Management Plan

The Green and Golden Bell Frog Key Population of the Georges River

August 2008

Catchment Management Authorities
CMA NEW SOUTH WALES

Department of Environment & Climate Change NSW

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Cover photograph: Aerial photo of the Georges River floodplain in south western Sydney.

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The Green and Golden Bell Frog (GGBF) *Litoria aurea* is a large, muscular species with a robust form. Adult frogs range from approximately 45mm to 100mm, with most individuals being in the 60-80mm size class.

The colouration of the back is variable, ranging from a vivid pea green splotched with almost metallic brass brown or gold (Figure 1) to almost entirely green (Figure 2a), or having golden bronze markings that almost cover the whole back (Figure 2b).

Tadpoles of the species reach up to 35mm in length and, at that size, can be readily identified (Figure 3). Smaller tadpoles are more difficult to distinguish from the tadpoles of other species and identification may need to rely on mouth part features (for details, refer to Anstis, 2002).

The former distribution of the GGBF ranged from the NSW north coast near Brunswick Heads southwards along the NSW coast to Victoria, where it extended into East Gippsland and west to Bathurst, Tumut and the ACT. In the 1960s, the species was considered widespread, abundant and commonly encountered. Today, the species exists as a series of isolated populations within its former range (see Figure 4).

Figure 1: ***Green and Golden Bell Frog***
Photo © Garry Daly

The GGBF is listed as 'endangered' under Schedule 1 of the NSW *Threatened Species Conservation Act 1995* (TSC Act), and 'vulnerable' under Schedule 1 Part 2

of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. As a consequence of its status, a recovery plan has been prepared under the TSC Act, while under the NSW *Environmental Planning and Assessment Act 1979* (EPA Act) consideration of this species is required when assessing the impact of development and activities on populations of the species and its habitats.

The Green and Golden Bell Frog *Litoria aurea* (Lesson 1829) Recovery Plan (draft) defines key populations as conservation management units and lists 43 such populations in NSW. The actions within the Recovery Plan are also listed as actions within the NSW Department of Environment and Climate Change (DECC) Priorities Action Statement for amphibians found at:

http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/pas_speciestype_details.aspx?type=Amphibians&kingdom=Animal

a) b)

Figures 2a & 2 b: ***Colour variants of the Green and Golden Bell Frog***
Photos © (a) Garry Daly (b) Dave Hunter

Figure 3: ***Tadpole of the Green and Golden Bell Frog*.**
Photo © Mark Parsons

The Georges River Management Plan

This Management Plan has been prepared to satisfy Action 11.3.4 of the Recovery Plan and Priority Action Statement (PAS) Action 21 for the GGBF. These require the NSW Department of Environment and Climate Change (DECC) to prepare and implement a 'GGBF Management Plan' for each key population on DECC estate and to liaise with other public authorities (e.g. local councils, government departments) to encourage the preparation and implementation of a 'GGBF Management Plan' for key populations occurring on other public lands.

This Management Plan is identified as the "Hammondville" key population in the species Recovery Plan. However, due to the historic distribution and recent records of the species along the Georges River and its tributaries, and the significant areas of suitable habitat in the vicinity, the "Georges River" key population is a more appropriate name for the population. It is likely that population elements did interact prior to extensive development in the area, thus the term "Georges River" population is inclusive of the current and historic locations where the species occurred within the lower Georges River catchment. The population is located within the Sydney Green and Golden Bell Frog (GGBF) Management Region, as defined in the Recovery Plan.

This Georges River GGBF Management Plan has been prepared to ensure that the Georges River GGBF population is successfully managed and monitored such that the species continues to persist at the location and measures of the population's viability are maintained or improved over time.

The purpose of this Management Plan is:

1. To identify and, where possible, address the threats and other issues/factors affecting or likely to affect the conservation of the species on the Georges River and contribute to the conservation of the species in the wider region.
2. To manage the species in accordance with the strategies outlined within the draft GGBF Recovery Plan.

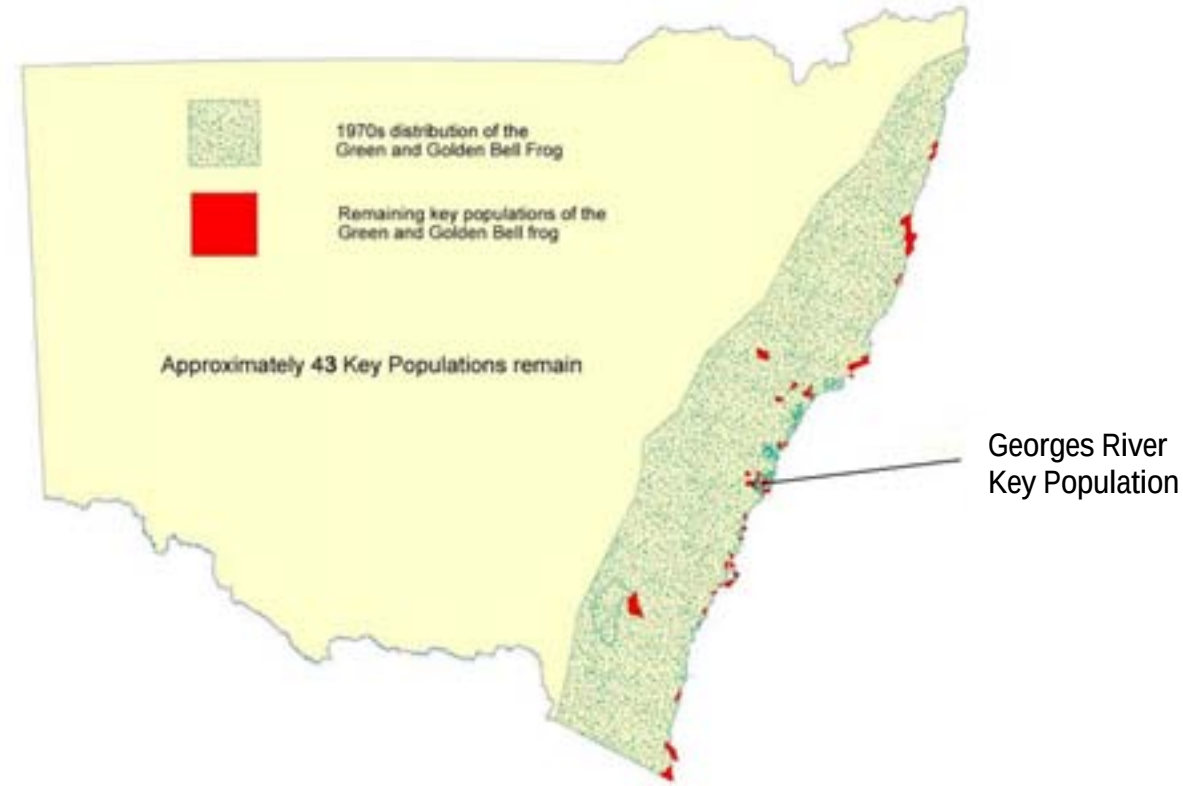

Figure 4: ***Previous and current distribution of the GGBF in NSW***

Management Objectives and Strategies

The objectives of the Georges River GGBF Management Plan are as follows:

1. To maintain the GGBF population and its outliers.
2. Where possible enhance existing GGBF habitat and thus measures of population viability.
3. To increase connectivity within and between sub-populations.

The following strategies have been identified to achieve these objectives:

1. Further development of GGBF breeding and other habitat components, where appropriate, on public and private lands.
2. Improvement of habitat within the GGBF key populations.
3. Education and communications to build awareness of the GGBFs and encourage further on-ground actions.
4. Reduction of external threats to GGBFs.
5. Monitoring and research to better understand the extent and dynamics of the Lower Georges River GGBF population
6. Coordination and communication between the various stakeholders, land managers and the community.

