



Additional Green and Golden
Bell Frog (*Litoria aurea*)
Surveys: NRE No. 1 Colliery

FINAL REPORT

September 2010

Wollongong:

8 Tate Street Wollongong 2500

Ph: (02) 4229 5222 Fax: (02) 4229 5500

email: wollongong@biosisresearch.com.au

Sydney:

18-20 Mandible Street, Alexandria, NSW 2015

Ph: (02) 9690 2777 Fax: (02) 9690 2577

email: sydney@biosisresearch.com.au

Melbourne:

38 Bertie Street Port Melbourne 3207

Ph: (03) 9646 9499 Fax: (03) 9646 9242

email: melbourne@biosisresearch.com.au

Canberra:

Unit 16 / 2 Yallourn Street, Fyshwick ACT 2609

Ph: (02) 6228 1599 Fax: (02) 6280 8752

email: canberra@biosisresearch.com.au

Ballarat:

449 Doveton Street North Ballarat 3350

Ph: (03) 5331 7000 Fax: (03) 5331 7033

email: ballarat@biosisresearch.com.au

Wangaratta:

26a Reid Street, Wangaratta

Ph: (03) 5721 9453 Fax: (03) 5721 9454

Email: Wangaratta@biosisresearch.com.au

Project no: s12294**Authors:**

Michael Roberts

Review:

Jennifer Charlton

Mapping:

Ashleigh Pritchard

DOCUMENT CONTROL SHEET

PROJECT	Green and Golden Bell Frog (<i>Litoria aurea</i>) Surveys at the Gujarat NRE Coking Coal Limited NRE No.1 Colliery, Russell Vale
----------------	--

BIOSIS PROJECT NO	S12294
--------------------------	--------

REPORT FOR	Gujarat NRE Coking Coal Limited
-------------------	---------------------------------

REPORT TITLE:	Additional Green and Golden Bell Frog (<i>Litoria aurea</i>) Surveys: NRE No.1 Colliery
----------------------	---

AUTHOR(S):	Michael Roberts
-------------------	-----------------

REVISION	PREPARED	INTERNAL REVIEW	EXTERNAL REVIEW	AMENDED
Draft V1	Michael Roberts	Jennifer Charlton	Danyil Skora/Chris Harvey (NRE)	22/9/2010
Final	Michael Roberts			22/09/2010

REVISION	ISSUED	NAME	SIGNED
Draft	20/09/2010	Michael Roberts	
Final	22/09/2010	Michael Roberts	

ACKNOWLEDGMENTS

Biosis Research acknowledges the contribution of the following people and organisations in preparing this report:

- Danyil Skora, Don Jephcott and Kamlesh Prajapati (Gujarat NRE Coking Coal Limited)
- Gary Leonard (Wollongong City Council)
- Melanie Thomson (Wollongong Resource Group Manager, Biosis Research)

ABBREVIATIONS AND COMMON TERMS

Biodiversity	The variety of biological life (plants and animals)
DECCW	NSW Department of Environment, Climate Change and Water (formerly NSW Department of Environment and Climate Change)
DEWHA	Department of the Environment, Water, Heritage and the Arts (formerly Department of Environment and Water Resources)
ERM	Environmental Resources Management
EEC	Endangered Ecological Community
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPI	Environmental Planning Instrument
GGBF	Green and Golden Bell Frog
KTP	Key Threatening Process
LEP	Local Environmental Plan
LGA	Local Government Area
Locality	10 km radius of Subject Site
NPWS	NSW National Parks and Wildlife Service (now part of the DECCW)
Proposal	Removal of Dam 6 from the NRE No. 1 Colliery, Russell Vale Pit Top
Subject Site	The area of direct likely impact. In this case, Dam 6 - previously identified by ERM to contain potential habitat for the GGBF.
Study Area	Area of possible direct impact and any areas subject to potential indirect impacts. In this case, the Study Area includes an additional 650 m buffer around the Subject Site.
TSC Act	<i>Threatened Species Conservation Act 1995</i>
sp.	species (singular)
spp.	species (plural)
ssp.	subspecies
var.	variety
WCC	Wollongong City Council

CONTENTS

1.0	INTRODUCTION	7
1.1	Green and Golden Bell Frog	10
1.2	Aims	12
2.0	METHODS	13
2.1	Contributors, qualifications and licences	13
2.2	Field surveys	13
3.0	RESULTS	17
3.1	Targeted surveys at Dam 6	17
3.2	Pit Top Dam	19
3.3	Habitat assessments	20
4.0	IMPACT ASSESSMENT	27
4.1	Part 3A (EP&A Act) impact assessment	27
4.2	Significant impact assessment under the EPBC Act	32
5.0	CONCLUSIONS AND RECOMMENDATIONS	36
6.0	REFERENCES	38

TABLES

Table 1: Contributors, qualifications and their roles	13
Table 2: Survey techniques and survey effort	13
Table 3: Weather conditions immediately before and during the survey	14
Table 4: Location details of the sites assessed for habitat condition in the Study Area	14
Table 5: Amphibian species recorded at Dam 6 during September targeted GGBF field surveys	18
Table 6: Amphibian species recorded at the Pit Top Dam during preliminary surveys	20
Table 7: Habitat characteristics and condition of various sites in the Study Area	21

FIGURES

Figure 1: The location of the Subject Site and Study Area in a regional context	8
Figure 2: Location of Dam 6 and Pit Top Dam in the Study Area	9
Figure 3: Location of previous Green and Golden Bell Frog records in the locality	11
Figure 4: Location of sites assessed for Green and Golden Bell Frog habitat quality	16
Figure 5: Potential habitat corridors and movement pathways that may be utilised by the Green and Golden Bell Frog in the Study Area.	26
Figure 6: Location of previous Green and Golden Bell Frogs and potential habitat in the Study Area.	28

PLATES

<i>Plate 1: Dam 6</i>	<i>18</i>
<i>Plate 2: Pit Top Dam (red circle indicates the location of the previous GGBF record)</i>	<i>19</i>

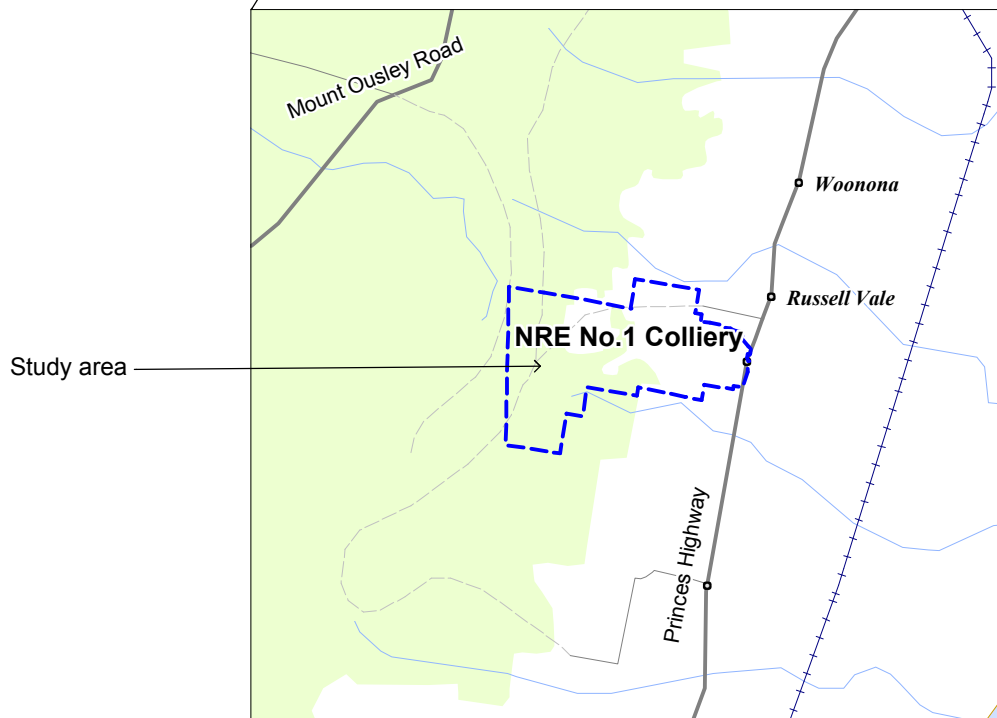
1.0 INTRODUCTION

Biosis Research has been engaged by Gujarat NRE Coking Coal Limited to undertake further targeted Green and Golden Bell Frog (*Litoria aurea*) surveys at Dam 6 located at their NRE No.1 Colliery, Russell Vale, in the Wollongong Local Government Area (LGA), herein referred to as the Subject Site (Figure 1). Dam 6 has been used previously to supplement water usage at NRE No.1 Colliery, however for quite some time (i.e. since early 1980s) the dam level has been influenced only by rainfall.

