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Green and Golden Bell Frog
*Litoria aurea* (Lesson, 1829)

**Other common names** Swamp Frog, Smooth Swamp Frog, Growling Grass Frog

**Conservation status**
The Green and Golden Bell Frog is listed as an Endangered Species on Schedule 1 of the New South Wales Threatened Species Conservation Act, 1995 (TSC Act).

**Description**
The Green and Golden Bell Frog is a relatively large frog with stout body form. Adult size ranges from approximately 45mm to approximately 100mm snout to vent length (SVL) with most individuals being in the 60-80 mm size class. Males are generally smaller than females (maximum size 70mm) and when mature, tend to have a yellowish darkening of the throat area. Males also develop nuptial pads on the inner finger and appears as a brown pigmented patch. Mature females are larger bodied (maximum size 90-100mm) (White & Pyke 1996).

The dorsal colouration is quite variable being a vivid pea green splotched with an almost metallic ‘brass’ brown or gold. The backs of some individuals may be almost entirely green whilst in others the golden brown markings may almost cover the dorsum. When the frogs are inactive colouration can darken to almost black. A glandular creamish white stripe extends from behind the eye almost to the groin. The lower margin of this dorsolateral stripe is black or dark brown, the upper margin is edged gold.

The belly is usually an immaculate granular creamish white. The lateral margins of the body are adorned with raised glandular creamish spots of irregular size. Legs are a variegated green and gold with the groin area and inside leg a brilliant electric blue. The fingers and toes have expanded terminal pads but are barely wider than the toe/finger itself. The toes are heavily webbed. The eye has a horizontally elliptical pupil and a golden yellow iris. Juveniles are similar to adults and metamorphose at 25-30mm SVL.

Tadpoles are relatively large reaching 65-80mm. They are deep bodied and possess long tails with a high fin that extends almost to mid-body. They swim actively and evade capture. As tadpoles become larger the golden dorsolateral stripe and a green tinge to the back can be observed just before limb growth commences (White 1995; R. Wellington pers. obs.).

**Distribution**
The Green and Golden Bell Frog was formerly distributed from the NSW north coast near Brunswick Heads southwards along the NSW coast to Victoria where it extends into East Gippsland (White & Pyke 1996; Gillespie 1996) west to Bathurst, Tumut and the ACT (Moore 1961; Osborne et al. 1996). There are records from the NSW tableland areas such as Armidale/Ulong, (New England Tableland) and Canberra, Cobargo and Jindabyne (Monaro Tableland).

In the 1960s the species was considered widespread, abundant and commonly encountered. They were even regularly used as dissection material for university students (Dakin 1948) and anecdotal accounts report their regular use as food by snake keepers such was their abundance (R. Wells; I. McArtney; J. Cann pers. comm.). Declines were noticed in the late 1970s and became severe in the 1980s such that today the species exists as a series of isolated coastal Green and Golden Bell Frog populations within its former known range.
In the last 5 years, surveys of known sites have failed to find any highland populations and fears are that these populations are now extinct. Many former coastal populations have also dramatically declined or disappeared altogether (White & Pyke 1996).

Current distribution consists of isolated pockets from various scattered locations throughout its former range. Most are coastal or near coastal with inland, upland and northern populations most affected. Since 1990 there have been approximately 50 locations in NSW where the species is confirmed to still exist (only 11 within conservation reserves). There are 6 populations of substantial size (numbers over 300), two are located in the metropolitan area of Sydney, two in the Shoalhaven and two on the mid north coast (one an island population) (White & Pyke 1996).

Recorded occurrences in conservation reserves

Ben Boyd NP, Botany Bay NP, Hat Head NP, Jarvis Bay NP, Kooragang Island NR, Killalea SRA, Myall Lakes NP, Nardoo NR, “Royal NP, Seven Mile Beach NP, Towra Point NR, “Tyagarah NR, Yuraygir NP (NPWS 1999). [*no longer considered present]

Habitat

The Green and Golden Bell Frog inhabits marshes, dams and stream sides, particularly those containing bullrushes Typha spp. or spikerushes Eleocharis spp. Optimum habitat includes water bodies which are unshaded, free of predatory fish Gambusia holbrooki, have a grassy area nearby and diurnal sheltering sites available such as vegetation and/or rocks (White & Pyke 1996). Some sites, particularly
in the Greater Sydney region, are in highly disturbed areas such as disused industrial sites, brick pits, landfill areas and even cleared land.