Stakeholder Consultation

The development of this Management Plan included a stakeholder workshop (29 June 2007) with the focus of identifying existing and possible management initiatives to support the draft GGBF Recovery Plan. Workshop attendance included representatives from:

- Liverpool City Council (LCC)
- Bankstown City Council (BCC)
- Fairfield City Council (FCC)
- Sydney Water Corporation
- Bankstown Airport Limited
- Georges River Environmental Education Centre
- Sydney Metropolitan Catchment Management Authority (Sydney Metro CMA)

A draft Plan was also distributed to the following stakeholders for comment:

NSW DECC	Boral
Sydney Metropolitan CMA (SMCMA)	Integral Energy
Sydney Water Corporation	Urbex
Roads and Traffic Authority (RTA)	Clarendon Residential Group
Department of Transport and Regional Services (DOTAR)	Demian Developments Pty Ltd
Department of Defence	The Hammond Care Group
Liverpool City Council	Voyager Point Environment Group

Bankstown City Council	Harris Creek Environment Group
Fairfield City Council	Frog and Tadpole Study Group (FATS)
Georges River Combined Councils Committee (GRCCC)	Georges River Environmental Education Centre
New Brighton Golf Club	Bankstown Bushland Society
Bankstown Golf Club	Australian Wetlands Pty Limited
Riverlands Golf Club	Biosphere Ecological Consultants
Riverwood/Georges River Golf Club	Fairfield Creeks and Wetlands Group
Liverpool Golf Club	Hammondville residents
Bankstown Airport Limited	Taronga Zoo

Plan Duration

The duration of this plan is three years from mid-2008 to mid-2011. Following this, the outcomes will be reviewed and the Plan revised.

Relationship with Other Plans

This Management Plan integrates with a number of the state-wide targets for natural resource management (NRM) set out as Priority E4 in the NSW Government's State Plan (2006), including:

- *By 2015 there is an increase in native vegetation extent and an improvement in native vegetation condition.*
- *By 2015 there is an increase in the number of sustainable populations of a range of native fauna species*.
- *By 2015 there is an increase in the recovery of threatened species, populations and ecological communities*.
- *By 2015 there is a reduction in the impact of invasive species.*

Similarly, the successful implementation of this Plan should contribute to a number of the Catchment Targets identified in the Sydney Metropolitan Catchment Management Authority (SMCMA) Catchment Action Plan (CAP) (draft as at 12/06/08). These include:

Biodiversity: Enhance ecological resilience and connectivity of bushland and aquatic habitats

- *CTB1 By 2016 the extent and condition of terrestrial native vegetation in all landscapes is maintained or improved.*
- *CTB3 By 2016 there is an increase in the connectivity of terrestrial native vegetation.*
- *CTB4 By 2016 aquatic and terrestrial threatened species and Endangered Ecological Communities (EECs) and populations are better conserved by implementing actions identified in the Priority Action Statements.*
- *CTB5 By 2016 the impact of terrestrial and aquatic invasive species on biodiversity is reduced by decreasing the number, distribution and impact of invasive weeds, pest animals and pathogens.*

Water: Enhance the positive connectivity of aquatic processes

- *CTW1 By 2016 there is a net improvement in the health of modified waterways and riparian corridors and conservation of natural waterways.*
- *CTW2 By 2016 there is an improvement in the condition and extent of wetlands.*
- *CTW3 By 2016 there is measurable progress towards achieving the Water Quality and River Flow Objectives adopted for each waterway.*

The (draft) Georges River Combined Councils Committee (GRCCC) Management and Implementation Plan (MIP) (GRCCC 2007a) identifies a number of actions for the nine (9) member councils which are also framed around the state-wide NRM targets. The actions identified in this Management Plan are in part or fully supported by the draft GRCCC MIP objectives. The MIP should also be considered in conjunction with the Strategic Future for the GRCCC – recommended structure report (GRCCC 2007b).

Under section 36B of the *Local Government Act 1993,* local councils are required to develop and implement Management Plans where GGBFs occur on public land under their care, control and management. It is envisaged that this Management Plan will satisfy this requirement with respect to the Georges River key population components that occur on public land in the Liverpool and Bankstown LGAs, as well as the possible requirement in Fairfield LGA. This Management Plan is intended to provide guidance, direction and coordination for stakeholders and/or land owner/managers and consent authorities in the vicinity of Georges River and its surrounds where the frog and/or its habitat occurs.

The Green Web Sydney (1997) Vegetation Management Plan identifies a range of vegetation management and rehabilitation objectives and aims to provide strategic guidance to Regional Organisations of Councils (ROCs), councils and other government authorities. This GGBF Management Plan strongly supports and provides linkage to the implementation of aspects of the Green Web strategies. It also encourages other strategic processes to give consideration to the objectives outlines within this plan, as appropriate.

Special requirements also operate that stipulate the implementation of actions arising out of recovery and threat abatement plans in Commonwealth areas. Additionally, a Commonwealth Government agency must not take any action that contravenes a recovery plan or threat abatement plan.

Figure 5: ***Green and Golden Bell Frogs sheltering in an Elkhorn Fern***
Photo © S. Marks

Background

Location

The Georges River key population (on latitude/ longitude 33^{o} 57' 01 S, 150^{o} 57' 55 E) is located nine kilometres west southwest of the Sydney central business district. The population occurs in the vicinity of the mid to lower Georges River floodplain to the east of the Liverpool central business district (Figure 5). The known GGBF population on the lower Georges River occurs in several locations, including in the vicinity of the wetlands at Hammondville, at Holsworthy and East Hills, and along Prospect Creek and Orphan School Creek.

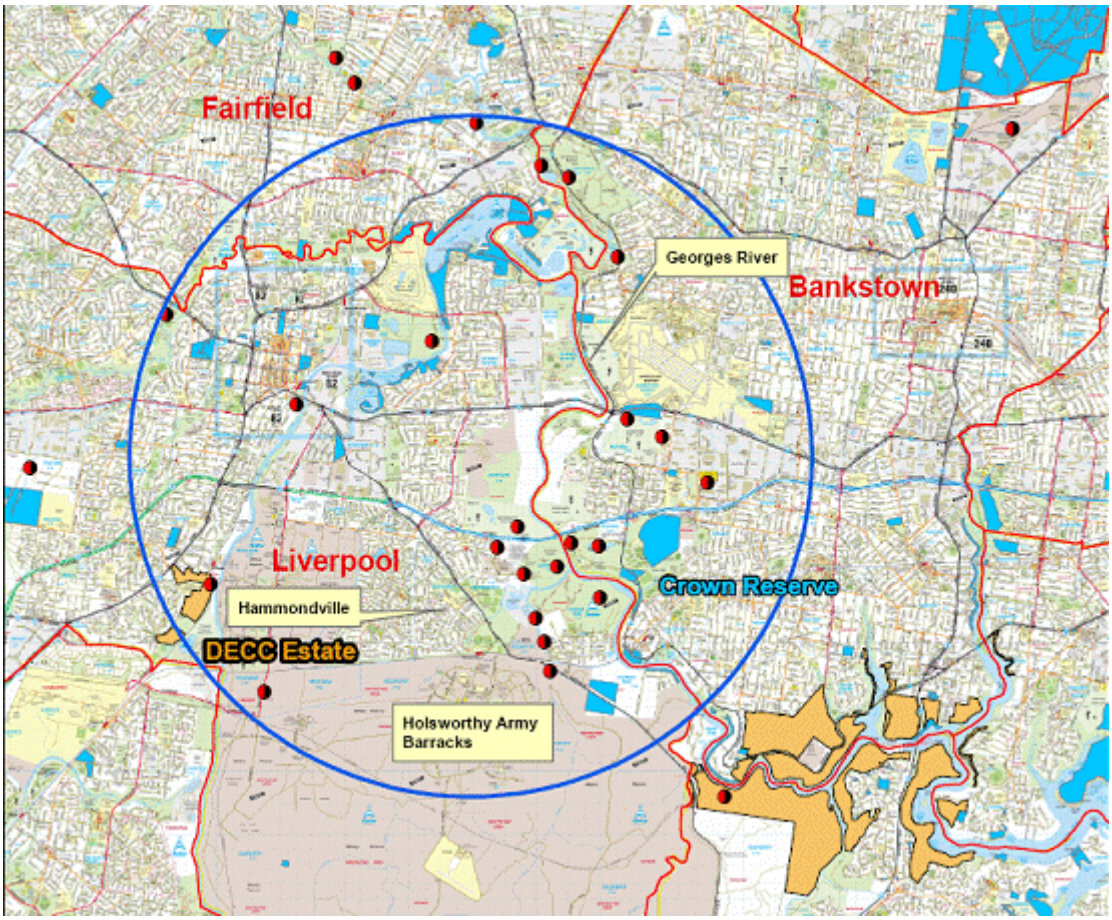

Figure 6: ***Map of the lower Georges River indicating the distribution of the Green and Golden Bell Frog based on recorded sightings***

The Georges River key population incorporates a meander loop of the mid to lower Georges River floodplain and its associated wetlands along with the wetlands of various tributaries along this part of the river. The population is primarily located in the Liverpool and Bankstown local government areas (LGA), however, Fairfield LGA is also known to have previously provided GGBF habitat and may still continue to support other cryptic population elements, as well as habitat.