Gujarat NRE Coking Coal Limited (hereafter referred to as NRE) is currently seeking approval for the upgrade of surface facilities at the NRE Colliery and to facilitate part of this upgrade, it has been identified that Dam 6 will require de-commissioning. The removal of this dam will allow for an appropriately battered slope to be constructed above NRE's proposed re-alignment of Bellambi Gully Creek via an open channel. The drainage system will focus on ensuring that Bellambi Gully Creek bypasses the stockpile area in normal and extreme weather conditions.

The upgrade of the surface facilities at the NRE Colliery requires approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Environmental Resources Management Australia Pty Ltd (ERM) has prepared the Environmental Assessment and during habitat assessments of the Study Area identified potential habitat for the Green and Golden Bell Frog (hereafter referred to as GGBF) at Dam 6. This species is listed as Endangered under the *Threatened Species Conservation Act 1995* (TSC Act) and Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). As such, significance assessments following the *Draft Guidelines for Threatened Species Assessment* (DEC & DPI 2005) and the *EPBC Act - Matters of National Environmental Significance Significant Impact Guidelines 1.1*. (DEWHA 2009) are required for the proposal.

Biosis Research was commissioned by NRE in May 2010 to undertake follow-up surveys to ERM's habitat assessment of Dam 6 (Figure 2). The level of survey effort used during the survey was based on *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna (Amphibians)* (DECC 2009). Dam 6 was defined as 'small areas of habitat' as it was less than 0.3 hectares in size (DECC 2009). It was acknowledged in this report that surveys did not occur at the optimum time for the detection of the GGBF, which is between August and February when this species is known to be most active (DECC 2009). Hence, further targeted surveys were recommended, and form the basis of the current report, to accurately inform the impact assessments required for the proposal.



This product incorporates data which is copyright to the Commonwealth of Australia (c.2003-)



BIOSIS RESEARCH Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES 2500

Figure 1: Location of the Study Area in a regional context

Date: 17 September 2010

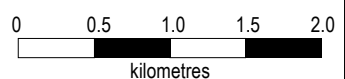
Drawn by: ANP

File number: 11659

Checked by: MWR

Location: P:\12200s\12294\Mapping\Report Figures\
12294 F1_Locality.WOR

Scale:





BIOSIS RESEARCH Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES 2500

Figure 2 - Location of Pit Top Dam, Dam No. 6 and previous record of Green and Golden Bell Frog.

Date: 17 September 2010

File number: 12294

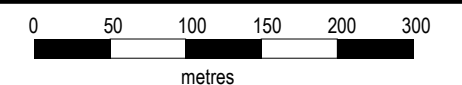
Location: ..P:\12200s\12294\Mapping\Report Figures\12294 F2 Dam Overview. WOR

Drawn by: ANP

Checked by: MWR

Acknowledgements:
Species data from DECCW/NPWS and Biosis Research Pty Ltd
This product incorporates Data which is copyright to
the Commonwealth of Australia (c.2003-)

Source: (c) Land and Property Management Authority
Panorama Avenue Bathurst NSW 2795
www.lpma.nsw.gov.au



Scale: 1:5,000 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56



Figure 2

1.1 Green and Golden Bell Frog

Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern Victoria (NSW Government 2009). The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area and diurnal sheltering sites nearby such as vegetation or rocks (NPWS 1999; White and Pyke 1996), although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 6 weeks to develop, feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species (DEC 2005).

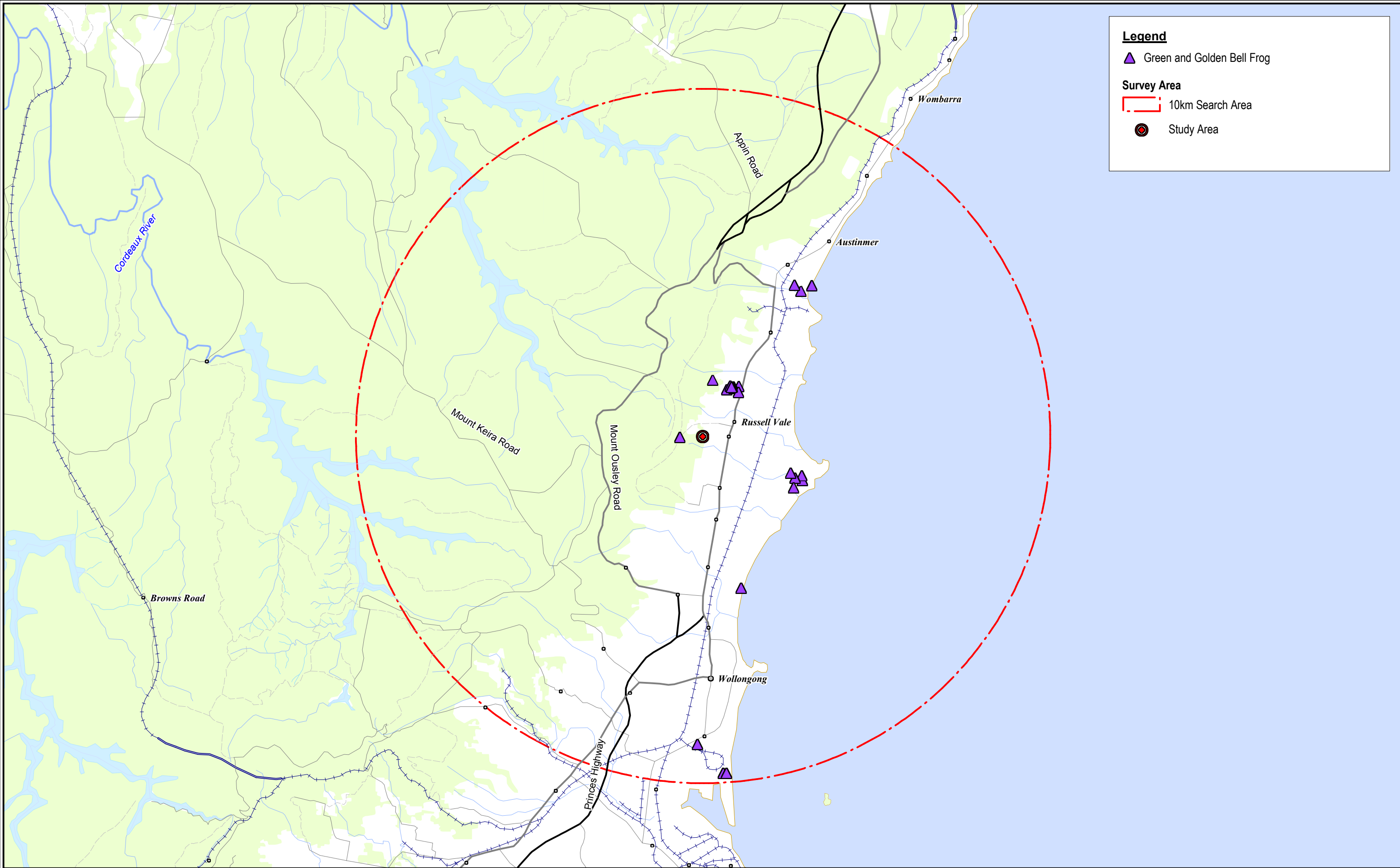
Previous records of GGBF within the locality are presented in Figure 3. The nearest record is approximately 650 m to the west of Dam 6 (recorded 19 November 1997 – Central CRA Survey Dataset) in the Study Area (Pit Top Dam). This record together with the presence of key habitat features suggests that suitable dams located in the Study Area could form part of a corridor for the GGBF in the locality.

