Chaffey Dam Augmentation and Safety Upgrade Project

Booroolong Frog Offset Plan

Prepared for
State Water

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Abbreviations

Abbreviation	Description
AHD	Australian Height Datum
BBAM	BioBanking Assessment Methodology
CMA	Catchment Management Authority
DoE	Department of Environment (Commonwealth), formerly SEWPaC
DP&I	Department of Planning and Infrastructure (NSW)
EEC	Endangered ecological community
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EIS	Environmental impact statement
FSL	Full Supply Level
GL	Gigalitre
MA	Management Area
NES	Matters of National environmental significance under the EPBC Act
NPW Act	*National Parks And Wildlife Act 1974* (NSW)
NSW	New South Wales
NV Act	*Native Vegetation Act 2003* (NSW)
OEH	Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water (DECCW) (NSW)
PVP	Property Vegetation Plan (under the NV Act)
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth)
SSI	State significant infrastructure
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

Executive Summary

The report provides an offset plan for the Booroolong Frog (*Litoria booroolongensis*) due to impacts resulting from a proposed safety upgrade and augmentation to the capacity of Chaffey Dam from 62 gigalitres (GL) to 100 GL at full supply level (FSL) by State Water. Although the project will impact on other ecological values, ecological offsets required for vegetation communities and other threatened species are addressed in other documentation. This report, therefore, only examines the impact and offset required for the Booroolong Frog.

The area and quality of Booroolong Frog habitat was surveyed along the entire length of both the impact and offset site, using a survey methodology prepared in consultation with and accepted by the Commonwealth Department of Environment (DoE), NSW Office of Environment and Heritage (OEH), and NSW Department of Planning and Infrastructure (DP&I). The survey was undertaken over one week, commencing Monday 14th October 2013, and conditions were consistent during this survey period. Reaches of habitat types were mapped along the entire length of both the impact and offset sites, and the length and width of suitable Booroolong Frog habitat recorded.

The project will impact on 4.09 ha of habitat for the Booroolong Frog (as measured in this study from detailed survey of the entire impact site). It is proposed to secure and manage an offset site on the Peel River south of Nundle, with a total area of 74.49 ha, including of 13.22 ha of identified Booroolong Frog habitat.

State Water and Namoi Catchment Management Authority (Namoi CMA) have commenced consultation with the 16 landholders (comprising private entities and Crown land) within the proposed offset site. In principle letters of agreement will be obtained from the landholders prior to determination of the project. It is proposed that the offset site will be managed in perpetuity by way of Property Vegetation Plans (PVPs) prepared under the *Native Vegetation Act 2003*, as agreed with the Namoi CMA. State Water will enter into an agreement with the Namoi CMA for the establishment of the PVPs. PVPs will then be established between the Namoi CMA and each landholder within the offset site. State Water will supply funding to the Namoi CMA to establish the PVP, and to fund the actions to be carried out by the landholders.

The survey identified that the vegetation and condition of Booroolong Frog habitat at the impact site was considered to be in better condition than the offset site, as it had less stock access, vegetation in better condition, and less erosion than the offset site. However, the number of Booroolong Frogs observed during a survey conducted for the Namoi CMA in early 2013, showed that an average of 24.1 individuals per kilometre of river were detected from the impact site, whilst 92.3 individuals per kilometre of river were detected from the offset site.

Offset calculations were conducted under both the Commonwealth and NSW assessment policies.

With regards to the Commonwealth 'Offset Assessment Guide' the overall outcome is that the impact site requires a 'net present value' of 2.45, and the offset site generates a net present value of 2.92, which is 118.93% of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Environmental Offsets Policy requirement.

The BioBanking credit calculations identified that 55 credits are required due to the impact of the project, and the offset site generates 79 credits. The Booroolong Frog is not a red-flagged species, and therefore based on these calculations the proposal will meet a "Tier 1" outcome as identified under the Interim Offset Policy for Major Projects (OEH 2011).

The proposed offset satisfies the relevant Commonwealth and NSW policies, and will lead to a long term conservation outcome for the Booroolong Frog.

1 Introduction

The Chaffey Dam Augmentation and Safety Upgrade Project (the project) proposes to increase the capacity of Chaffey Dam from 62 gigalitres (GL) to 100 GL at full supply level (FSL). This will increase the current FSL by 6.5 m, from 518.6 m Australian Height Datum (AHD) to 525.1 m AHD.

The project has been identified as having a significant impact on a population of the Booroolong Frog (*Litoria booroolongensis*, ngh environmental 2013). This species is listed as Endangered under both the NSW *Threatened Species Conservation Act 1995* (TSC Act) the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The project will have impacts upon the Booroolong Frog which cannot be avoided or mitigated, and therefore ecological offsets are proposed.

Previously, the proponent State Water, proposed to supply funding to the Namoi Catchment Management Authority (CMA) for management actions along a 9 km offset site (NGH, 2013). A number of comments were received from the then Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now Department of Environment, DoE), and the NSW Office of Environment and Heritage (OEH) with regards to the proposed offset. Many of these comments related to the fact that the Booroolong Frog offset site previously proposed is currently managed by landholders under a 10 year Management Agreement (MA) with Namoi CMA. The rationale for proposing those lands was that the MAs are due to expire in five years (2018), can be terminated with one month notice, and are not attached in any way to the title of the land. Nevertheless, because these lands are already subject to management for the Booroolong Frog and in perpetuity agreements could not be secured with all required landholders, an alternative offset site has been located (**Figure 1**).

To facilitate consideration of the new site proposed as a Booroolong Frog offset site, additional habitat survey works have been undertaken for both the impact and offset sites, and this report presents these results, together with new offset assessment calculations. Thus, this report includes:

- Details of the impact and offset sites (**section 1.1**)
- A brief summary of key Booroolong Frog habitat requirements (**section 1.2**)
- A description of the survey methodology (**section 2.1**) and results of Booroolong Frog habitat survey at the impact and offset assessment sites (**section 3.1**)
- Identification of key threats to Booroolong Frog habitat (**section 3.3**)
- Results of the riparian vegetation survey (**sections 2.3 and 3.2**)
- Management of the Booroolong Frog offset site (**section 4**)
- Commonwealth 'Offset Assessment Guide' calculations (**section 5**)
- NSW BioBanking offset calculations (**section 6**)
- Review of Proposed Offset against Relevant Offset Policies (**section 7**)

This report includes some figures which contain sensitive information such as the locations at which Booroolong Frogs have been observed and habitat mapping. These figures have been placed in **Appendix A** and supplied to relevant Commonwealth and NSW Government agencies for their consideration, but have been removed from the public exhibition version.

1.1 Study Sites

The study sites consisted of both the impact site and the offset site, and their locations are shown in **Figure 1**. Both the impact and offset sites are located along the Peel River, with the offset site approximately 7 km to the south of the impact site (**Figure 1**).

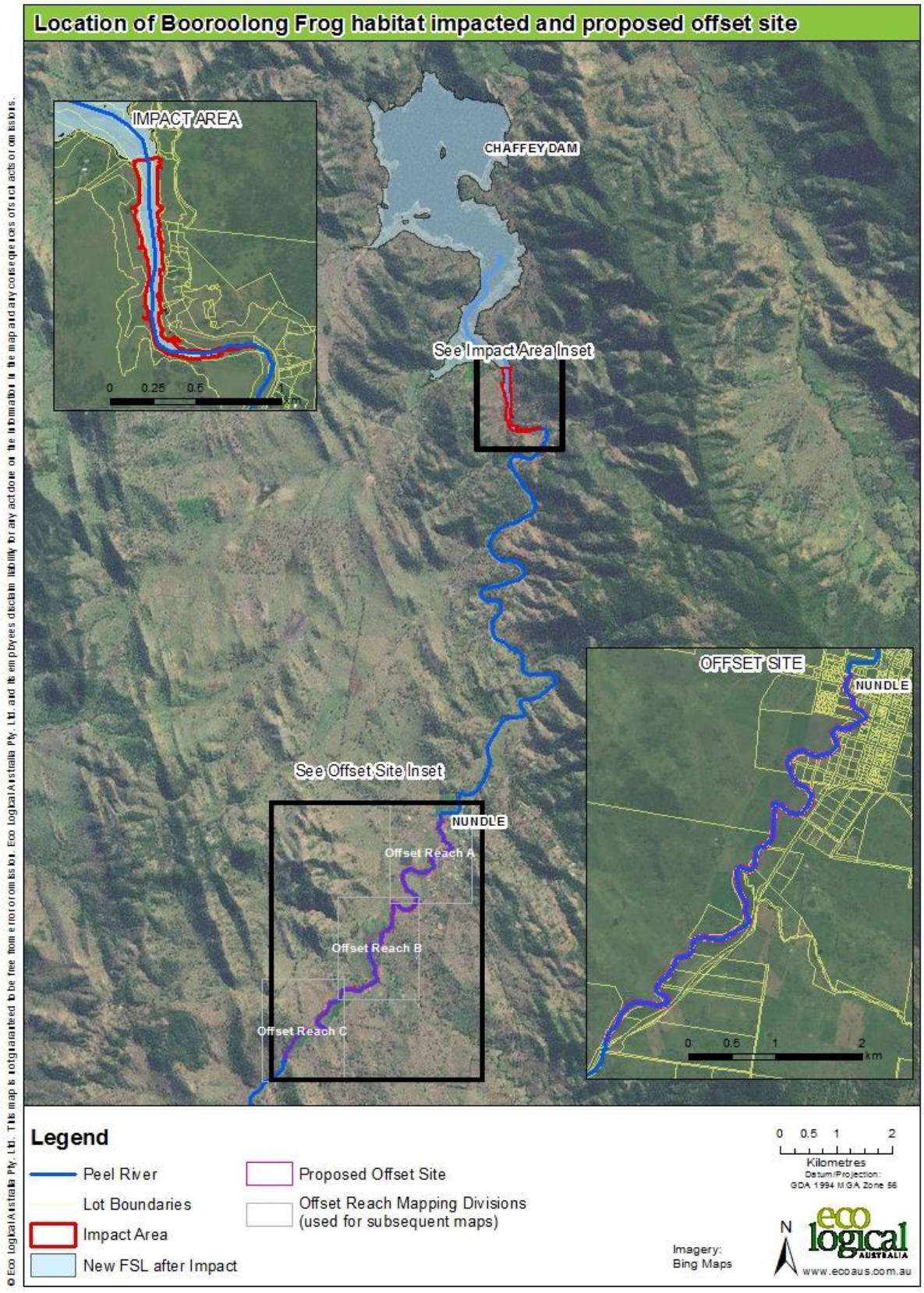


Figure 1: Location of Booroolong Frog habitat impact and proposed offset site.

