Green and Golden Bell Frog Monitoring, Arncliffe Enhancement Area, 2019-2020

Prepared by AMBS Ecology & Heritage Pty Ltd
for CPB Dragados Samsung Joint Venture

Draft Report

AMBS Reference: 17498

AMBS Ecology & Heritage
www.ambs.com.au contact@ambs.com.au 02 9518 4489

Document Information

Citation:	AMBS Ecology & Heritage 2020, *Green and Golden Bell Frog Monitoring, Arncliffe Enhancement Area, 2019-2020*. Consultancy report to CPB Dragados Samsung Joint Venture.
AMBS Reference:	17498
Versions:	Version 1: Draft Report issued 20 July 2020
Recipient:	Howard Chemney and Craig Gibson
Authors:	Christopher Jackson and Glenn Muir
Approved by:	Glenn Muir

Contents

1 Introduction 1
2 Methods 3
2.1 Tadpole Monitoring (Enhancement Area only) 3
2.2 Frog Monitoring (Enhancement Area) 3
2.3 Frog Monitoring (underpass) 3
2.4 Water Quality Sampling (Enhancement Area only) 3
2.5 Maintenance Check 3
3 Results 4
3.1 Tadpole Monitoring 4
3.2 Frog Monitoring (Enhancement Area) 4
3.3 Frog Monitoring (underpass) 5
3.4 Water Quality Sampling (Enhancement Area) 5
3.5 Maintenance Check (Enhancement Area) 5
4 Discussion 6
5 References 6
Appendix 1: Tadpole Survey Data 7
Appendix 2: Frog Survey Data 9
Appendix 3: Water Quality Data 10

Figures

Figure 1: Location of Enhancement Area 2
Figure 2: Photograph of GGBF at Enhancement Area Pond 3. 4

1 Introduction

AMBS Ecology & Heritage Pty Ltd (AMBS) was commissioned by the CPB Contractors Dragados Samsung Joint Venture (CDS) to undertake monitoring of the Green and Golden Bell Frog (*Litoria aurea*) (GGBF) in an area known as the "Enhancement Area" at Arncliffe. The Enhancement Area is located between the south-western boundary of the Kogarah Golf Course and the construction compound for the New M5 (the "Arncliffe Construction Compound") (Figure 1). It is situated between a known GGBF habitat area (the "RTA ponds") and intact parts of the Golf Course to the south-east (Figure 1).

The Enhancement Area incorporates six small ponds located near a drainage line that runs along the southern boundary of the Golf Course (Figure 1). Five of the ponds (Ponds 1 to 5) were constructed by CDS, with the permission of the Kogarah Golf Club. The sixth pond (Pond 6) is a small depression that fills with water occasionally after rainfall. This depression was present prior to the establishment of the Arncliffe construction compound (J. Brown, pers. com.).

GGBFs have previously been recorded in the RTA ponds and, on occasion, at a number of other sites in the vicinity, including some of the waterbodies on the Golf Course and some more ephemeral waterbodies south of the M5 (within a broad area between the Cooks River, Muddy Creek, Eve Street and West Botany Street, which is referred to herein as Barton Park). GGBFs are also currently being re-introduced to a site known as the "New M5 Habitat Area", also located to the south of the M5, as part of a captive breeding program funded by NSW Roads and Maritime Services (RMS).

An underpass beneath the M5, between the Golf Course and Barton Park, is located near Pond 4 in the Enhancement Area. This underpass was built during the construction of the M5 in the early 2000's and contains a cycle path and a fenced-off containment pond. Monitoring of the underpass was also undertaken by AMBS as part of the scope of work provided to CDS.

Monitoring of the RTA ponds, Kogarah Golf Course, Barton Park and the New M5 Habitat Area were undertaken as a separate commission for RMS.

Figure 1: Location of Enhancement Area

2 Methods

2.1 Tadpole Monitoring (Enhancement Area only)

Monitoring of tadpoles was undertaken in the Enhancement Area monthly, between September 2019 and May 2020 (the seasons during which GGBFs are most likely to breed). Techniques included visual observation and net sweeps. Surveys were undertaken diurnally. Visual observation involved watching each of the small ponds for signs of tadpole activity, prior to undertaking net sweeps. Net sweeps involved use of a long-handled net to sample the water body for tadpoles. Due to the small size of the ponds in the Enhancement Area, three net sweeps per pond were sufficient. Tadpoles observed or captured were identified, stage of development recorded, and counted (or an estimate of numbers made, if many tadpoles were encountered).

