

Appendix B (ii)

**Environmental Referral, North West Infrastructure Multi User Iron Ore Export
(Landside) Facility**

Flora and Vegetation Impact Assessment (Woodman 2011b)

Coffey Environments

North West Iron Ore Alliance

Port Survey Area

Flora and Vegetation Impact Assessment

July 2011



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1. Introduction

The North West Iron Ore Alliance (NWIOA) are proposing to construct port and rail facilities immediately east and south of Port Hedland. Woodman Environmental Consulting Pty Ltd (Woodman Environmental) have prepared for Coffey Environments (Coffey) a baseline flora and vegetation assessment of the Port survey area (Woodman Environmental 2011 in prep.). An assessment of potential impacts to flora and vegetation within the Port area is presented in this report.

2. Methods

The assessment of impacts of the proposal on flora and vegetation within the Port survey area was conducted using the Port layout provided to Woodman Environmental by Coffey (Figure 1). This area was overlaid on all known locations of conservation-significant flora within the survey area, and FCT mapping of the survey area (Figure 1), based on the baseline flora and vegetation report (Woodman Environmental 2011 in prep.).

Calculations using GIS software were undertaken to determine the number of known conservation-significant flora locations to be impacted (if any), and area of each FCT to be impacted.

2.1 Significance of Impact on Flora Taxa

The local distribution of a flora taxon is defined as the known distribution within the survey area. The regional distribution refers to the known regional distribution of throughout Western Australia, in particular in the Pilbara Region.

Impacts to the local distribution of conservation-significant taxa for the purposes of this assessment have been defined as being ‘Low’, ‘Moderate’ or ‘High’, depending upon the number of known locations or individuals that are proposed to be impacted (annual flora) or percentage of habitat area to be impacted (perennial flora), as per Table 1.

Table 1: Extent of Impact of Proposal on Locations of Conservation Significant Flora Taxa

Extent of Impact	Annual Flora	Perennial Flora
Low Impact	<25% of locations proposed to be impacted	<10 % of habitat area proposed to be impacted
Moderate Impact	25 – 50% of locations proposed to be impacted	10 – 30% of habitat area proposed to be impacted
High Impact	>50 % of locations proposed to be impacted	>30 % of habitat area proposed to be impacted

The significance of impact on the regional distribution of conservation-significant flora taxa depends upon the known range of the taxon throughout the region, in conjunction with previously known records of the taxon either within or in close proximity to the survey area.

The significance of impact on the regional distribution of conservation-significant flora taxa depends upon the significance of the local populations to the regional distribution of the taxon, and the level of impact to the taxon at the local level. The significance of the local population/s of the taxon to the regional distribution of the taxon has been determined by Table 2. The overall significance of impact on the regional distribution is then determined using Table 3.

Table 2: Significance of Local Populations to the Overall/Regional Conservation of Taxon

Ranking	Description
High	<ul style="list-style-type: none"> Known range of taxon either entirely located within the survey area, or within the survey area and to a radius of <10km of the survey area; and/or Taxon known from <10 discrete populations, including within the survey area; and/or Survey area on boundary of known regional distribution
Moderate	<ul style="list-style-type: none"> Known range of taxon extends <50km; and/or Taxon known from >10 discrete populations; and/or Survey area may be on boundary of known regional distribution
Low	<ul style="list-style-type: none"> Known range of taxa extends >50km; and/or Taxon known from >20 discrete populations; and/or Survey area not on boundary of known regional distribution

Table 3: Matrix of Regional Significance of Impact on Conservation-Significant Taxa

		Local Impact		
		Low	Moderate	High
Significance of Local Populations to the Overall/Regional Conservation of Taxa	Low	Low	Low	Low
	Moderate	Low	Moderate	Moderate-High
	High	Low	Moderate-High	High

2.2 Significance of Impact on Vegetation

The local distribution of FCTs refers to the area of each FCT mapped within the survey area. No regional information regarding the distribution of FCTs is available for the Pilbara Region; although a regional survey of the Pilbara Region is currently being undertaken by the DEC, no reports detailing FCTs on a regional scale are yet available.