The impact site consists of a 1,615 m stretch of the Peel River from the current FSL to the new FSL (as per ngh environmental 2013, see **Figure 1**).

The offset site is located upstream of the impact site, and consists of a 7.4 km section of the Peel River, comprised of the river bed and banks plus a 30 m riparian buffer from the top of bank on both sides (section **2.1**). Land on both sides of the river will be managed for conservation (refer to **section 4** for management actions), as well as the river bed itself, which is Crown land. This area consists of 47 separate land parcels, owned by 22 different entities, including Crown land which is not identified by a lot and DP (refer to **Table 12, Table 13** and **Figure 6 - Figure 8** in **Appendix A** – this information is considered to be sensitive and therefore has been provided only to agencies for their review). Within the identified riparian buffer, a total of six entities have landholdings less than 0.1 ha in size. These lands, which in total comprise 0.33 ha of land, are not proposed to be part of the offset site due to their small size. The remaining 16 landholder entities hold an estimated 74.49 ha of land within the 30 m riparian buffer, and it is these lands that are proposed as the offset site. Of this area, 13.22 ha have been identified as existing Booroolong Frog habitat.

State Water and Namoi CMA have commenced consultation with the landholder entities within the proposed offset site, and in principle letters of agreement will be obtained prior to determination of the project.

The township of Nundle is located to the north of the offset site.

1.2 Booroolong Frog Habitat Requirements

Booroolong Frog habitat requirements are summarised in **Table 1**. The species occupies rocky permanent stream habitats; likely has a high site fidelity (i.e. usually moving less than 50 m; Hunter 2001), and has a relatively short lifespan (Hunter 2001). It prefers a habitat with a mix of features including: bedrock near water for basking, extensive shallow and slow-flowing reaches with large emergent rocks (such as boulders, bedrock and cobble), littoral and riparian vegetation for refuge and foraging, and shallow pools and riffles with cobble for breeding and tadpole habitat (Anstis 2002, NWES 2009b, OEH 2012).

Table 1: Summary of Booroolong Frog habitat requirements (compiled from Anstis 2002, NWES 2009b, OEH 2012)

Foraging	• Stream banks or vegetation and fallen timber within 100 m of the waterway
Refuge	• During the day frogs shelter under rocks, or under littoral vegetation • If disturbed frogs will dive into water, or under rocks
Breeding	• Breeding habitat is permanent rocky streams with fringing groundcover or understorey vegetation • Males call from exposed rocks or rock crevices near shallow pools or runs • Egg deposition occurs in shallow, slow-flowing sections of stream or isolated rock pools along the stream margins
Tadpoles	• Tadpoles occupy slow-flowing sections of the stream or in isolated adjacent pools • The tadpoles are benthic, occurring on rocks and detritus in the streambed
General	• Primary habitat requirement is extensive rock bank structures along permanent rivers • Key features are rock crevices in relatively shallow, slow to medium flowing sections of stream. Most adults occur near slow-flowing connected or isolated pools with cobble or

	bedrock substrates • Bask in sun on exposed rock near flowing water. Bedrock areas exclude vegetation, so remain sunny, providing basking habitat • Fringing vegetation cover such as ferns, sedges or grasses provide refuge and foraging habitat • Species appears robust to a range of water quality parameters, and grazing • Booroolong Frogs rarely occur at large pools. Sand and gravel bars are also avoided as they lack refuge and oviposition sites

These attributes mean Booroolong Frog populations are considered highly susceptible to changes in the frequency, duration and volume of stream flows (too dry and there isn't sufficient water for the species to persist, and too wet inundates critical basking, and refuge sites, and enables predation by fish), and other habitat modification (e.g. bank erosion resulting from riparian vegetation removal contributes to higher sedimentation rates which smothers oviposition sites). Their requirement for basking habitat means they tolerate riparian grazing and tree clearing, but still require some littoral vegetation and fallen timber for refuge and foraging opportunities (NWES 2009b).

2 Methods

2.1 Offset Site Identification

The top banks of the Peel River were estimated from interpretation of aerial imagery. A 30 m buffer was then applied to both sides of the river, and this was overlaid with cadastre data. This was used to identify the area of land within the 30 m riparian buffer within the various lots (**Table 12**), and the area owned by these entities within the riparian buffer is summarised in **Table 13**. This information is considered to be sensitive, and is supplied in **Appendix A** for agency review.

The cadastre data utilised consisted of two GIS shapefile datasets supplied to WorleyParsons by Tamworth Regional Council. The first data dataset (date of supply to WorleyParsons 13 February 2013), covered approximately the northern 1.5 km of the offset site, and the second dataset (date of supply to WorleyParsons 16 July 2013), covered the offset site, except for approximately the northern 300 m. The two datasets were compiled together into one GIS shapefile and used to identify land details, ownership, and area within the river and the 30 m riparian buffer.

2.2 Booroolong Frog Habitat Assessment

A survey proforma was developed for Booroolong Frog habitat survey. Initially a survey methodology was presented to Department of Planning and Infrastructure (DP&I), DoE, and OEH at a meeting on 24th September 2013. Subsequent to the meeting a draft survey methodology was submitted to these agencies for review on 1st October 2013.

Written email comments from DoE and OEH on the proposed survey methodology were received on 4th October 2013. The agencies requested that data be collected along the entire length of the river at the impact and offset sites, including average length and width of each occurrence of a habitat type, and maximum water depth and substrate for pools, the number of crevices (to a maximum of 10 per habitat type), riparian vegetation extent, cover and percentage of exotic cover, and information on threats to Booroolong Frog habitat.

Based on comments from the agencies the survey methodology was subsequently amended to cover the entire length of both the impact and offset sites. The Booroolong Frog habitat survey proforma was again submitted to the agencies on 9th October 2013, and a copy is supplied in **Appendix B**. The agencies identified that the proforma and information to be collected would be adequate to inform a robust assessment of the proposed Booroolong Frog offset, as documented in an email received on 11th October 2013.

Data collected included the length and width of each habitat type, substrate, and the presence of weeds and other disturbances (e.g. bank erosion, livestock grazing). Crevices were assessed according to Appendix 3 of the National Recovery Plan for the Booroolong Frog (OEH 2012), which defines these as:

> *"…a space under or between rocks where a 2.5 cm wide, 1 cm high and 3 cm long piece of metal could be freely inserted, but which was no higher than 3 cm…Regardless of crevice length, continuous crevices in bedrock or under individual rocks are only counted as one crevice."*

The presence and number of crevices were assessed using a "wedge" for each section of habitat type.

Survey of Booroolong Frog habitat was performed by Eco Logical Australia (ELA) ecologists Dr Julie-Anne Harty and Katrina Cousins during one week, commencing Monday 14th October 2013. No rain occurred during the week, and thus water levels and associated habitat conditions did not change significantly over the survey period. The entire length of the impact and offset sites was surveyed.

The area of habitat for each reach was calculated by multiplying the length by the average habitat width (measured using a rangefinder). These areas were summed to produce the total area of habitat.

A previous survey conducted by North West Ecological Services (NWES 2013) for the Namoi CMA involved nocturnal and diurnal surveys for Booroolong Frogs at a study area which overlapped both the impact and offset sites in this study. North West Ecological Services present both abundance data and habitat type in their report. Given the availability of this data, no survey of frog abundance was undertaken. Instead the North West Ecological Services data is used to inform the species stocking rate attribute in this study.

2.3 Vegetation Survey

Riparian vegetation was assessed over a three day period (16 – 18 October 2013) by ecologist Matt Dowle. A rapid vegetation assessment method (qualitative assessment) was undertaken within a 30 m corridor either side of the river, within the impact site and offset site to record the vegetation type and condition present. The surveys included observations of the disturbances present, dominant weed species, erosion potential and grazing impacts. The relative condition was then mapped using a 5-point scale (poor, poor-medium, medium, medium-high, high).

Vegetation type nomenclature referred to in this plan is as defined within the Biometric Vegetation Types Database and utilised within the BioBanking Assessment Methodology (BBAM).

3 Results

3.1 Booroolong Frog Habitat Assessment

Approximately 7.45 km of the Peel River was assessed at the offset site, and 1.86 km downstream at the impact site (it is noted that some additional areas were assessed in the field for both the impact and offset sites and then subsequently removed from calculations when the GIS identified the correct boundaries).

The area of Booroolong Frog habitat was calculated as being 4.09 ha at the impact site and 13.22 ha at the offset site.

The impact and offset sites were similar in that they both occur on the Peel River, above Chaffey Dam, and thus experience largely unregulated flows (there is a small impoundment at Nundle). At the time of the survey the Peel River was in low flow condition, with flows often limited to a narrow area in the channel, particularly at the offset site. However, long, shallow and occasionally wide pools and riffles also occurred at both sites. Anecdotal evidence suggests the Peel River above Chaffey Dam rarely ceases to flow (pers. comm. Phil Dempsey October 2013).

Both sites were characterised by pool-riffle sequences, with in-channel bars, and benches. The offset site also had several large meanders. In terms of structural habitat availability for the Booroolong Frog, both sites had similar proportions of pools with gravel banks, and riffles with small rocks (**Figure 2**). Key differences were between the availability of riffles with large rocks (more at the offset site), rapids with large rocks (more at the impact site), and shallows with large rocks (much more at the impact site) (**Figure 2**).

The presence of bedrock and/or cobble adjacent to the stream is an important determinant of habitat suitability for the Booroolong Frog. Approximately 65 % of the impact site is comprised of bedrock, boulders or cobble, compared to 40 % at the impact site (**Figure 3**). The offset site also had a greater proportion of pools with dirt banks, than the impact site.

The locations of the mapped Booroolong Frog habitat types along the Peel River are shown in **Figure 9** for the impact site, and **Figure 10 - Figure 12** for the offset site.

Comparison of basic stream structural characters between the two sites revealed mean within-channel available habitat width at the impact site was 26.45 m (± 1.75 m SE), versus 18.32 m (± 0.47 SE) at the offset site (**Table 2**). Stream width (i.e. the wetted portion of the channel) was similar at the two sites (mean 7.86 m ± 0.65 SE at the impact site; mean 7.38 m ± 0.23 SE at the offset site) under current flow conditions, as was the crevice count (mean 6.07 ± 0.64 SE at the impact site; mean 5.19 ± 0.33 SE at the offset site).

