



Clearing Permit Decision Report

1. Application details

1.1. Permit application details

Permit application No.: 7009/1
Permit type: Purpose Permit

1.2. Proponent details

Proponent's name: BHP Billiton Iron Ore Pty Ltd

1.3. Property details

Property: Mining Leases 47/281 - 284, 47/289 - 291;
Miscellaneous Licences 45/129 - 136, 45/147, 45/190, 45/194, 47/92, 47/95;
Iron Ore (Mount Newman) Agreement Act 1972, Mineral Lease 244SA (AML 70/244);
Iron Ore (Marillana Creek) Agreement Act 1991, Mining Lease 270SA (AM 70/270);
Iron Ore (Mount Newman) Agreement Act 1964, Special Lease for Mining Operations Lease 3116/6038, Document I123402L, Lot 135 on DP 48926, F 963074 EL;
Lease 3116/3690, Document I123403L, Lot 6254 on DP 035659;
Lease 3116/6301, Document I123595L, Lot 48 on DP 048928, F 963074 EL;
Lease 3116/6300, Document I123596L, Lot 143 on DP 048927, F 963074 EL;
Lease 3116/6298, Document I123599L, Lot 141 on DP 048923, F 963074 EL;
Lease 3116/6400, Document I123701L, Lots 86, 87 on DP 213620;
Lease 3116/6329, Document I123720L, Lot 49 on DP 048931, F 963074 EL;
Lease 3116/6068, Document I150309L, Lot 136 on DP 048924;
Lease 3116/6297, Document 150310L, Lot 140 on DP 048922, F 963074 EL;
Lease 3116/4028, N105667L, Lot 92 on DP 60351, Lot 93 on DP 60352, Lot 94 on DP 60707, Lot 95 on DP 60708, Lot 96 on DP 60709, Lot 24 on DP 60348, Lot 25 on DP 60349, Lot 26 on DP 60350;
Lease 3116/3687, Document I154279L, Lot 65 on DP 048920, Lot 19 on DP 048921;
Lease 3116/6299, Document I163678L, Lot 142 on DP 048925, F 963074 EL;
Lease 3116/3684, N88235L, Lot 351 on DP 74327;
Iron Ore (Marillana Creek) Agreement Act 1991 pursuant to *Land Administration Act 1997*, K843924L, Lots 145 on DP 243202, 146 on DP 243202 and 243203, 147 on DP 243202, 149 on 243203, 150 on DP 243203, 155 on DP 220067, 156 on DP 194001, 220 on DP 243202; K843925L, Lot 148 on DP 93544;
Iron Ore (Mount Goldsworthy) Agreement Act 1964, Special Lease for Mining Operations, Lease 3116/5999, Document I126342L, Lot 125 on DP 219861, M653978L pursuant to *Land Administration Act 1997*, Lots 321, 322, 323,324, 325 on DP 74344

Local Government Area: Shires of Ashburton and East Pilbara, and Town of Port Hedland
Colloquial name: Newman Mainline Project

1.4. Application

Clearing Area (ha)	No. Trees	Method of Clearing	For the purpose of:
2,928		Mechanical Removal	Railway Construction, maintenance and associated activities

1.5. Decision on application

Decision on Permit Application: [Redacted]
Decision Date: [Redacted]

2. Site Information

2.1. Existing environment and information

2.1.1. Description of the native vegetation under application

Vegetation Description Beard vegetation associations have been mapped for the whole of Western Australia. 17 Beard vegetation associations are located within the application area (GIS Database):

Beard vegetation association 18: Low woodland; mulga (*Acacia aneura*);

Beard vegetation association 29: Sparse low woodland; mulga, discontinuous in scattered groups;

Beard vegetation association 43: Low forest; mangroves (Kimberley) or thicket; mangroves (Pilbara);

Beard vegetation association 82: Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana*;

Beard vegetation association 93: Hummock grasslands, shrub steppe; kanji over soft spinifex;

Beard vegetation association 111: Hummock grasslands, shrub steppe; *Eucalyptus gamophylla* over hard spinifex;

Beard vegetation association 117: Hummock grasslands, grass steppe; soft spinifex;

Beard vegetation association 127: Bare areas; mud flats;

Beard vegetation association 157: Hummock grasslands, grass steppe; hard spinifex, *Triodia wiseana*;

Beard vegetation association 173: Hummock grasslands, shrub steppe; kanji over soft spinifex & *Triodia wiseana* on basalt;

Beard vegetation association 175: Short bunch grassland - savanna/grass plain (Pilbara);

Beard vegetation association 216: Low woodland; mulga (with spinifex) on rises;

Beard vegetation association 562: Mosaic: Low woodland; mulga in valleys / Hummock grasslands, open low tree-steppe; snappy gum over *Triodia wiseana*;

Beard vegetation association 589: Mosaic: Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex;

Beard vegetation association 619: Medium woodland; river gum (*Eucalyptus camaldulensis*);

Beard vegetation association 647: Hummock grasslands, dwarf-shrub steppe; *Acacia translucens* over soft spinifex;

Beard vegetation association 676: Succulent steppe; samphire.

There have been numerous flora and vegetation surveys undertaken over the Newman mainline railway and surrounding area since 2008 (Onshore Environmental, 2014).

Based on those surveys, five broad floristic communities with 12 vegetation associations have been identified within the application area from Port Hedland to Chainage 38 (BHP Billiton, 2016; ENV, 2011):

Drainage

Drainage A (DA): A low open *Eucalyptus victrix* woodland over a high open *Acacia ampliceps* and *Acacia trachycarpa* shrubland over a low open *Acacia stellaticeps*, *Pluchea ferdinandi-muelleri* and *Corchorus incanus* subsp. *incanus* shrubland over a *Triodia epactia* hummock grassland over an *Aristida holathera* var. *latifolia*, *Eriachne obtuse* and **Cenchrus ciliaris* tussock grassland;

Major Drainage Line A (MDLA): Scattered low *Eucalyptus victrix* trees over a high open *Melaleuca argentea*, *Acacia ampliceps* and *Acacia trachycarpa* shrubland over scattered *Adriana tomentosa* var. *tomentosa* and *Pluchea ferdinandi-muelleri* shrubs over open *Triodia epactia* hummock grassland;

Major Drainage Line B (MDLB): Low open *Eucalyptus victrix* woodland over an *Acacia tumida* var. *pilbarensis* and *Acacia colei* var. *colei* shrubland over very open *Triodia epactia* hummock grassland;

Dune

Dune C (DC): Low open *Acacia stellaticeps*, *Acacia bivenosa* and *Acacia ampliceps* shrubland over a *Spinifex longifolius* and **Cenchrus ciliaris* open grassland over scattered *Gomphrena canescens* herbs.

Grassland

Grassland A (GA): *Triodia secunda* and *Triodia epactia* hummock grassland.

Hill/Rocky Outcrop

Rock Outcrop (RO): Scattered *Acacia colei* var. *colei* and *Acacia inaequilatera* shrubs over scattered herbs over scattered *Triodia* spp. hummock grasses.

Sandplain

Sandplain A (SA): Low *Acacia stellaticeps* shrublands over *Triodia epactia* and *Triodia secunda* hummock grasslands/ *Triodia epactia* and *Triodia secunda* hummock grasslands mosaic;

Sandplain B (SB): An open *Acacia colei* var. *colei* shrublands over low *Acacia stellaticeps* shrublands over *Triodia epactia* and *Triodia secunda* hummock grasslands/low *Acacia stellaticeps* shrublands over *Triodia epactia* and *Triodia secunda* hummock grasslands mosaic;

Sandplain O (SO): Scattered low *Eucalyptus victrix* and *Corymbia hamersleyana* trees over an open *Acacia ancistrocarpa*, *Acacia tumida* var. *pilbarensis*, *Acacia inaequilatera* and *Acacia trudgeniana* shrubland over a low open *Acacia stellaticeps* shrubland over a *Triodia epactia* and *Triodia lanigera* hummock grassland;

Sandplain P (SP): Low open *Eucalyptus victrix*, *Corymbia hamersleyana* and *Corymbia flavescens* woodland over an open *Acacia colei* var. *colei* shrubland over a low open *Acacia stellaticeps* and *Pluchea tetranthera* shrubland over *Triodia epactia* hummock grassland;

Sandplain Q (SQ): Scattered low *Corymbia flavescens* trees over open *Acacia ancistrocarpa* and *Acacia bivenosa*

shrubland over scattered low *Acacia stellaticeps* shrubs over a *Triodia epactia* and *Triodia lanigera* hummock grassland; and

Sandplain R (SR): Low open *Corymbia candida* subsp. *laetifolia* and *Corymbia hamersleyana* over *Acacia coleii* var. *coleii* and *Acacia tumida* var. *pilbarensis* open shrubland over *Triodia epactia* and *Triodia lanigera* hummock grassland.

Based on numerous surveys, 39 broad floristic communities with 107 vegetation associations have been identified within the application area from Chainage 14 to 313 and Chainage 401 to Newman (BHP Billiton, 2016; Onshore Environmental, 2014):

***Cenchrus Closed Tussock Grassland**

FP CcCs ChAa AtpAan: Closed Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* with Low Open Woodland of *Corymbia hamersleyana* and *Acacia aptaneura* and Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia ancistrocarpa* on red brown silty loam on floodplains.

***Cenchrus Open Tussock Grassland**

GP CcCs AaApr AsyAa: Open Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* with Low Open Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* over High Open Shrubland of *Acacia synchronicia* and *Acacia aptaneura* on red sandy clay loam on gilgai plains.

***Cenchrus Scattered Tussock Grasses**

FP Cc Sco: Scattered Tussock Grasses of **Cenchrus ciliaris* over Scattered Herbs of *Sclerolaena comishiana* on pale brown silty clay on floodplains.

