Approved **NSW Recovery Plan**

Recovery Plan for the Spotted Tree Frog (*Litoria spenceri*)

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NSW NATIONAL PARKS AND WILDLIFE SERVICE

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Recovery Plan for the Spotted Tree Frog (*Litoria spenceri*)

Executive Summary

This document constitutes the formal New South Wales Recovery Plan for the Spotted Tree Frog *Litoria spenceri*, and as such considers the conservation requirements of the species across its known range within the State. It identifies actions to be undertaken to ensure the long-term viability of the species in nature and the parties who will carry these out.

The Spotted Tree Frog is listed as Endangered (Schedule 1, Part 1) on the NSW *Threatened Species Conservation Act 1995* and Endangered on the Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999. The species, which grows between 50-60 mm in length, has a back which ranges in colour from pale brown to bright green to olive-grey, usually with numerous raised small 'warts'. In contrast its underbelly is pale and granular, and often flushed with pale orange toward the rear and underside of the hind limbs.

In New South Wales, the species has an extremely limited range, being apparently restricted to streams within Kosciuszko National Park in the south of the State. A high-density population was previously known from the upper reaches of Bogong Creek, but has recently experienced a sharp decline in numbers to a point where its future viability is in serious doubt. Of equal concern, no other breeding populations are currently known from New South Wales despite extensive survey in (visually) suitable habitat.

While the possible cause(s) of decline of the Bogong Creek population is (are) unknown, it is clear that without intervention it will likely become extinct in the near future. That being the case the current recovery plan emphasises the need for a captive breeding exercise, using remaining wild animals. The aim of this exercise will be to provide founder stock for a later re-introduction program at the same site, with the primary objective of restoring numbers to a previously high level. Pending the success of this program other re-introduction works may be considered elsewhere. Other actions associated with this intensive effort include: (i) monitoring and controlling exotic weeds in riparian habitats associated with Bogong Creek, (ii) monitoring and removing trout, a known predator of the Spotted Tree Frog, in that habitat previously occupied by the species, (iii) excluding fire from the same habitat, and (iv) conducting further additional survey to exhaust the possibility that the species does not occur elsewhere in the general vicinity of the known population.

It is intended that this recovery plan be implemented over a seven-year period, by which time the success (or otherwise) of the captive breeding and re-introduction program on Bogong Creek will be known. Actions identified in this recovery plan will be undertaken by the New South Wales National Parks and Wildlife Service, the Snowy Mountains Hydro-Electric Authority and the Amphibian Research Centre, using existing resources. An additional $42,400, donated by the Snowy Mountains Hydro-Electric Authority toward the program, will be used to employ consultants on specific recovery tasks.

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Director-General

BOB DEBUS MP
Minister for the Environment

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1 Introduction

Over the past two decades nearly thirty species of Australian amphibians have reportedly declined in distribution and abundance, with a small number of these now apparently extinct. With few exceptions the majority of declining species are forest-dwelling frogs that breed in streams. The reasons for this disturbing trend remain largely unknown, but the current situation appears to be part of much broader global trend of amphibian decline (Blaustein *et al*. 1994).

The Spotted Tree Frog, *Litoria spenceri*, is one such example of a declining frog species. Originally recorded from seventeen discrete localities across north-eastern Victoria and adjacent New South Wales, populations at four of these localities are now presumed extinct. Furthermore, the only significant population of the species in New South Wales, that occurring at Bogong Creek within Kosciuszko National Park, has recently undergone a precipitous decline in numbers.

This document constitutes the formal New South Wales State Recovery Plan for the Spotted Tree Frog and as such considers the conservation requirements of the species across its known range in the State. It identifies the actions to be taken to ensure the long-term viability of the species in nature and the parties who will carry these out. The attainment of this Recovery Plan's objectives is subject to budgetary and other constraints affecting the parties involved. It may also be necessary to amend this Recovery Plan in the event of new information or following recommended changes to the Recovery Program by the associated Recovery Team. The information in this Recovery Plan is accurate to March 2001.

2 Legislative Context

2.1 Legal Status

In view of its extremely limited distribution within the State, the Spotted Tree Frog is considered endangered and is listed on Schedule 1 of the *Threatened Species Conservation Act 1995* (the TSC Act).

In Victoria, the species is considered Threatened under the *Flora and Fauna Guarantee Act 1988*. At a National level, it is listed as an Endangered Species under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A recent revised assessment of the conservation status of the Spotted Tree Frog according to IUCN (1994) criteria listed the species as Critically Endangered (Robertson and Gillespie 1998). The species is considered a Priority A Vertebrate on the Priority Lists prepared by Endangered Species Advisory Committee (ESAC) for the Biodiversity Group of Environment Australia.

Among the consequences of listing as a threatened species on the TSC Act are that a recovery plan must be prepared, that consideration be given to the species in assessing the impacts of developments and activities with the aim of minimising adverse impacts, and that actions that are likely to result in the harming or picking of that species or damage its habitat are licensed.

2.2 Recovery Plan Preparation

The TSC Act requires that the Director-General of National Parks and Wildlife prepare recovery plans for all species, populations and ecological communities listed as endangered or vulnerable on the TSC Act schedules. Similarly, the EPBC Act requires the Commonwealth Minister for the Environment to ensure the preparation of a recovery plan for nationally listed species and communities or adopt plans prepared by others including those developed by State agencies. Both Acts include specific requirements for both the matters to be addressed by recovery plans and the process for preparing recovery plans.

This plan has been prepared to satisfy the requirements of the TSC act, but since it does not cover the full range of the species within Australia it may not meet all the requirements of the EPBC Act. To that latter end a National Recovery Plan for the species has already been drafted and is currently awaiting adoption by the Commonwealth Minister for the Environment (Robertson and Gillespie 1998).

2.3 Recovery Plan Implementation

The TSC Act requires that a public authority must take any appropriate measures available to implement actions included in a recovery plan for which they are responsible. Public authorities and councils identified as responsible for the implementation of Recovery Plan actions are required by the TSC act to report on measures taken to implement those actions. In addition the TSC Act specifies that public authorities must not make decisions that are inconsistent with the provisions of the plan. The only State government agency relevant to this plan is the NPWS.

The EPBC Act specifies that a Commonwealth agency must not take any action that contravenes a recovery plan.

2.4 Relationship to Other Legislation

The lands on which the Spotted Tree Frog occurs include those that are owned or managed by the NPWS. Relevant legislation includes:

- *National Parks and Wildlife Act 1974*
- *Environmental Planning and Assessment Act 1979*
- *Rural Fires Act 1997*
- *Environmental Protection and Biodiversity Conservation Act 1999*

The interaction of these Acts with the TSC legislation is varied. The most significant implications are described below and in Section 2.6.

