individuals could only be recorded when in close proximity unlike other more visible taxa during the survey. As such it is likely that this taxon occurs sparsely across the plain's landform of the Project Area. Although it did occur in unburnt areas, more individuals did appear to grow in the recently burnt plains and may be responding to recent fires.

Goodenia obscurata (P3) was only recorded from a single location within the TRW Survey Area. It was not known to be of significance at the time of survey as it was only described in late 2023 following the survey, and identified following a review of species in the consolidated report. It is expected that other individuals of this taxon would be present sparsely across the Project Area. However, this species was split from other similar species in the connate bract group of *Goodenia*, and given a Priority 3 status due to restricted information being available on its distribution. Following the review, additional records have been lodged, indicating an expanded distribution. It is now considered unlikely to be as restricted as initially determined.

Gymnanthera cunninghamii (P3) was recorded sparsely across the major and minor drainage lines of the Project Area. It would be considered likely that any drainage landform could support sparse individuals of this taxon. It was present in only restricted populations, with most recording only a single individual at any point.

Nicotiana umbratica (P3), *Phyllanthus hebecarpus* (P3), and *Bulbostylis burbridgeae* (P4) were recorded from the same habitat: the shaded overhang of large granite boulders, primarily occurring in vegetation type TcPAtpT1a with some records also in AtpTe. Both *N. umbratica* and *B. burbridgeae* are annual taxa that were not present during dry season surveys. However, *P. hebecarpus* is an upright low perennial shrub present both seasons of survey, and does not rely on the shaded overhangs for protection. *Phyllanthus hebecarpus* was only recorded during the TRW Survey, however would be expected to grow within the TR Survey Area in the large granite boulders of the south that had been recently burnt, as it was recorded in close proximity outside the Project Area in unburnt vegetation.

Rothia indica subsp. *australis* (P3) is a small annual herb only found from a single location in vegetation type PfT1o within the TRW Survey Area. It is unknown if it is linked to this vegetation type, or present due to the disturbed track adjacent to the site. It has been recorded in previous surveys in the locality and would be expected to occur more widely across the region following rains.

Triodia chichesterensis (P3) occurred as a dominant species across the low rolling plains of the Project Area, usually in association with semi-calcrete and quartz geology. This taxon was notably low lying among the other spinifex, with its short and compact leaf form occurring in dense clusters of individuals. Large numbers were recorded with periodic population estimates. However, the real number of individuals would be much higher as it was widespread and common where it did occur. Individuals of this taxon would be expected to occur anywhere along the vegetation type ChAaTc, or sparsely anywhere small instances of calcrete geology occur. This taxon was well represented across the Project Area. A count of this individuals present within a single 50x50m quadrat was estimated at between 5,000-7,000 individual plants.

Therefore, there are approximately 20,000 – 28,000 individuals present per hectare of vegetation type ChAaTc, equating to an estimate of between 17,543,800 and 24,561,320 individuals potentially present within the Project Area. This number is a rough estimate based on extrapolating individuals counted within quadrats and varies with natural variation of the vegetation type and should be used as a rough guide only.

Gomphrena leptophylla (P3) was previously recorded in close proximity to the Project Area. Existing records of *G. leptophylla* were visited during the TRW Survey for confirmation, and taxa identical to this were recorded and collected multiple times during the surveys. However, these collections were confirmed by Mike Hislop of the WA Herbarium to be



G. sordida (not significant). These specimens matched photographs from other reports (Ecoscape, 2021) in the locality and as such there may be confusion in the literature between the species. This species occurred in conjunction with minor granite outcroppings and vegetation types AeTe, and AtpTe, as well as on the banks of minor drainage vegetation type ChAspTrc. As such this taxon was considered to have a low likelihood of occurrence, with the caveat of potential taxonomic confusion.

Triodia basitricha (P3) was limited to pisolitic ironstone low rises and hills, which could be easily seen via aerial imagery. This geology appears limited within the Project Area and the locality, however is common more across the Hamersley Ranges. A small population was also recorded within an ecotonal area of vegetation type GWAaTs, which is not considered to be its primary habitat.

Ptilotus mollis (P4) was only recorded from a low hill on the east of the Project Area, and is considered unlikely to extend outside of the ironstone hill landform it occurs on. *Ptilotus mollis* is widespread across the Pilbara (DBCA, 2024) within a restricted landform of shale/high grade iron hills, and often in higher altitudes.