Ecology

The Green and Golden Bell Frog is frequently active by day and usually breeds in summer when conditions are warm and wet (Cogger 1992). Males call whilst floating in water and females produce a raft of eggs which initially float before settling to the bottom often amongst vegetation (Harrison 1922). Tadpoles take approximately 6 weeks to develop though this varies considerably and is dependent on temperature and other conditions (A. White pers. comm.; Pyke & White 1996). Tadpoles feed on algae and other vegetative matter adults are voracious insect eaters and will also readily eat other frogs and even juveniles of their own species. They are naturally preyed upon by various wading bird species and snakes and are also presumably fed on as larvae by tortoises, eels and other fish.

Threats

- Alteration of drainage patterns and stormwater runoff (White & Pyke 1996)
- A fungal pathogen (Berger & Speare 1998)
- Changes to water quality (Goldingay 1996)
- Predation by feral animals such as foxes and cats (Daly 1995 & 1996)
- Herbicides and other weed control measures.
- Road mortality where populations are already small due to other threats (Daly 1996)

- Predation by exotic fish particularly the Plague Minnow Gambusia holbrooki (Morgan & Buttemer 1996). Recently listed as a key threatening process under the TSC Act, 1995
- Loss of suitable breeding habitat through alteration by infilling and destruction of wetlands (Morgan & Buttemer 1996; Clancy 1996)

Management

- Development of measures to control or eradicate the introduced Plague Minnow Gambusia holbrooki
- Strategies to provide for the development or enhancement of frog habitat to improve reproductive success and recruitment at known sites.
- Protocols for the handling of frogs and educational strategies to minimise the inadvertent spread of fungal pathogens from site to site.
- Development of Environmental Impact Assessment Guidelines
- Development of site specific Plans of Management to improve conservation outcomes for targeted populations.
- Community awareness programs highlighting presence of populations and catchment management approaches to improving stormwater quality, habitat retention and management.
- Maintenance of captive bred populations for future possible re-introduction programs.

Recovery plans

A recovery plan is currently being prepared Green and Golden Bell Frog - juvenile for the Green and Golden Bell Frog. This plan will be exhibited and finalised during 2004.
References


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ENVIRONMENTAL IMPACT ASSESSMENT GUIDELINES

Green and Golden Bell Frog

*Litoria aurea* (Lesson, 1829)

Other common names: Bell Frog, Swamp Frog, Smooth Swamp Frog, Growling Grass Frog

The following information is provided to assist authors of Species Impact Statements, development and activity proponents, and determining and consent authorities, who are required to prepare or review assessments of likely impacts on threatened species pursuant to the provisions of the Environmental Planning and Assessment Act 1979.

These guidelines should be read in conjunction with the NPWS Information Circular No. 2: Threatened Species Assessment under the EP & A Act: The ‘8 Part Test’ of Significance (November 1996), the draft Green and Golden Bell Frog Recovery Plan (December 2002) and the species information profile (NPWS 1999).

Proponents, consent and determining authorities when considering development or other activity proposals must assess direct and indirect impacts on the Green and Golden Bell frog and/or its habitat. Direct impacts can include harm to individual frogs and loss/damage to breeding or other habitat components. Indirect impacts can include actions that increase or exacerbate threats (see threats section below) as a result of a development or activity.

**Survey**

The Green and Golden Bell Frog can be surveyed for using standard frog survey techniques. These should include:

- Dip-netting surveys for tadpoles (this may prove difficult and will require the use of a good identification guide [Anstis 2002] unless the surveyor has had considerable experience with tadpole identification).

Determining the adequacy of survey effort required is difficult. Factors that need to be considered in determining the amount of search effort required includes: the size of the wetland and any surrounding ancillary habitat present, its accessibility, the prevailing weather conditions, the amount of ground cover, the extent of fringing and emergent vegetation as well as the seasonal timing of the survey to be undertaken.

Experienced surveyors tend to gain a ‘feel’ for the suitability of a site even if frogs are not located on a single visit. It is likely that several visits to a site will be required to detect the species (ideally each survey separated by 2-4 weeks). Surveys must be undertaken during favourable seasonal and climatic conditions. Such surveys may need to be conducted over several activity-breeding seasons to be successful. The ideal timing of survey should be in the warmer activity period of the year usually between the months of August and March. The activity period begins later in the southern and more elevated portions of the species distribution and continues well into autumn in the north (G. Daly; M. Parsons pers. comm.). It is possible to observe the species outside the main activity period if warmer weather breaks torpor early. The species is most likely to be detected during and after heavy rainfall but this should not be taken to mean that the frogs definitely become active after a single rainfall event.

