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Terrestrial Flora Baseline Study

Emu Swamp Dam Project Severn River, Queensland

Final

Report to SKM P/L for Stanthorpe Shire Council

December, 2007

Executive Summary

The Emu Swamp Dam project involves the construction of a new water supply dam on the Severn River to the south-west of Stanthorpe, in far south-east Queensland. The project also includes additional infrastructure works, including the re-alignment of the Emu Swamp Road (ESRR) and construction of a town water supply line (TWS) linking the supply dam to Stanthorpe, and an extensive irrigation network (INW). Two potential inundation levels are being considered being a 738m Full Supply Level (FSL1) which includes all associated infrastructure, and a lesser 734.5m Full Supply Level (FSL2) which considers the TWS and ESRR only. Three D (3d) Environmental was commissioned to complete a flora assessment of the areas affected by dam inundation and additional associated infrastructure to allow a detailed and well informed assessment of the impact of the development on the areas floristic values values.

A desktop analysis of current available literature indicates that five regional ecosystems (RE's) mapped by the EPA (2005) are potentially impacted by the project. Three of these are listed as 'Endangered', one as 'Of Concern' and one as 'Not of Concern' under the Queensland *Vegetation Management Act 1999* (VMA). One 'Critically Endangered' vegetation community under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) has also been identified within the project area. Eight species of rare or threatened (EVR) flora including those of both state and national significance occur within, or in close proximity to, the area of inundation. An additional two EVR species are identified as occurring within the broader reaches of the INW. Sixty-two species of exotic flora are known from the study area.

The field survey confirmed the presence of 'Endangered' RE's and nationally significant vegetation communities in both the inundation area and related infrastructure corridors. Analysis of spatial data indicates that:

- 75.7 ha of 'Critically Endangered' woodland as per the EPBC Act will be affected by inundation if a Full Supply Level (FSL) of 738 m AHD is considered, with an additional 1.66 ha potentially affected by construction of associated infrastructure. A 734.5m FSL will impact 40 ha, with an additional 0.5 ha affected by construction of associated infrastructure.
- 101.5ha of 'Endangered' RE's and 6.2 ha of an 'Of Concern' RE will be impacted during inundation at FSL1 (738m AHD). An additional 2.2 ha of 'Endangered' RE's and 0.1ha of an 'Of Concern' RE will be affected by construction of associated infrastructure
- Inundation area 2 (FSL 734.5m AHD) will impact 40 ha of 'Critically Endangered' woodland as per definition of the EPBC Act with an additional 0.5 ha affected by construction of the ESRR and the TWS.
- Inundation area 2 (FSL 734.5m AHD) will impact 58 ha of 'Endangered' RE's, 3.2 ha of an 'Of Concern' RE, and impacts to an additional 1.7ha of 'Endangered' and 0.1ha to 'Of Concern' RE's will be associated with construction of ESRR and TWS.

Field survey recorded a total of 295 species of vascular plants within the study area. This included representation of seventy-five families and 180 genera. The predominant families are Poaceae (17%), Myrtaceae (8%), Asteraceae (8%), Fabaceae (8%), Cyperaceae (4%), and Mimosaceae (4%). Exotic species totalled 50, representing 17% of the total flora. A total of 47 species (16% of total flora) within the study area are considered as regionally and locally significant including high numbers of bioregionally endemic species and those at the extent of geographical range. The review of State and Federal database search results identified a total of 51 species of threatened flora (EVR) as potentially occuring within the project area.

The survey of the FSL1 area and the ESRR recorded six of the 51 species of EVR taxa potentially occurring in the study area. An additional six species are known to occur within a 5 km buffer of the inundation area. The most significant of these species is *Melaleuca williamsii* (syn. *Callistemon pungens);* this species has a sizeable population in riparian shrublands of the Severn River which will be directly impacted by inundation, effectively splitting an extensive population of the species in two. A significant population of *Acacia pubiflora* (Vulnerable EPBC, NCA) was also located within the impact corridor of the ESRR. Survey of the broader area associated with the TWS and INW recorded an additional 2 EVR species. A significant population *Grevllea scortechinii subsp. scortechinii* (Vulnerable-EPBC) was recorded on the Pozieres Rd section of the TWS, and *Mirbelia confertiflora* (Rare, NCA) was recorded on the TWS near Stanthorpe. A summary of the major potential impacts to EVR species is provided in **Table A**.

Table A.

Species Name	NCA Status	EPBC Status	Potential for Impacts
Acacia latisepala	R	-	Low. Minor impact to habitat associated with inundation area and all associated infrastructure.
Acacia pubifolia	V	V	High. Impact to essential habitat and populations of this species associated with proposed ESRR expected.
Boronia repanda	E	E	High. Major direct and indirect impact to essential habitat and populations of this species is possible on INW
Diuris parvipetala	R	-	Moderate. Herbrecs collections on the INW and known habitat associated with all infrastructure
Eucalyptus mckieana	Not listed	V	Moderate. Herbrecs collections on Fletcher Road on TWS route
Grevillea scortechinii subsp. *scortechinii*	V	V	High. Major direct and indirect impact to essential habitat and populations of this species is possible on INW
Goodenia macbarronii	Not listed	V	Moderate. Potential for impacts associated with inundation.
Melaleuca flavovirens	R	Not listed	High. Direct impacts expected in inundation area and indirect impacts possible downstream.
Melaleuca williamsii	V	V	High. Significant impact to essential habitat and populations of this species is expected as a result of inundation. Minor impacts to populations on associated infrastructure.
Mirbelia confertiflora	R	Not listed	Moderate. Potential for minor impacts associated with construction of the TWS.
Rulingia hermanniifolia	R	Not listed	High. Direct impacts associated with inundation likely.
Thelionema grande	R	-	High. Direct impacts associated with inundation likely..

Mitigation strategies for impacts associated with inundation are minimal and a range of potential habitat offset measures must therefore be considered as prescribed under the State Policy for Vegetation Management Offsets (DNRW 2006). These measures include acquisition of comparable habitats outside the inundation area, and the development and implementation of management plans to ensure the long-term retention of areas of essential habitat outside the area of direct impact. Additional measures include acquisition and rehabilitation of degraded land in the vicinity of the inundation area to ensure viable wildlife corridors.

Mitigation measures for impacts to significant floristic values on peripheral infrastructure are largely associated with constraint avoidance. Careful construction and engineering planning to avoid significant flora values wherever possible is required. The management of impacts to significant terrestrial flora values will require site and species specific management plans prior to construction, as a condition of the EIS approval.

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1. Introduction

3D Environmental (3D) have been commissioned by Stanthorpe Shire Council to prepare a baseline flora assessment of the proposed Emu Swamp Dam. The project involves the construction of a new water supply dam on the Severn River to the south-west of Stanthorpe in far south-east Queensland. The project also incorporates the realignment of the Emu Swamp Road (ESRR), construction of a water supply line linking the supply dam to Stanthorpe (TWS), and construction of an extensive irrigation network (INW).

The study process utilises previous land resource surveys and desktop aerial photograph analysis to determine information gaps and prioritise field survey assessment. From detailed, targeted field survey, a thorough assessment of the distribution, composition, condition and conservation values of vegetation communities and flora species within the project area will be ascertained, providing information to facilitate assessment of the environmental impacts of the project at a local, regional, state and national level.

1.1 Study Area Description

1.1.1 Site Location

The project area is located entirely within the Stanthorpe Plateau province of the New England Tableland Bioregion. The inundation area lies approximately 250 km WSW of Brisbane and 13 km SW of Stanthorpe, approximately 36 km north of the NSW border and is within the upper part of the Severn River catchment (**Figure 1**). The network of associated infrastructure stretches from Ballandean in the south to The Summit in the north, and westward to Amiens.

1.1.2 Geology and Geomorphology

The study area is located on an exposed section of the New England Batholith, an extensive granitoid complex of Devonian to Carboniferous age. The batholith forms the New England Tableland, an area otherwise known as the Granite Belt, which has its northern extent in the study area.

The dam site is located on the Severn River, which has incised a gently sloping valley into the granitic landscape. The valley slopes are of moderate gradients but are rocky and uneven with numerous granite tors and core-stones forming rock boulder piles, interrupted by flatter areas of loamy granite soils and rock pavements. Loamy plains formed on deeply weathered granites are extensive along the NEH and Fletcher Road between the inundation area and Stanthorpe. These deeply weathered plains form gentle slopes with occasional outcrops of granite core-stone protruding as rock piles and pavement above the land surface. The Severn River channel is bedrock controlled, although the main flood channel anastomoses between pockets of sandy and silty fluvial sediments deposited as a shallow blanket over the granite basement. The immediate river channel is usually on polished granite rock pavement, eroded and exposed during seasonal flood events.

Infrastructure, including the TWS, INW and ESRR traverse landform elements ranging from loam granite plains, alluvial drainage lines, and granite slopes and knolls.

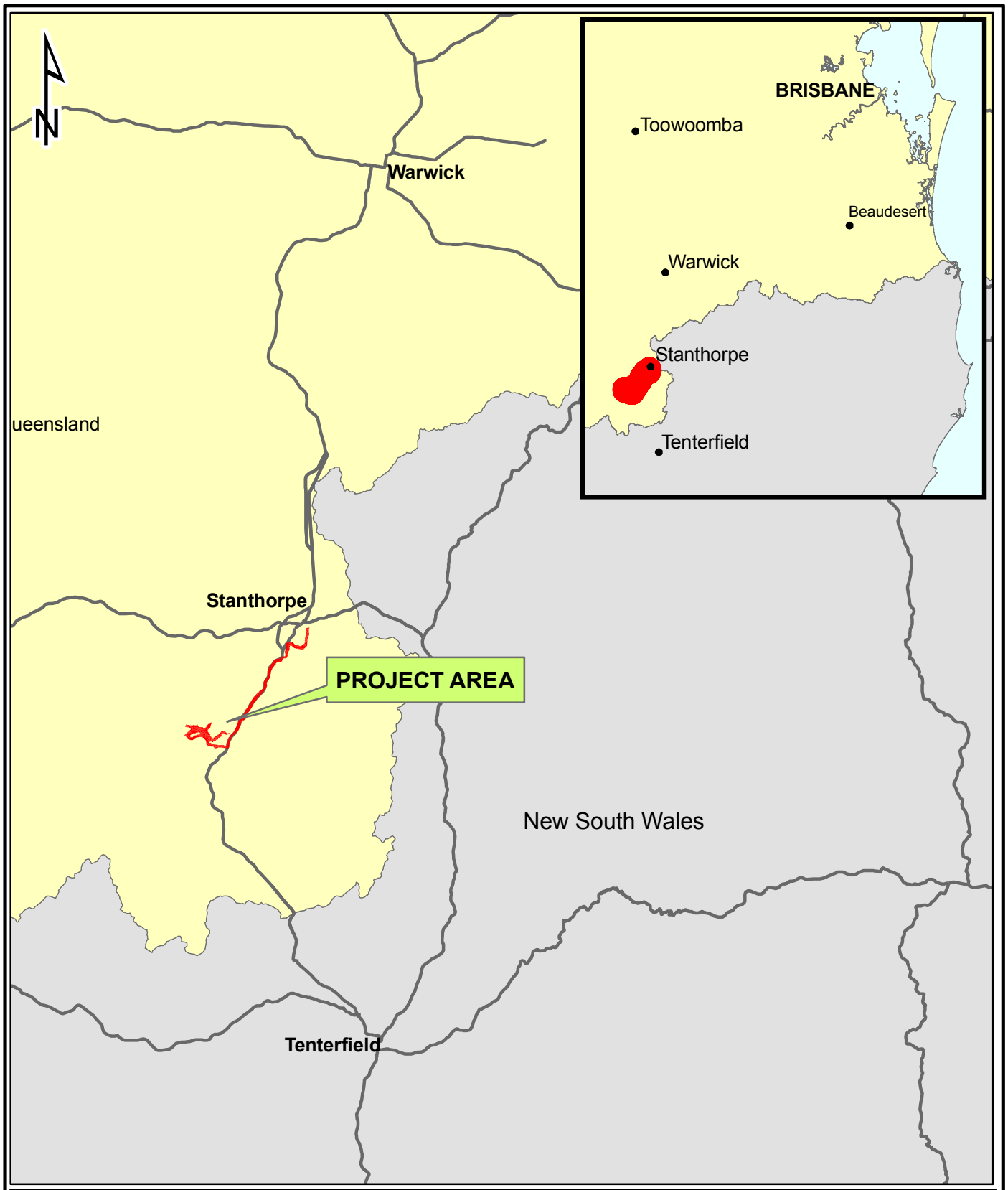

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Figure 1.
Study Location

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0 40 80 120 160
Kilometres

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1.2 Proposed Development

The proposed development is for the construction of an 18 000 ML water storage facility on the Severn River. The associated spillway would be located approximately 600 m upstream from the Fletcher Crossing Causeway, with an inundation zone extending approximately 6 km upstream. Two full supply levels (FSLs) have been proposed, including an 'urban use only' (FSL2 734.5m) and a larger dam option which incorporates both urban and agricultural activities (FSL1 738m). The proposed ESRR diverges from its existing alignment approximately 0.5 km south of its junction with Fletcher Road, heading to the north-west across a low saddle to join with Stalling Lane. The re-alignment traverses an exposed section of the New England Batholith, an extensive granitoid complex of Devonian and Carboniferous age supporting Eucalyptus and Callitris dominated woodland and shrubland. Location of the ESRR and Inundation area is shown in **Figure 2a**.

Associated lineal infrstructure includes a 23 km long water supply line (TWS) and an extensive irrigation network (INW). The TWS is proposed within the roadside corridor of Fletcher Road, before turning north-west along the New England Highway (NEH). The corridor swings west from the highway along peripheral road corridors to the town water treatment facility at Mt Marley located to the west of the Stanthorpe town centre. The INW extends southwards to Euki Rd near Ballandean and northwards to the townships of Poziers and Amiens. Approximately 130 km of irrigation pipeline is to be constructed adjacent to roadsides, and in unformed road easements in some locations. Construction will utilise piping with a range of internal diameters, depending on the distance from source and the number of suppliers on any given route. Pipes with internal diameters > 200mm will necessitate a disturbance corridor of 4 to 5 m width. Areas constructed using material with internal diameters < than 200mm will necessitate a disturbance corridor of 3 m.

The outlay of the TWS and INW is shown in **Figure 2b**. The INW has been broken into several sectors for ease of reference. These sectors are referred to throughout relevant appendices and within th descriptive section of the report.

1.3 Study Objectives

This study aims to provide a detailed assessment of the vegetation and flora values within the footprint of the proposed inundation area and associated infrastructure. This will allow a thorough assessment of the impacts that construction will have on the local vegetation, flora and flora habitat values. Identification of impacts will allow the development of mitigation strategies as well as allowing an assessment of the requirements for environmental offsets.

1.4 Scope

The scope of this study is an assessment and documentation of all vegetation and flora values within the project area. This requires a documentation of the occurrence, distribution and condition of vegetation communities of national and state significance, the occurrence and distribution of flora species of national state, and regional significance, the occurrence and distribution of exotic species, and identification of habitats within the project area with special conservation significance.

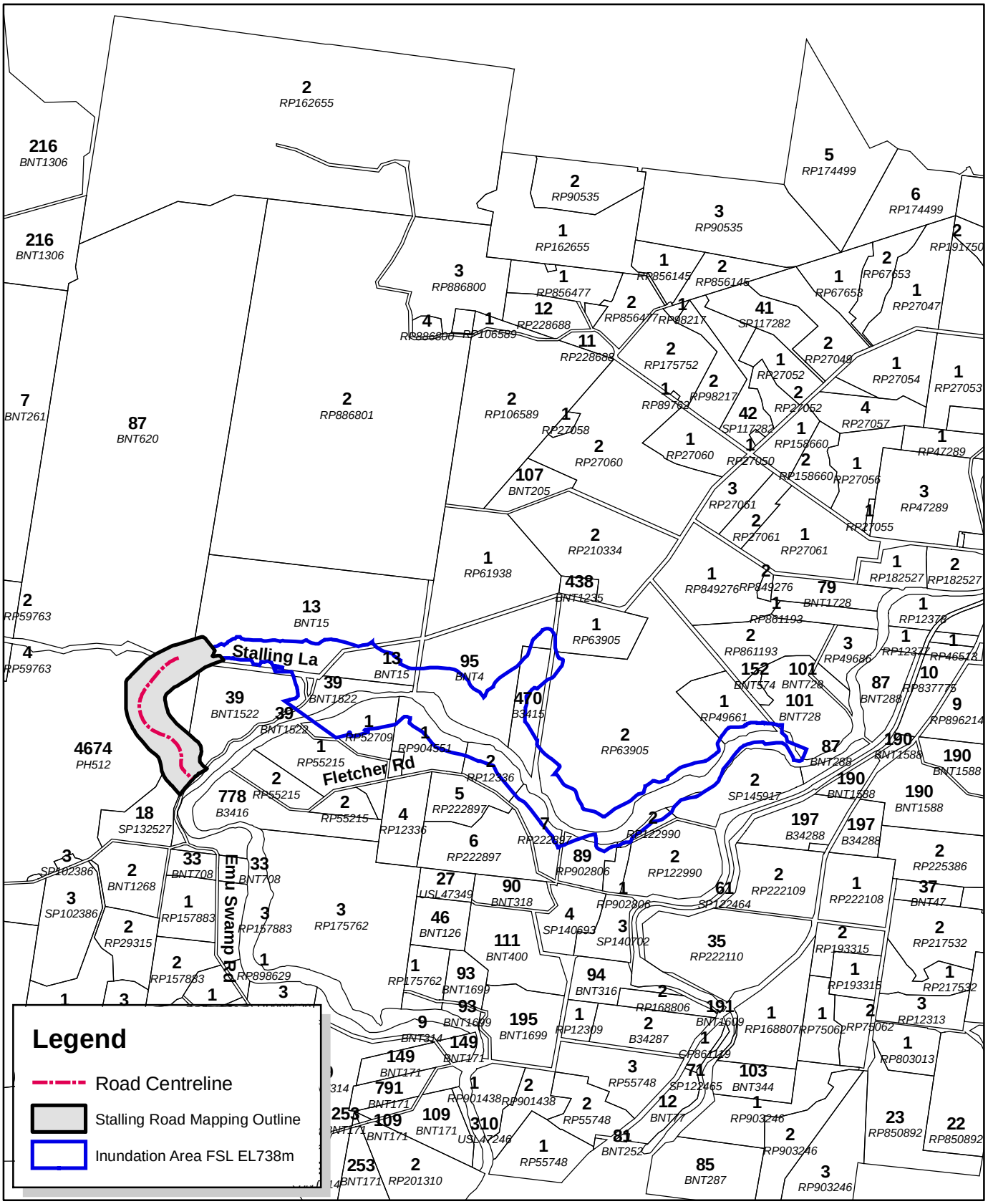

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Figure 2a. Location of the dam inundation area and the ESRR

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Metres

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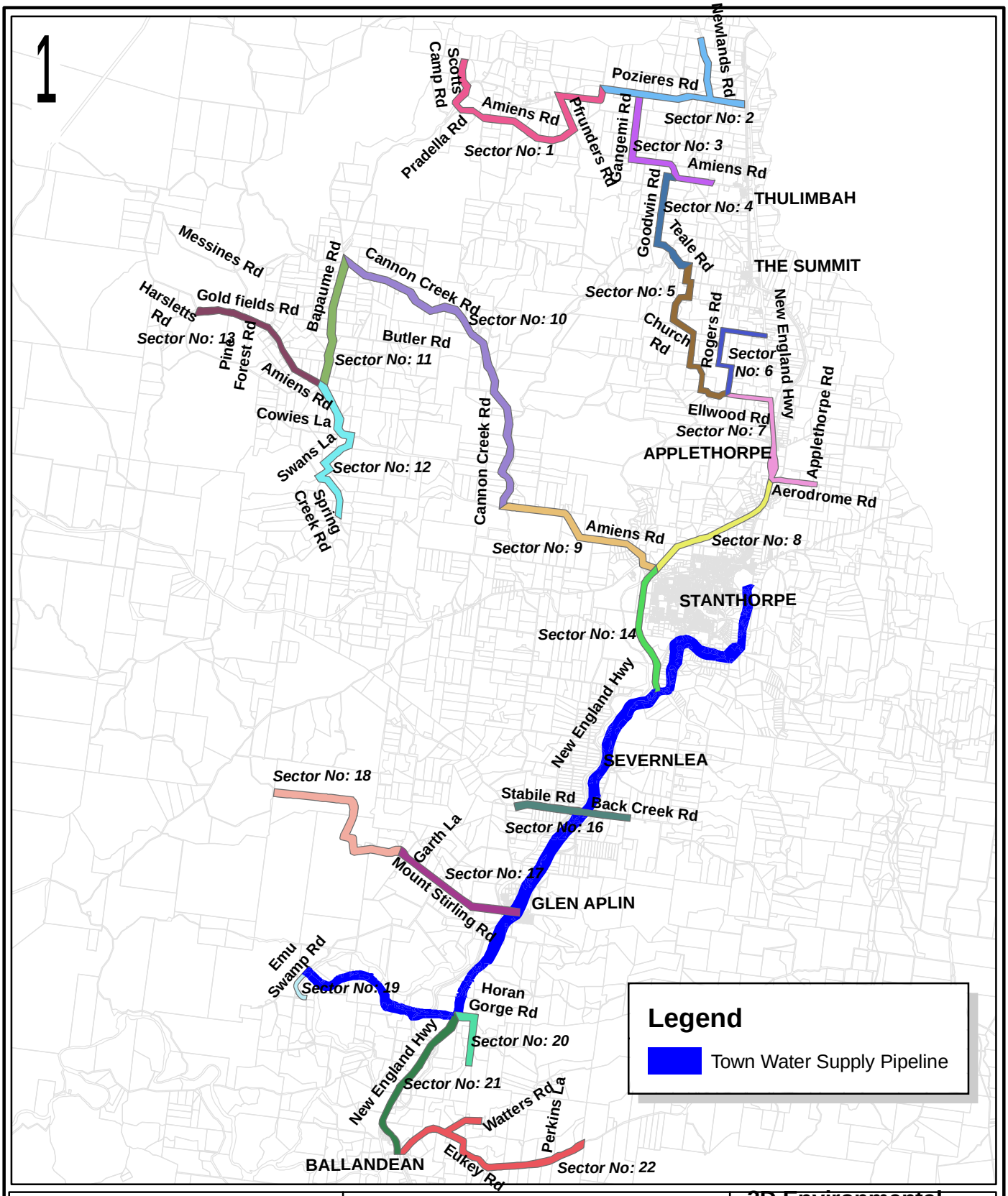

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Figure 2b: Location of the TWS and INW (shown in sectors).

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Kilometres

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2. Methods

2.1 Desktop Literature Review

A search of relevant databases provided background information regarding the presence and distribution of flora species known from the study area and the broader region. This included searches of the Commonwealth EPBC Online Protected Matters Search Tool, the Queensland Herbarium's HERBRECS database and the Queensland Environmental Protection Agency's (EPA) WildNet database. Regional Ecosystem (RE) mapping sourced from the Queensland Department of Natural Resources and Water (DNRW) provided the basis for vegetation community assessment, and site data extracts sourced from the Queensland Herbarium's HERBRECS and CORVEG databases provided a basis for assessment of flora species distributions. Previous mapping exercises were also reviewed, as well as biodiversity/conservation assessments, recovery plans and published ecological research completed by government agencies and private organisations over relevant sections of the study area.

2.2 Aerial Photograph Analysis and Site Location

A stereoscopic assessment of April 1999 1:40 000 scale aerial colour aerial photographs, the most recent available, allowed the establishment of preliminary vegetation line work and polygon attribution, completed in reference to the available regional ecosystem (RE) mapping. This provided a preliminary understanding of the limitations of the current certified RE mapping. Historical aerial photographs (1989) were utilised in the study as an aid to understanding site history, and to assist in the classification of non-remnant or regrowth vegetation.

A suite of survey sites were chosen from aerial photograph analysis to ensure that the field survey:

a) targeted a representative range of habitats within the study area;
b) sampled those communities that were useful for providing reference conditions for disturbed communities (best type examples); and
c) directed detailed sampling towards those communities that could not be adequately categorised through aerial photograph interpretation (API), or were considered critical to a range of Endangered, Vulnerable or Rare (EVR) flora species.

Further sites were added opportunistically during the field survey to provide a more complete data coverage and to verify the mapping units. Site locations **(Table 1)** are spatially illustrated in **Figures 3a** for the dam area and ESRR. Survey locations for the TWS and the INW are shown in **Figure 3b** (north) and **Figure 3c** (south). A summary of the survey locations for individual study components is provided in **Table 1.** Site co-ordinates are provided in **Appendix C** for the inundation area, TWS and the ESRR. More comprehensive quaternary site information is provided in **Appendix D** for the INW.

Table 1. Vegetation Survey Site Effort

Survey Effort	No of Locations
Dam Inundation Area	
Secondary	15
Quaternary	33

Survey Effort	No of Locations
TWS	
Quaternary	42
ESRR	
Secondary	3
Quaternary	7
INW	
Quaternary	168

2.3 Field Survey Technique

Field survey methods followed Queensland Herbarium standards (Neldner *et al.* 2005) using a combination of formalised secondary, tertiary and quaternary level sampling procedures, as well as informal site observations. Field proformas from Neldner *et al.* (2005) were modified to suit sampling requirements specific to this study and to incorporate data on vegetation condition, fauna habitat features and landscape function. The core field information recorded included site location, tenure, air photo and site photo references, landform and geological features, and vegetation community structure. Complete species lists were compiled wherever these were considered appropriate. Canopy height was meticulously measured at all sample locations using a clinometer and linear regression table, and canopy cover was recorded in secondary sites using measured crown intercept transects. A Garmin GPS 60 (Geographic Positioning System) was used to accurately record map coordinates for the site locations (GDA94).

Secondary sites consisted of a standard 50 m x 10 m plot located along the contour. Attempts were made to avoid sampling on vegetation community boundaries, which was difficult in some of the linear vegetation communities. Bitterlich measurements to measure basal area were completed at all sites except in linear communities where the method proved inappropriate. Full species lists for all strata were established during the secondary sampling procedure wherein the 500 m^2 plot was intensively sampled, followed by a detailed search of the vicinity to record additional species. While the vicinity search was broadly defined by the extent of the basal area sweep, it was in all cases confined to the target community. The abundance of all species within the plot was recorded by stem counts and a visually assessed ranking of cover abundance using the Braun-Blanquet scale.

Tertiary sites were completed in a similar fashion to the secondary procedure, except that non-woody species were not recorded. Several sites recorded at tertiary level comprised a full species list in a search area established via a radial sweep of the Bitterlich device. Survey to quaternary level was completed on sites where access permission was granted, and comprised a description of the floristic structure, composition, and the associated landform. Wherever a vegetation community was considered to be potential critical habitat for an EVR species, the search area was broadened and a more extensive species list was established from the extended search area. Flora species were also recorded on walking traverses, again with particular attention to locating EVR and regionally significant taxa.

Botanical voucher specimens were collected throughout the field survey to verify site floristics and to enable identification of those species that were taxonomically problematic. All material was pressed, labelled, and cross referenced, and of sufficient size and quantity to be incorporated into the

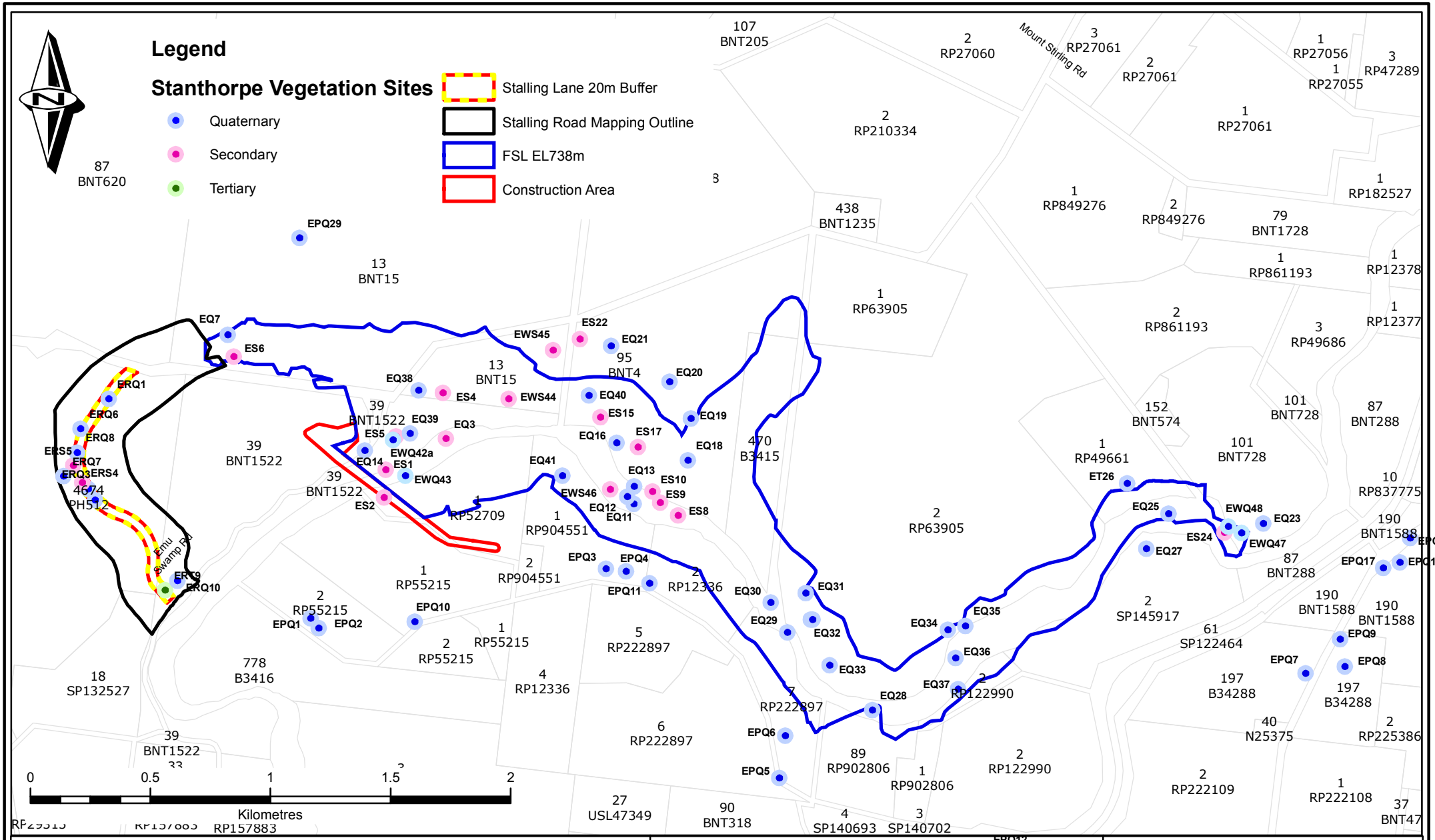

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Figure 3a:
Survey Locations in the inundation area

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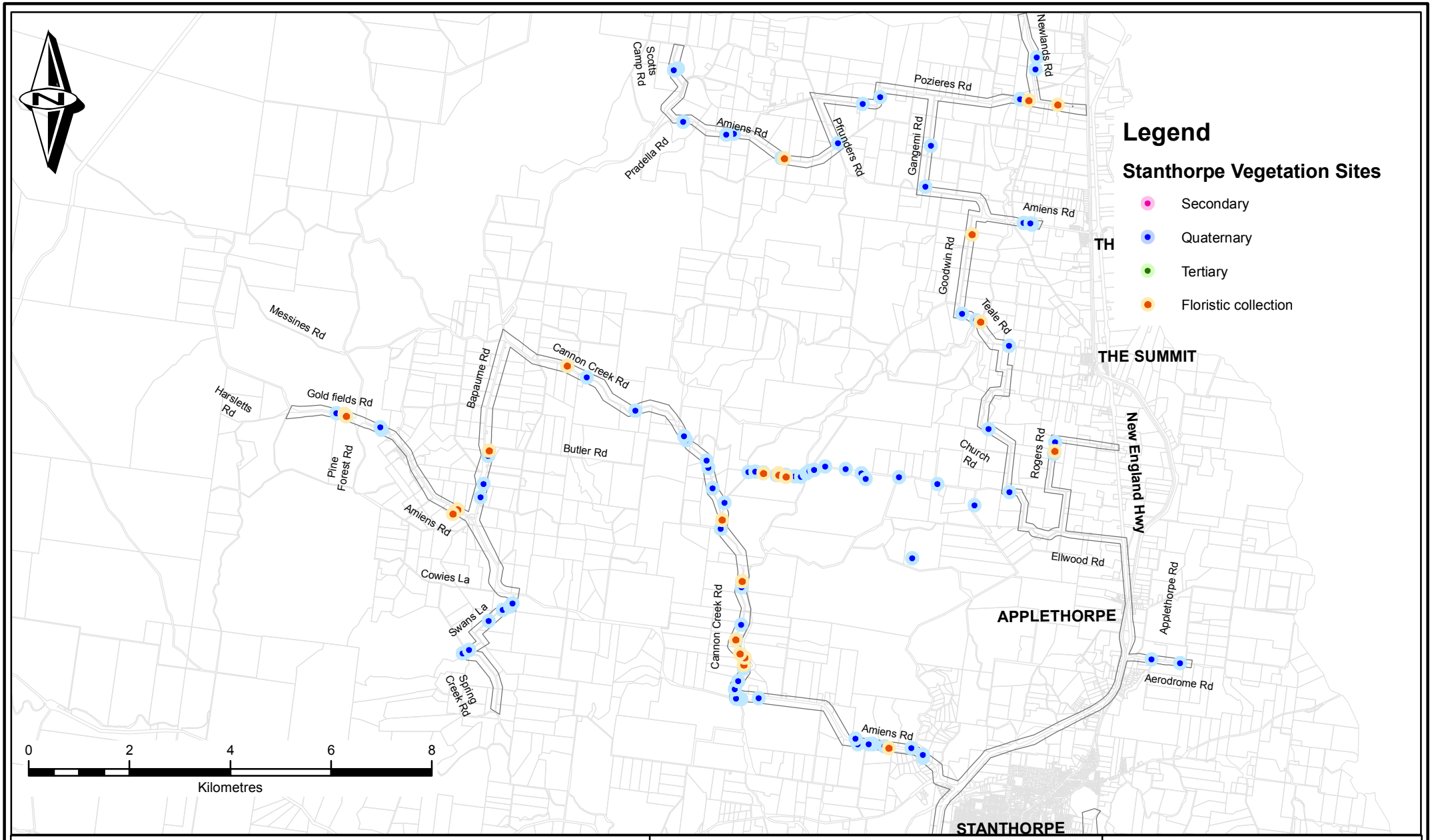

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Figure 3b:
Survey locations and intensity
TWS and INW (North)

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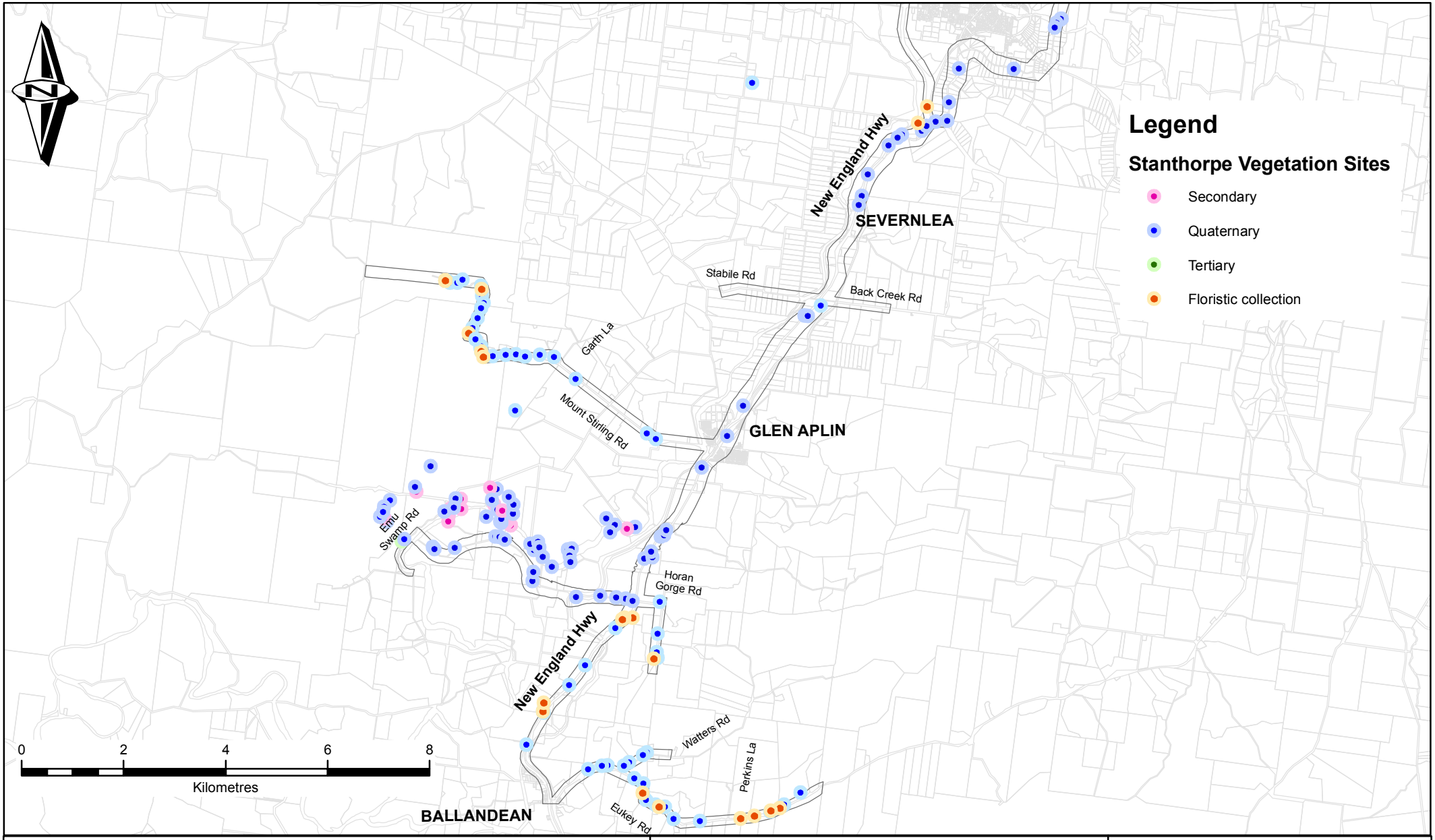

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Figure 3c:
Survey locations and intensity
TWS and INW (South) including inund. area

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Queensland Herbarium collection, if required. Expert advice on identification of problematic species was provided by Queensland Herbarium Advisory Services and a regional flora expert. Site/species field data was entered into an Excel spreadsheet, enabling analysis of flora values within vegetation communities and RE's.

The field survey of the inundation area was completed in two phases enabling a thorough assessment of vegetation communities and individual species. An initial survey was completed in December 2006, during which the bulk of the vegetation communities were sampled and floristic data gathered. A secondary winter survey was completed in June 2007. This allowed an assessment of seasonal floristic variation and allowed targeted searches for winter flowering (or emerging) species. Winter survey methods included secondary sampling of standard 50x10m plots in representative RE's in conjunction with a thorough floristic search of a 1 ha area in the site locality. Numerous meander searches were also undertaken through a range of ecosystems.

Single phases of survey were completed for the TWS (December 2006), the ESRR (June 2007), and the INW (July 2007). These surveys were directed at identifying constraints and as such, were focused on the identification of EVR flora species, vegetation communities (including RE's) with special conservation significance, and declared weed species. Comprehensive species lists were not compiled for these portions of the study although potentially significant species were collected and voucher specimens submitted for verification to the Queensland Herbarium. Due to the proximity of the road re-alignment survey area to the dam inundation area, and the inclusion of a number of detailed secondary survey locations in the road survey effort, floristic data collected during this survey has been incorporated into the overall species lists.

2.4 Classification of Land and Vegetation

A vegetation type is defined as a unit of structurally and floristically similar vegetation, whilst a land type is defined as a unit of structurally and floristically similar vegetation on a similar geology (Stanton and Morgan 1977, Sattler and Williams 1998). Land types in this exercise are referred to as 'vegetation communities' and are consistently referred to as such throughout this document. Vegetation communities are classified herein according to a primary geological subdivision and a vegetation type. These codes may be complemented by an appended code indicating particular structural attributes (e.g. a vine forest sub-canopy), or an indicator of vegetation condition. Explanatory notes for vegetation coding are discussed in **Section 5.1**.

Vegetation communities are often amalgamated to form RE's, and these communities may retain autonomy through classification as a regional ecosystem sub-unit. RE's are comprised of a three-part code of which the primary subdivision is the bioregional zone, followed by geology or land zone, with vegetation being the final subdivision in the classification. RE's are assessed on a state wide basis for conservation significance, as regulated by Queensland's *Vegetation Management Act 1999* (VMA). Vegetation structure is classified according to the system of Specht (1970) as modified by Neldner *et al.* (2005), (refer **Table 2).** This classification has been applied consistently to vegetation throughout the field survey and broader flora baseline study.

Table 2. Structural formation classes qualified by height for non-rainforest vegetation: Neldner *et al.* (2005) modified from Specht (1970).

Projective Foliage Cover	**70-100%**	**30-70%**	**10-30%**	**<10%**
Approximate Crown Cover%	80 - 100%	50 - 80%	20 - 50%	< 20%
Crown separation	closed or dense	mid-dense	Sparse	very sparse
Growth Form[1]	**Structural Formation Classes (qualified by height)**			
Trees[2] > 30 m	tall closed-forest (TCF)	tall open-forest (TCF)	tall woodland (TW)	tall open-woodland (TOW)
Trees 10 – 30 m	closed-forest (CF)	open-forest (OF)	woodland (W)	open-woodland (OW)
Trees < 10 m	low closed-forest (LCF)	low open-forest (LOF)	low woodland (LW)	low open-woodland (LOW)
Shrubs 2 – 8 m	closed-scrub (CSC)	open-scrub (OSC)	tall shrubland (TS)	tall open-shrubland (TOS)
Shrubs 1 – 2 m	closed-heath (CHT)	open-heath (OHT)	shrubland (S)	open-shrubland (OS)
Shrubs <1 m	-	Dwarf open-heath (DOHT)	dwarf shrubland (DS)	dwarf open-shrubland (DOS)
Succulent shrub[3]	-	-	succulent shrubland (SS)	dwarf succulent shrubland (DSS)
Hummock grasses	-	-	hummock grassland (HG)	open hummock grassland (OHG)
Tussock grasses	closed-tussock grassland (CTG)	tussock grassland (TG)	open tussock grassland (OTG)	sparse-tussock grassland (STG)
Herbs[4]	closed-herbland (CH)	Herbland (H)	open-herbland (OH)	sparse-herbland (SH)
Forbs	closed-forbland (CFB)	Forbland (FB)	open-forbland (OFB)	sparse-forbland (SFB)
Sedges	closed-sedgeland (CV)	Sedgeland (V)	open-sedgeland (OV I)	-

2.4.1 Classification of Remnant/Non-Remnant Vegetation

The definition of remnant vegetation adopted here follows EPA (2006):

> *Woody vegetation is mapped as remnant where the dominant canopy has greater than 70% of the height and greater than 50% of the cover relative to the undisturbed height and cover of that stratum and dominated by species characteristic of the vegetation's undisturbed canopy. An undisturbed stratum (or layer) is defined as one that shows no evidence of extensive mechanical or chemical disturbance (logging, clearing, poisoning, etc.) evident in field inspections or on the available historical aerial photographic record* (EPA 2006).

[1] Growth form of the predominant layer (the ecologically dominant layer).
[2] Trees are a woody plant more than 5 m tall usually with a single stem.
[3] Shrub is a woody plant less that 8 m tall either multi-stemmed or branching close to the ground, occasionally with a single stem.
[4] Herbland refers to associations in which the species composition and abundance is dependant on seasonal conditions and at any one time grasses or forbs may be predominant.

As a general rule applied in this study and consistent with standard herbarium methods, a vegetation polygon is classified as non-remnant if its total width is less than 15 m, and the vegetation polygon is less than 1 hectare (ha) in size and isolated from remnant vegetation communities.

2.5 Mapping Scale

For vegetation survey, Neldner *et al.* (1995) recommend a minimum of half the sampling density required by the Food and Agricultural Organisation of the United Nations (FAO 1979) for soil survey. This equates to a minimum of two sites per km^2 for 1:25 000 scale mapping, and 12.5 sites/km^2 for 1:10 000 scale mapping. As such, a proposed dam inundation area of 2.5 km^2 (excluding the pipeline easement) requires 31 sites for 1:10 000 scale mapping, assuming total cover of remnant vegetation. With cleared horticultural lands comprising 28% of the project area, site data requirements for 1:10 000 scale mapping in the project area are reduced significantly. With 48 sites sampled within the inundation area, the collected site information exceeds data requirements for 1:10 000 scale mapping. Highly detailed delineation of vegetation communities is constrained, however, by the spatial resolution of the available 1:40 000 scale aerial photographs used for the study.

2.6 Digital Processing and Accuracy

The marked aerial photographs were scanned at a resolution of 300 dpi. Each photo was then registered within ArcMap using the geo-registration extension against the digital cadastral database (DCDB). Upon completion of photo registration, the identified boundaries were captured as line work. Final editing was performed when all of the boundaries had been captured, prior to generation of polygons in ARC/INFO format.

The accuracy for the 1:40 000 scale aerial photography is equivalent to 1 mm on the photograph being equal to 40 000 mm on the ground. All aerial photograph line-work was between 1 – 2 mm on the aerial photography generating an accuracy of 40 to 80 m. The RMS error obtained during photo registration varies depending on the underlying terrain. In general, the RMS error for the 1:40 000 scale aerial photographs is in the range of 40 to 80 m, with variation due mainly to the underlying terrain - steeper terrain produces greater radial distortion on each photograph.

Shire wide spot imagery supplied by the SCC was utilised as a supplementary control for air photo registration on the INW. Spatial inconsistencies in the DCDB and Spot Imagery Spatial inconsistencies in the DCDB and Spot Imagery, which were used as a primary means of spatial registration, introduced an additional source of error into the spatial processing. As such, the vegetation line-work generated in the INW exercise is useful for identification of constraints and preliminary environmental planning. The accuracy of floristic collection points and survey locations is within the range of 4-8m, determined by GPS.

2.7 Flora Assessment Methods

The site selection method targeted samples of representative habitats throughout the study area for vegetation mapping purposes and also allowed assessment of the vascular flora of the project area. As discussed in **Section 2.3**, structural and floristic data was entered onto proformas and transferred into Excel format within a site by species framework. The dataset included a range of fields relevant to

the site e.g. location, condition status, community type, RE and VMA status. Data relevant to individual species, such as collection number, conservation status, exotic status, bioregional endemicity, disjunction, and distribution limit was assigned as determined by the literature review.

The resultant dataset provided a detailed flora list for the survey and allowed identification and mapping of a range of flora values, including taxa of state significance and other priority species and their habitats. Lists derived from the HERBRECS and WildNet databases and information contained within published and unpublished literature for the area were also assessed to assist in predictive analysis of species distributions. Interpretation of raw data assists in the assessment of spatial distribution of known records of Endangered, Vulnerable and Rare (EVR) flora and in identification of their habitat. Data output also assists in the development of a flora species checklist. Nomenclature follows Bostock and Holland (2007).

2.8 Limitations

As identified above, survey timing occurred in the summer (December) and winter (June-July) periods. While this effort proved sufficient to account for identification of the majority of the flora, it is considered a limiting factor in respect to the confirming identity of the vulnerable listed *Melaleuca williamsii* (syn *Callistemon pungens*), the rare listed *Melelaueca flavovirens* (syn. *Callistemon flavovirens*), and detecting the rare listed terrestrial orchid *Diuris parvipetala*, *Pterostylis longicurvata* and *P. woollsii*.

The Callistemon genus has recently been revised (see Craven 2006) with the conversion of Callistemon to Melaleuca accepted in Queensland (Bostock and Holland 2007). The new Melaleuca key is as yet unpublished, however it is understood that accurate identification relies on flowering material (Bean pers. comm. 2006, Harden 2002, Stanley and Ross 1986). It should therefore be noted that the identification of these taxa throughout the Emu Swamp baseline flora surveys is based on non-flowering material. Non-flowering specimens provided for identification to the Queensland Herbarium advisory services were identified as *Melaleuca* sp. On this basis, all records remain unconfirmed and have been tentavively placed under *M. williamsii* or *M. flavovirens* based on field characteristics as a precautionary approach. Surveys timed for the flowering period of October-November will be required if confirmation of the identity of these taxa throughout the study area is to be achieved. It should also be noted that *Melaleuca williamsii* is referred to as *Callistemon pungens* in the EPBC Act.

Diuris parvipetala is a terrestrial orchid listed as rare in the *Regulations of the Nature Conservation Act* 1992 and is a locally significant wildflower (Donatiu 2006). This species has the potential to occur in the study area (Donatiu 2006, HERBRECS data extract EPA 2006). Donatiu (2206) refers to *D. parvipetala* as having an active growth period bewteen September and February/March, during which time the species will flower and fruit. Surveys of the Emu Swamp Rd corridor and the irrigation alignment occurred outside of the potential flowering time. This also applies to *Pterosylis longicurva* and *P. woollsii* which are known to flower in the Sept-Oct period (Harden 2002).

Identification of indigenous and non-indigenous, recreational and commercial values associated with the flora of the study area has not been carried out as part of this study. While the data collected during this study may form the basis of these assessments, values are reliant upon engagement and input of key community interest groups and individuals.

3.0 Results - Literature Review

3.1 Certified Regional Ecosystem (RE) Mapping

The current certified 1:100 000 scale regional ecosystem mapping (version 5, 2003), which shows the distribution of RE's in the dam inundation area and the ESSR corridor is presented in **Figure 4a**. Certified regional ecosystem mapping for the TWS and INW (which shows Vegetation Management Status) is presented in **Figure 4b** (north) and **Figure 4c** (south).

Six RE's are mapped within the project area including all associated infrastructure. Based on classifications provided by the VMA, three of these REs are listed as 'Endangered', one as 'Of Concern' and one as 'Not of Concern'. RE's represented in the study area and their conservation status is summarized in **Table 3**.

Table 3. RE's within the proposed Emu Swamp Dam inundation area (including pipeline easement).

Regional Ecosystem	Status (VMA 1999)	Abbreviated Description
13.3.1*	Endangered	*Eucalyptus blakelyi* woodland on alluvial plains
13.12.2	Not of Concern	*Eucalyptus andrewsii, E. youmanii* woodland on igneous rocks
13.12.5*	Not of Concern	*Eucalyptus youmanii* on igneous rocks
13.12.6*	Of Concern	Shrubland on igneous rocks
13.12.8*	Endangered	*Eucalyptus melliodora* and/or *E. moluccana/ E. macrocarpa* and/or *E. conica* woodland on igneous rocks
13.12.9	Endangered	*Eucalyptus blakelyi* and/or *E. caliginosa* woodland to open forest on igneous rocks

**Indicates occurrence within the inundation area.*

The certified RE mapping identifies the 'endangered' RE 12.3.1 as the dominant vegetation community within the inundation area, with smaller areas of the endangered RE 13.12.9 and the 'not of concern' RE 13.12.2 impacted on the margins of the dam footprint.

3.2 Commonwealth EPBC Act

3.2.1 Endangered Ecological Communities

A search of the Commonwealth EPBC Online Protected Matters database indicates that the 'Critically endangered' vegetation community described as 'White Box (*E. albens)*, Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) Grassy Woodland and derived Native Grassland' is present in the vicinity of the project area (DEH 2006). Box – Gum Grassy Woodlands and Derived Grasslands are characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of White Box, Yellow Box or Blakely's Red Gum trees (DEH 2006).