The Georges River GGBF key population is located on public and privately-owned land, with the known focus of the population being located predominantly within habitat situated on council reserves, on Commonwealth lands (military areas) and some golf courses.

The private and public entities that own, manage or have a decision making responsibility with respect to land that either contains GGBF population elements, or appropriate habitat, in the mid to lower Georges River area (as covered by this Management Plan) include:

- Department of Defence
- NSW Department of Environment and Climate Change (DECC)
- Department of Lands (Crown Reserve)
- Sydney Metropolitan Catchment Management Authority (Sydney Metro CMA)
- Sydney Water Corporation
- NSW Roads and Traffic Authority (RTA)
- Liverpool City Council (LCC)
- Bankstown City Council (BCC)
- Fairfield City Council (FCC)
- Georges River Combined Councils' Committee
- Bankstown Airport Limited
- Boral
- Urbex
- Clarendon Residential Group
- Demian Developments Pty Ltd
- Golf Courses – New Brighton, Bankstown, Riverlands, Riverwood, Liverpool, Cabramatta and Sefton
- Private residents.

Habitat

The land on which current GGBF habitat occurs is comprised, in part, of lands that have been modified or reclaimed as a result of extensive development along the Georges River. The original low lying land and swamps described by early European explorers and settlers have largely vanished and been replaced with urban areas. It is likely that the current GGBF distribution coincides with this past pattern and extent of wetlands.

Existing GGBF habitat is comprised largely of created or modified water bodies. GGBFs inhabit the wetlands, water bodies and ponds that are interspersed amongst green space (such as golf courses and playing fields), residential development and major transport and infrastructure routes. Although some wetland areas persist along the Georges River, they are isolated and often in poor condition and/or are threatened by poor land management practices. The GGBF population utilises these vestiges of past wetlands and other created water bodies that fortuitously, rather than by design, afford various habitat features.

GGBFs have survived by using various components of their habitat during their lifecycle, such as:

- Breeding habitat. There are two types of breeding habitat:
    1. Permanent breeding habitat. This occurs in permanent water bodies, such as Williams Creek and in and around Lieutenant Cantello Reserve.
    2. Ephemeral breeding habitat. This exists throughout the area in sites that fill after heavy rain, such as ponds, drainage depressions, stormwater detention basins and culverts such as is found in Peterson Park and its

surrounds. No direct evidence is available to suggest these areas currently function as breeding habitat, though their value as potential breeding habitat remains. Reported sightings of juveniles in residences adjacent to Lieutenant Cantello Reserve suggest that breeding has occurred in the area in relatively recent times however the precise breeding site was not detected. Ephemeral swale habitat, often indicated by plant species known to prefer damp areas such as *Juncus spp*., *Schoenoplectus spp*., *Isolepis* spp. and *Baumea spp,* can be used for breeding. These habitat areas are often dry for much of the time when there have been periods of little or no rain. This can mean that at times they are overlooked for their habitat value.

- Foraging habitat. This includes areas of native or introduced grasses, tussock vegetation and emergent sedges and reeds bordering water features. Examples of suitable foraging habitat are evident within local wetland areas such as Voyager Point and the De Freitas wetland. Foraging habitat is also frequently found within golf courses, particularly surrounding or between water hazard features. These areas are vital for the GGBF to feed in relative safety from predators and to bask in the sun by day.
- Shelter habitat. This includes similar vegetation to that used for foraging, as well as rock piles, ground timber, crevices in the ground, around plant root systems and amongst ground debris. Significant areas of rock pile are likely to be limited; however, some examples may occur within the Holsworthy Military area. Shelter habitat may also be present in golf courses, reserves and residential backyards.
- Movement habitat. This is generally typified by wet areas such as creek lines, drains, connecting or partially connecting vegetation, easements, laneways and open areas that do not restrict movement. To a varying extent connected habitat occurs along the Georges River and some of its tributaries, such as Williams Creek.
- Over-wintering habitat. In some instances, this shares common features with shelter habitat, such as rock and rubble piles, ground timbers and logs and dense tussock vegetation. However, the sexes quite often differ in their selection of over wintering habitat and may seek to shelter in different areas and in less obvious locations, such as amongst overgrown or dense and moist vegetation.

The drainage pattern of the lower Georges River and its tributaries strongly mirrors current and historic distribution patterns for the species. Areas along and within the vicinity of the main drainage lines contain much of the remaining and potential habitat for the species. These drainages also provide the main opportunity for connectivity to be maintained between habitat and population elements (see Figure 7).

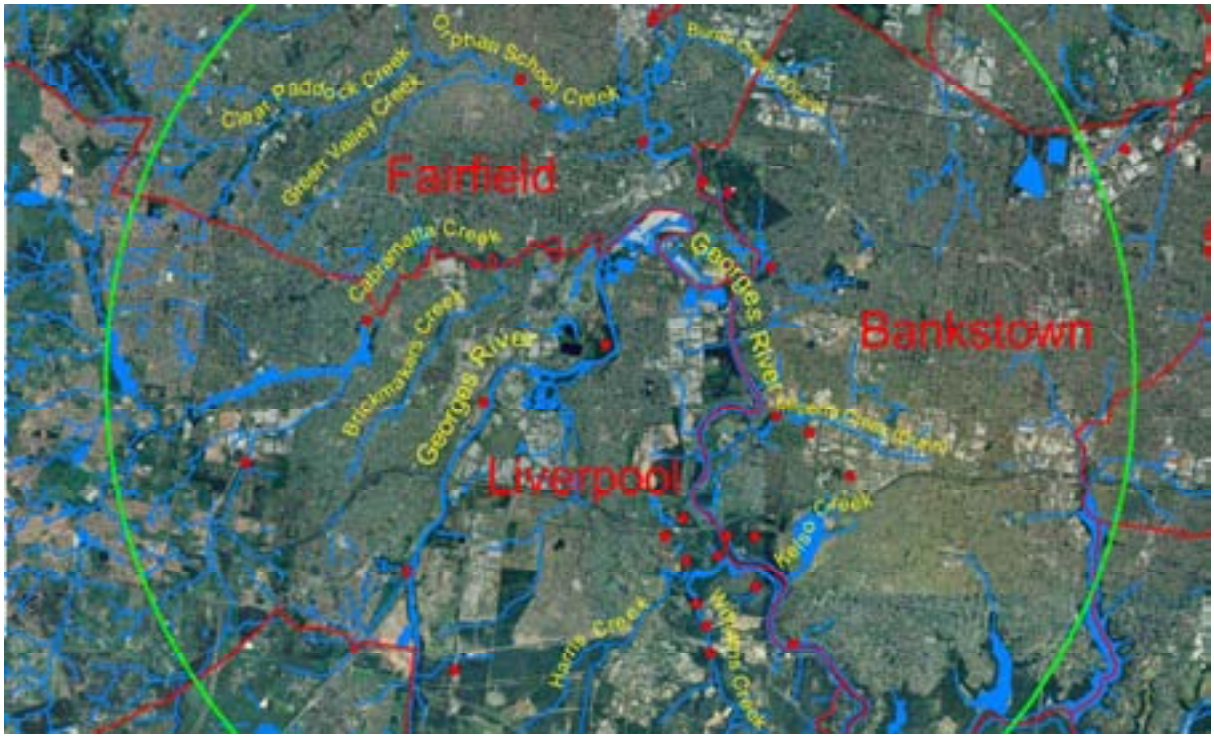

Figure 7: ***Creeks and potential habitat in the Lower Georges River area***

Species Status

The Lower Georges River key population of GGBF is one of three key populations that fringe the shores of Botany Bay, and one of four that inhabit the south-eastern Sydney region.

The species was once very widespread and abundant in the Sydney region, inhabiting the various coastal wetlands of the Botany Bay catchment including the Cooks River, Georges River and those associated with the Parramatta and Hawkesbury Nepean drainages. The former distribution of GGBFs has contracted to eight known locations at:

- Homebush Bay/Sydney Olympic Park
- Kurnell
- Greenacre (Upper Cooks River)
- Clyde/Rosehill (Parramatta River)
- Merrylands (Parramatta River)
- St Marys/Mt Druitt/Riverstone
- Arncliffe/Lower Cooks River
- Hammondville (Georges River)

Prior to European settlement, the Georges River consisted of swamps, mangroves, saltmarsh and expansive wetlands. During the mid to late nineteenth century development began along areas surrounding the Georges River and has since continued. In the past few decades, development has encroached on the River and its tributaries, consequently reducing the extent of vegetation corridors and isolated remnants of a once expansive GGBF population. In addition to residential development pressure, the Georges River has also been subject to extensive sand mining activities which have significantly altered the ecology of areas immediately

adjacent to the river. Of the potential wetland habitat areas that still remain, the majority are degraded or altered in nature, which has reduced the habitat value.