Small areas of habitat (< 0.3 Ha) should be surveyed for a minimum of one hour on three separate occasions during the species activity period. Larger areas, that may include whole wetlands and lagoon margins, are more difficult to survey and require a minimum of 3 separate four hourly searches during the species activity period.
Surveyors should be mindful that the species has a somewhat nervous disposition and will often attempt to evade detection. They are known to actively avoid torch-light and at such times will readily dive or swim off to another location.

Males mainly call between September and January however frogs will take advantage of favourable conditions outside these times and be heard calling. Eliciting a call response to tape playback can be a successful way of detecting the species and even a well rehearsed imitation call by experienced surveyors can have the same result.

Males normally call while floating in water and this can be useful in helping to confirm the identity of a calling frog (G. Pyke pers. comm.). However the call is extremely distinctive and should not be mistaken for any other species except perhaps in areas where other “Bell Frog” species may co-occur (central and southern tablelands Osborne et al. 1996; White and Pyke 1999). An absence of their call cannot be taken as an absence of the species without undertaking substantial site survey over several activity seasons.

During inactivity periods, Green and Golden Bell Frogs may also be found taking refuge under or inside objects (both natural and ‘man-made’) in the vicinity of their habitat. When searching care should be exercised not to excessively disturb or destroy these important refuge sites particularly when the frogs may be aestivating over winter (sometimes collectively) and in a state of torpor.

It is difficult to define the habitat requirements and/or preferences for this species but the various types of habitat utilised has been documented (see Pyke and White, 1996; 2001). In any case when assessing the suitability of habitat it should always be considered in the event of rainfall. A site when dry may appear unsuitable but this may change with moderate rains and so consideration should also be given to the species propensity to turn up to breed in ephemeral locations that are more often dry than wet. Quarries, brickpits, mining sites, STPs, banded or otherwise ‘retained’ areas, detention basins, drains, scrapes, depressions and farm dams along with the more natural coastal or floodplain wetland features such as swamps, ponded areas of intermittent creeklines, lagoons, billabongs and dune swales are all candidate sites for occupation by this species (White 1995; Pyke and White 1996; 2001; Hamer et al. 2002). Such sites are occupied and used mainly as breeding habitat.

Foraging habitat requirements include tall, dense, grassy vegetation and tussock forming vegetation is known to be used for foraging and shelter (A. Hamer pers. comm.; A. White pers. comm.).

Over-wintering sites are another important habitat component that requires consideration in any site assessment. Such habitat provides protection from disturbance during the cooler months of the year when individuals enter a period of quiescence/inactivity and become torpid. Such sites include the bases of dense vegetation tussocks, beneath rocks, timber, within logs or beneath ground debris including human refuse such as sheet iron etc (Pyke and White 2001; R. Wells pers. comm.; A. Hamer pers. comm.). Such sites may be adjacent to the breeding sites but may also be some distance away. The full range of possible habitat used for this purpose is not well understood and so assessments should be mindful of this information gap.

The congregation of large numbers of individuals at some breeding sites followed by a dwindling in number of observed animals during non-breeding stages suggests that individuals move off to seek other non breeding habitat where this is absent in situ. Consequently other ‘potential’ habitat attributes must be considered during any assessment of an area and not just the extent of breeding habitat. The sometimes skewed sex ratios of individuals found around breeding sites indicates there are sexual differences in the spatial and temporal use of various habitat components (M. Bannerman pers. comm.). Therefore the timing of any proposed disturbance to potential habitat may differ significantly in its direct impact on a local population of the species.

In some areas heavy urbanisation and other development has encroached on the species habitat. *Litoria aurea* is a species that has high tolerance to varying levels of certain physical and chemical factors in the environment (T. Penman pers. comm.). This ‘colonising’ capability appears to have pre-adapted the species to establish itself in the
altered habitats it often utilises. The species strong dispersal ability also means it may be able to satisfy its various habitat requirements, even when these are located some distance apart, provided suitable corridor connections are retained. Examples of this include over-wintering in household gardens and then breeding in wetlands or dams, quarries and other human constructions, considerable distances away.

**Life cycle of the species**

The general biology and ecology of *Litoria aurea* is described in the referenced literature (see Pyke and White 2001 for a review) and is summarised in the Draft Recovery Plan (NPWS 2003).

The Green and Golden Bell Frog is considered highly dependent on its breeding sites for long term survival at the various remnant population sites. The species is known to be highly fecund (5000+ eggs/spawn mass) and is therefore considered potentially capable of reproductively ‘bouncing back’ from population “bottleneck” situations provided threatening processes are removed or ameliorated.