Three taxa were considered to have a medium likelihood of occurrence following the surveys based on the reasoning below:

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) (P3) occurs in close proximity (~14 km) to the Project Area, and is known to occur in disturbed sandy areas and potentially following fire. With taxa that sprout following fire or disturbance it can be difficult to definitively say they would not grow in any particular area within its range. There are historic records in all cardinal directions of the Project Area.
- *Acacia levata* (P3) was recorded in close proximity to the Project Area (~11 km), in habitat that occurs within the Project Area (granite outcroppings). Many smaller granite outcroppings were heavily burnt and have some potential to support the taxon.
- *Stylidium weeliwollii* (P3) was recorded 23 km east of the Project Area in minor drainage that connects to the Project Area. Another species of *Stylidium* (*S. desertorum*) was recorded within the TR Survey Area in similar geology, and species of *Stylidium* are known to be small, cryptic, and short-lived in the Pilbara. It is also unknown how it responds to fires.

Acacia leeuweniana (P1) is considered to have a low likelihood of occurrence following the survey. Individuals of *Acacia leeuweniana* (P1) were noted to occur outside of the Project Area (to the west and south) within 5 km and could be easily seen via helicopter and along the vehicle access track. This taxon only appears to grow on the largest granite boulders and does not occur anywhere within the Project Area as the boulder formations do not appear to be large enough to accommodate the species. Recent fires are not expected to have impacted its presence as low trees of *Terminalia circumalata* are still present in these landforms, and dead trunks would be obvious for identification due to its minni-ritchie bark. As such, despite its close proximity and suitable habitat, this taxon was assessed as having a low likelihood of occurrence.

The threatened taxon *Quoya zonalis* (Previously *Pityrodia* sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4)) is known to occur to the east of the Project Area in the large ironstone/granite hills and mesas surrounding the Iron Bridge Mine. None of this landform exists within the Project Area and this taxon would not occur.



5.3 Flora of Other Significance

Of the vascular flora recorded during the survey, 18 were considered to be of other significance. Of these, three were considered to be range extensions, and six were considered to be significant for taxonomic reasons. Nine of these taxa were considered hybrids (Eight *Acacia*, one *Senna*) of other taxa occurring in the Project Area. The parent species of the hybrids are not significant, and hybridisation between these genera are commonplace, they are not discussed further.

Zornia muelleriana subsp. *congesta* and *Polygala galeocephala* have previously only been recorded in the Pilbara approximately 100 km north of the Project Area, in the localities of Port Hedland and Karratha. Both are annual taxa that are likely more widespread than previously recorded. *Zornia muelleriana* subsp. *congesta* is a low sprawling herb which was found growing among low to medium sized granite outcroppings, in the shaded overhangs. *Polygala galeocephala* is a low herb with purple/pink flowers, recorded from burnt drainage lines and the outskirts of granite outcroppings. It is possible that *P. galeocephala* is lesser known due to it being a fire ephemeral, as it was only recorded in burnt areas. Both of these taxa are more commonly found across the northern bioregions such as the Central, and Northern Kimberly, and Dampierland.

Portulaca digyna is a more significant range extension, with the closest known population ~600 km northeast in the Dampierland bioregion. This taxon is a cryptic annual herb, with foliage similar in colour to the red/orange dirt of the area, and pebble sized and shaped leaves. Even when flowering, the flowers are relatively small and inconspicuous. It is likely that this taxon is more widespread in the Pilbara than currently known. Woodman Consulting have recorded individuals that are likely to have been this taxon in the Pilbara previously (Woodman Environmental, 2016, 2019), however the condition was too poor to confirm. Specimens were confirmed by M. Hislop (Accession #9541).

Six taxa are considered significant for taxonomic reasons, and are considered by SLR to be potentially novel due to anomalous features.

Amaranthus aff. *undulatus* occurs in the same granite outcropping habitat as other significant flora (*N. umbratica* (P3), *P. hebecarpus* (P3), and *B. burbridgeae* (P4)), preferring the sheltered shaded overhangs of larger boulders. It was also identified by Ecoscape (2018) during surveys in the Turner River Survey Area and noted as a species of interest. SLR considers this species to be novel and with a potential to be classified as a significant species due to limited distribution and restricted habitat.

Bonamia pilbarensis (tight indumentum form) is a known variation to the common *B. pilbarensis* (also recorded within the Project Area). This variation is a known form of *B. pilbarensis*, occurring just south of Port Hedland, with a “denser indumentum of white hairs giving the plant a silver appearance” (Johnson, 2014). SLR believes that this form is distinctly different to *B. pilbarensis*, and should be considered either a novel species, or subspecies of the taxon, and unlikely to be of conservation significance.

Eriachne sp. Coongan Station (A.A. Mitchell PRP1566) is a low tussock grass found growing in sandy plains, often next to thin incised sheet flow channels. This species has been proposed as a new species pending listing, and has been recorded east of the Project Area near Coongan Station, in similar habitat of granite outcroppings and sandy plains. It is expected that this species will be given a priority status. This taxon was not known to exist during the TR and TRW Surveys, and was only highlighted following reviews by taxonomic specialists. As such, it is assumed that many individuals of *E. obtusa* recorded during the TR and TRW Surveys may be this novel taxon, as it is very closely related.