Impacts to the local distribution of FCTs for the purposes of this assessment have also been defined as being of 'Low', 'Moderate' or 'High', depending upon the proportion of the mapped area of each FCT that is proposed to be impacted, as per Table 4.

Table 4: Ranking of Local Impact on Floristic Community Types / Communities

Ranking of Proposed Impact	Extent of proposed impact
Low Impact	<105% of mapped area is proposed to be impacted
Moderate Impact	10 – 300% of mapped area is proposed to be impacted
High Impact	> 30 % of mapped area is proposed to be impacted

The local significance of FCTs can be measured by the extent of the FCT within the local area; the type of landforms they are associated with (and their extent in the local area); and the presence of significant flora taxa that are known from each FCT (Table 4). The local significance of FCTs is described in the baseline flora and vegetation survey report (Woodman Environmental 2011 in prep.). A local conservation significance ranking of ‘1’ is of the least local conservation significance; a local conservation significance ranking of ‘4’ is of the highest local conservation significance.

Table 5: Descriptions of Local Conservation Significance Rankings of Floristic Community Types in the Port Survey Area

Local Conservation Significance Ranking	Description
1	<ul style="list-style-type: none"> • FCT is widespread through the survey area (>10% of mapped area); • No conservation-significant flora known from the FCT
2	<ul style="list-style-type: none"> • FCT is widespread through the survey area (>10% of mapped area); and • Conservation-significant flora known from the FCT
3	<ul style="list-style-type: none"> • FCT is restricted within the survey area (<10% of the mapped area); and • No conservation-significant flora known from the FCT
4	<ul style="list-style-type: none"> • FCT is restricted within the survey area (<10% of mapped area); and • Conservation-significant flora known from the FCT

The local significance of impact to FCTs / communities is determined as a factor between the ranking of impact, and the local conservation significance of the FCT / community, as per Table 6.

Table 6: Local Significance of Impact to Floristic Community Types / Communities mapped within the Port survey area

		Local Impact		
		Low	Moderate	High
Significance of Local Populations to the Overall/Regional Conservation of Taxa	1, 2	Low	Low	Low
	3	Low	Moderate	Moderate-High
	4	Low	Moderate-High	High

An assessment of the impact to vegetation system associations (Department of Environment and Conservation 2007) has also been made. Please note the current extent of these vegetation system associations is 2007 data, and therefore recent clearing which may have taken place in the local area may not be reflected.

3. Results

3.1 Impact of Proposed Port Proposal on Conservation Significant Flora Taxa

A total of six conservation significant flora taxa are known from the NWIOA Port survey area (Woodman Environmental 2011 in prep.). Of these six taxa, the known locations of two of these will be impacted by the proposal: *Eragrostis crateriformis* (P3) and *Tephrosia rosea* ?var. *venulosa* (P1). *Eragrostis crateriformis* (P3) is listed as an annual flora taxa, whereas *Tephrosia rosea* ?var. *venulosa* (P1) is perennial.

Only two locations of *Eragrostis crateriformis* (P3) are known from the Port survey area. The location proposed to be impacted is located in mosaic 1/2, which is widespread through the survey area. A single individual was recorded at the location, however it is likely that more individuals would be present in this general area. The location which is not proposed to be impacted is positioned in FCT 4, to the south-east of the location to be impacted.

A total of five known locations of *Tephrosia rosea*?var. *venulosa* (P1) are proposed to be impacted, of a total of six known from within the survey area. These are all located in the same area, and most likely represent the same population. More than 220 individuals were recorded in these records. The sixth location of this taxon is positioned to the north-east of this area.

As per Table 1, the local impact on both of these conservation significant taxa can be ranked in terms of impact to known locations as ‘Moderate’ (*Eragrostis crateriformis* (P3)) and High (*Tephrosia rosea* ?var. *venulosa* (P1)). One known location of *Gomphrena leptophylla* (P3) is known from immediately outside of the proposed impact area.