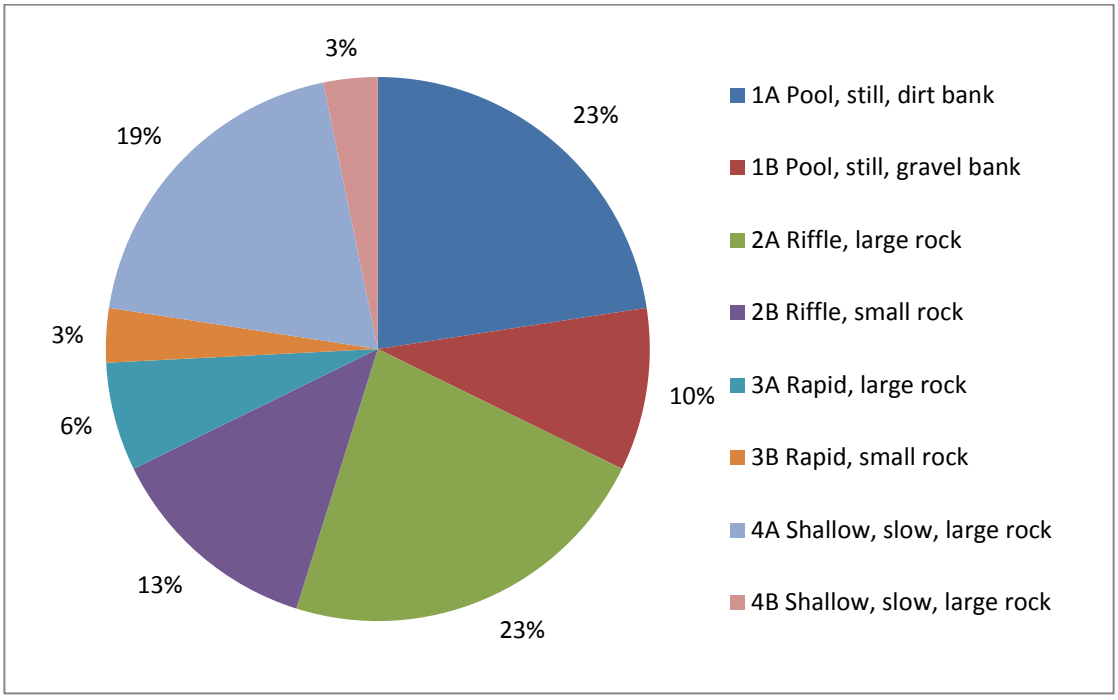
The offset site consists of both privately owned properties managed for primary production, as well as Crown land for the Peel River itself (which is currently used for stock watering and grazing). The impact site is a travelling stock route, and thus comprises primarily Crown land managed by the NSW Livestock Health and Pest Authority. This difference in land tenure and land use drives key differences in the littoral and riparian vegetation structure and condition, and bank condition of the sites.

Riparian vegetation at the offset site is comprised of isolated patches of remnant native overstorey species and exotics, and individual trees. Understorey and littoral vegetation is largely lacking, except for isolated patches of Blackberry (*Rubus fruiticosus*) and grazed pasture (**Plate 1** and **Plate 2**). This

lack of vegetation combined with mostly unmitigated cattle access to the stream is contributing to bank degradation and erosion, and instream sediment and nutrient loads.

Although riparian vegetation at the impact site is a similar mix of remnant native and exotic species, and is also largely limited to a thin strip adjacent to the stream, there is greater littoral and understorey vegetation density and diversity, because the grazing pressure is significantly reduced compared to the offset site (**Plate 3** and **Plate 4**). The banks are also generally in better condition.

a)



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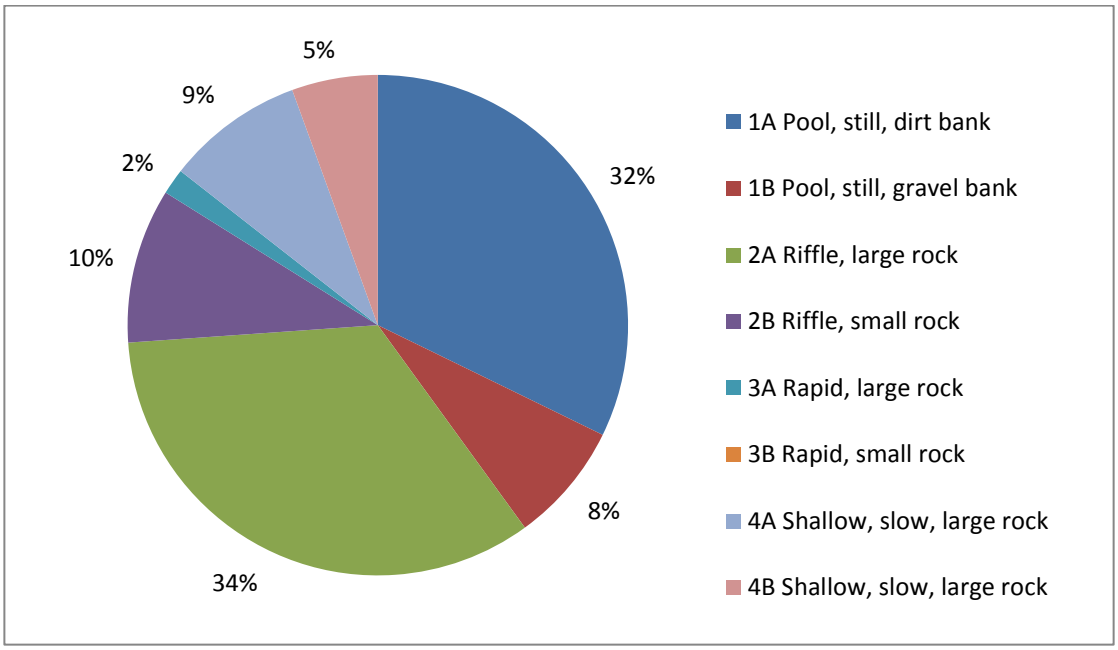
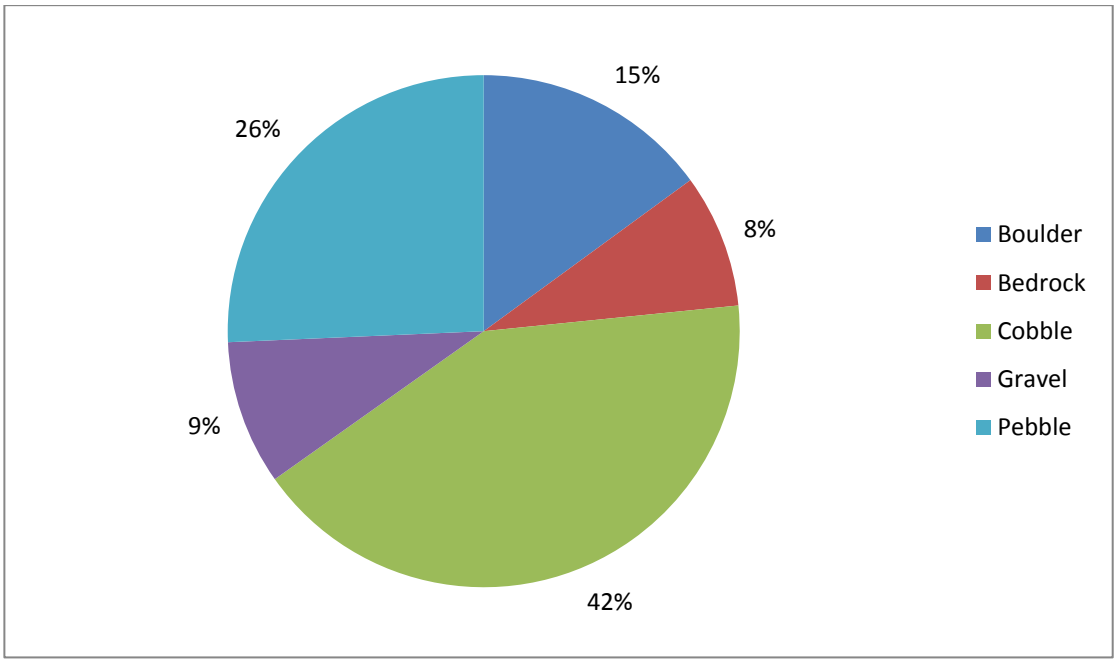


Figure 2: Proportion of habitat types for Booroolong Frog at a) the impact site and b) the offset site.

a)



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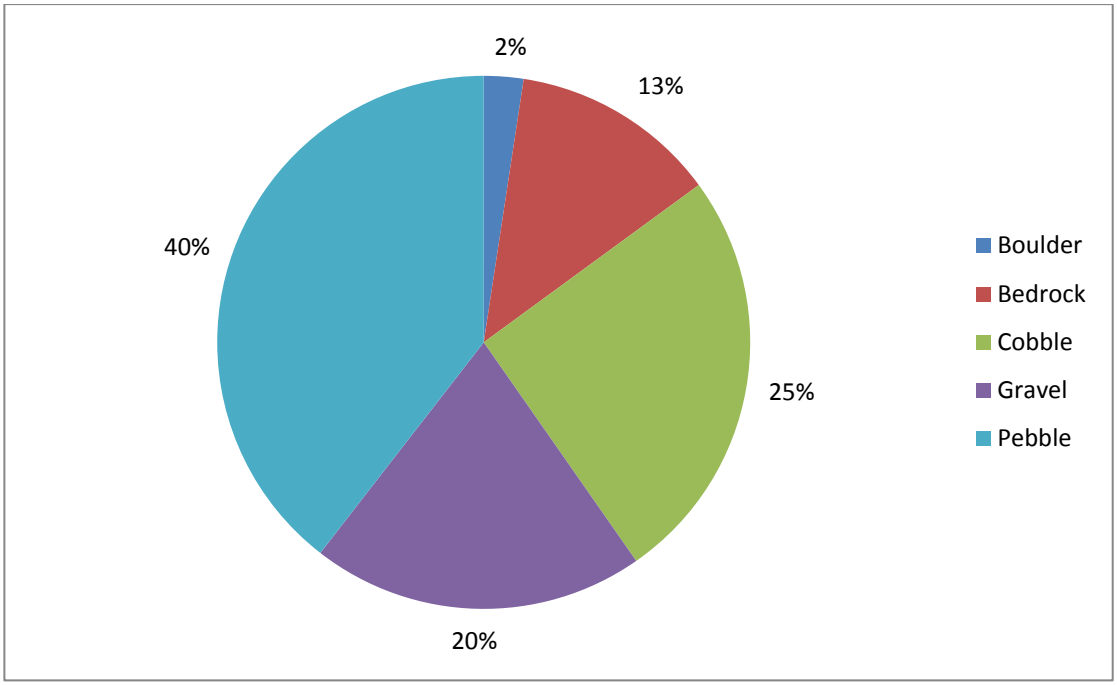

Figure 3: Proportion of substrate types at a) the impact site, and b) the offset site.