Tadpoles develop over an approximate three month period but this can vary depending on prevailing conditions. Some ephemeral breeding locations are prone to drying out before tadpoles have reached metamorphosis. This is considered critical for some of the remnant populations and is believed to be a limiting factor at those sites where recruitment appears to be poor (P. Gray pers. comm.). At other sites tidal inundation of breeding sites can be a factor affecting breeding success (A. Henderson pers. comm.; G. Pyke pers.comm.).

Metamorphlings are highly susceptible to predation and need to forage successfully soon after transformation to improve their chances of survival during the first over-wintering period. To this end, it is important that vegetation for foraging is retained around the breeding sites as well as connecting corridors of vegetation that enable movement away from breeding sites to other areas of habitat. Metamorphlings that remain in the vicinity of breeding sites where a resident population of adults remain are often cannibalised (A. White pers. comm.).

**Threatening processes**

Key Threatening Processes (KTPs) that have been listed under Schedule 3 of the Threatened Species Conservation Act 1995 and which have known or likely implications for the Green and Golden Bell Frog include:

- **Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish).**

  The presence of *Gambusia* in known or potential breeding sites is a matter of concern as *Gambusia* is known to feed on eggs and early stage tadpoles and to strip tail fins and limb buds at later stages of tadpole development. The density of fish, size of the water body, availability of other food sources and extent of emergent vegetation for shelter, all appear to be factors in the extent of impact *Gambusia* has on *Litoria aurea* breeding efforts (Morgan and Buttemer 1996; Webb and Joss 1997; A. White pers. comm.).

  Efforts to control or eradicate the fish should be considered in accordance with the Draft Gambusia Threat Abatement Plan but timing, scale and likelihood of reinfestation should be major considerations (NPWS 2002). The presence of *Gambusia* in a waterway is not to be taken as meaning that the Green and Golden Bell Frog is absent or that the habitat is rendered unsuitable. Some sites with *Gambusia* are still utilised by *L. aurea*, but with a likely reduced reproductive success rate, such sites may in any case provide vital foraging or shelter habitat for adults.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.**

  The Draft Recovery Plan identifies the destruction and alteration of wetlands and stormwater pollution as a major threat to the species and a significant contributor to its current conservation status.

  Developments and other activities have the potential to have obvious direct and not so obvious indirect impacts on these processes and include, among others, artificial opening regimes for coastal lagoons, deposition of fill to floodplain areas, diversions, water extraction, flood mitigation works and culvert construction in wetland areas that lower the watertable.

- **Clearing of native vegetation (as defined and described in the final determination**
of the Scientific Committee to list the key threatening process);

Alteration of habitat associated with grazing by stock, development or other land use activities that clear native vegetation results not only in direct loss of habitat but also isolation of habitat through creation of ‘barriers’ to movement between populations.

- **High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition;** and

This process is likely to result in direct losses as well as removes shelter/cover exposing the species to greater predation and eliminates food reserves.

- **Predation by the European Red Fox *Vulpes vulpes* (Linnaeus 1758).**

Predation by feral animals such as foxes is another likely threat particularly where populations are already stressed by impacts of other threatening processes.

Other threats include:

- **Chytridiomycosis**, a disease that has been recently listed as a KTP under the Commonwealth EPBC Act and has also had a preliminary listing as a KTP in NSW under the TSC Act.

Recent research has identified an important frog pathogen, an exotic frog chytrid fungus, known to cause chytridiomycosis, a usually fatal condition (L. Berger pers. comm.), and also known to be impacting on many other frog species as well as *Litoria aurea* (Berger et al. 1999; Mahony 1999; Mahony and Werkman 2001). This may ultimately prove to be the major causative factor in the recently reported wide scale decline in frogs generally in this country.

- **Broad scale application of herbicides**

Weed control activities involving the broad scale application of herbicides needs to be considered for their potential to impact on this species (Bidwell and Gorrie 1995; Mann and Bidwell 1998; 1999). Such impacts may be the direct result of the toxicity of the herbicides on frogs and tadpoles, as well as indirectly through broad scale ground cover loss.

- **Road Mortality**

At some sites, particularly where populations are impacted by a number of threats, road mortality can be an additional and quite significant mortality factor (Daly 1996).