The Draft Recovery Plan for the GGBF (Department of Environment and Conservation NSW 2005) refers to four ‘Key Populations’ in the Illawarra region, one of which occurs in the Study Area. A ‘Key Population’ is defined as the following:

“.....those populations considered to have significant measures of viability (regularly sighted at a locality, 10 or more adult individuals having been detected on more than one occasion over the last 5 years, breeding events having been observed over the last 10 years) and/or have a regional distribution considered essential or vital to the state-wide conservation of the species. The maintenance of the species representation within and across these regions is considered critical to the overall conservation of the species and in particular fundamental to conserving the widest genetic diversity possible and thus maximising the species evolutionary potential”

The key population that occurs in the Study Area and that is referred to in the Draft recovery plan includes the environments of the Russell Vale Site and is considered to be the northern most Illawarra population currently known (Department of Environment and Conservation NSW 2005):

“Woonona where a population occurs associated with the old Boral brickpit and the drainage lines of Collins Creek and the Bellambi Creek system (Farrahers, Hollymount, Cawley, Russell Vale and Rixon’s Pass Creeks) north of Wollongong. This population appears to utilise the coastal lagoons and wetland remnants and these drainage lines as connective corridors to other required habitat components towards the escarpment. This is the northern most Illawarra population currently known”.



Legend

▲ Green and Golden Bell Frog

Survey Area

10km Search Area

Study Area



BIOSIS RESEARCH Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES 2500

Figure 3 - Location of previous Green and Golden Bell Frog records in the locality.

Date: 17 September 2010

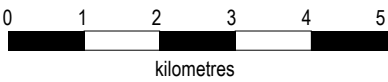
File number: 12294

Location:..P:\12200s\12294\Mapping\Report Figures\12294 F3_Green and Golden Bell Frog.WOR

Drawn by: ANP

Checked by: MWR

*Acknowledgements:
Species data from DECCW/NPWS and Biosis Research Pty Ltd
This product incorporates Data which is copyright to
the Commonwealth of Australia (c.2003-)*



Scale: 1:100,000 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56



Figure 3

1.2 Aims

The general aim of this report is to provide the methodology and results of subsequent targeted GGBF surveys carried out on the Subject Site in September 2010. This information has been used to carry out impact assessments (EP&A Act and EPBC Act) for the decommissioning of Dam 6 on the GGBF (Section 4.0 of this report). Habitat assessments were also carried out to identify other areas of potential habitat occurring in the wider Study Area. In addition, preliminary GGBF surveys (comprising nocturnal and diurnal techniques) were conducted at the Pit Top Dam in an attempt to confirm the presence of the species in the Study Area (Figure 2).

2.0 METHODS

The targeted GGBF survey and habitat assessments included searches of databases and historical records in addition to a field survey of the Study Area. This section outlines the specific methods used during the survey.

2.1 Contributors, qualifications and licences

The contributors to the preparation of this report, their qualifications and roles are outlined in Table 1.

Table 1: Contributors, qualifications and their roles

Name	Qualification	Role
Michael Roberts	B. Env Sc (Hons)	Consultant Zoologist – field surveys, report preparation
Jennifer Charlton	BSc (Zoology)	Consultant Zoologist – report review

2.2 Field surveys

2.2.1 Targeted surveys of GGBF

Targeted GGBF surveys were carried out at Dam 6 and immediate surrounds between 7th and 9th September 2010. The level of survey effort used during the survey was based on that described for GGBF in *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna (Amphibians)* (DECC 2009).

A combination of diurnal and nocturnal field techniques were utilised during the survey of Dam 6 and these are described in Table 2. Due to safety concerns at the Pit Top Dam (deep water), preliminary surveys were restricted to using call playback and spotlighting from the edge of the dam.

Table 2: Survey techniques and survey effort

Survey technique	Time of day	Survey effort
Active searches of dam and surrounding vegetation	Diurnal	3 person hours over three (3) separate days
Active searches (spotlighting) of dam and surrounding vegetation	Nocturnal	3 person hours over three (3) separate nights
Call playback, listening and follow-up searches	Diurnal	1.5 person hours over three (3) separate days
Call playback, listening and follow-up spotlighting	Nocturnal	1.5 person hours over three (3) separate nights
Tadpole surveys	Opportunistic	Not applicable

Temperature, relative humidity and rainfall immediately before and during the survey are presented in Table 3.

Table 3: Weather conditions immediately before and during the survey

Date	Temperature (°C)		Relative Humidity at 3 pm	Rainfall (mm)
	Min	Max		
4/9/2010	12.2	19.7	91.0	0
5/9/2010	16.3	21.3	35.0	0
6/9/2010	11.4	20.6	33.0	0
7/9/2010	10.6	14.8	62.0	0
8/9/2010	7.3	15.6	67.0	0
9/9/2010	10.0	20.6	65.0	0.8
10/9/2010	12.7	22.6	53.0	0

Notes_source: Bureau of Meteorology (2010) – temperature, humidity and rainfall data collected from Bellambi Weather Station. Survey dates are in bold.

2.2.2 Habitat assessments

Diurnal habitat assessments were carried out in the Study Area to identify GGBF habitat and potential movement corridors utilised by the species. A total of seven sites were assessed in the Study Area and the locations of these are presented in Table 4 and Figure 4.

Table 4: Location details of the sites assessed for habitat condition in the Study Area

Site name	Easting	Northing	Details
Corrimal Spring	305297	6195511	North-east of the Study Area and north of the Pit Top Dam
Rixson's Pass Dam	305388	6196692	South of Rixson's Pass and north of the Pit Top Dam
Basin No.1	305995	6196655	East of the Pit Top Dam and north of the Dam 6
Basin No.2 (Filter bed Dam)	306399	6196236	East of Basin No. 1
RV Emplacement – northern pond	306346	6196421	South of Russell Vale Golf Course and north of the emplacement area
Don's Dam	306639	6195866	North of the Stormwater Control Dam and adjacent to Bellambi Gully Creek
Stormwater control dam wetland	306678	6195679	South of Bellambi Gully Creek and approx west of Roadside Dam
Roadside Dam	306787	6195766	West of Princes Highway and north of Bellambi Gully Creek

The following criteria were used to evaluate habitat values at each location:

Good: good condition vegetation (e.g. *Typha* spp.) and water bodies supporting habitat components required by the GGBF for foraging, sheltering, breeding and movement.

Moderate: some key fauna habitat components required by the GGBF are missing, although linkages with other habitats in the landscape are usually intact, but sometimes degraded.

Poor: many fauna habitat elements required by GGBF in low quality remnants have been lost. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised. However, GGBF may still utilise these habitats on occasion.



BIOSIS RESEARCH Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES 2500

Figure 4 - Location of sites assessed for Green and Golden Bell Frog habitat quality.