2.5 Critical Habitat

The TSC Act makes provision for the identification and declaration of Critical Habitat for species, populations and ecological communities listed as endangered. Once declared, it becomes an offence to damage Critical Habitat (unless the TSC Act specifically exempts the action) and a Species Impact Statement is mandatory for all developments and activities proposed within Critical Habitat. To date, Critical Habitat has not been declared for this species under the TSC Act. The declaration of critical habitat is not considered to be a priority for the Spotted Tree Frog, as other mechanisms provide for the protection of this species. As the habitat of the Spotted Tree Frog is only known to occur on land managed by the NPWS, the type of developments or activities which are likely to occur are limited by the provisions of the NPW Act.

Under the EPBC Act Critical Habitat may be registered for any nationally listed threatened species or ecological community. When adopting a Recovery Plan the Commonwealth Minister for the Environment must consider whether to list habitat identified in the Recovery Plan as being critical to the survival of the species or ecological community. It is an offence under the EPBC Act for a person to knowingly take an action that will significantly damage critical habitat (unless the EPBC Act specifically exempts the action). This offence only applies to Commonwealth areas. However, an action that is likely to have a significant impact on a listed species is still subject to referral and approval under the EPBC Act. This recovery plan identifies those habitat features currently known to be critical to the survival of the Spotted Tree Frog in New South Wales, as required by the EPBC Act.

2.6 Environmental Assessment

The TSC Act amendments to the environmental assessment provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) require that consent and determining authorities (the Director-General of the National Parks and Wildlife in the case of NPWS estate) consider relevant recovery plans when exercising a decision making function under Parts 4 & 5 of the EP&A Act. Decision makers must consider known and potential habitat, biological and ecological factors, and regional significance of individual populations. In New South Wales, the only public authority that has a decision making function in relation to the Spotted Tree Frog is the NSW NPWS. Activities as defined under the EP&A Act require the approval of the Director-General. Any other action not requiring approval under the EP&A Act, and which is likely to have a significant impact on Spotted Tree Frog, requires a Section 91 licence from the NPWS under the provisions of the TSC Act. Such a licence can be issued with or without conditions, or can be refused. Additional public authorities may have a decision making function if the species is located in other areas in the future.

As the Spotted Tree Frog is listed nationally under the EPBC Act, any person proposing to undertake actions likely to have a significant impact on the species should refer the action to the Commonwealth Minister for the Environment for consideration. The Minister will then decide whether the action requires EPBC Act approval. This is in addition to any State or Local Government approval requirements specified above for the New South Wales EP&A Act. Administrative guidelines are available, from Environment Australia, to assist proponents in determining whether their action is likely to have a significant impact. In cases where the action does not require EPBC Act approval, but will result in the death or injury of a Spotted Tree Frog and the animal is in, or on a Commonwealth area, a permit issued by the Commonwealth Minister for the Environment under the EPBC Act, will be required. The Commonwealth Minister for the Environment can also delegate the role of assessment and approval to other Commonwealth Ministers under a Ministerial Declaration and to the States and Territories under bilateral agreements. The development of a bilateral agreement between NSW and the Commonwealth is not yet complete, but when in place will avoid the need for duplication of environmental assessment

3 Species Information

3.1 Description

The Spotted Tree Frog is a medium-sized species of amphibian in the Family Hylidae. Adult females attain a snout-vent length up to 61 mm, while adult males are smaller, attaining 50 mm (Watson *et al*. 1991). The back is highly variable, ranging from pale brown, to bright green, to olive-grey, with or without blotches, but usually with numerous small raised 'warts'. The underbelly is pale and granular, and is often flushed with pale orange toward the rear and underside of the hind limbs. Toes and fingers are distinctly flattened, with the discs moderately expanded; the fingers have distinct basal webbing and the toes are fully webbed. The head is broad and a distinct fold is present above the indistinct tympanum (Robertson and Gillespie 1998).

The tadpole is free swimming. The body is elongated and flattened and individuals reach a length of 40 mm prior to metamorphosis. The tail is moderately thick and has a rounded tip. The eyes are dorso-ventral and the mouth is ventral. The oral disc is large, relative to other closely related species, and the oral papillae have a wide anterior gap. There are two rows of anterior labile teeth and three posterior rows. Body colour is dark brown to black above, with fine silver chromatophores extending onto the flanks. Darker spots may be present on the dorsal surface. The ventral surface is darkly pigmented, while the tail fin and associated muscle are covered with fine melanophores (Hero *et al*. 1995).

3.2 Distribution

The Spotted Tree Frog has a limited and fragmented distribution, being predominantly confined to streams on the north-west side of the Great Dividing Range, from the Central Highlands of Victoria to Mount Kosciuszko in New South Wales. Across this narrow geographic region 17 discrete populations have been identified, four of which are presumed extinct (see Gillespie and Hollis 1996 for more details).

Only two populations have been identified in New South Wales, at Bogong Creek and in the upper Murray River, both within Kosciuszko National Park in the south of the State (Figure 1). There is no evidence to suggest that the Spotted Tree Frog was more widely distributed in the past.

3.3 Current Conservation Status

The Spotted Tree Frog was first discovered in New South Wales in January 1970 by Hal Cogger, near the bridge at the junction of Bogong Creek and the Alpine Way, Kosciuszko National Park (site 1) (NSW NPWS Wildlife Atlas). Later surveys conducted at this site by Ehmann *et al*. (1993), Gillespie and Hollis (1996) and Hunter and Gillespie (1999) failed to re-detect the species but identified a significant population elsewhere on Bogong Creek, some 12-15 kms upstream from the bridge, at Bourke's Gorge (site 2). Most of this population was recorded from a 1.6 km section of