### Viable local population of the species

It is difficult to determine what constitutes a viable local population however in the absence of a detailed specific local population study all populations should be considered significant and viable unless shown otherwise. The draft recovery plan for the Green and Golden Bell Frog has identified 44 key populations across its overall NSW distribution and these are considered viable populations based on current information (NPWS 2002). The key populations have been subdivided across 9 management regions that incorporate the species state-wide distribution. At most of these sites available information indicates that population sizes are generally small with breeding events infrequent. However at six key sites substantial populations have been found and regular breeding events recorded (NPWS 2002). Implementation of the recovery plan will attempt to address the data gaps for the other key populations where viability indicators (calling males, amplexus, spawning, tadpoles, metamorphlings and recruitment) are presently unavailable. At all sites little information is available about levels of successful recruitment from emergent metamorphling to adult.

Consequently to accurately determine viability of a particular population several seasons of intensive survey and monitoring is necessary. The difficulty of assessing viability is best illustrated via the example of several sites where populations were initially assumed, from the information available, to be in imminent danger of extinction. These were later revealed to be much larger and viable when further survey was completed (R. Porter; M. Bannerman; G. Pyke, R. Wright all pers. comm.). Clearly this illustrates the need for the precautionary principle to be applied in the absence of adequate information.

Additional populations not currently categorised as key populations within the draft recovery plan may be detected in the future. These populations, even when detected as low numbers of individuals, may have high conservation value and are to be considered significant and viable until shown otherwise.

### A significant area of habitat
The Green and Golden Bell Frog is most frequently detected in or around its breeding habitat. Such sites are of critical importance to the species and its availability appears to be a limiting factor in many locations. The species tends to congregate at breeding sites during the warmer months (August-March) and during these events aggregations of individuals may represent a substantial proportion of the total population from the surrounding area. Breeding habitat should therefore be afforded the highest level of protection and likely disturbances, during the breeding period in particular, should be totally avoided. However the breeding habitat cannot be considered in isolation from the other habitat components known to be essential for the species to complete its life cycle.

**Mitigating impacts**

The basic principles of protecting threatened species is to:-

1. Avoid direct impacts and retain habitat;
2. Minimise impacts where ever possible;
3. Mitigate or ameliorate impacts; and as a last resort
4. Compensate or offset for any unavoidable impacts.

Consequently consideration must be given to retention of all habitat components including foraging, shelter and over-wintering habitat that may be at some distance from the more readily identified breeding habitat. Under some circumstances, consent and determining authorities may be required to give consideration to habitat enhancement and perhaps habitat creation initiatives as a means of mitigating possible degradation to habitat or offsetting unavoidable habitat losses. In such circumstances an in-situ conservation outcome is paramount and there must be no net loss of habitat. Any habitat creation initiatives that are proposed as an offset to a development must be on a tested performance basis. Performance is to be measured by two successful breeding events that demonstrate that the life cycle has been completed in any created/enhanced habitat. Monitoring and mark recapture studies over an extended period would be required to demonstrate this and might reasonably be expected to take a minimum of 4 years ie the time taken for F1 female progeny to reach sexual maturity (2 years), breed successfully and any resulting progeny, in turn, to reach sexual maturity and breed (see Semlitsch 2002). Under exceptional circumstances consideration might be given to captive breeding initiatives that could assist with amplification of a local, at threat, population.

**Isolation/Fragmentation**

The Green and Golden Bell Frog has undergone considerable fragmentation of its once almost continuous state-wide distribution. Most of the remaining key populations are isolated by large distances from other key populations. Many of the remaining key populations also appear to exhibit meta-population structure being comprised of several semi-discreet, variably isolated, sub-populations with an assumed restricted gene flow between them. Maintenance of the migration/movement paths between various sites is therefore essential if the existing pattern of decline of the species is not to continue. Such movement corridors may include stream lines, other drainage features, swales and depressions as well as built structures and naturally vegetated areas. The species does however exhibit strong migration tendencies, is known to be capable of moving several kilometres and will, when necessary, move across ‘hostile’ ground, such as roads and cleared land to reach its desired habitat.

**Regional Distribution of Habitat**

The Green and Golden Bell Frogs historic distribution and hence habitat is contained within the NSW North Coast (8), Sydney Basin (29), South East Corner (5 - NSW) and South Eastern Highlands (1) Bioregions (Thackway & Cresswell 1995). The numbers of key populations identified within each of these bioregions (in parentheses) indicates that there has been an uneven pattern of decline with most severe decline being evident in the South eastern Highlands bioregion whereas the Shoalhaven area of the Sydney Basin has the greatest number of remnant key populations. The Recovery Plan for the Green and Golden Bell Frog places high conservation significance on all remaining key populations and its objective is to prevent any further losses of them. Considerable suitable habitat still occurs across all regions of the species distribution and so other remnant populations may still exist in this habitat. There is therefore a need
for targeted surveys in these potential habitat areas when developments in such areas are being considered.

