LOWER FITZROY RIVER
INFRASTRUCTURE PROJECT

Appendix H

An Assessment of the Potential Implications on Native Vegetation and Terrestrial Ecosystems

SunWater
MAKING WATER WORK

Gladstone Area Water Board

Proposal for raising Eden Bann Weir and construction of Rookwood Weir

An Assessment of the Potential Implications on Native Vegetation and Terrestrial Ecosystems

Pre-feasibility study commissioned by
Department of Natural Resources and Water

for
Department of Infrastructure

Nangura E S

Queensland Government

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Cover photo: Melaleuca fringing woodland, Fitzroy R. near Glenroy Crossing courtesy of : C. James

This report has been prepared by the consultant for the purpose of providing information to the proponent of the proposed project. It does not represent government policy.

Executive Summary

This vegetation study examines the distribution and composition of fringing woodland and other native vegetation adjacent to parts of the Fitzroy, Dawson and MacKenzie Rivers in central Queensland. This work supports detailed environmental planning for the proposal to raise the Eden Bann Weir and construct a new Weir at the Rookwood site. Such detail was not currently available through Government vegetation datasets which are based on 1:100,000 scale mapping.

The study involved an extensive vegetation survey, preparation of vegetation mapping at a scale of 1:25,000 and assessment of significant flora species potentially relevant to the weir study areas. Habitat condition was assessed for each vegetation community within the weir study areas using a bio-condition analysis methodology. The assessment generated local benchmark values for a key subset of alluvial habitats. The bio-condition assessment was subsequently applied to 24 disturbed not-remnant areas of vegetation within or near the upper river bank that may represent potential habitat recovery areas that could be used to offset losses through inundation after weir construction.

The vegetation mapping produced a GIS layer of Regional Ecosystems (RE) for each weir impoundment and these are included as a series of 16 A3 mapping sheets at 1:25,000. The survey data recognised numerous variations to the standard 1:100,000 RE mapping data produced by the Queensland Herbarium, with most of the variations relating to edges of the mapping units and reassignment of mapping unit labels resulting from more extensive on-ground sampling intensity.

A total of 240 plants were recorded with 10 being classed as rare or threatened under the *Nature Conservation (Wildlife) Regulation 2006*. Only one of these species, *Eucalyptus raveretiana-(vulnerable)* was found to have populations that would be directly impacted by the proposed weir developments. Up to 100 individual *Eucalyptus raveretiana* plants may be affected at maximum inundation levels. The 1:25,000 mapping for both weirs suggests that one hectare of an Endangered RE (brigalow) would be affected at proposed maximum levels, along with 225 hectares of Of Concern RE's and a further 1677 hectares of riverine and alluvial Regional Ecosystems listed as Not of Concern. The alternative EPA bio-status classification suggests that 1908 hectares of Of Concern RE's would be inundated at maximum development levels

The mapping of remnant vegetation above predicted Full Supply Level (FSL) for the weirs indicates the potential extent of impacts on riverine and alluvial ecosystems at the landscape scale. Remnant vegetation losses (Endangered and Of Concern RE taking into consideration both VMA status and EPA biostatus) include: Eden Bann 18.5m AHD FSL=449.5ha; Eden Bann 20.5m AHD FSL=740ha; Rookwood 47m AHD FSL=847ha; Rookwood 49m AHD FSL=1168ha. Narrowing of corridors, further fragmentation of many small remnants along with breakdown of existing linkages, and localised loss of ecosystem diversity will all result from inundation to FSL.

The bio-condition analysis found no sites for any habitat in near-pristine condition yet did conclude that roughly one third of sites were in relatively good condition for the 2006 landscape along the lower Fitzroy alluvial areas. Another third of the bio-condition sampling sites rated as having 'average' condition, and frequently included some weeds in the ground layers and other de-valuing impacts that possibly relate to recent grazing regimes and/or past logging activities. The proximity of extensive areas of cleared alluvial plain reduced the bio-condition score averages across most of the study area.

The bio-condition assessment of the not-remnant regrowth areas found that habitat elements essential for long term recovery were lacking or highly degraded. The condition assessments suggest that many sites would be unlikely to recover rapidly without management support that may include fencing to control grazing pressure, revegetation, artificial nest boxes, weed management and other site specific measures.

Preliminary investigations into potential vegetation management offsets identified (for the not-remnant regrowth on alluvial areas near the respective weir proposals) up to 474ha at Eden Bann 20.5m AHD FSL and up to 370ha at Rookwood 49m AHD FSL. The suitability and adequacy of these offsets will need to be determined and negotiated at the development approval stage, based on the offset policy and development assessment code applicable at the time.

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Definitions and Acronyms

AMTD – adopted mean thread distance (linear measure upstream from the river mouth)
API - air photo interpretation
ArcGIS – commercial software for GIS mapping
ASL – above mean sea level (see also FSL)
Bio Status – status of regional ecosystems as considered by the EPA for planning purposes
DEH – Commonwealth Department of Environment and Heritage
dbh – diameter at breast height (used as a simple measure of a tree's size)
E (for regional ecosystems) - as defined by the VMA and also followed in the Bio Status
E (for significant fauna and flora species) - as defined by the NCA and also by the EPBC
EB – code prefix for vegetation survey sites from field work relating to this report
EPA – Queensland's Environmental Protection Agency
EPBC – Commonwealth Environmental Protection and Biodiversity Conservation legislation
EVR – endangered, vulnerable and rare as applied to significant flora and fauna species
FSL – full supply level; relates to the still water level of a full reservoir at the 'new' height
GDA94 – Geodetic Datum of Australia 1994 (a reference position for GIS mapping procedure)
GHD – Consultancy supplier of earlier project material for planning of these weirs
GIS – geographic information system (a modern computerised mapping procedure)
NCA – Queensland's Nature Conservation Act 1992 and subordinate legislation
NoC – Not of Concern as defined by the VMA and also followed in the Bio Status
NRW – Queensland's Department of Natural Resources and Water (previously **DNR**, **DNRM**)
OC – Of Concern as defined by the VMA and also followed in the Bio Status
Offset – refer to NRW's Offset Policy (see References)
R - (for significant fauna and flora species) - as defined by the NCA
RE – regional ecosystem as defined by the Queensland Herbarium
RMS – root mean square (a mathematical calculation used in the GIS mapping activity)
SEVT – semi-evergreen vinethicket. (a type of low thick scrubby vegetation)
UTM – Universal Transverse Mercator (method used in fitting curved surfaces onto flat maps)
V - (for significant fauna and flora species) - as defined by the NCA and also by the EPBC
VM Status – status of regional ecosystems listed in the VMA
VMA – Queensland's Vegetation Management Act, Regulation and subordinate legislation
WONS – weed of national significance

1.0 Introduction

The vegetation study area relates to two proposed impoundments for stretches of the Fitzroy River, and the lower sections of the Dawson River and MacKenzie River along with sections of adjoining tributaries (see Fig. 1 on page 18). These are located in the northern and western parts of the Fitzroy Shire in central Queensland and the impoundments commence on the Fitzroy River at AMTD 141.2km (Eden Bann) and 265.4km (Rookwood). The Eden Bann proposal defined by Keane (2004) includes the raising of an existing weir by 4m to 18.5m AHD full supply level (FSL) as stage 2 and an additional 2m with inflatable air bag to achieve a 20.5m AHD FSL as stage 3. Correspondingly, the Rookwood Crossing proposal involves construction of 14m structure to 47m AHD FSL and an additional air bag to achieve 49m AHD FSL (Keane 2004). The raised water levels of both storages will have a direct impact upon fringing remnant vegetation and related riverine ecosystems. The areal extent of any native vegetation impacts at both species and community level has not been clearly known in the past and has been identified in preliminary weir studies as being relevant to planning procedures (Hyder 1999).

The standard vegetation mapping currently available for the study area is the Queensland Herbarium's Regional Ecosystem (RE) mapping. At a scale of 1:100,000 this dataset is of limited use to the Lower Fitzroy Weir project's environmental planning requirements. Development of further detailed vegetation mapping (1:25,000) along with targeted searching for other significant flora values will enable more thorough consideration of this suite of environmental factors relating to the weir proposals.

This vegetation study was commissioned by the Department of Natural Resources and Water, to examine the remnant vegetation patterns to increase precision of the RE vegetation mapping . in areas affected by development of Rookwood Weir and raising of Eden Bann Weir. Additional effort was prescribed for significant species (flora) searches, habitat condition evaluation, and identification and scrutiny of disturbed sites adjacent to the potential edges of the new impoundments, where the existing disturbed vegetation may have long term habitat restoration potential but not yet match the current 70/50 thresholds required of remnant vegetation. These disturbed sites were considered in respect of their potential as 'offset' areas for designated habitat recovery in the event that forest and woodland re-establishment was supported by the respective land management regimes at each site/property.

2.0 Methodology

2.1 Air Photo Interpretation and Linework Preparation

Vegetation mapping follows the Queensland Herbarium methodology as outlined by Neldner *et al*. (2004). Colour aerial photography at 1:40,000 (1999-2004) was used in the air photo interpretation (API) procedure in conjunction with a Geoscope mirrored stereo viewer. The Air photographs were scanned at 400dpi and imported into ArcGIS 8.3 where they were registered to a 2001 'Spotpan' satellite image covering the combined vegetation study area. Each image transformation used a minimum of 9 control points and the RMS error was usually below 15 in the flat alluvial terrain and up to 27 in the hilly landscapes away from the river systems.

Mappable boundaries of the discernable vegetation mapping units were identified through the stereo viewer and thence scribed onto transparency film. The resulting linework was converted through on-screen digitising to create vegetation mapping polygons in a GIS layer conforming to GDA94 and projected to UTM zone 55. Polygon attributes were simplified to include a data field entry specific to project mapping outputs, with scores applied for source of linework and vegetation reliability. More recent satellite imagery (2005) was used to adjust the extent of remnant mapping units especially where vegetation had reduced in areal extent since the 1999 photography.

2.2 Field effort/traverses

Ground truthing of mapping units was achieved by 4x4 vehicle, quad, pedestrian and speedboat traverses to encompass both banks of the 3 major rivers with points at 0.5km to 4km spacing depending

upon property access opportunities and soil/weather conditions at the time. Location of vegetation sampling and bio-condition sites was also opportunistic where 'reasonable' quality remnants were encountered with an overriding bias to evenly spread the distribution of sites for each RE across the study areas. Vegetation assessment followed method outlined in Neldner *et al* (2004) with site data assembled in a CORVEG compatible database.

2.3 Bio-condition Assessment: Remnant REs and Non-remnant (offset areas)

Bio-condition analyses were applied to RE subtypes following methods outlined by Eyre *et al*. (2006b). Sites were sampled at selected locations representative of relevant RE subtypes (interim reference sites). Site data from field sheets were converted to bio-condition scoring values and processed in MS Excel spreadsheets to produce the benchmarking values for the RE subtypes that most directly related to the inundation areas. Calculation of benchmarking values follows Eyre *et al.* (2006a). Several scores were excluded from the benchmarking calculation for 'extreme' poorer sites where the score was greater than 10 points below the mean for respective RE subtype.

Disturbed habitat zones were identified during air photo interpretation and adjusted during subsequent field excursions. Primarily, disturbed habitat zones were located within the greater river bank, below the adjoining plain and they were either (a) not identified within any RE polygon in the Queensland Herbarium RE Mapping or (b) would not be considered mappable as remnant vegetation at 1:25,000 in this study. Small areas of 'disturbed' were omitted from this assessment as they were included within RE polygons and thus were technically considered remnant vegetation under the Vegetation Management legislation (VMA).

Benchmarking values for the Bio-condition analysis of riparian offset zones were derived from the subset of interim reference sites surveyed earlier across both weir study areas. Field observations for the various bio-condition attributes were recorded where the bio-condition benchmark score was not met on most occasions.

2.4 Rare and Threatened Flora

Searches for Endangered, Vulnerable and Rare (NCA and EPBC) flora records and other evidence of presence included: query of the Queensland Herbarium Herbrecs database, query of the EPA's Wildnet database for EVR Flora data for Shires Duaringa, Fitzroy and Livingstone. These species were filtered further with targeting of known EVR flora associated with the adjoining serpentinite landscapes, selected targeting of known vine thicket species potentially present within the surrounding district and otherwise selecting species potentially relating to the alluvial plains and riverine ecosystems of the study areas. On-ground searching for EVR species was conducted, with any relevant specimens sent to Queensland Herbarium as voucher specimens.

2.5 GIS processing and Digital Photography

ARCGIS 8.3 software was used for vegetation mapping, digitising spatial processing and map preparation. Inundation contours supplied by NRW were intersected with the vegetation layers for calculation of potentially affected vegetation areas at the respective alternate full supply levels. Site photography was performed with Fuji Finepix 6800, Kodak LS633 and Canon Power Shot A410 using 4 megapixel image capture and JPEG file types.

2.6 Nomenclature and Identification

Nomenclature for plant names follows Henderson (2002) with the *Eucalyptus*/*Corymbia* group following CSIRO (2006). Plant Identification was assisted by the Queensland Herbarium identification service and through general Queensland flora texts and other local area plant books including: **Euclid** (CSIRO 2006), **AusGrass** (Sharp and Bryan 2002), **Flora of SE Qld V1,2 &3** (Stanley and Ross 1980 -1995)**, Wetland Plants of Queensland** (Stephens and Dowling 2002)**, Grasses of Queensland** (Tothill and Hacker 1981)**, Plants of Central Queensland** (Anderson 1999)**, Plants of Central Queensland** (Pearson 1989)**,** local botanists and local plant enthusiasts.

3.0 Results and Discussion

Field Search Coverage
Field excursions through the Eden Bann and Rookwood study areas included a total of 38+ field days, looked at 135 vegetation plots and an additional 300 observational stops. These are complemented by 165 bio-condition sampling plots with a further 28 riparian offset zones being examined against their respective bio-condition RE benchmarks. Location of vegetation observational sites and bio-condition sites is presented in Map 17 and Map 18 in Attachment 2.

3.1 Vegetation Distribution: Regional Ecosystems

The distribution of remnant vegetation within the respective weir study areas is presented as RE mapping units in a series of A3 maps at 1:25,000 (Maps 1-16 in Attachment 2). The following table summarises the RE mapping units and respective RE subtypes identified as being proximal to the inundation zones, on adjacent alluvial lands and in surrounding landscape generally.

Table 1 Regional Ecosystems of the Lower Fitzroy Weirs Study Area

RE	SHORT DESCRIPTION	VMA Status	EPA Bio-Status
Weir Inundation Zones			
11.3.1	Open forest dominated by *Acacia harpophylla* and/or *Casuarina cristata on alluvial plains.*	Endangered	Endangered
11.3.2	*Eucalyptus populnea* woodland on alluvial plains.	Of Concern	Of Concern
11.3.3 11.3.3c	*Eucalyptus coolabah* woodland with grassy understorey on alluvial plains.	Of Concern	Of Concern
11.3.4	*Eucalyptus tereticornis* grassy woodland on alluvial soils.	Of Concern	Of Concern
11.3.25	*Eucalyptus tereticornis* and E. *camaldulensis* fringing woodland. Includes subsets 25a, 25b, 25c, 25e, 25h.	Not of Concern	Of Concern
11.3.25f	Various *Melaleuca* species and may include *Callistemon sp*. in river channels.	Not of Concern	Of Concern
Other Adjacent Alluvial Areas			
11.3.6	*Eucalyptus melanophloia* woodland on alluvial plains with a grassy ground layer	Not of Concern	Of Concern
11.3.9	*Eucalyptus platyphylla, Corymbia spp*. woodland on alluvial plains	Not of Concern	no concern
11.3.11	Semi-evergreen vine thicket or semi-deciduous notophyll rainforest on alluvial plains	Endangered	Endangered
11.3.27	Freshwater wetlands with variable vegetation including open water with or without aquatic species and fringing sedgelands and Eucalypt woodlands	Not of Concern	Of Concern
11.3.30	*Eucalyptus crebra, Corymbia dallachiana* woodland on alluvial plains with grassy understorey	Not of Concern	No concern
11.3.38	*Eucalyptus tereticornis, Corymbia tessellaris,* and *C. dallachiana* tall grassy woodland on alluvial plains and magnetite deposits	Endangered	Endangered
RE's from the Surrounding Landscape			
Most of the following RE's do not directly connect with the inundation zones but are included as they are recorded as remnant vegetation in the surrounding landscape on the attached vegetation mapping sheets.			
11.4.1	Semi evergreen vine thicket ± *Casuarina cristata* on Cainozoic clay plains	Endangered	Endangered
11.4.2	*Eucalyptus spp.* and/or *Corymbia spp*. grassy or shrubby	Of Concern	Of Concern

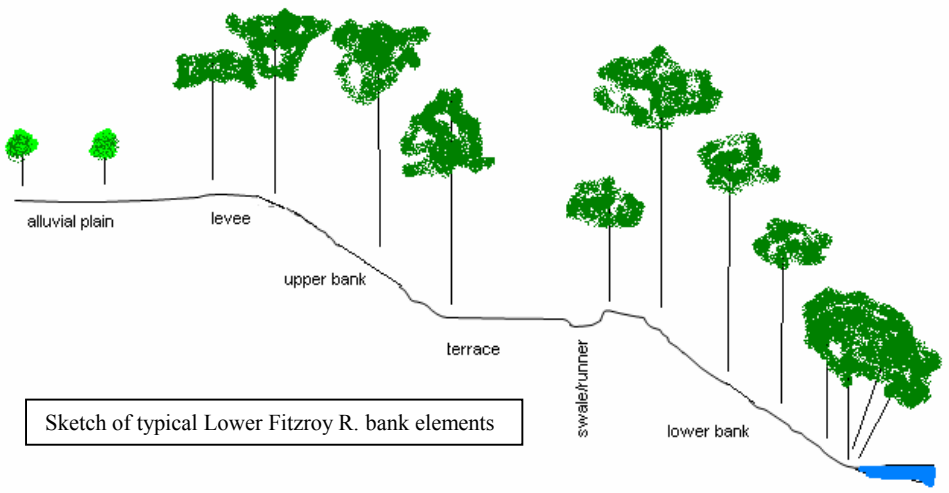
RE	SHORT DESCRIPTION	VMA Status	EPA Bio-Status
	woodland on Cainozoic clay plains		
11.4.3	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains	Endangered	Endangered
11.4.8	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains	Endangered	Endangered
11.4.9	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains	Endangered	Endangered
11.5.2	*Eucalyptus crebra +/- Corymbia spp* and *E. moluccana* on lower slopes of Cainozoic sand plains/remnant surfaces	Not of Concern	no concern
11.5.9	*Eucalyptus crebra* and other *Eucalyptus spp*. and *Corymbia spp*. woodland on Cainozoic sand plains/remnant surfaces	Not of Concern	no concern
11.7.2	*Acacia spp*. woodland on lateritic duricrust	Not of Concern	no concern
11.7.4	*Eucalyptus decorticans* and/or *Eucalyptus spp*., *Corymbia spp*., *Acacia spp., Lysicarpus angustifolius* on lateritic duricrust	Not of Concern	no concern
11.9.1	*Acacia harpophylla-Eucalyptus cambageana* open forest to woodland on fine-grained sedimentary rocks	Endangered	Endangered
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	Endangered	Endangered
11.9.9	*Eucalyptus crebra* woodland on fine-grained sedimentary rocks	Not of Concern	no concern
11.10.3	*Acacia catenulata* or *A. shirleyi* open forest on coarse-grained sedimentary rocks. Crests and scarps	Not of Concern	no concern
11.11.1	*Eucalyptus crebra* and/or *Acacia rhodoxylon* woodland on old sedimentary rocks with varying degrees of metamorphism and folding	Not of Concern	no concern
11.11.5	Microphyll vine forest ± *Araucaria cunninghamii* on old sedimentary rocks with varying degrees of metamorphism and folding	Not of Concern	no concern
11.11.7	*Eucalyptus fibrosa subsp. (Glen Geddes)* and *E. xanthope* woodland on serpentinite	Not of Concern	Of Concern
11.11.9	*Eucalyptus populnea* or *E. brownii* woodland on deformed and metamorphosed sediments and interbedded volcanics	Not of Concern	no concern
11.11.10	*Eucalyptus melanophloia* woodland on deformed and metamorphosed sediments and interbedded volcanics	Of Concern	Of Concern
11.11.14	*Acacia harpophylla* open forest on deformed and metamorphosed sediments and interbedded volcanics	Endangered	Endangered
11.11.15	*Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics over undulating plains.	Not of Concern	no concern
11.11.21	Semi-evergreen vine thicket on serpentinite	Of Concern	Endangered
11.12.1	*Eucalyptus crebra* shrubby to low woodland on igneous rocks	Not of Concern	no concern
11.12.2	*Eucalyptus melanophloia* woodland on igneous rocks, usually on undulating rises and hills, sometimes on lower colluvial slopes	Not of Concern	no concern
11.12.4	Semi-evergreen vine thicket with a sparse ground layer on low hills, ranges and boulder strewn slopes derived from various igneous rocks.	Not of Concern	Endangered

The RE mapping units follow the Queensland Herbarium's RE mapping and conform to the descriptions outlined in the REDD database (EPA 2005). Several of the alluvial RE's encountered during field efforts include RE's with multiple subtypes that have a strongly contrasting appearance. RE 11.3.25 in particular includes subtypes that vary from tall open eucalypt forests on upper river banks to open shrubby tea tree patches on sand banks in the wide river beds and both lacking many

common features that an untrained observer could use to connect them together as a single RE. However the rules of mapping at 1:25,000 require a minimum width of 25mtr and minimum size of 0.3ha to be observed. This has resulted in grouping all sub-types within their respective RE's in the mapping output excepting RE 11.3.25f (River channels: exposed stream bed and bars, water holes and open water). This subtype has been recognised in the mapping output to identify the extent of the sandy and rocky bars and to isolate the open water channels (over 35mtr wide) for presentation and for calculation of the area of RE's affected by inundation. Subtypes have been discussed and identified otherwise in the text, photo gallery and bio-condition analysis.

Vegetation mapping for the Dawson and adjacent areas was sourced from Pollock and Edginton (1999) who had applied a near identical method to achieve 1:25,000 scale in the Dawson River alluvials for an earlier project for Department of Natural Resources, Resource Management (Water Resource Allocation and Management). Additional vegetation mapping of remnant vegetation away from the immediate weir study areas was sourced from the current EPA RE mapping and is included on the attached vegetation mapping sheets to illustrate the landscape surrounding the two respective impoundments. We have applied small adjustments to the EPA RE mapping polygons on the edges of cleared lands where our 1:25,000 scale digital imagery supported any edge realignment. This is more of a cosmetic adjustment we have made for the purposes of presenting mapping that looks 'tidy' against a background satellite image within a GIS and is not offered as suggested changes to the EPA RE mapping data. Similarly a small area within Pollock and Edginton's mapping was also hollowed to reflect an apparent non-remnant state observed during field work. Again this is beyond the area of commission and is included for similar cosmetic purposes as stated above.

NOTE 1: RE 11.3.4 and RE 11.3.25e are difficult to distinguish in certain situations. Both units often have similar species composition and structural characteristics (commonly as *E. tereticornis* woodland) and the choice becomes confusing to some in the areas between the middle banks and adjoining alluvial plain. We have separated the units by the land element upon which the vegetation pattern was located with 11.3.4 interpreted to be present on older and relatively inactive terraces and higher river bank settings while 11.3.25e is typically found within active stream channels. The better examples of the *E. tereticornis* woodland community (RE11.3.4) within the upper river banks are located on the inside of larger sweeping bends at 'Weir Park', 'The Pocket', 'Glen Avon' and 'Redbank'.



