Appendix 2: Addendum Flora and Fauna Impact Assessment including Offset Plan

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Addendum Report

TERRESTRIAL AND AQUATIC FLORA AND FAUNA IMPACT ASSESSMENT ADDENDUM REPORT CHAFFEY DAM AUGMENTATION AND SAFETY UPGRADE

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ngh environmental

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1 INTRODUCTION

1.1 BACKGROUND

This Addendum Report - Terrestrial and Aquatic Flora and Fauna Impact Assessment (Flora and Fauna Addendum Report) has been prepared to address the additional survey requirements and State and Commonwealth assessment provisions identified in the Chaffey Dam Augmentation and Safety Upgrade Environmental Impact Statement (EIS) (WorleyParsons 2012) as well as to respond to the comments raised by Agencies during the public exhibition of the EIS.

In 2012 **ngh**environmental were engaged by WorleyParsons Services Pty Ltd (WorleyParsons) to undertake a terrestrial and aquatic flora and fauna assessment of the potential impacts associated with the augmentation and safety upgrade of Chaffey Dam (the Project), proposed to be carried out by State Water Corporation (State Water).

Chaffey Dam is located on the Peel River approximately 30 km south-east of Tamworth. Chaffey Dam is ranked by the NSW Dams Safety Committee as being in the "extreme" hazard category. This represents an inadequate flood capacity and is based on the population at risk and the severity of damage and loss that would result from dam failure (Dams Safety Committee 2008/2009). In terms of the Australian National Committee on Large Dams (ANCOLD) guidelines and NSW Dams Safety Committee risk framework, the dam failure risks at Chaffey Dam are considered to be intolerable.

The current storage capacity of the dam is 62 GL. Three alternative scenarios were initially considered by State Water – raising the dam to a permanent storage capacity of 80, 100 or 120 GL, as documented in the EIS (WorleyParsons 2012). The preferred option assessed in the EIS is to raise the capacity to 100 GL, increasing the Full Supply Level (FSL) by 6.5m. Since the 80 and 120 GL augmentation options were ruled out, only the 100 GL scenario was assessed in detail in the ecological impact assessments for the project. The comparative ecological impacts of the three scenarios are considered in Section 1.4 of this Addendum report.

1.1.1 History of the Project

The Project has been classified by the NSW Minister for Planning and Infrastructure as State Significant Infrastructure and is subject to the provisions of Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). On 23 January 2012, Director-General's Requirements (DGRs) were issued for the Project.

On 29 August 2012, State Water referred the Project to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

On 28 September 2012 the Minister for SEWPaC declared the project a controlled action, therefore the Project requires assessment and approval under the EPBC Act. SEWPaC advised that the Project would be assessed through an accredited assessment under Part 5.1 of the EP&A Act. On 19 October 2012, Supplementary DGRs were issued for the Project in relation to assessment of impacts to threatened species and communities listed under the EPBC Act.

The EIS was placed on public exhibition by the NSW Department of Planning and Infrastructure from 12 December 2012 until 31 January 2013. Section 8.2.5 of the EIS committed State Water to undertake additional surveys during summer 2012/2013 to further inform the flora and fauna impact assessment for

the Project in relation to Queensland Bluegrass (*Dichanthium setosum*) and the Booroolong Frog (*Litoria booroolongensis)*.

Submissions on the EIS, relevant to the flora and fauna impact assessment for the Project, were received from the Namoi Catchment Management Authority (Namoi CMA), the NSW Office of Environment and Heritage (OEH) and the Department of Planning and Infrastructure.

Section 8.2.6 of the EIS committed State Water to prepare and submit an Offset Plan with the Preferred Infrastructure Report or Response to Submissions report.

A response to submissions made on the EIS in relation to flora and fauna is provided at Appendix B. The response references relevant sections of this Flora and Fauna Addendum Report where additional information is provided. Substantial detailed information is contained within the Terrestrial and Aquatic Flora and Fauna Assessment prepared by **ngh**environmental (2012) and contained in the EIS as Appendix 8. These documents are referred to within this report as follows:

1. WorleyParsons (2012). Chaffey Dam Augmentation and Safety Upgrade Environmental Impact Statement State Significant Infrastructure. Report prepared for State Water.
2. **ngh**environmental (2012). Terrestrial and Aquatic Flora and Fauna Impact Assessment. Appendix 8 of WorleyParsons (2012).

1.1.2 Project Location and Layout

The Project comprises the augmentation and safety upgrade of the existing Chaffey Dam (Figure 1-1). The proposed works will result in an increase in the FSL of 6.5 m and an increase in the permanent storage capacity from 62 GL to 100 GL.

The Project is proposed to be carried out by State Water and includes the following components:

- Augmentation of the dam to 100 GL at FSL and safety upgrade, through raising of the dam wall and modification of the existing spillways.
- Modification of roads and bridges, including Tamworth-Nundle Road, Western Foreshore Road, Rivers Road, Bowling Alley Point Bridge and Hydes Creek Bridge.
- Relocation of facilities within the Bowling Alley Point Recreation Area and the South Bowlo Fishing Club.
- The Project will result in an increase to the FSL of approximately 185 ha surrounding the existing reservoir and an additional footprint of up to 38 ha for development of new roads and bridges.

1.2 STUDY SITE AND STUDY AREA DESCRIPTION

Chaffey Dam is located on the Peel River within the upper Namoi River catchment in north-east NSW. The dam is approximately 6 km south of the town of Woolomin, and approximately 13 km north of the town of Nundle.

The study site is defined as the areas directly affected by the Project, and includes those areas within the augmented FSL and works areas (Figure 1-1). The works areas include the roads and bridges to be realigned or relocated along Western Foreshore Road, Tamworth-Nundle Road and Rivers Road, as well as the area impacted by works to the dam wall, morning glory spillway and auxiliary spillway.

The study area centres on Chaffey Dam (Figure 1-1) and is defined as the study site plus surrounding areas which were investigated in order to undertake the impact assessment. The study area encompassed a 1km buffer from the new FSL.

The Project is located on land comprising Crown land, freehold, leasehold, road reserve and State Water acquired land. Existing land uses around Chaffey Dam include:

- The existing dam and reservoir
- Recreational and open space land uses, including:
    - Bowling Alley Point Recreation Area (managed by the Bowling Alley Point Recreation Reserve Trust)
    - South Bowlo Fishing Club
    - Nundle Fishing Club
    - Dulegal Arboretum (established by the now dissolved Dulegal Arboretum Association and opened in 1982, this area is noted for its scientific and recreational value, however it is no longer being maintained)
- Land under private ownership and leasehold, including rural residential properties and land used for grazing and dairy farming
- Roads and bridges
- State Water administration and maintenance facilities and Storage Custodian's residence

1.3 SCOPE OF THIS REPORT

At the time of writing the Terrestrial and Aquatic Flora and Fauna Impact Assessment and the EIS, the likely level of impact on two threatened species (Booroolong Frog and Queensland Bluegrass) was uncertain due to a lack of data that was based on recent surveys conducted in an appropriate season. The EIS committed to undertaking additional surveys to clarify the extent of likely impact based on current data, and the offsetting requirements for these species.

During the public exhibition of the EIS, submissions relevant to the flora and fauna impact assessment for the Project were received from Namoi CMA, OEH and the Department of Planning and Infrastructure.

This report provides an analysis of the updated survey data and a revised complete assessment of potential impact. It also addresses the comments raised by agencies during the public exhibition of the EIS.

In addition, further information is provided on the level of impact and proposed mitigation for the threatened Border Thick-tailed Gecko, which inhabits the dam wall.

These three species (Booroolong Frog, Queensland Bluegrass and Border Thick-tailed Gecko) are referred to in this report as the Subject Species.

Therefore the primary aims of this Flora and Fauna Addendum Report are to:

- Provide updated data on the abundance and distribution of the Booroolong Frog within the study area, listed as Endangered under both the *Threatened Species Conservation Act 1995* (TSC Act) and EPBC Act

- Determine the likelihood of occurrence of Queensland Bluegrass within the study site, listed as Vulnerable under both the TSC Act and EPBC Act
- Determine the potential impacts of the Project on the Booroolong Frog and Queensland Bluegrass
- Further define the mitigaitons measures to be put in place to avoid impacts to the Border Thick-tailed Gecko (*Uvidicolus sphyrurus),* listed as vulnerable under both the TSC Act and EPBC Act
- Provide an Offset Plan that meets the requirements of State and Commonwealth Government offset policies
- Provide a response to submissions received on the EIS in relation to flora and fauna

Furthermore, the assessment of impact to vegetation communities in the EIS was based on a worst case scenario estimation of the road and bridge construction footprints (works areas). A revised assessment is provided based on the detailed design of these areas and more accurate calculations of the extent of impact as a result of road and bridge construction activities.

This Addendum Flora and Fauna Assessment Report is accompanied by three appendices:

1. Appendix A - Updated Assessment of Impact based on additional data from surveys conducted over summer 2012/2013
2. Appendix B - Response to submissions
3. Appendix C - Offset Plan

State and commonwealth policies and guidelines that have been consulted in the preparation of this report include:

- Biobanking Assessment Methodology (DECC 2009a)
- EPBC Act Environmental Offsets Policy (SEWPaC 2012)
- Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DEWHA 2009)
- Namoi CMA Biodiversity Offsets Policy (Namoi CMA 2011)
- NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects (NSW OEH 2011)
- Threatened species assessment guidelines (DECC 2007)

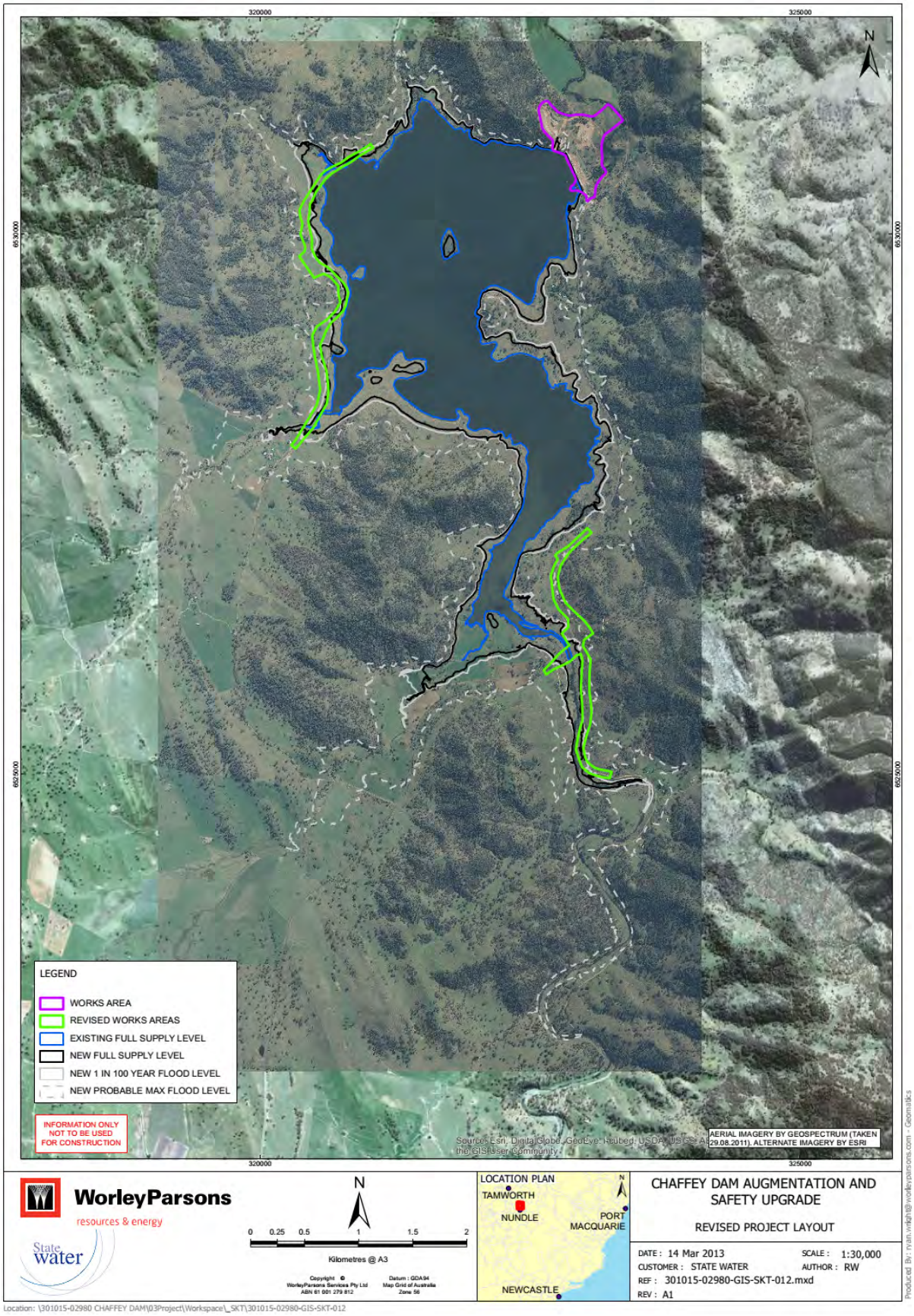

Figure 1-1. Project layout

1.4 ASSESSMENT OF ALTERNATIVES

The Terrestrial and Aquatic Flora and Fauna Assessment (**ngh**environmental 2012) assessed the ecological impacts in relation to threatened species of the proposed safety upgrade and augmentation to increase the dam capacity to 100 GL. Below is a comparison of ecological impacts under two alternative scenarios; a lower capacity of 80 GL; and a higher capacity of 120 GL. A comprehensive comparison of impacts of the alternative on vegetation communities is illustrated in Table 1-1.

As described in Section 2.1.9, augmentation of Chaffey Dam to 100 GL is expected to impact on approximately 1.6 km of Booroolong Frog habitat, with an average width of 14.5 m. This equates to an area of approximately 2.3 ha.

In comparison to the proposed 100 GL capacity, an additional 600 m, or 0.87 ha of Booroolong Frog habitat on the Peel River would be lost under the 120 GL capacity. Approximately 760 m, or 1.1 ha less of Booroolong Frog habitat would be lost under the 80 GL capacity. Under all scenarios this would be considered a significant loss of habitat. The National Recovery Plan for Booroolong Frog (NSW OEH 2012a) states that "habitat critical to the survival of the Booroolong Frog is rocky sections of permanent streams occupied by the species. Any action that reduces stream permanency or results in loss of rock crevices is likely to threaten the persistence of local populations of this species."

Impacts to the Border Thick-tailed Gecko are not expected to differ between the different augmentation scenarios. All scenarios would require construction works to the dam wall. Any loss of habitat on the upstream side of the dam wall through increased inundation would be replaced through the increased dam wall height.

As described in the Terrestrial and Aquatic Flora and Fauna Assessment (**ngh**environmental 2012) and shown in Table 1-1, the proposed augmentation to 100 GL is expected to result in the inundation of approximately 180 ha native and non-native vegetation. Comparatively, augmentation to 80 GL would result in the inundation of 67 ha of vegetation (38 ha listed under the TSC and EPBC Acts), while augmentation to 120 GL would result in the inundation of approximately 250 ha of vegetation (164 ha listed under the TSC and EPBC Acts), including native and exotic non-native vegetation (Table 1-1).

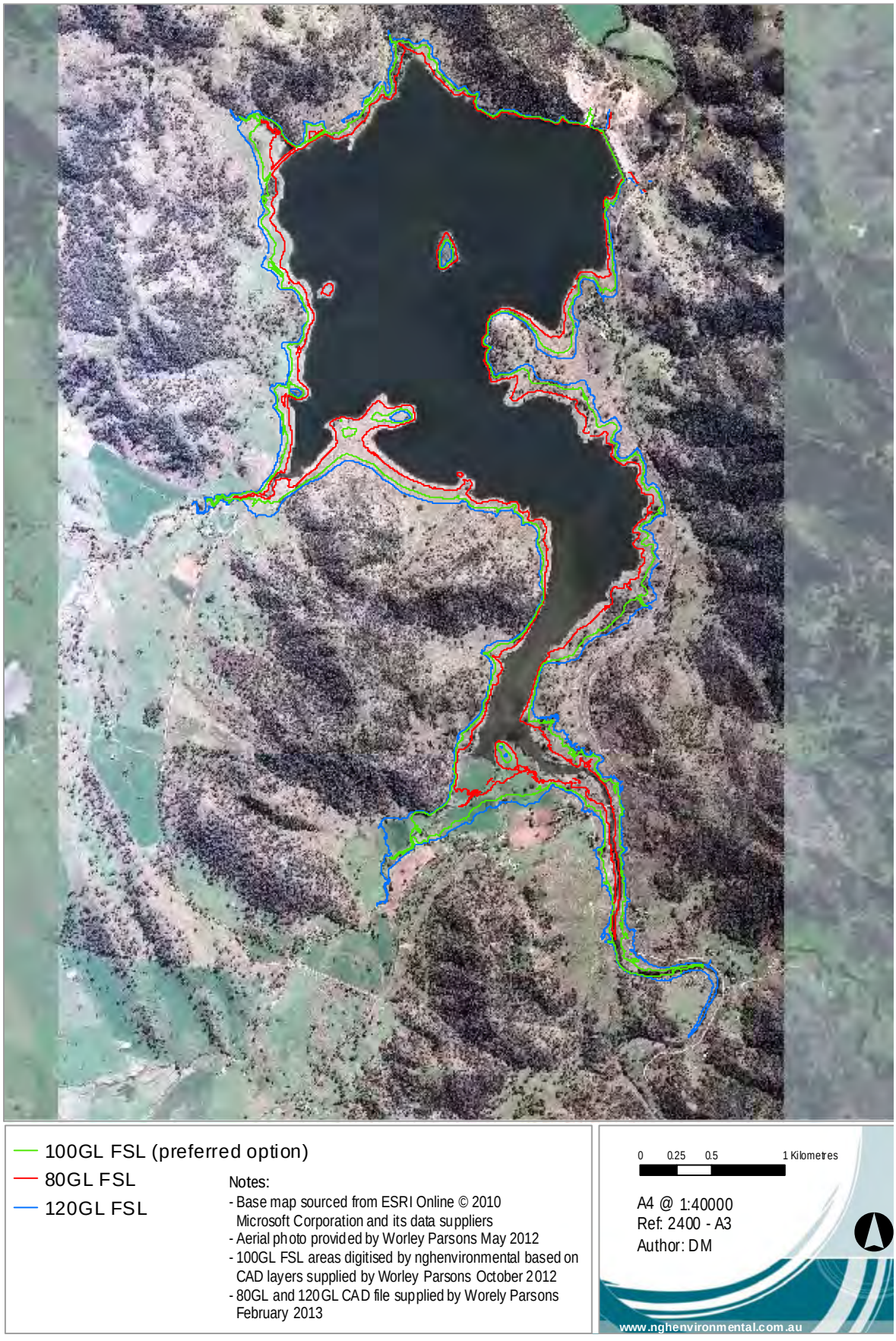

Figure 1-2 Comparison of Full Supply Level under the three storage capacity scenarios of 80 GL, 100 GL and 120 GL.

Table 1-1. Comparison of area of vegetation to be inundated under alternative scenarios of storage capacity

Vegetation Communities	Area to be inundated 100 GL (ha)	Area to be inundated 80 GL (ha)	Area to be inundated 120 GL (ha)
Regional Vegetation Community (RVC)			
Box–gum grassy woodlands, Brigalow Belt South and Nandewar (RVC 17)	30	7	46
Derived grasslands, Brigalow Belt South and Nandewar (RVC 28)	87	31	118
Silvertop Stringybark grassy open forests, eastern Nandewar and New England Tablelands (RVC 39)	3	1	4
River Oak Riparian Woodland, eastern NSW (RVC 71)	6	3	6
Wetlands and marshes, inland NSW (RVC 70)	0.24	0	0.24
Planted non-indigenous native vegetation (no RVC)	9	4	13
Exotic non-native vegetation	45	21	62
TOTAL RVC	**180.24**	**67**	**249.24**
White Box - Yellow Box - Blakely's Red Gum woodland and derived native grasslands			
Endangered Ecological Community (TSC)	117	38	164
Critically Endangered Ecological Community (EPBC)	6	1	10
Hollow Bearing Trees to be lost	**41**	**3**	**51**

2 SUBJECT SPECIES

2.1 BOOROOLONG FROG

Surveys conducted by **ngh**environmental and North West Ecological Services (NWES) in January and February 2013 were designed specifically to detect threatened species that were not detectable during surveys carried out for the Project in 2012. Survey effort was guided by previous desktop investigations and field surveys in areas of known or potential habitat.

Specifically, surveys for the Booroolong Frog were carried out by NWES during the species peak activity period, both inside and outside the new FSL, as requested by Department of Planning and Infrastructure (DP&I). Detailed survey data has been provided within this report.

2.1.1 Conservation Status

National

The Booroolong Frog is restricted to NSW and north-eastern Victoria tablelands and slopes from 200 m to 1300 m above sea level. The species is predominantly found along the western-flowing streams and their headwaters of the Great Dividing Range, although a small number of animals have been recorded in eastern-flowing streams (SEWPaC 2012; DECC 2005).

In early 1999, Booroolong Frogs were located along three small creeks, several kilometres north of the Murray River, near Jingellic, southern NSW. A subsequent survey was undertaken, searching for the frogs in four creeks (Burrowye, Walwa, Sandy, and Cudgewa Creeks) and the Murray River. Booroolong Frogs were found on Burrowye Creek at Burrowye, and on the banks of the Murray River near Jingellic, confirming the occurrence of the species in Victoria (The Victorian Frog Group 1999).

Within Victoria there are only two known locations for the Booroolong Frog in the north-east of the state; Burrowye/Guys Forest Creek at Burrowye and Koetong Creek within Mount Lawson State National Park (DSE 2013).

Overall, survey information indicates that the Booroolong Frog has undergone a severe decline and is no longer present across more than 50% of the species' former range (NSW OEH 2012a). Since 1998, surveys have been undertaken to determine the extent and cause of decline in the species.

The current geographic distribution of the Booroolong Frog extends from two streams near Tamworth in northern NSW to the Southern Highlands in Victoria. Though this represents a large extent of occurrence, the area of occupancy of the species is likely to represent only a tiny portion of this range (DEWHA 2007). The area of occupancy of this species is approximately 10 km² and is severely fragmented across its range (GAA 2006).

The most pronounced decline in the species' range has been across the Northern Tablelands where it was once common but has not been located in recent years despite extensive fauna surveys undertaken by the North-east Forest Biodiversity Study (NSW NPWS 1994), Regional Forests Assessment Program and others (NSW NPWS 2004). Specific surveys in the Northern Tablelands for the Booroolong Frog conducted in 1999 and 2000 failed to locate the species from a number of historic locations and other potentially suitable habitat (Gillespie 2000).

Regional (NSW)

The Booroolong Frog has disappeared from the Northern Tablelands of NSW and is now rare throughout most of the remainder of its range. Previously known populations within the Blue Mountains are no longer able to be located.

The Booroolong Frog is now known from a single catchment in northern NSW - the Peel River catchment, of which the Cockburn River is a sub-catchment (Anna Cronin *pers comm.* 2013).

The only records of the species in northern NSW outside the Northern Tablelands are from two streams near Tamworth, NSW. These populations appear to be highly restricted and surveys of other previous known localities and streams with potentially suitable habitat in the Tamworth-Murrurundi area failed to locate additional populations of the Booroolong Frog (Gillespie 2000).

The Booroolong Frog was historically widespread throughout the Central Tablelands, having been recorded from locations within and between tributaries of the Macquarie and Lachlan Rivers. Surveys throughout this region have failed to locate the species along many of these streams, suggesting it is now rare in the Central Tablelands region (Gillespie 1999; Gillespie 2000). The species persists in this region along the Turon River and Winburndale Creek in the Winburndale Nature Reserve (NSW NPWS 2004) and within the Abercrombie River Catchment (Gillespie 2000).

This report presents the most recent available survey data for the species in NSW.

Local (upper Peel River and Cockburn River within the Peel River Catchment).

Surveys by NWES (2009b) in 2008/2009 found the Booroolong Frog occurring in the headwater streams of the Namoi Catchment between 400 to 700 metres above sea level. NWES located a large population of this species upstream of Chaffey Dam on the Peel River (NWES 2009b). The population at that time was conservatively estimated to be between 600 and 800 frogs (NWES 2009a). The area was again surveyed in January and February 2013 by experienced herpetologists Phil Spark and Dr Andrew Stauber and the species was found to be distributed along the Peel River from upstream of Chaffey Dam (within the current FSL) to Pearly Gates Bridge, Wombramurra Creek, and further upstream on the Peel River over a total distance of 25 km. The area surveyed and recorded locations of frogs are shown in Figure 2-2. A total of 2289 Booroolong frogs were recorded over 25 km of surveyed Peel River and Wombramurra Creek. Note, there is still a section of the Peel River upstream of Pearly Gates Bridge that has not been surveyed. However it is considered likely that the frogs would occur here (Phil Spark *pers comm.* 2013).

A population of this size is presently unknown from anywhere else in the current distribution of the species (P. Spark, *pers. comm.).*

2.1.2 Degree of Protection in Reserves

The majority of extant populations of the Booroolong Frog occur along streams that are not within nature reserves and are continuing to be modified, primarily through cattle grazing and weed invasion, in a manner that is likely to continue to contribute to the decline of this species. Habitat modification will undoubtedly contribute to the continued decline of the Booroolong Frog in the short term and increase the susceptibility of the species to other factors likely to be impacting on the species (for example the disease chytridiomycosis and exotic fish).

2.1.3 Revised impact assessment

The large population of Booroolong Frogs approximately 1 km upstream of Chaffey Dam (634 individuals) that was documented in NWES (2009b) had fallen to 50 individuals in the 2013 surveys at that location. This supports the previous assertion of NWES (2009b) that such a large number of frogs at one location was an anomaly and not representative of the distribution along the rest of the Peel River. Furthermore, the summer 2013 surveys found that the Booroolong Frog was well distributed along the Peel River, upstream of Chaffey Dam for a distance of approximately 25 km.

As discussed in **ngh**environmental (2012), the high density of metamorph and juvenile Booroolong Frogs found at the junction of the Peel River with Chaffey Dam in 2008/2009 may have been a result of two floods that occurred in November and December 2008, washing eggs and possibly young tadpoles downstream (NWES 2009b). The summer 2013 surveys support this hypothesis, as this site does not currently support such a high abundance of individuals and the frog is well distributed upstream along the Peel River. It is likely that after the floods individual Booroolong Frogs migrated from Chaffey Dam upstream, and since that time there has been a spread in their distribution along the Peel River (Phil Spark, *pers. comm*.). According to NWES (2009b) there is approximately 99km of potential Booroolong Frog habitat in the Namoi Catchment.

A very rough (and conservative) estimate of the Booroolong Frog population in the Namoi catchment was made, based on the number of Booroolong Frogs recorded from the 66 x 500 metre survey transects over 99 km of stream. On average, three to four frogs were recorded per 500 m, equating to a total population of between 594 and 792 frogs. This calculation excluded the 634 individuals recorded immediately upstream of Chaffey Dam, because it was considered atypical. The calculation also assumes that frogs occur along the length of the stream, which was not known at the time of writing (NWES 2009b).

Given the potential for 600 individual frogs to be impacted by inundation to the new FSL, the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) concluded that:

"*the Project is likely to have a significant impact on the population of the endangered Booroolong Frog that occurs immediately upstream of Chaffey Dam on the Peel River. However, this impact will be localised and the impact to the species across its range is unlikely to be significant.*"

It was recommended that surveys be undertaken in coordination with Namoi CMA during summer 2012/2013 to provide an updated estimate of the number of frogs both at the Chaffey Dam site and further upstream on the Peel River, in order to more accurately assess potential impacts on the species.

2.1.4 Current Surveys

Targeted surveys for Booroolong Frogs and their habitat were undertaken by Phil Spark and Dr Andrew Stauber over 21 nights between 17 January and 21 February 2013. These surveys comprised a follow-up study for surveys undertaken in 2008/2009 by Phil Spark (NWES 2009b), and are therefore considered a suitable comparison. The timing and methodology of these surveys were undertaken in accordance with the Survey guidelines for Australia's threatened frogs (DEWHA 2010), the Threatened species survey and assessment guidelines: field survey methods for fauna (DECC 2009b) and the Hygiene Protocol for the Control of Disease in Frogs (DECC 2008). The supplementary DGR's requested that surveys be undertaken during the breeding period (mid-November to mid-December), however the activity period extends until February (as stated in DEWHA 2010) and is dependent on local climatic conditions. Phil Spark conducted the surveys in January and February 2013 in response to local conditions and his

knowledge of the population. The commencement of surveys in January 2013 is not considered to be a limitation due to the high activity levels observed during this period.

2.1.5 Methods

Night surveys were undertaken over the full width of the Peel River, commencing at the southern end of Chaffey Dam and working upstream. Handheld spotlights were used to survey the ground along the water's edge, and under emerging rocks and logs. Booroolong Frogs were captured where necessary to determine gender, and subsequently released.

A GPS location was recorded for each sighting, using Garmin hand-held units. For each individual, gender or developmental status was recorded, along with microhabitat details. Notes were also taken on the presence of other frog species, turtles and eastern water dragons.

2.1.6 Results

A distance of 21.3 km of the Peel River, immediately upstream of Chaffey Dam to Pearly Gates Bridge, was sampled during the 2013 summer surveys. Two areas were also sampled further upstream; 0.5 km of the Peel River approximately 11 km upstream of Pearly Gates Bridge, and 3.2 km of Wombramurra Creek, a tributary of the Peel River approximately 8.8 km upstream of Pearly Gates Bridge (south) (Figure 2-2). Thus a total distance of approximately 25 km of the Peel River and one of its tributaries was sampled in summer 2013. To date, 2289 Booroolong Frogs have been recorded over 21 nights of survey.

A total of 50 individuals were recorded over the 1.6 km of Peel River inside the new FSL (excluding four individuals within a 200 m section of the existing FSL) and 2235 individuals along the Peel River and its tributaries outside the new FSL.

Of the frogs recorded outside the new FSL, 2037 individuals were recorded over a 19.5 km stretch of the Peel River upstream of the new FSL, 118 individuals were recorded within a 1.5 km stretch of Wombramurra Creek, and a further 80 individuals were recorded within a 0.5 km stretch of the Peel River further upstream. The majority of Booroolong Frogs were confined to stream sections where large rocks were abundant.

This information is summarised in Table 2-1.

Table 2-1. Booroolong Frog survey results, summer 2013

Location	Number of frogs	Description	Distance surveyed
Immediately upstream of Chaffey Dam			
Inside existing FSL	4	From 100 m north of Bowling Alley Point Bridge to southern boundary of existing FSL	0.2 km
Inside new FSL	50	From southern boundary of existing FSL to boundary of new FSL on Peel River	1.6 km
Outside new FSL	2037	From boundary of new FSL upstream on Peel River to Pearly Gates Bridge	19.5 km
Survey locations at upstream extent of survey area			
Outside new FSL	118	Wombramurra Creek, 8.8 km upstream of Pearly Gates Bridge	3.2 km
Outside new FSL	80	Peel River, 11 km upstream of Pearly Gates Bridge	0.5 km
Total	2289		25.0 km

2.1.7 Current Population Status

Prior to the summer surveys being undertaken in January 2013, the most recent data on the population status of the Booroolong Frog upstream of Chaffey Dam was recorded in 2008/2009 (NWES 2009b). The recent surveys (January 2013) aimed to estimate the current population of Booroolong Frogs on the Peel River, both inside and outside the new FSL, to allow for a more informed assessment of impacts associated with the Project. These surveys have also assisted with the first recovery objective of the National Booroolong Frog Recovery Plan; to determine the distribution in areas that have not been the focus of targeted surveys (NSW OEH 2012a).

The surveys conducted in summer 2013 recorded a total of 2289 Booroolong Frogs along the Peel River and Wombramurra Creek. Of these 616 were males, 510 females, 339 metamorphs and 824 sub-adults. There appears to be no pattern in the concentration of sex or age classes along the Peel River.

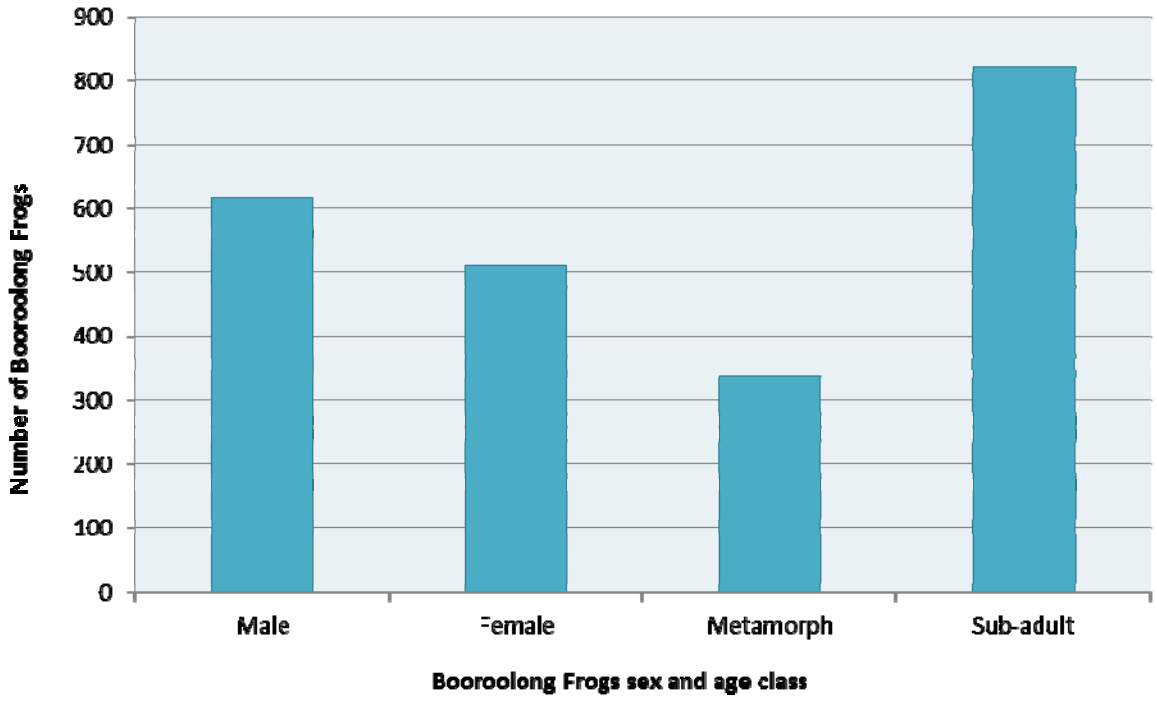

Figure 2-1 Sex and age class of Booroolong Frogs recorded in summer 2013 (NWES, 2013)

The summer 2013 surveys indicate that the Booroolong Frog population in the Peel River, immediately upstream of Chaffey Dam, currently comprises in the order of 2000 individuals, with a broad distribution along the length of the river surveyed (21.3 km). Fifty individuals were recorded within the new FSL, representing approximately 2.2% of the current known population of the Peel River (excluding the four individuals within the current FSL) surveyed in a 25 km stretch upstream of Chaffey Dam.