Table 2: Comparison of habitat attributes at the impact and offset sites.

Attribute	Habitat Type							
	1A Pool, still, dirt bank	1B Pool, still, gravel bank	2A Riffle, large rock	2B Riffle, small rock	3A Rapid, large rock	3B Rapid, small rock	4A Shallow, slow, large rock	4B Shallow, slow, small rock
Habitat Type (% occurrence)								
Impact	23	10	23	13	6	3	19	3
Offset	32	8	34	10	2	0	9	6
Average Stream Width (m)								
Impact	11.21	11.04	5.91	6.63	12.70	8.50	4.67	2.83
Offset	6.74	5.26	6.50	5.32	11.78	0	8.94	7.83
Average Length (m)								
Impact	129.51	59.57	31.16	10.79	22.36	4.00	60.00	103.80
Offset	75.26	50.62	21.01	13.34	19.62	0	26.40	35.51
Average Instream Habitat Width (m)								
Impact	23.34	31.44	25.46	34.03	25.98	22.00	25.65	27.77
Offset	17.71	18.30	18.46	17.88	17.99	0	19.18	20.48
Average Crevice Count (maximum of 10)								
Impact	9.29	3.67	6.00	3.00	3.50	4.00	5.67	6.00
Offset	4.75	4.79	5.48	5.59	6.67	0	5.56	5.89

Plate 1: Riffle habitat at the offset site.

Plate 2: Pool habitat at the offset site.

Plate 3: Riffle habitat at the impact site.

Plate 4: Pool habitat at the impact site.

The offset site includes areas of preferred shallow, slower and rocky habitats, opportunities for refuge and foraging, but has greater disturbance than the impact site.

3.2 Riparian Vegetation

Riparian vegetation within the impact site and offset site was identified as containing five vegetation types as outlined below and shown in **Figure 13 - Figure 16**.

3.2.1 River Oak Riparian Woodland

River Oak riparian woodland of the Brigalow Belt South and Nandewar Bioregions (Benson 84) NA191 (referred to in this document as 'River Oak Riparian Woodland') primarily occurred within a thin strip up to 15 m wide (from the Peel River) before it graded into a modified exotic community. River Oak Riparian Woodland within the study area was floristically and structurally degraded with a primarily exotic understorey resembling the exotic vegetation communities found adjacent. *Casuarina cunninghamia* (River Sheoak) was always present, with *Angophora floribunda* (Rough-barked Apple) observed on occasion, particularly at the southern ends of both the impact site and offset site. *Eucalyptus blakelyi* (Blakely's Red Gum) was also observed as part of this community at the southern end of the offset site, suggesting that the River Oak Riparian Woodland graded into a Box-Gum Woodland community. The mid-storey was largely absent across the whole of the study area. However, where a mid-storey was present it included regenerating *C. cunninghamia* and exotic shrubs such as *Rubus fruticosus* (Blackberry), *Rosa rubiginosa* (Sweet Briar), *Prunus* spp. and *Pyracantha* sp. The ground layer was dominated by a range of exotic species including *Bromus* spp., *Phalaris* sp., *Lolium* sp., *Vicia* sp., *Medicago sativa* (Lucerne), *Plantago lanceolata* and Thistles. Patches of native grass (*Microlaena stipoides, Poa* sp*., Bothriochloa macra* and *Austrostipa* spp.) were locally dominant and observed more commonly in the areas of higher condition (such as the southern parts of the impact and offset site).

The impact site was generally considered to be in a higher condition than the offset site due to the reduced grazing intensity and lower erosion potential. Some patches of River Oak Riparian Woodland towards the middle and southern end of the impact site on the western bank occurred within a rocky escarpment that had largely avoided the disturbance factors observed along most of the study area. In these patches, the condition of River Oak Riparian Woodland was considered to be medium to high, and dominated by native grasses and forbs with a moderate level of diversity.

3.2.2 Rough-barked Apple

A small patch (0.07 ha) of 'Rough-barked Apple' (*Angophora floribunda*) vegetation community was identified at the end of the impact area on the north-eastern bank, between the road and the river. The community closely resembles the biometric vegetation type *Rough-barked Apple riparian forb/grass open forest of Nandewar Bioregion* (NA197); however, the overstorey was predominantly regenerating and impacted from past disturbances. The understorey contained a number of loose and outcropping rocks and was dominated by native grasses (*Aristida* sp., *Austrostipa* spp. and *Poa* sp.). It contained a shrub layer of the native *Bursaria spinosa* (Blackthorn) and exotic *Rubus fruticosus* (Blackberry). The vegetation type was considered to be in medium condition with a moderate native diversity, low and grazing impacts and regeneration of the overstorey present.

3.2.3 Exotic – no overstorey

The ground layer was similar across all areas with this vegetation, both within the impact and offset site, being exotic dominated and floristically and structurally depauperate. Both the impact and offset site have been extensively grazed (though with lesser grazing at the impact site), and is subjected to stream bank erosion, high occurrences of exotic weeds and continued grazing pressures.

The 'Exotic – no overstorey' vegetation community consisted of a ground layer dominated by a range of exotic species including, *Bromus* spp., *Phalaris* sp., *Lolium* sp., *Vicia* sp., *Medicago sativa* (Lucerne), *Plantago lanceolata* and Thistles. Exotic shrubs such as *Rubus fruticosus* (Blackberry) *Rosa rubiginosa*

(Sweet Briar), *Prunus* spp. and *Pyracantha* sp. were common along the creek banks and often formed dense stands (particularly Blackberry).

3.2.4 Exotic – overstorey

The 'Exotic overstorey' vegetation community was similar in nature to the 'Exotic – no overstorey' vegetation community, but contained an overstorey of *Salix* sp. (Willows) and/or *Populus* sp. (Poplars).

3.2.5 Exotic – Casuarina regeneration

The 'Exotic – Casuarina regeneration' vegetation type was similar to 'Exotic – no overstorey', but contained regenerating *Casuarina cunninghamia* (River Sheoak). The saplings or young individuals occurred either on the creek banks or within the creek itself.

3.2.6 Condition of Riparian Vegetation

In general, both the impact and offset site are highly disturbed and severely modified as a result of historical and current grazing practices (**Figure 13 - Figure 16**), with cattle frequently observed grazing the stream bank and within the river corridor.

Sites of poor condition were exotic dominated and subject to higher grazing intensities, higher occurrences of exotic weeds (particularly Blackberry) and higher erosion potential. The higher condition sites were representative of areas containing increased native abundance and diversity and lower grazing intensity, lower occurrences of exotic weeds and lower erosion potential. Vegetation within the impact and offset sites were both predominately rated as being in "poor" condition, but the impact site had 12.7% of vegetation rated as 'medium-high' condition (**Table 3**), whereas the highest condition at the offset site was 'medium' (**Table 4**).

Table 3: Area of vegetation at the impact site

Condition Category	River Oak Riparian Woodland (ha)	Exotic - No Overstorey (ha)	Exotic with Overstorey (ha)	Exotic with Casuarina Regeneration (ha)	Rough-Barked Apple (ha)	Total Area (ha) (% total area in brackets)
Poor	0.55	6.84	0	0	0	7.39 (68.2%)
Poor-Medium	2	0	0	0	0	2 (18.5%)
Medium	0	0	0	0	0.07	0.07 (0.6%)
Medium-High	0.56	0	0.82	0	0	1.38 (12.7%)
High	0	0	0	0	0	0 (-%)
Total	3.11	6.84	0.82	0	0.07	10.84 (100%)

Table 4: Area of vegetation at the offset site

Condition Category	River Oak Riparian Woodland (ha)	Exotic - No Overstorey (ha)	Exotic with Overstorey (ha)	Exotic with Casuarina Regeneration (ha)	Total Area (ha) (% total area in brackets)
Poor	3.34	48.22	2.84	2.61	57.02 (78.9%)
Poor-Medium	7.60	2.96	0.00	0.00	10.56 (14.6%)
Medium	4.72	0.00	0.00	0.00	4.72 (6.5%)
Medium-High	0.00	0.00	0.00	0.00	0 (-%)
High	0.00	0.00	0.00	0.00	0 (-%)
Total	15.66	51.18	2.84	2.61	72.29 (100%)

A total of 15.66 ha of River Oak Riparian Woodland is present within the Booroolong Frog offset site (**Table 4**). The vegetation offset site for the Project (the North-Western Offset Site) has a 92 credit deficit for the River Oak Riparian Woodland community, calculated in accordance with the BBAM (WorleyParsons 2013). Given that the median ecosystem credits created per hectare for an offset under the BBAM is 9.3 (based on analysis of the average number of credits generated at offset sites in November 2011, and as used in the "Credit Converter", OEH 2013), this would result in an estimated 145 River Oak Riparian Woodland credits being provided by the Booroolong Frog Offset Site. The amount generated is much greater than the 92 credit shortfall for this vegetation community. It is also noted that as the vegetation within the Booroolong Frog Offset Site is heavily disturbed, the number of credits generated per hectare is likely to be higher than the median average. Thus, the overall offset outcome is likely to be much greater than the 92 credits offset shortfall for this vegetation type.

3.3 Threats to Booroolong Frog

A comparison of key threats to the Booroolong Frog occurring at the impact and offset sites is provided at **Table 5**. In addition observations of threats due to lack of fencing and potential for erosion were mapped and are shown in **Figure 17 - Figure 20**.

Of the threats, habitat modification arising from land management practices is the primary driver of differences in suitability for Booroolong Frog between the impact and offset sites. It was assumed Booroolong Frog populations at both sites experience similar rates of infection with Chytrid fungus, and predation by exotic fishes, foxes and cats.