Sketch of typical Lower Fitzroy R. bank elements

NOTE 2: Two small patches of RE 11.3.1 are recorded above the left bank near the Rookwood weir site and these communities could have been mapped by another team as 11.12.21 on the basis of the underlying geological unit. We have mapped it on the basis of the presence of alluvial soil, as an indicator of an upper level alluvial setting and the proximity to the adjoining 'coolabah gullies' that join both patches in the south and east. The maximum elevation of the patches also corresponds with the elevation of pre-clearing areas of 11.3.1 and 11.3.3 less than 1.5km away across the river to the west. Ironically the state and federal status for both 11.3.1 and 11.12.21 is Endangered so the choice of outcome is rather more academic than problematic.

3.2 Regional Ecosystem Descriptions

Status abbreviations: E – Endangered OC – Of Concern NoC – Not of Concern/no concern
VMA- Vegetation Management Status (VMA 1999) Bio - Biodiversity Status (EPA Qld)
Adapted from REDD database (EPA 2005), using site notes from field sites where available.

11.3.1 Brigalow/belah open forest on alluvial plains

Status: VMA – E Bio – E
Description: Open forest dominated by *Acacia harpophylla* and/or *Casuarina cristata*, with or without scatted emergent Eucalypts, sometimes with an extensive array of native grasses or introduced pasture species.
Structure formation range: Open forest/woodland
Tree/tall shrub layer: Emergents: 28mtr, Tree one layer: 8-10mtr, Tree two layer: 3-6mtr
Subdominant species: *Eucalyptus coolabah*
Shrub layer: Shrub height 4-5mtr, *Terminalia oblongata*
Ground layer: Height to <0.05mtr
Herbs/Forbs*: Eustrephus latifolius, Commelina ensifolia, Oxalis perennans, Atriplex muelleri, Capparis lasiantha*;
Ecological Notes: Typically found on upper banks, levees but predominantly and on alluvial plains.
Sites: EB330 – Riverslea, EB390 – Separation, EB595 – Weir Park

11.3.2 Poplar box woodland on alluvium

Status: VMA - OC Bio - OC
Description: *Eucalyptus populnea* woodland with an occasional distinct low tree layer, with a grassy ground layer.
Structure formation range: Woodland
Tree/tall shrub layer: 10-16mt
Subdominant species: *E. appererinja, Corymbia clarksoniana,* and *Eucalyptus coolabah.*
Shrub layer: 4-8mtr in height including; *Acacia fasciculifera* and A*cacia salicina*
Ground layer: 0.3mtr in height – affected by dry season at time of visit
Grasses: *Aristida sp*, *Chloris sp*, will also sometimes include *Bothriochloa decipiens.*
Ecological Notes: Will occur on alluvial plains with variable soil types including deep uniform clays and sometimes cracking clays. Occurring on high banks well above main flood channels, but may be occasionally flooded. Vulnerable to invasive pasture species such as *Cenchrus ciliaris*
Sites: Single site observed in upper section of Melaleuca Creek on levee, above inundation zone.

11.3.3 Coolabah woodland on alluvium

Status: VMA - OC Bio – OC
Description: *Eucalyptus coolabah* woodland, +/- *E. camaldulensis/E. tereticornis* with grassy understorey. A shrub/mid layer is often lacking or sparse, but the ground layer will be dominated by several native grasses or improved pasture grasses as observed in some sites.
Structure formation range: Woodland
Tree/tall shrub layer: 12-25mtr in height
Subdominant species: *Terminalia oblongata* and *Lysiphyllum hookeri* and may include; *M. bracteata* and *E. populnea*.
Shrub layer: 1-3mtr in height including; *Acacia farnesiana* and *Muehlenbekia florulenta*.
Ground layer: Height to 0.7mtr
Grasses: *Aristida ramosa, Bothriochloa decipiens*
Herbs/Forbs: *Marsilea drummondii, Malvastrum americanum,*
Others: *Cymbidium canaliculatum, Capparis lasiantha*
Ecological Notes: Several ground layer plants in this particular RE are seasonal and may be shown within the results as the sampling time were not optimal growing conditions. Many sites had a ground layer of *Megathyrsus maximus* or *Cenchrus ciliaris*. Typically on heavy black alluvial clay soils on higher banks and levees.
Sites: EB027 - Glenroy, EB034 – Coorumburra, EB358 – Fitzroy Pocket, EB388 – Separation, EB412 – Yarra.

11.3.3c Coolabah woodland in alluvial gullies and backwashes

Status: VMA - OC Bio - OC
Description: *Eucalyptus coolabah* woodlands with sedge/grass understorey in back swamps and old channels.
Structure formation range: Woodland to open-woodland
Tree/tall shrub layer: 23-26mt in height
Subdominant species: *E. tereticornis, E. camaldulensis, Lysiphyllum hookeri,* and *Acacia harpophylla.*
Shrub layer: 1-3mt in height; *Terminalia oblongata, Melaleuca bracteata, Alstonia constricta,* and *Atalaya hemiglauca.*
Ground layer: 0.2 to 0.6m in height
Grasses: *Aristida sp, Themeda triandra, Chloris gayana, Bothriochloa sp.*
Herbs/Forbs: *Eustrephus latifolius, Cyperus exaltatus, C. tuberosus.*
Others: *Cymbidium canaliculatum*
Ecological Notes: Found on Cainozoic alluvial plains or levees in flooded back swamps and old channels, soil is generally black clay or sometimes texture contrasting. Often in flooded ground but only seasonally inundated. Grassy understorey common, alternately a leafy ground cover remains present and few field sites were strongly influenced by introduced pasture species. *Parkinsonia aculeata* was occasionally present.
Sites: EB018 – Melrose, EB597 – Island Camp

11.3.4 Forest Red Gum Woodland on Alluvial Plains

Status: VMA - OC Bio – OC
Description: *Eucalyptus tereticornis* as dominant species with various other eucalypts present/locally dominant. A shrub layer is usually absent and frequently has a (tall) grassy ground layer.
Structure formation range: Woodland to Open forest
Tree/tall shrub layer: 20-30mtr in height
Subdominant species: *E. coolabah, Corymbia tessellaris, C. clarksoniana, Ficus racemosa var racemosa* and *E. populnea.*
Shrub layer: to 4mtr in height; *F. opposita, Planchonia careya, Cassia brewsteri ssp tomentosa* and *Diospyros humilis*
Ground layer: from 0.1 – 0.5mtr in height
Grasses: *Cynodon dactylon, Digitaria didactyla, Arundinella nepalensis,* and *Bothriochloa sp.*
Herbs/Forbs: *Eustrephus latifolius, Marsilea drummondii,* and *Solanum seaforthianum*
Ecological Notes: Mainly on deep cracking clays to fine textured soils. This RE is found on the upper banks, terraces and plains above water courses in alluvial soils. Commonly disturbed by grazing or historic logging. Introduced pasture species such as *Megathyrsus maximus var pubiglumis* have become dominant and this has impacted negatively on native grasses in many of the sites visited during this field work.
Sites: EB042 – Glen Avon

11.3.6 Silver-leaf ironbark woodland on alluvial plains

Status: VMA - NoC Bio – OC
Description: *Eucalyptus melanophloia* woodland on alluvial plains with a grassy ground layer.
Structure formation range: woodland to open woodland
Tree/tall shrub layer: 12-18mtr in height
Subdominant species: *E. populnea, E. crebra, Corymbia dallachiana,* and *E. tereticornis*
Shrub layer: 3-6mtr in height; *Callitris glaucophylla, Alphitonia excelsa, Lysicarpus angustifolius* and *Petalostigma pubescens*
Ground layer: 0.3-0.9mtr in height
Grasses: mostly open and dominated by perennial grasses.
Ecological Notes: Subject to several introduced grasses this RE is also subject clearing and thinning. Occurring in some areas on cracking clay soils on higher levees and alluvial plains, soils can be deep red and yellow loamy sand to light textured clays.
Sites: surrounding landscape

11.3.9 Poplar gum, Corymbia spp. woodland on alluvial plains

Status: VMA - NoC Bio – NoC at present
Description: *Eucalyptus platyphylla, Corymbia spp*. woodland on alluvial plains.

Structure formation range: Woodland
Tree/tall shrub layer: 20-30mtr in height
Subdominant species: *E. tereticornis, Lophostemon suaveolens, Eucalyptus acmenoides* and *E. drepanophylla*
Shrub layer:
Ground layer: 0.3-0.50mtr in height; Grasses: *Heteropogon contortus, Sorghum nitidum, Chrysopogon fallax, Alloteropsis semialata* and *Aristida holathera.*
Ecological Notes: May occur in wet depressions, and occurs generally close to major rivers, would rather a 'wet' influence and undergoes inundation frequently. Occurring on alluvial plains with a sandy surface and clay subsoil.
Sites: surrounding landscape

11.3.11 Semi-evergreen vine thicket on alluvial plains

Status: VMA - E Bio - E
Description: Semi-evergreen vine thicket or semi-deciduous notophyll rainforest on alluvial plains
Structure formation range: SEVT
Tree/tall shrub layer: Emergents ~30mtr in height, Canopy 12-18mtr in height
Subdominant species: Emergents: *Eucalyptus tereticornis* and *E. raveretiana;* Canopy: *Brachychiton australis, B. rupestris, Geijera salicifolia,* and *Lysiphyllum spp*
Shrub layer: 2-6mtr in height; *Diospyros humilis, Diospyros geminata,* and *Carissa ovata*
Ground layer: Herbs/Forbs: *Nyssanthes spp;*
Others*: Pachygone ovata, Cissus oblonga*, and *Jasminium didymium ssp*.
Ecological Notes: Occurs on Cainozoic alluvial plains.
Sites: EB330 – Riverslea, EB334 - Riverslea

11.3.25 Riverine open forest and woodlands

NB: Several subtypes of RE 11.3.25 were identified and processed as vegetation units and collectively mapped as a single mapping unit 11.3.25 except for sand banks and rocky bars which have been mapped as 11.3.25f. Open water has been excluded from this vegetation mapping unit simply for the purposes of the Lower Fitzroy Weir studies.

11.3.25a Black iron box woodland on alluvium

Status: VMA – NoC Bio – OC
Description: *Eucalyptus raveretiana* with a range of other tree and shrub species on alluvial soil in gullies and creeks.
Structure formation range: Woodland to open forest
Tree/tall shrub layer: Tree one layer: 25mtr, Tree two layer: 8mtr
Subdominant species: *E. tereticornis, E. coolabah, Casuarina cunninghamiana, Callistemon viminalis* and *Melaleuca trichostachya*.
Shrub layer: Shrub height: 1-3mtr, *Callistemon viminalis* and *M. trichostachya*. Often includes: *Acacia salicina*
Ground layer: Height to 0.1mtr
Grasses: *Digitaria didactyla, Bothriochloa sp*.
Herbs/Forbs: *Cyperus exaltatus*
Ecological Notes: Many patches of this particular RE is becoming over run with rubbervine (*Cryptostegia grandiflora*), - which also poses a future threat to the long term viability of the *E. raveretiana* population, especially on this extremity of its natural distribution.
Sites: EB346 – Yarra *<u>also</u>* Glenroy Creek but too narrow in width to reliably map.

11.3.25b Melaleuca leucadendra open forests fringing permanent water bodies and drainage gullies

Status: VMA - NoC Bio - OC
Description: *M. leucadendra* with or without *M. fluviatilis*, with various other canopy and shrub species and often a ground layer of short and tall grasses, matrush and sedges.
Structure formation range: Open forest to low woodland

Tree/tall shrub layer: 8-25mtr in height (Emergents to 35m)
Subdominant species: *Eucalyptus camaldulensis, E. tereticornis, Casuarina cunninghamiana,* and *Ficus racemosa var racemosa* and may include *Naucleua orientalis*
Shrub layer: 2-3mtr in height and will include; *M. trichostachya, Callistemon viminalis, F. opposita.*
Ground layer:
Grasses: *Chionachne cyathopoda, Digitaria didactyla, Cynodon dactylon,*
Herbs/Forbs: *Cyperus exaltatus, C. tuberosus, Commelina ensifolia,*
Ecological Notes: Black cracking clay alluvium, A variety of seasonal weeds were present including *Ricinus communis*, *Parkinsonia aculeata, Xanthium occidentale, Argemone ochroleuca*
Sites: EB014 – Redbank, EB302 – Weir Park, EB386 – Separation, EB563 – Slatey Creek

11.3.25c Forest Red Gum/River Red Gum woodland on soils derived from Serpentinite

Status: VMA - NoC Bio - OC
Description: *E. camaldulensis or E. tereticornis* fringing drainage lines derived from serpentinite.
Structure formation range: Open Forest to Woodland
Tree/tall shrub layer: 20-30mtr in height
Subdominant species: *Corymbia tessellaris, Melaleuca leucadendra, Casuarina cunninghamiana*, and *Callistemon sp.*
Shrub layer: 2 to 8mtr in height; *Ficus opposita, Alstonia constricta,* and *Melia azedarach*
Ground layer: to 0.6mtr in height Grasses: *Bothriochloa decipiens, Heteropogon contortus, Digitaria didactyla,* and *Arundinella nepalensis*
Ecological Notes: Soils derived from Serpentinite hills and slopes, particular environments are needed to create this particular RE and only two sites were documented. These sites are situated in Marlborough and Princhester Creeks, where waters have usually got high amounts of dissolved mineral substance from the surrounding environments. Meticulous habitat for the rare serpentinite callistemon species recognized to exist on Marlborough Creek. Few weed species were identified during searches including; *Emilia sonchifolia, Lactuca serriola, Stachytarpheta jamaicensis* and *Melinis repens.*
Sites: EB133 - Coorumburra

11.3.25e Forest Red Gum/River Red Gum woodland fringing permanent water courses

Status: VMA - NoC Bio - OC
Description: *Eucalyptus tereticornis or E. camaldulensis* fringing larger permanent water courses, in association with other fringing canopy covers, with a mixture of grass and herbs ground cover.
Structure formation range: Woodland to open forest
Tree/tall shrub layer: 25-28mtr in height
Subdominant species: *Corymbia tessellaris, Melaleuca leucadendra, Casuarina cunninghamiana, M. trichostachya, Ficus racemosa var racemosa,* and *Callistemon viminalis.*
Shrub layer: 1 to 4mtr in height; *Ficus opposita* and *Acacia salicina*
Ground layer: 0.1 – 0.7mtr in height
Grasses: *Themeda triandra, Arundinella nepalensis, Heteropogon contortus, Cynodon dactylon,* and *Chionachne cyathopoda.*
Herbs/Forbs: *Lomandra longifolia,* and *Oxalis perennans.*
Ecological Notes: Usually the upper banks of the river, generally the higher edge of the RE 11.3.25 polygon. Introduced pasture grasses such as *Megathyrsus maximus var pubiglumis* and *Cenchrus ciliaris* were frequently found to dominate particular RE, along with the occasional site possessing a localised abundance of *Parkinsonia aculeata* or the herbaceous weeds such as *Lactuca serriola* and *Argemone ochroleuca.*
Sites: EB007 – Redbank, EB142 – Homehill, EB300 – Weir Park, EB327 – Riverslea, EB387 – Separation, EB441 – The Pocket

11.3.25f Scattered Trees and Shrubs in River Channels

Status: VMA - NoC Bio - OC
Description: Any combination with or without of *Melaleuca leucadendra, Casuarina cunninghamiana, M. trichostachya* and *Callistemon viminalis* in river channels includes water holes and lagoons on sandy gravely substrate.

Structure formation range: Low woodland to open forest where tree species are present
Tree/tall shrub layer: 6-12mtr in height, usually void of emergent species
Shrub layer: Usually the shrub layer consist of low growing tree species such as the species listed in Subdominant species.
Ground layer: sparse but will include few species of native grasses and herbs/forbs
Ecological Notes: Several aquatic species may be abundant particularly in waterholes and pools.
Sites: EB158 – Redbank, EB170 – Southland, EB302 – Weir Park

11.3.25h Paperbark Teatree fringing permanent water courses and backwash gullies

Status: VMA - NoC Bio - OC
Description: *Melaleuca trichostachya* low woodland fringing water courses and backwash gullies with various other subdominant canopy species, with short grassy understorey with few shrub species.
Structure formation range: Low open forest or low woodland
Tree/tall shrub layer: 5-10mtr
Subdominant species: Appearing as emergent species to 25mtr; *Eucalyptus tereticornis, E. camaldulensis, M. leucadendra, Casuarina cunninghamiana,* occasional *E. coolabah.*
Shrub layer: Height to 2-5mtr; Ficus opposita
Ground layer: 0.3-1mtr in height
Grasses: *Bothriochloa decipiens,*
Herbs/Forbs: *Commelina ensifolia, Lomandra longifolia, Eustrephus latifolius, Sida cordifolia*
Ecological Notes: Mainly found on silty/loamy black alluvium, on the lower bank immediately adjacent to the water, or where water lies. Ground cover occasionally dominated by introduced pasture species such as *Megathyrsus maximus var pubiglumis* and *Cenchrus ciliaris* which out compete most native grasses and herbs.
Sites: EB143 – Homehill, EB156 – Redbank, EB301 – Weir Park, EB303 – Weir Park, EB411 – Yarra, EB596 – Island Camp

11.3.27 Freshwater wetlands on alluvial flood plains

Status: VMA - NoC Bio - OC
Description: Freshwater wetlands with variable vegetation including open water with or without aquatic species and fringing sedgelands and Eucalyptus woodlands.
Structure formation range: Various woodlands and grasslands on a variety of situations including lakes, billabongs, oxbows and depressions on floodplains.
Tree/tall shrub layer: Various
Subdominant species: A narrow fringing woodland is usually present, commonly dominated by; *Eucalyptus coolabah, E. tereticornis, E. camaldulensis.* Can be occasionally dominated by other species such as; *Acacia spp, and E. platyphylla,*
Shrub layer: Seldom present
Ground layer:
Grasses: Various grass species may be present depending on surrounding RE.
Herbs/Forbs: May have various aquatic species such as *Potamogeton sp, Chara spp,* and *Nitella spp.* And various sedges might be present within and fringing the water body
Ecological Notes: This RE is subject to trampling by large animals, and is occasionally impacted by modifications to hydrology due to the increased usage of irrigation and water extraction from the wetland or surrounding catchment. Important habitat for a diverse range of wetland land birds, and is significant habitat for the rare and threatened *Aponogeton queenslandicus.*
Sites: A single location visited solely to target *Aponogeton queenslandicus* but this site was insufficient in size to consider a mappable community.

11.3.30 Ironbark +/- Dallachy's ghost gum woodland on alluvial plains

Status: VMA - NoC Bio – NoC at present
Description: *Eucalyptus crebra, Corymbia dallachiana* woodland on alluvial plains with grassy understorey
Structure formation range: Woodland to tall woodland
Tree/tall shrub layer: 20-30mtr in height
Ground layer:
Grasses: *Hetropogan contortus, Bothriochloa bladhii* and *Themeda triandra*

Herbs/Forbs: *Indigofera spp, Glycine tabacina, Galactia tenuiflora* and *Tephrosia juncea*
Ecological Notes: Occurs on older floodplain complexes on Cainozoic alluvial plains and generally includes an extensive understorey of native grasses.
Sites: surrounding landscape

11.3.38 Assorted woodland with grassy understorey

Status: VMA – E Bio - E
Description: *Eucalyptus tereticornis, Corymbia tessellaris,* and *C. dallachiana* tall grassy woodland on alluvial plains and magnetite deposits.
Structure formation range: Tall woodland to woodland
Tree/tall shrub layer: 25-35mtr in height
Subdominant species: *Melaleuca bracteata, Melaleuca fluviatilis, Planchonia careya, Casuarina cunninghamiana* and *E. fibrosa sp (Glen Geddes M.I.Brooker 10230)*
Shrub layer:
Ground layer: 0.5-1.0mtr in height Grasses: *Arundinella nepalensis* and *Themeda triandra*
Ecological Notes: Important habitat for the rare and threatened species including *Stackhousia tryonii, Pimelea leptospermoides, Bursaria reevesii, Capparis thozetiana* and *Hakea trineura.* Occurs on alluvial plains and broad drainage lines overlying magnetite deposits derived from serpentinite.
Sites: surrounding landscape

11.4.1 Semi-evergreen vine thicket ± belah on Cainozoic clay plains

Status: VMA – E Bio - E
Description: SEVT ± *Casuarina cristata* on Cainozoic clay plains
Structure formation range: SEVT with emergents
Tree/tall shrub layer: 15-20mtr
Subdominant species: *Pouteria cotinifolia, Lysiphyllum hookeri, Capparis spp*. and *Terminalia oblongata*
Shrub layer: 2-5mtr in height; *Elaeodendron australe, Denhamia oleaster* and *Pittosporum spinescens*
Ground layer: 0.5-0.7mtr in height
Herbs/Forbs: *Ancistrachne uncinulata* and *Solanum ellipticum*
Others: *Cheilanthes spp*
Ecological Notes: 11.4.1 has been extensively cleared for agriculture but remnants provides habitat for the rare and threatened plant *Macropteranthes leiocaulis*. Occurs on Cainozoic clay plains including extensively weathered Tertiary basalt.
Sites: surrounding landscape

11.4.2 Eucalyptus and Corymbia spp. grassy or shrubby woodland

Status: VMA - OC Bio - OC
Description: *Eucalyptus spp.* and/or *Corymbia spp*. Grassy/shrubby woodland - Cainozoic clay plains
Structure formation range: woodland
Tree/tall shrub layer: 20-30mtr in height
Subdominant species: *Eucalyptus populnea/brownii* or *E. melanophloia +/- Corymbia dallachiana +/- C. tessellaris +/- E. crebra +/- E. platyphylla*
Shrub layer:
Ground layer:
Ecological Notes: This regional ecosystem is associated with both fine-textured Cainozoic sediments (land zone 4) and coarser-textured Cainozoic material (land zone 5).
Sites: surrounding landscape

11.4.3 Brigalow and/or belah shrubby open forest

Status: VMA - E Bio - E
Description: *A. harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains
Structure formation range: open forest, low woodland
Tree/tall shrub layer: 12-18mtr in height
Subdominant species: *Eucalyptus orgadophila, E. populnea, E. microcarpa, E. pilligaensis, E. cambageana, Brachychiton rupestris,*

Shrub layer: 2-6mtr in height *Eremophila mitchellii*, *Geijera parviflora, Carissa ovata and Alectryon diversifolius*

Ground layer: 0.2-0.5mtr in height

Grasses: *Aristida armata, A. leptopoda, A. ramosa, Chloris ventricosa, Digitaria brownii, Eriochloa pseudoacrotricha, Leptochloa ciliata, Panicum decompositum, Paspalidium caespitosum, P. constrictum*, and *Sporobolus actinocladus*

Herbs/Forbs: *Abutilon oxycarpum, Atriplex muelleri, Einadia nutans, Justicia procumbens, Rhagodia spinescens, Sclerolaena birchii, S. tetracuspis*, and *Sida cunninghamii*

Ecological Notes: Plains may be flat to gently undulating and soils are often cracking clay which is usually deep to very deep and often self mulching. Some surface stone, texture contrast soils and other clays may also be present in places.

Sites: surrounding landscape

11.4.8 Dawson Gum woodland to open forest with Brigalow

Status: VMA - E Bio - E

Description: *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains

Structure formation range: woodland to open forest

Tree/tall shrub layer: 15-25mtr in height

Subdominant species: *A. argyrodendron. E. thozetiana,* and *Eremophila mitchellii*

Shrub layer: 2-6mtr in height; *Carissa ovata* and *Geijera parviflora*

Ground layer:

Ecological Notes: Soils associated with this RE have a deep texture contrast with thin loamy or sandy surface horizons, with an occasional subsurface of gravel on level to gentle undulating plains formed from Cainozoic deposits.