***Cenchrus Tussock Grassland**

MA CcCs EvAciAh: Tussock Grassland **Cenchrus ciliaris* and **Cenchrus setiger* with Low Woodland of *Eucalyptus victrix*, *Acacia citrinoviridis* and *Atalaya hemiglaucata* on brown sandy loam on major drainage lines and adjacent flood plains; and

MA CcTtEa ChCa AbAtpAsc: Tussock Grassland of **Cenchrus ciliaris*, *Themeda triandra* and *Eulalia aurea* with Low Open Woodland of *Corymbia hamersleyana* and *Corymbia aspera* over High Open Shrubland of *Acacia bivenosa*, *Acacia tumida* var. *pilbarensis* and *Acacia sclerosperma* subsp. *sclerosperma* on brown loamy sand on levee banks of major drainage lines.

Acacia High Open Shrubland

GP Asy AsySaoEla CcCsCf: High Open Shrubland of *Acacia synchronicia* over Low Open Shrubland of *Acacia synchronicia*, *Senna artemisioides* subsp. *oligophylla* and *Eremophila lanceolata* over Very Open Tussock Grassland of **Cenchrus ciliaris*, **Cenchrus setiger* and *Chrysopogon fallax* on red light clay on gilgai plains; and

GR Atp Te TloAcoSau: High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* over Very Open Hummock Grassland of *Triodia epactia* and Very Open Tussock Grassland of *Tripogon loliiformis*, *Aristida contorta* and *Sporobolus australasicus* (with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda*) on skeletal brown sandy loam on granite plateaux / sheet outcrops.

Acacia High Shrubland

FP AaAscAan Tp: High Shrubland of *Acacia aptaneura*, *Acacia sclerosperma* subsp. *sclerosperma* and *Acacia ancistrocarpa* over Very Open Hummock Grassland of *Triodia pungens* on red brown sandy loam on floodplains and drainage lines;

MA AtpApyAse Ec TmbTtCpr: High Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia pyrifolia* var. *pyrifolia* and *Acacia sericophylla* with Scattered Trees of *Eucalyptus camaldulensis* subsp. *refulgens* over Open Tussock Grassland of *Themeda* sp. Mt Barricade (M.E. Trudgen 2471), *Themeda triandra* and *Cymbopogon procerus* on brown loam and gravels on major drainage channels;

ME AamAtrAcp CcEb Cv: High Shrubland of *Acacia ampliceps*, *Acacia trachycarpa* and *Acacia coriacea* subsp. *pendens* over Open Tussock Grassland of **Cenchrus ciliaris* and *Eriachne benthamii* with Very Open Sedges of *Cyperus vaginatus* on brown sand along medium drainage lines; and

MI AccAbAtp TtTE AstPfmPt: High Shrubland of *Acacia coleii* var. *coleii*, *Acacia bivenosa* and *Acacia tumida* var. *pilbarensis* over Open Hummock Grassland of *Triodia lanigera* and *Triodia epactia* with Low Open Shrubland of *Acacia stellaticeps*, *Pluchea ferdinandi-muelleri* and *Pluchea tetranthera* on orange sand on minor drainage lines and floodplains.

Acacia Low Woodland

FP ApaAaApr AsyEffPo CcAinAco: Low Woodland of *Acacia paraneura*, *Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia synchronicia*, *Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* over Open Tussock Grassland of **Cenchrus ciliaris*, *Aristida inaequiglumis* and *Aristida contorta* on red brown loam on floodplains.

Acacia Low Closed Woodland

FP Aa CfCc PlaEla: Low Closed Woodland of *Acacia aptaneura* over Very Open Tussock Grassland of *Chrysopogon fallax* and **Cenchrus ciliaris* with Scattered Shrubs of *Psydrax latifolia* and *Eremophila lanceolata* on red/brown clay loam on plains.

Acacia Low Open Forest

FP AciAa Cc Bb: Low Open Forest of *Acacia citrinoviridis* and *Acacia aptanera* over Tussock Grassland of **Cenchrus ciliaris* over Open Herbs of **Bidens bipinnata* on red brown loamy sand on floodplains;

SP AaAanApr TeTs EffGbDpe: Low Open Forest of *Acacia aptaneura*, *Acacia aneura* x *ayersiana* and *Acacia pruinocarpa* over Hummock Grassland of *Triodia epactia* and *Triodia* sp. Shovelanna Hill with Open Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Grevillea berryana* and *Dodonaea petiolaris* on red brown loamy sand on stony plains;

SP AaApr TmTwTp TtCfAin: Low Open Forest of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Hummock Grassland of *Triodia melvillei*, *Triodia wiseana* and *Triodia pungens* over Tussock Grassland of *Themeda triandra*, *Chrysopogon fallax* and *Aristida inaequiglumis* on red brown loam on plains;

SP Ax SggSbSg ApeEobEx: Low Open Forest of *Acacia xiphophylla* over Low Scattered Shrubs of *Senna glutinosa* subsp. *glutinosa*, *Streptoglossa bubakii* and *Senna glaucifolia* over Scattered Tussock Grasses of *Astrelba pectinata*, *Eriachne obtusa* and *Eragrostis xerophila* on red brown medium clay on basalt plains; and

SP AxAa EffAteAsy CfAcoSau: Low Open Forest of *Acacia xiphophylla* and *Acacia aptaneura* over Open Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Acacia tetragonophylla* and *Acacia synchronicia* over Very Open Tussock Grassland of *Chrysopogon fallax*, *Aristida contorta* and *Sporobolus australasicus* on red brown sandy clay loam on stony plains.

Acacia Low Open Heath

HS AbAsy TseTaTb: Low Open Heath of *Acacia bivenosa* and *Acacia synchronicia* over Hummock Grassland of *Triodia secunda*, *Triodia angusta* and *Triodia basedowii* on brown sandy loam on stony lower slopes and plains; and

SA Ast Tsc AtpAccMI: Low Open Heath of *Acacia stellaticeps* over Hummock Grassland of *Triodia schinzii* with High Open Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia colei* var. *colei* and *Melaleuca lasiandra* on red brown loamy sand on sandplains.

Acacia Low Open Woodland

FP AaAciApr AsyAscAb Tp: Low Open Woodland of *Acacia aptaneura*, *Acacia citrinoviridis* and *Acacia pruinocarpa* over Open Shrubland of *Acacia synchronicia*, *Acacia sclerosperma* subsp. *sclerosperma* and *Acacia bivenosa* over Very Open Hummock Grassland of *Triodia pungens* on red brown clay loam on floodplains and medium drainage lines;

FP AaAprCh EfrAteDpe AinCfAco: Low Open Woodland of *Acacia aptaneura*, *Acacia pruinocarpa* and *Corymbia hamersleyana* with Open Shrubland of *Eremophila fraseri*, *Acacia tetragonophylla* and *Dodonea petiolaris* over Tussock Grassland of *Aristida inaequiglumis*, *Chrysopogon fallax* and *Aristida contorta* on red sandy loam on floodplains; and

FP Ax AsyRe MpMtScu: Low Open Woodland of *Acacia xiphophylla* over High Open Shrubland of *Acacia synchronicia* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata*, *Maireana triptera* and *Sclerolaena cuneata* on red brown sandy clay loam on floodplains.

Acacia Low Woodland

FP AaAprAca EffDpeSe AcoDamAin: Low Woodland of *Acacia aptanera*, *Acacia pruinocarpa* and *Acacia catenulata* subsp. *occidentalis* over Open Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Dodonaea petiolaris* and *Sida ectogama* over Open Tussock Grassland of *Aristida contorta*, *Digitaria ammophila* and *Aristida inaequiglumis* on red orange clay loam on floodplains.

Acacia Open Heath

MI AadAluDpa Tp ElCh: Open Heath of *Acacia adsurgens*, *Androcalva luteiflora* and *Dodonaea pachyneura* over Open Hummock Grassland of *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* on brown loamy sand on minor drainage lines.

Acacia Open Scrub

ME AtpAanAcc TeTI Ch: Open Scrub of *Acacia tumida* var. *pilbarensis*, *Acacia ancistrocarpa* and *Acacia colei* var. *colei* over Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Scattered Low Trees of *Corymbia hamersleyana* on brown sandy loam along minor and medium drainage lines;

MI AtpGwApy TpTb CcCs: Open Scrub of *Acacia tumida* var. *pilbarensis*, *Grevillea wickhamii* subsp. *hispidula* and *Acacia pyrifolia* var. *pyrifolia* over Hummock Grassland of *Triodia pungens* and *Triodia basedowii* over Open Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* on brown sandy loam on minor drainage lines and floodplains; and

MI AtpPIAmo TpTs ChEl: Open Scrub of *Acacia tumida* var. *pilbarensis*, *Petalostylis labicheoides* and *Acacia monticola* over Open Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* on red brown sandy loam on minor drainage lines.

Astrelba Tussock Grassland

SP ApeAinSau SfCtrTbc Oa: Tussock Grassland of *Astrelba pectinata*, *Aristida inaequiglumis* and *Sporobolus australasicus* with Low Open Shrubland of *Sida fibulifera*, *Corchorus trilocularis* and *Tephrosia* sp. Bungaroo Creek

(M.E. Trudgen 11601) and Open Herbs of *Operculina aequisejala* on brown medium clay on basalt plains.

Corymbia Low Open Woodland

MI CcAa CcCs Tb: Low Open Woodland of *Corymbia candida* subsp. *dipsodes* and *Acacia aptaneura* over Open Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* and Very Open Hummock Grassland of *Triodia basedowii* on red brown loam on floodplains and minor drainage lines.

Corymbia Low Woodland

FP CcaCa AtpAcc Tp: Low Woodland of *Corymbia candida* and *Corymbia aspera* over Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia colei* var. *colei* over Open Hummock Grassland of *Triodia pungens* on brown medium clay on floodplains.

Eriachne Open Tussock Grassland

MI EbEfCf Ca AtrAcc: Open Tussock Grassland of *Eriachne benthamii*, *Eriachne flaccida* and *Chrysopogon fallax* with Scattered Low Trees of *Corymbia aspera* over High Open Shrubland of *Acacia trachycarpa* and *Acacia colei* var. *colei* on brown loamy sand along minor drainage lines.