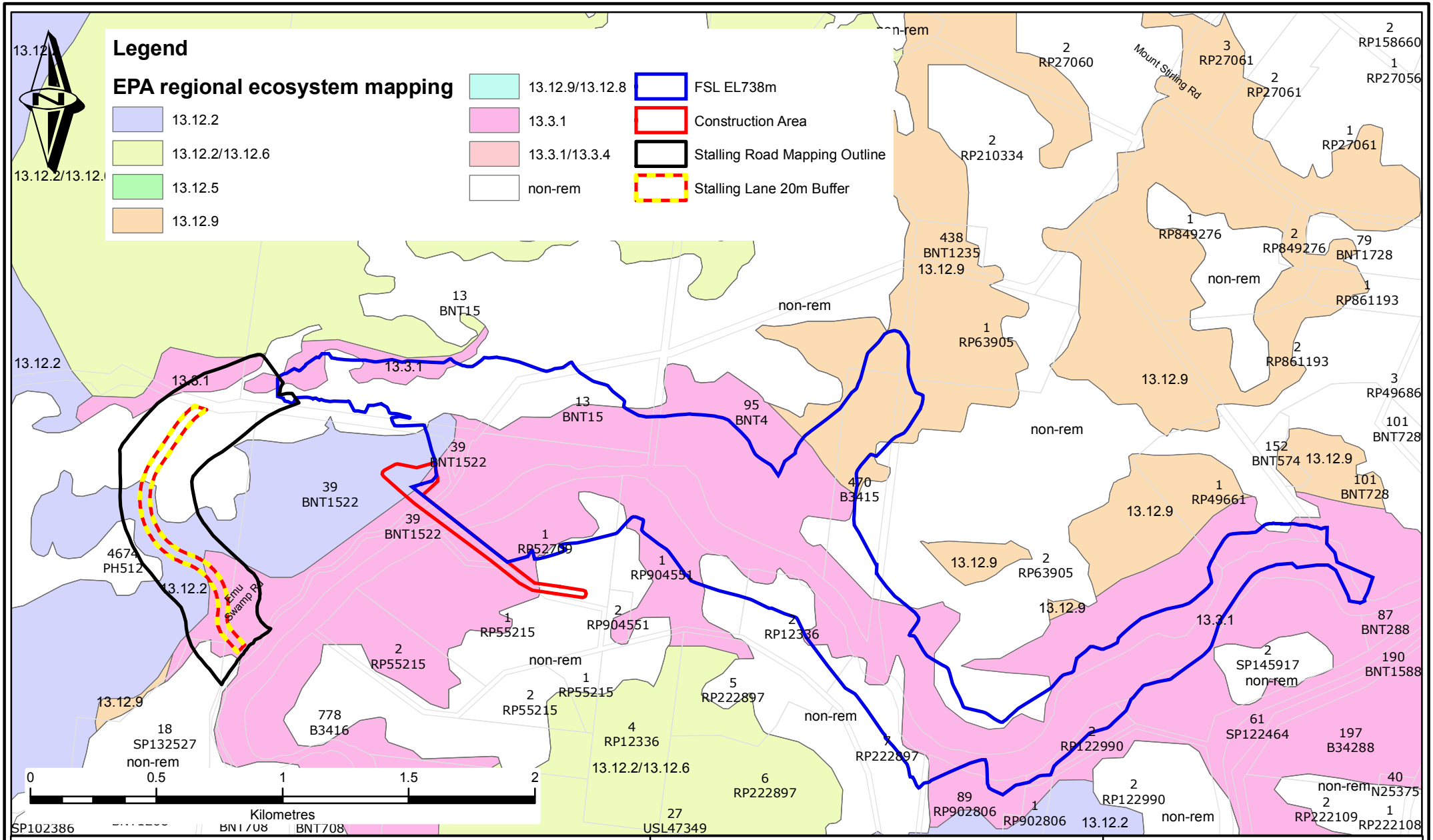

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Figure 4a: EPA regional ecosystem mapping for the inundation area and the ESRR

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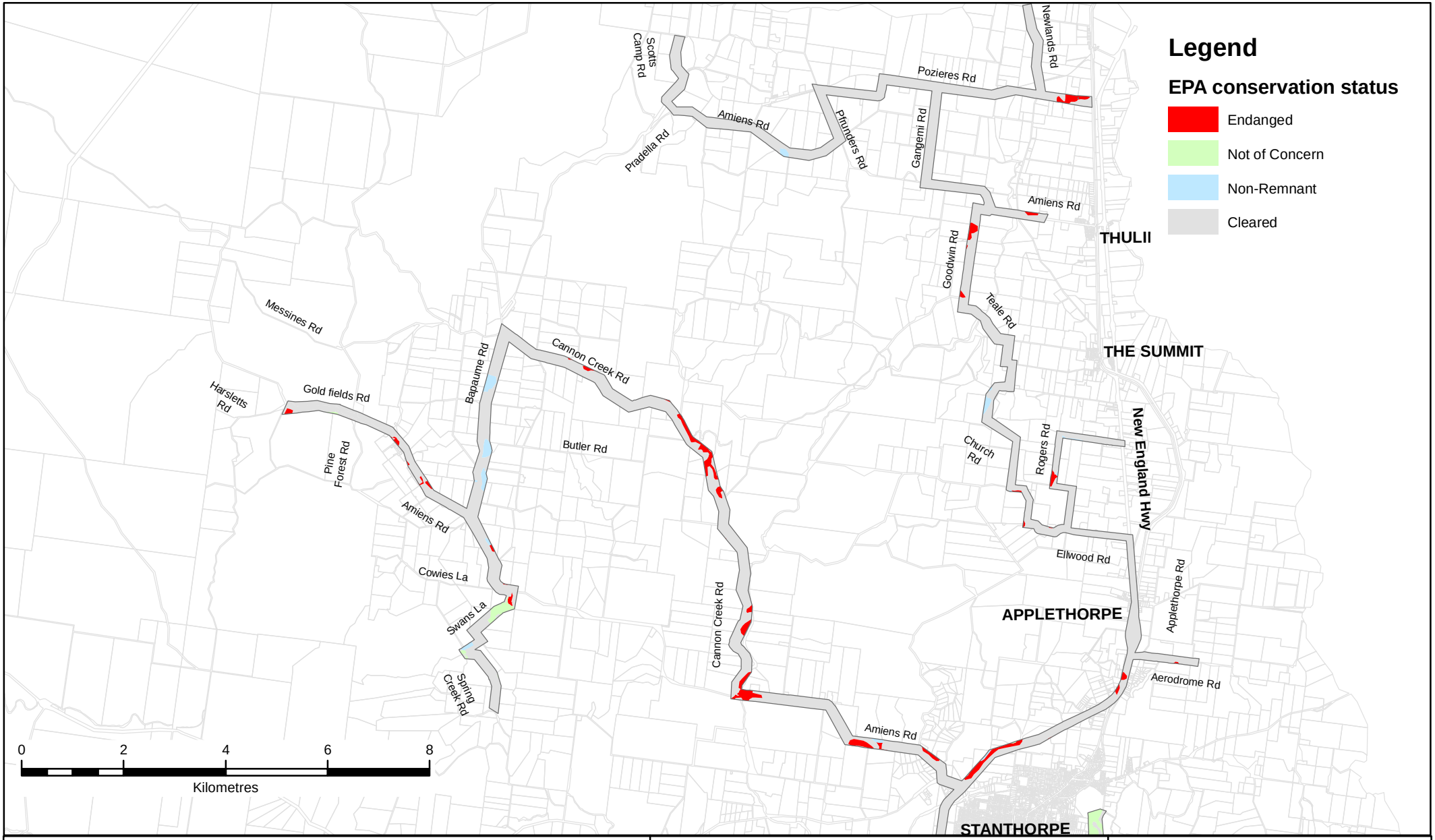

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© The State of Queensland (Department of Natural Resources) [2004]

Source: EPA
Regional Ecosystems Database: Version 5, 2003)
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Figure 4b:
EPA conservation status (VMS) for the INW and TWS (North)

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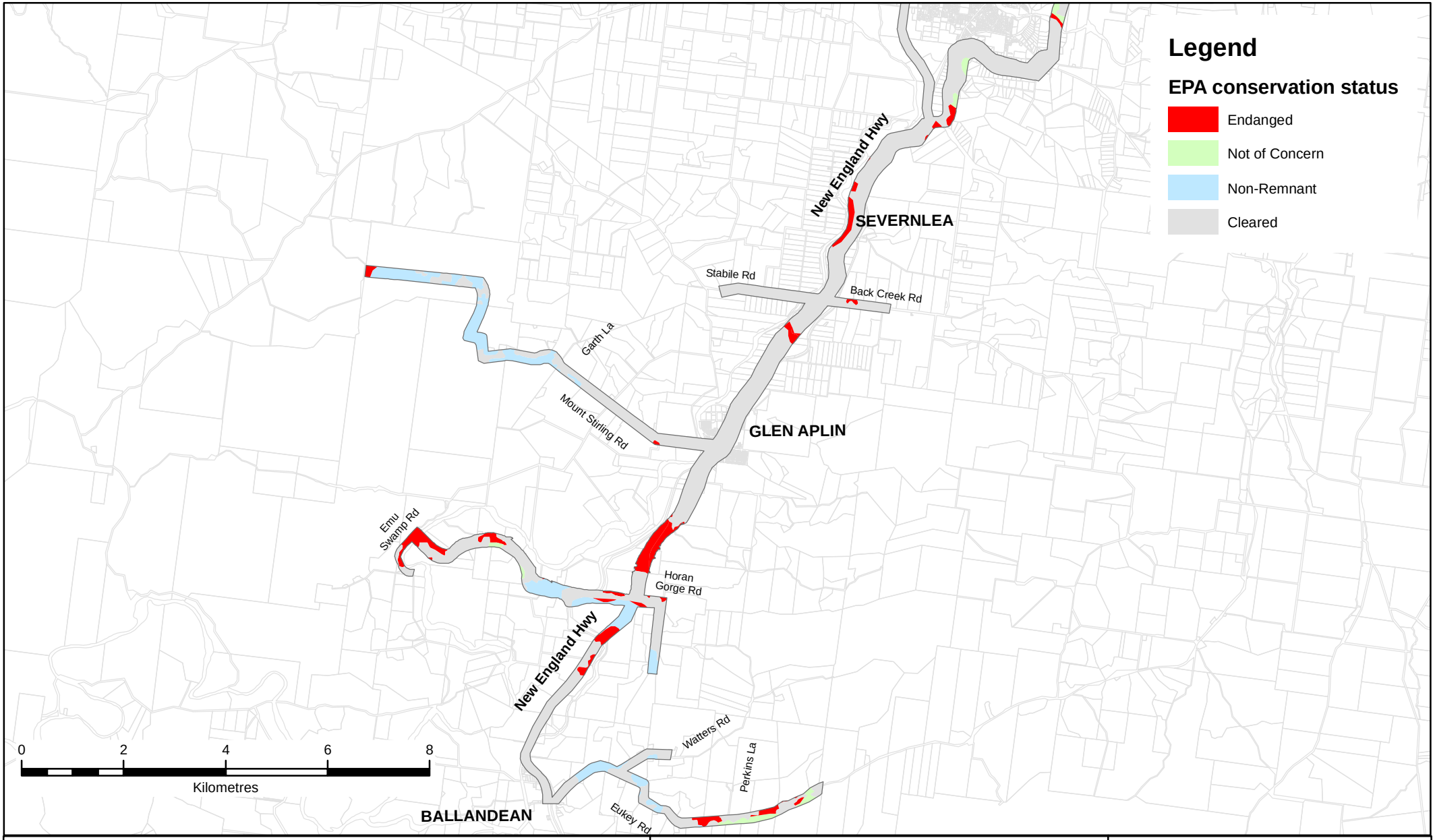

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Figure 4c:
EPA conservation status (VMS) for the INW and TWS (South)

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This ecological community has an extensive distribution along the western slopes and tablelands of the Great Dividing Range, from southern Queensland through NSW to central Victoria (Beadle 1981 in DEH 2006). In Queensland, it occurs in the Brigalow Belt South, New England Tableland and South-eastern Queensland bioregions (Environment Australia 2000). In the New England Tableland bioregion, it is recognised as a primary component of REs 13.3.1, 13.11.8, 13.12.8 and 13.12.9, and may also be a component of REs 13.3.4, 13.11.3 and 13.11.4 (DEH 2006). Analysis of the RE mapping for the study area indicates that the ecological community is represented in components of RE 13.3.1, and dominant proportions of RE's 13.12.8 and 13.12.9.

3.2.2 Endangered and Vulnerable Flora

The online EPBC Report identified five nationally endangered and 13 nationally vulnerable flora species with the potential to occur, or with habitat likely within the inundation area. An expanded search to incorporate the broader study area, including all associated infrastructure, identifies an additional one endangered and two vulnerable species **(Table 4)**.

3.3 Flora Data

3.3.1 HERBRECS Data

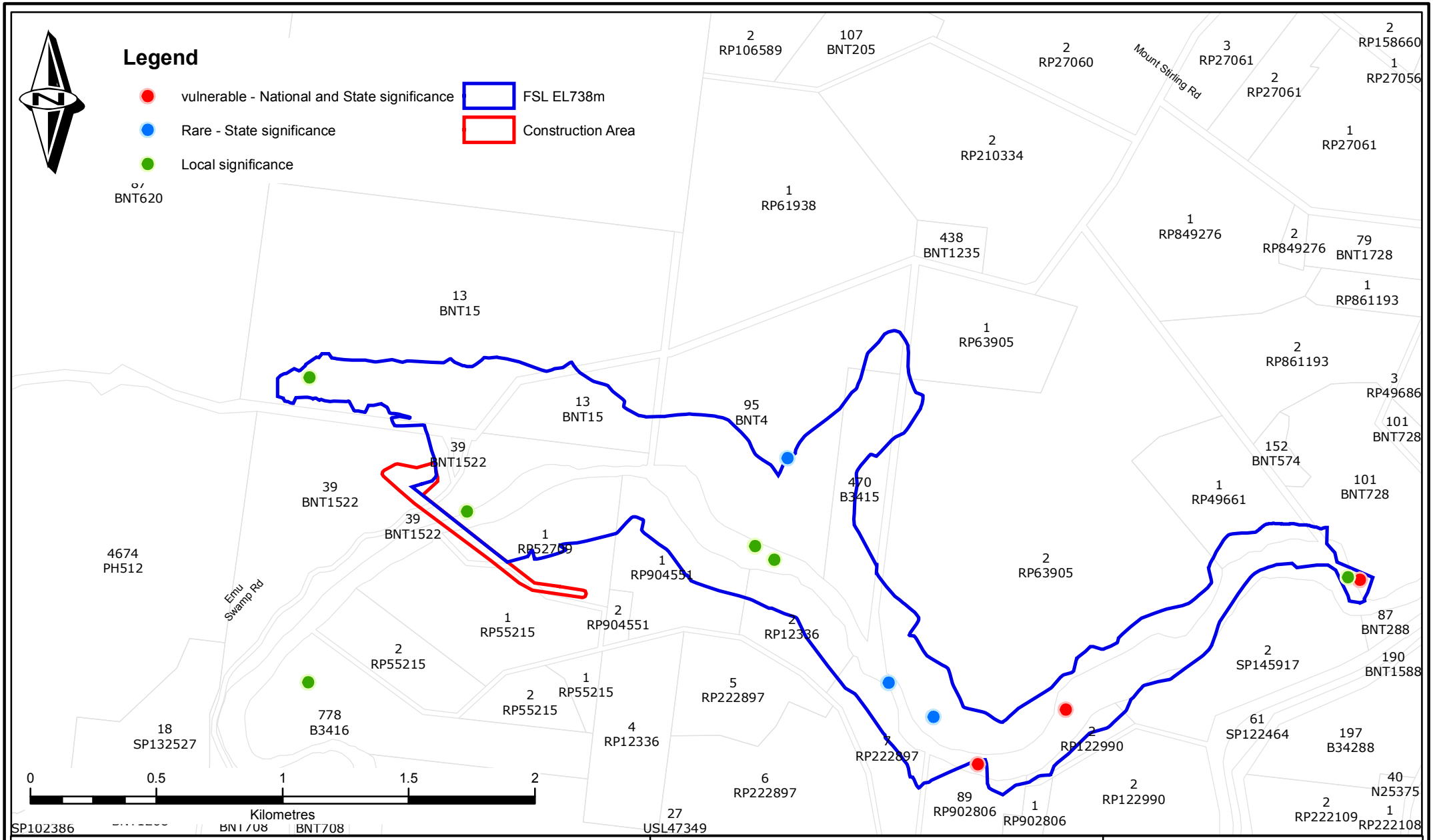
Data extracted from a defined area search of the Queensland Herbarium statewide HERBRECS database (EPA 2006) provided an inventory of specimens held in the Herbarium collection. Search results included specimen data in a number of fields with information on location, habitat, soil and geology types. The total search area defined by latitude 28°44'29" North 28°45'51" South, and 151°51'40" East/ 151°48'20" West, encompasses a historically well-collected area which includes records from the western margins of Girraween National Park.

The area is botanically relatively well known as evidenced by the return of 855 individual collections (516 species) from the database search. Of the 46 records of EVR flora, eight species occur within or in close proximity to the area of impact associated with the Emu Swamp dam proposal (**Table 4**). Furthermore, 85 records of exotic flora containing 62 species are known from the area.

Statewide HERBRECS data was utilised to provide information on the distribution of EVR species in the broader study area, incorporating the TWS and the INW. The locations of HERBRECS EVR taxa within the inundation area and ESRR are indicated in **Figure 5a** and within the broader study of the TWS and INW in **Figure 5b.**

3.3.2 EPA WildNet Data

A defined area search of the EPA wildlife database enabled retrieval of species lists based on records acquired by the EPA. The search over the study area identified 594 terrestrial flora species. This dataset does not specify sources however it is known to incorporate HERBRECS specimen data and CORVEG site data, and may also include information from research and monitoring programs, inventory programs including extension activities, literature records, wildlife permit returns and community programs. The output identifies State and Commonwealth listed EVR flora and the numbers of records for each taxon. Of the 21 EVR species listed, three species are listed as Endangered, three as Vulnerable and 14 as Rare in Queensland. Six EPBC species are recorded with one being nationally endangered and five listed as nationally vulnerable (**Table 4**).



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Source: Queensland Herbarium Herbrecs (2006)

Figure 5a: EVR and significant species locations from Herbrecs (EPA, 2006) in inundation area

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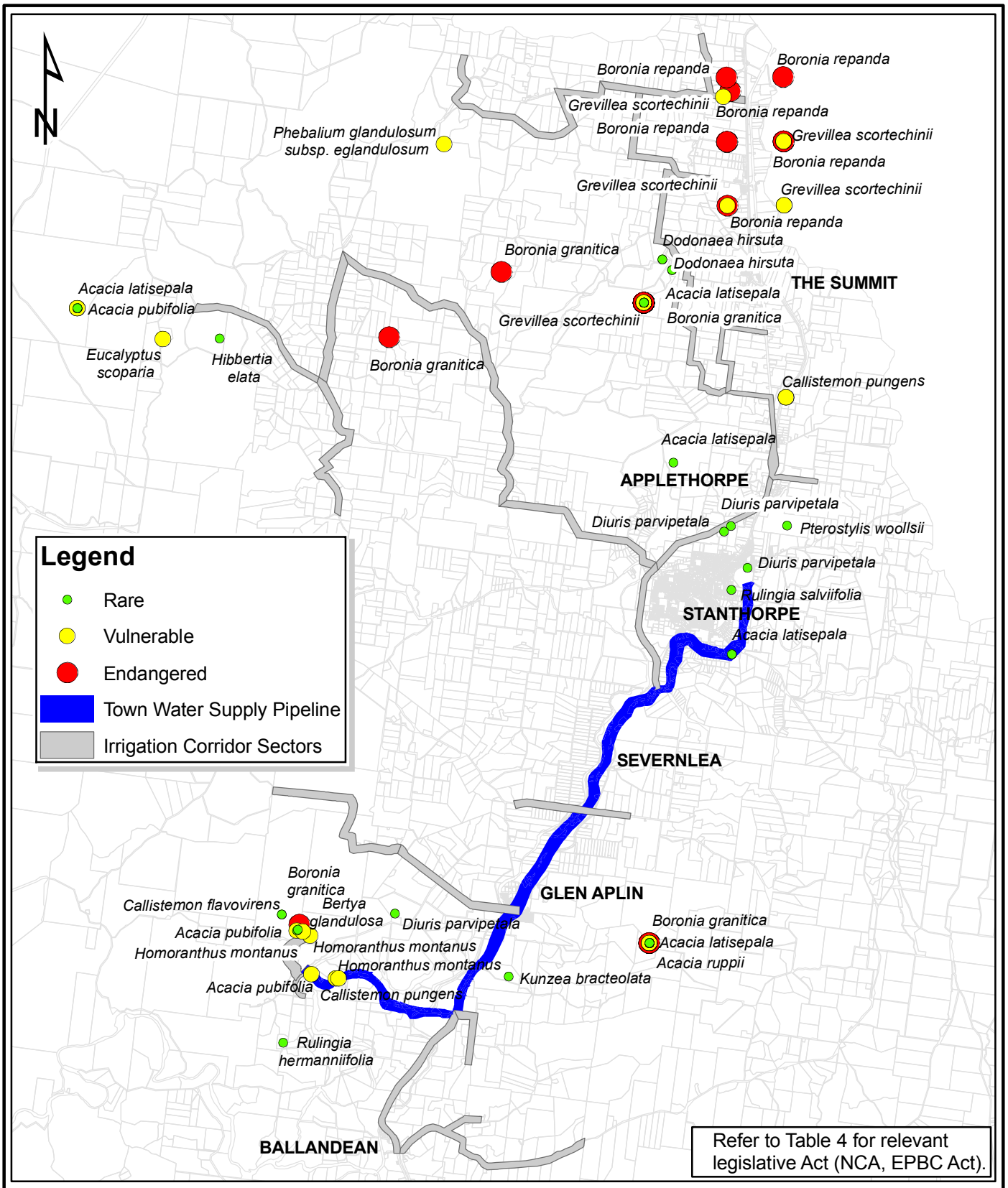

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Source: Queensland Herbarium Herbrecs Database (EVR Extract, 2007)
DIGITAL CADASTRAL DATA BASE

Figure 5b. EVR species (Herbrecs) in relation to the TWS and the INW

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3.3.3 EPA CORVEG Data

The search of the statewide CORVEG dataset sourced raw data derived from Queensland Herbarium vegetation sites. This dataset provides an insight into the intensity of previous sampling in the study area, and also contains flora species lists and abundances that can be directly linked to habitat and RE. A search request of the Queensland Herbarium CORVEG Database revealed no previous systematic sampling of vegetation communities within the inundation area or wider project area.

Table 4. Threatened flora species with potential to occur in the study area.

Species name	NCA	EPBC	H-RECS search records	W-Net search records	Records in dam impact area*	Records in TWS impact area	Records on Irr.Network
Acacia brunioides subsp. *granitica*	R	Not listed	1	1	No	No	No
Acacia latisepala	R	Not listed	4	6	Yes	Yes	Yes
Acacia pubifolia	V	V	2	3	Yes	Yes	No
Acacia ruppii[5]	V	E	1	1	No	No	No
Allocasuarina rupicola	R	Not Listed	2	2	No	No	No
Almaleea cambagei	Not listed	V	0	0	No	No	No
Babingtonia granitica	E	V	4	4	No	No	No
Bertya glandulosa	R	Not listed	1	5	No	Yes	No
Bertya recurvata	R	Not listed	2	2	No	No	No
Boronia amabilis	R	Not listed	0	1	No	No	No
Boronia granitica	E	E	4	5	No	Yes	No
Boronia repanda	E	E	7	7	No	Yes	Yes
Cadellia pentastylis	V	V	2	2	No	No	No
Caladenia atroclavia	E	E	0	0	No	No	No
Conospermum burgessiorum	R	Not listed	4	1	No	No	No
Cryptandra lanosiflora	R	Not listed	2	0	No	No	No
Cryptostylis hunteriana	-	V	0	0	No	No	No
Derwentia arenaria	R	-	2	0	No	No	No
Digitaria porrecta	R	E	0	0	No	No	No
Diuris parvipetala	R	Not listed	5	7	No	Yes	Yes
Diuris sheaffiana[6]	-	V	0	0	No	No	No
Dodonaea hirsuta	R	-	4	4	No	Yes	No
Eucalyptus mckieana	-	V	1	0	No	Yes	No
Eucalyptus scoparia	V	V	0	1	No	Yes	No
Euphrasia orthocheila subsp *orthocheila*	R	Not listed	1	0	No	No	No

[5] Not identified in EPBC search although single Herbrecs record in locality from Girraween NP.
[6] Listed in Qld Flora as *Diuris tricolor* (Bostock and Holland 2007).

Species name	NCA	EPBC	H-RECS search records	W-Net search records	Records in dam impact area*	Records in TWS impact area	Records on Irr.Network
Goodenia macbarronii	-	V	0	0	No	No	No
Grevillea scortechinii subsp. *scortechinii*	V	V	6	6	No	Yes	Yes
Hakea macrorrhyncha	R	Not listed	1	0	No	No	No
Hibbertia elata	R	Not listed	1	1	No	No	No
Homoranthus montanus	V	V	4	4	Yes	Yes	No
Leionema ambiens	R	-	2	0	No	No	No
Lepidium hyssopifolium	Not listed	E	0	0	No	No	No
Kunzea bracteolata	R	-	5	5	Yes	No	No
Macrozamia occidua	V	V	0	0	No	No	No
Macrozamia viridis	E	Not listed	0	1	No	No	No
Melaleuca flavovirens (syn. Callistemon flavovirens)	R	Not listed	4	4	Yes	No	No
Melaleuca williamsii (syn. Callistemon pungens)	V	V	3	3	Yes	Yes	No
Mirbelia confertiflora	R	Not listed	5	5	No	No	No
Olearia gravis	R	Not listed	1	3	No	No	No
Phebalium glandulosum subsp. *eglandulosum*	V	V	1	1	Yes	No	No
Phebalium whitei	V	V	3	3	No	No	No
Pterostylis longicurva	R	Not listed-	0	2	No	Yes	No
Pterostylis woollsii	R	-	2	3	No	Yes	No
Pultenaea foliolosa (ex P. stuartiana)	V	V	0	0	No	No	No
Rulingia hermanniifolia	R	-	1	1	No	Yes	No
Rulingia salviifolia[7]	R	-	1	1	No	No	No
Rutidosis glandulosa	R	Not listed	1	0	No	No	No
Thelionema grande	R	Not listed	2	0	No	No	No
Tylophora woollsi	E	E	1	0	No	No	No
Wahlenbergia glabra	R	Not listed	0	1	No	No	No
Zornia pallida	R	Not listed	1	0	No	No	No

[7] HERBRECS record refers to a cultivated specimen from Amethyst Nursery, 74 Ishmael Road, Camera, Brisbane

3.3.4 Significant non-EVR Flora

A summary information report on the values of Council Reserve 171 (Lot 39/BNT1522) Stalling Lane identifies *Acacia granitica, Acacia venulosa, Eucalyptus prava, Eucalyptus tinghaensis, Haemodorum planifolium, Isotoma anethifolia, Leionema rotundifolium, Philotheca myoporoides* subsp. *conduplicata, Spyridium scortechinii* and *Melaleuca* sp. (Severn River) as a significant non-EVR species occurring in the reserve. Of these, *Melaleuca* sp. (Severn River), is considered by the National Herbarium as a new species (L. Craven pers. comm. cited in SSC 2006) with a small population (20 individuals) known from the Severn River (Donaitu 2006).

3.3.5 Summary

The review of State and Federal database search results identified a total of 51 species of threatened flora that may potentially occur within the broader project area. Location data for threatened flora that are known to occur within the vicinity of the area of impact, including the Emu Swamp Dam inundation area, the TWS, the ESRR, and the INW are indicated in **Table 5**.

Table 5. Location summary data of threatened flora species known to occur within and in the vicinity of proposed inundation area

Species Name	NCA	EPBC	HERBRECS RECORDS
Acacia latisepala	R	-	• Single record from Wyberba, Bald Rock Ck, 6 miles S of Stanthorpe on granite.
Acacia pubifolia	V	V	• 15km SW of Stanthorpe 200 m N of gate on Stalling Lane on rocky hillside, SE slope. • 2km W of Rhumbalara railway crossing on Fletcher Lane, Fletcher (GPS 28 45 30 151 49 27) at base of steep, rocky hill, gritty siliceous loam. The shrub was recorded as suckering after a previous bushfire (1995) and is locally restricted and uncommon in woodland of *Eucalyptus prava* and *Callitris endlicheri* on granite.
Grevillea scortechinii subsp. *scortechinii*	V	V	• Specimen record on INW -Pozieres Road 4km north of Thulimba. Record in RE13.12.9
*Melaleuca flavovirens (*syn. *Callistemon flavovirens)*	R	Not listed	• 6 km W of Glen Aplin, Portion 87, Stalling Lane. Occasional on midslope of granite hill with outcropping rock in heathland with *Callitris endlicheri* emergents; • Woorarra Pastoral Lease, Stalling Lane, 7 km W of Glen Aplin in Eucalypt forest, growing along creek line on slope; • 3.3 km SE of Glen Aplin; • The Junction, Girraween N.P.; • Wyberba Bald Rock Ck 8 km SW of Stanthorpe.
*Melaleuca williamsii (*syn. *Callistemon pungens)*	V	V	• Fletcher Road, Severn River Crossing, near junction with Emu Swamp Road, Fletcher. Recorded as an occasional shrub to 3.5 m high on gravelly alluvium bywash along river bank, in riparian woodland-; • Flat Rock Ck Stanthorpe (2 records);
Eucalyptus mckieana	Not Listed	V	• About 400m W of Rhumbalara Railway crossing on Fletcher Lane, Fletcher (GPS 28 45 57 151 50 33). Lower slope of rocky ridge, gritty siliceous loam. Tree to 25m locally common in tall woodland with *Eucalyptus bridgesiana*, granite;
Homoranthus	V	V	• 6 km W of Glen Aplin, Portion 87, Stalling Lane.

Species Name	NCA	EPBC	HERBRECS RECORDS
montanus			• Mann's or Winkler's property off Stalling Lane, Fletcher Granite Belt; • N of Emu Swamp Rd. 5.5 km W of Glen Aplin Portion 87 Parish of Mundubbermere.
Boronia granitica	E	E	• Glen Aplin (16000m precision); • Amiens, 10 miles NW of Stanthorpe; • Ca 1 mile W of Jollies Falls, 5 miles N of Stanthorpe (16000 m precision); • Near The Summit (16000m precision); • 3.3km SE of Glen Aplin • Girraween National Park, near Wyberba and Wallangarra, Mt Norman; • State Forest 263, Marsh; • Thulimbah; • 15.7km SW of Stanthorpe, portion 87, Stalling Lane; • Ballandean – Stanthorpe; • The Summit.
Boronia repanda	E	E	• This species is known from a number of HERBRECS records on Pfunders Rd (Sector 1) and Pozieres Rd (Sector 2) within proposed irrigation pipeline corridor in disturbed roadside vegetation with the vulnerable *Grevillea scortechinii* subsp. *scorthechinii*;
Kunzea bracteocola	R	Not Listed	• 'Woorarra' Pastoral Lease, Stalling Lane, 7km W of Glen Aplin. • Girraween NP (4 records); • Glen Aplin area; • Wallangarra area.
Phebalium glandulosum subsp. *eglandulosum*	V	V	• Passchendale SF • 0.5 miles NE of Passchendaele.
Diuris parvipetala	R	Not Listed	• Murphys Creek, Glen Aplin (private property). Open cypress pine & Leptospermum heathland Rare in area; • Stanthorpe (Private Property). • Pilton area; • Property at 81 Amosfield Road, Stanthorpe. Grassy site with *Tricoryne* sp., *Wahlenbergia* sp. and *Thysanotus* sp. with shallow soil over granite Estimated 50 plants at site • On INW-2 HERBRECS records located in vicinity of NEH in Sector 8

3.4 Published and Unpublished Vegetation Reports

A number of reports are available which provide background information on the flora and habitat values of the study area and the surrounding landscape, and these are summarised below:

- McDonald *et al.* (1995) document the ecology and flora of the Girraween and Bald Rock National Parks, an area of 17 000 ha lying 10 km to the east of the Emu Swamp Dam study

area. Their study reports an exceptionally rich floral diversity, with 709 vascular plant species recorded and a number of the threatened flora species.

- *The Glove box Guide: A Guide to Vegetation Management in Stanthorpe Shire* (EPA 2003) provides background information on the vegetation communities and threatened flora of the Stanthorpe Shire and offers management information suitable to nature conservation management at the property scale. Further background on weed issues is available through the *Local Government Area Pest Management Plan* (Stanthorpe Shire Council 2004), which identifies problem and declared plant pest species and management actions.

- The *Stanthorpe Plateau Threatened Flora Recovery Plan 2007-2011* (Donatiu 2006) identifies threats and recovery objectives relevant to the long-term management of nine State (NCA) and nationally (EPBC) listed flora species found on the Stanthorpe Plateau. The plan contains considerable detail on the identification, populations, habitats and distributions of species which are considered to be poorly represented in the conservation estate. These include species with potential to occur in the areas impacted by the proposed dam and infrastructure such as *Boronia granitica, Boronia repanda, Callistemon pungens*, *Diurus parvipetala, Grevillea scortechinii subsp. scortechinii,* and *Homoranthus montanus.* Donatiu (2006) also reports that the eastern bank of the Severn River in the vicinity of the proposed dam contains the largest known stand of *Callistemon pungens* on the Stanthorpe Plateau with over 150 individual plants, and that the Severn River dam construction may have a significant impact on the population. Additionally, the area is known to support populations of an unnamed species of *Melaleuca (Melaleuca* sp. Severn River).

- Mapping of RE's, conservation values and threatened flora locations in roadside vegetation of the Stanthorpe Shire was carried out as part of the Roadside Remnants Project commissioned by the SSC and Queensland Murray Darling Commission in September 2005. Overlays indicating the point locations of threatened flora species were used during the field survey.

- The *Stanthorpe Shire Planning Scheme* (2004) identifies the Severn River as a Conservation Feature under the Conservation Overlay Code under the P4 code. This code requires protection of riparian areas from development that might result in damage to the watercourse banks or bed, or adversely impact on water quality, or cause loss of existing vegetation in the riparian area.

- A number of scientific publications, Hunter *et al.* (1997, 1998), Hunter (2000, 2003, 2004) and NPWS (2003) account for the distribution of granite belt threatened flora in northern NSW, providing detailed ecological analysis of the flora of the bioregion with a focus on the New England Batholith. The reports provide additional insight into the composition of vegetation communities and the regional distribution of flora species many of which occur in the Emu Swamp Dam study area.

- Biodiversity values of the New England Bioregion within Queensland have been assessed within the Biodiversity Planning Assessment (BPA) framework by the EPA (2001). The area is mapped as State Significant on the basis that: endangered and of concern RE's occur, populations of EVR taxa are known to exist within or throughout the area delineated (Criteria H); the area supports taxa restricted to one or several locations (Criteria la), and; the area provides wildlife refuge from habitat clearing (Criteria lb). The Stanthorpe Plateau is considered to have a high level of endemism attributed to factors such as diversity of heathland ecosystems, and isolation and persistence on granite substrates (EPA 2001, Sattler

et al. 1999). Furthermore the subregion contains the northern range limit for 86% of the NSW-recorded species. The Stalling Lane / Emu Swamp/ Murphy's Ck Road area is identified as a centre of diversity for plant species due to its high altitude and abundance of granite rocks, and as a special ecosystem for fauna (Emu Swamp riparian habitat). The Severn River was identified as an area with potentially high wetland values with further assessments recommended as part of future BPA process (EPA 2001).

- Biodiversity values of the area are also identified by Stanthorpe Shire Council (2006) in a summary report on Water Reserve 171 Stalling Lane (Lot 39/BNT1522). Values of this 68.2 ha lot are stated as follows:

  > *The Reserve has values that are part of a very large remnant tract with high context and connectively values, as part of a riparian bioregional corridor and has high values as wildlife refugium. Forms part of an area of significance which falls along the boundary of granite and traprock, with overlapping climatic influences placing granite and traprock species at the limits of their distribution. It is also an area of unusual plant diversity due to its high altitude and abundance of granite rocks* (SSC 2006, p. 24).

  The Reserve is dissected by ESRR with the land currently being used for grazing and wildflower conservation. It is known to support populations of threatened flora species and the endangered RE 13.3.1.

- The Queensland Murray Darling Commission (QMDC) have developed a Natural Resource Management Plan for the Queensland portion of the Murray-Darling Basin (QMDC 2007). A key management action is "no net loss of 'at risk' fauna and flora species and associated habitat as identified in State and Commonwealth legislation and the Environmental Protection Agency 2001 data by 2008", and is relevant to all threatened flora in the project area. The plan identifies a number of assets and threats and sets targets which are relevant to maintaining and protecting vegetation and flora values.

4. Results – Field Analysis

4.1 Classification of Land and Vegetation

4.1.1 Land Zones

Aerial photographic analysis completed in conjunction with detailed field survey identified two broad land zone subdivisions within the project area (**Table 6)**. These subdivisions are added as a prefix to a vegetation type to describe a vegetation community.

Table 6. Geological types and land zones identified within the Stage 2 project area.

Geological Attribute	Geological Description	EPA Land Zone
A	Alluvial plains, including fluvial deposits in riverine flood channels and associated exposed granite pavements.	3
G	Granitoid lithologies including rhyolites and granites.	12

4.1.2 Vegetation Communities

Vegetation communities identified within the project inundation area are tabulated in **Table 7** below with those recorded inside the inundation area indicated with an asterisk. A distribution map of the vegetation communities in the inundation area and the ESSR is shown in **Figure 6a,** with vegetation communities within the TWS and INW presented in in **Figure 6b** (north) and **Figure 6c** (south) with a legend for peripheral infrastructure included as **Figure 6d.**

Additional Descriptors: An appended 'X' may be applied in some locations as an indicator of community condition. As an example, a community code of G1bx represents a highly disturbed vegetation community which has retained sufficient structural integrity to be classified as 'remnant' according to the VMA (1999).

Table 7. Vegetation Communities within the Emu Swamp Dam study area.

Vegetation Community	Description	Reference Sites- Representative
	Eucalypt Woodlands and Open Forests	
A1a*	*Eucalyptus blakelyi, E. bridgesiana* shrubby open forest on fluvial deposits.	ES5, ES8,EQ25, EQ28 EPQ2, EPQ8, EPQ34
A1e*	*Eucalyptus blakelyi* open grassy woodland on alluvial flood plains	EQ37
G1e	*Eucalyptus blakelyi* woodland and open forest on gentle granite slopes and deeply weathered granite plains.	EPQ7, EPQ13, EPQ39
G1b*	*Eucalyptus melliodora,+/- Eucalyptus blakelyi+/-, Eucalyptus youmanii+/- Eucalyptus prava, ± E. bridgesiana, +/- E. crebra* woodland and open forest on granite slopes and weathered granite plains.	ES2, ES4, ES15, ES17, ET26, EPQ5, EQ18, EQ20, EQ26, EQ27, EQ35, EQ36, EQ38, EQ39, EPQ1, EPQ9, EPQ14, EPQ16, EPQ17, EPQ19, EPQ24, EPQ31, EPQ32, EPQ35, EPQ36, EPQ37
G1c	*Eucalyptus youmanii, Eucalyptus andrewsii* woodland and open forest on granite hillslopes.	ERS4, EPQ3, EPQ6, EPQ18, EPQ23, EPQ28, EPQ29, EPQ30
G1d*	Woodland and open forest with dominant *E. youmanii, Callitris endlicherii, Angophora subvelutina* on granite knolls.	EPQ7, EPQ3, EPQ6, ES17, EQ21, EQ22, EQ31, EQ34, EPQ15, EPQ33, EWS43, EWS45
G1f	*Eucalyptus conica ± Eucalyptus melliodora ± E. blakelyi* woodland on deeply weathered granite plains and slopes.	EPQ26, EPQ39, EPQ40, EPQ41, EPQ42.
G1g	*Eucalyptus callignosa ± Eucalyptus melliodora* woodland on deeply weathered granite plains and slopes.	STQ21, STQ21a, STQ23, STQ24, STQ122
	Shrubland and Sedgeland Communities	
A2a*	Closed shrubland, shrubland and sedgeland mosaic with emergent trees. Fluvial sediments and associated rock pavements of the main	ES1, ES9 EQ3,EQ32, EQ33,

Vegetation Community	Description	Reference Sites- Representative
	flood channel and associated overflow of the Severn River.	EPQ25
A2b*	Swampy grasslands of riverine flood channel overflows	EQ4
	Rock Pavement Communities	
R1*	In-stream granite boulder deposits associated with major fluvial systems (Severn River).	ES24, ES10
R2*	Granite rock pavements associated with dry eucalypt forest.	EQ12, ES10, EQ19, EQ32a, EWS46
R3*	Granite rock pavement associated with fluvial systems.	EQ29

**Indicates vegetation community recorded inside the dam inundation area.*

4.1.3 Regional Ecosystems

Vegetation communities have been classified into RE's based on landform associations, structural types and floristic assemblages. A total of six RE's were identified in the study area (**Table 8)**. A distribution map of the RE's in the inundation area and ESRR is shown in **Figure 7a**, with the north ern section of the TWS and INW shown in **Figure 7b** and the southern section in **Figure 7c.**

Further discussion concerning the classification and derivation of these RE's is provided in **Section 5.1.** The conservation status of these RE's is discussed in **Section 5.3**.

Table 8. RE's in the project area

Regional Ecosystem	Component Vegetation Communities	Regional Ecosystem Description*	Field Ref. Sites**
Alluvial plains, including fluvial deposits in riverine flood channels and associated exposed granite pavements.			
13.3.1*	A1a, A1ax, A1e, R3	*Eucalyptus blakelyi* woodland on alluvial plains	ES5, ES6, ES8,EQ25, EQ28 EPQ2, EPQ8, EPQ34
13.3.1x1**	A2a, A2ax	13.3.1x1 riparian shrubland on braided stream channels +/- emergent trees such as Eucalyptus blakelyi, Eucalyptus bridgesiana or Angophora floribunda.	ES1, ES9
Granitoid lithologies including rhyolites and granites			
13.12.2	G1h	*Eucalyptus andrewsii, E. youmanii* woodland on igneous rocks	EQ7, ES6, EPQ3, EPQ6, EPQ18, EPQ23, EPQ28, ES17, EQ21, EQ22, EQ31, EQ34, EPQ15, EPQ33
13.12.5*	G1c, G1d	*Eucalyptus youmanii* on igneous rocks	EQ7, ES6, EPQ3, EPQ6, EPQ18, EPQ23, EPQ28, EPQ29, EPQ30, ES17, EQ21, EQ22, EQ31, EQ34, EPQ15, EPQ33, EWS43, EWS44
13.12.6*	R1, R2	Shrubland on igneous rocks	ERS5, ES10, ES24, EWS46, EQ19, EQ29
13.12.8*	G1b, G1f	*Eucalyptus melliodora* and/or *E. moluccana/ E. macrocarpa* and/or *E. conica* woodland on igneous rocks	ES2, ES4, ES15, ES17, ET26, EPQ5, EQ18, EQ20, EQ26, EQ27, EQ35, EQ36, EQ38,

Regional Ecosystem	Component Vegetation Communities	Regional Ecosystem Description*	Field Ref. Sites**
			EQ39, EPQ1, EPQ9, EPQ14, EPQ16, EPQ17, EPQ19, EPQ24, EPQ31, EPQ32, EPQ35, EPQ36, EPQ37, EPQ26, EPQ39, EPQ40, EPQ41, EPQ42, EWQ42.
13.12.9	G1a	*Eucalyptus blakelyi* and/or *E. calignosa* woodland to open forest on igneous rocks	EPQ7, EPQ13, EPQ39, STQ21, STQ21a, STQ23, STQ24, STQ122

Truncated descriptions as per the REDD (Queensland Herbarium 2005).
* Indicates RE occurring within inundation area.
** Indicates new inclusion into REDD (Version 5.1, June, 2007)

4.1.4 Non-Remnant Vegetation Communities

As described in **Section 2.4**, non-remnant communities are those that do not meet the minimum height requirements or canopy cover requirements as prescribed under the VMA. The failure to meet these minimum requirements is usually the result of historical clearing or severe disturbance. Non-remnant communities also include those dominated by exotic species and plantations. Non-remnant classifications are indicated in **Table 9** with spatial distribution of individual non-remnant classifications in the various portions of the study area provided in previous figures.

Table 9. Non-remnant vegetation community classifications used in the study.

Non-Remnant Classification	Non-Remnant Community description
Grs	Secondary eucalypt communities
Gre*	Dominant Exotic Species – non plantation
Pl	Plantation (usually pinus)
Cl	Cleared areas including horticultural area

* *Found on pipeline easement only.*

4.2 Floristics

4.2.1 Flora

A total of 295 species of vascular plants were recorded within the dam inundation area incorporating results from the road re-alignment study (refer **Appendix A**). This includes all records from the baseline survey and inclusion of relevant HERBRECS records. Seventy-five families and 180 genera are represented. The predominant families are Poaceae (17%), Myrtaceae (8%), Asteraceae (8%), Fabaceae (8%), Cyperaceae (4%), and Mimosaceae (4%). Exotic species totalled 51, representing 17% of the total flora. It should be noted that the Irrigation Corridor survey focused on the identification of floristic constraints and as such, a comprehensive list of all flora species on the corridor was not compiled.

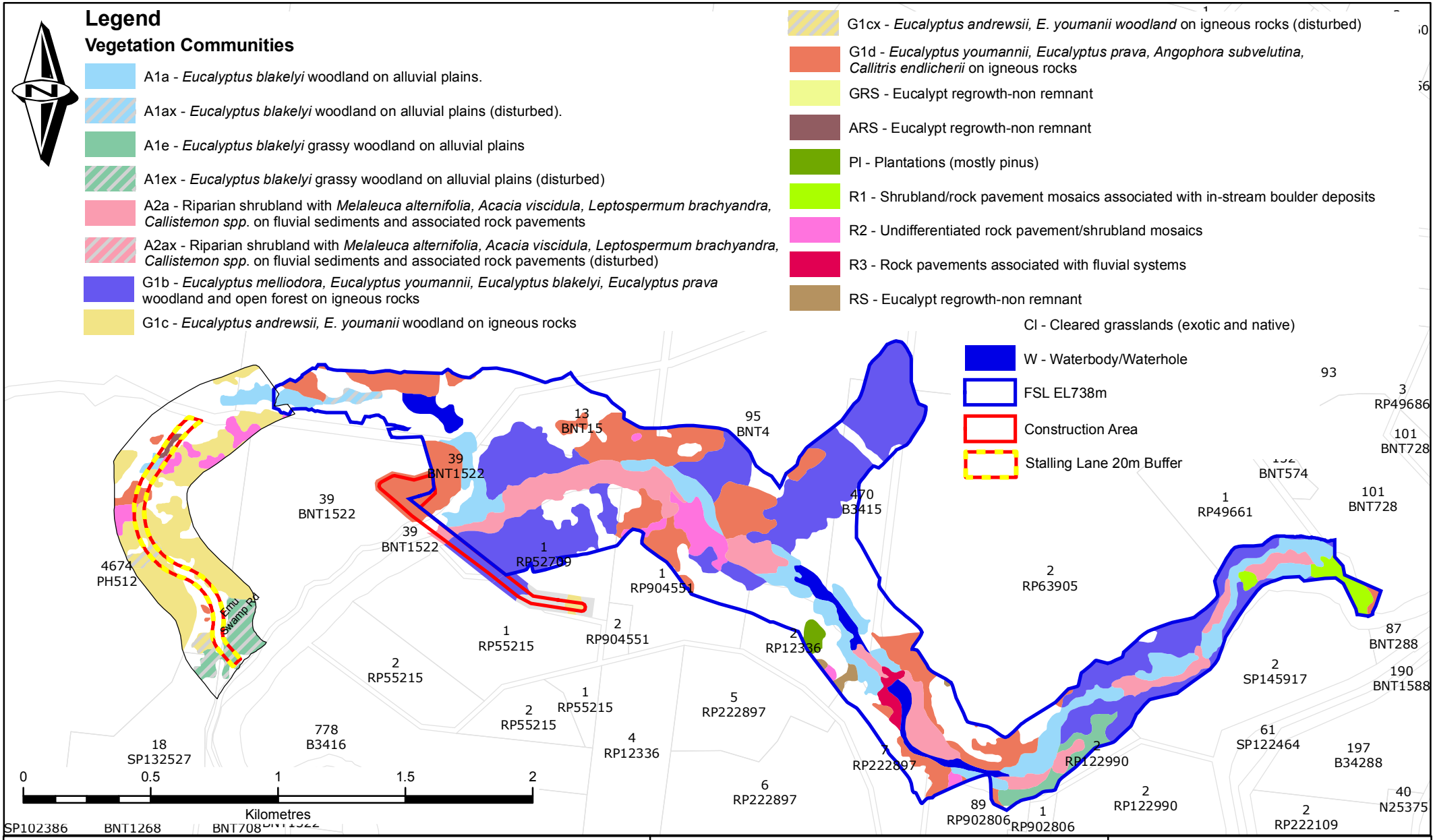

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Figure 6a: Vegetation communities in the inundation area and the Emu Swamp Road re-alignment corridor

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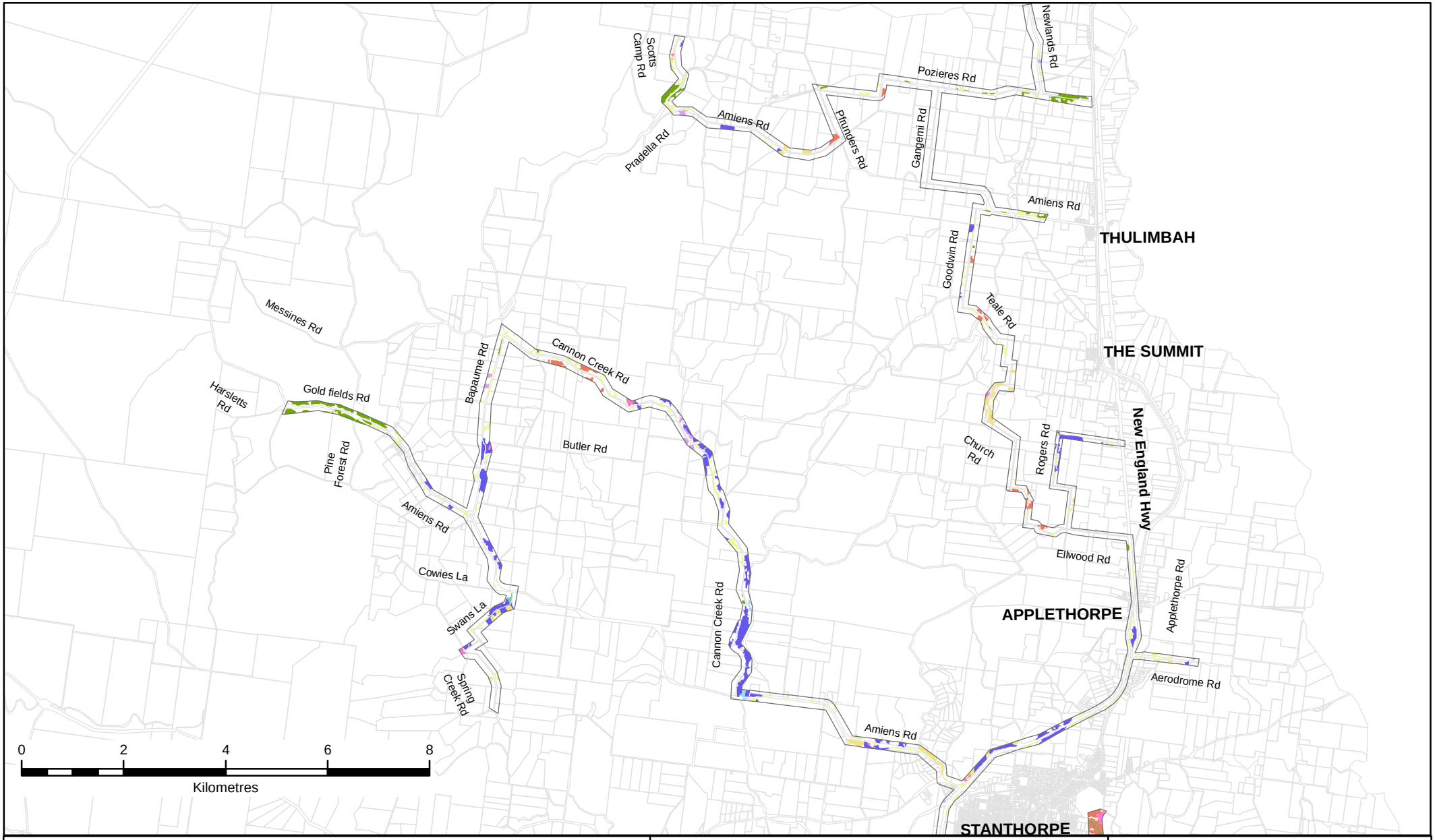

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Figure 6b:
Vegetation communities on the TWS and INW (North)

