

REPORT

GNaweEDA PROJECT: FLORA, VEGETATION AND FAUNA IMPACT ASSESSMENT

PREPARED FOR **DORAY MINERALS LIMITED**

April 18

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Executive Summary

Doray Minerals Limited (Doray) commissioned Stantec (formally MWH Australia Pty Ltd [MWH]) to undertake a flora, vegetation and fauna impact assessment (this Assessment) for the development of the proposed Gnaweeda Project (the Project). The Project is located approximately 40 kilometres (km) northeast of Meekatharra and approximately 15 km southeast of the existing Andy Well operations in the northern Murchison region of Western Australia. The Project comprises the proposed mine site and associated haul road corridor to transport ore to the mill at Andy Well. The overarching objective of this Assessment was to identify and assess the potential impact of the Project on vegetation units, broad fauna habitats, fauna and flora assemblages and flora and fauna of conservation significance.

The area to be assessed as part of this Assessment (the Development Envelope) comprises a 1,149 ha parcel of land that is contained completely within the Study Area. The Study Area comprises 2,516 ha of land that contains the flora, vegetation and fauna Survey Areas, as well as minor additions to completely encompass the Development Envelope. Additionally, an indicative Project Footprint (the Project Footprint) is presented in this Assessment which covers approximately 279.3ha. The Project Footprint is contained within the Development Envelope, but the exact layout is subject to change. Regardless of the final Project Footprint layout, Doray has committed to the Project remaining within the Development Envelope and disturbing no more than 279.3ha.

A total of 19 vegetation units and four fauna habitats were mapped across the Study Area. All nineteen (19) vegetation units and all four fauna habitats occur within the Development Envelope and have the potential to be affected by land clearing during the construction and operation of the Project. Clearing of up to 279.3ha of vegetation in the Application Area will represent the greatest direct impact on vegetation units and fauna habitats as a result of the Project. Other impacts of the Project on biodiversity are likely to include vehicle collisions, noise and vibration, dust emissions, artificial lighting, altered hydrology, altered fire regimes and the presence of introduced flora and fauna.

None of the vegetation units were considered to be of regional significance or analogous with any Threatened Ecological Communities (TECs) or Protected Ecological Communities (PECs). Five vegetation units were considered to be of local significance within the Study area as they supported conservation significant flora. Three of these vegetation units occurred in association with Outcrops and Ridges (A?paAgEm, CfAfEl and CfA?ptDp) and supported the Priority 1 species *Stenanthemum mediale*. Approximately 28.1ha, and 1.8ha of these vegetation units occur within the Development Envelope and Project Footprint respectively. Two vegetation units were associated with Chenopod Shrublands (SsMPnMc and EmAcSd) and supported the Priority 3 species *Gunniopsis propinqua*. Approximately 40.8 ha and 5.8 ha of these vegetation units occur within the Development Envelope and Project Footprint respectively. The remaining vegetation units to be affected by the Project are considered widespread and of limited significance.

A total of 151 vascular flora taxa were recorded within the Study Area, comprising only native flora taxa from 28 families and 55 genera. This composition is typical of the Western Murchison subregion and is similar to those found in the surrounding landscape, as determined by a previous survey by Mattiske Consulting that partially overlaps the Study Area. No introduced flora taxa (weeds) were recorded within the Study Area, however two introduced taxa (**Bidens bipinnata* and **Oxalis corniculata*) have potential to be introduced to the Study Area as they have been recorded at the associated Andy Well mine site.

Two flora of conservation significance were recorded from the Study Area: *Stenanthemum mediale* (Priority 1) and *Gunniopsis propinqua* (Priority 3). Impacts to *Stenanthemum mediale* were considered to be minimal as only six (6) populations comprising 71 individuals of *Stenanthemum mediale* occur within the Development Envelope. Additionally, only 28.1ha of this species habitat (vegetation units associated with Breakaways) occurs within the Development Envelope and therefore has the potential to be cleared.

Impacts to *Gunniopsis propinqua* were considered to be minimal as only two populations comprising an unknown number of individuals occur within the Development Envelope. The number of individuals was unknown as the species had senesced at the time of the survey. Disturbance to the area where the species was recorded has potential to impact upon the viability of the local population. Only 40.8ha of this species habitat (vegetation units associated with Chenopod Shrublands) occurs within the Development Envelope and therefore has the potential to be cleared. Although no other conservation significant flora were recorded during the survey, the desktop study assessed two conservation significant flora as likely to occur, and 13 as possible to occur within the Study Area. Given these species were not detected during the survey, there are unlikely to be substantial populations within the Study Area and therefore any potential impacts are considered to be Negligible.

Of the broad fauna habitats that have potential to be adversely affected, only the Breakaway habitat is considered to be of significance to fauna assemblages, fauna of conservation significance and/or SRE invertebrate fauna. Specifically, the Breakaway habitat has potential to support the Long-tailed Dunnart (*Sminthopsis longicaudata*). Approximately 28.1 ha and 1.8 ha of Breakaway habitat occurs within the Development Envelope and Project Footprint, respectively. The other broad fauna habitat types to be affected by the Project include Drainage, Shrubland on Plains and Mulga Woodlands. These are considered to be widespread, of limited significance and to have low SRE potential.

The fauna assemblages within the Study Area were not considered exceptionally biodiverse relative to the surrounding region. As such, the impacts of the Project on fauna assemblages are unlikely to be significant.

The desktop study identified 23 species of conservation significance that potentially occur within the Study Area. Of these, only the Long-tailed Dunnart was considered likely to occur, particularly within suitable Breakaway habitat. Potential impacts associated with clearing 1.8 ha of Breakaway habitat was considered to have a Minor impact given the area of Breakaway habitat outside the Project Footprint within the Study Area and wider surrounds. Four other species of conservation significance were considered Possible to occur. Due to the lack of dependence on specific habitats or recent local records, potential impacts from the Project were considered Negligible.

Doray Minerals Limited

Gnaweeda Project: Flora, Vegetation and Fauna Impact Assessment

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1. Introduction

Doray Minerals Limited (Doray) commissioned Stantec (formally MWH Australia Pty Ltd [MWH]) to undertake a flora, vegetation and fauna impact assessment (this Assessment) for the development of the proposed Gnaweeda Project (the Project). The Project is located approximately 40 kilometres (km) northeast of Meekatharra and approximately 15 km southeast of the existing Andy Well operations in the northern Murchison region of Western Australia. The Project comprises the proposed mine site and associated haul road corridor to transport ore to the mill at Andy Well.

This Assessment is based on data obtained and analysed during the following baseline surveys conducted for the Project in spring 2016:

- Gnaweeda level 2 flora and vegetation assessment (MWH 2017b); and
- Gnaweeda level 1 fauna assessment (MWH 2017a).

Three areas were considered when conducting this assessment (**Figure 1-1**):

- The **Study Area**: approximately 2,516ha in size comprising the combined Mine Survey Area, the Haul Road Survey Area and additions to the Survey Areas (**Section 2**).
- The **Development Envelope**: approximately 1,149ha that occurs within the Study Area and encompasses the entire indicative Project Footprint.
- The indicative **Project Footprint**: approximately 279.3ha comprising the indicative clearing footprint of the Project.

At the time of this Assessment, the Project Footprint had not yet been finalised; thus, the Development Envelope has been considered for the purposes of assessing potential impacts of the Project. The indicative Project Footprint occurs entirely within the Development Envelope, and regardless of the final layout of the Project Footprint, Doray has committed to maintaining this and disturbing no more than 279.3ha.

The overarching objective of this Assessment was to identify and assess the potential impact of the Project on vegetation units and fauna habitats, and flora and fauna of conservation significance within the Development Envelope. The supporting survey reports were undertaken under relevant guidelines current at the time the surveys were completed, including the following:

- Position Statement No. 2 Environmental Protection of Native Vegetation in Western Australia (EPA 2000).
- Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002).
- Guidance for the Assessment of Environmental Factors No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004b).
- Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia EPA (2004a)
- Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA and DPaW 2015)
- Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment EPA and DEC (2010)

Subsequent to the completion of the surveys, technical guidance has been reviewed by the EPA and the following updated documents have been considered in compiling this impact assessment:

- Environmental Factor Guideline – Flora and Vegetation (EPA 2016e)
- Environmental Factor Guideline – Terrestrial Fauna (EPA 2016a)
- Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)
- Technical Guidance: Sampling methods for Terrestrial vertebrate fauna (EPA 2016c)
- Technical Guidance: Terrestrial Fauna Surveys (EPA 2016d)

