Plan for the Eradication of Rabbits and Rodents on Subantarctic Macquarie Island

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Executive Summary

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Macquarie Island Nature Reserve and World Heritage Area has outstanding global conservation, geological, ecological and scientific values.

A long-term feral animal control program commenced on Macquarie Island in the 1960s resulted in the eradication of the weka, a predatory bird, by 1989 and cats by 2000. The proposed eradication of rabbits and rodents on Macquarie Island is an extension of this program.

The impacts caused by increasing rabbit and rodent populations on Macquarie Island Nature Reserve and World Heritage Area are very serious and there are currently no viable population control options for any of these three species of rabbits and rodents. These impacts include devastating effects upon native fauna, flora, geomorphology, natural landscape values and nutrient recycling systems.

Rabbits favour the large leafy megaherbs and grasses, which have no adaptations to cope with grazing. These vegetation types provide critical breeding habitat for a range of burrowing petrel and albatross species. Rabbit grazing is changing areas of tall tussock grassland to modified forms of herbfield, thereby affecting the breeding success of all burrowing seabird colonies on Macquarie Island. The loss of vegetation also causes destabilisation and erosion of steep peat-covered slopes, which also impacts on albatross, penguin and petrel nesting sites.

Black rats prey on seabird chicks and eggs, invertebrates and also impede plant seedling recruitment. Black rats are identified as an ongoing threat to at least nine bird species that currently breed on Macquarie Island.

House mice feed primarily on vegetation matter and inhibit plant regeneration through seedling recruitment and seed consumption. They are known to predate invertebrate species and may have had a significant impact on invertebrate populations on Macquarie Island. They may also predate burrowing seabird eggs and chicks. On other subantarctic islands they have been shown to feed on chicks of large albatross species.

Up to 24 bird species are expected to benefit from a pest eradication operation on Macquarie Island. Twelve of these bird species are listed as threatened under Tasmanian and/or Commonwealth threatened species legislation. It can be expected that many seabird species would rapidly re-colonise the island given habitat restoration and removal of predatory rodents.

Steep slopes denuded of vegetation have resulted in an increased incidence of landslides in recent years. It is critical that an eradication operation is conducted as soon as possible to halt further vegetation destruction and associated soil instability and to assist the recovery of seabird populations on Macquarie Island.

Recognising the significance of current issues, a Draft Plan for the Eradication of Rabbits and Rodents on Subantarctic Macquarie Island (the plan) was prepared. Australian and New Zealand experts undertook a peer review of this document. The result of this specialist advice is this plan, which using a combination of techniques, will target the three pest species in a single eradication operation. This will achieve the objective of restoring Macquarie Island's biodiversity and natural systems as much as possible.

This plan provides an overview of the issues resulting from increasing rabbit and rodent populations on Macquarie Island. To address these issues the only viable long-term solution is the eradication of these three last remaining animal pest species. A comprehensive operational plan for an eradication program on Macquarie Island has been developed, and an environmental impact statement on the proposed operation is currently in preparation.

The proposed Macquarie Island pest eradication operation will be undertaken during the winter months (May – September) to exploit seasonally low levels of all the target species and their natural food resources. It will coincide with the absence of most of the indigenous species, thus minimising or avoiding any effects on their populations.

The recommended methodology for eradicating rabbits and rodents on Macquarie Island is in two parts:

1. Aerially broadcast pellet baits containing brodifacoum - a second-generation anticoagulant - by helicopter. Use of differential global positioning system computers in helicopters will ensure accurate coverage. This operation is designed to eradicate rodents and to remove in excess of 95 per cent of rabbits.
2. Field teams will follow up on the ground to eliminate individual rabbits surviving the bait drops. These teams will use a range of techniques including daylight and spotlight shooting, fumigating burrows, trained dogs and trapping over a four-year time frame to ensure that rabbits are removed faster than they can breed.

Approvals to undertake an eradication operation targeting rabbits and rodents on Macquarie Island are required under the Australian Government *Environment Protection and Biodiversity Act 1999* and the Australian Pesticides and Veterinary Medicines Authority. These approvals will be sought after the finalisation of the environmental impact statement.

Part A – Introduction, Planning Processes and Summary

A1 - Introduction

European rabbits (*Oryctolagus cuniculus*) were introduced to Macquarie Island in the 1870s, while black (ship) rats (*Rattus rattus*) and the house mouse (*Mus musculus*) were first recorded on the island in the 1890s. Rabbits and rodents are the only remaining mammal pests following the successful eradication of feral cats from the island by 2000.

The eradication of rabbits and rodents on Macquarie Island is critical given their devastating cumulative impacts upon native fauna, flora, geomorphology, natural landscape values and nutrient recycling systems. The eradication of rabbits and rodents from the Macquarie Island Nature Reserve (12,870ha) is an ambitious but feasible management challenge. There have been numerous successes around the world using similar methods. These successes include a rodent eradication operation on New Zealand's Campbell Island (subantarctic - 11,300 ha), rabbit and rodent eradication operations undertaken on New Zealand's Enderby Island (subantarctic - 700ha) and on the French Territories' St Paul Island (subantarctic - 800ha).

A review of successful island eradication operations targeting rabbits and rodents reveals several consistent themes. These include:

1. Public and managerial support and belief in the program's merit and success.
2. Robust and meticulous planning.
3. Adequate funding to ensure all stages of the program is undertaken.
4. The use of highly skilled helicopter pilots with previous experience in eradication operations.
5. Highly motivated staff with appropriate experience and a commitment to the task they are undertaking.
6. The involvement of personnel responsive to living and working harmoniously in a small community in remote areas for extended periods.

The basic principles to achieving eradication must be met in every case for all target species:

- Methods used are humane and ethical.
- All individuals of the target species must be put at risk by the methods used.
- All target species must be killed at a rate faster than they can breed.
- Risk of reinvasion must be able to be managed effectively.

A2 - Planning processes

Funding through the Natural Heritage Trust (NHT) has expedited the planning processes for undertaking an eradication operation on Macquarie Island. The following three stages of planning have been completed or are underway:

Stage 1

Production of the *"Draft plan for the eradication of rabbits and rodents on subantarctic Macquarie Island"* hereafter referred to as the plan. The plan was completed in September 2004 and as a scoping document for the following stages. The plan was developed through the Biodiversity Conservation Branch of theTasmanian Department of Primary Industries and Water (BCB – DPIW).