**Limit of Known Distribution**

The distribution of the Green and Golden Bell Frog is currently limited to 44 key populations across its distribution (NPWS 2002). The majority of these key populations are near coastal and most are widely disjunct. Consequently the loss of any of these remaining key populations will increase fragmentation and widen existing disjunction. Therefore consideration of individual key populations should be in the context of its distributional limits at the regional level as well as at its northern most or southern most distributional limit to be consistent with the draft Recovery Plan.

**Adequacy of representation in conservation reserves or other similar protected area.**

The Green and Golden Bell Frog is known to occur within the following reserves:

- Yuraygir NP (2); Hat Head NP; Lake Innes NR; Myall Lakes NP (3); Kooragang Island NR; Seven Mile Beach NR; Meroo NP; Towra Point NR; Jervis Bay NP; Narrawallee NR; Ben Boyd NP and Nadgee NR. A key population also occurs within Commonwealth Bookeree NP and on Department of Defence land on Beecroft Peninsula both at Jervis Bay.

Whilst the species occurs within these reserves only in 11 of 44 (25%) of these cases does the major portion of the species key population habitat occur within that conservation reserve. Consequently the species is not adequately protected within the reserve system because the majority of the species habitat occurs on other tenures.

**Critical Habitat**

Critical habitat has not been declared for this species but may be reconsidered for declaration during the implementation of the recovery plan.

For Further Information contact
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References

NSW NPWS (1999) Green and Golden Bell frog *Litoria aurea* Threatened Species Information Profile. NPWS Hurstville, NSW


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Management Plan Preparation Guide

This document is intended to assist the preparation of effective Management Plans for Green and Golden Bell Frog populations. The preparation of site specific management plans is an identified action within the Green and Golden Bell frog Recovery Plan. This document should be read in conjunction with the Green and Golden Bell Frog Recovery Plan.

**Introduction**

The introduction should state the Plans purpose and include:

This Green and Golden Bell Frog (GGBF) population is identified as the [XX] Key Population within the GGBF Recovery Plan and is the [ZZ - extent] population within the [GGBF Management Region] identified therein.

This plan has been prepared to satisfy Action 12.3 of the NSW Recovery Plan for the Green and Golden Bell Frog that was developed in accordance with the Threatened Species Conservation Act 1995 (TSC Act).

This plan has been prepared to ensure that the GGBF population [NAME] located at [LOCATION] is successfully managed and monitored such that the species continues to persist at the location and measures of the populations viability are maintained or improve overtime.

[The Plan need not reiterate general biology and ecology of the species in great detail as this is published elsewhere and is summarized in the Recovery Plan. These review publications and the RP should be referred to.]

A brief description of the frog might be included and an illustration is desirable for ID purposes.

**Purpose of this plan**

1. To identify and where possible address the threats and other issues/factors affecting or likely to affect the conservation of the species at [X] location and contribute to the conservation of the species in the wider area and region.
2. Manage the species in accordance with the strategies outlined within the GGBF RP

**Location**

Provide a detailed description of the location.


Provide a map (at both local and regional scale) showing:

- current and historical distribution where known [locality records]
- tenure
- extent of known or likely habitat
- other relevant features
Include a description of the habitat components present and if possible a description of the vegetation communities. Where possible the map (or an air photo if available) should also depict the extent of known or likely habitat components in the vicinity including habitat corridors contributing to connectivity.

Describe the species status in the local area as far as is known.

*Include historical account of population in the area as far as is known.*

- When was it first known from the area?
- Where in the local area was it distributed and what habitat did it use?
- Any information relating to apparent declines or disappearances in the local area.

*Current knowledge of the population in the area.*

- What are the circumstances surrounding its rediscovery in recent times
- What areas is it now considered to be occupying and what local areas are considered likely to be important for it?
- What indicators do we have regarding population size and viability?