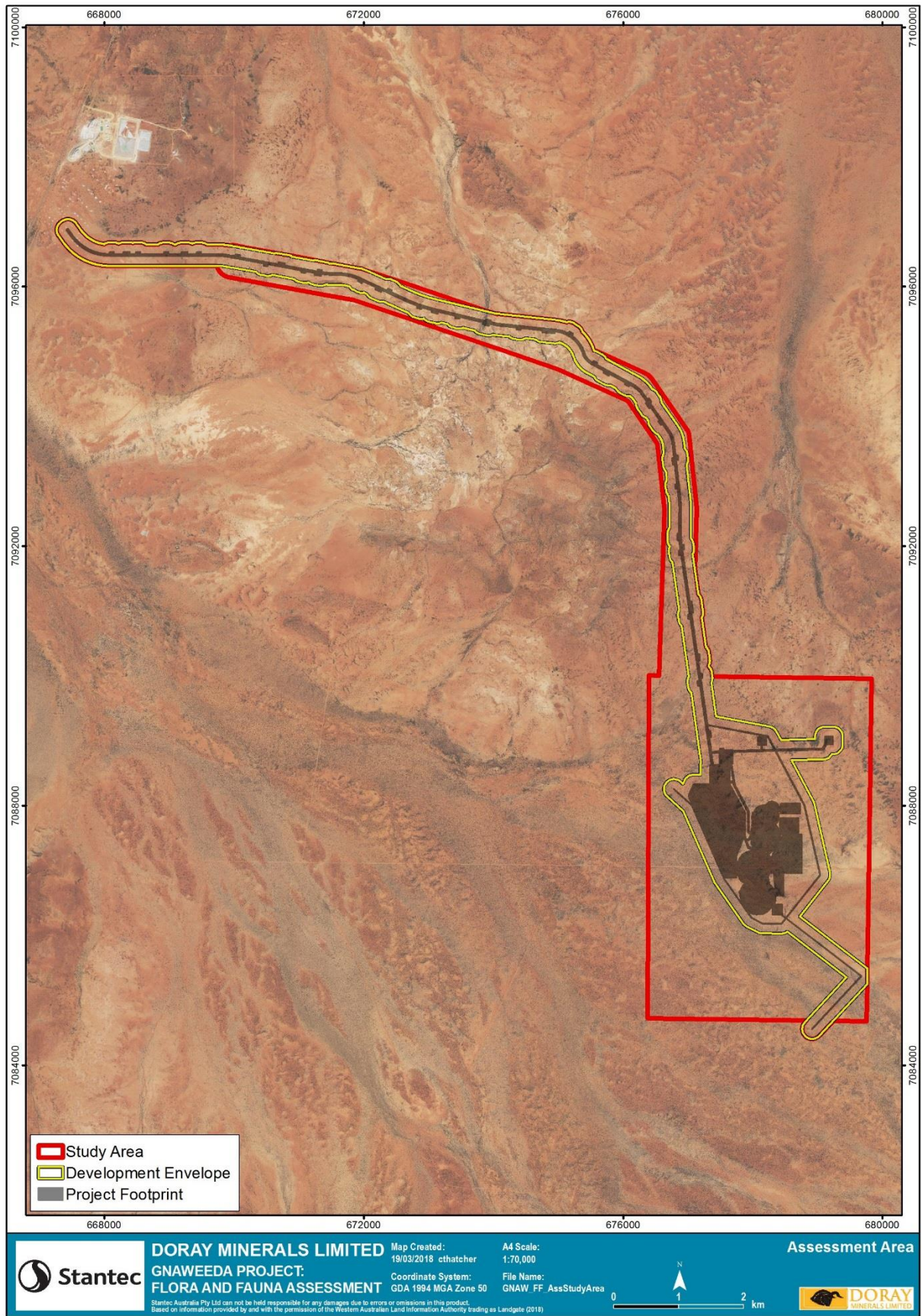


Figure 1-1: The Study Area for the Assessment, the Development Envelope and the Proposed Project Footprint .

2. Revision of the Extent of the Study Area

This Assessment is based on data obtained during a Level 1 terrestrial fauna survey (MWH 2017a) and a Detailed vegetation and flora survey (MWH 2017b). The surveys were of the Mine Survey Area and the Haul Road Survey Area. Subsequent to the completion of the surveys (November 2016), the Development Envelope for the Project was extended outside the Mine and Haul Road Survey Areas. Consequently, it was necessary for the Study Area to be extended (by 148ha; **Figure 2-1**) to include the expanded Development Envelope.

The Study Area was extended to incorporate realignment of the haul road in two areas and to incorporate the dewatering discharge point. These gaps were addressed by way of extrapolating vegetation and habitat mapping with reference to existing mapping and aerial imagery. Additionally, the Study Area was extended to the northwest for approximately two kilometres to connect the haul road with existing infrastructure associated with the Andy Well minesite. The extension of the haul road was addressed by aligning vegetation mapping and descriptions completed by Mattiske (Mattiske Consulting 2011) and associated habitats as interpreted for the same area by Bamford (2012).

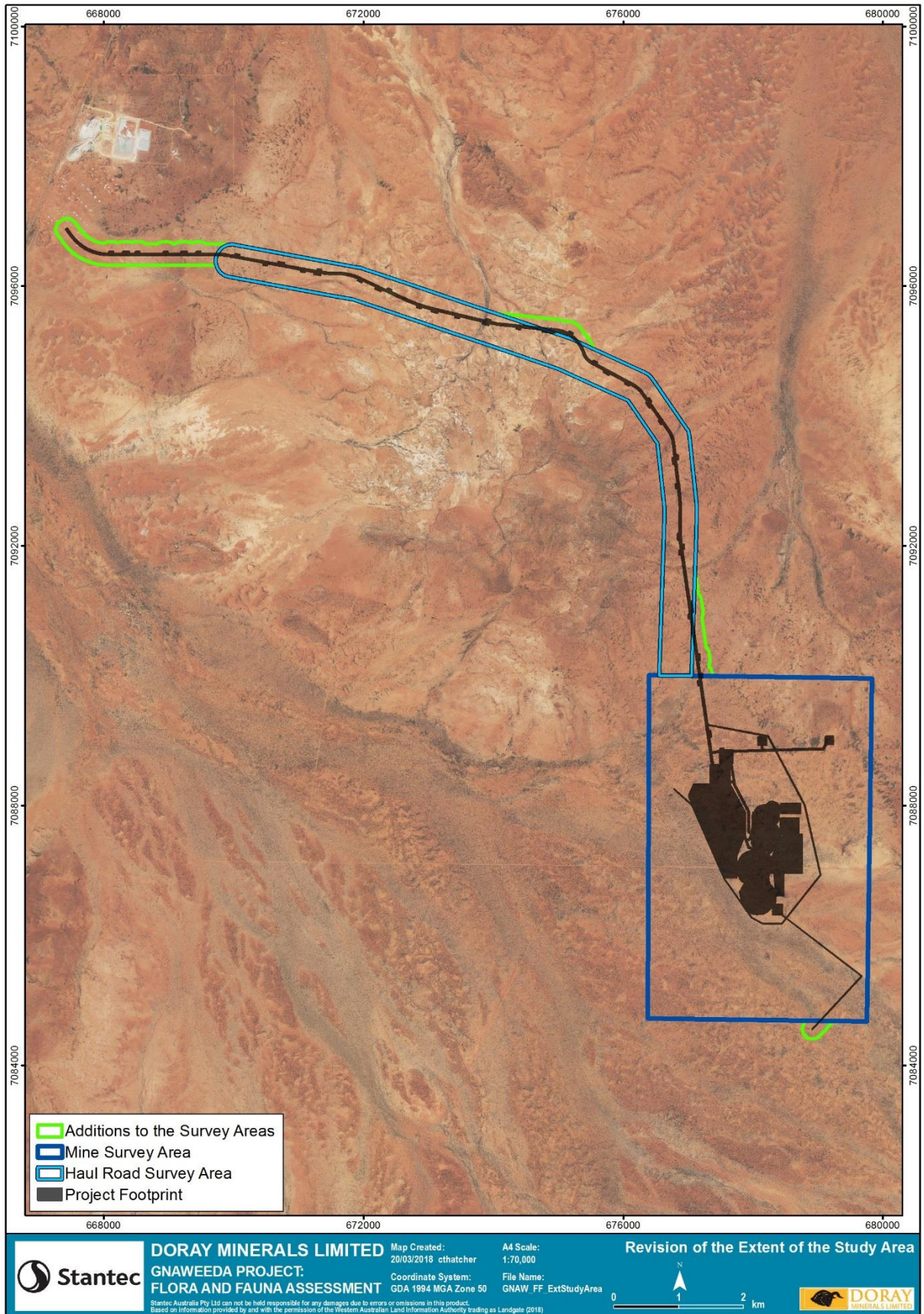


Figure 2-1: The expansion to the Study Area relative to the boundary of the flora and fauna Survey Areas for the Haul Road and Mine

2.1 Revisions to Vegetation mapping

The vegetation mapping completed by Mattiske Consulting (2011) for the Andy Well Mine Site was aligned with the mapping completed by MWH (2017b) for Gnaweeda. Additionally mapping was extrapolated using aerial imagery for areas where there was no existing mapping (**Table 2-1, Figure 2-2**).

Table 2-1: Areas of each Vegetation Unit within the Study Area comprising the Haul Road Survey Area, Mine Site Survey Area and the Additions to the Survey Areas.

Super-groups	Vegetation Code and description	Area (ha)					
		Mine Area	Survey	Haul Road Survey Area	Additions to the Survey Areas	Study Area	
Claypan	AmAtHll		13		<1	0	13
Acacia Shrublands	A?paA?pt		50		185	23	258
	A?paA?ptD		0		13	2	15
	A?ptEffEfo		11		46	0	58
Mulga Woodlands	A?paAprPo		84		1	0	85
	A?paEfoEff		931		0	7	938
	A?paEfoEffD		455		<1	5	461
<i>Eremophila spathulata</i> on quartz	A?ptEspEss		0		41	0	41
	AprEsp		41		103	90	235
	EsEm		78		4	0	82
	S1*		0		0	8	8
Chenopod Shrublands	A?ptEffSaa		0		12	0	12
	SsMPnMc		7		14	2	22
	EffMcSd		52		0	0	52
	EmAcSd		0		28	10	38
	AtEmSd		8		62	0	69
Outcrops and Ridges	A?paAgEm		0		26	<1	26
	CfAFeI		0		22	0	23
	CfA?ptDp		0		10	0	10
Disturbance	Na		68		3	<1	71
Total			1,798		570	148	2,516

* S1 is a vegetation unit that occurs in the area mapped and presented within Mattiske Consulting (2011).

