

Secretary Island

Secretary Island Operational Plan: Deer Eradication

FEBRUARY 2007



Department of Conservation
Te Papa Atawhai

Secretary Island

Secretary Island Operational Report: Deer Eradication

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FEBRUARY 2007

Produced by
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CONTENTS

1.0 Executive Summary	1
2.0 Background	2
3.0 Justification	4
4.0 Eradication Plan Design	5
<i>4.1 Design Principles</i>	5
<i>4.2 Plan Structure</i>	6
<i>4.3 Plan Review</i>	6
5.0 Goal and Objectives	8
6.0 Options for Eradication	9
7.0 Methods	10
<i>7.1 Knock-down Phase</i>	10
<i>7.2 Mop-up and Maintenance Phase</i>	14
<i>7.3 Development Work</i>	15
8.0 Infrastructure	17
<i>8.1 Track Network</i>	17
<i>8.2 Huts and Bivvies</i>	17
<i>8.3 Communications</i>	17

<i>8.4 Transportation</i>	<i>17</i>
<i>8.5 Quarantine</i>	<i>18</i>
<i>8.6 Co-ordination with Stoat Control Operations</i>	<i>18</i>
9.0 Monitoring	19
<i>9.1 Result Monitoring</i>	<i>19</i>
<i>9.2 Outcome Monitoring</i>	<i>19</i>
10.0 References	20
Appendix 1.	21
<i>Scheme Plan for Year One (06/07) Secretary Island Deer Eradication</i>	
Appendix 2.	22
<i>Location of Tracks and Huts on Secretary Island</i>	
Appendix 3.	23
<i>Year One Financial Allocation</i>	

1.0 Executive Summary

Secretary Island is 8140 hectares in size, steep, rugged and rises to 1196m above sea level. Red deer and stoats are the only introduced mammals to have established on the island. An earlier attempt to eradicate deer, during the 1970's and 1980's, was unsuccessful. A comprehensive pest eradication programme covering both Secretary and Resolution Islands was proposed for funding in 2004. The first stage, a stoat eradication project for Secretary Island, was initiated in 2004/05.

The eradication of red deer from Secretary Island is proposed to protect the ecological values of the island, and to test and develop methods for intensive control of deer. The project will aim to eradicate the existing population of deer and to limit or control any long-term re-establishment.

The programme will be broken into three phases, with a 'knockdown' phase (80% population reduction) occurring over the first two years. A 'mop-up' phase (removal of the remaining 20%) is planned for the following two years and the programme will then move into a 'maintenance' phase where measures to deal with any deer swimming to the island would be established. Before field operations commence an attempt will be made to collect a minimum of 30 snagged deer hair samples, along with a minimum of 30 deer bedding hair samples, with the aim of establishing an accurate population estimate using DNA marker based techniques. This will provide valuable data for monitoring progress toward eradication. Data management and close monitoring of field operations will be important for eradication efforts on Secretary Island.

As there has never been an eradication of deer from an island of similar size or habitat to that of Secretary Island the entire operation will be somewhat experimental in nature and there will be a need to annually review progress and revise or confirm the planned methods and work programme.

Main methods during the 'knock-down' phase will be ground hunting (utilising existing hut and track networks) with contract hunters using trained dogs, and helicopter hunting of alpine grasslands, slips, coastal fringes and open forest. Both techniques are known to be very effective methods of control and a good pool of highly skilled contractors is available locally. [Both will almost certainly continue to be major methods in subsequent mop-up and maintenance operations.]

As detailed knowledge is gained on key sites, some barrier fences will be constructed and team hunting considered. Following results of initial trials and monitoring of work elsewhere, the use of foliar bait poisoning, baits and lures, transmitter collars, capture nets or pens and night vision gear will be considered for introduction to the second year of the 'knock-down' phase and use during the 'mop-up' phase.

The use of skilled hunters with tracking dogs, remotely monitored capture pens and self-attaching transmitter collars are expected to be key tools during the maintenance phase. Therefore, the development or refinement of these methods will be integrated into the eradication programme from the start. Novel techniques and combining traditional hunting methods in a new mix may be needed to achieve eradication. Some development and trialling of non-traditional deer control techniques that show potential will be carried out, although most resources will be directed toward applying proven techniques.

2.0 Background

Secretary Island is part of Fiordland National Park, and is 8140 hectares in size. It is a steep and rugged island, rising to 1196m above sea level. It is separated from the mainland portion of Fiordland National Park by Thompson Sound to the east and by Doubtful Sound to the south (see Figure 1).

Secretary Is. was until the late 1950's or early 1960's entirely free of introduced browsing or grazing animals, and was one of the largest and most significant areas of indigenous vegetation in New Zealand remaining free of the effects of such animal pests. Until that time, the stoat was the only introduced animal that had succeeded in crossing the gap between the mainland and the island. The spread of red deer into Fiordland inevitably meant that Secretary Is. would be threatened by this species, a competent swimmer well capable of crossing either Sound to reach the island.

A red deer stag was intercepted and killed as it was swimming to Secretary Is. in 1959, and this was the first recorded evidence of red deer attempting to reach the island. Deer were not present in the southern sector of the island during a visit in 1959/60 by an Otago University botanical team. However, deer could easily have been present on the island in low numbers, especially in the western/northern areas (now known to be favoured areas) where the botanical team never visited.

Sporadic sign was confirmed from the southern end of the island from 1963, though it is unclear whether a resident breeding population was present. A fisherman reportedly saw and photographed a hind and fawn in Grono Bay some time prior to May 1966 (Brown and Evans, 1966). By 1970 a small resident population was confirmed in the southern (Gut) area, where 4 adult females were shot and 2 more driven from the island around the 'Gut' area in April 1970 (Paulin, 1970). In all probability deer had extended over much of the island in low numbers by this date. Their establishment was confirmed by helicopter hunting and ground observers in 1973-74, when deer were shot in moderate numbers all over the island, with a population large enough to have created tracks "over two feet wide and worn down exposing bare earth and roots" in some favoured areas (Evans, 1973).