Table 5: Comparison of threats known or expected to occur at the impact and offset sites.

Threat	Offset Site	Impact Site
Cattle Access	• Continual stock access and grazing	• Intermittent stock access and grazing

Threat	Offset Site	Impact Site
Erosion	• Extensive moderate to severe bank erosion and subsequent sedimentation and smothering of rock crevices • Low to high potential for erosion (**Figure 18 - Figure 20**)	• Limited moderate bank erosion and subsequent sedimentation and smothering of rock crevices • Low potential for erosion (**Figure 17**)
Habitat Modification	• Narrow and patchy riparian zone dominated by exotics and remnant native species • In-stream disturbance by Common Carp • Colonisation of the riparian zone by Willows and Blackberry	• Narrow and patchy riparian zone dominated by exotics and remnant native species • In-stream disturbance by Common Carp • Colonisation of the riparian zone by Willows and Blackberry
Fossicking	The level of fossicking activity is unknown, but can result in disturbance of rocks and sediment, which can cause impacts on the Booroolong Frog.	
Changed hydrological regime	It was assumed the two sites experience a largely natural flow regime, because they occur upstream of the only impoundment on the system (Chaffey Dam). There is small impoundment on the Peel River at Nundle, with a pump station, and three other on-farm pumps occur at the offset site. Their level of use is not known, and would require clarification to determine their influence on the permanence of flows in the stream.	
Disease (*Chytridiomycosis*)	North West Environmental Services (2009a) determined chytrid occurred at a site in the headwaters of the Peel River (in *Litoria davisea*). Tests for chytrid of other species at the same site, and another site further downstream on the Peel River returned negative results. A precautionary approach should be adopted, whereby it is assumed the Booroolong Frog populations at both the offset and impact sites could be infected with Chytrid.	
Predation by Exotic Fishes	• Common Carp (*Cyprinus carpio*) occurred in pools throughout the site • Plague Minnow (Gambusia sp.) occurred in some pools at the site • Other exotic fish may also occur (e.g. Brown Trout *Salmo trutta*, Rainbow Trout *Oncorhynchus mykiss*, Redfin Perch *Perca fluviatilis*, and Goldfish *Carassius auratus*)	• Common Carp and Plague Minnow were not noticed during surveys at the site, however, given the proximity of the site to Chaffey Dam it was assumed they occupy suitable habitats throughout the site • Other exotic fish may also occur (e.g. Brown Trout *Salmo trutta*, Rainbow Trout *Oncorhynchus mykiss*, Redfin Perch *Perca fluviatilis*, and Goldfish *Carassius auratus*)
Herbicide and Pesticide Use	It was assumed management practices at the sites include the use of chemical control for pest plants and animals. The frequency of use is not known, however given the different land tenure of the sites, it is reasonable to expect the type, and frequency of chemical controls between the two sites likely differs.	

3.4 Booroolong Frog Abundance

The Namoi CMA supplied Booroolong Frog survey data (NWES 2013). This data is unpublished, and was supplied as an excel file, but is understood to be the results from surveys carried out in early 2013 (NWES 2013). The results from these counts are shown in **Figure 21 - Figure 24**, and show that many more individuals per kilometre were recorded within the offset site (92.3) than the impact site (24.1, Table 6).

Table 6: Booroolong Frog abundance calculations

Site	Number of Individuals Observed *	Length of River (m) **	Density (individuals per km of river)
Impact Site	39	1,615	24.1
Offset Site	683	7,400	92.3

* Booroolong Frog observations from NWES (2013) data

** As determined using GIS

Thus, the density of Booroolong Frog individuals as recorded from the NWES (2013) survey was 383% higher in the offset site compared to the impact site. This is despite a disturbance consisting of stock grazing, disturbance to the riparian vegetation and banks which result in smothering of habitat crevices, and weed species at the offset site. It is therefore considered that there is potential for further population increase at the offset site with appropriate management of threats.

4 Offset Site Management

4.1 Lands and Agreements

The offset site will consist of the bed and banks of the Peel River, as well as lands within 30 m to either side of the "top-of-bank" for the Peel River along the length of the offset site. These lands occur over multiple landholdings (refer to **section 1.1** and **Appendix A: Figure 6 - Figure 8**, **Table 12** and **Table 13**).

As the location of the river banks is variable, and currently the boundary of the Booroolong Frog offset site is not delineated on the ground by fencing or other markers, the boundaries of the offset site will be surveyed and defined by clearly labelled permanent marker posts. This survey will also confirm the boundaries between Crown land and private landholdings. State Water will provide the survey plan to DP&I and Namoi CMA to confirm the boundaries of the offset site.

The offset site will be managed under Property Vegetation Plans (PVPs) under the NSW *Native Vegetation Act 2003* (NV Act). A PVP attaches to the land tenure, and is in perpetuity. The Namoi CMA will enter into a PVP with each of the 16 offset site landholders, including Crown land.

Consultation has commenced with the landholder entities within the proposed offset site, and in principle letters of agreement will be obtained prior to determination of the project. PVPs will be established prior to project construction works commencing.

State Water will also enter into an agreement with the Namoi CMA for the establishment of the PVPs. State Water will supply funding to the Namoi CMA to establish the PVP, and to fund the actions to be carried out by the landholders.

4.2 Management Actions

Each landholder will be responsible for implementation of the PVP management actions over the land in their ownership. It is expected that Crown lands will enter into contracts with appropriate parties to undertake PVP management actions over the land within its ownership.

The details of the management actions for the Booroolong Frog Offset Site are contained within the PVP template in **Appendix C**. This template includes:

- Suitable fencing of the riparian zone being required in perpetuity, with alternative off-stream stock watering sites to be maintained. Grazing allowed for no more than seven days at a time, with minimum 60 day between grazing events, as well as exclusion from 1st October to 28th February each year, and grazing must not reduce grass sward height to less than 15 cm at any time.
- Bank erosion will be reduced by limiting stock access, as well as controlling weeds which will allow native vegetation to improve and to stabilise banks and prevent erosion.
- Control of all infestations of weeds and feral animals, which will control weed increases and allow the recovery of native vegetation.

It is proposed that the following items related to management of fossicking will also be incorporated into the PVPs for the offset site:

- Management Action – Fossicking.
- Duration of Management – In perpetuity.
- Management Action Conditions:
    - 1. Fossicking is prohibited.
    - 2. Signage is to be erected and maintained at sites close to access roads that state that the lands are being managed to enhance habitat for Booroolong Frog, that unauthorised access is prohibited, and that fossicking is prohibited.

Implementation of suitable fencing is to occur within the first year of the PVPs, and be maintained in perpetuity. Weed management is to commence by the second year of the PVPs. This management is to seek to progressively reduce the extent and abundance of weed species, and to facilitate the recovery of native vegetation within the offset area over time.

The recovery of native vegetation is to be balanced against shading of the Peel River, which could reduce the Booroolong Frog habitat quality of the river. Where trees have grown with within 5 m of the river bed, the PVP landholders are to fell these trees so as to prevent shading of water.

4.3 Monitoring and Corrective Actions

The Namoi CMA will monitor the implementation of the management actions at the offset site, and enforce the completion of additional actions where required. It is recommended that the monitoring of the offset site occur yearly for the first three years of the PVPs, and at a five yearly interval thereafter.

Where required, the Namoi CMA is to enforce the PVPs to ensure that the management actions are being carried out and the performance measures identified in the PVP template achieved.

4.4 Benefits of the Proposed Management Actions to the Booroolong Frog

The primary benefit of the offset site to the Booroolong Frog will be the conservation security achieved by placing the offset site into a binding in perpetuity conservation covenant, which will be a PVP enforced by the Namoi CMA. The Namoi CMA is an agency which has been actively investigating the ecology of the Booroolong Frog, and which has funded management agreements with landholders elsewhere along the Peel River to improve Booroolong Frog habitat.

The survey and fencing of the offset site will exclude livestock which is degrading the riparian vegetation, causing disturbance to the river bed, and resulting in erosion pressures and sediment fouling of crevices used by the Booroolong Frog for breeding purposes. Limited controlled grazing will be allowed.

Landholders will also be required to control weeds. The control of weed species and limited stock grazing will allow the recovery of native vegetation. The recovery of native vegetation is anticipated to be a long term outcome, but with ongoing control and in perpetuity management will allow progressive improvements over time, with the greatest improvements estimated to occur within a 10 year time-frame.

Fossicking is not anticipated to currently be a major impact upon the Booroolong Frog at the offset site, but the signage to state that this activity is prohibited will reduce any disturbances to Booroolong Frog habitat that are currently occurring.

5 Commonwealth Offset Calculations

The EPBC Act 'Offsets Assessment Guide' has been applied to the impact site and proposed offset sites. **Table 7** and **Table 8** supply the values used for the various attributes in these calculations, along with a discussion and justification of the values utilised.

Table 7: Attribute data used for EPBC Act offset calculations

Site	Attribute	Discussion and Justification	Value Used
Impact	Area of habitat	The area of threatened species habitat to be lost was calculated from the habitat length and width measurements for the reaches within the impact site	4.09 ha
	Habitat Quality	The calculation of habitat quality is shown in **Table 8**	6
Offset	Area of habitat	The area of threatened species habitat to be managed was calculated from the habitat length and width measurements for the reaches within the offset sites	13.22 ha
	Time over which loss is averted (max. 20 years)	The project will have a greater than 20 year impact, and thus the maximum value of 20 years has been applied	20
	Risk of loss (%) without offset	The offset site is currently used for stock grazing and has continual cattle grazing. It is currently zoned under the Tamworth Regional Local Environment Plan 2010 as Rural Small Holding (RU4) over approximately the northern third of the site, and Primary Production (RU1) over the remainder (**Figure 4**). The land is therefore considered to be susceptible to future loss rated at 15% likelihood.	15%
	Risk of loss (%) with offset	A PVP is a binding in perpetuity agreement over land title. Any proposed clearing of native vegetation must be undertaken in accordance with the NV Act. The risk of future loss is therefore rated at 3%.	3%
	Confidence in result (%)	The confidence in the risk of loss is rated at 60% as although it is difficult to determine the risk of clearing and loss of the Booroolong Frog habitat, the numbers utilised are conservative given the zoning, current landuse, and proximity to Nundle, and a PVP is a binding covenant on title	60%
	Time until ecological benefit	It is anticipated that cattle could be excluded relatively quickly subject to fencing installation (i.e. around two months). Weed management could then commence. The time for native vegetation response and habitat improvement is rated as being 10 years, as this will allow substantial growth and habitat improvement over this period.	10

Site	Attribute	Discussion and Justification	Value Used
Offset	Start Habitat Quality	The calculation of habitat quality is shown in **Table 8**	5
	Future Habitat Quality without offset	The calculation of habitat quality is shown in **Table 8**	4
	Future Habitat Quality with offset	The calculation of habitat quality is shown in **Table 8**	7
	Confidence in result (%)	The confidence in the habitat scoring is rated at 80% as the scoring is based on consistent survey of Booroolong Frog, and high quality survey of the Booroolong Frog habitat quality	80%

The Offsets Assessment Guide habitat quality score is based on three attributes: context, condition and species stocking rate. The "How-to-use" guidelines do not provide any specific direction on how these three attributes should be combined to produce an integer score from 0 to 10, apart from stating that habitat quality should be assessed consistently on both the impact and offset site. For the purposes of the Booroolong Frog calculations, the context attribute has been excluded, as both the impact and the offset site both occur on the Peel River and therefore both sites effectively have the same context. The condition and species stocking rate attributes have each been given a 50% weighting.