The GGBF population utilises a mosaic of the vestiges of wetlands, water bodies and drainage features that provide the various habitat components necessary for them to persist. The majority of the known Georges River GGBF population is located in the Hammondville area in the vicinity of Lieutenant Cantello Reserve and Voyager Point, including Williams Creek and Harris Creek. This also includes components of the New Brighton and Riverlands Golf Courses.

Other older or more sporadic records of the GGBF exist for other sections of the Georges River and its tributaries, including:

- Orphan School Creek, Prospect Creek and Long Creek within Fairfield LGA
- Water bodies alongside Prospect Creek (within Mirambeena Regional Park and Lake Gillawarna), Bankstown Golf Course, Horsley Road and Deepwater Park, within Bankstown LGA
- Cabramatta Creek, Maxwells Creek, Glenfield Creek, Bill Morrison Park, Moorebank Avenue (near the Cambridge Avenue intersection) and Rosetta Street (in the vicinity of the decommissioned Warwick Farm Sewage Treatment Plant).

Threat Assessment

The major threats to the Georges River GGBF key population include:

1. Loss of habitat - including the removal of foraging habitat and occasional breeding habitat. Existing and potential GGBF habitat areas are under pressure from a number of proposed developments, including:
   - several large-scale housing developments in close proximity to the Georges River.
   - the expansion of the New Brighton Golf Course into Lieutenant Cantello Reserve.
   - development of the Riverlands Golf Course, Milperra.
   - development of the former Boral brickworks site, Chipping Norton.

   Proposed development in known and potential GGBF habitat should include options to mitigate impacts or improve habitat.
2. Introduced predators. These may prey on GGBF eggs, tadpoles or adults and include:
   - Plague Minnow (*Gambusia holbrooki*) – this fish is listed as a Key Threatening Process (KTP) and is present in most permanent water bodies, including at the proposed Riverlands Golf Club development site and in Lieutenant Cantello Reserve.
   - Carp (*Cyprinus carpio*) - also present in various water bodies
   - Red Fox (*Vulpes vulpes*) – listed as a KTP and has been sighted in the area covered in this plan
   - Feral and Domestic Cats (*Felis catus*).
3. Frog Chytrid disease (*Batrachochytrium dendrobatidis*). This frog fungal disease is listed as a KTP at both a state and national level, and is rapidly emerging as possibly the single greatest threat to the species (as well as to many other frog

species). The disease is thought to have been largely responsible for the failure of GGBF reintroduction efforts in the Sydney area. See Appendix 1 (Frog Hygiene Protocol) for advice on preventing the spread of this disease.

4. Habitat degradation. This includes weed invasion and general vegetation overgrowth in GGBF foraging and breeding areas, as is the case along sections of Williams Creek. Poor management practices on public reserves, along waterways and on golf courses have the potential to inhibit GGBF expansion into areas of suitable habitat. In particular, vegetation overgrowth in artificial habitat ponds can reduce the habitat value by reducing the area of open water. The lack of water as a result of drought or poor artificial habitat construction (e.g. leakage through pond liners) can also result in habitat degradation or loss.
5. Water quality. Many waterways, such as Orphan School Creek, receive urban runoff which is likely to contain pollutants, excess sediments and high nutrient loads. In addition, herbicide, pesticide and fertiliser application on public reserves and golf courses may threaten GGBF foraging and breeding habitat areas.
6. Native predators. These are particularly a threat where GGBF populations have declined to small size and are no longer robust. Native predators may include Eels (*Anguilla* spp.), the Red-bellied Black Snake (*Pseudechis porphyriacus*), the Australian White Ibis (*Threskiornis molucca*) and, potentially, the Silver Gull (*Larus novaehollandiae*) and other wader bird and snake species that may occur within the region. The White Ibis is a significant problem at Lake Gillawarna where there is also a record of GGBF.
7. Anthropogenic climate change (listed as a KTP) may result in changes to rainfall patterns that could affect the breeding habitat of the GGBF, in particular the presence of ephemeral ponds and the extent of wetland areas. The impact on reduced recruitment may lead to population decline or collapse at some sites, especially where populations are represented only by mature adults due to previous repeated breeding failures. Senescent populations may be unable to recover even if and when conditions do become suitable.
8. Fire and fire management has the potential to adversely impact frogs through the destruction of vegetation used for refuge, foraging or as shelter habitat. Fire regimes within the Holsworthy training area have been reported as possibly having a negative affect on potential GGBF habitat. In conducting fire management practices, efforts should be made to restrict burning in low lying areas and wetlands predominated by sedge and emergent macrophyte growth. These areas form important shelter and foraging habitat for the GGBF and generally pose a limited fire risk anyway.

   The use of chemical fire suppressants may also have negative impacts on the GGBF, and their use should be avoided in the vicinity of known or potential breeding sites.

Past and Current Management

This Management Plan builds on a range of past and current actions to manage the GGBF in the lower Georges River area. Past efforts at managing the species on private land have largely been development driven and lacking coordination and integration with other actions. This Plan aims to overcome this situation.

Management actions along with other measures undertaken within the relevant Lower Georges River area include:

1. Bankstown City Council

   - Bankstown Council has developed community education materials in relation to frog ponds and the Duck River biodiversity corridor. Materials include information on efforts to remove carp and goldfish from Maluga Passive Park and Sefton Golf Course pond, and to introduce Australian Bass, as well as details on native planting efforts to re-establish habitat corridors, in line with the Duck River Biodiversity Corridor Masterplan. The Council has also established purpose built frog ponds at these locations and at Band Hall Reserve. Whilst the Duck River area is outside the scope of this Management Plan, it adjoins the Georges River catchment and the education program highlights opportunities for similar initiatives.
   - The Council has also developed a White Ibis management plan, which was adopted in 2004. This Plan identifies several management actions to ensure the Ibis population does not spread or have a negative impact on biodiversity. Actions include: continued monitoring, habitat management (removal of vegetation utilised by Ibis and removal of nesting material and coating eggs), improved waste management with the provision of bins and skips at the tip and community education through signage and brochures.

2. Liverpool City Council

   - Liverpool Council is responsible for a number of bush regeneration works and projects throughout the LGA. These include programs at Lieutenant Cantello Reserve, Williams Creek, Light Horse Park, Blamfield Oval and Bill Morrison Park, all of which have GGBF records. Other reserves where bush regeneration occurs in the vicinity of Georges River or its tributary drainage include Ireland Park, Fassifern Park, McGirr Park, Elouera Bushland Reserve, Miller Park, Hinchinbrook Creek, Cabrogal Park, Bradshaw Park, Amalfi Park, Collimore Park, Brickmakers Creek near Lawrence Hargrave Road, Kelso Park, McMillan Park, Ernie Smith Reserve, Wattle Grove Lake near Anzac Creek, Clinches Pond, Harris Creek Reserve, Remount Park, Creekwood Reserve, Voyager Point Park, Lieutenant Cantello Reserve, Weaving Garden, Tusculum Park, Glen Regent Reserve, Leacocks Lane and Kylie Way. Where appropriate, these initiatives could be designed to include GGBF-related works and encourage reporting of frog sightings.
   - The three relatively natural wetlands at Voyager Point, Cabramatta Creek and at Lieutenant Cantello Reserve (Hammondville Park), and the constructed wetland at Riverside Park could include management provisions to improve refuge and foraging habitat for the GGBF.

3. Bankstown Airport

   - Situated east of the Georges River and covering an area of approximately 313 ha, the airport includes an Environment Protection Zone (below Deverall Park). The 2005 Environment Strategy for the airport includes a water management plan incorporating stormwater monitoring; an environmental initiative scheme for airport tenants; ranking airport tenants based on potential for environmental harm; conducting audits and the use of pollution reduction devices. The report also contains flora and fauna management objectives to preserve significant sites. The airport also has ISO 14001 certification.
   - In relation to the GGBF, there are a number of records associated with the various drainages leading to the airport site. Many of these records are based on anecdotal accounts from the 1960s (and therefore do not appear in the DECC Wildlife Atlas) and are associated with the extensive wetlands that existed at the time. The records indicate that the species is likely to have

traversed the drainage lines crossing airport land (R. Wells pers. comm.). Bankstown Airport publishes a newsletter for the airport community which often addresses environmental issues (e.g. stormwater protection, Clean Up Australia Day etc). This newsletter may also provide a forum for disseminating GGBF information to airport tenants and personnel.