Details of precisely when a breeding population established on the island will remain unknown. On the basis of the historical spread of red deer into the area, it is probable that deer most likely colonised the island from the east (across Thompson Sound) and could have remained undetected in the (still) favoured western areas for some years. (Note that a survey in 1973 showed no sign of deer, past or present, on nearby Bauza Island). Access to the island at the time was almost exclusively by boat, and as a result field observations were largely confined to the southern sector.

Control measures were implemented between 1970 and 1987 but were never intensive enough or applied widely enough over the island to have major impact on the total population. Methods included aerial helicopter shooting, ground hunting, snaring, a capture pen, and 1080 gel baiting of palatable plants. It became clear that 'eradicating' deer from Secretary Is. was a massive task, and while considerable effort went into the control measures, questions were raised regarding the viability of the project.

By 1985, the attitude was “even if extermination is unrealistic, it is possible to achieve an extremely low population at a level where animal damage to vegetation is regarded as insignificant” (Sanson and von Tunzelman, 1985).

By 1989, the attitude was more defeatist - “eradication of red deer from Secretary Is. is not an option. The existing technology will not achieve this at any price. Even if it did, continuous control and monitoring would be required to prevent re-invasion by deer swimming across to the island from the mainland” (Chisholm, WAM options paper, 1989).

The control budget was ceased in 1988/89. Some commercial aerial hunting continued into the 1990’s but its effect did not achieve a high level of control. The island was largely ignored until 2001 when Munn (2001) put forward a proposal for restoration of the island through control of deer and stoats to low levels.

Since 2001 there have been several expeditions to the island to assess the justification and potential for stoat eradication. This assessment has included invertebrate observations, bird counts, observations of freshwater fish communities, and monitoring for the presence of rodents and possums (see Munn 2001). Re-measurement of the New Zealand Forest Service permanent vegetation plots (Monks et al. 2005) and vegetation plots established by Prof Alan Mark (University of Otago) were also completed in 2004. In November 2003 a joint proposal for pest eradication from Auckland, Secretary and Resolution Islands was put forward to the government. In May 2004 funding was approved to undertake restoration of both Secretary and Resolution Islands over the next ten years.

The eradication proposal was based on a staged approach starting with work on the removal of stoats from Secretary Island, followed by a deer programme on Secretary Island, and then expanding the operation to also include Resolution Island. Over the 2004/5 summer a track network totalling more than 100 kilometres was established on Secretary Island. The three existing huts on the island were refurbished and the hut network was extended with the installation of six additional 2-person bivvies. Nine hundred and forty five stoat trap tunnels were set out over the autumn of 2005 and trapping commenced in July 2005. Three hundred wire mesh tunnels were subsequently removed in July 2006.

Detailed planning for the deer eradication phase of the programme started with the release of a scoping document in December 2005. This document identified issues of significance in relation to goal setting, potential methods, monitoring, and information needs. It was distributed, along with a response form, to a range of people known to have skills or knowledge in relation to deer control or island eradications. Assessment of the responses received and further research into some of the key topics has guided the development of this plan.

3.0 Justification

Until around 1960, Secretary Is. was one of the few places in New Zealand that remained free of the influence of any introduced grazing or browsing mammal. By 1975, the recently arrived but rapidly expanding deer population had already caused major damage to vegetation and soils via tracking – “spongy moss and humus over impervious granite has either been cut or damaged, leaving water gutters”. Observers also noted “many deeply worn deer leads...the ground surface is easily damaged and slow to heal over.” (Anon 1975).

The small five-finger tree *Pseudopanax colensoi* var *fiordensis* formed most of the sub-canopy layer in sub-alpine silver beech forest, but deer “essentially eliminated this layer” (Mark and Baylis, 1982). It was suggested that this selective browsing, along with trampling and a similarly reduced herb layer, rendered the forest floor prone to sheet erosion as illustrated by photos of dead *Pseudopanax* stems and exposed beech roots. The former significance of this species in the sub-canopy is virtually undetectable now.

In places, the hen-and-chicken fern *Asplenium bulbiferum* was the “overwhelmingly dominant” fern in the forest herb layer in the last section to be accessed by deer (talus slopes below cliffs on the SW side) (Mark and Baylis, 1982). Here, hen-and-chicken fern density was estimated at an amazing 25,000 plants per hectare. By contrast areas where deer had prior access (e.g. Grono Bay) the fern “had been severely depleted” and the ground cover of ferns greatly reduced.

Similarly, a number of other species have been impacted on. By 1982, Mark and Baylis reported “clear evidence of the subtle changes that are caused by selective browsing and of the significant loss of ground cover that will follow”.

Measurements of permanent forest plots on Secretary Is. from 1975 to 2003/04 have detected significant changes in composition and structure in the under storey with declines in most palatable or deer-preferred species (e.g. broadleaf *Griselinia littoralis*, mahoe *Melicytus ramiflorus*, kamahi *Weinmannia racemosa*), and little or no changes in many non-palatable species (Monks et al., 2005).

Removal of deer will remove the only introduced browsing species present on the island, and will enable the recovery or restoration of indigenous flora and natural vegetative processes.

Recent advances with deer control, pest eradications on islands, and the management of the potential for reinvasion of pests, have opened up the opportunity for effective management of island sanctuaries such as Secretary Island. With appropriate resources and the application of a well planned, systematic and thorough programme, it is now feasible to attempt to eradicate red deer from Secretary Island and establish a programme to manage re-invasion.

4.0 Eradication Plan Design

4.1 DESIGN PRINCIPLES

There are two key factors influencing the design of this eradication plan:

- The known likelihood of reinvasion by red deer and the need to establish a long-term control, or 'ongoing eradication', strategy.
- The experimental nature of the operation due to:
 - eradication of deer having never been attempted elsewhere on an island of the size and habitat type as Secretary Island.
 - the need to develop methods for the proposed control/eradication of deer on Resolution Island

Over recent years conservation managers have become willing to eradicate pests from islands where reinvasion is possible from animals swimming back to the island. The cost of running an efficient ongoing trapping programme to deal with potential re-colonisation of an island is easily outweighed by the resulting conservation benefits. Several islands in Fiordland are now being managed in this way, for stoats. Anchor Island is a good example, where stoats have been eradicated and a trapping programme established to prevent them re-colonising. The island is now an important kakapo management site. The efficiency of these island stoat eradications has in part been due to the initial eradication trapping programme being used to form the long-term trap network.