Stage 2

Production of the eradication plan targeting rabbits and rodents on Macquarie Island.

The document has taken into account a rigorous scientific and peer review of the DPERRMI document by experts from various fields within Australia and New Zealand. This stage also involved the finalisation of a communications plan, which identifies key stakeholders; who will be informed about the proposed eradication operation.

An operational plan for the eradication of rabbits and rodents on Macquarie Island has been developed, and gives detailed operational requirements to implement the program.

An environmental impact statement (EIS) for the eradication plan is being produced, as there is a requirement for a comprehensive EIS of the actual and potential environmental effects of the eradication program. The EIS summary will outline the significance of effects and the means by which these risks will be managed so as to ensure that adverse effects are avoided, remedied or mitigated. This document will assess statutory/regulatory requirements and assess the effects of the operation on:

- Non-target species (through disturbance and primary or secondary poisoning).
- Soil and water quality.
- Effects of the operation on human health.

Stage 3

The final phase of the planning process, which completes the operational plan and also involves obtaining the funds and adequate resources to carry out the proposed pest eradication operation on Macquarie Island.

A3 – Summary

While there are many precedent operations that provide guidance, the proposed rabbit and rodent eradication program on Macquarie Island is ambitious as it will be the largest attempted in the world to date. The remote location and adverse weather conditions, combined with the complexities of targeting three pest species, mean that the proposal is very challenging.

This plan recognises the requirement for eliminating all remaining mammalian pest species in a single “one-off” operation. There is common agreement that this is the most efficient (cost, logistical and environmental) and humane approach to achieve ecological restoration on Macquarie Island. It is also seen as a critical operation given the cumulative negative impacts upon native fauna, flora, geomorphology, natural landscape values and nutrient recycling systems brought about by increasing rabbit and rodent numbers.

Part B - Background

B1 - Regional context

The Macquarie Island environs have outstanding global conservation, geological, ecological and scientific values. In recognition of natural and cultural values, it has been accorded the highest possible status under international, national and state protected area classification systems. These designations include:

- Nature Reserve (*Nature Conservation Act 2002*)
- World Heritage Area (1997 managed through *EPBC Act 1999*)
- Biosphere Reserve (1977)
- National Estate property (1977)
- Register of Critical Habitat (*EPBC Act 1999*)

Macquarie Island Nature Reserve and World Heritage Area is situated approximately 1500 kilometres south, southeast of Tasmania in the subantarctic region of the Southern Ocean. The island is approximately 700 kilometres west, southwest of the Auckland Island group (NZ). There are 22 subantarctic island groups situated in the Southern Ocean, of which only two are Australian; Macquarie and the Heard and McDonald islands. Macquarie Island is also the only Biosphere Reserve in the world in the subantarctic biogeographical region.

Macquarie Island is the largest of the 71 nature reserves in Tasmania and the only nature reserve with World Heritage Area listing. The nature reserve adjoins the second largest Commonwealth Marine Protected Area in Australia at the southern and eastern boundaries. It is also one of 162 World Heritage-listed natural sites worldwide.

Macquarie Island Nature Reserve and World Heritage Area is among the world's most significant environmental sites.

B2 - Historical impacts

Macquarie Island's pioneering commercial sealing and penguin industries, in conjunction with shipwrecks along its coastline since the 1800s, have left a legacy of introduced feral pest species. The impacts associated with these introduced pests have been devastating and include:

- The extinction of two endemic terrestrial birds, the Macquarie Island rail (*Rallus phillipensis macquariensis*) and the Macquarie Island parakeet (*Cyanoramphus erythrotis*).
- Localised extinction and/or severely depleted grey petrel, blue petrel, white-headed petrel, common diving petrel, Wilson's storm-petrel, cape petrel, South Georgian diving petrel, fairy prion, Antarctic prion and sooty shearwater colonies on the main island system. Some of these species have been relegated to offshore vegetated rock stacks that are rabbit free, but may have a rodent presence, or survive in precariously small communities on the main island system.
- Introduction of three vascular plant species. A further two introductions occurred through the 1970s – 1980s. These introduced species appear to have benefited from severe rabbit grazing pressure.
- Severe modification of vegetation alliances and reduced abundance and distribution of most native vascular plants.
- Increased soil instability on steep slopes after vegetation removal.

- Disruption of nutrient cycling due to a decrease in bird colonies frequenting the island; resulting in potential changes in vegetation associations, edaphic conditions and invertebrate populations.
- Increase of subantarctic skua numbers leading to further predatory pressures on petrel and prion populations.

B3 - Macquarie Island vertebrate pest control program

A vertebrate pest management program conducted since the 1960s on Macquarie Island has resulted in the successful eradication of the weka (*Gallirallus australis scotti*) by 1989 and feral cat (*Felis catus*) by 2000. Rabbit densities have been monitored throughout this period and the collection of this data remains a high management priority. As part of this program, myxoma virus was introduced in the late 1970s, after European rabbit fleas (*Spilopsyllus cuniculus*) were released to act as a viral vector in 1968. Myxomatosis significantly reduced the rabbit population by 1985. Myxoma was always seen as a medium term solution for rabbit control until other effective techniques were available.

Unlike rabbits there are no viral control agents for rodents. Attempts to locally control rodent numbers were conducted between 1999 to February 2003 using brodifacoum rodenticide. This rodent control program had benefits to petrel and prion colonies but continual control of rats using rodenticides requires a high level of resources and is not seen as an effective methodology in the long term, due to continual reinvasion of the treated areas. Removing rats from isolated rock stacks is not viable due to their ability to swim reasonably long distances and therefore to reinvade from adjacent areas. This program ceased in 2003 due to concerns that bait shyness or anti-coagulant tolerance from partial poisoning may compromise the success of an eventual eradication operation.

It is critical that an eradication operation is conducted as soon as possible to halt further vegetation destruction and associated soil instability and to subsequently assist the recovery of seabird populations on Macquarie Island. It is expected that re-colonisation of the island by these seabird species would be rapid given habitat restoration and lack of predatory rodents.

B4 - Pest species targeted in this plan

European rabbit (*Oryctolagus cuniculus*)
Black rat (*Rattus rattus*)
House mouse (*Mus musculus*)

B4 (i)- European rabbit *(Oryctolagus cuniculus)*

Commercial sealing parties introduced European rabbits to Macquarie Island in the late 1860s as an alternative fresh food source.