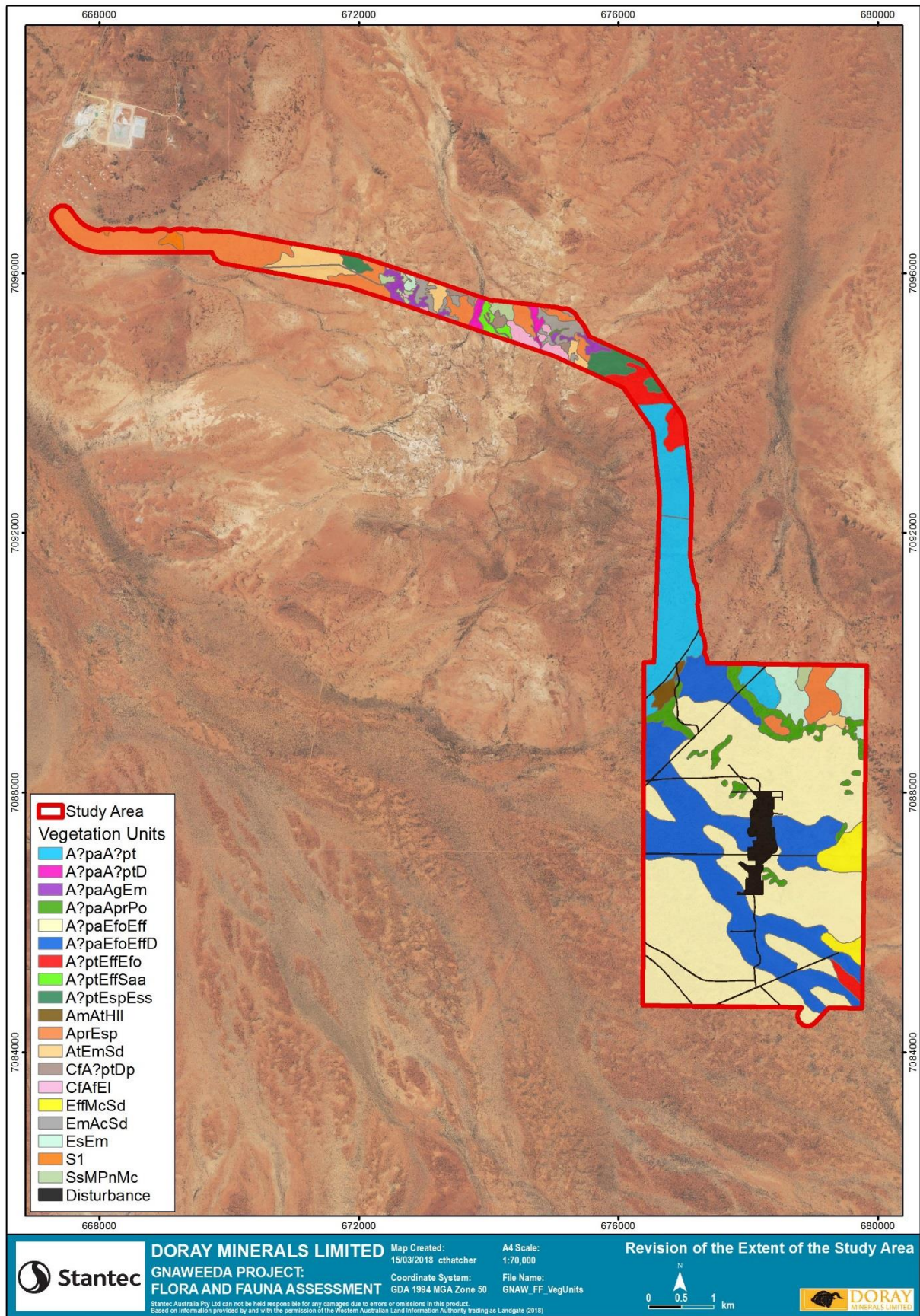


Figure 2-2: Vegetation mapping of the Study Area comprising the Haul Road Survey Area, Mine Site Survey Areas and the Additions to the Survey Areas.

2.2 Revisions to Habitat mapping

Habitat mapping of the Andy Well mine site (Bamford 2012) utilised the vegetation mapping undertaken by Mattiske Consulting (2011) and was aligned with the habitat mapping completed by (MWH 2017a) for Gnaweeda. Additionally mapping was extrapolated using aerial imagery for areas where there was no existing mapping (**Table 2-2, Figure 2-3**).

Table 2-2: Areas of each Fauna habitat within the Study Area comprising the Haul Road Survey Area, Mine Site Survey Area and the Additions to the Survey Areas.

Fauna Habitat	Area (ha)			
	Mine Survey Area	Haul Road Survey Area	Additions to the Survey Areas	Study Area
Breakaways	0	58.3	0.5	58.9
Drainage	604.3	14.2	7.3	625.8
Shrubland on Plains	195.7	494	132.2	821.9
Mulga Woodlands	930.7	0	7.4	938.1
Disturbance	68	3	0.2	71.3
Total	1,799	570	148	2,516

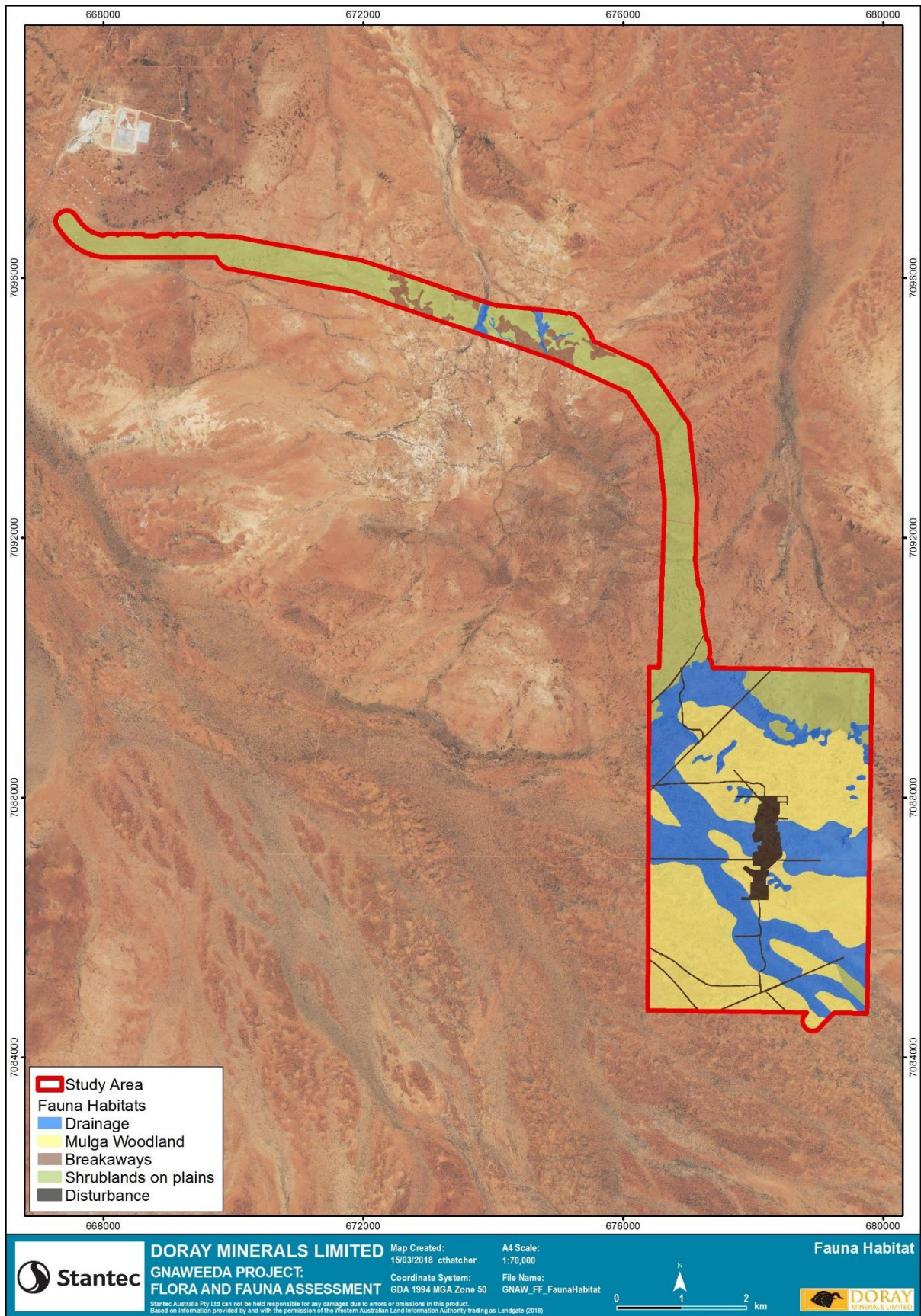


Figure 2-3: Fauna habitat mapping for the Study Area comprising the Haul Road Survey Area, Mine Site Survey Areas and the Additions to the Survey Areas.

3. Impact Assessment

3.1 Threatening Ecological Processes

Threatening processes relevant to flora, vegetation and fauna have been identified by the Biodiversity Audit of the subregion conducted by Desmond *et al.* (2001), the Environmental Factor Guidelines for flora, vegetation and fauna (EPA 2016a, e) and by the DOEE (DoEE 2018). Of these, threatening processes potentially caused by the Project are discussed in **Section 3.1.1** to **Section 3.1.9**. The impact of clearing and vehicle collision will be wholly contained within the Development Envelope, however other threatening processes including noise and vibration, dust emissions, artificial lighting, altered hydrology, altered fire regimes, introduced flora and fauna, are not restricted, and will potentially impact flora, vegetation and fauna occurring within and outside the Development Envelope. The degree to which this occurs varies with each threatening process and species.

