

# *Powelliphanta augusta* Recovery Strategy 2015 – 2020



## *P. augusta* Recovery Working Group:

Helen Otley, Planning Team, Hokitika  
Kath Walker, Science and Capability (Ecology)  
Rodney Phillips, Hokitika Conservation Services Team

## *Approved by:*

Mark Davies  
Director, Operations Western South Island Region  
March 2016

## **Part A – Background and context**

Background

First strategic period: 2007 - 2014

Genetic diversity

Mt Augustus ridgeline rehabilitation

Release sites within original range

Current situation

Development of a new strategy

Figure 1

Figure 2

## **Part B - Second strategic period: 2015 - 2020**

Recovery Strategy 2015 – 2020

Intermediate Outcomes

Management Approach during 2014 – 2020

- Captive Population
- Management of sites where snails currently exist
- Habitat restoration of mine site along A10-A13-A12 ridgeline
- Outcome monitoring
- Information recording and sharing
- Strategy implementation

## **Part C**

File notes of advice

References

Appendix 1 - Predator control

## **Part A – Background and context**

### **Background**

*Powelliphanta augusta* is a species of giant land snail endemic to New Zealand. It is found on Stockton Plateau, near to Westport, on the West Coast of the South Island. It was discovered in 2004 and found in habitat on Stockton Plateau and Escarpment, part of which was to be removed as part of an open cast coal mine owned by Solid Energy New Zealand Limited (SENZ). The history of the coal mine operation and the management of the species at the mine and on the adjacent PCL can be found in the first Conservation Strategy 2007 – 2012 (docDM-190955). The species was described in 2008 (Walker et al. 2008).

*P. augusta* is now found in approximately 3ha of original habitat (Site A), in two translocated populations beyond its natural range (Site B on the north-west corner of Stockton Plateau and the Mt Rochfort area at the southern end of Denniston Plateau) and the balance of the population is held in captivity (Fig. 1). It has the highest threat ranking, being ‘Threatened: Nationally Critical’ (K. Walker, pers. comm.).

Guidance for management is directed by a Conservation Strategy, which now requires updating.

### **First strategic period: 2007 - 2014**

The first Conservation Strategy covered the first five years of the programme (2007 – 2012), that being after the snails were captured, bought into captivity and half of them then translocated to Site B and Mt Rochfort.

The strategy had the following three long-term management aims:

1. To prevent the extinction of the taxon.
2. The minimum long-term aim is to secure one self-sustaining population of the taxon in the wild.
3. The optimum long-term aim is to secure one self-sustaining wild population of each genotype in the wild.

A number of intermediate outcomes and management actions to achieve these intermediate outcomes were also identified.

As a new strategy was not in place until 2015, management during 2013 and 2014 continued under the guidance of the 2007 – 2012 strategy.

### **Genetic diversity**

Part of the long-term aim is to secure the species known genetic diversity in the wild. In 2008, Trewick et al. (2008) showed that on mitochondrial DNA, the two morphotypes were different genotypes, which are referred to as the “northern morph” (A10 snail) and the “southern morph” (A12 snail). Later genetic analysis using both mitochondrial (mtDNA) and nuclear DNA found the same split between northern and southern morph snails (Buckley 2015).

Buckley also found that snails at the southern end of the A10 (i.e. snail search blocks 6 and 10 and part blocks 3A and 5B), which morphologically resembled the southern morph snails (Walker et al. 2008), based on both mtDNA and nuclear DNA belonged to the northern morph, but were still distinctively different from the northern morph (Buckley 2015). These snails are referred to as the “intermediate” snail.

The snails have always been housed in the captive facility according to their search block they were found in. The northern morph and intermediate snails have been held in individual breeding groups according to the snail search blocks they were found in (or where needed to make up a sufficient group size, with snails from an adjacent search block). Fortunately, the intermediate snails all group together in particular snail search blocks, and so have not been mixed with the northern morph snails, except for a few containers where some 5a snails (northern morph) have been mixed with some 3a and 3b snails (intermediate snails).