Monitoring of rabbit numbers on the island has indicated a dramatic increase since 1999. Reasons for an increasing rabbit population may be a combination of the following factors:

- Removal of a major predator - the feral cat - by 2000.
- Resistance to the myxoma virus leading to reduced effectiveness of the virus within the island's rabbit population.
- Successive warmer and drier winters possibly contributing to extended breeding seasons and kitten survival.

An increasing rabbit population is supported by observations and documentation of a marked acceleration in the rate of degradation of tussock communities and associated slope instability throughout the nature reserve. This is currently occurring predominantly on the coastal slopes and coastal fringe (Schulz and Lynn 2003; Bradshaw 2004; J. Scott UTAS unpublished data; DPIW unpublished data).

Monitoring of rabbit numbers indicated a peak in the population estimated at approximately 150,000 in the 1970s before falling as a result of the introduction of myxomatosis. The rabbit population has increased dramatically since 1999 (DPIW, internal reports). Increased degradation, including impacts in areas not previously recorded, has recently been documented. Rabbit grazing patterns have altered since the installation of plateau monitoring plots in 1974. Historical photo monitoring clearly indicates a rapid decline in tussock and large megaherb cover particularly on the steep south-west and west slopes of the island.

Concern about increasing vegetation impacts has led to the implementation of new population monitoring plots on coastal slopes. These plots have given an early indication of a marked difference in rabbit numbers on the coastal slopes in comparison to the eight plateau monitoring sites. Further sites were set up in the high rabbit-density coastal slope areas during 2005 to attain a clearer picture regarding population densities, particularly maximum densities through the winter period, when a proposed eradication operation would be undertaken. Mapping of areas of high rabbit densities and associated over-grazing impacts was undertaken throughout the island in 2004.

Negative impacts upon vegetation communities caused by rabbits include:

- Rabbits favour the large leafy megaherbs and grasses, which have no adaptations to cope with grazing. Macquarie Island supports the largest, most intact population in the subantarctic of two species of megaherbs, *Stilbocarpa polaris* (Macquarie Island cabbage) and *Pleurophyllum hookeri*. These have undergone extensive grazing damage, as have the two large tussock grasses *Poa foliosa* and *P.cookii.*
- Rabbits not only remove and damage leaves; they destroy flowers, kill seedlings, and destroy root systems, which consequently causes erosion of steep peat covered slopes.
- Rabbits disrupt the natural structure of the plant communities because they transport seeds in their fur, where previously no other furred animals existed before their arrival.
- Rabbits are a major factor in the spread and establishment of the introduced grass *Poa annua*, which prefers disturbed sites.
- Rabbits are negatively impacting on the island's biodiversity. By removing native vegetation rabbits are impacting on some of the 350 invertebrate species (insects and worms) that live in the soils and on the plants.

A study undertaken in 2003 reported that rabbit grazing was also affecting all burrowing seabird colonies (DPIW internal report). A reduction in ground cover at burrow entrances is exposing chicks and therefore increasing their detection by predatory subantarctic skua. Rabbit damage is also decreasing breeding success or causing restricted distribution of previously identified burrowing petrel-nesting habitat throughout the island. Other impacts to burrowing petrel species both directly and indirectly through the presence of rabbits and/or over grazing can be summarised as:

- Competition for burrows.
- Slope instability and erosion destroying nesting habitat or individual nesting sites.
- Flooding and snow blockage of nesting burrows.

- Provision of an abundant food source for the skua population, artificially inflating their numbers and therefore increasing predatory pressure upon petrel and prion populations (Jones & Skira 1979).

Slope instability and erosion brought about by rabbit over-grazing has also been found to negatively impact on albatross breeding slopes over the past six years (DPIW).

B4 (ii) - Black rats *(Rattus rattus)*

Black rats were first recorded on Macquarie Island in the 1890s. It is likely they were introduced through supplies brought ashore from sealing ships. Other introductions may have occurred through the shipwrecks recorded along the island's coastline. Issues relating to the presence of black rats on Macquarie Island include:

- Black rat numbers have greatly increased on Macquarie Island since the 1970s (Copson 2004).
- Black rats are identified as an ongoing threat to at least nine bird species currently breeding on Macquarie Island Nature Reserve (Appendix 3).
- Current distribution of black rats is closely correlated to tall tussock grassland (*Poa foliosa*) areas, which occur from sea level to the plateau edge (Copson & Whinam 2001), and offshore-vegetated stacks.
- Black rats have been found increasingly in herbfield associations raising concerns for plateau based Antarctic prion colonies.
- Black rats are predators of eggs and unattended chicks of burrowing petrels (Brothers 1984).
- Evidence suggests that it is the presence of rats preventing the smaller diving petrels and storm petrels recolonising the main island system.
- Rats have an ability to swim 500 metres, so an eradication operation will by necessity need to include all offshore and lake islets within this proximity.
- There is increasing evidence from New Zealand research of the damage rats and mice inflict upon invertebrate populations (Brown 2004).
- Evidence of rodents severely impeding seedling recruitment has been documented (Shaw, et al, 2005).

B4 (iii) - House mouse *(Mus musculus)*

House mice may have arrived on the island as early as 1820 and like black rats, probably gained access to the island through food stores and equipment brought ashore from ships. There is also potential for further introductions to have taken place as a result of shipwrecks. Issues relating to the presence of house mice on Macquarie Island include:

- Mice occur in all habitats and vegetation communities on Macquarie Island but have a preference for tussock grassland.
- Like rats, mice are also documented as eating the eggs of smaller bird species such as storm petrels (Johnstone 1985).
- Mice impede seedling recruitment.
- Mice impact on invertebrate fauna and affect island nutrient recycling systems.
- Evidence on subantarctic Gough Island has identified mice as being responsible for increased mortality of several species of seabird fledglings, including the Tristan albatross (*Diomedea dabbenena*) which is of similar size to the wandering albatross *(Diomedea exulans*), Atlantic petrel (*Pterodroma incerta*) and great shearwater (*Puffinus gravis*).

B5 – Non-action outcomes

Failure to complete the eradication plan will result in:

- Degradation of World Heritage values for which the island was listed.
- Losses to the biodiversity of the island and subantarctic region, a criterion for which the island was declared a Biosphere Reserve.
- Non-fulfilment of relevant objectives/prescriptions for the Macquarie Island Nature Reserve and World Heritage Area Management Plan 2006.
- Non-fulfilment of relevant objectives/prescriptions for the Commonwealth Marine Park Management Plan.
- Non-fulfilment of objectives for which nature reserves are declared under Tasmanian legislation.
- Compromising the protection and recovery of several threatened species listed under Commonwealth and/or Tasmanian legislation.
- A failure to assist in the restoration of natural ecological processes on the island.