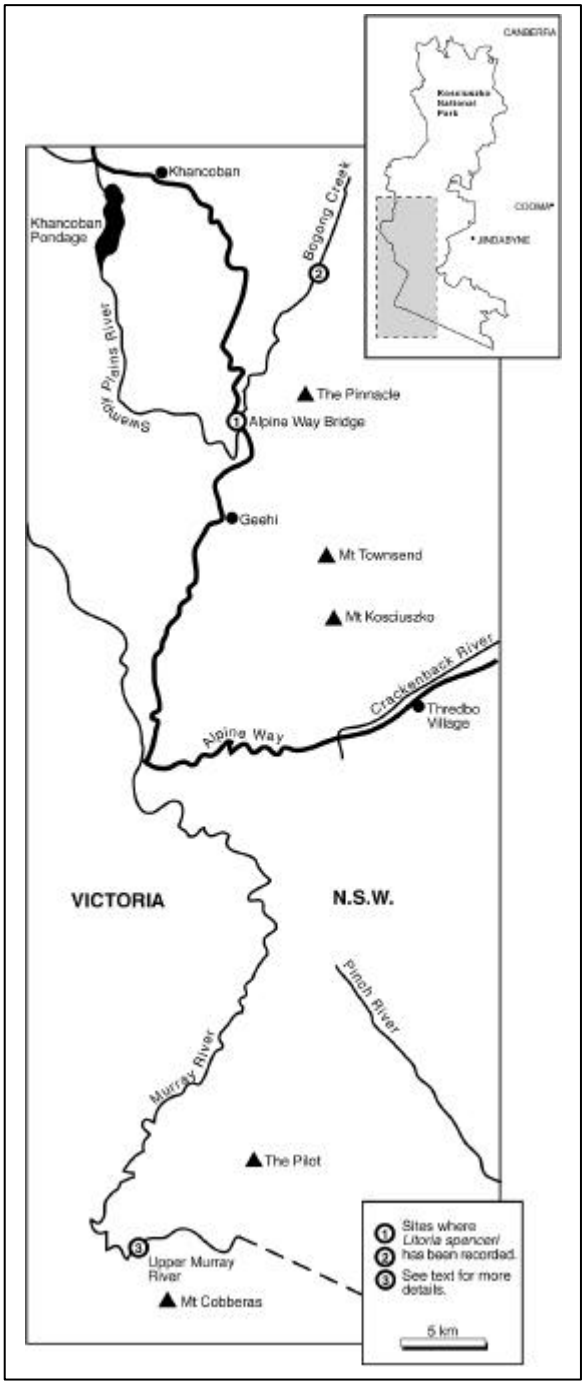

Figure 1. Map of Kosciuszko National Park illustrating sites at which the Spotted Tree Frog has been recorded.

the stream at the Gorge, above a substantial waterfall (> 4 m high). Lower numbers of animals were recorded below the waterfall (Hunter and Gillespie 1999). During the summers from 1993 to 1996 that part of the population above the waterfall consistently exceeded several hundred individuals and occurred at a density not recorded elsewhere for the species (Gillespie and Hollis 1996). However, since then the population has undergone a precipitous decline, with a maximum of two frogs recorded over the past three years (Gillespie 2000). Furthermore, breeding activity by the frogs has not occurred at the site for the past two years. Without some sort of active intervention, this population will likely become extinct.

The only other known population of the Spotted Tree Frog in New South Wales occurs in the nearby upper Murray River (site 3), and was first detected in 1996 by Hunter and Gillespie (1999). The current status of this population is unclear since only one sub-adult frog was ever found. Subsequent repeat surveys of the same area have failed to locate this or other individuals. All indications are that the density and size of this population was extremely low, and that it may now well be extinct.

3.4 Land Tenure

The two populations of the Spotted Tree Frog recorded as occurring in New South Wales are both within the boundaries of Kosciuszko National Park. The security of this National Park tenure is governed by the provisions of the *National Parks and Wildlife Act 1974* (NPW Act). The land is zoned 8a - National Park. Populations of the species are not expected to be found on adjacent lands of other tenures.

3.5 Habitat

Across its range the Spotted Tree Frog inhabits naturally-vegetated, rocky, swift-flowing upland streams in dissected mountainous country, between 200 and 1110 m above sea level (Gillespie and Hollis 1996). The two known populations in New South Wales are in remote areas with limited access, a common theme for populations elsewhere. At Bourke's Gorge on Bogong Creek (1080 m elevation), where the largest population has been recorded, the stream habitat is characterised by an exposed granite bed with numerous loose rocks and boulders and a limited amount of cobble and gravel. The stream consists of discrete pools with intervening riffles and small waterfalls, flowing among extensive areas of dry rock during summer. Several larger waterfalls (2-8 m high), occur downstream. Mean channel width is 8 m. Basal flow depth is highly variable, ranging from 10-40 cm in most pools to 3 m at the base of some waterfalls

Riparian vegetation along Bogong Creek is typical Montane Riparian Forest, dominated by a shrub layer of *Leptospermum grandifolium* and *L. lanigerum*, with scattered *Atherosperma moschatum* and a sparse canopy of *Eucalyptus delegatensis* and *E. dalrympleana*. There is a dense understorey dominated by *Bossiaea foliosa* and *Correa lawrenciana* with scattered sprawling *Podocarpus lawrenci*. Adjacent forest is mainly Montane Forest, dominated by *E. delegatensis* with a dense shrubby understorey of *Acacia dallachiana* and *B. foliosa*.

In the upper Murray River (900 m elevation), where the second population of Spotted Tree Frog was located, the stream consists of a channel approximately 4-5 m in width. Exposed bedrock dominates the streamside environment, with associated scattered loose rocks and cobble banks. Riparian vegetation is Montane Riparian Forest dominated by a dense shrub layer of *Leptospermum grandifolium, L. lanigerum* and *Coprosma quadrifida*, with scattered *Acacia melanoxylon, E. dalrympleana* and *E. rubida* forming a sparse canopy. Adjacent forest is Dry Montane Woodland and Rocky Outcrop Scrubland, characterised by a canopy of *E. mannifera, E. dives* and *E. radiata*, often sparse and stunted in form. The understorey is comprised of several prickly shrub and heath plant species.

3.6 Life History and Ecology

The distribution of individuals is usually patchy, being largely associated with loose rock substrates, rocky banks and rapids (Gillespie 1997b). Adjacent streamside vegetation is also used for sheltering and basking. Eggs are deposited under large instream boulders. Tadpole development occurs within the stream (Hero *et al*. 1995), in shallow pools or shallow margins of streams (Gillespie 1997b). The full range of habitats utilised by the species is unknown, but other riverine frogs have been found to range widely away from streams during the non-breeding period. There is no reason to believe that the Spotted Tree Frog would behave differently.

Adult Spotted Tree Frogs are active in the stream environment between early October and late April, although this varies between seasons and different populations (Gillespie 1997b). At Bogong Creek, adults and juveniles are mainly diurnal. Elsewhere, adult animals may exhibit a nocturnal habit. Calling activity, heralding the beginning of the breeding season, commences when weather conditions are suitable between late October and early December. Oviposition has been recorded between late November and the end of December. Clutch sizes vary from around 50 to nearly 1000, with a mean of approximately 500 (Gillespie 1997b). Larval development occurs within the stream

during summer and autumn, with metamorphosis occurring between mid-February and late March. Tadpoles do not appear to over-winter in the stream.

Age structure profiles, combining skeletochronological age estimates with those of frogs from mark-recapture experiments, indicate that at Bogong Creek a significant proportion of individuals live longer than 10 years once they reach adulthood. The oldest individual so far recorded, a female, reached 13 years (Gillespie 1997b). Age to sexual maturity is 3-4 years for males and 5-6 years for females. Mortality levels are very high until individuals reach 2-3 years of age.