Date: 20 September 2010

Drawn by: ANP

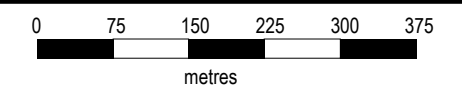
File number: 12294

Checked by: MWR

Location:-..P:\12200s\12294\Mapping\Report Figures\12294 F4_Habitat Assessment. WOR

Acknowledgements:
Species data from DECCW/NPWS and Biosis Research Pty Ltd
This product incorporates Data which is copyright to
the Commonwealth of Australia (c.2003-)

Source: (c) Land and Property Management Authority
Panorama Avenue Bathurst NSW 2795
www.lpma.nsw.gov.au



Scale: 1:7,500 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56



Figure 4

3.0 RESULTS

The results of the surveys have been broken up into the three components of the study:

- Targeted surveys at Dam 6 to inform the impact assessments (Section 4.0);
- Preliminary surveys at the Pit Top Dam; and,
- Habitat assessments undertaken of various sites in the Study Area.

3.1 Targeted surveys at Dam 6

The following section describes the results of the targeted surveys undertaken at Dam 6 including a description of the habitat characteristics and an inventory of the frog species recorded.

3.1.1 Habitat characteristics

The vegetation and habitat characteristics of Dam 6 were consistent with the previous survey in May 2010. The aquatic habitat within Dam 6 consisted of approximately 60% vegetation cover and was moderately disturbed by surrounding land uses, including; coal wash stockpiles, road ways and associated runoff. Dam 6 was dominated by senescent and re-growth *Typha domingensis* Narrow-leaved Cumbungi, *Schoenoplectus validus* and *Triglochin striata* Streaked Arrowgrass (Plate 1). The vegetation surrounding the dam comprised *Paspalum distichum* Water Couch, *Pennisetum clandestinum* Kikuyu, *Paspalum dilatatum* Paspalum, *Ageratina adenophora* Crofton Weed, *Bothriochloa macra* Red leg Grass, *Setaria parviflora* Pigeon Grass, *Conyza* spp. Tall Fleabane and *Verbena bonariensis* Purpletop. Scattered shrubs surrounding the dam consisted predominantly of *Acacia longifolia* subsp. *longifolia* Sydney Golden Wattle. Vegetation in Dam 6 has been mapped as Artificial Wetlands in *The Native Vegetation of the Illawarra and Coastal Plain* (NPWS 2002).

Water depth varied from less than 10 cm on the edges of the dam to in excess of one metre in the middle and eastern sections.

On the basis of these habitat characteristics, Dam 6 was considered to provide good quality habitat for the GGBF.



Plate 1: Dam 6

3.1.2 Animal species

There were no GGBF recorded during the field surveys at Dam 6. Incidental observations of other amphibian species utilising the Study Area during the field survey are listed in Table 5. The most abundant amphibian species recorded was the Eastern Common Froglet (*Crinia signifera*), followed by the Southern Brown Tree Frog (*Litoria ewingi*) and the Emerald Spotted Tree Frog (*Litoria peroni*). Tadpoles of the Southern Brown Tree Frog were recorded, as well as one large unidentified tadpole that was foraging in shallow water of the dam edge.

In comparison to the previous survey, frog species diversity was lower (seven species recorded in May 2010). However, the activity levels of frog species (calling and by observations), such as the Emerald Spotted Tree Frog, was significantly higher in the current survey.

Table 5: Amphibian species recorded at Dam 6 during September targeted GGBF field surveys

Common Name	Scientific Name	Observation Type
Emerald Spotted Tree Frog	<i>Litoria peroni</i>	Observed, heard
Eastern Common Froglet	<i>Crinia signifera</i>	Heard
Striped Marsh Frog	<i>Limnodynastes peroni</i>	Heard
Southern Brown Tree Frog	<i>Litoria ewingi</i>	Observed (adults and tadpoles), heard

3.2 Pit Top Dam

A combination of diurnal and nocturnal GGBF surveys was undertaken at the Pit Top Dam. A previous record of this species occurs at this location (recorded in 1997).

3.2.1 Habitat characteristics

The aquatic habitat of the Pit Top Dam was restricted to the western part of the dam and comprised approximately 5% vegetation cover (Plate 2). The dam was disturbed in response to usage of adjacent roads by trail bike riders. Flow was intermittent and maintained by two pipes on the eastern side of the dam to reduce the likelihood of potential algal blooms. Aquatic vegetation consisted of *Typha domingensis* Narrow-leaved Cumbungi and *Schoenoplectus validus* and the edges of the dam was predominantly made up of weeds and exotics such as, *Pennisetum clandestinum* Kikuyu, *Cirsium vulgare* Spear Thistle and *Taraxacum officinale* Dandelion. Regrowth rainforest tree species also bordered the dam including, *Livistona australis* Cabbage-tree Palm, *Toona ciliata* Red Cedar and *Pittosporum undulatum* Native Daphne. *Lantana camara* Lantana was the dominant shrub on the banks of the dam.



Plate 2: Pit Top Dam (red circle indicates the location of the previous GGBF record)

3.2.2 Animal species

The frog species recorded at the Pit Top Dam are presented in Table 6. The most abundant frog species recorded was the Common Eastern Froglet. A potential GGBF call was heard coming from the *Typha/Eleocharis* reedland on the western side of the dam in response to call playback. This individual did not call with the distinct GGBF complete repertoire, and as a result, it is considered to be an unconfirmed record that requires further investigation.

Table 6: Amphibian species recorded at the Pit Top Dam during preliminary surveys

Common Name	Scientific Name	Observation Type
Green and Golden Bell Frog*	<i>Litoria aurea</i>	Heard
Eastern Common Froglet	<i>Crinia signifera</i>	Heard
Striped Marsh Frog	<i>Limnodynastes peroni</i>	Heard
Emerald Spotted Tree Frog	<i>Litoria peroni</i>	Heard

Notes: *unconfirmed – a complete call was not heard from one individual

3.3 Habitat assessments

Descriptions of the habitats surveyed at the NRE Colliery are presented in Table 7. Potential habitat corridors that may be utilised by the GGBF in the Study Area are presented in Figure 5.

A majority of the surveyed sites were found to contain GGBF habitat, which was indicated by the availability of key fauna habitat elements required by the species for survival, including:

- presence of emergent aquatic vegetation such as *Typha domingensis* Narrow-leaved Cumbungi and *Eleocharis sphacelata*;
- presence of ground and shrub layers adjacent to the water body for foraging; and,
- presence of areas that can be utilised by the species for access/egress to sheltering (over-wintering) sites such as drainage lines, culverts, easements and periodically damp areas.

Table 7: Habitat characteristics and condition of various sites in the Study Area