It makes sense to apply this principle to the deer eradication project for Secretary Island - where work during the eradication phase contributes the establishment of the long-term programme to manage re-invasion. Not only will it result in financial efficiencies but it will also help achieve long-term success. Wherever possible, including methods (e.g. capture pens or self-attaching transmitter collars) likely to form the basis of the long-term management in the initial knockdown phase will provide for valuable learning and refinement of these techniques.

Applying lesson learnt from previous similar projects is difficult as there has never previously been any eradication of deer from an island of similar size or habitat to that of Secretary Island. The most similar project would be the recent eradication of red deer from Anchor Island in Dusky Sound. The Anchor Island project was started without a clear expectation of how the last remaining few deer would be removed from such a large island (1150 ha) and the techniques evolved as the project progressed. This eradication project provided many lessons.

Key learning points for getting the last few deer included:

- Having a team of skilled hunters that know the site very well and can work well together is important.
- Developing a good understanding of main deer trails, escape routes and behaviour when under pressure is invaluable when planning operations.
- Installing barrier fences to confine deer movement at key sites should be done prior to starting the 'mop-up' stage. (They provide options for ambush hunting, or the use of nets or pens).

- Self attaching transmitter collars have considerable potential (they are operating 24 hours a day over a long period and do not require regular servicing). Ideas on how to make them more effective were developed.

An assessment of why previous efforts in the 1970's and 1980's failed to achieve eradication, and comparisons with the Anchor Island project and the Murchison Mountains deer control programme, are included in the Secretary Island Deer Eradication - Scoping Document (Brown 2005a). Points raised in that document have also been taken in to account in preparing this operational plan.

4.2 PLAN STRUCTURE

This plan has three phases:

- | | | |
|----------------|-----------------|---------------------------------|
| 1. Knock-down | Years 1 & 2 | 80% population reduction |
| 2. Mop-up | Years 3 & 4 | Remaining 20% eliminated |
| 3. Maintenance | Year 5 & beyond | Ongoing removal of new arrivals |

These timeframes are probably quite ambitious considering current technologies and experience with similar operations. Regular review (annual) of timeframes and methods will be required as no other eradication of this nature or size has been completed to date. For this reason no specific detail is given on methods for the two year 'mop-up' phase and 'maintenance' phase.

At a general planning level it is expected that methods used in the 'mop-up' phase will be similar to those of the 'knock-down' phase. However, they will be more targeted to key sites and with the addition of developments made through trial work and addition of methods expected to form the basis of the 'maintenance' phase.

At present the 'maintenance' phase is expected to involve remotely monitored capture pens, self-attaching transmitter collars and with period ground checks by hunters with dogs.

This eradication project is an exercise in research by management. Due to the experimental nature of the project it will require close monitoring of field operations. An ability to make modifications at short notice in response to the results of various aspects of the programme is also needed. Therefore, the principal control methods (ground hunting & helicopter hunting) will not be tendered as large blocks of contract work. To ensure close supervision of the work and those lessons learnt are recorded and applied, a project manager employed by the Department of Conservation will oversee the programme. Where available, suitably skilled and locally available contractors will be engaged on a short-term daily or hourly contracts.

4.3 PLAN REVIEW

There will be a need for regular review of progress and planned actions because of the somewhat experimental nature of the work (research by management) and the scale of the operation.

Annual (May/June period) reviews will be carried out by a Southland Conservancy planning team for this project. Key staff for this team will be:

- Project manager for this deer eradication project (Dave Crouchley)
- Resolution/Secretary Island programme staff (Kerri-Anne Edge, Pete McMurtrie)
- Programme Manager, Biodiversity, Te Anau Area (Murray Willans)
- Technical Support Supervisor, Threats, Southland Conservancy (Grant Harper)
- Technical Support Manager, Southland Conservancy (Andy Cox)

This review process will be expanded at the end of years 1, 2 and 4 to include key staff from the planning team and the Department of Conservation Island Eradication Advisory Group. The year 4 review will include reassessment of the goals and objectives of this plan.

Proposed revisions that are accepted by the planning team, will be added to updated versions of the operational plan which will be prepared follow each review.

5.0 Goal and Objectives

As Secretary Island is within swimming distance of the nearby mainland (for red deer), it is clear that a 'one-off' eradication campaign is not appropriate. 'Eradication' (if feasible) refers to the complete removal of the existing population, but will have to be followed by long-term 'control' measures to limit re-invasion or re-establishment potential. The term "Ongoing Eradication" is suggested as a simple term to describe this form of island pest management.

The stated goal for the deer programme on Secretary Island is:

"To attempt the eradication of the existing population of deer from Secretary Island and prevention of their reestablishment, thereby making it one of the largest areas in New Zealand largely free of all mammalian pests".

More specific **Objectives** for the project that reflect the deer programme design are:

- 1 Obtain a more accurate population size estimate for deer on Secretary Is. in order to assist with planning and setting performance targets/measures relating to the removal of deer.
- 2 'Knockdown' (80%reduction) of the resident deer population by the end of Year 2.
- 3 'Mop-up' of the remaining resident population by the end of Year 4, and as far as is possible, maintain this zero level to Year 6 and beyond.
- 4 Monitor through regular field inspections and/or DNA sampling (see monitoring section for detail) the rate of re-invasion between Years 4 and 6, and beyond.
- 5 Gain experience and gather information on control and detection techniques most likely to be successful on Secretary Island and for the proposed eradication on the much larger Resolution Island. Results to be documented.
- 6 Monitor and document recovery of species and communities through vegetation monitoring (i.e. the established permanent plots) and the measurement of specific deer impacts (monitoring of seedling browse).
- 7 A formal review of the success of the operation, its methods, and stated goal and objectives in Year 4.

