Your ref: Byford Rail Extension
Our ref: 12532927

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Public Transport Centre
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Byford Rail Extension – Additional Floristic Community Analysis

Dear John

1. Introduction

1.1 Background

The Public Transport Authority of Western Australia (PTA) is proposing to develop the Byford Rail Extension (BRE) Proposal (the Proposal) as part of the Western Australian Government's METRONET vision. The BRE extends the existing electrified passenger rail network 8 km from Armadale Station, 26 km southeast of Perth, to the proposed new Byford Station.

The PTA referred the Proposal to the Environmental Protection Authority (EPA) in September 2020. The EPA decided to assess the Proposal and set the level of assessment at Public Environmental Review, with a 2-week public review period. The EPA determined the Proposal would impact key environmental factors: Flora and Vegetation, Terrestrial Fauna, Inland Waters and Social Surroundings.

The PTA have commissioned a number of studies to gain an understanding of the flora and vegetation within and surrounding the Proposal. These include:

– Report for Rail Reserves in the Shire of Serpentine Jarrahdale, Spring Flora and Vegetation Survey and Fauna and Habitat Assessment (GHD 2012)
– METRONET – Byford Extension Part One Flora and Fauna Assessment (AECOM 2020)
– Environmental Advice Armadale Train Line Platform and Signalling Upgrade Program (Aurora 2020)
– Byford Rail Extension Flora and Vegetation Assessment (GHD 2021).

These assessments were reviewed and relied upon to prepare the Flora and Vegetation chapter of the Environmental Review Document (ERD) for the Proposal.

The ERD and supporting assessments for the Proposal were published on the EPA website for public submissions between the 3 and 17 May 2021. The Department of Biodiversity, Conservation and Attractions (DBCA) submitted comments (DBCA 2021) which included a review of and advice on the Floristic Community Analysis (FCT) completed by GHD (2021). Following written and verbal correspondence between the PTA, DBCA and GHD it was agreed GHD review the FCT results based on DBCA guidance/interpretations outlined in DBCA (2021) and to undertake additional analysis for selected quadrats to further elucidate FCT relationships.

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1.2　Scope of work and purpose of this letter

The scope of work as determined by the PTA, DBCA and GHD was to:

– Update FCT mapping based on DBCA advice for quadrats BRE01, BRE02, and BRE05
– Undertake further statistical analysis of quadrats BRE07, BRE17 and BRE19 removing all weeds from the analysis
– Update/complete FCT mapping based on the results of quadrats BRE07, BRE17 and BRE19 and considering the DBCA advice.

This letter presents the methods and results of the above outlined scope of works. This letter should be read in conjunction with GHD (2021) and with reference to DBCA (2021).

1.3　Limitations and assumptions

This letter has been prepared by GHD for the PTA and may only be used and relied on by the PTA for the purpose agreed between GHD and the PTA as set out in section 1.2 of this letter. GHD otherwise disclaims responsibility to any person other than the PTA arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this letter were limited to those specifically detailed in this letter and are subject to the scope limitations set out in the letter.

The opinions, conclusions and any recommendations in this report are based on information reviewed and assumptions made by GHD at the date of preparation of the letter and those outlined in DBCA (2021). GHD disclaims liability arising from any of the assumptions being incorrect and has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the letter was prepared.

2.　Methodology

Species lists from GHD quadrats BRE07, BRE17 and BRE19 were extracted and used in the below described analysis. These quadrats were sampled as part of GHD (2021), which assessed a vegetation and flora survey area (referred to as the survey area) approximately 9 km long and covering 213.33 ha.

Based on DBCA guidance (Val English, pers. comm.) single site insertion was completed for GHD quadrats BRE07, BRE17 and BRE19 using two datasets, the Gibson *et al.* (1994) dataset (referred to as the Gibson Dataset) and the Keighery *et al.* (2012) dataset (accessed through *NatureMap* (DBCA 2021), referred to as the Keighery Dataset). PATN software was used to conduct the analyses. Presence/absence matrices that excluded weed taxa and singletons were compiled for the three GHD quadrats and the dissimilarity between quadrats was determined using the Bray-Curtis measure. A Cluster analysis (using Agglomerative Hierarchical Fusion, flexible unweighted pair-group mean average) was also undertaken using the Bray-Curtis matrix and results presented as a dendrogram.

Following the analyses, the FCT mapping provided in GHD (2021) was reviewed and updated based on the DBCA interpretations, further examination of aerial imagery and consideration of degraded vegetation (based on advice provided by DBCA, pers. comm.).