Mark-recapture data further indicate very high site fidelity for the Spotted Tree Frog (Gillespie 1997b). The average net movement of adults and juveniles at Bogong Creek in one season is less than 40 m. The maximum movement of any one individual is approximately 350 m. Longer movements generally coincide with the beginning and end of the active season. These findings are corroborated by the results of radio-tracking studies of Spotted Tree Frogs conducted at Bogong Creek (Gillespie 1997b).

The diet of the Spotted Tree Frog has not been well studied but appears to be typical of most anurans. Ehmann *et al*. (1993) examined faecal pellets from six frogs at Bogong Creek, noting an exclusively insectivorous content. No details were provided on the types of invertebrates consumed.

3.7 Ability of Species to Recover

Given the observed precipitous decline in the population of Spotted Tree Frog at Bogong Creek, and question marks about the continued existence of the only other known population in New South Wales, the ability of the species to recover to a position of viability (within the State) in nature is dubious. Successful recovery of this species, to meet the criteria of the TSC Act for down-listing, is probably unrealistic given the apparent limited distribution of the species, unless other major extant populations are discovered.

4 Management Issues

Surveys conducted thus far indicate that the Spotted Tree Frog has suffered a general decline in distribution and abundance across its entire range. Populations such as the one on Bogong Creek at Bourke's Gorge have recently undergone massive reductions in numbers, to the verge of extinction. Elsewhere, several populations are now presumed extinct. Causal factors under consideration (summarised by Gillespie and Hollis 1996 and Robertson and Gillespie 1998) include:

- disease;
- alteration of natural flow regimes of streams through man-made diversions, impoundment's etc.;
- habitat destruction and/or modification leading to increased sedimentation of streams;
- predation of eggs and tadpoles by introduced fish species (ie. trout);
- invasion of weed plant species (ie. blackberry) into riverine habitats and the use of herbicides to control them; and
- atypical climatic events (ie. extremes of temperature and/or rainfall and associated flooding).

A few of these factors may have contributed to the demise of the population of the Spotted Tree Frog at Bogong Creek.

4.1 Disease

Disease is a distinct possibility. During the 1995-1996 breeding season several dead and one sick frog were located along the stream at Bourke's Gorge. Closer examination of the dead animals revealed the presence of the Chytrid fungus *Batrachochytrium.* Subsequent screening of toe samples, collected from 90 apparently healthy frogs during the period 1993-1996, located chytrids in two animals. The positive samples were collected shortly before the population crash in March 1996 (Gillespie and Marantelli 2000).

Batrachochytrium has been identified in declining populations of several frog species in Australia, particularly those inhabiting riverine systems. Many aspects of the biology of this pathogenic fungus are poorly understood. For example, it has not yet been ascertained whether the fungus has been recently introduced to the Australian environment or has always been present. The epidemiology of the disease suggests the former is more likely. Research has indicated that the fungus is waterborne and particularly virulent to adult animals. In contrast, the disease does not kill tadpoles that instead carry infections in their mouthparts (Berger *et al*. 2000). Upon metamorphosis, however, fungal sporangia redistribute to the skin of the body of the frog, rapidly multiplying and causing thickening of the epidermis and the keratin layer. The actual cause of death of frogs such affected is unclear, but two differing hypotheses have been suggested. The first is that the chytrid releases proteolytic enzymes or other active compounds that are absorbed through the permeable skin of the frog. The second hypothesis is that the damage to skin function caused by the fungus alters the water or electrolyte balance of the frog, resulting in death.

There is some evidence to suggest that the fungus may impact more heavily on frog populations under some form of environmental stress, or when climatic conditions favour its proliferation. For example, frog declines in eastern Queensland during the mid- to late-1990's were largely confined to successive winters. Similarly, while the fungus has a broad host range potential, it only seems to have impacted greatly upon frog species with certain characteristics. These include having: (i) a restricted geographic distribution, (ii) small clutch sizes, (iii) aquatic larvae associated with streams, and (iv) individuals spending a large proportion of their time in and adjacent to streams. The Spotted Tree Frog has all of these characteristics.

4.2 Alteration of Natural Flow Regimes

The natural flow regime of Bogong Creek is subject to manipulation because it forms part of the Snowy Mountains Hydro-Electric Scheme, which is managed by the Snowy Mountains Hydro-Electric Authority (SMA). At Bourke's Gorge an aqueduct intake drains water from the creek to feed into the Murray Pressure Tunnel and from there to the nearby No. 1 and No. 2 Murray Power Stations. The aqueduct intake comprises a pondage with an 8 m high wall. Relatively constant low flow persists along the creek below the pondage wall, from bedrock seepage and three first-order tributaries. During late winter and spring, flushing flows from snowmelt and heavy rains overflow the wall and scour the channel downstream. These flows appear to have been adequate to maintain an open channel relatively free of riparian vegetation. This allows plenty of sunlight to penetrate the streambed providing suitable habitat for the frogs.

In addition, the overall reduction in water level during summer months provides favourable conditions for reproduction and tadpole development, but has made this section of the stream less favourable for predatory trout that occur above in the pondage, and down-stream below the waterfalls (G. Gillespie, Natural Resources and Environment, pers.observ.).

Establishment of the aqueduct system at Bourke's Gorge has not been entirely beneficial the Spotted Tree Frog. For various maintenance reasons the SMA release water back into the creek on an annual basis in autumn, and every five years a major release of water occurs during summer. These short-term peaks in flow are potentially detrimental to the frogs, as they sometimes coincide with the breeding and recruitment season. Significant increases in flow and velocity at that time are likely to flush eggs and larvae, as well as cause changes in water temperature which may inhibit growth and development of juvenile animals (Gillespie 1997b).

4.3 Increased Sedimentation

There has also been increased sedimentation at Bourke's Gorge, associated with the roading infrastructure supporting the aqueduct system. Sediment runoff has occurred along Bourke's Road and near the bridge above the area where the population occurred. High levels of sedimentation may influence the availability of oviposition sites for adult frogs (Gillespie 1997b), but whether the level of runoff in the present case has had a negative effect on Spotted Tree Frogs is unknown.

4.4 Predation by Trout

The possible impact on the Spotted Tree Frog of trout at Bourke's Gorge is diminished by the presence of a large waterfall immediately downstream of the area where the high density population was recorded (Hunter and Gillespie 1999). This waterfall forms an unscalable barrier to movement for any trout below. Downstream of this point trout are present in the creek in reasonable numbers and may have been the primary cause of decline of Spotted Tree Frog at the junction of Bogong Creek and the Alpine Way (G. Gillespie, Natural Resources and Environment, pers. observ.). The impact of trout on the low-density population of Spotted Tree Frog in the upper Murray River is unknown, but this introduced predator is present there in high numbers.