Eriachne Tussock Grassland

FP EbEa HI Acc: Tussock Grassland of *Eriachne benthamii* and *Eulalia aurea* with High Open Shrubland of *Hakea lorea* subsp. *lorea* over Open Shrubland of *Acacia colei* var. *colei* on brown medium clay on floodplains; and

ME EbEf Ev Te: Tussock Grassland of *Eriachne benthamii* and *Eriachne flaccida* with Low Woodland of *Eucalyptus victrix* over Hummock Grassland of *Triodia epactia* on brown grey silty loam on drainage depressions.

Eucalyptus Low Open Forest

MA EcEvEx ApyAtpGr TtEaCpr: Low Open Forest of *Eucalyptus camaldulensis* subsp. *refulgens*, *Eucalyptus victrix* and *Eucalyptus xerothermica* over High Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Acacia tumida* var. *pilbarensis* and *Gossypium robinsonii* over Open Tussock Grassland of *Themeda triandra*, *Eulalia aurea* and *Cymbopogon procerus* on red brown clay loam on major drainage lines.

Eucalyptus Low Woodland

ME EvAcp AtpAtrApy Tp: Low Woodland of *Eucalyptus victrix* and *Acacia coriacea* subsp. *pendens* over Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia trachycarpa* and *Acacia pyrifolia* var. *pyrifolia* over Open Hummock Grassland of *Triodia pungens* on brown loamy sand along minor and medium drainage lines; and

ME TtEaEte ApyAtpPI EvCh: Tussock Grassland of *Themeda triandra*, *Eulalia aurea* and *Eriachne tenuiculmis* with High Shrubland of *Acacia pyrifolia* var. *pyrifolia*, *Acacia tumida* var. *pilbarensis* and *Petalostylis labicheoides* and Open Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* on red brown silty loam on medium drainage lines and flood plains.

Eucalyptus Woodland

MA EcEv AciApyMg CcEaTt: Woodland of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Acacia citrinoviridis*, *Acacia pyrifolia* var. *pyrifolia* and *Melaleuca glomerata* over Tussock Grassland of **Cenchrus ciliaris*, *Eulalia aurea* and *Themeda triandra* on brown clay loam on banks of major drainage lines; and

MA EvAciEc TrcCcrApy CcEaTt: Woodland of *Eucalyptus victrix*, *Acacia citrinoviridis* and *Eucalyptus camaldulensis* subsp. *refulgens* over Low Open Shrubland of *Tephrosia rosea* var. *clementii*, *Corchorus crozophorifolius* and *Acacia pyrifolia* var. *pyrifolia* over Very Open Tussock Grassland of **Cenchrus ciliaris*, *Eulalia aurea* and *Themeda triandra* on brown loamy sand on channels of major drainage lines.

Eulalia Open Tussock Grassland

MI EaTt AxAcP AanAtp: Open Tussock Grassland of *Eulalia aurea* and *Themeda triandra* with Low Open Woodland of *Acacia xiphophylla* and *Acacia coriacea* subsp. *pendens* and Open Shrubland of *Acacia ancistrocarpa* and *Acacia tumida* var. *pilbarensis* on red brown clay on minor drainage lines.

Frankenia Low Open Shrubland

SF Fs Cc: Low Open Shrubland of *Frankenia setosa* with Scattered Tussock Grasses of **Cenchrus ciliaris* on red brown clay loam on saline flats.

Glinus Herbs

ME GI Ev Sn: Herbs of *Glinus lotoides* with Low Open Woodland of *Eucalyptus victrix* and Scattered Low Shrubs of *Senna notabilis* on pale brown loam on medium drainage lines.

Maireana Low Open Shrubland

FP MtPoSc AxAsy AinCc: Low Open Shrubland of *Maireana triptera*, *Ptilotus obovatus* and *Sclerolaena cuneata* with Scattered Low Trees of *Acacia xiphophylla* and *Acacia synchronicia* and Scattered Tussock Grasses of *Aristida inaequiglumis* and **Cenchrus ciliaris* on red sandy clay loam on wind scalded plains.

Melaleuca High Open Forest

MA MaEcEv MgAcAtr Cv: High Open Forest of *Melaleuca argentea*, *Eucalyptus camaldulensis* var. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Melaleuca glomerata*, *Acacia coriacea* subsp. *pendens* and *Acacia trachycarpa* over Very Open Sedges of *Cyperus vaginatus* on alluvial gravelly soils on major drainage channels with seasonal pools.

Mosaic: Acacia Low Open Woodland/Acacia Low Woodland

FP Mosaic mulga snakewood: Mosaic: Low Woodland of *Acacia paraneura*, *Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia synchronicia*, *Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* over Very Open Tussock Grassland of **Cenchrus ciliaris*; Low Open Woodland of *Acacia xiphophila* over High Open Shrubland of *Acacia synchronicia* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata*, *Maireana triptera* and *Sclerolaena cuneata* on red loamy sand on plains.

Mosaic: Triodia Hummock Grassland/Acacia High Open Shrubland

HS Mosaic low granite hills: Mosaic: Hummock Grassland of *Triodia epactia*, *Triodia basebowii* and *Triodia wiseana* with High Shrubland of *Acacia orthocarpa* and *Acacia inaequilatera* in brown loamy sand on low undulating granite hills; High Open Shrubland of *Acacia tumida* var. *pilbarensis* with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda* over Very Open Hummock Grassland of *Triodia epactia* over Very Open Tussock Grassland of *Tripogon loliiformis*, *Aristida contorta* and *Sporobolus australasicus* on skeletal brown sandy loam on granite plateau/sheet outcrops;

SA Mosaic granitic plains: Mosaic: Hummock Grassland of *Triodia lanigera* with High Open Shrubland of *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia stellaticeps*; High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda* over Very Open Hummock Grassland of *Triodia epactia* (and Very Open Tussock Grassland of *Tripogon loliiformis*) on orange loamy sand on undulating granitic plains with granitic outcrops; and

SP Mosaic granite / calcrete: Mosaic: Hummock Grassland of *Triodia longiceps*, *Triodia angusta* and *Triodia wiseana* with Low Open Shrubland of *Acacia bivenosa*, *Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* on brown sandy clay loam on stony calcrete plains; High Open Shrubland of *Acacia tumida* var. *pilbarensis* with Very Open Hummock Grassland of *Triodia epactia* over Very Open Tussock Grassland of *Tripogon loliiformis* on skeletal brown sandy clay loam on granite plateau / sheet outcrops.

Mosaic: Triodia Hummock Grassland

SA Mosaic sand plains: Mosaic: Hummock Grassland of *Triodia secunda* and *Triodia epactia* with Low Open Shrubland of *Acacia stellaticeps* over Scattered Tussock Grasses of *Sporobolus australasicus*; Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Scattered Low Trees of *Corymbia hamersleyana* over High Open Shrubland of *Acacia inaequilatera*, *Acacia ancistrocarpa* and *Acacia colei* var. *colei* on red orange sandy clay loam on plains.

Mosaic: Triodia Open Hummock Grassland/Triodia Hummock Grassland

HS Mosaic hill crests and slopes: Mosaic: Open Hummock Grassland of *Triodia lanigera*, *Triodia basedowii* and *Triodia epactia* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Low Open Shrubland of *Acacia atkinsiana* and *Acacia bivenosa* in brown sandy loam on hill crests and hill slopes; Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Woodland of *Acacia aptaneura* on brown sandy clay loam in drainage basins and on plains.

Pluchea Low Shrubland

FP PfmPrCI Ta SauCpePd: Low Shrubland of *Pluchea ferdinandi-muelleri*, *Pluchea rubelliflora* and *Carrissa lanceolata* over Open Hummock Grassland of *Triodia angusta* and Very Open Tussock Grassland of *Sporobolus australasicus*, *Chloris pectinata* and *Panicum decompositum* on grey medium clay on crusting plains.

Tecticornia Low Open Heath

SF TdcTibMf Ep: Low Open Heath of *Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J English KS552), *Tecticornia indica* subsp. *bidens* and *Muehlenbeckia florulenta* over Very Open Tussock Grassland of *Eragrostis pergracilis* on brown medium clay on saline flats and marsh.

Themeda Open Tussock Grassland

ME TtAinCa ChEl AmoPIAlu: Open Tussock Grassland of *Themeda triandra*, *Aristida inaequiglumis* and *Cymbopogon ambiguus* with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus leucophloia* subsp. *leucophloia* over Open Shrubland of *Acacia monticola*, *Petalostylis labicheoides* and *Androcalva luteiflora* on red brown alluvium on minor and medium drainage lines.

Themeda Tussock Grassland

FP TtEaCc ChEx AdAaAmc: Tussock Grassland of *Themeda triandra*, *Eulalia aurea* and **Cenchrus ciliaris* with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus xerothermica* over High Open Shrubland of *Acacia dictyophleba*, *Acacia ancistrocarpa* and *Acacia macraneura* on brown silty clay loam on floodplains;

GG TtEmuTmb ElChCfe AtpGrPl: Tussock Grassland of *Themeda triandra*, *Eriachne mucronata* and *Themeda* sp. Mt Barricade with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* and *Corymbia ferriticola* over High Shrubland of *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Petalostylis labicheoides* on red brown sandy loam in narrowly incised rocky drainage lines; and

ME TtCfEa ExEvCh PIAPApy: Tussock Grassland of *Themeda triandra*, *Chrysopogon fallax* and *Eulalia aurea* with Low Open Woodland of *Eucalyptus xerothermica*, *Eucalyptus victrix* and *Corymbia hamersleyana* and Shrubland of

Petalostylis labicheoides, *Acacia pachyacra* and *Acacia pyrifolia* var. *pyrifolia* on red sandy loam on medium drainage lines.