In addition, sods with alpine plants that were growing in the snail's original habitat east of Mt Augustus were lifted by hand and moved by truck in 2006 to a small site called "Downers Garden". Though several empty shells were found there in 2007, no live snails were found or are known to occur there now.

### **Mt Augustus ridgeline rehabilitation**

When the area occupied by *P. augusta* was mined, the land was split into mining blocks. The northern end of the range is mine block A10, the middle area is mine block A13 and the southern end is mine block A12 (Fig. 2). The most northern end of Site A, which is now the highest point, is known as NASA (Fig. 2).

During 2010 and 2011, SENZ rehabilitated the A10 mine block by creating a landform ready for vegetation to be directly transferred (a process abbreviated as VDT). At the end of 2011, SENZ indicated that it was planning to place VDT on approximately 4ha of the site. The site was called "Mt Augustus VDT". By June 12, 0.81ha had been laid, a further 0.21 ha were laid by October 12 and an additional 1.42ha by June 2013.

During 2013, the exact area of the Mt Augustus VDT site was enlarged to incorporate the south-east side of NASA. The most recent polygon of the Mt Augustus VDT site supplied to DOC in May 2015 is 4.1ha in size. By May 2016, SENZ had completed VDT placement to the extent indicated and committed in 2011 (4.1ha) (Fig. 2, 'Mt Augustus VDT'). A small area of the planned VDT area was not completed as there is no further suitable vegetation planned to be disturbed at Stockton Plateau. This area will be rehabilitated by hand planting nursery raised seedlings of species compatible with the altitudinal setting and surrounding native vegetation (Fig. 2, 'Mt Augustus hand planted rehab').

The A12 site was the highest point in the southern ridgeline prior to mining, but lowered by approximately 20-30m by mining, and is now a small flat triangular shaped area of exposed coal floor and is considered by SENZ to be completely rehabilitated.

The northern end of A12 drops off steeply and there is a distance of 200m to meet the southern end of the Mt Augustus VDT. This is mine block A13 and SENZ has not completed mining of this block, and no detailed rehabilitation plan has been designed by SENZ until final ground profiles are clear.

We understand that there is no further suitable vegetation planned to be disturbed at Stockton that would enable creation of any further snail habitat at the Mt Augustus site.

### **Release sites within original range**

In the absence of a current strategy that directed where snails could be released within the species original range, the Recovery Working Group made the decision to translocate the three genetic groups back to the same geographic positions (i.e. from north to south, northern morph, intermediates and southern morph snails).

The captive north morph population had sufficient rates of breeding and survival of all age classes in 2013, 2014 and early 2015 that some one and two year old snails were translocated to the northern portion of Mt Augustus VDT, and into the central-southern end of Site A (Fig. 2). The captive intermediate snail population also had sufficient rates of breeding and survival of all age classes that in May 2015 some two year old snails were translocated to the southern end of Site A (Fig. 2).

### **Current situation**

After eight years of intensive management of *P. augusta*, there is now:

- six wild populations of northern morph snails – one natural population and five translocated populations (three populations established using wild snails, one with captive hatched snails and one using translocated habitat)
- one wild population of intermediate snails – a population of wild and translocated (captive hatched) snails
- one wild population of southern morph snails – one shell of an adult snail was found in March 2014
- a population of northern morph snails held in captivity and managed to maximise both survival and breeding (although in the latter years more for survival than breeding)
- a population of intermediate snails held in captivity and managed to maximise both survival and breeding (although in the latter years more for survival than breeding)
- a captive population of A12 (southern-morph) snails held in captivity and managed to maximise both survival and breeding

There are wild populations at six locations:

- Site A - Natural and translocated population. Northern section all wild, except some captive born eggs released in northern corner and some young snails into the central-south area, all northern morph. Southern section wild and translocated 2015 (captive reared snails), all intermediate.
- Mt Augustus VDT - Snail habitat that was mined and then rehabilitated. Northern section translocated snail population (captive reared snails) 2013 - 2015, northern morph. Southern section reserved for intermediate (no releases as yet)
- A12 - Natural population on escarpment only. No releases. Southern morph.
- Site B - Translocated snail population (wild snails held briefly in captivity) 2006. Northern morph.
- R6 VDT - Snail habitat translocated to new site 2006/07. Snails translocated with habitat. Northern morph.
- Mt Rochfort Summit and Basin - Translocated snail population (wild snails held briefly in captivity) 2007. Northern morph.

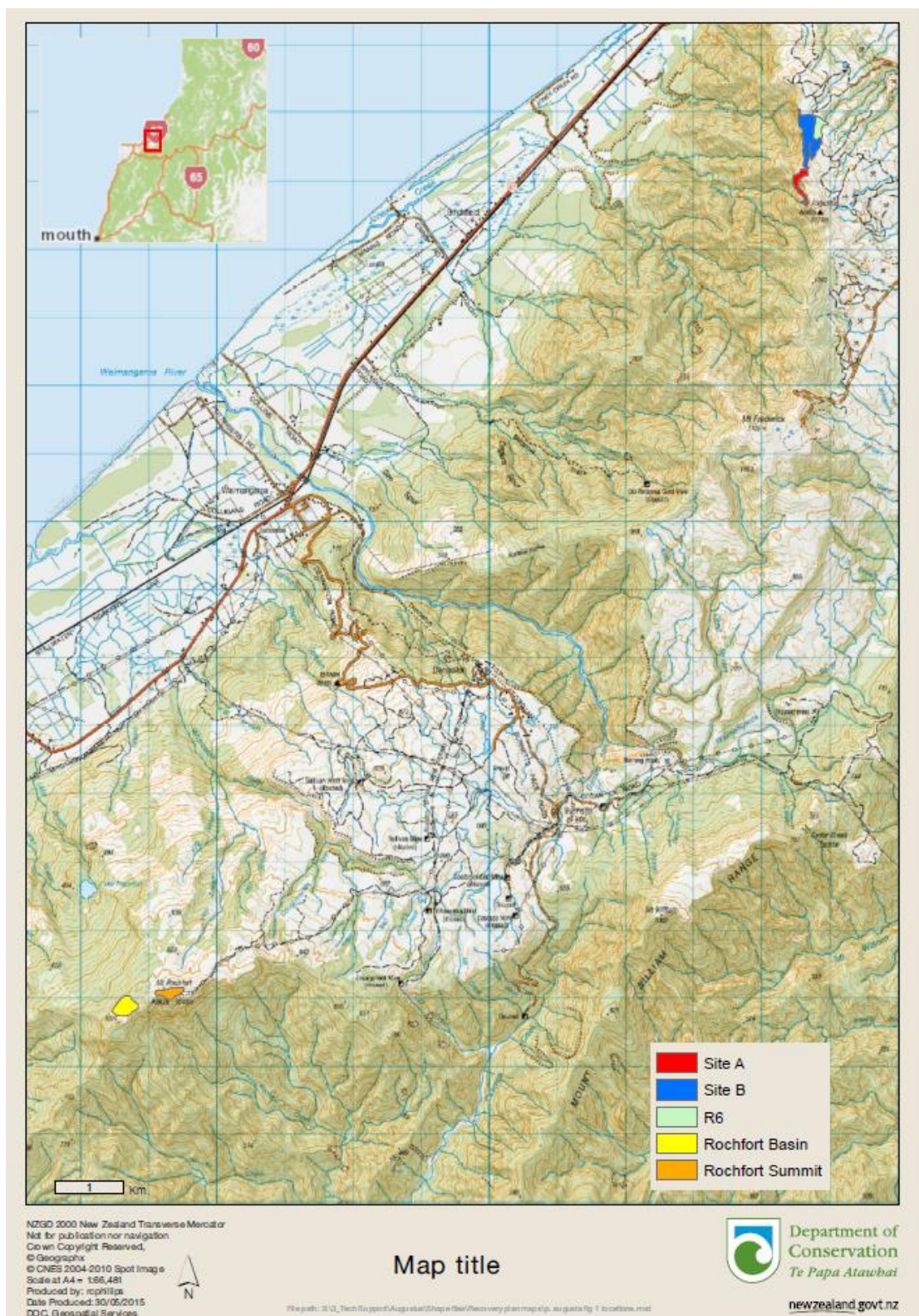