4. Fairfield City Council

- The Fairfield LGA has five wetlands, two of which are remnant, (De Freitas and Cabramatta Creek). The most recent constructed wetlands are Stockdale Reserve Wetland, Smithfield Wetland and Bonnyrigg Wetland. The total area of wetland in Fairfield LGA is estimated to be approximately 10 hectares.
- In 2001, Fairfield Council adopted a Creek Care program with the aim of maintaining and improving habitat and water quality in local creeks.
- The Council also sponsors StreamWatch initiatives at local schools. These initiatives have the potential to be expanded to include GGBF specific activities and reporting of GGBF sightings.
- The Council's Prospect Creek Stormwater Management Plan includes education initiatives for land managers of the golf course, nurseries and private open space. The aim of these initiatives is to reduce nutrient and organic matter loads, and to retain existing water bodies in their natural state (as opposed to piping and other hard engineering options).
- Council has also restored the concrete-lined Clear Paddock Creek into a more natural state with several ponds.
- Bush regeneration activities across the LGA include works at Green Valley Creek, Orphan School Creek, Prospect Creek, Cabramatta Creek and Clear Paddock Creek areas. These initiatives have the potential to assist GGBF and may in the future be considered as possible reintroduction sites (in consultation with DECC).

5. Commonwealth Department of Defence

- The Department of Defence has undertaken fauna surveys focussing on the potential occurrence of threatened species such as the GGBF across the Holsworthy Military facility. These surveys identified potential GGBF habitat that coincide with the vicinity of GGBF records.
- The DoD also owns the Holsworthy STP site which is currently managed by Sydney Water.

6. Sydney Water Corporation

- Sydney Water owns several areas of land in the catchment, including land associated with the Liverpool STP and along Prospect Creek. Property Environmental Management Plans (PEMPs) are being prepared, particularly for the more sensitive sites. Sydney Water properties have an environmental management system (EMS) in place, which include land management considerations. Some of these EMS's have the potential to influence GGBF related habitat management, enhancement and creation initiatives at known or potential sites.
- The existence of several remnant GGBF populations at STPs for several GGBF key populations suggests that processes occurring at these plants may be beneficial to the species. There have already been claims that remnant GGBF populations are in some way linked to contaminated sites, or sites with high salinity or other extreme water quality characteristics. STPs exhibit organic microbial processes, as well as chemical processes, that may be

conferring some benefit to GGBF against frog chytrid infection. This theory warrants further investigation.

7. Integral Energy

   - As part of the Hoxton Park/ Prestons training facility redevelopment there is a proposal to incorporate specific frog habitat features and other habitat enhancements. This proposal forms part of Integral Energy's biodiversity investment within the riparian zone of Cabramatta Creek. This initiative has the potential to provide GGBF habitat, and the possibility of facilitating re-colonisation or reintroduction, in an area previously inhabited by the species.

8. Riverlands Golf Course

   - A fauna survey and assessment was prepared in July 2007 for the proposed development of the golf course and adjoining land. This assessment included general nocturnal survey for multiple fauna species, but was conducted when GGBF activity was limited. The report only acknowledges one GGBF record within a ten km radius (many more are known), while application of the "seven part test" concluded that the development would not significantly impact on the status of the GGBF.
   - Another fauna survey and assessment was prepared in July 2007 for the proposed new access road to the Riverlands Golf Course and adjoining land. This report provides no detail of nocturnal survey and was again conducted in mid-winter during quiescent phase of the GGBFs. The report concluded that no GGBF were observed and determined that no habitat was available along or adjacent to the proposed road routes. A "seven part test" was not conducted. However, GGBF records exist for areas adjacent to route one and along route two of the proposal.

9. Voyager Point development

This land was previously owned by the Department of Defence and it is now proposed for rezoning as a residential area. A Vegetation Management Plan has been prepared for the proposed development area, which includes areas of Williams Creek. The area has good potential GGBF habitat value.

Future Management

The main focus of future GGBF management for the Georges River key population is discussed below and further detailed with management actions in the Implementation Plan section of this document.

1. Further development of GGBF breeding and other habitat components, where appropriate, on public and private lands.

Several housing developments in the vicinity of Georges River and its tributaries have the potential to impact on GGBF habitat and connectivity values.

- *Georges Fair Estate* - this development comprises 950 new residences on the former Boral Quarry site in Moorebank. The site includes a 35 hectare area of bushland (formerly a buffer zone for the quarry) with endangered ecological communities (EECs) of Castlereagh Ironbark Swamp Forest and Sydney Coastal Riverflat Forest. The bushland has the potential to be enhanced to increase GGBF habitat values. In the management of the bushland and corridor area, Liverpool City Council should consider options to mitigate urban impacts, such as addressing responsible cat ownership and restricting recreational activities, to ensure effective conservation.

- *Riverlands development* - this proposed development in Milperra, which includes 1000 residences, a high rise building, a new access road and a golf course, has the potential to impact connectivity and remove areas with potential GGBF habitat value, such as wetlands and a creek habitat corridor. A boat marina proposed for the southern end of the site is set to incorporate the three most southernmost dams and connect to the Georges River.
- Construction of a new access road to Benedict Sands and the Concrete Recyclers opposite the Riverlands development has been proposed to enable the site to be developed into a residential estate of up to 1000 residences. The existing consent for sand mining activities includes a condition for a 40 metre buffer zone between the site and the Georges River. Any development should include a similar buffer zone as an essential component to protect bushland and water quality. A biodiversity survey conducted along the Georges River in 2004 found the presence of GGBF at a Chipping Norton sand mine (DIPNR, 2004). It is therefore recommended that this area be included in survey work to determine whether GGBF are present and to identify areas where habitat could be created or enhanced.

2. Improvement of habitat within the GGBF key populations.

The following known areas of frog habitat should be given adequate consideration when planning to ensure that they are protected and/or investigated for enhancement and possible GGBF reintroduction:

- Horseshoe Pond and the decommissioned sludge ponds of Warwick Farm STP.
- The perched freshwater swamp at Howard Park (Lansvale), which is an old sand mining lagoon.
- Peterson Park and surrounds, including the constructed wetlands and stormwater polishing pond complex situated within the floodway, and the habitat in the low-lying boggy areas with dense reed growth.
- The sand mine at Hollywood Park (which is nearing the end of its lease), adjacent to Liverpool Golf Course. This area has excellent connectivity value and the potential for rehabilitation to create a range of GGBF habitat components.

New Brighton Golf Course (NBGC) and the adjacent reserve have areas of excellent frog habitat and recorded sightings of GGBF (A. White and R. Wells pers. comm.). A planned expansion of the golf course includes the re-contouring of swampy and low-lying areas, de-silting and deepening of existing ponds and a possible rezoning of an area of Lieutenant Cantello Public Reserve. This may result in loss of known GGBF habitat unless significant offsets are included in the design and consideration is given to the habitat requirements of the GGBF.

As the site is close to the most recent records of the GGBF in the area, it would be appropriate for any assessment to assume presence and promote effective habitat creation and enhancement as an incorporated component of any approvals given.

NBGC is involved in a stormwater harvesting project that uses runoff from adjacent developments and the M5 freeway on the existing golf course area. The project included building new and restoring existing water bodies, planting native grasses and wetland plants and the construction of a macrophyte bench in two of the water

features. The work was undertaken with advice from a wetland ecologist and it is likely habitat areas have been created suitable for the GGBF, however, greater benefits may result from specific consideration of GGBF requirements.

Areas where habitat maintenance to prevent GGBF habitat degradation and loss include:

- *Lieutenant Cantello Reserve and adjacent sites* - many of the water bodies in the vicinity of the reserve contain Plague Minnow. There is also evidence of motorbike use destroying some of the ephemeral habitat areas. Construction work, being undertaken by Hammondcare Nursing, adjacent to the main pond (owned by NBGC) has the potential to cause sedimentation or contamination of the water bodies. (Community uncertainty regarding the boundaries between Lieutenant Cantello Reserve and the adjoining properties owned by Hammondcare Nursing and NBGC highlights the need for greater clarification).
- *Williams Creek*: Records of GGBFs exist along the creek from 1975 to 1993, with more recent records in the surrounding areas. Weed invasion and vegetation overgrowth have reduced the quality of the habitat, and good management is important as the area has the potential to provide connectivity to habitat areas within the Holsworthy Military Reserve. It is recommended that Liverpool City Council develop and implement a management plan to improve and maintain habitat condition, and encourage connectivity to other valuable habitat areas. The council should seek collaboration with DECC to assist in the development of appropriate actions.