Polymeria sp. stoloniferous is a prostrate herb that seems to respond well to fire. This taxon is known to occur across the Pilbara by M. Hislop (Pers. Comm. 2023), and into the Kimberly. As such it is unlikely to be of significance despite never being formally described.



Solanum aff. *cleistogamum* is a low shrub that can be reliably differentiated from traditional *S. cleistogamum* (*sens. lat.*) by its habitat in sandy drainages, upright low shrub habit, and dense prominently orange prickles on the stem. It is unknown if this taxon is a distinct species or an edaphically driven form, and no distinction in fruit nor flower was noted.

Trianthema aff. *oxycalyptum* is a low herb found growing on the sandy plains of the Project Area. Taxonomically this entity has features of many similar *Trianthema* in the region, with the leaves and form of *T. glossostigmum*, and the seeds and operculum of *T. oxycalyptum*. SLR considers this to be a novel entity which can easily be distinguished by the combination of features, and apex of the floral whorl. However, the genus is poorly described and in need of review to accommodate current taxonomy. SLR has reviewed specimens and photographs suggesting this novel taxon may occur as far as Marble Bar, and into the Kimberley region, and as such is unlikely to be of conservation significance.

5.4 Introduced Flora

Eleven introduced (weed) flora taxa were recorded in the Project Area. Locations and numbers of the taxa were recorded when encountered, however all the introduced taxa should be considered to be more widespread than illustrated.

Common Prickly Pear (**Opuntia ?stricta*) was common through the major drainage of the TRA Survey Area, spread in conjunction with cattle movement and rain events. *Opuntia* species are considered weeds of national significance (WoNS) and Declared Pests (DP).

Calotrope (**Calotropis procera*) is considered a DP, occurring across major drainage landforms, alongside **Opuntia ?stricta*. The remaining weed taxa are considered to be widespread in the Pilbara, generally dispersed by wind, water, and cattle.

5.5 Vegetation Types and Mapping Reliability

Mapping reliability was considered either high or moderate-high across the Project Area, directly relating to recent fires. Where the fire affected vegetation in January 2022, mapping reliability was considered moderate-high, as the dominant *Acacia* could not confidently determined with many varying juveniles sprouting in many places. However, Fortescue provided high-resolution aerial imagery of the area prior to the burn, which allowed for mapping from sampled areas with some confidence. Where the vegetation was unburnt, mapping confidence was considered high. The entire burnt area was surveyed by helicopter and then walked to confirm and install sites.

Five broad landforms (clay, drainage, hills, outcroppings, and plains) were recorded within the Project Area. Vegetation within the Project Area was representative of existing broad scale vegetation and soil and land system mapping for the area.

The Project Area is represented by four broad vegetation associations, the most dominant of which is the Abydos Plain (Chichester 93) association. This vegetation association is restricted to the Pilbara, predominantly in the Chichester (PIL01) subregion, with 99.88% of its pre-European extent considered to currently remaining. However, this dataset is no longer being updated as of 2018, and these numbers do not take into account any impacts since then.

5.6 Vegetation of Conservation Significance

No vegetation types were considered representative of any TECs or PECs within the Project Area. The Gregory Land System Priority 3 community identified by the database searches was not recorded during the Survey, and no aligning landform (linear sand dunes) was present.



Vegetation type AsyAISf was considered to be locally significant as it was similar in composition to the 'Mitchell grass and Roebourne Plain grass plain Gilgai' Priority 3 ecological community, which is a sub-community of the 'Four plant assemblages of the Wona Land System (previously 'cracking clays of the Chichester and Mungaroon Range')'.

However, as the AsyAISf vegetation type does not intersect the Wona Land system, it is not considered to represent the 'Mitchell grass and Roebourne Plain grass plain on Gilgai' Priority 3 ecological community. It is still considered locally significant however as it supports a population of *Neptunia longipila* (P2) and is limited in distribution within the Project Area, and unlikely to be widespread outside the Project Area. Vegetation type ChAspTe also supported some *N. longipila* (P2), due to some isolated patches of clay appearing in the landform. These are considered isolated ecotonal patches and ChAspTe is not considered to be the primary habitat of *N. longipila* (P2), however is still considered locally significant due to its presence.