Table 7 presents the impact to the known habitat area (FCTs and community types) of each of the six conservation significant flora taxa known from the survey area. The overall local impact ranking to each of these taxa is also given (based on habitat area for those annual flora taxa for which no known locations will be impacted).

Table 7: Proposed Impact to Known Habitat of Conservation Significant Flora Taxa within the Port survey area

Conservation Significant Flora Taxa	Known Habitat	Habitat Area in Port survey area (ha)	Proposed Impact to Habitat area (ha)	Percentage of Habitat area to be impacted	Local Impact Ranking (Table 1)
<i>Eragrostis crateriformis</i> (P3) (annual)	4, 1/2	710.3	212.9	30.0	Moderate
<i>Gomphrena leptophylla</i> (P3) (annual)	1/2	1011.6	203.6	20.1	Moderate
<i>Gomphrena pusilla</i> (P2) (annual)	3, 4	311.6	11.3	3.6	Low
<i>Goodenia nuda</i> (P4)	1/2	1011.6	203.6	20.1	Moderate

Conservation Significant Flora Taxa	Known Habitat	Habitat Area in Port survey area (ha)	Proposed Impact to Habitat area (ha)	Percentage of Habitat area to be impacted	Local Impact Ranking (Table 1)
<i>Gymnanthera cunninghamii</i> (P3) (perennial)	5, 11/5	457.9	68.0	14.9	Moderate
<i>Tephrosia rosea</i> ?var. <i>venulosa</i> (P1) (perennial)	1/2, 4	1312.9	212.9	16.2	Moderate – High *

*Although five of the six known locations of *Tephrosia rosea* ?var. *venulosa* (P1) will be impacted, the impact to habitat area of this taxon is 16.2 %. Therefore, the local impact ranking to this taxon has been ranked as Moderate-High (Table 7). The local impact ranking of *Eragrostis crateriformis* (P3) remains at Moderate.

Although the known locations of the other conservation significant flora taxa known from the survey area will not be impacted, known habitat area for each of these will be impacted (Table 5). This ranges from 3.6 % of the habitat area of *Gomphrena pusilla* (P2) to 20.1 % of the habitat area of *Gomphrena leptophylla* (P3) and *Goodenia nuda* (P4) (which is unlikely to occur in the survey area; these records are from historical data held by the DEC).

Table 8 presents the significance of the local populations of these taxa to their regional conservation status (Table 2).

Table 8: Significance of Local Populations of Conservation Significant Flora in Terms of their Regional Distribution

Conservation Significant Flora Taxa	Significance of Local Population	Description
<i>Eragrostis crateriformis</i> (P3)	Low	Known range of taxon extends >50 km Taxon known from approximately 5 populations Survey area not on boundary of known range of taxon
<i>Gomphrena leptophylla</i> (P3)	Low	Known range of taxon extends >50 km Taxon known from approximately 5 populations Survey area not on boundary of known range of taxon
<i>Gomphrena pusilla</i> (P2)	Moderate / High	Known range of taxon extends >50 km Taxon known from approximately 2 populations Survey area is on boundary of known range of species (taxon known from Port Hedland and Broome)
<i>Goodenia nuda</i> (P4)	Low	Known range of taxon extends >50 km Taxon known from approximately >20 populations Survey area not on boundary of known range of taxon
<i>Gymnanthera cunninghamii</i> (P3)	Low	Known range of taxon extends >50 km Taxon known from approximately >10 populations Survey area not on boundary of known range of taxon
<i>Tephrosia rosea</i> ?var. <i>venulosa</i> (P1)	Low	Known range of taxon extends >50 km Taxon known from approximately 5 populations Survey area not on boundary of known range of taxon

The regional significance of the impact of the proposal on conservation significant flora taxa within the survey area is listed in Table 9, based on Table 3.