3.1.1 Clearing

The loss of fauna habitat and vegetation as a direct result of land clearing and excavation is considered to be the primary impact of the Project on terrestrial flora, vegetation and fauna. Land clearance is listed as a Key Threatening Process under the EPBC Act, although it is also recognised as a necessary component of developing a resources project in an undeveloped area. Development of the Project will result in a maximum loss of 279.3 ha (Project Footprint), and this may occur anywhere within the Development Envelope according to Project requirements.

Clearing is believed to be the largest and most widespread threat to Australian biodiversity (Evans *et al.* 2011). Clearing would reduce the size and quality of habitats through edge effects and habitat fragmentation, and is likely to heighten the effects of other threatening processes such as introduced flora (Keighery 2010), introduced fauna (Doherty *et al.* 2015) and altered fire regimes (Knorr *et al.* 2014). The impact of clearing is particularly high when landforms such as breakaways are removed, as there is limited opportunity and ability to recreate and rehabilitate such habitat features post mine closure.

3.1.2 Vehicle Collision

In addition to the clearing of vegetation, the construction of roads can reduce habitat quality, alter animal behaviour, promote activity of predatory (often introduced) fauna, and the most significant, direct mortality through vehicle collision (Polak *et al.* 2014). Incidents typically only involve individuals; however the cumulative effect can be considerable (Gleeson and Gleeson 2012). Collisions with animals are more likely to occur at night (Rowden *et al.* 2008). Additionally, vehicle collision is likely to promote species which feed on road-kill carrion, potentially driving other species away from the area and altering the local species assemblage (Dickman 1996).

3.1.3 Noise and Vibration

The development and ongoing operation of the Project is likely to generate noise and vibration due to blasting, general operation of heavy machinery and vehicles, diesel generators and the presence of personnel. The effects of noise on wildlife have been well studied, although responses vary depending on age and sex (for a comprehensive summary see Newport *et al.* 2014). Impacts caused by noise range from interruptions in feeding and resting behaviour to complete abandonment of an area (Newport *et al.* 2014). Noise may lead to reduced population densities in small mammals and nest failure and decreased population densities in birds (Slabbekoorn and Ripmeester 2008). Constant levels of noise may also interfere with species communication, via acoustic interference (Parris and Schneider 2009). Species that may be especially at risk of disturbed communication are those that use calls to communicate or navigate (e.g. bat species).

3.1.4 Dust Emissions

The development and operation of the Project will create dust emissions due to construction, blasting, haulage and general traffic activities, which will also impact areas beyond the Development Envelope. Dust emissions have the potential to affect surrounding vegetation and water sources. High levels of dust have been associated with a reduction in plant growth and productivity, and alteration of soil chemistry leading to changes in vegetation community structure (Farmer 1993). Such effects are also likely to impact faunal assemblages via a reduction in food resource availability and shelter. However, studies in semi-arid regions of Western Australia have failed to prove negative effects of dust on arid-zone flora, suggesting that the impact of dust emissions within these ecosystems is not as prominent as observed in other areas (Matsuki *et al.* 2016).

3.1.5 Artificial Light

Fauna have potential to be affected by exposure to artificial light, which may interfere with biological and behavioral activities that are governed by the length of day (photoperiod), including reproduction, dormancy, foraging and migration (Bradshaw and Holzapfel 2007, Le Corre *et al.* 2002, Stone *et al.* 2015). Some examples include reduced foraging activity in nocturnal mice (Bird *et al.* 2004) and suspension of normal feeding and reproductive behaviour in nocturnal frogs (Bird *et al.* 2004, Harder 2002). Light pollution has also been shown to interfere with timing of songbird choruses, potentially leading to reduction in breeding success or survival (Miller 2006). See Longcore and Rich (2004) for a broad review of some of the ecological consequences of light pollution. The Project will operate 24 hours a day and is likely to require substantial artificial lighting during construction and ongoing operation. This artificial lighting may have detrimental effects on resident mammal, bird, reptile, and amphibian species occurring within the vicinity of light sources, within and outside the Development Envelope.

3.1.6 Altered Hydrology

Availability of water and nutrients is the primary limiting factor in arid and semi-arid environments (James *et al.* 1995). The degree to which ecosystems depend on water varies with the particular structure and function of ecosystems, which in turn are likely to vary over time (Hatton and Evans 1998). For example, floodplains, flood-outs and riparian fringes are the most productive habitats in the landscape because soils are fertile and water supply is relatively continuous as a result of reliable run-on and accessible ground water. The vast majority of ecosystems in the Murchison region do not feature accessible water for any length of time. The term 'altered hydrology' relates specifically to a range of actions that may impact upon water dependent ecosystems via diversion of natural hydrological flows and reduction in the extent of watersheds. Additionally, 'altered hydrology' may involve dewatering for the Project where water may be pumped into the surrounding environment and inundate previously dry areas. Additionally, this water may be of a chemical composition e.g. elevated salinity, which may be detrimental to vegetation.

3.1.7 Altered Fire Regimes

Project development and ongoing operation may alter the fire regime of the Development Envelope and the surrounding region through unplanned fire. This may be caused by vehicle movements and/or other Project activities such as hot work. Fire may impact flora, vegetation and fauna by causing long-term habitat modification resulting from unnatural fire frequency and intensity (Woinarski *et al.* 2014). The value of many habitats to fauna lies in the mosaic of ages (Parr and Andersen 2006, Southgate *et al.* 2007, Woinarski 1999). Fires that are too frequent, hot or extensive that occur during hot, dry times of the year can eliminate this mosaic, and reduce the capacity of these habitats to support diverse assemblages (Law and Dickman 1998).

3.1.8 Introduced Flora

Although no introduced flora were recorded from the Study Area, introduced flora may be present but were not detectable due to survey timing (MWH 2017b). Additionally, Mattiske Consulting (2011) identified two introduced taxa, **Bidens bipinnata* and **Oxalis corniculata*, from the Andy Well mine site. These two weed

species may occur within the haul road survey area adjacent to the Andy Well mine site. An additional taxon, *Portulaca oleracea*, was recorded as a weed from the Andy Well mine site, however this taxon is no longer considered to be a weed.

Environmental weeds potentially present in the Development Envelope or at the Andy Well mine site may be spread through vehicle usage. Furthermore, new weed species may be introduced into the Development Envelope by mobile equipment during construction and operation of the Project. Weed invasion is widely recognised as having a negative impact on native flora and fauna species, as it can fundamentally alter the composition and structure of native vegetation communities (Cowie and Werner 1993, Gordon 1998). In the extreme, entire ecosystems can be modified directly by weed species outcompeting native species (Sodhi and Ehrlich 2010), and indirectly by providing additional fuel which may alter the local fire regime (Miller *et al.* 2010). The habitats within the Study Area are potentially weed free, and as such native vegetation communities may undergo substantial changes should invasive flora be introduced and become established.

3.1.9 Introduced Fauna

Introduced fauna, both herbivorous and predatory, can cause fundamental changes to ecosystems and are thought to have contributed to the decline and extinction of many Australian species (Abbott 2002, Burbidge and McKenzie 1989, Ford *et al.* 2001, Short and Smith 1994, Woinarski *et al.* 2014, 2015). Of the 21 key threatening processes listed under the EPBC Act, 12 relate to introduced flora and fauna, including predation by the Red Fox (*Vulpes vulpes*) and the feral Cat (*Felis catus*) which are known to have major negative impacts on small and medium-sized native Australian vertebrates (Dickman 1996).

Two species of introduced fauna, European Cattle (*Bos taurus*) and Dog (*Canis familiaris*), were recorded in the Study Area during the Survey (MWH 2017a). An additional eight species have been recorded within the vicinity of the Study Area: Goat (*Capra hircus*), Camel (*Camelus dromedarius*), Fox (*Vulpes vulpes*), Donkey (*Equus asinus*), Cat (*Felis catus*), Rabbit (*Oryctolagus cuniculus*), House Mouse (*Mus musculus*) and Domestic Pigeon (*Columba livia*) (MWH 2017a). Of the ten species occurring or potentially occurring in the Study Area, all but four, the Feral Cat, House Mouse, European Cattle and Domestic Pigeon (*Columba livia*) – are listed as 'Declared Pests' under the *Biosecurity and Agriculture Management Act 2007* (WA), which calls for reduction of their numbers when they are wild or feral.

The Project may provide additional resources or habitat which may attract and support increased feral animals in the area, particularly as feral species tend to have a greater resilience to change. For example, introduced predators may be attracted into the Development Envelope as a result of the scavenging opportunities generated by the presence of road kill along roads (Dickman 1996) or food at landfill facilities, which may in turn adversely affect populations of native fauna. Additionally, cleared areas within the Study Area will have reduced habitat complexity which in turn would make native species more susceptible to feral predation.

3.2 Flora and Vegetation

3.2.1 Impacts on Vegetation

A total of 18 vegetation units were delineated within the Study Area. A maximum of 279.3 ha of vegetation within the Development Envelope will be removed for the Project, potentially affecting all 19 vegetation units present in the Study Area (**Table 3-1, Figure 3-1**).