4.5 Invasion by Weed Plant Species

The invasive blackberry (*Rubus* spp.) is common along most sections of Bogong Creek and in some locations has replaced native understorey shrub species. Apart from this negative impact, there is no documented evidence to suggest that its presence has deleteriously affected the Spotted Tree Frog, although some authors have raised concerns that where left uncontrolled, such introduced vegetation may eventually encroach on basking sites of frogs (Hunter and Gillespie 1999).

4.6 Atypical Climatic Events

There is no documented evidence to suggest that wider conservation problems (ie. greenhouse effect, ozone depletion and associated increased exposure to U-V radiation) may be affecting populations of Spotted Tree Frog anywhere across its distribution.

5 Previous Recovery Actions

5.1 Survey

In New South Wales three major survey efforts for Spotted Tree Frogs have been conducted, each focussed on the western fall of Kosciuszko National Park. This geographic area is thought to contain all of the potentially suitable habitat for the species within the State (as described by Gillespie and Hollis 1996).

In late-1992 and early 1993, Ehmann *et al*. (1993) searched for Spotted Tree Frogs at nine separate sites on five different streams within the Park. Three of these sites were on Bogong Creek and included the locality of the specimen collected by Hal Cogger in the early 1970's. Details of the other four streams surveyed were not provided. The species was only detected at one site, on Bogong Creek, approximately 12 km north and upstream of the Alpine Way bridge.

Shortly following these surveys, Gillespie and Hollis (1996) searched for Spotted Tree Frogs at 10 sites on four streams during the period 1993-94; Bogong Creek, Leatherbarrel Creek, Three Rocks Creek and the Geehi River. Frogs were detected at 3 sites, all on Bogong Creek, within the general vicinity of the population recorded by Ehmann *et al*. (1993).

In the most extensive survey conducted to-date in New South Wales, Hunter and Gillespie (1999) searched for Spotted Tree Frogs along 25 streams within the catchments of the Upper Murray, Swampy Plains, Tooma, Tumut and Goodradigbee Rivers. A total of 43 sites, covering 57 km of watercourse, was surveyed over two consecutive summer seasons (1996-97). Despite this considerable effort the species was only detected at two sites, one in the upper Murray River and the other at Bogong Creek, the latter being the same population identified earlier by Ehmann *et al*. (1993) and Gillespie and Hollis (1996).

5.2 Research and Monitoring

More generally, the advertisement call of the Spotted Tree Frog has been recorded; its larvae has been described and other aspects of its biology determined (Watson *et al*. 1991; Hero *et al*. 1995; Gillespie 1997b). Egg deposition (oviposition) sites have also been identified.

Various research and monitoring activities have been undertaken on the population of Spotted Tree Frogs at Bourke's Gorge, Bogong Creek, since 1994. Aspects of these studies have been summarised by Gillespie (1997b, 1998). Recruitment, growth, survivorship, mortality, activity patterns, habitat use, movement patterns and reproductive behaviour of frogs have been

examined using mark-recapture (toe-clipping) techniques. Habitat use, activity patterns and development of tadpoles have also been investigated. Skeletochronology has been used to derive age estimates for adult frogs, which, when combined with population age-profiles obtained from mark-recapture data, have enabled some assessment of age-specific mortality.

Long-term monitoring of all extant populations in Victoria has also been established, with detailed demographic information collected at one site for comparison with results from Bogong Creek. In addition to these data, radio-tracking techniques have been utilised to study sheltering sites, movement patterns and dispersal of animals. Also in Victoria and at Bogong Creek, studies examining the effects of trout predation on survivorship of tadpoles have been conducted. These studies have demonstrated that tadpoles are highly vulnerable to predation by trout, and that trout are able to significantly impact upon juvenile recruitment. Trials are currently underway to assess the benefits to frog populations of exclusion and eradication of trout from some Victorian streams.

Live and dead animals from New South Wales and Victoria have been screened for pathogenic diseases, most notably Chytrid Fungi which have been implicated in the decline of frogs elsewhere in Australia. Two frogs collected from the Bogong Creek population were found to have the disease.

5.3 Genetic Studies

A population genetics study, using allozyme electrophoresis, has been conducted by Gillespie (1997a). Individual Spotted Tree Frogs were sampled from Bogong Creek and from seven populations in Victoria. No fixed allelic differences were detected, but substantial variation in allelic frequencies was found between adjacent populations and some populations contained unique alleles. Preliminary analyses indicate substantial genetic subdivision between populations in different stream systems, suggesting that remaining populations of Spotted Tree Frogs are quite insular. Further analyses, using various DNA techniques, have been proposed to define better the degree of differentiation and the time scale of separation between populations, as well as any potential variation between individuals within the same populations (Robertson and Gillespie 1998).

5.4 Management

Habitat for Spotted Tree Frogs in New South Wales is entirely within Kosciuszko National Park, which is managed by NPWS for a range of values including biodiversity conservation. General management activities of benefit to Spotted Tree Frogs include controlled burning elsewhere in the Park to reduce the incidence of extreme wildfire, weed control and limiting public access into streams such as Bogong Creek, where the most extensive population of the species has been recorded.

In the latter half of 1999, NPWS arranged with the SMA to ensure that annual and five-yearly releases of water into Bogong Creek occurred outside of the breeding season of the Spotted Tree Frog. These negotiations also saw a commitment from the SMA to replace components of the roading infrastructure associated with the aqueduct system at Bourke's Gorge (ie. bridge and adjacent siltation traps) so as to reduce sediment runoff into the creek. These works were completed in April 1999. Ongoing activities will include: (i) monitoring for presence (and if necessary control) of noxious weeds, (ii) regular checking and clearing of siltation traps adjacent to the bridge, (iii) checking and/or replacement of erosion control measures associated with newly created roll-overs on the road approaching the bridge itself, and (iv) re-establishment of native vegetation adjacent to the bridge (Nicholas Graham-Higgs and Associates Pty Ltd 1998).

NPWS also funded a study which examined the feasibility of excluding trout from Bogong Creek, in the section above the Alpine Way Bridge upstream to Bourke's Gorge (Saddlier and Gillespie 1997). The study suggested that trout eradication from this section of the creek could be achieved, in theory, through application of the fish toxin rotenone at several strategic locations including all headwater tributaries. Recolonisation of the stream by trout downstream of this section could then be prevented by construction of an artificial barrier. However, the practicality of doing this was questioned and the cost of undertaking necessary measures was prohibitive. Similar concerns were raised about controlling trout using the same means in adjacent streams containing potentially suitable habitat for Spotted Tree Frogs.