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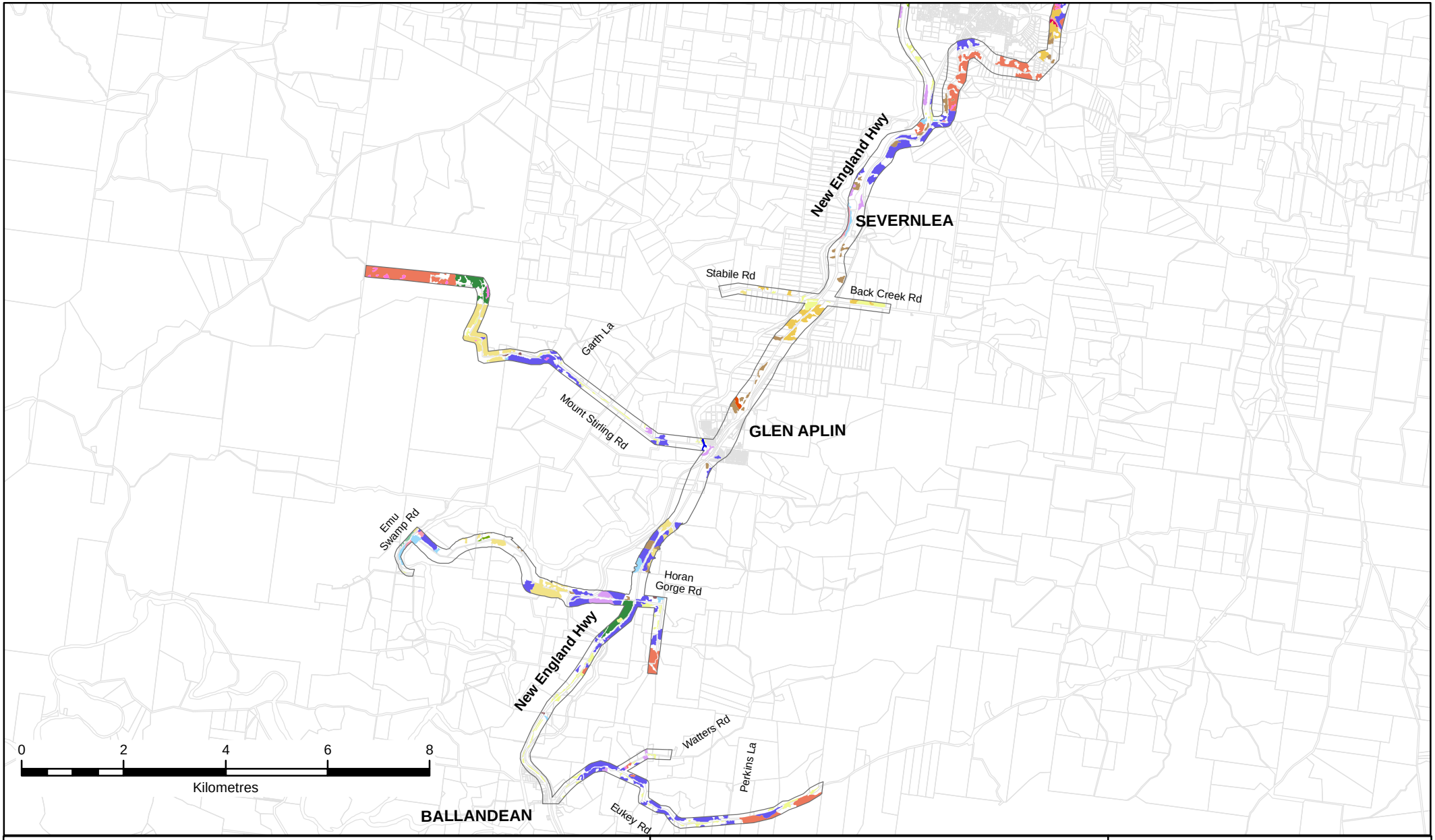

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Figure 6c:
Vegetation communities on the TWS and INW (South)

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Legend

Vegetation Community

- A1a, *Eucalyptus blakelyi* woodland on alluvial plains.
- A1e, *Eucalyptus blakelyi* grassy woodland on alluvial plains
- A2a, Riparian shrubland with *Melaleuca alternifolia, Acacia viscidula, Leptospermum brachyandra, Callistemon spp.* on fluvial sediments and associated rock pavements
- G1b, *Eucalyptus melliodora, Eucalyptus youmannii, Eucalyptus blakelyi, Eucalyptus prava* woodland and open forest on igneous rocks
- G1c, *Eucalyptus andrewsii, E. youmanii* woodland on igneous rocks
- G1d, *Eucalyptus youmannii, Eucalyptus prava, Angophora subvelutina, Callitris endlicherii* on igneous rocks
- G1e, *Eucalyptus blakelyi* grassy woodland on weathered granite soils
- G1g, *Eucalyptus calignosa, Eucalyptus melliodora* woodland and open forest on weathered granite soils
- R2, Undifferentiated rock pavement/shrubland mosaics
- Grs, Eucalypt regrowth-non remnant
- Ars, Eucalypt regrowth-non remnant
- Pl, Plantations (mostly pinus)
- Cl, Cleared grasslands (exotic and native)
- W, Waterbody/Waterhole

NOTES:

Figure 6d:
Vegetation Communities Legend

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0 2 4 6 8
Kilometres

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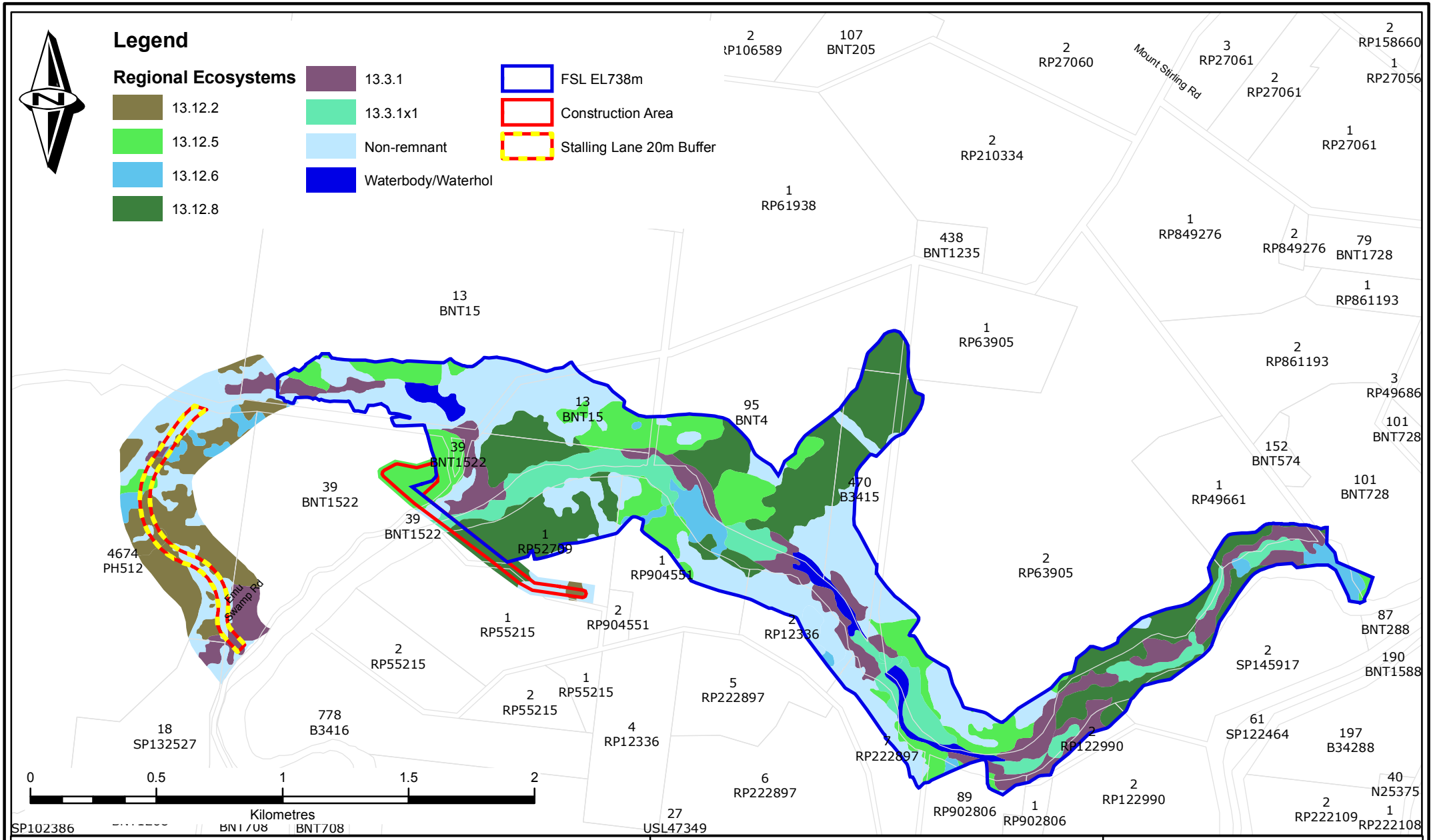

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Figure 7a: EPA regional ecosystem mapping for the inundation area and the ESRR

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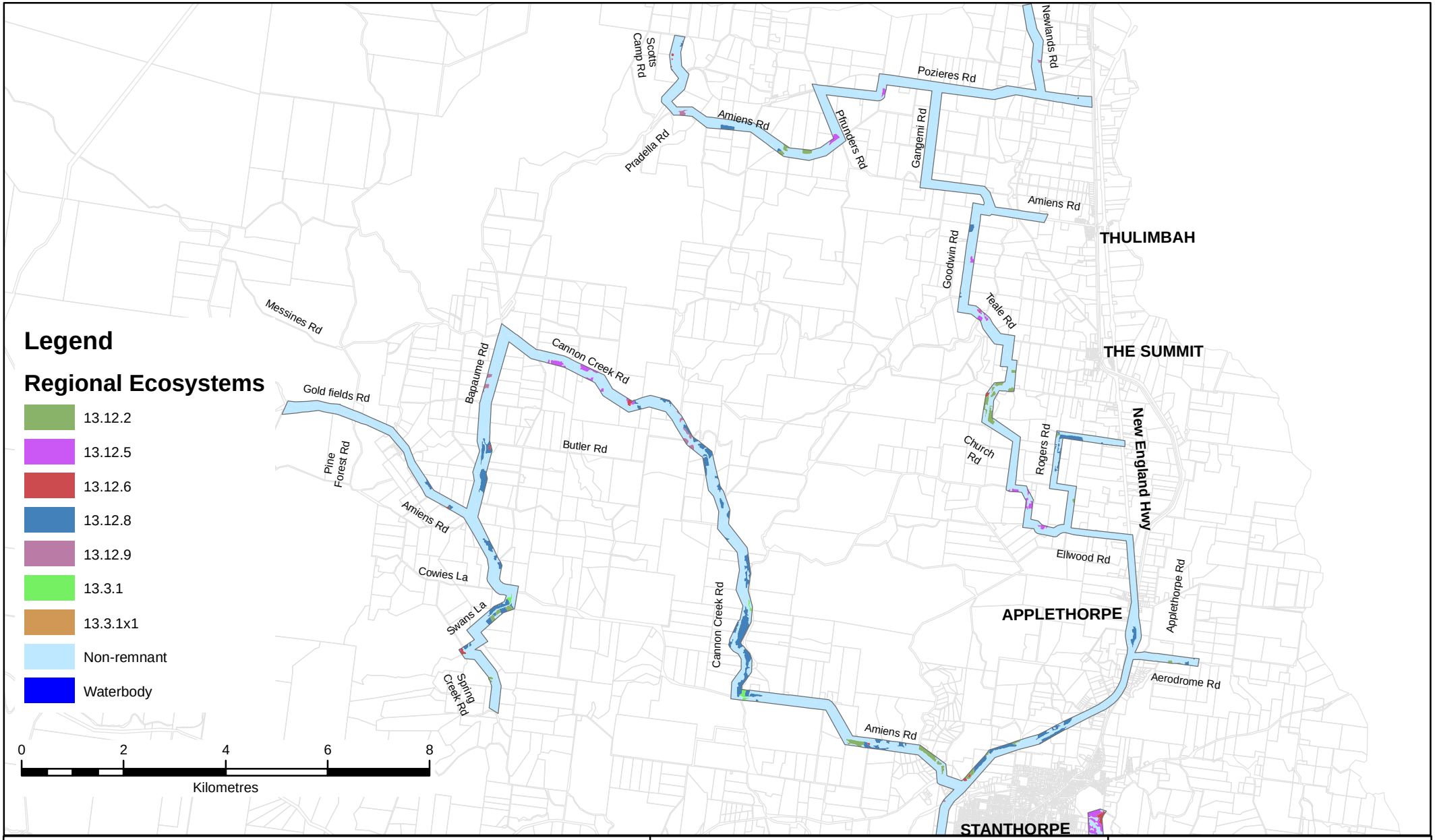

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Figure 7b:
Regional ecosystems on the TWS and INW (north)

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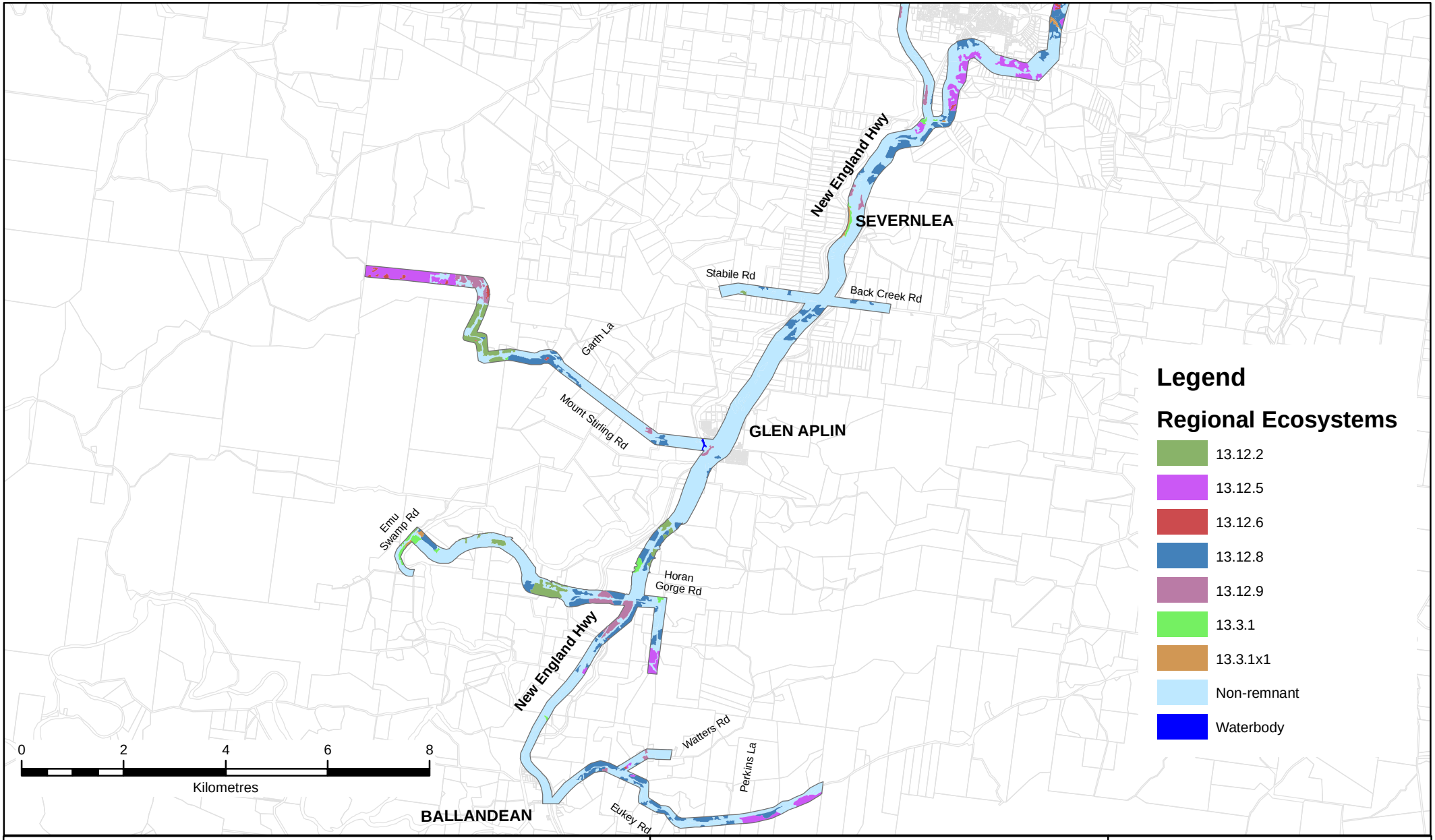

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Figure 7c:
Regional ecosystems on the TWS and INW (South)

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4.2.2 Threatened Flora

Inundation Area and ESRR: The survey of the dam inundation area and ESRR recorded six of the 51 species of EVR taxa potentially occurring in the study area. An additional six species are known to occur within a 5 km buffer of the inundation area based on database analysis. Of the six species scheduled under the NCA, two are listed as nationally 'vulnerable' under the EPBC Act. The survey of the proposed road re-alignment corridor recorded two out of the 51 species of EVR taxa potentially occurring in the study area. Both of these species are listed as 'vulnerable' under the EPBC Act (1999) and the NCA (1992).

Threatened flora collections for the survey are tabulated in **Table 10a** for the dam area and **Table 10b** the ESSR. The spatial distribution of survey records for inundation area and the ESSR is shown in **Figures 8a**.

Table 10a. Records of Threatened Flora (Dam Area).

SPECIES	EPBC	NCA	COLL #	E	N	SITE	MAP UNIT	RE
Acacia latisepala	-	R	7940+	0386399	6919217	19	R2	13.12.6
Acacia latisepala	-	R	7962+	0386801	6818326	29	R3	13.12.6
Acacia latisepala	-	R	7970+	0386978	6818189	33	A2a	13.3.1
Goodenia macbarronii	V	-	-	0394227	6819220	H'Recs	H'Recs	H'Recs
Melaleuca flavovirens	-	R	7857+	0385127	6819004	1	A2a	13.3.1
Melaleuca flavovirens	-	R	8031+	0385808	6818623	misc	R1	13.3.1x
Melaleuca flavovirens	-	R	-	0388696	6818739	EWQ47	G1c	13.12.2
Melaleuca flavovirens	-	R	-	038862	6818740	EWQ48	R1	13.12.6
Melaleuca flavovirens	-	R	7980+	0384497	6818327	misc	A2a	13.3.1
Melaleuca flavovirens	-	R	7981+	0384497	6818327	misc	A2a	13.3.1
Melaleuca flavovirens	-	R	7982+	0384497	6818327	misc	A2a	13.3.1
Melaleuca williamsii	V	V	-	0386065	6818918	EWQ46	R1	13.3.1x
Melaleuca williamsii	V	V	-	038862	6818740	EWQ48	R1	13.12.6
Melaleuca williamsii	V	V	-	0385127	6819004	1	A2a	13.3.1
Melaleuca williamsii	V	V	-	0386271	6818867	9	A2a	13.3.1
Melaleuca williamsii	V	V	-	0384497	6818327	H'Recs	H'Recs	13.3.1
Melaleuca williamsii	V	V	7852+	0385127	6819004	1	A2a	13.3.1
Melaleuca williamsii	V	V	7945+	0388623	6818743	24	R1	13.12.6
Melaleuca williamsii	V	V	7954+	0387155	6818002	28	A1a	13.3.1
Melaleuca williamsii	V	V	7968+	0386978	6818189	33	A2a	13.3.1
Melaleuca williamsii	V	V	7975+	0387503	6818219	36	G1b	13.12.8
Melaleuca williamsii	V	V	7976+	0388670	6818733	misc	R1	13.12.6
Melaleuca williamsii	V	V	7977+	0388671	6818733	misc	R1	13.12.6
Melaleuca williamsii	V	V	7979+	0384497	6818327	misc	A2a	13.3.1
Rulingia hermaniifolia	-	R	7958+	0386801	6818326	29	R3	13.12.6
Thelionema grande	-	R	7957+	0386801	6818326	29	R3	13.12.6
Thelionema grande	-	R	8028+	0386017	6819096	misc	R1	13.3.1x
Thelionema grande	-	R	-	0388639	6818740	EWQ48	R1	13.12.6
Thelionema grande	-	R	-	0388644	6818756	misc	R1	13.12.6
Thelionema grande	-	R	-	0386907	6818379	32a	A2a	13.3.1

Table 10b. Baseline survey records of Threatened Flora (Road Re-alignment Area)

SPECIES	EPBC	NCA	COLL #	E	N	Site	Map Unit	RE
Acacia pubiflora (population of 15 individuals)	V	V	8010+	0383825	6819021	H'Rec	R2	13.12.6
Melaleuca williamsii (3 individuals)	V	V	Obs. only	0383851	6819198	Trav	A1ax	13.3.1
Melaleuca williamsii	V	V	7943+	0383856	6819174	Trav.	A1ax	13.3.1

* Trav. denotes recorded on walking traverse.

TWS and INW: The survey of the TWS recorded 3 out the possible 51 potential EVR species with one of these being listed as Vulnerable under the EPBC Act, 1999. An additional species, *Eucalyptus mckieana,* listed as Vulnerable (EPBC Act, 1999) was added on account of a Herbrecs collection in the vicinity of the TWS corridor on Fletcher Road, although was not recorded during the survey.

The survey of the INW recorded three out of the 51 species of EVR taxa potentially occurring in the study area. Of these, two are listed as 'Vulnerable' under the EPBC Act (1999) and the NCA (1992) and one species is listed as 'Rare' under the NCA.

Threatened flora collections for the TWS and INW are provided **Table 10c** and **Table 10d** respectively. The spatial distribution of these survey records on the respecitive pipeline corridors is shown in **Figure 8b** (north) and **Figure 8c** (south)**.**

Table 10c. Records of threatened flora on the TWS (Pipeline Area – Fletcher Rd and NEH to Stanthorpe).

SPECIES	EPBC	NCA	COLL #	E	N	Site	Map Unit	RE
Acacia latisepala	-	R	7947+	0393761	6826261	EPQ37	Cl	NR
Acacia latisepala (requires confirmation)	-	R	7942+	0394505	6826650	EPQ34	G1b	13.12.8
Acacia latisepala (requires confirmation)	-	R	7985+	0386045	6818591	EPQ3	Cl	NR
Eucalyptus mckieana	V	-	H'R	0387137	6817399	H'Rec	G1c	13.12.2
Mirbelia confertiflora	-	R	EPQ31/1	0394916	6826751	EPQ31	G1b	13.12.8
Melaleuca williamsii	V	V	7943+	0394505	6826650	EPQ34	G1b	13.12.8
	V	V	7930+	0397051	6828670	EPQ25	G1f	13.12.8
	V	V	7938+	0393351	6825700	EPQ38	Cl	NR
	V	V	7921+	0388601	6817375	EPQ14	G1b	13.12.8

Table 10d. Baseline survey records of Threatened Flora (Irrigation Corridor)

SPECIES	EPBC	NCA	COLL #	E	N	Site	Map Unit	RE
Acacia latisepala (confirmed by BRI)	-	R	IS26	369861	6835569	Trav.	Cl	Non-remnant
Acacia latisepala (confirmed by BRI)	-	R	IS31	382364	6837662	Trav.	Cl	Non-remnant
Acacia latisepala (confirmed by BRI)	-	R	IS32	382394	6837619	Trav	Cl	Non-remnant

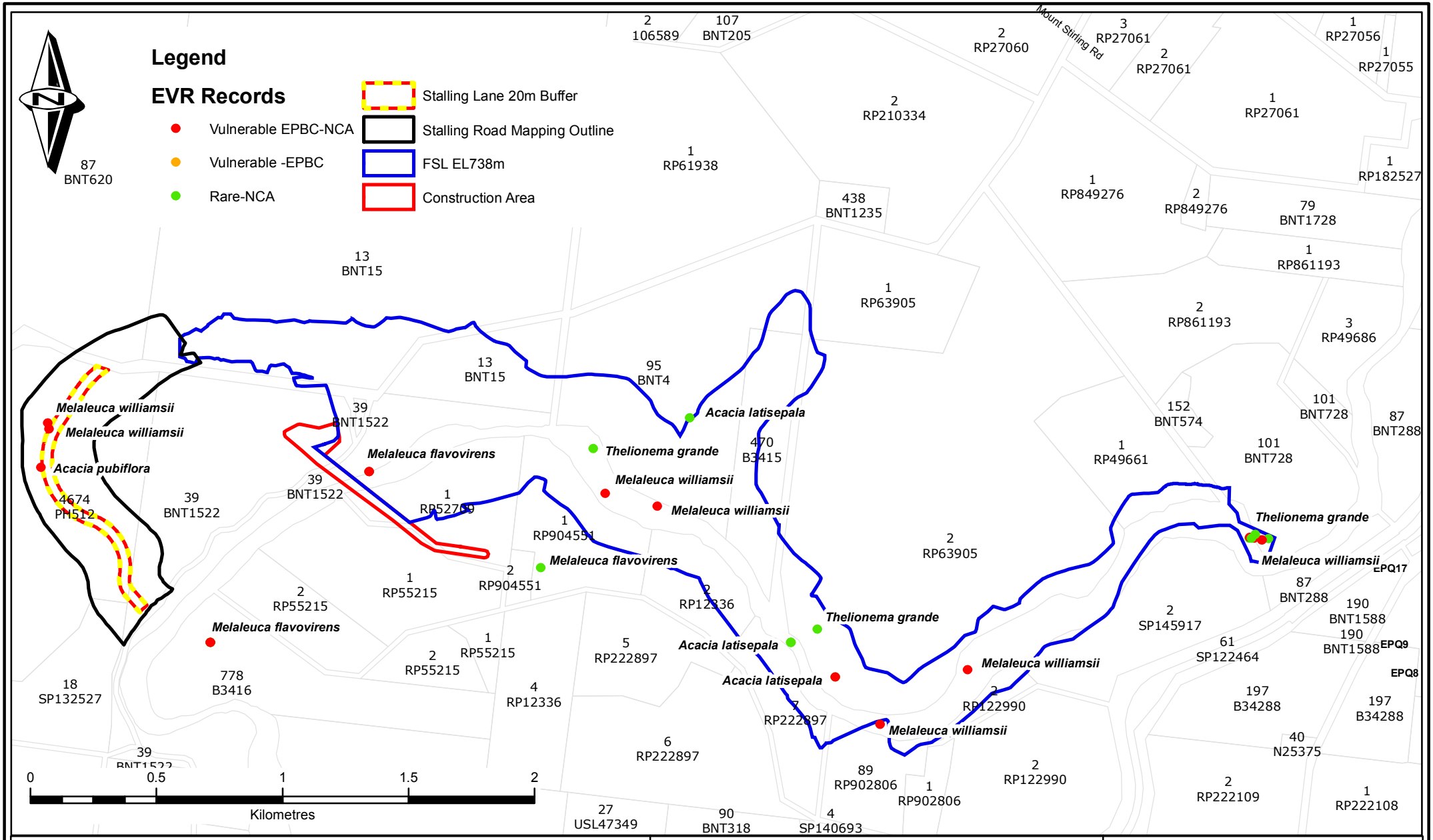
SPECIES	EPBC	NCA	COLL #	E	N	Site	Map Unit	RE
Acacia latisepala (confirmed by BRI)	-	R	IS40	388535	6816968	Trav.	Cl	Non-remnant
Acacia latisepala (ID remains tentative)	-	R	IS16	385809	6822112	Trav.	Cl	Non-remnant
Acacia latisepala (ID remains tentative)	-	R	IS16a	394514	6827024	Trav.	Cl	Non-remnant
Acacia latisepala (ID remains tentative)	-	R	IS24	No gps	No gps	Trav.	G1g	RE13.12.9
Acacia latisepala (ID remains tentative)	-	R	IS42	394332	6826706	Trav.	Grs	Non-remnant
Grevillea scortechinii subsp. *scortechinii*	V	V	Obs.	396491	6843813	Trav.	Cl	Non-remnant
Grevillea scortechinii subsp. *scortechinii*	V	V	Obs.	396687	6843784	Trav.	Cl	Non-remnant
Grevillea scortechinii subsp. *scortechinii*	V	V	IS45	396521	6843810	Trav.	Cl	Non-remnant
Melaleuca williamsii	V	V	IS42	386974	6815160	Trav	G2ax	13.3.1x1
Melaleuca williamsii	V	V	Obs.	386996	6815333	Trav	Cl	Non-remnant
Melaleuca williamsii	V	V	Obs.	394995	6839496	Trav	Cl	Non-remnant

4.2.3 Significant non-EVR Flora

A range of criteria may be applied to determine taxa which are significant at the regional and local scale. EPA (2001) identify values such as; taxa at risk or of management concern; taxa of scientific interest as relictual (ancient or primitive), endemic taxa or locally significant populations, highly specialised taxa whose habitat requirements are complex and distributions are not well correlated with any particular RE's, taxa important for maintaining genetic diversity (such as complex spatial patterns of genetic variation, geographic range limits, highly disjunct populations), taxa critical for management or monitoring of biodiversity (functionally important or ecological indicators), or economic and culturally important taxa. It is acknowledged that the attribution of these criteria to taxa at the bioregion scale is performed using the expert panel process which includes processes beyond the scope of the current study. This study relies on an analysis of HERBRECS data for the Stanthorpe area, EVR data for south-east Queensland, and reviews of relevant literature. In summary the survey recorded a total of 47 significant species (16% of total flora). Survey results relate specifically to the dam inundation zone, due to the process of detailed site survey in the area. Results are summarised against significance categories below and are detailed in **Table 11**.

- 26 locally significant species (9%), (Includes notable wildflower species and species of wetland microhabitats associated with Severn River. Input from local wildflower interest groups is likely to increase the number of wildflower species);
- 13 bioregional endemics (46%);
- Five species with an isolated distribution or disjunct population (2%);
- 30 species reach the northern and/or southern extent of overall geographical distribution, (10%);
- 4 species in the wild of special scientific interest (1%), (un-described or newly described, ancient or primitive);
- Species important to listed or significant invertebrate/vertebrate fauna species require further assessment in conjunction with the fauna study component;

- Species known to hold sentimental, cultural or recreational value or within local indigenous and non-indigenous community require further assessment. Identification of values is reliant on input from local community representatives as part of EIS process;
- Species of commercial interest have not been assessed however may include species valued for commercial cut wildflower industry and apiaries. Further assessment is reliant on input from local community and industry representatives as part of EIS process.



NOTES:

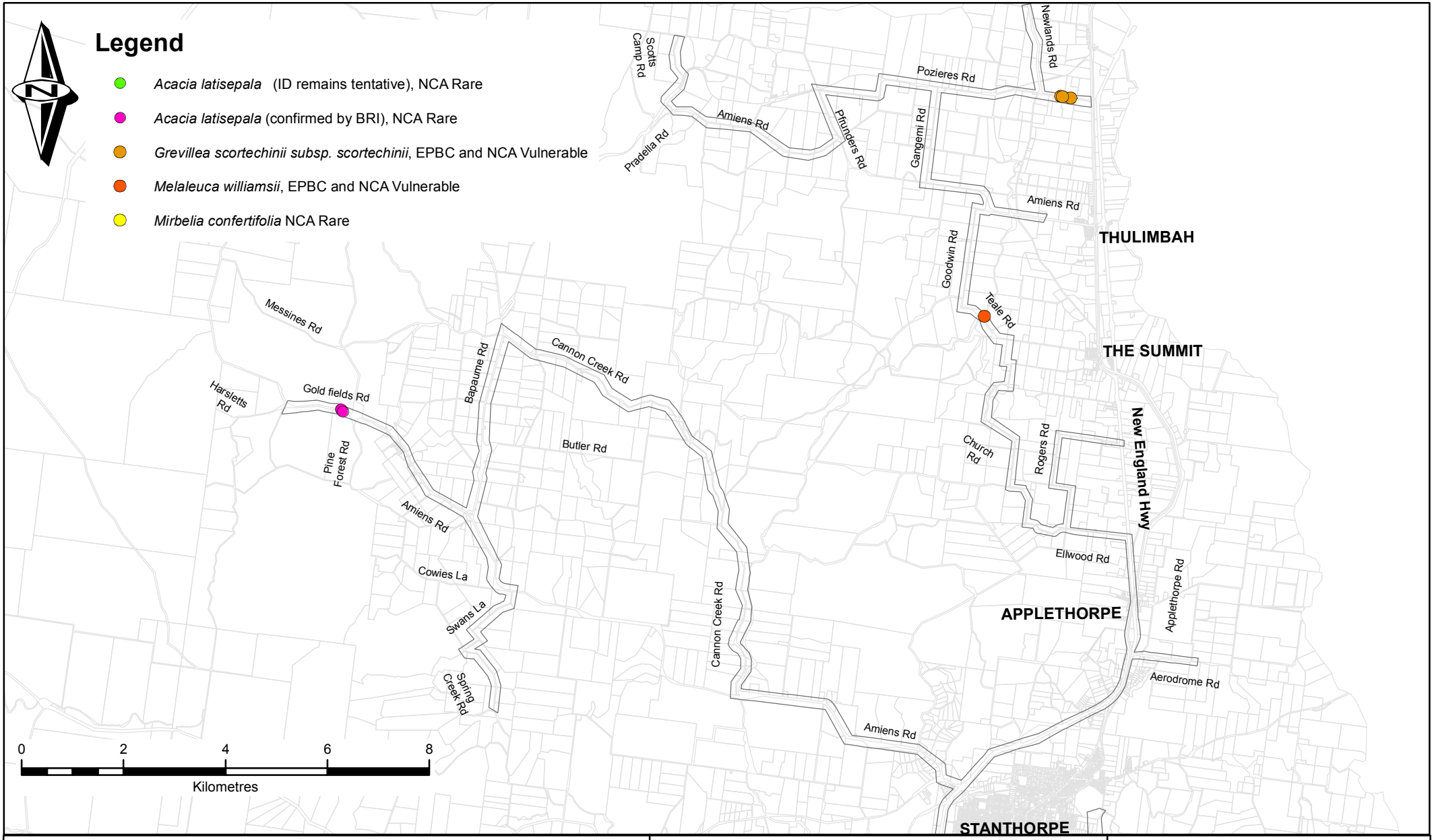
(i) This plan has been produced for exclusive use of the client and **3D Environmental**
(ii) Aerial photography has been registered as a best fit on the boundaries shown and position is approximate only.
(iii) Vegetation data has been captured at aerial photography scale and should not be used at a scale greater than the aerial photography scale.
Aerial Photography scale 1:37,500

Figure 8a:
EVR Records in the inundation area

Client
Stanthorpe Shire Council

3D Environmental
Vegetation Assessment
& Mapping Specialists
P. O. Box 959
Kenmore, Qld 4069
Phone: (07) 3411 9072; (07) 3878 4344
Mobile: 0404 577 285; 0409 426 916
www.3denvironmental.com.au

Scale 1:20,000	**Drawn By** DG	**Checked** DS	**File Path** C:\3denvironmental\Stanthorpe\sstanedits_evr_a3l	**Date** 24/09/07	A3



NOTES:

(i) This plan has been produced for exclusive use of the client and **3D Environmental**
(ii) Aerial photography has been registered as a best fit on the boundaries shown and position is approximate only.
(iii) Vegetation data has been captured at aerial photography scale and should not be used at a scale greater than the aerial photography scale.
Aerial Photography scale 1:37,500

Figure 8b:
EVR Records in the TWS and INW (North)

Client
Stanthorpe Shire Council

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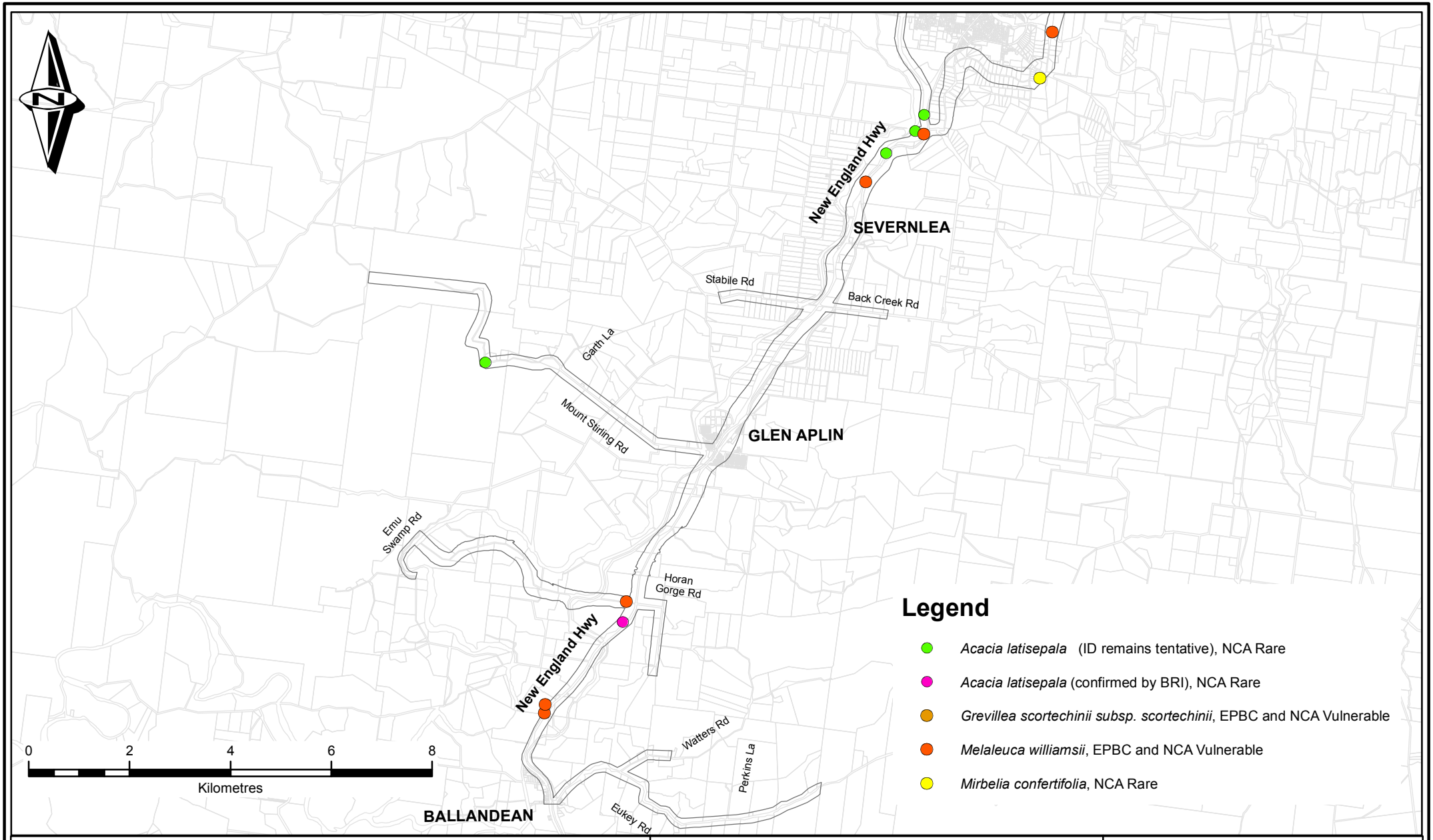
Scale 1:100,000	**Drawn By** DG	**Checked** DS	**File Path** C:\3denvironmental\SIA\si_veg_a3l	**Date** 26/09/07	A3



N O T E S:

(i) This plan has been produced for exclusive use of the client and **3D Environmental**
(ii) Aerial photography has been registered as a best fit on the boundaries shown and position is approximate only.
(iii) Vegetation data has been captured at aerial photography scale and should not be used at a scale greater than the aerial photography scale.
Aerial Photography scale 1:37,500

Figure 8c:
EVR Records in the TWS and INW (South)

Client
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www.3denvironmental.com.au

Scale 1:100,000 | **Drawn By** DG | **Checked** DS | **File Path** C:\3denvironmental\SIA\si_veg_a3l | **Date** 26/09/07 | A3

Table 11. Records of significant non-EVR flora

TAXON	SITE	E	N	MAP UNIT	RE	LOCAL SIG.	BIOREG. ENDEMIC	DISJ.	AT/NEAR DISTR. LIMIT	*SCIENTIFIC INTEREST*
Acacia adunca	EWQ47	0388696	6818739	G1c	13.12.5	x	x		x	
	EWQ47	0388696	6818739	G1c	13.12.5	x	x		x	
	EWQ48	0388623	6818740	R1	13.12.6	x	x		x	
	24	0388623	6818743	R1	13.12.6	x	x		x	
	misc	0386017	6819096	R1	13.3.1x	x	x		x	
Acacia betchei	6	0384501	6819536	A1a	13.3.1	x	x		x	
Acacia granitica	misc	0384497	6818327	A2a	13.3.1	x	x			
	7	0384470	6819566	G1c	13.12.5	x				
Actinotis helianthi	2	0385120	6818888	G1b	13.12.8	x				
	4	0385384	6819344	G1b	13.12.8	x				
	29	0386801	6818326	R3	13.12.6	x				
Asperula ambleia	5	0385171	6819142	A1a	13.3.1	x		x	x	
	6	0384501	6819536	A1a	13.3.1	x			x	
Baloskion stenocoleum	misc	0383902	6819114	G1c	13.12.5				x	
Bossiaea scortechinii	33	0386978	6818189	A2a	13.3.1		x		x	
Calytrix tetragona	10	0386240	6818913	A2a	13.3.1	x				
	EWQ46	0386065	6818918	R1	13.3.1x	x				
Carex appressa	9	0386271	6818867	A2a	13.3.1	x				
	EWQ42	0385158	6819129	A1a	13.3.1	x				
	EWQ46	386065	6818918	R1	13.3.1x	x				
	EWQ48	038862	6818740	R1	13.12.6	x				
	1	0385127	6819004	A2a	13.3.1	x				
	6	384501	6819536	A1a	13.3.1	x				
	8	386347	6818813	A1a	13.3.1	x				
Carex lobolepis	9	0386271	6818867	A2a	13.3.1	x				
	Herbrecs			Herbrecs	Herbrecs	x				
Centrolepis fascicularis	Herbrecs			R3	13.12.6			x	x	
Cheiranthera cyanea subsp. borealis	33	0386978	6818189	A2a	13.3.1		x	x		
Choretum candolei	misc			R3	13.12.6				x	
Daviesia latifolia	Herbrecs			Herbrecs	Herbrecs				x	

Deyeuxia decipiens	Herbrecs			Herbrecs	Herbrecs			x	x	
Dillwynia sericea	16	0386022	6919116						x	
	17	0386180	6819098	G1d	13.12.5				x	
	24	0388623	6818743	R1	13.12.6				x	
	EWS45	0385828	6819045	G1c	13.12.5`				x	
	EWQ46	0386065	6818918	R1	13.3.1x				x	
	EWQ47	0388696	6818739	G1c	13.12.5				x	
	EWQ48	038862	6818740	R1	13.12.6				x	
Dipodium variegatum	6	0384501	6819536	A1a	13.3.1	x				
	17	0386180	6819098	G1d	13.12.5	x				
Eleocharis philippinensis	9	0386271	6818867	A2a	13.3.1	x				
Eucalyptus caliginosa	Herbrecs			Herbrecs	Herbrecs				x	
Eucalyptus prava	23	0388785	6818779			x	x		x	
	2	0385120	6818888	G1b	13.12.8	x	x		x	
	17	0386180	6819098	G1d	13.12.5	x	x		x	
	26	0388217	6818947	G1b	13.12.8	x	x		x	
	27	0388298	6818674	G1b	13.12.8	x	x		x	
	EWS44	0385640	6819299	G1d	13.12.5	x	x		x	
	EWS45	0385828	6819045	G1c	13.12.5`	x	x		x	
	EWQ46	0386065	6818918	R1	13.3.1x	x	x		x	
	EWQ47	0388696	6818739	G1c	13.12.5	x	x		x	
Eucalyptus youmanii	2	0385120	6818888	G1b	13.12.8		x		x	
	EWQ43	0385210	6818979	G1b	13.12.8		*x*			
	4	0385384	6819344	G1b	13.12.8		x		x	
	17	0386180	6819098	G1d	13.12.5		x		x	
	35	0387544	6818353	G1b	13.12.8		x		x	
	36	0387503	6818219	G1b	13.12.8		x		x	
	EWQ42	0385158	6819129	A1a	13.3.1		x		x	
	EWS44	0385640	6819299	G1d	13.12.5		x		x	
	EWS45	0385828	6819045	G1c	13.12.5`		x		x	
	EWQ47	0388696	6818739	G1c	13.12.5		x		x	
Geranium neglectum	9	0386271	6818867	A2a	13.3.1				x	
Grevillea viridiflava	33	0386978	6818189	A2a	13.3.1	x	x		x	

Haemodorum planifolium	Herbrecs			Herbrecs	Herbrecs	x	x		x	
	EWQ47	0388696	6818739	G1c	13.12.5	x	x		x	
Hakea microcarpa	24	0388623	6818743	R1	13.12.6				x	
	Herbrecs			Herbrecs	Herbrecs				x	
Hibbertia sp. (Girraween NP D.Halford+ Q1611)	Herbrecs			Herbrecs	Herbrecs					*x*
Hovea graniticola	16	0386022	6919116			x	x		x	
	2	0385120	6818888	G1b	13.12.8	x	x		x	
	4	0385384	6819344	G1b	13.12.8	x	x		x	
	10	0386240	6818913	A2a	13.3.1	x	x		x	
	17	0386180	6819098	G1d	13.12.5	x	x		x	
	24	0388623	6818743	R1	13.12.6	x	x		x	
	EWQ43	0385210	6818979	G1b	13.12.8	x	x		x	
	EWS45	385828	6819045	G1c	13.12.5`	x	x		x	
	EWQ46	386065	6818918	R1	13.3.1x	x	x		x	
	EWQ47	0388696	6818739	G1c	13.12.5	x	x		x	
	EWQ48	038862	6818740	R1	13.12.6	x	x		x	
Isotoma anethifolia	1	0385127	6819004	A2a	13.3.1	x	x		x	
	27	0388298	6818674	G1b	13.12.8	x	x		x	
	29	0386801	6818326	R3	13.12.6	x	x		x	
	EWQ47	0388696	6818739	G1c	13.12.5	x	x		x	
Juncus planifolius	EWQ46	386065	6818918	R1	13.3.1x	x				
Juncus prismatocarpus	1	0385127	6819004	A2a	13.3.1	x				
Leionema rotundifolium	Herbrecs			Herbrecs	Herbrecs	x	x		x	
Lepironia articulata	EWQ48	038862	6818740	R1	13.12.6	x				
Leptospermum arachnoides	Herbrecs			Herbrecs	Herbrecs				x	
Leucopogon melaleucoides	4	0385384	6819344	G1b	13.12.8				x	
	6	0384501	6819536	A1a	13.3.1				x	
	EWQ43	0385210	6818979	G1b	13.12.8				x	
	EWS44	0385640	6819299	G1d	13.12.5				x	
	EWS44	0385640	6819299	G1d	13.12.5				x	
	EWS45	0385828	6819045	G1c	13.12.5`				x	
	EWQ46	0386065	6818918	R1	13.3.1x				x	

	EWQ47	0388696	6818739	G1c	13.12.5				x	
	EWQ48	038862	6818740	R1	13.12.6				x	
Melaleuca alternifolia	1	0385127	6819004	A2a	13.3.1	x			x	
	9	0386271	6818867	A2a	13.3.1	x			x	
	24	0388623	6818743	R1	13.12.6	x			x	
	5	0385171	6819142	A1a	13.3.1	x			x	
	6	0384501	6819536	A1a	13.3.1	x			x	
	10	0386240	6818913	A2a	13.3.1	x			x	
	33	0386978	6818189	A2a	13.3.1	x			x	
	EWQ42	0385158	6819129	A1a	13.3.1	x			x	
	EWQ46	0386065	6818918	R1	13.3.1x	x			x	
	EWQ48	038862	6818740	R1	13.12.6	x			x	
Melaleuca pityoides	6	0384501	6819536	A1a	13.3.1	x			x	*x*
	EWQ42	0385158	6819129	A1a	13.3.1	x			x	*x*
Melaleuca sp. (Severn River) (DGF7852+DJS)	1	0385127	6819004	A2a	13.3.1	x			x	*x*
	misc	0385662	6811950	R1	13.3.1x	x			x	*x*
	misc	0388708	6818660	R1	13.3.1x	x			x	*x*
	EWQ48	038862	6818740	R1	13.12.6	x			x	*x*
Melaleuca trichostachya	Herbrecs			Herbrecs	Herbrecs				x	
Myriophyllum striatum	9	0386271	6818867	A2a	13.3.1			x	x	
Phragmites australis	8	386347	6818813	A1a	13.3.1	x				
	9	0386271	6818867	A2a	13.3.1	x				
Prostanthera saxicola	Herbrecs			Herbrecs	Herbrecs				x	
Pultenaea hartmanii	6	384501	6819536	A1a	13.3.1		x		x	
Schoenoplectus mucronatus	9	0386271	6818867	A2a	13.3.1	x				
Spyridium scortechinii	10	0386240	6818913	A2a	13.3.1				x	
	24	0388623	6818743	R1	13.12.6				x	
	EWQ46	386065	6818918	R1	13.3.1x				x	
	EWQ47	0388696	6818739	G1c	13.12.5				x	
	EWQ48	038862	6818740	R1	13.12.6				x	
Trichoglin procera	9	0386271	6818867	A2a	13.3.1	x				
Typha domingensis	9	0386271	6818867	A2a	13.3.1	x				
	EWQ42	0385158	6819129	A1a	13.3.1	x				

Zieria laevigata (sens. lat.)	29	0386801	6818326	R3	13.12.6					*x*
	misc	0388811	6818604	A1a	13.3.1					*x*

4.2.4 Exotic Flora

The focus of the field survey was to identify locations of declared weeds under *Land Protection (Pest and Stock Route Management) Act 2002*, Weeds of National Significance (WONS) and those afforded status in the Stanthorpe Shire Council Local Government Pest Management Plan (2005). Analysis of HERBRECS data, coupled with site survey results indicated a total of 50 exotic species in the project area. This includes four species which are declared weeds under the *Land Protection (Pest and Stock Route Management) Act* 2002 (LPA) in the inundation area. Six LPA declared species and eight species identified in the local government pest management plan were recorded in the irrigation corridor. All exotic species recorded during the field survey are listed in **Table 12** and are included in the preliminary species list for the area (refer to **Appendix A**).

The survey recorded high numbers of cosmopolitan species typical of disturbed areas such as roadsides, orchards and farmland. Common and widespread species recorded on disturbed roadsides include African Love Grass (*Eragrostis curvula*), Whisky Grass (*Andropogon virginicus*), Coreopsis (*Coreopsis lanceolata),* Blue Heliotrope (*Heliotropium amplexicaule),* Cobblers Pegs (*Bidens pilosa*), Tall Fleabane (*Conyza bonariensis*), and Purpletop (*Verbena bonariensis).* Among these, African Love Grass and Coreopsis are likely to rapidly invade any disturbance associated with the pipeline development.

More highly invasive species were limited to isolated occurrences with survey records of Mother of Millions (*Bryophyllum myriophyllum*), Prickly Pear (*Opuntia stricta*), Blackberry (*Rubus spp.*), Japanese Honeysuckle (*Linocera japonica*), Small-Leaved Privet (*Ligustrum sinense*), and Pampas Grass (*Cortaderia selloana).* These species have the ability to completely dominate and severely alter the ecosystems in which they invade. Significant infestations of Japanese Honeysuckle occur within RE13.3.1 on the edge of the inundation area at Stalling Lane.

Table 12. Exotic Species collected during the survey.