No vegetation units recorded within the Study Area are considered to be of regional significance or analogous with any Threatened Ecological Communities (TECs) or Protected Ecological Communities (PECs). Five vegetation units were considered to be of local significance within the Study area as they are considered significant for supporting Priority Flora (**Table 3-1**). The five units were recorded within Outcrops and Ridges and Chenopod Shrublands. These broad groups mainly occurred along the Haul Road Survey Area, with minor occurrences in the Mine Survey Area. The conservation significant flora associated with these vegetation units were recorded within the Haul Road Survey Area. Areas of these vegetation units that are known to support conservation significant flora within the Development Envelope are presented in **Table 3-1**. The other vegetation units to be affected by the Project are considered widespread and of limited significance.

Table 3-1: Extent of each Vegetation Unit within the Study Area, Development Envelope and Project Footprint presented as a proportion of the Study Area

Super-groups	Vegetation Code and description	Conservation significant flora	Study Area		Development Envelope		Project Footprint	
			Ha		Ha	%	Ha	%
Claypan	AmAtHll	-	13.0		0.2	1.5	0	0.0
Acacia Shrublands	A?paA?pt	-	257.9		125.4	48.6	12.8	5.0
	A?paA?ptD	-	15.3		9.7	63.4	1.2	7.8
	A?ptEffEfo	-	57.7		38.1	66.0	4.2	7.3
	S1	-	8.1		8.1	100.0	1.6	19.8
Mulga Woodlands	A?paAprPo	-	85.3		32.2	37.7	11.5	13.5
	A?paEfoEff	-	938.1		343.0	36.6	104.3	11.1
	A?paEfoEffD	-	460.5		200.7	43.6	60.8	13.2
<i>Eremophila spathulata</i> on quartz	A?ptEspEss	-	40.7		30.6	75.2	3.9	9.6
	AprEsp	-	234.5		168.4	71.8	15.7	6.7
	EsEm	-	82.2		2.7	3.3	0.3	0.4
Chenopod Shrublands	A?ptEffSaa	-	11.7		4.7	40.2	0.6	5.1
	SsMPnMc	<i>Gunniopsis propinqua</i> (P3)	22.2		14.3	64.4	2.1	9.5
	EffMcSd	-	51.7		13.7	26.5	0.2	0.4
	EmAcSd	<i>Gunniopsis propinqua</i> (P3)	37.5		26.5	70.7	3.7	9.9
	AtEmSd	-	69.3		44.4	64.1	4.2	6.1
Outcrops and Ridges	A?paAgEm	<i>Stenanthemum mediale</i> (P1)	26.1		19.5	74.7	1.6	6.1
	CfAfEl	<i>Stenanthemum mediale</i> (P1)	22.5		2.8	12.4	0	0.0
	CfA?ptDp	<i>Stenanthemum mediale</i> (P1)	10.3		5.8	56.3	0.2	1.9
Disturbance		-	71.3		58.3	81.8	50.5	70.8
Total			2,515.9		1,149.0	45.7	279.3	11.1

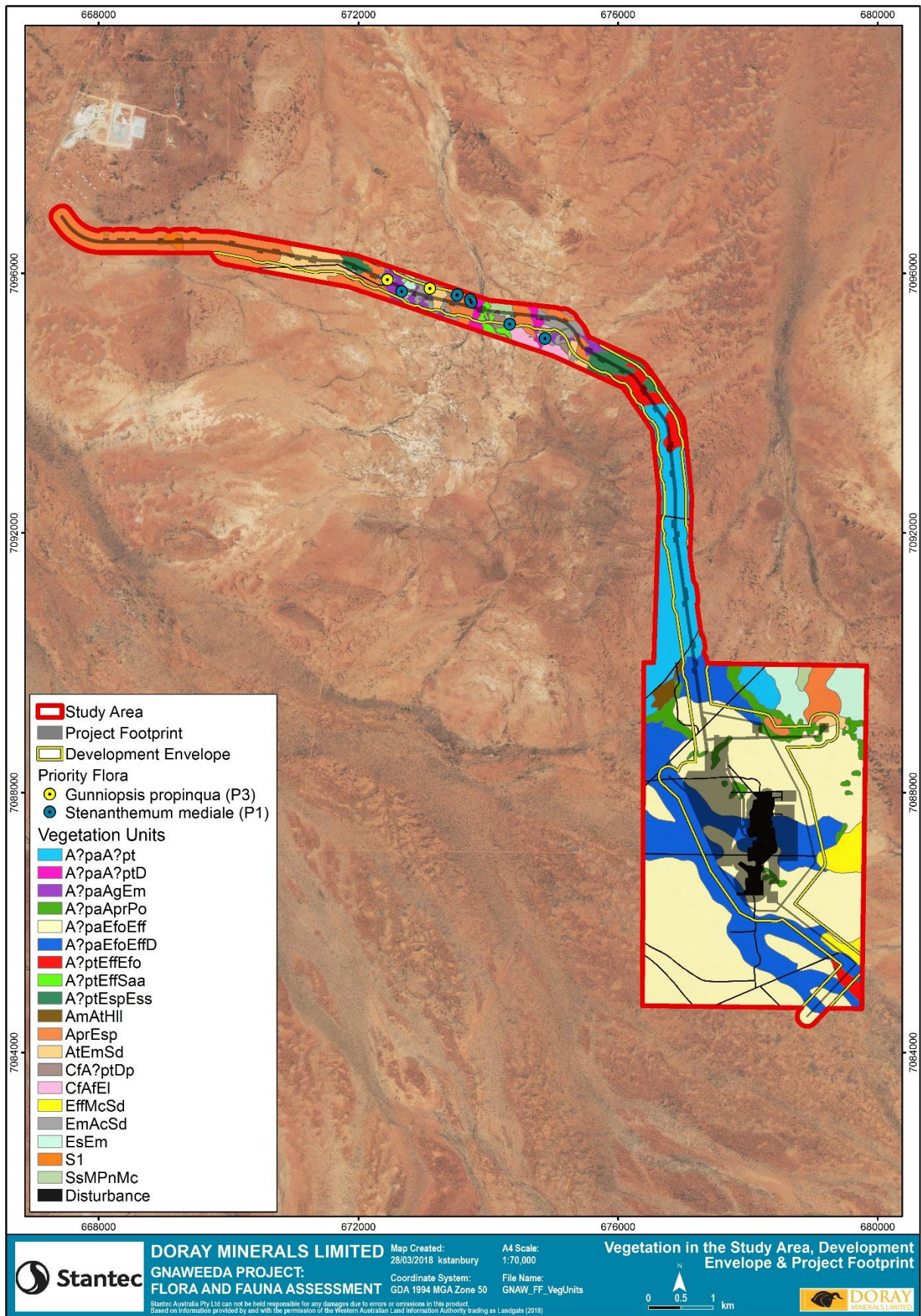


Figure 3-1: Development Envelope and Project Footprint with respect to vegetation units

3.2.2 Impacts on Flora Assemblages

A total of 151 vascular flora taxa were recorded within the Study Area, comprising only native flora taxa representing 28 families and 55 genera. The most represented families were Fabaceae (33 taxa), Chenopodiaceae (20 taxa) and Poaceae (17 taxa). The most represented genera were Acacia (22 taxa), Eremophila (15 taxa) and Senna (10 taxa). This floristic composition is typical of the Western Murchison subregion (Curry *et al.* 1994). No introduced flora taxa (weeds) were recorded within the Study Area, however two introduced taxa (**Bidens bipinnata* and **Oxalis corniculata*) have potential to occur as they were recorded at the associated Andy Well mine site. These assemblages are similar to those found in the surrounding landscape, as determined by a previous survey that partially overlaps the Study Area (Mattiske Consulting 2011, MWH 2017b).

The Study Area did not contain an exceptionally high level of floristic diversity given the surrounding region and the bioregion in general. Clearing of vegetation for the Project is unlikely to significantly affect the floristic diversity of the area.

3.2.3 Impacts to Flora of Conservation Significance

The desktop assessment identified two threatened flora (*Eremophila rostrata* subsp. *rostrata* and *Pityrodia augustensis*) and 63 priority listed flora as potentially occurring within the Study Area. Of the 65 conservation significant flora, two were considered likely to occur, while 13 were considered possible to occur within the Study Area. Additionally, two priority flora not identified by the desktop assessment were recorded within the haul road survey area: *Stenanthemum mediale* (P1) and *Gunniopsis propinqua* (P3). For definitions regarding the likelihood of occurrence for species of conservation significance, refer to (MWH 2017b).

Pre-determined categories were used to rank the expected local impacts of the Project on flora of conservation significance (Table 3-2). These impacts were considered within a broader, regional context (Table 3-3). Impacts were assessed based on the assumption that no management actions or mitigation strategies would be implemented. Of the 17 species assessed, two were assessed as having a Minimal level of impact, and 15 were assessed as having Negligible impact (Table 3-3).

Species specific management actions and strategies to manage the impacts of the Project on flora of conservation significance were also developed (Table 3-3). The level of impact of the Project on these species is likely to be reduced should the recommended actions and strategies be implemented. More general management recommendations are provided in Section 4.