5.5 Captive Breeding

During the mid-1990's facilities were developed at the Amphibian Research Centre (ARC) in Melbourne, Victoria, for captive husbandry of populations of Spotted Tree Frogs. In the first instance, this program allowed for successful breeding and rearing of progeny from wild founder stock captured in the Taponga River, Victoria. The captive colony resulting from these animals has since been used for various research activities, but over the longer-term is being viewed of as a potential source of animals for re-introduction purposes at the original collection site (see Robertson and Gillespie 1998 for further details).

The captive husbandry techniques developed for the Spotted Tree Frog by the ARC have also been more recently applied, following surveys conducted by NPWS and a hired consultant at Bogong Creek during the summer of 1999/2000. These surveys revealed no breeding at the site for a second consecutive year. Moreover, only one adult male animal was found despite intensive effort. To prevent likely extinction of the population, the NPWS and ARC established a second captive breeding colony of the species as a matter of urgency. Since no adult females could be captured at the same site to provide an initial breeding pair, a suitable animal was obtained from the next-nearest secure population which occurred in the west branch of the Kiewa River, Victoria. Fortuitously, animals from the latter site phenotypically resemble animals from Bogong Creek more closely than animals from elsewhere. Since the genetics of this latter population are as equally distant from Bogong Creek animals as from other populations, this attribute was not deemed an important consideration in the process. Prior to this work the NPWS prepared an Emergency Transfer Program proposal, conforming with standard translocation policy guidelines (NPWS 1998). The proposal detailed each component of the removal exercise and also the associated captive breeding program, the continuation of which is a key action in this plan (see below). Other relevant licences and approvals were also obtained at the same time. Finally, the National Recovery Team for the Spotted Tree Frog endorsed the action prior to it being undertaken.

5.6 National Recovery Process

A National Recovery Team was established in 1994 to oversee and direct research and management of the Spotted Tree Frog across its entire range. Representatives from NPWS, SMA, the Victorian Department of Natural Resources and Environment, Parks Victoria, University of Canberra, University of Melbourne, Latrobe University, Environment Australia and Conservation Groups are currently represented. The Team will guide the implementation of the National Recovery Plan, a draft version of which has been written according to guidelines specified in the *Endangered Species Protection Act* 1992. The National Plan broadly outlines the survey, research, monitoring and management actions necessary to improve the conservation status of the species in New South Wales and Victoria. It is yet to be officially approved by the Commonwealth.

5.7 Public Education and Awareness

No community education or involvement programs relating to the Spotted Tree Frog have been conducted in New South Wales. In Victoria, conservation of the species has been promoted through education and training of staff in land management agencies, production of a poster and an identification pamphlet, and extensive media promotion to the general public. An information profile on the Spotted Tree Frog has been produced and released as part of the NPWS' Threatened Species Information Program (New South Wales National Parks and Wildlife Service 1999). A copy is also available on the NPWS website. The Threatened Species Network has similarly produced a website with a profile of the species.

6 Proposed Recovery Objectives, Actions and Performance Criteria for 2000-2007

The overall objective of this Recovery Plan is to prevent the extinction of the Spotted Tree Frog in New South Wales by re-establishing a viable breeding population of the species at Bogong Creek. In the short-term this will require maintaining an existing captive-breeding colony established from wild animals, followed by re-introduction of progeny over a period of time. Amelioration of known threats and monitoring of perceived threats to the population will be integral to this process.

Specific Objective 1: Maintain Emergency Captive Breeding Program.

As described previously, as at the summer 1999/2000 it was evident from intensive survey effort that the population of Spotted Tree Frogs at Bogong Creek was likely faced with imminent extinction. No breeding had occurred there for two consecutive years, and only one adult male animal was present. Given this scenario, an emergency captive breeding exercise was established at the ARC using the remaining male animal and an adult female animal from the next-nearest (Victorian) population. Using this initial breeding pair, it is hoped that enough progeny can be raised to provide stock for later re-introduction at Bogong Creek. The most critical action relating to this recovery plan is therefore to maintain (and if necessary enhance) the existing captive colony until such time as the species can be successfully re-established in the wild.

Action 1: Maintain (and if necessary enhance) captive breeding colony using animals removed from Bogong Creek and elsewhere (Priority 1).

Using founder stock collected from Bogong Creek and the Kiewa River, a captive-breeding colony of the Spotted Tree Frog will continue to be maintained at the Amphibian Research Centre (ARC) in Melbourne, Victoria. This captive colony will be maintained at least for the period of time necessary to rear progeny for the purposes of the re-introduction program, after which its function and ongoing value will be assessed. The existing founder population will be supplemented by other wild animals collected at either of the above sites. The National Recovery Team for the Spotted Tree Frog has endorsed this action.

At such time as a viable captive-breeding colony has been established at the ARC, NPWS will consider options for a second captive colony at a separate institution. This may be necessary as a preventative measure because of the possibility, however remote, that the single captive population could be destroyed by accident or become infected with a pathogen.

Embarking on such an exercise will be contingent on securing additional funds not costed here.

Performance Criterion 1

Within two years, a successful breeding event has occurred within the captive population held at the ARC, and progeny are reared through metamorphosis. Then, once a viable captive-breeding population has been established, possibilities for a second captive colony are explored.

Specific Objective 2: Re-establish Breeding Colony at Bogong Creek.

Provided the initial captive breeding exercise is successful, animals produced from the program will be re-introduced to Bogong Creek at Bourke's Gorge. The fate of these animals will be monitored until such time as it can be demonstrated that a viable breeding population has re-established *in situ*.

Action 2.1: Re-introduce captive-bred stock into Bogong Creek (Priority 1).

Sub-adult animals produced from the captive-breeding program will be re-introduced to Bogong Creek at Bourke's Gorge during the third year of the recovery program, and for at least each of the following two years thereafter. Rather than using tadpoles, sub-adults will be used so as to markedly reduce chances of mortality upon release. Prior to release, animals will be screened for pathogenic diseases likely to impact on both the success of the reintroduction effort and on the local streamside fauna.

Before undertaking the reintroduction exercise, a detailed Translocation Program proposal conforming with standard translocation policy guidelines, will be developed by the NPWS. This proposal will require endorsement from the National Recovery Team for the Spotted Tree Frog. Any other relevant licences and approvals will also need to be obtained at the same time.

Action 2.2: Monitor success of re-introduction program (Priority 1).

Since male and female Spotted Tree Frogs do not reach sexual maturity until they reach four and five years of age, respectively, evidence of successful breeding (ie. egg clutches and tadpoles) at Bogong Creek may not be recorded until the end of the first lifetime of this plan. In

the interim, the success of the re-introduction program will be measured by the rate of survival of captive-bred stock at Bogong Creek in each of the successive years following re-introduction. Persistence of re-introduced animals will be monitored by NPWS on at least a twice-yearly basis throughout the re-introduction program.