2.2 Frog Monitoring (Enhancement Area)

Conditions for frog activity at the end of 2019 were extremely poor due to an extended period of dry, hot weather from mid-October onwards. Monitoring of frogs in the Enhancement Area was only undertaken on one occasion between September and December 2019 (on a relatively warm night in mid-October, after cold weather in September). Conditions changed considerably in early 2020, with two periods of heavy rainfall recorded; approximately 55 mm fell over 2 days on 17 and 18 January 2020 and approximately 390 mm fell over 4 days from 7 to 10 February 2020 (recorded at Observatory Hill by the Bureau of Meteorology). Frog surveys were undertaken on four occasions between January and May 2020; the first on 20 January 2020 (immediately after the first heavy rainfall event) and the last on 27 May 2020.

Techniques included call detection, call-playback and spotlighting. Surveys were undertaken nocturnally. Each small pond was surveyed for a 7-minute period, which involved 3 minutes of listening for calling frogs, 30 seconds of call-playback, 30 seconds of listening, 30 seconds of call-playback, 30 seconds of listening and 2 minutes of spotlighting (in that order). Spotlighting of the area between each pond was also undertaken, whilst walking between the ponds. Any frogs heard or seen were identified and counted. Any GGBFs observed were captured if possible, then measured, weighed and tagged (if large enough to tag), then released at the point of capture.

2.3 Frog Monitoring (underpass)

Monitoring of frogs at the M5 underpass involved two ecologists spotlighting in the underpass and around the entrances to the underpass on both sides, for 10 minutes (i.e. 20 person-minutes). Surveys were undertaken nocturnally, generally on one of the same nights as frog monitoring was undertaken in one of the other areas. Any frogs observed or heard calling were identified and counted. Any GGBFs observed were captured if possible, then measured, weighed and tagged (if large enough to tag), then released at the point of capture.

2.4 Water Quality Sampling (Enhancement Area only)

Sampling of several water quality parameters was undertaken in each of the Enhancement Area ponds monthly between September 2019 and May 2020, using a hand-held probe. Measurements taken included pH, salinity, temperature and dissolved oxygen (the four parameters for which survival thresholds for GGBF tadpoles have been assessed by Mahony and Beranak [undated]). Measurements of turbidity and other parameters were also taken.

2.5 Maintenance Check

A check of the ponds for maintenance or other issues was undertaken at the same time as the water quality sampling.

3 Results

3.1 Tadpole Monitoring

No GGBF tadpoles were detected in any of the Enhancement Area ponds during any of the surveys.

Striped Marsh Frog (*Limnodynastes peronii*) tadpoles were recorded during almost every survey, usually in Pond 4 (seven surveys) or Pond 5 (four surveys), and occasionally in the other ponds (Pond 2, two occasions; Pond 1, two occasions; Pond 3, once; Pond 6, once).

Data from the tadpole surveys are provided in Appendix 1.

3.2 Frog Monitoring (Enhancement Area)

Three GGBFs were detected in the Enhancement Area during the 2019-2020 monitoring; one at Pond 3 following the heavy rainfall event in February (Figure 2), one in Pond 4 in April and a second in the drainage line between Ponds 4 and 5, also in April.

Two other frog species were detected in the Enhancement Area during the 2019-2020 monitoring; the Striped Marsh Frog and the Common Eastern Froglet (*Crinia signifera*). The Striped Marsh Frog was recorded in all ponds except Pond 4 (which is where tadpoles were most frequently recorded) and the Common Eastern Froglet was recorded in Pond 5 in April and May.

Data from the frog surveys are provided in Appendix 2.

Figure 2: Photograph of GGBF at Enhancement Area Pond 3.

3.3 Frog Monitoring (underpass)

GGBFs were detected in or near the underpass twice during the 2019-2020 monitoring. Three GGBFs were observed at the end of a drainage line near the southern side of the underpass area following a rainfall event in January and a second was observed in May, within the Eve Street Wetland Reserve near the entrance to the underpass.