Sites: surrounding landscape

11.4.9 Brigalow shrubby open forest to woodland with yellowwood on Cainozoic clay plains

Status: VMA - E Bio - E

Description: *Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains

Structure formation range: woodland to open forest

Tree/tall shrub layer: 12-16mtr in height;

Subdominant species: *Lysiphyllum cunninghamii, Eremophila mitchellii* and *Casuarina cristata*

Shrub layer: Shrubs occur in the tall (2-8mtr) and mid (1-2mtr) story levels of this RE and include; *Alectryon diversifolius, Carissa ovata, Pittosporum spinescens, Ehretia membranifolia, Geijera parviflora* and *Flindersia dissosperma*

Ground layer: Ground layer is generally sparse

Ecological Notes: This RE is particularly cleared for cropping and pasture purposes. This RE can include seasonally ponded gilgai and may contain the rare and threatened plant *Aponogeton queenslandicus*. Often this RE is associated with soils of deep to deep cracking clays ranging from red to grey brown and may include surface gravels.

Sites: surrounding landscape

11.5.2 Ironbark, +/- Corymbia spp and gum-topped box on lower slopes

Status: VMA - NoC Bio - NoC at present

Description: *Eucalyptus crebra +/- Corymbia spp and* E. moluccana on lower slopes of Cainozoic sand plains/remnant surfaces

Structure formation range: Woodland

Tree/tall shrub layer: 20-30mtr in height

Subdominant species: *C. clarksoniana, C. citriodora, Acacia rhodoxylon, E. exserta, E. tenuipes* and *Allocasuarina luehmannii*

Shrub layer:

Ground layer:

Ecological Notes: Shrub layer may be sparse to mid-dense, and a low density ground layer is also usually present. Occurs on Cainozoic sand plains often below hills and ranges.

Sites: surrounding landscape

11.5.9 Ironbark and other eucalypt woodland on sandy plateaus and broad crests

Status: VMA - NoC Bio – NoC at present
Description: *Eucalyptus crebra* and other *Eucalyptus spp*. and *Corymbia spp*. woodland on Cainozoic sand plains/remnant surfaces. Plateaus and broad crests
Structure formation range: Woodland to open forest
Tree/tall shrub layer: 20-30mtr in height
Subdominant species: *C. clarksoniana, C. dallachiana, E. tenuipes* and *E. exserta*
Shrub layer: 10-15mtr in height; *Acacia excelsa, A. leiocalyx, Melaleuca nervosa* and *Lysicarpus angustifolius*
Ground layer:
Ecological Notes: Usually sparse ground cover, below a sparse to shrubby mid layer on Cainozoic sand plains, plateaus and broad crests.
Sites: surrounding landscape

11.7.2 Acacia spp. woodland on lateritic duricrust

Status: VMA - NoC Bio – NoC at present
Description: Acacia spp. woodland on lateritic duricrust scarp retreat zone
Structure formation range: woodland – open forest
Tree/tall shrub layer: emergents to 30mtr in height, canopy to 20mtr in height
Subdominant species: *Eucalyptus thozetiana, E. crebra, E. decorticans* and *E. exserta*, canopy may include; *Acacia rhodoxylon, A. burrowii, A. sparsiflora, A. crassa* and *A. blakei*
Shrub layer: 3-6mtr in height; *Acalypha eremorum, Croton phebalioides* and *Carissa ovata*
Ground layer: 0.-3 to 0.6mtr in height
Grasses: extremely sparse; mainly dominated by *Aristida caput-medusae, Paspalidium rarum, Brachiaria foliosa*
Herbs/Forbs: mainly dominated by *Sida filiformis*
Ecological Notes: This type of vegetation is usually growing between bare rock in shallow lithosol soils. Occurs on scarps and adjacent tops, dissected tablelands and buttes formed from chemically altered sediments.
Sites: surrounding landscape

11.7.4 Gum topped ironbark and other Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius woodland

Status: VMA - NoC Bio – NoC at present
Description: *E. decorticans* and/or *E. spp*., *Corymbia spp*., *Acacia spp., Lysicarpus angustifolius* on lateritic duricrust
Structure formation range: Woodland
Tree/tall shrub layer: 20-30mtr in height
Subdominant species: *E. crebra, E. decorticans, Corymbia trachyphloia, E. tenuipes, C. watsoniana* and *Callitris glaucophylla*
Shrub layer: 2-4mtr in height; *Lysicarpus angustifolius, Acacia spp*. or *E. exserta*
Ground layer:
Ecological Notes: Usually with shallow soils over low hills and ranges.
Sites: surrounding landscape

11.9.1 Brigalow-Dawson gum open forest to woodland

Status: VMA - E Bio - E
Description: *Acacia harpophylla-Eucalyptus cambageana* open forest to woodland on fine-grained sedimentary rocks
Structure formation range: woodland to open forest
Tree/tall shrub layer: 12-14mtr in height, emergents to 20mtr in height
Subdominant species: *Eucalyptus thozetiana*
Shrub layer: 2-4mtr in height; *Eremophila mitchellii, Carissa ovata* and *Geijera parviflora*, with *Terminalia oblongata*
Ground layer: frequently sparse

Ecological Notes: Extensively cleared for cropping and pasture, this RE is associated with slopes and crest of undulating plains below Cainozoic and Proterozoic ridges and escarpments. Soils are of texture contrast, often with surface stone or gravel, clays, sandy clay loams and cracking clays.
Sites: surrounding landscape

11.9.5 Brigalow and/or belah open forest

Status: VMA – E Bio - E
Description: *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks
Structure formation range: open forest to woodland
Tree/tall shrub layer: 10-20mtr in height
Subdominant species: *Geijera parviflora* and *Eremophila mitchellii* and *Melaleuca bracteata* present along water courses
Shrub layer: 2-5mtr in height; *Carissa ovata, Owenia acidula, Croton insularis, Denhamia oleaster* and *Notelaea microcarpa*
Ground layer:
Ecological Notes: This RE is also extensively cleared for pasture and cropping and occurs on fine-grained sediments over gentle undulating plains, valley floors and foot slopes. Soils are generally black or grey to brown cracking texture contrasting clays, and are shallow to moderately deep.
Sites: surrounding landscape

11.9.9 Ironbark woodland on fine-grained sedimentary rocks

Status: VMA - NoC Bio – NoC at present
Description: *Eucalyptus crebra* woodland on fine-grained sedimentary rocks
Structure formation range: Woodland
Tree/tall shrub layer: 25-30mtr in height
Subdominant species: *E. moluccana, E. albens, E. crebra, E. tereticornis,* and *Callitris baileyi.*
Shrub layer:
Ground layer:
Ecological Notes: This particular RE is extensively cleared or thinned for improved pasture. Generally a grassy woodland, it mainly occurs on slopes and lower slopes, on Cainozoic to Proterozoic consolidated, fine-grained sediments.
Sites: surrounding landscape

11.10.3 Lancewood open forest on coarse-grained sedimentary rocks

Status: VMA - NoC Bio – NoC at present
Description: Acacia catenulata or A. shirleyi open forest on coarse-grained sedimentary rocks. Crests and scarps
Structure formation range: Open Forest
Tree/tall shrub layer: 8-12mtr in height; Emergents to 25mtr in height
Subdominant species: *A. sparsiflora* and *A. rhodoxylon;* Emergents include: *Eucalyptus decorticans* and *E. exserta*
Shrub layer: A sparse shrub layer of various species may be present
Ground layer:
Grasses: Various grass species may occur
Herbs/Forbs: Various herb/forb species may occur
Ecological Notes: Occurring on crests and ridge tops formed on consolidated, medium to coarse-grained sediments, this particular RE is habitat to various rare and threatened species such as *A. deuteroneura, A. lauta, A. wardellii* and *Bertya calycina*.
Sites: surrounding landscape

11.11.1 Rosewood and Iron Bark woodland on old sedimentary rocks

Status: VMA - NoC Bio – NoC at present
Description: *Eucalyptus crebra* and/or *Acacia rhodoxylon* woodland on old sedimentary rocks with varying degrees of metamorphism and folding
Structure formation range: Woodland
Tree/tall shrub layer: 12-17mtr

Subdominant species: *Corymbia clarksoniana, E. coolabah, E. camaldulensis, E. melanophloia* and *Lysiphyllum hookeri*

Shrub layer: 1-4mtr in height; *Atalaya hemiglauca, Acacia stenophylla, Eremophila bignoniiflora, Alectryon diversifolius, Pittosporum spinescens,* and *Carissa ovata*

Ground layer: 0.2-0.5mtr in height

Grasses: *Arundinella nepalensis, Themeda triandra, Chloris sp.,* and *Cymbopogon refractus*
Herbs/Forbs: *Salsola kari, Sclerolaena tetracuspis, Einadia hastata, Abutilon oxycarpum, Enchylaena tomentosa,* and *Sida cordifolia*.

Ecological Notes: On metamorphic rocky plains above major river channels.

Sites: EB600 – Island Camp

11.11.5 Microphyll vine forest ± Araucaria cunninghamii on old sedimentary rocks

Status: VMA – NoC Bio – NoC at present

Description: Microphyll vine forest ± *Araucaria cunninghamii* on old sedimentary rocks with varying degrees of metamorphism and folding

Structure formation range: Rainforest/SEVT

Tree/tall shrub layer: 9-15mtr in height

Subdominant species: *Flindersia australis, Backhousia kingii, Excoecaria dallachiana, Melia azedarach, Ficus spp., Strychnos arborea, Macropteranthes leichhardtii* and *Alstonia constricta*

Shrub layer: 1-3mtr in height; *Croton spp., Abutilon spp., Capparis spp. Acalypha eremorum* and *Codonocarpus attenuatus*

Ground layer: Various ferns and vines may be present, at 50-80% of the entire ground cover

Ecological Notes: Soil is of shallow loams and clays with minor areas of deeper cover and geology is formed from moderately to strongly deformed and metamorphosed sediments. The rainforest is located in the higher altitude areas in moist microhabitats such as gullies, and tends to be the notophyll type.

Sites: surrounding landscape

11.11.7 Bloodwood species woodland on serpentinite

Status: VMA - NoC Bio - OC

Description: *Eucalyptus fibrosa subsp. (Glen Geddes)* and *E. xanthope* woodland on serpentinite

Structure formation range: Tall open forest or woodland

Tree/tall shrub layer: 16-20mtr in height

Subdominant species: *E. crebra, Lysiphyllum carronii,* and *Alphitonia excelsa*

Shrub layer: 1.5mtr in height; *Acacia leptostachya, Hakea trineura* and *Macrozamia serpentina*

Ground layer: 0.3-0.5mtr in height

Grasses: *Heteropogon contortus, Aristida sp*
Herbs/Forbs: various endemics including; *Capparis humistrata* and *Stackhousia tryonii*

Ecological Notes: Significant RE for various endemics and occurs on steep mountains, undulating low hills and colluvial aprons formed from serpentinite. This includes remnant laterised surfaces in more elevated areas, with shallow to moderately deep dark clays to clay loams. Some sites may include rainforest elements in the understorey.

Sites: EB036 – Coorumburra, EB087 – Eden Bann, EB122 – Eden Bann

11.11.9 Poplar box or Browns Box woodland on metamorphics

Status: VMA – NoC Bio – NoC at present

Description: *Eucalyptus populnea* or *E. brownii* woodland on deformed and metamorphosed sediments and interbedded volcanics

Structure formation range: woodland to open woodland

Tree/tall shrub layer: 18-20mtr in height

Shrub layer:

Ground layer:

Ecological Notes: Occurs on strongly deformed and metamorphosed sediments and interbedded volcanics undulating rises and lower slopes of hills.

Sites: surrounding landscape

11.11.10 Silver leafed ironbark woodland

Status: VMA - OC Bio - OC
Description: *Eucalyptus melanophloia* woodland on deformed and metamorphosed sediments and interbedded volcanics.
Structure formation range: Woodland/low shrubby woodland
Tree/tall shrub layer: 9-15mtr
Subdominant species: can include *E. moluccana* and *E. tereticornis*
Shrub layer:
Ground layer:
Ecological Notes: Occurs on moderately to strongly deformed and metamorphosed sediments and Permian sediments particularly on lower slopes.
Sites: surrounding landscape

11.11.14 Brigalow open forest on metamorphics

Status: VMA – E Bio - E
Description: *Acacia harpophylla* open forest on deformed and metamorphosed sediments and interbedded volcanics
Structure formation range: Open forest to SEVT
Tree/tall shrub layer: 15-25mtr in height
Subdominant species: Various Eucalypt species, and *Casuarina cristata*
Shrub layer: 8-12mtr in height; *Geijera parviflora* and *Eremophila mitchellii*
Ground layer: several evergreen vine thicket species may be present
Ecological Notes: Generally a shrubby open forest to SEVT, occurs on colluvial lower slopes on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics.
Sites: surrounding landscape

11.11.15 Ironbark woodland on undulating plains

Status: VMA - NoC Bio – NoC at present
Description: *Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics over undulating plains.
Structure formation range: woodland/vine thickets
Tree/tall shrub layer: 17-28mtr in height
Subdominant species: *E. exserta*, *E. drepanophylla, E. platyphylla, Corymbia setosa, C. clarksoniana, E. melanophloia, C. dallachiana*
Shrub layer: *Petalostigma pubescens* and *Alphitonia excelsa*
Ground layer:
Ecological Notes: Highly susceptible to dry back during drought times. Often occurs on moderately to strongly deformed and metamorphosed sediments and interbedded volcanics and Permian sediments.
Sites: surrounding landscape

11.11.21 Semi-evergreen vine thicket on serpentinite

Status: VMA - OC Bio - E
Description: Semi-evergreen vine thicket on serpentinite
Structure formation range: SEVT
Tree/tall shrub layer: 10-15mtr in height
Subdominant species: *Brachychiton rupestris, Austromyrtus bidwillii,* and *Cupaniopsis wadsworthii,*
Shrub layer: 2-4mtr in height; *Diospyros sp, Turraea pubescens, Quassia bidwillii, Alyxia ruscifolia*, *Croton insularis* and *Neoroepera buxifolia*
Ground layer:
Ecological Notes: Habitat for rare and threatened flora species including *Quassia bidwillii* and *Neoroepera buxifolia*. Occurs on upper slopes, gullies, footslopes, and narrow hillcrests, with shallow to moderately deep red clays formed from moderately weathered serpentinite hills.
Sites: surrounding landscape

11.12.1 Ironbark shrubby to low woodland

Status: VMA – NoC Bio – NoC at present
Description: *Eucalyptus crebra* shrubby to low woodland on igneous rocks
Structure formation range: low woodland/shrubby low woodland/low open woodland
Tree/tall shrub layer: 20-30mtr in height
Subdominant species: *E. persistens, E. exserta,* and *Corymbia erythrophloia*
Shrub layer:
Ground layer: Grasses: can include *Dichanthium sp*. as an understorey grassland
Ecological Notes: Occurs on a range of different igneous rocks, generally found on undulating rises.
Sites: surrounding landscape

11.12.2 Silver leafed ironbark woodland on igneous rocks

Status: VMA - NoC Bio – NoC at present
Description: *Eucalyptus melanophloia* woodland on igneous rocks, usually on undulating rises and hills, sometimes on lower colluvial slopes.
Structure formation range: Woodland to open woodlands
Tree/tall shrub layer: 20-25mtr in height
Subdominant species: *E. orgadophila, Corymbia erythrophloia,* and *E. moluccana*
Shrub layer:
Ground layer:
Ecological Notes:
Sites: surrounding landscape

11.12.4 Semi-evergreen vine thicket and microphyll vine forest on igneous rocks

Status: VMA - NoC Bio – NoC at present
Description: Semi-evergreen vine thicket with a sparse ground layer and several shrub species.
Structure formation range: SEVT
Tree/tall shrub layer: 6-10mtr in height, 16-20mtr emergent species
Subdominant species: *Corymbia erythrophloia, C. tessellaris, Pleiogynium timorense, Petalostigma pubescens, Brachychiton australis,* and *Diospyros humilis*
Shrub layer: 1-2mtr in height; *Carissa ovata, Sida cordifolia*, can also include: *Aglaia sapindina* and *Mackinlaya macrosciadia*
Ground layer: 0.3-0.6mtr in height
Grasses: *Arundinella nepalensis*
Herbs/Forbs: *Scleria sphacelata* and *Adiantum hispidulum*
Others: *Cissus opaca, Cissus oblonga,* and *Smilax australis*
Ecological Notes: Occurs on low hills and ridges formed from Mesozoic to Proterozoic igneous rocks including granite.
Sites: EB171 – Southland

3.2.1 Vegetation Maps of RE's –

The RE mapping layer for the Lower Fitzroy Weirs is presented as a series of 16 x A3 maps as per the following sheet diagrams (Fig. 2 and Fig. 3). These 1:25,000 A3 map sheets are included in Attachment 2.

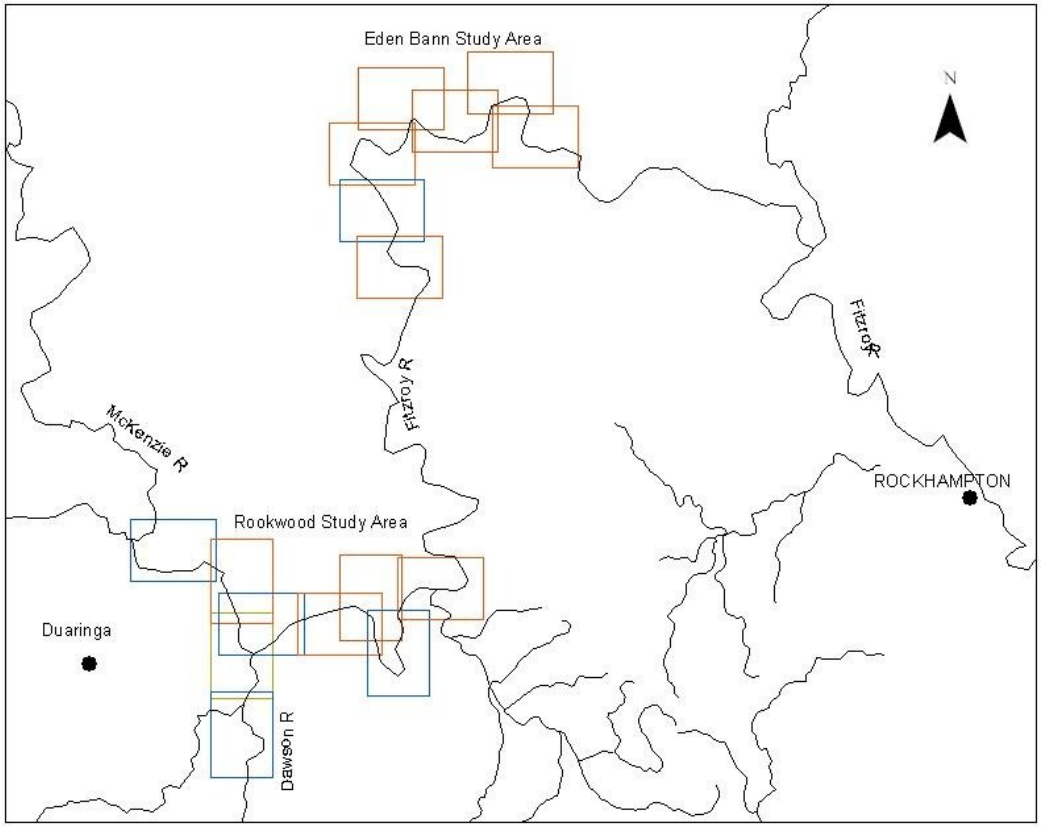


Figure 1. General Location of Lower Fitzroy Weir Study Areas

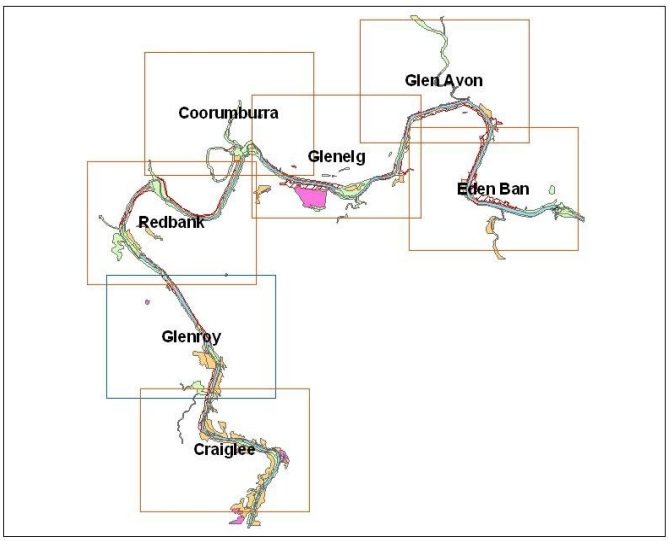


Figure 2. Key to Eden Bann Vegetation MapSheets

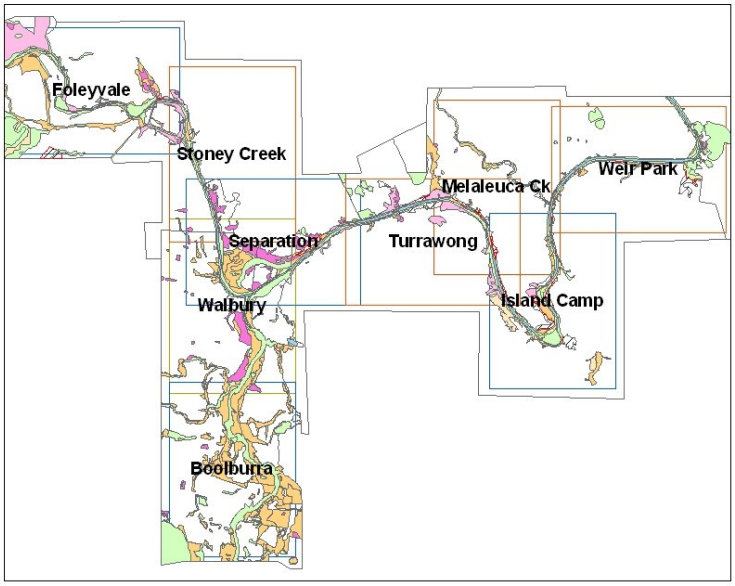


Figure 3. Key to Rookwood Vegetation Map Sheets

3.3 Regional Ecosystems Potentially Affected by Inundation

Desktop analysis of the 1:25,000 RE mapping has identified the extent of vegetation impacts that are predicted to result from raising the waters of the Fitzroy, Dawson and MacKenzie Rivers for Eden Bann FSL 18.5m AHD and Rookwood FSL 47m AHD respectively (Table 2). Slightly more extensive areas were identified for FSL 20.5m AHD and FSL 49m AHD . Near complete loss of most species present in the affected parts of several regional ecosystems is predicted for each of the proposed supply levels, with only the larger tree species likely to survive for a decade or longer.