**Threat Assessment**

Following the identification of the need for the preparation of this Management Plan an assessment of the extent of available habitat was made and, using the Recovery Plan as a guide, an assessment of the general and local threats known or considered likely to be operating was made. [Figure X depicts the habitat components that have been identified [breeding habitat, foraging habitat, shelter habitat, movement corridors etc]

The following threats have been identified [List]  a)  b)  c)

**Management Actions Required**

The following are some of the already identified requirements of the Management Plan and some other possible requirements dependent on local circumstances for the [X] GGBF population.

a) Undertake a conservation ranking assessment - Action 11.3.1 of the RP [this protocol is to be completed by the NPWS]

b) Monitoring of the population 4 times per year in accordance with the RP monitoring procedure [or perhaps at a greater frequency/intensity if part of a broader research monitoring project]

c) Where this is not adequately known determine what is the extent of habitat for the species in the area (where possible categorise habitat type, breeding; foraging, shelter & over-wintering habitat components)

d) Gather population viability factors for this population ie maximum numbers of adults seen over time; breeding event indications (indicated by numbers of calling males, amplexus observed; tadpoles or spawn observed; gravid females observed; metamorphs observed; juveniles observed) to determine current status. [longevity, movement patterns and mortality may also be detected if the site is one of those selected for more intense monitoring/research including mark recapture (PIT tag) studies].

e) Identify threats to the population (from threats observable in the vicinity) eg *Gambusia* present; tidal or flood inundation; water pollution; reports of sick or dying individuals, local pesticide treatments; impacts of existing management actions in the vicinity etc [see RP threats section]
Steps required to be undertaken to appropriately manage the local population will include:

(a)  
(b)  
(c)  

[Ideally these should also identify data gaps and a means of filling them.]

From an assessment of the above information gathering and assimilation formulate possible strategies to mitigate the identified threats to the species at that location.

- Does failure to successfully breed appear to be limiting the population?
- Is there ample suitable breeding habitat available?
- Is there good connectivity between nearby areas of potential habitat?
- Is there ample foraging or shelter habitat in the immediate vicinity of breeding habitat?

A management action might be to develop suitable breeding habitat with appropriate vegetation, shelter sites and other habitat features and/or to develop swale like depressions and other intervening ‘damp’ habitat areas vegetated with suitable tussock forming vegetation to facilitate reduced risk movement paths.

- Are there representative areas of all habitat components for the species at each of the sites where it is known to occur?
- Can these be provided eg rock piles and ground timbers such as logs/sleepers, tussock vegetation and emergent reeds/sedges for shelter and surrounding grassy foraging areas.

Is the body of water forming the primary breeding habitat free of predatory fish?

- If not can they be feasibly eliminated or controlled (refer to Gambusia TAP) or if not is it possible to provide ancillary breeding habitat beyond the reach of the identified threats within the main water body.
- Can some contingency mechanism be installed for draining the ancillary breeding habitat to eliminate Gambusia and perhaps the frog chytrid pathogen (a breeding pond construction and habitat guide is to be prepared).

Can any existing management practices be modified or timed in such a way as to reduce or eliminate potential for impact on the specific local population? [Examples of these might include – mowing/slashing practices; application of herbicides/weed control; flood control/lagoon opening procedures; hazard reduction measures;]

The management plan should identify a summary of the actions necessary to maintain or enhance the GGBF population at [XX]. It should identify those responsible or who have agreed to participate or undertake certain components. A cost estimate should be provided and an indication of whether funding is available or will need to be sought. A time frame for undertaking the various tasks identified should also be provided. [A table would be an efficient way of presenting this information]

**Monitoring and Reporting**

Monitoring of this population of the GGBF is necessary to establish baseline information on the viability of the population and to enable detection of any changes in status and perhaps adjusted management actions.

The monitoring of this population is the responsibility of [agency]. The required monitoring will be undertaken by [Council X environment staff; consultant X; Volunteers under supervision of X; DEC area staff; Researcher X in collaboration with DEC area staff, SF NSW staff etc].

Monitoring should consist of 4 site inspections per year. Each site visitation should consist of 1 diurnal visit and two nocturnal visits (say a minimum of two person hours
during the day and say 2 person hrs/night for two consecutive nights). However this may need to be of longer duration at some sites depending on the area and complexity of habitat present and the numbers of frogs present requiring processing. The purpose of the monitoring should be to detect tadpoles by dip netting of water bodies and incidental frog observation by day and the recording of any abiotic factors eg WQ parameters, climatic factors (time since last rain should also be ascertained); nocturnal visits should endeavour to determine absolute measures of frog abundance over two consecutive evenings and will record numbers of calling males, amplexus, spawn masses, numbers of juveniles, numbers/size and sex of adults; (repeated four times per year – but may be more frequent where implemented as a component of a broader research project or where resources allow), frogs should, where possible, be captured by hand following the DEC(NPWS) frog hygiene protocol. The standard recording sheets allow sex, size, weight, age class and breeding condition to be recorded; (at some sites microchip mark and recapture may be employed as part of broader research but this will be negotiated with and sanctioned by the RP coordinator); measures obtained over time should be recorded on the standard recording sheet and a copy of this is to be forwarded to the recovery plan coordinator; an NPWS licensed individual must be present to undertake this work).