6.0 Options for Eradication

The Secretary Island Deer Eradication - Scoping Document (Brown 2005a) gives a detailed summary of potential methods for deer control or eradication on Secretary Island. Please refer to this document for detailed comments on; Previous Use, Pros, Cons, Unknowns, Key Points for the following methods:

- Aerial Baiting
- Ground Baiting (1080 gel)
- Aerial Hunting
- Ground Hunting
- Capture Pens
- Radio Transmitter (Tx) Collars, Wings and Fences
- Other Methods
- FLIR (Forward looking infra-red)

Assessment of comments received on the scoping document, and further research into some of the key topics, has guided the selection of methods included in this plan.

Apart from the selection of methods on their individual merits, a key consideration has been to develop a mix of proven methods that complement each other. When introducing additional methods or techniques, as development and trial work progresses, there will also be a need to consider how these might mesh with the rest of the programme.

Due to the scale and experimental nature of this eradication, annual reviews and revision of progress and methods will fine-tune the work for the following year. The use of skilled hunters with tracking dogs, remotely monitored capture pens and self-attaching transmitter collars are expected to be key tools during the maintenance phase. Therefore, the development or refinement of these methods will be integrated into the eradication programme from the start. It is expected that as the programme progresses the mix of methods and techniques deployed will end up as a combination of traditional control methods with the addition of new technologies to increase their effectiveness.

Some development and trialling of potential deer control techniques that could contribute to achieving eradication needs to be carried out.

Rejected Techniques - Aerial Baiting (1080 carrot bait) has been excluded as a method due to the uncertain efficacy and high costs. There would also be a requirement for comprehensive (expensive) associated monitoring and not being able to record individual kills would mean the the loss of useful data. FLIR (FORWARD LOOKING INFRA-RED) has also been excluded following field inspections confirming its limitation for application to this project (P. McClelland, pers. comm.).

7.0 Methods

7.1 KNOCK-DOWN PHASE

The following comments on each method relate to its application during the 'knock-down' phase of the programme (Years One and Two). The use of foliar bait poisoning, baits and lures, transmitter collars, capture nets or pens and night-vision gear will be considered for inclusion in the second year of the 'knock-down' phase if results from the development trials show promise. Trials are expected to include the use of barrier fences, baits & lures, transmitter collars, nets and capture pens. As these methods are being developed for the 'mop-up' phase, detailed planning of this phase will be postponed until trial results are forthcoming.

7.1.1 *Ground Hunting*

Ground hunting will primarily be achieved using contract hunters, each operating with a trained deer indicator dog. The use of an appropriately skilled dog can greatly increase the effectiveness of ground hunting when deer numbers are low and the animals are under heavy hunting pressure. Spotlighting at appropriate sites will also be invaluable.

Fortunately there is a pool of skilled contract hunters available within the Te Anau region. These hunters gained valuable experience working on the Anchor Island deer eradication project and/or in the deer control programme in the Murchison Mountains. They also have considerable experience working on other pest control programmes and in the venison recovery industry in previous years.

Field observations made by skilled and experienced hunters will be a vital factor in assessing and reviewing techniques as the project progresses.

Hunters will work individually, based at separate hut sites (see Figure 1). The huts will form the centre of 9 ground hunting 'blocks'. The 'blocks' will not have strict boundaries and where possible hunters will not concurrently operate in 'blocks' adjoining each other to reduce the risk of hunting in the same area. Team hunting will be introduced during the later phases of the programme.

Ground hunting will be pulsed. That is, several short sessions of 9 days hunting will be programmed with resting periods of at least 2 weeks between each session to give time for human and dog scent to be rained off. A minimum of four sessions will occur each year with the main effort being during the roar period (see Figure 2: Scheme Plan for Year One (06/07) Secretary Island Deer Eradication).

Each 9 day hunting session will consist of two consecutive, overlapping, 5 day periods with approximately half of the hunting blocks being covered during each period. The last day of the first period and the first day of the second period will overlap so as to act as a change-over day. Hunters will shift blocks on this change-over day. Each block will be hunted at least once during each hunting session. This means that several hunters will individually work their allocated blocks at any one time to achieve the island-wide coverage desired in each session.

One or more of the three western blocks (North Ridge, Rocky Point, Stanley Burn) which hold the highest densities of deer, will be hunted twice during each hunting session, by different hunters.

The ground hunting programme detailed above will achieve a total ground hunting effort of 325 hunter days per year during the 'knock-down' phase. This is about half the ground hunting effort per hectare when compared to the knock-down phase of the Anchor Island deer eradication project. However, helicopter hunting did not contribute significantly to the Anchor Island project, where on Secretary Island there is considerable scope for aerial hunting. It is expected that possibly up to 50% of deer taken during the knock-down phase may be taken through helicopter hunting. This level of ground hunting effort is approximately **18 times** the level of ground hunting effort per hectare when compared to the Murchison Mountains control programme.

Ground hunters will be required to record GPS data for deer shot or sighted, plus any concentrations of deer sign and the location of main travel tracks. Knowledge gained during ground hunting operations will help the ground hunters to be more effective during the latter phases of the programme and in addition provide information for planning other operations.

7.1.2 Aerial Hunting

Helicopter hunting is proven as one of the most effective methods for controlling deer in New Zealand. Most helicopter hunting has been carried out as part of commercial deer or venison recovery and has been concentrated in open habitats. Removal of deer from open areas during the years this industry was functioning also significantly reduced deer numbers in surrounding densely forested areas.

Open forest habitats also provide opportunities for helicopter hunting when not having to recover animals. Helicopter culling in forest habitat has become a key tool in recent control operations in the Kaweka Mountains and the Wapiti Area of Fiordland National Park. Helicopter culling in forested areas of the western Wapiti Area during 2005/06 achieved a return of 13.79 deer per hour.