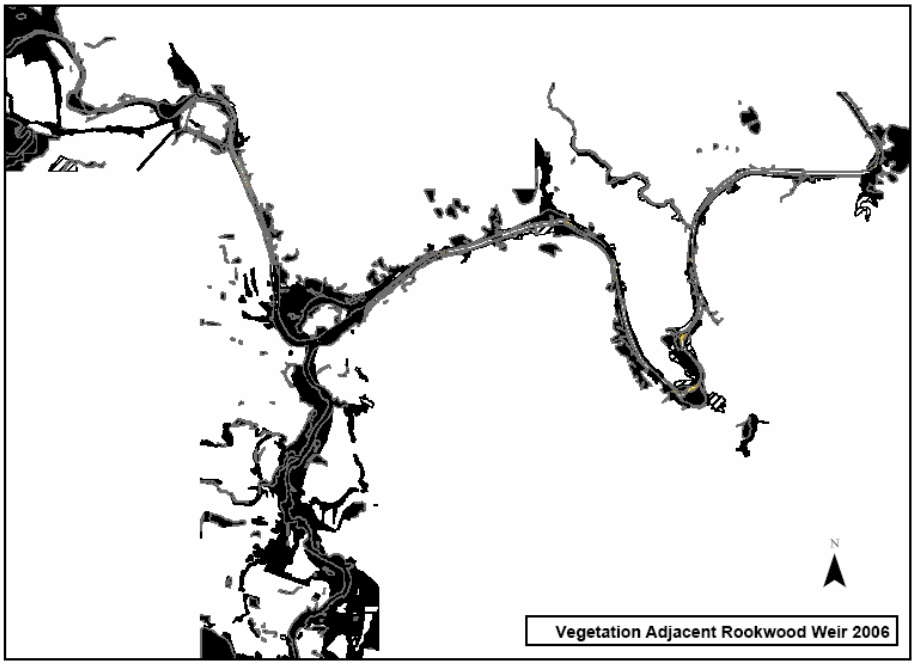
Table 2 Spatial Extent in hectares of RE's affected by Inundation (excluding open water)

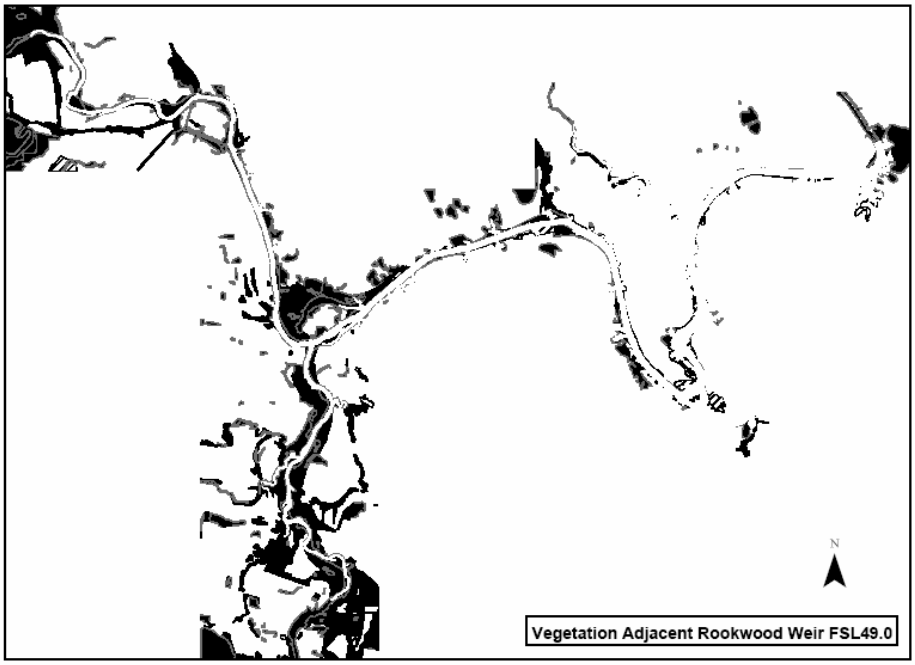
RE	VMA Status	EPA Bio-status	Eden Bann		Rookwood	
			FSL 18.5	FSL 20.5	FSL 47.0	FSL 49.0
11.3.1	E	E	0.2	0.3	0.05 (0.2**)	1.4 (0.5**)
11.3.3	OC	OC	2.0	6.9	35.1	74.7
11.3.3/11.3.1	OC	OC			15.1	35.2
11.3.3/11.3.2	OC	OC			0.8	1.3
11.3.4	OC	OC	1.0	2.3	0.1	1.3
11.3.25 (*not f*)	NoC	OC	333.6	499	643	888
11.3.25f*	NoC	OC	88.4	141.9	136.9	147.8
11.3.25/11.3.3	OC	OC	22.1	32.7	15.6	19
11.3.27/11.3.25	OC	OC		50.5		
11.11.1/11.3.3	OC	OC			0.2	1.1
11.11.7	NoC	OC	2.2	6.3		
Sub-total above			***449.5***	***740***	***847***	***1169.8***
11.12.2	NoC	NoC		0.1	5.3	9.8
not remnant (clear)	-	-	85.3	227.3	230.4	528.6
not remnant (regrowth)	-	-	26.7	55.9	43.8	75.3
Total area			**561.5**	**1023**	**1127**	**1784**

*11.3.25f - sand banks, gravel and rocky bars (excluding open water: new weirs re-create open water)
**Areas for 11.3.1 also have additional figure estimated for capillary effects in soil.

Map 19(a) and (b). Remnant Vegetation about the Eden Bann Impoundment before/after Inundation at proposed new level.

The potential impact to the narrow band of fringing vegetation in the downstream quarter is noticeable despite the scale of presentation (line-work artificially fills the river channel in Map 19a).
Note: the vegetation impacts within the upstream quarter of the weir pool are generally restricted to 'in channel' habitats, especially sand banks, rocky bars and gravel beds of sub-type RE 11.3.25f. This illustration does not reliably indicate runners and breakouts that affect open pasture and other disturbed lands.





Map 19(c) and (d). Remnant Vegetation about the Rookwood Impoundment before/after Inundation at proposed new level.

The potential impact to the narrow band of fringing vegetation in the downstream quarter is noticeable despite the scale of presentation (line-work artificially fills the river channel in Map 19c).
Note: the vegetation impacts within the upstream section of the proposed weir pool (above the Dawson/MacKenzie Junction) are generally restricted to 'in channel' habitats, especially sand banks, rocky bars and gravel beds of sub-type RE 11.3.25f. This illustration does not reliably indicate runners and breakouts that affect open pasture and other disturbed lands.

Brigalow - RE 11.3.1 (Endangered)
Two small brigalow patches (RE 11.3.1) are located above the right bank near the proposed Rookwood weir site and for the most part appear to sit just above the proposed water level at FSL 49m AHD . Closer examination of the spatial extent of the brigalow patches and subsequent comparison with 1mtr contour data from earlier planning studies (GHD 1999) provided a clearer picture of the potential impacts at the two full supply levels. The southern edge of the larger (6ha) patch extends to 46m ASL, suggesting an area of approximately 0.2 ha would be inundated at FSL 49m AHD with less than half of this area inundated at FSL 47m AHD . The vegetation in this southern edge includes an occasional mature *Acacia harpophylla* whereas the dominant species present in the affected area is *Terminalia oblongata* (yellowwood), a smaller tree species that is usually sub-dominant in similar brigalow communities.

However a greater potential impact to the brigalow remnants exists to vegetation situated above the relevant inundation contour due to capillary action of water through the soil and impacting upon potentially sensitive species, in this case *A. harpophylla*. This procedure has not been applied to the other riparian ecosystems as the larger dominant species in RE's 11.3.3, 11.3.4 and 11.3.25 are considered more resilient to this effect in alluvial soils (N Hoy, *pers. comm*.., 28 Jan 2006). Calculations for the capillary effect also included an allowance for wave action (30cm) and led to the adoption of a 2.0mtr vertical addition to the inundation impact level as a precautionary measure for the brigalow community. The resulting areas impacted remained under 1 ha as shown in Table 2.

Freshwater wetland RE 11.3.27 (VMA=**Not Of Concern,** Biodiversity **- Of Concern)**
The Horseshoe Lagoon on Coorumburra is an oxbow lagoon 3km long, roughly 20-40 mtr wide and fills from either local runoff or from healthy runs in the Fitzroy River and/or Marlborough Ck. A mixture of alluvial woodland or occasional forest adjoins the lagoon although the original fringing woodland along much of the lagoon's length is at least very disturbed and often absent in the southern and western parts. The GHD contour data suggests that the lagoon's fringing woodlands should not be significantly affected by the Eden Bann Weir's standing water level at FSL18.5m AHD . However at FSL20.5 the greater balance of fringing remnant woodland around the Horseshoe Lagoon will be inundated. This is reflected in the 50.5ha of RE 11.3.27/11.3.25 impacted by the weir proposal as listed in Table 2.

Overview of Predicted Impacts to Riparian Remnant Vegetation (11.3.25, 11.3.3, 11.3.4).
The three RE's (11.3.3, 11.3.4, 11.3.25) have been grouped for discussion here but not for the occasional similarities in floristic or structural composition that exists before any inundation occurs. Also they are grouped because the recovery of fringing vegetation after inundation will include characteristics that relate to each of these communities, although not with any sense of balance or proportion in any way.
Vegetative impacts caused by the elevated water levels of these new weirs can be broadly grouped into three stages: (a) immediate, (b) medium term and (c) long term effects.

(a) Immediate effects of inundation: Widespread flora deaths, especially in smaller plants, re-colonisation of some annuals and other weedy species at the water edge. The immediate effects commence after the first filling of the weir pool and may take several weeks to be realised. Most plants that are completely immersed will drown in the early weeks. In the shallower edges the ground layer species and most of the shrubby species will be expected to perish by either drowning outright or drowning of the roots. Most of the riparian trees species have a greater tolerance to periodic inundation and will several weeks to months to drown. A small suite of species will begin establishing populations along the edges of the weir pool including the amphibious aquatics, some grasses and numerous waterborne weeds.

(b) Medium term effects of inundation: Slower deaths of resilient woody species and re-colonisation of perennials. The trees that survive the initial pond retention phase will be most of the typical species of the riparian ecosystems of RE 11.3.25. *Melaleuca leucadendra, M. trichostachya, M. fluviatilis, Eucalyptus tereticornis, E. camaldulensis, E coolabah* and *Callistemon viminalis* are the most common trees within the inundation zones and all are likely to survive several weeks to months in the least. Examples of the melaleucas and eucalypts surviving more than ten years in the Eden Bann Weir pool at depths up to 2mtr are readily found along the weir margins. Adventitious aeroid roots are produced especially from the melaleucas and callistemons especially in the area near the full supply water line over the early years. However the rate of death of these plants appears to increase with time and/or

depth as the Eden Bann pond suggests. Grass, herbs, forb and other aquatic species are likely to begin to re-establish occupancy in more suitable areas depending on shade, slopes, soils, height of inundation above previous pond levels etc.

(c) Long term effects: Slow changes to Re-establish fringing vegetation. The re-established water line at the full supply level becomes akin to the original pool margins before the impoundment development. Colonisation of fringing species from RE 11.3.25b and 11.3.25h can commence but this is frequently a very slow process under natural conditions. Reconstruction of the transitional sequences of the riparian vegetation upward from the water edge through the lower bank and thence mid-bank is unlikely to progress very far within the first few dozen years. Such re-colonisation will be impeded by many environmental variables including competition from the existing vegetation, soil properties, flooding regimes, land-use and seed availability. Cohorts of *Melaleuca leucadendra* on muddy sheets along receding flood-water lines suggest this is feasible over time along the lower Fitzroy River (N Hoy pers. *comm.,* 28 Dec 2006)

Communities that were expected to be affected but will not be.

Another endangered community from alluvial flats in the serpentine areas (RE 11.3.38), no longer persists in the area affected FSL 20.5mtr. The pre-clearing extent of 11.3.38 formerly occupied parts of the area to be inundated on the lower parts of Princhester and Marlborough Creeks but agricultural land improvements have removed most traces of the former community. A similar outcome relates to RE 11.3.9 although in this case the community remains intact near the upper limits of FSL 20.5 along Marlborough Ck but well away from the potential inundation zone.

Several other RE's were identified by earlier studies as being potentially susceptible to inundation (Hyder 1999 and Keane 2004). This included RE 11.3.2 and RE 11.11.21. The predictions were reasonably based upon the 100,000 scale RE mapping and did not have access to the fine detail available in the GPS controlled survey data as prepared for the earlier GHD work on these proposals. These earlier estimates have simply been updated and clarified by this report.

3.4 Comparison with EPA's RE Mapping

The Queensland Herbarium's 100,000 scale 'RE Mapping' is occasionally contradicted and therefore potentially enhanced by the 1:25,000 detail included in this report. Correspondingly this work adds to the earlier 1:25,000 Remnant Vegetation mapping for the Dawson-MacKenzie River junction area of Pollock and Edginton (1999). Several updates to the RE Mapping can be suggested by this latest 1:25,000 mapping result, granted that the Dawson-MacKenzie work has already been considered by the Queensland Herbarium and the EPA. Such updates can help to increase in precision due to scale and greater opportunity to ground truth predictions available through the extensive field traverses available to the authors during preparation of this report.
The majority of updates identified herein relate to converting predictions of 11.3.3 to 11.3.25 and 11.3.4, mostly in long tracts along the banks of the Fitzroy River with sampling intensity being the critical factor influencing the decision to apply any alternate RE to a mappable unit of remnant vegetation. Some smaller patches were updated due to the fact that our field work visited the mapping unit and could thus recommend a change to the relevant RE. We have also trimmed the edges of mapping polygons to increase the boundary precision, a fact that may remain valid until the next fire, flood or update of satellite imagery or aerial photography layers used in mapping procedures.

We have recognised more subtle changes to RE mapping such as polygon subdivision and recognition of smaller standalone remnants available to this work with the larger scale of mapping. Also we have included several seasonal lagoons in mapping the surrounding landscape (despite localised loss of fringing tree species) as they may well still exhibit wetland values without the surrounding woodland canopy. These have been labelled on the maps as 'disturbed' 11.3.27 as we could not quantify the quality in the wetland system in our timeframe and thus we have not attempted to clarify the remnant status of these sites. These particular areas are not affected by the higher inundation levels of the weir proposals as they typically occur in older overflow channels on elevated parts of the alluvial plain.

3.5 Lower Fitzroy Weir Flora: Native and non-native flora

A full listing of all 387 plants observed and identified during site recordings and other field traverses appears in Appendix one. This includes two endangered, six vulnerable and two rare plants as classified under the Nature Conservation Act 1992 (NCA). Several of these EVR species were collected at sites that potentially serve to extend the documented natural range of these species. Additionally 8 significant weeds species were recorded along with a handful of environmental weeds of lesser importance. One non-native vine species (*Luffa* sp) collected during field survey appears to be poorly recorded in central Queensland and samples of two unusual tree taxa were collected for expert review because field staff were not sure if these were variations, hybrids or perhaps undescribed subspecies. These specimens have been identified as a variation in the case of the river red gum and a naturally occurring hybrid between *Eucalyptus coolabah/E. melanophloia.*

3.5.1 Common plants

The suite of common plants located during field studies was predictable for the environments examined and is not inconsistent with the floral assemblage reported by Hyder (1999) and Pollock *et al*. (2004). The occasional presence of the broadleaved tree *Nauclea orientalis* (Leichardt tree) along the fringing vegetation of the lower bank appears in stark contrast to the smaller leaved sclerophyllous vegetation dominated by the eucalypts, melaleucas and callistemons that so dominate the riverine communities. The smaller listing of native grasses, forbs and herbs is a function of the extent of exotic grasses in the ground layer, grazing activity along with dry seasonal conditions and low level of familiarity of collectors with the limited vegetative and reproductive material available to support field identification.

Two separate and unrelated 'species' did present taxonomic challenges to the field studies. One relates to the series of plants that occupy the range of forms of between those described for *Eucalyptus teretecornis* and *E. camaldulensis*. Much of the Eden Bann study area seemed mostly free of the confusing intergrade between the two species, while the Rookwood study area was often populated by one or both species with at least one recurring "hybrid" that seemed to share characteristics midway between them. Tree form and bark appearance was not always a reliable trait to use in identification, and the greater confusion resulted from the mid-way shape and dimensions of the operculum. Unfortunately no viable measure of seed was found to support further field identification so seedless specimens were sent to the Herbarium for their attention. (Submission of this report may precede the return of identification as they were collected and sent at the end of the field traverse program).

A comparable dilemma exists with *Melaleuca leucadendra* and a possible subspecies, variety or hybrid. This 'variety' was collected and sent to the Herbarium for identification and is generally similar to *M. leucadendra* except it has slightly narrower leaves, and flowers in December compared to winter *M. leucadendra* (J. McCabe *pers. comm*. 2006). This 'variety' was included as *M. leucadendra* as it was often difficult to conclude when the difference existed, except when the flowering/fruiting sequence was in operation.

3.5.2 Weeds and other non-native plant species

Significant weeds found during field efforts included five Weeds of National Significance (WONS) and three other weeds that are listed by NRW as declared pests. A brief synopsis of their presence appears in Table 3.

Non-native plant species were the predominant cover in the ground layer in about 30% of sites visited. In most of these sites the non-native dominance was expressed by introduced pasture grasses, especially *Megathyrsus maximus var pubiglumis* (green panic) and *Cenchrus ciliatus* (buffel grass) with a far smaller proportion of cover taken by *Chloris sp* (Rhodes grass) and *Urochloa mosambicensis* (Sabi grass). Other non-native species to dominate parts of the ground layer were *Parthenium hysterophorus* (parthenium weed) and *Zygophyllum apiculatum* (gallweed). *Acacia farnesiana* (a naturalised thorny acacia) with sparsely branched and creeping habit was found on the highest proportion of sites in the study although in very low density. The greater share of sites dominated by the non-native grasses existed on the lower part of the Eden Bann section, where the green panic dominance was often over 75%. Buffel grass was more common in areas that had a relatively sparser or damaged woodland canopy cover whereas Rhodes grass and Sabi grass seldom covered any more than 10% of the ground cover in any site.

Table 3 Significant Weeds found in the Vicinity of the Lower Fitzroy Weir Study Areas

Weed Species	Qld Pest Class	Comment
Acacia nilotica (**prickly acacia**)	2, WONS*	Very scarce, only a handful of specimens sighted across the entire study area.
Bryophylum delagoense (**mother of millions**)	2	Very scarce, One patch located near the proposed Rookwood Weir site.
Cardiospermum grandiflorum (**balloon vine**)	3	Occasional to sometimes common, mostly on grassy river bank areas.
Cryptostegia grandiflora (**rubbervine**)	2, WONS*	Locally common in a few locations. Dominant population in bed of Melaleuca Ck.
Lantana camara (**lantana**)	3, WONS*	Occasional presence, rarely common.
Opuntia sp (**prickly pear**)	2	Occasional presence, usually not on lower river banks
Parkinsonia aculeata (**parkinsonia**)	2, WONS*	Occasional presence, rarely common. Certainly seems under control on most properties.
Parthenium hysterophorus (**parthenium**)	2, WONS*	Occasional to common in actively grazed areas. Scarce or Absent in many areas during survey. The population can quickly change with rainfall
*WONS= Weed of National Significance		

3.6 Potential Commercial Timber - Salvage Logging

No attempt was made to quantify or systematically record the extent of any large trees (>600mm dbh for common hardwoods (forest red gum, river red gum, coolabah) with potential commercial value, however incidental recordings and other general observations were occasionally noted during the field surveys of the larger trees within the inundation zones. Furthermore numerous conversations with many of the relevant landholders suggests the presence of varying quantities of commercial timber exists within the inundation zones of both Eden Bann and Rookwood proposed impoundments. Site access, legal availability, royalties, simplicity of extraction and other logistical factors etc. were not granted any specific attention in considering these observations and discussions.

The greater part of this potential commercial timber resource is represented by either *Eucalyptus tereticornis* or *E. camaldulensis* with the occasional *E. coolabah* in some places. Numerous large specimens of *Melaleuca leucadendra* and several other occasional species also sit below the proposed inundation levels and some this non-eucalypt timber may also have a commercial potential. The market interest for these non-eucalypt species may not be strong due the likelihood that fibrous barked trees in flooded areas can often have concealed sub-surface scars full of silt that devalue the timber (R. Healey. *pers comm*.. Jan 2007) However, the callistemons and melaleucas in particular are likely to survive inundation in many of the shallower areas of the proposed impoundments. This is supported by evidence at Eden Bann that currently suggests some trees can survive for many years in the weirs at depths of up to 2mtrs with favourable water level pattens. Therefore the salvage harvest of any timber should be limited to trees that will not survive inundation or trees that are otherwise earmarked for removal under any other genuine reason. Additionally, in the context of maintaining the values of fringing vegetation corridors, it would be counter productive for salvage harvest activities to cause or otherwise facilitate extensive disturbance to any remnants or other important vegetation that is to be retained above the inundation contours.

3.7 Rare and Threatened Species

3.7.1 Significant Flora targeted for review

The following table summarises the rare and threatened (EVR) flora identified in preliminary searches as potentially significant to the inundation zones of the Lower Fitzroy Weirs and other adjacent habitats. These EVR species are pooled in broad habitat groups as a convenient way of addressing the various taxa.

Table 4 Rare and Threatened Flora Potentially Relevant to Inundation Zones

Family	Scientific Name	Proximity to Weirs	Status NCA	Status EPBC	Habitat group
EUPHORBIACEAE	*Actephila sessilifolia*		R	-	Vine-Scrub
APONOGETONACEAE	*Aponogeton queenslandicus*	NEAR	R	-	Alluvial
SAPINDACEAE	*Atalaya calcicola*		R	-	Vine-Scrub
PITTOSPORACEAE	*Bursaria reevesii*	-	V	-	Serpentine
SURIANACEAE	*Cadellia pentastylis*	NEAR	V	V	Vine-Scrub
MYRTACEAE	*Callistemon sp* (Marlborough Ck G.N.Batianoff+MC9108006)	ON SITE	-	-	Alluvial
CAPPARACEAE	*Capparis humistrata*		**E**	-	Serpentine
CAPPARACEAE	*Capparis thozetiana*	-	V	V	Serpentine
APOCYNACEAE	*Cerbera dumicola*		R	-	Serpentine
MYRTACEAE	*Corymbia xanthope*	NEAR	V	V	Serpentine
CYCADACEAE	*Cycas ophiolitica*		**E**	**E**	Serpentine
COMBRETACEAE	*Dansiea elliptica*		R	-	Vine-Scrub
POACEAE	*Dichanthium setosum*		R	V	Alluvial
MYRTACEAE	*Eucalyptus raveretiana*	ON SITE	V	V	Alluvial
MALVACEAE	*Gossypium sturtianum*		R	-	Vine-Scrub
PROTEACEAE	*Hakea trineura*		V	V	Serpentine
ARECACEAE	*Livistona nitida*		R	-	Alluvial
COMBRETACEAE	*Macropteranthes fitzalanii*		R	-	Vine-Scrub
COMBRETACEAE	*Macropteranthes leiocaulis*		R	-	Vine-Scrub
ZAMIACEAE	*Macrozamia serpentina*	NEAR	**E**	-	Serpentine
ASCLEPIADACEAE	*Marsdenia brevifolia*		V	V	Vine-Scrub
ASCLEPIADACEAE	*Marsdenia hemiptera*		R	-	Vine-Scrub
EUPHORBIACEAE	*Neoroepera buxifolia*	NEAR	V	V	Serpentine
ASTERACEAE	*Olearia sp* (Glenavon P.I.Forst+PIF15039)		**E**	-	Serpentine
APOCYNACEAE	*Parsonsia lenticellata*		R	-	Vine-Scrub
POACEAE	*Paspalidium scrabrifoliium*		R	-	Alluvial
THYMELEACEAE	*Pimelea leptospermoidies*	VERY NEAR	R	V	Serpentine
FABACEAE	*Pultenaea setulosa*	NEAR	V	V	Serpentine
SIMAROUBACEAE	*Quassia bidwillii*		V	V	Serpentine
STACKHOUSIACEAE	*Stackhousia tryonii*	NEAR	R	-	Serpentine

Only one EVR species was detected in the proposed inundation zones: *Eucalyptus raveretiana*. Brief description and synopsis of each species considered appears below. A more detailed discussion is also included to address the nature of the affected populations of *E. raveretiana* along with the relevance of inundation.