Table 8: Habitat quality rankings

Site	Attribute	Discussion and Justification	Value Given
Impact	Condition	The impact site has intermittent stock grazing as it is a travelling stock route, moderate condition littoral and riparian vegetation, and limited bank erosion. It also has exotic weed species including willows and blackberry, and in-stream disturbance by Common Carp (refer to **Table 5**)	8
	Species Stocking Rate	The number of Booroolong Frogs observed within the impact site was 24.1 individuals per kilometre of the Peel River (**section 3.4**)	4
		Overall Habitat Quality	6
Offset Start Quality	Condition	The offset site has continual stock grazing, significant understorey and littoral vegetation loss, and extensive moderate to severe bank erosion, as well as exotic weed species, and in-stream disturbance by Common Carp (refer to **Table 5**)	3
	Species Stocking Rate	The number of Booroolong Frogs observed within the offset site was 92.3 individuals per kilometre of the Peel River (**section 3.4**)	7
		Overall Habitat Quality	5

Site	Attribute	Discussion and Justification	Value Given
Offset Future Habitat Quality without offset	Condition	Constant stock grazing will be ongoing which will continue to result in understorey and littoral vegetation loss, further exacerbate bank erosion, as exotic weed species, and in-stream disturbance by Common Carp (refer to **Table 5**)	2
	Species Stocking Rate	The number of Booroolong Frogs would be expected to decline over time, especially with smothering of oviposition sites due to bank erosion	5
		Overall Habitat Quality	4
Offset Future Habitat Quality with offset	Condition	Stock grazing will be excluded, weeds will be controlled, which will both improve riparian and littoral vegetation condition. This management will also stop bank erosion and sediment currently present will be reduced by river flows over time.	7
	Species Stocking Rate	The number of Booroolong Frogs would increase over time, especially as additional oviposition sites become available with a reduction in smothering due to bank erosion	7
		Overall Habitat Quality	7

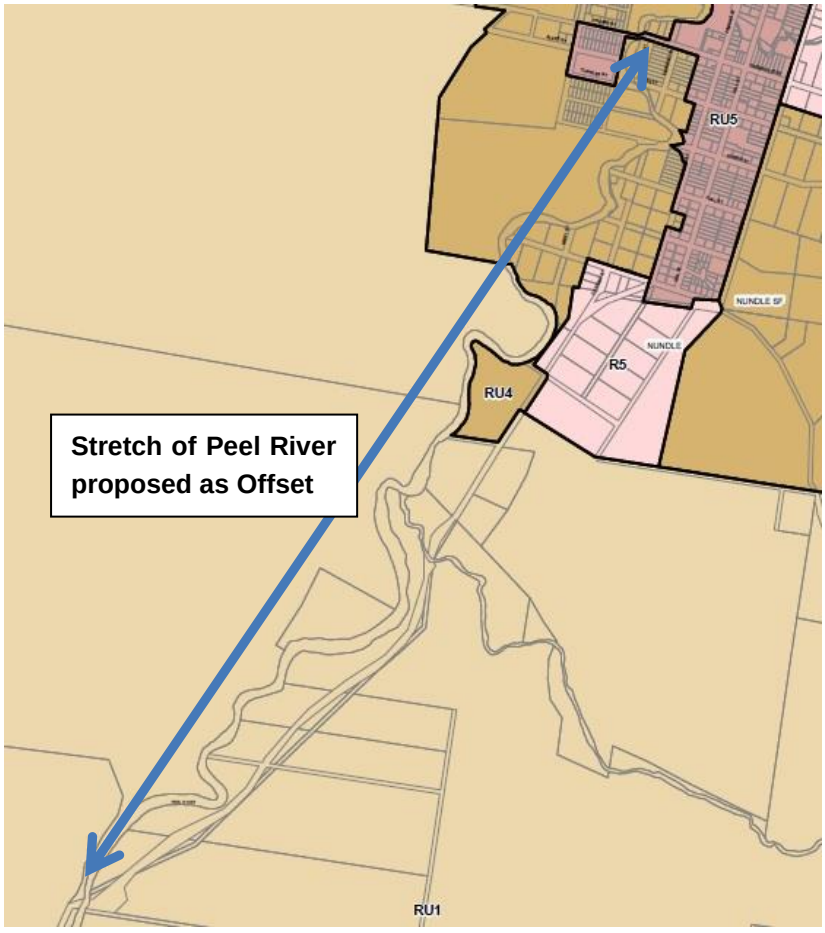

Figure 4. Zoning of the offset site

The overall outcome is that the impact site requires a 'net present value' of 2.45, and the offset site generates a net present value of 2.92 net present value which is 118.93% of the EPBC Act Environmental Offsets Policy requirement.

6 NSW BioBanking Offset Calculations

For the impact site, BioBanking credit calculations are based on the area of habitat affected, the $T_{G\ spp1}$ (which is an attribute relating to the ability of the species to respond to improvement in site value with management actions at the offset site) as per equation 13 from the BBAM (DECC 2008) below:

Equation 13: Species credits – number of credits required at the development site

$$\text{Number of species credits required for a threatened species at the development site} = \frac{H_{loss}}{T_{G\ spp1}} \times 10$$

For the offset site BioBanking credit calculations are based on the area of habitat to be managed, and the $\%\Delta S_{gain}$ gain resulting from the management actions) as per equation 13 from the BBAM (DECC 2008) below:

Equation 14: Species credits – number of credits created at the biobank site

$$\text{Number of species credits created for a species at the biobank site} = H_{current} \times \%\Delta S_{gain} \times 10$$

In addition, both equation 13 and 14 are multiplied by a scaling factor of 10. It is noted that landscape scale factors which are applied to ecosystem credits under the BBAM do not affect the calculation for species credit species. As this document deals solely with offsets for the Booroolong Frog these therefore have not been included in this document and calculations as they are not required.

The numbers used for the various attributes for these calculations are supplied below in **Table 9**, along with a discussion of the numbers selected.

The attribute numbers were then applied as per the relevant BioBanking calculations, and these are supplied in **Table 9**. The credit calculations identify that 55 credits are required due to the impact. The proposed offset site generates 79 credits.

The Booroolong Frog is not a red-flagged species, and therefore based on these calculations the proposal will meet a "Tier 1" outcome as identified under the 'Interim Offset Policy for Major Projects' (OEH 2011).

Table 9: Attribute data used for BioBanking calculations

Attribute	Discussion	Value Used
H_{loss}	The area of threatened species habitat to be lost was calculated from the habitat length and width measurements for the reaches within the impact site	4.09 ha
$T_{G\ spp1}$	For the BBAM training course Eco Logical Australia have been instructed by OEH that Bionet contains the most up to date information on threatened species, and that this will be incorporated into the BioBanking calculator when it is updated in the near future. On inspection of the Bionet database, the T_G value was found to be 0.75 (refer to **Figure 5**).	0.75
$H_{current}$	The area of threatened species habitat to be managed was calculated from the habitat length and width measurements for the reaches within the offset site	13.22 ha
$\%\Delta S_{gain}$	The BBAM methodology identifies that where a threatened species crosses multiple management zones that the default value of 0.6 (60%) should be applied	0.6

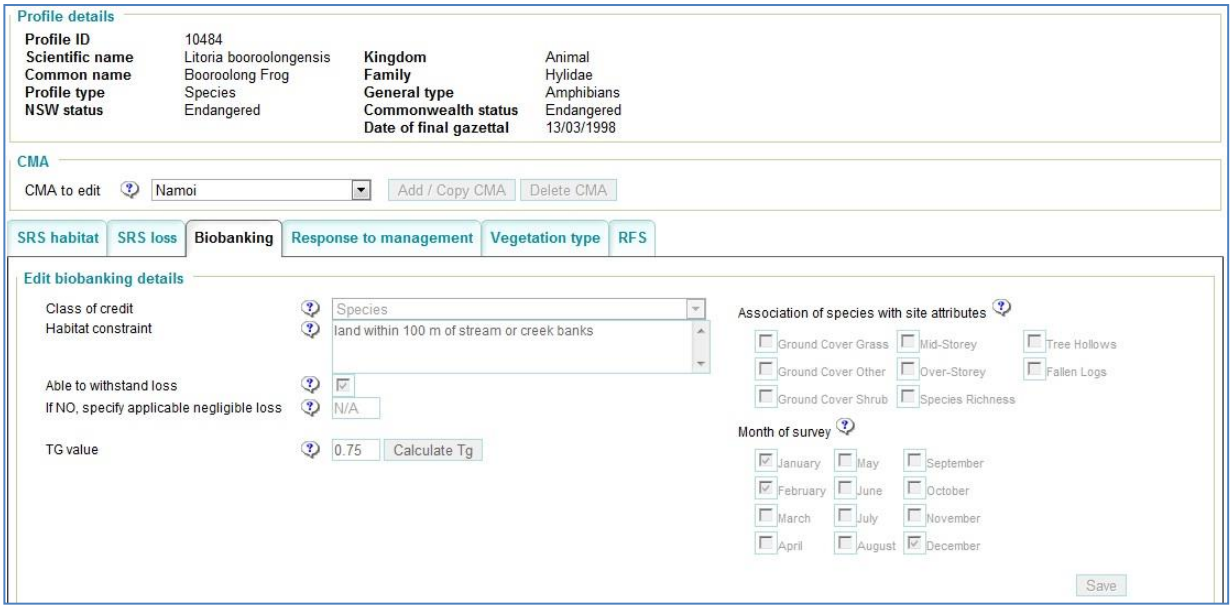

Figure 5. Screenshot of Bionet database for Booroolong Frog T_G value (taken on 28/10/2013).