### **Development of a new strategy**

In 2012, we began the process of developing a new strategy for the programme. By late 2013, we had identified that we needed to have senior managerial support for some of the key management approaches and that this direction would then allow the strategy to be fully developed. This was primarily around the management approach in the first strategy of not establishing additional translocated populations unless the current populations in the wild appeared to be failing.

As Director - Conservation Services Northern and Western South Island Region, in March 2014 Mike Slater approved the recommendation to continue to have this management approach in the new strategy. The discussion and decision can be found at Part A: Background material: [DOCDM-1105816](#) and Part B: Recommendations: DOCDM-1142379.

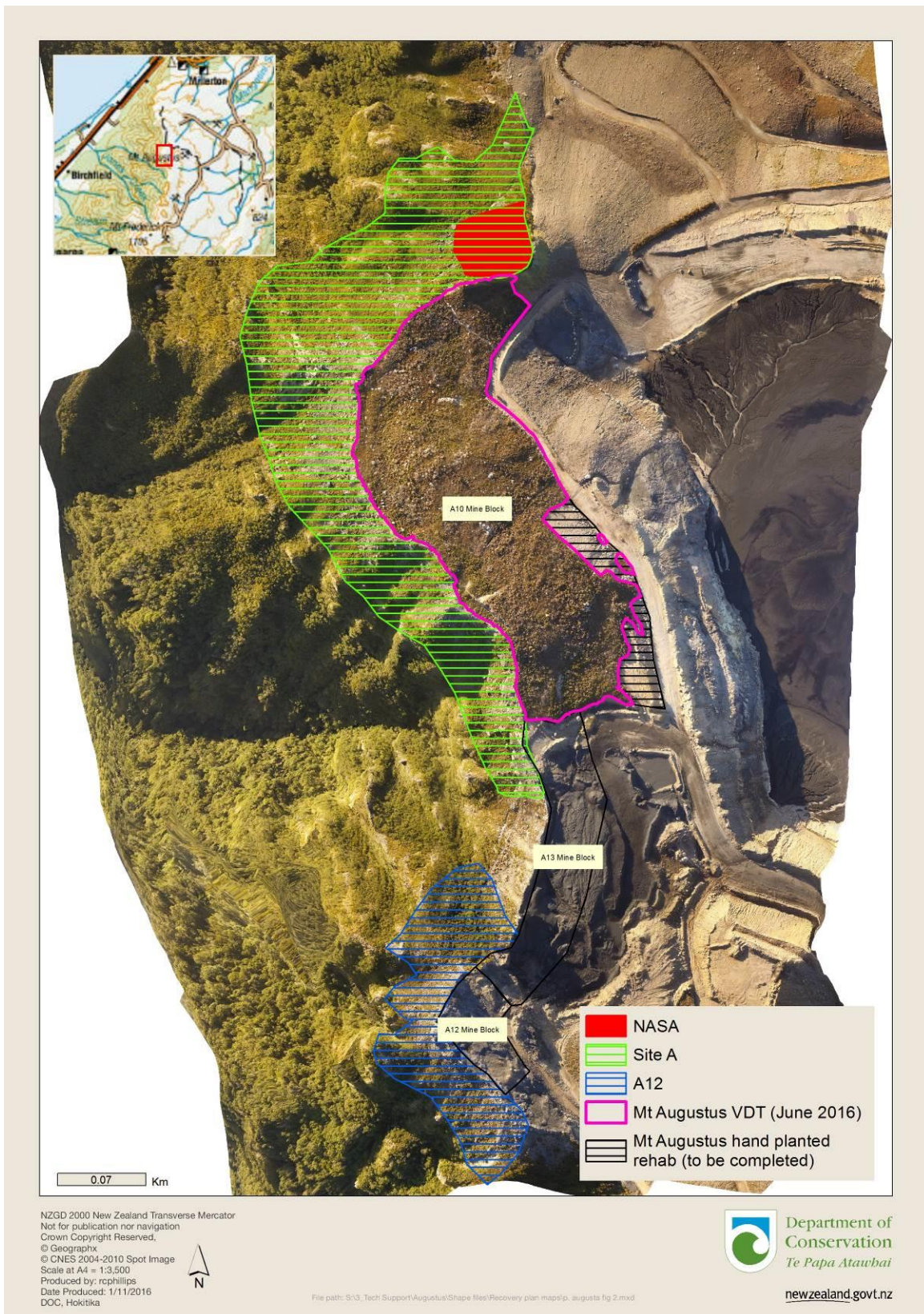
In October 2014, a first full draft of the strategy was present to SENZ for their comments. SENZ registered disparate views, principally in relation to the strategy's strict adherence to limiting release of captive snails to just the area in which the snails were originally found.