3.7.2 Significant EVR impacted by inundation at Full Supply Level

Eucalyptus raveretiana is a medium to large tree from riparian habitats with a natural distribution that roughly includes sub-coastal ranges between Rockhampton and Charters Towers. The southern limit of the population includes watercourses that drain out of the lower end of the Boomer Range, with Melaleuca, Leura and Glenroy Creeks accounting for a large proportion of the species' local habitat. It is listed as vulnerable at state and national level with principal threats suggested by EPA (2001) as being (a) Habitat disturbance and smothering by rubbervine (*Cryptostegia grandiflora*), (b) timber harvesting of this species and (c) disturbance of habitat during timber harvesting operations.

E. raveretiana occurs within the weir study, with a significant population (200 trees over 5mtr high) found along Melaleuca Ck within or beside the Rookwood Inundation Zone at FSL 49m AHD, the location being indicated on Map 18 by the series of red stars. The population estimates were obtained by recording stem counts over a series of eight x 100m sampling transects for *E. raveretiana* specimens over 5mtr in height, with sampling events at roughly 400m spacing running along the bed and banks of Melaleuca Ck, and suggested an approximate density of 44 trees per Km of Creek on average. Field observations produced an estimate of about 100 *E. raveretiana* plants that appeared to lie within the assumed inundation level at FSL 49m AHD. A downstream subset of these, numbering approximately 40 specimens were considered to be located in or near FSL 47m AHD.

The population of *E. raveretiana* along Melaleuca Ck includes what appears to be a reasonable proportion of larger mature trees (dbh > 0.8mtr) and a patchy mix of younger trees and saplings. These characteristics suggest the *E. raveretiana* population does not appear to be in any rapid state of decline at this southern extent of it's natural range. However, it should be noted here that this very population is currently facing the very real threat of habitat destruction including the foreseeable deaths of individual trees, large and small from a serious rubbervine infestation. The field site photograph in Attachment 2 (EB 516) gives an indication of the nature of the rubbervine menace along this section of Melaleuca Ck. A second photo illustrating a contiguous section of this fringing woodland further upstream along Melaleuca Ck depicts a large tree of E. Raveretiana growing in a lesser disturbed riparian setting.

Two populations of *E. raveretiana* were detected in the Eden Bann study area with one specimen located very near the inundation zone for the Eden Bann FSL 20.5m AHD (Map 17 Attachment 2). This very large tree sits mid-bank in the lower-most reach of Glenroy Ck, near the junction with the Fitzroy River and field observations suggest it is approximately 2mtr + above FSL20.5m AHD . The balance of the *E. raveretiana* population found on Glenroy Ck were located further upstream above the still water limit of FSL 20.5. An additional population was recorded on Ten Mile Ck, to the west of 'Redbank' and another un-named branch of Green Ck nearby to the north. Population density estimates for these two populations of 48 trees/km for Ten Mile Ck and 40 trees/km for the Green Ck site however the riparian vegetation along both of these creeks is frequently disturbed and greatly fragmented or otherwise cleared as they separately cross the last 4km of alluvial plain to the Fitzroy River.

Population estimates and localised distribution relevant to the Eden Bann inundation zones in Princhester and Marlborough were prepared for *Callistemon sp* (Marlborough Ck G.N.Batianoff+ MC9108006) as a species of interest. It is not listed as rare or threatened at either state or national level and therefore has not been added to this report.

3.7.3 EVR flora descriptions and summary of relevance to weir study area

EVR flora species with relevance to weirs Discussion

Extracts for plant descriptions and habitat requirements were adapted from the following sources: Batianoff *et al*. (2000), Stanley and Ross (1988), Brooker and Kleinig (2004), DEH (2006), Stevens and Dowling (2002).

Alluvial and clay plain EVR Species

***Scientific name* (Common name)** **FAMILY** **NCA (EPBC)**

Aponogeton queenslandicus **APONOGETONACEAE** **R** **(-)**

Description: Seasonally emergent aquatic plant which occurs throughout much of coastal Queensland, with a tuberous base supporting almost always floating leaves, and flowering spikes which are shortly emergent above the water surface.
Habitat: Occurs in deep temporary freshwater pools which have access to full sun and have clay bottoms (Stephens, Dowling 2002). Not usually found in permanent waters.
Reason for consideration: Typical *A. queenslandicus* habitat is ephemeral RE 11.3.27 water holes.
Population relevance to weir inundation zones: The maximum inundation level for either reservoir does not cover any alluvial plain where 11.3.27 occurs. The Horseshoe Lagoon on Coorumburra is mapped as 11.3.27, although no species of *Aponogeton queenslandicus* were found. It is likely that aquatic species will be less affected by water rise as the aquatic habitat properties of the Lagoon seem likely to remain the similar in most sections except shallow areas gaining greater depth at full supply level 20.5mtr.
Voucher specimens sent: yes ( ) -collected from 11.3.27 waterhole on alluvial plain

Dichanthium setosum **POACEAE** **R** **(V)**

Description: Perennial, tufted grass to 70cm tall
Habitat: Uncommon across it's natural distribution but has been found in a broad range of soils across Queensland.
Reason for consideration: Historic record was encountered in broad district searching.
Population relevance to weir inundation zones: Highly unlikely that there would be a naturally sustainable population living within a close proximity of the standing water level on the lower Fitzroy River and subsequently it is not considered to be an issue in respect to these reservoirs.
Voucher specimens sent: NIL LOCATED

***Eucalyptus raveretiana* (Ironbox)** **MYTACEAE** **V** **(V)**

Description: Tree to 25mtr tall.
Habitat: Found along rivers and creek and prefers a silty to loamy soil in the inland Rockhampton region to the northern Fitzroy Catchment (EUCLID, 2006).
Reason for consideration: Known to the author from the upper catchment of Melaleuca and Glenroy Creeks.
Population relevance to weir inundation zones: The Melaleuca Ck population will be marginally affected at FSL 47 and clearly impacted at FSL49mtr. The Glenroy Ck (1) and Six Mile Ck (?) populations may have a limited number of outlying individuals affected by inundation at FSL 20.5. FSL 18.5 is unlikely to affect *E. raveretiana* with no specimens observed within the 18.5 mtr zone.
Voucher specimens sent: Melaleuca CK ( ) Glenroy Ck ( ) Six Mile Ck ( )

***Livistona nitida* (Carnarvon fan palm)** **ARECACEAE** **R** **(-)**

Description: Cabbage palm to ten mtrs +
Habitat: Limited to a few known places on alluvium in the upper Dawson River Catchment
Reason for consideration: Scattered cabbage palm trees found sporadically along lower Fitzroy R.
Population relevance to weir inundation zones: Any potential presence would most likely be within inundation zone as L. nitida exhibits preference for low lying alluvials. Nil specimens located from

extensive field traverses so it is therefore concluded that it would be unlikely for any naturally sustainable populations to occur within the respective weir pools at FSL 20.5 or FSL49.0.
Voucher specimens sent: NIL LOCATED

Paspalidium scrabrifoliium **POACEAE R (-)**

Description: Perennial, tufted grass to 100cm tall
Habitat: Endemic to brigalow communities on alluvial soils especially RE 11.3.1
Reason for consideration: Historic species record picked up in broad scale district search, preferred habitat (RE 11.3.1) remnants found near weir pools suggesting relic populations may persist.
Population relevance to weir inundation zones: The 11.3.1 brigalow communities have been found to occur above FSL 20.5 and FSL 49.0. No specimens were collected during field searches yet populations could potentially occur. Suggest additional searches targeting 11.3.1 near Rookwood weir site at more appropriate seasonal conditions to look for this species.
Voucher specimens sent: NIL LOCATED

Serpentine Endemics (Eden Bann Study Area only)

Bursaria reevesii **PITTOSPORACEAE V (-)**

Description: Small upright tree/shrub
Habitat: Eucalypt woodland on serpentine hills
Reason for consideration: Known to occur on serpentine soils in nearby hills and ranges and may possibly occur within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Data queries and field searching did not produce any records within any proximity to the respective inundation zones. Incidental plants may potentially occur but it is not expected that any significant and/or naturally sustainable populations will exist within the inundation zone.
Voucher specimens sent: NIL LOCATED

Callistemon sp **(Marlborough Ck G.N.Batianoff+MC9108006)** **MYRTACEAE - -**

Description: Small upright shrubby tree to 4mtr tall
Habitat: Riparian forests and woodlands with serpentine alluvium.
Reason for consideration: Recorded on alluvium soil in Princhester and Marlborough Creeks. Historic EVR data also identifies both creeks as essential habitat RE within 1km of the 20.5mtr FSL.
Population relevance to weir inundation zones: Populations in Princhester and Marlborough Creeks lie within the 18.5mtr FSL and many plants will be adversely affected by the raised water levels.
Voucher specimens sent: Yes ( )

Capparis humistrata **CAPPARACEAE E (-)**

Description: Low erect woody shrub to 1m
Habitat: *Eucalyptus fibrosa* woodland on serpentinite soils.
Reason for consideration: Known to occur on serpentine soils in nearby hills and ranges and may possibly occur within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Preference for serpentine soils, often on stony hillsides. No specimens found during field searches yet incidental plants may potentially occur. Consequently it is considered unlikely that any naturally sustainable populations of this species would currently occur below FSL 20.5.
Voucher specimens sent: NIL LOCATED

Capparis thozetiana **CAPPARACEAE V (V)**

Description: Prostrate shrub to 40cm high
Habitat: *Eucalyptus fibrosa* woodland on serpentinite hill slopes
Reason for consideration: Known to occur on serpentine soils in nearby hills and ranges and may possibly occur within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Preference for serpentine soils often on stony hillsides, unlikely to be any naturally sustainable populations of this species within raised inundation zones. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

Cerbera dumicola **APOCYNACEAE R (-)**

Description: Small tree to 6mtr
Habitat: Sandy loam to hard red soil in open forests of *Acacia shirleyi* and scrubs of rosewood and lancewood
Reason for consideration: Specimen records present for the broader search area.
Population relevance to weir inundation zones: This tree is not typically found in riverine communities. Was not sighted during field searches and would not be affected by the raised water levels in the plant's preferred habitat.
Voucher specimens sent: NIL LOCATED

Corymbia xanthope **(Glen Geddes bloodwood) MYTACEAE V (V)**

Description: Small to medium height tree, tessellated grey or light brown bark and strongly discolours leaves.
Habitat: Occurring on soils derived from serpentinite in nearby hills and ranges, restricted between Rockhampton and Marlborough. Expected to occur on serpentine slopes within 0.5km of the Eden Bann weir pool.
Reason for consideration: Serpentine endemic, known to occur in surrounding areas.
Population relevance to weir inundation zones: Unlikely to be any naturally sustainable populations of this species within inundation zones. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: Yes ( )

Cycas ophiolitica **(Marlborough blue) CYCADACEAE E (E)**

Description: Trunked cycad to about 3mtr high.
Habitat: Eucalypt woodland and forest often on serpertinite, with patchy distribution.
Reason for consideration: Serpentine endemic, may occur in surrounding hills within 1.0km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Unlikely to be any naturally sustainable populations of this species within inundation zones. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

Hakea trineura **PROTEACEAE V (V)**

Description: Multi-stemmed open shrub to 3mtr tall.
Habitat: Eucalypt woodland on serpentine soils
Reason for consideration: Known records within 1.5km of Eden Bann weir pool on serpentinite.
Population relevance to weir inundation zones: Unlikely to be any naturally sustainable populations of this species within inundation zones. More frequently found on stony/gravely soils with low clay content.
Voucher specimens sent: NIL LOCATED

Macrozamia serpentina **ZAMIACEAE E (-)**

Description: Small cycad with underground stem and rigid dark green upright fronds.
Habitat: Open forest and woodland on serpentinite hills between Rockhampton and Marlborough.
Reason for consideration: Known serpentine endemic, expected to occur in serpentine habitats on Eden Bann, Glen Avon and Mt Fairview.
Population relevance to weir inundation zones: Unlikely to occur in any significant numbers near FSL 20.5 at it appears to demonstrate a strong preference for soils on the adjacent serpentine hills. Found in sites above FSL 20.5 on Glen Avon, Mt Fairview, Eden Bann and not yet confirmed on Marble Ridges.
Voucher specimens sent: Yes ( )

Marsdenia brevifolia **ASCLEPIADACEAE V (V)**

Description: Herbaceous vine with white sap
Habitat: Occurs in open forest on brown loam soil or red serpentine soils.
Reason for consideration: HERBRECS data has evidence of three records of this species in local serpentine hills, possibly may occur within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Preference for serpentine soils often on stony hillsides, unlikely to be any naturally sustainable populations of this species within raised inundation zones. Incidental plants may occur but nil found during field searches

Voucher specimens sent: NIL LOCATED

Neoroepera buxifolia **EUPHOBIACEAE V (V)**

Description: Small tree/shrub to 4-5mt.
Habitat: In serpentine communities especially on alluvium.
Reason for consideration: Known populations within the Princhester and Marlborough Creeks area and associated drainage lines.
Population relevance to weir inundation zones: Population present in upper region of Princhester and Marlborough Creeks, no specimens found in lower sections near inundation zone. Not considered significant to weir inundation levels due to lack of presence.
Voucher specimen: Yes ( ), from upstream section of Marlborough Ck, NIL LOCATED In Weir Zone.

Olearia sp. **(Glenavon P.I.Forster+PIF15039) ASTERACEAE E (-)**

Description: Upright daisy with shrubby habit to 1mtr.
Habitat: Eucalypt woodland on serpentinite hills
Reason for consideration: EVR data records for populations on Glenavon, possibly may occur within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Preference for serpentine soil often on stony hillsides, unlikely to be any naturally sustainable populations of this species below FSL 20.5. Incidental plants may occur within the Eden Bann inundation zone but nil found during field searches.
Voucher specimens sent: NIL LOCATED

Parsonsia lenticellata **(narrow leaved parsonsia) APOCYNACEAE R (-)**

Description: Slender wiry twiner with light coloured bark.
Habitat: Depauperate rainforests in coastal districts, serpentinite and non serpentinite soils.
Reason for consideration: Historic EVR data suggest there is potential habitat within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Unlikely to be any naturally sustainable populations of this species within FSL 20.5 as the preferred habitat on the serpentine hills excludes the alluvial clay and loam of the weir inundation zone. Incidental plants may occur below FSL 20.5 but nil specimens were found during field searches.
Voucher specimens sent: NIL LOCATED

Pimelea leptospermoidies **THYMELEACEAE R (V)**

Description: Small upright shrub to 1.2mtr.
Habitat: Eucalypt woodland on serpentine hills
Reason for consideration: Known to occur on serpentine soils in nearby hills and ranges and may possibly occur within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Unlikely to be any naturally sustainable populations of this species below FSL 20.5 as the preferred habitat on the serpentine hills excludes the alluvial clay and loam of the weir inundation zone. Specimens were found on a hillside above the inundation zone at approx 35mtr ASL in the serpentinite woodland. Incidental plants may occur below FSL 20.5 but any presence is unlikely to be part of a naturally sustainable population due to the soil properties and proximity to seasonal flooding levels otherwise.
Voucher specimens sent: Yes ( )

Pultenaea setulosa **FABACEAE V (V)**

Description: Upright shrub to about 1.5mtr tall
Habitat: Eucalypt woodland on serpentine hills
Reason for consideration: EVR records indicate populations on 'Eden Bann' and 'Mt Fairview', known to occur on serpentine soils in nearby hills and ranges and may possibly occur within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Preference for serpentine soils often on stony hillsides, unlikely to be any naturally sustainable populations of this species within inundation zones. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

***Quassia bidwillii* (Quassia)** **SIMAROUBACEAE** **V** **(V)**

Description: Upright tree to 6mtr tall with red flowers and fruit.
Habitat: Found from Gympie to Mackay in dry rainforests and rainforests edges, also found in scrub on serpentine soils.
Reason for consideration: Known to occur on serpentine soils in local hills and ranges and may possibly occur within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Preference for serpentine soils unlikely to be any naturally sustainable populations of this species within the 20.5 and 49mtr FSL's. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

Stackhousia tryonii **STACKHOUSIACEAE** **R** **(-)**

Description: Small and often scrawny herbaceous plant
Habitat: Eucalypt woodlands on serpentinite soils, also occurring on non-serpentinite soils.
Reason for consideration: Known to occur on serpentine soils in nearby hills and ranges and may possibly occur within 0.5km of the Eden Bann weir pool.
Population relevance to weir inundation zones: Preference for serpentine soils unlikely to be any naturally sustainable populations of this species within inundation zones. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

Semi-evergreen Vine-thicket EVR (Rookwood sites)

Actephila sessilifolia **EUPHORBIACEAE** **R** **(-)**

Description: Shrub/small tree 1-6m in height
Habitat: Semi-evergreen vine thickets (SEVT) mostly on red soils or scree slopes.
Reason for consideration: Historic species record picked up in broad scale district searches, preferred habitat formerly found near weir pools, relic populations possible.
Population relevance to weir inundation zones: Preference for scrub soils, unlikely to be any naturally sustainable populations of this species within the 20.5 and 49mtr FSL's. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

Atalaya calcicola **SAPINDACEAE** **R** **(-)**

Description: Upright tree to 10m in height
Habitat: Dry rainforest and deciduous vine thickets on various metamorphic soils
Reason for consideration: Historic species record picked up in broad scale district search**.**
Population relevance to weir inundation zones: Preference for scrub soils, unlikely to be any naturally sustainable populations of this species within the 20.5 and 49mtr FSL's. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

***Cadellia pentastylis* (Ooline)** **SURIANACEAE** **V** **(V)**

Description: *C. pentastylis* is a medium to large tree to 25mtr with roundish bright green leaves and a dark tessellated type bark.
Habitat: Found in vine thickets and brigalow communities although much of these habitats have been cleared for agriculture in the past.
Reason for consideration: Known to the author from a brigalow community nearby to the north of Rookwood weir pool. Relic populations considered possible in brigalow/scrub pockets adjacent to the riparian systems.
Population relevance to weir inundation zones: A small population was located during field searches along the banks of MacKenzie River in the upper reaches of the proposed weir pool at FSL 49.0. It is questionable that this is a naturally sustainable population of *C. pentastylis* with long term sustainability as suggested by the following on-site evidence: small number of individuals sighted, relatively poor health of the remnant community, fragmented nature of the landscape and ongoing habitat disturbances. This population occurs on the upper left bank some 8+mtr vertically above the FLS 49.0 highest weir level in a brigalow remnant persisting at the edge of a cleared alluvial plain. The

population should not be affected by the elevated water level at this location as the water remains in the bed of the MacKenzie River near the upper limit of the Rookwood weir pool.
Voucher specimens sent: Yes

Dansiea elliptica **COMBRETACEAE** **R** **(-)**

Description: Shrub/tree ranging from 5-30m in height
Habitat: Low elevation dry rainforests and semi-evergreen vine thickets
Reason for consideration: Historic species record picked up in broad scale district search, preferred habitat formerly found near weir pools, relic populations possible
Population relevance to weir inundation zones: Preference for scrub soils, unlikely to be any naturally sustainable populations of this species within the 20.5 and 49mtr FSL's. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

Gossypium sturtianum **(Sturt's desert rose)** **MALVACEAE** **R** **(-)**

Description: Upright woody shrub to 3mtr high.
Habitat: Usually found on sandy or gravely soils along dry creek beds and rocky slopes.
Reason for consideration: Historic record (c.1938) within 10km of survey area, preferred habitat formerly found near weir pools, relic populations possible.
Population relevance to weir inundation zones: The site where this recording of this species occurred is in that of rosewood scrubs/woodlands well above the respective FSL levels. Much of the Fitzroy Rivers banks are that of silty alluvium and not the typical substrate for this particular plant and are unlikely to have any naturally sustainable populations within the respective FSL's. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

Macropteranthes fitzalanii **COMBRETACEAE** **R** **(-)**

Description: Small ever-green tree/shrub to 15m in height
Habitat: SEVT and littoral rainforest
Reason for consideration: Historic species record picked up in broad scale district search, preferred habitat formerly found near weir pools, relic populations possible.
Population relevance to weir inundation zones: Preference for scrub soils, unlikely to be any naturally sustainable populations of this species within the 20.5 and 49mtr FSL's. Incidental plants may occur but nil found during field searches.
Voucher specimens sent: NIL LOCATED

Macropteranthes leiocaulis **COMBRETACEAE** **R** **(-)**

Description: Evergreen upright tree to 25m
Habitat: Typically restricted to isolated pockets of sub-coastal dry scrub, especially vine thickets.
Reason for consideration: Historic species record picked up in broad scale district search, preferred habitat formerly found near weir pools, relic populations possible.
Population relevance to weir inundation zones: No specimens located during field searches, unlikely to find any naturally sustainable populations that will be affected by the raised weir pools.
Voucher specimens sent: NIL LOCATED

Marsdenia hemiptera **ASCLEPIADACEAE** **V** **-**

Description: Climbing woody vine with clear green sap.
Habitat: SEVT in gorges or low lying areas near water courses
Reason for consideration: HERBRECS data records two accounts of this species.
Population relevance to weir inundation zones: Highly unlikely that there would be a naturally sustainable population living within a close proximity of the standing water level on the lower Fitzroy River and subsequently it is not considered being an issue in respect to these reservoirs.
Voucher specimens sent: NIL LOCATED

3.8 Essential Habitat Mapping

Rookwood Study Area – Essential Habitat Mapping

Review of EPA essential habitat mapping for the Rookwood Weir study area returned nil Essential Habitat Species Records and nil Essential Habitat Area. This is consistent with the lack of other EVR flora records and also suggests an absence of EVR fauna records for the study area. The inclusion of any confirmed EVR flora records (*E. raveretiana*) collected during this study within the Essential Habitat mapping procedure will likely generate essential habitat areas that associate with the weir inundation zone. Due consideration of the *E. raveretiana* population in Melaleuca Creek will contribute to any essential habitat issues that we can reasonably predict for the near future for the Rookwood study area.

The *Aponogeton queenslandicus* specimen collected during field work from a small isolated waterhole on the cleared alluvial plain at 'Weir Park' is unlikely to generate any Essential Habitat Mapping Areas due to waterhole's relative isolation from mappable remnant vegetation. However, this small EVR population is unlikely to bear any direct relationship to the proposed Rookwood Weir impoundment. It may yet become relevant if development activities utilised access via 'Weir Park'.

Eden Bann Study Area - Essential Habitat Mapping

Review of EPA essential habitat mapping for the Eden Bann Weir study area reveals two Essential Habitat Areas (EPA 2006). Serpentine EVR flora trigger essential habitat mapping along Marlborough Ck in the upper reach of the weir pool at FSL20.5. A second essential habitat area is located around the Glenroy Crossing and relates to one EVR fauna species (*Rheodytes leukops*). This fauna related essential mapping has not been considered further within this vegetation study.

The Marlborough Ck essential habitat mapping area relates to serpentine endemics on hills and colluvials (*Stackhousia tryonii, Pimelea leptospermoides* and *Capparis thozetiana*) and *Neoroepera buxifolia* along watercourses. Field searches in this study did not return evidence of these species within the inundation zone for FSL 20.5 although it is possible that isolated individuals of *N. buxifolia* may have escaped detection in the bed of Marlborough Ck. In contrast field traverses have returned records of *Callistemon sp* (Marlborough Ck G.N.Batianoff+MC9108006) along the bed of the creek and these records are likely to contribute to a future Essential Habitat mapping procedure and may thence generate further essential habitat areas associated with lower sections Marlborough Ck, within the FSL 18.5 and FSL 20.5 inundation zone.