Part C – Eradication Methods

The majority of successful eradication projects undertaken on large islands, targeting rabbits and/or rodents, have used a basic methodology of aerial broadcasting of the rodenticide brodifacoum in pellet form by helicopter and, where rabbits are targeted, following up with ground hunting teams using dogs. Helicopters utilise differential global positioning systems (DGPS) to guarantee accuracy of bait coverage. Table 1 below illustrates some successful rabbit and/or rodent eradication operations using this methodology with brodifacoum as the toxin, which have enhanced ecological restoration of these islands. Other successful eradications of rats and rabbits have been conducted using carrot bait and the compound 1080.

Table 1. Successful eradication operations incorporating aerial broadcasting of brodifacoum linked with DGPS (note that follow-up ground hunting has been required to completely eradicate rabbits)

Location	Country	Date	Hectares	Species
Campbell Island	New Zealand	July 2001	11,300	3
Raoul Island	New Zealand	July 2002	3,500	2 + 3
Kapiti Island	New Zealand	Sept 1996	1,956	2 + 3
Hermite Island	Australia	Nov 1999	1,000	1
St Paul Island	French Territories	Jan 1997*	800	1 + 5
Enderby Island	New Zealand	1993	700	4 + 5
Species key: 1 = Black rat (*Rattus rattus*), 2 = Pacific rat *Rattus exulans*) , 3 = Norway rat (*Rattus norvegicus*), 4 = House mouse (*Mus musculus*), 5 = European rabbit (*Oryctolagus cuniculus*) * completed in 1999				

C1 - Control versus eradication

Various population management approaches have been considered for rabbits and rodents on Macquarie Island. Considerations have included intermittent to ongoing control and eradication of the pest species. Control options are characterised by:

- Having on-going costs yet subject to annual budget priorities (i.e. risks to continuation)
- Being more expensive in the long term
- Being time-consuming to undertake, yet with limited staff to implement
- Having sustained pressure to maintain benefits of earlier work
- Being reliant on manual techniques as there are no known viral control organisms for rodents
- Current techniques for rabbit control are largely ineffective now that myxoma virulence is reduced.
- Absence of a single control action that can target three species simultaneously

C2 - Justification for eradication

Eradication is considered optimal for the following reasons:

- It is the only way to protect the long-term integrity of native fauna, flora and other natural values for which Macquarie Island was designated a nature reserve and World Heritage Area.
- It is cost efficient in the medium to long term.
- Ongoing baiting with anticoagulant toxins or infection with viral agents is seen to be inefficient and inhumane. Eradication is ethically a more humane approach.
- All three pest species may be targeted simultaneously using the same treatment and methods in a sustained eradication operation.
- The terrestrial area (12,870 ha) rugged terrain of Macquarie Island makes comprehensive control of rabbit and rodent populations infeasible.

In view of the above, eradication of rabbits and rodents from Macquarie Island is the only viable method to achieve long-term management objectives. Other supporting documentation for the eradication of rabbits and rodents from Macquarie Island Nature Reserve includes:

- World Heritage Area Management Plan;
- Macquarie Island Nature Reserve and World Heritage Area Management Plan 2006. PWS;
- Commonwealth Macquarie Island Marine Park Management Plan;
- Draft Fauna Recovery Plan – Macquarie Island Burrowing Petrels 2004. DPIW.
- Draft Recovery Plan for 10 Species of Southern Seabirds – 2004-2009. DEH.
- Issues Paper – Population status and threats to southern seabirds listed as threatened under the Environmental Protection and Biodiversity Conservation Act 1999. DEH August 2004.
- Albatross and giant petrel recovery plan – DEH 2001 – 2005; and
- Two scientific papers on long term rabbit damage to coastal slope vegetation and soil stability by Scott and Kirkpatrick, UTAS (in prep.).

A report of the scientific meeting of the first meeting of parties of the Agreement on the Conservation of Albatrosses and Petrels (ACAP 2004), www.acap.aq identified that the detrimental impacts caused through the introduction of non-native species is potentially one of the greatest threats to albatross and petrel populations.

The goal of a proposed eradication operation targeting rabbits, rats and mice on Macquarie Island and its associated offshore sea stacks, is to facilitate the restoration of natural ecosystems and native species. The target species are the only remaining mammal pest

species on Macquarie Island, and their eradication is the primary means of achieving this goal. Other methodologies may be considered as the plan develops.

It is highly likely that at least 22 bird species will benefit from an eradication operation targeting rabbits and rodents (Appendix 3). These consist of 11 petrel species, four albatross species, four prion species, one penguin, one cormorant and one tern. Twelve of these species are considered threatened under Tasmanian State and/or Commonwealth statutes. Another two species may also benefit from the operation in the medium to long term even though identified as being initially impacted by a proposed baiting operation.

Removal of rabbits will benefit the vegetation, especially populations of the two megaherbs and the two tussock grasses, and will halt soil instability on steep coastal slopes where this vegetation has been destroyed. The steep coastal slopes of the southern part of the island, which have been coming under increasing rabbit grazing pressure over the past six years, represent the only extensive ungrazed tussock slopes remaining.

Removal of rabbits and rodents will also restore the 'natural' rate of peat formation around the island, which has been impacted by rabbit and rodent grazing.

Following other pest eradication operations on subantarctic islands the recovery of vegetation, invertebrate and bird populations has been rapid and dramatic. Exclusion of rabbits from exclosure plots on Macquarie Island have shown that recovery of native vegetation is reasonably rapid once grazing stops.

C3 - Methods Considered

C3 (i) - Introduction

A variety of eradication and control techniques were evaluated and these are discussed in this section. Manual control techniques such as shooting, trapping and fumigating burrows are not discussed as they have been ruled out as suitable techniques on Macquarie Island for anything other than localised control. The high level of resources required to implement these techniques on an island-wide scale are such that an attempted eradication is a more cost-effective option to short-term control.

A range of toxins were considered in early draft stages and from these brodifacoum emerged as the preferred toxin to use for aerial baiting. Alternative toxins assessed included sodium monofluoroacetate (compound 1080), cholecalciferol and Pindone. Brodifacoum was the preferred toxin due to its proven use in similar operations, toxicity to target animals, low to nil water solubility and relative ease of handling, whilst also avoiding logistical complexities involved with using more than one toxin and bait type.