Species	Common Name	Regional Ecosystem	Declaration Status*	WONS**	SSC Status***
Acetosella vulgaris	Sheep Sorrel	Non-remnant	Not declared	-	-
Andropogon virginicus	Whisky Grass	13.12.6, 13.3.1	Not declared	-	Low
Asparagus officinalis	Asparagus	13.3.1	Not declared	-	-
Avena sp.	An Oats Grass	13.3.1	Not declared	-	-
Bidens pilosa	Farmers Friend	13.12.6, 13.12.8, 13.3.1	Not declared	-	-
Bryophyllum sp	Mother of Millions	Non-remnant, 13.12.5, 13.12.8, 13.3.1	Class 2	-	Medium
Carduus sp.	A Thistle	13.3.1	Not declared	-	-
Chondrilla juncea	Skeleton Weed	Non-remnant	Not declared	-	-
Cirsium vulgare	Thistle	Non-remnant, 13.3.1	Not declared	-	-
Conyza bonariensis	Tall Fleabane	Non-remnant, 13.12.6, 13.12.8, 13.3.1	Not declared	-	-
Coreopsis lanceolata	Coreopsis	Non-remnant, 13.12.6, 13.12.8, 13.3.1	Not declared	-	-
Cortaderia selloana	Pampas Grass	Non-remnant	Not declared	-	Medium

Species	Common Name	Regional Ecosystem	Declaration Status*	WONS**	SSC Status***
Cosmos bipinnatus	Cosmos	Non-remnant, 13.3.1	Not declared	-	-
Cyperus flavescens		Non-remnant,	Not declared	-	-
Datura ferox	Fierce Thornapple	Non-remnant,	Not declared	-	-
Datura stramonium	Common Thornapple	Non-remnant,	Not declared	-	-
Digitaria sanguinalis	Summer Grass	Non-remnant,	Not declared	-	-
Echinochloa crus-galli	Barnyard Grass	Non-remnant,	Not declared	-	-
Eleusine indica	Crowsfoot Grass	Non-remnant,	Not declared	-	-
Eragrostis curvula	African Love Grass	Non-remnant, 13.3.1	Not declared	-	-
Erodium cicutarium	Common Storksbill	Non-remnant	Not declared	-	-
Heliotropium amplexicaule	Blue Heliotrope	Non-remnant, 13.3.1	Not declared	-	-
Hordeum glaucum	Northern Barley grass	Non-remnant	Not declared	-	-
Hypochoeris radicans	Flatweed	Non-remnant, 13.12.8, 13.3.1	Not declared	-	-
Ligustrum sinense	Small leaved Privet	Non-remnant, 13.3.1	Class 3	-	High
Ligustrum lucidum	Large leaved Privet	Non-remnant, 13.12.8	Class 3	-	High
Lonicera japonica	Japanese Honeysuckle	13.3.1	Not declared	-	-
Mentha piperata	A Peppermint	13.3.1	Not declared	-	-
Myriophyllum aquaticum	Parrots' Feather	13.3.1	Not declared	-	-
Oenothera glazioviana		Non-remnant	Not declared	-	-
Oenothera stricta subsp. *stricta*		Non-remnant	Not declared	-	-
Opuntia stricta	Prickly Pear	Non-remnant	Not declared	-	-
Oxalis corniculata var. *corniculata*	Oxalis	Non-remnant, 13.12.8, 13.3.1	Not declared	-	-
Paspalum urvillei	Vasey Grass	Non-remnant	Not declared	-	-
Petrorhagia nanteuilii		13.3.1	Not declared	-	-
Phytolacca octandra	Inkweed	Non-remnant, 13.3.1	Not declared	-	-
Plantago lanceolata	Plantain	Non-remnant, 13.3.1	Not declared	-	-
Rubus anglocandicans	Blackberry	Non-remnant, 13.3.1	Not declared		-
Rubus fruticosus agg.	Blackberry	Non-remnant, 13.3.1	Class 3	WONS	
Rumex conglomeratus	Clustered Dock	Non-remnant, 13.3.1	Not declared	-	-
Rumex crispus	Curled Dock	Non-remnant, 13.3.1	Not declared	-	-
Salix sp.	Willow	Non-remnant	Class 1	WONS	-
Senecio madagascariensis	Fireweed	Non-remnant, 13.3.1	Class 2	-	High

Species	Common Name	Regional Ecosystem	Declaration Status*	WONS**	SSC Status***
Tagetes minuta	Stinking Roger	Non-remnant, 13.3.1	Not declared	-	-
Trifolium repens var. *repens*	White Clover	Non-remnant, 13.3.1	Not declared	-	-
Urtica urens	Stinging Nettle	Non-remnant	Not declared	-	-
Verbena bonariensis	Purpletop	Non-remnant, 13.12.6, 13.12.8, 13.3.1	Not declared	-	-
Verbena incompta	Purpletop	Non	Not declared	-	-
Vulpia muralis		Non	Not declared	-	-

* As per *Land Protection (Pest and Stock Route Management) Act 2002*
***Weed of National Significance*
**** Control priority status under the Stanthorpe Shire Council Local Government Pest Management Plan (2005)*

5. Results Analysis

5.1 Regional Ecosystem Descriptions and Rationale for Classification

5.1.1 Regional Ecosystem 13.3.1 (including 13.3.1x1)

Description: *Eucalyptus blakelyi woodland on alluvial plains*
Status VMA (1999): *Endangered*
Status EPBC Act (1999): *Critically Endangered (Veg. Com. A1a, A1e)*
Vegetation Communities: *A1a, A1e, A2a, R3*
Reference Sites: *ES5, ES6, ES8*

Threatened Flora*: Melaleuca flavovirens* (R), *Melaleuca williamsii* (V), *Thelionema grande* (R)
Exotic Flora*: Avena* sp., *Bidens pilosa, Cirsium vulgare, Conyza bonariensis, Coreopsis lanceolata, Eragrostis curvala, Heliotropium amplexicaule, Linocera japonica, Oxalis corniculata* var. *corniculata, Rosa anglocandicans, Senecio madagasgarensis, Verbena bonariensis.*

Regional ecosystem 13.3.1 has a relatively continuous occurence along the affected length of the Severn River. Small areas are also located on the INW where it is associated largely with watercourse crossings and alluvial flood plains, and minor highly disturbed communities on the road re-alignment corridor. This RE displays a range of structural variations.

A major component of this RE is vegetation community A1a, a woodland and open forest community which occupies discontinuous slivers of alluvium along the Severn River with minor attenuations along tributary gully lines. Development of the community has stabilised fluvial sediments along river meander bends and channel overflows, although minor areas of rock pavement may represent a small portion of the occupied landform. *Eucalyptus blakelyi* and *Eucalyptus bridgesiana* form the dominant canopy component of this vegetation community. The subcanopy tends to be shrubby in

wetter locations with a well developed structural layer dominated by *Melaleuca alternifolia* with *Leptospermum brachyandrum, Bursaria spinosa*, and *Notelaea linearis*.

Photograph 1. Vegetation community *A1a* (RE13.3.1) at site ES5 (turnoff to Stalling Lane)

Vegetation community A1e represents a grassy woodland variant of the RE which occupies a sandy alluvial flood plain marginal to the main river channel. Only one occurrence of community A1e is mapped in the inundation area with a minor highly disturbed example recorded on the road re-alignment corridor.

Photograph 2. Grassy Woodland of *E. blakelyi* (vegetation community A1e-RE 13.3.1) on sandy alluvial plain (EQ37).

Vegetation Community A2a represents a riparian shrubland and sedgeland complex. At the time of survey, this vegetation community had no RE equivalents described in REDD (2006). Upon advice from the Qld Herbarium, this vegetation community was classified as RE13.3.1x1. The description of this complex has since been incorporated into the Updated REDD (released June 2007) based on information provided to EPA throughout the course of this study. It should be noted however that as apparent in the recently released REDD (2007), that the description of this unit has been applied as the major structural formation of RE13.3.1. It is suggested that this mis-represents the true extent of this sub-type and the original RE description (as referred to in the section heading above) is the dominant vegetation community in the majority of locations. For this reason, 13.3.1x1 has been applied to the classification of vegetation community A2a until this discrepancy has been corrected.

The community occupies the anastomosing complex of flood channels and overflows that define the Severn River (in the inundation area), and may occur on shallow pockets of fluvial sediment, or on exposed rock pavement associated with the main river flood channel where the community has been mapped as R3. A low shrub layer of 4-6 m, with *Melaleuca alternifolia* a dominant species, is characteristic. Other characteristic species may include *Acacia floribunda, Acacia viscidula,*

Leptospermum brachyandrum and *Bursaria incana.* A subcanopy layer of 3 m is generally present comprising the undescribed *Melaleuca* sp. (Severn River) and *Acacia viscidula.* The EVR species *Melaleuca williamsii* and *Melaleuca flavovirens* are present in isolated groves or as scattered individuals within the subcanopy layer. The ground cover is dominated by *Carex appressa, Lomandra longifolia* and *Gahnia aspera* and may support various infestations of exotic species. Emergents of *Angophora floribunda, Eucalyptus blakelyi, Eucalyptus bridgesiana* and *Callitris endlicheri* may be scattered throughout.

Photograph 3. An overview of shrubland community A2a on the Severne River (near site EQ32). The community has been classified as RE13.3.1x1 recognising a potential new RE.

Rock pavement community R3 is confined to immediate river margins and in-stream areas in general association with community A2a. The community has been separated wherever possible to assist in defining essential habitat for significant species, although it is mapped with RE13.3.1 for convenience and to recognise its association with fluvial systems. The rock pavements generally have a polished appearance due to the abrasive affects of flooding, and the occupying vegetation is often confined to narrow cracks and crevasses which have allowed minor soil development. These communities support *Melaleuca flavovirens, M. williamsii*, the undescribed *Melaleuca* sp. (Severn River) and *Thelionema grande*. Other typical species may include *Actinotus helianthii, Acacia pruinosa, Acacia velutina, Carex appressa, Goodenia purpurescens, Isotoma anethiifolia* and *Leptospermum polygalifolium*.

Photograph 4. Rock pavement community R3 fringng the Severn River (EQ29) is habitat for the rare lily *Thelioneme grande*.

5.1.2 Regional Ecosystem 13.12.2

Description: *Eucalyptus andrewsii, E. youmanii woodland on igneous rocks*
Status: *Not of Concern*
Vegetation Communities: *G1c*
Reference Sites*: ERS4*

This RE occupies the steeper granite knolls and hillslopes fringing the northern section of the inundation area and is traversed by the proposed road corridor on the steep upper portions of the granite saddle. Well developed areas area also present on the TWS corridor and the INW Corridor. The type is restricted to the margins of, and areas outside of the immediate inundation area.

This RE is typified by vegetation community G1c, and where sampled intensively on the road re-alignment corridor, possessed an intact canopy structure dominated by *Eucalyptus andrewsii* with scattered *Eucalyptus prava* and *Callitris endlicheri.* The sub-canopy is dominated by *Angophora floribunda* and *E. prava* with a typically shrubby layered understorey of *Leptospermum brevipes, Cossinia quinquifera, Acacia aduncta, Notelaea linearis* and *Melichrus urceolatus*. The sparse ground cover is composed of *Lepidosperma laterale var. laterale, Lomandra confertiflora* var. *pallida, Gahnia aspera* and *Entolasia stricta.* A total of 28 native species were recorded in the site ERS4 on the road corridor. No EVR or exotics species were recorded in this locality.

On the network, the major occurrences of this RE are found on the on the Mt Stirling Road (Sector 18) with scattered occurrences on other network sections, mainly in northern regions. The type is generally indicative of a rocky substrate and due to potential construction difficulties associated with basement rock should be avoided if possible.

The RE provides potential habitat for a considerable number of EVR species including *Acacia pubifolia, Bertya glandulosa, Boronia granitica, Homoranthis montanus* and *Melaleuca flavovirens.* These species were not located during the study.

Photograph 5. Woodland with *E. andrewsii* on the Mt Stirling section of the INW (STQ 30). The type generally occupies rockier locations.

5.1.3 Regional Ecosystem 13.12.5

Description: *Eucalyptus youmanii on igneous rocks*
Status: *Not of Concern*
Vegetation Communities: *G1d*
Reference Sites*: ES17, EWS43, EWS44*

This RE is represented by vegetation community G1d in this exercise and is represented throughout the majority of the study area including inundation area and peripheral lineal infrastructure. The type occupies rocky knolls and exposed granite pavements adjacent to the Severn River in several locations along its inundated length, as well as in several locations on the proposed pipeline corridor, a minor section on the road re-alignment corridor, and an extensive number of scattered fragments along the INW.

The typifying canopy species is *Eucalyptus youmanii,* which is generally associated with a dense canopy and sub-canopy of *Callitris endlicheri.* Other species associated with this community include *Eucalyptus prava* and *Angophora subvelutina.* On granite pavements in the distal areas of Mt Stirling Road (INW) *Eucalyptus youmanii* mixes with *Eucalyptus eugenioides.*

The RE occupies similar habitats to RE 13.12.2 and its occurrence is generally indicative of rockier substrate. RE 13.12.5 provides potential habitat to EVR species including *Acacia pubifolia, Homoranthus montanus* and *Macrozamia viridis*. No collections were recorded in spite of intensive search effort.

Photograph 6. RE 13.12.5 with a typical dense canopy and sub-canopy dominated by *Callitris endlicherii.* Callitris is not typical of the RE type description (REDD, 2006)

5.1.4 Regional Ecosystem 13.12.6

Description: *Shrubland on igneous rocks*
Status: *Of Concern*
Vegetation Communities: *R1, R2*
Reference Sites: *ES10, ES24, EWS46, ERS5*

Rock pavement shrubland communities are relatively abundant in the project area, associated with fluvial systems and as mosaics within the broader fringing woodland communities. Separation of this RE into distinctive sub-types or component vegetation communities is warranted in this exercise to distinguish habitat types for particular EVR species.

The most extensive example of this pavement type is R1, sampled in the Severn River flood channel at ES24 within the dam inundation area. This community represents an extensive boulder deposit which is periodically scoured during flood events. Elevated portions of the community demonstrate a floristic assemblage more typical of terrestrial environments, and include *Callitris endlicheri* shrublands with emergent *Angophora floribunda.* Lower areas, such as boulder washouts and crevasses, possess floristic assemblages typical of fluvial environments, and may include *Acacia floribunda, Bursaria spinosa, Leptospermum brachyandrum, L. brevipes, Melaleuca alternifolia* and *Notelaea linearis.* The EPBC listed species *Melaleuca williamsii* (nationally Vulnerable) was recorded from this community. Other EVR's recorded were *Acacia latisepala, Melaleuca flavovirens, Thelionema grande* and *Rulingia hermanifolia*.

Photograph 7. Vegetation community R1 on the Severn River Flood Channel

Vegetation community R2 is manifest in the landscape as exposed rock pavement shrublands scattered thoughout the broader mosaic of eucalypt woodland communities. This community is well represented in the dam inundation area with minor occurrences along along both the TWS corridor and the INW. Its best development is recorded on the central portions of the proposed ESRR (on the broad crest of the granite saddle) immediately west of the Stalling Lane Reserve. This community comprises a mosaic of low woodland dominated by *Eucalyptus prava* and *Callitris endlicheri,* with a shrubby understorey dominated by *Leptospermum brevipes, Leucopogon muticus, Notelaea linearis, Jacksonia scoparia* and open rock pavement. The rock pavement supports areas of dwarf shrubland dominated by *Callitryx tetragona, Dillwynia sericea, Babingtonia densifolia, Acacia granitica, Melichrus urceolatus (sens. lat.), Hovea graniticola,* and *Boronia anethifolia*. Typical groundcovers include *Tripogon loliformis, Cheilanthes sieberi* subsp. *sieberi, Panicum effusum* var. *effusum, Entolasia stricta, Pomax umbellata, Gahnia aspera, Dianella longifolia* var. *longifolia, Lepidosperma laterale* var. *laterale, Patersonia sericea* and *Isotoma anethifolia.* Several individuals of *Acacia pubifolia* were recorded on the ESRR in this community.

Analysis of EPA HERBRECS and essential habitat data indicates that the community provides suitable habitat for a number of EVR species including *Boronia granitica, Homoranthus montanus, Bertya glandulosa,* and *Kunzea bracteolata* with records of these located in similar habitat to the north of Stalling Lane. The 'rare' (NCA) species *Acacia latisepala* is a prominent species within this community, and as previously mentioned, *Acacia pubifolia* is associated with this RE on the road re-alignment corridor.

This RE will be directly impacted within the dam inundation area, as well as during construction of the proposed ESRR. Scattered occurrences of the RE along the TWS and INW can be avoided though thorough route alignment planning.

Photograph 8. *Acacia pubifolia* in rock pavement community (R2) on road re-alignment corridor (Site ERS5)

5.1.5 Regional Ecosystem 13.12.8

Description: *Eucalyptus melliodora and/or E. moluccana/ E. macrocarpa and/or E. conica woodland on igneous rocks*
Status (VMA, 1999): *Endangered*
Status (EPBC, 1999): *Critically Endangered (vegetation community G1b only)*
Vegetation Communities: *G1b, G1f*
Reference Sites: *ES2, ES4, ES15, ES26*

Much of the occurrence of this RE within the inundation area is currently mapped on Land Zone 3 (RE 13.3.1) in the certified EPA RE mapping, and the distribution provided in **Figure 7a** reflects the dominant nature of granitic lithologies (land zone 12) in the study area. This RE comprises three vegetation communities which are discussed briefly in the following paragraphs.

Vegetation community G1b is the most abundant of these communities, being present on weathered granite landforms within the inundation area, with patches extending along the NEH on the proposed pipeline corridor, as well as scattered remnants along many sectors of the proposed INW. The community was sampled to secondary level in the inundation area at Site ES2 (as well as ES4, ES15, ES26) wherein 39 species were recorded. *Eucalyptus melliodora* forms the dominant canopy stratum at an average height of 20 m in association with *E. youmanii* and *E. blakelyi*. The subcanopy is generally sparse with *E. prava, Angophora floribunda* and *E. youmanii* comprising the dominant species.

A well-developed shrub layer may be present which typically comprises *Acacia floribunda, Acacia pruinosa, Callitris endlicheri, Cassinia quinquifera, Hovea graniticola, Jacksonia scoparia, Leptospermum brevipes, Leptospemum polygalifolium, Leucopogon muticus* and *Melichrus urceolatus*. The ground-cover tends to be grassy and broken by areas of exposed bedrock, with typical species being *Austrostipa diversiflora, Cymbopogon refractus, Dianella longifolia* var. *stenophylla Gahnia aspera, Fimbristylis dichotoma,* and *Themeda triandra.* Typical herbs and subshrubs include *Actinotis helianthi, Cheilanthes sieberi* subsp. *sieberi, Chrysocephalum apiculatum, Goodenia purpurescens, Hibbertia linearis* var. *obtusifolia, Lomandra multiflora* subsp. *multiflora, Podolepis neglecta, Trachymene incisa, Tricoryne elatior, Vittandinia dissecta* var. *dissecta,* and *Wahlenbergia graniticola*. Exotics in this community are minor and limited to *Bidens pilosa.*

Photograph 9. Woodland of *Eucalyptus melliodora* (RE13.12.8) on deeply weathered granite. Photograph taken at site ET26.

On the INW, vegetation community G1b occurs on a number of road sections, with better developed examples occurring on the lower eastern portion of Canon Creek Road (Sector 10 12), on Horan Gorge Road (Sector 20), and minor sections on Amiens Rd (d) (Sector 1). *Eucalyptus melliodora* forms the dominant species in these communities although may mix with a number of species which include *Eucalyptus nova-anglica, Eucalyptus bridgesiana* and *Eucalyptus blakelyi,* merging with RE 13.12.9 in some locations. The communities on the INW typically possess a native grassy ground cover and as such, are protected under the Commonweath's EPBC Act (1999).

Photograph 10. RE13.12.8 on the east side Canon Creek Road adjacent to the Severn River. The community occupies rocky lower slopes where *E. bridgesiana* may form a prominent associated canopy species.

Vegetation community G1f (refer to Photograph 11) occurs as isolated remnants on the proposed town supply pipeline corridor near Stanthorpe, coinciding with minor areas on the INW (Sector 16), occupying similar weathered granitic landforms to vegetation community A1b. The community is sampled with observation points from the road margins only, recorded during the process of roadside searches for EVR species. *Eucalyptus conica* dominates the canopy of this community although associated canopy species may include *Eucalyptus youmanii, Eucalyptus blakelyi* and *Eucalyptus melliodora*.

RE 13.12.8 also includes a mixed woodland variation on loamy granite plains in the Euki Road area where typical canopy species include *Eucalyptus melliodora, Eucalyptus youmanni, Eucalyptus bridgesiana, Eucalyptus prava* and *Angophora floribunda. Eucalyptus blakelyi* may also be present. The assignment of an appropriate RE to this community is difficult although landform suggests an affinity with RE 13.12.8, being classified as such accordingly. This community is located on the proposed INW and can be readily avoided by pipeline construction on an appropriate side of the road.

Photograph 11. Vegetation type G1f (RE13.12.9) adjacent to the NEH (Site EPQ41)

Photograph 12. Loamy Granite plain on Eukey Road supporting a mixed woodland of *E. melliodora, E. bridgesiana, E. prava* and *Angophora floribunda.* The mix of species in this community makes assignment to an RE difficult although landform association indicates an affinity with RE 13.12.89. The northern side of this road easement is cleared.

5.1.6 Regional Ecosystem 13.12.9

Description: *Eucalyptus blakelyi and/or E. calignosa woodland to open forest on igneous rocks*
Status (VMA)*: Endangered*
Status (EPBC): *Critically Endangered*
Vegetation Communities: *G1e,*
Survey Locations: *Quaternary Sites (EPQ13)*

This RE is represented by two vegetation communities, G1e and G1g, and is recorded on theTWS and the INW and as such, was only sampled to Quaternary level during roadside searches for EVR species.

The best type example of vegetation community G1e is recorded on the Fletcher Road section of the proposed TWS pipeline (EPQ13-refer to Photograph 12). Here the community occupies a deeply weathered granite plain, and generally occurs as isolated areas or mosaics amongst broader areas of RE 13.12.8. *Eucalyptus blakelyi* dominates the canopy at an average height of 18 m, and the ground cover is grassy, dominated by *Themeda triandra*. Numerous minor examples of this RE are found on the INW including communities on Canon Creek Road (Sector 10 - Site STQ71), Amiens Rd (d) (Sector 1 - STQ143), and on Rodgers Road (Sector 6). The majority of these communities can be readily avoided by ensuring pipeline construction is confined to either a cleared roadside easement, or through construction on an appropriate side of the road.

Photograph 13. Vegetation type G1e (RE13.12.8) on Fletcher Road (Site EPQ15)

Vegetation community G1g represents tall open forest on granite footslopes which are typically dominated *Eucalyptus calignosa* although may be mixed with *E. melliodora.* These communities are prominent on the INW with well developed examples on the Mt Stirling Road (Sector 18) and on the NEH south of its junction with Fletcher Road (Sector 21). A very narrow easement between the road and vegetation exists in the Mt Stirling Road example and it is expected that some degree of disturbance to this community will occur, dependant on the pipeline diameter used on this section. As this section of road forms the distal region of a peripheral route, it is expected that narrow diameter piping will be utilised and major impacts can be avoided. This RE may provide suitable habitat to EVR species *Macrozamia viridis, Pterostylis woollsii, Grevillea scortechinii* subsp. *scortechinii, Acacia ruppii* and *Diuris parvipetala*. No collections were recorded in spite of intensive search effort. Seasonal survey to coincide with the optimal flowering period for *Diuris parvipetala* and *Ptersostylis woolsii* provide the best opportunity to record this species.

Photograph 14. Tall *Eucalyptus calignosa* open forest on the roadside margins of distal portions of the Mt Sterling Route. Easement between the track and adjacent vegetation is extremely narrow.

5.2 Non-Remnant Community Descriptions and Rationale for Classification

The classification of vegetation in regard to remnant/non-remnant status is relatively simple in the project area. The majority of areas cleared historically have been maintained as open areas or horticultural lands, and regrowth communities are limited to minor areas on roadsides and occasional pockets amongst woodland communities. Historical (1989 black and white) photographs were utilised throughout the study and were useful in gaining additional insights into the non-remnant status of disturbed communities. Non-remnant communities are recognised according to the strict definition supplied by the EPA (2006), and outlined briefly in **section 2.5.** The following section provides a description of, and rationale for, the classification of non-remnant communities within the study area.

5.2.1 Community Grs - Sclerophyll regrowth

Vegetation Status: *Non-Remnant*

Non-remnant communities under the classification of RS are restricted to minor pockets along roadsides and several minor areas of historical disturbance amongst woodland communities within the inundation area. The majority of these communities comprise species similar to their parent woodland types, with a far greater proportion of *Acacia* species in the canopy. With a general canopy height below 10 m, their status as non-remnant vegetation conforms to VMA legislative definitions.

5.2.2 Community Pl - Plantation including exotic and native species

Vegetation Status: *Non-Remnant*

This classification includes all plantation communities within the study area, including Pinus plantations marginal to the inundation area on Fletcher Road, and several well established Pinus Plantations on roadsides in the northern section of the INW.

5.2.3 Community Cl - Cleared areas

Vegetation Status: *Non-Remnant*

This classification includes all cleared areas, including exotic grasslands, urban areas, and agricultural areas of fruit orchards and small crops. No formal survey sites were located in these areas but species were recorded from observations made during roadside searches for EVR species.

5.2.4 Community RE – Areas infested by exotic species

Vegetation Status: *Non-Remnant*

Only a minor area of this non-remnant classification is mapped on the pipeline easement. The community manifests in the landscape as a degraded wetland dominated by the scrambling Rose Bramble. (*Rubus albicandicans*) This classification does not include remnant communities with a dominant exotic groundcover.

5.3 Conservation Status of Vegetation

5.3.1 State Conservation Status

The conservation status of vegetation communities on a state-wide basis is governed by the *Vegetation Management Act* (1999). The VMA assigns conservation status to REs based on the relative proportion of their pre-clearing extent represented in the bioregional landscape. Conservation categories are listed as 'Endangered', 'Of Concern', and 'Not of Concern'. The conservation status of REs within the study area is represented in **Table 13** and a spatial distribution of these communities is provided in **Figures 9a** and for the inundation area and ESRR, and **Figures 9b** for northern portion of TWS and INW, and **Figure 9c** for the southern portion.

Table 13. Conservation status of RE's in the study area as per the VMA.

Regional Ecosystem	Description
Endangered	
13.3.1	*Eucalyptus blakelyi* woodland on alluvial plains
13.12.8	*Eucalyptus melliodora* and/or *E. moluccana/ E. macrocarpa* and/or *E. conica* woodland on igneous rocks
13.12.9	*Eucalyptus blakelyi* and/or *E. calignosa* woodland to open forest on igneous rocks
Of Concern	
13.12.6	Shrubland on igneous rocks
Not of Concern	
13.12.2	*Eucalyptus andrewsii, E. youmanii* woodland on igneous rocks
13.12.5	*Eucalyptus youmanii* on igneous rocks

5.3.2 National Conservation Status

Vegetation communities with national status are classified in accordance with guidelines outlined in the Commonwealth Department of Environment and Heritage EPBC Policy Statement for White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands (DEH 2006). Vegetation communities form the basis for EPBC classification, and are used here to provide an indication of the spatial distribution of EPBC listed communities within the study area. A classification of EPBC listed communities is provided in **Table 14**, with their spatial distribution indicated in **Figures 10a** for the inundation area and ESRR, and **Figure 10b** and **Figure 10c** for the northern and southern portions of the TWS and the INW respectively.

Table 14. National conservation status of vegetation communities in the study area as per the EPBC Act.

Vegetation Community	EPBC Status
A1a	Critically Endangered.
G1b	Critically Endangered.
A1e	Critically Endangered.
G1e	Critically Endangered.

6. Impacts of the Project on Flora Values

Impacts to terrestrial flora will occur during activities associated with the proposed dam project, including construction, inundation, operation and construction of associated infrastructure. These impacts may be direct, or indirect. Direct impacts are usually immediate and may be associated with physical disturbance such as road clearing, whilst indirect impacts may take many years to manifest in the affected environments. Sufficient and relevant information is required to determine the extent of such impacts on terrestrial flora and biodiversity values. Probable and potential impacts associated with dam construction and associated infrastructure are discussed briefly below.

6.1 Direct Impacts

6.1.1 Loss of Vegetation of National, State, Bioregional and Catchment Significance

This includes the loss of 'Endangered' and 'Of concern RE's' (as per the VMA), and locally significant vegetation communities. Habitat loss will occur as a direct result of inundation/impoundment, or through road re-alignment required to correct a route displacement, and pipeline construction. For the inundation area, opportunities for direct mitigation are minimal, and remediation and offset areas must be considered. The total area of vegetation communities of state significance (VMA) to be impacted by dam inundation, road re-alignments and pipeline corridors (including TWS and INW) is detailed in **Table 15a** and **Table 15b**. Impacts to vegetation communities of national significance (EPBC) on individual project components, including total impacts, are given in **Table 16a** and **Table 16b**.

It should be noted that assessment of impacts created by road corridors and pipelines is preliminary only, dependant on final construction layout. Calculations for habitat loss on the ESRR are based on a disturbance buffered 10m either side of a defined road centre line. This produces a preliminary assessment of impacts which may require adjustment following detailed engineering design. Direct impact to vegetation communities on lineal infrastructure (TWS and INW) considers communities that can not be avoided during construction activities and assumes a 5m maximum impact width.

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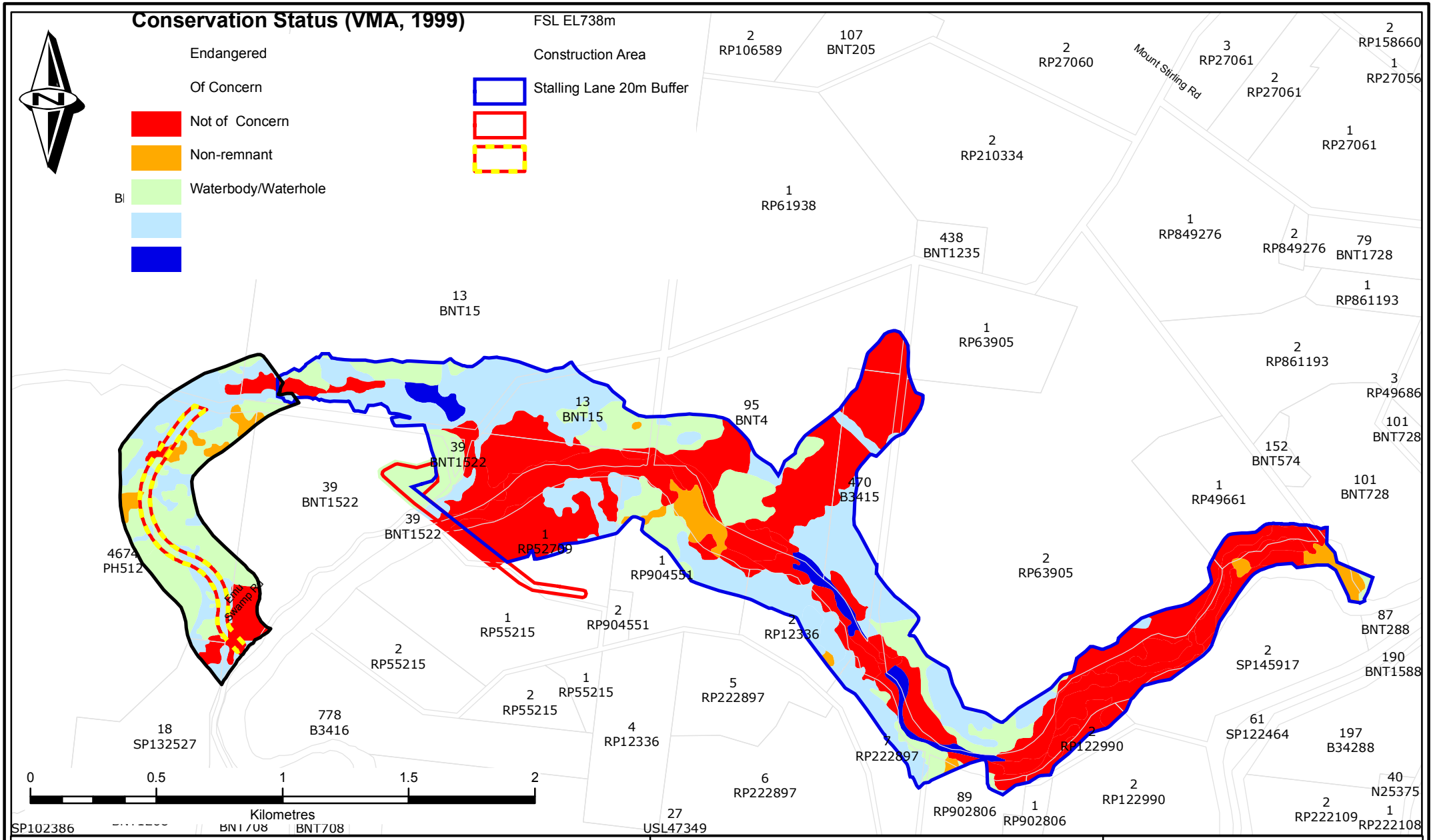

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Figure 9a: Conservation status in the dam inundation area

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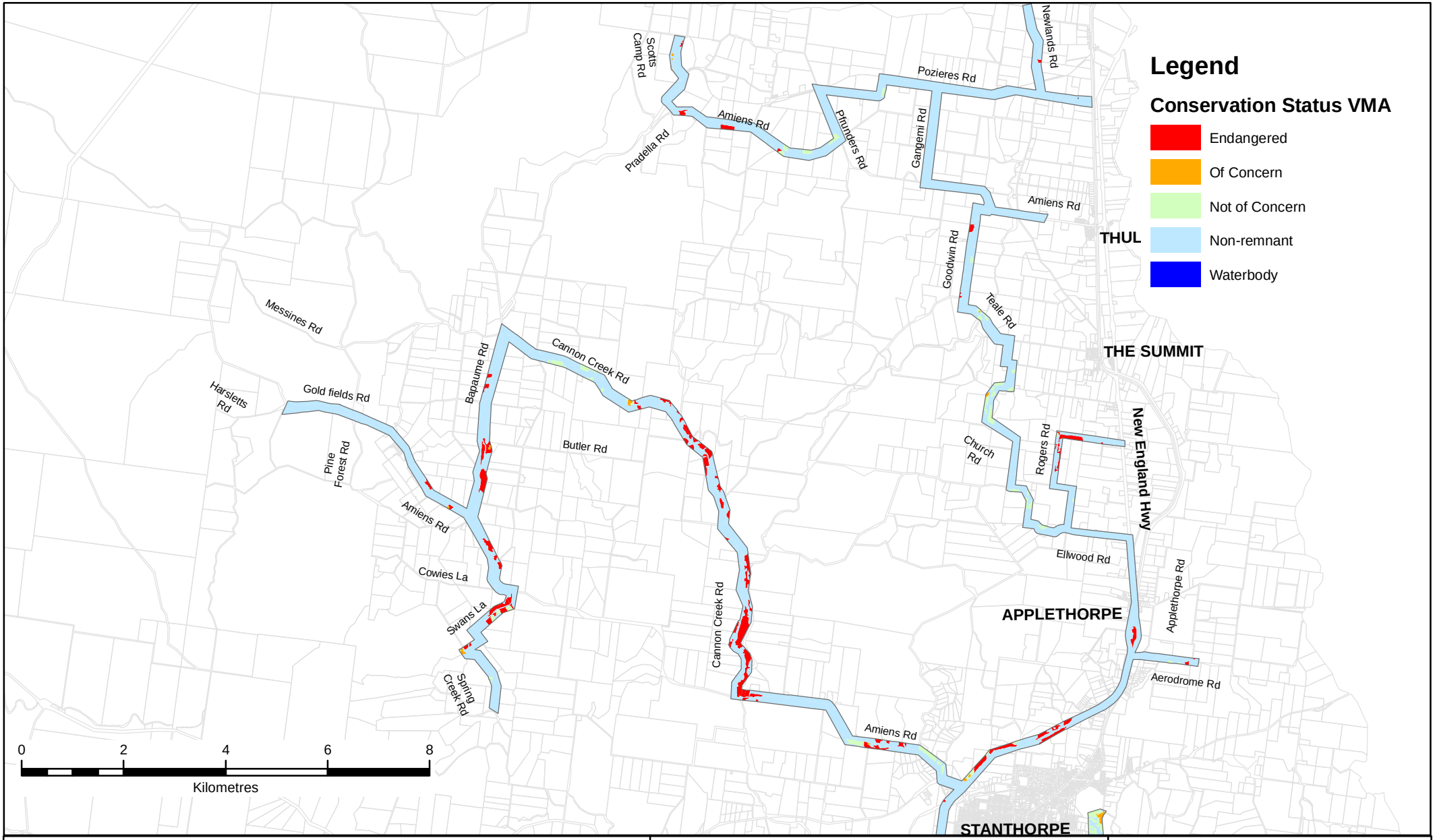

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Figure 9b:
Conservation status (VMA) for TWS and ESRR (North)

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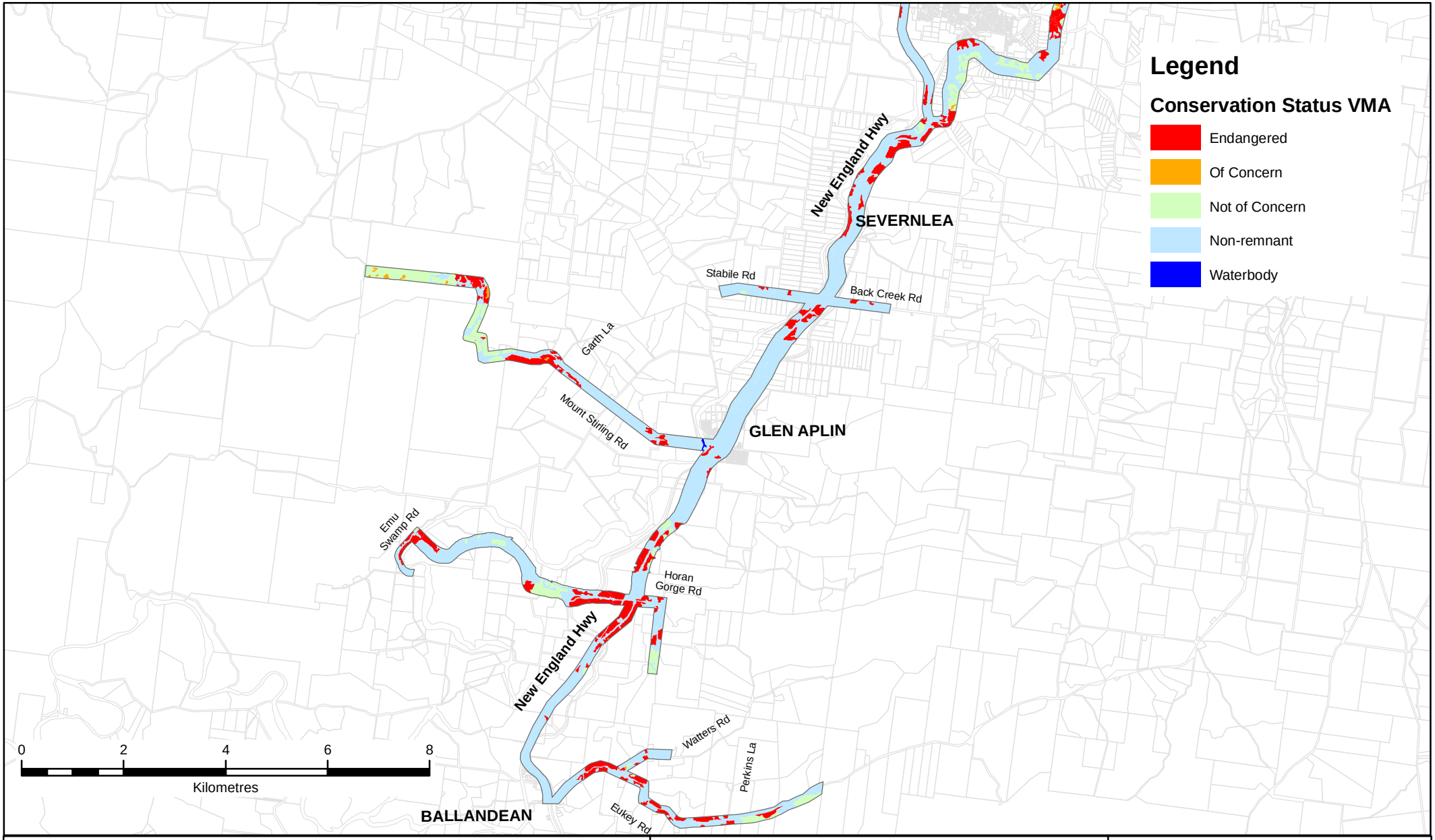

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Figure 9c:
Conservation status (VMA) for TWS and INW (South)

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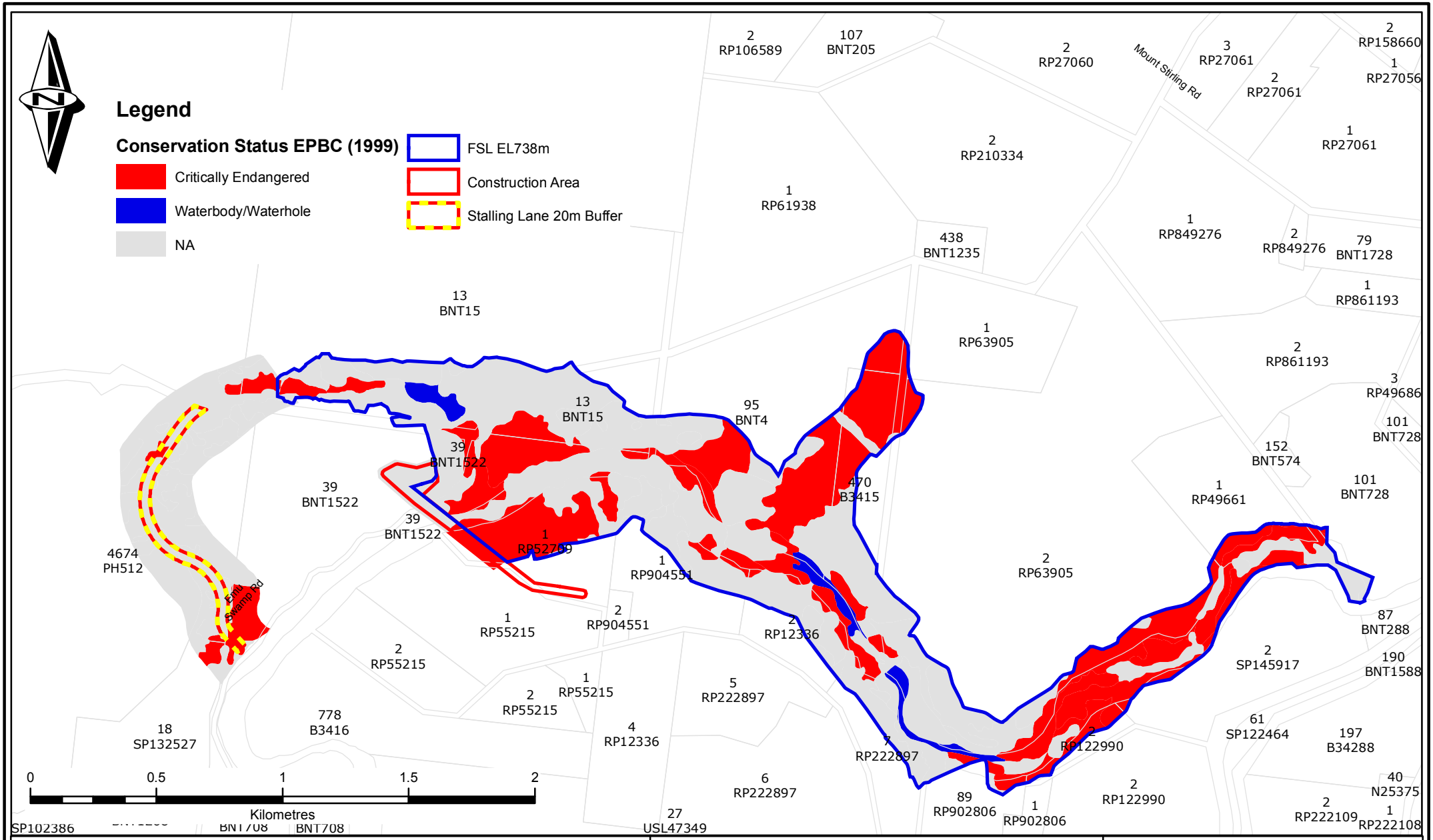

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Figure 10a:
National habitat conservation significance in the inundation area (EPBC, 1999)

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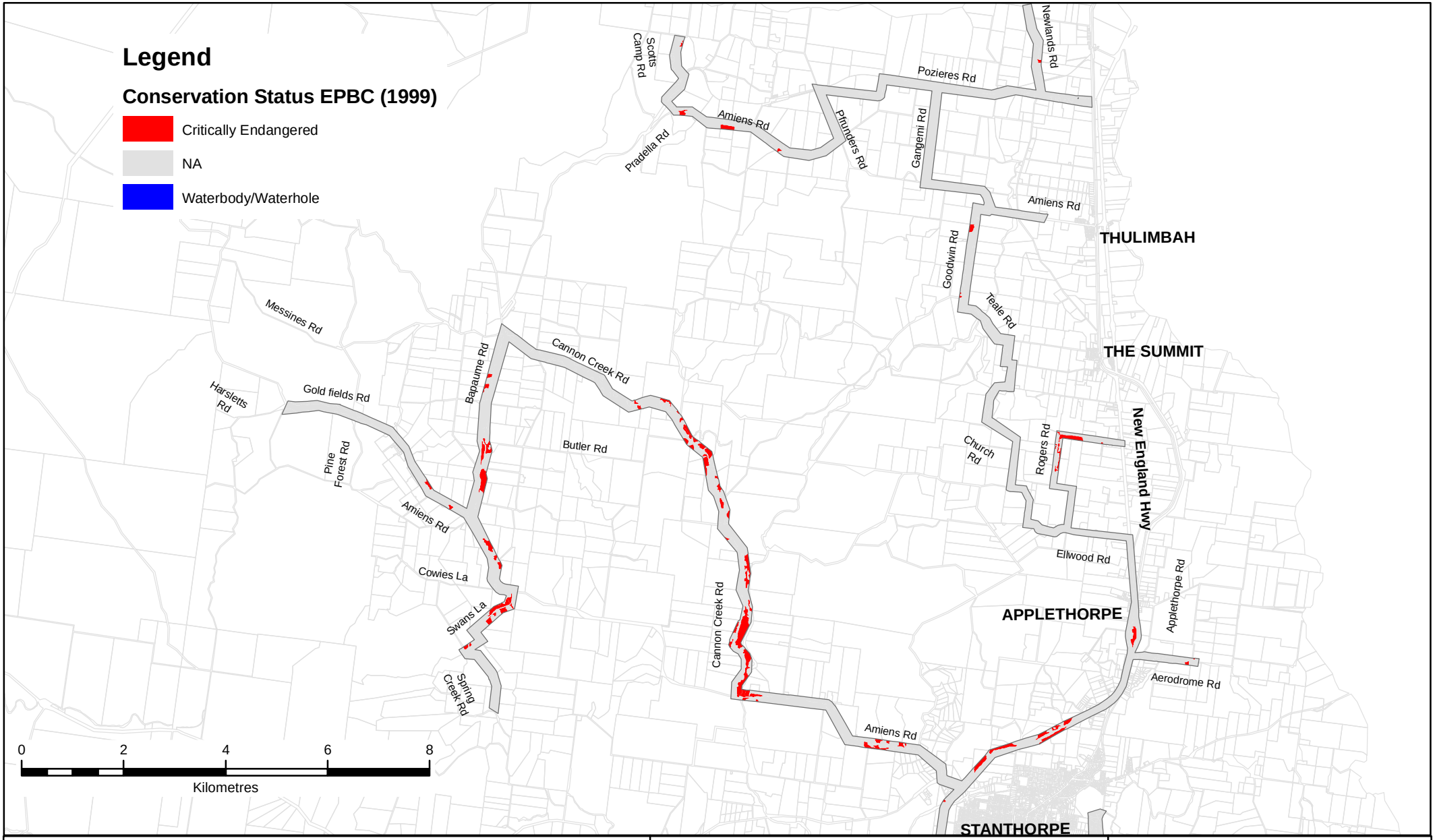

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Figure 10b:
Habitat conservation significance (EPBC) on TWS and INW (north).

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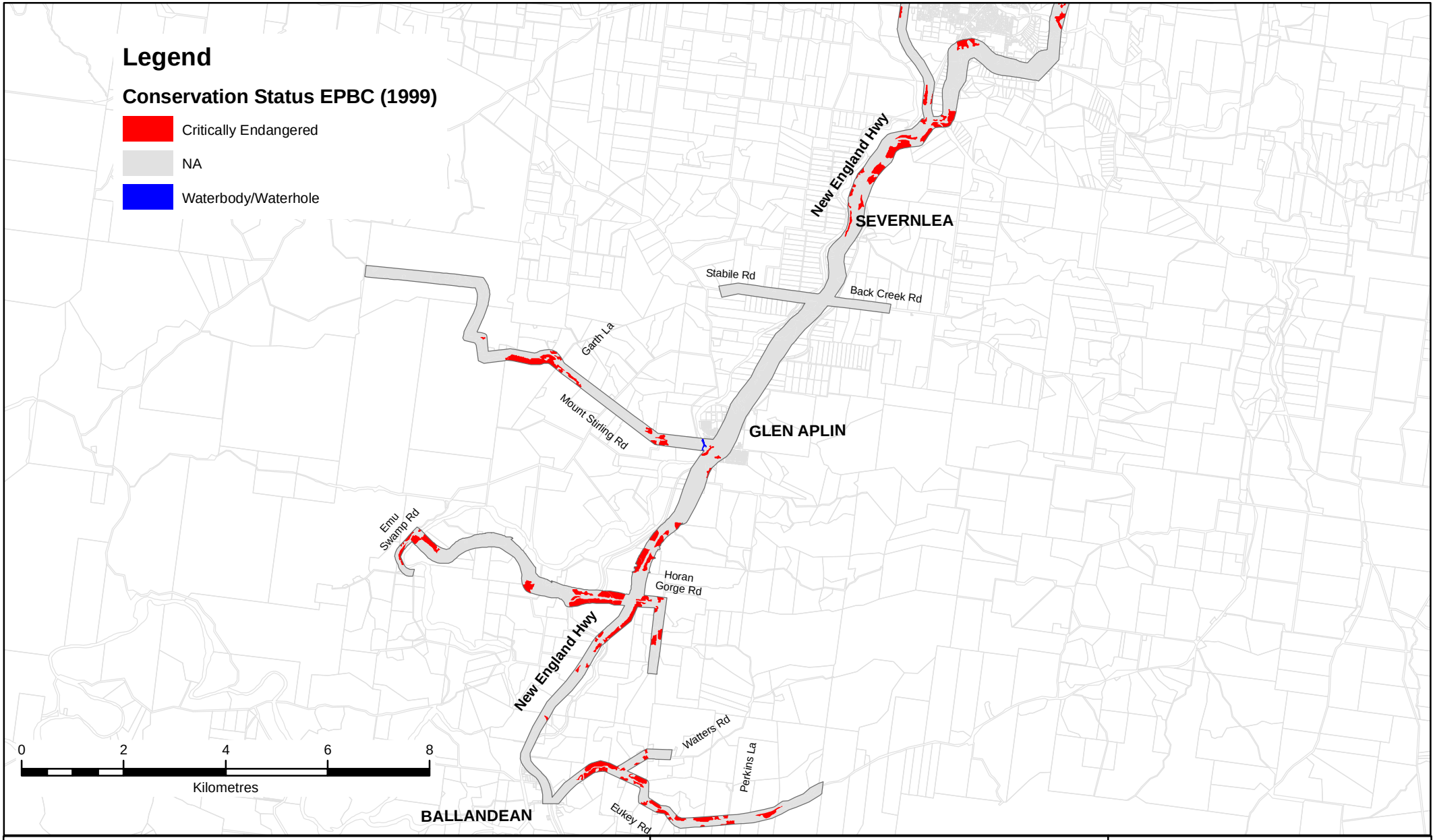

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Figure 10c:
Habitat conservation significance (EPBC) on TWS and INW (South).

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Table 15a. Total impacts of project to vegetation communities of state significance assuming inundation zone 1 (738m AHD), ESSR, TWS and INW.

RE	Inundation Area 1 (ha)	TWS and INW (ha)**	Road Corridor (ha)*	Total Area of Impact (ha)
Endangered RE's				
13.3.1	25.9	0	0.5	**26.4**
13.3.1x1	20.6	0	0	**20.6**
13.12.8	52.9	1.2	0	**54.1**
13.12.9	0	0.4	0	**0.4**
Of Concern RE's				
13.12.6	6.2	0	0.12	**6.32**

** Based on a road corridor buffered 10m either side of the proposed road centreline.*
*** based on a 5m maximum disturbance width*

Table 15b. Total impacts of project to vegetation communities of state significance assuming inundation zone 2 (734.5mAHD), ESSR and TWS only.

RE	Inundation Area 2 (ha)	TWS only (ha)**	Road Corridor (ha)*	Total Area of Impact (ha)
Endangered RE's				
13.3.1	17.4	0	0.5	**17.9**
13.3.1x1	16.8	0	0	**16.8**
13.12.8	23.1	1.2	0	**23.3**
13.12.9	0	0	0	**0**
Of Concern RE's				
13.12.6	3.1	0	0.12	**3.2**

** Based on a road corridor buffered 10m either side of the proposed road centreline.*
*** based on a 5m maximum disturbance width*

Table 16a. Total impacts of project to vegetation communities of national significance (EPBC) assuming inundation Zone 1, ESRR, TWS and INW.

RE	Inundation Area 1 (ha)	TWS and INW (ha)**	Road Corridor (ha)*	Total Area of Impact (ha)
Critically Endangered Vegetation Community				
A1a	22.8	0	0.15	**23.0**
A1e	3.1	0	0.38	**3.5**
G1b	52.9	1.08	0	**54.0**
G1e	0	0.05	0	**0.1**
Total Area Impacted				**80.6**

** Based on a road corridor buffered 10m either side of the proposed road centreline.*
*** based on a 5m maximum disturbance width*

Table 16b. Total impacts of project to vegetation communities of national significance (EPBC) assuming inundation zone 2, ESSR and TWS only.