**Fig. 1** Geographic locations of the sites where *P. augusta* exist





**Fig. 2 Geographic locations of the sites within the original snail habitat where *P. augusta* exists**  
 OIAD-830 Talia P Attachment - *Powelliphanta augusta* Recovery Strategy 2015



## Part B - Second strategic period: 2015 - 2020

### ***Recovery Management Aim***

The long-term management aims identified in the first Conservation Strategy are considered relevant and are appropriate aims for the second strategic period and are therefore restated below with minor modification to clarify terms that caused some uncertainty, and with the addition of an explicit desired evolutionary trajectory.

The long-term recovery aims:

1. To prevent the extinction of the species.
2. To secure one self-sustaining population of the species in the wild, with allelic diversity not too dissimilar to what it might have been without the mining disturbance.
3. To ensure genetic diversity within the species is protected, with each distinctive genotype and phenotype represented in the wild population.

The allelic diversity is one that is not too dissimilar to pre-mining disturbance. This assessment of diversity was contained in the first strategy, but not explicitly so (i.e. it was described in the rationale section but was not stated in the long-term recovery aims).

#### **Definitions**

A population will be considered self-sustaining and secure when:

- the population trend is stable or increasing;
- there is an effective breeding population, productive enough to replace each generation;
- at least 50% of the adult breeding population were themselves reared on the site

The genetic diversity of the species will be considered protected when there is a self-sustaining population of each genotype/phenotype.

In the New Zealand threat-ranking system, population trend is assessed over either a ten year or three generation time period, whichever is larger (Townsend et al 2008). One generation is the time between an egg being laid and the middle of the snail's sexually mature adult life (R. Hitchmough pers. comm. 2014). Based on the *P. augusta* captive population, the timeframe for three generations is estimated at a minimum of 30 years.

### ***What is the timeframe for assessing the long-term recovery aims?***

Given how population trend will be defined, the absolute minimum timeframe at which population trend should be first assessed is ten years, and which is 2019/2020 as the monitoring programme began in 2009/2010. The second strategy will thus bring the species work programme up to the point in time when the long-term recovery aims can be assessed.

The 2015 – 2020 strategy is limited to five years because management decisions will depend on whether the snail populations at the release sites are assessed in 2020 as being self-sustaining and secure.