C3 (ii) - Myxomatosis

Myxomatosis was introduced onto Macquarie Island in 1978 as a viral control agent for rabbits and had reduced numbers drastically by 1985. Blood samples were collected in February and March 2004 and screened. This screening has indicated myxomatosis is present[1] on the island in the majority of specimens sampled. Advice from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) initially is that they are fairly sceptical about the benefits of introducing a virulent myxoma virus into such a population. Because the Macquarie Island rabbit population is increasingly resistant to

myxomatosis it is likely that it will play no future role in rabbit control on Macquarie Island. In addition the Commonwealth Serum Laboratories (CSL) are not currently producing any further batches of the virus, supplies of the virus on the island have all been exhausted and no further stocks exist or can be obtained.

C3 (iii)- *Rabbit Haemorrhagic Disease* (RHD)

RHD is a highly lethal virus specific to European rabbits. It was introduced into Australia and New Zealand as a control agent of rabbit populations.

Recent analysis of blood samples has indicated that Macquarie Island rabbits have no apparent immunity to RHD.

An early introduction of RHD to Macquarie Island was not considered, as experts did not see it as beneficial to current eradication plans, and that it may lead to one less available eradication tool if used prematurely.

C3 (iv) – Brodifacoum

Brodifacoum, like other anticoagulant toxicants, acts by interfering with the normal synthesis of vitamin K-dependant clotting factors, in the liver of vertebrates (Hadler and Shadbolt 1975). Brodifacoum is a second-generation anticoagulant used mainly as a rodenticide and will require a permit from the Australian Pesticides and Veterinary Medicines Authority (APVMA) for use on rabbits and rodents in an aerial application on Macquarie Island.

Peer review advice generally agrees that brodifacoum is the most efficient toxin to target rabbits and rodents. Advances in technology such as the use of aerial baiting techniques linked to differential GPS navigational systems and second-generation anti-coagulants, supported by scientific trials, have resulted in an increase in practical experience and knowledge in the field of island pest eradication operations. These techniques have been developed in New Zealand over the past decade and used regularly with a high degree of success around the world in a variety of environments, including the subantarctic.

The proposed technique on Macquarie Island will be by aerial application of 20ppm (0.002%) brodifacoum in 10mm, 2g cereal based pellets, applied by helicopter and supplemented with limited hand spreading of baits around all infrastructure. Repeat coverage will be undertaken in steep and high rabbit density areas. The bait pellets are resistant to moist conditions and are expected to be highly palatable. The pellet is also resistant to fragmentation. A trial using non-toxic bait pellets (supplied by Animal Control Products, Wanganui, New Zealand) was conducted on Macquarie Island during March 2005 to assess palatability, and further trials using the same bait were conducted during the winter of 2005 to assess weathering and other aspects. From these trials, it is evident that the baits supplied by ACP are palatable even after considerable weathering.

Cereal seed used in bait manufacture is ground to flour, screened to 1.5 mm (smaller than cereal seed) and heated, thereby denaturing the proteins required for germination. This mitigates any concerns for potential weed invasions.

The amount of toxin in each bait is minute, i.e. .002% (20 parts per million). If 250 tonnes of brodifacoum bait were used in this operation, this would equate to 5kg of toxin spread over the 12,870 ha area. For this operation to be successful, it is critical that enough bait is broadcast to ensure that every rabbit and rodent has access to it. Factors considered in assessing brodifacoum include:

- It has proved a successful component in previous[2] large island eradication operations targeting rabbits and/or rodents in climatic conditions similar to those experienced on Macquarie Island.
- It is effective on target species after one feeding event; therefore bait aversion issues arising through the consumption of sub-lethal doses are avoided. Bait aversion is a serious issue identified in the use of first generation anticoagulants that could jeopardise an eradication operation.
- Due to its lethal effect on all target species it simplifies logistics and reduces costs of the operation.
- Previous experience from other subantarctic rabbit and rodent eradication operations such as Enderby and St Paul islands indicated that by using recommended methodologies, one would expect a 90% knockdown of the rabbit population on an initial application and up to 9% on the second. Applications will be spaced 10 to 14 days apart to maximise target species access to bait.
- It is not mobile in the soil through leaching (i.e., it binds to soil particles) and is extremely insoluble in water implying nil to low likelihood of contamination of lakes, tarns, water ways, marine environment or drinking water catchment dams at the proposed prescription rates.
- It is highly toxic in minute amounts (.002% - 20 parts per million) to rabbits and rodents therefore negating potential neophobic[3] reaction towards the bait, therefore enhancing eradication potential.
- It has a half-life of 12 to 25 weeks dependent on soil type. Uptake by non-target species will therefore be dependent upon bait disintegration timeframes, which is expected to be moderately fast in the moist Macquarie Island conditions. Trials conducted over 2005 have demonstrated the effective longevity of specific baits in the Macquarie Island winter environment.
- It is likely to cause primary and secondary poisoning of non-target species, which needs to be addressed in the environmental impact statement.
- It may have decreased effectiveness in tussock grassland (however there is now little of this remaining on Macquarie Island). Previous rabbit eradication operations conducted on Enderby and St Paul islands indicated this and the reasons are unknown, but may be related to bait lodging in plant material thereby making it less accessible to rabbits. This however posed no issues to rodent access. This issue will be mitigated through targeting open rabbit feeding areas adjacent to dense tussock areas and undertaking repeat coverage of identified rabbit high-density areas.
- Its use will require approval through Australian Pesticides and Veterinary Medicines Authority (APVMA). This may be a twelve-month approval process and the application will be submitted at the same time as an EPBC Act referral. As the proposed methodologies have proven successful in multiple island eradication operations targeting rabbits and rodents both in Australia and overseas (see Table1, page 12) there is sufficient technical information available to support an application.
- Dispersal of bait requires aerial broadcasting above wildlife colonies to ensure adequate coverage over the island[4].
- It is potentially harmful to humans if consumed.
- Bitrex is a taste-inhibiting agent added to brodifacoum to deter human ingestion. As it has been associated with a degree of bait aversion in rodents, only brodifacoum which has not had bitrex added will be used.