RE	Inundation Area 2 (ha)	TWS only (ha)**	Road Corridor (ha)*	Total Area of Impact (ha)
Critically Endangered Vegetation Community				
A1a	16.9	0	0.15	**17.1**
A1e	0.5	0	0.38	**0.9**
G1b	23.1	0	0	**23.1**
G1e	0	0	0	**0**
Total Area Impacted				**41.1**

** Based on a road corridor buffered 10m either side of the proposed road centreline*
*.** based on a 5m maximum disturbance width*

6.1.2 Loss of Essential Habitat for Terrestrial Flora Species

Essential habitat for state significant taxa are indicated in the EPA RE mapping (refer to **Appendix B**) which provides spatial information on known areas of habitat. Habitat suitability maps for state significance species that were collected during the field survey within the inundation area only are provided as **Figure 11.** Suitability maps for known collections of EPBC species represented within the inundation area presented in **Figure 12.** Predictive habitat analysis for state significant taxa and nationally significant taxa within the inundation area is provided in **Figure 13** and **Figure 14.** These figures identify the potential habitat for EVR species that were not recorded in the baseline survey yet have a high potential to to occur based on analysis of available literature. It should be stressed that habitat suitability maps are generated for the inundation area only. The inundation area is the only portion of the project where avoidance is not a feasible mitigation strategy. The heavy disturbance to roadside vegetation on major lineal infrastructure corridors creates a distribution of EVR species that is highly unpredictable, and in general, these predictive analyses are not informative.

Dam Inundation Area: Direct impacts of inundation/impoundment associated with the proposed Emu Swamp Dam will include the loss of essential habitat, and impacts on populations of:

- one national (EPBC Act) species - *Melaleuca williamsii (syn. Callistemon pungens);*
- five state (NCA) species - *Acacia latisepala, Thelionema grande, Rulingia hermaniifolia, Melaleuca flavovirens* and *Melaleuca williamsii*;
- 47 regionally and locally significant flora species.

The greatest impacts are on the essential habitats of *Melaleuca williamsii*, *M. flavovirens* and *Melaleuca* sp. (Severn River). In the study area, these species are restricted to the riparian zone of the Severn River in REs 13.3.1 and 13.12.6. Inundation is likely to impact on the viability of these taxa. The population of *Melaleuca williamsii* within the dam inundation area likely represents the largest known stand of the species on the Stanthorpe Plateau, and considerably increases the extent of the population recognised by Donatiu (2006). Inundation will effectively divide the population into two disjunct occurrences, as well as have a potential impact on occurrences immediately downstream from the dam wall.

Populations of *Acacia pubiflora, Boronia granitica, Homoranthus montanus, Kunzea bracteolata* and *Bertya glandulosa* are known from the Stalling Lane Public Reserve 171 Lot 39/BNT 1522. These records are outside the inundation area however suitable habitat may occur. They were not located during the baseline survey in the inundation area. Based on habitat requirements identified in the available literature, they are considered to have the potential to occur in RE's 13.12.2 and 13.12.5, with results from this survey indication likely occurrence in suitable areas of RE 13.12.6. A significant population of *Acacia pubifolia* was recorded on the corridor for the proposed ESRR in RE 13.12.6. Due to the intensity of the site survey and lack of any confirmed records, impacts on *Boronia granitica, Homoranthus montanus, Kunzea bracteolata* and *Bertya glandulosa* are likely to be minimal. Impacts to known populations of *Acacia pubifolia* on the ESRR will be dependant on the final road design, and the effectiveness of mitigation measures to prevent habitat loss and degradation.

A population of *Diuris parvipetala* is known to occur to the north of the inundation area. Based on its preferred habitat of RE 13.3.1, 13.12.5 and 13.12.9 (Donatiu 2006), this terrestrial orchid has the potential to occur within the area of proposed impact. No populations were detected during the baseline survey. The taxa is however difficult to detect in the field outside of the Sept-Dec flowering time period.

***Town Water Supply Pipeline*:** Herbarium records of *Acacia pubiflora* and *Homoranthus montanus* situated along Fletcher Road were not located during the baseline survey despite targeted searches.

The roadside habitat was heavily disturbed and subject to fire several months before the survey. These, and other roadside records including *Melaleuca williamsii* (three individuals on the southern margin of Fletcher Rd 0.5 km from the junction of the NEH, and one record from the rocky creek-line south of Mt Marley) and *Acacia latisepala* (two records from NEH 4 km south of Stanthorpe) represent constraints to the proposed pipeline alignment. Further constraints are posed by a single record of *Mirbelia confertiflora* (Rare) in remnant roadside vegetation and HERBRECS records of the *Eucalyptus mckieana* (Vulnerable EPBC). The latter species is restricted in Queensland to the Fletcher area and known from roadside tall woodland with *Eucalyptus bridgesiana* (RE 13.12.2) about 400m W of Rhumbalara Railway crossing on Fletcher Lane (GPS 28 45 57 151 50 33). The HERBRECS data refers to the species being 'locally common' however it was not identified during the survey on account of lack of fertile material.

Opportunities to avoid these species must be considered. It should be noted, however, that three of the *Melalueca williamsii* records were from highly disturbed non-remnant vegetation and long-term viability of the species in these communities is questionable.

***Emu Swamp Road Re-alignment*:** Water Reserve 171 - Stalling Lane is reported to support populations of threatened flora species including *Boronia granitica* and *Homoranthus montanus*, although verified collections of these species have only been made on rocky hillslopes to the north of Stalling Lane. The proposed ESRR diverges from the Emu Swamp Road passing to the immediate west of Water Reserve 171 prior to junction with Stalling Lane. The proposed bypass road will impact a range of habitats similar to those occurring in the Stalling Lane Reserve.

Two EVR species were recorded on the road re-alignment corridor being *Acacia pubifolia* (Vulnerable) and *Melaleuca williamsii* (Vulnerable). Fifteen individuals of *Acacia pubifolia* within a 1 000 m^2 search area were recorded in RE 13.12.6, mostly adjacent to the proposed alignment. Impact to essential habitat and populations of this species associated with proposed ESRR are expected. Two shrubs of *Melaleuca williamsii* were recorded in RE 13.3.1 (A1ax), approximately 20-30 m west of the proposed alignment. The degree of impact to essential habitat and populations of this species is dependant on sensitive road design and effective pre and post construction mitigation and management measures.

***Irrigation Network*:** Four confirmed populations of *Acacia latisepala* were recorded for the pipeline network. The identity of an additional four records awaits clarification from the Queensland Herbarium. Approximately 123 individuals were recorded within the four confirmed populations with three populations occurring in disturbed non-remnant vegetation in the road reserve.

Grevillea scortechinii subsp. *scortechinii* (Vulnerable EPBC and NCA) is endemic to the Stanthorpe Plateau and confined to several small populations between Stanthorpe and Dalveen where it is known from the Cottonvale and Applethorpe districts mainly in cleared road and railway verges (Donatiu 2006, Galbraith & Sparshott 2003). It is represented in Queensland by 11 herbarium collections, the majority of which are from the Pozieres Rd location (EPA HERBRECS Extract 2006). It is not known to be conserved in any protected areas (Galbraith & Sparshott 2003). The majority of the known populations are in areas of heavily disturbed roadside subject to a range of threatening processes such as edge effects, weed intrusions, inappropriate management, and too frequent fire, (Donatiu 2006). Subsequently high importance value is assigned to populations which inhabitat relatively intact forest (Donatiu 2006) although non-remnant vegetation may retain significant importance.

A large population of *Grevillea scortechinii* subsp. *scortechinii* was recorded on Pozieres Road in the north of the study area. The population consists of approximately 50 individuals (over a linear

distance of approximately 100m) of low almost prostrate 0.25-0.5 m shrubs. Plants are situated on the northern side of the road in a narrow verge of disturbed regrowth located between the road drain and a Pinus plantation. One plant was observed on the southern side of the road on the immediate road margin in *Imperata cylindrica* with regenerating shrubs of *Daveisia* sp. adjoining an apple orchard windbreak. The population is highly vulnerable to any form of roadside disturbance.

Melaleuca williamsii (syn. *Callistemon pungens*) was recorded in three locations along the INW. Two populations are in disturbed non-remnant vegetation and one in remnant RE 13.3.1 woodland of *E. blakelyi*.

The endangered *Boronia repanda* is known from a number of HERBRECS records on Pfunders Rd (Sector 1) and Poziers Rd (Sector 2) within proposed pipeline corridor in disturbed roadside vegetation with the vulnerable *Grevillea scortechinii* subsp. s*corthechinii*. *B. repanda* is endemic to the Stanthorpe Plateau restricted to scattered populations around Cottonvale, Thulimbah, Amiens and Passchendaele and a recently located record to the east of Stanthorpe on the border with New South Wales (Donatiu 2006). It occurs in regional ecosystems (13.12.2-13.12.6) and is not known to be conserved in national parks (Donatiu 2006). Donatiu (2006) notes the population on Pozieres Road on Council roadside & private freehold consisting of 50-100 individuals. Major impact to essential habitat and populations of this species is possible and dependant of additional survey, sensitive design and pre and post construction mitigation and management measures.

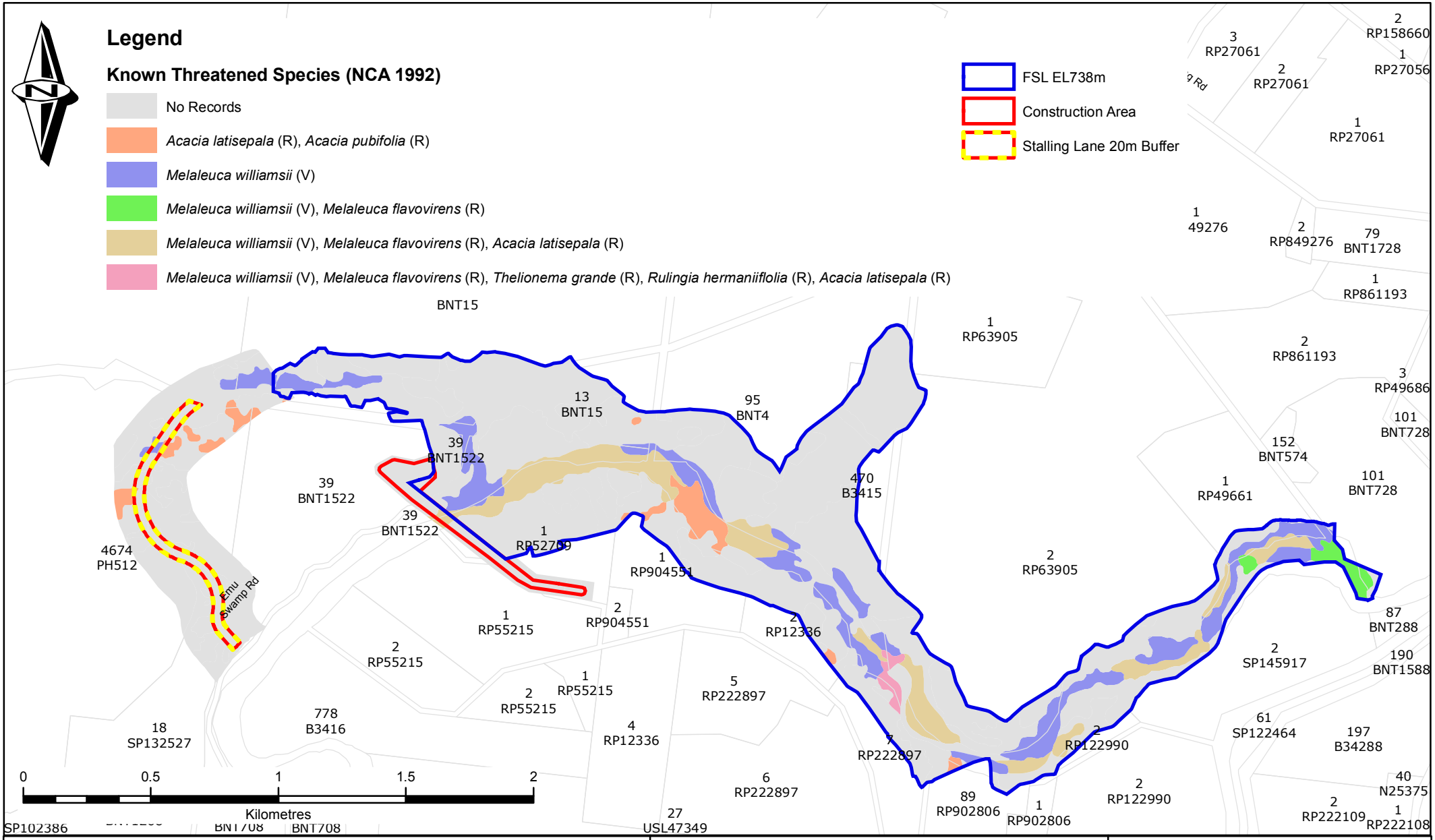

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Figure 11: Habitat suitability for known threatened species of state significance in the inundation area (NCA, 1992)

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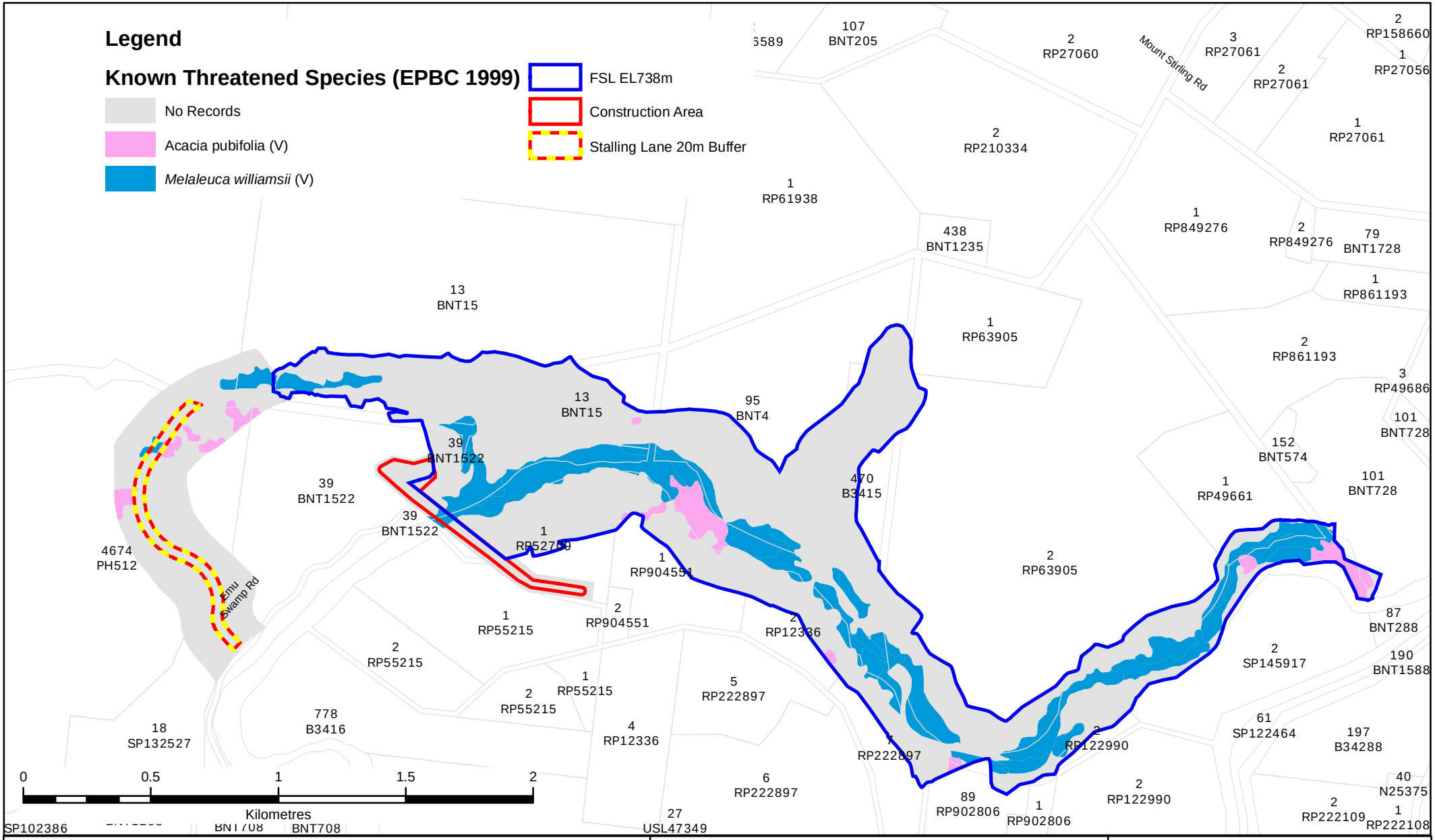

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Figure 12: Habitat suitability for known threatened species of national significance in inundation area (NCA, 1999)

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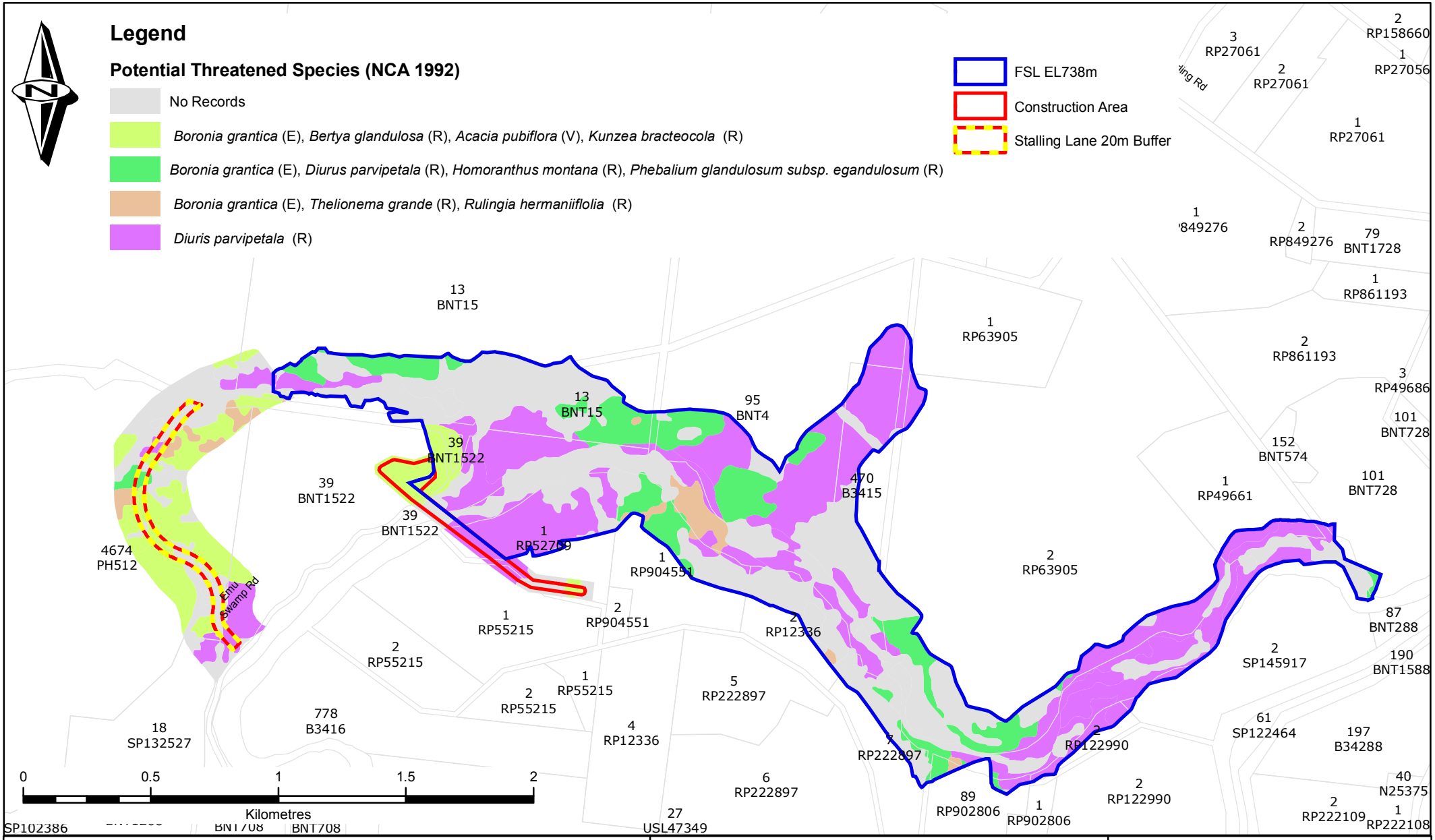

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Figure 13: Potential habitat suitability for threatened species of state significance in the inundation area (NCA, 1999)

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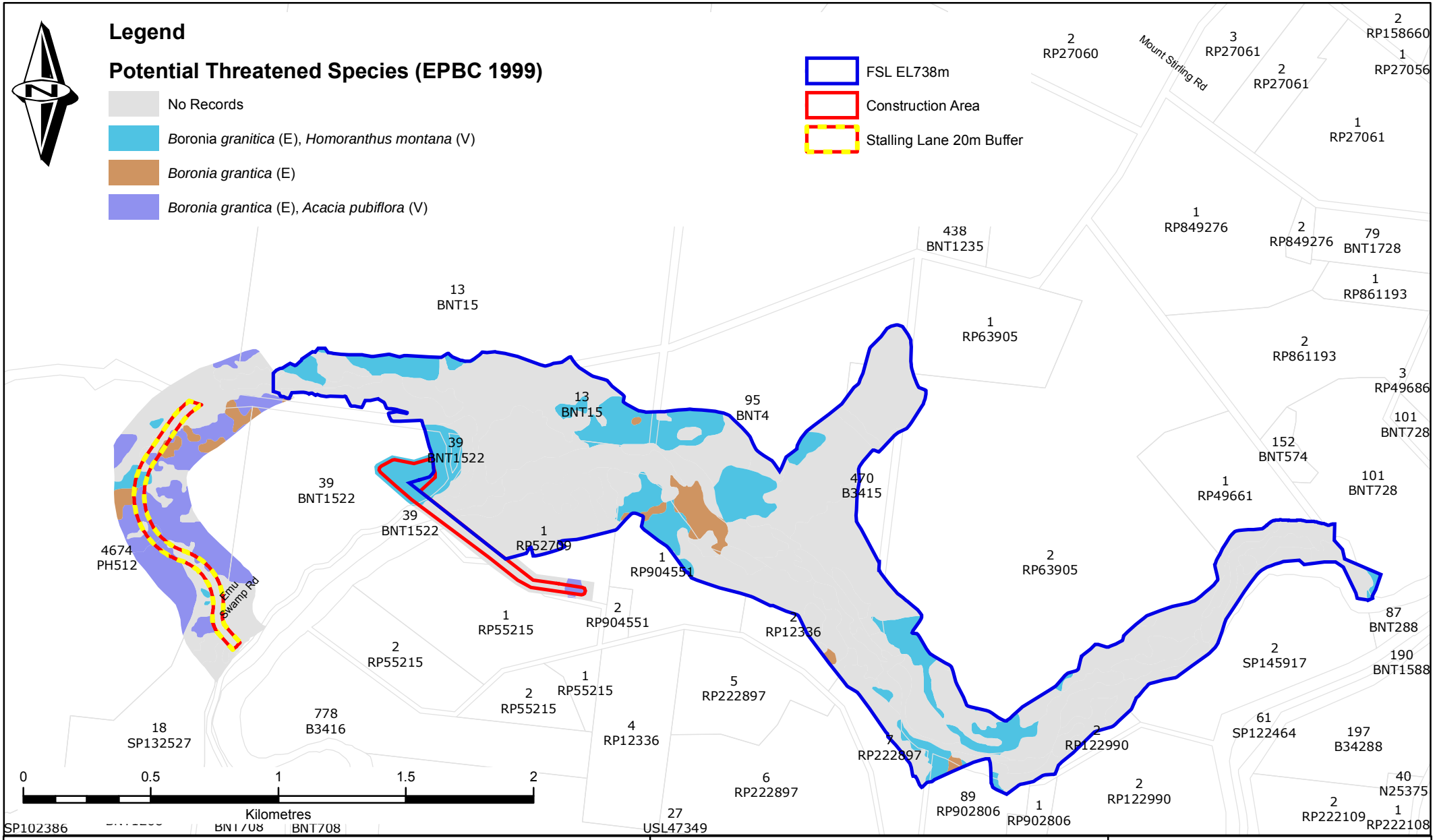

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Figure 14: Potential habitat suitability for threatened species of national significance in the inundation area (EPBC, 1999)

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A summary of threatened species occurrences and habitat suitability in relation to the inundation area, TWS corridor, ESRR and INW Corridor is provided in **Table 17** below. Habitat suitability assessment adapts the draft guidelines defined by EPA (2002) and attempts to determine the known and possible extent and importance of Essential and General Habitat for Priority Flora. The classification is primarily derived from the judgement of the survey team based on litertature review, data analysis, and experience gained in the field.

Essential Habitat – Known: Remnant Units or sites known to contain the taxon because there is a significant number of individuals present that are self-maintaining by sexual or vegetative means, or a significant number of individuals known to be present at a certain stage of the growth cycle of the vegetation in which the taxon grows.

Essential Habitat – Possible: Remnant Units or sites that are likely to contain the taxon because there is habitat containing essential resources of a size capable of supporting a significant number of individuals that are self-maintaining by sexual or vegetative means; or habitat which is proximate to and buffering a known occurrence of a population (as defined above for EHK); or habitat which is potentially important, but due to a lack of search effort individuals have not been recorded

General Habitat – Known: Remnant Units or sites known to contain the taxon but relatively few individuals have been recorded (for example, due to infrequent dispersal events from nearby or distant populations); or the habitat is known to be sub-optimal; or there is insufficient information to determine whether the habitat is essential.

General Habitat – Possible: Remnant Units or sites that are unlikely to contain the taxon because the habitat is sub-optimal habitat and there have been no reported sightings of individuals that are self-maintaining.

Absence - Known or Absence – Suspected: The absence of the taxon is known or suspected because absences are consistently recorded based on intensive targeted survey; or it is locally extinct and never likely to recolonise the location; or the area is unlikely to be suitable as a reintroduction or translocation site; or the area has been cleared since the latest release of vegetation mapping by the Queensland Herbarium.

Index of Confidence: In addition to describing habitat for a taxon, an qualitative index of confidence is applied using a High, Medium and Low rating as follows:

- High – personal observations or records from other reputable sources (for example, 90% certainty);
- Medium – information from sources of reasonable/mixed reliability (location accuracy/taxa identification) (for example, 70% certainty); and
- Low – information from sources of unknown reliability (for example, 50% certainty).

Table 17. Summary of Occurrence, Habitat Suitability and Impact Assessment of EVR and EPBC threatened flora

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
Acacia brunioides subsp. *granitica* (no common name)	R	-	No records in study area. Otherwise known from Girraween NP & Wallangarra areas in swampy heath and Eucalyptus, Callitris woodlands on granite boulder slopes & pavements RE 13.12.2, 13.12.6. In NSW known from Gibraltar Range and Backwater (Hunter et al. 1998).	• Suitable habitat potential in 13.12.2 & 13.12.6; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat potential in 13.12.2 & 13.12.6; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat potential in 13.12.2 & 13.12.6; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat potential in 13.12.2 & 13.12.6; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Acacia latisepala (no common name)	R	-	Known from Girraween NP in Eucalyptus, Callitris woodlands on granite boulder slopes & pavements RE 13.12.2. Conserved in Girraween and Bald Rock NP (Hunter et al. 1998) and from Torirngton area in NSW (Hunter et al. 1998). HEREBRECS records from Amiens & Bapaume districts.	• Suitable habitat in 13.12.2; • Not previously recorded; • Survey records in RE 13.3.1 and 13.12.6; • Essential habitat-known (H). Occurs in low densities generally on granitic hill slopes.	• Suitable habitat in 13.12.2; • Known from 2 records in roadside vegetation on New England Highway within TWS corridor; • No survey records; • Essential habitat-possible (M).	• Suitable habitat in 13.12.2; • Not previously recorded; • No survey records; • Essential habitat-possible (H). Occurs in low densities generally on granitic hill slopes.	• Suitable habitat in 13.12.2; • Previously recorded; • Survey records (4 confirmed populations with four additional records requiring confirmation); • Essential habitat known (H).	Low. Minor impact to habitat and populations is expected through loss of individuals from clearing of pipeline easement, machinery movement, and stockpiling of soil. Dependant on sensitive design and pre and post construction mitigation and management measures. Known to regenerate after fire and will colonise disturbed situations.

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
Acacia pubifolia (Velvet Wattle)	V	V	Potential habitat in 13.12.2 & 13.12.5. Known from Ballandean, Wybera, Wallangarra and Fletcher districts. Known from remnant vegetation near Stalling Lane and non-remnant roadside vegegtation along Fletcher Rd.	• Suitable habitat; • Previously recorded immediately to west of dam impact area; • No survey record; • General habitat possible (M).	• Suitable habitat; • Previously recorded by 1 HERBRECS record from Fletcher Road within pipeline corridor; • No survey record; • General habitat known (M).	• Suitable habitat; • Not previously recorded; • Recorded on survey with 13 individuals within a 1 000m^2 search area in RE 13.12.6; • Essentail habitat known (H).	• Sup-optimal habitat; • Not previously recorded with closest record approx. 2 km west of end of Sector 13; • No survey records; • Absence suspected (H).	High. Impact to essential habitat and populations of this species associated with proposed Emu Swamp Rd realignment expected. Speceis Management Plan and pre-construction survey recommended.
Acacia ruppii (Rupps Wattle)	V	E	Potential habitat 13.12.2, 13.12.9. HERBRECS search results indicate this species is restricted to Girraween N.P. Also known from NSW Nth Coast;	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sup-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sup-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Allocasuarina rupicola (no common name)	R	Not Listed	Potential habitat in 13.12.6. No records in area. HERBRECS records indicate this species is restricted to Girraween NP ioin high granite peaks & upland drainage line margins. Also occurs in northern NSW in Boonoo Boonoo NP (Hunter et al. 1998).	• Sub optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
Almaleea cambagei (no common name)	Not listed	V	Known from Torrington State Conservation Area on the New England Tablelands, with a few populations potentially occurring in the adjacent agricultural lands (DECC 2007). While the species is reported from Girraween NP in Queensland (DECC 2007) there are no records listed in Bostock & Holland (2007) or in HERBRECS.	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Babingtonia granitica (no common name)	E	V	Known from heath 13.12.6 where it occurs in shallow peaty soils formed in the crevices of granite outcrops dominated by heath (Bean 1997 in Donatui 2006). Three known populations at Ballandean, Doctors Ck near Lyra, & Girraween NP (Donatui 2006).	• Suitable habitat; • Not previously recorded; • No survey record; • Essential habitat-possible (L).	• Sup-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Known from a HERBRECS record to the north of Stalling Lane (13.12.5/13.12 .6); • No survey record; • Essential habitat-possible (L).	• Sup-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Bertya glandulosa (no common name)	R	-	Known from Wybera, Wallangarra and Stalling Lane.	• Suitable habitat; • Not previously	• Sub-optimal habitat; • Not previously	• Suitable habitat; • Known to occur	• Sub-optimal habitat; • Not previously	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			Suitable habitat in open woodland to woodland of *Eucalyptus* spp. and *Callitris* sp.; shrubland on rocky hillsides with exposed rock pavements RE 13.3.2, 13.12.6.	recorded; • No survey record; • Essential habitat-possible (L).	recorded; • No survey records; • Absence suspected (H).	immediately to the north of the proposed road Emu Swamp Rd realignment area (13.12.6); • No survey record; • Essential habitat-possible (L).	recorded; • No survey records; • Absence suspected (H).	
Bertya recurvata (no common name)	R	Not listed	HERBRECS records from Amiens, Wybera, Lyra area and Girraween NP. Habitat data suggests suitable habitat in study area in 13.12.2 and 13.12.6.	• Suitable habitat; • Not previously recorded; • No survey record; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • No survey record; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Boronia amabilis (no common name)	R	Not listed	Known from Ballandean, Lyra, Wybera and Girraween NP in RE's 13.12.2 & 13.12.6.	• Suitable habitat; • Not previously recorded; • No survey record; • Absence suspected.	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected.	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected.	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected	None expected
Boronia granitica (Granite Boronia)	E	E	Known from Girraween NP, Amiens area (Harslett Rd, Mt Hutton Rd & Sonego Rds), near The Summit and Paschendale	• Suitable habitat; • Not previously recorded; • No survey record; • Absence	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence	• Suitable habitat; • Previously recorded immediately to the north of the proposed Emu Swamp	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			districts in regional ecosystems 13.12.2-13.12.6 in shrubby woodland, open forest and heath (Donatui 2006). In NSW from Torrington, Severn River Nature Reserve, the Barbs near Pindari Dam, Kings Plains National Park and Howell (Hunter et al. 1998).	suspected (H).	suspected (H).	road realignment area; • No survey record; • Essential Habitat-Possible (H).	suspected (H).	
Boronia repanda (Repand Boronia)	E	E	Endemic to Stanthorpe Plateau with known national distribution restricted to scattered populations around Cottonvale, Thulimbah, Amiens and Passchendaele and a recently located record to the east of Stanthorpe on the border w ith New South Wales (Donatui 2006). Occurs in regional ecosystems 13.12.2-13.12.6 in shrubby woodland, open forest and heath (Donatui	• Suitable habitat; • Not previously recorded; • No survey record; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • No survey record; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • No survey record; • Absence suspected (H).	• Suitable habitat; • Previously recorded from a number of HERBRECS records on Pfunders Rd (Sector 1) and Poziers Rd (Sector 2) within proposed pipeline corridor in disturbed roadside vegetation with the vulnerable *Grevillea scortechinii* subsp.	High. Major direct and indirect impact to essential habitat and populations of this species is possible as a result of irrigation network. Impact assessment dependant on additional survey to inform sensitive design and pre and post construction mitigation and management measures.

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			2006) & in non-remnant.				*scorthechinii;* • No survey records; • Essential habitat possible (H).	
Cadellia pentastylis (Ooline)	V	V	In Qld from RE 13.11.7 vine thicket on metamorphics in Sundown NP. In NSW west from near Tenterfield and north from Terry Hie Hie from vine thickets and woodlands. (Harden 2002).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Caladenia atroclavia (no common name)	E	E	Known to occur in *Eucalyptus campanulata* open forest on igneous rocks (RE 13.12.1).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Conospermum burgessiorum (no common name)	R	Not listed	Known to occur in *Eucalyptus andrewsii, E. youmanii* woodland on igneous rocks (RE 13.12.2).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Cryptandra lanosiflora (no common name)	R	Not listed	Known to occur in *Eucalyptus andrewsii, E. youmanii* woodland	• Unsuitable habitat; • Not previously	• Unsuitable habitat; • Not previously	• Unsuitable habitat; • Not previously	• Unsuitable habitat; • Not previously	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			on igneous rocks (RE 13.12.2) and in Girraween NP. Also in NSW from heath and open forest on exposed rocky sites at higher altitudes on the escarpment (Harden 2002). Occurs in Gibraltar Range NP, New England NP, Werrikimbe NP, Black Mountain at GlenElgin State Forest, Backwater, Bolivia Hill, the Liverpool Range and ParlourMountains (Hunter et al. 1998).	recorded; • No survey records; • Absence suspected (H).	recorded; • No survey records; • Absence suspected (H).	recorded; • No survey records; • Absence suspected (H).	recorded; • No survey records; • Absence suspected (H).	
Cryptostylis hunteriana (Leafless tongue Orchid)	Not listed	V	Known from Wide Bay and Moreton districts extending into NSW from Gibraltar Range NP south into Victoria. A mostly coastal species but can be found in a range of habitats including dry sclerophyll forests, heaths, dunes, riparian (stream-side) areas, swampy forests, swampy areas and wetlands areas.	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			Difficult to detect flowering between December and February yet generally found growing on sandy or stony clay soils, often in sandstone areas.					
Derwentia arenaria (no common name)	R	Not listed	In Qld known from Wybera and Rimptons Hill area Glen Aplin in open shrubland on granite rock outcrops (RE 13.12.6). In NSW known from rocky slopes and river flats, in sandy soils, often in eucalypt woodland; western edge of tablelands and Slopes, north from Mendooran (Harden 2002).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Digitaria porrecta (no common name)	R	E	All HERBRECS records from western parts of Darling Downs in grasslands.	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
Diuris parvipetala (no common name)	R	-	Known from grassland areas near granite outcrops and has been observed in association with *Stylidium graminifolium*, *Chrysocephalum apiculatum* and *Themeda triandra* (Donatui 2006). Endemic to eastern Australia, w ith a know n national distribut ion of seven disjunct populations extending from southern Queensland to an outlier northwest of Glen Innes in New South Wales (Copeland 2004 in Donatui 2006). In Qld potential habitat in RE 13.3.1, 13.12.2, 13.12.9, and 13.12.5.	• Suitable habitat RE 13.3.1, 13.12.2, 13.12.5, 13.12.9; • Previously recorded to the north of dam impact area; • No survey records; • Essential habitat possible (M).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Essential habitat possible (M);	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Essential habitat possible (M);	• Suitable habitat; • 2 HERBRECS records located in vicinity of New England Highway in Sector 8; • No survey records however seasonal survey in flowering period (Sept.-Nov) not carried; • Essential habitat possible.	Medium. Surveys in flowering season should be considered.
Diuris sheaffiana[8] (Painted Diuris)	Not listed	V	In Qld known to be widespread in Moreton and Darling Downs districts in eucalypt	• Unsuitable habitat; • Not previously recorded;	• Unsuitable habitat; • Not previously recorded;	• Unsuitable habitat; • Not previously recorded;	• Unsuitable habitat; • Not previously recorded;	None expected

[8] Listed in Qld Flora as *Diuris tricolor* (Bostock & Holland 2007).

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			open forest (Stanley & Ross 1989). Potential habitat in RE 13.3.1, 13.12.2, 13.12.9, and 13.12.5, 13.3.1. No records in study area. Grows in sclerophyll forest among grass (Harden 2002). In NSW known to be sporadically distributed on the western slopes, from south of Narrandera to the far north of NSW (DECC 2007).	• No survey records; • Absence suspected (H).	• No survey records; • Absence suspected (H).	• No survey records; • Absence suspected (H).	• No survey records; • Absence suspected (H).	
Dodonaea hirsute (no common name)	R	Not listed	Known from Amiens and Girraween districts in eucalyptus forest with granite boulders consistent with RE 13.12.2, 13.12.5. In NSW from north coast at Copmanhurst, Bald Rock and Boonoo Boonoo NP and Torrington (Hunter *et al*. 1998).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • 2 HERBRECS records located to the west of Teale Rd in Sector 4 in Amiens District; • No survey records; • Absence suspected (H).	None expected
Eucalyptus mckieana (McKie's Stringybark)	Not listed	V	Main distribution is in NSW where it is geographically restricted to the drier western side of the New England Tablelands of	• Suitable habitat; • Not previously recorded in inundation area however	• Suitable habitat; • Previously recorded in in Fletcher area in RE 13.12.2 400m W of	• Suitable habitat; • Not previously recorded; • No survey records;	• Suitable habitat; • Not previously recorded; • No survey records;	Low. Potential impacts associated with TWS pipeline corridor in proximity of Rhumbalara Railway crossing

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			NSW, from Torrington to Bendemeer (DECC 2007) and between Inverell and Guyra in the Retreat, Tenterden, Gilgai areas and recorded in Kings Plain National Park (Hunter *et al.* 1998). Qld populations represents northern limit of geographical distribution where it restricted to a few collections in the Fletcher area in RE 13.12.2.	known to be restricted to Fletcher area; • No survey records; • General habitat known (M).	Rhumbalara Railway crossing of Fletcher Lane. Qld population poorly known and restricted to Fletcher area; • No survey records; • General habitat known (H).	• Absence suspected (H).	• General habitat known (M).	on Fletcher Lane. Further surveys recommended for town supply water supply line clearance.
Eucalyptus scoparia (Wallangarra White Gum)	V	V	Known from mountain tops and upland granite pavements. Occurs in RE 13.12.3 which is wholly confined to Girraween NP. Single record from Mt Ferguson near Amiens.	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Single record from Mt Ferguson approx. 1km Sth of Goldfields Rd in Sector 13. • No survey records; • Absence suspected (H).	None expected
Euphrasia orthocheila subsp *orthocheila* (no common name)	R	Not listed	One low precision 1875 record from Stanthorpe district. Habitat unspecified. In NSW thought to	• Unsuitable habitat; • Not previously recorded;	• Unsuitable habitat; • Not previously recorded;	• Unsuitable habitat; • Not previously recorded;	• Unsuitable habitat; • Not previously recorded;	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			be extinct throughout much of its former range, and recorded from Dorrigo to Tenterfield and west to Torrington, although most records are very old. Currently only known from two swamps in the Tenterfield area (DECC 2007).	• No survey records; • Absence suspected (H).	• No survey records; • Absence suspected (H).	• No survey records; • Absence suspected (H).	• No survey records; • Absence suspected (H).	
Grevillea scortechinii subsp. *scortechinii* (NSW subsp. refereed to as 'Backwater Grevillea')	V	V	In Qld endemic to Stanthorpe Plateau, known from several populations between Stanthorpe and Dalveen in non-remnant roadsides with potential habitat in RE's 13.3.1, 13.12.1, 13.12.2, 13.12.6, 13.12.8, 13.12.9. (Donatiu 2006).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Known populations on margins of Poziers Rd and Prfunders Rd; • Survey records Poziers Rd; • Essential habitat known (H).	High. Major direct and indirect impact to essential habitat and populations of this species is possible in Sector 2 and dependant of sensitive design and pre and post construction mitigation and management measures.
Goodenia macbarronii (Narrow Goodenia)	Not listed	V	Known from the western slopes of the Great Dividing Range in NSW, south from the Guyra and Inverell districts and also in north-eastern Victoria and the Darling Downs in Queensland (DECC	• Suitable habitat; • Known from vicinity of dam impact area (Fletcher area on pavement seepage slopes) with potential to	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (M).	• Suitable habitat; • Known from R2 rock pavements (RE 13.12.6) ; • No survey records; • Essential habitat possible (M).	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (M).	Moderate. Potential for impacts associated with dam.

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			2007). Recorded from Stalling Lane on rock pavements of 13.12.6 (Donatiu 2006).	occur on R2 rock pavements (RE 13.12.6) and those associated with R1 (13.3.1) along the Severn River. • No survey records; • Essential habitat possible (M).				
Hakea macrorrhyncha (no common name)	R	Not listed	Known from RE 13.12.2. Qld records limited to Giraween NP and Lyra area.	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H)..	None expected
Hibbertia elata (no common name)	R	Not listed	In Qld from Wallangarra district with one 1944 low precision record in HERBRECS. Potential habitat in RE 13.12.1. In NSW known from shallow soils on rocky slopes in the Mudgee - Rylstone - Merriwa district (Harden 2002).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Homoranthus	V	V	Known from	• Suitable	• Sub-optimal	• Suitable	• Sub-optimal	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
montanus (Mountain Mouse Bush)			Stanthorpe Plateau from Mt Jibbinbar (Sundown) and Stalling Lane (Fletcher) in RE's 13.11.1, 13.12.5, 13.12.6 (Donatiu 2006).	habitat; • Previously recorded to north of inundation area; • No survey records; • Essential habitat possible (RE 13.12.5, 13.12.6) (L).	habitat; • Previously recorded on Fletcher Rd roadside; • No survey records (area recovering from burn at time of survey); • Absence suspected (H).	habitat; • Previously recorded to north of Stalling Lane; • No survey records; • Essential habitat possible (RE 13.12.5, 13.12.6) (L).	habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	
Leionema ambiens (Forest Phebalium)	R	Not listed	Known in SE Qld from Girraween NP, Wybera (Bald Rock Ck) areas in heathland/shrubland and dry eucalypt forest associated with granite boulders and rocky creek banks. Uncommon in NSW in heath in crevices of granite boulders, north from Backwater (Guyra district), (Harden 2002).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
*Lepidium hyssopifolium (*Basalt Peppercress*)*	Not listed	E	Not recorded in Qld (Bostock and Holland 2007). In NSW a rare speceis known from Bathurst district and near Qld border (Harden 2002).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
Kunzea bracteolata (no common name)	R	Not listed	Known from Giraween NP with record from Stalling Lane in shrubland on granite slopes and pavements RE 13.12.6. Extends southwards into NSW to Guy Fawkes River (Hunter *et al.* 1998)	• Potentially suitable habitat; • Previously recorded to west of inundation area; • No survey records; • Essential habitat possible (13.12.6), (M).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Potentially suitable habitat; • Previously recorded to north of Stalling Lane; • No survey records; • Absence suspected (M).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Macrozamia occidua (no common name)	V	V	A rare species, occurring in a few small stands in Sundown National Park, in dry eucalypt woodlands on skeletal soils on slopes (RBGS 2004).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Macrozamia viridis (no common name)	E	Not listed	Highly localised and probably rare, on sandy soils over granite in moderately wet eucalypt woodlands in the Wyberba district of the Qld Darling Downs (RBGS 2004). Potential habitat in 13.3.1, 13.12.9.	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Melaleuca flavovirens (syn. *Callistemon*	R	Not listed	Known from Girraween NP, Wallangara,	• Known habitat; • Previously	• Unsuitable habitat; • Not	• Unsuitable habitat; • Not	• Unsuitable habitat; • Not	High. Direct impacts expected in inundation area

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
flavovirens) (no common name)			Stalling Lane (Fletcher). Habitat in RE 13.3.1x and 13.12.6. In NSW from Gibraltar Range SF, Boonoo Boonoo NP, Guy Fawkes NP and Mann River Nature Reserve (Hunter *et al.* 1998).	recorded in close proximity to inundation area (downstream from proposed dam wall); • Survey recorded numerous populations known within riparian situations of Severn River in 13.3.1, 13.3.1x; • Essential habitat known (H).	previously recorded; • No survey records; • Absence suspected (H).	previously recorded; • No survey records; • Absence suspected (H).	previously recorded; • No survey records; • Absence suspected (H).	and indirect impacts possible downstream.
Melaleuca williamsii (syn. *Callistemon pungens*) (no common name)	V	V	Known from Qld in Girraween NP, Severn River Fletcher, in Stanthorpe area and extending to NSW from Oxley Wild Rivers NP near Armidale, Howell, Mount Balala, Guyra, Mann River Nature Reserve and New England National Park. (Hunter *et al.* 1998). Donatiu (2006) refers to habitat in RE	• Known habitat; • Previously recorded in close proximity to inundation area (downstream from proposed dam wall). Donatiu (2006) reports estimations of over 150 individual plants; • Survey	• Sup-optimal habitat; • Not previously recorded; • Survey records in non-remnant; • Essential habitat known (H).	• Suitable habitat; • Previously recorded in close proximity; • Survey recorded single population of 4 individuals in RE 13.3.1 (A1ax) on drainage line; • Essential habitat known (H).	• Sup-optimal habitat; • Not previously recorded; • 3 populations recorded on survey; • Essential habitat known (H) in 13.3.1 and non-remnant.	High. Significant impact to essential habitat and populations of this species is expected as a result of inundation. Emu Swamp road realignment population located approximately 20-30 m west of the proposed alignment. Impacts to 3 populations on irrigation corridor

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			13.3.4-13.3.5 in riparian areas along rocky watercourses or sandy creek beds.	recorded numerous populations known within riparian situations of Severn River in 13.3.1x and in 13.3.1, with scattered occurences in 13.12.6 on margins of 13.3.1x. Surveys suggest populations of >1000; • Essential habitat known (H).				is possible however dependant on sensitive design and pre and post construction mitigation and management measures.
Mirbelia confertiflora (no common name)	R	Not listed	Occurs on low heaths of granite pavements RE 13.12.6. HERBRECS data indicates its occurrence from 2 locations in Stanthorpe area at Giraween NP and Jollys Falls near the Summit. Not common in NSW in dry sclerophyll forest and heath on granite, and confined to Gibraltar Ra. N.P. and Boonoo	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • Single survey records; • Essential habitat known (H) (13.12.8)	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	Low. Opportunities to avoid single individual by sensitive siting of pipeline supply line.

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			Boonoo N.P. (Harden 2002) although Hunter *et al.* (1998) record it from Eagle Creek, Warra SF and adjacent private properties and Parlour Mountains.					
Olearia gravis (no common name)	R	Not listed	In Qld known from RE 13.12.2 in low open forest of *E. andrewsii, E. prava, E. youmanii* and shrubland on granite pavements from Wybera and Girraween NP. . In NSW known from dry sclerophyll forest in mountainous regions; north from Torrington and Gibralter Range (Harden 2002, Hunter *et al.* 1998)	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Supoptimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Supoptimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Phebalium glandulosum subsp. *eglandulosum* (no common name)	V	V	Known from 3 disjunct populations extending from Stanthorpe south Glen Innes (Donatui 2006). Population of 20 individuals known from Paschendale area (Donatiu 2006). In NSW known from heath amongst granite	• Suitable habitat; • Previously recorded to north/west of inundation area in elevated granitic hills; • No survey records; • Essential	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Previously recorded to north of Stalling Lane in elevated granitic hills; • No survey records; • Essential habitat	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			outcrops in the Torrington district (Harden 2002).	habitat possible (L).		possible (M).		
Phebalium whitei (no common name)	V	V	Confined to the Darling Downs Pastoral District, Qld, from Lyra to Girraween National Park in the Stanthorpe district (BRI collection records; Wilson 1970) (DEWR 2007). Two small populations known from Girraween National Park over about 10 ha with about 1000 plants in total (BRI Rare and Threatened Plant database 2001 in DEWR 2007)). Occurs in Bald Rock Creek and Girraween NP near Wallangarra (Stanley & Ross 1983).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected
Pterostylis longicurva (A Greenhood)	R	Not listed	2 HERBRECS records from private property in Glen Aplin area and otherwise from Girraween NP among granite rocks in light open forest (Stanley and Ross 1989). Potential habitat in	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (L).	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (L).	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (L).	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (L).	Possible. 2 HERBRECS records from private property in Glen Aplin area indicate rarity of this species in study area. Not recorded for survey however a difficult species to detect

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			RE 13.3.1, 13.12.9. Harden (2002) refers to habitat on shady slopes in sclerophyll forests of inland ranges with a distribution north from Coonabarabran district.					away from flowering time which, from HERBRECS specimen data, appears to be March-May.
Pterostylis woollsii (Long-Tailed Greenhood)	R	Not listed	Potential habitat in RE 13.3.1, 13.12.9. Known as a widespread but disjunct terrestrial orchid from NSW north coast, central tablelands, north west slopes and central western slopes south to Victoria among rocks on ridges and slopes and among grass in sclerophyll forest (Harden 2002).	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (L).	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (L).	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (L).	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (L).	2 HERBRECS records from private property in Glen Aplin area indicate rarity of this species in study area. Known to be a widespread but disjunct taxa (Harden 2002). Not recorded for survey however a difficult species to detect away from flowering time
Pultenaea foliolosa (ex. P. stuartiana) (no common name)	Not listed	V	In Qld known from 20 collections in Darling Downs distruct with a single 1044 low precision record from Eukey area near Stanthorpe. Habitat details unavailable but potentially eucalyptus	• Potentail habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Potentail habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Potentail habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			woodland 13.12.2, 13.12.5. In NSW known from dry sclerophyll forest to woodland, on a variety of well-drained substrates (Harden 2002) and from Torrington area (Hunter *et al.* 1998).					
Rulingia hermanniifolia(no common name)	R	Not listed	Known from Stanthorpe area in Girraween, Fletcher, Lyra, Wybera districts in eucalyptus woodlands, open forests RE 13.12.2 and heathlands on pavements 13.12.6. disjunct population in NSW from sandstone substrates where it is confined to coastal areas from Broken Bay to Botany Bay, also south to Jervis Bay, and along the Shoalhaven R (Harden 2002).	• Suitable habitat; • Not previously recorded; • Survey recorded 1 population of 5-10 individuals on exposed rock pavement; • Essential habitat known (H) 13.3.1x, and possible for 13.12.6.	• Sub optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • No survey records; • Essential habitat possible (L).	• Sub optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	High. Direct impacts associated with inundation likely.
Rulingia salviifolia (no common name)	R	R	The single HERBRECS record refers to a cultivated specimen from Amethyst Nursery, 74 Ishmael Road,	• Unsuitable habitat; • Not previously recorded; • No survey records;	• Unsuitable habitat; • Not previously recorded; • No survey records;	• Unsuitable habitat; • Not previously recorded; • No survey records;	• Unsuitable habitat; • Not previously recorded; • No survey records;	None expected.

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			Camera, Brisbane. Otherwise known from Mt Barney and Border ranges in wet eucalypt forest.	• Absence suspected (H).	• Absence suspected (H).	• Absence suspected (H).	• Absence suspected (H).	
Rutidosis glandulosa (no common name)	R	Not listed	Known from western Darling Downs with single low precision record from Thulimbah.	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	None expected.
Thelionema grande (no common name)	R	-	Girraween, Amiens, Wybera and Thulimbah areas in RE 13.12.6 assocaited with rock pavements. Also known from Mt Barney/Mt Maroon and in NSW from northern tablelands and north west slopes north from Boonoo Boonoo, Bald Rock, Gibraltar Range and Werrikimbe National Parks, Boonoo State Forest, Torrington, Bolivia Hill and Howell on sandy soils around granite outcrops, at	• Suitable habitat; • Survey recorded with 4 populations of 50-100 individuals on exposed rock pavements associated with 13.3.1x and 13.12.6 • Essential habitat known (H) 13.3.1x, 13.12.6.	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Sub-optimal habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	High. Direct impacts associated with inundation likely.