There are a large number of golf courses along the Georges River, many of which have or at least had GGBF colonies. It is therefore recommended that all golf courses be encouraged, or required, to adopt environmentally responsible management practices. In particular, management and maintenance plans should include:

- Enhancement and creation of water hazard and wetland areas as potential GGBF habitat.
- The maintenance of important connectivity corridors, particularly along riparian zones.
- The appropriate use of pesticides and herbicides.

3. Education and communications to develop awareness of the GGBFs and encourage further on-ground actions.

Education of on-ground staff and environmental volunteers in identification of the GGBF is also recommended to further assist in the reporting of frogs and to develop a more comprehensive understanding of its distribution in the area. In the event that the GGBF occurs on an industrial site it may be beneficial to train selected staff in identification and reporting along with a protocol on what to do if the frogs are found on a particular site.

There is potential for Sydney Olympic Park Authority (SOPA) to act as a 'lighthouse' to educate neighboring regions about managing the GGBFs. The SOPA site provides an excellent example of ongoing monitoring, implementation of responsible management practices and successful creation and ongoing maintenance of GGBF habitat components. The site is therefore also useful as a demonstration site to

educate and assist other land managers to do the same. The provision of tours and workshops could be used to further disseminate this information.

4. Reduction of external threats to GGBFs.

Although an amphibian survey conducted in the Holsworthy Military Reserve by Australian Museum Business Services (AMBS) in 1995 did not find GGBFs, the species is still considered likely to occur as it is highly mobile and has been identified in adjacent areas, such as Williams Creek and Minto Heights (Recsei, 1995). To protect the species the 1995 AMBS study made the following recommendations:

- Adoption of an altered fire regime, including avoiding burning over spring and summer when GGBFs are most active, and restricting fires to low intensity and low frequency to assist GGBF dispersal through reduced undergrowth, while avoiding depletion of food sources. Due to arson events during the high fire danger periods of late spring and summer the Department of Defence (DoD) has been unable to implement this fire regime since about 2000. Other mechanical hazard reduction practices have been undertaken to reduce the risk of arson related fires impacting on DoD land.
- Avoiding using areas that provide potential GGBF habitat, such as the low lying 'demolition areas' and other ephemeral zones, as explosion sites. It is understood that military training changes since 1995 have reduced the frequency at which these practices now occur.
- Enhancement of potential habitat areas by widening existing water bodies and managing the impact of pollutants. Riparian restoration works along Williams Creek have been undertaken. Minor habitat enhancement works at selected ephemeral and intermittent stream pool areas are likely to benefit the status of the GGBF on the site. Such works would require a cooperative endeavour from the DoD, DECC and Liverpool City Council to be implemented and monitored.

5. Monitoring and research to better understand the extent and dynamics of the Parramatta River GGBF population.

New Brighton Golf Course has developed and implemented an environmental management strategy and action plan that includes sustainable approaches to all aspects of golf course management practices. The NBGC hosts school StreamWatch and wastewater management programs, as well as field days with the Georges River Environmental Education Centre. These programs provide opportunities for frog surveys and monitoring, and perhaps GGBF reintroduction or supplementation trials in the future.

NBGC is currently liaising with the Department of Primary Industries (DPI Fishing and Aquaculture) to investigate ways to eradicate *Gambusia* and Carp from existing golf course water features.

Targeted survey and ongoing spot monitoring of sites considered to be of high habitat value would provide a more comprehensive understanding of current GGBF status in the Georges River area. Surveying should include all 'green areas' (reserves, golf courses, decommissioned sand mines, wetlands, STPs and low lying areas) along the Georges River and its tributaries. A focused community survey of key suburbs including Voyager Point and Hammondville to raise GGBF awareness and encourage reporting of frog sightings would also likely yield further sightings and

contribute to an updated local status report. Frog interest groups, such as the Frog and Tadpole Study Group (FATS), could be encouraged to assist with systematic survey efforts across the local area and further encourage community involvement.

6. Coordination and communication between the various stakeholders, land managers and the community.

There needs to be continual liaison between DECC, Liverpool, Bankstown and Fairfield Councils, the community and other stakeholders such as the Department of Defence, various golf courses and developers to address conservation concerns for the GGBF in the Georges River area.

The three local Councils need to be aware of sensitive lands under development pressure and act to ensure that adequate habitat is preserved, enhanced or created to suit the GGBF.

Council's considering development applications that have GGBF implications should use the following hierarchy:

- avoid the disturbance or destruction of GGBF habitat
- if habitat is to be disturbed, minimise the disturbance and ensure appropriate rehabilitation occurs
- if habitat is to be lost, ensure that appropriate offsets are provided

Initiatives such as the creation of an electronic email forum to assist stakeholders in discussing their issues and solutions would be beneficial to not only the Georges River area but would be of value to all stakeholders involved in the conservation of the GGBF statewide. Also encouraging ground staff to attend on-site or educational workshops held by DECC or the Sydney Olympic Park Authority to learn about the management of GGBF habitat.

Review

A review of the plan is required after 2.5 years (eg. early 2011) as a basis for its next iteration. This should include a meeting of stakeholders to discuss recent results and recommendations for adding to and modifying management actions.

Informal review of the plan is also encouraged both within organisations and through networks and partnerships. All recommendations to improve the plan should be directed to the DECC contact on the inside front cover of this Plan.

Implementation

The Implementation Plan in the following table provides a framework of actions for the management focus outlined above. The Implementation Plan should be read and actioned with reference to the draft GGBF Recovery Plan and PAS.

For each management action, the Implementation Plan describes:

- the linkages to the draft Recovery Plan and PAS
- the stakeholders responsible for the management action (lead organisation/group in bold)
- the estimated cost associated with the management action, and possible sources of funding
- the time frame for undertaking the various tasks is also provided.

Some management actions apply to more than one strategy (see 'Objectives and Strategies' section) in the plan.

Actions attributed to certain parties will be subject to available funding and resourcing, unless they are conditions of existing approvals or proposals, or are a result of a statutory requirement.

In the tables below, the acronyms under “Responsibility” and “Funding Sources” stand for the following organisations/groups:

- ARC = Australian Research Council
- COC = Caring for Our Country program by the Federal Government (which replaced the the Natural Heritage Trust on 1 July 2008).
- CMA = Catchment Management Authority
- DECC = NSW Department of Environment and Climate Change
- DEWHA = Department of the Environment, Water, Heritage and the Arts
- DoD = Department of Defence
- DoP = Department of Planning
- DPI = Department of Primary Industries (Fisheries)
- Env Trust = Environmental Trust
- FATS = Frog and Tadpole Study Group
- Fox TAP = Fox Threat Abatement Plan for NSW
- GRCCC = Georges River Combined Councils Committee
- GREEC = Georges River Environmental Education Centre
- SM CMA = Sydney Metropolitan Catchment Management Authority

Implementation Plan

Strategy 1: *Further development of GGBF breeding and other habitat components, where appropriate, on public and private lands*

ACTION	RECOVERY PLAN LINKS / PAS LINKS	RESPONSIBILITY†	COST*	FUNDING SOURCES	TIMEFRAME
1.1 Investigate areas with potential for GGBF habitat to be created and/or enhanced.	Action 11.3.3 / PAS 9	DECC, relevant landowners, Liverpool, Bankstown and Fairfield Councils, GRCCC, SMCMA	$20,000	COC, Env Trust, development driven assessment requirements	2008 - 2009
1.2 Investigation / survey of areas with historical GGBF records.	Action 12.3.1	DECC, relevant landowners, Liverpool, Bankstown and Fairfield Councils, GRCCC, SMCMA	$10,000	COC, Enl Trust	2008 -2009
1.3 Consent authorities to ensure no net losses of habitat resulting from proposed and future developments. Any losses are to be accompanied by appropriate offsetting.	Actions 10.3.1, 11.3.1, 11.3.3, 14.3.1 / PAS 1, 5, 30	DECC, **Liverpool, Bankstown and Fairfield Councils**, DoP	Recurrent funding for statutory functions	N/A	2008 - 2011
1.4 Development of a set of standards / guidelines for GGBF habitat design.	Action 11.3.3	DECC, CMA	underway	COC, CMA	2008
1.5 Re-creation and rehabilitation of GGBF habitat will be required to follow the prescribed habitat guidelines when undertaken as a requirement of development.	Action 11.3.1	**Liverpool, Bankstown and Fairfield Councils**, DECC, DoP	minimal	N/A	2008-2011
1.6 Investigation of the habitat potential of areas within the Holsworthy training area and enhancement of such habitat.	Action 11.3.3	DECC in liaison with DoD	$5,000 assessment; enhancement cost undetermined	COC, DoD	2008-2010
1.7 The proposed Riverlands Golf Course development should include GGBF habitat elements and be designed with a vision for potential GGBF colonisation (see actions 2.4, 4.2 and 4.4)	Action 11.3.3, 11.3.1	**Bankstown Councils**, DECC, Riverlands Golf Course	Included in development cost as biodiversity investment or offset	Riverlands Golf Course	2008