Triodia Closed Hummock Grassland

FP TITp AscAbMg: Closed Hummock Grassland of *Triodia longiceps* and *Triodia pungens* with Shrubland of *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia bivenosa* and *Melaleuca glomerata* on brown sandy clay loam on undulating floodplains; and

SA TbTI AsyAscElo Aa: Closed Hummock Grassland of *Triodia basedowii* and *Triodia longiceps* with High Shrubland of *Acacia synchronicia*, *Acacia sclerosperma* subsp. *sclerosperma* and *Eremophila longifolia* and Low Open Woodland of *Acacia aptaneura* on red brown clay loam on plains.

Triodia Hummock Grassland

CP TITe AbAstPfm: Hummock Grassland of *Triodia longiceps* and *Triodia epactia* with Low Open Shrubland of *Acacia bivenosa*, *Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* on brown sandy clay loam on stony calcrete plains;

CP TwTa Es AbPIApy: Hummock Grassland of *Triodia wiseana* and *Triodia angusta* with Open Mallee of *Eucalyptus socialis* subsp. *eucentrica* and Open Shrubland of *Acacia bivenosa*, *Petalostylis labicheoides* and *Acacia pyrifolia* var. *pyrifolia* on light brown clay loam on calcrete plains and rises;

FP Tb AaApr Eff: Hummock Grassland of *Triodia basedowii* with Low Open Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Eremophila forrestii* subsp. *forrestii* on red sandy loam on floodplains;

FP TbTp AaGb Go: Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Woodland of *Acacia aptaneura* and *Grevillea berryana* over Low Open Shrubland of *Gompholobium oreophilum* on brown sandy clay loam on drainage depressions;

FP TsTI AbAsPfm: Hummock Grassland of *Triodia secunda* and *Triodia longiceps* with Low Open Shrubland of *Acacia bivenosa*, *Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* on orange sandy clay loam on stony floodplains;

FS Ts CdHc AanAiGw: Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Low Open Woodland of *Corymbia deserticola* subsp. *deserticola* and *Hakea chordophylla* over Open Shrubland of *Acacia ancistrocarpa*, *Acacia inaequilatera* and *Grevillea wickhamii* subsp. *hispidula* on red brown sandy loam on footslopes and stony plains;

FS TsTpTw El AbApaAan: Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia pungens* and *Triodia wiseana* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and Open Shrubland of *Acacia bivenosa*, *Acacia pachyachra* and *Acacia ancistrocarpa* on red brown loam on footslopes and low undulating hills;

HC Te AdCc Gw: Hummock Grassland of *Triodia epactia* with Open Shrubland of *Abutilon* sp. *Dioicum* and *Cajanus cinereus* and Scattered Tall Shrubs of *Grevillea wickhamii* subsp. *hispidula* on brown silty loam on dolerite ridges;

HC Te AiAanAarr: Hummock Grassland of *Triodia epactia* with High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia arrecta* on brown sandy loam on low undulating hills;

HC TeTI ArAiAb: Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Open Shrubland of *Acacia robeorum*, *Acacia inaequilatera* and *Acacia bivenosa* on brown sandy loam on low dolerite/basalt hills;

HC Tw AiAb IrSao: Hummock Grassland of *Triodia wiseana* with High Open Shrubland of *Acacia inaequilatera* and *Acacia bivenosa* over Low Open Shrubland of *Indigofera rugosa* and *Senna artemisioides* subsp. *oligophylla* on red silty loam on dolerite hill crests;

HC TwTbrTp ElCh AmaGwAb: Hummock Grassland of *Triodia wiseana*, *Triodia brizoides* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over High Open Shrubland of *Acacia maitlandii*, *Grevillea wickhamii* subsp. *hispidula* and *Acacia bivenosa* on red brown sandy loam on hill crests and upper hill slopes;

HS TbrTw El AbPoSgg: Hummock Grassland of *Triodia brizoides* and *Triodia wiseana* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Scattered Low Shrubs of *Acacia bivenosa*, *Ptilotus obovatus* and *Senna glutinosa* subsp. *glutinosa* on brown silty loam on scree slopes;

HS TbTeTw AtpGw AanAbAac: Hummock Grassland of *Triodia basedowii*, *Triodia epactia* and *Triodia wiseana* over High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* and *Grevillea wickhamii* over Low Open Shrubland of *Acacia ancistrocarpa*, *Acacia bivenosa* and *Acacia acradenia* on red brown silty/sandy loam on undulating low hills and stony plains;

HS TeTbTw AorAi: Hummock Grassland of *Triodia epactia*, *Triodia basedowii* and *Triodia wiseana* with High Open Shrubland of *Acacia orthocarpa* and *Acacia inaequilatera* on brown loamy sand on low undulating granite hills;

HS TeTw Ch AiAan: Hummock Grassland of *Triodia epactia* and *Triodia wiseana* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* on red brown sandy loam on granite and quartz hill slopes and footslopes;

HS TITwTe AtpAerAcc AiAor: Hummock Grassland of *Triodia lanigera*, *Triodia wiseana* and *Triodia epactia* with High Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia eriopoda* and *Acacia coleii* var. *coleii* in swales with High Open Shrubland of *Acacia inaequilatera* and *Acacia orthocarpa* on rises on red brown silty clay/sandy loam on undulating hills and swales;

HS Tp Ir Gp: Hummock Grassland of *Triodia pungens* with Low Shrubland of *Indigofera rugosa* and Scattered Low Trees of *Grevillea pyramidalis* on brown sandy loam on quartz and granite hill;

HS TpTbTe Ch Ai: Hummock Grassland of *Triodia pungens*, *Triodia basedowii* and *Triodia epactia* with Scattered Low Trees of *Corymbia hamersleyana* over Scattered Tall Shrubs of *Acacia inaequilatera* on brown sandy clay loam on dolerite hill slopes;

HS TsTp AaAprAci AaElISgl: Hummock Grassland of *Triodia* sp. Shovelanna Hill and *Triodia pungens* with High Open Shrubland of *Acacia aptaneura*, *Acacia pruinocarpa* and *Acacia citrinoviridis* and Open Shrubland of *Acacia aptaneura*, *Eremophila latrobei* subsp. *latrobei*, *Senna glutinosa* subsp. *x luerssenii* on red loamy sand on upper hill slopes;

HS TsTbTp EICH AhiAad: Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia wiseana* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over Low Open Shrubland of *Acacia hilliana* and *Acacia adoxa* var. *adoxo* on red brown sandy loam on hill slopes;

HS Tw Cd AarAsiAb ArhAprAa: Hummock Grassland of *Triodia wiseana* with Low Open Woodland of *Corymbia deserticola* over Low Shrubland of *Acacia arrecta*, *Acacia sibirica* and *Acacia bivenosa* in red loamy sand on hill slopes with Low Open Woodland of *Acacia rhodophloia*, *Acacia pruinocarpa* and *Acacia aptaneura* on red sandy loam on rocky hill crests;

HS Tw EICHhc AanAbAa: Hummock Grassland of *Triodia wiseana* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*, *Corymbia hamersleyana* and *Hakea chordophylla* and Open Shrubland of *Acacia ancistrocarpa*, *Acacia bivenosa* and *Acacia aptaneura* on red sandy loam on hill slopes;

HS TwTbTt EIECh PcaPasAhi: Hummock Grassland of *Triodia wiseana*, *Triodia brizoides* and *Triodia* sp. Shovelanna Hill with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia*, *Eucalyptus xerothermica* and *Corymbia hamersleyana* over Low Open Shrubland of *Ptilotus calostachyus*, *Ptilotus astrolasius* and *Acacia hilliana* on brown loam on eroded outcropping upper slopes and crests;

HS TwTpTs EI AprAaAan: Hummock Grassland of *Triodia wiseana*, *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* over Open Shrubland of *Acacia pruinocarpa*, *Acacia aptaneura* and *Acacia ancistrocarpa* on red brown loam on plains and low hills;

ME TpTb Ch AtpAcc: Hummock Grassland of *Triodia pungens* and *Triodia basedowii* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia coleii* var. *coleii* on red brown loamy sand on levee banks and floodplains;

ME TpTI ExAciCh PIAPyGr: Hummock Grassland of *Triodia pungens* and *Triodia longiceps* with Low Woodland of *Eucalyptus xerothermica*, *Acacia citrinoviridis* and *Corymbia hamersleyana* over High Shrubland of *Petalostylis labicheoides*, *Acacia pyrifolia* var. *pyrifolia* and *Gossypium robinsonii* on red brown clay loam on medium drainage lines and surrounding floodplains;

MI TITE Ch AtrAanAac: Hummock Grassland of *Triodia longiceps* and *Triodia epactia* with Scattered Low Trees of *Corymbia hamersleyana* over High Shrubland of *Acacia trachycarpa*, *Acacia ancistrocarpa* and *Acacia acradenia* on brown loamy sand on minor drainage lines;

SA Tb AaApr Aan: Hummock Grassland of *Triodia basedowii* with Scattered Tall Trees of *Acacia aptaneura* and *Acacia pruinocarpa* over High Open Shrubland of *Acacia ancistrocarpa* on red sand on sand plains;

SA Tb ChEg SpBeKp: Hummock Grassland of *Triodia basedowii* with Low Open Woodland of *Corymbia hamersleyana* and *Eucalyptus gamophylla* over Low Open Shrubland of *Scaevola parvifolia*, *Bonamia erecta* and *Kennedia prorepens* on red loamy sand on sand plains;

SA TeTI Ai Aco: Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Open Shrubland of *Acacia inaequilatera* over Open Tussock Grassland of *Aristida contorta* on red brown sandy clay loam on raised plains and quartz hills;

SA TI AiAan Ast: Hummock Grassland of *Triodia lanigera* with High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia stellaticeps* on red orange sandy loam on sandy plains;

SA Tp Ev AccAst: Hummock Grassland of *Triodia pungens* with Low Woodland of *Eucalyptus victrix* over Low Shrubland of *Acacia coleii* var. *coleii* and *Acacia stellaticeps* on grey brown sandy loam on sandy plains;

SD TscTb Ad CtCcuSc: Hummock Grassland of *Triodia schinzii* and *Triodia basedowii* with High Open Shrubland of *Acacia dictyophleba* over Low Open Shrubland of *Corchorus tectus*, *Crotalaria cunninghamii* and *Sida cardiophylla* on red sand on linear sand dunes;