The effectiveness of helicopter hunting on Secretary Island is likely to be significantly greater than earlier efforts in the 1970's and 1980's which were predominantly based on commercial deer recovery. Apart from the alpine grasslands and sub-alpine scrub areas, there are considerable opportunities for helicopter hunting on Secretary Island with the numerous slips, the coastal fringe, and areas of open forest.

There are several helicopter companies, with suitably skilled pilots, based in Te Anau. Two local pilots, Richard Hayes and Kim Hollows, have an extensive knowledge of the island from hunting Secretary Island over several years.

Helicopter hunting will be carried out periodically throughout each year as conditions dictate, with the aim of completing a minimum of 35 hours. This equates to approximately **10 times** the effort per hectare when compared to the Murchison Mountains control programme. Weather conditions will be monitored to ensure favourable conditions are utilised. The Met Service automated weather station on the Secretary Island - accessible through the internet - is ideal for this purpose.

Generally, use of the two preferred helicopter operators will be alternated, depending on their availability. Doing so will utilise the varying hunting styles and helicopter types of these two operators. Using two operators will also introduce a competitive element, giving an added incentive for high performance.

If neither of the two preferred operators are available and ideal hunting (weather) conditions occur other locally available operators/pilots will be considered for use.

It is important to have experienced shooters familiar with helicopter shooting and working with the individual pilots. The Anau Area staff that have helicopter shooting experience with the preferred operators through the Murchison Mountains deer control and Fiordland chamois control programmes will be used for this project.

As with the ground hunting, GPS positional data will be recorded for all deer shot or sighted during helicopter operations.

7.1.3 *Barrier Fences*

Barrier fences were constructed on Anchor Island during the later stages of the deer eradication programme; they did not play a significant role in the removal of deer. However, hunters involved in that programme agree that had sites been selected and fences constructed earlier in the programme, they would have played a more important role and the last few deer would have been accounted for quickly.

Sites for barrier fences need to be chosen carefully and be constructed in a way that makes best use of natural barriers or restrictions in the landscape to deer movement. They have the potential to enhance sites for use of ambush hunting (possibly in conjunction with team hunting), nets, self attaching transmitter collars, and capture pens. As all of these methods are planned for inclusion in the 'mop-up' phase, as well during the 'maintenance' phase of the programme then site selection and construction will be started as early in the 'knock-down' phase as possible.

Permanent fencing materials will be used in their construction (generally deer netting with StapleLok™ steel posts and an occasional wooden post) to provide durability. They will be constructed in a way that allows for their removal should it be required.

There is no expectation of how many barrier fences will be constructed at this stage as it will depend on site selection following accumulation of field knowledge. Based on experiences on Anchor Island it would be reasonable to guess that at least two sites per block are likely (i.e., approximately 18 sites in total).

7.1.4 *Capture Pens*

One capture pen already exists on Secretary Island at The Gut. This pen was constructed during the era of commercial live capture of deer and is known to have been a very productive pen. It has not been used for several years but will be resurrected early in the programme. A small number of additional pens may be installed during the 'knock-down' phase if particularly favourable sites (for likely captures and easy monitoring) are identified during field operations.

To be of use during the 'knock-down' phase, any capture pen will need to be at a site that can be accessible for monitoring in conjunction with planned ground or helicopter operations. A system of remote monitoring would not be available during the 'knock-down' phase due to the need for further development. Any capture pen construction would be done with the suitability of being part of the 'maintenance' phase in mind.

As with barrier fences, permanent fencing materials will be used in their construction to provide durability, but they will be constructed in a way that allows for their removal should it be required.

7.1.5 *Self-attaching Radio Transmitter (Tx) Collars*

Experience gained through the Anchor Island deer eradication project indicates that self-attaching transmitter collars have potential to make a significant contribution to

the 'mop-up' and (particularly) the maintenance phases of an island deer eradication project. The positive aspect this tool has over all other methods is that the collars are operationally effective 24 hours a day for periods of many months without requiring servicing. Animals collared can readily be tracked by helicopter and then shot from the helicopter.

Tx collared animals have successfully been used as "Judas" type animals in control programmes, especially for goats (Gregory, 2002). Some simple trials with using Tx collared deer as "Judas" animals have been carried out within the Murchison Mountains deer control programme. Results indicate that this technique may enhance helicopter hunting operations to some degree. The main thrust of the Tx collar work will be as a means of locating individual animals rather than collaring "Judas" animals.

Work on Anchor Island also identified several problems with the collar design and the setting techniques. The team working on the Anchor Island project has since designed an alternative collar setup but have yet to trial its effectiveness. Recent enquiries into similar work being done in other countries have identified two other collar designs being developed and similar problems being encountered with the setting techniques. Those working on these collar designs are suggesting similar remedies to the setting techniques that have been proposed by the Anchor Island team (R. Schultz pers. comm).

It is expected that development work with self-attaching Tx collars will be able to produce a workable tool for tagging deer in the near future. Expectations are that an effective design will be available for trialling on Secretary Island over the second half of Year One. Some on-site trialling of this method during the 'knock-down' phase will help develop setting skills among the field team and enable site specific problems to be resolved. It is likely to be more of a key tool used more often during the 'mop-up' and maintenance phases of the programme.

7.1.6 Ground Baiting (1080 gel)

The Secretary Island Deer Eradication - Scoping Document (Brown 2005a) identifies ground baiting with foliar baited 1080 gel as a promising option, especially as a one-off knock-down method. The need for favourable (dry) weather conditions, toxin persistence and the subsequent possible exposure of hunting dogs to the toxin, plus the need for additional result monitoring, are four key factors to consider when considering the use of toxins as a knockdown method.

Due to the need for associated monitoring when using toxins, the importance of knowledge gained about deer habits and site use through intensive ground hunting, and the difficulty of forecasting favourable weather for foliar baiting, 1080 gel toxic has not been selected a main knock-down method. However, it may be an option for use in selected (discrete) blocks that are difficult to cover through ground hunting. The effectiveness of this method will be monitored during an operation being planned by the West Coast Conservancy. The result will help in evaluating inclusion of this method in the 'mop-up' phase or the later stages of the 'knock-down' phase of this programme. Although this operation is targeting goats, red deer are also present in the area.