Other frog species recorded in or near the underpass were Striped Marsh Frogs and Peron's Tree Frogs (*Litoria peronii*). Striped Marsh Frogs were recorded in the vicinity on every survey and Peron's Tree Frogs on two of the surveys (October and April).

Data from the frog surveys are provided in Appendix 2.

3.4 Water Quality Sampling (Enhancement Area)

Pond temperatures were within the overall survivorship range indicated by Mahony and Beranak (undated) in all the Enhancement Area ponds throughout the season, with most ponds being in the higher survivorship range from November to February. Water quality was good from September to January and March to May, with salinity, dissolved oxygen and pH being in the overall survivorship or higher survivorship range in all ponds containing water and turbidity levels low during those periods.

In February, a major rainfall event caused backfilling from the Cooks River, up the drainage line next to the Enhancement Area and through to and including Pond 6. Water quality in Pond 6 was poor at that time, with elevated salinity levels and low dissolved oxygen. Dissolved oxygen was also low in some of the other ponds in February.

Water quality data are provided in Appendix 3.

3.5 Maintenance Check (Enhancement Area)

Water is supplied to the Enhancement Area ponds by Kogarah Golf Club (CDS 2017) (except for Pond 6). Similarly, the area around the ponds is maintained as a low grassland, via regular mowing as part of Kogarah Golf Club's overall grounds maintenance (CDS 2017) (except for Pond 6). Overall, water was kept supplied to most of the ponds throughout the season, with the exception of some periods in December (at the height of the drought) and April, although some ponds were dry or had low water levels at other times. At times, the grassland around the ponds was cut too short. Weeds have established to varying extents in most of the ponds.

4 Discussion

Monitoring of the underpass area over the 2019-2020 activity season recorded a small number of GGBFs on two occasions: the first at the end of a drainage line on the southern side of the M5, shortly after a rainfall event in January, which was the first heavy rainfall that had occurred for months; the second being an individual that was recorded in the Eve Street Wetland Reserve near the entrance to the underpass in May.

Similarly, monitoring of the Enhancement Area recorded a small number of GGBFs utilising the area on occasion, all of which were detected in the months following an extreme rainfall event in February. All the GGBFs recorded in the Enhancement Area were found in or near Ponds 3 and 4, which are the closest ponds to the underpass. The GGBF recorded at Pond 3 in February is the first GGBF recorded on Kogarah Golf Course since 2016.

In general, water was maintained to most of the ponds in the Enhancement Area throughout most of the season by Kogarah Golf Club and the area around the ponds was maintained as a low grassland (except for Pond 6, which is a 'natural' depression surrounded by dense Kikuyu). At times, the grass around the ponds was mown too short; however, this is expected to be rectified by the Club over the next (2020-2021) GGBF activity season. Weeds and/or dense aquatic vegetation became established in most of the ponds over the course of the season and it is recommended that some hand weeding is undertaken (N.B. it is AMBS' understanding that management of weeds in the ponds is not part of the responsibilities assumed by the Golf Club).

5 References

CDS (2017). GGBF Habitat Enhancement Area, Maintenance and Management Principles, dated 1 September 2017.

Mahony, M. and Beranak C (undated). *Water Quality parameters measured to assess suitability for Green and Golden Bell Frog occupancy*. Unpublished report provided to NSW Roads and Maritime Services.