3.　Results

3.1　DBCA interpretation

The DBCA has provided the following FCT analysis interpretations based on the results presented in Table 13 of GHD (2021). Advice provided by the DBCA indicate that similarity indices for the FCTs that have closest affinity to the quadrats are the most effective way in elucidating the most logical FCT assignments.

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Other typical habitat features such as soil and landform, and hydrological status of quadrats should also be compared, as well as 'typical' floristics and structure of the FCT as defined by Gibson *et al.* (1994). However, the statistical results, particularly similarity indices should be relied upon where logical conclusions can be drawn (DBCA, pers. comm.).

Table 1 outlines DBCA's recommended FCT assignments where alignment with that proposed by GHD differed.

Table 1   FCT analysis interpretations (from DBCA 2021)

Quadrat	GHD FCT alignment (GHD 2021)	DBCA FCT alignment
BRE01	FCT 3a	FCT 3b
BRE02	FCT 3a	FCT 3b
BRE05	FCT 3a	FCT 3b
BRE07	FCT 3a	FCT 3c
BRE17	FCT 6 (inconclusive)	FCT 3c
BRE19	FCT 3a	FCT 3c

3.2   Floristic analyses

The floristic analyses outputs for GHD quadrats BRE07, BRE17 and BRE19 excluding weeds are presented in Attachment 1 and interpreted below.

3.2.1   GHD quadrat BRE07

Initial results when analysed against the Gibson and Keighery datasets (as presented in GHD (2021) and reproduced in Table 2 below) showed BRE07 had greatest similarity with quadrats from FCT 25, 3c, 3b and 6. This quadrat was located in a strip of degraded vegetation, and the presence of FCT 6 in the top similarities suggests that weeds may be influencing/hiding the underlying FCT. Quadrat BRE07 was re-analysed against both the Gibson and Keighery datasets excluding weeds (Table 3). The results indicate greatest similarities with FCTs 3a, 3c, 25 and 20b. The highest similarity for the Gibson dataset was FCT 3a and FCT 25 for the Keighery dataset. FCT 25 is centred on the Spearwood and Quindalup systems and encompasses *Eucalyptus gomphocephala – Agonis flexuosa* woodlands; this is not considered a logical conclusion. Considering the results presented in Table 2 (analysis including weeds) and Table 3 (analysis excluding weeds) it seems logical to conclude that the vegetation in this area is likely to represent a transition between FCTs 3a and 3c.

The vegetation located west of the railway line and within the rail corridor (both west and east) in the vicinity of BRE07 is considered to represent FCT 3a. Quadrat BRE07 is likely located in an ecotone (transition zone), with vegetation transitioning from FCT 3a to FCT 3c at this location.

3.2.2   GHD quadrat BRE17

Initial results when analysed against the Gibson and Keighery datasets (as presented in GHD (2021) and reproduced in Table 2 below) showed BRE17 had greatest similarity with quadrats from FCT 3c, 6, 20c and 3a. This quadrat is located in a narrow strip of vegetation (<20 m wide) within the rail corridor on the western side of the rail line. Vegetation south of this quadrat (and represented by BRE16) is in better condition (rated Good) and shows greatest similarity with FCT 3a. When Quadrat BRE17 was re-analysed against both the Gibson and Keighery datasets excluding weeds (Table 3), it showed greatest similarity to FCT 3c. While removing weeds have demonstrated it is most similar to 3c, the percentage similarities are low, being 25% or less. Based on the analyses it would be logical to conclude the patch of vegetation represented by BRE17 is likely to have previously represented FCT 3c. However, due to the degraded condition of the vegetation and ongoing direct impacts from disturbances such as weeds and vegetation

maintenance/pruning altering the vegetation structure through removal of the overstorey, it was concluded the vegetation represented by BRE17 no longer represents an extant example of FCT 3c.

3.2.3   GHD quadrat BRE19

Initial results when analysed against the Gibson and Keighery datasets (as presented in GHD (2021) and reproduced in Table 2 below) showed BRE19 had greatest similarity with quadrats from FCT 3c, 6 and 3a. This quadrat is located in a narrow strip of vegetation (<20 m wide) within the rail corridor on the eastern side of the rail line. When Quadrat BRE19 was re-analysed against both the Gibson and Keighery datasets excluding weeds (Table 3), it showed greatest similarity to FCT 3c as well as FCT 11, 20c and 3a. Based on the analyses and DBCA's recommended FCT assignments, it is logical to conclude the vegetation represented by BRE19 is likely to represent FCT 3c.