This suggests that the current impacts to the Booroolong Frog as a result of the Project are not as severe as initially assessed based on surveys undertaken in 2008/2009. However, as the Booroolong Frog is known to exhibit large fluctuations in abundance from one year to the next, as occurred when 634 individuals were observed within 1 km of Chaffey Dam, population abundance is not an accurate indicator of population resilience (NSW OEH 2012a). Therefore a more accurate reflection of impact to this species is to assess impact in relation to Booroolong Frog habitat.

2.1.8 Habitat

Surveys in summer 2013 found the Booroolong Frog to be well distributed along the Peel River, upstream of Chaffey Dam. These surveys showed that the entire 25 km of Peel River and Wombramurra Creek surveyed was occupied by Booroolong Frogs and is therefore considered to provide suitable habitat for the species. The presence of metamorph and sub-adult life stages in the area surveyed confirms all 25 km is suitable breeding habitat for the species. Assuming an average habitat width of 14.5 m, this equates to an area of 36.3 ha of known habitat confirmed on the Peel River and Wombramurra Creek. As stated above (section 2.1.3), the as yet unsurveyed section of the Peel River as shown in Figure 2-2 is considered likely to be occupied by Booroolong Frogs (Phil Spark *pers. comm.).*

The current data indicates that the Booroolong Frog is utilising the majority of habitat along the 25 km stretch of the Peel River immediately upstream of Chaffey Dam. Furthermore, it is known that the species uses a range of habitats at different life stages, with tadpoles developing in slow-flowing connected or isolated pools (Anstis 2002). It is therefore evident that the Booroolong Frog has a reliance on both riffle and pool habitats, which are the features that comprise the surveyed sections of the Peel River. The summer 2013 surveys also indicate that the Booroolong Frog has a microhabitat preference for riffles with large rocks (33%) followed by rapids with large rocks (26%) (Figure 2-3).

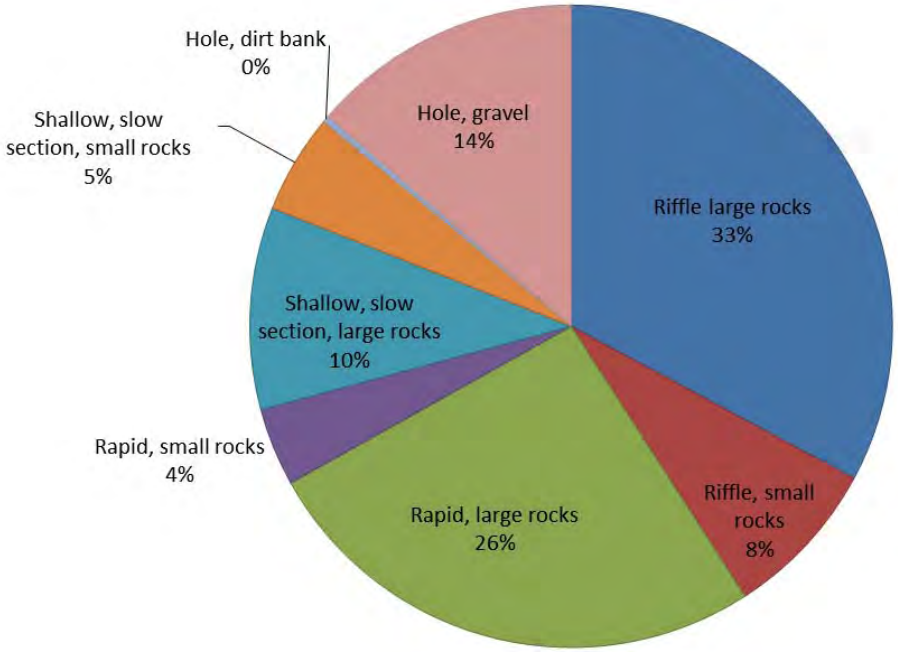

Figure 2-3 Microhabitat selection by Booroolong Frogs surveyed in summer 2013 in the Peel River and Wombramurra Creek. (source NWES 2013).

In the 2012 Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), riffle habitats were assessed as optimal Booroolong Frog habitat both within the new FSL and outside of the new FSL. Given the outcomes of the summer 2013 surveys, the loss of habitat as a result of inundation to the new FSL has been re-assessed to include the entire length of the river between the existing FSL and the new FSL for a distance of 1.6 km. At an average width of 14.5 m, this equates to an area of 2.3 ha, or 6.4% of the known Booroolong Frog habitat on the Peel River is that will be impacted as a result of inundation.

2.1.9 Potential Impacts

It is estimated that the area of Booroolong Frog habitat to be impacted by inundation to the new FSL is 2.3 ha. This is based on the mean width of the Peel River (14.5 m) within the distance between the existing FSL and the new FSL (1.6 km). Some areas of this habitat are already negatively impacted by shading, depth and substrate. Fifty Booroolong Frogs were recorded within this area during surveys in summer 2013.

Based on simulated 100 year dam volumes, the minimum duration over which the additional inundation will occur is expected to be between eight and 21 weeks, although inundation to the new FSL could take up to several years. Thus the magnitude of the impact on the individuals recorded within the FSL will initially be low and gradual. Given the proven ability of the frogs to move according to changed conditions evidenced by the four individuals recorded within the existing FSL, this may mitigate (slow) the

rate of habitat loss and provide an opportunity for the natural migration of individuals upstream, thereby reducing the impact to the species.

Water levels in the reservoir fluctuate with corresponding rainfall, inflow and drought events. Following implementation of the Project, the reservoir water level will not always be at the new FSL. According to simulated 100 year dam volumes, following augmentation to 100 GL the reservoir will only be at FSL 24% of the time. Further, the reservoir will be at or below the existing FSL around 21% of the time.

The changes in the reservoir storage level means that 100% of the 2.3 ha of Booroolong Frog habitat is only inundated when the reservoir is at 100% capacity (i.e. 24% of the time). While the suitability of habitat for the frogs once it has been inundated and the water level has dropped is unknown, for all storage levels below 100% the impact is less, to the point where the storage reduces to the existing FSL (or below) and the impact is zero.

The distribution of Booroolong Frog along the Peel River recorded in the summer 2013 surveys compared to the recorded distribution and abundance in 2009 (NWES 2009b) suggests that the Booroolong Frog is capable of migrating upstream and downstream and is resilient to a wetting and drying cycle. Thus, habitat currently occupied by the Booroolong Frog inside the new FSL may intermittently provide habitat for the Booroolong Frog following implementation of the Project, when reservoir levels are below the new FSL.

Due to uncertainties regarding the timing of initial inundation and the quality of the habitat post-inundation, the permanent loss of habitat inside the new FSL has been assessed. The National Recovery Plan for the Booroolong Frog states that "*any action that reduces stream permanency or results in loss of rock crevices, is likely to threaten the persistence of local populations of this species*". Therefore, despite the current abundance of the Booroolong Frog along the Peel River, the loss of 1.6 km (6.4%) of known Booroolong Frog habitat is considered to have a significant impact at a local and regional level. This population immediately upstream of Chaffey Dam forms the largest and most continuous distribution of the species known in northern NSW, and potentially Australia. As such, an Offset Plan has been prepared to satisfy the legislative requirements with the aim of reducing known threatening processes occurring along the Peel River, thereby contributing to the recovery of the Booroolong Frog in the Namoi catchment (Appendix C).

An Assessment of Significance in accordance with the EPBC Act *Significant Impact Guidelines 1.1 Matters of National Environmental Significance* is provided in Appendix A.

2.1.10 Management measures for Booroolong Frog

Due to the nature of the Project, impacts to the Booroolong Frog through inundation to the new FSL are unavoidable and cannot be mitigated. Accordingly, management measures are outlined below.

Major factors contributing to the decline of the Booroolong Frog within the Namoi catchment include disease (Chytridiomycosis) and habitat degradation (e.g. erosion due to vegetation clearing, stock grazing, and fossicking; weed invasion; sedimentation) (NSW OEH 2012a). As such, recommendations and management measures for the Booroolong Frog have been proposed in order to respond to these factors and contribute to the recovery of this species along the Peel River. As part of these management measures an Offset Plan which will strive to "improve or maintain" the existing population has been proposed and is included in Appendix C.

- A management plan will be developed and implemented for the Booroolong Frog that will include provision for:

  - Remediation and threat mitigation as required at offset sites (e.g. stock exclusion, weed removal, removal of exotic shading vegetation, protection from fossicking).
  - Post-construction monitoring for a minimum of two years to monitor the success of remediation and threat mitigation measures outside of the FSL, and to monitor the impacts of inundation on Booroolong Frog populations located within the FSL. This will be dependent on the rate of inundation and consultation with the relevant parties (e.g. Namoi CMA). Annual auditing and reporting would be required in order to detect potential problems associated with implementing mitigation measures (e.g. landholder compliance) as well as annual monitoring during the summer breeding season to assess the success of those measures and response of the Booroolong Frog population.
  - Following further consideration of mitigation strategies and consultation with OEH and Namoi CMA, relocation is no longer proposed for the Booroolong Frog.
  - Any monitoring undertaken must comply with the Hygiene Protocol for the Control of Disease in Frogs (DECC 2008) in order to prevent the spread of Chytridiomycosis.
- Riparian restoration and protection program. This will include:
  - Rehabilitation of the riparian zone both inside and outside of the new FSL to promote regeneration of native riparian vegetation
  - Weed control with a focus on woody weeds such as willows and Blackberry.
  - Signage to reduce human access.

These management measures have been designed in consultation with OEH, Namoi CMA and relevant experts. These management plans will form part of the approved Offset Plan (Appendix C).

2.1.11 Expected or Predicted Effectiveness of proposed mitigation

Threats to the Booroolong Frog are relatively well known and documented. Primary threats include disturbance and siltation impacts from fossicking and stock trampling, weed infestation, shading from exotic vegetation, chytrid, predation on adults frogs by foxes and predation on tadpoles by exotic fish such as European Carp.

The Offset Plan and management measures therein aim to address as many of these threats as possible by implementing private conservation agreements with landholders that ensure the management of riparian habitats along the Peel River with the aim of reducing the operation of these threats. The details of the implementation, timing, duration and nature of management activities will be finalised in consultation with Namoi CMA, OEH, SEWPaC and other relevant species experts.

2.2 QUEENSLAND BLUEGRASS

An historical record exists for Queensland Bluegrass in the Bowling Alley Point cemetery from early February 2003 (Appendix A.1). The cemetery is located in close proximity (approximately 500m east) to the Chaffey Dam reservoir and the habitat that occurs within the cemetery is similar to that which occurs within the area to be inundated by the proposed augmentation.

Targeted surveys carried out by **ngh**environmental in October 2012 did not locate Queensland Bluegrass at the location of the previous recording or elsewhere in the study area. However, as the species is more likely to be flowering (and thus identifiable) in summer, it was determined that summer surveys were necessary to determine whether it is present or absent in the study area. Without these surveys the

employment of the precautionary principle assumed that there was the potential for a significant impact to Queensland Bluegrass as a result of the Project. It was estimated that approximately 10 ha of high quality box gum woodland providing suitable habitat for Queensland Bluegrass, would be impacted by the Project as a result of both inundation and construction (**ngh**environmental 2012).

2.2.1 Survey Methods

A targeted summer survey for Queensland Bluegrass was undertaken from the 31 January to 1 February 2013 by two experienced botanists. This survey timing was considered suitable for detecting the species as the survey was carried out in the known flowering period for the species (NSW OEH 2012b) and the previous record was recorded on the 10 February 2003. A total of 13 person hours was dedicated to Queensland Bluegrass surveys (Table 2-2). The timing and effort devoted to this survey is considered to be adequate to confidently assess the presence or absence of this species.

Foot based surveys were conducted employing parallel transects spaced approximately 5 m to 10 m apart through areas of suitable habitat. A total of five foot based transect surveys were conducted, one at the location of the previous record (outside of the area of impact) and four within the area to be impacted by the Project, focusing on areas of better quality habitat. Areas immediately adjacent to the area to be impacted where also included.

A single driving transect was also conducted through lower quality habitat while moving between foot based survey locations. This consisted of observing from both sides of a slow moving vehicle, stopping when required to confirm species identifications.

The locations of transects and associated survey effort are described in Table 2-2. A map of survey effort is presented in Figure 2-4.

Table 2-2 Queensland Bluegrass targeted survey locations and effort

Transect No.	Targeted survey location description	Survey effort (person hours)
1	Bowling Alley Point cemetery	2.0
2	Box-Gum Woodland, eastern foreshore, north of Bowling Alley Point Recreation Area	3.5
3	Box-Gum Woodland derived grassland, eastern foreshore, between transect 2 and 4 (driving)	1.0
4	Box-Gum Woodland, eastern foreshore, opposite access road to cemetery	3.0
5	Box-Gum Woodland, eastern foreshore, north of Bowling Alley Point Bridge	2.0
6	Box-Gum Woodland derived grassland along northern verge of the Tamworth – Nundle Road within proposed road works area	1.5
Total		13.0

Figure 2-4 Queensland Bluegrass targeted survey locations

2.2.2 Results

From the six transect surveys conducted, no Queensland Bluegrass individuals were identified and it is considered unlikely that any would have been overlooked. Despite extensive searches, the previous record of this species within the Bowling Alley Point cemetery was not detected and thus not able to be verified.

The more common species of Bluegrass (*Dichanthium sericeum*), which is not listed as threatened under Commonwealth or State legislation, was identified along all transects within the areas to be impacted (being particularly abundant at transect 4) however, it was not detected within the cemetery. Considering that species of *Dichanthium* are generally shade intolerant it is possible that the overstorey within the cemetery has developed to the extent as to render the habitat unsuitable for either *D. sericeum* or *D. setosum* and that the threatened species no longer persists at this location.

2.2.3 Potential impacts and mitigation

The Terrestrial and Aquatic Flora and Fauna Impact Assessment conducted by **ngh**environmental in 2012 concluded that due to a previous record of the species (from 2003) in close proximity to the study area and that similar habitat occurred within the area to be impacted, a population of Queensland Bluegrass could exist and be impacted by the Project. As such, further surveys were recommended during the peak flowering period of Queensland Bluegrass in order to detect the species if it occurs, and accurately assess the impact of the Project on Queensland Bluegrass.

Targeted searches conducted on the 31 January and 1 February 2013 did not detect Queensland Bluegrass, either at Bowling Alley Point cemetery where it had previously been recorded, or in optimal habitat within the study area.

Given the suitability of the timing of the surveys and that all areas of better quality habitat within the area to be impacted were searched and the species not detected, it is considered that the species does not occur on the site and will not be impacted by the Project. No further recommendations are considered to be required for this species.

2.3 BORDER THICK-TAILED GECKO

The Border Thick-tailed Gecko is listed as vulnerable under the TSC Act and the EPBC Act. This species is patchily distributed on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree (NSW OEH 2012c). It is most common in the granite country of the New England Tablelands, occurring at sites ranging from 500 to 1100 m elevation. Populations are mostly fragmented, with over 50 discrete sites currently known that are separated by at least 2 km (NSW OEH 2012c).

There are 11 records in six locations of the Border Thick-tailed Gecko within 10 km of the dam wall, from between 1993 and 2008 (Appendix A.1). Most recently, this species has been recorded on the dam wall and in the remnant vegetation of Goat Mountain, adjacent to the dam wall (NWES 2009a and **ngh**environmental 2012).

With the placement of additional rock and associated activities with raising of the dam wall, this species may be impacted by construction of the Project. The artificial rocky surface area of the downstream dam wall currently provides approximately 50,000 m^2 of Border Thick-tailed Gecko habitat. The upstream face of the dam wall above the existing FSL provides approximately an additional 6,000 m^2 of suitable rocky habitat.

In the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) it was recommended that an ecologist be engaged to locate and remove Border Thick-tailed Geckos to a safe location in the Goat Mountain remnant prior to construction works on the dam wall. However, relocation is now deemed an inappropriate strategy given the unknown size of the population on Goat Mountain and therefore unknown habitat availability. Consultation with OEH has been carried out in order to form a strategy to maintain the population on the dam wall during construction, thus avoiding significant impacts to the gecko.

Surveys carried out by **ngh**environmental in October 2012, in a total survey effort time of 240 person minutes, confirmed the presence of the Border Thick-tailed Gecko on the dam wall and on Goat Mountain to the immediate north of the dam (**ngh**environmental 2012). The recommended survey period is November to February (SEWPaC 2011), however confirmation of the species presence on the dam wall was achieved in October, therefore no further surveys were considered to be required.

The proposed mitigation measures set out in Section 4 aim to avoid impacts to the population of Border Thick-tailed Geckos on the dam wall.

2.3.1 Habitat and Population at Chaffey Dam

Artificial habitat for the Border Thick-tailed Gecko is provided by the large rocks that form the existing dam wall. In 2008 and 2009 NWES conducted targeted searches for the Border Thick-tailed Gecko, and found it to be relatively common on the dam wall, as well as in shrubby rocky remnants around Woolomin, including Goat Mountain, to the immediate northwest of the dam wall.

The Border Thick-tailed Gecko was observed by NWES in 2008 on the dam wall (NWES 2009a). The species was also found to be relatively common within the locality and the region, recorded many times in shrubby rocky remnants around Woolomin, including Goat Mountain, to the immediate northwest of the dam wall. Geckos were also found to be relatively common within woodland remnants, dry open forests with a patchy and continuous shrub layer (NWES 2009a). NWES (2009a) concluded that the geckos on the dam wall are likely to be part of a much larger population in the remnant habitat of Goat Mountain.

One individual was found on Goat Mountain during surveys by **ngh**environmental in October 2012. A further three individuals were found on the crest of the dam wall in October 2012. However, due to access and safety issues, it was not possible to survey the whole of the artificial rock pile of the dam wall.

Construction associated with the raising of the dam wall has been designed to avoid impacts to the Border Thick-tailed Gecko. Provided that the proposed mitigation measures are carried out, the Project is not considered to have an impact on this species at a local, regional or national scale. No natural habitat for the species will be removed. An area of artificial habitat on the dam wall will be removed and replaced. An offset is not required for this species in accordance with the EPBC Act Environmental Offsets Policy and the NSW BioBanking Assessment Methodology. .

2.3.2 Potential Impacts

Surveys by **ngh**environmental in October 2012 confirmed the presence of the Border Thick-tailed Gecko on the dam wall (three individuals). The Gecko is known to currently inhabit the dam wall but due to the access and safety issues in surveying such a habitat the number of individuals is unknown.

It has been estimated that approximately 52,600 m^2 of the dam wall habitat will be impacted by both inundation (2,600 m^2) and construction (50,000 m^2). The rock used for raising of the dam wall will be

consistent with that currently inhabited by the species on the dam wall, therefore impacts to Border Thick-tailed Gecko habitat will only be temporary and short-term. Post-construction, the Border Thick-tailed Gecko will have access to the entire dam wall, including additional habitat created as a result of raising the dam wall. There will be no operational phase impacts on the species.

No other Border Thick-tailed Gecko habitat will be impacted as a result of the Project. Mitigation measures have been designed to maintain habitat for the Border Thick-tailed Gecko throughout the construction process, and are detailed in Section 2.3.3.

The Gecko occurs naturally on Goat Mountain to the immediate north of the dam wall and this population will not be impacted by the Project. Given it's occurrence in surrounding areas and the likelihood that it will recolonise the dam wall post construction, the impact is unlikely to be significant.

No naturally occurring population of the species will be impacted by the Project. Furthermore the proposed offset location northwest of the dam encompasses Goat Mountain which supports a known population of the species. There will be no translocation of individuals from the dam wall into already occupied habitats.

2.3.3 Mitigation and management measures for the Border Thick-tailed Gecko

To avoid impacts to the Border Thick-tailed Gecko during the construction phase, works will follow a staged and strategic plan for the clearing and excavation. The entire wall will not be impacted simultaneously, therefore the geckos should be able to continue to utilise areas of the wall during construction. A Fauna Management Plan will be prepared and implemented to guide the construction phase activities including the following considerations:

- Prior to the commencement of construction works to the downstream face of the dam wall, an area of artificial habitat will be established at the base of the dam wall at the northern end. The area of artificial habitat will be created from the same material to be used for raising of the dam wall. This will be done in a method and location that ensures existing habitat and the environment in general isn't adversely affected.
- Pre-clearing surveys will be undertaken at each stage of construction. This will include a pre-clearing survey immediately prior to the start of works to locate individual geckoes and move them to the area of constructed habitat at the base of the existing dam wall.
- Any Border Thick-tailed Geckoes located during surveys of the first section will be removed to the area of artificial habitat.
- Each section of the dam wall subject to rock placement will be surveyed for Border Thick-tailed Geckoes immediately prior to commencing work in that section.
- Addition of rock to the downstream face of the dam wall will be carried out gradually.
- Any Border Thick-tailed Geckoes located during surveys of subsequent sections will be removed to the adjacent completed section of dam wall (i.e. the new dam wall habitat).

State Water will ensure that the works follow a staged construction process in order for these measures to be implemented.

The wildlife corridor created in late 2011 and early 2012 linking Goat Mountain with the Peel River and habitat areas to the east was designed as a movement corridor for fauna, but is currently adversely impacted by stock and weeds.

- Weed management would be ongoing as per the Vegetation Management Plan particularly focusing on Coolatai Grass infested areas around the dam wall and planted wildlife corridor. Coolatai grass has been identified as a key threatening process for the Border Thick-tailed Gecko.

2.3.4 Expected or Predicted Effectiveness of proposed mitigation

The mitigation measures proposed for the Border thick-tailed Gecko have been developed in consultation with State Water and OEH to provide certainly of practicality and acceptability. Assumptions have been based on available data on the distribution of the species locally, elsewhere in the study area and within the artificial habitat of the dam wall. Adverse impact on the species will be avoided through the staged approach to dismantling the dam wall that State Water have committed to.

2.4 THREATENED FLORA SPECIES AND VEGETATION COMMUNITIES

2.4.1 EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Box-Gum Grassy Woodlands and Derived Grasslands were historically found throughout the western slopes and tablelands of the Great Dividing Range from southern Queensland to Victoria. Due to land clearing, weed invasion and overgrazing, less than 5% of the original extent remains in good condition, and this is largely made up of disjunct patches scattered throughout the region. Generally found on soils of moderate to high fertility, the community occurs where rainfall is between 400 and 1200 mm per year, and at altitudes of between 170 m and 1200 m (NSW Scientific Committee 2002). Blakely's Red Gum and Yellow Box are most common in grassy woodlands on the tablelands, whereas White Box predominates in woodlands on the western slopes. In the woodlands of the northern regions of NSW the community contains many species, such as Native Olive (*Notelaea microcarpa*), that are not generally found in the southern areas. It is also significant for containing the Nandewar Bioregion, in which there is a unique type of the community found. Box-Gum Woodland in the Nandewar Bioregion may have Western Grey Box (*Eucalyptus microcarpa)* or Coastal Grey Box (*E. moluccana*) as a dominant or co-dominant overstorey species. Historically (prior to 1750), the bioregion had an area of Box-Gum Grassy Woodland and Derived Grassland totalling approximately 151 198 ha, of which 94% has been cleared, so that today just 9 045 ha remains (NPWS 2000). The Tamworth Regional Council area, which includes Chaffey Dam and the surrounding region, was once extensively covered by Box-Gum Woodland, which has now largely been cleared. Just 1.3% of the council area is protected in a national park or nature reserve, and problems such as the invasion of woodland by Coolatai Grass (*Hyparrhenia hirta*) and other weeds, heavy stock grazing, and continued land clearing are having a considerable impact on the remaining Box-Gum Woodland of the area.

Some of the Box-gum grassy woodlands, Brigalow Belt South and Nandewar (Regional Vegetation Community RVC 17) vegetation community within and surrounding the project site meets the definition of the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland listed as a Critically Endangered Ecological Community (CEEC) under the EPBC Act.

The distribution of the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC is shown on Figure 4-1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) within the study area and within a 1km radius of the site.

As described in Section 5.3.1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (Table 5-2), approximately 6 ha of EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland occurs within the area to be impacted by the inundation to the new FSL. A further 4 ha of this community was expected to be impacted by the required realignment of roads.

Also as described in Section 5.3.1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment, approximately 506 ha of the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland community occurs within a 1 km buffer around the study site.

Following the refinement of the road works areas though the detailed design phase, the impact to this community has been reduced by more than 25% to 1.4 ha. The area to be inundated will remain unchanged (approximately 6 ha), however given the reduction in impact from the works areas, a total of approximately 7.4 ha of the EPBC listed community will be impacted by the Project.

As documented in the Terrestrial and Aquatic Flora and Fauna Impact Assessment, the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland will not be significantly impacted by the Project.

No offset is required under the EPBC Offsets Policy. An offset is required for all vegetation loss under the NSW BioBanking Assessment Methodology

2.4.2 TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland

All of Box-gum grassy woodlands, Brigalow Belt South and Nandewar (RVC 17) and Derived grasslands, Brigalow Belt South and Nandewar (RVC 28) vegetation communities within and surrounding the project site meet the definition of the White Box-Yellow Box-Blakely's Red Gum woodland listed as an Endangered Ecological Community (EEC) under the TSC Act.

As described in Section 5.3.1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), and shown in Figure 2-5 approximately 117 ha of this community occurs within the area to be inundated by the new FSL. Approximately 1300 ha of the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland occurs within a 1 km buffer around the study site. An additional 63 ha was expected to be impacted by the required realignment of roads.

Following refinement of the road footprint works areas, the impact to this community has been reduced by more than 50% to 33 ha. The area to be inundated will remain unchanged (approximately 117 ha), however given the reduction in impact from the works areas, a total of approximately 150 ha of the TSC listed community will be impacted by the Project.

As documented in the Terrestrial and Aquatic Flora and Fauna Impact Assessment, the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland will not be significantly impacted by the Project. However, in accordance with the NSW BioBanking Assessment Methodology offsets for this community are provided in the Offset Plan.

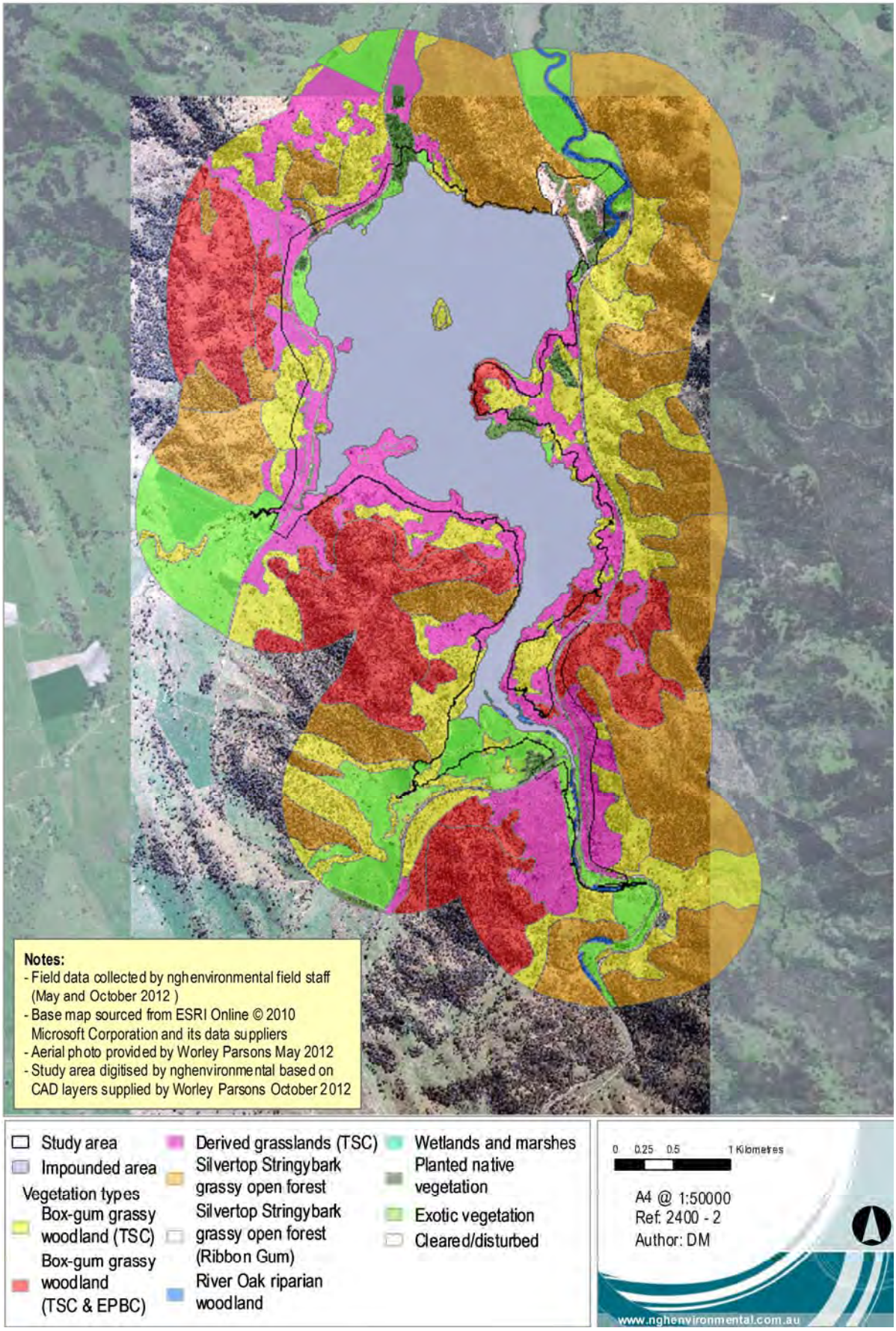

Figure 2-5 Vegetation Communities within the study area

2.4.3 Small Snake Orchid and Euphrasia arguta

The Small Snake Orchid (*Diuris pedunculata*) is listed as endangered under the TSC Act and the EPBC Act. *Euphrasia arguta* is listed as critically endangered under the EPBC Act.

Table 3-2 and Figure 3-1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) documents the location of targeted surveys and the associated survey effort for these species during the original survey of the site.

Targeted searches were carried out in suitable habitat for these species during October 2012. Survey timing was considered suitable for the Small Snake Orchid. Although not optimal, the survey timing was also considered suitable for detecting *Euphrasia arguta* given that flowering has previously been recorded in October. Further, it would have been possible to identify this species in its vegetative state if it was not flowering at the time of survey.

As documented on the Terrestrial and Aquatic Flora and Fauna Impact Assessment, targeted surveys did not detect these species and it is considered unlikely that the Small Snake Orchid or *Euphrasia arguta* occur within the study area and that they are unlikely to be impacted by the Project.

The locations of nearest records for the Small Snake Orchid and *Euphrasia arguta* are provided in the Habitat Evaluation attached as Appendix B to the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), Appendix 8 to the EIS (WorleyParsons 2012).

2.4.4 Justification for not targeting Eucalyptus rubida *subsp*. barbigerorum*,* Thesium australe *and* Bothriochloa biloba *as part of this assessment.*

The potential for these species to be present at the development site and to be impacted by the proposed works was assessed within the habitat evaluation included as Appendix B of nghenvironmental 2012. Further justification for not specifically targeting these species as part of the assessment is as follows:

Eucalyptus rubida subsp. *barbigerorum* – As stated in the habitat evaluation, this species is a conspicuous species. It may be detected at any time of year and during the course of the original vegetation surveys, almost all of the areas of impact were traversed by vehicle or foot. This species was not detected and no further targeted surveys were considered warranted.

Thesium australe – Potential habitat for this species was present at the site in localised areas and was not of high quality. Additionally, the nearest record of the species is approximately 50 km north-east of the site. Accordingly, it was considered unlikely that it would occur at the site.

The timing and location of the targeted flora surveys carried out at the site in spring (October) 2012 would have also been suitable for detecting this species and it was not identified.

Bothriochloa biloba – Heavier soils with which this species is associated were present at the site however, not the preferred brown or black clays. One record from 1997 was located in Nundle approximately 10 km from the site.

2.5 OTHER THREATENED FAUNA SPECIES

2.5.1 Murray Cod

The Murray Cod (*Maccullochella peelii)* was once abundant throughout the Murray-Darling river system, but overfishing and environmental changes have drastically reduced its numbers. The species has been selectively stocked in other river systems in New South Wales, Victoria and Western Australia, but has generally failed to establish itself in those areas. It occurs naturally in the waterways of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs (NSW DPI accessed 12/03/2013). The species now has a patchy distribution and abundance across its historic range and was listed as nationally threatened in 2003. The Murray Cod is not listed as threatened in New South Wales, but is identified as a member of the listed endangered ecological community Aquatic *Ecological Community in the Natural Drainage System of the Lower Murray River Catchment (Fisheries Management Act 1994)* (DEH 2003).

As stated in the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), the Murray Cod, which is listed as vulnerable under the EPBC Act, occurs within Chaffey Dam as well as downstream and upstream areas.