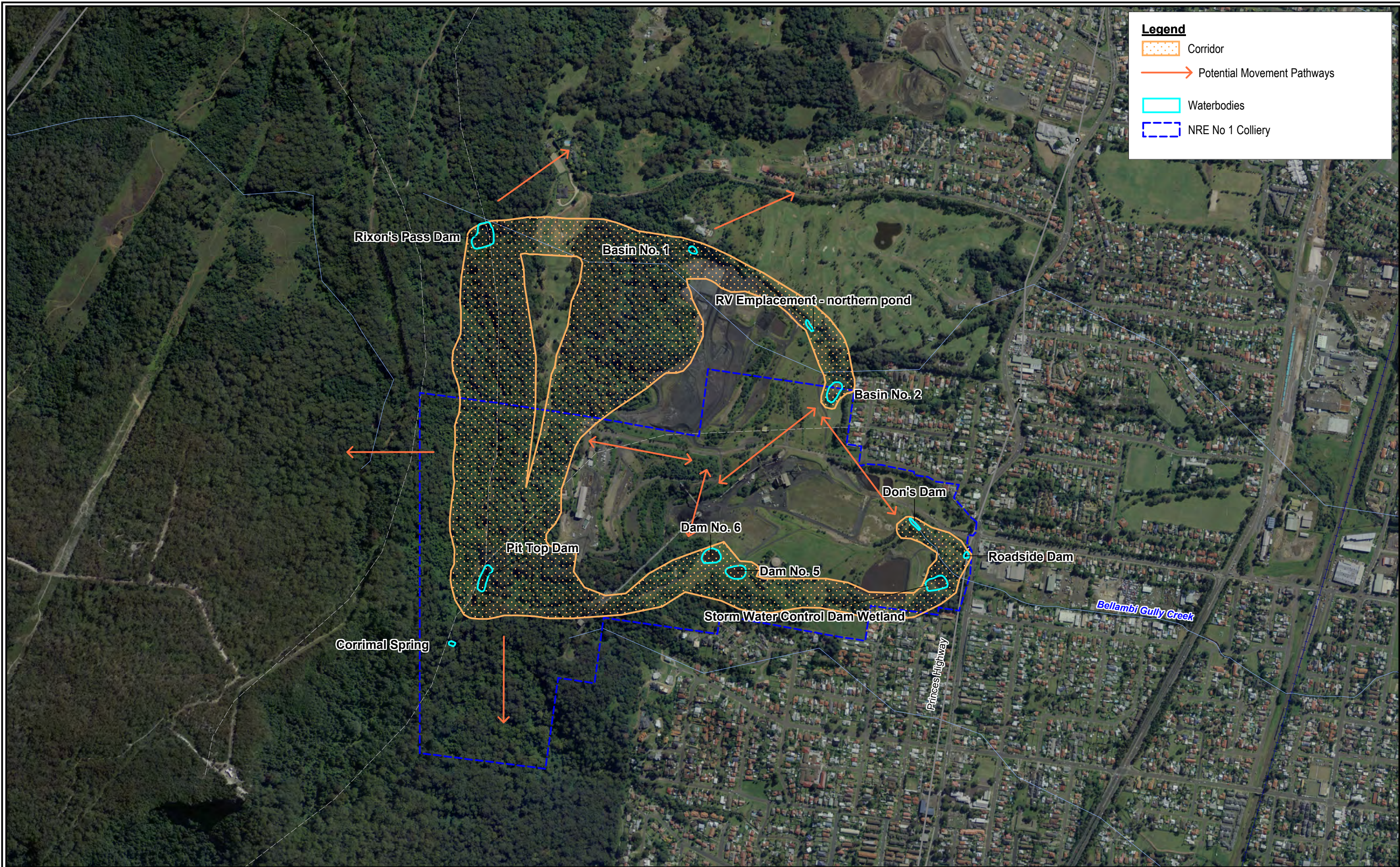
Site name	Habitat characteristics and condition
 Corrimal Spring	Poor condition GGBF habitat – lacked emergent aquatic vegetation and had high levels of disturbance primarily from the run-off of the adjacent roadside. Aquatic vegetation comprised <i>Spirodella</i> spp. Duckweed and <i>Wolffia</i> spp. Tiny Duckweed. <i>Cyperus eragrostis</i> bordered the dam. Rainforest tree species including <i>Ceratopetalum apetalum</i> Coachwood and <i>Cyanthea</i> spp. Tree Fern were located on the western side of the dam. The habitat present at this site may provide a marginal corridor for the GGBF to other areas of potential habitat in the Study Area including the Pit Top Dam and Rixson’s Pass Dam.
 Rixson’s Pass Dam	Good condition GGBF habitat - comprised the full complement of features required by the species for breeding, foraging and sheltering. Aquatic vegetation was approximately 60% cover and comprised sedges and rushes including <i>Typha domingensis</i> Narrow-leaved Cumbungi and <i>Eleocharis sphacelata</i>. The dam was surrounded by <i>Solanum mauritianum</i> Wild Tobacco Bush, <i>Pittosporum undulatum</i> Native Daphne, <i>Lantana camara</i> Lantana and <i>Acacia binervata</i> Two-veined Hickory. The habitat present at this site also provides potential corridors for the GGBF to the Pit Top Dam and other habitats present in the eastern part of the Study Area.

Site name	Habitat characteristics and condition
 Basin No.1	Poor condition GGBF habitat - highly disturbed as a result of coal wash and upslope catchment run-off. No aquatic vegetation in water bodies. Dominant vegetation surrounding the water body comprised <i>Lantana camara</i> Lantana and <i>Erythrina</i> spp. Coral Tree. The water body present at this site may form a potential east-west corridor for the GGBF.
 Basin No.2 (Filter bed Dam)	Good condition GGBF habitat – contained full complement of GGBF habitats, particularly sheltering habitat. Aquatic vegetation comprised <i>Typha domingensis</i> Narrow-leaved Cumbungi and <i>Schoenoplectus validus</i>. <i>Lantana camara</i> Lantana and <i>Acacia binervata</i> Two-veined Hickory was common surrounding the dam. <i>Pennisetum clandestinum</i> Kikuyu formed a thick ground cover on slopes surrounding the dam. The habitat present at this site also provides potential corridors for the GGBF encompassing the RV Emplacement northern pond, Basin No.1 Dam and Rixson's Pass Dam to the west and the Stormwater Control Dam Wetland, Don's Dam, Roadside Dam, and Bellambi Gully Creek to the south and other habitats present in the wider Study Area which are linked by an unnamed tributary of Bellambi Gully Creek.

Site name	Habitat characteristics and condition
 RV Emplacement – northern pond	Moderate condition GGBF habitat – relatively ephemeral, contained aquatic vegetation such as <i>Typha domingensis</i> Narrow-leaved Cumbungi and introduced species such as <i>Hydrocotyle bonariensis</i>. Surrounding areas dominated by <i>Lantana camara</i> Lantana, <i>Andropogon virginicus</i> Whisky Grass and <i>Pennisetum clandestinum</i> Kikuyu. The habitat present at this site would provide a potential GGBF corridor between Rixson’s Pass Dam and other habitats in eastern part of the Study Area.
 Don’s Dam	Moderate condition GGBF habitat - contained aquatic vegetation such as <i>Typha domingensis</i> Narrow-leaved Cumbungi and slopes of the dam were dominated by <i>Lantana camara</i> Lantana, <i>Ageratina adenophora</i> Crofton Weed and <i>Acacia binervata</i> Two-veined Hickory. The habitat present at this site would provide a potential GGBF corridor between the Stormwater Control Dam Wetland, Bellambi Gully Creek and other habitats in eastern part of the Study Area.

Site name	Habitat characteristics and condition
 Stormwater control dam downstream wetland (southern end)  Stormwater control dam downstream wetland (northern end)	Good condition GGBF habitat – contained large areas of foraging habitat for the GGBF in the form of <i>Pennisetum clandestinum</i> Kikuyu and <i>Andropogon virginicus</i> Whisky Grass, sheltering habitat in form of <i>Casuarina glauca</i> Swamp Oak and <i>Melaleuca</i> spp. Tea-tree, and breeding habitat consisting of meadows of sedges and rushes dominated by <i>Typha domingensis</i> Narrow-leaved Cumbungi and <i>Eleocharis sphacelata</i>. This habitat forms an important movement corridor for the GGBF to areas of other potential habitat in the eastern part of the Study Area.

Site name	Habitat characteristics and condition
 Roadside Dam	Moderate condition GGBF habitat – disturbed as a result road run-off. Contained aquatic vegetation such as <i>Typha domingensis</i> Narrow-leaved Cumbungi, bordered by <i>Ageratina adenophora</i> Crofton Weed and planted shrubs <i>Callistemon</i> spp. Bottlebrush. This habitat forms important movement corridors for the GGBF to areas of other potential habitat in the eastern part of the Study Area.



Legend

- Corridor
- Potential Movement Pathways
- Waterbodies
- NRE No 1 Colliery



BIOSIS RESEARCH Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES 2500

Figure 5 - Green and Golden Bell Frog habitat corridors and movement pathways.