Further Essential Habitat Mapping Areas are likely to be generated for the EVR specimen records lodged as a result of this study for the EVR flora collected during field searches. These will relate to *E. raveretiana* at Glenroy Ck and Six Mile Ck, *Callistemon sp* (Marlborough Ck G.N.Batianoff+ MC9108006) and a small isolated set of serpentine shrubs along Princhester Ck and the genuine serpentinite hill records of the remaining serpentine endemics up slope away from the Eden Bann Weir inundation zone.

This is consistent with the lack of other EVR flora records and also suggests an absence of EVR fauna records for the study area. The inclusion of any confirmed EVR flora records (*E. raveretiana*) collected during this study within the Essential Habitat mapping procedure will likely generate essential habitat areas that associate with the weir inundation zone.

4.0 Bio-condition Assessment and Benchmarking – Remnant Vegetation

4.1 Comments on Bio-condition Assessment

Bio-condition habitat assessment provides a method of evaluating a terrestrial ecosystem through examination of characteristics of a selected subset of habitat elements. These elements will serve as de-facto habitat quality indicators for many of the flora and fauna species of the habitats in question. The Bio-condition concept and methodology is introduced and thoroughly explained in Eyre (2006a) however the following notes should help an uninformed reader better understand some of the concepts in the absence of the aforesaid source methodology.
Many of the elements used in Bio-condition are self explanatory with their very appropriate titles and other elements are listed below.
Tree and shrub layer elements:

- Tree recruitment – measure of tree species that are regenerating on site by seed/suckers etc
- Large trees – calculated from number of trees over 60cm dbh and no. of hollow limbs
- Tree height – average height of the dominant tree layer on site
- Leaf litter – (dependent on tree layers for organic material, benefits delivered at the ground)
- Canopy health – measure overall tree canopy cover filtered by apparent tree health through crown density / disease signs
- Shrub cover

Ground layer elements:

- Diversity overall – number of native species in tree, shrub, forb/herb, grass and 'other' categories.
- Perennial grass – grass that lasts more than a year
- Perennial herbs – last more than a season, typically have woody stems
- Annual herbs/grasses – non woody, usually last the one growing season
- Logs and decay – fallen logs over 100mm dia. + longer than 500mm, and % of rotting wood
- Weed cover – measured as a percentage of ground covered by the weeds

The remaining three are **landscape elements** calculated by desktop GIS analysis

- Patch size – relates to the collective size of single or connected native vegetation remnants
- Connectivity – scored on the target remnant's connections with other remnant areas
- Context – based on the variety of other remnant communities in immediate neighbourhood

The Bio-condition assessment approach is a simple and convenient method for use in ecological field survey work. Unfortunately it is a moderately coarse method of quantifying the 'quality' woody habitats in and dynamic environment such as that found in the Lower Fitzroy alluvial system..

4.2 Bio-condition Analysis

The general location of the 160 bio-condition sampling sites is illustrated on Map 17 (Eden Bann) and Map 18 (Rookwood) in Attachment 2. Property aggregations referred in text below appear on Map 18 (Eden Bann) and Map 19 (Rookwood). One hundred and forty three bio-condition sites directly relate to habitats potentially affected by proposed inundation levels. The remaining seventeen sites include habitats in nearby regional ecosystems that may have been affected by the weir developments are an integral part of the landscape surrounding the proposed weir impoundments. The latter group of sites is not included in the data analysis due to a small sample count for each of these additional habitats. The term habitat has been applied in discussion to reduce the confusion than may occur between the two levels of regional ecosystems and regional ecosystem sub-types. This bio-condition field sampling and analysis followed a 'habitat' approach so like areas could be more effectively compared. Particularly the floristic differences between subtypes of RE 11.3.25 were occasionally far greater than the differences between an adjoining RE, especially RE 11.3.4.

Additionally no bio-condition sites were applied to the sub-type RE 11.3.25f (vegetated sand banks, rocky bars etc., within the river channel) due to (a) the combination of shortage of material to measure and (b) the fact that site variation within RE 11.3.25f was so broad the data would be difficult to

successfully analyse and (c) exposure to flooding events means these sites are often highly dynamic and can change dramatically within a short period of time.

There are a great many variables that can affect many of the habitat elements and a few notable factors are likely to influence the collection of data for this assessment. Climatic conditions can influence data seasonally and the storm rain received in the latter part of this survey clearly provided a leafy boost to the perennial grasses for a short period which generated an increase in some ground layer scoring for several of the Rookwood sites. Interestingly the annuals didn't respond as well as the perennials, suggesting more rainfall may have been required to trigger a widespread growth cycle in the annuals. Grazing activity and control burning/bushfire are two other variables that can occur in the short term to influence bio-condition scoring, especially the ground layer elements. Given the inability to control these and other variables the data is evaluated with simple graphical means to indicate the trends that can be observed. The authors have concluded that far larger sample sizes would be required to support the application of more detailed statistical analysis of the data.

Note: API cannot give a reliable estimate of bio-condition due the inability to view the composition and visualise structural detail of most vegetation communities. Subsequently it is not feasible to produce reliable mapping of RE habitat condition.

4.3 Bio-condition Result – Habitat Condition at Property Level

The following first pass analysis reviews the bio-condition scores averaged at property level and allows a comparison with the calculated benchmark for the three more distinctive habitats. None of the sites could be considered to be in pristine condition due to a range of disturbing factors and consequently no scores reached the potential maximums. Potential maximum bio-condition site scores for each habitat were conceived by adding the sum of the third highest score for each element recorded in the field data.

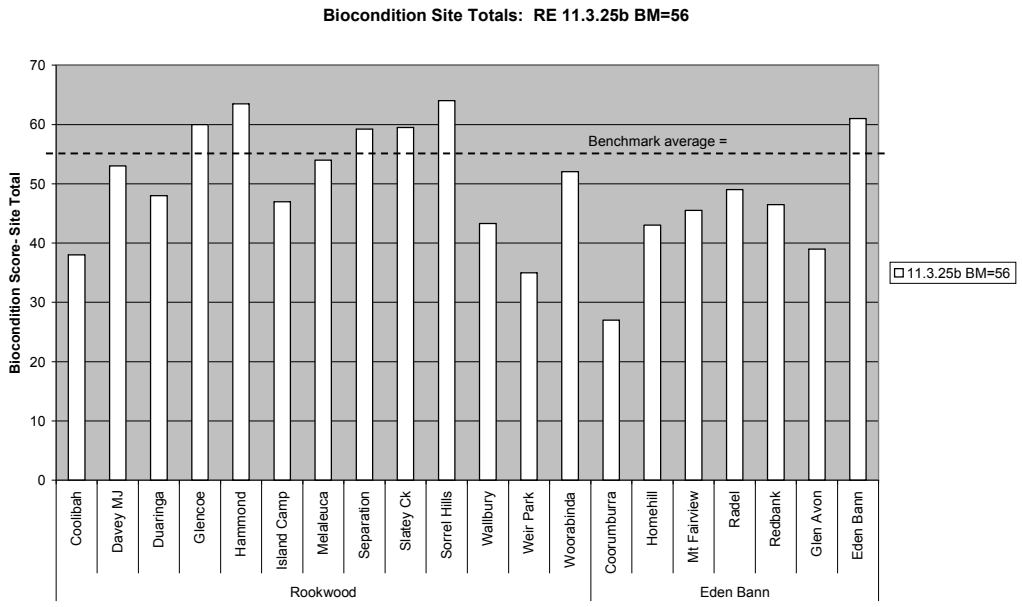


Figure 4. Bio-condition Site Scores Averaged by Properties for RE 11.3.25b (n=31)

Potential maximum score = 88

Lower scores in the Eden Bann Weir were frequently influenced by low values in the Landscape GIS elements, reflecting the extensive clearing on the alluvial plains. This pattern is consistent across all habitats examined. The Rookwood landscape includes several large remnants along the river and in nearby hills and properties with cultivation on alluvial plains adjacent the river seldom graze the river banks hence the higher ground layer scoring. The lower values at Coorumburra and Weir Park party reflect presence of sandbanks within the sample sites.

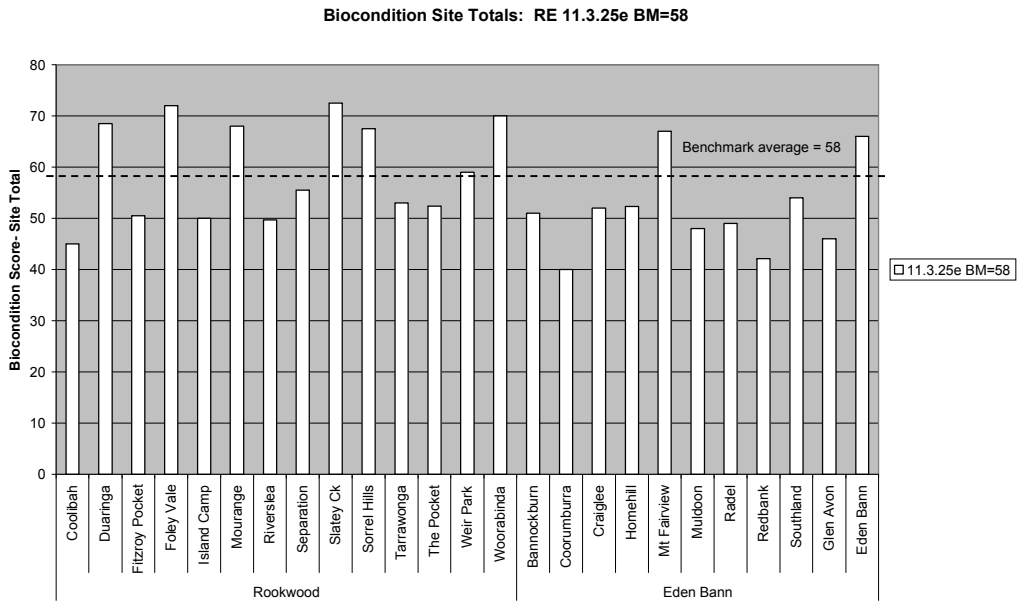


Figure 5. Bio-condition Site Scores Averaged by Properties for RE 11.3.25e (n=50)

Potential maximum score = 94

Many of these sites were experiencing invasion of green panic, buffel grass and other introduced pasture grasses. Only a small number of sites were affected by nuisance environmental or other noxious or declared weeds. Previous logging in many sites also reduced the scoring results.

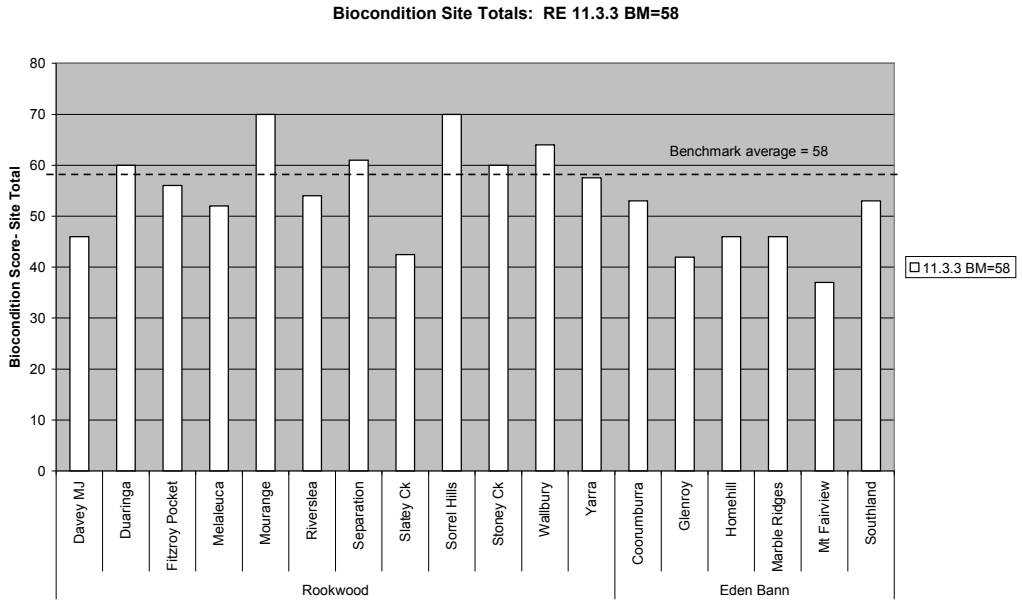


Figure 6. Bio-condition Site Scores Averaged by Properties for RE 11.3.3 (n=24)

Potential high score = 93

RE 11.3.3 was frequently located on the upper bank or adjacent alluvial plain beside RE 11.3.25e that typically occurs on the upper mid banks of the Fitzroy River. RE 11.3.3 starts to replace 11.3.25 on the upper and mid bank above Glenroy crossing. The field data for RE 11.3.25 returned the same benchmark value as RE 11.3.25e yet 11.3.3 has lower average diversity and canopy cover in shrub and tree layers. Benchmarking scores are relevant within each sampled habitat (RE) not across them.

4.3.1 Bio-condition Result– Comparison Above/below Inundation

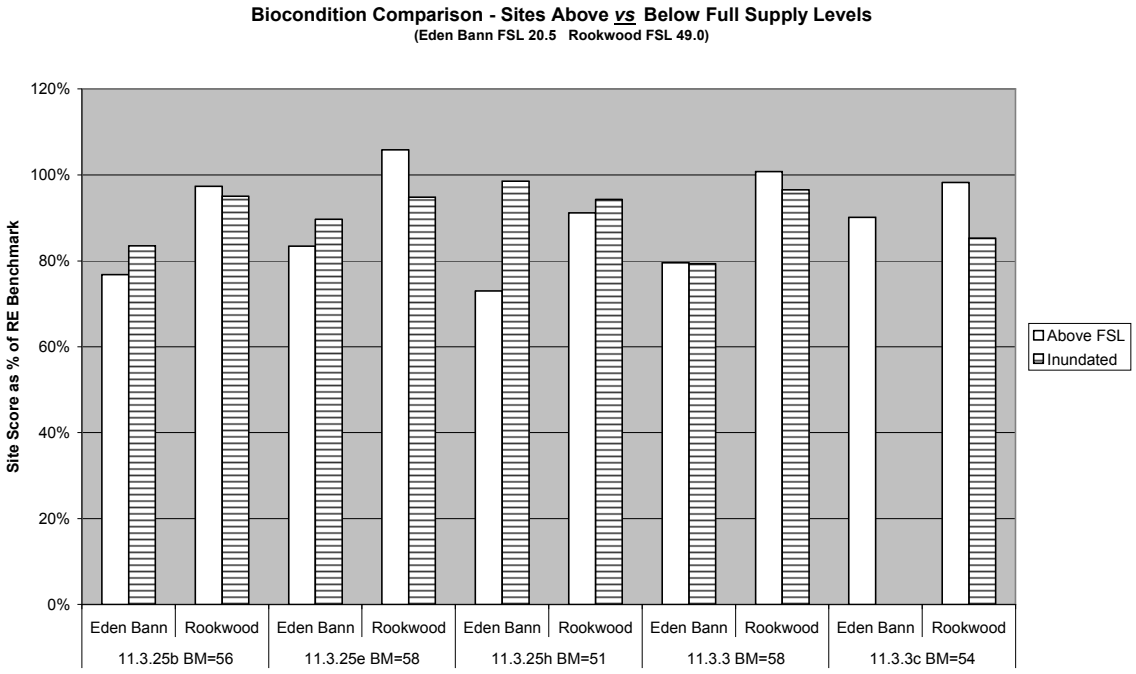


Figure 7. Comparison of Bio-condition Above/below Inundation Contours. (n=113)
Scores averaged across all sites for each habitat and expressed as a percentage of habitat Benchmark.

Few scores in Figure 7 reach the 100% benchmark level as these scores are averages they are weighed down by the lower extreme values. We did not leave out the lower values because these sites were within areas mapped as remnant vegetation and appeared to meet the EPA guidelines for remnant vegetation. Presenting all site scores was graphically challenging for the authors in the current report format and was considered to be of limited value for areas meeting the remnant vegetation 70/50 rule.

The comparison between areas below the inundated contours (FSL 49 at Rookwood and FSL 20.5 Eden Bann) reveals occasional variation at this level of examination. The sample sizes for the Coolabah woodland habitats (RE 11.3.3 and RE 11.3.3c) were very small in the inundated areas with three sites collectively. Given that it was earlier reported that some 70 + hectares of coolabah woodland may be affected at FSL 49mtr it now seems relevant in hindsight that a few extra bio-condition sites within RE_11.3.3 would have been more appropriate.

4.3.2 Bio-condition Result – Trends Between Two Weirs

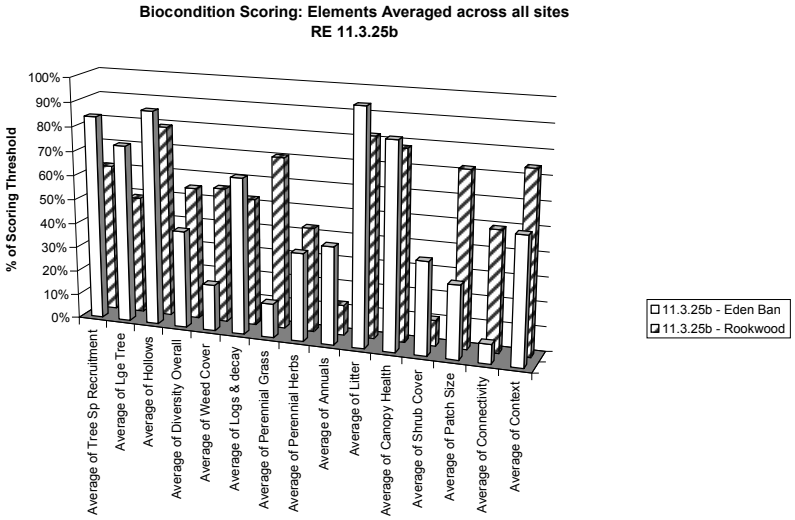


Figure 8. Comparison of Bio-condition elements between Weir Sites -RE 11.3.25b (n=31)

Comparison of 11.3.25b sites for each weir area suggests a higher average level of cover in the ground layer for the Rookwood sites. Interestingly both the weed cover and the perennial grass cover recordings were substantially higher at Rookwood. The GIS elements (patch size, connectivity and context) reflect the presence of larger tracts of remnant for the Rookwood area, notably at 'Island Camp' and along the, Dawson and McKenzie Rivers. This corresponds with the higher average for overall diversity recorded for the Rookwood sites.

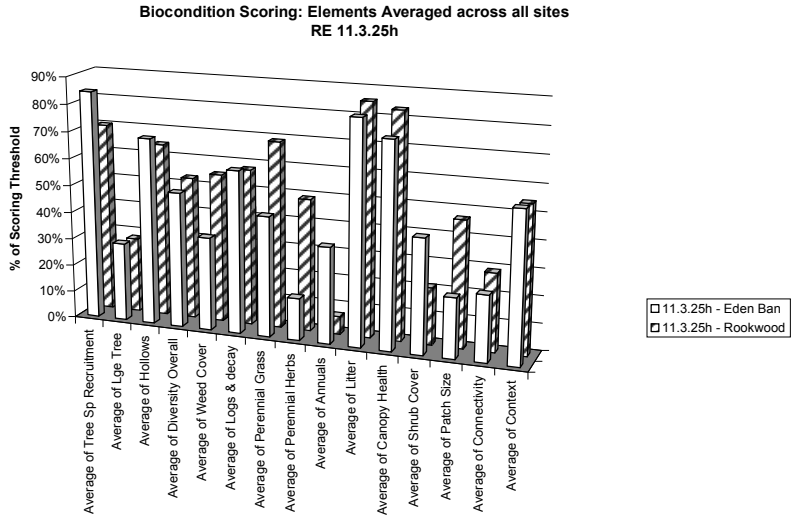


Figure 9. Comparison of Bio-condition elements between Weir Sites -RE 11.3.25h (n=27)

Landscape elements continue higher scoring at Rookwood sites. Cover scores for perennial grasses and annuals score higher at Rookwood – possible due the storm rains received before the last two weeks of field work that were undertaken at Rookwood sites – grass cover was noticeably growing each week.

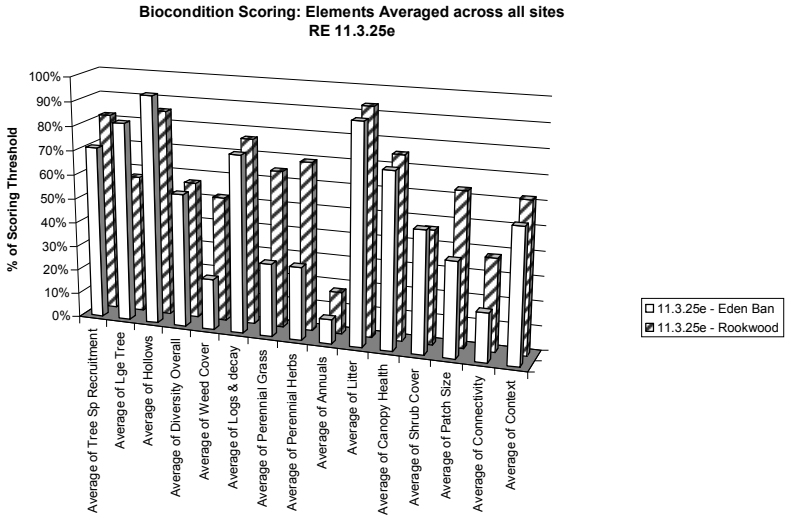


Figure 10. Comparison of Bio-condition elements between Weir Sites- 11.3.25e (n=50)

Higher landscape and ground cover scores (rain) at Rookwood as discussed earlier. Higher weed cover score at Rookwood relates to the rain in sites where the weed cover was dominated by introduced pasture grasses. It was uncommon for bio-condition sites to be dominated by weeds other than grasses – a selection bias continually applied by field staff, introduced pasture grasses were exempted from this approach as they are likely to remain in the landscape if not become more dominant over time.

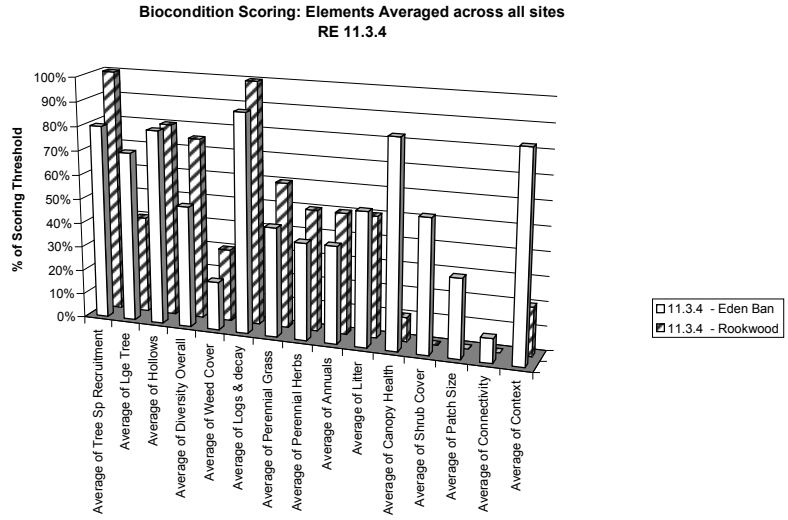


Figure 11. Comparison of Bio-condition elements between Weir Sites -RE 11.3.4 (n=5)

The higher ground cover scores are consistent with the rainfall theory and this is reflected in field notes. The distinctively lower scores in landscape attributes for Rookwood require deeper investigation as this habitat commonly occurs on the inner flank of wide bends and corners, away from the forested hills that have supported higher scores in other site assessments of the previous habitats.