The species is stocked in these areas to enhance recreational fisheries and the Murray Cod is regularly caught in the waterways. As part of the State Government's fish stocking program, 25,000 Murray Cod had been introduced to Chaffey Dam to the summer of 2004/2005. It is therefore not a rare species in the area.

The Project will have minimal impacts on the Murray Cod for the following reasons:

- Mitigation measure and safeguards to avoid impact to the species are outlined in nghenvironmental (2012) section 6.1.3. These include measures to maintain water quality in the dam during construction.
- As the species is mobile it is unlikely to be impacted during the construction phase of the project
- The species occurs in a wide range of habitats (flowing and still water). The proposed works will retain availability of existing habitats, though the occurrence of riverine habitat will slightly decrease and the extent of still waters will increase.
- Cold water pollution impacts are currently mitigated through the use of a multi-level off-take operating protocols downstream areas. The proposed works are unlikely to increase this impact under appropriate management measures.

The information below is summarised from **ngh**environmental (2012) and was presented in the EIS (Worley Parsons 2012).

A desktop assessment of New South Wales dams ranked Chaffey Dam as a low priority in terms of cold water pollution potential to downstream environments because of small discharge volumes and predominately an extraction from shallow depths (and hence warm temperatures) (Preece 2004). Cold water releases from Chaffey Dam were predicted by IESC Pty Ltd (1974) to lower the downstream temperature by 6 to 10°C with the potential for resultant fish kills. Bishop and Harris (1990) reported lower water temperatures later into summer and depressed temperatures for up to 50km downstream of Chaffey Dam. Differences in water temperatures of the Peel River upstream and downstream of Chaffey Dam were simulated with a reservoir water quality model over two periods from 1995-1997 and 2005-

2007. The simulated water temperature is often up to 10°C cooler during January and February because of extraction of hypolimnetic cool waters as shown in Figure 5-3. (GHD 2008b). Cold water pollution therefore does occur at Chaffey Dam.

Chaffey Dam has a multi-level offtake (i.e. intake) tower that can be configured to extract water from a range of reservoir depths. In particular water from the reservoir can be extracted from two different depths simultaneously through the multi-level intake. Hence, there is opportunity to control the temperature of the released waters during the period of thermal stratification through extraction of cooler deep (hypolimnetic) waters, warmer surface (epilimnetic) waters or a blend. While the multi-level offtake tower is typically positioned within the thermocline there is some release from the hypolimnion and surface waters (Preece 2004). Impacts on this species from the Project will therefore be negligible.

2.6 THREATENED SPECIES HABITAT AVAILABILITY

2.6.1 Historical threatened species data

In preparing the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), the following databases were searched for records of EPBC Act and TSC Act listed threatened species previously recorded within a 10 km radius of the site:

- Primary Industries Fisheries Records viewer
- OEH Bionet Wildlife Atlas:
- EPBC Protected Matters Search tool

The results of database searches were detailed in Appendix A of **ngh**environmental (2012) (Appendix 8 of the EIS). Appendix B of **ngh**environmental (2012) provides a threatened species evaluation table that assesses the likelihood of occurrence and the potential for impact on those species revealed in database searches.

In summary, the database searches returned three trees, three shrubs, four forbs (including one orchid) and two grasses listed as threatened that occur or have the potential to occur within 10 km of the study site. Forty-two migratory or threatened terrestrial fauna species and/or their potential habitats have been recorded within 10 km of Chaffey Dam. Of these species, 16 are listed under the TSC Act, and 25 under the EPBC Act. Five of these threatened fauna species and three of the listed migratory species have been recorded within the study area since 1990; the Brown Treecreeper, Speckled Warbler, Little Lorikeet, Border Thick-tailed Gecko, Booroolong Frog, White-bellied Sea-eagle, Rainbow Bee-eater and Great Egret.

Appendix A shows the NSW OEH Wildlife Atlas data[1] of records within 10 km of the site and 1 km of the site and notes the EPBC Act status of TSC Act listed Species. The EPBC Act Protected Matters search tool does not provide location records of threatened species predicted to occur.

[1] This information is sensitive and is not to be reproduced or put on public display. The data is provided to **ngh**environmental under a data licence agreement that prohibits its display at a resolution that would allow the identification of threatened species locations. The data is provided for the review of OEH, SEWPaC and DP&I.

These are historical records of threatened flora and fauna species within a 1 km radius of Chaffey Dam, and are in addition to those detected by **ngh**environmental in 2012 and NWES in 2013. Record locations for Booroolong frogs were not provided in NWES 2009.

Targeted surveys and threatened species evaluations carried out by **ngh**environmental (2012) for the EIS ruled out the likelihood of impacts on all but one fauna species (Booroolong Frog) and one flora species (Queensland Bluegrass).

Forty-two migratory or threatened terrestrial fauna species and/or their potential habitats have been recorded within 10 km of Chaffey Dam. Of these species, 16 are listed under the TSC Act, and 25 under the EPBC Act. Five of these threatened fauna species and three of the listed migratory species have been recorded within the study area since 1990; the Brown Treecreeper, Little Lorikeet (Austeco 1990; GHD 2008), Speckled Warbler, Border Thick-tailed Gecko (NWES 2009a; **ngh**environmental 2012), Booroolong Frog (NWES 2009a; NWES 2009b; **ngh**environmental 2012), White-bellied Sea-eagle (GHD 2008; **ngh**environmental 2012), Rainbow Bee-eater (Austeco 1990) and Great Egret (GHD 2008).

An evaluation of the likelihood and extent of impacts on threatened fauna, found 19 other species with the potential to occur at the site (**ngh**environmental 2012). They included the Gang-gang Cockatoo, Varied Sittella, Little Eagle, Swift Parrot, Hooded Robin, Turquoise Parrot, Barking Owl, Powerful Owl, Scarlet Robin, Flame Robin, Australian Painted Snipe, Diamond Firetail, Large-eared Pied Bat, Spotted-tailed Quoll, Eastern Bentwing-bat, South-eastern Long-eared Bat, Squirrel Glider, and Grey-headed Flying-fox.

However, the impacts to these species were assessed to be low, as the habitat present at the site is not considered to be optimum and none of these species were recorded in surveys of the site. For some species, only a small amount of potential and marginal foraging habitat will be impacted by the Project (Swift Parrot, Powerful Owl, Scarlet Robin, Large-eared Pied Bat, Spotted-tailed Quoll). Other resources such as hollow-bearing trees for Squirrel Gliders and nesting or roosting resources for threatened birds and bats are low in abundance and quality at the study site.

An assessment of threatened species habitat in relation to vegetation communities was included in Section 4.2.3, 4.2.4 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012). Detailed assessment of the potential for impact on threatened species potentially present within the study area as a result of the project was undertaken in Appendix B of Terrestrial and Aquatic Flora and Fauna Impact Assessment. Threatened species evaluations were undertaken for all threatened species for which there were previous records in the locality. In order to determine whether a threatened species was likely to be impacted by the Project, the evaluation took into consideration the age and proximity of records with 10 km of the site, the availability of suitable habitat on the site, and the likelihood that the activity would impact on habitat for the species.

3 REVISED IMPACT ASSESSMENT

3.1 SUMMARY OF POSITIVE CHANGE IN OVERALL IMPACT

As a result of additional surveys, data analysis and detailed design since the submission of the EIS (Worley Parsons 2012) the extent of impact of the project has been reduced as follows:

- Impact of road works areas has been refined and reduced from a worst case scenario of 168 ha in total to a realistic area of 38 ha in total.
- Updated surveys have shown that the number of Booroolong Frogs to be impacted on reduced from 634 to 50 individuals over time (note: continued fluctuation of frog numbers is likely).
- Updated surveys have shown that there will be no impact on Queensland Bluegrass following confirmation that the species does not occur on site.

3.2 SUMMARY OF POTENTIAL IMPACTS ON THREATENED SPECIES

Table 3-1 provides a revised summary of the potential impacts to the Subject Species Queensland Bluegrass, Booroolong Frog, and Border Thick-tailed Gecko as a result of the Project.

Table 3-2 provides an updated assessment of impact for vegetation communities.

Table 3-1 – Revised Assessment of impact to Subject Species

Species	Extent of impact from inundation (inside FSL)	Extent of impact from construction (outside FSL)	Total
Queensland Bluegrass	None	None	N/A
Booroolong Frog	50 individuals	None	50 individuals
Booroolong Frog Habitat	1.6 km of known Booroolong Frog habitat on the Peel River	None	1.6 km
Border Thick-tailed Gecko	None	Unknown number of individuals living within the artificial habitat of the dam wall.	Unknown number of individuals living within the artificial habitat of the dam wall.
Border Thick-tailed Gecko Habitat	2,600 m^2 (area of upstream face of dam wall to be inundated).	50,000 m^2 (area of downstream face of dam wall).	52,600 m^2

Table 3-2 Revised areas of impact based on updated and more specific data on area of impact for roads and bridges.

Regional Vegetation Community (RVC)	Area to be inundated (ha)	Road area total	Road area overlap with FSL	Road Impact area	Area within a 1 km radius (ha)
Endangered Ecological Community (TSC)	117	63	n/a	33	117
Critically Endangered Ecological Community (EPBC)	6	4	n/a	1.5	509
Box–gum grassy woodlands, Brigalow Belt South and Nandewar (RVC 17)	30	6	0	6	1014
Derived grasslands, Brigalow Belt South and Nandewar (RVC 28)	87	31	4	27	293
Silvertop Stringybark grassy open forests, eastern Nandewar and New England Tablelands (RVC 39)	3	1	0	1	892
River Oak Riparian Woodland, eastern NSW (RVC 71)	6	0	0	0	15
Wetlands and marshes, inland NSW (RVC 70)	0.25	0	0	0	0
Planted non-indigenous native vegetation (no RVC)	9	2	0	2	21
Exotic non-native vegetation	45	4	2	2	276
TOTAL	**180.25***	**44**	**6**	**38**	**2510**

*This total area does not include existing cleared and disturbed areas

4 MITIGATION AND MANAGEMENT MEASURES

A comprehensive list of mitigation measures designed to avoid and minimise impacts to threatened species is provided in section 6.1 of **ngh**environmental (2012), amended by this report for the Border Thick-tailed Gecko (Section 2.3.3).

Detailed descriptions of the proposed management measures for the Booroolong Frog are detailed above in this report (Section 2.1.10) and in the attached Offset Plan (Appendix C). The Offset Plan provides details of proposed management actions and monitoring to be undertaken in the offset sites for the Booroolong Frog and Box-Gum Woodland.

5 CONCLUSION

Chaffey Dam is ranked by the NSW Dams Safety Committee as being in the "extreme" hazard category, having inadequate flood capacity, which is based on the population at risk and the severity of damage and loss that would result from dam failure (Dams Safety Committee 2008/2009). In terms of the Australian National Committee on Large Dams (ANCOLD) guidelines and NSW Dams Safety Committee risk framework, the dam failure risks at Chaffey Dam are considered to be intolerable. The proposed upgrade will provide the opportunity to bring the dam up to an acceptable level of risk. The proposed augmentation will increase water security for the region.

Specific recommendations and mitigation measures have been proposed in order to minimise where possible the level of impact on threatened species and ecological communities as a result of the Project. Where residual impacts remain, an Offset Plan has been prepared in accordance with the *Principles for the use of biodiversity offsets in NSW* and the *EPBC Environmental Offsets Policy* order to counterbalance specific impacts of the Project on biodiversity.

Rigorous surveys for the Queensland Bluegrass indicate that the species is unlikely to occur within the study area and is therefore unlikely to be impacted by the Project. As such, recommendations and mitigation measures specific to Queensland Bluegrass are not required.

The implementation of the proposed offset and management measures will assist in reducing the operation of threatening process on the larger population of Booroolong Frogs on the Peel River resulting in positive long term impacts. The proposed measures have been developed with reference to the National Recovery Plan for the Booroolong Frog (NSW OEH 2012a) in consultation with Namoi CMA, OEH, SEWPaC and species experts, with the overall aim of improving the habitat available for the species outside of the new FSL.

The proposed offset strategy and associated management and monitoring programs provide excellent opportunities for improving knowledge of the operation of threats on the Booroolong Frog population, the distribution of the frog beyond the known occurrence in the Peel River, and the protection of the existing population. The extent of impact on the frog population will be loss of approximately 2.2% of the known population on the Peel River (50 frogs from a population of over 2285).

An assessment of significance according to the EPBC Act Significant Impact Guidelines has been undertaken and is provided in Appendix A. The loss off 1.6 km of Booroolong Frog habitat on the Peel River constitutes a loss of 6.4% of the known occupied habitat of the species on the Peel River. As the species' known range is approximately 50% of its historic distribution (NSW OEH 2012a) and the Peel River is considered to be the stronghold of the species in northern NSW, the loss of 6.4% of the known occupied habitat for the species is considered to be significant. As such, an offset is required under both the State and Commonwealth offset policies.

The Border Thick-tailed Gecko will not be adversely impacted by the Project. A population of the Gecko occurs within the artificial habitat created by the construction of the existing dam wall. Construction associated with the raising of the dam wall has been designed to avoid impacts to the Border Thick-tailed Gecko. This habitat will be removed gradually and replaced in the same quantity and type of material so that the artificial habitat is restored. The loss of habitat during construction will be temporary at worst. Coolatai Grass infestations around the dam that pose a threat to survival of the Gecko will be controlled under the Vegetation Management Plan. The proposed mitigation measures for the Border Thick-tailed Gecko on the dam wall are considered to be effective in avoiding significant impacts to the species. There are no other habitats suitable for the Border Thick-tailed Gecko that will be impacted as a result of the Project.

An offset strategy under the EPBC Environmental Offsets Policy is not required for the Border Thick-tailed Gecko.

Offsets for Border Thick-tailed Gecko habitat are not required as no habitat for the species is being lost. However, the offsets provided for vegetation loss in accordance with the *Principles for the use of biodiversity offsets in NSW* incorporate Goat Mountain, an area of known habitat for the species. Goat Mountain is known to support a population of the Border Thick-tailed Gecko which is not currently protected.

No significant impacts to the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland or the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland are expected to result from the Project. Accordingly, an offset strategy under the EPBC Environmental Offsets Policy is not required for this community.

Residual impacts to vegetation, including the TSC Act listed EEC, will be offset at a ratio of approximately 2:1 and will be representative of all vegetation types to be impacted by the Project. In addition, management measures will target the restoration of foreshore areas, control of weeds and implementation of grazing regimes suitable for regeneration of understorey elements of the communities.

Thus, overall, the Project can be deemed acceptable in that, notwithstanding the residual impacts, the losses can be offset and substantial conservation gains can be achieved for threatened species and vegetation communities impacted by the Project through the ongoing monitoring and management of offset areas.

6 REFERENCES

Anstis, M. (2002). Tadpoles of South-eastern Australia: a Guide with Keys. Reed New Holland, Sydney.

Austeco (1990). Chaffey Dam Enlargement Proposal: Impact on Terrestrial Fauna. Report prepared for Department of Water Resources.

Campbell, A. (1999). Declines and disappearances of Australian frogs. Canberra, ACT: Environment Australia.

Department of Environment and Climate Change (DECC) (2007). Threatened species assessment guidelines (DECC 2007). Published by Department of Environment and Climate Change NSW, Sydney.

Department of Environment and Climate Change (DECC) (2009a). BioBanking Assessment Methodology. Published b Department of Environment and Climate Change NSW, Sydney.

Department of Environment and Climate Change (DECC) (2009b). Threatened species survey and assessment guidelines: field survey methods for fauna (Amphibians), Sydney.

Department of Environment and Heritage (DEH) (2003). Nationally threatened species and ecological communities: Murray Cod (*Maccullochella peelii peelii*).

Department of Sustainability and Environment (DSE) (2013). Booroolong Frogs rebound following Floods. http://www.dse.vic.gov.au/about-dse/media-releases/booroolong-frogs-re-bound-following-floods.

Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (2011). Survey guidelines for Australia's threatened reptiles.

Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (2012). Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010). Survey guidelines for Australia's threatened frogs. http://www.environment.gov.au/epbc/publications/threatened-frogs.html.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009). Matters of National Environmental Significance: Significant Impact Guidelines 1.1.

GHD (2008). Chaffey Dam Upgrade Ecological Assessment. Report prepared for State Water Corporation.

Namoi Catchment Management Authority (Namoi CMA) (2011). Namoi Catchment Management Authority Biodiversity Offsets Policy.

New South Wales Department of Environment and Climate Change (NSW DECC) (2008). Hygiene protocol for the control of disease in frogs. Information Circular Number 6. DECC (NSW), Sydney South.

nghenvironmental (2012). Chaffey Dam Augmentation and Safety Upgrade. Terrestrial and Aquatic Flora and Fauna Impact Assessment. Report prepared for State Water Corporation.

NSW Department of Primary Industries Fishing and Aquaculture (NSW DPI) (2013). Murray cod *Maccullochella peelii.* [Internet] Accessed 12/03/2013.

NSW Office of Environment and Heritage (NSW OEH) (2011). NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects.

NSW Office of Environment and Heritage (NSW OEH) (2012a). National Recovery Plan for Booroolong Frog (*Litoria booroolongensis*) Office of Environment and Heritage (NSW), Hurstville.

NSW Office of Environment and Heritage (NSW OEH) (2012b). Bluegrass - Namoi: Distribution and vegetation associations. http://www.environment.nsw.gov.au/threatenedspeciesapp/profileData.aspx?id=10221&cmaName=Namoi.

NSW Office of Environmental and Heritage (NSW OEH) (2012c). Threatened species and ecological communities of NSW, Border Thick-tailed Gecko - Profile. Accessed 11/03/2012.

NWES (2009a). Flora and Fauna Impact Assessment for the proposed Chaffey Dam Safety Upgrade Options 1 & 2- Addendum report to the GHD Ecological Assessment Report.

NWES (2009b). Review of the conservation status of the Booroolong Frog (*Litoria booroolongensis*) within the Namoi River Catchment. Report prepared for the Namoi Catchment Management Authority.

WorleyParsons (2012). Chaffey Dam Augmentation and Safety Upgrade Environmental Impact Statement State Significant Infrastructure. Report prepared for State Water.

APPENDIX A REVISED THREATENED SPECIES IMPACT ASSESSMENT

A.2 EVALUATION TABLE FOR SUBJECT SPECIES

Using searches undertaken for the Central West CMA catchment, Canbelego Downs and Bogan-Macquarie sub-catchments using the OEH Atlas of NSW Wildlife threatened species database (as the subject site occurs close to the boundaries of these sub-catchments) and over a 10 kilometre radius using the Commonwealth EPBC Act Protected Matters search tool.

Species	Description of habitat[2]	Presence of habitat	Likelihood of occurrence	Possible impact?
Dichanthium setosum **Queensland Bluegrass** **TSC-V, EPBC-V**	Bluegrass is an upright grass less than 1 m tall. Occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, as well as in Queensland and Western Australia. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. Flowering time is mostly in summer. Associated with heavy basaltic black soils. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). It is open to question whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat. Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis, Myoporum debile, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Medicago minima, Leptorhynchos squamatus, Lomandra* aff. *longifolia, Ajuga australis, Calotis hispidula* and *Austrodanthonia, Dichopogon, Brachyscome, Vittadinia, Wahlenbergia* and *Psoralea* species. Locally common or found as scattered clumps in populations.	Typical habitat absent.	Unlikely. Recorded at Bowling Alley Point (500 m east of the study area) in similar habitat to that in areas around the dam. However species not detected during targeted surveys in January 2013.	No. Species not detected during optimal flowering period despite rigorous searches.
Litoria booroolongensis **Booroolong Frog**	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from much of the Northern Tablelands, however several populations have recently been recorded in the Namoi	Present	Present	High. Assessment of significance has been prepared.

[2] Information sourced from species profiles on OEH Atlas of NSW Wildlife threatened species database (http://www.environment.nsw.gov.au/threatenedspecies/) or the Australian Government's Species Profiles and Threats database (SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)

Species	Description of habitat2	Presence of habitat	Likelihood of occurrence	Possible impact?
TSC-E, EPBC-E	catchment. The species is rare throughout most of the remainder of its range. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Shelter under rocks or amongst vegetation near the ground on the stream edge. Sometimes bask in the sun on exposed rocks near flowing water during summer. Known to be associated with the following vegetation formation: dry sclerophyll forests (shrub/grass sub-formation), dry sclerophyll forests (shrubby sub-formation), forested wetlands, freshwater wetlands, grassy woodlands, heathlands, wet sclerophyll forests (grassy sub-formation). Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools. Forage on stream banks or vegetation and timber within 100m of stream. May shelter on stream banks or vegetation and fallen timber within 100m of stream. Best detected from December to February.			
Uvidicolus sphyrurus **Border Thick-tailed Gecko** ***TSC-V, EPBC-E***	Found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree. Most common in the granite country of the New England Tablelands. Often occurs on steep rocky or scree slopes. Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter.	Present – dam wall	Present - on dam wall	No. Artificial habitat to be gradually removed and replace in a staged manner under the supervision of an ecologist.

A.3 ASSESSMENT OF SIGNIFICANCE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999.

The *Environment Protection and Biodiversity Conservation Act* 1999 specifies nine factors to be taken into account in deciding whether a development is likely to significantly affect Endangered Ecological Communities, threatened species and migratory species listed on the schedules of the Act. These 'significant impact criteria' are listed within the 'Significant Impact Guidelines for Matters of National Environmental Significance' (DEWHA 2009).

The following assessments of significance considers the potential impact of the proposed action on the Booroolong Frog (EPBC-E) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC-CEEC).

Booroolong Frog *(Litoria booroolongensis)*, EPBC-E

Is there a real chance or possibility that the action will:

a) ***lead to a long-term decrease in the size of a population?***

In summer 2013 a total of 50 individuals were recorded over the 1.6 km of Peel River inside the new FSL (excluding four individuals within a 200 m section of the existing FSL) and 2235 individuals along the Peel River and its tributaries outside the new FSL.

Of the frogs recorded outside the new FSL, 2037 individuals were recorded over a 19.5 km stretch of the Peel River upstream of the new FSL, 118 individuals were recorded within a 1.5 km stretch of Wombramurra Creek, and a further 80 individuals were recorded within a 0.5 km stretch of the Peel River further upstream. Thus the surveys have found the Booroolong Frog to be well distributed along 25 km of the Peel River indicating that this entire stretch of river provides important habitat for the species.

The Booroolong Frog is known to exhibit large fluctuations in abundance from one year to the next, therefore population abundance is not a useful indicator of population resilience (NSW OEH 2012). Therefore impacts have been assessed in relation to Booroolong Frog habitat. The lack of long-term studies on the Booroolong Frog within the Namoi Catchment, and probably elsewhere, makes it difficult to ascertain the reasons for these explosive population events. While the population seems to be viable in this moment in time, it may be much more restricted in future years due to changing conditions such as drought or flooding (Phil Spark, *pers. comm.*).

b) ***reduce the area of occupancy of a species?***

The Project will reduce the area of occupancy for the Booroolong Frog. Given the outcomes of the summer 2013 surveys, the loss of habitat as a result of inundation to the new FSL has been assessed to include the entire length of the river between the existing FSL and the new FSL for a distance of 1.6 km. At an average width of 14.5 m, this equates to an area of 2.3 ha that will be inundated as a result of the Project. This constitutes 6.4% of the known occupied habitat on the Peel River, which is considered to be the stronghold of the species in northern NSW. In isolation this level of impact would place pressure on the long term viability of a local population.

c) ***fragment an existing population into two or more populations***

The Project will not fragment an existing population into two or more populations. The area of inundation is at the southernmost point of Chaffey Dam. There is unsuitable habitat available for the

Booroolong Frog at Chaffey Dam, and there are no recent records for the Booroolong Frog downstream of the dam.

d) ***adversely affect habitat critical to the survival of a species?***

The National Recovery Plan for Booroolong Frog (OEH 2012) states that "habitat critical to the survival of the Booroolong Frog is rocky sections of permanent streams occupied by the species. Any action that reduces stream permanency (e.g. pumping water) or results in loss of rock crevices (e.g. smothering by weeds or sedimentation), is likely to threaten the persistence of local populations of this species." The area of river that will be inundated as a result of the Project contains habitat critical to the survival of the Booroolong Frog. The habitat equates to 6.4 % of the total known habitat along the Peel River, immediately upstream of Chaffey Dam.

e) ***disrupt the breeding cycle of a population?***

It is unknown to what extent the project will disrupt the breeding cycle of the Booroolong Frog within the impact area. Breeding is known to occur in spring and early summer, from October through to early January. The species uses a range of habitats at different life stages, with tadpoles developing in slow-flowing connected or isolated pools (Anstis 2002). Tadpoles take 2-4 months to develop, metamorphosing in late summer to early autumn (NSW OEH 2012; Anstis 2002). It is therefore evident that the Booroolong Frog has a reliance on both riffle and pool habitats, which are the features that comprise the surveyed sections of the Peel River. The loss of habitat for the Booroolong Frog as a result of the Project will also reduce the extent of breeding habitat for this species.

f) ***modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?***

The Project will result in the effective removal of 2.3 ha of known habitat for the Booroolong Frog. Not enough is currently known about this species, therefore the impacts of the Project on the population of the Booroolong Frog along the Peel River cannot be fully understood. The site to be inundated is historically known as a high density location, probably due to floods in 2008. Suitable habitat is a limiting factor for the persistence of the Booroolong Frog, therefore the removal of 6.4% of habitat of the local population is deemed to contribute to the decline of the species.

g) ***result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?***

The Project will not result in the establishment of invasive species in the habitat of the Booroolong Frog, either within the impact area or further upstream. Threats from invasive species such as predatory fish and foxes already exist, and will not be exacerbated by the Project.

h) ***introduce disease that may cause the species to decline?***

The Project will not increase the impact of infection with the amphibian chytrid fungus on the Booroolong Frog population along the Peel River. Chytrid fungus is already a known threat in the area, and will not be amplified by the Project.

i) ***interfere with the recovery of the species?***

The National Recovery Plan for Booroolong Frog *Litoria booroolongensis* identifies eight overall objectives each with a number of priority actions within it (NSW OEH 2012). The overall objective of recovery is to minimise the probability of extinction of the Booroolong Frog in the wild, and to increase the probability of populations becoming self-sustaining and viable in the longer term.

Recovery Plan Objective	Recovery Plan Objective details	State Water response
1	Determine the species distribution in areas that have not been the focus of targeted surveys.	State Water and Namoi CMA funded the summer 2013 surveys along the Peel River, which has increased our understanding of the present status and distribution of the Booroolong Frog along 25 km of the Peel River. A management plan will be developed and implemented by State Water for the Booroolong Frog population on the Peel River that will include provision for post-construction monitoring for a period of 2 years to monitor the impacts of the Project on the population both within and outside the new FSL.
3	Reduce the impact of known or perceived threats contributing to the ongoing decline of the Booroolong Frog.	The management plan to be developed and implemented by State Water for the Booroolong Frog population on the Peel River will include provision for an Offset Plan which includes remediation and threat mitigation as required at offset sites (e.g. stock exclusion, weed removal, restoration of the riparian zone).
4	Determine population trends across the species range, and in areas subject to different management regimes.	Post-construction monitoring will detect changes in populations both within and outside of the new FSL, and relate those changes to specific habitat features and the presence/absence of threats at recorded locations.
6	Identify other potentially threatening processes.	Post-construction monitoring will record the presence/absence of Chytridiomycosis within the population Post-construction monitoring will also allow for the detection and quantification of other threatening processes presently unknown that may be contributing to the decline of the species.
7	Increase community awareness and involvement in the Booroolong Frog recovery program.	State Water to consider future possibilities for raising community awareness and collaborative work with Namoi CMA.
8	Achieve the effective implementation of the recovery plan.	All of the actions above will contribute to effectively implementing the objectives of the recovery plan.

OEH has prepared a Priorities Action Statement (PAS) to promote the recovery of threatened species and the abatement of key threatening processes in New South Wales. A Priorities Action Statement (PAS) has identified 19 broad strategies to help the recovery of the Booroolong Frog. Seven of these action statements will be contributed to by State Water.

Priorities Action Statement	Priorities Action Statement details	State Water response
1	Prepare and implement an annual monitoring program to determine population status and the influence of management actions	A management plan will be developed and implemented by State Water for the Booroolong Frog population on the Peel River that will include provision for post-construction monitoring for a minimum of 2 years to monitor the population within the new FSL. An offset site management plan will also monitor the population at sites outside of the new FSL along the Peel River. Monitoring will be designed to monitor the influence of management actions and to actively respond to the success or failure of those actions accordingly.
2	Determine current distribution and abundance in relation to landscape and habitat quality attributes.	Surveys in summer 2013 determined the current distribution and abundance of the Booroolong Frog along the Peel River in relation to landscape and habitat quality attributes. This will be further assessed during the post-construction monitoring and offset site monitoring programs.
4	Determine the influence of habitat disturbance on persistence, abundance and demography.	The effects of habitat degradation (stock, weeds, erosion, humans) on the presence and distribution of the Booroolong Frog will be considered as part of the monitoring programs to be implemented as part of the Booroolong Frog Management Plan and the Offset Site Management Plan.
7	Use management agreements and incentives for riparian fencing and re-snagging to reduce further habitat degradation and enhance the extent of suitable habitat.	Conservation Agreements at offset sites will be implemented to reduce the impacts of habitat degradation and disturbance, and promote restoration of the riparian zone. This will be detailed in the Offset Site Management Plan.
10	Investigate and implement options for reducing the potential impact of introduced fish, including the control of	Control of carp in streams is deemed to be ineffective, therefore it has not been recommended (Anna Cronin, *pers. comm.*).

Priorities Action Statement	Priorities Action Statement details	State Water response
	carp in streams with known populations.	However, the presence and abundance of predatory fish will be monitored during post-construction and offset site monitoring programs.
16	Negotiate, develop and implement conservation management agreements for known high priority sites.	Conservation Agreements will be implemented at offset sites according to the Offset Plan and Offset Site Management Plan. The offset site will be located on the Peel River where Booroolong Frogs are known to occur. The Peel River is a high priority site.
17	Implement hygiene protocol to reduce the transmission of harmful pathogens within and between populations.	The hygiene protocol for the control of disease in frogs will be implemented when working with frog populations.

The Threat Abatement Plan (TAP) 'Infection of amphibians with chytrid fungus resulting in chytridiomycosis' has two broad objectives:

Threat Abatement Plan	Threat Abatement Plan details	State Water response
1	To prevent amphibian populations or regions that are currently chytridiomycosis-free from becoming infected by preventing further spread of the amphibian chytrid within Australia.	The hygiene protocol for the control of disease in frogs will be implemented when working with frog populations.
2	To decrease the impact of infection with the amphibian chytrid fungus on populations that are currently infected.	As above

References

Anstis, M. (2002). *Tadpoles of South-eastern Australia: a Guide with Keys.* Reed New Holland, Sydney.

NSW Office of Environment and Heritage (NSW OEH) (2012). National Recovery Plan for Booroolong Frog (*Litoria booroolongensis*) Office of Environment and Heritage (NSW), Hurstville.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009). Matters of National Environmental Significance: Significant impact guidelines 1.1.

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Is there a real chance or possibility that the action will:

j) ***reduce the extent of an ecological community?***

Approximately 10 ha of EPBC-listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (hereafter called Box-Gum Woodland) is likely to be inundated or be cleared as a result of the Chaffey Dam safety upgrade and augmentation (the Project). The works are thus going to effectively clear this extent of the community from the landscape. Field surveys conducted within a 1 km buffer zone surrounding Chaffey Dam and subsequent GIS mapping indicate that there is approximately 506 ha of Box-Gum Woodland currently present in the area.

k) ***fragment or increase fragmentation of an ecological community?***

Habitat within the study area has already been highly modified and fragmented due to agricultural and recreational pressures. Habitat for this community is substantially more contiguous above the new FSL in areas where it currently exists. There is approximately 1300 ha of lower-quality TSC-listed Box-Gum Woodland that is present in the buffer zone which also assists in the connectivity of the EPBC-listed community. Considering this, the Project is unlikely to result in any substantial further fragmentation of Box-Gum Woodland in the region.

l) ***adversely affect habitat critical to the survival of an ecological community?***

A draft National Recovery Plan for Box-Gum Woodland (2010) states that habitat critical to the survival of Box-Gum Woodland is "*on the moderate to highly fertile soils of the western slopes of NSW and Queensland, the northern slopes of Victoria, and the tablelands of the Great Dividing Range from southern Queensland through NSW and the ACT*". It also suggests that any areas that meet the minimum conditional criteria for Box-Gum Woodland should be considered critical to the survival of the community. Within the area to be affected by the Project, 10 ha of habitat that meets the conditional criteria will be adversely affected by inundation or vegetation removal.

m) ***modify or destroy abiotic factors necessary for an ecological community's survival?***

The area surrounding the dam that is to be inundated will have a number of abiotic factors altered. In essence, there will be increased saturation of the soil by water (raising of the water table) as well as potential erosion and sedimentation impacts. It is assumed that the changes in abiotic factors that the area will experience will effectively remove 10 ha of Box-Gum Woodland. However, this is unlikely to place the local occurrence of the community (506 ha within a 1 km buffer zone that will not be impacted) at risk of extinction.

n) ***cause a substantial change in the species composition of an occurrence of an ecological community?***

Impacts resulting from inundation would be likely to substantially change the species composition of the community within the study area. The removal of all Box-Gum Woodland within the Project boundaries (10 ha) is expected to occur. The proposed works are unlikely to cause a substantial change in the species composition of Box-Gum Woodland outside of the Project boundaries (outside the new FSL and road footprint areas).

o) ***cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including assisting invasive species to become established or causing regular mobilisation of chemicals or pollutants into the ecological community?***

There will be a substantial reduction in the quality or integrity of approximately 10 ha of Box-Gum Woodland due to the predicted inundation. The Project has the potential to spread weeds such as the invasive Coolatai Grass (*Hyparrhenia hirta*) and Blackberry (*Rubus fruticosus* aggregate) that are already common in the vicinity of the dam. Many of these species are already established within and near to the Box-Gum Woodland that surrounds the dam. Safeguards have been proposed that will ensure weeds are adequately controlled at the site, and a Vegetation Management Plan will be prepared for the Project. With the appropriate implementation of weed controls during and following construction, weed impacts of the Project are not expected to be significant.