***Note: costs are indicative only and subject to available funding; † lead organisation or group responsibility in bold**

Strategy 2: *Improvement of habitat within the GGBF key populations*

ACTION	RECOVERY PLAN LINKS / PAS LINKS	RESPONSIBILITY†	COST*	FUNDING SOURCES	TIMEFRAME
2.1 Identification and protection of ephemeral and permanent habitat (link to 1.1 and 1.2).	Actions 11.3.3, 11.3.1	DECC, **Liverpool, Bankstown and Fairfield Councils**	Partially included in costing for 1.1; other recurrent or negligible	recurrent	2008-2009
2.2 Identification and protection of areas with potential to strengthen habitat connectivity (link to 1.1, 1.2 & 2.1)	Actions 11.3.3, 11.3.1	DECC, **Liverpool, Bankstown and Fairfield Councils**	Partially included in costing for 1.1; other costs recurrent or included as component of other initiatives	Councils, CMA, COC, GRCCC	2008-2009
2.3 Development of guidelines for creek management.	Action 11.3.3	GRCCC, relevant Councils, CMA	undetermined	GRCCC, CMA	2009-2010
2.4 Joint council effort at reducing the amount of rubbish entering local waterways, including more widespread installation of gross pollutant traps, trash racks and similar devices.	Actions 11.3.3, 14.3.2	GRCCC, relevant Councils, CMA, DECC	Recurrent	Councils, DECC	2008 - ongoing
2.5 Adoption of environmental management practices within the Holsworthy training area to improve potential habitat areas for the GGBF.	Action 11.3.3	DoD in consultation with DECC and DEWHA	undetermined	recurrent funding	2009-2010
2.6 Golf clubs to adopt environmental management guidelines that ensure effects on golf course water bodies from herbicide, pesticide and fertiliser application are kept to a minimum.	Action 11.3.3 / PAS 9	**DECC**, Local Golf Clubs including (but not limited to) Riverlands and New Brighton (including current entity or future organisations)	DECC, relevant Councils and Golf Clubs	Golf course running costs	2008-2009

***Note: Costs are indicative only and subject to available funding; † lead organisation or group responsibility in bold**

Strategy 3: *Education and communications to build awareness of the GGBFs and encourage further on-ground actions*

ACTION	RECOVERY PLAN LINKS / PAS LINKS	RESPONSIBILITY†	COST*	FUNDING SOURCES	TIMEFRAME
3.1 Conduct GGBF education programs targeting schools and residents in the Liverpool, Bankstown and Fairfield area, particularly those close to the Georges River or other significant water bodies	Action 14.3.2 / PAS 32	DECC, Liverpool, Bankstown and Fairfield Councils, GREEC	undetermined	Env Trust, CMA, Councils	2008 - ongoing
3.2 Development of an early education program for primary students, including frog identification.	Action 14.3.2	GREEC, DECC, FATS	<$6000	Env Trust, COC	2008-2010
3.3 Georges River Environmental Education Centre to provide GGBF education and links to council GGBF conservation activities.	Action 14.3.2	GREEC, Liverpool, Bankstown and Fairfield Councils, DECC	minimal	Recurrent GREEC funds, Env trust	2008 - ongoing
3.4 Development of a feedback mechanism for the community and volunteer groups to encourage reporting of GGBF sightings.	Action 14.3.2	DECC, councils and other stakeholder contacts	$2000/pa	Env Trust, COC	2008 - ongoing
3.5 Liaise with local media (newspapers, newsletters, radio, TV) so as to encourage GGBF reporting (e.g. implementation of Management Plan) and to raise awareness.	Action 14.3.1 / PAS 33	DECC, CMA, GRCCC	minimal	recurrent	2008 – ongoing
3.6 Education program to focus on the various Golf clubs in the area with the aim to raising the profile of GGBFs and their use of golf courses as important habitat areas.	Action 14.3.1 / PAS 32	DECC, CMA, Liverpool, Bankstown and Fairfield Councils	<$5000	Env Trust, GRCCC, CMA	2009-2010
3.7 Education of council field staff and contractors, with the aid of the NPWS Frog Hygiene Protocol, concerning contamination and impact on GGBF habitat (link to Action 4.1).	Actions 11.3.5, 14.3.2 / PAS 32	DECC, Liverpool, Bankstown and Fairfield Councils	minimal	recurrent	2009-2010
3.8 DECC to distribute to land managers and residents Best Management Practice guidelines as regards GGBF habitat creation, enhancement and maintenance. Information for residents to include backyard habitat components for frogs.	Actions 14.3.1, 11.3.3 / PAS 9	DECC	underway	recurrent	end 2008

ACTION	RECOVERY PLAN LINKS / PAS LINKS	RESPONSIBILITY†	COST*	FUNDING SOURCES	TIMEFRAME
3.9 Distribution of information to residents to reduce opposition against and dispel uncertainties about local backyard frog ponds (e.g. smell, noise) to encourage their creation and maintained use.	Actions 14.3.1, 14.3.2	**Liverpool**, Bankstown and Fairfield **Councils** in collaboration with DECC, FATS	<$5,000	Councils, DECC, CMA	2008 – ongoing
3.10 Develop a GGBF brochure to be distributed to target audiences to assist with education about GGBF and opportunities for community involvement.	Actions 14.3.1, 14.3.2 PAS 32	Councils, DECC, CMA, FATS, GREEC, environment and bush regeneration groups	Minimal, in-kind	Nominated groups	2008 – ongoing

***Note: costs are indicative only and subject to available funding; † lead organisation or group responsibility in bold**

Strategy 4: *Reduction of external threats to GGBFs*

ACTION	RECOVERY PLAN LINKS / PAS LINKS	RESPONSIBILITY†	COST*	FUNDING SOURCES	TIMEFRAME
4.1 Implementation of the NPWS Frog Hygiene Protocol during any interaction with GGBF or its habitat to prevent the spread of chytrid fungus.	Action 11.3.5 / PAS 15	All Stakeholders	Nil	In-kind	2008 – ongoing
4.2 Survey of GGBF habitat for presence of *Gambusia holbrooki* and, with reference to the *Gambusia* Threat Abatement Plan (TAP), and where possible remove *Gambusia* from sites as well as reduce further spread to unoccupied GGBF habitat. (Link to 1.1, 1.2 & 2.1).	Action 11.3.2 / PAS 6	DECC, Liverpool, Bankstown and Fairfield Councils, DPI Fisheries, GRCCC	<$5,000	DECC, COC, CMA	2008-2009
4.3 Efforts taken to avoid introducing, and to continually exclude, *Gambusia* in the water bodies of proposed developments, including the Riverlands Golf Course development.	Action 11.3.2, 11.3.3	Liverpool, Bankstown and Fairfield Councils, DECC, Golf Courses	minimal	In-kind	2008-2011
4.4 Survey of potential GGBF habitat that *Cyprinus carpio* occupy and examine opportunities to eradicate and prevent further spread to unoccupied habitat (Link to 4.2).	Action 11.3.2 / PAS 14	DECC, Liverpool, Bankstown and Fairfield Councils, Landowners, DPI Fishing and Aquaculture	<$5,000	COC, SM CMA, sponsorship	2008-2011
4.5 Consult with local golf courses regarding pesticide use and habitat management. Development and adherence to standards regarding pesticide and herbicide use, creation of boundaries / out of play zones, use of organic chemicals, hand weeding near water bodies, disuse of sprinklers in wet conditions or post herbicide and pesticide application. (Link to 4.3, 3.6, 3.8).	Actions 11.3.2, 11.3.3	DECC, Liverpool, Bankstown and Fairfield Councils, CMA, GRCCC	minimal	In-kind	2008-2010
4.6 Development of a list of requirements to ensure GGBF surveys for fauna assessments or similar are comprehensive.	Actions 12.3.1, 11.3.1	DECC, Liverpool, Bankstown and Fairfield Councils	negligible	recurrent	2008