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			altitudes above 800 m (Harden 2002, Hunter *et al.* 1998).					
Tylophora woollsi (no common name)	E	E	Known from *Eucalyptus andrewsii, E. youmanii* woodland on igneous rocks 13.12.2. Single HERBRECS record from Girraween NP. In NSW known from wet sclerophyll forest and rainforest in the Clouds Creek area near Nymboida and in sclerophyll forest and is conserved within Bald Rock and Gibraltar Range NP's (Harden 2002).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Suitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	Single HERBRECS record in Girraween NP. Not recorded in field survey. No impacts expected.
Wahlenbergia glabra (no common name)	R	Not listed	In Qld from steep cliff faces on rhyolite and basalt in Main Range and McPherson Range;. In NSW it occurs in crevices of basalt outcrops in McPherson Range (Harden 2002).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• Unsuitable habitat; • Not previously recorded; • No survey records; • Absence suspected (H).	• No impacts expected.
Zornia pallida (no common name)	R	Not listed	Single low precision HERBRECS record from Applethorpe. Otherwise known from Warwick, Tansey, Gayndah	• Unsuitable habitat; • Not previously recorded; • No survey	• Unsuitable habitat; • Not previously recorded; • No survey	• Unsuitable habitat; • Not previously recorded; • No survey	• Unsuitable habitat; • Not previously recorded; • No survey	• No impacts expected.

Species Name	NCA Status	EPBC Status	Occurrence & Distribution	Inundation Area	Town Water Supply	Emu Swamp Rd Realignment	Irrigation Network Corridor	Potential for Impacts
			districts.	records; • Absence suspected (H).	records; • Absence suspected (H).	records; • Absence suspected (H).	records; • Absence suspected (H).	

Restriction/fragmentation of habitat/wildlife corridors: Direct loss or fragmentation of habitat/wildlife corridors may occur as a result of impoundment or transport route re-alignment. Impact assessment requires a critical knowledge of habitat connectivity through review of relevant biodiversity planning studies and the application of finer scale mapping conducted in this exercise to provide more detailed assessment of potential wildlife corridors. The Biodiversity Planning Assessment for the New England Bioregion assigned the Severn River corridor as being of State Significance. From the detailed vegetation mapping completed as a requirement of this EIS process, it is apparent that the Severn River provides a continuous riparian corridor within the area of inundation, linking riparian habitats to adjacent woodland communities. Inundation will impact on the viability of the Severn River as a wildlife corridor and as a wildlife refuge within an otherwise fragmented landscape.

6.2 Indirect Impacts

Potential Impacts on Vegetation Downstream from the Impoundment

A 600 m reach of the Severn River downstream from the proposed impoundment wall to the causeway on Fletcher crossing was assessed in the mapping exercise to determine the likely indirect effects the impoundment will have on downstream flora values. Young *et al.* (2001) describe some of the general affects of river impoundment on hydrological process as being related to:

- A reduction in the overall downstream flow volume, particularly downstream from irrigation points;
- A restriction in the downstream movement of sediment through natural fluvial processes; and
- A decrease in seasonal flow variability by sustaining flood peaks and prolonging the drought or periods of non-flow.

These impacts of impoundment on downstream habitats will be most pronounced close to the impoundment wall and decrease with distance downstream. The length of downstream reach impacted will depend on the degree to which hydrological processes are affected, which is influenced by the size and number of downstream tributaries. It should also be noted that a minor impoundment of the Severn River, present approximately 2 km downstream from the Fletcher Crossing causeway, has severely impacted the integrity of riparian vegetation in the vicinity. Minor localised impacts to populations of *Melaleuca williamsii*, *Melaleuca flavovirens* and *Melaleuca* sp. (Severn River) downstream from the proposed dam wall are possible, although full assessment of these impacts will be dependant on hydrological studies. A summary of downstream impacts is provided in **Appendix F**.

Changes in Soil Moisture Regime/Stream Hydrology

Elevated water tables within the inundation area buffer zone and seasonal waterlogging of soils may have adverse impacts on existing riparian vegetation. Scouring and channel armouring in downstream situations may influence bank stability and affect integrity of riparian vegetation. Changes in the soil moisture content may affect communities fringing the inundation area including the possibility of dieback in *Eucalyptus* species through soil waterlogging adjacent to the impoundment.

Creation of a Niche for Weed Infestation

Dam Inundation Area: Habitat degradation brought about through changes in the hydrological regime may facilitate the invasion of exotic species into affected areas. Invasions of exotic species are known to alter the composition of vegetation communities. This may affect areas upstream of the impoundment, downstream of impoundment, and on impoundment margins. This does not consider aquatic weeds assessed in other study components.

The major threat to habitat degradation through exotic species invasion is posed by those species which occur at various levels of infestations along the alluvial margins of the Severn River. Highly invasive and declared weed species are listed in **Table 18** with brief notes on existing and potential threat. The margins of inundation areas in particular have potential for severe weed infestation, through permanent increases in soil moisture content which creates a potential niche for weed infestation.

Lineal Infrastructure: With the exception of several minor areas on Mt Stirling Road (irrigation corridor), Mt Marley (on the TWS), and central areas of the ESRR, the proposed lineal corridors traverse highly degraded landscapes with a large number of exotic species present. The most abundant of these are environmental weeds including *Eragrostis curvula* (Love Grass), *Andropogon virginicus* (Whisky Grass), *Rubus* spp. (Blackberry) and a number scattered declared weed species including *Opuntia stricta* (Class 3-LPA) and *Ligustrum sinense* (Class 3-LPA). A summary of the major invasive weed species encountered during the survey is provided in **Table 18**. The spread of these species along disturbance corridors facilitating penetration into undisturbed vegetation communities risks long-term loss of essential habitat and loss of ground cover integrity. Long-term impacts to vegetation integrity may be caused through changes in fire regime created by a shift in ground cover dominance to exotic species. Evidence of death from wildfire to *Melaueca williamsii* and *M. flavovirens* was observed on alluvium at the Fletcher Rd causeway crossing the Severn River where roadsides and riparian margins are heavily infested with African Love Grass.

At considerable risk are populations of *Acacia pubifolia* (Vulnerable) on the ESRR corridor. Facilitated spread of exotic ground covers into otherwise pristine examples of RE 13.12.6 on this alignment poses considerable risk to these populations with possible invasion of exotic grasses causing potential changes to fire regimes. This risk extends to populations of known EVR species in the Stalling Lane Reserve to the east. Careful management of these risks is required to ensure habitat loss and impacts negative to the local populations does not occur.

Habitat Degradation through Increased Usage of Adjacent Woodland Communities by Exotic Fauna

Feral Deer were observed in several locations in the vicinity of the inundation area. The increased availability of permanent water has the potential to facilitate the expansion of the deer population, which if left unchecked, will impact on the viability of fringing habitats for significant flora species.

Table 18. Highly invasive and declared weed species on the TWS and INW.

Species Name	Class *	Local Priority**	Potential Threat
African Love Grass (*Eragrostis curvula*)	-	Low	Major infestations along roadsides and on disturbed river margins have potential to alter fire regimes and cause negative impacts to essential habitat and populations of

			threatened flora. Increased infestations on margins will compete for nutrients and reduce recruitment opportunities for native groundcovers and threatened/significant flora.
Coreopsis (*Coreopsis lanceloata*)	-	-	Widespread groundcover weed in majority of habitats. Increased infestations on margins will compete for nutrients and reduce recruitment opportunities for native groundcovers and threatened/significant flora.
Fireweed (*Senecio madasgarensis*)	2	High	Localised infestations on RE 13.3.1 along Severn River frontage.
Japanese Honeysuckle (*Lonicera japonica*)	-	-	Heavy infestation in endangered RE 13.3.1 on Stalling Lane indicates the potential of this weed to degrade significant habitat.
Blackberry (*Rubus spp.*)	3	-	Scattered infestations exist throughout the riparian zone and on alluvial margins. Highly invasive species capable of choking of riparian habitat. Weeds of National Significance.
Small leaved Privet (*Ligustrum sinense*)	3	High	Minor infestations currently within the riparian zone on alluvium. Potential for increasing populations on margins and downstream.
Whisky Grass (*Andropogon virginicus*)	-	Low	Minor infestations along roadsides and on disturbed river margins may influence fire intensity and frequency by increasing fuel loads and compete for nutrients.

* As per *Land Protection (Pest and Stock Route Management) Act 2002.*
* As per *Stanthorpe Shire Council Local Government Pest Management Plan Version 1 2005-2009.*

7. Impact Mitigation

The following recommendations are made to mitigate for direct impacts to significant vegetation communities and species incurred during dam inundation, road, and pipeline construction. The management of indirect impacts is dealt with in **Section 7.2**.

7.1 Management of Direct Impacts

7.1.1 Dam Inundation Area

There is limited scope for the avoidance of impacts to terrestrial flora within the proposed inundation area. Mitigation measures proposed relate the establishment of compensatory habitat through a number of inter-related mechanisms being:

- A suitable vegetation management offset strategy developed to meet the regulatory requirements of Queensland's Policy for Vegetation Management Offsets DNR&W (2007)*;*
- Creation of adequate and suitable compensatory habitat for EVR species affected by inundation; and
- Conservation of habitat for EVR species though establishment of binding conservation agreements.

A thorough assessment of the extent of impacts to significant vegetation communities has been documented throughout this report and suitable Vegetation Management Offsets (VMO's) must be identified to satisfy legislative requirements.

A specific Species Management Plan for individual EVR flora species affected by inundation should be prepared. This is to address specific issues of management to ensure no long-term impacts to overall populations of EVR species are imposed and may recommend activities such as seed collection, propagation and translocation. Seed collection of EVR species recorded in the inundation area should be undertaken prior to inundation and may be subject to permit requirements. Propagation and rehabilitation of suitable habitat within a VMO area should be considered as a means to offset impacts to areas of essential habitat. The establishment of binding conservation agreements in areas with known populations of impacted EVR species, within VMO areas or other compensatory habitats where these species will be retained (e.g. within the dam lease area), may also be considered as a mitigating measure.

7.1.2 Emu Swamp Road Re-alignment and Infrastructure Related to Dam Construction

Avoidance of any areas of significant vegetation or known populations of EVR species is fundamental to the mitigation strategy, although a range of measures can be considered as detailed in the section below.

- Detailed design of the road alignment considering identified significant terrestrial flora values is required;
- Following finalisation of the preferred alignment, significant terrestrial flora values that can not be avoided should be surveyed accurately on the ground. Where individual species can be avoided and retained, then suitable buffers should be erected around each species or population to avoid incidental damage by factors such as machinery movement, soil dumping,

windrowed vegetation, and by potential sediment/erosion events. These following measures are to be addressed in individual species management plans;

- In cases where direct impact to significant species is unavoidable these species must be tagged for possible translocation and under the guidance of a translocation plan;
- Individual habitat trees should be retained and protected from damage through the use of tree girdles and or temporary barriers and buffers.

An EMP for construction activities detailing how impacts to significant flora values will be managed must be prepared. Impacts to significant vegetation communities should be considered in the preparation of the finalised VMO plan and impacts to EVR species is to be considered in establishment of compensatory habitat. An individual Site Management Plan (SMP) should be prepared for any area identified with specific terrestrial flora values including large populations of EVR species. This may include the area of RE13.12.6 hosting significant populations of *Acacia pubifolia* on the proposed ESRR.

7.1.3 Town Water Supply and Irrigation Network

Avoidance of areas of significant vegetation or known populations of EVR species is fundamental to the mitigation strategy.

- The finalisation of the alignment should consider the location of significant terrestrial flora values and avoidance of these areas through route adjustment should be pursued;
- Specific mitigation measures identified in **Appendix E** for the INW and TWS should be considered wherever possible;
- Prior to road construction, detailed on ground survey to accurately locate boundaries of significant vegetation communities and tagging of individual EVR species should be undertaken;
- Individual habitat trees should be retained and protected from damage through the use of tree girdles and/or temporary barriers.

A thorough EMP for construction activities detailing how impacts to significant flora values will be managed must be prepared. Impacts to significant vegetation communities should be considered in the preparation of the finalised VMO plan and impacts to EVR species is to be considered in establishment of any compensatory habitat proposal. An individual Site Management Plan (SMP) should be prepared for any area identified with specific terrestrial flora values including large populations of EVR species. Individual SMP's should be considered for the populations of *Grevillea scortechinii* subsp. *scortechinii* and *Boronia repanda* on Pozieres Road (Sector 2).

7.2 Management of Indirect Impacts

7.2.1 Dam Inundation Area

A number of potential indirect impacts associated with dam construction are identified in **Section 6.1.** These include; potential impacts to the integrity of vegetation downstream from the proposed causeway including endangered RE 13.3.1 woodlands and shrublands; localised waterlogging of soils adjacent to the inundation area causing woodland dieback; and creation of a niche point for weed infestation, and fragmentation of wildlife corridors. Of these, the management of weeds is most

readily addressed. Several specific measures should be considered as a means to mitigate for, and measure the indirect impacts of dam construction. These include:

- Development of a specific Weed Management Plan (WMP) for areas within the dam lease area. This should focus on control of major invasive weed species identified in **Table 18** and should incorporate planning for long-term control of weeds in habitats essential to a range of EVR species, as well as within the broader mosaic of vegetation communities in the dam vicinity;
- The establishment of permanent monitoring sites in downstream locations to identify any indirect impacts that changes in hydrological regime may have on significant species. Particularly relevant are the impacts that any changes to hydrological regime may have on populations of *Melaleuca williamsii, Melaleuca flavovirens,* and the regionally significant *Melaleuca* sp. (Severn River) downstream from the dam wall. The populations of EVR species in areas downstream from the dam wall and upstream above the inundation area should also be assessed prior to construction as a means to establish meaningful baseline data;
- VMO planning should consider the establishment (or restoration) of habitat connectivity in fragmented vegetation on the impoundment margins. This will not only facilitate wildlife movement, but act as a buffer to exotic species invasion.

7.2.2 Emu Swamp Road Re-alignment and Infrastructure Related to Dam Construction

Indirect impacts may relate to degradation of habitat through exotic species invasion, sedimentation and erosion. This may impact the long-term viability of EVR species populations and habitat integrity. Procedures identified to minimise indirect impacts are summarised below.

Exotic Species Invasion

An EMP must be developed which includes details of procedures to prevent the spread of weeds into adjacent habitats with high integrity, potentially threatening the long term viability of populations of EVR species. This might include procedures to minimize ground disturbance in vegetation communities adjacent to areas of direct impact. A WMP which ranks priority weed species, provides strategies for control, and identifies management actions must be prepared prior to construction.

Sedimentation and Erosion Control

In severe cases, sedimentation has the potential to smother native flora species, particularly sensitive ground covers, and prevent regeneration of native species. This may facilitate invasion of exotic species into previously undisturbed vegetation communities resulting in a long-term cycle of habitat degradation. In a catastrophic form, slope failure resulting of landform disturbance has potential to fragment habitats and corridors, as well as severely impact flora habitat values. Preventative measures which must be considered in an SMP include:

- the installation of filter/sediment fences, filter drains, filter strips, grass outlet sediment traps and sediment basin traps around all culverts, drains, soil stockpiles and all other areas which may have the potential to erode or be effected by sedimentation;
- erosion control devices such as catch drains, slope drains, diversion drains and energy dissipaters in conjunction with sediment traps installed to divert stormwater around the construction site;

- stabilising by sterile grassing or another approved method materials stockpiled for long periods;
- stabilising of disturbed areas such as drains and batters;
- minimising as far as practicable the area of land which is bare of vegetation at any one time;
- planning the stages of various works to minimise erosion; and
- shallow diversion channels to prevent, as far as practical, large amounts of stormwater from entering the construction site.

7.2.3 Town Water Supply and Irrigation Network

Issues relating to indirect impacts on the INW and TWS corridor are similar to those on the road re-alignment site although due to the considerable length of the route and degraded nature of the landscape, will be much more difficult to manage and identify. The major concern is the spread of exotic species into vegetation communities with high structural integrity. This may occur on the distal areas of Mt Stirling Road (INW), and on the slopes of Mt Marley (TWS) where the proposed pipeline easements are unformed, passing though intact remnant vegetation. Specific WMP's for these areas should be prepared. The pre-construction eradication of exotic species on roadside margins may help control the spread of these species into intact vegetation communities.

Indirect impacts to EVR species caused by roadside disturbance are difficult to predict as survey records indicate that degraded non-remnant vegetation can host a range of significant species. These are often scattered throughout the landscape in a random distribution. Whilst attention can be directed to the management of direct impacts in degraded landscapes, the requirements for management of Indirect impacts in these areas are much more difficult to gauge, and the outcomes less predictable.

8. Residual Impacts

A summary of impacts on individual EVR flora species in the project area including the inundation area and all proposed infrastructure is provided in **Table 19.** This includes an assessment of potential impacts, an outline of recommended impact mitigation measures, and an assessment of residual impacts. A summary assessment of likely impacts to locally significant species in the project area is provided in **Table 20,** although it should be noted that specific mitigation measures have not been developed for these species and major impacts will result from both direct and indirect disturbance**.**

It should be noted that the degree of residual impact will be related to the successful implementation and long term management of a number of proposed mitigation measures which include Vegetation Management Offset Plans; Weed Management Plans, and Species Specific Management Plans.

Table 19. Summary of Impact Assessment for individual EVR species

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
Acacia brunioides subsp. *granitica* (no common name)	R	-	None expected	• No Actions Required	• Residual impact unlikely
Acacia latisepala (no common name)	R	-	**Low**: Minor impact to habitat and populations is expected through loss of individuals from clearing of pipeline easement, machinery movement, and stockpiling of soil. Dependant on sensitive design and pre and post construction mitigation and management measures. Known to regenerate after fire and will colonise disturbed situations.	• Pre-construction clearance of peripheral infrastructure; • Avoidance of recorded locations where possible; • Propagation of genetic material from populations by cutting and/or seed stock; • Establishment of compensatory habitat.	• Long term residual impacts unlikely; • Known survey records indicate capability for species to colonise heavily disturbed areas; • Limited potential for habitat degradation due to possible increased recreational use of habitat. Species generally occupies areas of poorer soil where potential for exotic species invasion is low; • High likelihood for success of propagation from cuttings and/or seed stock and dependant on availability of seed, seed viability and propagation techniques; • Success of establishing seedling stock into compensatory habitat dependant on site selection, site preparation, planting techniques, short and long term management of immediate site and broader habitat. • Likely success of translocation is low given rocky substrates. Potential for direct loss of individual specimens following translocation is high.
Acacia pubifolia (no common name)	V	V	**High**. Impact to essential habitat and populations of this species associated with proposed Emu Swamp Rd realignment expected. Species Management Plan and pre-construction survey recommended.	• Pre-construction clearance of peripheral infrastructure, particularly on ESRR; • Sensitive route allocation and avoidance of recorded locations where possible; • Species management plan devised and implemented taking full account of species ecology, distribution and threatening processes;	• Residual impact possible; • Potential for habitat degradation associated with possible increased recreational use of areas of compensatory habitat; • High likelihood for success of propagation from cuttings and/or seed stock and dependant on availability of

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
				• Propagation of genetic material from populations subject to direct impact by cutting and/or seed stock; • Establishment of suitable compensatory habitat (RE13.12.6, RE13.12.5, RE13.12.2); • Suitable fire management planning and implementation of management plans in areas purchased for compensatory habitat; • Weed management plans developed and implemented for road margins and areas of compensatory habitat. Infestation of African Love Grass on margins of new road is highly likely. In the longer term this may facilitate change to fire regimes which may impact habitat;	seed, seed viability and propagation techniques; • Success of establishing seedling stock into compensatory habitat dependant on site selection, site preparation, planting techniques, short and long term management of immediate site and broader habitat. Potential for residual impact and species loss is considered high if these measures are not carried out in accordance to a costed species management plan; • Likely success of any translocation is low given rocky substrates therefore high potential for residual impact by way of direct loss of individual specimens following translocation.
Acacia ruppii (Rupps Wattle)	V	E	None expected	• No Actions Required	• Residual impact unlikely
Allocasuarina rupicola (no common name)	R	Not Listed	None expected	• No Actions Required	• Residual impact unlikely
Almaleea cambagei (no common name)	Not listed	V	None expected	• No Actions Required	• Residual impact unlikely
Babingtonia granitica (no common name)	E	V	None expected	• No Actions Required	• Residual impact unlikely
Bertya glandulosa (no common name)	R	-	None expected	• No Actions Required	• Residual impact unlikely
Bertya recurvata (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Boronia amabilis	R	Not	None expected	• No Actions Required	• Residual impact unlikely

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
(no common name)		listed			
Boronia granitica (Granite Boronia)	E	E	None expected	• No Actions Required	• Residual impact unlikely
Boronia repanda (Repand Boronia)	E	E	**High**. Major direct and residual impact to essential habitat and populations of this species is possible as a result of irrigation network. Impact assessment dependant on additional survey to inform sensitive design and pre and post construction mitigation and management measures.	• Pre-construction clearance of peripheral infrastructure, particularly on Pozieres Road section of the INW; • Account for and flag all individual specimens to within area of direct impact; • Determine if species population and degree of impact warrants route revision; • Species management plan devised and implemented taking full account of species ecology, distribution and threatening processes; • Propagation of genetic material from populations by cutting and/or seed stock; • Translocation of individual specimens subject to direct impact;	• Residual impact possible; • Recorded locations of this species are in non-remnant vegetation and there is limited opportunity for re-establishment of suitable compensatory habitat; • Likelihood of success of propagating species from cuttings and/or seed stock is unknown and dependant in part on availability of seed, and seed viability. Success of establishing seedling stock into compensatory habitat is unknown and dependant on site selection, site preparation, planting techniques, short and long term management of immediate site and management of the broader habitat. Potential for direct loss is considered high. • Likely success of translocation unknown and dependant on site conditions; site selection, site preparation, translocation techniques, short and long term management of immediate site and management of the broader habitat. Potential for direct loss is considered high.
Cadellia pentastylis (Ooline)	V	V	None expected	• No Actions Required	• Residual impact unlikely
Caladenia atroclavia (no common name)	E	E	None expected	• No Actions Required	• Residual impact unlikely
Conospermum burgessiorum (no common	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
name)					
Cryptandra lanosiflora (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Cryptostylis hunteriana (Leafless tongue Orchid)	Not listed	V	None expected	• No Actions Required	• Residual impact unlikely
Derwentia arenaria (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Digitaria porrecta (no common name)	R	E	None expected	• No Actions Required	• Residual impact unlikely
Diuris parvipetala (no common name)	R	-	Moderate. Surveys in flowering season (spring) should be considered to determine occurrence in potential habitat.	• Pre-construction seasonal survey of inundation area should be considered to account for any unrecorded specimens; • Establishment of areas of compensatory habitat to account for impacted areas of RE13.3.1, 13.12.2, 13.12.5, 13.12.9; • Translocation of any subsequently recorded specimens (within areas of direct impact) to within areas of suitable compensatory habitat.	• Residual impact possible; • Residual impact dependant on success of detection of additional populations and translocation. As a terrestrial orchid, flowering period is limited and hence detection in the field is reliant upon timing of field survey in potential habitat; • Likely success of translocation unknown and dependant on site selection, site preparation, planting techniques, short and long term management of immediate site and broader habitat. Potential for direct loss is considered high.
Diuris sheaffiana[9] (Painted Diuris)	Not listed	V	None expected	• No Actions Required	• Residual impact unlikely
Dodonaea hirsute (no common	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely

[9] Listed in Qld Flora as *Diuris tricolor* (Bostock & Holland 2007).

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
name)					
Eucalyptus mckieana (McKie's Stringybark)	Not listed	V	Low. Potential impacts associated with TWS pipeline corridor in proximity of Rhumbalara Railway crossing on Fletcher Lane. Further surveys recommended for town supply water supply line clearance.	• Pre-construction clearance of section of TWS along Fletcher Road; • Compilation and implementation of a species specific management plan; • Flagging of individuals within area of direct impact; • Avoidance of any recorded individuals through route re-location; • Use of tree girdles, establishment of buffers and pre-construction pruning to minimise damage to peripheral specimens; • Establishment of suitable areas of compensatory habitat (RE13.12.2, RE13.12.5); • Seed collection and propagation for use within areas of associated re-vegetation.	• Residual impact possible; • Residual impact will be minimal if proposed mitigation measures implemented; • Some potential for degradation of areas of essential habitat through weed invasion of ground cover along disturbed road edges. This may facilitate changes in fire regime and threaten long-term viability of the species.
Eucalyptus scoparia (Wallangarra White Gum)	V	V	None expected	• No Actions Required	• Residual impact unlikely
Euphrasia orthocheila subsp *orthocheila* (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Grevillea scortechinii subsp. *scortechinii* (NSW subsp. refered to as 'Backwater Grevillea')	V	V	High. Major direct and residual impact to essential habitat and populations of this species is possible in Sector 2 and dependant of sensitive design and pre and post construction mitigation and management measures.	• Pre-construction clearance of peripheral infrastructure, particularly on Pozieres Road section of the INW; • Account for and flag all populations of the species specimens to within area of direct impact; • Determine if species population and degree of impact warrants route revision; • Species management plan devised and implemented taking full account of species ecology and distribution; • Preservation of genetic stock through propagation by seed and/or cuttings of	• Residual impact possible; • Difficult to establish suitable compensatory habitat as known population occurs within highly degraded roadside non-remnant vegetation; • Loss of individual species and decrease in population size will occur to populations directly impacted, although likely success of propagation translocation efforts is unknown requiring further investigation; • Residual (and direct) impacts can be

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
				individuals subject to direct impact; • Translocation of individual specimens subject to direct impact;	avoided through route-relocation.
Goodenia macbarronii (Narrow Goodenia)	Not listed	V	Moderate. Potential for impacts associated with dam although species not recorded during survey.	• Establishment of areas of suitable compensatory habitat (RE13.12.6, RE13.3.1x1). • Population surveys within areas of compensatory habitat and consideration given to species introduction into suitable locations. • Control of exotic species (fauna and flora) within areas of established compensatory habitat will be essential to avoid habitat degradation and potential loss of species	• Residual impact possible; • Possible minor residual impact to populations within dam impact area although no specimens were recorded during survey; • Residual impact likely to be extremely limited.
Hakea macrorrhyncha (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Hibbertia elata (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Homoranthus montanus (Mountain Mouse Bush)	V	V	None expected	• No Actions Required	• Residual impact unlikely
Leionema ambiens (Forest Phebalium)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Lepidium hyssopifolium (Basalt Peppercress)	Not listed	E	None expected	• No Actions Required	• Residual impact unlikely
Kunzea bracteolata (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Macrozamia occidua (no common	V	V	None expected	• No Actions Required	• Residual impact unlikely

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
name)					
Macrozamia viridis (no common name)	E	Not listed	None expected	• No Actions Required	• Residual impact unlikely
*Melaleuca flavovirens (*syn. *Callistemon flavovirens)* (no common name)	R	Not listed	High. Direct impacts expected in inundation area and residual impacts possible downstream.	• Recommendation for a pre-construction study (completed within flowering season) in order to provide an accurate account of populations within the dam inundation area to be impacted; • Establishment of compensatory habitat (RE13.3.1, RE13.3.1x1) within suitable sections of the Severn River or similar watercourse with known populations of the species; • Devise and implement a species specific management plan which considers species ecology; • Seed collection from within suitable locations with subsequent propagation by approved and qualified native plant nursery; • Use of propagated seedlings for re-vegetation/rehabilitation of degraded habitat; • Management of exotic species within known populations and within areas of compensatory habitat; • Implementation of a downstream monitoring program to account for any changes to species health and ecology which may adversely affect peripheral populations.	• Residual impact possible; • Known habitat will be fragmented; • Potential for adverse affects on peripheral populations through facilitated weed invasion and changes to downstream ecology, particularly if mitigation measures are ineffectively implemented; • Success of re-establishment of seedling stock dependant on site selection, site preparation, planting techniques, short and long term management of immediate site, and broader habitat management. Potential for direct loss is considered high.
Melaleuca williamsii (syn. *Callistemon pungens*) (no common name)	V	V	High. Significant impact to essential habitat and populations of this species is expected as a result of inundation. Emu Swamp Road realignment	• Recommendation for a pre-construction study (completed within the flowering season) to enable accurate identification and to provide an accurate account of populations within the dam inundation area to be impacted; • Flagging of all specimens within the area of	• Residual impact possible; • Known population of the species will be fragmented (divided in two); • Potential for adverse affects on peripheral populations through weed invasion and changes to downstream ecology, particularly if mitigation

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
			population located approximately 20-30 m west of the proposed alignment. Impacts to 3 populations on irrigation corridor is possible however dependant on sensitive design and pre and post construction mitigation and management measures.	direct impact for peripheral infrastructure (INW and TWS); • Establishment of buffers to ensure potential for impacts associated with machinery movement and soil stockpiling are minimised. • Establishment of compensatory habitat (RE13.3.1, RE13.3.1x1) within suitable sections of the Severn River or similar watercourse which support populations of the species. • Devise and implement a species specific management plan which considers species ecology; • Seed collection from within suitable locations for propagation by an approved native plant nursery; • Use of propagated seedlings for revegetation/rehabilitation of degraded habitat; • Management of exotic species within known populations and within areas of compensatory habitat; • Management of fire within known populations and within areas of compensatory habitat; • Implementation of a downstream monitoring program to account for any changes to species health and ecology which may adversely affect peripheral populations.	measures are ineffectively implemented; • Success of re-establishment of seedling stock dependant on site selection, site preparation, planting techniques, short and long term management of immediate site, and broader habitat management. Potential for direct loss is considered high.
Mirbelia confertiflora (no common name)	R	Not listed	Low. Opportunities to avoid single individual by sensitive siting of TWS.	• Pre-construction clearance of TWS; • Avoidance of recorded locations where possible; • Propagation of genetic stock by seed and/or cuttings; • Translocation of individual specimens subject to direct impact; • Establishment of compensatory habitat.	• Residual impact possible; • Potential for residual impact through exotic species invasion along areas of disturbance associated with construction of the TWS; • Likelihood for success of translocation or re-establishment of seedling stock dependant on site selection, site

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
					preparation, planting techniques, short and long term management of immediate site, and broader habitat management.
Olearia gravis (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Phebalium glandulosum subsp. *eglandulosum* (no common name)	V	V	None expected	• No Actions Required	• Residual impact unlikely
Phebalium whitei (no common name)	V	V	None expected	• No Actions Required	• Residual impact unlikely
Pterostylis longicurva (A Greenhood)	R	Not listed	**Low**: 2 HERBRECS records from private property in Glen Aplin area indicate rarity of this species in study area which may be a reflection of low collection intensity. Not recorded for survey however a difficult species to detect away from flowering time which, from HERBRECS specimen data, appears to be March-May.	• Pre-construction surveys in flowering period necessary to confirm absence of populations from impact areas.	• Residual impact possible.
Pterostylis woollsii (Long-Tailed Greenhood)	R	Not listed	**Low:** 2 HERBRECS records from private property in Glen Aplin area indicate rarity of this species in study area which may be a reflection of low collection intensity. Known to be a widespread but disjunct taxa (Harden 2002). Not recorded for survey however a difficult species to detect away from flowering time	• Pre-construction surveys in flowering period necessary to confirm absence of populations from impact areas.	• Residual impact possible.
Pultenaea	Not	V	None expected	• No Actions Required	• Residual impact unlikely

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
foliolosa (ex. P. stuartiana) (no common name)	listed				
Rulingia hermanniifolia (no common name)	R	Not listed	High. Direct impacts associated with inundation likely.	• Pre-construction survey of inundation area to more accurately determine populations; • Flagging of individual specimens for potential collection of seed and/or cutting material; • Potential for translocation is limited given plant is rooted on rocky sites with minimal soil development; • Establishment of areas of suitable compensatory habitat (RE13.12.6, RE13.3.1x1). • Population surveys within areas of compensatory habitat and consideration given to species introduction into suitable locations; • Devise and implement a species specific management plan • Control of exotic species (fauna and flora) and fire management within areas of established compensatory habitat will be essential to avoid habitat degradation and potential loss of species.	• Residual impact possible; • Suitability of the species for propagation by seed and/or cutting is unknown; • Likelihood for success of re-establishment of nursery grown seedling stock dependant on seed collection, seed viability, site selection, site preparation, planting techniques, short and long term management of plantings and immediate site, and broader habitat management; • Likelihood of success of translocation is unknown however potential for loss of individual specimens during the translocation process is high given plant is often rooted in rocky sites with minimal soil development.
Rulingia salviifolia (no common name)	R	R	None expected	• No Actions Required	• Residual impact unlikely
Rutidosis glandulosa (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Thelionema grande (no common name)	R	-	High. Direct impacts associated with inundation likely.	• Pre-construction survey of inundation area to more accurately determine populations; • Flagging of individual specimens for potential propagation and/or translocation; • Establishment of areas of suitable compensatory habitat (RE13.12.6,	• Residual impacts possible; • Loss of known habitat for the species; • Suitability of the species for translocation is unknown and likelihood of loss of individual specimens during translocation process is possible;

Species Name	NCA Status	EPBC Status	Preliminary Impact Assessment	Mitigation and Compensatory Actions	Residual Impact Assessment
				RE13.3.1x1); • Population surveys within areas of compensatory habitat and consideration given to species introduction into suitable locations; • Devise and implement a species specific management plan; • Control of exotic species (fauna and flora) within areas of established compensatory habitat will be essential to avoid habitat degradation and potential loss of species.	• Likelihood for success of translocation or re-establishment of seedling stock dependant on site selection, site preparation, planting techniques, short and long term management of immediate site, and broader habitat management. • Potential for changes to downstream hydrology associated with dam construction to impact on species habitat in peripheral areas.
Tylophora woollsi (no common name)	E	E	None expected	• No Actions Required	• Residual impact unlikely
Wahlenbergia glabra (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely
Zornia pallida (no common name)	R	Not listed	None expected	• No Actions Required	• Residual impact unlikely

Table 20. Summary Potential Impact Assessment of non-EVR Priority Flora.

Taxon	Potentianl Impacts	Regional Ecosystems
Acacia adunca	Minor local impacts expected.	13.3.1x, 13.12.5, 13.12.6
Acacia betchei	Minor local impacts expected.	13.3.1
Acacia granitica	Minor local impacts expected.	13.3.1
Acacia latisepala	Minor local impacts expected.	13.3.1, 13.12.5, 13.12.6
Actinotis helianthi	Minor local impacts expected.	13.12.8, 13.12.6
Asperula ambleia	Major impacts to population expected to this locally rare and regionally significant species. The Qld distribution is poorly known and limited to 2 HERBRECS records in the Darling Downs district. Otherwise known from NSW from Northern, Central and Southern Tablelands regions (Harden 1992).	13.3.1
Baloskion stenocoleum	Minor local impacts expected.	13.12.5
Bossiaea scortechinii	Minor local impacts expected.	13.3.1
Callitrix tetragona	Minor local impacts expected.	13.3.1, 13.3.1x, 13.12.5
Carex appressa	Minor local impacts expected. Likely to colonise margins of inundation area.	13.3.1x, 13.3.1, 13.12.6
Carex lobolepis	Minor local impacts expected. Likely to colonise margins of inundation area.	13.3.1
Centrolepis fascicularis	Minor local impacts expected.	13.12.6
Cheiranthera cyanea subsp. *borealis*	Minor local impacts expected.	13.3.1
Choretum candolei	Minor local impacts expected.	13.12.6
Daviesia latifolia	Minor local impacts expected.	13.12.6
Deyeuxia decipiens	Minor local impacts expected.	13.12.6
Dillwynia sericea	Minor local impacts expected.	13.3.1x, 13.12.5, 13.12.6
Dipodium variegatum	Minor local impacts expected.	13.3.1, 13.12.5
Eleocharis philippinensis	Minor local impacts expected. Likely to colonise margins of inundation area.	13.3.1
Eucalyptus caliginosa	Minor local impacts expected.	13.12.6
Eucalyptus prava	Minor local impacts expected.	13.3.1x, 13.12.5, 13.12.8
Eucalyptus youmanii	Minor local impacts expected.	13.3.1, 13.12.5, 13.12.8,
Geranium neglectum	Minor local impacts expected.	13.3.1
Grevillea viridiflava	Minor local impacts expected.	13.3.1
Haemodorum planifolium	Minor local impacts expected.	13.3.1
Hakea microcarpa	Minor local impacts expected.	13.12.6
Hibbertia sp. (Girraween NP D.Halford+ Q1611)	Minor local impacts expected.	13.12.6
Hovea graniticola	Minor local impacts expected.	13.3.1, 13.3.1x,

Taxon	Potentianl Impacts	Regional Ecosystems
		13.12.6, 13.12.8, 13.12.5
Isotoma anethifolia	Minor local impacts expected.	13.3.11, 3.12.5, 13.12.6, 13.12.8
Juncus planifolius	Minor local impacts expected. Likely to colonise margins of inundation area.	13.3.1x
Juncus prismatocarpus	Minor local impacts expected. Likely to colonise margins of inundation area.	13.3.1
Leionema rotundifolium	Minor local impacts expected.	13.12.5
Lepironia articulata	Minor local impacts expected. Likely to colonise margins of inundation area.	13.12.6
Leptospermum arachnoides	Minor local impacts expected.	13.12.5
Leucopogon melaleucoides	Minor local impacts expected.	13.3.1x, 13.3.1, 13.12.5, 13.12.6, 13.12.8
Melaleuca alternifolia	Minor local impacts expected.	13.3.1, 13.3.1x, 13.12.6
Melaleuca pityoides	Minor local impacts expected.	13.3.1
Melaleuca sp. (Severn River) (DGF7852+DJS)	Major impacts expected to localised population.	13.3.1, 13.3.1x, 13.12.6
Melaleuca trichostachya	Minor local impacts expected.	13.3.1,
Myriophyllum striatum	Major impacts expected to localised disjunct population.	13.3.1
Phragmites australis	Minor local impacts expected. Likely to colonise margins of inundation area.	13.3.1
Prostanthera saxicola	Minor local impacts expected.	13.12.6
Pultenaea hartmanii	Minor local impacts expected.	13.3.1
Schoenoplectus mucronatus	Minor local impacts expected. Likely to colonise margins of inundation area.	13.3.1
Spyridium scortechinii	Minor local impacts expected.	13.3.1, 13.3.1x, 13.12.5, 13.12.6
Trichoglin procera	Minor local impacts expected. Likely to colonise margins of inundation area.	13.3.1
Typha domingensis	Minor local impacts expected. Likely to colonise margins of inundation area.	13.3.1
Zieria laevigata (sens. lat.)	Minor local impacts expected.	13.3.1, 13.12.6

9. References

Accad, A, Neldner, V.J, Wilson, B.A. and Neihus, R.A. (2006). *Remnant Vegetation in Queensland. . Analysis of remnant vegetation-1997-1998-1999-2000-2001-2002-2003, including regional ecosystem information*. Queensland Herbarium, Environmental Protection Agency, Brisbane.

Batianoff, G. and Butler, D. (2002). Assessment of invasive naturalised plants in south-east Queensland. *Plant Protection Quarterly* 17(1): 27-34.

Bean, A.R. 1997. Reinstatement of the genus Babingtonia Lindl. (Myrtaceae, Leptospermoideae). *Austrobaileya* 4, 627-645

Berwick, S. (1996). Action Statement No. 72 Narrow Goodenia Goodenia macbarronii, Flora and Fauna Guarantee. Sited in Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee (the Committee) on amendments to the list of Threatened Species under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (No Date)

Brooker, M. I. H. and Kleinig, D. A. (1999) Field Giude to Eucalypts, Volume 1, South-eastern Australia. Blooming Books, Hawthorn, Victoria.

Craven, L.A. and Jones, S.R. 1991. A taxonomic review of *Homoranthus* and two new species of *Darwinia* (both Myrtaceae, Chamelaucieae). *Australian Systematic Botany* 4(3), 513-533.

Department of Environment and Heritage (2006) *Environment Protection and Biodiversity Conservation Act, Protected Matters Report.* Commonwealth of Australia, Canberra. Accessed on 23/12/06 at http://www.environment.gov.au/biodiversity/threatened/index.html.

Department of Environment and Heritage (DEH). (2006) *Box Gum listing Advice and Conservation Advice.* Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee (TSSC) on Amendments to the List of Ecological Communities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Commonwealth of Australia, Canberra. Online at http://www.environment.gov.au/epbc/publications/box-gum/index.html (accessed on 23/12/06).

Department of Environment and Heritage (DEH). (2006) *White Box –Yellow Box-Blakely's Red Gum grassy woodlands and derived native grasslands information guide.* Online at http://www.environment.gov.au/epbc/publications/box-gum/index.html (accessed on 23/12/06).

Department of Environment and Heritage (DEH). (2006) *White Box –Yellow Box-Blakely's Red Gum grassy woodlands and derived native grasslands Species List.* Commonwealth of Australia, Canberra. Online at http://www.environment.gov.au/epbc/publications/box-gum/index.html (accessed on 23/12/06).

Department of Environment and Heritage (DEH). (2006) *Environment Protection and Biodiversity Act, Policy Statement 1.1. Significant Impact Guidelines, Matters of National Environmental Significance.* Commonwealth of Australia, Canberra. Online at http://www.environment.gov.au/epbc/publications/box-gum/index.html (accessed on 23/12/06).

Donatiu, P. (2006). *Stanthorpe Plateau Threatened Flora Recovery Plan 2007-2011.* Report to Department of the Environment and Heritage, Canberra. Queensland Murray-Darling Committee, Toowoomba, Queensland.

Donatiu, P. (2006). *Stanthorpe Public Lands Report.* Queensland Murray-Darling Committee Inc., Brisbane.

Environmental Protection Agency (2001). New England Tableland Flora and Fauna Expert Panel Report. In: New England Tableland Biodiversity Planning Assessment. Environmental Protection Agency, Brisbane.

Environmental Protection Agency (2002) Biodiversity Assessment and Mapping Methodology (Version 2). Biodiversity Planning Unit, Environmental Protection Agency Brisbane.

Environmental Protection Agency (2005). Regional Ecosystem Description Database (REDD). Version 5.0. Updated December 2005. Environmental Protection Agency, Brisbane.

FAO (1979). *Soil Survey Investigations for Irrigation.* Soil Bulletin 42. Food and Agricultural Organisation of the United Nations, Rome.

Galbraith, R. and Sparshott, K. (2003). *The Glovebox Guide: A Guide to Vegetation Management in Stanthorpe Shire.* Stanthorpe Shire Council, Stanthorpe. Environmental Protection Agency, Toowoomba.

Halford, D. 1995. *Homoranthus montanus* Craven & S.R. Jones (Myrtaceae): A Conservation Statement. Unpublished Report. Queensland Herbarium, Brisbane.

Harden, G. J. (ed), 1993-2002. *Flora of New South Wales.* Vols. 1-4. University of New South Wales Publishing, Sydney.

Hunter, J.T. (2000). Fragmentation and its implications for species richness and conservation of vascular plants on granitic outcrops of the New England Batholith. *Proceedings of the Royal Society of Queensland* 109: 75-82.

Hunter, J.T. (2003). Persistence on inselbergs: The role of obligate seeders and resprouters. *Journal of Biogeography* 30: 497-510.

Hunter, J.T. (2003). Factors affecting range size differences for plant species on rock outcrops in eastern Australia. *Diversity and Distributions* 9: 211–220.

Hunter, J.T. (2004). Factors affecting the nestedness of rock outcrop floras of the New England batholith of eastern Australia. *Proceedings of the Royal Society of Queensland* 111: 31-38.

Hunter, J.T. and Bruhl, J.J. (1997). Significant range extensions for 10 species of vascular plants in northern New South Wales. *Austrobaileya* 4: 691-694.

Hunter, J.T. and Clarke, P.J. (1998). The vegetation of granitic outcrop communities on the New England Batholith of eastern Australia. *Cunninghamia* 5: 547-618.

Jones, D.L. (1988). *Native Orchids of Australia.* Reed Books, Sydney.

McDonald, B., Gravatt, C., Grimshaw, P. and Williams, J. (1995). *The Flora of Girraween and Bald Rock National Parks.* Queensland Department of Environment and Heritage, Brisbane.

Neldner V.J., Crossley D.C. and Cofinas, M. (1995). Using Geographic Information Systems (GIS) to determine the adequacy of sampling in vegetation surveys. *Biological Conservation* 73: 1 17.

Neldner V.J., Wilson, B.A., Thompson, E.J. and Dilleward, H.A. (2005). *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland.* Version 3.1. Updated September 2005. Queensland Herbarium, Environmental Protection Agency, Brisbane.

NSW National Parks and Wildlife Service (2002). *Recovery Plan for* Boronia granitica *(Granite Boronia).* NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. (2002). *White Box Yellow Box Blakely's Red Gum Woodland Fact Sheet.* Online at http://www.nationalparks.nsw.gov.au/pdfs/box-gum_factsheet.pdf (accessed on 10/1/06).

NSW Scientific Committee (2002). *White Box Yellow Box Blakely's Red Gum Woodland – endangered ecological community listing.* Final Determination. NSW Scientific Committee, Sydnet, NSW. Online at http://www.nationalparks.nsw.gov.au/npws.nsf/content/boxgum+woodland+endangered+ecological+community+listing (accessed on 10/1/06).

NSW NPWS. (2002). Recovery Plan for *Boronia granitica* (Granite Boronia). NSW National Parks and Wildlife Service, Cof fs Harbour.

NSW NPWS. (2003). *Threatened Species of the New England Tablelands and North West Slopes of New South Wales.* NSW National Parks and Wildlife Service, Coffs Harbour, New South Wales.

Queensland Murray Darling Commission (2007) Queensland Murray Darling Basin Regional Natural Resource Management Plan. Online at http://www.qmdc.org.au/publications/regional-nrm-plan.html. (Accessed 20 September 2007).

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems.* Environmental Protection Agency, Brisbane.

Specht, R.L. and Specht, A, (1999). *Australian Plant Communities: Dynamics of Structure, Growth and Biodiversity*. Oxford University Press, Melbourne.

Stanley, T.D. and Ross, E.M. (1983). *Flora of South-eastern Queensland Volume 1*. Queensland Department of Primary Industries, Brisbane.

Stanley, T.D. and Ross, E.M. (1986). *Flora of South-eastern Queensland Volume 2.* Queensland Department of Primary Industries, Brisbane.

Stanley, T.D. and Ross, E.M. (1986). *Flora of South-eastern Queensland Volume 3.* Queensland Department of Primary Industries, Brisbane.

Stanthorpe Shire Council. (2004). Stanthorpe Shire Planning Scheme. Stanthorpe Shire Council, Stanthorpe.

Stanthorpe Shire Council (2005). *Local Government Area Pest Management Plan, Version 1 2005-2009.* Stanthorpe Shire Council, Stanthorpe, Queensland.

Stanthorpe Shire Council (2006). *Public Lands Report, Stalling Lane, Reserve 171, Summary Information.* Stanthorpe Shire Council, Stanthorpe, Queensland.

Walker, J. and Hopkins, M.S. (1990). Vegetation. In: Gunn, R.H.. Beattie, J.A., Reid, R.E. and Graaff, R.H.M v. d. (Eds), Australian Soil and Land Survey Handbook: Guidelines for Conducting Surveys, pp.58 - 86. Inkata Press, Melbourne.

Woodall, P. F. and Woodall, L. (2005) *Common Wildflowers of Girraween and Bald Rock National Parks*. Taita Publishers, Moorooka.

Young W.J (2001). *Rivers as Ecological Systems – The Murray Darling Basin.* (Editor). CSIRO Land and Water, Canberra.

10. Appendices

Appendix A. Combined Flora Species List

FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
Adiantaceae	*Adiantum aethiopicum*	6							6
Apiaceae	*Actinotis helianthi*				1	2			3
Apocynaceae	*Araujia sericea**	1							1
Araliaceae	*Astrotricha longifolia*			1			1		2
	Hydrocotyle peduncularis						1		1
	Trachymene incisa		1	1		3			5
Asparagaceae	*Asparagus officinalis**	1							1
Asphodelaceae	*Bulbine semibarbata*						1		1
Asteraceae	*Asteraceae (DGF8024+)*			1					1
	Asteraceae (DGF8035+)			1					1
	*Bidens pilosa**	4	1		2	2			9
	Brachyscone microcarpa				1				1
	Brachyscone stuartii		1						1
	*Carduus sp.**	1							1
	Cassinia quinquifera	3		2		3			8
	*Chondrilla juncea**							1	1
	Chrysocephalum apiculatum					3			3
	*Cirsium vulgare**	2							2
	*Conyza bonariensis**	5	1		2	1			9
	*Conyza sp.**	1							1
	*Coreopsis lanceolata**	3	1		1	1			7
	*Cosmos bipinnatus**							1	1
	Cyanthillium cinereum	1							1
	Cynoglossum australe	1							1
	Eclipta prostrata	1							1
	*Hypochaeris radicata**	3				1			4

[10] * denotes exotic species. Nomenclature follows Bostock and Holland (2007).

FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
	Olearia elliptica			2					2
	Podolepis neglecta			1		1			2
	Senecio diaschides	2	1		1				4
	*Senecio madagascariensis**	5							5
	*Tagetes minuta**	2							2
	Vittandinia dissecta var. dissecta					2			2
Blechnaceae	*Doodia caudata*	1							1
Boraginaceae	*Heliotropium amplexicaule**	1							1
Byttneriaceae	*Rulingia hermaniifolia (R-NCA)*				1				1
Campanulaceae	*Isotoma anethifolia*	1		1	1	1			4
	Lobelia andrewsii						1		1
	Lobelia purpurascens	2							2
	Lobelia purpurescens	1							1
	Wahlenbergia gracilis						1		1
	Wahlenbergia graniticola	2		1		3			6
Caprifoliaceae	*Lonicera japonica**	1							1
Caryophyllaceae	*Petrorhagia nanteuilii**	1			1				2
Centrolepiadaceae	*Centrolepis fascicularis*				1				1
Chenopodiaceae	*Chenopodium auricomiforme*						2		2
Commelinaceae	*Commelina diffusa*	4				2			6
	Commelina longifolia			1					1
Convolvulaceae	*Dichondra repens*	3		2		1			6
Cupressaceae	*Callitris endlicheri*	2	1	4	2	5			14
Cyperaceae	*Carex appressa*	5	1		1				7
	Carex lobolepis	1					1		2
	Cyperaceae sp. indet				1				1
	Cyperus conicus	1							1
	Cyperus difformis						1		1
	*Cyperus flavescens**							1	1
	Eleocharis philippinensis	1							1
	Fimbristylis dichotoma					1			1
	Gahnia aspera	4		4	1	4			13

FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
	Lepidosperma gunnii			1					1
	Lepidosperma laterale subsp. laterale	4	1	1	2				8
	Lepironia articulata				1				1
	Schoenoplectus mucronatus	1							1
Dennstaedtiacaea	*Pteridium esculentum*	3		1					4
Dilleniaceae	*Hibbertia cistoidea*						1		1
	Hibbertia linearis var. obtusifolia			1		3			4
	Hibbertia sp. (Girraween NP D.Halford+ Q1611)						1		1
	Hibbertia stricta				1				1
Ericaceae	*Brachyloma daphnoides var. daphnoides*					2			2
	Leucopogon melaleucoides	1	1	4	1	2			9
	Leucopogon muticus		1	3	1	4			9
	Leucopogon neoanglicus		1	2					4
	Melichrus urceolatus (sens. lat.)	2		4		4			10
	Styphelia viridis subsp. breviflorus			3		1			4
Eriocaulonaceae	*Eriocaulon scariosum*				1				1
Fabaceae	*Aotus subglauca var. subglauca*						1		2
	Bossiaea obcordata						1		1
	Bossiaea rhombifolia subsp. rhombifolia			1	1	1			3
	Bossiaea scortechinii	1							1
	Crotolaria sp. (DGF8025+)			2					2
	Daviesia latifolia						1		1
	Daviesia mimosoides subsp. mimosoides			1					1
	Desmodium brachypodum					1			1
	Desmodium varians	1				1			2
	Dillwynia sericea		1	3	2				7
	Glycine clandestina	1				1			2
	Glycine sp. (DGF7926+DJS)					1			1
	Hardenbergia violacea			1					1
	Hovea graniticola	1	1	3	2	3			11
	Jacksonia scoparia	2		4		5			11
	Mirbelia confertiflora								1

FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
	Mirbelia speciosa subsp. speciosa			1					1
	Pultenaea hartmanii	1							1
	Pultanaea sp. (DGF8034+)			1					1
	Pultenaea sp. (DGF8015=)			3					3
	*Trifolium repens var. repens**	1							1
	*Vicia sativa subsp. sativa**	2				1			3
Gentianaceae	*Centaurium erythraea*					1			1
Geraniaceae	*Erodium cicutarium**							1	1
	Geranium neglectum	1							1
	Pelargonium australe subsp. australe	1							1
Goodeniaceae	*Dampiera purpurea*			1	1	2			4
	Goodenia hederacea			1		2			3
	Goodenia macbarronii						1		1
	Goodenia rotundifolia		1			1			2
	Scaevola ramosissima			1	1				2
Haemodoraceae	*Haemodorum planifolium*			1			1		2
Haloragaceae	*Gonocarpus micranthus subsp. ramosissimus*						1		1
	Myriophyllum crispatum			1					1
	Myriophyllum implicatum		1						1
	Myriophyllum striatum	1							1
Hemoracallidaceae	*Dianella caerulea*	3				1			4
	Dianella longifolia var. longifolia	2		5	2	2			11
	Dianella longifolia var. stupata					1			1
	Stypandra glauca		1	2					3
	Thelionema grande	1	1		3				5
Iridaceae	*Patersonia sericea var. sericea*			2		1	1		4
Johnsoniaceae	*Tricoryne elatior*	2		1		2			5
Juncaceae	*Juncus continuus*	4	1			1			6
	Juncus planifolius		1						1
	Juncus prismatocarpus	1							1
	Juncus usitatus	1							1
Juncaginaceae	*Trichoglin procera*	1							1

FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
Lamiaceae	*Mentha piperata**	1							1
	Plectranthus graveolens								1
	Plectranthus parviflorus		1		1				2
	Prostanthera saxicola						1		1
Lauraceae	*Cassytha filiformis*	3			1				4
	Cassytha pubescens		1		1		1		3
Laxmanniaceae	*Eustrephus latifolius*	1							1
	Laxmannia compacta						1		1
	Lomandra multiflora subsp. multiflora			1	1	2			4
	Lomandra confertiflora subsp. pallida			2					2
	Lomandra filiformis			1					1
	Lomandra leucocephala subsp. leucocephala			1	1				2
	Lomandra longifolia	6			1	1			8
	Thysanotus tuberosus subsp. tuberosus						1		1
Liliaceae	*Undetermined (DGF7956+DJS)*	1							1
	Undetermined (DGF8036+DJS)			1					1
Mimosaceae	*Acacia adunca*		1	2	2				5
	Acacia betchei	1							1
	Acacia cultriformis						1		1
	Acacia falcata	1							1
	Acacia filicifolia						2		2
	Acacia floribunda	6		3	2	4			15
	Acacia granitica	1		1					2
	Acacia irrorata subsp. irrorata				1				1
	Acacia latisepala (Rare-NCA)	1			2				3
	Acacia pruinosa			3		3			6
	Acacia pubifolia (V-NCA/EPBC)				1				1
	Acacia stricta		1						1
	Acacia venulosa	1	1	2	1				5
	Acacia viscidula	5	1			2			8
Myrtaceae	*Angophora floribunda*	6	1	4	2	4			17
	Angophora subvelutina					1			1

FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
	Calytrix tetragona	1	1						2
	Eucalyptus blakelyi	8		1		7			16
	Eucalyptus bridgesiana	2		1		5			8
	Eucalyptus caliginosa						1		1
	Eucalyptus crebra			2		1			3
	Eucalyptus laevopinea					1			1
	Eucalyptus mckieana (V-EPBC)						1		1
	Eucalyptus melliodora	1		1		6			8
	Eucalyptus moluccana			1					1
	Eucalyptus nova-anglica					1			1
	Eucalyptus prava		1	4		3			9
	Eucalyptus youmanii	1		4		5			10
	Leptospemum brevipes					1			1
	Leptospemum polygalifolium					1			1
	Leptospermum arachnoides						1		1
	Leptospermum brachyandrum	6	1		2	1			10
	Leptospermum brevipes	3	1	4	2	5			15
	Leptospermum polygalifolium	5	1	1	3	1			11
	Melaleuca alternifolia	7	1		2				10
	Melaleuca flavovirens (R-NCA)	4	1	1	1				7
	Melaleuca pityoides	2							2
	Melaleuca sp. Severn River (DGF7852+DJS)	1	2		1				4
	Melaleuca trichostachya						1		1
	Melaleuca williamsii (V-NCA/EPBC)	6	2		5		2		15
Oleaceae	*Ligiustrum sinense**	1							1
	*Ligustrum lucidum**					1			1
	Notelaea linearis	3			2	1			6
	Notelaea microcarpa	2	1	4	1	2			10
Onagraceae	*Ludwigia peploides subsp. montevidensis*	2			1				3
	*Oenothera glazioviana**							1	1
	*Oenothera stricta subsp. stricta**							1	1
Orchidaceae	*Dipodium variegatum*	1		1					2

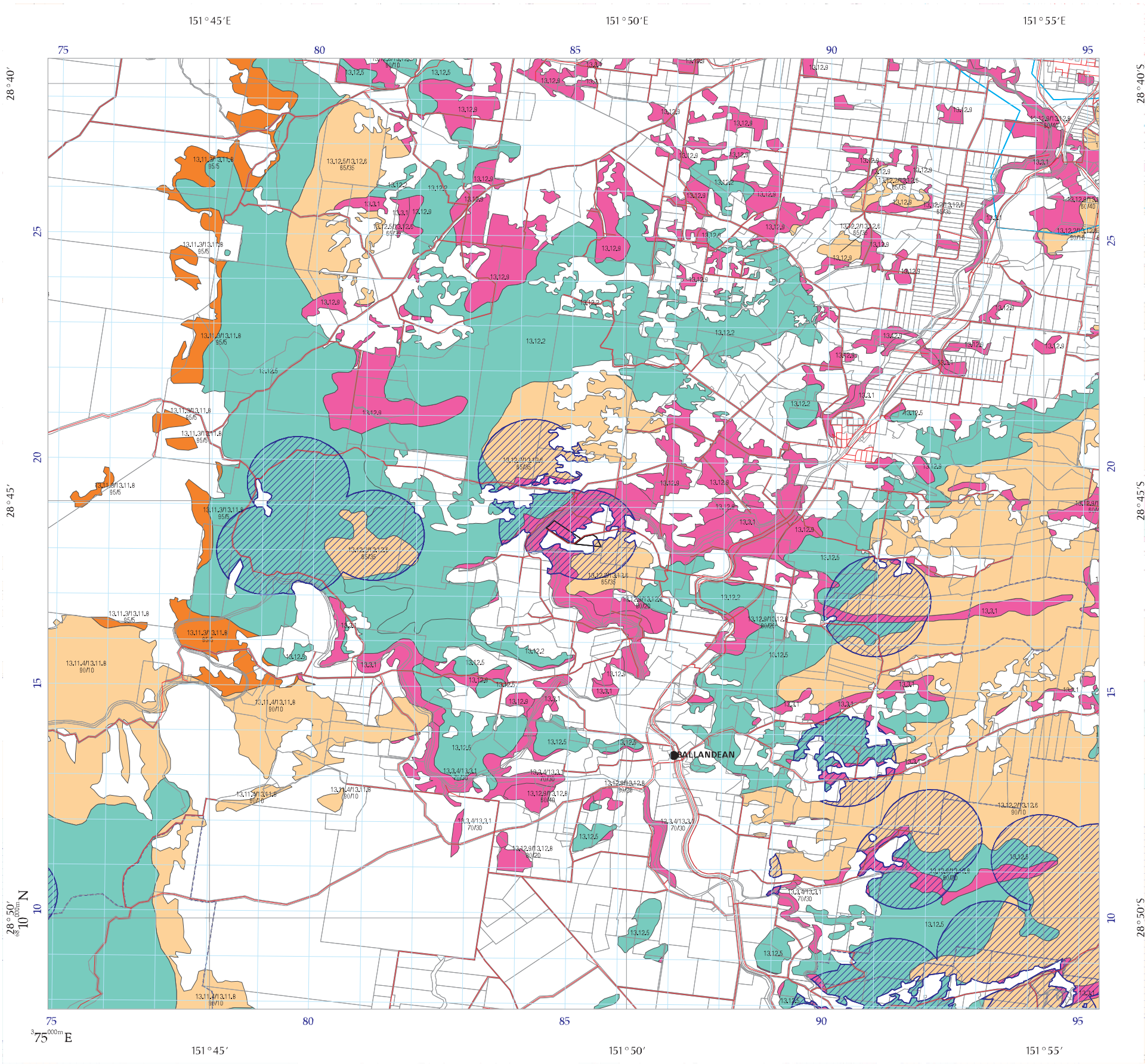
FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
Oxalidaceae	*Oxalis corniculata var. corniculata**	4				3			7
Phyllanthaceae	*Phyllanthus virgatus*	1		1					2
	Poranthera corymbosa						1		1
Phytolaccaceae	*Phytolacca octandra**	1							1
Pittosporaceae	*Billardiera scandens*						1		1
	Bursaria incana						1		1
	Bursaria spinosa	7	1	2	1	3			14
	Bursaria spinosa subsp. spinosa			1	1				2
	Cheiranthera cyanea subsp. borealis	1							1
Plantaginaceae	*Plantago lanceolata**	3							3
Poaceae	*Alloteropsis semialata*		1				1		2
	*Andropogon virginicus**	1	1		2				4
	Ariistida gracilipes					1			1
	Aristida sp.			1	1				2
	Aristida warburgii			1	1				2
	Arundinella nepalensis	4		2	1				7
	Austrodanthonia tenuior	1				1	1		3
	Austrostipa densiflora						1		1
	Austrostipa rudis subsp. rudis	2	1	2		1			6
	Austrostipa scabra subsp. scabra						1		1
	*Avena barbata**	3							3
	Cymbopogon refractus	2	1	4	1	3			11
	Deyeuxia decipiens						1		1
	Deyeuxia gunniana						1		1
	Dichelachne micrantha					1			1
	Dichelachne rara	4				1			5
	Digitaria ramularis						2		2
	*Digitaria sanguinalis**							1	1
	*Echinochloa crus-galli**							1	1
	Echinopogon caespitosus var. caespitosus	1							1
	*Eleusine indica**							1	1
	Enneaopogon sp.	1							1

FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
	Entolasia stricta	4	1	3	1	1			10
	*Eragrostis curvula**	2							2
	Eragrostis elongata						1		1
	Eragrostis leptostachya		1	1		1	1		4
	Eragrostis sp.					1			1
	*Festuca pratensis**	2							2
	*Hordeum glaucum**							1	1
	Imperata cylindrica	3		2		1			6
	Microleana stipoides	1							1
	Notodanthonia longifolia				1	1	1		3
	Panicum effusum var. effusum	1		1		2	1		5
	Paspalidium gracile			1			1		2
	Paspalum distichum	1					1		2
	*Paspalum sp.**	1							1
	*Paspalum urvillei **							1	1
	Phragmites australis	2							2
	Poa sieberiana var. sieberiana	2				1			3
	Poaceae (DGF7845+DJS)	2				1			3
	Poaceae (DGF7892+DJS)	1							1
	Poaceae (DGF7936+DJS)			1					1
	Poaceae (DGF8023+DJS)			2					2
	Poaceae (DGF8037+DJS)				1				1
	Sarga leiocladum					2			2
	Themeda triandra	3		3	1	6			13
	Tripogon loliformis		1	1		1			3
	*Vulpia muralis**							1	1
Polygonaceae	*Acetosella vulgaris**							1	1
	Persicaria decipiens				1				1
	Persicaria strigosa	1							1
	*Rumex conglomeratus**	1							1
	*Rumex crispus**	2			1				3
Proteaceae	*Conospermum taxifolium*			1			1		2

FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
	Grevillea viridiflava	1							1
	Hakea microcarpa				1		1		2
	Persoonia cornifolia						1		1
	Petrophile canescens			1			1		2
Ranunculaceae	*Ranunculus innundatus*	1							1
Ranunculiaceae	*Clematis microphylla var. microphylla*	2		1	1	1			5
Restoniaceae	*Baloskion stenocoleum*			1					1
Rhamnaceae	*Cryptandra amara var. longifolia*					1			1
	Pomaderis prunifolia	2			1				3
	Spyridium scortechinii	1	1	1	2				5
Rosaceae	*Rubus anglocandicans**	3							3
Rubiaceae	*Asperula ambleia*	2							2
	*Galium aparine**	2							2
	Opercularia hispida				1				1
	*Polycarpon tetraphyllum**	1							1
	Pomax umbellata			1		1			2
Rutaceae	*Leionema rotundifolium*						1		1
	Zieria aspalathoides subsp. aspalathoides						1		1
	Zieria compacta	2		1	1				4
	Zieria laevigata (sens. lat.)	1			1				2
Santalaceae	*Choretum candolei*				1				1
Sapindaceae	*Dodonaea falcata*			2			1		3
	Dodonaea triquetra						1		1
	Dodonaea viscosa subsp. spatulata		1	1	1				3
	Dodonaea viscosa var. angustifolia	1		1	1				3
Scrophulariaceae	*Undetermined Herb (DGF8024+DJS)*			1					1
Scropulariaceae	*Veronica plebeia*					2			2
Sinopteridaceae	*Cheilanthes distans*	1		1					2
	Cheilanthes sieberi subsp. sieberi	4	1	3	2	4			14
Solanaceae	*Datura ferox**							1	1
	*Datura stramonium**							1	1
	Solanum sp. (sterile indetermined)			1					1

FAMILY	SPECIES[10]	13.3.1	13.3.1x	13.12.5	13.12.6	13.12.8	H'Recs	Non-Rem	Total Survey Records
Sterculiaceae	*Brachychiton populneus subsp. populneus*						1		1
Stylidiaceae	*Stylidium graminifolium*	1			2				3
	Stylidium laricifolium				1	1			2
Thymeliaceae	*Pimelea neoanglica*	6	1	3		1			11
Typhaceae	*Typha domingensis*	2							2
Urticaceae	*Urtica urens**							1	1
Verbenaceae	*Verbena bonariensis**	6	1		1	1			10
	*Verbena incompta**				2			1	1
Xanthorrhoeaceae	*Xanthorrhoea johnstonii*	2		3	1	1			7
Xyridaceae	*Xyris complanata*						1		1
Undetermined	*Undet Herb (DGF 7934+DJS)*			1					1
	Undetermined Herb (DGF7938+DJS)			1					1
	Undetermined Herb (DGF7959a+DJS)				1				1
	Undetermined herb (DGF8020+DJS)	1							1
Total Records		309	52	177	105	182	57	17	908

Appendix B. Essential Habitat



2003 REGIONAL ECOSYSTEM MAP

Based on 2003 Landsat TM imagery

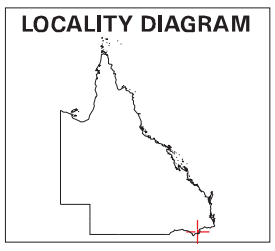
Requested By: ENVIROMAP@OPTUSNET.COM.AU
Date: 12 Dec 06 Time: 08.21.11

Centered on Lot on Plan:
2 RP55215

This is a copy of the certified regional ecosystem map defined by the map extent for the purpose of the *Vegetation Management Act 1999.* Areas of property maps of assessable vegetation (PMAVs) are not shown on this map.

Queensland Government

LOCALITY DIAGRAM



2000 0 2000 m

Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

2003 Remnant endangered regional ecosystem
- Dominant
- Sub-dominant

2003 Remnant of concern regional ecosystem
- Dominant
- Sub-dominant

2003 Remnant not of concern regional ecosystem

Non-remnant

Plantation Forest

Dam or Reservoir

2003 Remnant Vegetation Cover (RVC)

Vegetation Management Act Essential Habitat
Area identified as essential habitat by the EPA for a species of wildlife listed as endangered, vulnerable, near threatened or rare under the *Nature Conservation Act 1992.*
For further information on VMA Essential Habitat, please see the attached VMA Essential Habitat map.

Subject Lot

Certified Map Amendment area

Roads

Bioregion boundary

National Park, Conservation Area State Forest and other reserves

Cadastre line
The maximum spatial error of parcels extracted for this map from the Digital Cadastral Data Base(DCDB) range from: 14m to 251m at a 95% confidence level. Property boundaries shown are provided as a locational aid only.

Towns

Defined map areas are labelled with the regional ecosystem (RE) code along with the percentage breakdown if more than one RE occurs within the area. Detailed definitions of regional ecosystems are available from www.epa.qld.gov.au/REDD. Defined map areas smaller than 5ha may not be labelled.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/-100 metres. The extent of remnant regional ecosystems as of 2003, depicted on this map is based on rectified 2003 Landsat TM imagery (supplied by SLATS, Department of Natural Reources and Water).

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Natural Resources and Water, the Environmental Protection Agency and MapInfo Australia Pty Ltd, makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

All datasets are updated as they become available to provide the most current information as of the date shown on this map.

Additional information is required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.nrw.qld.gov.au/vegetation or contact the Department of Natural Resources and Water.

Digital regional ecosystem data is available in shapefile format, for Lot on Plans from www.epa.qld.gov.au/REDATA or from the Queensland Herbarium for larger areas.
Email: regional.ecosystem@epa.qld.gov.au

Appendix C. Survey Locations and Effort

Vegetation Survey Site Locations[11].

Vegetation Survey Site No.	Survey Effort	Location	
		Latitude	Longitude
Dam inundation area			
ES1	Secondary	0385127	6819004
ES2	Secondary	0385120	6818888
EQ3	Secondary	0385378	6819133
ES4	Secondary	0385366	6819324
ES5	Secondary	0385171	6819142
ES6	Secondary	0384501	6819536
EQ7	Quaternary	0384470	6819566
ES8	Secondary	0386347	6818813
ES9	Secondary	0386271	6818867
ES10	Secondary	0386240	6818913
EQ11	Quaternary	0386162	6918862
EQ12	Quaternary	0386134	6918891
EQ13	Quaternary	0386163	6918935
EQ14	Quaternary	0385041	6919083
ES15	Secondary	0386022	6819223
EQ16	Quaternary	0386090	6919116
ES17	Secondary	0386180	6819098
EQ18	Quaternary	0386388	6819042
EQ19	Quaternary	0386399	6919217
EQ20	Quaternary	0386310	6819371
EQ21	Quaternary	0386067	6819520
EQ22	Quaternary	0385991	6819545
EQ23	Quaternary	0388785	6818779
ES24	Secondary	0388623	6818743
EQ25	Quaternary	0388390	6818821
ES26	Secondary	0388217	6818947
EQ27	Quaternary	0388298	6818674
EQ28	Quaternary	0387155	6818002
EQ29	Quaternary	0386801	6818326
EQ30	Quaternary	0386733	6818450
EQ31	Quaternary	0386879	6818489
EQ32	Quaternary	0386900	6818379
EQ32a	Quaternary	0386907	6818379
EQ33	Quaternary	0386978	6818189
EQ34	Quaternary	0387470	6818336
EQ35	Quaternary	0387544	6818353
EQ36	Quaternary	0387503	6818219
EQ37	Quaternary	0387514	6818090
EQ38	Quaternary	0385265	6819335
EQ39	Quaternary	0385229	6819155
EQ40	Quaternary	0385975	6819313
EQ41	Quaternary	0385864	6818979

[11] Map Datum GDA94 and locations recorded on Garmin GPS.

EWQ42	Quaternary (1ha search area)	0385158	6819129
EWQ43	Quaternary (1ha search area)	0385210	6818979
EWS44	Secondary (1ha search area)	0385640	6819299
EWS45	Secondary (1ha search area)	0385825	6819502
EWS46	Secondary (1ha search area)	0386063	6818921
EWQ47	Quaternary (1ha search area)	0388695	6818740
EWQ48	Quaternary (1ha search area)	0388639	6818767
Pipeline Supply Corridor			
EPQ1	Quaternary	0384815	6818384
EPQ2	Quaternary	0384849	6818344
EPQ3	Quaternary	0386045	6818591
EPQ4	Quaternary	0386130	6918580
EPQ5	Quaternary	0386768	6817719
EPQ6	Quaternary	0386793	6817896
EPQ7	Quaternary	0388962	6018156
EPQ8	Quaternary	0389125	6818183
EPQ9	Quaternary	0389105	6818298
EPQ10	Quaternary	0385249	6818371
EPQ11	Quaternary	0386227	6818530
EPQ12	Quaternary	0387627	6817402
EPQ13	Quaternary	0388098	6817433
EPQ14	Quaternary	0388601	6817375
EPQ15	Quaternary	0388417	6817393
EPQ16	Quaternary	0388738	6817325
EPQ17	Quaternary	0389285	6818594
EPQ18	Quaternary	0389355	6818618
EPQ19	Quaternary	0389397	6818719
EPQ20	Quaternary	0390093	6819950
EPQ21	Quaternary	0390904	6821154
EPQ22	Quaternary	0391303	68121827
EPQ23	Quaternary	0397157	6428746
EPQ24	Quaternary	0397140	6828746
EPQ25	Quaternary	0397051	6828670
EPQ26	Quaternary	0397017	6828575
EPQ27	Quaternary	0396215	6827765
EPQ28	Quaternary	0395142	6827770
EPQ29	Quaternary	0384925	6827418
EPQ30	Quaternary	0394945	6827114
EPQ31	Quaternary	0394916	6826751
EPQ32	Quaternary	0394683	6826730
EPQ33	Quaternary	0394416	6826556
EPQ34	Quaternary	0394505	6826650
EPQ35	Quaternary	0394026	6826476
EPQ36	Quaternary	0393934	6826419
EPQ37	Quaternary	0393761	6826261
EPQ38	Quaternary	0393351	6825700
EPQ39	Quaternary	0393232	6825277
EPQ40	Quaternary	0393173	6825094
EPQ41	Quaternary	0392104	6822928
EPQ42	Quaternary	0392172	6822922
Road Re-alignment Corridor			
ERQ1	Quaternary	0389750	6893000

ERQ2	Quaternary	0383917	6818877
ERQ3	Quaternary	0383888	6818923
ERS4	Secondary	0383863	6818950
ERS5	Secondary	0383825	6819021
ERQ6	Quaternary	0383856	6819174
ERQ7	Quaternary	0383785	6818977
ERQ8	Quaternary	0383841	6819075
ERT9	Tertiary	0386271	6818867
ERQ10	Quaternary	0386240	6818913

Appendix D. Quaternary Site Data-Irrigation Network

Irrigation Network - Quaternary site data

Site No	Easting	Northing	Structure	Canopy Species	Sub-canopy shrubs	Weeds	Geology	RE	Photo
STQ1	392036	6813570	Open forest	*E. bridgesiana (d), E youmanii (o),*		Love Grass	Gently sloping granite loam plain	13.12.9	110, 111
STQ2	391708	6813329	Open forest	*E. bridgesiana (d), E youmanii (o),*		Love Grass	Gently sloping granite loam plain	13.12.9	
STQ3	391439	6813192	Woodland	*E. youmannii (o), E. prava (o), E. Melliodora(o), Angophora floribunda(o)*		Love Grass	Gently sloping granite loam plain	13.12.9	112, 113
STQ4	390055	6813013	Open forest	*E. youmannii (o), Angophora floribunda (o), E. blakelyi (o)*		Love Grass	Gently sloping granite loam plain	13.12.9	114
STQ5	389545	6813050	Woodland	*E.blakelyi (f), E. melliodora (o), Callitris endlicherii (d-subcanopy)*		Love Grass	Granite loam plain passing to rock mound	13.12.9	
STQ6	389016	6814353	Woodland	*E.bridgesiana (o)*		Love Grass	Granite loam plain passing to rock mound	13.12.8	115
STQ6a	388941	6814307	Woodland	*E.melliodora (a), E. youmanii (d), E. prava (d), Calltris endlicherii (d-subcanopy)*		Love Grass	Gently sloping granite loam plain	13.12.9	
STQ7	388669	6814164	Woodland	*E. youmanii (d), Angophora floribunda*		Love Grass	Granite rock mound	13.12.5	
STQ8	388565	6814092	Woodland	*E. melliodora (a), E. blakelyi (o), Angophora woodsiana (o)*		Love Grass	Gently sloping granite loam plain	13.12.9	
STQ9	388767	6813846	Woodland	*E. youmanii (d), E.prava (o), Callitris endlicherii (d-sub-canopy)*		Love Grass	Granite knoll passing into sloping loam plain	13.12.5	116
STQ10	388949	6813746	Woodland	*E.melliodora (a), E. prava (o), Callitris endlicherii (d-sub-canopy)*		NR	Gentle granite slope	13.12.9	
STQ11	388941	6813557	Woodland	*E. melliodora (a), E. costata (ironbark collected-o), Angophora woodsiana*		NR	Granite knoll passing into sloping loam plain	13.12.9	117
STQ12	389001	6813428	Woodland	*E. melliodora (a), Angophora floribunda (o), Callitris endlicherii (d-sub-canopy)*		NR	Granite loam plain with outcropping boulders	13.12.9	118
STQ13	389189	6813328	Woodland	*E. melliodora (f), Angophora floribunda (o), E. prava (o), Callitris endlicherii (d-sub-canopy)*		NR	Granite loam plain	13.12.9	
STQ14	389375	6813285	Woodland	*E. melliodora (ff), Angophora woodsiana*		NR	Granite loam plain		
WQ1	389252	6813292	Cleared			*Opuntia stricta* (class 3)			
STQ15	389227	6816212	Woodland (fire	*E. melliodora (o), Callitris endlicherii*	*Acacia neriifolia*	NR	Granite footslope	13.12.5??	120

Site No	Easting	Northing	Structure	Canopy Species	Sub-canopy shrubs	Weeds	Geology	RE	Photo
			degraded)	*(o-dead), Brachichiton populneus (o)*					
STQ16a	389214	6816321	Woodland	*E.melliodora (f), Angophora woodsiana (o), Brachychiton populneus (o), Callitris endlicherii (f-sub-canopy)*		NR	Granite footslope with rocky knolls	13.12.9	121
STQ17	389228	6816682	Woodland	*E. melliodora (o), Angophora woodsiana (o)*		Love grass	Granite loam plain	13.12.9	122
STQ18	389269	6817315	Tall Open Forest	*E. blakelyi (d)*		Love Grass	Alluvial flood plain	13.3.1	123
STQ19	385060	6823614	Woodland	*E. calignosa (f). E. melliodora (o)*		Love Grass	Granite Loam Plain	13.12.9	124
STQ20	385093	6823617	Tall Open Forest	*E. youmanii (f), E. calignosa (f)*		NR	Rock pavement mixed with granite loam plain	13.12.5	
STQ21	385154	6823572	Tall Open Forest	*E. calignosa (f), E. calignosa (o)*		NR	Granite loam plain	13.12.9	
STQ21a	385295	6823571	Tall Open Forest	*E. calignosa (f), E. calignosa (o)*		Love Grass	Granite loam plain	13.12.9	
STQ22	385399	6823635	Tall Open Forest	*E. melliodora (f), E. calignosa*		NR	Granite loam plain	13.12.9	
STQ23	385763	6823513	Tall Open Forest	*E. calignosa (f), E. calignosa (o)*		NR	Granite loam plain	13.12.9	
STQ24	385779	6823321	Tall Open Forest	*E. melliodora (f), E. calignosa (o), E. bridgesiana*		NR	Granite loam plain	13.12.9	
STQ25	385816	6823171	woodland	*E. calignosa (f), E. prava (o),*		NR	Granite loam plain	13.12.5	
STQ26	385766	6823072	Woodland	*E. calignosa (f), E. prava (o),*	*Leptospermum brevipes*	NR	Granite loam plain	13.12.5	
STQ27	385692	6822873	Open forest	*E. calignosa, E. bridgesiana (o)*	*Acacia neriifolia, Dodonea triquetra*	NR	Granite loam plain with outcropping boulders	13.12.5	
STQ28	385592	6822686	Open forest	*E. calignosa (f), E. prava (f),*		NR	Granite loam plain with outcropping boulders	13.12.5	132
STQ29			Woodland	*E. youmanii (f), E. prava (f)*		NR	Granite Boulder Pile	13.12.5	
STQ30	385745	6822300	Woodland	*E. andrewsii (f), E.prava (f)*		NR	Granite Boulder Pile	13.12.2	
STQ31	385768	6822326	Tall Open Forest	*E. melliodora (f), E. bridgesiana (o), Angophora floribunda (o)*		NR	Granite outwash	13.12.9	133
STQ32	385766	6822227	Woodland	*E. andrewsii (f), Callitris endlicherii (f), E.prava (f)*		NR	Granite Boulder Pile	13.12.2	
STQ33	385993	6822134	Woodland	*E. andrewsii (f), Callitris endlicherii (f)*		NR	Granite Boulder Pile	13.12.2	
STQ34	386246	6822154	Tall Open Forest	*E. blakelyi (d), Angophora floribunda (o)*		NR	Granite outwash plain	13.12.8	
STQ35	386446	6822168	Woodland	*E. youmanii (f), Angophora floribunda (o), Callitris endlicherii (d-sub-canopy)*		NR	Loamy granite plain with outcropping granite boulders	13.12.5	
STQ36	386629	6822126	Woodland	*E. melliodora (f), Angophora floribunda (o)*		NR	Granite outwash plain	13.12.9	
STQ37	386914	6822156	Woodland	*E. melliodora (f), Angophora floribunda (o), E. youmanii (o)*		NR	Granite loam plain with outcropping pavement	13.2.9	135
STQ38	387196	6822116	Woodland	*E. youmanii (a), E. melliodora (o)*		NR	Granite slope with scattered boulders	13.12.5	
STQ39	387619	6821685	Woodland	*E. melliodora, Angophora floribunda*	*Acacia spp.,*	NR	Granite loamy plain	13.12.9	

Site No	Easting	Northing	Structure	Canopy Species	Sub-canopy shrubs	Weeds	Geology	RE	Photo
			(heavily degraded)		*Jacksonia thoesioides*				
STQ40	386431	6821065	Woodland (non-remnant)	*E. blakelyi, E. bridgesiana*		Love Grass, Coriopsis	Granite loam plain	Non-remnant	
STQ41	389016	6820617	Woodland	*E. blakelyi*		NR	Granite loam plain	13.12.8	
STQ42a	389193	6820505	Woodland	*E. melliodora*		NR	Granite loam plain	13.12.9	
STQ42	393845	6830901	Woodland	*E. andrewsii, Angophora floribunda*		NR	Granite pavement	13.12.2	
STQ42b	393845	6830841	Shrubland	*E. youmanii, E. andrewsii*		NR	Granite loam plain	Non-remnant	
STQ43	393844	6830895	Woodland/shrubland (non-remnant)	*E. bridgesiana (o)*		Opuntia stricta (class 3)	Granite loam plain	Non-remnant	
STQ44	393481	6631007	Woodland	*E. bridgesiana, E. melliodora*		NR	Granite loam plain	13.12.9	
STQ45	392856	6831110	Regrowth woodland-non remnant	*E. bridgesiana, Callitris endlicherii, Acacia neriifolia, Eucalyptus youmanii*			Rocky granite slope	Non-remnant	
STQ46	393084	6831071	Open forest (heavily disturbed)	*E. bridgesiana, E.melliodora*		NR	Rocky granite slope	13.12.9	
STQ47	392839	6831119	Tall woodland	*E. melliodora*		Love grass	Rocky granite slope	13.12.9	
STQ48	392775	6831106	Woodland	*E. andrewsii*		NR	Rock pavement/granite knoll	13.12.2	
STQ49	392555	6831108	Open forest	*E. andrewsii, Angophora floribunda, E. youmanii*		NR	Granite plain with outcropping boulders	13.12.2	
STQ50			Woodland(non-remnant)	*E. youmanii, E. andrewsii*		NR	Granite plain with outcropping boulders	Non-remnant	
STQ51	393618	6831035	Open Forest	*E. bridgesiana (f), E. calignos, E. melliodora(f)*		NR	Granite loamy plain	13.12.9	
STQ52	390590	6832026	Tall Open Forest	*E.bridgesiana (d), Stringybark (sp ??)*		NR	Granite loam plain	13.12.9	
STQ53	390239	6832006	Tall Open Forest	*E. nova-anglica (d)*	*Leptospermum brevipes, Acacia app., Banksia integrifolia*	Rose Bramble, Blackberry	Alluvial flood plain	13.3.1	
STQ54	390196	6832009	Sedgeland	*Phragmites australis, Rose Bramble, Blackberry*		Rose Bramble, Blackberry	Alluvial flood plain/swamp	13.3.1x1	143
STQ55	390139	6832016	Woodland	*E. bridgesiana(d)*	*Leptospermum brevipes*	NR	Alluvial flood plain	13.3.1	
STQ56	390115	6832202	Woodland	*E. bridgesiana(d)*		NR	Alluvial flood plain	13.3.1	144
STQ57	390178	6832363	Woodland	*E.bridgesiana(d)*		NR	Rocky granite slope	13.12.9	
STQ58	390288	6832626	Woodland	*E.bridgesiana(d), E. calignosa(?)*	*Acacia dominant*	NR	Alluvial flood plain	13.3.1	
STQ59	390288	6832626	Woodland (non-remnant)	*E.bridgesiana*		Blackberry	Granite Rock mound/slope	Non-remnant	
STQ60	390303	6832819	Open forest	*E.bridgesiana (d), E. novo-anglica(-f), Angophora floribunda*		NR	Gentle slope on granite loam	13.12.8	
STQ61	390136	6833183	Woodland	*E. melliodora (d), E.youmanii (o)*		*Opuntia stricta* (class 3)	Gentle slope on granite loam	13.12.9	145
STQ62	390237	6833480	Woodland	*E. melliodora (d), E.youmanii (o), E.*		NR	Gentle slope on granite	13.12.9	

Site No	Easting	Northing	Structure	Canopy Species	Sub-canopy shrubs	Weeds	Geology	RE	Photo
				bridgesiana ®			loam		
STQ63a	390253	6834344	Tall Open Forest	*E. nova-anglica (d), E. melliodora (o)*		NR	Gentle slope on granite loam (outcropping rocks)	13.12.9	
STQ64	390250	6834229	Tall Open Forest	*E. melliodora (d)*		NR	Granite loam Plain	13.12.9	
STQ65	389833	6835391	Woodland	*E. nova-anglica*		NR	Granite loam plain	13.12.9	
STQ66	389668	6836189	Woodland (non-remnant)	*E. blakelyi*		NR	Granite loam plain	Non-remnant	
STQ68	389583	6836599	Woodland	*E.blakelyi (f), E. melliodora (o), E. nova-anglica*		NR	Granite loam plain	13.12.8	146
STQ69	389557	6836741	Woodland	*E. blakelyi (f), E. melliodora (o)*		NR	Granite loam plain	13.12.8	
STQ70	389143	6837151	Woodland (heavily degraded)	*E. blakelyi*		NR	Granite loam plain	13.12.8	
STQ71	389102	6837224	Woodland	*E. blakelyi (a), E. nova-anglica*		NR	Granite loam plain	13.2.8	147
STQ72	387170	6838392	Woodland	*E. nova-anglica, E. blakelyi (o)*		NR	Granite pavement	13.12.5	
STQ73	388934	6387540	Woodland	*E. blakelyi (a), E. nova-anglica*		NR	Granite loam plain	13.12.9	
STQ74	388142	6837736	Woodland	*E.bridgesiana (a), E. blakelyi*		NR	Granite loam plain	13.2.8	
STQ77	386781	6838626	Woodland	*E. nova-anglica (f), E. bridgesiana (o)*		NR	Granite rock pavement	13.12.5	
STQ78	386781	6838626	Woodland	*E. melliodora (f), E. calignosa, E. bridgesiana (o)*		NR	Granite loam plain	13.12.9	
STQ79	385231	6836936	Woodland	*E. youmanii (f), E.melliodora (o)*		NR	Granite pavement	13.12.5	
STQ80	385213	6836836	Tall woodland	*E. calignosa (f), E, melliodora (o)*		NR	Granite loam plain between rock outcrops	13.12.9	
STQ81	385126	6836277	Tall woodland	*E. calignosa (f), E, melliodora (o)*		NR	Granite pavement	13.12.5	
STQ82	385066	6836011	Cleared	*Cleared*	*Cleared*	NR	Cleared	Cleared	
STQ83	384604	6835763	Woodland (regrowth)	*Acacia spp, Callitris endlicherii*		NR	Granite loam plain	non-remnant	
STQ84	382202	6837685	shrubland (non-remnant)	*E. blakelyi, Jacksonia thesioides*		NR	Granite loam plain between rock outcrops	Non-remnant	
STQ85			Plantation	Plantation	*Plantation*	Plantation	Plantation	Plantation	
STQ86	382360	6837661	Shrubland (non-remnant)			*Opuntia stricta* (class 3)	Granite loam plain with outcropping pavement	Non-remnant	
STQ87	382394	6837619	Shrubland (non-remnant)			*Opuntia stricta* (class 3)	Granite loam plain	Non-remnant	149
STQ88	383102	6837350	Woodland (non-remnant)	*E. blakelyi*		NR	Granite loam plain	Non-remnant	
STQ89	389907	6835904	Woodland (non-remnant)	*E. blakelyi*		NR	Gently sloping granite loam plain	non-remnant	150
STQ90	390385	6836514	Open forest	*E.blakelyi (f), E.bridgesiana*		NR	Gently sloping granite loam plain	13.12.8	151
STQ91	390517	6836519	Open forest	*E. melliodora (f), E. youmanii (o)*		NR	Granite loam plain with outcropping pavement	13.12.9	152
STQ92	390676	6836502	Open forest	*E. calignosa, E.bridgesiana (o), E. youmanii*		NR	Gently sloping granite loam plain	13.12.5	153

Site No	Easting	Northing	Structure	Canopy Species	Sub-canopy shrubs	Weeds	Geology	RE	Photo
STQ93	390941	6836453	Open forest	*E. youmanii (f), E.melliodora (f)*		NR	Granite loam plain with outcropping pavement	13.12.9	156
STQ94	391103	6836454	Open forest	*E. melliodora (d)*		NR	Gently sloping granite loam plain	13.12.9	
STQ95	391127	6836452	Open forest	*E.youmanii (d)*		NR	Granite pavement	13.12.5	159
STQ96	391303	6836431	Open forest	*E. calignosa (d), E. melliodora (o), E. bridgesiana (o)*		NR	Granite loam plain	13.12.9	
STQ97	391426	6836418	Open forest	*E. bridgesiana (d), E. calignosa (o)*		NR	Granite loam plain with outcropping boulders	13.12.8	161
STQ98	391539	6836491	Open forest	*E. bridgesiana, E. blakelyi*	*Leptospermum brachyandrum*	NR	Alluvial flood plain	13.3.1	162
STQ99	391594	6836533	Woodland	*E. blakelyi (d)*		NR	Gently sloping granite loam plain	13.12.8	163, 164
STQ100	391687	6836554	Open forest	*E. calignosa (d) E. bridgesiana (o)*		NR	Gently sloping granite loam plain	13.12.9	165
STQ101	391906	6836621	Open forest	*E. calignosa (d) E. bridgesiana (o)*		NR	Gently sloping granite loam plain (with occasional pavements)	13.12.9	
STQ102	392316	6836569	Woodland	*E.blakelyi (f), E.bridgesiana (o) E. calignosa (f)*		NR	Gently sloping granite loam plain	13.12.8	
STQ103	392517	6936517	Shrubland	*Callitris endlicherii (d), Eucalyptus prava (o)*		NR	Granite escarpment	13.12.6	170
STQ104	392517	6936534	Woodland	*E. youmanii (d), Angophora floribunda*		NR	Granite loam	13.12.5	171
STQ105	392624	6836484	Woodland	*Callitris endlicherii (d), Eucalyptus prava (o), Eucalyptus youmanii*		NR	Granite pavement	13.12.6	173
STQ106	392712	6836376	Shrubland	*Callitris endlicherii (d), Eucalyptus prava (e)*		NR	Granite pavement	13.12.6	
STQ107	393372	6836409	Woodland	*E. youmanii (d), E.melliodora (o)*	*Callitris endlicherii*	NR	Granite pavement	13.12.5	
STQ108	363637	6836408	Woodland	*E.melliodora (f), Angophora floribunda (o)*		NR	Granite loam plain with outcropping boulders	13.12.9	
STQ109	394132	6836275	Woodland	*E. andrewsii (f), Callitris endlicheri*	*Callitris endlicherii*	NR	Granite pavement	13.12.2	
STQ110	394307	6036231	Woodland	*E. andrewsii (f), E.melliodora (o) Callitris endlicheri (o)*	*Callitris endlicherii*	Bryophyllum	Granite pavement	13.12.2	
STQ111	388738	5817192	Open forest	*E. melliodora (f)*		NR	Granite loam soils	13.12.9	
STQ112	388397	6816799	Tall woodland	*E. calignosa (f)*		NR	Granite loam soil	13.12.9	
STQ112 a	388738	5817192	Tall woodland	*E.melliodora (o), E. calignosa*		NR	Granite loam soils	13.12.9	
STQ113	387803	6816069	Shrubland	*Callitris endlicherii (d), E. melliodora (o)*		NR	Granite loam	13.12.6	
STQ114	387489	6815675	Woodland (non-remnant)	*E.bridgesiana (f), E.blakelyi (f)*		NR	Granite loam	Non-remnant	
STQ115	386651	6814509	Woodland	*E. blakelyi (f), E. bridgesiana (o),*	*Callitris*	NR	Granite slope with scattered	13.12.8	

Site No	Easting	Northing	Structure	Canopy Species	Sub-canopy shrubs	Weeds	Geology	RE	Photo
				Angophora floribunda (o)	*endlicherii (d)*		boulders		
STQ116	387864	6814028	Woodland	*E. melliodora (f), E. blakelyi (o). Angophora floribunda (f)*		NR	Granite slope with scattered boulders	13.12.9	
STQ117	388249	6814104	Woodland	*E. blakelyi (f). E. melliodora (o), Callitris endlicherii (f), Angophora floribunda (o)*	*Callitris endlicherii*	NR	Granite slope with scattered boulders	13.12.8	
STQ118			Woodland	*E. blakelyi (f). E. melliodora (o), E. youmanii (o), Callitris endlicherii (f), Angophora floribunda (o)*		NR	Granite slope with scattered boulders	13.12.8	
STQ119	386974	6815160	Shrubland (non-remnant)	*Melaeuca williamsii, Acacia spp.*		Rose Bramble, Blackberry	Alluvial floodplain (swamp)	Non-remnant	175
STQ120	386996	6815133	Open forest	*Eucalyptus blakelyi (d)*	*Callitris endlicherii (d)*	Rose Bramble, Blackberry	Alluvial floodplain (swamp)	13.3.1	176
STQ121	384707	6832917	Woodland	*E. youmanii (f)*	*E.prava (f), Callitris endlicherii (a)*	NR	Granite pavement	13.12.5	
STQ122	384839	6832980	Tall woodland	*E. calignosa (f), E. blakelyi (o), Angophora floribunda (o)*		NR	Granite loam soils	13.12.9	177
STQ123	385225	6833561	Woodland	*E. andrewsii (f), E. youmanii, Angophora floribunda (o), E. melliodora (o)*		NR	Granite pavement	13.12.5	
STQ124	385506	6833780	Open forest	*E. andrewsii (f), E. youmanii, Angophora floribunda (o), E. melliodora (o)*	*Callitris endlicherii*	NR	Granite pavement	13.12.5	
STQ125	385652	6833844	Open forest	*E. blakelyi (f), Angophora floribunda (f)*		NR	Granite loam plain	13.12.8	
STQ125 a			Woodland	*E. andrewsii (a), E youmanii (f), Callitris endlicherii*		NR	Granite pavement	13.12.2	
STQ126	396018	6841429	Woodland (non-remnant)	*E. youmanii (d)*		NR	Granite pavement	Non-remnant	
STQ127	396011	6841446	Woodland (severely disturbed)	*E. blakelyi (f), E. youmanii (f)*		NR	Granite loam plain	Non-remnant	
STQ127 a	395850	6841463	Woodland (non-remnant)	*E. blakelyi (f), E. youmanii (f)*		NR	Granite loam plain	Non-remnant	
STQ128	393897	6842181	Woodland (non-remnant)	*E. prava (f), E. youmanii (f)*		NR	Granite loam plain	Non-remnant	
STQ129	394009	6842997	Woodland (non-remnant)	*Eucalyptus spp.*		NR	Granite loam plain	Non-remnant	
STQ130	395779	6843919	Woodland (non-remnant)	*Angophora floribunda (f), E.nova-anglica, E. bridgesiana*		NR	Granite loam plain	Non-remnant	
STQ131	395779	6843919	Plantation/shrubland	*Pinus.*		NR	Granite loam plain	Plantation	
STQ132	395952	6843894	Woodland (non-remnant)	*E. blakelyi (a), E.youmanii (f), E. bridgesiana*		Blackberry	Alluvial soils adjacent to drainage line	Non-remnant	

Site No	Easting	Northing	Structure	Canopy Species	Sub-canopy shrubs	Weeds	Geology	RE	Photo
STQ133	396687	6893784	Woodland (non-remnant)	*E. andrewsii*		NR	Granite loam plain	Non-remnant	
STQ134			Woodland (non-remnant)	*E. youmanii (f)*		NR	Granite loam plain	Non-remnant	
STQ135	396083	6844512	Woodland	*E. blakelyi (f), E. bridgesiana (o), E. youmanii (o)*		NR	Granite loam plain	Non-remnant	
STQ136	396109	6844749	Woodland (non-remnant)	*E. blakelyi, Leptospermum brevipes, Acacia spp.*		NR	Granite loam plain	Non-remnant	
STQ137	393004	6843961	Woodland (non-remnant)	*E. youmanii (f), E. blakelyi (o)*		NR	Granite Loam plain	Non-remnant	
STQ138	392653	6843822	Woodland (non-remnant)	*E.blakelyi, E. youmanii*		NR	Granite Loam plain	Non-remnant	
STQ139	392166	6843041	Woodland	*E. youmanii*	*Leptospermum brevipes, Acacia spp.*	Ligustrum sinense	Granite Loam plain	Non-remnant	
STQ140	391557	6942688	Woodland	*E. andrewsii (f), E. blakelyi, Acacia sp.*		NR	Granite rock pile	13.12.2	
STQ141	391093	6842740	Cleared	exotic spp		Japanese honeysuckle	Granite rock pavement	Cleared	181
STQ141a			Woodland	*E. andrewsii (d)*		NR	Granite rock pavement	13.12.2	
STQ142	391038	6842749	Woodland	*E. melliodora (d)*		NR	Granite loam plain with outcropping boulders	13.12.9	
STQ143	390099	6843231	Woodland	*E. blakelyi (f), E. bridgesiana, Angophora floribunda*		NR	Granite loam plain	13.12.8	182
STQ145			Woodland	*E. blakelyi (f), E. andrewsii (o)*		NR	Granite loam plain	13.12.8	
STQ146			Woodland (non) remnant	*E.blakelyi (f), Angophora floribunda*		NR	Granite loam plain with outcropping boulders	Non-remnant	183, 184
STQ147			Woodland (non-remnant)	*E. bridgesiana*		NR	Granite loam plain with outcropping boulders	Non-remnant	
STQ149	388960	6844512	Woodland (non-remnant)	*E. blakelyi*		NR	Granite loam plain	Non-remnant	
STQ150	394822	6841234	Woodland	*E.blakelyi (o), E. melliodora (o) (E.andrewsii on boulder piles)*		NR	Granite loam plain with outcropping boulders	13.12.9/13.12.5	
STQ151			Woodland (non-remnant)	*E.bridgesiana (f), E.blakelyi (f)*		NR	Granite loam plain	Non-remnant	
STQ153	394626	6839658	Woodland (non-remnant)	*E. melliodora, E.bridgesiana*		Opuntia stricta (class 3)	Granite loam plain surrounding boulder pile	Non-remnant	
STQ154	394906	6839533	Woodland	*E. youmanii (f), E. andrewsii (f), E. prava(o), Callitris endlicherii*		NR	Granite pavement	13.12.5	
STQ155	394995	6839496	Shrubland (riparian)	*Callsitemon sp, Acacia sp.*		NR	Granite pavement	13.3.1x1	
STQ156	395562	6839019	Cleared	*exotic spp.*		Japanese honeysuckle	Granite loam soils	Cleared	
STQ157	396474	6837106	Woodland	*E.blakelyi (f), E.melliodora (o)*		NR	Granite loam plain with	13.12.9	

Site No	Easting	Northing	Structure	Canopy Species	Sub-canopy shrubs	Weeds	Geology	RE	Photo
							outcropping boulders		
STQ158	396474	6837106	Woodland	*E. youmanii (f), E.andrewsii (o)*		NR	Granite rock pile	13.12.2	
STQ160	396452	6836880	Low Woodland (heavily degraded)	*E. bridgesiana (f), E. melliodora (o), Callitris endlicherii, Leptospermum brevipes*		NR	Granite rock pavement	13.12.5	
STQ163	395156	6837367	Low Woodland (heavily degraded)	*E. andrewsii (f), Callitris endlicherii*		NR	Granite pavement	13.12.2	
STQ164	394883	6935939	Woodland/shrubland complex	*E. nova-anglica*		NR	Granite pavement	13.12.6	
STQ165	394870	6835853	Tall Open Forest	*E. nova-anglica (f), E. youmanii*		NR	Granite loam plain with outcropping boulders	13.12.8	
STQ166	395564	6836115	Woodland	*E. youmanii (d), E. blakelyi (o), Callitris endlicherii*		NR	Granite loam plain with outcropping boulders	13.12.8	188
STQ167	398956	6832722	Woodland	*E. nova-anglica (d)*	*Calltris endlicherii, Jacksonia sp.*	NR	Granite Loam soils	13.12.8	
STQ168	398391	6832797	Woodland (heavily degraded)	*E. nova-anglica (d)*		NR	Alluvial flood plain	13.3.1	

Appendix E. Constraints and Mitigation Measures on the INW

Appendix E1. Floristic constraints on INW.