Table 10: BioBanking credit calculations

Site	Equation data	Credits
Impact Site	4.09 / 0.75 X 10	55 credits
Offset Site	13.22 X 0.6 X 10	79 credits

7 Review of Proposed Offset against Relevant Offset Policies

The proposed offset is reviewed against relevant Commonwealth, NSW and Namoi CMA offset policies in **Table 11** below. Based on this review, the proposed offset is considered to be compliant with all of these policies.

Table 11: Review of proposed offset against relevant offset policies

No.	Policy	Response
	Commonwealth EPBC Act Environmental Offsets Policy	
1	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	The proposed offset will deliver an offset which will deliver 118.93% of the impact occurring according to the offset assessment guide calculations (section 5)
2	Be built around direct offsets but may include other compensatory measures	A direct offset is proposed
3	Be in proportion to the level of statutory protection that applies to the protected matter	The level of statutory protection has been included in the offset assessment guide calculations
4	Be of a size and scale proportionate to the residual impacts on the protected matter	The size and scale of impacts on the protected matter (Booroolong Frog) has been assessed via survey along the length of the impact site, and the proposed offset is proportional to these impacts
5	Effectively account for and manage the risks of the offset not succeeding	The key risk of the offset not succeeding relates to securing landholder agreement. Consultation has commenced and in principle letters of agreement will be obtained prior to determination. Once the PVPs are secured, they constitute an in perpetuity covenant, and the Namoi CMA will have the ability to enforce the agreements
6	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)	The offset is additional to what is already required – no management for the Booroolong Frog currently occurs on the proposed offset site
7	Be efficient, effective, timely, transparent, scientifically robust and reasonable	The proposed offset comprises management of a 7.4 kilometre section of the Peel River which is efficient and effective. The offset calculations are based on a scientifically robust survey method applied in the same manner to both the impact and offset sites

No.	Policy	Response
8	Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	The governance arrangements are transparent and will be monitored and enforced by the Namoi CMA

NSW Offset Principles for Major Projects (State Significant Development and Infrastructure)

1	Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.	Aspects relating to avoidance and mitigation have been dealt with in the Environmental Assessment
2	Offset requirements should be based on a reliable and transparent assessment of losses and gains.	The BBAM methodology has been used to assess the losses and gains
3	Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.	The proposed offset is targeted to the Booroolong Frog. Other offsets are dealt with separately
4	Offsets must be additional to other legal requirements.	The offset is additional to legal requirements
5	Offsets must be enduring, enforceable and auditable.	The offset is an in perpetuity PVP, and will be enforceable and auditable by the Namoi CMA
6	Supplementary measures can be used in lieu of offsets.	Supplementary measures are not proposed in this instance
7	Offsets can be discounted where significant social and economic benefits accrue to NSW as a consequence of the proposal.	Whilst the project will deliver significant social and economic benefits, no discounting is applied to the proposed offset

Namoi CMA Biodiversity Offsets Policy

1	Offsets will be used as a last resort, after consideration of alternatives to avoid and/or mitigate impacts	The project will have impacts upon the Booroolong Frog which cannot be avoided or mitigated, and therefore ecological offsets are proposed. Aspects relating to avoidance and mitigation have been dealt with in the project Environmental Impact Statement and Preferred Infrastructure Report
2	Offset areas be kept within the Namoi Catchment boundaries (either wholly or in part as a contiguous area of native vegetation)	The offset is within the Namoi Catchment
3	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	The offset is for the same species as is impacted (Booroolong Frog)
4	Offsetting must achieve biodiversity benefits in perpetuity and be registered on title	The offset will be in perpetuity
5	Offset conditions must be monitored, enforceable, clearly mapped, recorded and publicly available	The offset will be monitored and enforced by Namoi CMA, and will be “on title” as a PVP
6	An offset area, once designated, cannot be used for further offsetting of subsequent developments in future	The offset will not be used for the offset of future developments as it will be designated “on title” as a PVP

8 Conclusion

The project will impact on 4.09 ha of habitat for the Booroolong Frog (as measured in this study from detailed survey of the entire impact site). It is proposed to secure and manage 74.49 ha of land, including 13.22 ha of Booroolong Frog habitat, within the offset site for long term conservation of the Booroolong Frog.

The offset site will be managed in perpetuity by way of Property Vegetation Plans (PVPs) prepared under the *Native Vegetation Act 2003*, as agreed with the Namoi Catchment Management Authority (CMA). State Water will enter into an agreement with the Namoi CMA for the establishment of the PVPs. PVPs will then be established between the Namoi CMA and each landholder within the offset site. State Water will supply funding to the Namoi CMA to establish the PVP, and to fund the actions to be carried out by the landholders. Key management actions include appropriate fencing of the offset site to exclude livestock, and control of weed species.

State Water and Namoi CMA have commenced consultation with the landholder entities within the proposed offset site, and in principle letters of agreement will be obtained prior to determination of the project. The boundary of the offset site will be determined by survey with clearly labelled permanent boundary marker posts installed.

The offset site accounts for 118.93% of the impact under the EPBC Act offset assessment guide calculations. In accordance with the BBAM credit calculations, 55 credits are required due to the project impact, and the offset site will generate 79 credits.

The proposed offset site meets the Commonwealth, NSW and Namoi CMA offset policy requirements, and will lead to a long term conservation outcome for the Booroolong Frog.

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Appendix A: Sensitive Information Mapping

This section contains mapping of sensitive information such as the locations at which Booroolong Frogs have been observed and habitat mapping. This information is supplied to agencies for their consideration, but has been removed from the public exhibition version.

The area shown for the offset site is indicative only, and will be confirmed via survey (section 4).

Refer to **Figure 6 - Figure 8** for cadastre boundaries and lot numbers. It is noted that some figures for the offset site have artificial cadastre lines which are an artefact of merging two cadastre datasets together (**Figure 10 - Figure 12, Figure 14- Figure 16, Figure 18 - Figure 20,** and **Figure 22 - Figure 24**).

Appendix B: Booroolong Frog Habitat Proforma

STATE WATER CHAFFEY DAM OFFSET (13SYDENV-0003) – BOOROOLONG FROG HABITAT ASSESSMENT

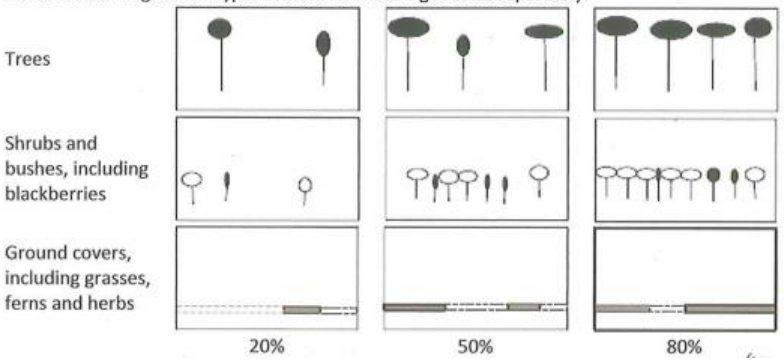
ELA Recorder:	Julie-Anne Harty	Date:		Section Details:
Section Number:		Photos:		
Waypoint:		Time:		

SECTION START & FINISH					Water Level at the Time of Sampling*:
Zone:	Start Waypoint:		Finish Waypoint:		
	E:	N:	E:	N:	

Distance (m)		**WPT**	**Habitat Code(1)**	**Pool Depth(2)**	**Pool Substrate(3)**	**Habitat Width (m)**			**Stream Width (m)**			**Bankfull Width (m)**			**Crevice Count(4)**	**Disturbance(5)**

*	CD – completely dry; IP – isolated pools; LF – low flow/low level; MF – moderate flow; HF – high flow; BF – bankfull
(1)	1A – pool, still, dirt bank; 1B – pool, still, gravel bank; 2A – riffle, large rock; 2B – riffle, small rocks; 3A – rapid, large rocks; 3B – rapid, small rocks; 4A – shallow, slow, large rocks; 4B – shallow, slow, small rocks; 5 – cobble; 6 - bedrock
(2)	SD – slow-deep (>0.5 m); SS – slow-shallow; FD – fast-deep (>0.5 m); FS – fast-shallow
(3)	Silt, sand, gravel, pebble, cobble, boulder, bedrock
(4)	Note whether one bank only, and which bank; count up to ten; using crevice wedge
(5)	NF – not fenced; PSER – point source erosion; SED – sedimentation; WE – water extraction point; PSP – point source pollution; OTHR – anything else Intensity rating – nil, slight, moderate, severe

Riparian vegetation proforma.

STRUCTURAL COMPOSITION (at three points within each vegetation polygon)			
Canopy > 5 m Midstorey 1-5 m Groundcover < 1 m	Using the diagrams below as a guide, choose the category that best describes the percent cover of each vegetation type. Evaluate left and right bank separately. 	0	0%
		1	< 20%
		2	21-50%
		3	51-80%
		4	> 80%

DISTURBANCE								
	LB				RB			
Grazing	nil	slight	moderate	severe	nil	slight	moderate	severe
Grazing by	sheep	kangaroos	rabbits	wombats	sheep	kangaroos	rabbits	wombats
	cattle	goats	deer	horses	cattle	goats	deer	horses
Weeds	nil	slight	moderate	severe	nil	slight	moderate	severe
Weed species								
Stock pugging	nil	slight	moderate	severe	nil	slight	moderate	severe
Erosion / sedimentation	nil	slight	moderate	severe	nil	slight	moderate	severe
Water extraction	Present / absent Type:				Present / absent Type:			
Point source pollution	nil Type:	slight	moderate	severe	nil Type:	slight	moderate	severe
Other								

Appendix C: Namoi Booroolong Frog Property Vegetation Plan Template

NAMOI
Catchment Management Authority
Conservation
PROPERTY VEGETATION PLAN
Native Vegetation Act 2003

‘Insert Property Name’
Insert Property Address 1
Insert property Address 2

This Property Vegetation Plan applies to the land described in Schedule 1, as shown on Map 1 in Schedule 4 of this agreement.