Risks associated with toxin persistence and some ethical concerns in relation to targeting deer with 1080 poison are of particular concern to several of the contract hunters expected to be engaged on this programme (Brown 2005b, Crouchley, *pers. comm.*). Holding this method in reserve will give hunters an opportunity to show

whether ground hunting and aerial hunting are effective as the main knock-down methods on their own - without the requirement to add toxin use into the programme.

Strong “buy-in” to the project by the team of ground hunters in the early stages will be important. Having a committed and skilled team will be important for achieving success during the more demanding ‘mop-up’ and ‘maintenance’ phases.

Other wider issues, such as the potential for use of 1080 poison preventing commercial recovery operations being used to control deer on the nearby mainland populations will need to be considered.

7.1.7 Other Methods

Other methods such as the use of baits and lures or night vision gear may be considered for inclusion in the second year of the ‘knock-down’ phase if results of development and trial work are favourable. Trial work with new methods will generally be done at more accessible sites but may extend to on-site trials on Secretary Island before they are considered main methods. Trials on Secretary Island will be done with the aim of assessing any site specific problems and as a site free from rat and possum disturbance.

7.2 MOP-UP AND MAINTENANCE PHASES

Methods to be used during the ‘mop-up’ and ‘maintenance’ phases will be determined as a result of evaluation and review of methods used in the knockdown phase’ and results of trials and development work.

For further comments on details of potential methods for the Mop-up and Maintenance Phases please refer to the ‘Plan Structure’ sub-section of ‘Plan Design Principles’ section (page 9) and the ‘Methods - Development Work’ section (page 20).

At the time of preparation of this plan the application of methods during the ‘mop-up’ and ‘maintenance’ phases is expected to be as follows:

Mop-up Phase

- Ground hunting - Effort similar to during ‘knock-down’ phase but more targeted to key sites and introduction of team hunting. Integration with use of nets, baits and possibly also helicopter hunting.
- Aerial hunting - Similar effort to during ‘knock-down’ phase but more targeted to key sites and used as follow-up to setting of self-attaching transmitter collars.
- Capture pens and nets - Construction of capture pens should be complete and resources would be directed at operating (setting) the capture pens at the key times of year. Remote monitoring of pens at some sites would allow them to be operated for longer periods. Remotely monitored capture nets could be included in this programme and would be targeted at barrier fence sites and other “hot spots” identified during the ‘knock-down’ phase.
- Self-attaching transmitter collars - Once perfected this method would be targeted at sites identified during the ‘knock-down’ phase. They will be particularly useful at sites difficult to hunt by ground or helicopter. Checking of up take will be combined with helicopter hunting.
- Baits and Lures - Good bait options identified during trial work will be used in conjunction with all of the methods identified above.

Maintenance Phase

- Ground hunting - Much reduced level of effort to previous phases. Specific sites where sign of deer may have been identified would be targeted. Team hunting is likely to be required. Annual coverage of all areas would be required to monitor/detect presence of deer. Baits, monitoring cameras and hair snagging devices may be useful in assisting this work.
- Aerial hunting - Reduced effort to previous phases but more targeted to key sites and optimum weather conditions and times of year. Would be combined with checking of self-attaching transmitter collars.
- Capture pens and nets - Capture pens would only be operated at key sites and numbers may be reduced from the number operated during the 'mop-up' phase. All pens would be able to be monitored remotely and would be operated at key times of year or after deer sign had been detected. Trail monitoring cameras may be useful in detecting deer presence at pens left open when not in operation (Heavy rainfall quickly eliminates tracking sign.) Nets may be used for specific follow up of deer found.
- Self-attaching transmitter collars - Collars would be set at all key "hotspots" identified during the previous phases. They will be an important method during this phase as they can operate 24 hours a day, 7 days a week without any immediate follow-up required. Checking of up take will be combined with helicopter hunting and other monitoring work.
- Baits and Lures - Options identified during trial work will be used in conjunction with all of the methods identified above.

7.3 DEVELOPMENT WORK

Very few eradications of red deer on large islands have been undertaken. Most available methods have been developed as part of mainland control programmes or recreational or commercial hunting activities. It will be important to refine these techniques to suit the island eradication programme. Combining various methods in new and innovative mixes or sequences could also help achieve success.

In addition to trials on Secretary Island, testing alternative or modified methods will be carried out at sites close to the Te Anau base. The Burwood Bush Scientific Reserve and the Murchison Mountains Specially Protected Area of Fiordland National Park are two sites that will be favourable for this work as the Department of Conservation has greater control of access and hunting activities at these sites than at other local areas.

Trial work will initially focus on:

Remote monitoring of capture pens - This method is likely to involve the use of a satellite-modem based remote-monitoring system. There are existing capture pens in the Murchison Mountains where this new technology could readily be trialled.

Self-attaching transmitter collars - There are now three alternative designs to that used on Anchor Island and in the Murchison Mountains suitable for trialling. There are suitable sites for this in the Murchison Mountains and other ground and aerial telemetry work already being carried out in the area.

Baits and lures

A variety of baits and lures used elsewhere for deer will be trialled at Burwood Bush. Internet researching has identified some options, along with some casual trials with salt lures in the Murchison Mountains in recent years. Experience from elsewhere indicates that time of year or seasonal factors could be a factor in bait attractiveness.

Trial monitoring cameras

The use of simple digital still cameras will be useful for monitoring deer activity at bait or transmitter collar sites. Having a date and time recording function, these monitoring cameras may prove useful in helping to target hunting activity at key sites on the island. They may also become a useful monitoring tool during the 'maintenance' phase of the programme.

Night vision equipment

This equipment may be used for hunting open sites later in the programme when remaining animals have become more nocturnal due to sustained hunting pressure.