Constraint Point	Constraint	Vegetation Description/EVR Species Habitat	Vegetation Condition	Side of Road	Length of Constraint (m. approx)	Average Width of road side easement*
Road Sector 1 (Scotts Camp Road, Pradella Road, Amiens Rd (d), Prfunder Rd)						
1	Endangered RE 13.12.9	Medium *Eucalyptus blakelyi*, *Eucalyptus melliodora*, *Eucalyptus andrewsii* open forest.	Vegetation has been heavily degraded due to timber removal	South	200m	5m
1a	Endangered RE 13.12.9	Medium *Eucalyptus blakelyi*, *Eucalyptus melliodora*, *Eucalyptus andrewsii* open forest.	Vegetation has been heavily degraded due to timber removal	South	400m	5-10m
2	Endangered RE 13.12.8	Medium *Eucalyptus melliodora* woodland and open forest.	Vegetation is in moderate to good condition. Vegetation has retained native ground cover	South	100m	10m
Road Sector 2 (Pozieres Rd including Newlands Road)						
3	Population of *Grevillea scortechinii* subsp. *scortechinii* within road easement	Non–remnant shrubland/grassland in easement between roadside and Pinus plantation. Approx 50 individuals within 100m section of road verge.	Poor	North	300m	7m
4	*Grevillea scortechinii* subsp. *scortechinii* within road easement	Non–remnant grassland in easement between roadside and Pinus plantation. Single individual.	Poor	South	10m	3m
4a	*Boronia repanda*	HERBRECS records in non–remnant regrowth shrubland in easement between roadside and Pinus plantation. Not recorded in field survey. Population size unknown but suspected to be limited to scattered individuals.	Poor	Undetermined	Undetermined	Undetermined
Road Sector 3 (Gangemi, Amiens Rd C)						
No Major Constraints						
Road Sector 4 (Teale Rd)						
5	*Melaleuca williamsii*	2 shrubs approx. 10m from road edge on rock pavement along	Poor with infestation of Blackberry.	North	10m	3m

Constraint Point	Constraint	Vegetation Description/EVR Species Habitat	Vegetation Condition	Side of Road	Length of Constraint (m. approx)	Average Width of road side easement*
		degraded watercourse with Lomandra longifolia, Phragmites, Blackberry and Willow. Non-remnant riparian zone.				
Road Sector 5 (Church Road to Ellwood Road)						
			No Major Constraints			
Road Sector 6 (Rogers Road)						
6	RE 13.12.9	Medium *E. blakelyi, E. melliodora, E. bridgesiana* woodland on granite loam plain.	Moderate. Intact ground cover although community has been fragemented through partial clearing	East	500m	<3m
Road Sector 7 (Ellwood Rd, NEH, Aerodrome Rd)						
			No Major Constraints			
Road Sector 8 (NEH north of Stanthorpe)						
			No Major Constraints			
Road Sector 9 (Amiens Roads A)						
7	RE13.12.6 (of concern) -Rock pavement/shrubland community	Rock pavement shrubland with *Callitris endlicheri* and emergent *E. youmanii.*	Poor with invasion of Love Grass along roadside margins and fragmentation of adjacent habitats	South	50m	3
8	RE13.12.9	Tall *Eucalyptus bridgesiana +/- Eucalyptus blakelyi* woodland on gentle granite slope.	Moderate to good with minimal timber extraction and minor ween invasion into ground layers	North	300m	5
9	RE13.3.1/RE13.3.1x 1(Endangered-VMA,1999)	Tall *Eucalyptus bridgesiana* open forest on alluvial soils.	Moderate with well developed shrubby ground cover. *Rosa anglicans* has invaded the ground cover extending from flood channel	North	100	5
10	RE13.3.1/RE13.3.1x 1(Endangered-NCA)	Tall *Eucalyptus bridgesiana* open forest on alluvial soils.	Moderate with well developed shrubby ground cover. *Rosa anglicans* has invaded the ground cover extending from flood channel	South	100	3
Road Sector 10 (Canon Creek Road)						
11	RE13.12.8 (Endangered NCA, EPBC)	Medium *Eucalyptus bridgesiana, Eucalyptus melliodora +/_ E. novo-anglica +/- E. youmanii* woodland on granite footslopes.	Moderate to good. Native grass cover present within much of the community	East-North East	3000	3
12	RE13.12.9 (Endangered NCA, EPBC)	Medium *Eucalyptus blakelyi, E. melliodora* open forest on loamy granite plain.	Heavily disturbed. Minor fragmented remnant	East-North-East	500	3-5

Constraint Point	Constraint	Vegetation Description/EVR Species Habitat	Vegetation Condition	Side of Road	Length of Constraint (m. approx)	Average Width of road side easement*
13	RE13.12.9 (Endangered NCA, EPBC)	Medium *Eucalyptus blakelyi, E. melliodora* open forest on loamy granite plain.	Moderate. Community has been subject to extensive timber extraction although ground cover is in reasonable condition with a dominance of native species	West	300	7
14	RE13.12.9 (Endangered NCA, EPBC)	Tall open forest with *E. bridgesiana, E. blakelyi, E. melliodora* on loamy granite plain.	Moderate to poor. Community has been subject to extensive timber extraction. Ground cover is degraded in places with exotic spp.	East	400	7
Road Sector 11 (Bapaume Rd)						
15	RE13.12.8 (Endangered NCA, EPBC)	*Eucalyptus melliodora,* woodland, with scattered rock pavement.	Moderate. Community has been subject to extensive timber extraction. Ground cover comprises predominantly native grasses and shrubs. Separated from roadside by a buffer of non-remnant vegetation	West	100	15
16	RE13.12.8 (Endangered NCA, EPBC)	Tall *Eucalyptus bridgesiana, Eucalyptus melliodora, Eucalyptus youmanii* woodland on granite plain with scattered rock pavement.	Moderate. Community has been subject to extensive timber extraction. Ground cover comprises predominantly native grasses and shrubs	West	300	5
17	RE13.12.8 (Endangered NCA, EPBC)	Medium *Eucalyptus melliodora, Eucalyptus youmanii* woodland, with scattered rock pavement.	Moderate. Community has been subject to extensive timber extraction. Ground cover comprises predominantly native grasses and shrubs	East	500	5
17a**	RE13.12.8 (Endangered NCA, EPBC)	Medium *Eucalyptus melliodora, Eucalyptus youmanii* woodland.	*This community may have been cleared	East	500	Unconfirmed
Road Sector 12 (Swans Lane)						
18	13.3.1 (Endangered NCA, EPBC)	*Eucalyptus blakelyi +/- E. calignosa* woodland.	Moderate to poor. Ground cover has been heavily grazed	West	100	5
19	13.12.8 (Endangered -NCA)	Medium *Eucalyptus melliodora, Eucalyptus bridgesiana, Eucalyptus youmanii* woodland, with scattered rock pavement.	Moderate. Ground cover has retained native spp. Moderate timber extraction heavily grazed	West	1000	5
20	13.12.8 (Endangered –NCA, EPBC)	*Eucalyptus melliodora, Eucalyptus youmanii* woodland, with scattered *E. andrewsii* associated with rock pavement rock pavement.	Moderate. Ground cover has retained native spp. Moderate timber extraction heavily grazed	East	200	5

Constraint Point	Constraint	Vegetation Description/EVR Species Habitat	Vegetation Condition	Side of Road	Length of Constraint (m. approx)	Average Width of road side easement*
21	13.12.8 (Endangered NCA, EPBC)	*Eucalyptus melliodora, Eucalyptus youmanii* woodland, with scattered *E. andrewsii* associated with rock pavement rock pavement.	Moderate. Ground cover has retained native spp. Moderate timber extraction heavily grazed	East	200	5
Road Sector 13 (Amiens Rd B-Barracks Road)						
22	*Acacia latisepala* (Rare NCA)	Secondary shrubland on pavement margins of roadsides with *Acacia* spp., *Jacksonia scoparia, Leptospermum* spp. Large population.	Poor. Vegetation is regrowth from clearing	North & South	Point Locations	10
Road Sector 14 (New England Highway)						
23	*Acacia latisepala* (Rare NCA)	Secondary shrubland on disturbed non remnant margins of roadsides.	Poor. Vegetation is regrowth from clearing	West	Point Location	10
Road Sector 15 (Church Road to Ellwood Road)						
Town Water Supply Route						
Road Sector 16 (Stabiles Road – Black Creek Road)						
24	13.12.9 (Endangered-NCA)	Woodland with *E. conica, E. melliodora,* and *E. bridgesiana* on loamy granite plain with scattered rock outcrop.	Moderate to poor. Vegetation has been highly fragmented with extensive timber removal	North	100m	5-10
25	13.12.9 (Endangered-NCA)	Woodland with *E. conica, E. melliodora, E. bridgesiana* on loamy granite plain with scattered rock outcrop.	Moderate to poor. Vegetation has been highly fragmented with extensive timber removal.	North	150	5-10
Road Sector 17 (Mt Stirling Road East)						
26	13.12.8 (Endangered)	Medium *E. melliodora* woodland. Sub-canopy of native shrubs including *Jacksonia* sp, *Acacia* spp.	Moderate to poor with areas of heavy timber extraction.	North	150	5-10
27	13.12.8 (Endangered NCA, EPBC)	Tall *E. melliodora* woodland with canopy to 30m. Sub-canopy of native shrubs including *Jacksonia* sp, *Acacia* spp.	Moderate. Ground cover is native. Exotics in niche areas only. Moderate timber extraction.	South		5-10
28	13.12.9 (Endangered NCA-EPBC)	Medium *E. blakelyi* dominant woodland on gently sloping granite loam plain.	Moderate to poor. Ground cover has been heavily grazed and is in poor condition. Moderate timber extraction.	North		10+
Road Sector 18 (Mt Stirling Road West)						
29	13.12.8	Secondary woodland with *E.*	Poor. Community is borderline remnant	South	500	5

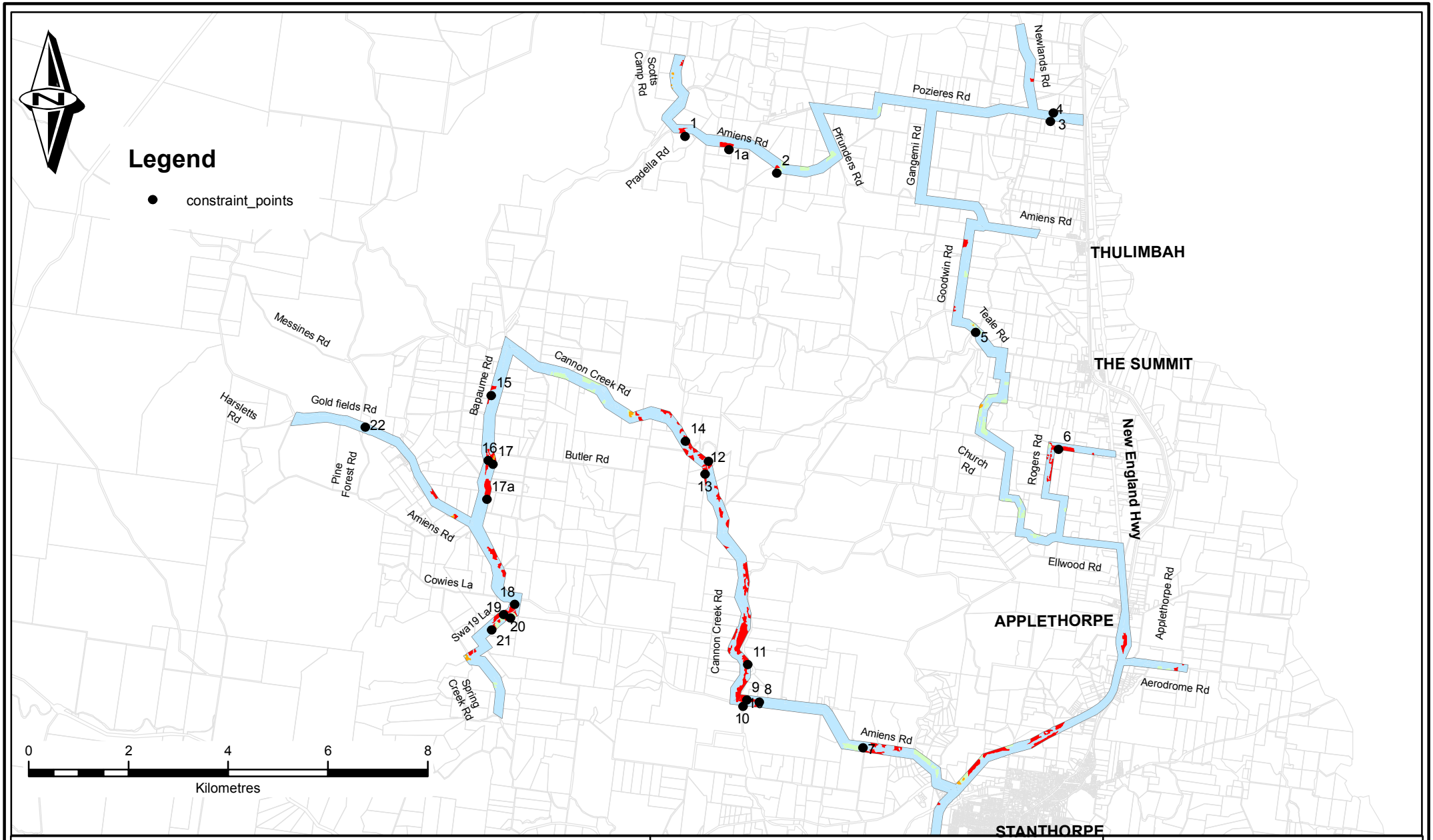
Constraint Point	Constraint	Vegetation Description/EVR Species Habitat	Vegetation Condition	Side of Road	Length of Constraint (m. approx)	Average Width of road side easement*
	(Endangered-NCA)	*melliodora, Angophora floribunda* with a dense shrubby layer.	with heavily degraded ground cover dominated by Love Grass			
30	13.12.8 (Endangered-NCA EPBC)	Woodland with *E. melliodora, E. youmanii floribunda* with a dense shrubby layer.	Moderate to poor. Community has suffered moderate timber extraction and exotic grass spp. (Love Grass) have penetrated community margins.	North	200	5-10
31	13.12.8 (Endangered – NCA, EPBC)	Woodland with *E. melliodora, E. youmanii floribunda* with a dense shrubby layer. Scattered rock pavements with *E. youmanii.*	Good. Shrubby understorey dominated by native species with native ground cover.	South	1200	3
32	13.3.1 (Endangered-NCA)	Tall open forest with *E. blakelyi* and well developed shrubby sub-canopy.	Good condition. Limited timber extraction and well developed native shrub layer and ground cover	South	150	5-10
33	*Acacia latisepala* (Rare NCA)	Secondary shrubland on pavement margins of roadsides with *Acacia* spp., *Jacksonia scoparia, Leptospermum* spp. Large population.	Non-remnant grassland on disturbed road margins.	West	Point	5-10
34	13.12.8 (Endangered NCA-EPBC)	Open forest with *E. melliodora, E. bridgesiana, E. youmanii, Angophora floribunda* Scattered rock pavements with *E. youmanii.* Colluvial granitic soils.	Good condition. Intact vegetation with native ground cover and limited disturbance.	East	100m	<3
35	13.12.8 (Endangered-NCA)	Tall open forest with *E. calignosa, E. melliodora, E. bridgesiana, Angophora floribunda.* Loamy granite plain. *E. youmanii floribunda* Scattered rock pavements with *E. youmanii.* Colluvial granitic soils.	Good condition. Moderately grazed and retains native ground cover. Minor timber extraction.	North East	700m	<3
36	13.12.8 (Endangered-NCA)	Tall open forest with *E. calignosa, E. melliodora, E. bridgesiana, Angophora floribunda.* Loamy granite plain. *E. youmanii floribunda* Scattered rock pavements with *E. youmanii.* Colluvial granitic soils.	Good condition. Moderately grazed and retains native ground cover. Minor timber extraction.	North-South (both sides)	700m	<3
Road Sector 20 (Horans Gorge Road)						

Constraint Point	Constraint	Vegetation Description/EVR Species Habitat	Vegetation Condition	Side of Road	Length of Constraint (m. approx)	Average Width of road side easement*
37	13.12.8 (Endangered-NCA, EPBC)	Medium to tall open forest with *E. melliodora, Angophora floribunda* on granite loam plain.	Good condition. Minor timber extraction. Native grassy ground cover with developing shrub layer.	East	250	5
38	13.12.8 (Endangered-NCA, EPBC)	Medium to tall open forest with *E. melliodora, Angophora floribunda* on granite loam plain.	Good condition. Minor timber extraction. Native grassy ground cover with developing shrub layer.	West	250	5
39	13.12.8 (Endangered-NCA, EBPC)	Medium to tall open forest with *E. melliodora, E. calignosa, E. blakelyi (E. youmanii* and *Callitris endlicheri* on rock pavements). Granite loam plain.	Moderate to poor condition. Heavy timber extraction and invasion of exotic species (love grass) into ground cover.	north	400	5-7m
Road Sector 21 (New England Highway-Ballandean Section)						
40	13.12.8 (Endangered)	Tall open forest with *E. calignosa, E. melliodora.* Granite slope with scattered rock pavement.	Good condition. Minor timber extraction. Native grassy ground cover well preserved.	West	1200	5
41	13.12.8 (Endangered)	Open forest *E. melliodora, E. blakelyi, E. youmanii.* Granite slope with scattered rock pavement.	Moderate to poor condition. Heavy timber extraction and invasion of exotic species (love grass) into ground cover.	East	1200	10
41a	*Acacia latisepala* (Rare NCA)	Secondary shrubland on pavement margins of adjacent to remnant RE13.12.9.	Moderate-disturbed margins of community	West	Point Location	5
42	*Melaleuca williamsii* (Vulnerable EPBC NCA)	Degraded riparian vegetation (non-remnant with Rose Bramble and *Acacia sp.*	Poor-dominated by exotics.	East	Point Location	10
43	*Melaleuca williamsii* (Vulnerable EPBC NCA)	Marginal to Open Forest with *E. blakelyi* on alluvial soils (RE13.3.1)	Poor on margins. Moderate in intact open forest.	West	Point Location	10
Road Sector 22 (Euki Road)						
44	13.12.8 (Endangered-NCA-EPBC)	Woodland with *E. melliodora, E. blakelyi, Angophora floribunda* with sub-canopy of *Callitris endlicheri.* Granite slope.	Good condition. Community has retained native ground cover with intact canopy structure	North	600	5-7 (with powerline easement)
45	13.12.9 /13.12.8 (Endangered –NCA, EPBC)	Woodland with *E. blakelyi, E. melliodora, Angophora floribunda* with sub-canopy of *Callitris*	Good condition. Community has retained native ground cover with intact canopy structure	South	300	<3

Constraint Point	Constraint	Vegetation Description/EVR Species Habitat	Vegetation Condition	Side of Road	Length of Constraint (m. approx)	Average Width of road side easement*
		endlicheri. Rocky granite slope.				
46	13.12.8 (Endangered)	Woodland with *E. melliodora, E. youmanii, Angophora floribunda, E. blakelyi* with sub-canopy of *Callitris endlicheri.* Granite loamy plain.	Moderate condition. Native ground cover intact although community has suffered from some timber extraction	North	400	3-5
47	13.12.8	Woodland with *E. melliodora, E. youmanii, Angophora floribunda, E. blakelyi* with sub-canopy of *Callitris endlicheri.* Granite loamy plain.	Good condition. Native ground cover intact. Minor timber extraction	North	150	5-10
48	13.12.8 (Endangered)	Woodland with *E. melliodora, E. youmanii, Angophora floribunda, E. blakelyi* with sub-canopy of *Callitris endlicheri.* Granite loamy plain.	Good condition. Native ground cover intact. Minor timber extraction	South	500	5
49	13.12.8 (Endangered)	Woodland with *E. melliodora, E. youmanii, Angophora floribunda, Callitris endlicheri.* Granite loamy plain with minor granite pavement	Good condition. Native ground cover intact. Minor timber extraction	North	400	5-10m >10m in places
50	13.12.8 (Endangered)	Woodland with *E. bridgesiana, E. youmanii, E. melliodora, Angophora floribunda, E. prava.* Minor E. *blakelyi.* Granite loamy plain.	Good condition. Native ground cover intact. Minor timber extraction	South	800	<3

** Indicates distance between roadside and adjacent vegetation. EVR species may be present within this easement.*

*** Indicates vegetation community that may have been cleared post aerial photograph capture.*



N O T E S:

(i) This plan has been produced for exclusive use of the client and **3D Environmental**

(ii) Aerial photography has been registered as a best fit on the boundaries shown and position is approximate only.

(iii) Vegetation data captured has beed capture at aerial photography scale and as such should not be used at a scale greater thanthe aerial photography scale.

Aerial Photography scale 1:37,500

Figure E2a: Constraint Points (North)

Client Stanthorpe Shire Council

3D Environmental
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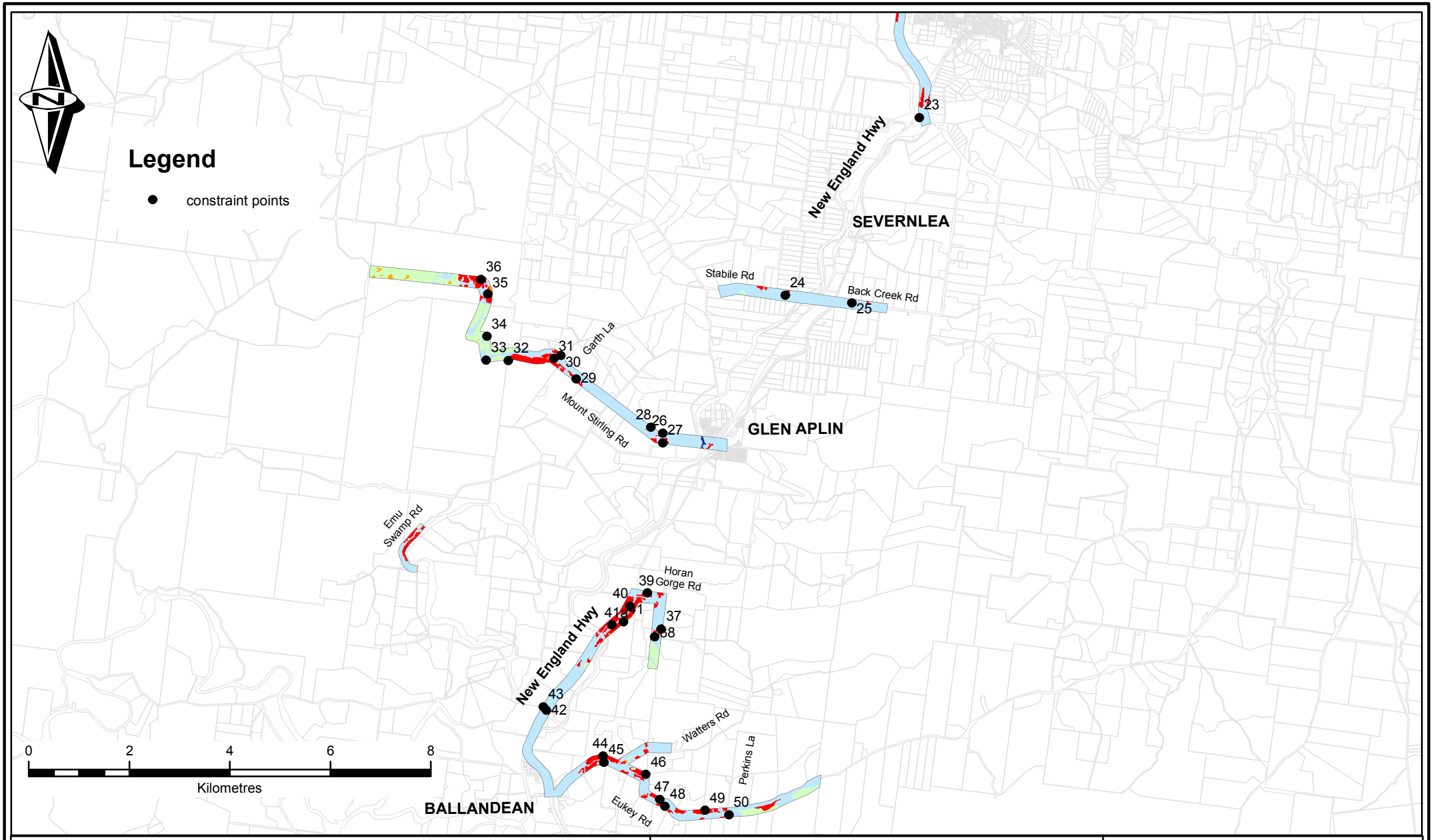
Scale 1:101,025	**Drawn By** DG	**Checked** DS	**File Path** C:\3denvironmental\SIA\si_veg_a3l	**Date** 11/09/07	A3



N O T E S:

(i) This plan has been produced for exclusive use of the client and **3D Environmental**

(ii) Aerial photography has been registered as a best fit on the boundaries shown and position is approximate only.

(iii) Vegetation data captured has beed capture at aerial photography scale and as such should not be used at a scale greater thanthe aerial photography scale.

Aerial Photography scale 1:37,500

Figure E2b: Constraint Locations (South)

Client Stanthorpe Shire Council

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Scale 1:100,256	**Drawn By** DG	**Checked** DS	**File Path** C:\3denvironmental\SIA\si_veg_a3l	**Date** 11/09/07	A3

Appendix E2- Mitigation Measures on the INW

The following section presents recommendations to mitigate impacts to significant regional ecosystems and species incurred during construction of the Town Water Supply Pipeline. Mitigation measures relate largely to avoidance, although in some areas, impacts to significant vegetation communities and plant species will be inevitable. Appendix E2 is divided into two sections with a preliminary section providing a brief outline of preferred route alignments followed by details of potential mitigation measures at specific CP's identified in the study.

Suggested Route Alignments

The following section presents brief commentary on each of the individual potential corridor alignments where significant floristic constraints have been identified. A preferred construction corridor is identified relating largely to position on roadside, recognizing the requirements to balance floristic impact with impacts to infrastructure including roads and public facility. Continual roadside crossing in an attempt to eliminate floristic impact has not been considered as a viable option, recognizing only the least constrained path.

Sector 1 (Scotts Camp Road, Pradella Road, Amiens Rd (d), Prfunder Rd): Location of pipeline on the north side of Amiens Road (D) will minimise impacts to significant RE's at CPs 1,1a & 2. Alternatively pipeline construction should be restricted to the road side easements (5m) that provide buffer to these communities. The east side of Pradella and Scotts Camp Roads is preferential as this will limit potential sedimentation of the adjacent creek.

Sector 2 (Pozieres Rd including Newlands Road): A major population of *Grevillea scortechinii* subsp. *scortechinii* is located on the north side of Pozieres Road (CP3) with scattered individuals of this species located on the south side (CP4). Additionally Herbarium records of the endangered *Boronia repanda* on Pozieres Road were not located during the field survey and pose a constraint to this sector. Analysis of location data suggest that a few individuals may occur on north side of road in the same habitat as the Grevillea. Until detailed surveys are carried out an accurate knowledge of the population is speculative. Construction on the south side of Pozieres Road, in conjunction with propagation of genetic stock, and as a lasr resort, translocation of individual specimens on the finalised alignment, will limit impacts to this species however should be guided by a Species Management Plan. It should be noted that the roadside easement and drain is very narrow on the south side of the road and this will be a limiting factor. Alternative strategies might involve location of the pipeline route inside the adjoining Pinus plantation on the north side, or preferably total avoidance on this section of road. It is considered that the population size on the north side of the road is too large to be effectively translocated. Herbarium records indicate that this is a highly significant and well known population of the species.

Sector 4 (Teale Rd): Single individual of *Melaleuca williamsii* (CP5) on margin of non-remnant riparian zone. Construction on south side will eliminate impacts.

Sector 6 (Rogers Road): Location of irrigation corridor on the west side of Rogers Road and the north side of the access track to the New England Highway (alongside cultivated paddocks) will eliminate impacts to RE13.12.9.

Sector 9 (Amiens Road A): Construction of corridor on the north side of Amiens Road will minimise impacts to significants RE's and present the most physically constructible route. This is provided that pipeline construction can be facilitated in the 5m wide easement that separates

significant vegetation from Amiens Road (A) on the north side (at CP10). A rocky slope fringing the northern portion of Amiens Road near its junction with the NE Highway may also be a significant physical impediment to construction in this location. Stringing the pipeline from the road bridge crossing of the Severn River should be investigated to mitigate against impact to aquatic habitat.

Sector 10 (Canon Creek Road): A relatively continuous and intact remnant of RE13.12.8 (Endangered NCA –EPBC) extends for a distance of 3km (CP11) along the east side of Canon Creek Road forming a buffer between the road and the Severn River. The easement between the road and vegetation is very narrow in this location (generally <3m). Construction of the road pipeline on the western side of the road will avoid impact to this vegetation. It should be noted however that the western side of this road is particularly rocky which may cause some physical impediment to construction. Impacts to significant vegetation communities at CP's 12 & 13 can be mitigated against by construction of the pipeline in the cleared easement between the road and the vegetation (if this is possible).

Sector 11 (Bapaume Rd): Vegetation constraints are present at points 15, 16 and 17 with fragmented remnants of RE13.12.8 (endangered VMA, EPBC). The most northern occurrence and point 15 occurs on the western side of the road, although is separated from road by a relatively wide easement (15m+) of non-remnant woodland. Construction within this easement is recommended if the western side of the road is utilised. Constraints at points 16 and 17 (road side stands of RE13.12.8) straddle both sides of the road and pipeline construction should be restricted to the roadside easement if possible. Minor impacts to the extent of this vegetation might not be avoidable. In summary, the irrigation pipeline can be constructed on either side of the road along this section, although recognition of constraints and appropriate mitigation measures is required to minimise disturbance to significant vegetation.

Sector 12 (Swans Lane): A continuous strip of remnant vegetation spans both sides of the road at CP's 18 to 20. Roadside easements are of limited width (3m approx) and construction along this section of roadside will cause some impact to significant vegetation communities in this area. Impacts to significant RE13.12.8 will be reduced if construction is located on the eastern side of the road, although this side possesses a greater number of physical constraints including a number of outcropping granite boulders.

Sector 13 (Amiens Rd B-Barracks Road): A number of specimens of *Acacia latisepala* (Rare – NCA) are located on both sides of Barracks Road in shrubby regrowth in the easement between a Pinus plantation and the roadside. Apart from this species, no significant flora or vegetation communities are located on this sector. Alignment on either side of this road sector will require specimen flagging and possible translocation. Construction on the northern portion of the roadside would have a lower impact to existing infrastructure.

Sector 15 (NE Highway south of Stanthorpe): Scattered specimens of *Acacia latisepala* (Rare-NCA) were located on the western easement of the NEH within highly degraded non-remnant vegetation (CP23). The potential for a number of specimens of this acacia to be located within the roadside easement (both west and east) exists, and pre-construction clearance along this sector is recommended to identify all specimens and determine if translocation is a feasible mitigation strategy.

Sector 16 (Stabiles Road-Back Creek Road): Minor occurrences of RE 13.12.8 are located on the north side of Stabiles Road (CP24), and Back Creek Road (CP25) on a loamy granite plain with scattered rock outcrop. This community has been highly fragmented. Irrigation pipeline construction on the south side of this sector avoid disturbance to these communities, although a considerable easement between road and vegetation on the north side can be utilised if required.

Sector 17 (Mt Stirling Road East): Minor occurrences of RE13.12.8 (CP26 and CP27) must be negotiated on this section of the network. The northern occurrence is heavily disturbed and location of the alignment on the north side of this road section is preferable to location on the south where the vegetation has retained moderate condition. Sufficient easement should be present between the road and a small occurrence of RE13.12.9 at CP28 to avoid disturbance to this community during construction, providing roadside drainage can be negotiated successfully.

Sector 18 (Mt Stirling Road West): Construction of the pipeline corridor on the northern portion of this road section will mitigate against impacts to a minor occurrence of highly degraded RE13.12.9 (CP29) and a major intact occurrence of this type at CP31. A considerable easement is present on the northern portion of the road in most locations although construction may be constrained by physical conditions (granite outcrops). Construction to the north will also avoid impacts to a small section of RE13.3.1 (CP32) and a large population of *Acacia latisepala* (Rare-NCA) at CP33.

Well-developed woodland (RE13.12.9) is present on the east side of the roadside at CP35 and on both sides of the roadside at CP36. Limited roadside easement is present in this vicinity. Consideration can be given to construction of the pipeline under the existing access track at CP36 to avoid impacts to this vegetation providing drainage can be adequately re-instated. Otherwise some impact is inevitable to this community. A relatively wide powerline easement is also present along the eastern side of the road south of CP36 which can be utilised to avoid impacts to an intact representation of the NOC RE13.12.5.

Sector 25 to 26 (Horans Gorge Road): Major constraints on this portion of roadside include two remnants of RE13.12.8 which straddle the road at CP37 and CP38. Confining construction to the existing roadside easement if possible will limit impacts to these remnants. A wide easement exists on the south side of Horan's Gorge Road south of CP39 which may be utilised to avoid impacts to this community if necessary. Several physical impediments including large granite outcrops are present on this easement.

Sector 25 to 27 (New England Highway-Ballandean Section): The west side of the NEH is constrained by steep slopes and a section of RE13.12.9 immediately south of the Fletcher Road junction (CP40). A potential population *Acacia latisepala* (Rare-NCA) is also indicated on the western side of the road by location of a single specimen at CP41a. The roads eastern margin has a relatively wide easement (5-10m) between road and adjacent vegetation and presents the most suitable option although steep slopes and drainage may limit the ability to utilise this area effectively. Several areas between the junction of Horans Road and the Rail overpass to the south are occupied by rock outcrop with scattered areas of granite pavement shrubland (RE13.12.6-Of Concern) interspersed in the woodland mosaic. These areas are too small to represent adequately in the mapping database. Two separate records of *Melaleuca williamsii* (Vulnerable –NCA, EPBC) at a watercourse crossing point (CP42, CP43) should be avoided by placement of the pipeline corridor within a 5m wide cleared easement east of the highway. This will also prevent impacts to a small remnant of RE13.3.1 in the near vicinity.

Sector 27 to 28 (Euki Road): Several major floristic constraints exist on the Euki Section. Woodlands of *E. melliodora* (RE13.12.8) and *E. blakelyi* straddle the road at CP44 and CP45 respectively where the community occupies uncharacteristically steep and rocky landforms. The south side of this road is cut directly into a rocky embankment and no (or very limited) roadside easement exists. The north side at CP44 has a gentler topography and a 5-7m wide roadside easement exists, which is currently occupied by a powerline (or possibly a telephone cable). The north side of Euki road in this location presents the more favourable option for pipeline construction. The south side of Euki road is constrained by occurrences of RE13.12.8 at CP48 and CP50, whilst the north side is

constrained by occurrences of RE13.12.8 at CP46, CP47 and CP49. In general, the roadside easement on the northern side of Euki Road in this area is wider, better formed, and presents a more viable construction option. These Constraints will require further examination on the ground prior to construction to determine the most appropriate route location.

Mitigation Measures at Specific Constraint Points

A brief outline of potential and preferred mitigation measures at specific CP's identified in the survey is provided below in **Table E2**.

Table E2. Mitigation measures at specific CP's

CP	Type of Constraint	Potential mitigation measures/comments
1	Endangered RE13.12.9	• Locate pipeline on north side of road to avoid this community, or: • Locate on south side and restrict construction to the roadside easement
2	Endangered RE13.12.8	• Locate pipeline on north side of road to avoid this community, or: • Locate on south side and restrict construction to the roadside easement
3 & 4	*Grevillea scortechinii subsp. scortechinii* –Vulnerable Species EPBC, NCA; Potential location of *Boronia repanda* Endangered Species EPBC, NCA (HERBRECS-not located in field survey)	• Seasonal survey to determine population extent of *Boronia repanda*; • Locate pipeline on the north side of the road within easement and utilise low impact construction methods to avoid major population impacts. Investigate potential for translocation of impacted individuals;
5	Location of *M. williamsii* (Vulnerable NCA-EPBC) on north side of Teale Road	• Avoidance of any individuals by tagging specimens and ensuring adopted corridor is clear of these.
6	Endangered RE13.12.9	• Location of irrigation corridor on the west side of Rogers Road and the north side of the access track to the New England Highway (alongside cultivated paddocks) will eliminate impacts to RE13.12.9
7	Of concern RE13.12.6	• Pipeline construction on the north side of Amiens Road (A)
8	Endangered RE13.12.8	• South side of road presents least impact to significant RE's and should be adopted if possible • Pipeline construction on the north side of Amiens road is feasible if roadside easement can be utilised
9	RE13.3.1 (Endangered- NCA)	• Utilise existing easement on north side of road if feasible and string pipeline to bridge to avoid riparian impacts
10	RE13.3.1 (Endangered- NCA)	• Utilise existing easement on south side of road if feasible and string pipeline to bridge to avoid riparian impacts
11	Endangered RE 13.12.8	• Road side construction on the west and south west side of the road is the only feasible way to avoid impacts to this community due to limited roadside easement
12	Endangered RE 13.12.8	• Heavily degraded remnant although impact can be avoided by corridor construction on the ESE side of road
13	Endangered RE 13.12.8	• Irrigation corridor constrained on both sides of road by significant RE (CP 12&13). Construction within roadside easement is the only option to avoid direct impact. Easement is widest on the south side. Some impact to this community is expected if construction on the north side is the favoured construction option
14	Endangered RE 13.12.8	• Heavily degraded remnant although impact can be avoided by corridor construction on the ESE side of road
15	Endangered RE 13.12.8	• Significant vegetation on west side of road is separated from road by easement of secondary (non-remnant vegetation) which can be utilised for construction. East side of road presents a more favourable construction corridor in this location
16&17	Endangered RE 13.12.8	• Road is constrained on both east and west side by remnant endangered vegetation. Utilisation of roadside easement on construction alignment if viable. Minor impacts to RE13.12.8 can be expected in this area.

CP	Type of Constraint	Potential mitigation measures/comments
17a	Endangered RE 13.12.8	• Road is constrained on eastern side by remnant endangered vegetation. This remnant may have been cleared post capture of imagery. Check status, width of roadside easement.
18	Endangered RE RE13.3.1	• East side of swan lane should be utilised for construction to mitigate impacts to this community.
19	Endangered RE 13.12.8	• Minimum roadside easement in this location and impacts to this RE will occur with construction on the west side of the road easement. Option to construct corridor on the eastern roadside will reduce impact to significant RE's due to length of intersection.
20 & 21	Endangered RE 13.12.8 (two) minor occurences	• Minimum roadside easement in this location and impacts to this RE will occur during construction. Option to construct corridor on the eastern roadside will reduce impact to significant RE's in this vicinity.
22	*Acacia. latisepala* (Rare NCA)-SSC database with voucher specimen submitted to Qld Herbarium	• A wide easement exists between roadside and adjacent pinus plantation which provides some flexibility to route location on north side of road. Following verification by Queensland Herbarium, specimens should be flagged and avoided during pipeline construction
23	*Acacia. latisepala* (Rare NCA)	• Located in a wide easement on non-remnant vegetation on east side of NEH. Potential for other scattered occurrences in location. Pre-construction roadside clearance tagging individual specimens will assist in appropriate route alignment to avoid impacts.
24	Endangered RE 13.12.9	• Construction on south side of road will minimise impacts to this community. If construction on north side of road is a favoured option, existing roadside easement should be utilised wherever possible.
25	Endangered RE 13.12.9	• Construction on south side of road will minimise mitigate impacts to this community. If construction on north side of road is a favoured option, existing roadside easement should be utilised wherever possible
26	Endangered RE 13.12.8	• Considerable roadside easement (north side) exists in this location. This is preferred roadside option with minimal impacts to significant RE's expected. Similar community on south side of road has greater degree of structural integrity.
27	Endangered RE 13.12.8	• Impacts to this community can be avoided by roadside construction on the north side where greater roadside easement exists and vegetation community is heavily fragmented
28	Endangered RE 13.12.9	• Considerable roadside easement (north side) exists in this location which should be utilised to avoid impacts to this vegetation community.
29	Endangered RE 13.12.8 (highly degraded secondary community)	• Marginal remnant community although should be avoided by construction of pipeline on the north side of the road.
30	Endangered RE 13.12.8	• Roadside easement should be utilised when possible Minor impacts to this community may be incurred. South side of road constrained by well developed woodland (RE13.12.19).
31	Endangered RE 13.12.8	• Extensive community fringes the south side of the road in this location with limited easement. Pipeline construction on the north side of the road within wide easement will mitigate against major impacts to this community.
32	Endangered RE 13.3.1	• Well developed easement exists on south side of road. Construction on north side of road will minimise impacts to significant communities on this section of road.
33	*Acacia. latisepala* (Rare NCA)	• Large population of specimens located in non-remnant shrubland on the south side of road. Construction on the north side of easement will minimise impact to population.
34	Endangered RE 13.12.8	• Minor area of this RE on east side of road. Limited roadside easement and minor impacts expected during construction. West side of road can be investigated as an alternative option although this area is likely to be physically constrained.
35 & 36	Endangered RE 13.12.9	• Extensive strip on both sides of access track with minimum easement. • Consider using existing access track as a construction corridor, followed by road re-instatement is a possible mitigation measure.

CP	Type of Constraint	Potential mitigation measures/comments
37	Endangered RE 13.12.8	• A 5m wide easement (occupied by a power/phone line) exists on east side of road and should be utilised where appropriate. Detailed comparison with easement suitability on the west side of the road should be undertaken for determination of final route suitability.
38	Endangered RE 13.12.8	• A 5m wide easement exists on west side of road and should be utilised where for construction where appropriate to minimise impacts to this community.
39	Endangered RE 13.12.8	• A 5-10m wide easement exists on south side of Horan's Gorge Road which should be considered as an easement for construction. This easement is physically constrained by rock and boulder outcrop.
40	Endangered RE 13.12.9	• West side of NEH physically constrained by steep slopes and limited easement, and significant vegetation. East side of highway should be utilised for pipeline construction where roadside easement is considerably wider .
41	Endangered RE 13.12.8 (highly disturbed)	• Utilisation of 5-7m wide easement for pipeline construction will minimise impacts to this community. Construction access to this easement is however highly constrained by steep embankment and drainage.
42	*Melaleuca williamsii* (Vulnerable EPBC NCA)	• Tag specimen prior to construction an utilise cleared easement on either side of site location. East side of road is most likely option (See CP 39 below).
43	*Melaleuca williamsii* (Vulnerable EPBC NCA)	• Tag specimen prior to construction and utilise cleared easement between roadside and site record (7 to 10m).
44	Endangered RE 13.12.8	• Utilise easement on north side of road (5m) for construction. Easement is currently occupied by powerline. • Minor impacts expected in some areas where easement narrows or is constrained by rock.
45	Endangered RE 13.12.9	• Utilise easement on north side of road to avoid this community (see CP40). • Currently highly constrained by limited easement (< 2m) and steep cut on roadside.
46	Endangered RE 13.12.8	• Utilise constructed roadside easement wherever possible (3-5m) for construction. • Examine in detail south side of road for easement width to determine if a southern alignment reduces construction impacts to this RE.
47	Endangered RE 13.12.8	• Utilise constructed roadside easement wherever possible (3-5m) for construction.
48	Endangered RE 13.12.8	• Utilise constructed roadside easement wherever possible (3-5m) for construction if a southern roadside alignment is chosen. • Examine in detail north south side of road for easement width to determine if this option has lower ecological impact
49	Endangered RE 13.12.8	• Utilise constructed roadside easement wherever possible (5-10m) for construction. • Determine the possible construction on south side of Euki Road is feasible to decrease impacts
50	Endangered RE 13.12.8	• Laterally extensive occurrence fringing the southern margin of road. • Separated from roadside by a narrow easement of <2m. Use northern portion of road for construction to reduce impact

Appendix E3. Mitigation Measures on the TWS

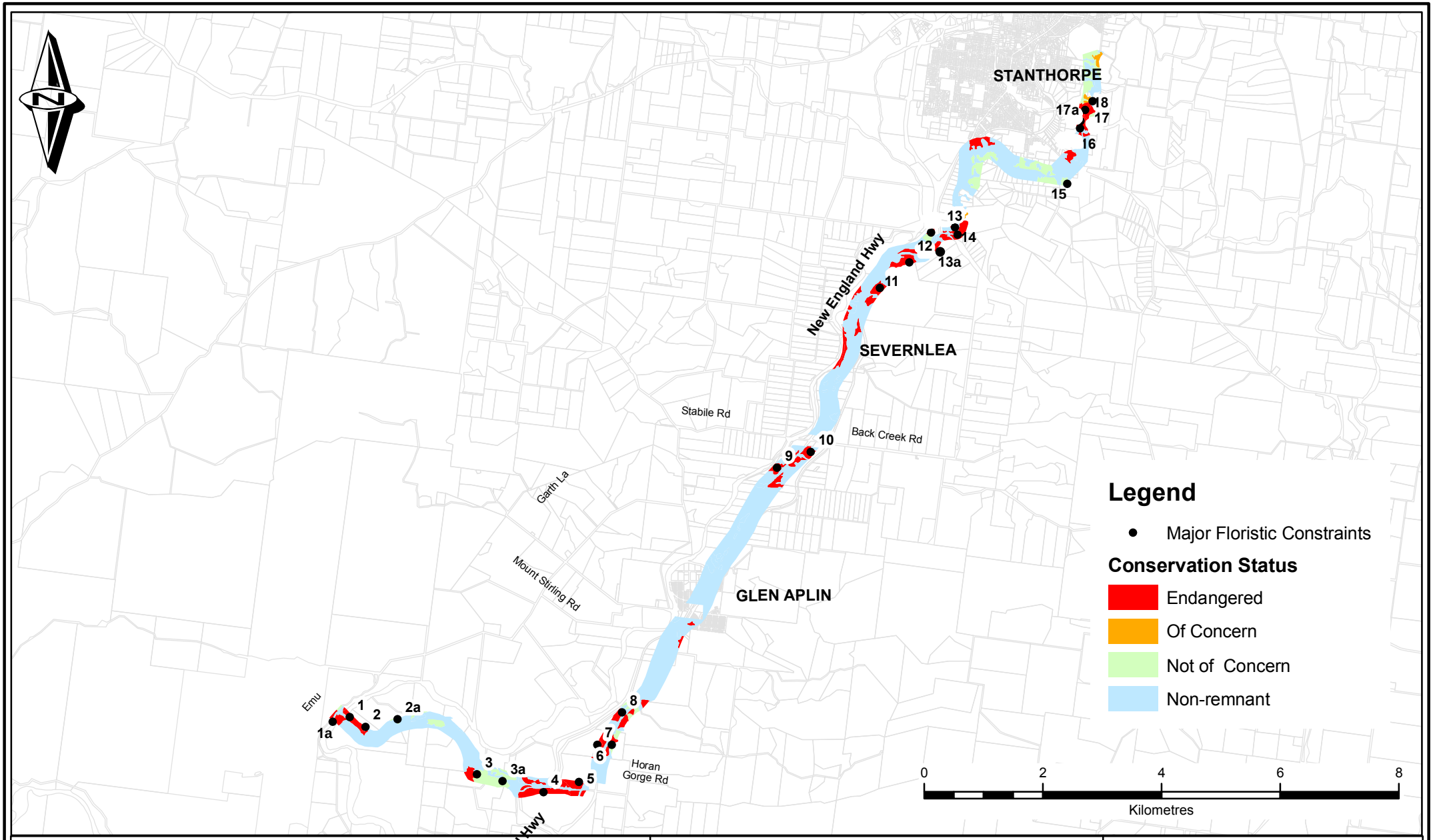
Table E3, in conjunction with **Figure E3**, identifies the major constraint points on the proposed TWS alignment and suggests measures to mitigate against the major potential impacts. Mitigation measures relate largely to avoidance, although in some areas, impacts to significant vegetation communities and plant species will be inevitable.

Table 15. Mitigation measures at specific CP'ss

CP	Type of Constraint	Potential mitigation measures/comments
1a	Endangered RE 13.3.1x1 – Severn River Crossing. Located specimens of *Melaleuca williamsii* on south side of causeway	• Construction of pipeline as close a practical to the causeway, or immediately alongside causeway; • Specimens of *Melaleuca williamsii* are located on the south side of causeway. These should be flagged and avoided during construction activity; • The upstream (north) side of the causeway presents the option of least impact to sensitive riparian vegetation.
1	Endangered RE13.12.8	• Locate pipeline on south side of road to avoid this community, or: • Locate on north side and restrict construction to the roadside easement. This easement is extremely narrow in areas and is constrained by a low cutting and inconveniently located drainage.
2	Endangered RE13.3.1	• Locate pipeline the south side of road to avoid this community, or; • Locate on south side and restrict construction to the roadside easement.
2a	HERBRECS records of *Acacia pubifolia* and *Homoranthus montanus* on north side of road in non-remnant vegetation (could not be located during the roadside survey)	• Pre-construction clearance of the finalised alignment in this area in further effort to locate specimens; • Flag specimens if located and avoid if possible; • Attempt translocation if impact unavoidable.
3	Endangered RE13.12.8	• Locate pipeline on north side of road in non-remnant vegetation to avoid this community, or: • Locate on south side and restrict construction to the roadside easement.
3a	Herbrecs record of *Eucalyptus mckeana* (Vulnerable EPBC) within RE13.12.2	• Utilise north side of roadside easement and locate pipeline in non-remnant vegetation; • Pre-construction roadside clearance of remnant vegetation on the south side to locate specimens; • Use of buffers, tree girdles and pruning to avoid damage to specimens subject to peripheral impact.
4	Well developed example of Endangered RE13.12.9 on south side of Fletcher Road	• Locate pipeline on the north side of roadside in non-remnant vegetation; • Easement on south side of irrigation corridor is extremely narrow and difficult for effective location of pipeline easement.
5	Endangered RE13.12.8 and 13.12.9 located on the north side of road. Endangered RE13.12.9 on south side of road	• Pipeline construction on the north side of Fletcher Road in this location presents the option of least impact. A wide roadside easement exists on the north side of the road which can be utilised for construction.
6, 7 & 8	Endangered RE13.12.8 located on both east and west side of NEH	• A wide easement exists on the west side of the NEH between roadside and remnant vegetation. This should be utilised for pipeline construction to minimise impacts to significant vegetation.
9&10	Scattered remnants of RE13.12.8 on both east and west sides of NEH	• Examine width of roadside easement on both sides of NEH to determine the side of least impact. Preliminary indications are that the west (NW) side of the NEH presents an easement of sufficient width to accommodate pipeline construction without impact to sensitive vegetation.
11	Endangered RE 13.12.8	• Road side construction on the North-West side of the NEH will accommodate pipeline construction without impact to remnant vegetation; • South –east side of NEH present a highly disturbed roadside easement which can be potentially utilised for construction although presents a steep roadside cutting which will provide additional constraint

CP	Type of Constraint	Potential mitigation measures/comments
		construction; • A number of potential *Acacia latisepala* (Rare –NCA) were located on the south side of the NEH in this location. Some confusion as to the identification of these specimens has been indicated by the Queensland Herbarium and confirmation is required. Pre-constuction clearance of roadside is recommended in this area to locate potential specimens.
12	Endangered RE 13.12.8	• Utilising the easement of Whisky Gully Road on its merge with the NEH (currently barricaded) will minimise the impact on sensitive vegetation communities in this location.
13	Endangered RE 13.3.1	• Minimise clearing width by utilising cleared road side easement if possible; • Ensure pipeline easement follows existing road alignement and clearing is minimised adjacent to gully and alluvial flat which hosts sensitive vegetation; • Detailed site inspection considering both ecological and engineering constraints is required to determine most sensitive route location.
13a	Survey collection-*Melaleuca williamsii* (Vulnerable EPBC, NCA) within drain in non-remnant vegetation	• Positively identify and tag specimen locating any incidental additional records • Locate pipeline easement on NW side of road to avoid species and avoid disturbance of deeply incised drain. • Consider propogation to replace individual speciment if disturbed
14	Endangered RE 13.12.8	• Well developed intact remnant exists on the east side of road with limited easement between roadside and vegetation; • The option of locating a pipeline on the north-east side side of the road is severely constrained by a semi-permanent stream which parallels the road alignment with limited easement separating the road from the stream; • Detailed site investigation is required to determine the most appropriate alignment and construction method for the pipeline in this location.
15	Surveyed location of *Mirbelia confertifolia* (Rare, NCA)	• Located on east side of road with on rock pavement. Limited potential for direct impact. Species locations should be flagged. • Utilise non remnant vegetation on west side of road easement for construction corridor to avoid the potential for direct impact.
16	Endangered RE 13.12.8	• Narrow track defines approximate location for pipeline easement in this location; • Construction of the eastern side of the existing road will place a greater portion of the pipeline in non-remnant vegetation and should be the preferred alignment; • Consider utilising track for pipeline construction followed by track re-instatement and stabilisation; • Pipeline construction is likely to incur direct impact to significant vegetation in this location and construction easement should be minimised.
17	Endangered RE RE13.3.1	• Crossing of major stream will necessitate disturbance to riparian vegetation; • Engineering consideration should be given to the use of low impact construction methods at stream crossing. This may include elevating pipeline above stream channel or directly anchoring to stream channel; • Methods which require a wide disturbance corridor should be utilised only where alternative methods are not feasible.
17a	Surveyed location of *Melaleuca williamsii* (Vulnerable NCA/EPBC)	• Stream crossing area should be survey pre-construction and total population tagged for identification; • Avoidance of the species within the corridor of direct impact should be the primary mitigating measure; • Propogation to replaced destroyed individuals should be employed if direct impact can-not be avoided.
18	Endangered RE 13.12.8 (two) minor occurences	• Narrow track defines approximate location for pipeline easement in this section; • Consider utilising track for pipeline construction followed by track re-

CP	Type of Constraint	Potential mitigation measures/comments
		instatement and stabilisation; • Pipeline construction is likely to incur direct impact to significant vegetation in this location and construction easement should be minimised.



N O T E S:

(i) This plan has been produced for exclusive use of the client and **3D Environmental**
(ii) Aerial photography has been registered as a best fit on the boundaries shown and position is approximate only.
(iii) Vegetation data captured has beed capture at aerial photography scale and as such should not be used at a scale greater thanthe aerial photography scale.
Aerial Photography scale 1:37,500

Figure E3:
Major Floristic Constraints for the Town Water Supply

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Stanthorpe Shire Council

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Scale 1:85,000	**Drawn By** DG	**Checked** DS	**File Path** C:\3denvironmental\SIA\si_veg_a3l	**Date** 03/12/07	A3

Appendix F. Summary of Potential Downstream Impacts

Affect of Impoundment on Hydrological Regime	Affect on Fluvial /Hydrological Process	Potential Impact on Riparian Vegetation	Potential Impact on Sensitive Species/ Communities
Reduction in overall downstream flow volume	• Overall reduction in groundwater levels near channel; • Changes to sedimentary deposition including a decrease in bedload size; • Reduction in the frequency of disturbance to river bed; • Gradual narrowing of river channels through influx of fine sediment.	• Species diversity may decrease through a simplification/homogenisation of bedform and microhabitat.	• Loss of habitat for EVR species including *Acacia latisepala, Melaleuca williamsii, Melaleuca flavovirens, Rulingia hermaniifolia, Thelionema grande*; • Loss of habitat for significant species *Mirbelia confertiflora*, and *Melaleuca* sp. (Severn River); • Potential dieback of deep rooted species including *Eucalyptus* spp. associated with the immediate riparian zone
Impediment to downstream sediment transport	• Armouring of flood channel immediately downstream from impoundment through channel scour; • Reduction in bedload size and erosion of coarse fluvial deposits.	• Erosion/undercutting of stream banks and alluvial deposits immediately downstream from impoundment wall and resultant loss of associated riparian vegetation.	• Loss of habitat for EVR species including *Acacia latisepala, Melaleuca williamsii, Melaleuca flavovirens, Rulingia hermaniifolia, Thelionema grande*; • Loss of habitat for regionally significant species notably *Melaleuca* sp. (Severn River); • Loss of habitat trees through erosion of stream banks; • Creation of unvegetated niches with potential for exotic weed invasion.
Decrease in seasonal flow variability	• Simplification of fluvial processes and reduction possible reduction in bedform complexity.	• Species diversity may decrease through simplification/homogenisation of bedform & microhabitat; • Increasing seasonal predictability of flow may favour invasion of exotic species of natives; • Potential for creation of a niche for exotic species invasion.	• Loss of habitat for EVR species including *Acacia latisepala, Melaleuca williamsii, Melaleuca flavovirens, Rulingia hermaniifolia, Thelionema grande*; • Loss of habitat for regionally significant species notably *Melaleuca* sp. (Severn River); • Loss of native species diversity.