Table 3-2: Ranking criteria for Project local impacts on flora of conservation significance

Impact	Description [#]
Negligible	No perceived effect on population
Minimal	No population decline expected
Low	Short-term population decline expected within Development Envelope (recovery expected after life of the Project)
Moderate	Permanent population decline expected – no perceived threat to population persistence
High	Permanent population decline expected – persistence of local population threatened
Extreme	Local population extinction likely

[#]these impacts can be expected within the Development Envelope and surrounding 10 km

Table 3-3: Project impacts on flora of conservation significance, with suggested management actions

Species Conservation listing	Conservation listing	Number of populations (individuals) or Likelihood or occurrence (MWH 2017b)			Localised impacts	Regional context	Species specific management actions
		Study Area	Development Envelope	Project Footprint			
<i>Stenanthemum mediale</i>	Priority 1	7 (106)	6 (71 individuals)	0 (0 individuals)	<p>Minimal Six (6) populations of the species occurs within the Development Envelope.</p> <p>28.1 ha of Breakaway habitat occurs within the Development Envelope. This includes 1.8 ha of vegetation associated with the Granite Outcrops which occur in the Project Footprint.</p>	<p><i>Stenanthemum mediale</i> is known to occur primarily in the Murchison region, with one population known from the Great Victoria Desert (WAH 2016). The Western Australian Herbarium has 22 specimens lodged (WAH 2017). The majority of the specimens and records are from the east and southeast of Meekatharra near the ex-Kaluwiri Pastoral Lease. A significant population of <i>Stenanthemum mediale</i> is known to occur north of Cue with approximately 137 individuals recorded from 47 point locations (Coffey Environments 2013). This population along with the six locations of <i>Stenanthemum mediale</i> within the Study Area fill in a distributional gap for the conservation significant taxon in the Murchison bioregion. The known population distribution extends from Mount Magnet in the south-west to Mount Gould in the north-west, across to Wiluna in the north-east and Sandstone in the south-east (WAH 2017).</p>	<p><i>Stenanthemum mediale</i> was recorded exclusively from the Breakaways associated with vegetation units A?paAgEm, CfAfEl and CfA?ptDp within the Haul Road Survey Area. Clearing of the breakaways should be avoided to reduce the risk of impacting the species, particularly within the area that has not been surveyed (Additions to the Survey Areas) (Section 2).</p>
<i>Gunniopsis propinqua</i>	Priority 3	2 (2)	2 (unknown number of individuals as the species had senesced at the time of the survey)	1 (unknown number of individuals as the species had senesced at the time of the survey)	<p>Minimal Two (2) populations of the species are known to occur within the Development Envelope.</p> <p>40.8ha of the SsMPnMc and EmAcSd vegetation associations occur within the Development Envelope. This includes 5.8ha of these vegetation associations within the Project Footprint.</p>	<p><i>Gunniopsis propinqua</i> is known to occur in the Murchison, Gascoyne, Pilbara and Yalgoo regions (WAH 2016). It is known from habitat comprising stony sandy loam, lateritic outcrops and winter-wet sites (WAH 2016).</p> <p>The Western Australian Herbarium has 17 specimens lodged (WAH 2017). According to the specimen information, <i>Gunniopsis propinqua</i> extends from Paraburdoo in the Pilbara bioregion to Laverton in Murchison bioregion, some 800 km. Of the 17 specimens lodged, two were collected from lands managed for conservation by Parks and Wildlife (WAH 2017).</p>	<p><i>Gunniopsis propinqua</i> was recorded from two locations within the vegetation units SsMPnMc and EmAcSd, which occur within the Chenopod Shrubland broad habitat at the north-western end of the Haul Road Survey Area. Both specimens were in the process of senescing. Further targeted surveys during a more optimal survey period (6 to 8 weeks after sufficient rainfall) may increase the known distribution of this conservation significant taxon in the Study Area. Although this species is only a Priority 3 species, efforts should be made to avoid clearing Chenopod Shrubland habitat, particularly vegetation units SsMPnMc and EmAcSd where possible.</p>
<i>Calytrix verruculosa</i>	Priority 3	Likely			Negligible	There are records 24 km south west of the Study Area and the Study Area contains suitable habitat (Sandy clay).	Not Applicable
<i>Drummondita miniata</i>	Priority 3	Likely			Negligible	There are records 20 km south east of the Study area and the Study Area contains suitable habitat (breakaways).	Avoid clearing breakaway habitat where possible.
<i>Acacia speckii</i>	Priority 4	Possible			Negligible	The Study Area is within the distribution of this taxon, however there are no records within 40 km of the Study Area.	Not Applicable
<i>Dodonaea amplisemina</i>	Priority 4	Possible			Negligible	The Study Area is within the distribution of this taxon, however there are no records within 40 km of the Study Area.	Not Applicable
<i>Goodenia berringbinensis</i>	Priority 4	Possible			Negligible	There are records 9.5 km north west of the Study Area, however the Study Area is unlikely to contain suitable habitat.	Not Applicable

Species Conservation listing	Conservation listing	Number of populations (individuals) or Likelihood or occurrence (MWH 2017b)			Localised impacts	Regional context	Species specific management actions
		Study Area	Development Envelope	Project Footprint			
<i>Grevillea inconspicua</i>	Priority 4	Possible			Negligible	There are records 30 km south west of the Study Area, which may contain suitable habitat.	Not Applicable
<i>Homalocalyx echinulatus</i>	Priority 3	Possible			Negligible	The Study Area is within the distribution of this taxon, however there are records 40 km away and the Study Area may contain suitable habitat (Breakaways, sandstone hills).	Not Applicable
<i>Maireana prosthochaeta</i>	Priority 3	Possible			Negligible	The Study Area is centred within the distribution of this taxon and may contain suitable habitat, however there no records within 40 km of the Study Area	Not Applicable
<i>Menkea draboides</i>	Priority 3	Possible			Negligible	There are records 33 km south west of the Study Area, which may contain suitable habitat (Red sand or clay, granite).	Not Applicable
<i>Ptilotus lazaridis</i>	Priority 3	Possible			Negligible	The Study Area is within the distribution of this taxon, and may contain suitable habitat, however there are no records within 40 km of the Study Area.	Not Applicable
<i>Ptilotus luteolus</i>	Priority 3	Possible			Negligible	The Study Area is within the distribution of this taxon, and may contain suitable habitat, however there are no records within 40 km of the Study Area.	Not Applicable
<i>Rhodanthe sphaerocephala</i>	Priority 1	Possible			Negligible	The Study Area is within the distribution of this taxon, and may contain suitable habitat, however there are no records within 40 km of the Study Area.	Not Applicable
<i>Sida picklesiana</i>	Priority 3	Possible			Negligible	The Study Area is within the distribution of this taxon, and may contain suitable habitat, however there are no records within 40 km of the Study Area.	Not Applicable
<i>Verticordia jamiesonii</i>	Priority 3	Possible			Negligible	The Study Area is within the distribution of this taxon, and may contain suitable habitat (Sandy clay soils. Lateritic breakaways), however there are no records within 40 km of the Study Area.	Not Applicable
<i>Wurmbea</i> sp. Denham Pool (F. Hort et al. 2216)	Priority 1	Possible			Negligible	There are records 23 km north east of the Study Area.	Not Applicable

3.3 Fauna

3.3.1 Impacts on Fauna Habitats

A total of four fauna habitats were delineated across the Study Area. A maximum of 279.3 ha of fauna habitat within the Development Envelope will be removed for the Project, potentially affecting all four broad fauna habitats present in the Study Area (**Table 3-4, Figure 3-2**). Of the broad fauna habitats that have potential to be adversely affected, only the Breakaway habitat is considered to be of significance to fauna assemblages, fauna of conservation significance and/or SRE invertebrate fauna. The other broad fauna habitat types which may be affected by the Project include; Drainage, Shrubland on Plains and Mulga Woodlands. Each of these is considered widespread, of limited significance and of low SRE potential.

Table 3-4: Habitat extents in the Study Area, Development Envelope and Project Footprint presented as a proportion of the Study Area

Fauna habitat	Category#	Study Area	Development Envelope		Project Footprint	
		Ha	Ha	%*	Ha	%*
Breakaways	<ul style="list-style-type: none"> Limited extent Significant Medium SRE potential 	58.9	28.1	47.7	1.8	3.1
Drainage	<ul style="list-style-type: none"> Widespread Limited Significance Low SRE potential 	625.8	256.5	41.0	73.7	11.8
Shrubland on Plains	<ul style="list-style-type: none"> Widespread Limited Significance Low SRE potential 	821.9	463.0	56.3	49.1	6.0
Mulga Woodlands	<ul style="list-style-type: none"> Widespread Limited Significance Low SRE potential 	938.1	343.0	36.6	104.3	11.1
Disturbance	N/A	71.3	58.3	81.8	50.5	70.8
Totals		2515.9	1149.0	45.7	279.3	11.1

#see (MWH 2017a) for definitions.