The Landholder is authorised to undertake the activities set out in Schedule 2 and agrees to carry out the management actions and management action details set out in Schedule 2. The Landholder agrees to comply with the requirements of Schedule 3.

Notes:

1. The Director-General of Department of Premier and Cabinet (or delegate) will notify the Registrar-General once all landholders and parties with a prescribed interest have consented to the registration of this PVP. Once notified by the Director-General, the Registrar-General is required to register this PVP. This PVP will then be binding on all current and future landholders.
2. This Plan does not exempt the landholder from any Council clearing consent requirements.
3. In order to carry out the works under this PVP, the Landholder may be required to obtain other approvals from other government agencies.

Insert landholder Name

Name of the Landholder	Signature	Date

Consent to register this plan in accordance with s. 31 of the Native Vegetation Act 2003 (for any other person or entity who may have a prescribed interest)	Signature	Date

Bruce Brown

General Manager of the Namoi Catchment Management Authority Delegate of the Minister administering the *Native Vegetation Act 2003*	Signature	Date

CMA File Ref: ########## **Request No:** #####

SCHEDULE ONE — DESCRIPTION OF LAND TO WHICH THIS PVP APPLIES

Lot	DP	LGA	County	Parish

…….
Initials & Date

SCHEDULE TWO — AUTHORISED ACTIVITIES AND MANAGEMENT ACTIONS

MANAGEMENT ACTIONS FOR CONSERVATION PVP

1. The management actions and management action details are to be continued for, or completed within, the duration specified in the column "Duration of Management Action".
2. The management actions and management action details set out below must be undertaken in the specified map unit as identified in Schedule 4.

Map Number (as per Schedule 4)	Map Unit (Area ha)	Management Action	Duration of Management Action	Management Action Conditions
1	1 (## ha)	Fencing	In perpetuity	**1.** All fencing undertaken as part of this project is to be maintained in a stock proof condition. **2.** To protect wildlife, fencing erected as part of this project will have a top strand and a bottom strand consisting of plain wire. If barbed wire is used on the top or bottom strand, aluminium tag bunting must be applied along the entire length. **3.** Electric fence wires will not be placed closer than 30cm to the ground. **4.** Off-stream alternative stock watering schemes must be maintained in an operational condition for the term of this Agreement.
1	1 (## ha)	Grazing	In perpetuity	**1.** Ground cover will be maintained at greater than 90% at all times (70% for areas west of Narrabri). **2.** Livestock will graze the project area for no more than 7 days at a time, with a minimum stock exclusion period of 60 days between grazing events. Livestock will be excluded from the project area for the period 1st October to 28th February inclusive. Grazing must not reduce the grass sward height to less than 15cm at any time
1	1 (## ha)	Pest and weed Control	In perpetuity	**1.** The Funding Recipient is to control all infestations of weeds within the project area.

				2. The Funding Recipient is to control all feral animals within the project area. **3.** The Funding Recipient is to restrict any disturbance of native vegetation required to conduct the weed treatment to the minimum extent necessary. **4.** The Funding Recipient may only use chemicals registered under the Pesticides Act 1999 for use around waterways for weed control in the project area.
1	1 (## ha)	General	In perpetuity	**1.** Cultural sites must be protected from damage at all times. If a site, or suspected site, is found any on-ground work must stop and the Namoi CMA contacted immediately. **2.** Clearing of native vegetation must be undertaken in accordance with the Native Vegetation Act 2003 **3.** Standing and fallen dead timber must not be removed 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. **4.** Fertiliser will not be applied within the project area. **5.** Gravel extraction will not occur within the project area. **6.** Machinery access will be restricted to designated tracks. **7.** No active burning will occur within the project area. **8.** No exotic fish releases are permitted within the project area. **9.** Rocks will not be moved or removed from the project area.

				10. All signage (if provided by Namoi CMA) will be maintained and any damage will be reported to Namoi CMA. **11.** All Media releases regarding the project must carry the Namoi CMA logo and be approved by Namoi CMA prior to release. **12.** Surface water extraction will be limited during periods of drought and low flows to maintain water pools in the project area. **13.** 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. **14.** 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.

Definitions

Cultivation: means the penetration, breaking, turning over, tilling or ploughing of the soil surface, via manual or mechanical means, for the purpose of farming.

Environmental weed: means any other significant or common weed species (ie. exotic, non-native) that impacts the natural environment in a negative or invasive manner that is not formally listed as a noxious weed in NSW under the *Noxious Weeds Act 1993*.

Groundcover: means any type of herbaceous vegetation or pasture (ie. grasses, herbs, forbs, organic litter) native and non-native, living or dead.

ha: means a spatial measurement of physical area in hectares.

Map Unit: means a spatially-defined area of land within the designated PVP area, pertaining to the approvals described within the PVP; and usually containing particular environmental characteristics that affect the options allowed within the PVP.

Regrowth (native vegetation): means all native vegetation that has regrown since 1 January 1990. Regrowth does, however, not include native vegetation that has regrown after: unlawful clearing of Remnant vegetation, and/or bushfires, floods, drought or other natural events that cause the clearing of Remnant vegetation.

Remnant (native vegetation): means any native vegetation that is not considered to be Regrowth (as per the above definition).

Routine Agricultural Management Activities (RAMA): means farming, safety and other miscellaneous activities where clearing native vegetation does not require approval under the *Native Vegetation Act 2003*. All clearing associated with RAMA must only be undertaken to the minimum extent necessary. This means that all practical steps must be made to limit the extent of native vegetation clearing undertaken using RAMA. It is illegal to progressively clear land for a purpose outside the scope of RAMA.

Slashing: means using a mower and/or small tractor and slasher implement to cut, mow or slash groundcover to a desired level, height or density.

SCHEDULE THREE - STANDARD CONDITIONS

Commencement

1. This PVP will commence from the date at which it is signed by the Minister administering the *Native Vegetation Act 2003* (or delegate).

Words and phrases used

2. In this Schedule:

> "CMA" means the Catchment Management Authority that is a party to this property vegetation plan ("PVP");
>
> "Landholder" means the landholder who is a party to this PVP and once this PVP is registered all future landholders;
>
> "the works under this PVP" means the clearing, the management actions, the mitigating actions and all other works that the Landholder is authorised or required to take under this PVP;
>
> "the Land" means the land to which this PVP applies; and
>
> "OEH" means the Office of Environment and Heritage within the Department of Premier and Cabinet and includes its successor departments or agencies.

Monitoring and auditing

3. The carrying out of any works under this PVP may be subject to auditing by officers of the CMA or OEH who are authorised officers under the *Native Vegetation Act 2003*, as set out in sections 34 and 35.
4. Subject to reasonable notice, the Landholder will allow authorised officers of the CMA or OEH access to the Land and allow those officers to do all things reasonably necessary for the purpose of monitoring or auditing compliance with this PVP.
5. Clauses 3 and 4 do not affect the powers of authorised officers of the CMA, OEH or other government agencies to carry out investigations under the *Native Vegetation Act 2003*.

Registration of PVP on Title

6. For the purpose of sections 31(1) and 31(2) of the *Native Vegetation Act 2003,* the Landholder consents to the registration of this PVP in accordance with section 31 of the *Native Vegetation Act 2003.*

Dispute resolution

7. The parties agree to attempt to resolve any dispute in relation to this PVP by negotiation in the first instance. Such negotiation may involve agreeing on a variation to the PVP. However, this clause does not apply to a dispute relating to a possible breach of the *Native Vegetation Act 2003*.
8. Where appropriate, if negotiations are not successful, the CMA agrees to provide a written notice to the Landholder setting out the nature of any contravention and requesting the Landholder to take the steps specified in that notice, in the time specified in that notice, to rectify that contravention. This clause does not apply to a possible breach of the *Native Vegetation Act 2003*.
9. The Landholder agrees to comply with that notice in the time specified in the notice. Failure to comply with that notice is a breach of this plan. If the Landholder does not comply with the notice, the Minister (or delegate) may consider terminating this plan, in accordance with the procedure set out in section 30 of the *Native Vegetation Act 2003*. The CMA or OEH may also take other action under that Act.
10. The landholder also agrees to provide access to the property to officers of the CMA and OEH.

Note: The procedure for varying or terminating a PVP is set out in section 30 of the *Native Vegetation Act 2003* and clause 11 of the *Native Vegetation Regulation 2005*.

Subdivision

11. The Landholder agrees to notify the CMA of any proposal to subdivide the Land.

12. The Landholder agrees to submit to the CMA an application to vary this PVP to divide it into separate PVPs relating to the Land as subdivided in the same or similar terms to this PVP, if so requested by the CMA.

Apportionment of risk/indemnity

13. The parties agree to apportion risk as follows:

    (i) The CMA accepts the risk for the actions of CMA staff in entering the Land and carrying out functions associated with this PVP and for the actions of other visitors to the Land as organised by the CMA.

    (ii) All other risks associated with this PVP and the works under this PVP rest with the Landholder.

Disclosure of Information

14. Subject to clause 15, personal information contained in this PVP will be treated in accordance with the *Privacy and Personal Information Protection Act 1998*, under which you have rights of access and correction.

15. Information contained in this PVP may be disclosed:

    (i) In the case of a PVP that specifies a date for the definition of "regrowth", certain information from the PVP will be included on the register of PVPs and development consents, which will be publicly available on the Internet and available for inspection at the office of the CMA.

    (ii) to OEH for compliance and statistical purposes.

    (iii) in circumstances where disclosure is otherwise required or authorised by law, including the Government Information (Public Access) Act 2009.

SCHEDULE FOUR — MAPS

Map 1 PVP Area and Conservation Area (Scale1:20,000)

ecological AUSTRALIA

HEAD OFFICE
Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY
Level 6
299 Sussex Street
Sydney NSW 2000
T 02 8536 8650
F 02 9264 0717

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

NEWCASTLE
Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

MUDGEE
Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1230
F 02 6372 9230

PERTH
Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 08 9322 1358

WOLLONGONG
Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 4268 4361

GOSFORD
Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1220
F 02 4322 2897

DARWIN
16/56 Marina Boulevard
Cullen Bay NT 0820
T 08 8989 5601

BRISBANE
51 Amelia Street
Fortitude Valley QLD 4006
T 07 3503 7193

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