Appendix 1: Tadpole Survey Data

Pond	Date	*Litoria aurea*		*Litoria peronii*		*Limnodynastes peronii*		*Crinia signifera*		Other	
		Total	Stage(s)	Total	Stage(s)	Total	Stage(s)	Total	Stage(s)	Total	Stage(s)
1	25 Sep 2019	-	-	-	-	-	-	-	-	-	-
2	25 Sep 2019	-	-	-	-	17	B	-	-	-	-
3	25 Sep 2019	-	-	-	-	-	-	-	-	-	-
4	25 Sep 2019	-	-	-	-	25, 1	B, C	-	-	-	-
5	25 Sep 2019	-	-	-	-	-	-	-	-	-	-
6	25 Sep 2019	-	-	-	-	-	-	-	-	-	-
1	31 Oct 2019	-	-	-	-	-	-	-	-	-	-
2	31 Oct 2019	-	-	-	-	-	-	-	-	-	-
3	31 Oct 2019	-	-	-	-	-	-	-	-	-	-
4	31 Oct 2019	-	-	-	-	3, 7, 2	B, C, D	-	-	-	-
5	31 Oct 2019	-	-	-	-	-	-	-	-	-	-
6	31 Oct 2019	-	-	-	-	-	-	-	-	-	-
1	6 Dec 2019	-	-	-	-	-	-	-	-	-	-
2	6 Dec 2019	-	-	-	-	-	-	-	-	-	-
3	6 Dec 2019	-	-	-	-	-	-	-	-	-	-
4	6 Dec 2019	-	-	-	-	-	-	-	-	-	-
5	6 Dec 2019	-	-	-	-	50+	B	-	-	-	-
6	6 Dec 2019	-	-	-	-	-	-	-	-	-	-
1	20 Dec 2019	-	-	-	-	-	-	-	-	-	-
2	20 Dec 2019	-	-	-	-	-	-	-	-	-	-
3	20 Dec 2019	-	-	-	-	-	-	-	-	-	-
4	20 Dec 2019	-	-	-	-	-	-	-	-	-	-
5	20 Dec 2019	-	-	-	-	-	-	-	-	-	-
6	20 Dec 2019	-	-	-	-	-	-	-	-	-	-
1	5 Feb 2020	-	-	-	-	-	-	-	-	-	-
2	5 Feb 2020	-	-	-	-	-	-	-	-	-	-
3	5 Feb 2020	-	-	-	-	-	-	-	-	-	-
4	5 Feb 2020	-	-	-	-	8	B	-	-	-	-
5	5 Feb 2020	-	-	-	-	-	-	-	-	-	-
6	5 Feb 2020	-	-	-	-	-	-	-	-	-	-
1	25 Feb 2020	-	-	-	-	20+, 10+	B, C	-	-	-	-
2	25 Feb 2020	-	-	-	-	-	-	-	-	-	-
3	25 Feb 2020	-	-	-	-	-	-	-	-	-	-
4	25 Feb 2020	-	-	-	-	10+	C	-	-	-	-
5	25 Feb 2020	-	-	-	-	-	-	-	-	-	-
6	25 Feb 2020	-	-	-	-	-	-	-	-	-	-
1	9 Apr 2020	-	-	-	-	-	-	-	-	-	-
2	9 Apr 2020	-	-	-	-	-	-	-	-	-	-
3	9 Apr 2020	-	-	-	-	-	-	-	-	-	-
4	9 Apr 2020	-	-	-	-	2, 4, 1	A, B, C	-	-	-	-
5	9 Apr 2020	-	-	-	-	1	C	-	-	-	-
6	9 Apr 2020	-	-	-	-	1	B	-	-	-	-

Pond	Date	*Litoria aurea*		*Litoria peronii*		*Limnodynastes peronii*		*Crinia signifera*		Other	
		Total	Stage(s)	Total	Stage(s)	Total	Stage(s)	Total	Stage(s)	Total	Stage(s)
1	29 Apr 2020	-	-	-	-	-	-	-	-	-	-
2	29 Apr 2020	-	-	-	-	-	-	-	-	-	-
3	29 Apr 2020	-	-	-	-	-	-	-	-	-	-
4	29 Apr 2020	-	-	-	-	6	B	-	-	-	-
5	29 Apr 2020	-	-	-	-	9	B	-	-	-	-
6	29 Apr 2020	-	-	-	-	-	-	-	-	-	-
1	27 May 2020	-	-	-	-	37	B	-	-	-	-
2	27 May 2020	-	-	-	-	50+	B	-	-	-	-
3	27 May 2020	-	-	-	-	7	B	-	-	-	-
4	27 May 2020	-	-	-	-	2	B	-	-	-	-
5	27 May 2020	-	-	-	-	8	B	-	-	-	-
6	27 May 2020	-	-	-	-	-	-	-	-	-	-