Table 9: Regional Significance of Impact to conservation significant flora taxa within the Port survey area

Conservation Significant Flora Taxa	Local Impact Ranking (Table 7)	Significance of Local Population (Table 8)	Regional Significance of Proposed Impact
<i>Eragrostis crateriformis</i> (P3)	Moderate	Low	Low
<i>Gomphrena leptophylla</i> (P3)	Moderate	Low	Low
<i>Gomphrena pusilla</i> (P2)	Low	Moderate / High	Low
<i>Goodenia nuda</i> (P4)	Moderate	Low	Low
<i>Gymnanthera cunninghamii</i> (P3)	Moderate	Low	Low
<i>Tephrosia rosea</i> ?var. <i>venulosa</i> (P1)	Moderate – High	Low	Low

3.2 Impact of Proposed Port Proposal on Vegetation

A total of 16.9 % of the total Port survey area is proposed to be impacted (379.6 ha). This includes 1.8 ha mapped as Cleared, and 8.2 ha mapped as being Water. The proposed impact extent to each FCT, mosaic and community type mapped within the Port survey area is detailed in Table 10, with the ranking of local impact (Table 4).

Table 10: Conservation Significance Rankings and Ranking of Local Impact to Floristic Community Types and Communities, Port survey area

FCT / Mosaic / Community	Conservation Significance Ranking (Woodman Environmental in prep.)	Total Area within Port Survey Area (ha)	Total Area of Proposed Impact (ha)	Percentage of total area Proposed to be Impacted	Ranking of Local Impact (Table 4)
1/2	1	1011.6	203.6	20.1	Moderate
2	1	56.9	43.4	76.3	High
3	4	10.3	2.0	19.4	Moderate
4	2	309.8	9.3	3.0	Low
5	2	362.6	63.4	17.5	Moderate
10	1	56.5	0.6	1.1	Low
11	1	62.7	1.3	2.0	Low
11/5	1	95.3	4.6	4.8	Low
12	1	205.4	41.4	20.1	Moderate
C	-	45.9	1.8	3.9	-
W	-	34.0	8.2	24.2	-
Total	-	2251.0	379.6	16.9	Moderate

Although FCT 2 has been ranked ‘High’ in terms of the local impact (76.4 % of the mapped area is proposed to be impacted), a large portion of this FCT was also mapped as a mosaic with FCT 1 (‘1/2’), and therefore this lessens the overall impact to this

FCT. The percentage of proposed impact to all other FCTs and communities is less than 20.1 % of the total mapped area.

A total of four vegetation system associations occur within the Port survey area, of which three are proposed to be impacted by Port proposal. Table 11 presents the vegetation system associations to be impacted, the current extent of each and the extent of clearing proposed. The clearing will not take the current extent (2007 data) of any of these vegetation system associations to below the 30 % pre-european threshold level.

Table 11: Proposed Impact to Vegetation System Associations (Department of Environment and Conservation 2007), Port survey area

Vegetation System Association	Description	Current Extent (ha)	Pre-European Extent Remaining (%)	Extent Proposed to be Impacted (ha)
Abydos Plain 43	Low forest; mangroves (Kimberley) or thicket; mangroves (Pilbara)	179,517	82.8	8.5
Abydos Plain 127	Bare areas; mud flats	719,966	96.9	98.4
Abydos Plain 589	Mosaic: Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex	809,636	99.9	0
Abydos Plain 647	Hummock grasslands, dwarf-shrub steppe; Acacia translucens over soft spinifex	196,371	100.0	267.0

4. Discussion and Conclusions

The known locations of two conservation significant flora taxa are proposed to be impacted: *Eragrostis crateriformis* (P3) (one of two known locations) and *Tephrosia rosea* ?var. *venulosa* (P1) (five of six known locations). The habitat area of all six conservation significant flora taxa known from the Port survey area will be impacted. There will be a Low local impact to one taxon (*Gomphrena pusilla* (P3)); a Moderate local impact to a further four taxa (*Eragrostis crateriformis* (P3); *Gomphrena leptophylla* (P3); *Goodenia nuda* (P3) (if this taxon does occur in the area) and *Gymnanthera cunninghamii* (P3). There will be a Moderate-High local impact to *Tephrosia rosea* ?var. *venulosa* (Table 7).