It is not expected that there will be any regular mobilisation of fertilisers or herbicides or other chemicals or pollutants into the ecological communities within the buffer zone around the dam that will kill or inhibit the growth of native species in the ecological community. Weed control will occur during and after the project, which will likely involve the application of herbicides to exotic species, but this is unlikely to cause the death or injury of native species in the ecological community.

p) ***interfere with the recovery of an ecological community?***

The recovery of the ecological community within the Project boundaries (10 ha) will be prevented due to inundation and construction works. The management of the Box-Gum Woodland outside the new full supply level in perpetuity (roughly estimated to be 75 ha) should ensure that its condition is improved and the rate of recovery is accelerated. In this sense, there should be a beneficial effect on the recovery of Box-Gum Woodland outside of the project boundaries as the result of the proposed Offset Plan..

The draft National Recovery Plan for Box-Gum Woodland (2010) identifies seven overall objectives each with a number of priority actions within it. The specific objective to be achieved is to minimise the risk of extinction of the ecological community.

Recovery Plan Objective	Recovery Plan Objective details	State Water response
1	Achieving no net loss in extent and condition of the ecological community throughout its geographic distribution	The loss of approximately 10 ha of Box-Gum Woodland within the Project boundary will be offset by the active management in perpetuity of the ecological community in the surrounding area. The active management of TSC-listed Box-Gum Woodland outside the boundary has the potential to considerably increase the area of the EPBC-listed community in the region.
3	Increasing protection of sites in good condition	Depending on the final calculated value of the area to be offset, it is likely that between 40 and 75 ha of Box-Gum Woodland will be protected and actively managed in perpetuity by State Water, as well as protecting a larger area of the lower quality TSC-listed ecological community.
4	Increasing landscape functionality of the ecological community through	The Box-Gum Woodland that surrounds the dam has been degraded as the result

	management and restoration of degraded sites	of moderate to heavy grazing and recreational activities. With the active management of both TSC- and EPBC-listed Box-Gum Woodland around the dam, including the reduction of stocking rates and weed management, there should be a rapid and noticeable increase in the landscape functionality of the ecological community.
6	Increasing transitional areas around remnants and linkages between remnants	The offset site, which already has a much greater contiguity than the patches within the immediate vicinity of the dam, will be managed to benefit the connectivity of higher quality patches by increasing the quality of the TSC-listed community that often surrounds them. In time, it is likely that the size of the high-quality patches will expand to encompass the surrounding lower-quality habitat.
7	Bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland	As much of the offset sites are located on leasehold land, there will be considerable landholder involvement in the management of the Box-Gum Woodland. A Conservation Agreement is likely to be established, and a number of management measures will be suggested. These may include, but are not limited to, the exclusion of feral species, weed control, and the management of stock grazing for conservation purposes. It is expected that a number of land managers (for different leaseholds) will be heavily involved in all of these aspects.

References

Department of Environment, Climate Change and Water NSW (2010). National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland, Draft for Public Comment. Department of Environment, Climate Change and Water NSW, Sydney.

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009). Matters of National Environmental Significance: Significant impact guidelines 1.1.

APPENDIX B RESPONSE TO SUBMISSIONS

Documents referred to in this response to submissions are:

3. WorleyParsons (2012) Chaffey Dam Augmentation and Safety Upgrade Environmental Impact Statement State Significant Infrastructure. Report prepared for State Water.
4. **ngh**environmental (2012). Terrestrial and Aquatic Flora and Fauna Impact Assessment. Appendix 8 of WorleyParsons (2012).

Concern/Issue	Comment	nghenvironmental response
Namoi Catchment Management Authority (CMA) Submission, dated 30 January 2013		
Length of aquatic environment inundated	The length and impacts of the additional stream environment inundation needs to be clarified, especially with regard to the Booroolong Frog habitat.	Following surveys on the Peel River in January 2013, impacts to the Booroolong Frog have been further assessed and are discussed in more detail within the Addendum Flora and Fauna Report.
Booroolong frog population decline and habitat loss	Additional research and investigation be undertaken prior to project approval into possible mitigation measures for the protection and conservation of the Booroolong frog and its habitat.	Refer to Addendum Flora and Fauna Report for detailed discussion of mitigation and management measures.
Impacts on terrestrial biodiversity	Namoi CMA is consulted during the preparation of the Biodiversity Management Plan including the Booroolong Frog Management and the Vegetation Management Plans.	Namoi CMA will be consulted during the preparation of these documents.
Net loss of native vegetation and compliance with the Namoi CMA Biodiversity Offsets Policy 2011	Namoi CMA is consulted during the preparation of the Offset Strategy. Recommended inclusions in the offset strategy:	Namoi CMA has been consulted throughout the preparation of the Offset Plan and will continue to be consulted throughout the during the finalisation and implementation of the plan.
	➢ consideration of the Namoi CMA Biodiversity Offset Policy 2011,	➢ The Namoi CMA Biodiversity Offset Policy 2011 has been considered in development of the Offset Plan.
	➢ offsets achieve multiple identifiable benefits,	➢ The offsets proposed in the Offset Plan are deemed adequate to benefit biodiversity matters that may be or will be impacted by the Project.
	➢ the whole 203 ha of native vegetation be adequately offset,	➢ The Biobanking calculator has been used to calculate an

Concern/Issue	Comment	nghenvironmental response
		adequate offset for the loss of habitat as a result of the Project. This is discussed in more detail in the Offset Plan.
	➢ the Biobanking Assessment Methodology should be used,	➢ The Biobanking Assessment Methodology has been used.
	➢ at least 203 ha be planted to native vegetation to offset net loss of native vegetation, ➢ that a pro-rata area of native vegetation be planted to offset the loss of equivalence and functional time lags,	➢ The Biobanking Assessment Methodology and EPBC Offsets Assessment Guide have been used to calculate suitable offsets under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Planting of native vegetation in riparian zones was recommended in Section 6.1.3 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012).
	➢ that an Offset Monitoring Plan is included in the Offset Strategy,	➢ An Offset Monitoring Plan will be developed as part of the Offset Package.
	➢ that processes are in place to complete a Conservation Property Vegetation Plan to secure the biodiversity offsets.	➢ State Water has commenced discussions with Namoi CMA and relevant land owners on the Peel River with a view to undertaking individual Conservation Agreements with each landowner in order to implement the recommended management actions along the offset site for the Booroolong Frog on the Peel River. It is proposed that existing agreements between Namoi CMA and landholders would be dissolved once agreements are in place between state Water and landholders. ➢ State Water is the owner of the land nominated as the vegetation offset site. ➢ A conservation agreement would be administered under the NP&W Act by OEH
Office of Environment and Heritage (OEH) Submission, dated 1 February 2013		
Impact Assessment		
Issue 1 **Selection of threatened flora**	That the Proponent provide adequate justification for not targeting *Eucalyptus rubida* subsp. *barbigerorum, Thesium*	The potential for these species to be present at the development site and to be impacted by the proposed works was assessed within the habitat evaluation included as Appendix B of **ngh**environmental

Concern/Issue	Comment	nghenvironmental response
species for targeted surveys.	*austral* and *Bothriochloa biloba as* part of this assessment.	2012. Further justification for not specifically targeting these species as part of the assessment is as follows: *Eucalyptus rubida subsp. barbigerorum* – As stated in the habitat evaluation, this species is a conspicuous species. It may be detected at any time of year and during the course of the original vegetation surveys, almost all of the areas of impact were traversed by vehicle or foot. This species was not detected and no further targeted surveys were considered warranted. *Thesium australe* – Potential habitat for this species was present at the site in localised areas and was not of high quality. Additionally, the nearest record of the species is approximately 50km north-east of the site. Accordingly, it was considered unlikely that it would occur at the site. The timing and location of the targeted flora surveys carried out at the site in spring (October) 2012 would have also been suitable for detecting this species and it was not identified. *Bothriochloa biloba* – Heavier soils with which this species is associated were present at the site however, not the preferred brown or black clays. One record from 1997 was located in Nundle approximately 10 km from the site. The timing and location of the summer surveys for Queensland Bluegrass (*Dichanthium setosum*, refer Issue 2 below) carried out at the site in January 2013 would have also been suitable for detecting this species and it was not identified.
Issue 2 **Timing of surveys for *Dichanthium setosum***	That the proponent undertake additional targeted surveys for *Dichanthium setosum* of an appropriate intensity and during the optimal period for detectability.	Targeted surveys for *Dichanthium setosum* were undertaken in January 2013. The survey results and subsequent impact assessment are provided in the Addendum Flora and Fauna Report.
Issue 3 **Assessment of impacts to threatened fauna species**	That the proponent quantify habitat surrounding the site that is suitable for threatened species identified as using, or potentially using, the area. This could be conducted as part of the offset strategy.	Offset site surveys were conducted in February 2013. An assessment of those sites as suitable habitat for threatened species was undertaken and the results are provided in the Addendum Flora and Fauna Report.

Concern/Issue	Comment	nghenvironmental response
Issue 4 **Assessment of impacts to the Booroolong Frog.**	Review and amend the assessment of impacts to the Booroolong Frog by adopting a more precautionary approach. Undertake adequate population and habitat surveys throughout the Upper Peel (note: this will inform both the assessment of impacts and the potential for offsets).	Booroolong Frog surveys were conducted in January and February 2013. The results of those surveys and a revised impact assessment are provided in in the Addendum Flora and Fauna Report. The survey results and revised impact assessment have been considered in the development of the Offset Plan.
Mitigation and Offset Strategy		
Issue 5 **Mitigation of indirect impacts associated with construction**	That the Proponent specifically consider strategies that mitigate impacts to riparian areas for terrestrial biodiversity that are dependent on such habitat.	A Vegetation Management Plan will be prepared and implemented during construction of the Project. Restoration and revegetation of the riparian zone has been proposed. It has been recommended that the riparian zone of the Peel River be replanted at the new Full Supply Level (FSL) along upstream waterways for a minimum of 10 m from the new FSL and along the shoreline of the dam where practicable, particularly in areas identified as having a high risk of erosion. It has also been recommended that revegetation be undertaken using native species of local provenance. These activities will not only reduce bank and soil erosion, but also enhance habitat available for terrestrial flora and fauna. Provisions for weed management will be incorporated into the Vegetation Management Plan, which will improve the condition of habitat available for biodiversity.
Issue 6 **Relocation of fauna from the impact area**	Demonstrate consideration of the high risks and potentially significant impacts of relocation of affected fauna as a mitigation measure; and Provide specific alternative strategies for mitigation, or reconsider the level of impact on the Booroolong Frog and Border Thick-tailed Gecko and how this affects biodiversity offset requirements.	Following further consideration of mitigation strategies and consultation with OEH and Namoi CMA, relocation is no longer proposed for the Border Thick-tailed Gecko or the Booroolong Frog. The size of the Border Thick-tailed Gecko population on Goat Mountain is currently unknown and therefore certainty of available habitat cannot be provided. Consultation with OEH has been carried out and a strategy formulated to maintain the Border Thick-tailed Gecko population on the dam wall during construction, thus avoiding significant impacts to the species. This strategy is detailed in the Addendum Flora and Fauna Report. Offsets for the Border thick-tailed Gecko are not required as mitigation measures to be implemented during construction will enable the persistence of the

Concern/Issue	Comment	nghenvironmental response
		existing population on the artificial habitat of the dam wall. Notwithstanding this, the known habitat for the species on Goat Mountain is incorporated within the offset site north west of the dam. The certainty of conservation outcomes from translocation of the Booroolong Frog cannot be guaranteed. Suitable receiving sites within the Namoi Catchment cannot be identified.
Issue 7 **Adequacy of the exhibited offset strategy**	➢ It is OEH's preference by that the Proponent submit a final offset plan prior to project determination.	• An Offset Plan is provided as an appendix to the Addendum Flora and Fauna Report.
	➢ Proponent should consider the *OEH Interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects* with which OEH would review any future offset plan.	• This document has been considered in development of the Offset Plan.
	➢ OEH considers that the Proponent's reference to the potential use of the Credit Converter for the conversion of outstanding credit requirements to areas of habitat is inappropriate (p. I-2). The Credit Converter is a tool developed under the Biodiversity Certification Assessment Methodology (BCAM); Tier 3 Variation Criteria C of the OEH Offset Policy refers to the use of BBAM (and not BCAM) for the conversion of ecosystem credits into hectares.	• Page I-2 of Appendix I to the Terrestrial and Aquatic Flora and Fauna Impact Assessment states that "*The OEH endorsed BioBanking methodology would be employed in determining the suitability of any proposed offset sites as BioBanking plot data already exists for the study area*". The Offset Plan includes the results of the BioBanking Assessment Methodology (BBAM) for both the development AND offset sites. These results have been used to determine the suitability of the offset provided in the Offset Plan. The Credit Convertor was utilised only for estimation of the offset area likely to be required and to demonstrate the likelihood of the availability of such areas. As this tool is provided on the BioBanking Assessor Resources web page, it was considered appropriate for this purpose.

Concern/Issue	Comment	nghenvironmental response
	➢ OEH notes the Proponent's reference to the management and security of offset sites, and in particular the likelihood that Conservation Property Vegetation Plans (CPVPs) would be used as a mechanism for doing so (p. I-5 – I-6). The OEH Guidance on Appropriate Mechanisms for Securing Biodiversity Offsets asserts that the preferred mechanisms for securing offsets are: the establishment of a biobanking site with a Biobanking agreement under the TSC Act; the retirement of biobanking credits; and dedication of land as a public reserve under the NPW Act. Although establishment of CPVPs to secure offsets may be considered where it is not possible to negotiate the use of any other recommended mechanism, the above mechanisms (in addition to Page 7 others detailed in the latter Guidance) are preferred. Note that rezoning and s88 covenants (as alluded to by the Proponent) are not recommended mechanisms.	• In relation to the TSC listed EEC White Box-Yellow Box-Blakely's Red Gum Woodland an offset site that meets the requirements or the OEH Offsets Policy has been identified. The suitability of the offset site has been assessed using the Biobanking Assessment Methodology (refer to Appendix C of the Flora and Fauna Addendum Report). The offset site is on land owned by State Water. • In relation to the TSC and EPBC Act listed Booroolong Frog, An offset site has been proposed that meets the requirements of State and Commonwealth offset policies. It is proposed that the offset site will be managed under separate Management Agreements (legally binding contracts) with the individual land holders along the Peel River. Such agreements are established and have been operating since 2009 between Namoi CMA and relevant landholders and it is proposed that State Water would assume responsibility for those management contracts.
	➢ With reference to how the Offset Strategy would address Offset Principle 9, the Proponent claims to have addressed assessment requirements for both the Impact site and the offset sites. Clearly, this has not been undertaken for the offset areas as these have yet to be identified, and uncertainties need to be addressed with regard to specific impacts on several threatened species (as discussed above).	• An assessment of the impact site was provided in the Terrestrial and Aquatic Flora and Fauna Impact Assessment and further assessment of this site is provided in the Addendum Flora and Fauna Report. An assessment of habitat within the offsite sites was undertaken during survey investigations in early February 2013. Offset sites are identified and the outcomes of the assessment documented on the Offset Plan.
	➢ It should be noted that the offset strategy needs to include all native vegetation communities to be affected, not just those listed under the EPBC and TSC Acts.	• The Offset Plan and associated calculations have included all native vegetation communities to be impacted by the Project.
	That the Proponent considers the above points in their preparation of a detailed biodiversity offset plan, and address all known and potential impacts arising from the Project.	Refer to above responses, Offset Plan and Addendum Flora and Fauna Report.

Concern/Issue	Comment	nghenvironmental response
Department of Planning and Infrastructure, dated 15 February 2013		
Adequate information has not been provided to enable the department to assess the impacts of the proposed action on all relevant matters of NES.	See comments provided on 27 November 2012.	Additional information is provided in the Addendum Flora and Fauna Report and Offset Plan following further detailed surveys, further assessment of impacts, refinement of mitigation measures and consultation with agencies and species experts.
Insufficient detail has been provided on proposed measures to mitigate impact on matters of NES to enable an assessment of the merit of these components of the proposal.	See comments provided on 27 November 2012. Proposed mitigation measures should be accompanied by sufficient information and analysis as to their appropriateness, likelihood of success, potential problems, performance criteria, monitoring and safeguards, or contingency measures that would be put into place (including thresholds that would prompt them) should any problems arise.	The mitigation measures proposed for the Booroolong Frog are based on the objectives and actions set out in the National Recovery Plan for the Booroolong Frog (NSW OEH 2012). The threats and objectives identified in this recovery plan are based on published literature and consultation with relevant agencies and experts. The proposed mitigation measures have been further refined in consultation with Namoi CMA, OEH and experts with local knowledge. These mitigation measures will be monitored and audited as part of the management plans proposed. Further detail and discussion of mitigation measures, management and monitoring are provided in the Flora and fauna addendum report and the Offset Plan.
The department takes a precautionary approach to translocations of species. There is concern that individuals may be relocated into areas of unsuitable habitat, or to areas already occupied by the species at carrying capacity, and could ultimately result in the mortality of individuals. The spread of chytrid fungus would also be of particular concern in the case of frogs.	There is currently no monitoring or safeguards proposed to identify and mitigate against these potential problems. Furthermore, no evidence is provided as to the likely success in relation to the species of interest.	Following further consideration of mitigation strategies and consultation with OEH and Namoi CMA, the translocation of individuals is no longer recommended. Impacts to matters of NES have been re-assessed and alternative mitigation measures are proposed in the Addendum Flora and Fauna Report.

Concern/Issue	Comment	nghenvironmental response
The EIS does not provide a detailed proposal to offset the residual impacts of the proposed action on matters of NES, in accordance with the Commonwealth Offsets Policy (references in earlier comments).	Refer to comments provided on 27 November 2012.	An Offset Plan is provided as an appendix to the Addendum Flora and Fauna Report. The Offset Plan has been developed in accordance with the EPBC Act Environmental Offsets Policy (2012) and in consultation with OEH, SEWPaC and the Namoi CMA.
Department of Planning and Infrastructure, dated 27 November 2012		
Supplementary DGR 3 **b) A comparative description of the impacts of each alternative on the NES matters protected by controlling provisions of Part 3 of the EPBC Act for the action**	Please provide details of the comparative impacts of each alternative action (80GL and 120GL augmentations) on listed threatened species and EECs. Note: the same level of detail is not required as for the proposed augmentation, however, the location of the FSL, PMF and impacts on relevant matters of national environmental significance (NES), including habitat for threatened species, should be outlined.	A comparative analysis of habitat loss and subsequent impacts on relevant matters of national environmental significance under the three storage capacity scenarios is provided in the Addendum Flora and Fauna Report.
Supplementary DGR 4 **a) quantification and description of, and maps showing, the location, nature, extent and where relevant, the condition, of all vegetation types occurring on and adjacent to the vegetation on site**	The area (in hectares) of each vegetation community mapped within the proposed FSL and within 1 km of the proposed FSL must be provided.	The area (in hectares) of each vegetation community mapped within the proposed FSL and within 1 km of the proposed FSL was provided at Table 8-4 in the EIS (and Table 5-1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment). The Addendum Flora and Fauna Report provides the revised area of impact to each vegetation community following a reduction in the size of proposed road construction footprints (Revised Works Areas).
c) quantification and description of, and maps showing, the distribution and abundance of EPBC Act listed threatened species and ecological communities within the site and in surrounding areas that may be impacted by the proposal. This	c) Please provide descriptions and maps showing the distribution and abundance of EPBC Act listed threatened species (including all known records and survey methodologies) within the site and surrounding areas. Please provide the area (in hectares) of EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland mapped within the FSL and within 1 km of the FSL.	Maps showing the locations of all threatened species recorded at the Project site during current surveys were provided in the EIS, including a map showing the distribution of EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Figure 4-1 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment). Additional information on EPBC listed species is provided in the Addendum report. Areas of EPBC Act listed White Box-Yellow Box-Blakely's Red Gum

Concern/Issue	Comment	nghenvironmental response
should include, but not be limited to, up-to-date survey results for the Booroolong Frog, Murray Cod, Border Thick-tailed Gecko, Small Snake Orchid, Bluegrass, Euphrasia arguta, and the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community (and any other relevant listed species and ecological communities)	Adequate surveys for the Booroolong Frog and Bluegrass have not been undertaken. It is not clear whether surveys targeting the Border Thick-tailed Gecko are adequate.	Grassy Woodland and Derived Native Grassland mapped within the FSL and within 1 km of the FSL were provided at Table 8-4 in the EIS (and Table 5-1 in the Terrestrial and Aquatic Flora and Fauna Impact Assessment).. Further surveys were undertaken for the Booroolong Frog and Bluegrass in January and February 2013. A revised impact assessment for these species is provided in the Addendum Flora and Fauna Report. . Further detail on the surveys carried out for the Border Thick-tailed Gecko and the subsequent impact assessment for this species is provided in the Addendum Flora and Fauna Report.
d) quantification and description of, and maps showing, the nature, location and extent of habitat for EPBC Act listed threatened species and ecological communities (as in 4(c)) within the site and in surrounding areas (including upstream, within and downstream of the impoundment) that may be impacted by the proposal	Please address the requirements of DGR 4 d) for all threatened species known or likely to occur on the site or be impacted by the proposal	An assessment of threatened species habitat within and surrounding the site was included in Section 4.2.3, 4.2.4 and Appendix B of the Terrestrial and Aquatic Flora and Fauna Impact Assessment. Habitat available for threatened species both within the site and in surrounding areas is further described in the Addendum Flora and Fauna Report.
e) a detailed description of the methodology, timing, effort and results of all targeted surveys undertaken for all relevant EPBC Act matters and associated habitat, how the methodologies compare with any relevant guidelines or policies and a description of any limitations and constraints of the surveys	Please provide a description of the survey effort undertaken for this assessment targeting the Border Thick-tailed Gecko (i.e. not combined with other species). Please address this requirement for the Booroolong Frog and Bluegrass when additional surveys have been undertaken for these species. Please compare survey methodologies and effort targeting EPBC listed threatened species with relevant guidelines or policies (where available).	Survey effort for surveys carried out in 2012 was provided in Table 3.5.2 of the Terrestrial and Aquatic Flora and Fauna Impact Assessment. Further detail on survey effort, including for additional surveys carried out for the Booroolong Frog and Queensland Bluegrass in 2013 is provided in the Addendum Flora and Fauna Report.

Concern/Issue	Comment	nghenvironmental response
undertaken	Please describe any limitations or constraints of the surveys undertaken.	
Supplementary DGR 5 **a) a detailed description and assessment of the nature and extent of all relevant impacts, including short-term and long-term direct, indirect, facilitated and cumulative impacts, that the action will have or is likely to have on threatened species and ecological communities listed under sections 18 and 18A of the EPBC Act during all stages of the project (e.g. before and during construction, operational and (if relevant) decommissioning stages)**	Information provided for the Booroolong Frog, Border Thick-tailed Gecko, Bluegrass, Murray Cod and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is insufficient to adequately assess the impacts of the proposal on these matters. Please provide more detailed information for these matters (see DGRs 4 c, d & e).	Further detail on these species is provided in the Addendum Flora and Fauna Report.
b) whether any relevant impacts are likely to be unknown, unpredictable or irreversible	Please provide this analysis for all relevant matters of NES.	The potential impacts to the Booroolong Frog and Border Thick-tailed Gecko have been further assessed and described in detail in the Addendum Flora and Fauna Report. The impact assessment has taken a precautionary approach and assumed a worst-case scenario of impacts to matters of NES. The impact (if any) on the Border Thick-tailed Gecko is considered to be temporary and reversible. Details on mitigation measures to be implemented prior to and during construction of the dam wall are provided in the Addendum Report. Abundance data are not available for the population of geckos that inhabits the dam wall Impacts to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland vegetation community and are considered to be irreversible and have been taken into account in the impact assessment and calculation of offsets.

Concern/Issue	Comment	nghenvironmental response
c) analysis of the scale of the relevant impacts for each EPBC Act listed threatened species and ecological community – including in a local, regional and national context	This requirement has not been addressed in sufficient detail for each matter of NES. Please address.	The scale of the relevant impacts for the Booroolong Frog, Border Thick-tailed Gecko and the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland vegetation community has been further assessed in the Addendum Flora and Fauna Report.
d) any technical data and other information used or needed to make a detailed assessment of the relevant impacts	Technical data and other information used to assess impacts on matters of NES (including data from previous surveys referred to in the EIS) must be provided.	All the relevant data required to assess impacts on matters of NES have been provided in the EIS and the Addendum Flora and Fauna Report. Data relating to the Booroolong Frog has been provided to SEWPaC by State Water and is subject to a confidentiality agreement with Namoi CMA.
6. Proposed safeguards, mitigation and offset measures **a) a description of how the action has been designed to avoid impacts to threatened species and ecological communities**	Please address in relation to avoidance of impacts, as distinct from mitigation or offsetting of impacts.	Considering the nature of the Project, avoidance of impacts was not deemed possible on the whole, following discarding of the "Do Nothing" option for augmentation and safety upgrade and the selection of the preferred augmentation option. Impacts to the Border Thick-tailed Gecko have been reassessed, and a strategy to avoid impacts to this species has been developed in consultation with OEH. This is detailed in the Addendum Flora and Fauna Report.
b) a consolidated list of mitigation measures proposed to be undertaken to prevent or minimise the relevant impacts of the action, before, during and after construction and during operation	A definitive list of mitigation measures is not provided for all relevant matters of NES. Please provide	Mitigation measures have been refined and are included in the Addendum Flora and Fauna Report.
c) an assessment of the expected or predicted effectiveness of the mitigation measures, including a justification of the location and design of mitigation measures to	Please provide this analysis for all relevant matters of NES and associated mitigation measures.	The mitigation measures proposed for the Booroolong Frog are based on the objectives and actions set out in the National Recovery Plan for the Booroolong Frog (OEH 2012). The threats and objectives identified in this recovery plan are based on published literature and consultation with relevant agencies and experts. The

Concern/Issue	Comment	nghenvironmental response
be implemented to ensure their effectiveness. This analysis should be based on best available knowledge and baseline data for the relevant matters		proposed mitigation measures have been further refined in consultation with Namoi CMA, OEH and experts with local knowledge. Additional detailed information on mitigation measures for the Gecko and EEC is provided in the Addendum Report and Offset Plan.
d) a description of the objectives of the mitigation measures, thresholds for corrective actions, and the corrective actions to be implemented should these thresholds be exceeded	Please address this requirement for all relevant matters of NES.	Details of the proposed management actions and monitoring requirements are provided in the Addendum Report and the Offset Plan.
e) any statutory or policy basis for the mitigation measures	Please address for all existing and any additional mitigation measures.	The relevant statutory or policy basis for proposed mitigation measures is provided in the Addendum Flora and Fauna Report and the Offset Plan.
f) details of environmental management plans that set out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including the person or agency responsible for implementing these programs and provisions for independent environmental auditing	Please provide details of provisions made for independent environmental auditing of relevant management, mitigation and monitoring programs.	A number of management plans have been proposed including a Booroolong Frog Management Plan, Vegetation Management Plan, and riparian management activities. The specific requirements for environmental auditing will be detailed within each of these management plans. The management plans and sub plans will form a part of the Offset Plan (where relevant). Details such as timing, duration and frequency of monitoring and party responsible will be outlined in more detail in the Offset Site Management Plan and in the individual plans and sub-plans, following finalisation and approval of the offset plan.
h) in the event that impacts cannot be avoided or mitigated, a description of any offsets to compensate for any predicted or potential residual impacts on	The need for offsets is identified in the EIS but a detailed offset proposal, including information on how the proposal is consistent with the EPBC Act offset policy, for relevant matters of NES has not been provided. Please address this requirement.	An Offset Plan is provided as an appendix to the Addendum Flora and Fauna Report. The Offset Plan has been developed in accordance with the EPBC Act Environmental Offsets Policy (2012) and in consultation with OEH, SEWPaC and the Namoi CMA.

Concern/Issue	Comment	nghenvironmental response
threatened species and ecological communities. This should be in accordance with the EPBC Act Environmental Offsets Policy.		
An overall conclusion as to the environmental acceptability of the proposal must be provided, including discussion on compliance with principles of ESD and the objects and requirements of the EPBC Act. Reasons justifying undertaking the proposal in the manner proposed should be outlined. Measures proposed or required by way of offset for any unavoidable impacts on NES matters, and the relative degree of compensation, should be re-stated here	The conclusion does not satisfactorily address the environmental acceptability of the project, particularly in relation to known and potential impacts on threatened species and ecological communities, and proposed mitigation and offset measures. It will be necessary to update the conclusion when all of the department's requirements have been adequately addressed.	A revised conclusion is provided in the Addendum Flora and Fauna Report, which takes into account recent detailed survey information for the Booroolong Frog and Queensland Bluegrass, further assessment of impacts, refinement of mitigation measures and consultation with species experts.

APPENDIX C OFFSET PLAN

WorleyParsons

resources & energy

Offset Plan

CHAFFEY DAM AUGMENTATION AND SAFETY UPGRADE

MARCH 2013

ngh environmental

Document Verification

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TABLES

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ACRONYMS AND ABBREVIATIONS

BBAM	BioBanking assessment methodology
BCC	BioBanking credit calculator
CA	Conservation Agreement
CEEC	Critically endangered ecological community
CPVP	Conservation property vegetation plan
Cwth	Commonwealth
DECCW	Refer to OEH
DP&I	(NSW) Department of Planning and Infrastructure
EEC	Endangered ecological community
EIS	Environmental impact statement
ha	hectares
km	kilometres
m	Metres
NES	Matters of National environmental significance under the EPBC Act (*c.f.*)
NPW Act	*National Parks And Wildlife Act 1974* (NSW)
NSW	New South Wales
NV Act	*Native Vegetation Act 2003* (NSW)
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PFC	Projected foliage cover
SEWPaC	(Cwth) Department of Sustainability, Environment, Water, Population and Communities
SSD	State significant development
SSI	State significant infrastructure
TEC	Threatened ecological community – as defined under relevant law applying to the proposal
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

1 INTRODUCTION

1.1 BACKGROUND

The Chaffey Dam Augmentation and Safety Upgrade Project (the Project) proposes to increase the capacity of Chaffey Dam from 62GL to 100GL at Full Supply Level (FSL), which will increase the current FSL by 6.5 m which will increase the current FSL by 6.5 m, from 518.6 m Australian Height Datum (AHD) to 525.1 m AHD. Associated works will include the modification of selected roads and bridges, including Tamworth-Nundle Road, Western Foreshore Road, Rivers Road and Bowling Alley Point Bridge.

A flora and fauna assessment was conducted as part of the Environmental Impact Statement (EIS) for the Project, pursuant to Part 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

Director-General's Environmental Assessment Requirements (DGRs) for the EIS were issued on 23 January 2012 by the Director-General of the Department of Planning and Infrastructure (DPI). The DGRs were accompanied by comments from other relevant NSW Government Agencies, comprising the Department of Primary Industries (Office of Water, Agriculture, Mineral Resources, Forestry and Fisheries), Environment Protection Authority, Office of Environment and Heritage (Heritage Council of NSW), Namoi Catchment Management Authority (CMA) and Roads and Maritime Services.

On 29 August 2012, the Project was referred to the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On 28 September 2012, SEWPaC advised that the Commonwealth Environment Minister deemed the Project to be a Controlled Action pursuant to the EPBC Act.

On 19 October 2012, supplementary DGRs were issued by the DP&I on behalf of SEWPaC. Both the DGRs and supplementary DGRs contained specific requirements relating to environmental offsets under both State and Commonwealth legislation. The Commonwealth *EPBC Act Environmental Offsets Policy* applies to the Project because it is deemed to have a significant impact on an endangered species, the Booroolong Frog.

The Project comprises "*development for the purpose of water storage… carried out by or on behalf of a public authority that has a capital investment value of more than $30 million*" pursuant to Schedule 3 of State Environmental Planning Policy (State and Regional Development) 2011 and as such, comprises a State Significant Infrastructure project. Accordingly, the *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects* (hereafter referred to as the OEH SSI interim offsets policy) applies to The Project.

An EIS was prepared by WorleyParsons and placed on public exhibition from 11 December 2012 to 31 January 2013. Public submissions were received by the Department of Planning and Infrastructure during the EIS public exhibition period. A submission from Namoi CMA requested the consideration of the *Namoi Catchment Management Authority Biodiversity Offsets Policy*.

A Preferred Infrastructure Report has been prepared to respond to the issues raised in submission, including the requirement for environmental offsets.

This Offset Plan has been developed in consultation with OEH, SEWPaC, Namoi CMA and additional relevant experts.

It has been developed to satisfy NSW and Commonwealth requirements with regard to offsetting, specifically:

- The DGRs and supplementary DGRs issued by DP&I
- OEH SSI Interim Offsets Policy
- OEH's Principles for the use of biodiversity offsets in NSW
- Namoi CMA Biodiversity Offsets Policy
- EPBC Act Environmental Offsets Policy

A hierarchy of principles in regard Project impacts to biodiversity values within the study area have been followed:

1. Avoid impact
2. Minimise impact
3. Mitigate impacts
4. Offset residual impacts

Wherever possible, impacts to biodiversity values are avoided. For example, the area of native vegetation to be impacted has been reduced substantially (to 1.4 ha) as a result of the reduction in size of works areas. Where impacts are unavoidable, mitigation and management measures have been incorporated into the Project to reduce impacts. In some instances there are residual impacts that cannot be adequately mitigated.

Residual impacts are proposed to be offset in accordance with the NSW OEH SSI interim offsets policy. Where significant residual impacts to matters of national environmental significance remain, these are also proposed to be offset in accordance with the EPBC Act Environmental Offsets Policy.

Residual impacts identified for the Project include:

- A loss of 160 ha of naturally occurring native vegetation including areas comprising 150 ha of a listed Endangered Ecological Community (EEC).
- A loss or modification of habitat for a variety of protected and threatened native fauna species. This includes 2.32 ha of habitat suitable for the endangered Booroolong Frog.