## Recovery Strategy 2015 – 2020

### *Intermediate Outcomes*

Outcomes to be achieved by 2020 are:

- The species has not become extinct.
- There is an insurance population of the northern morph and intermediate snails held in captivity and the populations are mixed age and self-sustaining. Only releases of surplus snails have occurred.
- There is an insurance population of the southern morph snail held in captivity and it has increased in size, is mixed age and is self-sustaining. No releases of the southern morph snail have occurred.
- Much of the area that snails occupied when the species was discovered in 2004 has been appropriately rehabilitated, and is gradually returning to a condition able to support snails beyond 100 years.
- The population of A10 snails in Site A is stable or increasing.
- Monitoring has occurred and there has been a 10 year trend assessment of population abundance/density, size class distribution and recruitment in the wild populations.

These outcomes are relatively similar to the intermediate outcomes identified in the first strategy, but reflect the situation as of 2015 and how we have advanced since 2007 towards achieving the long-term management aims.

#### **Definitions**

In terms of the captivity outcomes, 'self-sustaining' is defined as being a population that maintains its population size and structure through the egg production by captive adults, rather than needing to add snails from a wild population

### ***Management Approach during 2015 – 2020***

The management approach consists of five streams of work:

- Captive Population
- Management of sites where snails currently exist
- Habitat restoration of mine site along A10-A13-A12 ridgeline
- Outcome monitoring
- Information recording and sharing

How the strategy should be implemented is also discussed in this document.

The strategy's timeframe extends beyond the 10-year financial legal responsibility of SENZ to *P. augusta* (the 2015/16 financial year being the final year of funding). SENZ indicated in 2014 that any financial support beyond 2015/16 would not be possible, except for potentially undertaking some site management actions (e.g. predator, weed, people control on Stockton Plateau).

The management approach does not include any large-scale releases and the captive management actions should not lead to high rates of egg production. However, during the life of the strategy, some captive northern morph and intermediate eggs and snails may become surplus to the aims of the captive population. Where these snails should be released is detailed in the captive population section.

### ***Iwi involvement***

*P. augusta* is a taonga species and Stockton and Denniston Plateaux is within the rohe of Ngāti Waewae. They were consulted in June 2015 about the draft strategy and they requested to be consulted about any potential plans to remove or relocate the species.

## **Captive Population**

### **Northern morph snails and Intermediate snails**

#### *Actions*

- 1) Maximise survival, with a particular focus on the health and survival of sub-adult and adult snails.
- 2) Keep snails separate to prevent new matings.
- 3) Snails that are considered surplus (e.g. eggs and recently hatched snails produced post June 2015) should be released.
- 4) The release sites for the northern morph and intermediate snails will be identified when the need arises. The potential release sites for the northern morph snails are Site A northern section, Mt Augustus VDT northern section, Site B, R6 VDT and Mt Rochfort Summit and Basin sites. The potential release sites for the intermediate snails are Site A southern section and Mt Augustus VDT southern section.

#### *Rationale*

We have assessed that an insurance population of northern morph and intermediate snails should have at least 500 snails of mixed age and be self-sustaining. During 2014 and 2015, we had a surplus of northern morph and intermediate snails, and therefore, we undertook a number of releases to reduce the population size but retaining the mixed age, self-sustaining characteristics of the population.

Therefore, the focus for 2015 – 2020 is on maximising survival, particularly of the sub-adult and adult snails because there are fewer of these age classes. A mixed age population structure will enable manager to undertake the action of rapidly producing more snails, if this was to be needed in the future (post 2020).

The potential release sites for the northern morph and intermediate snails are those sites where the snails already exist.

### **Southern morph snails**

#### *Actions*

- 5) Maximise survival and breeding rates of southern morph population to the extent compatible with a healthy and secure captive population.
- 6) Provide “luxury” care to all adults (e.g. 2 snails to a tray) to prolong as far as possible the breeding potential of adult snails
- 7) No snails will be released.