Performance Criterion 2

Within seven years a breeding population of Spotted Tree Frogs is re-established at Bourke's Gorge on Bogong Creek.

Specific Objective 3: Ameliorate Known Threats and Monitor Perceived Threats to Population at Bogong Creek.

Presently, there is a range of known or potential threats to the population of Spotted Tree Frogs at Bourke's Gorge on Bogong Creek. NPWS and the SMA will conduct the following range of actions to effectively deal with these threats;

Action 3.1: Coordinate annual release of water into Bogong Creek (Priority 1).

In conjunction with the SMA, NPWS will help co-ordinate annual water releases so as to minimise adverse impacts on the frog population at Bogong Creek. This strategic approach will aim to prevent changes in flow regimes which may: (i) in the first instance impact upon the reintroduction program, and (ii) result in reduced breeding success for Spotted Tree Frogs or reduced survivorship of tadpoles into the future.

Action 3.2: Continue to implement measures to reduce sedimentation of Bogong Creek at Bourke's Gorge (Priority 1).

To ensure that sedimentation of Bogong Creek at the newly built Bourke's Gorge Bridge is minimised, the SMA will regularly check and clear associated concrete siltation traps. Further erosion from the road leading up to the bridge will also be controlled, if necessary, by maintenance of existing erosion control structures. Rehabilitation of riparian habitat near these works will also be undertaken (see Nicholas Graham-Higgs and Associates Pty Ltd 1998).

Action 3.3: Monitor for exotic weeds at the Bourke's Gorge Bridge and control if and when necessary (Priority 2).

Exotic weeds found growing in association with the newly built bridge at Bourke's Gorge will be controlled by the SMA. Weed control will be undertaken if and when necessary using mechanical rather than chemical methods.

Action 3.4: Monitor extent of exotic weed infestation along Bogong Creek and control if and when necessary (Priority 2).

Although present and locally abundant on Bogong Creek, exotic weeds such as the blackberry (*Rubus* spp.) do not currently encroach upon preferred streamside habitat of the Spotted Tree Frog. Nevertheless, the possibility exists that into the future spread of these weeds might be detrimental. In the interim, the NPWS will monitor the cover of blackberry at Bourke's Gorge, along that section of Bogong Creek where the reintroduction program will be focussed. Monitoring of extent of weed cover will occur at the same time that the population of Spotted Tree Frogs is being censused. As per above, any weed control will be undertaken if and when necessary using mechanical rather than chemical methods.

Action 3.5: Monitor presence and relative abundance of trout on Bogong Creek at Bourke's Gorge and establish eradication program if and when necessary (Priority 2).

Trout are currently not considered to be a major threat to the Spotted Tree Frogs in the Bourke's Gorge area of Bogong Creek, by virtue of their apparent absence from that section of the stream. Nevertheless, NPWS will continue to monitor this situation into the future and establish an eradication program if and when deemed necessary. At such time as this occurs NPWS will seek collaboration from NSW Fisheries. Monitoring of the stream for presence of trout at Bourke's Gorge will occur at the same time that the population of Spotted Tree Frogs is being censused, initially through visual assessment and then by other techniques if found to be present.

Downstream of Bourke's Gorge, below an unscalable waterfall, trout are present in reasonable numbers but at this point in time it is not economically feasible to eradicate them. The same situation exists in the upper Murray River, where a second population of Spotted Tree Frogs occurred but may now be extinct. Should it become possible in the future to remove trout from these areas using a cost-effective means, then eradication programs may be considered. However, this will only occur at such time that it can be demonstrated that it is possible to re-establish breeding populations of Spotted Tree Frogs (in the first instance at Bourke's Gorge).

Action 3.6: Maintain existing fire management strategy adjacent to Bogong Creek (Priority 2).

Controlled burning is routinely undertaken within the boundaries of Kosciuszko National Park by NPWS, but not immediately adjacent to Bogong Creek. NPWS will maintain its current policy of no controlled burning in this general area. Furthermore, in an emergency wildfire

situation, NPWS will not use fire retardants in the same area, except in instances where use is critical for control of a fire.

Performance Criterion 3

Measures that ameliorate identified threatening processes for the population at Bogong Creek are implemented. Perceived threats to the population at Bogong Creek are monitored and dealt with appropriately if and when necessary.

Specific Objective 4: Identify Other Populations of the Species.

Although there have been several intensive surveys for Spotted Tree Frogs in New South Wales, a few areas of likely habitat remain to be adequately searched. Once this work is completed all streams where the species is likely to occur will have been investigated. Issues relating to management of these populations will have to be considered at such time they are discovered.

Action 4: Survey remaining likely habitat in New South Wales (Priority 1).

One-off surveys for Spotted Tree Frogs will be conducted on; (i) lower sections of Bogong Creek, below the crossing of the Alpine Way, and in a few smaller watercourses within the same catchment, and (ii) in the Upper Murray River, between Leather Barrel and Tin Mine Creeks. Surveys will be designed and conducted by NPWS in collaboration with an appropriate consultant.

Performance Criterion 4

Within three years, the spatial extent of other extant populations of the species is determined.

Specific Objective 5: Further Investigate Role of Disease in Decline of Populations

In view of the currently unexplained dramatic decline of the population of the Spotted Tree Frog at Bogong Creek, and the potential for disease to be implicated, it is essential to investigate further this possibility. This issue is also being tackled as part of the national recovery process for the species.

Action 5: Screen dead, moribund and diseased frogs and implement preventative measures when conducting survey and/or monitoring (Priority 3).

Any dead, moribund or diseased frogs encountered during future survey and monitoring will be collected and forwarded to a specialist laboratory for analysis, and any possible contribution of disease to the species decline will be determined. Strict procedures, as outlined by the Declining Amphibian Taskforce, will be instigated by field workers to prevent inadvertent transmission of any disease organism.

Performance Criterion 5

The role of disease in the decline of populations of the Spotted Tree Frogs is investigated and measures put in place by field workers to further reduce this possibility.

Specific Objective 6: Improve Community Awareness of Conservation Significance of the Spotted Tree Frog

To raise community awareness of the conservation significance of the Spotted Tree Frog, this plan recommends that promotion of the species through high profile media avenues.

Action 6: Media publicity campaign (Priority 3).

High profile media publicity will be sought, where appropriate, as the re-introduction program is implemented. This will be primarily achieved through written articles as well as other public media avenues (ie. radio interviews).

Performance Criterion 6

Within two years, at least three high profile media-related activities are undertaken.

Specific Objective 7: Continue Role in National Recovery Process

The current plan does not advocate establishment of a New South Wales Recovery Team for the Spotted Tree Frog. Issues relating to conservation management of the species are effectively dealt with by the National Recovery Team, on which NPWS and the SMA (the relevant State agencies) are represented. Not withstanding this, NPWS will be responsible for administrative issues relating to the State-wide recovery effort, including the issue and management of contracts for components of the program and obtaining permits to enable work to proceed. The major cost for management of the program will also be met by NPWS. Other participating agencies will be responsible for their own costs.