SP Tb AaApr AwaAnAi: Hummock Grassland of *Triodia basedowii* with Low Open Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia wanyu*, *Acacia ancistrocarpa* and *Acacia inaequilatera* on red brown silty loam on stony plains;

SP TbTp HIAanAi Ch: Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with High Open Shrubland of *Hakea lorea* subsp. *lorea*, *Acacia ancistrocarpa* and *Acacia inaequilatera* and Scattered Low Trees of *Corymbia hamersleyana* on red brown loamy sand on stony plains;

SP TITE Ai AanAb: Hummock Grassland of *Triodia lanigera* and *Triodia epactia* with High Open Shrubland of *Acacia inaequilatera* over Low Open Shrubland of *Acacia ancistrocarpa* and *Acacia bivenosa* on orange loamy sand on sandy plains;

SP TpTb AccAi AccAan: Hummock Grassland of *Triodia pungens* and *Triodia basedowii* with High Open Shrubland of *Acacia colei* var. *colei* and *Acacia inaequilatera* over Shrubland of *Acacia colei* var. *colei* and *Acacia ancistrocarpa* on red brown sandy loam on stony plains;

SP TpTb Eg PIAbAan: Hummock Grassland of *Triodia pungens* and *Triodia basedowii* with Open Mallee of *Eucalyptus gamophylla* and Shrubland of *Petalostylis labicheoides*, *Acacia bivenosa* and *Acacia ancistrocarpa* on red brown loamy sand on stony plains and footslopes;

SP Ts Ai: Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with High Open Shrubland of *Acacia inaequilatera* on red brown loamy sand on hill slopes and stony plains; and

SP TsTbTp EgEt AbApaApr: Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia wiseana* and *Triodia pungens* with Very Open Mallee of *Eucalyptus gamophylla* and *Eucalyptus trivalva* over Open Shrubland of *Acacia bivenosa*, *Acacia pachyacra* and *Acacia pruinocarpa* on red brown sandy loam and clay loam on stony plains.

Triodia Open Hummock Grassland

GR Te AdTmaCci PclCc: Open Hummock Grassland of *Triodia epactia* with Open Shrubland of *Abutilon* sp. *Dioicum*, *Triumfetta maconochieana* and *Cajanus cinereus* over Very Open Tussock Grassland of *Paspadium clementii* and **Cenchrus ciliaris* on skeletal brown loamy sand on granite rockpiles;

HC TbTp EI AatAmmAma: Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Open Shrubland of *Acacia atkinsiana*, *Acacia marramamba* and *Acacia maitlandii* on brown sandy loam on hill crests and hill slopes;

HC TbTp EICh AmoApy: Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* and *Corymbia hamersleyana* over Open Shrubland of *Acacia monticola* and *Acacia pyrifolia* var. *pyrifolia* on brown sandy loam on hill slopes and hill crests;

MI TeTb Ch CciApy: Open Hummock Grassland of *Triodia epactia* and *Triodia basedowii* with Scattered Low Trees of *Corymbia hamersleyana* over Open Shrubland of *Cajanus cinereus* and *Acacia pyrifolia* var. *pyrifolia* on red sandy loam on minor drainage lines;

SA TI AanApa ApaAprCh: Open Hummock Grassland of *Triodia lanigera* with Open Shrubland of *Acacia ancistrocarpa* and *Acacia pachyacra* and Scattered Low Trees of *Acacia paraneura*, *Acacia pruinocarpa* and *Corymbia hamersleyana* on red sandy loam on stony plains;

SA TI CzCh Ai IalmTbc: Open Hummock Grassland of *Triodia lanigera* with Low Open Woodland of *Corymbia zygomorphia* and *Corymbia hamersleyana* over Open Shrubland of *Acacia inaequilatera* over Low Open Shrubland of *Isotropis atropurpurea*, *Indigofera monophylla* and *Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601) on orange red loamy sand on sand plains; and

SP TpTm AaExAca ApaEffAad: Hummock Grassland of *Triodia pungens* and *Triodia melvillei* with Low Open Woodland of *Acacia aptaneura*, *Eucalyptus xerothermica* and *Acacia catenulate* subsp. *occidentalis* and Open Shrubland of *Acacia pachyacra*, *Eremophila forrestii* subsp. *forrestii* and *Acacia adsurgens* on red brown clay loam or silty loam on stony plains and floodplains.

Typha Sedges

MA TdCv EcEv AciAcp: Sedges of *Typha domingensis* and *Cyperus vaginatus* with Open Woodland of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over Low Open Woodland of *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* on brown clayey sand on permanent pools along major drainage lines.

Based on ENV (2008a), a total of 14 broad floristic communities with 14 vegetation associations have been identified within the application area from Chainage 313 to 401:

Acacia aneura open woodland

AaAnTp/*Cc: *Acacia aneura* (mixed subspecies) low open woodland over *Acacia ancistrocarpa* shrubland over *Triodia pungens* open hummock grassland over **Cenchrus ciliaris* tussock grassland.

Acacia aneura shrubland

AaAsCf/*Cc: *Acacia aneura* (mixed subspecies), *Acacia ancistrocarpa*, *Acacia pruinocarpa* and *Acacia synchronicia* shrubland over *Triodia pungens* very open hummock grassland over *Chrysopogon fallax* and **Cenchrus ciliaris* tussock grassland.

Acacia citrinoviridis woodland/shrubland - drain / riparian

AcAs*Cc: *Acacia citrinoviridis* and mixed *Acacia* species high shrubland over **Cenchrus ciliaris* tussock grassland.

Acacia dictyophleba shrubland

AdAnTp/*Cc: *Acacia dictyophleba* high open shrubland over mixed *Acacia* shrubland over *Triodia pungens* open hummock grassland over **Cenchrus ciliaris* tussock grassland.

Acacia dictyophleba and Acacia ancistrocarpa high shrubland – drain/riparian

AdTp: *Acacia dictyophleba*, *Acacia marramamba* and *Acacia ancistrocarpa* high shrubland over *Triodia pungens* very open hummock grassland over **Cenchrus ciliaris*, *Chrysopogon fallax* tussock grassland.

Acacia pruinocarpa low woodland

ApAsCf/*Cc: *Acacia pruinocarpa* low woodland over mixed *Acacia* shrubland over *Chrysopogon fallax* and **Cenchrus ciliaris* tussock grassland.

Acacia pruinocarpa shrubland over *Senna artemisioides* scrub

ApSaCf: *Acacia pruinocarpa* and mixed *Acacia* species shrubland over *Senna artemisioides* (mixed subspecies) low shrubland over *Chrysopogon fallax* and **Cenchrus ciliaris* tussock grassland.

Acacia synchronicia shrubland

AsTp*Cc: *Acacia synchronicia* and mixed *Acacia* species shrubland over *Triodia pungens* hummock grassland over **Cenchrus ciliaris* and *Chrysopogon fallax* tussock grassland.

Corymbia aspera low open woodland

CaAn*Cc: *Corymbia aspera* low open woodland over mixed *Acacia* species shrubland over *Triodia pungens* open hummock grassland over **Cenchrus ciliaris* open tussock grassland.

Corymbia hamersleyana woodland - plains

ChAp*Cc: *Corymbia hamersleyana*, *Corymbia semiclara* and *Corymbia* aff. *opaca* scattered low trees over mixed *Acacia* shrubland over *Triodia basedowii* and *Triodia pungens* very open hummock grassland over **Cenchrus ciliaris* tussock grassland.

Eucalyptus gamophylla low open mallee woodland

EgApTp: *Eucalyptus xerothermica* low open woodland over *Eucalyptus gamophylla* low open mallee woodland over mixed *Acacia* shrubland over *Triodia pungens* open hummock grassland over **Cenchrus ciliaris* tussock grassland.

Eucalyptus leucophloia subsp. leucophloia low open woodland on hill slopes

ElAaTw/Tp: *Eucalyptus leucophloia* subsp. *leucophloia* low open woodland over *Acacia aneura* var. *aneura*, *Acacia bivenosa*, *Senna glutinosa* subsp. *glutinosa* shrubland over *Triodia wiseana*, *Triodia pungens*, *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) hummock grassland over **Cenchrus ciliaris* open tussock grassland.

Eucalyptus victrix low woodland - drains/riparian

EvAc*Cc: *Eucalyptus victrix* low woodland over mixed *Acacia* species shrubland over *Triodia pungens* very open hummock grassland over **Cenchrus ciliaris* tussock grassland.

Eucalyptus xerothermica low open woodland - riparian

ExAa*Cc: *Eucalyptus xerothermica* low open woodland over mixed *Acacia citrinoviridis* and other *Acacia* species shrubland over *Triodia pungens* open hummock grassland over **Cenchrus ciliaris* open tussock grassland.

ENV (2008a) mapped a total of 12 broad floristic communities with 12 vegetation associations within the application area between Chainage 334 to 336:

Maireana triptera low shrubland

AsMtTp: *Acacia synchronicia* scattered tall shrubs scattered over *Maireana triptera* and *Eremophila cuneifolia* low shrubland over *Triodia pungens* and **Cenchrus ciliaris* scattered tussock grasses.

Corymbia candida subsp. dipsodes low open woodland – drainage line

CcGwTb: *Corymbia candida* subsp. *dipsodes*, *Corymbia hamersleyana* and *Eucalyptus gamophylla* low open woodland over *Grevillea wickhamii* subsp. *hispidula*, *Acacia dictyophleba* and *Eremophila longifolia* open shrubland over *Keraudrenia velutina* subsp. *elliptica* over *Triodia basedowii* open hummock grassland.

Highly degraded *Vachellia farnesiana open shrubland

Ch*Vf*Cc: *Eucalyptus camaldulensis* var. *obtusa* and *Corymbia hamersleyana* low open woodland over *Acacia pruinocarpa*, *A. sclerosperma* subsp. *sclerosperma* and *A. synchronicia* high shrubland over *A. tetragonophylla* and **Vachellia farnesiana* open shrubland over **Cenchrus ciliaris* open tussock grassland.