The GGBF monitoring will be coordinated by [Officer Name – contact details] with the four monitoring periods occurring during the breeding/activity period of August to March (ideally during or following suitable weather conditions within each time slot).

Session 1 – 1 August – September
Session 2 – October – November
Session 3 – December – January
Session 4 – February – March

The standard recording sheets will be completed during each of the above periods and the data will be collated by [NAME] and a copy forwarded to [XXX].

**Review**

A meeting of stakeholders will be organised to occur following the activity period each season where results and trends will be discussed and recommendations for additional/modification of management strategies adopted.
**Green and Golden Bell Frog Monitoring Data Recording Sheet**

Date: _____________________________
Start Time: _____________________________
Finish Time: _____________________________

Surveyors: _____________________________; _____________________________; _____________________________; _____________________________;

Frog Hygiene system in place: Y/N

Location: AMG

Prevailing Weather: _____________________________
Last Rain: _____________________________

Wet Bulb Temp: _____________________________
Dry Bulb Temp: _____________________________

**Frog Monitoring**

Number of calling Males: _____________________________; with call playback Y/N

No. of adult females: _______; No. of adult males: _______; Total Adults: _______;  
No. Juveniles/metamorphs: _______; No. of amplexing pairs: _______;  
Spawn Masses: _______;  

<table>
<thead>
<tr>
<th>Capture No.</th>
<th>Sex</th>
<th>SVL (mm)</th>
<th>Mass (g)</th>
<th>Capture Recapture</th>
<th>Microchip No.</th>
<th>Note</th>
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**Tadpole Monitoring and Survey Data Recording Sheet**

urostyle
Tadpoles present Y/N  Positive Id Y/N
Tadpole No. estimate ________________
Size classes of tadpoles present: ________________

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<th>Tad No.</th>
<th>Body Length (BL)</th>
<th>Total Length (TL)</th>
<th>Tail Depth (TD)</th>
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Frog Surveys
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<th>Capture No.</th>
<th>Species</th>
<th>Sex</th>
<th>SVL (mm)</th>
<th>Mass (g)</th>
<th>Capture Recapture</th>
<th>Microchip No.</th>
<th>Note</th>
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Appendix 5: Making a submission regarding this draft recovery plan.

**SUBMISSION**

**DRAFT RECOVERY PLAN**

Name Individual/Organisation: ______________________________________________________

______________________________________________________________________________

Postal Address: ________________________________________________________________

______________________________________________________________________________

Postcode: __________________________ Contact Number(s): __________________________

Date: ______________________________

**Draft Recovery Plan:** Green and Golden Bell Frog *Litoria aurea* Recovery Plan

The DEC will consider all written submissions received during the period of public exhibition and must provide a summary report of those submissions to the Minister for the Environment prior to final approval of this recovery plan.

Please note that for the purposes of the NSW Privacy and Personal Information Protection Act 1998, any comments on this draft recovery plan, including your personal details, will be a matter of public record and will be stored in DEC records system for a period of up to 2 years from the closing date. The submission of personal information is voluntary. Copies of submissions will be available on request, at the DEC Office responsible for the preparation of the recovery plan.

Should you not wish to have your personal details disclosed to members of the public, please indicate below why you wish your personal details to remain confidential to DEC. Please note that access to the details may be requested under the Freedom of Information Act 1989. You will be consulted if this happens.

Further information on the Privacy and Personal Information Protection act 1998 and the Freedom of Information Act 1989 may be obtained from the DEC FOI/Privacy Contact Officer (ph: 02 9585 6460) or the DEC website: www.nationalparks.nsw.gov.au

☐ Yes, please keep my personal details confidential to DEC (explain why)

Submissions should be received no later than the advertised date. Submissions should be addressed to the:

Director-General of Department of Environment and Conservation  
c/o Green and Golden Bell Frog *Litoria aurea* Recovery Plan Coordinator,  
Threatened Species Unit  
Metro Conservation Programs and Planning  
Department of Environment and Conservation  
PO Box 1967  
Hurstville  
NSW 2220

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1 Note: Members of the public may inspect submissions for free or ask for a copy. Copying charges are to be charged at the current FOI rate ie $30/hr

2 An assessment must be made by the relevant DEC Threatened Species Unit, as to whether the request for confidentiality will be agreed to. DEC must contact the affected person as to its decision as per the DEC guide to privacy and handling public submissions (NPWS 2002).