[2] See Table 1, page 12.
[3] Bait aversion
[4] See Section C5

C4 – Recommendation

Eradication of rabbits and rodents should be attempted using:

1) **Brodifacoum baits as the toxic agent in an aerial application**.
2) **Intensive ground hunting to eradicate rabbits surviving a bait drop**. Techniques to use include day and night shooting, trapping, fumigating burrows and use of rabbit detection dogs. Dogs are considered essential to the success of the operation by locating surviving rabbits. Hunting teams will be required for some years after the aerial bait application in order to apply sufficient pressure to kill surviving rabbits faster than they can breed. Monitoring over this time will guide the degree of follow-up resources required in subsequent years.

C5 - Environmental Impacts

There is a requirement for a comprehensive environmental impact statement (EIS) of the actual and potential environmental effects of eradicating European rabbits, black rats and the house mouse from Macquarie Island. The EIS summary will outline the range and significance of effects and the means by which these risks will be managed to ensure that adverse effects are avoided, remedied or mitigated. This document will assess the statutory/regulatory requirements and consider the effects of the operation on:

- Non-target species through disturbance and primary/secondary poisoning.
- Soil and water quality.
- Effects of operation on human health.

Preparation of this document has commenced and a draft version is scheduled for completion in 2007.

Four bird species have been identified at risk from a proposed eradication operation using helicopters and anticoagulant bait. Species potentially affected through the use of brodifacoum include the subantarctic skua, kelp gull and black duck. King penguins have been identified as potentially being affected by helicopter operations (see Table 2). None of these identified species are classified as threatened under State or Commonwealth statutes. Anticoagulant bait has also been identified as harmful to humans if consumed.

The majority of Macquarie Island's fauna are marine mammal and bird species, consisting of seals and seabirds using the island for breeding and moulting. The breeding season for the majority of wildlife is through the summer periods of October – April. The timing of the eradication operation will avoid these periods through conducting operations during the winter period of May to September. The majority of native wildlife present on the island during the proposed operation derives their food directly from the ocean; therefore brodifacoum bait will not be attractive to them.

The following issues have been identified and considered for aerial broadcasting of brodifacoum on Macquarie Island.

- Poisoning of non-target species through direct ingestion of brodifacoum baits and secondary poisoning through preying/scavenging upon target species.
- Disturbance to non-target wildlife species through helicopter operations.
- Pollution of station water supply and risks to personnel.
- Other freshwater pollution (lakes, pools and streams).
- Effects on marine water quality adjacent to coastline.

C5 (i) - Wildlife poisoning and disturbance

It is acknowledged that there will be some loss of individuals of non-target species in undertaking this proposed operation through the effects of primary and secondary poisoning. Susceptible native species may include the kelp gull, giant petrels, subantarctic skua, and possibly black duck. The loss of individuals within these species is expected to have minimal effects upon their overall population dynamics. Populations of these species are expected to recover quickly after the eradication operation due to migration and natural breeding recovery. It is important to recognise that while some wildlife losses will occur, planning will aim to minimise this and ultimately the populations will benefit.

Helicopter disturbance has also been identified as a factor, which could also potentially cause disturbance in king penguin colonies. Table 2 identifies those species at risk and their classification under the Tasmanian *Threatened Species Protection Act 1995* (TSP Act 1995) and the Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999).

The effects of primary and secondary poisoning as well as helicopter disturbance will be minimised through undertaking the proposed operation in the winter months of May and September, when most native bird and marine mammal species are absent.

Table 2

Species potentially at risk from poison and/or disturbance during May-September operation

Species	Classification		Numbers on island (pairs)	Type of potential impact			
				Toxin		Disturbance	
	TSP Act 1995	*EPBC Act 1999*		Primary	Secondary	heli	human
King penguin*		M	>200,000	N	N	Y	Y
Gentoo penguin		M	< 5,000	L	N	Y	Y
Wandering albatross*	E	V,M,Mig	<20	L	N	Y	Y
Light-mantled sooty albatross	V	M, Mig	2,000	L	N	Y	N
Southern giant petrel	V	E,M,Mig	2,000	L	H	Y	Y
Northern giant petrel	V	V,M,Mig	1,000	L	H	Y	Y
Grey petrel*		M,Mig	<50	L	N	N	Y
Blue petrel**	V	V,M	< 600	L	N	N	Y
Macquarie Is. cormorant	V	V,M	660	L	N	Y	Y
Antarctic tern**	E	E,M	< 50	N	N	Y	N
Kelp gull		M	< 150	H	L	Y	Y
Subantarctic skua**		M	< 350	L	H	N	N
Black duck		Mig	?	H	N	Y	Y
Elephant seal	V	V,M	18,000 pups	N	N	Y	Y
Subantarctic fur seal	E	V,M	<10 pups	N	N	Y	Y

E = Endangered; V = Vulnerable; H = High; L = Low; ? = unknown; * = breeding; ** = a few overwintering indiv.
M = Listed as a Marine Species under EPBC Act Mig = Listed as a migratory species under EPBC Act
N = No; Y = Yes

Part D - Operational timing

The timing of the operation is critical to its success. The window of opportunity for logistical and operational phases has been extended as much as possible in recognition of the limiting subantarctic conditions, without compromising the health and safety of personnel or wildlife breeding seasons.

Every effort will be made to conclude the eradication program by August; however contingency planning will extend this timeframe into September if necessary. Eradication operations will be undertaken during the winter months between May and September for the following reasons.

- to exploit low natural food resources of target species, increasing both bait acceptance and effectiveness and therefore providing maximum impact.
- to coincide with decreased breeding and increased mortality leading to lower annual population levels of pest species through the winter period.
- to correspond with low annual populations of indigenous species and avoid their sensitive breeding seasons. This will create minimum disturbance and impact upon non-target species due to the majority of animals being absent from the island between May and September and;
- to avoid the summer tourist season and minimise the number of personnel on the island. There will be a small Australian Government Antarctic Division (AGAD) contingent present during proposed eradication operations.

The earliest perceived timeframe for this proposed operation to be undertaken will be at least 18 months a project manager commences duties (which will occur after funding for the project is secured). A minimum 18-month lead in period to the proposed program is required for the project manager to be able to achieve the relevant approvals and detail the complex logistical planning required. Note that the 18 month time-frame is with respect to a May date to commence the operation. While 18 months is seen as a minimum, 24 months is highly desirable to ensure all planning is completed to a high level of competency. This timeframe may extend as planning progresses.