Four units are considered to be significant for the following reasons, all of which appear to be represented outside the Project Area on aerial imagery to some extent:

- **AspTba** – Covering only 67.37 ha (0.61% of the Project Area and supporting *Triodia basitricha* (P3). This vegetation occurs on darker pisolitic ironstone, in a thin band stretching east and west of where it occurs in the Project Area. It is unlikely to occur outside this geology and appears to be limited in the locality. *Triodia basitricha* has a wide range across the Pilbara, and is not restricted to the locality. As such AspTba is considered locally significant.
- **ChAaTc** – Covering 877.19 ha, this vegetation supports large numbers of *Triodia chichesterensis* (P3) which occurs as a dominant to subdominant (with *T. wiseana*) low hummock grassland. The landform that supports this vegetation (very low calcrete/quartz expressions across plains) is scattered within the Project Area, and always supported *T. chichesterensis* when it did occur. Given the numbers of *T. chichesterensis* within this vegetation type, ChAaTc should be considered of regional significance.
- **TcAtpTla** – Covering 42.93 ha, this vegetation was restricted to the larger granite boulder outcroppings of the Project Area, this vegetation was limited in distribution in the locality. This unique landform supported three priority taxa (*Phyllanthus hebecarpus* (P3), *Nicotiana umbratica* (P3), and *Bulbostylis burbridgeae* (P4)), as well as the potentially novel taxon *Amaranthus aff undulatus*. The granite boulder geology also creates habitat for numerous fauna taxa, and is a common canvas for traditional art. Given the restricted distribution and refuge of multiple significant flora taxa, this vegetation and landform should be considered regionally significant.

Two additional vegetation units (GwAaTs, and ChAaTs) were considered locally significant due to restricted distribution within the Project Area (<1%). However, neither of these units are dominated by any species that are considered uncommon or restricted, and both appear to be well represented outside the Project Area based on aerial imagery. GwAaTs supported one population of *Triodia basitricha* (P3) which was considered to be present due to the ecotonal landform of the nearby vegetation type AspTba.

5.7 Survey Adequacy

The survey effort for all three surveys were in accordance with the scope of works, and appropriate for a detailed flora and vegetation survey in the Pilbara. At least three flora sites were sampled within each vegetation type within the Project Area where possible. Three vegetation types could not be sampled with three flora sites due to restricted distribution and recent burns. One was sampled with two sites (AanTI) and two with a single site (AsyAISf



and GwAaTs). All other vegetation types were able to be sampled with three or more sites over the consolidated survey effort.

The inventory of vascular flora, and records of significant flora and weed species was compiled using site data and opportunistic observations made while traversing between sites and during systematic targeted searching. The entire Project Area was not systematically searched, and therefore additional flora taxa, and records of significant flora and weed species may be recorded with additional survey effort. Where the Project Area was recently burnt, on ground survey effort was reduced.

The species accumulation curve was approaching asymptote following the survey analysis. When a curve approaches an asymptote, it indicates sampling effort has been sufficient to adequately collect the species comprising the floral assemblage at the locations sampled. The value at which the curve asymptotes can also be used as an approximate measure of the total size of the species complement at that location. The species accumulation curve and the richness estimators approached asymptote but did not plateau, indicating additional survey could record additional vascular flora taxa. The curve however is conservative, as opportunistic and unconfirmed flora are not included, and when these are included then the number of flora recorded (463) is 107.77% to 123.29% of the expected species richness. Due to the variation between burnt and unburnt areas, this can affect the species accumulation curve to give the effect of additional floristic variation, which would not be present in stabilised unburnt vegetation.



6.0 Conclusion

- No Threatened flora species pursuant to the EPBC Act 1999 and/or gazetted as Threatened pursuant to the BC Act 2016 were recorded during the survey.
- Twelve DBCA listed Priority flora were recorded; *Neptunia longipila* (P2), *Euphorbia clementii* (P3), *Euploca mutica* (P3), *Goodenia obscurata* (P3), *Gymnanthera cunninghamii* (P3), *Nicotiana umbratica* (P3), *Phyllanthus hebecarpus* (P3), *Rothia indica* subsp. *australis* (P3), *Triodia basitricha* (P3), *T. chichesterensis* (P3), *Bulbostylis burbidgeae* (P4), and *Ptilotus mollis* (P4).
- Six taxa were recorded that were considered to be potentially novel taxa. Two of these (*Amaranthus* aff. *undulatus* and *Eriachne* sp. Coongan Station (A.A. Mitchell PRP1566)) are considered to be of potential conservation significance.
- Eleven introduced species were recorded during the survey, including **Opuntia ?stricta* (WoNS, DP) and **Calotropis procerus* (DP).
- Much of the Project Area was recently burnt, leading to low mapping reliability in burnt areas, and an increase in fire ephemeral species.
- Twenty three vegetation types were mapped within the Project Area across clay, drainage, hills, outcroppings, and plains. The majority of the Project Area was represented by Mixed *Acacia* species over *Triodia lanigera*/*T. epactia* plains.
- No TECs or PECs were recorded within the Project Area.



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