Date: 22 September 2010	Drawn by: ANP
File number: 12294	Checked by: MWR
Location:-..P:\12200s\12294\Mapping\Report Figures\12294 F5_GGBF Corridors. WOR	

Acknowledgements:
Species data from DECCW/NPWS and Biosis Research Pty Ltd
This product incorporates Data which is copyright to
the Commonwealth of Australia (c.2003-)

Source: (c) Land and Property Management Authority
Panorama Avenue Bathurst NSW 2795
www.lpma.nsw.gov.au



Scale: 1:10,000 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56



Figure 5

4.0 IMPACT ASSESSMENT

Clean water flowing into Bellambi Creek from the NRE No. 1 Colliery is currently captured via a pipeline diverting it underneath and past the current stockpiling and coal loading arrangements. NRE have proposed to remove this pipeline and replace it with an appropriately engineered and re-aligned open channel constructed on the southern side of the coal stockpile area. Construction of the open channel will involve the removal of Dam 6.

The GGBF is listed as Endangered under the TSC Act and Vulnerable under the EPBC Act.

4.1 Part 3A (EP&A Act) impact assessment

The proposal will be assessed under Part 3A of the EP&A Act. This section provides an assessment of the impacts of the proposal on the GGBF following Step 3 (and Appendix 3) of the Draft *Guidelines for Threatened Species Assessment* (DEC & DPI 2005).

The GGBF is known to occupy areas with a variety of habitat features throughout its range. However, there are important habitat components that the species requires to survive, including ephemeral water bodies, grassy areas for foraging and refuge, shelter sites, basking sites and over-wintering sites (Pyke and White 2001). The presence of exotic predatory fish *Gambusia holbrooki* is considered a crucial limiting factor affecting the long-term survival of the species (Pyke and White 2001). The species breeds in still or slow flowing water bodies with some aquatic emergent vegetation, such as *Typha* spp. (bull-rushes) or *Eleocharis* spp.

The GGBF was assessed to have a high likelihood of occurrence in the Study Area, on the basis of the proximity of previous records and the presence of suitable habitat features.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The GGBF spends much of its time amongst emergent aquatic (esp. *Typha* spp.) or riparian vegetation, but also uses and disperses into other areas including fallen timber adjacent to breeding habitat and other vegetation such as grassland, cropland and modified pastures. In addition, GGBF are known to move considerable distances and have been found several kilometres from the nearest breeding habitat (Pyke and White 2001).

The Subject Site and Study Area supports breeding habitat for the GGBF. One previous record of the GGBF occurs in the Study Area at the Pit Top Dam, approximately 650 metres to the west of the Subject Site (collected in 1997). Other proximate records of this species occur in the wider locality including a cluster of records located approximately 1.5 kilometres to the north of the Study Area (Figure 6). In 2004 over 100 individual GGBF were released into six constructed ponds at this location. Recent surveys have indicated that the abundance of individuals within this population are decreasing (Gary Leonard, personal communication, 2010), which may due to mortality or the dispersal of individuals to suitable areas in the locality.



BIOSIS RESEARCH Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES 2500

Figure 6 - Location of previous Green and Golden Bell Frogs and potential habitat in the Study Area.

Date: 20 September 2010

File number: 12294

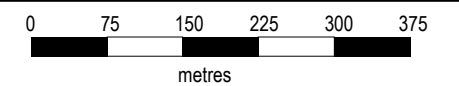
Location:-..P:\12200s\12294\Mapping\Report Figures\12294 F6_Previous GGBF Records. WOR

Drawn by: ANP

Checked by: MWR

Acknowledgements:
Species data from DECCW/NPWS and Biosis Research Pty Ltd
This product incorporates Data which is copyright to
the Commonwealth of Australia (c.2003-)

Source: (c) Land and Property Management Authority
Panorama Avenue Bathurst NSW 2795
www.lpma.nsw.gov.au



Scale: 1:7,500 at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56



Figure 6

Dam 6 provides foraging, breeding and sheltering habitat for the GGBF. The Study Area contains movement corridors (between breeding and sheltering locations), which encompasses Dam 6 (Figure 5). The proposal would remove up to 0.19 ha of breeding, foraging and sheltering habitat and may disrupt the movement of this species between suitable areas of habitat. The removal of habitat from Dam 6 represents 17.0% of similar habitat available in the Study Area and 0.98% available in the locality.

As a component of this assessment, targeted surveys were undertaken for the GGBF at Dam 6 in May and September 2010. No GGBF were recorded. Conditions during these surveys were not ideal for the detection of the species, despite the September survey occurring in the recommended time frame between August and February (*Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna (Amphibians)* (DECC 2009)). Thus, a precautionary approach has been taken and the GGBF is assumed to utilise Dam 6. It is recommended that further surveys be undertaken at Dam 6. The most suitable time to survey for the GGBF is between January and February when this species is known to breed, and preferably after rain (DECC 2009). However, Illawarra populations of the GGBF are known to breed later in this period and into March (Gary Leonard, personal communication, 2010). As such, all attempts should be made to undertake further studies at this time.

In order to mitigate the impacts of removing potential habitat of the GGBF from the Subject Site, translocation of the species (if detected) has been proposed to Dam 5 (Figure 3). Dam 5 occurs approximately 30 metres from Dam 6, but does not contain preferred habitat such as emergent aquatic vegetation, basking areas and sheltering habitat. As such, the enhancement of Dam 5 is required before the implementation of the proposal, in consultation with the DECCW, to a level considered satisfactory to provide ongoing habitat for this species in the Study Area. If the species is detected during subsequent surveys of the site, a translocation plan will also need to be developed and proposed to DECCW. The translocation plan is conditional upon detecting the species at the optimum time period. If the species is not detected at this time, recommendations regarding the formulation of these plans will need to be re-evaluated.

Given the commissioning of further GGBF surveys on the Subject Site during the optimum time period, the enhancement of Dam 5 as an offset for the removal of Dam 6, and the availability of other areas of potential habitat within the Study Area, it is considered unlikely that the proposal would have a major impact on the life cycle of the GGBF.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The GGBF inhabits marshes, dams and streams sides, particularly those containing bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Optimum habitat for this species includes water bodies that are unshaded, free of predatory fish (e.g. Plague Minnow) and that also contain nearby sheltering and basking sites. The species is typically active by day and breeds in summer when conditions are warm and wet. Females produce a raft of eggs that initially float before settling to the bottom amongst aquatic vegetation (Pyke and White 2001).

The proposal would remove 0.19 ha of potential breeding, foraging and sheltering habitat for the GGBF. This represents approximately 17.0% of potential habitat in the Study Area and 0.98% in the locality.

Vegetation community forming habitat	Proposed to be removed (ha)	% Study Area	% Locality
Artificial wetland	0.19	17.0	0.98
Total vegetation (ha)	0.9	1.1	19.2

The wetland habitat present on the Subject Site is likely to be used by the GGBF as a movement corridor to other potential breeding habitats present in the Study Area (Figure 5) and is therefore important for the long-term survival of the species in the locality. The proposed enhancement of Dam 5, located 30 metres from the Subject Site, would help mitigate impacts of the proposal on habitat connectivity for this species.

Given the implementation of further GGBF surveys at the optimum time, translocation plans being developed for Dam 5 if the species is detected, and the availability of other suitable habitats in the Study Area, it is considered unlikely that the proposal would have a major impact on the habitat of the GGBF.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The GGBF mainly occurs in coastal lowland areas of eastern New South Wales and Victoria. The northern most population occurs near Grafton on the New South Wales north coast, whilst the southern most population exists near Lakes Entrance, in south-eastern Victoria (Department of Environment and Conservation NSW 2005).

The extent of occurrence of the GGBF is estimated to be approximately 150,000 km² (Department of Environment and Conservation NSW 2005). However, this species occurs as widely disjunct sub-populations across its range and the loss of any of these populations is likely to increase population fragmentation and widen existing disjunction (Department of Environment and Conservation NSW 2005).