Action 7: Continue NPWS and SMA participation in the National Recovery Team and associated planning process (Priority 2).

NPWS and SMA will participate in National Recovery Team meetings as required.

Performance Criterion 7

NPWS and SMA attend meetings when necessary and provide input into the national recovery process.

7 Implementation

Table 1 allocates responsibility for the implementation of recovery actions specified in this plan to relevant government agencies and/or parties for a period of seven years from the time this recovery plan is adopted, and identifies costs associated with each recovery action. The total estimated cost for the implementation of these actions is $151,700. These funds will be provided from existing resources within the NPWS, the ARC and SMA.

8 Social and Economic Consequences

Since the Spotted Tree Frog is only known to occur within Kosciuszko National Park and no physical changes are proposed, the social and economic impacts of the recovery plan are expected to be negligible. If, in the future, trout control and/or eradication is logistically and financially feasible at Bogong Creek downstream from Bourke's Gorge, then this may impact on the social activities of amateur anglers. The implications of this for the local tourism industry are unknown but likely to be minor given that Bogong Creek is not a major trout fishery for the region.

The recovery plan could have social benefits for the general public, increasing awareness of the natural heritage values of Kosciuszko National Park. This would particularly be the case for recreational users of the Park and adjacent local communities.

9 Biodiversity Benefits

The widely publicised decline and extinction of a number of amphibian species at a State, National and International level is a cause of serious concern for biodiversity conservation. Better understanding of factors limiting populations of Spotted Tree Frogs, together with protection and appropriate management of habitat for the species, will assist in the conservation of other riverine frogs in Australia. Such species include the Boorolong Frog (*Litoria boorolongensis*), Tablelands Tree Frog (*Litoria subglandulosa*), Peppered Tree Frog (*Litoria piperata*), Leaf-Green Tree Frog (*Litoria phyllochroa*) and Leseur's Frog (*Litoria lesueri*). A broad approach to catchment protection and management for frogs will also have associated benefits for other significant riverine fauna, such as native fish (ie. Mountain Galaxia), as well as flora (see Robertson and Gillespie 1998).

Through awareness of the fate of the Spotted Tree Frog the profile of all threatened species will be raised in the general community. This in turn will lead to greater opportunities for the conservation of threatened species and increased protection of biodiversity.

10 Preparation Details

This Recovery Plan was prepared by Andrew Claridge, Senior Threatened Species Officer, Southern Directorate (NPWS) and Graeme Gillespie of the Arthur Rylah Institute, Department of Natural Resources and Environment, Melbourne (Victoria). Additional assistance from Ken Green, Fauna Conservation Officer, and Graeme Enders, Manager, of the Reserve Conservation Unit, Southern Directorate (NPWS), is greatly appreciated. The plan was edited by Michael Saxon (NPWS), Manager, Threatened Species Unit, Southern Directorate.

11 Review Date

In relation to its status as the State endorsed Recovery Plan for the Spotted Tree Frog, any major changes to this Recovery Plan will require the revised Plan to be placed on public exhibition in NSW and re-approval by the NSW Minister for the Environment. The NPWS, Environment Australia or other Recovery Team members should be contacted if it is believed any change to the Recovery Plan or to the Recovery Program should be considered.

A major review of this recovery plan will occur within seven years of the date of its publication, at which time the success of the reintroduction program at Bogong Creek can be properly assessed.

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13 Acronyms Used in this Document

ARC - Amphibian Research Centre
NPWS - NSW National Parks and Wildlife Service
SMA - Snowy Mountains Hydro-Electric Authority

Table 1: Implementation and Costing Table.

Allocation of responsibility for implementation of recovery actions specified in this plan to relevant agencies. Costing for each action are also identified. Priority is categorised as 1 (Essential), 2 (Highly Desirable) or 3 (Desirable). In the fund source column 'in kind' indicates the value of contributions offered in various forms by government agencies and other groups to implement recovery actions.

Action No.	Action Description	Priority	Responsible Party	Funding Source	2000-01	01-02	02-03	03-04	04-05	05-06	07-08	Total Cost
1	Maintain captive breeding colony and rear progeny for re-introduction to Bogong Creek	1	NPWS ARC	NPWS* in kind SMA**	10,000 10,200	 10,000 10,500	 10,000 10,500	 10,500 9,000				10,000 40,700 30,000
2.1	Reintroduce captive-bred animals to Bogong Creek	1	NPWS	in kind			2,800	2,800	2,800			8,400
2.2	Monitoring program at Bogong Creek	1	NPWS	in kind	#	2,800	2,800	2,800	2,800	2,800	2,800	16,800
3.1	Control release of water into Bogong Creek	1	SMA	N/A	ψ	ψ	ψ	ψ	ψ	ψ	ψ	ψ
3.2	Continued sediment control and monitoring at Bogong Creek	1	SMA	in kind	5,700	700	700	700	700	700	700	9,900
3.3	Monitor extent of weeds at Bourke's Gorge Bridge and control where necessary	2	SMA	in kind	2,500	2,500	2,500	2,500	2,500	2,500	2,500	17,500
3.4	Monitor extent of weeds along Bogong Ck	2	NPWS	N/A	#	#	#	#	#	#	#	#
3.5	Monitor trout at Bogong Creek	2	NPWS	N/A	#	#	#	#	#	#	#	#
3.6	Maintain existing fire management strategy	2	NPWS	N/A	ψ	ψ	ψ	ψ	ψ	ψ	ψ	ψ
4	Survey remaining likely habitat	1	NPWS	SMA**	10,000							10,000
5	Screen dead and moribund frogs for pathogenic diseases	3	NPWS	in kind	200	200	200	200	200	200	200	1,400
6	Media awareness campaign	3	NPWS	in kind	300	300	300	300	300	300	300	2,100
7	Attend recovery team meetings	2	NPWS SMA	in kind in kind	350 350	350 350	350 350	350 350	350 350	350 350	350 350	2,450 2,450
Sub-Total				NPWS*	10,000							10,000
Sub-Total				SMA**	10,000	10,500	10,500	9,000				40,000
Sub-Total				in kind	19,600	17,200	20,000	20,500	10,000	7,200	7,200	101,700
Total				All Sources	39,600	27,700	30,500	29,500	10,000	7,200	7,200	151,700

Key: * From NPWS Threatened Species Budget Funds 2000-2001. ** Monetary donation from the SMA. # Costs for this action covered by costs associated with monitoring program for frogs at Bogong Creek. ψ No direct cost; however, action must be considered by relevant authorities.

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