Overall, there will be a Low impact to the regional conservation status of all of these conservation significant flora taxa (Table 9).

A total of 16.9 % of the Port survey area is proposed to be impacted (379.6 ha). There is a Moderate local impact ranking to four FCTs and mosaics within the Port survey area: mosaic 1/2, and FCTS 3, 5 and 12, with the ranking of local impact on the other FCTs and communities being ranked Low (Table 10). The only FCT to be ranked a local conservation significance ranking of ‘4’ was FCT 3 (Woodman Environmental in prep.): this FCT has been mapped over a relatively small area; contains the conservation significant taxon *Gomphrena pusilla* (P2); and is on a relatively uncommon landform type (coastal limestone ridge). There are other examples of the limestone ridge formation to the north of the Port survey area, however they are outside of the survey area.

The proposed impacts will not reduce the vegetation system associations of the survey area to below the 30 % pre-european extent threshold level (Table 11).

5. Recommendations

The following recommendations are given:

- The extent of clearing within FCT 3 be reduced as far as practicable;
- A suitable weed hygiene plan be implemented to prevent the further encroachment or movement of current locations of introduced flora through the survey area.

6. References

Department of Environment and Conservation (2007a)

CAR Reserve Analysis 2007. Supplied by the Department of Environment and Conservation.

Woodman Environmental Consulting Pty Ltd (in prep.)

North West Iron Ore Alliance Port Project Flora, Vegetation and Mangal Studies. Unpublished report (CE11-19-01), for Coffey Environments, in preparation 2011.

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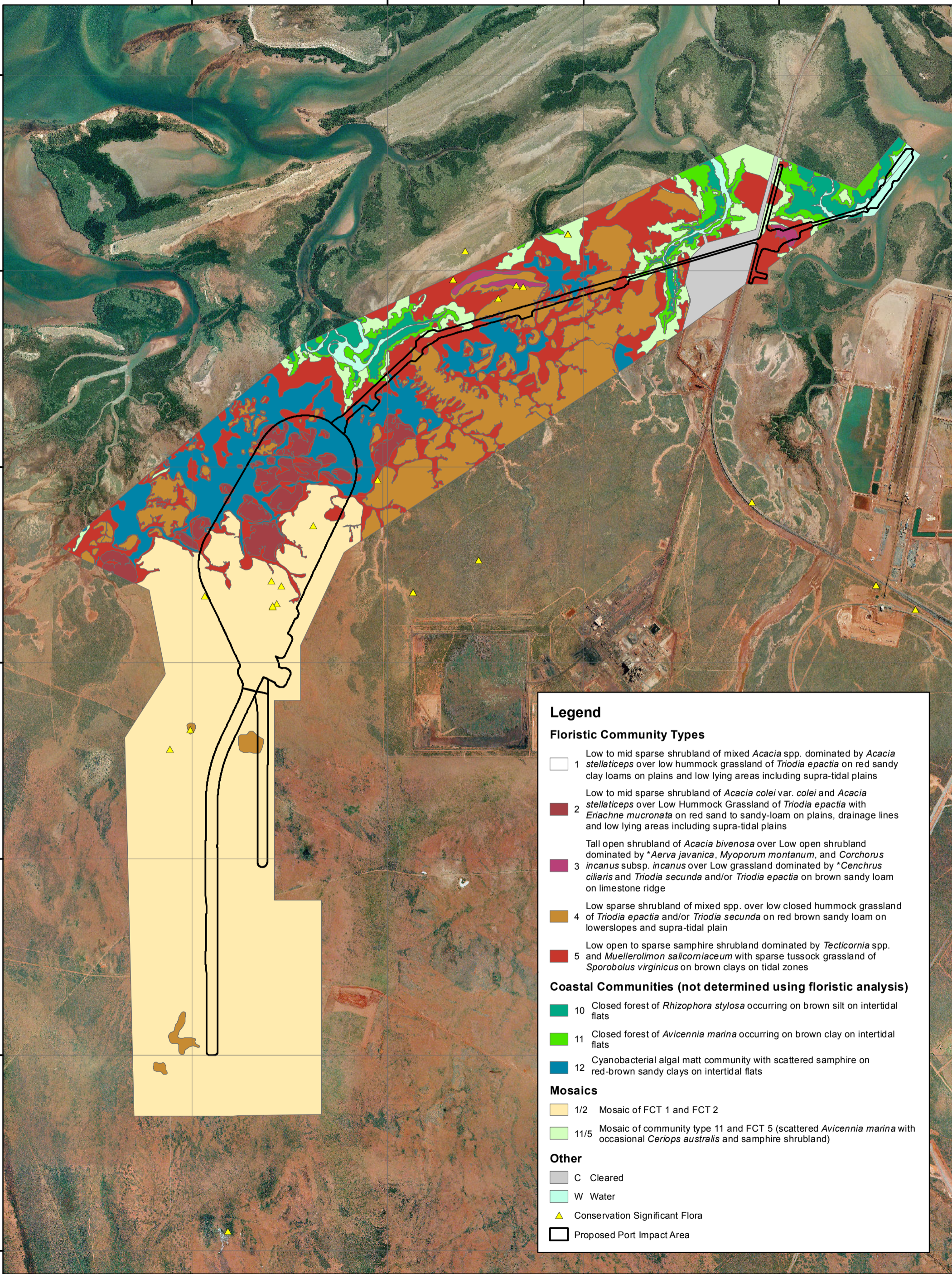
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Legend