Highly degraded – former quarry works

ChApTb: *Corymbia hamersleyana* scattered low trees over *Acacia pruinocarpa* scattered shrubs over *Triodia basedowii* very open hummock grassland over *Aristida inaequiglumis*, *A. contorta* and **Cenchrus ciliaris* tussock grassland.

Acacia pruinocarpa high shrubland

ChAp*Tp: *Corymbia hamersleyana* scattered low trees over *Acacia pruinocarpa* and mixed *Acacia* spp. high shrubland over *Triodia pungens* open hummock grassland.

Corymbia hamersleyana open woodland

ChGwTb/Tw: *Corymbia hamersleyana* and *Eucalyptus gamophylla* low open woodland over *Grevillea wickhamii*

subsp. *hispidula*, *Acacia pyrifolia* and *A. pruinocarpa* high shrubland over *Keraudrenia velutina* subsp. *elliptica* low scattered shrubs over *Triodia basedowii* and *T. wiseana* open hummock grassland.

Former drainage line

EcAa*Cc: *Eucalyptus camaldulensis* var. *obtusa*, *Corymbia hamersleyana* low open woodland over *Acacia aneura* var. *pilbarana* scattered shrubs over **Cenchrus ciliaris* and *Aristida inaequiglumis* very open tussock grassland.

Acacia ancistrocarpa shrubland floodplain

EgAaTp: *Eucalyptus gamophylla* and *E. xerothermica* low open woodland over mixed *Acacia* spp. shrubland over *Triodia pungens* very open hummock grassland over **Cenchrus ciliaris* tussock grassland.

Eucalyptus xerothermica and Acacia aneura var. pilbarana high shrubland

Ex/AaAsTp: *Eucalyptus xerothermica* and *Acacia aneura* var. *pilbarana* over *Acacia* spp., *Eremophila* spp. *Ptilotus obovatus* var. *obovatus*, *Psyrax latifolia* and *Anthobolus leptomerioides* open shrubland over *Maireana triptera* low open shrubland over *Triodia pungens* and **Cenchrus ciliaris* hummock/tussock grassland.

Acacia paraneura low woodland

Ex/ApTp: *Acacia paraneura* low woodland over *A. sclerosperma* subsp. *sclerosperma*, *A. aneura* and *A. synchronicia* and *Eremophila* spp. shrubland over *Triodia pungens* hummock grassland over **Cenchrus ciliaris* scattered grasses.

Eucalyptus xerothermica and E. gamophylla woodland

Ex/EgAsTp: *Eucalyptus xerothermica* and *E. gamophylla* low woodland over *Acacia sclerosperma* subsp. *sclerosperma* and other mixed *Acacia* spp. open shrubland over *Triodia pungens* hummock grassland.

Triodia angusta hummock grassland

ExAsTa: *Eucalyptus xerothermica* scattered low trees over *Acacia sclerosperma* subsp. *sclerosperma* and other *Acacia* spp. shrubland over *Triodia angusta* hummock grassland.

* denotes weed species.

Clearing Description	Newman Mainline Project. BHP Billiton Iron Ore Pty Ltd proposes to clear up to 2,928 hectares of native vegetation within a total boundary of approximately 14,363 hectares, for the purposes of railway construction, maintenance and associated activities. The project is located between Port Hedland and Newman, through the Shires of Ashburton and East Pilbara, and Town of Port Hedland.
Vegetation Condition	Excellent: Vegetation structure intact; disturbance affecting individual species, weeds non-aggressive (Keighery, 1994); To: Completely Degraded: No longer intact; completely/almost completely without native species (Keighery, 1994).
Comment	A number of flora and vegetation surveys have been conducted within and surrounding the application area (BHP Billiton, 2016). Given the large size of the application area, a vegetation consolidation exercise was undertaken by Onshore Environmental (2014). Vegetation associations identified as occurring within the application area have been based on the results of selected surveys that were deemed to provide the best overall coverage of the application area (BHP Billiton, 2016). The proposed clearing is for the construction and maintenance of the Newman mainline railway (BHP Billiton, 2016). The application area covers 26 clearing permits that are in the area, some of which have expired. The intention is for CPS 7009/1 to replace these existing permits.

3. Assessment of application against Clearing Principles

(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.

Comments	Proposal may be at variance to this Principle The application area is located within the Chichester, Fortescue, Hamersley and Roebourne subregions of the Pilbara Interim Biogeographic Regionalisation for Australia bioregion (IBRA), and the Augustus subregion of the Gascoyne IBRA (GIS Database). At a broad scale, vegetation of the Chichester subregion is comprised of undulating Archaean granite and basalt plains include significant areas of basaltic ranges. Plains support a shrub steppe characterised by <i>Acacia inaequilatera</i> over <i>Triodia wiseana</i> hummock grasslands, while <i>Eucalyptus leucophloia</i> tree steppes occur on ranges (CALM, 2002). The Hamersley subregion can be described as Mulga low woodlands over bunch grasses on fine textured soils in valley floors and <i>Eucalyptus leucophloia</i> over <i>Triodia brizoides</i> on skeletal soils of the ranges (CALM, 2002). The Fortescue subregion is comprised of River gum woodlands fringe the drainage lines, and it is the northern limit of Mulga (<i>Acacia aneura</i>). An extensive calcrete aquifer (originating within a palaeo-drainage valley) feeds numerous permanent springs in the central Fortescue, supporting large permanent wetlands with extensive stands of river gum and cadjeput <i>Melaleuca</i> woodlands (CALM, 2002). The Roebourne subregion is comprised of coastal and sub-coastal plains with grass savannah of mixed bunch and hummock grasses, and dwarf shrub steppe of <i>Acacia stellaticeps</i> or <i>A. pyrifolia</i> and <i>A. inaequilatera</i> . Uplands are dominated by <i>Triodia</i> hummock grasslands and drainage lines support <i>Eucalyptus victrix</i> or <i>Corymbia Hamersleyana</i> woodlands (CALM, 2002). The Augustus subregion is characterised by Mulga woodland with <i>Triodia</i> occur on shallow stony loams on rises, while the
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shallow earthy loams over hardpan on the plains are covered by Mulga parkland (CALM, 2002).

The objective of this application is to consolidate 26 existing clearing permits held by BHP Billiton Iron Ore Pty Ltd. Existing live permits are to be surrendered and future clearing is to be conducted under CPS 7009/1. An assessment against the 10 clearing Principles has previously been conducted for the existing 26 clearing permits to be consolidated into CPS 7009/1. The proposed clearing of 2,928 hectares is the total of the remaining clearing allocation of the 26 clearing permits that are to be replaced. The proposed clearing has not increased in the area already approved under the existing clearing permits; however the total boundary has increased from 11,648.99 hectares to 14,363 hectares, to align with tenure boundaries (BHP Billiton, 2016).

The vegetation within the application area is considered to be in a 'completely degraded' to 'excellent' condition (BHP Billiton, 2016). The vegetation considered 'completely degraded' is due to clearing associated with railway infrastructure and associated activities, access tracks, weeds and grazing (BHP Billiton, 2016; GIS Database). Native vegetation adjacent to the application area is in a similar condition to that of the application area (BHP Billiton, 2016).

Sections of the clearing permit boundary intersect the Priority 1 Priority Ecological Community (PEC) 'Fortescue Marsh (Marsh Land System)' (BHP Billiton, 2016; GIS Database). This PEC is and is listed on the Directory of Important Wetlands of Australia as a wetland of national significance (DPaW, 2014). There is an existing road and rail line which transverses the PEC. BHP Billiton (2008) have stated that no borrow pits will be constructed within the Fortescue Marsh area, with the nearest proposed borrow pit approximately 400 metres north of the wetlands. Potential impacts to PEC as a result of the proposed clearing may be minimised by the implementation of a restricted clearing condition.

There have been numerous flora and vegetation surveys undertaken over the Newman mainline railway and surrounding area since 2008 (Onshore Environmental, 2014). A review of the surveys identified 15 Priority Flora species which have been recorded within the application area (BHP Billiton, 2016):

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) (Priority 1);
- *Aristida jerichoensis* var. *subspinulifera* (Priority 3);
- *Bulbostylis burbridgeae* (Priority 4);
- *Eremophila spongiocarpa* (Priority 1);
- *Gomphrena pusilla* (Priority 2);
- *Goodenia nuda* (Priority 4);
- *Gymnanthera cunninghamii* (Priority 3);
- *Heliotropium muticum* (Priority 1);
- *Lepidium catapycnon* (Priority 4);
- *Pterocaulon intermedium* (Priority 3);
- *Rhagodia* sp. Hamersley (M. Trudgen 17794) (Priority 3);
- *Rostellularia adscendens* var. *latifolia* (Priority 3);
- *Sida* sp. Barlee Range (S. van Leeuwen 1642) (Priority 3)
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) (Priority 1); and
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (Priority 3).

The flora species *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) has only been recorded from a single location within the application area (BHP Billiton, 2016). There are multiple records of this species within 15 kilometres of the application area. The proposed clearing of one record of this species is unlikely to impact the conservation significance of this species.

The flora species *Heliotropium muticum* was recorded in three distinct populations, totalling 56 individuals, within the Mooka location within the application area (BHP Billiton, 2016). BHP Billiton (2016) has recorded populations of *H. muticum* extending at least 1 kilometre from the application area. Based on the density of *H. muticum* within the application area, it is likely that approximately 56 individual plants of this species will be impacted by the proposed clearing (BHP Billiton, 2016). This species is known as a disturbance opportunist, most commonly recorded after fire or other disturbance (DEC, 2012), and it is considered likely this species will return after disturbance or during rehabilitation. The removal of these individual plants is unlikely to result in a significant impact upon species distribution given that 216 records of this species have been identified outside of the application area, the two southern populations of this species do not include any records within the application area, and this species has been recorded in the broader region (BHP Billiton, 2016). Potential impacts to Priority Flora can be minimised by the implementation of a flora management condition.