Significant residual impacts identified for the Project include:

- A loss of 2.32 ha of habitat suitable for the endangered Booroolong Frog.

1.2 PURPOSE AND SCOPE OF THIS REPORT

As part of mitigating the biodiversity impacts of the augmentation and safety upgrade of Chaffey Dam (the Project), offset sites are required. This Offset Plan aims to address the requirements of both State Government and Commonwealth biodiversity offset policies including the Namoi CMA Biodiversity Offsets Policy.

In NSW, offset sites are required to be comparable in terms of vegetation and habitat type and sufficient in area to allow the long-term improvements of the offset site to compensate for the loss of habitat at the development site. The BioBanking Assessment Methodology (BBAM) (DECC 2009) is used in this report to assess the biodiversity values that will be impacted upon as a result of the Project (at the 'development site') and to determine if the values contained at a designated site nearby (the 'offset site') are adequate as an offset. The results of the BBAM are interpreted with regard to the OEH SSI interim offsets policy.

Under Commonwealth legislation, the EPBC Act Environmental Offsets Policy (2012) applies to all protected matters under the EPBC Act. Offsets provide environmental benefits to counterbalance the impacts that remain after avoidance and mitigation measures, and can help to achieve long-term environmental outcomes for Matters of National Environmental Significance (MNES) protected under the EPBC Act. The Offsets Assessment Guide used in this report is a tool for assessing the suitability of offset proposals, and has been used in conjunction with the EPBC Act Environmental Offsets Policy.

Whilst the NSW and Commonwealth offset policies are focused on different levels of biodiversity protection, it is the aim of this plan to ensure that the processes are consistent and complementary to allow for both objectives to be met within one offset package.

1.3 DETAILED METHODOLOGY

1.3.1 Steps in the assessment

This Offset Plan aims to achieve the following objectives:

NSW	Commonwealth
Objectives	
1a) Determine the ecosystem and threatened species credits required at the *development site* using the BBAM (Section 2.1).	2a) Determine the area of habitat to be significantly impacted by the development specifically as it relates to MNES (Section 3.1).
1b) Determine the ecosystem and threatened species credits that would be generated at the *offset site* using the BBAM (Section 2.2).	2b) Determine if the proposed offset site meets the 90% direct offset requirement (Section 3.1 and Appendix B).
1c) Make an assessment as to whether the development site impacts can be adequately compensated for by the protection and management of the proposed *offset site* (compare 1a to 1b: Section 2.3).	2c) Make an assessment as to whether the development site impacts can be adequately compensated for by the protection and management of the direct offsets proposed and discuss other compensatory requirements (Section 3.2).
1d) Make recommendations for the security and management of the *offset site*, to ensure that its biodiversity values are protected and maintained in perpetuity (Section 4).	2d) Make recommendations for any additional security and management requirements to ensure that biodiversity values as they relate to MNES, are protected and maintained in perpetuity (Section 4).

Key outputs of the BioBanking credit calculator (BCC) and the EPBC Act Offsets Assessment Guide are provided in Appendix A and Appendix B of this report, respectively. With regard to the NSW assessment, vegetation type nomenclature referred to in this plan is as defined within the Biometric Vegetation Types Database and utilised within the BBAM.

1.3.2 Key resources

BioBanking Assessment Methodology (online calculator version 2)

The BBAM was used to undertake Steps 1a and 1b. The discussion in Section 2.3 is based on the outputs of the assessment and supplemented by additional information relevant to the sites, as detailed below.

The assessment calculations were undertaken using the NSW Office of Environment and Heritage (OEH) BioBanking Calculator (online version 2), under the direction of an accredited BioBanking assessor (Brooke Marshall, ID35).

Environment Protection and Biodiversity Conservation Act 1999 Offsets Assessment Guide

The Offsets Assessment Guide is used to support application of the EPBC Act Environmental Offsets Policy (October 2012). The Offsets Assessment Guide utilises a balance sheet approach to estimate impacts and offsets for threatened species and ecological communities listed under the EPBC Act.

The assessment calculations were conducted by staff trained in the use of the Offsets Assessments Guide by the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC).

Site assessments and investigations

This assessment utilises information gained from a number of assessments as well as additional survey, undertaken by two botanists (Dave Maynard and Brenton von Takach Dukai), two ecologists (Jacqui Coughlan and Freya Gordon), and experts Phil Spark and Dr Andrew Stauber to further delineate homogenous zones and threatened species habitats and derive plot data at the development and offset sites.

Previous assessments that are relevant to the study site include:

- Austeco (1990). Chaffey Dam Enlargement Proposal: Impact on Terrestrial Fauna. Report prepared for Department of Water Resources, August 1990
- GHD (2007). Chaffey Dam upgrade, further assessment of long-term options. Contract No 3571, State Water Corporation
- GHD (2008a). Chaffey Dam Upgrade Ecological Assessment
- GHD (2008b). Chaffey Dam Upgrade Preliminary environmental assessment (stage 1) summary report, State Water Corporation
- MHL (2005). Chaffey Dam Upgrade Environmental Investigations, Manly Hydraulics Laboratory and NSW Department of Commerce
- Grant (2007). *in* GHD (2008a) Chaffey Dam Upgrade Ecological Assessment. Proposed Augmentation of Chaffey Dam: Environmental Assessment: The Platypus. Report prepared by Dr T.R. Grant of Education and Environment Services Pty. Ltd. for GHD Services Pty Ltd and State Water
- Molino Stewart (2010). Chaffey Dam safety upgrade – Auxiliary spillway REF
- Molino Stewart (2011). Chaffey Dam Augmentation, Preliminary Environmental Assessment
- NWES (2009a). Flora and Fauna Impact Assessment for the proposed Chaffey Dam Safety Upgrade Options 1 & 2 – Addendum report to the GHD Ecological Assessment Report
- NWES (2009b). Review of the conservation status of the Booroolong Frog (*Litoria booroolongensis)* within the Namoi River Catchment. Report prepared for the Namoi Catchment Management Authority.
- **ngh**environmental (2012). Terrestrial and aquatic flora and fauna impact assessment, Chaffey Dam Augmentation and Safety Upgrade. Report prepared for State Water.
- **ngh**environmental (2013). Addendum Report. Terrestrial and aquatic flora and fauna impact assessment, Chaffey Dam Augmentation and Safety Upgrade. Report prepared for State Water.

These assessments describe the existing environment at the study site and evaluate the presence of known and potential threatened species and communities. Survey effort has included targeted surveys for threatened species known to occur and with the potential to occur.

1.4 THE DEVELOPMENT SITE: OVERVIEW

Chaffey Dam is located on the Peel River approximately 30 km south-east of Tamworth. The Project comprises the augmentation and safety upgrade of the existing Chaffey Dam (Figure 1-1). The proposed works will result in an increase in the full supply level (FSL) of 6.5 m and an increase in the permanent storage capacity from 62 GL to 100 GL.

The Project is proposed to be carried out by State Water and includes the following components:

- Augmentation of the dam to 100 GL at FSL, through raising of the dam wall and modification of the existing spillways.
- Modification of selected roads and bridges, including Tamworth-Nundle Road, Western Foreshore Road, Rivers Road and Bowling Alley Point Bridge.
- Relocation of facilities within the Bowling Alley Point Recreation Area and the South Bowlo Fishing Club.

The Project will result in an increase to the FSL footprint of approximately 185 ha, in areas surrounding the existing reservoir and an additional footprint of up to 38 ha for the realignment of existing roads and bridges.

1.4.1 Impacts of the Project

The Project will impact on areas of habitat that comprise EEC and habitat for threatened species. Impacts on native vegetation will predominately result from inundation with additional areas being cleared for associated road works (refer Table 1-1).

Impacts to vegetation to be offset in accordance with OEH SSI Interim Offsets Policy (and consequently the BBAM) are highlighted in Table 1-1.

Table 1-1 Approximate impact areas of the Project by vegetation type

Regional Vegetation Community	Area to be inundated (ha)	Additional Road Area Impact (ha)
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion (TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland EEC)	117	33
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	3	1
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	6	0
Semi-permanent open freshwater wetlands of the inland slopes and plains	0.24	0
Planted non-indigenous native vegetation	9	2
Exotic non-native vegetation	45	2
TOTAL	**180.25**	**38**

Impacts on threatened species and communities

The Project will result in the effective removal (through inundation or clearing) of approximately 150 ha of Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, which is listed as an EEC (White Box-Yellow Box-Blakely's Red Gum Woodland) under the NSW TSC Act.

Approximately 7 ha of this community also meets the criteria for the Commonwealth (EPBC Act) listed White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grasslands Critically Endangered Ecological Community (CEEC). The Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) concluded that no significant impact to this CEEC will result from the Project. Accordingly, no offset for the Yellow Box - Blakely's Red Gum grassy woodland is required under the EPBC Act Environmental Offsets Policy.

The Project will result in the inundation of an area supporting a population of the endangered Booroolong Frog (*Litoria booroolongensis*) (TSC and EPBC Acts) along the Peel River, directly upstream of Chaffey Dam. Approximately 2.32 ha of habitat for this species would be effectively removed as a result of the Project. This would result in a significant impact to this species.

Requirement to offset

All residual impacts are required to be offset in accordance with the NSW OEH SSI interim offsets policy. Where significant residual impacts to matters of national environmental significance remain (such as the Booroolong Frog), these are also required to be offset in accordance with the EPBC Act Environmental Offsets Policy.

1.5 THE PROPOSED OFFSET SITE: OVERVIEW

State Water has nominated an area, approximately 980 ha in size, on the northern and western foreshore of the dam for consideration as an offset site. The Land identified for Offset is in the name of Water Administration and Ministerial Corporation (WAMC). This land is vested in State Water and available for State Water to enter into covenants or agreements (Figure 1-1). The area west of the Western Foreshore Road is currently leased to local farmers for grazing on a permissive occupancy basis. They have been informed that this lease will be terminated on 31 December 2013 and from that time onwards the land will be available for dedication as an offset area. To the east of the Western Foreshore Road, the offset area is not being used for any activities excluding the far eastern section where it surrounds the existing dam. Within this area, there appears to be some grazing by cattle on the floodplain associated with the Peel River. The Peel River is also accessed by the general public for recreational purposes.

The offset site contains similar vegetation to that within the development footprint. Yellow Box – Blakely's Red Gum grassy woodland occupies the lower slopes and Rough-barked Apple – Silvertop Stringybark forest on the steeper upper slopes and River Oak riparian woodland along the Peel River, however, it also includes another community, White Box grassy woodland, which occurs as an intermediate between the Yellow Box and Silvertop Stringybark communities.

The Yellow Box – Blakely's Red Gum grassy woodland and White Box grassy woodland (collectively "Box-gum woodland") are considered to comprise the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland EEC. Components of these communities also comprise the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (CEEC).

The offset site supports known habitat for threatened fauna species including the Regent Honeyeater, Border Thick-tailed Gecko and Speckled Warbler (Atlas of NSW Wildlife accessed 24/08/2012; NWES 2009a). The offset site provides suitable habitat for a range of other threatened fauna species including the Spotted-tailed Quoll, Little Lorikeet, and woodland birds including the Brown Treecreeper.

An additional offset area upstream along the Peel River for a length of 9 km is proposed for the Booroolong Frog. This area is known habitat for the Booroolong Frog (Figure 3-1). The proposed offset site is currently managed by landholders under a 10 year Management Agreement (MA) with Namoi CMA. Lands currently subject to this MA are displayed in Appendix C. These MAs are due to expire in five years (2018). The current MAs have a range of conditions agreed to by four Funding Recipients, however the implementation and effectiveness of actions carried out under these conditions are not monitored. Despite these MAs, residual threats to the Booroolong Frog such as stock access and weeds, are still ongoing (Phil Spark, *pers. comm.*). The current MAs focus on restrictions in land use, but do not include actions to actively manage and improve habitat along the Peel River. Under the present management the future quality of the offset site is uncertain. Furthermore, the proposed offset plan will incorporate additional management measures to value-add to those conditions already in place. Management actions for the offset site will greatly improve on restoration and revegetation of the riparian zone. The effectiveness of management actions will be assessed during annual monitoring. Compliance with those management measures will also be assessed. Management Plans will be adaptive to allow for amendments in response to monitoring results.

The location of the 'development site' and proposed 'offset sites' are shown in Figure 1-1 and Figure 3-1.

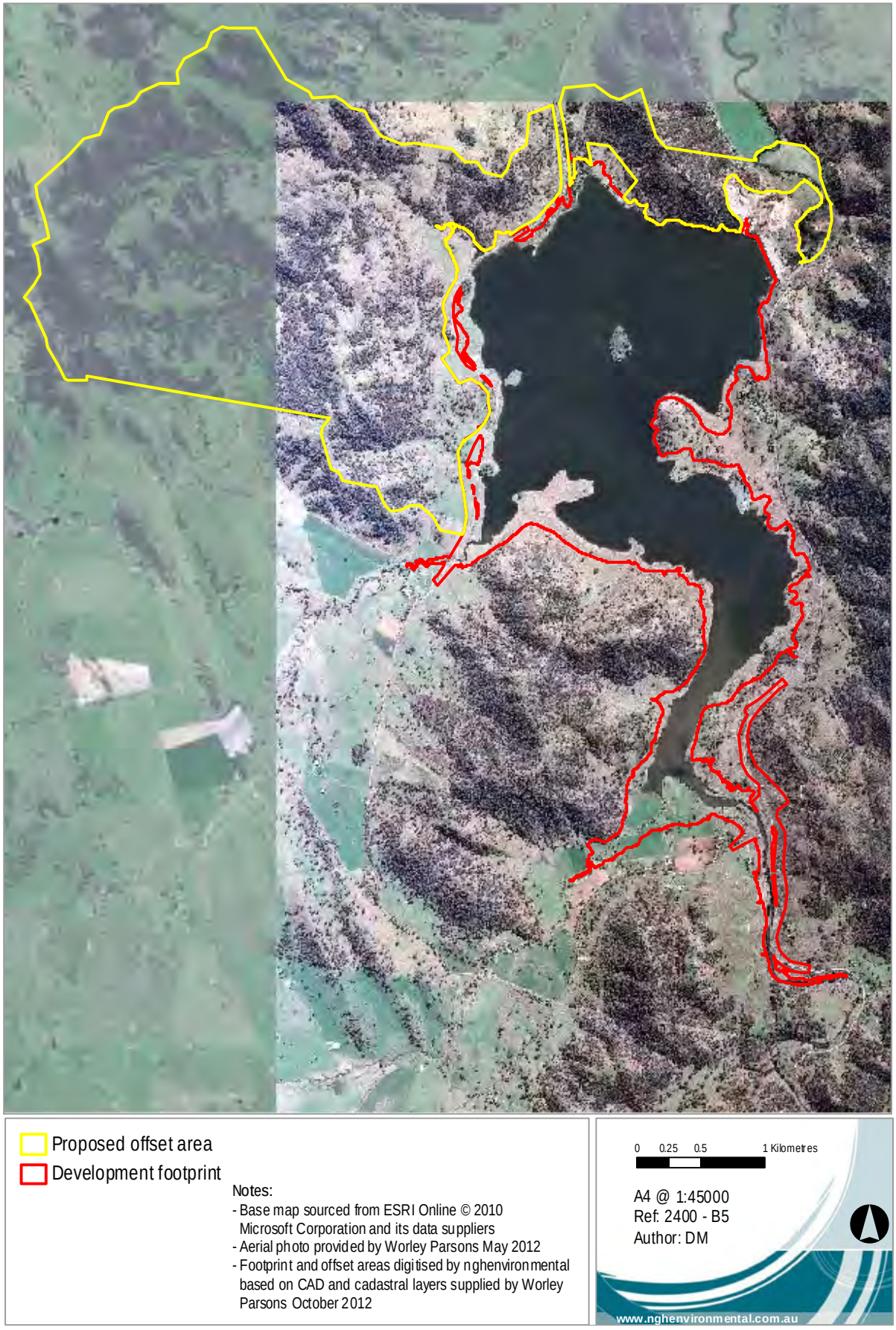


Figure 1-1 Development site and proposed offset site for the Project

2 NSW OFFSET REQUIREMENTS

The OEH endorsed BBAM has been utilised to assess the suitability of the proposed offset site to adequately offset the impacts associated with the development with regard to the requirements of the State. The key steps that are involved in the methodology are outlined below along with explanations for key decisions and any variations from the methodology. The BBAM assesses the development and proposed offset sites individually to determine the number of credits that are required of generated respectively. As such, each assessment is outlined individually.

2.1 DEVELOPMENT SITE CREDITS

Within the BCC, this assessment is proposal ID 0035/2013/0467D V1.

2.1.1 Delineation of the development site

For the purposes of this assessment, the development site was defined as all areas that would be permanently impacted by the proposal. This included the entire area within the new FSL and all areas within the proposed road works footprint.

2.1.2 Landscape assessment

The development site occurs within the Namoi Catchment Management Area, Peel subregion. The majority of the site falls within the Tamworth - Keepit Slopes and Plains Mitchell Landscape along the northern, western and southern foreshores of the dam. Some areas in close proximity to the dam occur within the Peel Channels and Floodplain Mitchell Landscape while on the eastern side of the dam and upstream areas of the development site, some areas extend into the Nundle Hills Mitchell Landscape. For the purposes of the BioBanking Calculator, the Tamworth - Keepit Slopes and Plains Mitchell Landscape has been used as it is the dominant landscape across the development site.

Two '1000 ha assessment circles' were required to cover the development site (outer yellow lines, Figure 2-1)[1]. Adjacent remnant vegetation has been disturbed by clearing and agricultural practices in the past and the properties continue to be grazed by cattle. The vegetation communities are comprised of forest, woodland and derived grasslands with a predominantly native species composition although some areas that have been subject to pasture improvement now contain predominately exotic vegetation.

Within the northern assessment circle, the percentage overstorey cover is scored as 21-30% before and after development within the 1000 ha circle and 31-40% prior to development and 21-30% after development within the 100 ha circle. Within the southern assessment circle, the percentage overstorey cover is scored as 51-60% before and after development within the 1000ha circle and 41-50% before and after development within the 100ha circle. The 100 ha circles has been placed to capture the greatest impact from the development as required by the BBAM.

The 'most limiting link' was identified in the south-west of the development site and has a width of approximately 160 m. The average condition of the link is moderate to good, determined on the basis of

[1] A small proportion of the development site occurs outside of the assessment circles. This area is predominantly cleared of overstorey and therefore would not influence the landscape assessment. This approach was discussed with the OEH BioBanking team (Andrew Remnant *pers. comm.* 04.02.3013) and considered appropriate.

overstorey cover and projected foliage cover (PFC) has been rated at >25% of the lower benchmark. The groundcover in this area is predominately exotic.

The development would have a major impact on this link as it would be inundated within the new FSL. No native or midstorey/ground cover was recorded within the after development fields.

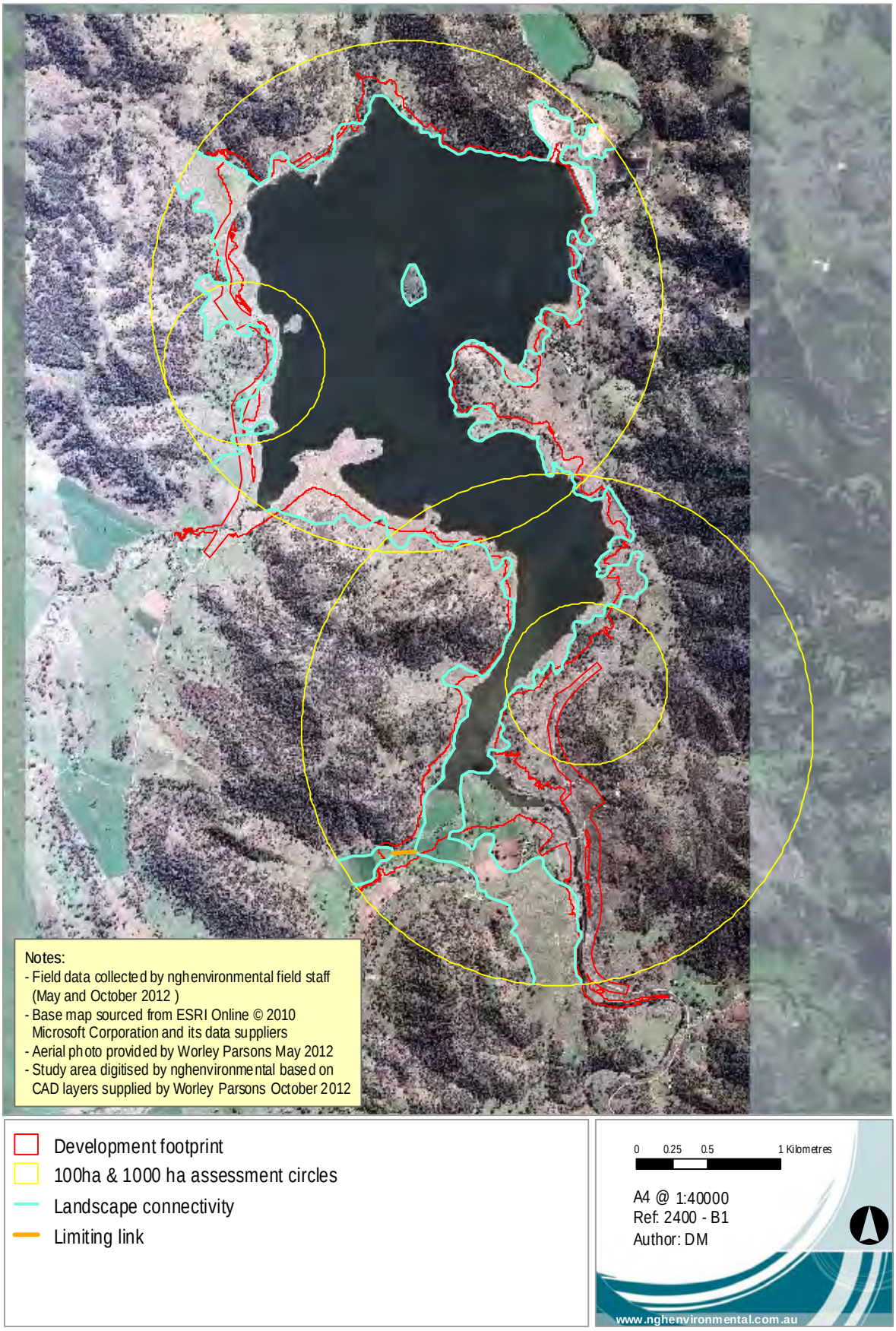


Figure 2-1 Landscape assessment for the development site

2.1.3 Mapping zones

'Homogenous vegetation zones' were mapped during the Terrestrial and Aquatic Flora and Fauna Impact Assessment (FFA) (**ngh**environmental 2012) for the Project and have been refined during subsequent surveys. It should be noted that although separate vegetation types were defined in the FFA for Box-Gum grassy woodland and derived grassland, that within the BBAM, derived grasslands are included within the vegetation types they are derived from. Hence, the Box-Gum grassy woodland and derived grasslands have been mapped as a single zone.

Three homogenous zones were mapped on the basis of vegetation type and condition corresponding to the permanent development footprint. Dominant vegetation types were determined with reference to previous detailed assessments at the site (**ngh**environmental 2012) and the OEH Biometric Vegetation Types Database. It should be noted that there are only two Biometric condition categories for native vegetation: 'low' and 'moderate to good'. The 'moderate to good' category includes the relatively degraded pasture derived from woodland communities as it is still predominately native, albeit low diversity. Although all zones are considered moderate to good, the plot data are intended to provide the more precise measurement of vegetation quality in the Biometric assessment.

The zones are defined in Table 2-1 and mapped on Figure 2-2[2]. Remnant areas were assessed to be over 500 ha for all zones as all surrounding vegetation is considered to be native vegetation. Plot data was collected based on the entire area of each homogenous zone and the number of plots conducted was sufficient to meet the minimum requirements for these areas. However, once the site was divided into two assessment circles, then the number of plots required becomes specific to each homogenous zone within each circle and the number required increased. The condition of the vegetation at the site is relatively consistent, that the BBAM is being used only to indicate the suitability of the proposed offset and that the number of plots undertaken was sufficient to satisfy the requirements of the methodology. It was decided in consultation with OEH (David Coote *pers. comm.* 06.02.13) that it was acceptable to duplicate some of the plot data within each assessment circle to meet the required number of plots. Plots that have been duplicated are denoted in Table 2-1 by an asterisk (*). Plots duplicated are those that were located closest to the relevant assessment circle.

Geographic/habitat features were selected with respect to threatened species as outlined in Table 2-2. Suitable habitat was identified at the development site for eight species.

'After development' management scores were decreased to zero, assuming that all habitat within the development footprint would be effectively removed by the Project.

[2] No individual map unit was less than 0.25ha. Vegetation that did not qualify as native vegetation was not mapped. This included areas with no native overstorey, no native mid storey and where less than 50% of the ground cover is indigenous species or greater than 90% of the ground cover was cleared.

Table 2-1. Development site: homogenous zones

Assessment circle	ZONE ID	Vegetation type code	Vegetation name	Condition	Area effectively removed (ha)	Plot IDs
North	1	NA237	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Moderate/ Good	89.58	D4, D5, D6, D7*, D8*, D9*
North	2	NA196	Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Moderate/ Good	3.11	D1, D2, D3*, D16
South	4	NA237	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Moderate/ Good	62.77	D7*, D8*, D9*, D14, D15
South	5	NA196	Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Moderate/ Good	0.54	D3*
South	6	NA191	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Moderate/ Good	5.71	D11, D12, D13

* Duplicated plot data

Table 2-2 Threatened species considered to occur at the development site according to relevant habitat features

Common name	Scientific name	Feature
Austral Toadflax	*Thesium australe*	Coastal headlands, grassland, grassy open forest or woodland on fertile or moderately fertile soils
Grey-headed Flying-fox (Breeding)	*Pteropus poliocephalus*	Land within 40 m of rainforest, coastal scrub, riparian or estuarine communities
Border Thick-tailed Gecko	*Uvidicolus sphyrurus*	Land within 100 m of rocky areas
Narrow-leaved Black Peppermint	*Eucalyptus nicholii*	Shallow or infertile soils
Black-breasted Buzzard	*Hamirostra melanosternon*	Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts
Dungowan Starbush	*Asterolasia* sp. 'Dungowan Creek'	Land within Dungowan Dam area near Tamworth in Peel CMA subregion
Pale-headed Snake	*Hoplocephalus bitorquatus*	Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber
Booroolong Frog	*Litoria booroolongensis*	Land within 100 m of stream or creek banks

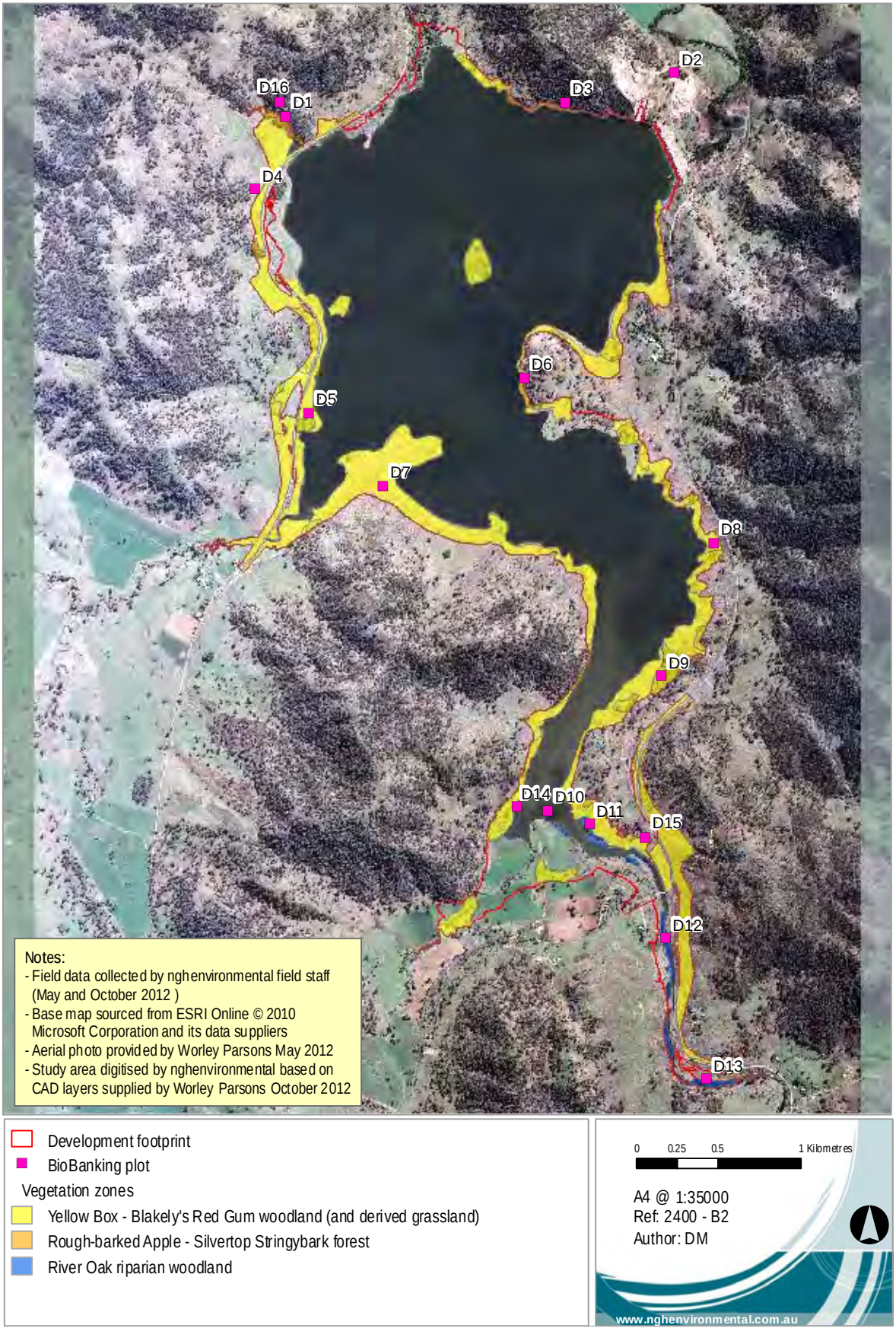


Figure 2-2 Development site homogenous zones and plot locations

2.1.4 Credit calculator results

Species predicted to occur

The species listed in Table 2-3 are predicted by the BCC to occur at the development site and contribute to the ecosystem credits required to be offset. The Tg values are accessed by the BBAM from the Threatened Species Profile Database (TSPD). They are a measure of the species ability to respond to improvement in site value or habitat value at a BioBank (offset) site. They are also used in the calculations performed for the development site to determine ecosystem credits required.

Table 2-3 Species predicted by the BCC to occur at the development site

Scientific name	Common name	Tg value
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	0.5
Dasyurus maculatus	Spotted-tailed Quoll	0.35
Falsistrellus tasmaniensis	Eastern False Pipistrelle	0.45
Glossopsitta pusilla	Little Lorikeet	0.58
Grantiella picta	Painted Honeyeater	0.75
Lathamus discolor	Swift Parrot	0.75
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	0.75
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	0.75
Neophema pulchella	Turquoise Parrot	0.55
Ninox connivens	Barking Owl	0.33
Ninox strenua	Powerful Owl	0.33
Nyctophilus timoriensis	Greater Long-eared Bat (south eastern form)	0.48
Petaurus australis	Yellow-bellied Glider	0.43
Petaurus norfolcensis	Squirrel Glider	0.45
Petroica boodang	Scarlet Robin	0.6
Petroica phoenicea	Flame Robin	0.6
Phascolarctos cinereus	Koala	0.83
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	0.75
Pteropus poliocephalus	Grey-headed Flying-fox	0.93
Pyrrholaemus saggitatus	Speckled Warbler	0.4
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	0.45
Stagonopleura guttata	Diamond Firetail	0.75
Tyto novaehollandiae	Masked Owl	0.33
Xanthomyza phrygia	Regent Honeyeater	0.75

Species requiring survey

A total of 15 species were returned by the calculator requiring survey (Table 2-4). An extensive series of surveys were undertaken as part of the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012) which allowed for the confident conclusion that ten of these species were unlikely to occur at the development site and would not be impacted by the development. No impact was assumed for an additional three species based on the lack of habitat availability within the development site and proximity of nearest records. One species, the Border Thick-tailed Gecko, is known to occur at the site but will not be impacted by the Project. One species requiring survey, the Booroolong Frog, was recorded during surveys at the site and has the potential to be impacted by the development. The impact to this species generates species credits that require offsetting.

Table 2-4 Species requiring survey at the development site and potential to be impacted

Scientific name	Common name	Impacted?	ID method	Loss	Units of loss	Tg value
Thesium australe	Austral Toadflax	No	Survey	0.00	indiv	0.58
Hieraaetus morphnoides	Little Eagle	No	Survey	0.00	ha	0.74
Circus assimilis	Spotted Harrier	No	Survey	0.00	ha	0.74
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	No	Survey	0.00	ha	0.93
Dichanthium setosum	Bluegrass	No	Survey	0.00	indiv	0.13
Digitaria porrecta	Finger Panic Grass	No	Assumed	0.00	indiv	0.75
Phascogale tapoatafa	Brush-tailed Phascogale	No	Assumed	0.00	ha	0.5
Lophoictinia isura	Square-tailed Kite	No	Survey	0.00	ha	0.74
Callocephalon fimbriatum	Gang-gang Cockatoo	No	Assumed	0.00	ha	0.5
Uvidicolus (Underwoodisaurus) sphyrurus	Border Thick-tailed Gecko	No	Survey	0.00	ha	0.75
Eucalyptus nicholii	Narrow-leaved Black Peppermint	No	Survey	0.00	indiv	0.7
Hamirostra melanosternon	Black-breasted Buzzard	No	Survey	0.00	ha	0.74
Asterolasia sp. 'Dungowan Creek'	Dungowan Starbush	No	Survey	0.00	indiv	0.13
Hoplocephalus bitorquatus	Pale-headed Snake	No	Assumed	0.00	ha	0.3
Litoria booroolongensis	Booroolong Frog	Yes	Survey	2.32	ha	0.4

Red flags: Director-General approval required

When using the BioBanking assessment pathway, red flags generated by the assessment indicate that the Project will not be permitted without the approval of the Director General (Department of Premier and Cabinet).