Part E – Monitoring

Biological research has been undertaken in the reserve since 1948. Baseline data collected has been used to monitor modification of native fauna and flora communities by pest species over this period. Ongoing collection of data from historical monitoring sites and attaining further baseline information will be critical in detecting not only further impacts to native communities, but also in examining non-target responses, after an eradication operation has taken place. The following areas have been identified for ongoing research and data collection.

E1 - Current and ongoing monitoring

- Historical fixed point photo-monitoring detecting vegetation condition and erosion taken at two-year intervals – (BCB, UTAS).
- Monitoring of abundance and distribution of burrow nesting and other seabird populations – (BCB, DTAE).
- Monitoring of existing rabbit count areas. Counting of numbers/hectare in other identified high-density areas. Mapping high-density areas and rabbit grazing impacts – (BCB, DTAE).

- Maintenance and updating of databases - (BCB).
- Monitoring of rodent presence or absence in various vegetation alliances plateau sites (BCB, DTAE).

E2 - Monitoring / baseline work for implementation prior to eradication operation

- Surveys of terrestrial and freshwater invertebrate fauna to provide baseline information for long-term monitoring, (UTAS, BCB).
- Assessment of king penguin disturbance effects by helicopters (DPIW, DTAE).

E3 - Monitoring during eradication phase (Years 1-5)

- On ground calculations of remaining brodifacoum bait in and adjacent to areas of high rabbit density one week after the second aerial application to assess if there is any requirement for follow up works (Project Manager – DTAE).
- Deployment of up to 14 rabbit detection dogs following brodifacoum operations - DTAE.
- Comprehensive rabbit and rodent scats/sign searching throughout the island (Field Operational Team – DTAE).
- Deployment of rodent detection dog/s and intensive use of rodent tracking tunnels and other monitoring methods when rabbits have been reduced to an undetectable level – DTAE.
- Collection of potential affected non-target species for testing (DTAE, BCB).

E4 - Post eradication monitoring projects

- Monitoring of vegetation recovery and individual vascular species distribution variation (BCB, DTAE, AAD and UTAS).
- Assessment of the abundance, distribution and recovery of seabird populations – (BCB, DTAE).
- Monitoring of edaphic changes – (UTAS, BCB).
- Monitoring for weed expansion and assessment of the need or practicality of control measures (BCB, DTAE, UTAS and AAD).
- Monitoring for new weed invasions on Isthmus and Sandy Bay tourist sites (BCB, DTAE).
- Monitoring recovery of affected non-target species responses to the operation (BCB, DTAE).

Part F - Consultation and Communication

Success of this operation will lead to significant benefits to Macquarie Island Nature Reserve and to the subantarctic region. It is therefore essential that support be attained from the public, non-government organisations and private enterprise, as well as Australian government organisations.

A communications plan has been prepared identifying key stakeholders who will be informed about the proposed eradication operation. Consultation about the eradication plan will be ongoing. During this phase the benefits, long term cost savings and issues will be explained.

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Appendix 1 - Planning Objectives

1. To protect one of the criteria for which Macquarie Island was inscribed on the World Heritage list:

Natural Criterion (iii) Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

2. To fulfil functions for which the reserve was recognised as a Biosphere Reserve under the UNESCO Man and the Biosphere Reserve Program:

Contributing to the conservation of landscapes, species and genetic variation: Research, monitoring, training and education related to local, regional, national and global conservation and sustainable development issues.

3. To fulfil the purpose of reservation of a Nature Reserve, as set out in Schedule 1 of the Tasmanian *Nature Conservation Act 2002*:

The conservation of the natural biological diversity or geological diversity of the area of land, or both, and the conservation of the natural values of that area of land that are unique, important or have representative value.

(a) Contribute to the natural biological diversity or geological diversity of the area of land, or both; and
(b) Are unique, important or have representative value.

4. To fulfil objectives of the "Macquarie Island Nature Reserve and World Heritage Area Management Plan."

- *To protect and manage the reserve as a natural habitat for its indigenous flora and fauna.*
- *To prevent further accidental introductions of alien flora or fauna and to eradicate or control, as far as possible, previously introduced species that affect or endanger native species or their habitat.*
- To facilitate the recovery of previously exploited species*.*
- *To reverse the impacts of alien introductions to the reserve*

5. To fulfil the strategic objectives of the "Macquarie Island Marine Park" through,

- Protection of the conservation values of the south eastern section of the Macquarie Island region including protecting inter alia:
- Migratory feeding and breeding ranges of marine mammals and seabirds
- Threatened species dependant upon that area
- To provide an effective conservation framework which will contribute to the integrated and ecologically sustainable use and management of the Macquarie Island Region.
- To provide a scientific reference area for the study of ecosystem function within the Macquarie Island region
- To manage the area as part of the National Representative System of Marine Protected Areas.

6. To assist in the restoration of natural ecological processes and the protection of the biodiversity of the Macquarie Island Nature Reserve by the control or eradication of established alien vertebrate species having adverse impacts on them.

7. To allow visitors to see and appreciate the natural values of the reserve by reducing the impacts of introduced species as far a s possible.

Appendix 2 - Abbreviations used in the text

ACAP -	Agreement on the Conservation of Albatrosses and Petrels
AGAD -	Australian Government Antarctic Division
APM -	Assistant Project Manager (Macquarie Island rabbit and rodent eradication)
APVMA -	Australian Pesticides and Veterinary Medicines Authority.
AQIS	Australian Quarantine and Inspection Service
BCB -	Biodiversity Conservation Branch, DPIW, Tasmanian Government
CSIRO -	Commonwealth Scientific and Industrial Research Organisation.
CSL -	Commonwealth Serum Laboratories.
DEH -	Australian Government Department of the Environment and Heritage (as of February 2007 DEW – Dept of Environment and Water Resources)
DGPS -	Differential Global Positioning System
DMIMP -	Draft Macquarie Island Management Plan
DPIW	Department of Primary Industries and Water, Tasmanian Government
DOC -	Department of Conservation, New Zealand
DTAE -	Department of Tourism, Heritage and the Arts, Tasmanian Government
EIS -	Environmental Impact Assessment
EPBC Act -	*Environmental Protection and Biodiversity Conservation Act 1999*
IEAG -	DOC Island Eradication Assessment Group
NHT -	Natural Heritage Trust (DEH)
NZ -	New Zealand
PM -	Project Manager – (Macquarie Island rabbit and rodent eradication)
RHD -	Rabbit Haemorrhagic Disease (also RHDV, RCD, or Calicivirus)
SC -	Steering Committee (Macquarie Island rabbit and rodent eradication)
TSPA -	*Threatened Species Protection Act 1995*
UTAS -	University of Tasmania

Appendix 3 - Species expected to attain long term benefits from an eradication operation targeting rabbits and rodents on Macquarie Island.