*percentages denote extent of that habitat type as a proportion of that habitat existing within the Study Area

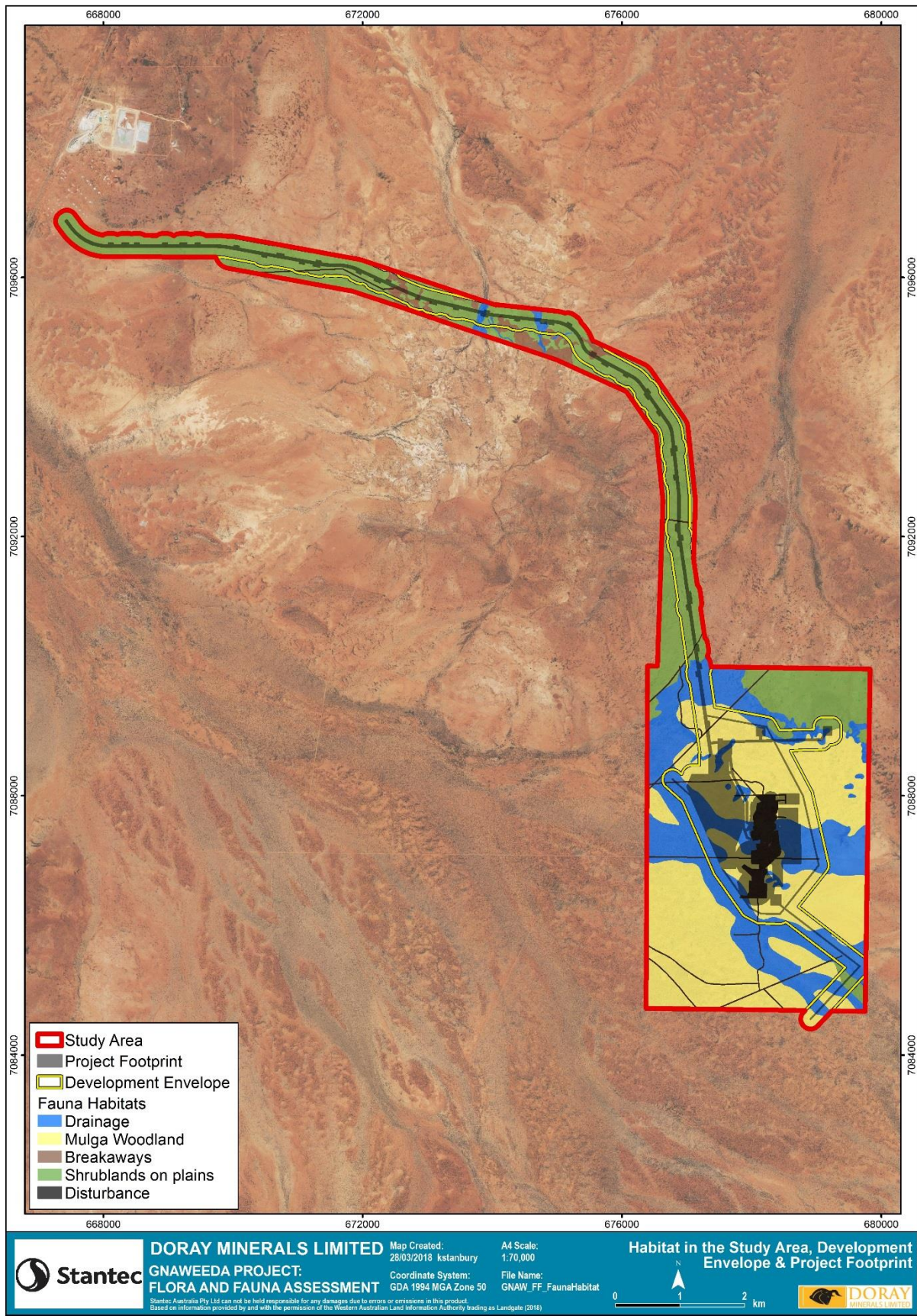


Figure 3-2: Development Envelope and Project Footprint with respect to fauna habitats

3.3.2 Impacts to Vertebrate Fauna Assemblages

A total of 208 vertebrate fauna species, comprising 20 native mammal, ten introduced mammal, 127 native bird, one introduced bird, 49 reptile and one amphibian species, were identified as potentially occurring in the Study Area during the desktop study (MWH 2017a). A total of 21 vertebrate fauna species were recorded during the Survey, comprising three mammals (one native), 13 birds and five reptile species (MWH 2017a). The majority of these species form assemblages that occur across a variety of habitats present within and surrounding the Study Area. These assemblages are similar to those found in the surrounding landscape, as determined by previous surveys (MWH 2017a).

In terms of fauna assemblages, the Study Area was not determined to be an area of exceptionally high biodiversity from a regional point of view. Clearing of vegetation and vehicle collisions are likely to result in the direct loss of individuals during initial clearing activities; however, those assemblages occurring across a range of habitats or those occurring in widespread habitats are unlikely to be significantly impacted by the Project. From a regional perspective, the impacts of the Project on fauna assemblages are unlikely to be significant.

3.3.3 Impacts to Vertebrate Fauna of Conservation Significance

The desktop study of the Survey identified 23 species of conservation significance that potentially occur in the Study Area; 17 of these were considered Unlikely to occur and are not discussed further in this Assessment (MWH 2016b). Of the remaining six species, one species was assessed as Likely to occur, and four were assessed as Possible to occur (**Table 3-6**). One species listed of conservation significance at the time of the Level 1 fauna report, the Rainbow Bee-eater (*Merops ornatus*) is no longer listed as being of conservation concern as of January 2018 (DBCA 2018). For definitions regarding the likelihood of occurrence for species of conservation significance, refer to (MWH 2017a).

Pre-determined categories were used to rank the expected local impacts of the Project on fauna of conservation significance (**Table 3-5, Table 3-6**). These impacts were considered within a broader, regional context (**Table 3-6**). Impacts were assessed based on the assumption that no management actions or mitigation strategies would be implemented. Of the six species assessed, one was assessed as having a Minimal level of impact (Long-tailed Dunnart), while the remaining were assessed as having Negligible impact (**Table 3-6**).

Species specific management actions and strategies to manage the impacts of the Project on fauna of conservation significance were also developed (**Table 3-6**). The level of impact of the Project on these species is likely to be reduced should the recommended actions and strategies be implemented. More general management recommendations are provided in **Section 4**.

Table 3-5: Ranking criteria for Project local impacts on fauna of conservation significance

Impact	Description [#]
Negligible	No perceived effect on population
Minimal	No population decline expected
Low	Short-term population decline expected within Development Envelope (recovery expected after life of the Project)
Moderate	Permanent population decline expected – no perceived threat to population persistence
High	Permanent population decline expected – persistence of local population threatened
Extreme	Local population extinction likely

[#]these impacts can be expected within the Development Envelope and surrounding 10 km

Table 3-6: Project impacts on fauna of conservation significance, with suggested management actions

Species	Localised impacts	Regional context	Species specific management actions
<p>Long-tailed Dunnart (<i>Sminthopsis longicaudata</i>)</p> <p>Priority 4 – DBCA</p> <p>No major threats identified to species, and protected on the basis of being (a) rare and not considered threatened although could be if circumstances change; or (b) is not conservation dependent but is close to qualifying as Vulnerable.</p>	<p>Minimal</p> <ul style="list-style-type: none"> The species was not recorded within the Study Area but was assessed as Likely to occur, as suitable habitat occurs within the Breakaway habitat in the Haul Road Survey Area. Clearing of suitable habitat is likely to pose the largest threat of the Project to the species. <ul style="list-style-type: none"> The species is often associated with rocky, hilly areas, breakaways, occasionally open areas with a stony, rocky mantle (van Dyck and Strahan 2008), represented by the Breakaways of the Study Area. Approximately 28.1ha of Breakaway habitat is located in the Development Envelope, including 1.8 ha in the Project Footprint. Due to the limited mobility of the species, individuals will not be able to relocate in advance of progressive clearing. An increase in the feral cat population has potential to impact the species within and surrounding the Project. The species is likely to occur in low densities within the Study Area, if at all present, particularly in the Development Envelope 	<ul style="list-style-type: none"> Clearing of the Breakaway habitat in the Development Envelope will reduce the amount of high quality habitat available for this species within the region. The species was recorded ~37 km southwest of the Study Area from 1981, with additional records 55 km north of the Study Area from 2009 at Peak Hill (DPaW 2016a, b). Little is known of the regional distribution of this species; however, it is unlikely that any local impacts would manifest at a regional scale. 	<ul style="list-style-type: none"> During the design and planning phase of the Project, consider aligning infrastructure footprints to avoid Breakaway habitat that has been identified as likely to support the Long-tailed Dunnart.
<p>Fork-tailed Swift (<i>Apus pacificus</i>)</p> <p>Migratory (EPBC Act 1999) Schedule 5 (Migratory) (WC Act)</p> <p>Species migratory between Australia and much of Asia. Therefore protected under international agreements CAMBA, JAMBA and ROKAMBA. There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals (DoEE 2018)</p>	<p>Negligible</p> <ul style="list-style-type: none"> The species was not recorded within the Study Area but was assessed as Possible to occur, based on habitat preferences and previous records. Within Australia the species is almost entirely aerial, and therefore has the potential to fly over any of the habitats present within the Development Envelope, although is unlikely to be dependent on any specific habitats. It is unlikely that the species will be adversely impacted by development of the Project 	<ul style="list-style-type: none"> Potential habitat is widespread and common through region (Johnstone <i>et al.</i> 2013), 	<ul style="list-style-type: none"> Not Applicable
<p>Grey Falcon (<i>Falco hypoleucos</i>)</p> <p>Schedule 3 – WC Act</p> <p>Largest threat to species is associated with clearing for agriculture, which has reduced habitat in semi-arid zones (Garnett <i>et al.</i> 2011). Also grazing by exotic herbivores is likely to have reduced regeneration of trees in the arid zone, therefore reducing nesting habitat availability (Garnett <i>et al.</i> 2011).</p>	<p>Negligible</p> <ul style="list-style-type: none"> The species was not recorded within the Study Area and was assessed as Possible to occur only. The species inhabits lightly treed inland plains, gibber deserts, sandridges, pastoral lands and timbered watercourses (Pizzey and Knight 2007). The species is not common in the Murchison region. The species may infrequently fly over the Study Area without utilising any particular habitats present. The species is likely to occur in low densities or as a visitor only. The species is highly mobile and adults, during the non-breeding season, would be expected to disperse ahead of clearing. 	<ul style="list-style-type: none"> The Grey Falcon is widespread across much of Australia with scattered records across the Murchison (Barrett <i>et al.</i> 2003, Garnett and Crowley 2000). The species was not recorded from any Survey conducted within the vicinity of the Study Area (MWH 2017a). Suitable foraging and nesting habitat for the Grey Falcon is widespread across the Murchison Region. 	<ul style="list-style-type: none"> Not Applicable
<p>Peregrine Falcon (<i>Falco peregrinus</i>)</p>	<p>Negligible</p> <ul style="list-style-type: none"> The species was not recorded within the Study Area and was assessed as Possible to occur only. The species occurs along 	<ul style="list-style-type: none"> The Peregrine Falcon is widespread across much of Australia (Barrett <i>et al.</i> 2003, Garnett and Crowley 2000). 	<ul style="list-style-type: none"> Not applicable