DNA analysis of hair samples

The use of DNA analysis of deer hair samples has been identified as a likely principal result monitoring tool. It may be possible to calculate a reasonably accurate population estimate using DNA based methods recently developed for red deer by Graham Nugent of Landcare Research Ltd. Te Anau Area staff have been assisting Landcare Research over recent years, by collecting hair samples from deer removed from the Murchison Mountains. Further collaboration with Landcare Research during the development of this technique will be considered (as resources allow) if it appears that it will be useful for the success of the overall programme. Although it should be acknowledged this technique for calculating deer population estimates in New Zealand is still at the development stage.

Individual identification of animals through DNA analysis was useful in understanding what animals were remaining during the later stages of the Anchor Island deer eradication. The development of a reliable device for collecting snagged hair samples from free-ranging red deer is one task that the project team will develop as this could become a key monitoring tool during the 'mop-up' and 'maintenance' phases. It will help in deciding where to focus effort and possibly indicate what animals have swum to the island.

8.0 Infrastructure

The 'Secretary Island Operational Plan: Stoat Eradication' (Golding et.al., 2005) gives detail on the infrastructure established to support the stoat eradication. This same infrastructure will also support the Secretary Island deer programme. Please refer to this document for details.

Some notes on the infrastructure that related specifically to the deer eradication programme are given below.

8.1 TRACK NETWORK

All routes marked in Figure 1 have been cut, cleared and marked to the 'marked route' standard as set out in the Standards New Zealand Handbook: Tracks and Outdoor Structures (SNZ HB 8360, OLDDM-724391).

Some additional access routes may need to be marked to simplify access to 'hotspots' as they are identified. The existing track network gives good access to most of the island for hunting. However, parts of the upper Mahoe catchment are a considerable distance from a track and a main ridge in this valley appears to be an obvious route for adding another track to improve access to this area (see Figure 1). Following reconnaissance of this route during the 'knock-down' phase consideration will be given to cutting a track along this route to improve access during the 'mop-up' stage.

8.2 HUTS AND BIVVIES

The locations of the huts and bivvies are shown in on Figure 1 [NB - these still have to be added by IMU]. No additional huts or bivvies will be required for the deer eradication programme. Hunters may at times camp temporarily at other sites to facilitate quick early morning or evening access to key hunting sites.

8.3 COMMUNICATIONS

Communication to Te Anau from Secretary Island will be provided by single sideband (SSB) radios at the huts and bivvies and by handheld VHF radios while in the field. A portable mini-repeater has been erected on All Round Peak to provide local VHF coverage around the island and an emergency link to Te Anau Base via the Mt Irene Marine Repeater on VHF Channel 66.

8.4 TRANSPORTATION

The Department's boat, 'MV Southern Winds', is based in Doubtful Sound and will provide both transport and accommodation in and around Secretary Island during the

project. MV Southern Winds also has two small tenders which can be used to transport staff to shore.

Helicopters will be used to position teams and stores on the island.

8.5 QUARANTINE

Island quarantine for this programme will be undertaken in accordance with the Island Biosecurity Plan: Southland Conservancy, Appendix 4 (Agnew & Roberts, 2004).

As the contract ground hunters will be required to supply their own food they will be supplied with lidded plastic containers in which to pack it. They will be required to ensure that all food products are clean and well packaged, especially with vegetables i.e. potatoes must be pre-washed, lettuce must not have dirt on the root system. Food containers and personal gear will be packed using the self quarantine check list (Fiordland Island Quarantine Procedures TEAAO-14955) and then inspected by DOC staff prior to each trip. Particular care with cleaning mud from boots and seeds from velcro fasteners or pack pockets will be highlighted to hunters working on Secretary Island.

8.6 CO-ORDINATION WITH STOAT CONTROL OPERATIONS

The timing of stoat trap servicing trips will be arranged so that they do not coincide with ground hunting operations to prevent any conflict of hut use. It is not considered necessary to 'rest' hunting blocks from human disturbance by requiring a specified separation period between this fieldwork and hunting as the stoat trap servicing will not require any off-track work.

Personnel completing stoat trap servicing will be able to contribute to deer work by recording where animals or fresh sign is seen, checking Tx collar sites or hair snag sites etc that are situated on or near tracks.

9.0 Monitoring

9.1 RESULT MONITORING

Initial field operations will aim to collect a number of snagged deer hair samples with the intention of establishing an accurate population estimate using DNA marker based techniques. This work will be undertaken in collaboration with Landcare Research Ltd, who has been working toward developing a DNA based method for estimating deer population densities in New Zealand (Nugent et.al., 2005). The project team will endeavour to collect a sufficient number of snagged hair samples [~30+] at the start of the programme and also collect hair samples and jaw bones (for dental aging) from all deer ground shot or captured. An accurate population estimate for red deer on Secretary Island will provide valuable data for monitoring progress toward eradication.

As this method is being developed it will be part of a suite of result monitoring methods (In effect, Secretary Island will be a 'test' for the technique - another part of the research by management nature of the work). The ground hunting programme during the 'knock-down' and 'mop-up' phases will be structured in a way so that traditional return for unit effort calculations can be made to measure population decline.

Result monitoring during the later stages of the 'mop-up' phase will switch to detection monitoring as numbers decline to very low levels. Hunters using skilled dogs will be the key tool for this work.

9.2 OUTCOME MONITORING

Existing (FRI and University of Otago) permanent vegetation monitoring plots will provide long-term outcome monitoring of vegetation responses to deer eradication. These plots were last re-measured in 2003 (forest) and 2005 (grassland) with next re-measurement due 7 to 10 years after. Photos that have been taken in association with measuring these plots will be useful for showing vegetation response to changing deer numbers.

To provide an initial measure of vegetation recovery, standard SRI (seedling ratio index) monitoring will be established at sites near the existing permanent forest plots. Two sites of ten transects each will be installed in the Stantley Burn and Nee Stream areas during November 2006. These will be re-measured every three years.