Floristic Community Types

- 1 Low to mid sparse shrubland of mixed *Acacia* spp. dominated by *Acacia stellaticeps* over low hummock grassland of *Triodia epactia* on red sandy clay loams on plains and low lying areas including supra-tidal plains
- 2 Low to mid sparse shrubland of *Acacia coleii* var. *coleii* and *Acacia stellaticeps* over Low Hummock Grassland of *Triodia epactia* with *Eriachne mucronata* on red sand to sandy-loam on plains, drainage lines and low lying areas including supra-tidal plains
- 3 Tall open shrubland of *Acacia bivenosa* over Low open shrubland dominated by *Aerva javanica*, *Myoporum montanum*, and *Corchorus incanus* subsp. *incanus* over Low grassland dominated by *Cenchrus ciliaris* and *Triodia secunda* and/or *Triodia epactia* on brown sandy loam on limestone ridge
- 4 Low sparse shrubland of mixed spp. over low closed hummock grassland of *Triodia epactia* and/or *Triodia secunda* on red brown sandy loam on lowerslopes and supra-tidal plain
- 5 Low open to sparse samphire shrubland dominated by *Tecticornia* spp. and *Muellerolimon salicorniaceum* with sparse tussock grassland of *Sporobolus virginicus* on brown clays on tidal zones

Coastal Communities (not determined using floristic analysis)

- 10 Closed forest of *Rhizophora stylosa* occurring on brown silt on intertidal flats
- 11 Closed forest of *Avicennia marina* occurring on brown clay on intertidal flats
- 12 Cyanobacterial algal matt community with scattered samphire on red-brown sandy clays on intertidal flats

Mosaics

- 1/2 Mosaic of FCT 1 and FCT 2
- 11/5 Mosaic of community type 11 and FCT 5 (scattered *Avicennia marina* with occasional *Cerriops australis* and samphire shrubland)

Other

- C Cleared
- W Water
- ▲ Conservation Significant Flora
- ▭ Proposed Port Impact Area



**NWIOA Port Study Area
Proposed Impact Area**

Revision: A - July 2011

Author: Cathy Godden
 WEC Ref: Coffey11-19-02
 Filename: Coffey11-19-02-f01.mxd

Scale: 1:35,000 (A3) Grid: MGA Zone 50

Figure

1

This map should only be used in conjunction with WEC report Coffey11-19-02.