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Table 2 *Summary of floristic analysis for quadrats BRE07, BRE17 and BRE19 as presented in GHD (2021) (by individual quadrat, single site insertion, including weeds)*

Quadrat	Single Site Insertion (Gibson Dataset)				Single Site Insertion (Keighery Dataset)				Final Determination (from GHD 2021)
	Similarity	FCT	SCP Q	Dendrogram	Similarity	FCT	SCP Q	Dendrogram	
BRE07 VC: D	28.99%	3c	talb4	Clustered with quadrats from 3a. Part of a larger clade with quadrats from FCT 3a.	30.77%	25	much04	Clustered with quadrats from 3c. This was part of a larger clade with quadrats from FCT 3a.	**FCT 3a** Part of clade with FCT 3a. DBCA database mapping over area is 3a.
	27.91%	3b	card12		29.41%	3c	talb1		
	26.92%	6	card4		28.92%	3b	card12		
BRE17 VC: D	28.57%	3c	DUCK-2	Clustered with quadrats from FCT 6. Part of a larger clade with quadrats from FCT 6.	30.30%	3c	DUCK-2	Clustered with two quadrats from 3a. Part of a larger clade with quadrats from FCT 5, 6 and other FCTs.	**FCT 6 / inconclusive**
	28.00%	6	card4		27.78%	20c	talb6		
	27.03%	20c	talb6		25.58%	3a	m5306		
BRE19 VC: G	31.25%	3c	talb4	Clustered with quadrats from 3c. Part of a larger clade with quadrats from FCT 3a, 3b and 3c.	33.33%	3c	talb4	Clustered with quadrats from 3c. Part of a larger clade with quadrats from FCT 3a, 3b and 3c.	**FCT 3a** Part of clade with FCT 3.
	30.51%	3c	WATER-3		32.00%	6	card4		
	30.14%	3a	BRIX-2		31.88%	3a	Punr02		

Table 3 *Summary of additional floristic analysis quadrats BRE07, BRE17 and BRE19 (by individual quadrat, single site insertion, excluding weeds)*

Quadrat	Single Site Insertion (Gibson Dataset)				Single Site Insertion (Keighery Dataset)				Final Determination
	Similarity	FCT	SCP Q	Dendrogram	Similarity	FCT	SCP Q	Dendrogram	
BRE7 VC: D	31.33%	3a	lamb2	Clustered with quadrats from FCT 3a. Part of a larger clade with quadrats from FCT 3a.	33.33%	25	mulch04	Clustered with quadrat a from FCT 3c. Part of a larger clade with quadrats from FCT 3a.	**FCT 3a/3c** Quadrat likely in an ecotone (transition zone) between FCT 3a and 3c.
	30.19%	3c	talb4		32.73%	3c	talb4		
	27.12%	20b	card8		30.95%	3a	lamb2		
BRE17 VC: D	22.64%	3c	talb4	Clustered with quadrats from FCT 6. Part of a larger clade with quadrats from FCT 3c.	25.00%	3c	Duck-2	On own clade. Part of a larger clade with quadrats from FCT 3c and S15.	**FCT 3c** Not considered TEC due to degraded condition (not extant example of community).
	22.22%	3a	lamb1		22.22%	3c	talb4		
	21.05%	3c	Duck-2		21.54%	3a	brick6		
BRE19 VC: G	29.17%	3c	talb4	Clustered with quadrats from FCT 6 and 11. Part of a larger clade with quadrats from FCT 3c and 1b.	32.00%	3c	talb4	On a clade with a quadrat from FCT 11. Part of a larger clade with quadrats from FCT 3c, 5 and 11.	**FCT 3c** Mixed results, but most similar to FCT 3c.
	28.57%	11	rowe01		28.17%	20c	Rush01		
	24.56%	3a	waro06		28.00%	3c	Duck-1		

Abbreviations: VC = Vegetation Condition, G = Good and D = Degraded.

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3.3   Updated FCT mapping

GHD has updated the FCT mapping provided in GHD (2021) based on the DBCA interpretations and the additional floristic analysis completed for selected quadrats. A summary of the vegetation types and FCTs present in the survey area is provided in Table 4. Updated mapping of FCTs within the GHD (2021) flora and vegetation survey area is present in Attachment 2.