The Illawarra populations have been referred to as ‘Key Populations’ in the Draft Recovery Plan that has been prepared for the GGBF (Department of Environment and Conservation NSW 2005) and specific reference is made to the population located to the north of the Study Area (Boral Brick pit, Woonona). Consequently, it is entirely appropriate to consider the potential population occurring in the Study Area to be a component of this ‘Key Population’ and as such, be within the limit of the known distribution of the GGBF species at a regional level.

How is the proposal likely to affect current disturbance regimes?

The Study Area has been subjected to long-term and ongoing disturbances associated with mining activities, road construction, golf courses and the development of semi-industrial and residential areas. The proposal is likely to increase the level of disturbance within the Study Area, although this is likely to be temporary, and will be mitigated appropriately through the enhancement of Dam 5 and the preservation of other habitats identified in the Study Area (Section 3.3).

How is the proposal likely to affect habitat connectivity?

The removal of Dam 6 would disconnect important habitat corridors utilised by this species and potentially nullify access and egress between the eastern and western parts of the Study Area. As such, removing Dam 6 from the Study Area, and the construction of an open channel creates a barrier to the movement of the GGBF in the Study Area. Barriers in the Study Area already occur in the form of the golf course, mining infrastructure and the stockpiling area.

In order to mitigate the impacts of corridor fragmentation, the enhancement of Dam 5 (immediately adjacent to the Subject Site) is proposed to occur before the decommissioning of Dam 6. It is recommended that further targeted surveys be undertaken to assess the status of the GGBF in the wider Study Area, to confirm the presence of the species in the region, and how it utilises and moves between available habitats in the landscape (e.g. breeding, overwintering sites etc.). Particular attention should be given to the 'Key Population' (refer to the Draft Recovery Plan prepared for the GGBF) identified to the north of the Study Area, as well as an investigation into the status of the individuals that were released into the Edgewood property in 2004 (Gary Leonard, personal communication, 2010). Collectively, this information would inform the future directions undertaken in the Study Area and ensure the preservation of the GGBF in the locality.

Therefore, given an assessment of the status of the species and an examination of how it utilises the available habitats in the Study Area, the appropriate enhancement of Dam 5, further targeted surveys of the GGBF in the optimum time period, and the preservation of existing habitats surrounding the Subject Site, the proposal is considered unlikely to affect habitat connectivity for the GGBF.

How is the proposal likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for the GGBF.

Conclusion

Based on the above assessment the proposal is considered **unlikely** to have a major impact on the GGBF. This assessment is conditional on the following aspects of the proposal being undertaken:

- Further targeted GGBF surveys in the optimum time period (early March for the Illawarra populations);
- Assessments of the other available habitats utilised by this species in the Study Area;
- Assessments of populations known to occur in the locality, which could provide reference information for the future directions undertaken on the Subject Site;
- The preparation of enhancement plans for Dam 5 to ensure that the removal of habitats on the Subject Site are appropriately mitigated; and,
- The preparation of translocation plans, if the species is detected on the Subject Site in future surveys, to re-locate tadpoles and adults to Dam 5 or other appropriate areas in the locality.

4.2 Significant impact assessment under the EPBC Act

The Draft Recovery Plan for the GGBF (Department of Environment and Conservation NSW 2005) refers to four Key Populations, one of which occurs in the vicinity of the Study Area. Thus, the Study Area is considered to contain an ‘*important population*’ of the Green and Golden Bell Frog because:

- i. it is likely to be a key source population either for breeding or dispersal;
- ii. it is likely to be necessary for maintaining genetic diversity; and/or,
- iii. the Study Area is at or near the limit of the species range at a regional level.

An action has, will have, or is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of the species

The wider Study Area supports potential breeding habitat for the GGBF and a previous record occurs west of the Subject Site at the Pit Top Dam (collected in 1997). The artificial wetland present on the Subject Site also represents potential foraging and breeding habitat and is connected to (and forms a potential movement corridor with) other breeding, foraging and sheltering habitat available in the Study Area.

The ‘Key Population’ referred to in the Draft Recovery Plan for the GGBF is located to the north of the Study Area and was believed to be still extant in 2007. In addition, several 100’s

of individuals were released near this area (Edgewood property) in 2004. Given the movement patterns of this species (up to several kilometres) between breeding habitats (Pyke and White 2001), it is entirely appropriate to consider that this population utilises habitats available on the Subject Site and other parts of the Study Area.

The proposal includes the removal of Dam 6 on the Subject Site, which would result in the removal of breeding, foraging and sheltering habitat for the GGBF, and the construction of an open channel, which may disrupt the movement of this species within the Study Area. Mitigation of this impact includes the proposed enhancement of Dam 5 (which currently contains no habitat for the GGBF), located approximately 30 metres from the Subject Site. Given that the mitigation measures are implemented, and other identified corridors within the Study Area (Figure 5) are not compromised, it is unlikely that the proposal would lead to a long-term decrease in the size of the population.

Reduce the area of occupancy of an important population

The status of the population in the Study Area is currently unknown. Further targeted surveys spanning the Subject Site, Study Area and immediate parts of the locality are required at the optimum time period (i.e. early March) to ascertain the area of occupancy of the population. This should comprise targeted surveys at each of the potential habitats identified in this report, concurrently with surveys of known 'reference' populations to the north of the Study Area.

The removal of Dam 6 is proposed to be offset by the enhancement of Dam 5, located approximately 30 metres from the Subject Site. Therefore, following the collection of the information above and with the implementation of appropriate mitigation measures, it is unlikely that the proposal would reduce the area of occupancy of the population.

Fragment an existing important population into two or more populations.

The GGBF is a highly mobile species, capable of moving several kilometres between breeding sites. There are some accounts of the GGBF moving between five and 10 kilometres to breeding sites (Department of Environment and Conservation NSW 2005).

The proposal includes the removal of Dam 6 and the construction of an open channel. The removal of Dam 6 is proposed to be mitigated by the enhancement of Dam 5, whilst the open channel may create a potential barrier to movement for this species. Other barriers in the Study Area include the golf course, coal stockpiling area and residential areas to the east of the Subject Site. To mitigate the impacts associated with the barriers created by the open channel, GGBF crossing structures are recommended to permit the movement of the species within the Study Area.

Further targeted studies are required of the Subject Site, and other suitable habitats in the Study Area, to ascertain the movement corridors utilised by the GGBF. Given the ranging patterns of the species, which may span between the Subject Site and the area occupied by the species to the north of the Study Area, these surveys need to be carried out at a regional scale. Therefore, provided the mitigation measures are implemented and the regional scale surveys of

this species are undertaken to inform future directions, the proposal is considered unlikely to fragment an existing population into two or more populations.

Adversely affect habitat critical to the survival of a species

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations and ecological communities. In relation to a threatened species, 'critical habitats' refer to areas that are necessary for activities such as foraging, breeding, roosting, or dispersal and to maintain genetic diversity and long-term evolutionary development (DEWHA 2009). The habitat elements provided by Dam 6 are considered critical to the survival of the GGBF.

In order to mitigate the impacts of removing Dam 6, Dam 5 is proposed to be enhanced as a replacement habitat. Therefore, it is unlikely that the proposal would adversely affect habitat critical to the survival of the GGBF because it would be replaced following the implementation of mitigation measures.

Disrupt the breeding cycle of an important population

The GGBF breeds in any still or slow flowing water bodies with some aquatic emergent vegetation. If the species is detected in further surveys, a translocation plan would be developed (in consultation with the DECCW). This plan would indicate the most appropriate timing of the translocation to ensure that the breeding cycle of the species is not disrupted. Therefore, the proposal is not considered to disrupt the breeding cycle of the GGBF.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal would involve the removal of GGBF habitat from Dam 6 and its replacement at Dam 5 following the development of an enhancement and translocation plan. The enhancement of Dam 5 would occur to a level conducive of it providing breeding, foraging and sheltering habitat for the GGBF. Thus, the proposal is unlikely to decrease the availability or quality of habitat for the GGBF.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat

The presence of the exotic predatory fish, Plague Minnow *Gambusia holbrooki* is considered a factor affecting the long-term survival of the GGBF (Pyke and White 2001). The proposal is considered unlikely to increase the abundance of this species in the Study Area.