Appendix 2: Frog Survey Data

Location	Pond	Date	Species (captured/observed/heard)	Number
Eastern Frog Corridor	N/A	15 Oct 2019	*Limnodynastes peronii* (Ob or Hd) *Litoria peronii* (Ob)	4 3
Enhancement Area	1	15 Oct 2019		
	2	15 Oct 2019	*Limnodynastes peronii* (Hd)	8
	3	15 Oct 2019	*Limnodynastes peronii* (Ob)	1
	4	15 Oct 2019		
	5	15 Oct 2019		
	6	15 Oct 2019		
Eastern Frog Corridor	N/A	20 Jan 2020	*Litoria aurea* (Ob) *Limnodynastes peronii* (Ob)	3 8
Enhancement Area	1	20 Jan 2020		
	2	20 Jan 2020		
	3	20 Jan 2020	*Limnodynastes peronii* (Ob)	1
	4	20 Jan 2020		
	5	20 Jan 2020	*Limnodynastes peronii* (Ob)	2
	6	20 Jan 2020		
Eastern Frog Corridor	N/A	20 Feb 2020	*Limnodynastes peronii* (Ob)	3
Enhancement Area	1	20 Feb 2020	Limnodynastes peronii (Hd)	2
	2	20 Feb 2020		
	3	20 Feb 2020	*Litoria aurea* (Ob)	1
	4	20 Feb 2020		
	5	20 Feb 2020	*Limnodynastes peronii* (Hd)	2
	6	20 Feb 2020	*Limnodynastes peronii* (Ob and Hd)	6
Eastern Frog Corridor	N/A	4 Apr 2020	*Litoria peronii* (Ob) *Limnodynastes peronii* (Ob)	1 1
Enhancement Area	1	4 Apr 2020		
	2	4 Apr 2020	*Limnodynastes peronii* (Ob and Hd)	4
	3	4 Apr 2020		
	4	4 Apr 2020	*Litoria aurea* (Capt)	1
	N/A	4 Apr 2020	*Litoria aurea* (Ob) on other side of drainage line between Ponds 4 and 5	1
	5	4 Apr 2020	*Limnodynastes peronii* (Ob and Hd) *Limnodynastes peronii* (Hd) *Crinia signifera* (Hd)	6 3 2
	6	4 Apr 2020	*Limnodynastes peronii* (Obs and Hd)	5
Eastern Frog Corridor	N/A	27 May 2020	*Litoria aurea* (Capt) *Limnodynastes peronii* (Ob)	1 1
Enhancement Area	1	27 May 2020		
	2	27 May 2020	*Limnodynastes peronii* (Hd)	1
	3	27 May 2020		
	4	27 May 2020		
	5	27 May 2020	*Crinia signifera* (Hd)	2
	6	27 May 2020		