Table 4   Summary of vegetation types and SCP FCTs

Vegetation type	FCT alignment	Area (ha)
VT01	**FCT 3a, 3b and 3c.** This vegetation type contains all FCT 3 subgroups based on the floristic analyses and DBCA's FCT assignments. **FCT 3a:** Quadrats located in Lambert Lane Nature Reserve and the rail corridor (BRE08, BRE12, BRE13 and BRE16) had greatest similarity with quadrats from FCT 3a. Based on GHD interpretation (2021) and DBCA's quadrat assignments, FCT 3a is located in Lambert Lane Nature Reserve, the western part of Fletcher Park and along the rail corridor. Quadrat BRE07 located in Fletcher Park is likely to represent a transition between FCTs 3a and 3c. While this quadrat has been assigned FCT3a/3c it is located in an area mapped as FCT 3a. **FCT 3b:** Quadrats located in the eastern part of Fletcher Park (BRE01, BRE02 and BRE05) had greatest similarity with quadrats from FCT 3b. Based on DBCA's quadrat assignments, one patch of FCT 3b is present within the survey area. **FCT 3c:** Quadrat BRE19 located within the rail corridor on the east side of the railway line had greatest similarity with quadrats from FCT 3c. The area represented by this BRE19 is mapped as FCT 3c. There is one patch of FCT 3c present within the survey area.	FCT 3a: 14.03 FCT 3b: 2.14 FCT 3c: 0.65 Total: 16.82
VT03	**Does not align with SCP FCTs.** BRE quadrats from VT03 have low affinities to SCP quadrats and do not logically align with any SCP FCTs. This result is supported by single site insertion analyses	1.70
VT04	**Does not align with SCP FCTs.** BRE quadrats from VT04 have low affinities to SCP quadrats and do not logically align with any SCP FCTs. This result is supported by single site insertion analyses.	3.91
VT05	Vegetation type represents modified vegetation and no quadrats sampled. No analyses undertaken.	0.08
VT06	**Does not align with SCP FCTs / No longer represents an extant example of FCT 3c** Vegetation type represents modified vegetation and limited quadrats sampled. One quadrat, BRE17 showed the greatest similarity to FCT 3c. However, due to the degraded condition of the vegetation represented by this quadrat and ongoing direct impacts from disturbances such as weeds and vegetation maintenance/ pruning altering the vegetation structure through removal of the overstorey, it was concluded the vegetation represented by BRE17 no longer represents an extant example of FCT 3c.	12.95
VT07	Vegetation type represented planted vegetation and no quadrats sampled. No analyses undertaken.	20.91
VT08	Vegetation type represented planted vegetation and no quadrats sampled. No analyses undertaken.	12.05
VT09	Vegetation type represents modified vegetation and no quadrats sampled. No analyses undertaken.	2.39
Cleared	-	142.52
Total		**213.33**

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4.   Conclusions

The updated significant vegetation (FCT) mapping presented in this letter is based on the DBCA interpretations and further floristic analysis of selected quadrats sampled as part of GHD (2021). The updated mapping indicates the presence of three significant vegetation communities within the GHD (2021) flora and vegetation survey area, including:

– *Corymbia calophylla – Kingia australis* woodlands on heavy soils, Swan Coastal Plain (FCT 3a) TEC
– *Corymbia calophylla – Eucalyptus marginata* woodlands on sandy clay soils (FCT 3b) TEC
– *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands (FCT 3c) TEC.

Advice provided by the DBCA indicate that similarity indices for the FCTs that have closest affinity to assessed quadrats are the most effective way in elucidating the FCT assignments. Other considerations used to test the logic of the FCT assignment include typical habitat features such as soil and landform, hydrological status of quadrats, as well as 'typical' floristics and structure of the FCT as defined by Gibson *et al.* (1994) (DBCA, pers. comm.). DBCA advised where the condition of a sampled quadrat or patch of vegetation represented by the quadrat is in Degraded or worse condition, it is reasonable to conclude it would no longer represent an extant example of the community (Val English, pers. comm.).

GHD notes the updated significant vegetation (FCT) mapping differs from data available in the DBCA Threatened and Priority Communities Database and included as part of the recovery plans for both FCT 3a and 3c (DEC 2011; English and Blyth 2000). The occurrences of FCT 3b, FCT 3c, and FCT 3a south of Thomas Road presented in this letter represent new locations/areas of these FCTs. The mapping of FCT 3a increases the current recorded occurrence of this FCT in the Lambert Lane Nature Reserve and Fletcher Park area, represented by occurrences 9, 10 and 11 in DEC (2011).

Regards

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Enc

cc: Drew Farrar, GHD, Manager – Environmental Assessment and Approvals

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References

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Attachment 1

Floristic Analyses outputs

Attachment 2

Figure of updated FCT mapping