Relevant to the development site, these include:

- Yellow Box – Blakely's Red Gum grassy woodland (vegetation type being >70% cleared or it contains an EEC)

Under the BioBanking assessment pathway, clearing these vegetation types would not be permitted without the approval of the Director General. In this instance however, the Project is being assessed according to the SSI Interim Offsets Policy and the BioBanking assessment methodology is solely being used to assess the appropriateness of the proposed offset. As such, approval of the Director General is not required.

A high number of credits can be expected to be generated for this entity.

Credit summary

The BioBanking credit statement produced the following ecosystem and species credits required to offset the loss of habitats as a result of the development proposed (summarised in Table 2-5, provided in full as Appendix A).

Table 2-5. Development site permanent habitat loss: credit summary

Biometric vegetation type	Area impacted (ha)	Credits required
Ecosystem credits		
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	152.35	8128
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	3.65	254
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	5.71	323
Species credits		
Booroolong Frog	2.32	58

2.2 OFFSET SITE CREDITS

Within the BCC, this assessment is proposal ID 0035/2013/0507B V1.

2.2.1 Delineation of the offset site

Several allotments constitute the offset site as listed in Table 2-6. The allotments are contiguous, though exclude the existing Western Foreshore Road and associated road reserve. The offset site is contiguous with the development site. The delineation of the offset site for the Booroolong Frog is further discussed in Section 3.

Table 2-6 Allotments constituting the offset site

Lot	DP	Lot	DP
1	589247	7012	1026362
1	589245	2	615111
5	1139917	1	1174369
2	589247		
6	1139917	2	631895

Lot	DP	Lot	DP
3	615111	7	1139917

2.2.2 Landscape assessment

The offset site occurs within the Peel subregion of the Namoi Catchment Management Area. The majority of the site falls within the Tamworth - Keepit Slopes and Plains Mitchell Landscape with some areas in close proximity to the dam within the Peel Channels and Floodplain Mitchell Landscape. On the eastern side of the dam, the offset area just extends into the Nundle Hills Mitchell Landscape. For the purposes of the BioBanking Calculator, the Tamworth - Keepit Slopes and Plains Mitchell Landscape has been used as this is the dominant landscape within the offset site.

Two '1000 ha assessment circles' were required to cover the offset site (outer yellow lines, Figure 2-3). Similarly to the development site, adjacent remnant vegetation has been disturbed by clearing and agricultural practices in the past and the properties continue to be grazed by cattle. The vegetation communities are comprised of forest, woodland and derived grasslands with a predominantly native species composition although some areas that have been subject to pasture improvement now contain predominately exotic vegetation.

Within the eastern assessment circle, the percentage overstorey cover is scored as 21-30% before the offset and estimated to increase to 31-40% after the offset within the 1000 ha circle. Within the 100 ha assessment circle native vegetation cover is scored as 41-50% prior to the offset and estimated to increase to 51-60% after the offset. Within the western assessment circle, the percentage overstorey cover is scored as 51-60% before and 61-70% after the offset within the 1000 ha circle and 71-80% before and 81-90% after the offset within the 100 ha circle. The 100 ha circles has been placed to capture a representative sample within each 1000 ha assessment circle.

The 'most limiting link' was identified in the central area of the offset site providing connectivity from the east to the west with a width of approximately 100 m. The average condition of the link is moderate to good, determined on the basis of overstorey cover and PFC has been rated at >25% of the lower benchmark. The groundcover in this area is predominately native and has also been rated at >25% of the lower benchmark.

The offset would be likely to have a positive impact on this link (evidence of good regrowth potential was noted onsite, connecting it with adjacent vegetation to the south. This would increase the width to over 500 m and this was recorded in the 'after BioBank' field.

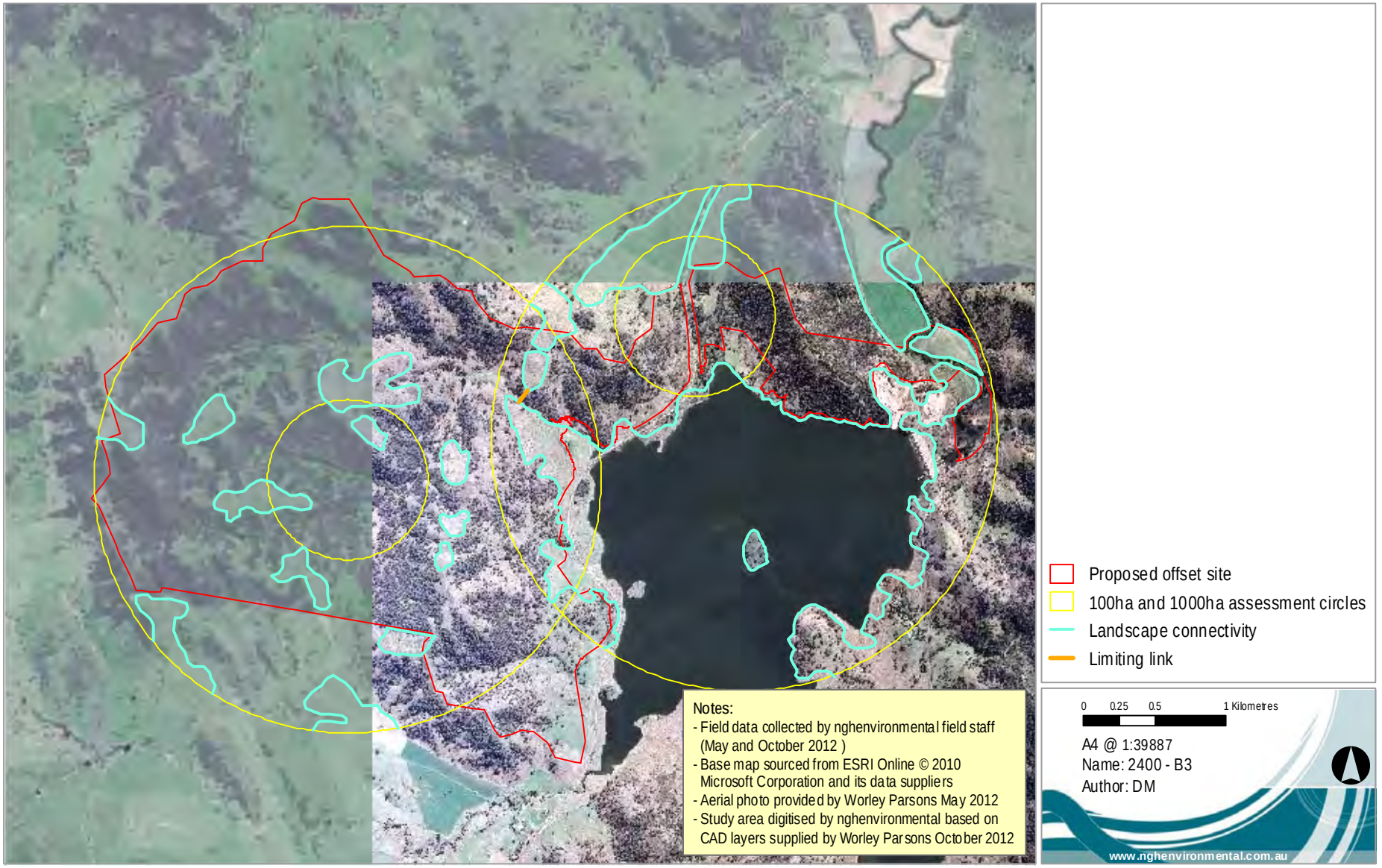


Figure 2-3 Landscape assessment for the offset site

2.2.3 Mapping zones

Homogenous vegetation zones were broadly mapped for the majority of the offset site during the original Terrestrial and Aquatic Flora and Fauna Assessment (**ngh**environmental 2012) which included broad scale mapping to encompass a one kilometre radius of the development site of which, the offset site is continuous. During surveys conducted during February 2013 to collect plot data at the offset site, the homogenous zones were more accurately refined. As discussed for the development site, derived grasslands are included within the vegetation types they are derived from.

Four homogenous zones were mapped on the basis of vegetation type and condition corresponding to the defined offset site. Dominant vegetation types were determined with reference to the previous detailed assessments at the site (**ngh**environmental 2012) and the OEH Biometric Vegetation Types Database. All vegetation within the offset site was considered to be in moderate to good condition.

The zones are defined in Table 2-7 and mapped on Figure 2-4[3]. Remnant areas were assessed to be over 500 ha for all zones as all surrounding vegetation is considered to be native vegetation.

Plot data was collected based on the entire area of each homogenous zone and the number of plots conducted was sufficient to meet the minimum requirements for these areas. An exception was the number of plots required for the Rough-barked Apple – Silvertop Stringybark forest. During the refinement of the area of impact for the Project, following the development site surveys, two plots (D1 and D16) were now located within the proposed offset. In addition Plot D3 was located slightly upslope of the development site (but still representative of the vegetation within the development site) and also located within the proposed offset. The plot data from these plots has been used within the offset site calculations. Given the consistency of the vegetation within this homogenous zone and the close proximity of the offset site to the development site, plot D2 has also been included as it was also considered to be highly representative of vegetation and habitat features within the proposed offset site. The use of the development site plot data for this homogenous zone was discussed with OEH (David Coote *pers. comm.* 06.02.13) and considered to be acceptable given the objectives of the assessment, that it was representative of the offset site and that the particular vegetation type is common and not of conservation significance.

Two plots were conducted within the River Oak riparian woodland within the offset site and two were conducted within this community upstream of the new FSL on the Peel River (plots O17 and O18 – not shown on Figure 2-4) within an area proposed as an offset for the Booroolong Frog. These plots were included within the assessment to make up the minimum plot requirement and also because they were considered to be representative of the vegetation within the offset site.

Plot O19 was not included within the assessment as it was within an area not being considered as an offset and not representative.

Similarly to the development site, offset site plot data was duplicated only when required to satisfy the minimum plot requirements for each assessment circle. Plots that have been duplicated are denoted in Table 2-7 by an (*). Plots duplicated are those that were located closest to the relevant assessment circle.

Geographic/habitat features were selected with respect to threatened species as outlined in Table 2-8.

[3] No individual map unit was less than 0.25 ha. Vegetation that did not qualify as native vegetation was not mapped. This included areas with no native overstorey, no native mid storey and where less than 50% of the ground cover is indigenous species or greater than 90% of the ground cover was cleared.

'After BioBank' management scores were as determined by the BCC and not modified.

Table 2-7 Offset site: homogenous zones

Assessment circle	ZONE ID	Vegetation type code	Vegetation name	Condition	Area within offset (ha)	Plot IDs
East	1	NA237	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Moderate/ Good	76.6	O6*, O7*, O14, O16, O20
West	5	NA237	Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Moderate/ Good	48.98	O3, O4, O6*, O7*
East	2	NA196	Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Moderate/ Good	91.29	D1*, D2, D3*, D16*, O9*
East	3	NA191	River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Moderate/ Good	6.98	O17, O18, O21, O22
East	4	NA226	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Moderate/ Good	53.3	O10*, O11*, O12*, O13*, O15*
West	6	NA196	Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Moderate/ Good	557.31	O1, O2, O5, O9*, D1*, D3*, D16*
West	7	NA226	White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Moderate/ Good	142.75	O8, O10*, O11*, O12*, O13*, O15*

* Duplicated plot data

Table 2-8 Threatened species and relevant habitat features considered to potentially occur at the offset site

Scientific name	Common name	Feature
Thesium australe	Austral Toadflax	Coastal headlands, grassland, grassy open forest or woodland on fertile or moderately fertile soils
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	Land within 40 m of rainforest, coastal scrub, riparian or estuarine communities
Uvidicolus sphyrurus	Border Thick-tailed Gecko	Land within 100 m of rocky areas
Eucalyptus nicholii	Narrow-leaved Black Peppermint	Shallow or infertile soils
Asterolasia sp. 'Dungowan Creek'	Dungowan Starbush	Land within Dungowan Dam area near Tamworth in Peel CMA subregion
Hoplocephalus bitorquatus	Pale-headed Snake	Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber
Litoria booroolongensis	Booroolong Frog	Land within 100 m of stream or creek banks

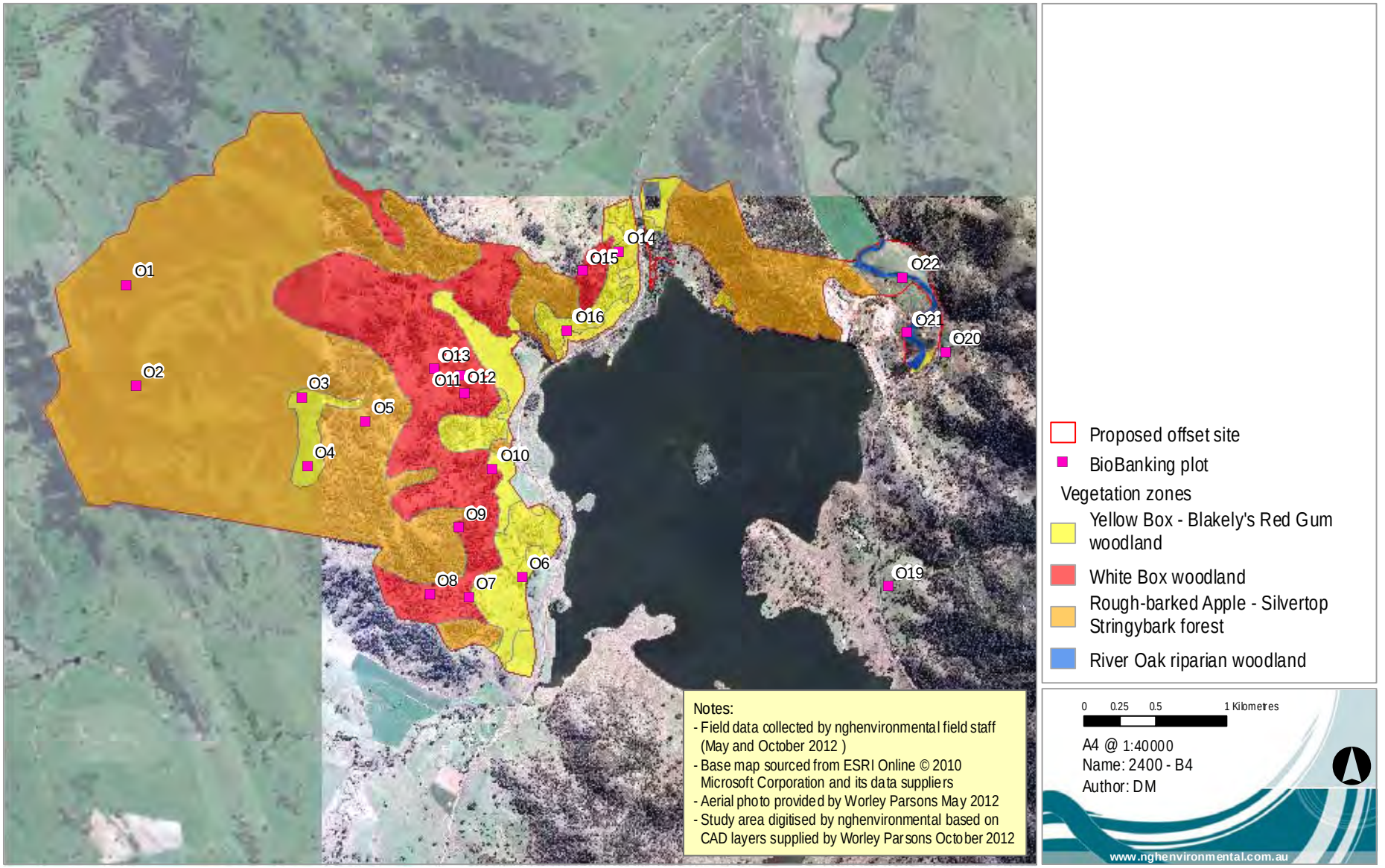


Figure 2-4 Offset site homogenous zones and plot locations

2.2.4 Credit calculator results

Species predicted to occur

The species listed in Table 2-9 are predicted by the BCC to occur at the offset site and contribute to the ecosystem credits generated.

Table 2-9 Species predicted to occur at the offset site

Scientific name	Common name	Tg value
Burhinus grallarius	Bush Stone-curlew	0.4
Cercartetus nanus	Eastern Pygmy-possum	0.5
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	0.5
Dasyurus maculatus	Spotted-tailed Quoll	0.35
Falsistrellus tasmaniensis	Eastern False Pipistrelle	0.45
Glossopsitta pusilla	Little Lorikeet	0.58
Grantiella picta	Painted Honeyeater	0.75
Lathamus discolor	Swift Parrot	0.75
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	0.75
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	0.75
Neophema pulchella	Turquoise Parrot	0.55
Ninox connivens	Barking Owl	0.33
Ninox strenua	Powerful Owl	0.33
Nyctophilus timoriensis	Greater Long-eared Bat (south eastern form)	0.48
Petaurus australis	Yellow-bellied Glider	0.43
Petaurus norfolcensis	Squirrel Glider	0.45
Petroica boodang	Scarlet Robin	0.6
Petroica phoenicea	Flame Robin	0.6
Phascolarctos cinereus	Koala	0.83
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	0.75
Pteropus poliocephalus	Grey-headed Flying-fox	0.93
Pyrrholaemus saggitatus	Speckled Warbler	0.4
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	0.45
Stagonopleura guttata	Diamond Firetail	0.75
Tyto novaehollandiae	Masked Owl	0.33
Xanthomyza phrygia	Regent Honeyeater	0.75

Species requiring survey

A total of 14 species were returned by the calculator as requiring survey (Table 2-10). Note, survey is not essential for the offset site. These species are assumed *not* to occur, unless demonstrated to occur

through survey. An extensive series of surveys were undertaken as part of the Terrestrial and Aquatic Flora and Fauna Impact Assessment however the majority of these did not focus on the offset site. As such it cannot be said with confidence that the majority of these species would be managed at the offset site and it is assumed that most would not. The exception is the Border Thick-tailed Gecko, which was detected during surveys on Goat Mountain on the northern foreshore of the dam just west of the auxiliary spillway. A conservative estimate of a minimum of 2 ha of habitat for this species would be managed at the offset site. Species credits are generated for this species.

An additional offset area, upstream along the Peel River, is proposed for the Booroolong Frog and surveys have detected the species in this area. The Booroolong Frog offset site has been assessed using the EPBC EOP. The OEH 'Credit Convertor Tool' was utilised to gain a rough estimate of the area of habitat required to offset the 58 species credits required. The tool returned a value of 10 ha. The additional area proposed according to the EPBC EOP contains approximately 13 ha (or 9 km) of habitat for this species. On the basis of these results, the proposed offset would appear to be adequate to satisfy the requirements of the BBAM. This calculation of the offset site for the Booroolong Frog is considered to be appropriate, therefore it has not been included in the assessment of threatened species.

Table 2-10 Species requiring survey at the offset site and those that would be managed

Scientific name	Common name	Managed at offset site?	ID method	Gain	Units of gain	Survey date
Thesium australe	Austral Toadflax	No		0.00	indiv	
Hieraaetus morphnoides	Little Eagle	No		0.00	ha	
Circus assimilis	Spotted Harrier	No		0.00	ha	
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	No		0.00	ha	
Dichanthium setosum	Bluegrass	No		0.00	indiv	
Digitaria porrecta	Finger Panic Grass	No		0.00	indiv	
Phascogale tapoatafa	Brush-tailed Phascogale	No		0.00	ha	
Lophoictinia isura	Square-tailed Kite	No		0.00	ha	
Callocephalon fimbriatum	Gang-gang Cockatoo	No		0.00	ha	
Uvidicolus sphyrurus	Border Thick-tailed Gecko	Yes	Survey	2.00	ha	17/10/2012
Eucalyptus nicholii	Narrow-leaved Black Peppermint	No		0.00	indiv	
Hoplocephalus bitorquatus	Pale-headed Snake	No		0.00	ha	
Litoria booroolongensis	Booroolong Frog	No		0.00	ha	
Asterolasia sp. 'Dungowan Creek'	Dungowan Starbush	No		0.00	indiv	

Credit summary

The BioBanking credit statement produced the following ecosystem and species credits that are generated at the proposed offset site (summarised in Table 2-11, provided in full as Appendix A).

Table 2-11. Offset site: credit summary

Biometric vegetation type	Area offset (ha)	Credits generated
Ecosystem credits		
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	125.76	1500
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	196.05	2019
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	649.88	7310
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	6.98	60
Species credits		
Border Thick-tailed Gecko	2.00	12

2.3 CREDIT COMPARISON: DISCUSSION

The summary in Table 2-12 compares the ecosystem credits generated at the offset site with those required for the development site.

Table 2-12 Credit comparison summary

Biometric vegetation type	Permanent habitat loss (ha)	Area within offset (ha)	Development credits required	Offset credits generated	Credit difference
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	152.35	125.76	8128	1500	-6628
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	3.65	649.88	254	7310	7056
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	5.71	6.98	323	60	-263
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	0	196.05	0	2019	2019
Total	**161.71**	**978.67**	**8705**	**10889**	**2184**

Overall, the proposed offset provides a 6:1 offset to development area ratio with an ecosystem credit surplus of 2184 credits. The proposed offset provides like for like with regards to the vegetation types it contains however, it does not meet the credit requirements on this basis. The largest deficiency is that of the Yellow Box – Blakely's Red Gum grassy woodland (comprising Box-Gum grassy Woodland EEC) with a credit shortfall of 6628 credits. This is considered to be somewhat compensated for by the White Box grassy woodland contained at the offset site (also comprising the Box-Gum grassy woodland EEC) which is identified in the BCC credit report (Appendix A) as a suitable offset option for this vegetation type. Considering that both these communities are afforded the same level of statutory protection and provide similar threatened species habitats, this is considered to be appropriate and is supported in principle by OEH (David Coote *pers. comm.* 22.02.13). In combining these two vegetation types, a 2.1:1 offset to development area ratio is achieved with a 4609 credit deficit. This is discussed further below with regard to the SSI Interim offsets policy.

The results of the BBAM also show a shortfall in the amount of River Oak riparian woodland contained within the offset site. The current proposed offset offers a 1.2:1 offset to development area ratio with a 263 credit deficit. An offset site upstream of the new FSL has been proposed for the Booroolong Frog and has been calculated according to EPBC Environmental Offsets Policy (EOP). It is considered likely that this offset will satisfy the ecosystem credit requirements for the River Oak riparian woodland as well as the species credit requirements for the Booroolong Frog.

The proposed offset may be somewhat deficient according to the outputs of the BBAM methodology with respect to the Yellow Box – Blakely's Red Gum grassy woodland however, a number of other factors should be considered in assessing its suitability. The vast majority of the community that is to be impacted comprises derived grassland that has been degraded by grazing and recreational pressures. The proposed offset also contains degraded areas however, there are extensive areas were the overstorey is regenerating and with proper management would respond well resulting in a net improvement to the biodiversity values at the site within a relatively short time frame.

In addition, the offset site provides an important corridor for connectivity between areas of native vegetation east and west of the reservoir. The reservoir in its present state forms a large barrier in a landscape that has also been extensively cleared for agriculture. The offset would improve the function of this corridor and secure it in perpetuity.

The offset is also located within the catchment for Chaffey Dam and would contribute to the preservation and improvement of catchment values associated with the water supply.

Although the Rough-barked Apple – Silvertop Stringybark forest community that comprises the majority of the offset site is considered to be a common vegetation type, it also provides high quality habitat for a range of threatened species such as the Masked Owl, which contributed the largest number of ecosystem credits for this vegetation type in the development site assessment. The large area to be included in the offset (approximately 650 ha) provides habitat suitable for species with large home ranges and it also provides a buffer for the Yellow Box and White Box grassy woodland communities. This vegetation type also supports habitat for the threatened Border Thick-tailed Gecko which is known to occur within the offset site and generated a surplus of 12 species credits in the assessment.

An offset site, upstream of Chaffey Dam along the Peel River, is proposed for the Booroolong Frog and surveys have detected the species in this area. The Booroolong Frog offset site has been assessed according to the EPBC EOP and is further discussed in Section 3.1.1. The additional area required, according to the EPBC EOP, is approximately 13 ha of habitat for this species. It is considered that the requirements of the EPBC EOP for the Booroolong Frog will also satisfy the requirements of the BBAM.

2.4 ASSESSMENT AGAINST THE OEH SSI INTERIM OFFSETS POLICY

The OEH SSI interim offsets policy relates to proposals that are assessed by DP&I under the State Significant Development (SSD), SSI or former Part 3A provisions of the EP&A Act, and are not being considered as part of the BioBanking Scheme.

This interim policy:

- Acknowledges that proposals assessed as State significant projects or Part 3A do not have to meet the "improve or maintain" standard, which is required under the BioBanking scheme (this would be a Tier 1 standard);
- Nevertheless, adopts the use of the BioBanking Assessment Methodology (BBAM) for the purpose of:
    - quantifying and categorising the biodiversity values and impacts of State significant projects or Part 3A proposals;
    - establishing, for benchmarking purposes, the offsets that would be required if the State significant project or Part 3A proposal had been expected to meet the improve or maintain standard;
    - provides a structured approach to determining how proposals may, in lieu of meeting the improve or maintain standard, meet one of two alternative standards established under this policy referred to as Tier 2 'no net loss' and Tier 3 'mitigated net loss'.

The BBAM has been used in determining the suitability of the proposed offset. The credit comparison in Section 2.3 demonstrates that the current proposed offset site is a Tier 3 'mitigated net loss' standard.

In considering whether a mitigated net loss standard is appropriate consideration should be given to:

- Whether the credits required by the calculator are available on the market
- Whether alternative offset sites (other than credits) are available on the market
- The overall cost of the offsets and whether these costs are reasonable given the circumstances

The BioBanking Public Register was searched on the 26 February 2013 and no credits for the Yellow Box – Blakely's Red Gum community were found to be available on the market. The currently proposed offset site is land owned by State Water and is suitable for use as an offset (i.e. it offers like for like offsets). Alternative areas of crown land have been identified around the dam that would be suitable as offsets however, these are not immediately available and negotiations would have to be entered into that may be both time consuming and costly. Therefore a Tier 3 'mitigated net loss' standard is considered appropriate.

To achieve a 'mitigated net loss' outcome, it is possible to apply specific variation criteria according to the OEH SSI interim offsets policy to the point that:

- Suitable offset sites can be found within a reasonable timeframe
- The costs of offsetting is brought within a reasonable range[4]
- An offset to clearing ratio of at least 2:1 vegetated to cleared hectares is achieved

[4] As stated in the OEH SSI Interim Offsets Policy, "*What is reasonable is contingent upon a range of factors and needs to be considered on a case by case basis"*.

The current proposed offset site is owned by State Water and is available immediately. Avoiding the need to acquire additional land brings the cost of offsetting within a reasonable range. Application of the BBAM shows that an overall ratio of 6:1 vegetated to cleared hectares is achievable including a ratio of 2.1 : 1 for the Box-Gum grassy woodland TEC. Although a ratio of 1.2 : 1 is currently proposed for the River Oak riparian woodland it is highly likely that additional areas will be included within the Booroolong Frog offset area that will meet the 2 : 1 ratio for this vegetation type.

The variation criteria that may be applied to achieve a 'mitigated net loss' standard is outlined in Table 2-13 along with comments on how each of these apply to the current proposal.

Table 2-13 Variation criteria for a Tier 3 'mitigated net loss' standard

Variation criteria	When is this option appropriate?	How this applies to this proposal
Convert ecosystem credits for one vegetation type to any vegetation type within the same vegetation formation in the same IBRA bioregion	When no matching ecosystem credits are available	Insufficient credits are available at the offset site for Yellow Box – Blakely's Red Gum grassy woodland. White Box grassy woodland credits have been used to satisfy the 2:1 vegetated to cleared hectares requirement for the Box-Gum grassy woodland TEC
Convert one type of species credit to another type of species credit with the same or more endangered conservation status	When species credit is not available and the matching species credit is considered a greater conservation priority.	Not applicable to this proposal.
Remove/reduce the need for offsetting	Where clearing is minimal (less 4 ha) and where the vegetation is not a highly cleared vegetation type or a Commonwealth or State listed TEC.	Not applicable to this proposal as a TEC is being impacted.
Convert ecosystem credits required to hectares and, if necessary, convert hectare figure to an estimate of land value	Where suitable offset sites are known to exist but: • there is insufficient time to secure the offset sites at the time the decision is made; or • the proposal is to use the services of a third party provider such as the Nature Conservation Trust to secure offset sites and an estimate of cost is required.	Not applicable to this proposal.
Waive the requirement for species credits **NB: This criteria should not be used for EPBC Act listed species where the proposal is a controlled action**	Where no matching credits are available and all ecosystem credits have been obtained in accordance with this policy	Not applicable to this proposal. Species credits apply to an EPBC listed species, the Booroolong Frog. An offset site has been proposed for this species using the EPBC Environmental Offsets Policy (EOP).
Convert ecosystem credits to a regional conservation priority as identified in a regional conservation plan or similar	When no matching credits are available and variation 1 is not feasible	Variation 1 employed.

2.5 PRINCIPLES FOR THE USE OF BIODIVERSITY OFFSETS IN NSW[5] – CHECKLIST

The following principles, developed by OEH, provide a useful framework for developing offset proposals. They have been considered in developing this Offset Plan, as detailed below.

Impacts must be avoided first by using prevention and mitigation measures.

Offsets are then used to address remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

The proposal has avoided and mitigated to the extent that the proposed new FSL is the minimum required to meet the long term objectives of the Project. The road works footprint has been minimised to avoid impacts to some areas of EEC. Mitigation measures have been applied and are outlined in the Flora and Fauna Addendum Report. Residual impacts are being offset only, primarily resulting from inundation by the raised water level of the dam.

All regulatory requirements must be met.

Offsets cannot be used to satisfy approvals or assessments under other legislation, e.g. assessment requirements for Aboriginal heritage sites, pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

The Offset Plan will be required as part of the NSW consent and Commonwealth controlled action conditions. The proposed offsets will not be used to satisfy approvals or assessments under other legislation.

Offsets must never reward ongoing poor performance.

Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

This is addressed in two ways:

a) The offset site will be set up in perpetuity – this removes the incentive to degrade the offset site to facilitate development at a later date

b) The management measures will have clear targets and be set out to push most management to the beginning of the agreement, where successful accomplishment of targets would be rewarded by less intensive management in ongoing years. This suits measures such as weed control which are more easily achieved with intensive efforts than small ongoing efforts.

Offsets will complement other government programs.

A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks and incentives for private landholders.

A Conservation Agreement (CA) is an option being considered for security of the offset site. Private conservation lands complement public reserves and contribute to the protected area system in NSW

Offsets must be underpinned by sound ecological principles.

They must:

[5] Accessed 28 February 2013 from http://www.environment.nsw.gov.au/biocertification/offsets.htm

- *include the consideration of structure, function and compositional elements of biodiversity, including threatened species*
- *enhance biodiversity at a range of scales*
- *consider the conservation status of ecological communities*
- *ensure the long-term viability and functionality of biodiversity.*

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

BioBanking credit calculation is the most accurate and demonstrable way to take these issues into account and has been used in formulating this plan. The management measures to be implemented on the offset sites focus on restoration and removal of threatening process which are both highly effective ways to enhance threatened species resilience and persistence. Additionally, progress and outcomes of such management measures can be monitored and adapted over time to ensure continuing beneficial outcomes.

Offsets should aim to result in a net improvement in biodiversity over time.

Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.

Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset against the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.

Offsets may include enhancing habitat, reconstructing habitat in strategic areas to link areas of conservation value, or increasing buffer zones around areas of conservation value and removal of threats by conservation agreements or reservation.

This offset plan:

- Identifies threats to the offset site's values
- Sets out suitable management measures that can be undertaken for the long-term
- Includes enhancement options, where required

Offsets must be enduring - they must offset the impact of the development for the period that the impact occurs.

As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or a private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

The offset plan for this development is required in perpetuity. The offset will be secured by Conservation Agreement or a Conservation Property Vegetation Plan and managed for the life of the impact and potentially beyond.

Offsets should be agreed prior to the impact occurring.

Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

It is proposed that all offset arrangements are approved and in order prior to construction.

Offsets must be quantifiable - the impacts and benefits must be reliably estimated.

Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- *the area of impact*
- *the types of ecological communities and habitat/species affected*
- *connectivity with other areas of habitat/corridors*
- *the condition of habitat*
- *the conservation status and/or scarcity/rarity of ecological communities*
- *management actions*
- *level of security afforded to the offset site.*

These points are addressed in this document. As stated, biometric assessment offers the most demonstrable method to undertake the first six points and BioBanking has been designed to address the last point – long term security. While it is not mandatory, aspects of the system should at least be considered. The offset will be secured by a Conservation Agreement or a Conservation Property Vegetation Plan ensuring the long term security of the offset.

The best available information/data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- *they protect land with high conservation significance*
- *management actions have greater benefits for biodiversity*
- *the offset areas are not isolated or fragmented*
- *the management for biodiversity is in perpetuity (e.g. secured through a conservation agreement).*

These points have been considered in the selection of offset site. The offset site and proposed security and management meet the above objectives.

Management actions must be deliverable and enforceable.

Management actions and their objectives, proposed methods of delivery and monitoring requirements are outlined in Section 4 of this plan.

Offsets must be targeted.

They must offset impacts on the basis of like-for-like or better conservation outcome. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance

condition by management actions and the removal of threats. Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

Offsets have been proposed based on biodiversity values that will be impacted and achieve a 'like for like' outcome with regard to the vegetation types being impacted. Proposed offsets are also targeting threatened species being impacted by the development.

Offsets must be located appropriately.

Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

Locating the offset site adjacent to the impacts within the same vegetation types achieves this aim.