Introduce disease that may cause the species to decline, or

Infection by amphibian chytridiomycosis disease is a serious threat to the GGBF. To avoid introducing this disease into areas within the Study Area, all works related to the proposal

nearby or within watercourses of the Study Area should adhere to the guidelines developed by the NPWS, *Hygiene Protocol for the Control of Disease in Frogs* (NPWS 2001).

Interfere substantially with the recovery of the species.

A draft recovery plan has been prepared for the GGBF (Department of Environment and Conservation NSW 2005). The main objectives of the plan are:

- Manage threats impacting on currently known populations so as to stabilise and prevent further decline; and,
- Return the species to its former distribution, abundance and role in the ecosystem wherever possible.

Five specific objectives that aim to achieve the overall recovery objectives above are:

- Increase the security of key GGBF populations by preventing the further loss of habitat of key populations and where possible secure opportunities for increasing protection of habitat areas;
- Ensure extant populations are managed to eliminate threats;
- Implement habitat management initiatives;
- Establish captive populations; and,
- Increase the level of awareness of the conservation status of the GGBF and provide greater opportunity for community involvement in the implementation of the recovery plan.

The proposal will be undertaken in accordance with the guidelines set out in the recovery plan for this species through the implementation of mitigation measures including; the replacement of habitat and further targeted studies of the GGBF in the Study Area and wider locality. This will ensure that the proposal would not interfere with the recovery of the species.

Based on the above assessment, the GGBF is **unlikely** to be significantly impacted by the proposal which is conditional upon the implementation of mitigation measures. However, using the precautionary approach NRE will be submitting a Referral under the provisions of the EPBC Act to ensure that all aspects as appropriate are assessed in respect of the GGBF.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This report provides the results of further targeted GGBF surveys conducted at Dam 6 located within the NRE No.1 Colliery, Russell Vale site. Dam 6 was found to provide good quality habitat for GGBF due to the presence of healthy stands of Cumbungi, lack of any predatory fish and the availability of other key fauna habitat elements required by the species for breeding, foraging and sheltering (NPWS 1999; White and Pyke 1996).

GGBF was not recorded during field surveys at Dam 6. Four other species of amphibians, including Eastern Common Froglet, Emerald Spotted Tree Frog, Striped March Frog and Southern Brown Tree Frog were recorded. Tadpoles of the Southern Brown Tree Frog and one unidentified species were also recorded during field surveys. Frog species, such as the Dwarf Tree Frog (*Litoria fallax*) previously recorded at the site during the May 2010 surveys, was not recorded. However, higher levels of frog activity were noted.

The proposal includes the removal of Dam 6 and the construction of an open channel to manage surface water flow at the NRE No. 1 Colliery Russell Vale site. This would involve the removal of potential GGBF breeding, foraging and sheltering habitat from Dam 6 and the replacement of habitat at Dam 5. Accordingly impact assessments were conducted following the Draft *Guidelines for Threatened Species Assessment* (DEC & DPI 2005) for Part 3A projects, and EPBC *Significant Impact Criteria* for vulnerable species was also undertaken.

These assessments concluded that the proposal would be unlikely to have a significant impact on the GGBF. The nature of this assessment was conditional on the following aspects of the proposal being undertaken:

- The enhancement of Dam 5 (currently containing no suitable GGBF habitat elements) should be conducted using careful planning and in consultation with the DECCW and WCC. This will ensure that the decommissioning of Dam 6 and the subsequent removal of breeding, sheltering and foraging habitat from this location is appropriately mitigated;
- Further targeted surveys should be conducted using the same techniques described in this report in early March (and preferably after rain) across the NRE Colliery (particularly the potential habitats identified in this report) to accurately determine the presence of the species and to determine the extent of their utilisation (e.g. breeding, foraging, over-winter sites) of the Study Area before the proposal might modify these environments;
- Targeted surveys should be recommended to adjacent landholders located to the north of the Study Area to ascertain the extent and movement of the species at a regional scale. These surveys should comprise the population of GGBF located on the Edgewood property. Individuals in this population have been subject to regular assessments and any contemporary information gathered on their extent and

movements may be used for comparative purposes and importantly, as they may also utilise parts of the Study Area; and,

- A translocation plan should be developed in consultation with the DECCW for individual GGBF (if detected) from Dam 6 to Dam 5 to ensure minimal disruption to the species.

Habitat assessments of other potential GGBF habitats in the Study Area were also conducted during these surveys to guide the future operations of NRE. These assessments concluded that a majority of water bodies occurring in the Study Area provide moderate to good quality GGBF habitat and may form components of movement corridors utilised by this species to access breeding and sheltering locations. In addition, preliminary surveys were also carried out at the Pit Top Dam (location of previous record of GGBF in 1997) and an unconfirmed record of the GGBF was made. As such, in conjunction with the recommendations made in relation to the proposal, the following are suggested to inform future operations of NRE:

- Targeted surveys of the identified potential habitat sites should be conducted particularly in areas such as the Rixson's Pass Dam and the Stormwater Control Dam Wetland, which were assessed as good quality GGBF habitat;
- The threats to the survival of GGBF across the Study Area should be assessed. This may include water quality testing at various sites to help ascertain potential limiting factors affecting the colonisation of habitats identified in the Study Area; and,
- Subsequent surveys by boat at the Pit Top Dam should be conducted to permit closer observations of the areas identified to contain potential GGBF (i.e. where the unconfirmed record was taken).

Finally, a plan of management following the guidelines outlined in the Draft Recovery Plan for the GGBF (Department of Environment and Conservation NSW 2005) should be developed to identify and outline the long term goals and objectives for the conservation of the species within the Study Area and broader locality. This will be imperative as the GGBF is currently rare in the Illawarra region and any location where it occurs is of critical conservation significance.

6.0 REFERENCES

- DEC (2005). Green and Golden Bell Frog: Threatened Species Profile, <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10483>, Department of Environment and Conservation
- DEC & DPI (2005) 'Draft Guidelines for Threatened Species Assessment - Part 3A of the Environmental Planning and Assessment Act 1979.' NSW Department of Environment and Conservation and Department of Primary Industries.
- DECC (2009) 'Threatened species survey and assessment guidelines: Field survey methods for fauna - Amphibians.' Department of Environment and Climate Change NSW.
- Department of Environment and Conservation NSW (2005) 'Green and Golden Bell Frog *Litoria aurea* (Lesson 1829) Recovery Plan, Draft.' DEC NSW, Hurstville, NSW.
- DEWHA (2009) 'Matters of National Environmental Significance: Significant Impact Guidelines 1.1.' Commonwealth of Australia, Canberra.
- NPWS (1999). Green and Golden Bell Frog: Threatened Species Information, http://www.nationalparks.nsw.gov.au/PDFs/tsprofile_green_golden_bell_frog.pdf, National Parks and Wildlife Service
- NPWS (2001) 'Hygiene protocol for the control of disease in frogs.' NSW National Parks and Wildlife Service, Hurstville.
- NPWS (2002) 'Native Vegetation of the Illawarra Escarpment and Coastal Plain.' NPWS, Hurstville.
- NSW Government (2009). BioNet, <http://www.bionet.nsw.gov.au/Area.cfm>, NSW Government
- Pyke GH and White A (2001) A review of the biology of the Green and Golden Bell Frog *Litoria aurea* (Anura: Hylidae). *Australian Zoologist* 31(4), 563-598.
- White AW and Pyke GH (1996) Distribution and conservation status of the Green and Golden Bell Frog *Litoria aurea* in New South Wales. *Australian Zoologist* 30, 177-189.