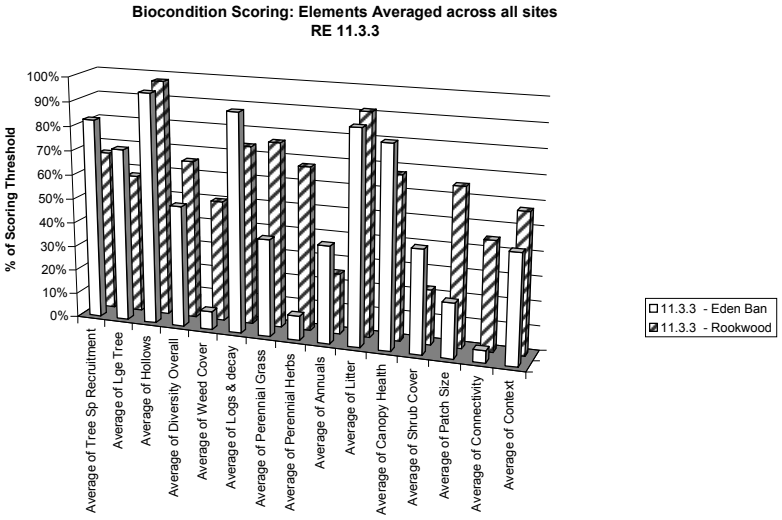


Figure 12. Comparison of Bio-condition elements between Weir Sites -RE 11.3.3 (n=24)

The average values for large trees and tree recruitment is lower at Rookwood, although review oft the field data sheds little light as to why this may be so and as the sample sizes were similar (13, 11) it is difficult to explain the 10% difference in these two elements. The higher ground cover scores can be attributed in part to the storms and it is likely that the larger proportion of cultivated alluvial plain near the Rookwood sites relates to lower grazing pressure and hence the higher ground cover scores.
The landscape elements are again higher for the Rookwood sites, following the trend identified earlier.

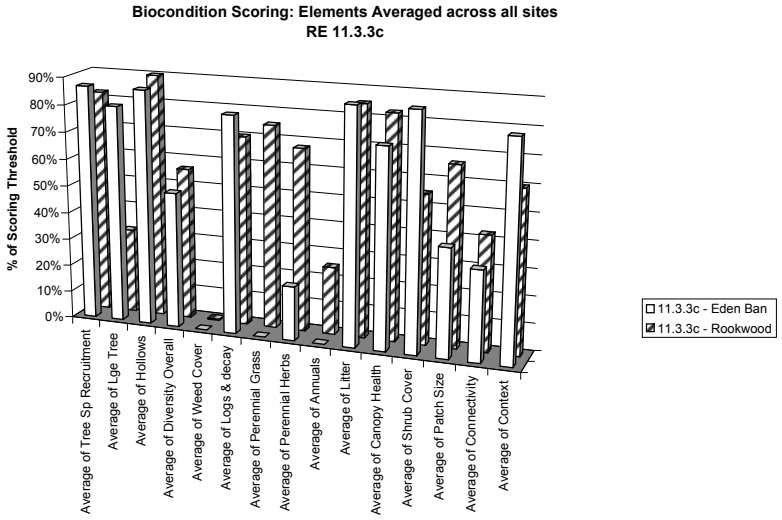


Figure 13. Comparison of Bio-condition elements between Weir Sites -RE 11.3.3c (n=11)

Given the small sample size it is unclear that this data can be used to suggest any reliable trends to compare the two weir study areas.

4.3.3 Bio-condition Result- Grazing and Past Logging

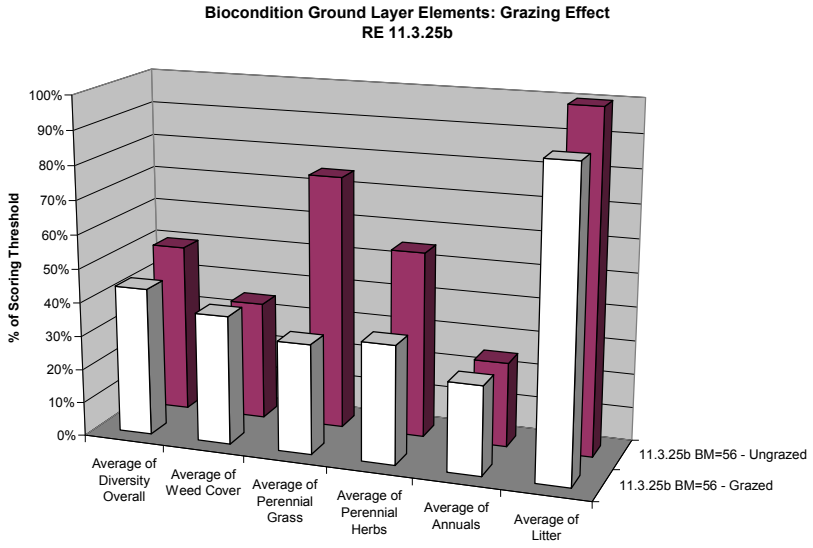


Figure 14. Grazing Effect on Ground Layer Elements -RE 11.3.25b (n=20)

Comment: This data does not reflect the intensity of grazing, as only presence/absence of livestock activity was noted. The trend to higher scores at Rookwood sites for perennial grass and herb cover is consistent with the suggestion of storm rain sponsoring a growth surge in perennial yet no great increase in annuals. Perhaps heavier rains and less of the following hot weather may have supported a better response from the annuals.

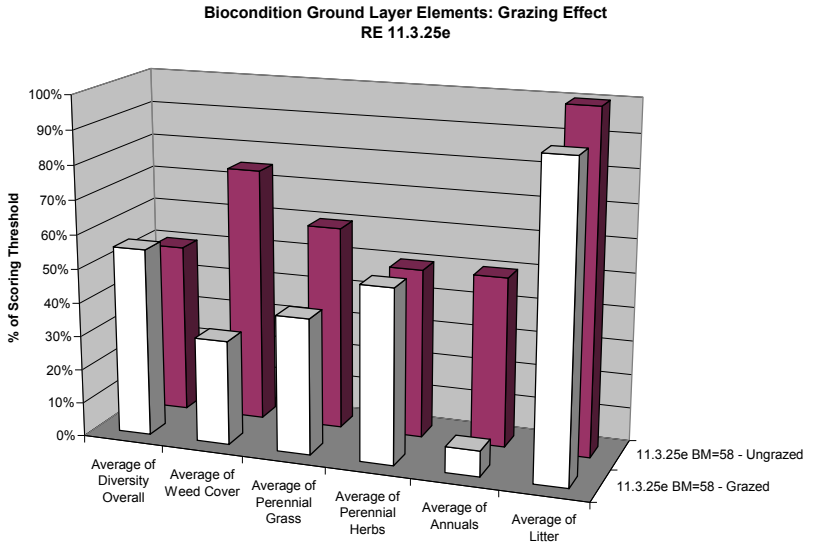


Figure 15. Grazing Effect on Ground Layer Elements -RE 11.3.25e (n=39)

Comment: This data does not reflect the intensity of grazing, as only presence/absence of livestock activity was noted. The higher weed cover score is accommodated by the abundance of introduced pasture grasses and the storm rains. The higher annuals score for Rookwood is clearly significant with a relatively large sample size but the reasoning for this is not clear at this time.

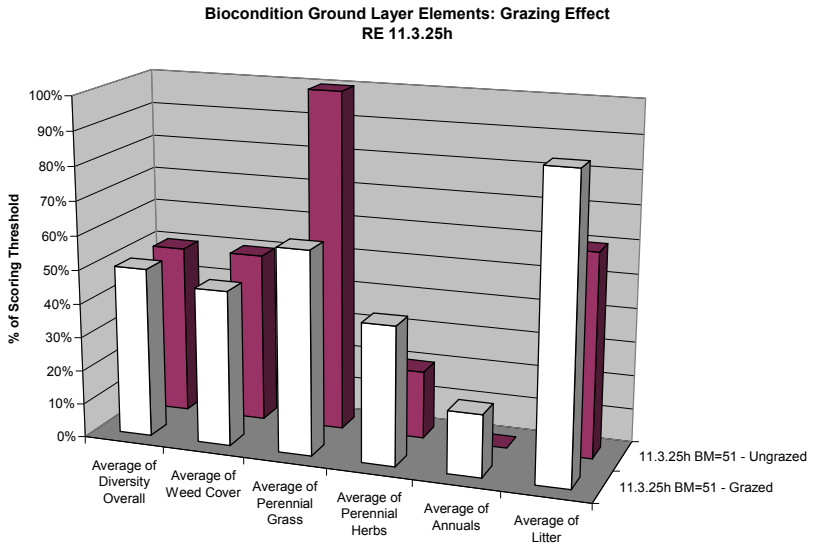


Figure 16. Grazing Effect on Ground Layer Elements -RE 11.3.25h (n=25)

Comment: This data does not reflect the intensity of grazing, as only presence/absence of livestock activity was noted. The contrast in scores for perennial grass cover and annual cover is very dramatic. An explanation for this pattern is not clear from examination the field data alone other than the species recordings in the field data.

4.3.4 Bio-condition results- Logging effect and Tree Layer

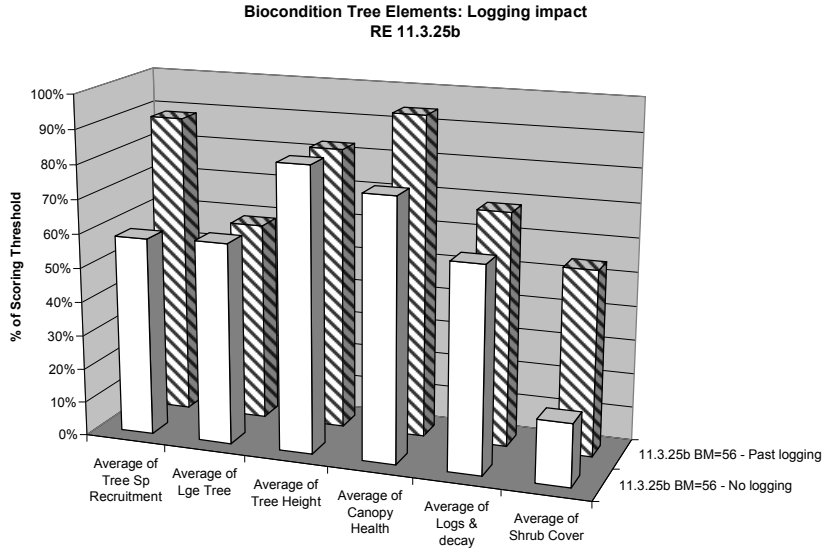


Figure 17. Past Logging Activity vs. Ground Layer Elements -RE 11.3.25b (n=19)

The logged/ not logged comparison is included as a method of displaying longer term changes between similar habitats. Without details on logging history, age and intensity it is difficult to draw any conclusions or infer the source of the trends that may be apparent in the charted data.

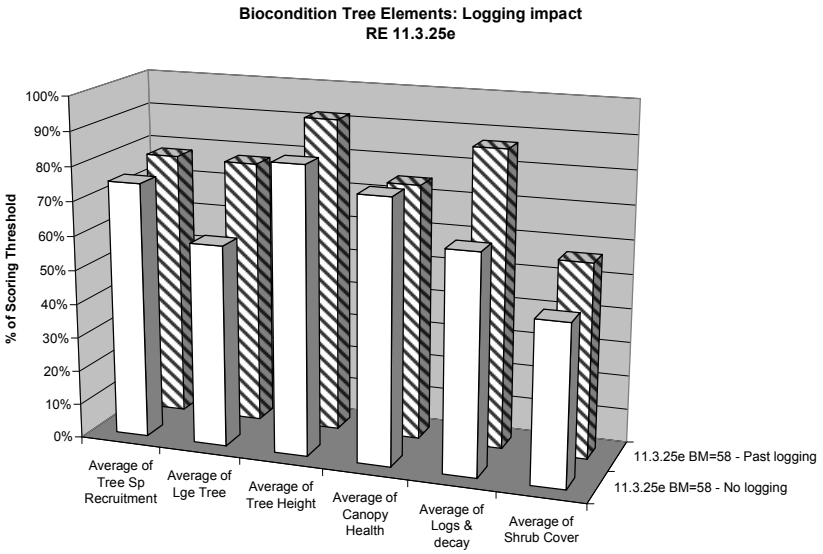


Figure 18. Past Logging Activity vs. Ground Layer Elements -RE 11.3.25e (n=40)
Please refer to comments for Figure 17

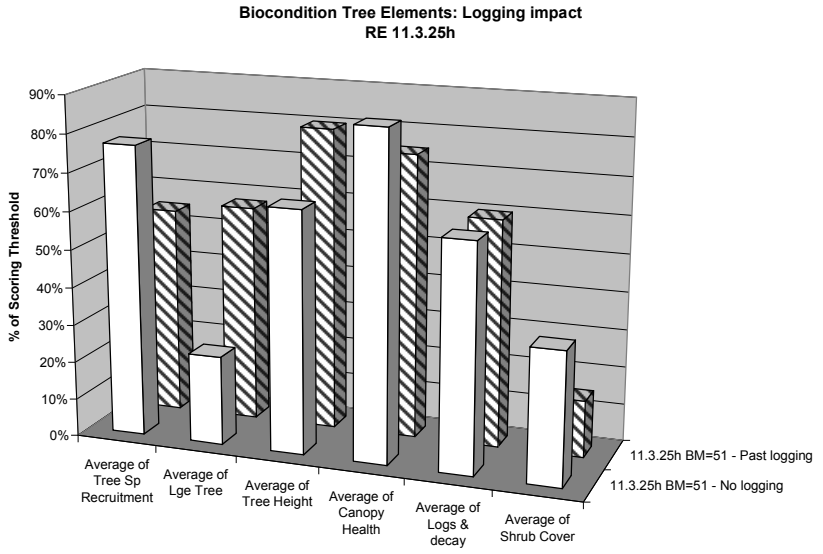


Figure 19. Past Logging Activity vs. Ground Layer Elements -RE 11.3.25h (n=24)
Please refer to comments for Figure 17

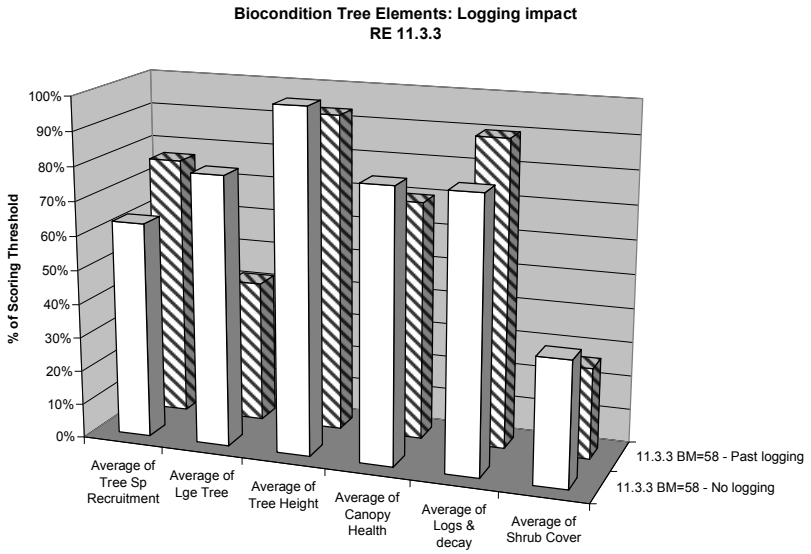


Figure 20. Past Logging Activity vs. Ground Layer Elements -RE 11.3.3 (n=18)
Please refer to comments for Figure 17

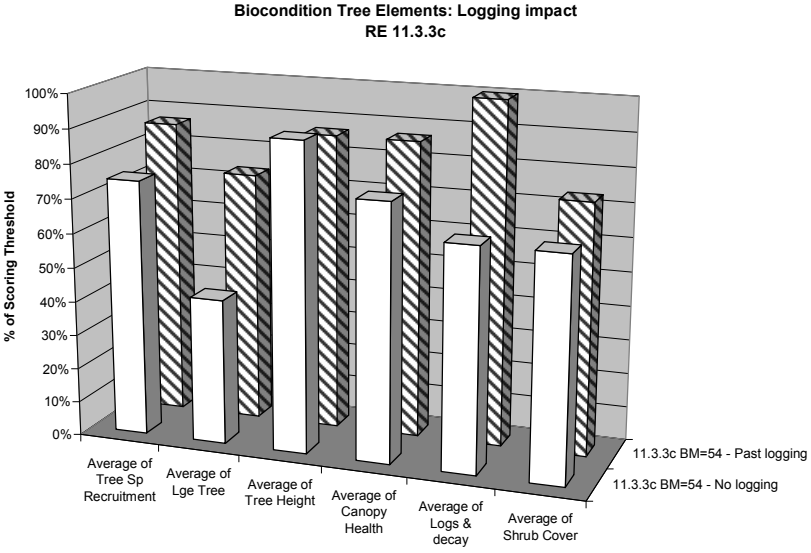


Figure 21. Past Logging Activity vs. Ground Layer Elements -RE 11.3.3c (n=7)
Please refer to comments for Figure 17

4.4 Bio-condition Assessment Benchmarks

Assessment benchmarks

It is relevant to note that the benchmark values used in the study were not developed from pristine sites as no known available sampling areas could be considered to remain in suitable pristine condition. Few conservation reserves exist near the lower Fitzroy River that include riparian habitats and the two that are located further downstream in the Rockhampton City Barrage reach have been invaded by aggressive tropical grasses and rubbervine as in the case of the Long Island Bend CP.

The assessment benchmark values were thus developed from sites within the study area and are based on averages calculated from a suite of the 'better condition' sites sampled during the field survey visits. These 'better' sites were used as a surrogate reference set of average of 'good' condition as sampled at the time of the field survey investigations.

The assessment benchmarks used for bio-condition assessment are presented in the following table (Table 5). The figures in the table relate to the site data sheets for biocondition assessment and may be in the form of a ratio, percentage, count, height and cover score. The landscape attribute figures are scores relevant to the assessment methodology.

Table 5 Bio-condition Assessment Benchmarks for the Lower Fitzroy Sites
(Note .- The greater part of this data was obtained from sites in the drier part of the year.)

	Regional Ecosystem (RE subtype where indicated)							
Bio-condition Assessment Element	**RE 11.3.25b**	**RE 11.3.25c**	**RE 11.3.25e**	**RE 11.3.25h**	**RE 11.3.3**	**RE 11.3.3c**	**RE 11.3.4**	**RE 11.3.1**
Over storey recruitment	63	100	70	73	66	84	76	67
Nos. of large trees	9	7	10	4	7	11	8	2
Nos. of large trees with hollows >10cm	1	0	3	1	2	3	3	1
Tree canopy height	17	23	22	14	24	20	25	14
Tree spp richness	3	4	4	3	3	4	4	4
Shrub spp richness	1	3	2	1	2	2	2	0
Grass (native) spp richness	4	5	3	3	3	3	3	4
Herbs and forb spp richness	4	8	4	4	4	5	3	4
Other spp richness	0	1	1	0	1	1	0	1
Weed cover %	28%	10%	35%	28%	30%	28%	36%	10%
Nos. of fallen woody logs >10cm dia.	5	9	8	5	11	10	10	18
Nos. of logs in advanced decay	1	1	1	1	2	2	2	6
Native perennial grass	18	36	14	22	13	11	16	21
Native perennial herbs and forbs	6	2	6	3	3	3	3	6
Native annual grass, herbs and forbs	5	2	1	2	1	2	2	0
Litter	37	32	38	28	42	39	38	40
Tree canopy cover	77	59	63	70	59	63	57	69
'Un-healthiness' of canopy	22	3	21	14	18	17	10	16
Shrub canopy cover	1	8	3	2	1	3	2	0
Landscape Attributes (GIS) (*these scores are of little relevance for sites away from the study area*.)								
Patch size	6	10	5	4	5	6	5	9
Connectivity	2	3	2	1	2	2	1	2
Context	3	4	3	3	3	3	3	4

4.5 Bio-condition – Long-term Reference Sites

Potential Reference Sites

Although the bio-condition site data supported the development of benchmark scores for this project, the data collected is not suitable as a typical reference marker for these RE's for two reasons. Firstly the sites used in this study selected sub-types of two REs (11.3.25 and 11.3.3) which may not be suitable for other bio-condition studies. Secondly, the dry seasonal conditions have reduced the ability to record a more complete suite of species in ground layer elements and cover estimates also appear to be lower than would otherwise occur in more favourable conditions. The dry season site data does suggest several locations where bio-condition reference data could be collected in better seasons, if not on the same sites identified herein. The following sites were the highest scoring locations in their respective habitat (Table 6)

Table 6 Highest Scoring Sites as Potential Growing Season Reference Locations

Site	RE	Location		Site	RE	Location
EB111	11.3.25b	Eden Bann		EB381	11.3.3	Stoney Ck
EB563	11.3.25b	Slatey Ck		EB511	11.3.3c	Glencoe
EB306	11.3.25e	Weir Park		EB042	11.3.25e	Bannockburn
EB128	11.3.25h	Coorumburra		EB054	11.3.4	Glenavon
EB357	11.3.25h	Fitzroy Pocket		Not specified	11.11.7	Eden Bann
EB610	11.3.25h	Island Camp				

5.0 Riparian Offset Zones and Bio-condition Review

A vegetation management 'Offset' can be considered as using a restored patch of degraded habitat recovering over a given period of time to replace a corresponding area of remnant habitat that has gained the appropriate approvals for clearing. The Offset identification procedure includes many factors relating to the outgoing vegetation community, the chosen offset site, current vegetation condition, ongoing land management actions, tenure and pre-requisite ratios in the trade-off calculation.

NRW's 'Policy for Vegetation Management Offsets' (NRW 2006b) commits to follow the VMA purpose to 'manage the environmental effect of clearing…' and thus includes 'maintains ecological processes'. The Offset policy further states that an Offset arrangement will likely target an effort to 'maintain the extent, structure and function of: regional ecosystems, essential habitat and vegetation associated with watercourses' (NRW 2006b).

This Offset policy is triggered by the proposed Lower Fitzroy weir developments in the Performance Requirements (PR) in four places:

- PR 2 - for RE 11.3.1 (brigalow) near the Rookwood Weir site
- PR 3 - for RE 11.3.3 (coolabah), RE11.3.4 (blue gum on alluvials)
- PR 6 – vegetation associated with any watercourse for RE 11.3.25 (fringing woodlands).
- PR 5 can be applied to RE 11.3.27 as a natural wetland. Horseshoe Lagoon is mapped as RE 11.3.27/11.3.25 and approximately 50ha is expected to be inundated at FSL20.5mtr.

The NRW Offset policy already defines some assessment criteria for offset determination. In the context of the Lower Fitzroy Weirs vegetation study area it stands to reason that the primary suite of possible offsets must firstly consider the replacement of the potentially missing ecological elements identified above from the riparian vegetation located along the lower and middle river banks along with the connecting creeks and associated tributaries. For example: constriction, fragmentation and isolation are three of the more distinctive and unfortunately detrimental impacts to the remaining riparian communities of the Lower Fitzroy that will be facilitated by the weir developments.