10.0 References

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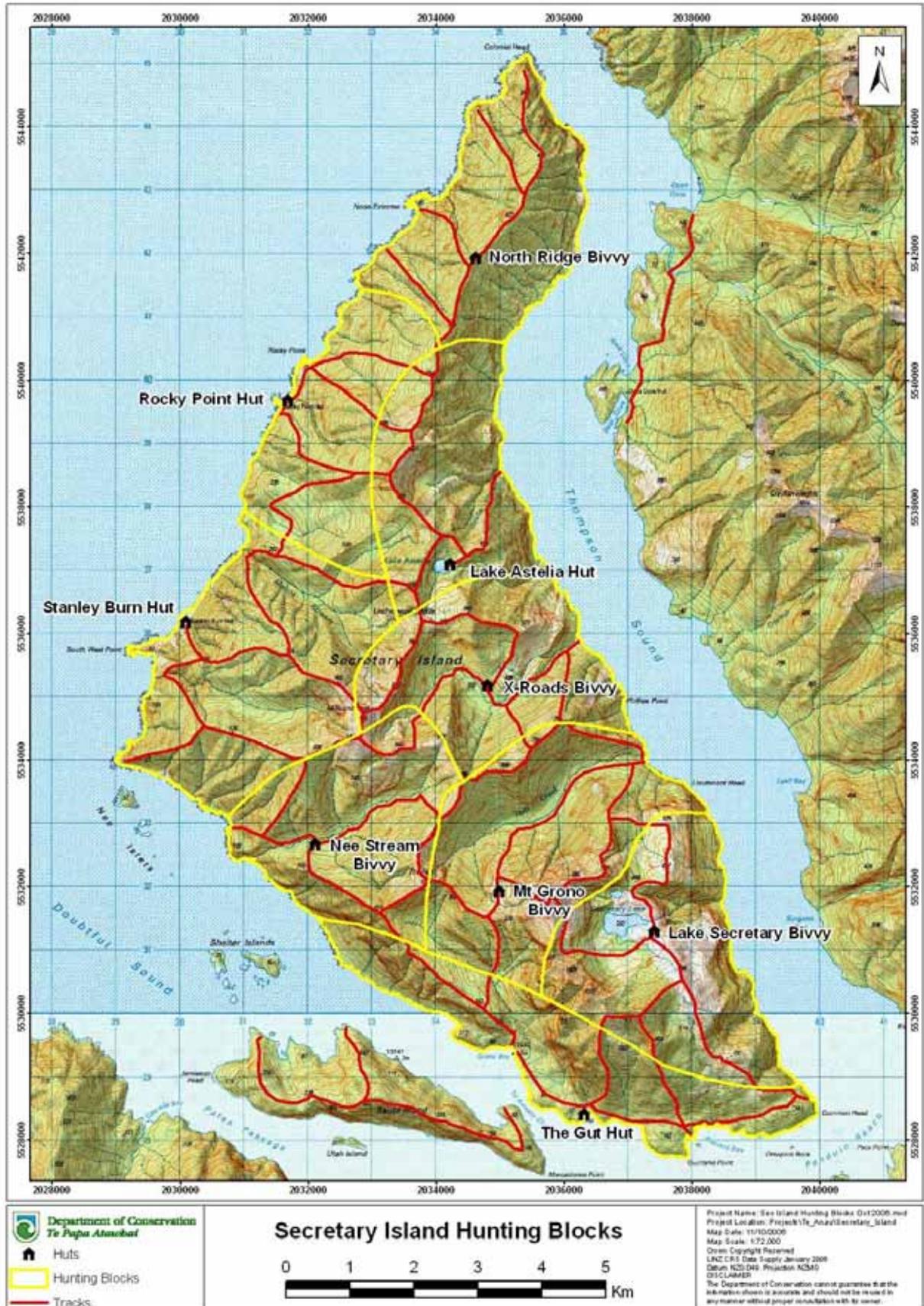
Appendix 1.

SCHEME PLAN FOR YEAR ONE (06/07) SECRETARY ISLAND DEER ERADICATION

	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07
Operational Plan	Completion of operational plan											Review
Hair Snagging for DNA		Develop snagging device	Set Snags									
Folia Bait Poisoning		Cost & collate information			Monitor results of West Coast goat trial site							Decide use/sites
Lures/Baits	Research options	Establish B/W trial-Ongoing monitoring			Bait/ Salt	Bait/ Salt	Bait/ Salt		Bait/ Salt		Bait/ Salt	
Self-attaching Tx Collars	Research options	Refine technique and trial in Murchison Mountains					Install sample				Install sample	
Monitoring Cameras		Test effectiveness at bait/lure, barrier fence sites					Trial use on Secretary Island					
Helicopter Hunting			Hunting flights timed depending on weather conditions, to achieve budgetted hours									
Ground Hunting												
Barrier Fences		Design build prototype										
Capture Pens		Build Prototype - Test remote monitoring system										
Southern Winds												
Veg (SRI) Monitoring												

Appendix 2.

LOCATION OF TRACKS AND HUTS ON SECRETARY ISLAND



Appendix 3.

YEAR ONE FINANCIAL ALLOCATION

Planning		
Planning	2500	
Review/IEAG	1600	
1080	500	
		4600
Ground Hunting		
Contractors	80000	
Transport (heli/boat)	40000	
Field Expenses & gear	3000	
		123000
Helicopter Hunting		
Helicopter hire	33000	
Ammunition and gear/maintenance	1500	
		34500
Fences & Pens		
Contractor	7000	
Materials	4000	
Transport	5000	
		16000
Development Work		
Remote Monitoring	15000	
Tx Snare Collars (gear/heli)	3500	
Baits and lures (baits & gear)	2000	
Monitoring Cameras, Night Vision etc.	2500	
		23000
DNA Monitoring		
Staffing	4000	
Transport	2900	
Field expenses and materials	900	
Dental Aging	400	
Analysis	5000	
		13200
Vege Monitoring		
Transport	1400	
Staffing	4000	
Field Expenses	300	
		5700
Total		220000
Plus:		
Project Manager (.75)		
Vessel 'Southern Winds' support		