Species	Localised impacts	Regional context	Species specific management actions
<p>Threats and reasoning for listing</p> <p>Schedule 7 (Special Protection) (WC Act);</p> <p>Habitat loss appears to be a major threat, particularly in woodland areas where the species nests in areas with cliffs. Other threats include accidental poisoning from dog baits and historically agricultural chemicals DDT and Deildrin which cause a decrease in eggshell thickness (DoE 2016b).</p>	<p>coastal cliffs, rivers and ranges as well as wooded watercourses and lakes nesting on cliffs, granite outcrops and quarries (Johnstone and Storr 1998).</p> <ul style="list-style-type: none"> The species may infrequently fly over the Study Area without utilising any particular habitats present. The species is likely to occur in low densities or as a visitor only. The species is highly mobile and adults, during the non-breeding season, would be expected to disperse ahead of clearing. 	<ul style="list-style-type: none"> Species identified from six DPaW (2016b) records within 50 km of the Study Area all within the last 20 years. Species may infrequently fly over the Study Area while dispersing or foraging but is unlikely to breed due to the lack of suitable habitat. 	
<p>Meekatharra Slider (<i>Lerista eupoda</i>)</p> <p>Priority 1 - DBCA</p>	<p>Negligible</p> <ul style="list-style-type: none"> The species was not recorded within the Study Area and was assessed as Possible to occur only. The species occurs in open Mulga areas on loamy soils between Meekatharra and Cue (Cogger 2014, Wilson and Swan 2013). Clearing of suitable habitat is likely to pose the largest threat of the Project to the species. <ul style="list-style-type: none"> Species prefers sandy soils and abundant leaf-litter. Possible habitat occurs in the sandy substrate that is moderately common along margins of the Minor Drainage habitat. The Study Area occurs just outside the known distribution for the species. Approximately 256.5ha of Minor Drainage habitat is located in the Development Envelope, including 73.7 ha in the Project Footprint. Due to the limited mobility of the species, individuals will not be able to relocate in advance of progressive clearing. The species is likely to occur in low densities within the Study Area, if at all present 	<ul style="list-style-type: none"> Clearing of the Minor Drainage habitat in the Development Envelope will reduce the amount of high quality habitat available for this species within the region. The species was recorded on nine occasions from 70 km southeast of the Study Area (DPaW 2016b), with the most recent from 2014. Little is known of the regional distribution of this species; however, it is unlikely that any local impacts would manifest at a regional scale. 	<ul style="list-style-type: none"> During the design and planning phase of the Project, consider aligning infrastructure footprints to avoid Minor Drainage habitat.

4. General Management Recommendations

The following broad management recommendations have been developed as a guide for mitigating the potential impacts of the Project to flora, vegetation and fauna. Management recommendations specific to flora of conservation significance are listed in **Table 3-3** and those specific to fauna of conservation significance are listed in **Table 3-6**.

4.1 Project Design

- During Project design, consider options for aligning infrastructure footprints to avoid or minimise clearing areas that are known to or have been identified as likely to support species of conservation significance, such as Breakaway habitat and vegetation units associated with the breakaways: A?paAgEm, CfAfEl and CfA?ptDp and chenopod shrubland: SsMPnMc and EmAcSd.
- Design artificial lighting to illuminate designated operations areas and limit illumination of the surrounding landscape.

4.2 Habitat Removal and Modification

- When clearing, where practicable, minimise clearing of areas that are known to or have been identified as likely to support species of conservation significance, such as Breakaway habitat and vegetation units associated with the breakaways: A?paAgEm, CfAfEl and CfA?ptDp and chenopod shrubland: SsMPnMc and EmAcSd.
- Demarcate clearing boundaries in the field using Doray personnel or appropriate representatives.
- Stockpile cleared vegetation, topsoil and oversize waste overburden separately to ensure maximum reuse of these resources in subsequent rehabilitation.
- Implement dust suppression measures to reduce the effects of dust on vegetation and natural water bodies during clearing and construction.
- Minimise and manage impacts to natural surface hydrology to ensure the Drainage Line habitats is maintained.
- Minimise potential for waterbirds to be attracted to artificial water sources.
- Wherever possible, undertake clearing progressively over time to allow fauna to disperse to other suitable habitats within the surrounds.
- Retain corridors or linkages, for example culverts underneath roads in key habitat areas, so that fauna can move between remaining habitat patches.
- Consider timing of clearing activities to reduce the impact on nesting birds.

4.3 Project Operations

- Implement an Environmental Management Plan (EMP) that contains specific management actions for fauna, flora and introduced flora.
- Implement dust suppression measures to reduce the effects of dust on vegetation and natural water bodies – dust suppression measures should include management of vehicle speed on unsealed roads, but should also consider other factors such as proximity of natural vegetation to blasting and excavation (which can also result in accelerated deposition of dust on vegetation and in drainage systems).
- Prepare and implement a weed management strategy to prevent the spread of existing weed species and the establishment of new weeds. The weed management strategy should ensure that any machinery (particularly for earthworks) entering the Project should be subject to quarantine/hygiene measures that ensure that no contaminated soils or weed seeds enter the area.
- Manage fuel loads of weeds to reduce risk of high fire intensity.
- Conduct monitoring and control of feral animals and implement management measures to prevent the increase of feral species numbers and control the attraction of any new feral species to the Project, including proper hygiene practices and appropriate disposal of waste.

- Prepare and implement a strategy for prevention of unplanned fires. Such a strategy should include initiatives such as all vehicles being fitted with fire extinguishers and all personnel being trained in their use.
- Implement measures to minimise road kill, especially for nocturnal species or those prone to vehicle collisions – such measures could include changing the speed and times at which vehicles travel, signage, erecting fences or barriers, and providing alternative routes for fauna in strategic areas where fauna are known to cross major transport routes.
- Investigate strategies to reduce impacts of high frequency traffic on fauna and barriers to fauna dispersal created by the haul road corridor.
- Modify existing habitat to make it less suitable for feral cats e.g. reduce fragmentation by rehabilitating tracks and clearings and making it more structurally complex with shelter and escape sites (DoE 2016a).
- Educate mine site personnel and contractors with respect to the natural environment, with particular focus on flora and fauna of conservation significance.

4.4 Rehabilitation and Closure

- Implement a progressive rehabilitation and closure plan to ensure disturbed areas are rehabilitated as soon as practicable.
- Implement a revegetation strategy which involves:
 - Ensuring cleared areas are contoured and landscaped so that they are stable;
 - Application of stocked topsoil stored during the clearing of native vegetation;
 - Weed monitoring and management;
 - Revegetation of the temporarily cleared areas at the earliest convenience; and
 - Monitoring of success of revegetation works, including appropriate management and mitigation measures.
- Close artificial water bodies created during mining activity.
- Reconstruct linkages among fragmented fauna habitats.

5. Conclusions

The inventory of flora and fauna developed from the Surveys suggests that flora and fauna assemblages and vegetation and habitats in the Study Area are representative of those in equivalent parts of the Murchison bioregion, and that the Study Area does not represent an area of particularly high biodiversity from a regional perspective (MWH 2017a, b). The Surveys did however confirm the occurrence of two flora of conservation significance within the Development Envelope, *Stenanthemum mediale* and *Gunniopsis propinqua*.

None of the vegetation units within the Study Area were considered to be of regional significance or analogous with any Threatened Ecological Communities (TECs) or Protected Ecological Communities (PECs). Five of these vegetation units were considered to be of local significance within the Study area as they supported conservation significant flora.

The flora species of conservation significance that were confirmed within the Study Area were *Stenanthemum mediale* and *Gunniopsis propinqua*. *Stenanthemum mediale* occurred in association with vegetation units on Outcrops and Ridges, of which 28.1ha and 1.8ha occur within the Development Envelope and Project Footprint, respectively. The species *Gunniopsis propinqua* occurred in association with two vegetation units on chenopod shrublands (SsMPnMc and EmAcSd) of which 40.8 ha and 5.8 ha occurs within the Development Envelope and Project Footprint, respectively. Impacts to both of these species is anticipated to be minimal as relatively small areas of suitable habitat occur within the Development Envelope and suitable habitat is likely to occur in the surrounds. Impacts to other flora of conservation significance is considered to be negligible.

Of the fauna habitats that have potential to be adversely affected, one was considered to be of significance to fauna assemblages and/or fauna of conservation significance. The Long-tailed Dunnart is considered Likely to occur within the Breakaway habitat. In total, 28.1 ha and 1.8 ha of this habitat occurs within the Development Envelope and Project Footprint, respectively. Clearing of this habitat should be minimised where possible to reduce impacts to the Long-tailed Dunnart.

Although the Long-tailed Dunnart is Likely to occur, expected project impacts to this species is anticipated to be minimal as the clearing of breakaway habitat is only a small area and the habitat is widely distributed in the surrounds. Anticipated impacts to all other fauna of conservation significance is anticipated to be negligible.

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