Common Name	Classification		Breeding Status
	EPBC Act 1999	*TSP Act 1995*	
Gentoo Penguin	M		c
Wandering albatross	V,M,Mig	E	c
Black-browed albatross	M,Mig	E	c
Grey-headed albatross	V,M,Mig	E	c
Light-mantled sooty albatross	M,Mig	V	c
Southern giant petrel	E,M,Mig	V	c
Northern giant petrel	V,M,Mig	R	c
Grey petrel	M,Mig	E	c
Blue petrel	V,M	V	c
White-headed petrel	M	V	c
Soft-plumaged petrel	V,M	E	u
Cape petrel	M	E	c
Slender-billed prion	M		u
Antarctic prion	M		c
Fairy prion (southern)	V, Mig	E	c
Sooty shearwater	M, Mig		c
Wilson's Storm Petrel	M,Mig	R	c
Grey-backed storm petrel	M		u
Common diving petrel	M		c
South Georgian diving petrel	M		c
Macquarie Island cormorant	V,M	V	c
Black duck +	Mig		c
Antarctic tern (New Zealand)	E,M	E	c
Subantarctic skua +	M		c

E = Endangered; V = Vulnerable; R = Rare; c = Confirmed breeding; u = Unconfirmed breeding.
M = Listed as a Marine Species under EPBC Act Mig = Listed as a migratory species under EPBC Act
+ = Potential for initial impacts to individuals followed by favourable conditions for population increases

Appendix 4: Toxins assessed for use on Macquarie Island.

Sodium monofluoroacetate (1080)
This is the only substance currently registered in Tasmania for use in baits to control rabbits, ship rats and house mice. While biodegradable it can cause secondary poisoning in non-target animals that may feed on carcasses, e.g. giant petrels and skua at Macquarie Island. No antidotes are available for cases of accidental or secondary poisoning. Dogs are particularly susceptible to 1080 and their use for follow up work during the early stages of the eradication program would therefore be very limited. As 1080 is highly water-soluble the prolonged wet conditions experienced on Macquarie Island mean that it would not be suitable for use in a broad scale operation on the island.

Assessment/actions:

- Sodium monofluoroacetate (1080) is not suitable for use in the broad scale eradication program proposed for rabbits, rats and mice on Macquarie Island.
- Sodium monofluoroacetate may be used in a very localised situation where rodents appear to have developed resistance to anticoagulant baits.
- Only trained and licensed operators would be permitted to handle sodium monofluoroacetate bait if they are used.

Cholecalciferol:
Cholecalciferol (vitamin D_3) is registered for the control of rats and mice in Tasmania. It is a single-feed bait which causes heart failure in rodents 2-4 days after they have ingested a lethal dose. Rabbits are less susceptible to cholecalciferol and it is unlikely to be effective in the proposed combined eradication program for rabbits and rodents. As it is not an anticoagulant rodenticide the possibility of using it for local control of rodents, e.g. around buildings and/or establishing burrow-nesting bird colonies, prior to the eradication operation should be considered.

Assessment/actions:

- Cholecalciferol is not suitable for use in the proposed broad scale eradication program for rodents and rabbits at Macquarie Island.
- As it is not an anticoagulant bait cholecalciferol may be considered for short-term, localised control of rodents prior to the eradication program.

Anticoagulant baits:
No single anticoagulant toxin is currently registered for use on rabbits, ship rats and mice in Tasmania, although such toxins as pindone and brodifacoum are registered for rabbits and rodents respectively. They have the advantage over 1080 that antidotes are available if accidental or secondary poisoning occurs. Two types of anticoagulant toxins are available, first generation toxins which usually requires several feeds over a period of several days to be effective. These toxins are generally considered safer from the point of view of secondary poisoning. Second generation toxins that can provide a lethal dose in one feed although animals will continue feeding for several days after ingesting a lethal dose. Secondary poisoning can occur with these toxins.

Pindone:
Pindone is used to control rabbit populations in Tasmania mainly in situations where 1080 cannot be used, e.g. around urban areas where there are increased

risks of accidental poisoning. Effective antidotes are available for pindone. It is not registered for use on rodents in Tasmania.

It is a first generation anticoagulant toxin which can be obtained in a form that is not water-soluble but the baits would still have to be available to target species over several days for them to take effective doses.

Assessment/actions:

- The need for target species to take several feeds over a number of days, together with the conditions on Macquarie Island, mean that pindone is not as a viable option.

Brodifacoum:

Brodifacoum is a second generation, anticoagulant bait used mainly as a rodenticide. It is effective after one feed meaning that animals do not develop an aversion by consuming sub-lethal doses. While there is a level of risk through both primary and secondary poisoning of non-target species and an antidote, vitamin K, is available and experience elsewhere (below) has shown that with careful management any losses are low. Most native vertebrate species will not be present on the island during the operation (Table 6/1, above).

The active ingredient is not water-soluble and would not enter the environment through leaching. While it is known to be toxic to some fish there are no freshwater species on the island and effects on marine fish would be very small due to the limited quantity of bait entering the environment and the high-energy nature of the coastal waters quickly dispersing it. Invertebrates are not generally affected by brodifacoum. However a literature review by Booth *et al.* (2001) concluded that it did cause mortality in some species of mollusc and recommended that further studies should be carried out.

Brodifacoum has been used extensively on rodent eradication programs on New Zealand Islands. It was successfully used in a program to eradicate both rabbit and house mice on Enderby Island (the Auckland Islands), in one operation, and recently in the eradication of Norway rats *(Rattus norvegicus)* on Campbell Island. Baits have therefore been developed, tested and used for airdrop operations under the conditions found on Macquarie Island.

Assessment/actions:

- Brodifacoum meets the requirements of the proposed program at Macquarie Island to a high level.
- Investigate the registration for brodifacoum for use to control rabbits in Tasmania, alternatively the registration for a one off operation on Macquarie Island.
- Further planning in this document is based on the use of brodifacoum baits.
- Anticoagulant baits may also be used in the eradication of localised pockets of rabbits that are liable to remain after the main bait drop.