The flora species *Tephrosia rosea* var. Port Hedland is densely distributed along the northern section of rail line both within and adjacent to the application area (BHP Billiton, 2016). Based on the density of *Tephrosia rosea* var. Port Hedland in the application area, it is likely that approximately 324 individual plants of *Tephrosia rosea* var. Port Hedland will be impacted by the proposed clearing (BHP Billiton, 2016). The removal of these individual plants is unlikely to result in a significant impact upon species distribution given that 643 records of this species have been identified outside of the application area, there are large populations of this species adjacent to the application area, and this species has been recorded in the broader region (BHP Billiton, 2016). Potential impacts to this species can be minimised by the implementation of a flora management condition.

There is a dense population of *Eremophila spongiocarpa* occurring on the edge of the Fortescue Marsh within the application area. This species is endemic to the Fortescue Marsh, but occurs extensively across the entire marsh area (BHP Billiton, 2016). Potential impacts to this species can be minimised by the implementation of a

restricted clearing condition.

There is one record of *Gomphrena pusilla* within the application area. This record is a historical record, and this species has not been identified at the recorded location in subsequent surveys (BHP Billiton, 2016).

The remaining Priority Flora species recorded within the application area are well distributed in the local and regional area (BHP Billiton, 2016; DPaW, 2016). The proposed clearing is not likely to have a significant impact on these Priority Flora species. BHP Billiton (2016) will avoid Priority Flora species where practicable.

There were 20 fauna habitat types recorded within the application area (Biologic, 2014; BHP Billiton, 2016). Most of the faunal habitats within the application area are considered to be common and widespread within the subregion and faunal assemblages are unlikely to be different to those found in similar habitat located elsewhere in the region, with the exception of Gorge/Gully and Major Drainage Line habitats (GIS Database). The proposed clearing of 2,928 hectares of native vegetation within a 14,363 hectare boundary is unlikely to have a significant impact on faunal diversity in a regional and local context.

There are 38 weed species recorded within the application area (BHP Billiton, 2016). Weeds have the potential to alter the biodiversity of an area, competing with native vegetation for available resources and making areas more fire prone. Potential impacts to biodiversity as a result of the proposed clearing may be minimised by the implementation of a weed management condition.

Based on the above, the proposed clearing may be at variance to this Principle.

Methodology BHP Billiton (2016)
Biologic (2014)
CALM (2002)
DEC (2012)
DPaW (2014)
DPaW (2016)
Onshore Environmental (2014)

GIS Database:
- IBRA WA (Regions - Sub Regions)
- Pre-European vegetation
- Threatened Ecological Sites Buffered

(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Comments Proposal may be at variance to this Principle

There has been numerous fauna surveys previously conducted over the application area. Biologic (2014) undertook a consolidation of fauna habitat mapping across BHP Billiton Iron Ore's tenure. Based on the results of these surveys the following 20 broad fauna habitats have been identified within the application area (Biologic, 2014; ENV, 2008a; ENV, 2008b; ENV, 2011):

- Artificial Northern Quoll Habitat;
- Boulders;
- Crest / Slope;
- Drainage Area;
- Fortescue Marsh Samphire;
- Floodplain;
- Gilgai;
- Gorge/Gully;
- Granite Domes;
- Low Rise;
- Major Drainage Line;
- Minor Drainage Line;
- Mulga;
- Plain;
- Riverine;
- Rocky Hills;
- Sand Plain;
- Stony Plain;
- Tidal Flats; and
- Valley.

Excluding the Gorge/Gully and Major Drainage Line habitats, all these habitats are considered to be common and well represented within the region (BHP Billiton, 2016; Biologic, 2014). The Gorge/Gully habitat is significant as it contains important habitat features that provide shelter and denning sites; however this habitat type only represents a very small portion of the application area. The proponent will minimise disturbance to this habitat where clearing will only occur for the maintenance of the rail line (BHP Billiton, 2016). The Major Drainage Line habitat contains breeding and foraging sites for a number of bird species and significant tree

hollows that may be used by avian fauna species for roosting and nesting. This habitat is also important for dispersal of mammal and reptile species in the local area. Potential impacts to this habitat type may be minimised by the implementation of a vegetation management condition. Many parts of this habitat have been degraded by existing activities and invasion of weeds (BHP Billiton, 2016). The Gorge/Gully and Major Drainage Line habitats lie within existing clearing permit boundaries (GIS Database). No additional impacts to these habitats are likely to be significantly above those already authorised to clear.

Fauna surveys in the area have recorded a total of 19 species of conservation significance within the application area (BHP Billiton, 2016). Based on habitats within the application area and surrounding records, a further 30 species of conservation significance could potentially be found within the application area (BHP Billiton, 2016). Of these 19 species, 12 are bird species that are considered highly mobile and have a wide distribution and may use the application area for foraging as part of a larger territory area (BHP Billiton, 2016). The habitat present within the application areas is not considered core habitat for these avian species (BHP Billiton, 2016; GIS Database).

The Northern Quoll (*Dasyurus hallucatus* - Endangered) has been recorded at several locations within the application area, with extensive records between Mooka and Redmont Camp (BHP Billiton, 2016; ecologica, 2008). Northern Quoll are both arboreal and terrestrial, inhabiting ironstone ridges, scree slopes of sandstone or ironstone and granite boulders and outcrops. Northern Quoll also inhabits drainage lines and riverine habitats where it utilises tree hollows as den sites. While the habitats within the application area are utilised by the Northern Quoll (specifically the Major Drainage Line), the proposed clearing is linear and narrow, intersecting only small sections of favourable habitat, which is also present in the local and regional area (Biologic, 2014). Potential impacts on the Northern Quoll will be managed under the proponents Draft Northern Quoll Management Plan which has been developed for their rail expansion project in consultation with the Department of Parks and Wildlife. Potential impacts to the Northern Quoll may be minimised by the implementation of an exclusion zone, a restricted clearing condition, a fauna management condition and vegetation management condition.

The Greater Bilby (*Macrotis lagotis* – Vulnerable) are known to utilise habitats including stony downs, cracking clays, desert sandplains and dune fields, spinifex grassland and *Acacia* species shrublands on red earths (Johnson, 2008). Evidence of Bilby was recorded in sand plain habitat, particularly around Turner River (Biologic, 2013). There is likely to be a low impact on this species given that the Sand Plain habitat within the application area is widespread throughout the Pilbara and the linear, narrow nature of the application area. Areas of dune, sandplain and stony plain interspersed with Mulga woodland within application area are potentially suitable habitat for the Bilby. This habitat is widespread in Chichester subregion (Biologic, 2013). Potential impacts to the Bilby may be minimised by the implementation of vegetation management condition.

The Ghost Bat (*Macroderma gigas* - Vulnerable) occurs in a wide variety of habitats, and requires an undisturbed cave, deep fissure or disused mine shaft in which to roost. These features do not occur within the application area (Biologic, 2014). This species is known to forage over the habitats within the application area and surrounds, and there is evidence of Ghost Bats within rail culverts (BHP Billiton, 2016). However, impacts are considered to be low as there are no suitable caves within the area (BHP Billiton, 2016; Biologic, 2014). Given the linear, narrow corridor nature of the application area and that suitable foraging habitat extends outside the application area, proposed clearing unlikely to impact the conservation significance of this species.

There is only one record of the Pilbara Olive Python (*Liasis olivaceus barroni* - Vulnerable) within the application area, in an area of cleared land at a rail crossing (BHP Billiton, 2016). This species is usually encountered in the vicinity of permanent waterholes in rocky ranges or riverine vegetation. The most significant habitat for this species within the application area is the Gorge/Gully and Major Drainage Line habitat (BHP Billiton, 2016). Potential impacts to the Pilbara Olive Python may be minimised by the implementation of vegetation management condition.

The Pilbara Flat-headed Blind-snake (*Anilius ganei*) (Priority 1 - DPaW) was recorded at one location within application area (BHP Billiton, 2016). The preferred habitat type for this species is Gorge/Gully which is mostly absent from application area (BHP Billiton, 2016; GIS Database).

The Brush-tailed mulgara (*Dasyercus blythi*) (Priority 4 - DPaW) was recorded within the sandplain habitat within the application area (BHP Billiton, 2016). Suitable habitat for this species is extensive outside application area (BHP Billiton, 2016; Biologic, 2013).

The Western Pebble-mound Mouse (*Pseudomys chapmani*) (Priority 4 - DPaW) is restricted to the Pilbara, where it is recognised as an endemic species. While the Crest / Slope and Stony Plain habitats of the application area may be utilised by the Western Pebble-mound Mouse, there are large areas of suitable habitat for this species adjacent to the application area and BHP Billiton (2016) has advised that active Pebble-mouse mounds will be avoided, where practicable.

The proposed clearing of 2,928 hectares within a total boundary of 14,363 hectares is unlikely to have an impact on the local fauna population. This application will replace 26 existing clearing permits in the vicinity. As the proposed clearing amount is not above the total of the existing clearing permits, it is not likely to have a greater impact on fauna than what has been previously approved.

Based on the above, the proposed clearing may be at variance to this Principle.

Methodology BHP Billiton (2016)
Biologic (2013)
Biologic (2014)
ENV (2008a)
ENV (2008b)
ENV (2011)
Johnson (2008)

GIS Database:
- Imagery

(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

Comments Proposal is not likely to be at variance to this Principle

According to available databases, there are no known records of Threatened Flora within the application area (GIS Database). A search of the Department of Parks and Wildlife's Threatened and Priority Flora databases identified no Threatened Flora species within the application area (DPaW, 2016).

There have been numerous flora and vegetation surveys undertaken over the Newman mainline railway and surrounding area since 2008 (Onshore Environmental, 2014). No Threatened Flora species have been recorded within the application area (BHP Billiton, 2016).