Appendix 3: Water Quality Data

Date	Pond	General Condition	pH	ORP [mV]	% Sat	Diss. O2 [mg/l]	Conduct [uS/cm]	Conduct [ms/cm]	Salinity	Turbidity [NTU]	Temp [C°]
25 Sep 2019	1	Full	7.2	291	69.1	7.1	132	106	0.1	15.5	14.4
25 Sep 2019	2	Full	6.8	120	27.5	2.9	197	149	0.1	40.1	12
25 Sep 2019	3	Full	7.1	243	59.8	5.7	215	183	0.1	5.5	17
25 Sep 2019	4	Full	6.6	225	58.1	5.8	104	77	0.04	27.6	15.5
25 Sep 2019	5	Almost dry	6.5	179	43	4.3	106	88	0.06	44.1	15.2
25 Sep 2019	6	Dry	-	-	-	-	-	-	-	-	-
31 Oct 2019	1	Full	7.9	-46	29.6	2.9	142	0.2	0.11	1.1	26.1
31 Oct 2019	2	Full	7.8	-21	33.5	3.1	166	0.2	0.13	0.3	24.7
31 Oct 2019	3	Full	7.6	-105	30.1	2.8	153	0.2	0.12	3.1	25.6
31 Oct 2019	4	Full	7.4	-166	18.6	1.8	159	0.2	0.11	12.6	31.7
31 Oct 2019	5	Almost dry	7.1	-121	26.2	3.9	315	0.3	0.19	15.6	30.1
31 Oct 2019	6	Dry	-	-	-	-	-	-	-	-	-
6 Dec 2019	1	¾ full	6.85	379	2.4	0.2	223	111	0.11	2.2	22.5
6 Dec 2019	2	½ Full	6.85	350	4.5	0.38	264	132	0.13	6.1	21.76
6 Dec 2019	3	1/3 Full	7.2	148.8	5.2	0.43	214	107	0.1	8.2	24.45
6 Dec 2019	4	Almost dry	-	-	-	-	-	-	-	-	-
6 Dec 2019	5	Full	6.45	18.2	0.3	0.02	155	76	0.007	2.5	22.2
6 Dec 2019	6	Dry	-	-	-	-	-	-	-	-	-
5 Feb 2020	1	Moderate	6.7	20.9	0	0	180	166	0.09	0	20.5
5 Feb 2020	2	Low	6.6	75.4	0.6	0.05	104	116	0.06	1.5	19.6
5 Feb 2020	3	Almost Dry	-	-	-	-	-	-	-	-	-
5 Feb 2020	4	Low	6.5	-41.8	0.2	0.01	482	445	0.23	384	20.9
5 Feb 2020	5	Almost Dry	-	-	-	-	-	-	-	-	-
5 Feb 2020	6	Dry	-	-	-	-	-	-	-	-	-
25 Feb 2020	1	1/2 full. Overgrown	6.7	19.7	-1.4	0.12	196	187	0.09	269	22.7
25 Feb 2020	2	1/2 full	6.8	51	17.9	1.44	182	189	0.08	40.2	27
25 Feb 2020	3	Almost dry	-	-	-	-	-	-	-	-	-
25 Feb 2020	4	1/2 full	6.4	53.2	5.2	0.42	144	148	0.07	15.8	26.4

Date	Pond	General Condition	pH	ORP [mV]	% Sat	Diss. O2 [mg/l]	Conduct [uS/cm]	Conduct [ms/cm]	Salinity	Turbidity [NTU]	Temp [C°]
25 Feb 2020	5	1/2 full	6.5	-28.4	0.7	0.05	317	328	0.15	30.3	26.6
25 Feb 2020	6	3/4 full	7.1	-117	1.4	0.09	1050	1074	0.52	50.3	26.1
9 Apr 2020	1	Dry	-	-	-	-	-	-	-	-	-
9 Apr 2020	2	Dry	-	-	-	-	-	-	-	-	-
9 Apr 2020	3	Dry	-	-	-	-	-	-	-	-	-
9 Apr 2020	4	Very Low	6.68	-20	-	-	171	149	0.08	717	18.04
9 Apr 2020	5	Full	6.35	19.6	-	-	233	203	0.11	47.4	18.21
9 Apr 2020	6	Overflowing	6.62	-32.7	-	-	1482	1285	0.75	25.7	17.93
29 Apr 2020	1	100%	7.6	-184	14.7	1.9	194	0.3	0.15	0.1	17.7
29 Apr 2020	2	75%	7.6	-115	21.6	1.9	190	0.3	0.13	2.4	16.1
29 Apr 2020	3	Dry	-	-	-	-	-	-	-	-	-
29 Apr 2020	4	Low	-	-	-	-	-	-	-	-	-
29 Apr 2020	5	25%	7.2	-253	25.9	2.2	275	0.4	0.2	38.8	16.4
29 Apr 2020	6	Dry	-	-	-	-	-	-	-	-	-
27 May 2020	1	100%	8	-36	36.1	3.2	137	0.3	0.12	0.2	12.3
27 May 2020	2	100%	8.1	-31	33.6	3	174	0.3	0.12	0.1	12.4
27 May 2020	3	50%	8	-33	35.8	3.1	252	0.4	0.17	9.6	13.5
27 May 2020	4	100%	7.6	-100	43.7	3.5	186	0.3	0.14	5.5	13.1
27 May 2020	5	100%	7.7	-104	44.6	3.6	180	0.3	0.15	3.9	12
27 May 2020	6	100%	7.3	-111	43.8	3.5	8000	13.9	7.96	0.8	13.7