ACTION	RECOVERY PLAN LINKS / PAS LINKS	RESPONSIBILITY†	COST*	FUNDING SOURCES	TIMEFRAME
4.7 Investigate and identify and address any additional threats to the GGBF locally. (Link to other survey/assessment Actions 1.1, 1.2, 2.1, 2.2, 4.2 & 4.3)	Action 11.3.2	DECC, partly via other actions	<$5,000	COC, Env Trust, CMA, GRCCC	2008-2010
4.8 DECC to contact relevant landholders, using existing council networks, in relation to synchronisation of fox baiting programs that are currently in place.	Action 10.3.1 / PAS 3	DECC, Liverpool, Bankstown and Fairfield Councils	undetermined	Existing funding, recurrent funding and Fox TAP	2008 – 2010
4.9 Holsworthy training area adopt a sensitive approach to fire regimes in and near water bodies and sedgelands and endeavour to maintain these areas free of pollutants. When revising fire management plans these areas need to be given strategic protection consideration where possible.	Action 11.3.2	DoD, DECC, local councils	undetermined	recurrent	2009-2011
4.10 Investigate numbers of the White Ibis at GGBF sites and their likely impacts on the GGBF. Where required, seek DECC support for implementation of control measures as necessary (to run jointly with investigations conducted for other GGBF key populations).	Action 11.3.2 / PAS 3, 14, 26	DECC Liverpool, Bankstown and Fairfield Councils	Dependent on findings	COC, DECC, SMCMA, Research Grants	2008 - 2010

***Note: costs are indicative only and subject to available funding; † lead organisation or group responsibility in bold**

Strategy 5: *Monitoring and research to better understand the extent and dynamics of the Georges River GGBF population*

ACTION	RECOVERY PLAN LINKS / PAS LINKS	RESPONSIBILITY†	COST*	FUNDING SOURCES	TIMEFRAME
5.1 Targeted surveys of areas that have furnished recent and historic GGBF records. (Link to Actions 1.1, 1.2, 2.1 and 2.2).	Action 12.3.1 / PAS 31	DECC, Post Graduate University Students, Consultants, FATS	<$15,000	COC, CMA	2008 - 2011
5.2 Established ongoing monitoring for any remnant populations identified.	Action 12.3.1	DECC, relevant LGA and stakeholder	undetermined	N/A	2008 - ongoing
5.3 Development of a joint initiative between Holsworthy training area and Frog Conservation Organisation e.g. FATS or University researchers to enable continued GGBF monitoring and habitat protection.	Actions 12.3.1, 14.3.1, 14.3.2	DECC, DoD, FATS, University Zoology/Ecology Departments	minimal	N/A	2009-2010
5.4 Establish community monitoring programs centred on recent and historic GGBF habitat that, during targeted surveys, show evidence of possible GGBF presence (link to Action 5.1).	Action 14.3.2 / PAS 31	DECC, Councils, community stakeholders	<$5,000	Env Trust, COC, CMA, Councils	2008 -2010
5.5 Conduct a review of GGBF genetic studies that worked on, among other things, determining variability within and between Lower Georges River GGBF populations to identify evolutionary significant units, so as to inform possible future interconnection initiatives and establish definitive baseline data. (Link to Recovery/PAS).	Action 12.3.2 / PAS 26	DECC, Expert conservation geneticist	<$10,000	COC, ARC	2008 - 2011
5.6 Investigate options and likely corridors that could be used to ultimately link local GGBF populations (link to Action 2.2).	Action 12.3.2	DECC, Consultant, Landcare/ bushcare Groups, local government initiatives, CMA, GRCCC	<$5,000	COC, Env Trust, Councils	2008 - 2010

***Note: costs are indicative only and subject to available funding; † lead organisation or group responsibility in bold**

Strategy 6: *Coordination and communication between the various stakeholders, land managers and the community*

ACTION	RECOVERY PLAN LINKS / PAS LINKS	RESPONSIBILITY†	COST*	FUNDING SOURCES	TIMEFRAME
6.1 Education for Council Parks and Reserves staff and other relevant field staff from other agencies to report frog observations and communication with the DECC	Actions 14.3.1, 10.3.1, 14.3.2	DECC, other stakeholders	minimal	Env Trust	2008-2011
6.2 DECC to continue to liaise with large landholders in relation to GGBF conservation concerns on private lands.	Action 10.3.1 / PAS 1, 9, 18	DECC	Negligible	In-kind	2008 - 2010
6.3 Review of the DA approval process and address the need to trigger GGBF consideration in areas of relevant councils.	Action 11.3.1	DECC, **Liverpool, Bankstown and Fairfield Councils**	negligible	In-kind	2008-2009
6.4 DECC to continue to liaise with Liverpool, Bankstown and Fairfield councils regarding future development proposals on current and potential GGBF habitat. This will ensure that GGBF is adequately considered in any future development proposals.	Actions 10.3.1, 11.3.1 / PAS 1	**DECC**, Liverpool, Bankstown and Fairfield Councils, GRCCC	negligible	In-kind	2008 - 2010
6.5 Developments that have required specific GGBF habitat creation and management as part of consent conditions must provide monitoring/performance details to Council and DECC.	Action 10.3.1	DECC, **Liverpool, Bankstown and Fairfield Councils**	Negligible	In-kind	2008 - 2010
6.6 Creation of an electronic email forum that will facilitate coordination of the Lower Georges River GGBF Management Plan.	Action 14.3.2 / PAS 24	DECC, SMCMA, GRCCC	Minimal	In-kind	2008-2009

***Note: costs are indicative only and subject to available funding; † lead organisation or group responsibility in bold**

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Appendices

Appendix 1: Frog Hygiene Protocol

Individuals studying or surveying frogs often travel and collect samples of frogs from multiple sites. Green and Golden Bell Frogs can be particularly sensitive to the introduction of infectious pathogens, such as the frog chytrid fungus. Therefore, it is important that frog workers recognise the boundaries between sites and undertake measures that reduce the likelihood of spreading infection. Detailed procedures, measures and background are provided in the *"Hygiene Protocol for the Control of Disease in Frogs"*, which can be obtained from the Department of Environment and Climate Change, or downloaded from:
http://www.nationalparks.nsw.gov.au/pdfs/hyprfrog.pdf

Appendix 2: GGBF Captive Breeding and Translocation

The Department and Environment and Climate Change is currently guided by a Policy for the Translocation of Threatened Fauna in NSW that will apply to all proposals to translocate threatened fauna species (see NPWS 2001 - Policy and Procedures Statement No. 9). This Policy outlines four possible justifications for translocation of threatened fauna that include: species recovery, biodiversity reconstruction, emergency transfer and research.

The merits and usefulness of captive breeding and translocation for GGBFs to supplement or re-establish a population as a conservation measure have also been identified in the draft GGBF Recovery Plan. Whilst captive breeding and reintroduction or supplementation may be deemed a desirable initiative as part of this Management Plan, *in situ* conservation of the existing population is always a priority, even if later focus is drawn to reintroduction or supplementation initiatives. In any event all proposals for reintroduction/supplementation will have to be subject to the Policy for the Translocation of Threatened Fauna in NSW. It should not be assumed that such measures will be a simple solution to the decline or disappearance of a local population or population sub-unit and gain automatic approval from the DECC.

Several trials have already been undertaken to determine the feasibility and merits of undertaking captive breeding and release as reintroduction or supplementation exercises. Such trials have been undertaken both in concert with habitat creation/enhancement measures as well as without any habitat manipulation. To date there have been several reintroduction failures where releases of tadpoles or juvenile frogs have shown initial promise and survived to transformation or early adult stage but have then failed to survive to maturity and establish a self sustaining population e.g. Sir Joseph Banks Reserve, Botany and Long Reef Golf Course, Dee Why. Other sites have had supplementation releases of captive bred stock but where there was also a remaining residual element of the population in that area. At such sites releases have appeared to initially benefit the local population. However because releases have also been in concert with habitat creation initiatives it is difficult to determine whether the habitat creation has benefited and boosted breeding success of the remnant population, or if apparent increases can be attributed to recruitment of released captive bred specimens e.g. Arncliffe M5 East site and Edgewood site Woonona.

It should be emphasised here that the Policy for the Translocation of Threatened Fauna in NSW indicates that in no way should translocation be considered as a mitigative measure when determining the significance of a proposal on a local population of a threatened species. The NSW DECC has prepared Environmental Impact Assessment (EIA) Guidelines that provide guidance to development proponents, consultants and consent authorities. These guidelines further reaffirm the DECC position on translocation and the general inappropriateness of it being considered as a component of development proposals.

Ultimately decisions to conduct GGBF translocations and captive breeding are at the NSW DECC's discretion and will be assessed on merit and on a site-by-site basis. Factors such as the provenance of translocated individuals, whether threatening processes continue to operate at a site, as well as costs and an ability to monitor outcomes for an extended period will all be considerations for the benefit of improved understanding and future proposals.