Offsets must be supplementary.

They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space cannot be used as offsets.

The proposed offset is not covered by any existing covenants or agreements. The land is owned by government however, it is not being managed for conservation. The offset is considered supplementary.

Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

Monitoring requirements are outlined in Section 4 of this plan and have been designed to ensure that the actions lead to positive biodiversity outcomes.

2.6 ASSESSMENT AGAINST THE NAMOI CATCHMENT MANAGEMENT AUTHORITY BIODIVERSITY OFFSETS POLICY

The Namoi CMA has developed a biodiversity offsets policy specific to activities that occur within the Namoi Catchment to ensure that biodiversity values within the Namoi Catchment are protected. The principle objective of the policy is to avoid further loss of biodiversity that will result in critical thresholds identified in the Catchment Action Plan being crossed.

The policy states that any offsets proposed for the Namoi Catchment will need to:

Compensate for predicted impacts of a development proposal on biodiversity values

The ability of the proposed offset site to compensate for the predicted impacts of the proposal has been assessed according to the NSW OEH SSI Interim Offsets Policy and the EPBC Act Environmental Offsets Policy. According to these policies, the proposed offset compensates for the predicted impacts of the proposed development.

Ensure that the development results in no net loss of native vegetation in the catchment

The development will result in the loss of native vegetation through inundation and construction activities. However, management actions proposed at the offset site (refer to Section 4) will result in regeneration of woodland communities within areas that have been previously cleared. The majority of these areas where regeneration will occur will ultimately by occupied by a State and Commonwealth listed EEC (Box-Gum grassy woodland). Given that much of the development site has been cleared of overstorey vegetation, the potential gains at the offset site are considered likely to result in a net gain in terms of the native vegetation that would have originally occupied the development site.

Ensure that development avoids the Namoi catchment or sub-catchments crossing critical thresholds identified in the Namoi CAP

a) 30% (in cleared sub-catchments) woody native vegetation extent threshold

b) 70% (in intact sub-catchments) woody native vegetation extent threshold

c) 30% of Regional vegetation Communities threshold within the Catchment

As discussed above, the proposed management of the offset site is considered likely to result in a net gain for the State and Commonwealth listed Box-Gum grassy woodland EEC. Gains are also likely for the more common vegetation types that are to be impacted (i.e. the Rough-barked Apple – Silvertop Stringybark forest). With the proposed management of the offset site, it is considered unlikely that the development will result in vegetation within the Namoi Catchment or sub-catchments crossing critical thresholds.

Be consistent with the existing NSW Government and Commonwealth legislative requirements as a minimum standard.

NSW Government and Commonwealth offset requirements have been addressed in Sections 2 and 3. The proposed development has been assessed against all relevant legislative requirements within the Environmental Impact Statement for the development (WorleyParsons 2013).

In addition, the following principles must be applied when considering using biodiversity offsets in the Namoi Catchment for any development:

Offsets will be used as a last resort, after consideration of alternatives to avoid and/or mitigate impacts

The proposal has avoided and mitigated to the extent that the proposed new FSL is the minimum required to meet the long term objectives of the Project. The road works footprint has been minimised to avoid impacts to some areas of EEC. Mitigation measures have been applied and are outlined in the Flora and Fauna Addendum Report. Residual impacts are being offset only, primarily resulting from inundation by the raised water level of the dam.

Offsets must be kept within the Namoi Catchment boundaries (either wholly or in part – as a contiguous area of native vegetation)

The proposed offset sites occur wholly within the Namoi Catchment (being adjacent to the development site). The area proposed is predominately contiguous with the majority only being separated by a single lane dirt road. The proposed Booroolong Frog offset is separated from the majority of the offset site, however this is considered appropriate given the specificity of the habitat requirements of this species.

Offsets must be of the same vegetation type and be at least the size, equivalent biodiversity value & configuration of the vegetation lost through development and additional to existing native vegetation areas

As discussed above, the proposed offset contains the same vegetation types and with proposed management will result in a net gain to biodiversity values.

Offsetting must achieve biodiversity benefits in perpetuity and be registered on title.

The offset will be secured by Conservation Agreement or a Conservation Property Vegetation Plan and managed in perpetuity. Both of these management vehicles are registered on title.

Offset conditions must be monitored, enforceable, clearly mapped, recorded and publicly available.

Monitoring requirements are outlined in Section 4 of this plan and have been designed to ensure that the actions lead to positive biodiversity outcomes. A management plan will be produced for the offset that will clearly outline management actions and their locations and will be publicly available.

An offset area, once designated, cannot be used for further offsetting of subsequent developments in the future

Both State and Commonwealth offset policies enforce the principle of 'additionality'. Any future offsets would have to meet the requirements of these policies and would have to be additional to what already exists.

3 COMMONWEALTH OFFSET REQUIREMENTS

The EPBC Act Environmental Offsets Policy (EOP) (SEWPaC 2012) outlines the Commonwealth Government's approach to the use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This policy relates to all matters protected under the EPBC Act. As the proposed action has been determined to be a 'Controlled Action', and the potential for significant impact to the endangered Booroolong Frog remains, the EPBC Act EOP applies and must be addressed for this species.

An Assessment of Significance has been undertaken for the Booroolong Frog in view of new survey results from 2013 (Appendix A). Overall, the removal of 6.4% of known Booroolong Frog habitat immediately upstream of Chaffey Dam has the potential to significantly impact this population. Habitat for the Booroolong Frog is a limiting factor, and this is the largest and most continuous population currently known from anywhere in NSW, and potentially Australia. The National Recovery Plan for Booroolong Frog (NSW OEH 2012a) states that "habitat critical to the survival of the Booroolong Frog is rocky sections of permanent streams occupied by the species. Any action that reduces stream permanency or results in loss of rock crevices is likely to threaten the persistence of local populations of this species."

The suitability of the proposed offsets to specifically offset the residual impacts on the Booroolong Frog has been assessed using the Offsets Assessment Guide (OAG) which accompanies the EPBC Act EOP. The methodology applied in utilising the guide and the results obtained are described below.

This Offset Plan has also been produced according to the NSW BioBanking Assessment methodology which is a methodology endorsed by the NSW OEH. The overarching offset principles outlined in the EPBC Act EOP and how the current Offset Plan addresses these principles are also presented below.

As documented in the Terrestrial and Aquatic Flora and Fauna Impact Assessment (**ngh**environmental 2012), no significant impact to the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC will result from the Project. In accordance with the EPBC Act EOP, no offset is required for this community.

However, the offset proposed under the NSW OEH SSI Interim Offsets Policy for the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland EEC incorporates a large area of the EPBC listed CEEC. As such, information is provided here to demonstrate the conservation outcomes for the CEEC through implementation and management of the proposed offset site.

3.1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE REQUIRING OFFSETS

3.1.1 Booroolong Frog

The Project will impact on 2.32 ha of Booroolong Frog habitat along a 1.6 km stretch of the Peel River as a result of inundation. Known Booroolong Frog habitat is present upstream of the dam along an additional 23 km of the Peel River and one of its tributaries (Refer to Flora and Fauna Addendum Report). Therefore the loss of 1.6 km constitutes 6.4 % of known Booroolong Frog habitat along the Peel River.

"Area of habitat" was used as the impact attribute for input into the OAG. Area of habitat was chosen opposed to "number of individuals" because the Booroolong Frog can exhibit large fluctuations in abundance from one year to the next, therefore population abundance is not a useful indicator of

population resilience (NSW OEH 2012). Also, there is confidence in the known amount of habitat available for the Booroolong Frog, whereas the number of individuals can vary according to conditions during the time of the survey and detection rates.

Methods

The Offsets Assessment Guide (OAG) was run according to the information contained in the document titled 'How to use the Offsets Assessment Guide' (which is published on the SEWPaC's EPBC Act environmental offsets policy web page) and also from information obtained during the OAG workshop (conducted by SEWPaC and attended by **ngh**environmental staff members).

In running the OAG with respect to the Booroolong Frog, the user is required to enter a number of variables which require a quantitative assessment of the habitat quality at the development and offset site and also factors such as the time until the ecological benefit of the offset is realised, the risk of the loss of the offset and the level of confidence in these results. The reasoning used in reaching these values is discussed individually for each below. A conservative approach has been adopted.

Quality of habitat to be impacted and the start quality of habitat at the offset site

The overall habitat quality score (0-10) was determined by considering the following factors (as outlined in the 'How to use the Offsets Assessment Guide') individually:

- Site condition. Condition of the site in relation to the ecological requirements of the species including diversity of habitat and the number of habitat features.
- Site context. The biodiversity importance of the site in terms of its landscape position.
- Species stocking rate. The usage and/or density of a species at a particular site.

The contribution of these factors was then weighted according to their level of importance to achieve an overall habitat quality score. The results of this analysis are provided in the tables below.

Table 3-1 Habitat quality of Booroolong Frog habitat to be impacted by the development

Factor	Score	Importance	Reasoning
Site condition	8	1	The Booroolong Frog has specific habitat requirements, which include a mosaic of microhabitats including riffles, pools, cobble banks or bedrock structures within stream margins (NSW OEH 2012). The Peel River, upstream of Chaffey Dam and within the new FSL (the development site) is known habitat for the Booroolong Frog and supports a breeding population. The impact site contains all of the habitat variables important to the Booroolong Frog, which is evidenced by its even distribution along this 1.6 km section of the river.
Site context	7	2	The development site is located at the very northern end of the population of Booroolong Frogs that occur along the Peel River. There is no opportunity for the Booroolong Frog to move further north due to the presence of Chaffey Dam. In this sense, the loss of the development site will not fragment the population. Upstream of the impact site there is an abundance of suitable habitat for the Booroolong Frog, currently occupied for a distance of at least 19.5 km. Previous surveys in 2009 found the majority of the population to be located within the new FSL, however it appears that this was probably due to floods in 2008 which washed eggs, and possibly young tadpoles, downstream (NWES 2009). Surveys undertaken in January 2013 have not found the concentration of Booroolong Frogs to be as high within the impact

Factor	Score	Importance	Reasoning
			site, and a healthy distribution of Booroolong Frogs occurs upstream of the new FSL for a distance of 19.5 km to Pearly Gates Bridge. Two other locations were surveyed upstream of this location at Wombramurra Creek and near the headwaters of the Peel River, where 118 and 80 individuals were recorded respectively. The stretch of river from Pearly Gates Bridge to these locations (8-11 km) was not surveyed, however it is highly likely that the Booroolong Frog inhabits these areas also (Phil Spark, *pers. comm.*). The importance of the site to this population of Booroolong Frog is not as significant as previously thought. Threats that occur at the impact site include habitat degradation (sedimentation due to erosion, inappropriate stock management and fossicking), predation by foxes (Anna Cronin *pers. comm*.), exotic predatory fish, and disease (NSW OEH 2012).
Species stocking rate	8	3	The role of the area to be impacted in sustaining the community within the area to be impacted is considered to be relatively important. Surveys in January 2013 found there to be 50 Booroolong Frogs within the impact site (inside the new FSL), 2037 frogs 19.5 km directly upstream of the new FSL. This indicates that while the impact site provides valuable habitat for the Booroolong Frog, upstream areas provide the same value.
Overall habitat quality score	8		

Table 3-2 Starting quality of Booroolong Frog habitat to be offset

Factor	Score	Importance	Reasoning
Site condition	8	1	The condition of the offset site has the same score as the development site. Due to the offset site's location immediately upstream of the development site, it has the same habitat features and is subject to the same pressures. This is evidenced by the species being well distributed along the 25 km of the Peel River and Wombramurra Creek that has recently been surveyed.
Site context	7	3	The offset site occurs within a landscape that is subject to stock pressures and human disturbance. With the removal of habitat directly north of the site, the offset site will contain the northernmost extent of the Booroolong Frog population on the Peel River. The offset site provides important linkages to the south of the site.
Species stocking rate	8	2	The occurrence of the Booroolong Frog population within the offset area is considered to be important to the survival of the species within the broader area. Densities in this area are currently extremely high (approximately 7 frogs every 100 m). The density of frogs can vary considerably among years, with a study in Victoria recording a seven fold difference in the abundance of adult males from one year to the next (NSW OEH 2012; Hunter 2007). With the implementation of management measures to reduce the impacts of habitat degradation along the Peel River, factors such as erosion and sedimentation will maintain and improve habitat available for the Booroolong Frog.

Factor	Score	Importance	Reasoning
Overall habitat quality score	8		

Time over which loss is averted for the offset

As the offset site is to be legally secured in perpetuity, the maximum forecast term of 20 years was selected for this variable.

Future quality with or without offset and time until ecological benefit

Although the offset site currently provides suitable habitat for the Booroolong Frog, without the implementation of management measures to reduce the impacts of habitat degradation along the Peel River through establishment of an offset site, factors such as erosion, weed invasion, predation on adults by foxes, predation by introduced fish, shading from introduced Willows, sedimentation and substrate disturbances as a result of stock trampling and fossicking, will reduce the quality and availability of habitat for the species. Even though the species occurs in the presence of ongoing threats, there is a risk that overall habitat quality would degrade to a value of 7.

The values of the future quality of the site, with implementation of an offset, are largely based on the management actions proposed as part of the offset plan. This includes the following actions relevant to the Booroolong Frog:

- Riparian protection and restoration
    - Eradication of weeds
    - Stock exclusion
    - Native revegetation of the riparian zone
    - Prevention of fossicking
    - Limit herbicide and pesticide use
- Predator control
    - Prevent impacts from introduced predatory fish
    - Fox control
- Monitoring
    - Identify population trends in relation to stream drying and riparian restoration
    - Adhere to strict quarantine protocols, such as those outlined in the 'Hygiene protocols for the control of disease in frogs' (NSW NPWS 2001)
    - Identify presence/absence of threats at offset site in order to quantify the success or failure of management measures implemented (e.g. predator and weed abundance, riparian vegetation condition, fossicking activities)

It is considered reasonable that the overall quality of the habitat for the Booroolong Frog within the offset site could be increased to a value of 9 by implementing these management actions.

The proposed management measures have been identified as objectives in the National Booroolong Frog Recovery Plan (NWS OEH 2012). As the degradation at the site has been largely caused by stock access, weed invasion and human disturbance, and that the management actions described above are ensured to be carried out as part of a management plan, a confidence level of 80% has been applied. This is considered reasonable as it still allows for unforeseen circumstances such as extreme weather events, or unknown responses to those management measures. It should be noted that an adaptive management plan will be adopted in order to detect and respond to those factors.

An estimate of one year has been given for the time until ecological benefit. The proposed management measures will be incorporated prior to construction and while some of the measures will be evident immediately (prevent stock access and fossicking activities), other measures will be evident over a longer timeframe (riparian restoration, weed control). It is considered that it will take a minimum of one year for the habitat quality improvement of the offset site to be realised.

Risk of loss of the offset site with or without the offset

The offset site is currently utilised as a watering point for stock and for recreational activities including fossicking. The offset site is owned by multiple private landowners and is not protected by any conservation agreements or reservation schemes. A Management Agreement between landholders and Namoi CMA currently exists for the offset site, however management conditions in place are not monitored or audited, and there is evidence that these conditions are not being met sufficiently (Phil Spark, *pers. comm.*). These MAs are due to expire in five years (2018), however the Proponent proposes to assume management of the lands subject to these MAs and value-add to current management measures. The proposed management of the offset site detailed in this Offset Plan (Section 4) will incorporate additional conditions subject to ongoing monitoring, thereby reducing the risk of loss of the offset site. There are no known pending mining leases or development applications that apply to the offset site.

As stated in the 'How to use the Offsets Assessment Guide', degradation to the quality of the site due to current management practices and use should not be incorporated into the risk of loss as these factors are incorporated in the quality score. However, it is considered reasonable that future land management practices be taken into account. An estimate of 30% risk of loss without offset has been applied as the site is unprotected, however there is no indication that it is likely to be lost in the future.

With the offset in place, the risk of loss is considered to be very low as the offset would be legally secured in perpetuity. There is a small chance that the offset may be lost due to unforeseen circumstances. A 5% risk of loss has been applied to account for this.

Considering the extensive amount of field survey and time spent on assessing the site, a good understanding of the site and associated land use pressures has been obtained. Furthermore, State Water is a public entity with a good reputation. The estimated values for risk of loss are considered to be reasonably informed; an 80% confidence in these results has been applied.

Results

Utilising the values described above, the OAG returned a 100.08% direct offset for the impact (included as Appendix B). No additional compensatory measures are considered to be required.

3.1.2 Box-Gum grassy woodland CEEC

Approximately 7.38 ha of Box-Gum grassy woodland that meets the criteria for the EPBC listed CEEC will be impacted by the development. As documented in the Terrestrial and Aquatic Flora and Fauna Assessment, this impact will not be significant.

However, the proposed offset site contains approximately 207 ha of the community which variably meets the EPBC criteria based on understorey diversity, the density of mature trees and the presence of overstorey regeneration. The OAG was run using the above figures as detailed below.

Methods

The Offsets Assessment Guide (OAG) was run as described above for the Booroolong Frog. As with the Booroolong Frog, a conservative approach has been adopted. The reasoning used in reaching key values for each of the OAG inputs is discussed individually for each below.

Quality of habitat to be impacted and the start quality of habitat at the offset site

The overall habitat quality score (0-10) was determined by considering the following factors (as outlined in the 'How to use the Offsets Assessment Guide') individually:

- Site condition. Including vegetation condition (weediness), structure and species diversity.
- Site context. The biodiversity importance of the site in terms of its landscape position.
- Species stocking rate. The number of individual populations at the site.

The contribution of these factors was then weighted according to their level of importance to achieve an overall habitat quality score. The results of this analysis are provided in the tables below (as the offset site is immediately adjacent to the area to be impacted, the start quality of both areas was considered to be the same.)

Table 3-3 Habitat quality of Box-Gum grassy woodland CEEC to be impacted by the development

Factor	Score	Importance	Reasoning
Site condition	8	1	The area to be impacted north of the camping ground exhibits quite a high diversity of native forbs. Weeds are common but not prolific. The area south of the camping ground has a moderate diversity and similar weediness. Overstorey regeneration was evident in all areas. Areas of the community with a moderate to high diversity within the development area are rare.
Site context	6	2	The areas to be impacted are located adjacent to a large barrier, Chaffey Dam, and are also subject to high recreational pressures and grazing. Other high quality areas also exist in the area that are not subject to such intense pressures.
Species stocking rate	7	3	The role of the area to be impacted in sustaining the community within the area to be impacted is considered to be relatively important, however, not essential to the survival of the community. The community is not widespread within the area to be impacted.
Overall habitat quality score	8		

Table 3-4 Starting habitat quality of Box-Gum grassy woodland CEEC to be offset

Factor	Score	Importance	Reasoning
Site condition	7	2	Generally, a moderate diversity of native forbs is present with small patches of high diversity. Lower diversity areas are widespread as are common pasture weeds. Regeneration of the overstorey is evident throughout.
Site context	7	1	The offset site occurs within a landscape that has been cleared for agriculture and is subject to grazing pressures. It provides an important link in habitat between the north and south of the dam, however, similar examples of the community are common

Factor	Score	Importance	Reasoning
			throughout the broader area.
Species stocking rate	6	3	The occurrence of the community within the offset area is not considered to be essential to the survival of the community within the broader area, however some higher quality areas would provide an important source for dispersal. It is anticipated that this value would increase substantially through the offset
Overall habitat quality score	7		

Time over which loss is averted for the offset

As the offset site is to be legally secured in perpetuity, the maximum forecast term of 20 years was selected for this variable.

Future quality with or without offset and time until ecological benefit

The values for these variables are largely based on the management actions proposed as part of the offset plan including the following relevant to Box-Gum grassy woodland:

- Weed control
- Feral and or native herbivore control
- Stock grazing management
- Assisted regeneration

It is considered reasonable that the overall quality of the habitat for the Box-Gum grassy woodland CEEC within the offset site could be increased to a value of 8 over a period of 10 years by maintaining these management actions. Conversely, if current land management practices continue, it is considered likely that the site would potentially degrade in quality predominately due to a continued loss of diversity within the groundcover. Over the 10 year period it is considered likely that the overall habitat quality would degrade to a value of 6.

As the degradation at the site has been largely caused by weed invasion and grazing and that the management actions described above are ensured to be carried out as part of a management plan for the forecast period, a confidence level of 85% has been applied. This is considered reasonable as it still allows for unforeseen circumstances such as extreme weather events.

Risk of loss of the offset site with or without the offset

The offset site is currently utilised for grazing and is situated within a landscape where this is the dominant land use. It is owned by State Water and leased to private landowners and not protected by any conservation agreements or reservation schemes. There are no known pending mining leases or development applications that apply to the offset site. As stated in the 'How to use the Offsets Assessment Guide', degradation to the quality of the site due to current management practices and use should not be incorporated into the risk of loss as these factors are incorporated in the quality score however, it is considered reasonable that future land management practices be taken into account. Given the land is owned by State Water, it is considered unlikely that future land use would lead to the loss of the offset site unless the site was sold, which must be considered as a possibility. An estimate of 10% risk of loss without offset has been applied as the site is unprotected however it is considered unlikely that it would be lost over the forecast term.

With the offset in place, the risk of loss is considered to be very low as the offset would be legally secured in perpetuity. There is a small chance that the offset may be lost due to unforeseen circumstances. A 5% risk of loss has been applied to account for this.

Considering the extensive amount of field survey undertaken, a good understanding of the site and associated land use pressures has been obtained. The estimated values for risk of loss are considered to be reasonably informed, however a conservative 70% confidence in these results has been applied.

Results

Utilising the values described above, the OAG returned a 304.18% direct offset for the impact (included as Appendix B).

3.2 PRINCIPLES OF THE EPBC ACT EOP

In order to satisfy the EPBC Act EOP suitable offsets must:

Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action

Booroolong Frog

The Project will directly impact upon approximately 2.32 ha of Booroolong Frog habitat on the Peel River. According to the EPBC Offset Assessment Guide (OAG), an offset of 13.1 ha (or 9 km) of Booroolong Frog habitat is required to provide a 100% direct offset for the anticipated impact to this species.

There is 23.2 km upstream of the new FSL that is known habitat for the Booroolong Frog, within which 2235 individuals were recorded in summer 2013. It is proposed to establish an offset site immediately upstream of the new FSL for a distance of 9 km (Figure 3-1).

Several allotments constitute the Booroolong Frog offset site as listed in Table 3-3. The allotments are contiguous and the offset site is contiguous with the development site. The delineation of the offset site for the Booroolong Frog is further discussed in Section 3.

Table 3-5 Allotments constituting the Booroolong Frog offset site (supplied by Tamworth Regional Council, 2013)

Lot	DP	Lot	DP
10	1125418	1	744739
7317	1140215	297	40575
99	755335	304	705107
7008	1060952	6	595586

The proposed offset site contains Booroolong Frog habitat that is considered to be in similar condition to that to be impacted providing a 100% direct offset (as calculated by the OAG). Proposed management measures at the offset site will ensure that the long-term viability of Booroolong Frog habitat at the site is maintained or improved. This can be confidently expected with measures such as stock exclusion, weed and predator control, and restoration and revegetation of the riparian zone. These actions are in response to known threats listed in the National Recovery Plan for the Booroolong Frog and will reduce habitat degradation along the Peel River (NSW OEH 2012). Measures to discourage fossicking will also be implemented, adopting an adaptive approach in consultation with Namoi CMA.

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

The Project will directly impact upon approximately 7.4 ha of vegetation considered to comprise the CEEC. The proposed offset site contains approximately 207 ha of vegetation considered to comprise the

CEEC in slightly lower condition to that to be impacted providing a 304% direct offset (as calculated by the OAG). Proposed management measures at the offset site will ensure that the long-term viability of the CEEC at the site is maintained or improved.

Be built around direct offsets but may include other compensatory measures

Booroolong Frog

The proposed offset site offers a 100% direct offset for Booroolong Frog habitat to be impacted by the Project. Negotiations are underway to implement a CA with private landholders along a 9 km reach of the Peel River which is known Booroolong Frog habitat. These CAs will be legally binding agreements ensuring the site is secured in perpetuity. Under these CAs State Water will assume management of lands currently managed by landholders under a 10 year Management Agreement (MA) with Namoi CMA). These MAs were due to expire in five years (2018). Management of the offset site will incorporate additional management measures to value-add to those conditions already in place under the current MAs. Monitoring of the offset site will ensure compliance with those management measures and allow for adaptive management.

As a 100% direct offset will be achieved, no other compensatory measures are required in accordance with the EPBC Act EOP.

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

The proposed offset site offers a 304% direct offset in terms of the same aspect of the environment that is to be impacted (Box-Gum grassy woodland CEEC). A Conservation Agreement (CA) or Conservation Property Vegetation Plan (CPVP) is proposed within the current offset plan for securing the direct offset. Either the CA or CPVP would be a legally binding agreement ensuring the site is secured in perpetuity.

Be in proportion to the level of statutory protection that applies to the protected matter

Booroolong Frog

The offsets required for protected matters with higher conservation status must be greater than those with a lower status. The "endangered" conservation status of the Booroolong Frog was used in the OAG, to give an annual probability of extinction of 1.2%. This is an automated value in the OAG and is an estimate of the average chance that a species or ecological community will be completely lost in the wild each year, given recent rates of decline.

The proposed offset site provides a 100% direct offset for the endangered Booroolong Frog.

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

The offsets required for protected matters with higher conservation status must be greater than those with a lower status. The proposed offset site provides a direct offset for the CEEC and the same level of statutory protection applies.

Be of a size and scale proportionate to the residual impacts on the protected matter

Booroolong Frog

A total of 9 km of Booroolong Frog habitat has been proposed to offer a 100% direct offset as calculated by the OAG. This corresponds to a 5.6:1 development to offset site ratio, which far exceeds the 1.2:1 development to offset site ratio calculated by the BBAM. According to the OAG the size and scale of the proposed offset is suitable.

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

The proposed offset site offers a 304% direct offset as calculated by the OAG which confirms that the size and scale of the offset is suitable. An offset is not required for this community under the EPBC Act EOP as the Project will not have a significant impact on the community.

Effectively account for and manage the risks of the offset not succeeding

Booroolong Frog

The proposed offset site provides a 100% direct offset. It is recognised in the EOP that direct offsets present a lower risk than other compensatory measures as they are more likely to result in a conservation gain for a protected matter. The direct offset will be managed in perpetuity for biodiversity under a legally binding agreement which provides surety of the offset succeeding for the long-term. An adaptive management plan will be incorporated into the management of the offset site. This will ensure that the results of offset site monitoring will guide and improve management over the long-term.

White box-Yellow Box Blakely's Red Gum Grassy Woodland

The proposed offset site provides a 304% direct offset. It is recognised in the EOP that direct offsets present a lower risk than other compensatory measures as they are more likely to result in a conservation gain for a protected matter. The direct offset will be managed in perpetuity for biodiversity under a legally binding agreement which provides surety of the offset succeeding for the long-term.

Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.6)

Booroolong Frog

The offset site provides a 100% direct offset for Booroolong Frog habitat on a like for like basis. Management of the offset site will incorporate additional measures to those set out by the current MAs. The establishment of Conservation Agreements will ensure the long-term and effective management and protection of the offset site.. Under the current MAs, the offset site is subject to residual threats and is not being managed effectively The offset site will count toward the offset required under the TSC Act for River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions. No additional compensatory measures are considered to be required to account for any residual impact to Booroolong Frog habitat on the Peel River.

White box-Yellow Box Blakely's Red Gum Grassy Woodland

This Offset Plan has been produced incorporating the BioBanking methodology which is a methodology endorsed by the NSW OEH. As stated in the EOP, a state or territory offset will count toward an offset under the EPBC Act to the extent that it compensates for the residual impact to the protected matter identified under the EPBC Act. The offset site provides a 304% direct offset for the CEEC on a like for like basis. However, it should be noted that although an offset is not required for this community, this Offset Plan does meet the requirements of an offset site according to the EPBC EOP.

Be efficient, effective, timely, transparent, scientifically robust and reasonable

Booroolong Frog

This Offset Plan has been prepared in accordance with the requirements of the NSW OEH and EPBC EOP. The Offset Plan will be effective, and will be implemented prior to and during the impact arising from the

action. The offset site will be protected in perpetuity, and will be subject to an adaptive management plan in order to guide and improve management over the long-term. Management of the offset site is based on expert and local knowledge, as well as the the objectives of the National Recovery Plan for the Booroolong Frog (NSW OEH 2012).

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

An Offset Plan has been prepared in accordance with the requirements of the NSW OEH. This Offset Plan is not required to satisfy the direct offset requirements of the EPBC EOP for this community.

The Offset Plan will be effective, being implemented immediately after the impact arising from the action.

Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

Booroolong Frog

A CA is recommended within the current Offset Plan for securing and managing the direct offset. This ensures that the site is protected in perpetuity and that restrictions on land use that apply will be attached to the title, as will management measures.

During the operational life of the dam, the management and maintenance of the offset site will be auditable through the Project's Offset Site Management Plan which will detail monitoring and reporting requirements (Section 4).

White box-Yellow Box Blakely's Red Gum Grassy Woodland CEEC

A CA or CPVP is proposed within this Offset Plan for securing and managing the direct offset. This ensures that the site is protected in perpetuity and that restrictions on land use that apply will be attached to the title, as will management measures.

During the operational life of the dam, the management and maintenance of the offset site will be auditable through the project's Offset Site Management Plan which will detail monitoring and reporting requirements.

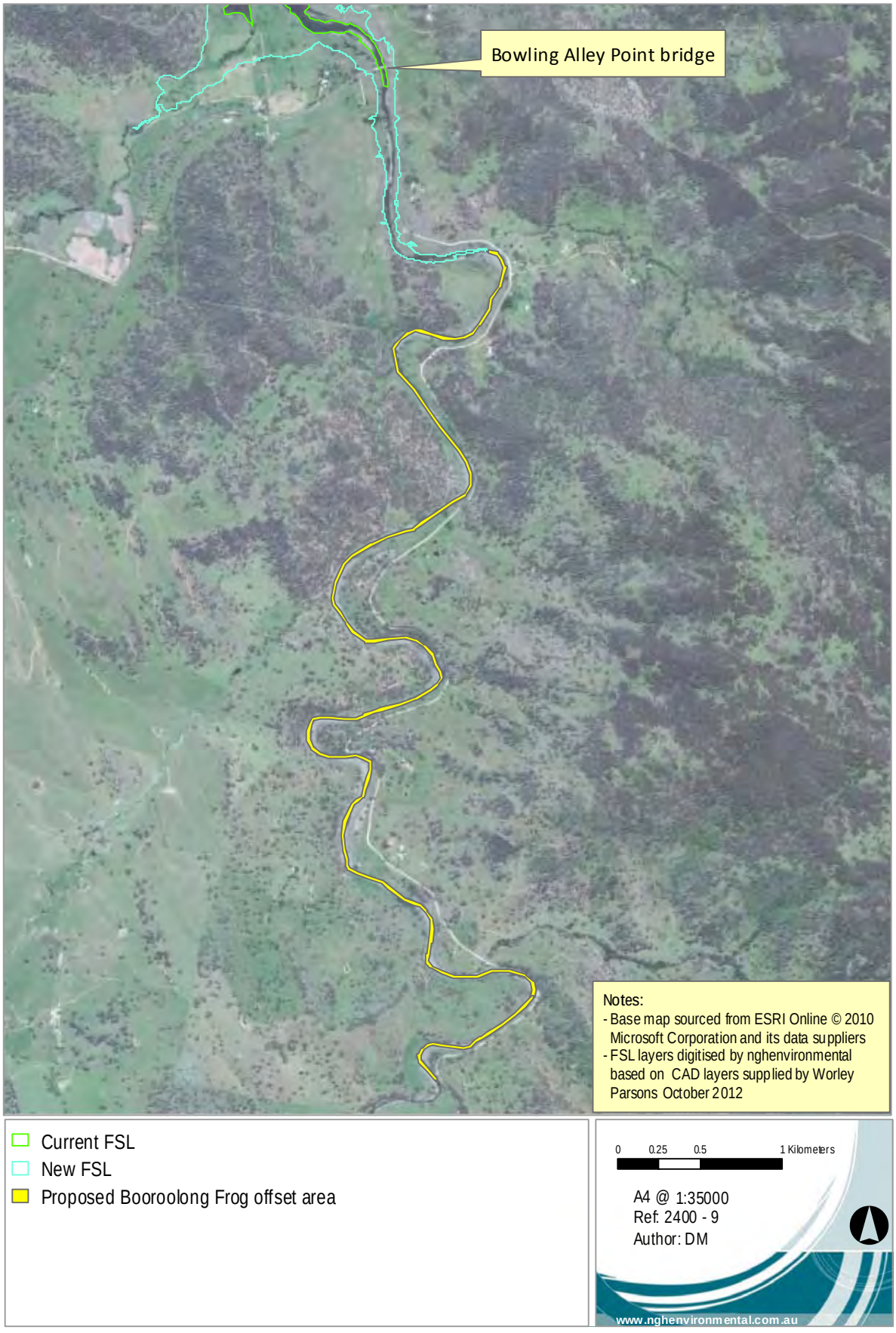


Figure 3-1 Proposed offset site for the Booroolong Frog

4 MANAGEMENT OF THE OFFSET SITE

4.1 MANAGEMENT VEHICLES

An appropriate management vehicle is required that:

- Secures the site in perpetuity
- Allows for the ongoing management of the site (including how the designated management actions will be funded)

The following six options are considered by OEH as being suitable and acceptable for securing an offset site in perpetuity as outlined in the OEH *Guidance on Appropriate Mechanisms for Securing Biodiversity Offsets* document. Note that option 6 (a CPVP) is only considered acceptable where the first five are not able to be negotiated:

1. BioBanking agreement, a system set up by OEH and offering the most security in terms of ongoing management outcomes
2. Dedication to the public reserve system
3. Conservation Agreement (CA)
4. Trust agreement
5. Planning Agreement
6. Conservation Property Vegetation Plan (CPVP)

North-western offset area (as assessed using the BBAM)

It is proposed that a CA or CPVP will be established over the offset area that will be attached to the land title. To ensure that the CA or CPVP is binding on successors in title, an abstract of the CA or CPVP will be registered with the Land and Property Management Authority under the *Real Property Act 1900.*

The CA or CPVP will be a legally binding agreement under relevant Acts and will include management actions associated with the offset area that will apply in perpetuity. These management actions should be consistent with recommendations specified in this document.