- **Constriction** of the width of the riparian corridor. The fringing woodlands along the riverbanks may be only slightly reduced in width in the more distant upstream sections, whereas in the lower sections closer the weir structure the loss of community width in the lower and mid bank vegetation will be far more distinctive. This problem is compounded by post clearing activities where accessible upper banks have been cleared as an extension of clearing activity on the adjoining alluvial plain.
- **Fragmentation** in the continuity of the riparian corridor where the upper bank/levee/plain vegetation has been either cleared or is another non-alluvial habitat. The latter is very evident near the first few kilometres above the Eden Bann Weir structure at the current FSL. The elevated water level is now closer to the steep rocky terrain of the adjacent hills and space for alluvial and riparian vegetation is very limited above the newer water line.
  In some of the more fully developed pastoral areas the historic tree clearing has progressed below the levee/top bank and continued down to mid or lower bank and this is often quite noticeable on lower parts of the proposed Rookwood impoundment where the weir development will result in little viable vegetation remaining on the banks at FSL 49.0mtr.
- **Isolation** of larger remnant patches and many smaller vegetation remnants may also occur where the riparian corridor is fragmented or completely severed over a distance.

Potential Offset areas have thus been identified for the Rookwood and Eden Bann proposals with the desire to maintain the maximum coverage of each bank with fringing woodlands, preferably comparable riparian communities despite conceding that this will not always be a practical and simple. Priority areas (**Primary Offset**) have been proposed by this study as offsets in order to firstly reduce the potential constriction, fragmentation and isolation impacts to other remnant vegetation. These areas are located at or near the proposed waterline at the respective FSLs. The minimum width of the fringing corridor consolidated by the Offsets should be at least 50m in width or preferably more wherever practicalities allow. 50m is suggested as the minimum corridor width of the future riparian woodlands as it is consistent with many sections of the existing fringing vegetation.

A significantly more sustainable remnant vegetation corridor would extend out to 100mtr or 200mtr from the weir/river edge. These greater distances are recognised as a contemporary preference for retention of vegetation along river frontages as indicated in FBA (2007). A subset of the offset target areas cover lands greater than 50mtr from the proposed FSLs and these have been labelled in this study as **Option Offsets** for these areas are considered as a secondary priority.

In addition to the mapped Primary and Option Offset areas, other parts of the surrounding alluvial landscape do still have residual regrowth potential i.e. suckering native woody vegetation activity and native ground layer species. Any such additional areas if/where required should be considered at the property level as the issues are more likely to be specific to that location and very significant to any respective landholder. The edges of the lesser developed adjoining alluvial plains may be considered as potential offset target areas for two main reasons: (a) to increase the width of the fringing riparian corridor where the bank is naturally narrow and steep, and (b) to allow for vegetation corridor to wrap around creeks, gullies and even breakouts in several places. Additionally, the overflows, runners and inner section of the larger bends deserve a more site specific consideration as large areas of productive, accessible and often improved agricultural land may be involved.

5.1 Riparian Offset Zone Site Consideration

More than half of the riparian offset zones are situated along the upper river bank and /or levee and descend to either the edge of existing vegetation or the proposed inundation contour. Typically each of the respective zones extends laterally along the river bank until remnant vegetation returns to the upper bank or until some other landscape factor influences. Cleared areas on the alluvial plain adjacent riparian offset zones seldom contained the desired volume of regenerating canopy elements or other regenerating components that were recorded on the upper banks, terraces and benches. One particular exception included an alluvial plain site at Coorumburra that was examined as a riparian offset zone because the estimated width of the fringing vegetation remnant at FSL 20.5m AHD was less then 20mtr/10mtr in places and field staff considered this was too narrow to represent a sustainable community in the long term. Casual observation and comparison of narrow fringing vegetation remnants along the Eden Bann Weir Pool appear to support this assumption. Wider areas (50mtr+) have more structure and diversity while narrow areas <10mtr have less diversity and broken structure etc.

The Riparian offset zones examined did not cover the projected edges of the weir when the inundation extends up gullies, creek and runners. These 'breakouts' tend to create two particular problems for ongoing recovery of a riparian corridor:

- (1) They fragment the continuity of the Riparian forest, sometimes shortening it to 200mtr segments – corridor width becomes even more critical in these shorter sections. And
- (2) The breakouts may represent a very extended shore line through open pasture with far fewer woodland habitat values then the areas near the river bank.

These extended areas also potentially intruded well in the various properties joining the respective weir impoundments in a landscape principally devoted to agriculture production. Given the shortage of any quality disturbance habitat values, the authors elected to defer closer review of such areas for 'future actions should the need demand such action and hence if this option was to be considered as a viable means to achieve habitat recovery in especially if required to meet contemporary environmental planning guidelines like those detailed within the NRW Vegetation Offset Policy.

5.2 Description of Riparian Offset Zones

A summary of Riparian offset zone sampling sites appears below in Table 7. The data are arranged separately in four parts: for each Weir and at the respective FSL alternatives. The locations of proposed Primary and Option Offset areas are marked on Maps 20a (Eden Bann) and Map20b (Rookwood). The adoption of a these Offset areas can help to reduce many of the long term negative impacts the Lower Fitzroy weir developments this vegetation mapping project predicts for the adjoining remnant vegetation.

Greater detail for each site is included in the field summary sheets (Appendix 3). These data sheets roughly describe the subset of riparian offset zones that were examined during the field survey. These sites were also examined in the context of Bio-condition in an effort to quantify the various habitat

elements contained within. Anecdotal notes are presented that support the Bio-condition analysis and also may indicate future practical aspects of the site as may be useful for any management or planning events. Digital photos for the sampled Riparian offset zone sites are included in Appendix 3a.

Bio-condition Result. All of the riparian offset zones are considered to be in 'Low Condition' as defined within the methodology for the overall reduced canopy cover of these non-remnant areas. Ironically the relatively high scores achieved in the bio-condition analysis appear to compare favourably with the intact remnant areas but this is more likely a feature of the generic methodology applied being influenced by higher scores figures in the ground and shrub layer elements. A small percentage of the ground layer score can be attributed to the later timing of this field component being several weeks after the early summer storms that were experienced towards the end of the primary vegetation survey and bio-condition phase. The flush of growth in annuals and smaller perennials produced higher cover and species diversity scores than the very dry season experienced earlier on.

Table 7 Summary of Riparian offset zone Sampling Sites

Offset Summary - EDEN BANN FSL18.5mtr

			Offset Area (Ha)			
AMTD (Km)	**Property**	**Site code**	**Primary**	**Option**	***Future Veg (RE-code)***	***Future RE-Status***
142 right	Marble Ridges	EB102xtr	7.36		*11.3.3/11.3.25*	*O-dom*
145 left	Eden Bann	EB747 option		71.41	*11.3.4/11.3.25*	*O-dom*
145 left	Eden Bann	EB747ab	13.91		*11.3.4/11.3.25*	*O-dom*
146 right	(RL Edwards)	EB093xtr	0.81		*11.3.25*	*NotOfC*
150 right	Mt Fairvw MGD	EB744	46.35		*11.3.3/11.3.25*	*O-dom*
151 left	Eden Bann	EB073xtr	18.32		*11.3.3/11.3.25*	*O-dom*
155 left	Glen Avon	EB717abcd	7.97		*11.3.3/11.3.25*	*O-dom*
155 right	Mt Fairvw MGD	EB745	29.65		*11.3.3/11.3.25*	*O-dom*
159 right	Mt Fairvw MGD	EB746a	8.26		*11.3.3/11.3.25*	*O-dom*
160 right	Mt Fairvw MLD	EB746xtr	22.27		*11.3.3/11.3.25*	*O-dom*
165 left	Glen Avon	EB720	9.91		*11.3.25/11.3.3*	*O-dom*
165 left	Glen Avon	EB722	33.25		*11.3.3/11.3.25*	*O-dom*
167 right	Bannockburn	EB045xtr	9.10		*11.3.3/11.3.25*	*O-dom*
167 right	Bannockburn	EB045xtr		46.81	*11.3.3/11.3.25*	*O-dom*
171 left	Coorumburra	EB031xtr	4.85		*11.3.3/11.3.25*	*O-dom*
171 left	Coorumburra	EB130xtr	9.38		*11.3.3/11.3.25*	*O-dom*
173 left	Coorumburra	EB725	16.80		*11.3.4/11.3.25*	*O-dom*
177 right	Redbank	EB736a	15.86		*11.3.3/11.3.25*	*O-dom*
178 left	Coorumburra	EB724	30.48		*11.3.4/11.3.25*	*O-dom*
181 left	Redbank	EB734	9.13		*11.3.25*	*NotOfC*
182 right	Redbank	EB735	16.52		*11.3.4/11.3.25*	*O-dom*
183.5 left	Redbank	EB733	6.10		*11.3.25*	*NotOfC*
185 right	Redbank	EB737	3.64		*11.3.4/11.3.25*	*O-dom*
187 left	(Radel)	EB021xtr	8.71		*11.3.25*	*NotOfC*
189 right	Redbank	EB738	15.68		*11.3.4/11.3.25*	*O-dom*
192.5 right	Melrose	EB743xtr	8.68		*11.3.3/11.3.25*	*O-dom*
194.5 left	Glenroy	EB741b	2.05		*11.3.25*	*NotOfC*
194.5 left	Glenroy	EB741xtr		17.78	*11.3.3/11.3.25*	*O-dom*
196 left	Redbank South	EB741	9.31		*11.3.3/11.3.25*	*O-dom*
196 left	Redbank South	EB741		10.81	*11.3.3/11.3.25*	*O-dom*
		Totals	**364.3**	**146.8**		

Offset Summary - Eden Bann_FSL20.5mtr

AMTD (Km)	**Property**	**Site code**	**Offset Area (Ha) Primary**	**Option**	***Future Veg (RE-code)***	***Future RE-Status***
142 right	Marble Ridges	EB102xtr	5.86		*11.3.3/11.3.25*	*O-dom*
145 left	Eden Bann	EB747 option		66.91	*11.3.4/11.3.25*	*O-dom*
145 left	Eden Bann	EB747ab	12.11		*11.3.4/11.3.25*	*O-dom*
146 right	(RL Edwards)	EB093xtr	0.42		*11.3.25*	*NotOfC*
150 right	Mt Fairvw MGD	EB744	39.37		*11.3.3/11.3.25*	*O-dom*
151 left	Eden Bann	EB073xtr	16.76		*11.3.3/11.3.25*	*O-dom*
155 left	Glen Avon	EB717abcd	5.19		*11.3.3/11.3.25*	*O-dom*
155 right	Mt Fairvw MGD	EB745	28.38		*11.3.3/11.3.25*	*O-dom*
159 right	Mt Fairvw MGD	EB746a	7.42		*11.3.3/11.3.25*	*O-dom*
160 right	Mt Fairvw MLD	EB746xtr	19.79		*11.3.3/11.3.25*	*O-dom*
165 left	Glen Avon	EB720	8.67		*11.3.25/11.3.3*	*O-dom*
165 left	Glen Avon	EB722	33.17		*11.3.3/11.3.25*	*O-dom*
167 right	Bannockburn	EB045xtr	8.49		*11.3.3/11.3.25*	*O-dom*
167 right	Bannockburn	EB045xtr		46.66	*11.3.3/11.3.25*	*O-dom*
171 left	Coorumburra	EB031xtr	4.20		*11.3.3/11.3.25*	*O-dom*
171 left	Coorumburra	EB130xtr	6.67		*11.3.3/11.3.25*	*O-dom*
173 left	Coorumburra	EB725	16.80		*11.3.4/11.3.25*	*O-dom*
177 right	Redbank	EB736a	14.59		*11.3.3/11.3.25*	*O-dom*
178 left	Coorumburra	EB724	30.32		*11.3.4/11.3.25*	*O-dom*
181 left	Redbank	EB734	8.51		*11.3.25*	*NotOfC*
182 right	Redbank	EB735	15.99		*11.3.4/11.3.25*	*O-dom*
183.5 left	Redbank	EB733	5.95		*11.3.25*	*NotOfC*
185 right	Redbank	EB737	3.64		*11.3.4/11.3.25*	*O-dom*
187 left	(Radel)	EB021xtr	7.69		*11.3.25*	*NotOfC*
189 right	Redbank	EB738	14.72		*11.3.4/11.3.25*	*O-dom*
192.5 right	Melrose	EB743xtr	6.55		*11.3.3/11.3.25*	*O-dom*
194.5 left	Glenroy	EB741b	1.96		*11.3.25*	*NotOfC*
194.5 left	Glenroy	EB741xtr		17.78	*11.3.3/11.3.25*	*O-dom*
196 left	Redbank South	EB741	8.52		*11.3.3/11.3.25*	*O-dom*
196 left	Redbank South	EB741		10.81	*11.3.3/11.3.25*	*O-dom*
		Totals	**331.7**	**142.2**		

Offset Summary - ROOKWOOD_FSL47mtr

			Offset Area (Ha)			
AMTD (Km)	**Property**	**Site code**	**Primary**	**Option**	***Future Veg (RE-code)***	***Future RE-Status***
265 right	(Randell K)	EB304xtr	4.28		*11.3.3/11.12.2*	*O-dom*
266.5 right	Weir Park(Res)	EB305xtr	1.41		*11.3.3/11.12.2*	*O-dom*
267 right	Weir Park(Res)	EB319xtr	0.50		*11.3.3/11.12.2*	*O-dom*
267.5 right	(N Raddon)	EB318xtr	2.70		*11.3.3/11.12.2*	*O-dom*
268 right	(T Holland)	EB317	3.38		*11.3.3/11.12.2*	*O-dom*
268 right	(T Holland)	EB317xtr	49.58		*11.3.3/11.12.2*	*O-dom*
269 left	Weir Park	EB709a	9.40		*11.3.4/11.3.25*	*O-dom*
269.5 right	Coolabah	EB314xtr	30.56		*11.3.3/11.3.25*	*O-dom*
274 right	Riverslea	EB700abcd	18.31		*11.3.3/11.3.25*	*O-dom*
275.5 right	Riverslea	EB701b	4.05		*11.3.3/11.3.25*	*O-dom*
276 left	FitzroyPkt	EB704	11.00		*11.3.3/11.3.25*	*O-dom*
277 right	Riverslea res	EB334xtr	6.02		*11.3.11*	*E*
277.5 left	FitzroyPkt res	EB336xtr	1.68		*11.3.3/11.3.25*	*O-dom*
278 left	The Pocket	EB457xtr	8.70		*11.3.3/11.3.25*	*O-dom*
278 right	Riverslea	EB702	5.98		*11.3.3/11.3.25*	*O-dom*
279 right	(P Hanrahan)	EB703	8.81		*11.3.3/11.3.25*	*O-dom*
280 left	The Pocket	EB708	15.03		*11.3.3/11.3.1*	*E-sub*
280 left	The Pocket	EB708xtr		40.94	*11.3.4/11.3.25*	*O-dom*
280 left	The Pocket	EB708xtr	12.99		*11.3.4/11.3.25*	*O-dom*
284 right	Island Camp	EB711	23.60		*11.3.4/11.3.25*	*O-dom*
287 right	Island Camp	EB604xtr	12.41			
289 left	The Pocket	EB706/707	27.26		*11.3.3/11.3.25*	*O-dom*
300 left	Yarra	EB705/706	32.06		*11.3.3/11.3.25*	*O-dom*
307 left	Separation	EB400xtr		35.66	*11.3.3/11.3.1*	*E-sub*
311.5 right	Walbury	EB483xtr	4.84		*11.3.3/11.3.25*	*O-dom*
315 right	Walbury	EB479xtr	5.29		*11.3.3/11.3.25*	*O-dom*
320 left	Stoney Creek	EB383xtr		7.75	*11.3.3/11.3.1*	*E-sub*
322 left	Stoney Creek	EB380xtr	9.76		*11.3.3/11.3.25*	*O-dom*
Melaleuca Ck	Fitzroy Pocket	EB349xtr		9.12	*11.3.3/11.3.1*	*E-sub*
Melaleuca Ck	Fitzroy Pocket	EB350xtr		10.64	*11.3.3*	*O-dom*
Melaleuca Ck	Fitzroy Pocket	EB352xtr		8.17	*11.3.3/11.3.1*	*E-sub*
		Totals	**309.6**	**112.3**		

Offset Summary - ROOKWOOD_FSL49mtr

AMTD (Km)	Property	Site code	Offset Area (Ha) Primary	Option	*Future Veg (RE-code)*	*Future RE-Status*
265 right	(Randell K) Weir	EB304xtr	3.16		*11.3.3/11.12.2*	*O-dom*
266.5 right	Park(Res) Weir	EB305xtr	1.23		*11.3.3/11.12.2*	*O-dom*
267 right	Park(Res)	EB319xtr	0.45		*11.3.3/11.12.2*	*O-dom*
267.5 right	(N Raddon)	EB318xtr	2.57		*11.3.3/11.12.2*	*O-dom*
268 right	(T Holland)	EB317	3.38		*11.3.3/11.12.2*	*O-dom*
268 right	(T Holland)	EB317xtr	43.79		*11.3.3/11.12.2*	*O-dom*
269 left	Weir Park	EB709a	6.75		*11.3.4/11.3.25*	*O-dom*
269.5 right	Coolabah	EB314xtr	20.10		*11.3.3/11.3.25*	*O-dom*
274 right	Riverslea	EB700abcd	14.33		*11.3.3/11.3.25*	*O-dom*
275.5 right	Riverslea	EB701b	3.35		*11.3.3/11.3.25*	*O-dom*
276 left	FitzroyPkt	EB704	8.52		*11.3.3/11.3.25*	*O-dom*
277 right	Riverslea res	EB334xtr	6.02		*11.3.11*	*E*
277.5 left	FitzroyPkt res	EB336xtr	0.81		*11.3.3/11.3.25*	*O-dom*
278 left	The Pocket	EB457xtr	7.21		*11.3.3/11.3.25*	*O-dom*
278 right	Riverslea	EB702	5.78		*11.3.3/11.3.25*	*O-dom*
279 right	(P Hanrahan)	EB703	6.77		*11.3.3/11.3.25*	*O-dom*
280 left	The Pocket	EB708	14.03		*11.3.3/11.3.1*	*E-sub*
280 left	The Pocket	EB708xtr	10.33		*11.3.4/11.3.25*	*O-dom*
280 left	The Pocket	EB708xtr		40.94	*11.3.4/11.3.25*	*O-dom*
284 right	Island Camp	EB604xtr	12.27		*11.3.3/11.11.1*	*O-dom*
287 right	Island Camp	EB711	21.23		*11.3.4/11.3.25*	*O-dom*
289 left	The Pocket	EB706/707	24.41		*11.3.3/11.3.25*	*O-dom*
300 left	Yarra	EB705/706	28.70		*11.3.3/11.3.25*	*O-dom*
307 left	Separation	EB400xtr		35.66	*11.3.3/11.3.1*	*E-sub*
311.5 right	Walbury	EB483xtr	4.76		*11.3.3/11.3.25*	*O-dom*
315 right	Walbury	EB479xtr	5.29		*11.3.3/11.3.25*	*O-dom*
320 left	Stoney Creek	EB383xtr		7.75	*11.3.3/11.3.1*	*E-sub*
322 left	Stoney Creek	EB330xtr	6.92		*11.3.3/11.3.25*	*O-dom*
Melaleuca Ck	Fitzroy Pocket	EB349xtr		5.97	*11.3.3/11.3.1*	*E-sub*
Melaleuca Ck	Fitzroy Pocket	EB350xtr		10.01	*11.3.3*	*O-dom*
Melaleuca Ck	Fitzroy Pocket	EB352xtr		8.17	*11.3.3/11.3.1*	*E-sub*
		Totals	**262.2**	**108.5**		

Offset Management Factors for Further Consideration

Several additional factors compound the application of offset areas beyond the aspects discussed above:

- Re-vegetation, seeding, and direct planting to enhance the development of the vegetation;
- Weed control and transport management to minimise weed seed spread;
- Fire management;
- Pest animal management;
- Access and ongoing maintenance servicing;
- Fencing and grazing impact control;
- Off river watering for livestock;
- Flood events plus subsequent recovery thereafter; and
- Tenure related issues.

Further it seems very likely from the field observations on the age and apparent growth rates of young trees that a repeat of the weather conditions in the past three years will result in for recovery of regrowth not-remnant taking considerably longer than the periods specified in the Offset Policy.

Offset Potential vs. Clearing/thinning approval or other corresponding activities.
Many of the areas examined for Offset purposes included native regrowth as a natural recovery of the former vegetative community that had presumably been cleared to help the property's productivity. At some of the riparian offset target locations there appeared to have been signs of 'sucker control' and other vegetation treatment from earlier management activity. As the vegetation survey field staff did not raise this topic with landholders the authors are not positioned to comment beyond the notes that were recorded during field observations and are conscious of respecting the various landholders' perceived 'rights' and property management objectives.

Even in the absence of recent or ongoing regrowth control during field surveys, it does seem relevant to consider the immediate future of the potential Offset areas on lands not owned or managed by the NRW or the Weir proponent in the context of vegetation clearing authority under the VMA. A search for active clearing permits (Nov 2006) returned nil result for the weir study area. The authors had also recently sought data from NRW that may indicate the existence of certified PMAVs, PMAV applications or even tenure changes/applications that could potentially provide authority to remove woody regrowth vegetation in the study area. This latter process is relatively simple with a title search through the Lands Service Centre in Rockhampton NRW although it needs to be undertaken for each Lot/Plan involved and a commercial cost per search is required for external requests. The weakness with this approach is that the title search result is only accurate on the day of request, further relevant applications could be lodged immediately thereafter. While investigating the title search option the authors received a recommendation through local Vegetation Management staff to delay such a search until after the end of June 2007 as the data for PMAVs, PMAV applications etc should be mostly complete and more suitable for this purpose at that time (D Moore, *pers. comm*.).

6.0 Recommendations

1. To consider the use of this 1:25,000 vegetation mapping as a reasonable representation of the remnant and not-remnant vegetation along the Lower Fitzroy Weir Study areas as the methodology herein followed the methods defined by the EPA for Regional Ecosystem Mapping in Queensland.

2. This vegetation mapping be made available to support the integrated planning assessment process for the Lower Fitzroy Weirs especially in relation to the Vegetation Management Act and subordinate legislation, relevant NRW policies and other associated requirements. This may be achieved by either:

(a) tendering this vegetation mapping to EPA Herbarium for consideration as mapping changes to the Regional Ecosystem Mapping or
(b considering this vegetation mapping in support of an application for vegetation management for the explicit purposes of the weir development (thus potentially not impacting as vegetation mapping changes upon the respective local landholders).

3. To consider formal communication with NRW Vegetation Management to identify PMAV and other vegetation management approvals on lands within and immediately adjoining the Lower Fitzroy Weir development sites (e.g. FSL + 200m landward). This may include requesting notification of any potential approvals that affect the pattern and values of vegetation and potential offset areas through clearing, 'locking areas in' under the PMAV and other co-operative matters as may be feasible within the government agencies. A corresponding communication to EPA to request ongoing currency in advice over matters relating to remnant vegetation mapping changes, updates to EVR flora and fauna records and essential habitat mapping, Biodiversity Mapping Assessments or changes and other relevant matters that apply to the Lower Fitzroy Weir development sites.

4. That a project specific Offset objective be to: attempt to maintain a continuous riparian corridor at least 50m wide above/beyond each respective new weir's FSL along adjoining Fitzroy, Dawson and McKenzie Rivers (plus major tributaries) and that the long term targets for the Offset's habitat condition give due consideration to the bio-condition result presented within this report, allowing for the seasonal limitations of the data collected in the course of this study.

5. The suitability and adequacy of the proposed offsets will need to be further investigated during the EIS stage.

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