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology BHP Billiton (2016)
DPaW (2016)

GIS Database:
- Threatened and Priority Flora List

(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

Comments Proposal is not likely to be at variance to this Principle

The application area is situated within the boundary of the 'Ethel Gorge aquifer stygobiont community' Threatened Ecological Community (GIS Database). Due to its subterranean nature and dependence on groundwater, this community is predominately impacted by groundwater drawdown or dewatering (CALM, 2002). The proposed clearing of native vegetation is unlikely to impact the Ethel Gorge aquifer stygobiont community.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology CALM (2002)

GIS Database:
- Threatened Ecological Sites Buffered

(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

Comments Proposal is not at variance to this Principle

The application areas fall within the Gascoyne and Pilbara IBRA (GIS Database). The vegetation within the application areas is recorded as Beard vegetation associations 18, 29, 43, 82, 93, 111, 117, 127, 157, 173, 175, 216, 562, 589, 619, 647 and 676.

The above Beard vegetation associations retain approximately 99% or above of their pre-European extent at both the state and bioregion level (Government of Western Australia, 2014). The areas proposed to be cleared are not a significant remnant of native vegetation.

Based on the above, the proposed clearing is not at variance to this Principle.

Methodology Government of Western Australia (2014)

GIS Database:
- IBRA WA (regions - subregions)
- Pre-European Vegetation

(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

Comments Proposal is at variance to this Principle

There are seven major watercourses and seven minor named creeks that traverse through the application area, with numerous riparian vegetation types mapped in association with these watercourses (BHP Billiton, 2016; Onshore Environmental, 2014; GIS Database). These riparian vegetation types are widespread in the region, however due to the linear nature of the proposed clearing it may impact the flow of the drainage lines during heavy rainfall (GIS Database). The clearing of riparian vegetation has the potential to cause localised erosion and degrade faunal habitats. However, given the proposed clearing is spread over a large area, it is not anticipated that it will have a significant impact on minor drainage lines within the application area. Provided disturbance to riparian habitats is avoided or minimised where possible, and weed hygiene procedures are followed, the proposed works are not expected to substantially impact these vegetation units. Potential impacts to riparian vegetation may be minimised through the implementation of a vegetation management and staged clearing condition.

The application area intersects the Fortescue March PEC which is an ecologically important wetland (BHP Billiton, 2016; DPaW, 2014). The application area only intersects a minor section of the PEC. Potential impacts to PEC as a result of the proposed clearing may be minimised by the implementation of a restricted clearing condition.

Based on the above, the proposed clearing is at variance to this Principle.

Methodology BHP Billiton (2014)
BHP Billiton (2016)
DPaW (2014)
Onshore Environmental (2014)

GIS Database:
- Hydrography, linear

(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Comments Proposal may be at variance to this Principle

The application area is mapped as occurring on the Adrian, Boolaloo, Boolgeeda, Calcrete, Capricorn, Christmas, Cowra, Divide, Elimunna, Fan, Fortescue, Granitic, Jamindie, Littoral, Macroy, Mallina, Marsh, Mckay, Newman, Platform, River, Robe, Rocklea, Uaroo, Urandy and Wona land systems (GIS Database).

The majority of the land systems are generally not susceptible to erosion, except for the Christmas, Divide, Elimunna, Fan, Fortescue, Jamindie, Littoral, Mallina and River land systems (van Vreeswyk et al., 2004). These land systems have a moderate to high risk of erosion, in particular the Fortescue and River land systems (van Vreeswyk et al., 2004). Potential impacts from erosion as a result of the proposed clearing may be minimised by the implementation of a staged clearing condition.

The proposed clearing of native vegetation is up to 2,928 hectares, however, this amount has already been approved under existing permits, and future clearing is mainly of a linear nature (BHP Billiton, 2016). Any potential land degradation in association with waterways can be mitigated through revegetation and rehabilitation of areas after they are no longer required. Potential impacts from erosion may be minimised by the implantation of an erosion management condition.

Based on the above, the proposed clearing may be at variance to this Principle.

Methodology van Vreeswyk et al. (2004)

GIS Database:
- Rangeland Land System Mapping

(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Comments Proposal is not likely to be at variance to this Principle

The application area is not located within any conservation area (GIS Database). The nearest conservation area is Karijini National Park, located approximately 25 kilometres east of the application area (GIS Database).

Given the distance of the application area from Karijini National Park, the proposed clearing is not likely to provide a significant ecological linkage or fauna movement corridor and is not likely to impact the environmental values of the conservation area.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology GIS Database:

(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Comments Proposal is not likely to be at variance to this Principle

The application area is located within the Newman Water Reserve Public Drinking Water Source Area (PDWSA) (GIS Database). This PDWSA has been assigned a Priority 1 rating under the Water Source Protection Classification system. Advice from the Department of Water (DoW) (2016) noted that BHP Billiton is the water service provider for this water source and that for the benefit of the community, planning decisions on proposed land uses in the reserve need to be carefully considered. It was noted that clearing activities associated with railway construction and maintenance are compatible with conditions within a P1 PDWSA (DoW, 2016).

The application area crosses seven major and seven minor watercourses including Coonarrie Creek, Coondiner Creek, Fortescue River, Turner River, Turner River East, Warrawanda Creek, Yule River, Coorong Creek, Edgina Creek, Gillam Creek, Homestead Creek, Kalgan Creek, Shovelanna Creek, and Two Camel Creek (BHP Billiton, 2016). Any clearing proposed within the applied clearing area is likely to occur along the existing rail network where impact has already occurred. If clearing of riparian vegetation is required there may be some localised short term sedimentation during the clearing process however, this is not likely to be an ongoing issue. Potential impacts to surface water quality as a result of the proposed clearing may be minimised by the implementation of a watercourse management condition.

The application area has a groundwater salinity that is marginal to saline (500 – 3000 milligrams/Litre Total Dissolved solids) (GIS Database). The proposed clearing of 2,928 hectares of native vegetation (at various locations) within an application area of approximately 14,363 hectares that has extensive amounts of vegetation remaining, is unlikely to result in any significant impacts to groundwater quality.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology BHP Billiton (2016)
DoW (2016)

GIS Database:
- Groundwater Salinity, Satewide
- Hydrography, linear
- Public Drinking Water Source Areas (PDWSAs)

(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Comments Proposal is not likely to be at variance to this Principle

Massive surface water runoff and localised flooding occurs following intense rainfall events in the Pilbara (BHP Billiton, 2016). However, given that the proposed clearing of 2,928 hectares of native vegetation is to be undertaken at various locations within an application area of approximately 14,363 hectares, stretching across seven catchments, the proposed clearing is not likely to increase the potential for flooding (GIS Database).

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology BHP Billiton (2016)

GIS Database:
- Hydrographic Catchments – Catchments

Planning instrument, Native Title, RIWI Act Licence, EP Act Licence, Works Approval, Previous EPA decision or other matter.

Comments

There are two native title claims over the application area (DAA, 2016). However, the mining tenure has been granted in accordance with the future act regime of the *Native Title Act 1993* and the nature of the act (i.e. the proposed clearing activity) has been provided for in that process, therefore, the granting of a clearing permit is not a future act under the *Native Title Act 1993*.

There are several Sites of Aboriginal Significance located in the area applied to clear (DAA, 2016). It is the proponent's responsibility to comply with the *Aboriginal Heritage Act 1972* and ensure that no Sites of Aboriginal Significance are damaged through the clearing process.

It is the proponent's responsibility to liaise with the Department of Environment Regulation, the Department of Parks and Wildlife and the Department of Water, to determine whether a Works Approval, Water Licence, Bed and Banks Permit, or any other licences or approvals are required for the proposed works.

The clearing permit application was advertised on 2 May 2016 by the Department of Mines and Petroleum inviting submissions from the public. No submissions were received.

Methodology DAA (2016)

4. References

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5. Glossary

Acronyms:

BoM	Bureau of Meteorology, Australian Government
DAA	Department of Aboriginal Affairs, Western Australia

DAFWA	Department of Agriculture and Food, Western Australia
DEC	Department of Environment and Conservation, Western Australia (now DPaW and DER)
DER	Department of Environment Regulation, Western Australia
DMP	Department of Mines and Petroleum, Western Australia
DRF	Declared Rare Flora
DotE	Department of the Environment, Australian Government
DoW	Department of Water, Western Australia
DPaW	Department of Parks and Wildlife, Western Australia
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DotE)
EPA	Environmental Protection Authority, Western Australia
EP Act	<i>Environmental Protection Act 1986</i> , Western Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Federal Act)
GIS	Geographical Information System
ha	Hectare (10,000 square metres)
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union
PEC	Priority Ecological Community, Western Australia
RIWI Act	<i>Rights in Water and Irrigation Act 1914</i> , Western Australia
TEC	Threatened Ecological Community

Definitions:

{DPaW (2015) Conservation Codes for Western Australian Flora and Fauna. Department of Parks and Wildlife, Western Australia}:-

T	<p>Threatened species: Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).</p> <p>Threatened fauna is that subset of ‘Specially Protected Fauna’ declared to be ‘likely to become extinct’ pursuant to section 14(4) of the Wildlife Conservation Act.</p> <p>Threatened flora is flora that has been declared to be ‘likely to become extinct or is rare, or otherwise in need of special protection’, pursuant to section 23F(2) of the Wildlife Conservation Act.</p> <p>The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.</p>
CR	<p>Critically endangered species Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p>
EN	<p>Endangered species Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p>
VU	<p>Vulnerable species Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.</p>
EX	<p>Presumed extinct species Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.</p>
IA	<p>Migratory birds protected under an international agreement Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.</p>
CD	<p>Conservation dependent fauna Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the</p>

Wildlife Conservation Act 1950, in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.

- OS Other specially protected fauna**
Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.
- P Priority species**
Species which are poorly known; or
Species that are adequately known, are rare but not threatened, and require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
- P1 Priority One - Poorly-known species:**
Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
- P2 Priority Two - Poorly-known species:**
Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
- P3 Priority Three - Poorly-known species:**
Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
- P4 Priority Four - Rare, Near Threatened and other species in need of monitoring:**
(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.