As a CA or CPVP is attached to the land title. The land owner (currently State Water) is ultimately responsible for funding the management actions required at the offset site and monitoring the effectiveness of their implementation. State Water, as the owners of the site will hold this responsibility.

Proposed Booroolong Frog offset area

As the proposed offset of 9 km of the Peel River occurs on multiple private properties (refer Appendix C) and only a proportion of these properties are proposed to be included within the offset, CAs are proposed. As the majority of these lands are not owned by State Water and the land owners are ultimately responsible for funding management actions an agreement between the land owners and State Water will need to be negotiated. The proposed offset site is currently managed by landholders under a 10 year Management Agreement (MA) with Namoi CMA. Lands currently subject to this MA are displayed in Appendix C. Namoi CMA supports the proposal to terminate their MAs in lieu of the CAs coming into effect. The proposed offset plan will incorporate additional management measures to value-add to those conditions already in place. Monitoring of the offset site will ensure compliance with those management measures and allow for adaptive management. State Water will be responsible for funding

the management actions required at the offset site and monitoring the effectiveness of their implementation. This will be further detailed in the Offset Site Management Plan.

4.2 MANAGEMENT PLAN NORTH-WESTERN OFFSET AREA

The BCC recommends specific management measures as they apply to each vegetation zone within an assessment. The requirements for the proposed offset site were returned by the offset credit statement (Appendix A) for all vegetation zones as follows:

- Cat and/or fox control
- Exclusion of miscellaneous feral species
- Feral and /or native herbivore control/exclusion (e.g. rabbits, goats, deer etc)

These management measures would be incorporated into a detailed management plan for the offset site. In addition, the following measures would also be undertaken:

- Restriction of public access including fencing and signage
- Weed control (several noxious weeds are widespread across the offset site)
- Management of stock grazing for conservation purposes (this would be conducted in consultation with a local agronomist)
- Assisted regeneration of cleared areas by either stock exclusion or strategic rehabilitation including plantings
- Implementation of controlled burns

The management plan would be prepared and be ready for implementation with the establishment of the offset site. A summary of the proposed management measures, their justification, proposed actions and monitoring are provided in Table 4-1. All management measures are the responsibility of State Water.

For each of the measures described, the detailed management plan for the site would:

- Describe the existing situation
- Detail the proposed management measure including
    - Specific locations where management is required
    - The objectives of the management
    - The proposed actions to achieve the objectives
    - Identify persons responsible
    - Estimated costs and timeframes
- Proposed monitoring regime
- Reporting requirements

At the end of the operational life of the dam, the ongoing management would be the responsibility of the landowner. It is expected that by this time the majority of the required management actions would have been undertaken and ongoing management tasks will largely coincide with routine agricultural activities. Land use restrictions will remain in place on the offset site so that any activities undertaken on the offset site must be compatible with the site's overall function: to improve biodiversity values.

For the duration of the project, the success of the management actions would be audited and reported as part of an annual environmental report for the project.

Table 4-1 Summary of management measures for the north-western offset area

Note, all management measures are the responsibility of State Water

Management measure	Objective	Justification	Action	Timing	Monitoring
Cat and/or fox control	To minimise the presence of cats and foxes within the offset site	Predation by cats and foxes can have serious impacts on the populations of native fauna, particularly threatened species	• Install preventative fencing suitable for the target species • Conduct baiting as part of existing pest management strategies (Namoi CMA, Central North LHPA)	• At establishment of the offset site • Ongoing as required	• Monthly inspections of fencing • Recording of cat and or fox numbers (indicated by deaths)
Exclusion of miscellaneous feral species Feral and /or native herbivore control/exclusion (eg. rabbits, goats, deer etc)	To minimise the presence of feral species and/or native herbivores	Feral species can compete for resources with native fauna Overgrazing by herbivores can prevent the successful ongoing establishment and persistence of native vegetation and lead to degradation	• Survey to determine the presence of target species • Install preventative fencing suitable for the target species	At establishment of the offset site	Monthly inspections of fencing
Restriction of public access including fencing and signage	To minimise adverse impacts resulting from interference by humans	Various activities such as rubbish dumping, recreational vehicle use (motorcycles and 4WDs) and camping (including collection of firewood) can lead to degradation of habitats. Humans are often a vector for weed ingress and spread.	• Install suitable preventative fencing • Install adequate signage • Conduct regular inspections • Take enforcement action where required	• At establishment of the offset site • Ongoing	Monthly inspections of fencing, signage and for evidence of human disturbance

Management measure	Objective	Justification	Action	Timing	Monitoring
Weed control	To minimise the occurrence of weeds within the offset site particularly Weeds of National Significance (WoNS) and listed noxious weeds	Weeds compete with native species and degrade habitats. The offset site has extensive infestations of noxious weeds including Blackberry, Sweet Briar, Hawthorn and Bathurst Burr	• Preparation of a weed management plan which would include: • Survey to identify target locations for weed control • Weed control using appropriate methodologies considering target species and landscape context	• At establishment of the offset site • Ongoing as required	• Annual survey to record progress and identify additional target locations • Adaptation of the weed management plan if required
Management of stock grazing for conservation purposes	To prevent overgrazing and encourage the regeneration of native vegetation	Proper stock grazing management can control weeds and assist in the recovery of previously heavily grazed areas	• Prepare a grazing management plan in consultation with a qualified local agronomist • Ensure any lease holders comply with the plan	• At establishment of the offset site • Ongoing	Annual inspection by a qualified agronomist and subsequent modification of the plan if required.

Management measure	Objective	Justification	Action	Timing	Monitoring
Assisted regeneration of cleared areas by either stock exclusion or strategic rehabilitation including plantings	To rehabilitate previously cleared areas (particularly those derived from EECs) to be representative of the original vegetation	Much of the cleared areas have resulted from clearing an EEC. Re-establishment of the overstorey in these areas will contribute to the conservation of this community and provide connectivity and habitats for threatened flora and fauna.	• Prepare a vegetation management plan which would include measures to: • Strategically exclude stock from areas that are naturally regenerating • Conduct rehabilitation plantings in more heavily grazed areas where regeneration has been suppressed • Integrate the grazing management plan	• At establishment of the offset site • Ongoing	• Annual inspections of naturally regenerating areas • Regular monitoring and adaptive management of planted areas as required by the vegetation management plan
Implementation of controlled burns	To re-introduce a more natural fire regime and assist in the recovery of degraded areas	Fire is an integral part of the Australian landscape. Many plant species depend on it for successful germination. Fire can also assist in maintaining the balance of species within an ecosystem	• Prepare a fire management plan in conjunction with an ecologist and the local RFS • Conduct burns as per the plan	• At establishment of the offset site • Ongoing	As required by the fire management plan

4.3 MANAGEMENT AND MONITORING PLAN BOOROOLONG FROG OFFSET

The management measures and monitoring proposed for the offset site have been recommended in consideration of the National Recovery Plan for the Booroolong Frog and recommendations in NWES (2009).

Management measure	Description	Objective	Justification	Action	Timing	Responsibility[6]
Riparian protection and restoration	**This will be achieved by implementing the six management measures detailed below.**	**Improve habitat condition, quality and availability along the Peel River**	**This constitutes one of the most important recovery actions for the conservation of the Booroolong Frog (Action 3.1, NSW OEH 2012)** **See Appendix 2 of the Recovery Plan**	**A Conservation Agreement will be negotiated with landholders and an Offset Site Management Plan (OSMP) prepared**	**Prior to construction and ongoing**	**State Water**
Eradication of weeds	A known threat to the species. Weeds, particularly large woody weeds such as willows, are known to create excessive shading and surface roots fill rock crevices required by the Booroolong Frog for oviposition. Control and eradicate exotic trees and shrubs, and other environmental weeds, which have the potential to dominate the riparian zone	Reduce shading Improve availability of breeding habitat	Identified as one of the management practices recommended in the Recovery Plan (pp.18, NSW OEH 2012). Recommended by Phil Spark (NWES 2009) and Namoi CMA.	Develop and implement a Booroolong Frog Management Plan[7] and a Vegetation Management Plan. This will include: • Control and eradication of weeds within the riparian zone, particularly willows • The annual report to be prepared as part of the OSMP will detail the weed management	Ongoing	State Water

[6] The preparation of all management plans is currently the responsibility of State Water, however those responsible for implementing those plans will be detailed in the Offset Site Management Plan.

[7] The proposed Booroolong Frog Management Plan will need to be adaptive in order to respond to the results of monitoring and management measures.

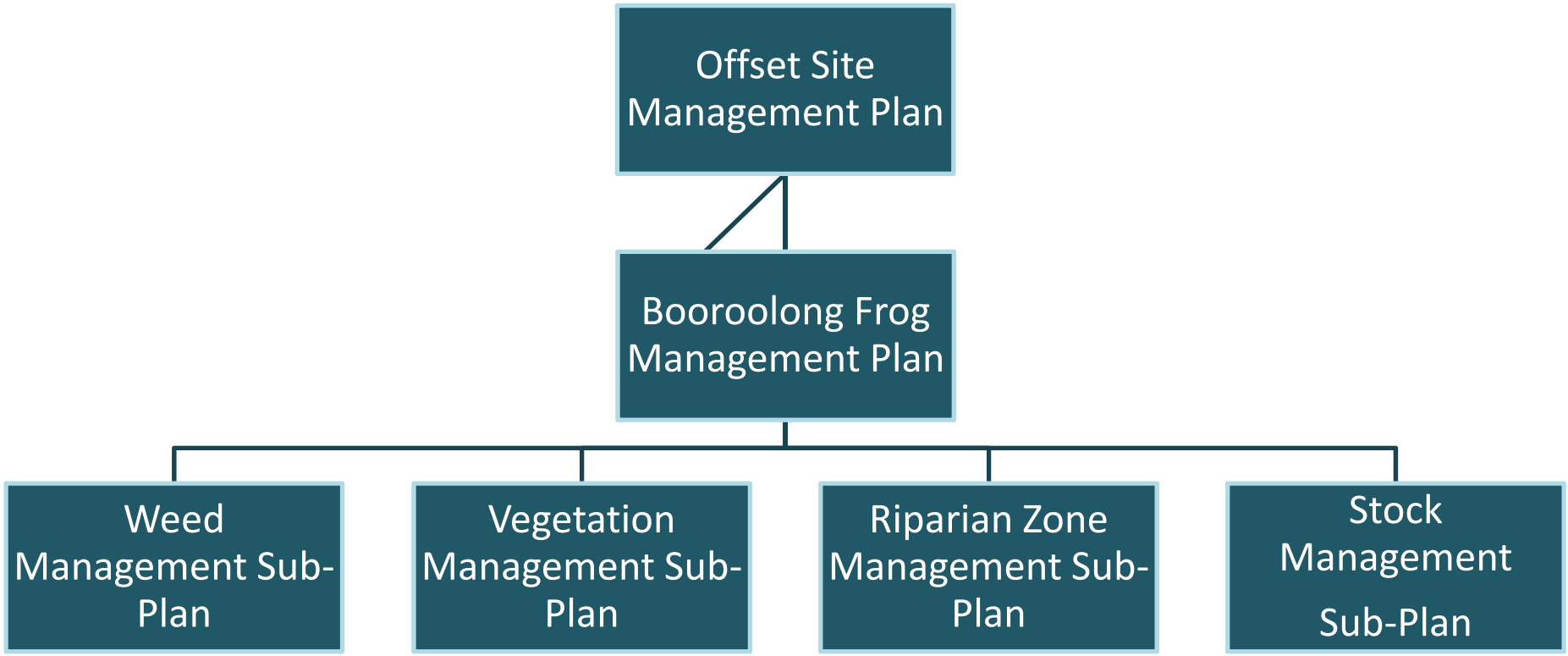
Management measure	Description	Objective	Justification	Action	Timing	Responsibility[6]
	(e.g. Willows, Blackberry)			actions undertaken, their location, and success.		
Stock exclusion	Disturbance by stock creates erosion and increased sediment loads. Increased sediment can change the rocky riffle zones by filling the crevices under rocks within the stream bed, eliminating the habitat that provides protection for the Booroolong Frog and their eggs (NWES 2009). Restrict stock access to the riparian zone.	Reduce erosion Reduce sedimentation	Identified as one of the management practices recommended in the Recovery Plan (pp.18, NSW OEH 2012). Recommended by Phil Spark (NWES 2009) and Namoi CMA.	• Stock Management Sub-plan. This will include: • Restricting stock access to the riparian zone according to the Conservation Agreements • The annual report to be prepared as part of the OSMP will detail the success and/or failure of stock exclusion and provide recommendations to improve on any issues, if relevant	Ongoing	Development of the Stock Management Sub-plan will be the responsibility of State Water
Native revegetation of the riparian zone	Rehabilitate and revegetate the riparian zone which is currently impacted by erosion.	Reduce erosion Reduce sedimentation Improve habitat availability for other threatened terrestrial species	Identified as one of the management practices recommended in the Recovery Plan (pp.18, NSW OEH 2012). Recommended by Phil Spark (NWES 2009) and David Coote (OEH).	Vegetation Management Plan. This includes: • Rehabilitation and revegetation within a 30m buffer of the river bank in consultation with Namoi CMA and species experts • Native species of local provenance will be used	Ongoing	State Water

Management measure	Description	Objective	Justification	Action	Timing	Responsibility[6]
				• Provide details of actions and success of efforts within the annual report prepared as part of the OSMP		
Prevention of fossicking	Dredging for precious metals increases stream erosion and sedimentation, damages and remove rock habitats, and may result in the increased proliferation of weeds. This may have a significant impact on this species (NSW OEH 2012). Signage is proposed.	Reduce erosion Reduce sedimentation Increase community awareness and involvement in the Booroolong Frog recovery program	The Recovery Plan identifies fossicking as representing a possible conflicting use in the Namoi Catchment (NSW OEH 2012). Identified as an issue by OEH and Namoi CMA.	Booroolong Frog Management Plan • Considering the social implications of preventing fossicking an adaptive approach in consultation with Namoi CMA will have to be undertaken. • Incorporate signage to discourage fossicking	Ongoing	State Water
Limit water extraction	During drought periods; maintaining stream flow and water pools for as long as possible will assist the Booroolong frogs to survive droughts.	Maintain habitat availability	Recommended by Phil Spark (pp.4, NWES 2009) Stream drying is a major threat identified in the Recovery Plan (pp.8, NSW OEH 2012)	Booroolong Frog Management Plan • Water extraction will be limited according to the CAs	Ongoing	State Water
Limit herbicide and pesticide use	The active ingredient in many formulations, glyphosate, and the surfactants, has been shown to be toxic to frogs and tadpoles. Limit chemicals used to those on an approved list, and limit application	Maintain and improve habitat condition and quality	Identified as a potential contributing factor for the decline of the Booroolong Frog in the Recovery Plan (pp.9, NSW OEH 2012). Recommended by Phil Spark (pp.5, NWES 2009) and Namoi CMA.	Booroolong Frog Management Plan • Provide a list of approved chemicals within the CAs, including recommended methodology • Provide a list of	Ongoing	State Water

Management measure	Description	Objective	Justification	Action	Timing	Responsibility[6]
	methods to approved and recommended techniques to minimise potential impacts			alternative methods within the CAs		
Predator control						
Prevent impacts from introduced predatory fish	Restricting stocking programs and preventing habitat alterations that may enhance the spread or density of introduced fish species (Action 3.5, NSW OEH 2012). Liaise with fishing clubs and State Fisheries. Exotic fish control has been attempted by Namoi CMA with dubious results (Anna Cronin, *pers. comm*.), therefore it has not been recommended as part of this Offset Plan.	Reduce predation threats to tadpoles and frogs Reduce in-stream sediment disturbance caused by exotic fish such as carp	Identified as a major threat in the Recovery Plan (pp.9, NSW OEH 2012). Identified as one of the management practices recommended in the Recovery Plan (pp.18, NSW OEH 2012). Recommended by Phil Spark (pp.53, NWES 2009).	Booroolong Frog Management Plan • Monitor predatory fish abundance and distribution during offset site monitoring and provide detail in annual report prepared as part of the OSMP • Prohibit stocking of predatory fish within the conditions of the CAs	Ongoing	State Water
Fox control	Foxes may be a threat to the Booroolong Frog (Clemann 2003). Fox baiting has broad benefits to livestock production and biodiversity protection and can be implemented with the assistance of the Livestock Health and Pest Authorities	Reduce predation threats to the Booroolong Frog and other fauna	Recommended by Phil Spark (pp.53, NWES 2009). Will benefit other biodiversity matters and is easy to implement.	Booroolong Frog Management Plan • Conduct fox baiting in coordination and with the assistance of LHPA and/or Namoi CMA • Provide details of the timing and effort of baiting efforts in the	Ongoing	State Water

Management measure	Description	Objective	Justification	Action	Timing	Responsibility[6]
	(LHPA)			annual report prepared as part of the OSMP		
Monitoring						
Identify population trends in relation to stream drying and riparian restoration	These factors to be considered during monitoring will relate to climate change, stream bank protection and weed management.	Identify the effectiveness of the proposed management measures Enable adaptive management if any problems arise Results will contribute to our understanding of the decline and recovery of the Booroolong Frog	Recommended in the Recovery Plan (Action 4.1, NSW OEH 2012). Recommended by Phil Spark (pp.53, NWES 2009).	Booroolong Frog Management Plan • Annual monitoring will be conducted during the peak activity period of the Booroolong Frog. • Monitor stream and riparian zone condition during monitoring activities • Monitoring will be audited through the preparation of annual reports	Monitoring is to be conducted annually between October and March	State Water
Adhere to strict quarantine protocols, such as those outlined in the 'Hygiene protocols for the control of disease in frogs' (NSW NPWS 2001)	The disease Chytridiomycosis is contributing to the historic and continued decline of the Booroolong Frog, and is present within the population along the Peel River.	Reduce the transmission of potentially harmful pathogens both within and among populations of the Booroolong Frog	Any projects involving the handling of frogs should incorporate protocols to minimise the potential spread of harmful pathogens among individual frogs	Booroolong Frog Management Plan • Monitoring of the Booroolong Frog will adhere to these hygiene protocols		Contractor

Management Plan Hierarchy in relation to the Booroolong Frog



5 CONCLUSION

This Offset Plan has been prepared to demonstrate that the Project impacts can be adequately compensated for by the protection and management of two proposed offset sites.

In offsetting the vegetation types to be cleared, the BBAM has been utilised and with consideration to the OEH SSI Interim Offsets Policy and Principles for Biodiversity Offsets in NSW, the proposed offset site is considered adequate. The proposed offset site is available and can be secured in perpetuity. Ecosystem credits for River Oak riparian woodland and species credits for the Booroolong Frog are required under the BBAM, however an additional offset site has been calculated for this community and species according to the EPBC OAG.

As documented in the Terrestrial and Aquatic Flora and Fauna Assessment, no significant impact to the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC will result from the Project. In accordance with the EPBC Act EOP, no offset is required for this community. However, the offset proposed under the NSW Principles for the use of offsets policy for the TSC listed White Box-Yellow Box-Blakely's Red Gum Woodland EEC incorporates a large area of the EPBC listed CEEC. As such, information is provided here to demonstrate the conservation outcomes for the CEEC through implementation and management of the proposed offset site according to the EPBC Act EOP.

The EPBC OAG has been utilised to propose an adequate offset site immediately upstream of the development site. Negotiations are underway to implement a CA with private landholders along a 9 km reach of the Peel River which is known Booroolong Frog habitat. These CAs will be legally binding agreements ensuring the site is secured in perpetuity. These CAs will assume management of lands currently managed by landholders under a 10 year Management Agreement (MA) with Namoi CMA. Thus the success of securing these CAs is evident. Management of the offset site will incorporate additional management measures to value-add to those conditions already in place under the current MAs. Monitoring of the offset site will ensure compliance with those management measures and allow for adaptive management. The offset package as a whole is considered to satisfy all State and Federal requirements.

Proposed measures for the security and management of the offset sites, to ensure that its biodiversity values are protected and maintained in perpetuity, have been provided.

6 REFERENCES

Austeco (1990). Chaffey Dam Enlargement Proposal: Impact on Terrestrial Fauna. Report prepared for Department of Water Resources, August 1990.

Clemann, N. (2003). *Flora & Fauna Guarantee Act* Action Statement for the Booroolong Frog *Litoria booroolongensis*. Department of Sustainability and Environment, East Melbourne.

DECC (2009) BioBanking Assessment Methodology and Credit Calculator Operational Manual. NSW *Department* of Environment and Climate Change, Sydney.

Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (2012). *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy.* Department of Sustainability, Environment, Water, Population and Communities, Canberra ACT.

GHD (2007). Chaffey Dam upgrade, further assessment of long-term options. Contract No 3571, State Water Corporation

GHD (2008a). Chaffey Dam Upgrade Ecological Assessment

GHD (2008b). Chaffey Dam Upgrade Preliminary environmental assessment (stage 1) summary report, State Water Corporation.

Grant (2007). *in* GHD (2008a) Chaffey Dam Upgrade Ecological Assessment. Proposed Augmentation of Chaffey Dam: Environmental Assessment: The Platypus. Report prepared by Dr T.R. Grant of Education and Environment Services Pty. Ltd. for GHD Services Pty Ltd and State Water

MHL (2005). Chaffey Dam Upgrade Environmental Investigations, Manly Hydraulics Laboratory and NSW Department of Commerce

Molino Stewart (2010). Chaffey Dam safety upgrade – Auxiliary spillway REF

Molino Stewart (2011). Chaffey Dam Augmentation, Preliminary Environmental Assessment

NWES (2009a). Flora and Fauna Impact Assessment for the proposed Chaffey Dam Safety Upgrade Options 1 & 2 – Addendum report to the GHD Ecological Assessment Report

NWES (2009b). Review of the conservation status of the Booroolong Frog (*Litoria booroolongensis)* within the Namoi River Catchment. Report prepared for the Namoi Catchment Management Authority.

nghenvironmental (2012). Terrestrial and aquatic flora and fauna impact assessment, Chaffey Dam Augmentation and Safety Upgrade. Report prepared for State Water.

NSW National Parks and Wildlife Service (2001b). Threatened Species Management Information Circular No. 6. *Hygiene Protocol for the Control of Disease in Frogs*. NPWS, Hurstville, NSW.

NSW Office of Environment and Heritage (NSW OEH) (2011). *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects.*

NSW Office of Environment and Heritage (NSW OEH) (2012). *National Recovery Plan for Booroolong Frog* (*Litoria booroolongensis*) Office of Environment and Heritage (NSW), Hurstville.

APPENDIX A BIOBANKING ASSESSMENT METHODOLOGY CREDIT STATEMENTS

A.1 DEVELOPMENT SITE

BioBanking Credit Calculator

NSW GOVERNMENT | Office of Environment & Heritage

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 27/02/2013 Time: 8:40:29PM Tool version: 2.0

Development details

Proposal ID:	0035/2013/0467D
Proposal name:	Chaffey Dam Augmentation
Proposal address:	Chaffey Dam Nundle NSW 2340
Proponent name:	State Water Corporation
Proponent address:	PO Box 1018 Dubbo NSW 2830
Proponent phone:	1300662077
Assessor name:	Brooke Marshall
Assessor address:	PO Box 470 Bega NSW 2550
Assessor phone:	6492 8333
Assessor accreditation:	0035

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	89.58	4,617	Yes
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	3.11	218	No
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	62.77	3,511	Yes
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	0.54	36	No
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	5.71	323	No
Total	161.71	8,705	

Credit profiles

1. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196)

Number of ecosystem credits required	218
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Blakely's Red Gum - Rough-Barked Apple flats woodland of the NSW western slopes (Benson 281), (CW111) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box - Apple Box valley herbaceous woodland mainly of the NSW western slopes (Benson 275), (CW207) White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282), (CW209) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) Cabbage Gum open forest or woodland on flats of the North Coast and New England Tablelands, (HU526) Blakely's Red Gum - Yellow Box grassy open forest or woodland of the	Peel - Namoi Wollemi (Part A) Yengo - Hunter/Central Rivers Wyong Armidale Plateau Stanthorpe Plateau

New England Tablelands, (NA113) Black Sallee grassy woodland of the New England Tablelands, (NR113) Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tablelands, (NR127) Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the New England Tablelands, (NR131) Candlebark - Manna Gum woodland of the New England Tablelands, (NR146) Fuzzy Box open forest of the New England Tableland Bioregion (Benson 203), (NR165) Manna Gum - Rough-barked Apple - Yellow Box grassy woodland/open forest of the New England Tablelands and North Coast, (NR186) New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tablelands, (NR214) Snow Gum - Black Sallee grassy woodland of the New England Tablelands, (NR237) Snow Gum - Mountain Gum - Mountain Ribbon Gum grassy open forest of the New England Tablelands, (NR238) Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest of the eastern New England Tablelands and North Coast, (NR239) Snow Gum woodland of the New England Tablelands and North Coast, (NR240) Yellow Box - Broad-leaved Stringybark shrubby open forest of the New England Tablelands, (NR282) Yellow Box - Grey Box - Red Gum woodland of the central eastern parts of the New England Tablelands, (NR283)	

2. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196)

Number of ecosystem credits required	36
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	**Offset options - CMA sub-regions**
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Cabbage Gum open forest or woodland on flats of the North Coast and New England Tablelands, (HU526) Blakely's Red Gum - Yellow Box grassy open forest or woodland of the New England Tablelands, (NA113) Black Sallee grassy woodland of the New England Tablelands, (NR113) Blakely's Red Gum - Yellow Box grassy open forest or woodland of the	Peel - Namoi Yengo - Hunter/Central Rivers Wyong Armidale Plateau Stanthorpe Plateau

New England Tablelands, (NR127) Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the New England Tablelands, (NR131) Candlebark - Manna Gum woodland of the New England Tablelands, (NR146) Fuzzy Box open forest of the New England Tableland Bioregion (Benson 203), (NR165) Manna Gum - Rough-barked Apple - Yellow Box grassy woodland/open forest of the New England Tablelands and North Coast, (NR186) New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tablelands, (NR214) Snow Gum - Black Sallee grassy woodland of the New England Tablelands, (NR237) Snow Gum - Mountain Gum - Mountain Ribbon Gum grassy open forest of the New England Tablelands, (NR238) Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest of the eastern New England Tablelands and North Coast, (NR239) Snow Gum woodland of the New England Tablelands and North Coast, (NR240) Yellow Box - Broad-leaved Stringybark shrubby open forest of the New England Tablelands, (NR282) Yellow Box - Grey Box - Red Gum woodland of the central eastern parts of the New England Tablelands, (NR283)	

3. Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237)

Number of ecosystem credits required	4,617
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	**Offset options - CMA sub-regions**
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282), (CW209) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tablelands, (NA144) White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (NA226) White Cypress Pine - Silver-leaved Ironbark grassy woodland of the Nandewar Bioregion, (NA230)	Peel - Namoi Tingha Plateau Kerrabee - Hunter/Central Rivers

4. Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237)

Number of ecosystem credits required	3,511
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box - Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 282), (CW209) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tablelands, (NA144) White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (NA226) White Cypress Pine - Silver-leaved Ironbark grassy woodland of the Nandewar Bioregion, (NA230)	Peel - Namoi Tingha Plateau Kerrabee - Hunter/Central Rivers

5. River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84), (NA191)

Number of ecosystem credits required	323
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84), (NA191) River Red Gum riverine woodlands and forests in the Nandewar and Brigalow Belt South Bioregions (Benson 78), (NA193)	Peel - Namoi Tingha Plateau Kerrabee - Hunter/Central Rivers Pilliga - Central West

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Booroolong Frog	Litoria booroolongensis	2.32	58

A.2 OFFSET SITE

BioBanking Credit Calculator

NSW GOVERNMENT Office of Environment & Heritage

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE.

Date of report: 27/02/2013 Time: 9:23:31PM Tool version: 2.0

Biobank details

Proposal ID:	0035/2013/0507B
Proposal name:	Chaffey Dam Offsets
Proposal address:	Chaffey Dam Nundle NSW 2340
Proponent name:	State Water Corporation
Proponent address:	PO Box 1018 Dubbo NSW 2830
Proponent phone:	1300662077
Assessor name:	Brooke Marshall
Assessor address:	PO Box 470 Bega NSW 2550
Assessor phone:	6492 8333
Assessor accreditation:	0035

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	80.56	953	No
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	48.98	594	No
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	91.29	874	No
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	6.98	60	No
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	53.30	554	No
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	557.31	6,436	No
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	142.75	1,465	No
Total	981.17	10,936	

Credit profiles

1. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196)

Number of ecosystem credits required	874
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

2. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands, (NA196)

Number of ecosystem credits required	6,436
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

3. White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (NA226)

Number of ecosystem credits required	554
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

4. White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (NA226)

Number of ecosystem credits required	1,465
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

5. Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237)

Number of ecosystem credits required	953
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

6. Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion, (NA237)

Number of ecosystem credits required	594
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

7. River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84), (NA191)

Number of ecosystem credits required	60
CMA sub-region	Peel - Namoi
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	>100 ha

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Border Thick-tailed Gecko	Underwoodisaurus sphyrurus	2.00	12

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Cat and/or Fox control
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Exclude miscellaneous feral species
River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84)	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Cat and/or Fox control
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Exclude miscellaneous feral species
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of south western New England Tablelands	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Cat and/or Fox control
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Exclude miscellaneous feral species
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Cat and/or Fox control
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Exclude miscellaneous feral species
Yellow Box - Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)

APPENDIX B EPBC OFFSETS ASSESSMENT GUIDE OUTPUTS

B.1 BOOROOLONG FROG

Threatened species habitat						
Area of habitat	Yes	The new FSL will inundate Booroolong Frog habitat along the Peel River	**Area**	2.32	Hectares	Booroolong Frog mapping and surveys (nghenvironmental 2012 & Phil Sparks 2013 survey)
			Quality	**8**	Scale 0-10	
			Total quantum of impact	1.86	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					

Threatened species hab										
Area of habitat	Yes	1.86	Adjusted hectares	Protect and manage habitat upstream of new FSL	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	13.1	**Risk of loss (%) without offset**	30%
									Future area without offset (adjusted hectares)	9.2
					Time until ecological benefit	1	**Start quality (scale of 0-10)**	8	**Future quality without offset (scale of 0-**	7

Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**	**Start value**	**Future value without offset**
Number of features e.g. Nest hollows, habitat trees	No						
Condition of habitat Change in habitat condition, but no change in extent	No						

itat										
Risk of loss (%) with offset	5%									
Future area with offset (adjusted hectares)	12.4	3.28	80%	2.62	2.06	1.86	100.08%	Yes		
Future quality with offset (scale of 0-10)	9	2.00		0.00	0.00					
Future value with offset		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**		**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**

APPENDIX C BOOROOLONG FROG OFFSET LAND TENURE

C.1 MANAGEMENT AGREEMENTS CURRENTLY CONTRACTED BY NAMOI CMA

The shaded areas indicate those areas contracted to landholders under a Management Agreement with Namoi CMA. Different colours represent different landholders.

C.2 LANDHOLDER MANAGEMENT AGREEMENT WITH NAMOI CMA

MANAGEMENT AGREEMENT

The Fund's Recipient agrees to carry out the terms of the Management Agreement hereunder and acknowledges that the term of the Management Agreement is ten (10) years from the date the CMA issues the Certified Completion of Works Report.

Management Conditions

1. The project area refers to the location of agreed activities described by this funding agreement as identified in *Schedule Four –Plan of Works*.
2. Cultural sites must be protected from damage at all times.
3. Clearing of native vegetation must be undertaken in accordance with the Native Vegetation Act 2003
4. All fencing is to be maintained in a stock proof condition for the life of this Agreement.
5. To protect wildlife, any fencing erected in the project area will not have a top strand or a bottom strand consisting of barbed wire.
6. Electric fence wires will not be placed closer than 30cm to the ground.
7. Surface water extraction will be limited during periods of drought and low flows to maintain water pools in the project area.
8. Surface water extraction or stock watering laneways will be located at pools, as far as practicable from Booroolong Frog habitat of riffles and small rapids.
9. Livestock access to the project area will not exceed 14 days per annum. Livestock will be excluded from the project area for the period 1st October to 28th February inclusive.
10. The Funding Recipient is not to remove any standing or fallen dead timber from the project area except to allow for the construction or maintenance of tracks and fences where clearing is to the minimum extent necessary and any necessary approvals have been granted.
11. Fertiliser will not be applied within the project area.
12. Gravel extraction will not occur within the project area.
13. Machinery access will be restricted to designated tracks.
14. No active burning will occur within the project area without agreement from Namoi Catchment Management Authority.

15. No exotic fish releases are permitted within the project area.

16. Landholder will not move or remove rocks from the project area.

17. Landholder will avoid handling frogs in a manner which may spread Chytrid fungus. Namoi CMA can provide a copy of the NPWS 'Hygiene Protocol for the control of Disease in Frogs' upon request.

18. All signage (if provided by Namoi CMA) will be maintained and any damage will be reported to Namoi CMA.

19. All Media releases regarding the project must carry the Namoi CMA logo and be approved by Namoi CMA prior to release.

Pest and Weed control

20. The Funding Recipient is to control all infestations of pests and weeds within the project area.

21. Control activities must be in accordance with relevant legislation governing the use of pesticides and herbicides.

22. The Funding Recipient is to restrict any disturbance of native vegetation required to conduct the weed treatment to the minimum extent necessary.

23. The Funding Recipient may only use chemicals registered under the Pesticides Act 1999 for use around waterways for weed control in the project area.

24. The Funding Recipient or subcontractor must keep records in line with the Pesticides Act 1999 and a copy must be provided to the Namoi CMA upon request.

25. Use of chemicals within the stream channel (streambank toe to streambank toe) will not occur from dates 1st October to 28th February inclusive.