#### *Rationale*

As of 2015, there are around 130 A12 southern morph snails held in captivity. This is considered to be an insufficient number to support a wild population with a moderate – high establishment probability. The future of the population, including release options, will be considered in 2020.



***General captive population actions***

- Best practice snail captive procedures are followed at all times. These are documented in a ‘Best Practice for *P. “Augustus”* Captive Management’ document (DOCDM-499357, requires updating). This is a live document that is updated as required.
- Best practices procedures for care and production of worms for feeding are followed at all times (document to be produced). This will be a live document that is updated as required.
- The conditions under which the snails are held (e.g. light and temperature levels, container size, feeding regime, number of snails per container) will be managed primarily to maximise survival, and secondly to allow for sufficient egg production for the northern morph and intermediate snail populations to be self-sustaining and for the southern morph population to increase.
- The three age classes of the three types will be spread across the three storage units.
- The storage units are kept under 24hr surveillance (via the temperature-cell phone alarm system).

<b>Action</b>	<b>Responsibility</b>	<b>DOC Resources/year</b>	<b>DOC Group</b>
Maintain the captive population as three separate genetic populations	DOC	\$51,000, but see memo 2304923	NWSI opex, with external funding/partnership sought

The resources required are calculated as follows:

General running costs (regardless of captive population size) = \$11,000

Labour costs of \$35/yr/snail for 500 northern morph snails, 500 intermediate snails and 150 southern morph snails (includes time in lab and time to manage lab, lab staff and data) = \$40,000.

## Management of sites where snails currently exist

### *Management Approach during 2015 - 2020*

Sites where snails currently exist will be managed to ensure threats are appropriately addressed and monitored, and new threats identified.

The following site issues have been identified:

- Erosion
- Weeds
- People
- Fire
- Predators
- Browsers

Denniston Plateau including Mt Rochfort is located on public conservation land. Most of the Mt Rochfort site is an implemented DOC nationally important ecosystem site, although the *P. augusta* Summit and Basin populations are not within the site. However, areas where snails occupy are important uphill buffer sites (within this nationally important ecosystem site) and need to be managed. The Mt Rochfort nationally important ecosystem site and adjacent buffer areas is being managed by the Buller Service team. The top half of the 4WD road to Mt Rochfort is maintained by a Concessionaire

### Erosion

Action	Responsibility	DOC Resources/year	DOC Group
<b>Stockton Plateau</b> Monitor and maintain effective sediment controls along the escarpment from Site A to the A12 VDT site to prevent undue impacts on underlying habitat.	SENZ		
The erosion trapping devices should be removed only when the amount of fresh silt being trapped is minimal and/or when the benefits of allowing the snails to move between the plateau and escarpment outweigh the costs of loss of snail habitat to coal fines/silt smothering, and a mechanism for <i>Juncus squarosus</i> weed seed transport, to Site A.	SENZ as directed by DOC	Is unlikely to occur during 2015 - 2020	
<b>Mt Rochfort</b> Reduce road gravel flowing over the lower Summit snail site at Mt Rochfort by proper channel and stormwater control and silt-fence erection on the downhill side of the Mt Rochfort tower road.	DOC	2 days two people, \$500 materials, once during life of strategy	Buller Service team

### Rationale

On Stockton Plateau, SENZ has a responsibility has a landowner adjacent to public conservation land (PCL) to ensure that its activities do not negatively affect the adjoining PCL. This includes ensuring that silt does not enter PCL.

### Weeds

Invasive weeds including but not limited to gorse and *Juncus squarossus* are controlled to zero density in the sites where *P. augusta* is found.

Action	Responsibility	DOC Resources/year	DOC Group
<b>Stockton Plateau</b> There is at least annual surveillance for weeds at snail sites.	SENZ, but see note below		
Where significant weed infestations are present, effective control is undertaken using methods that considers the effects on snails (spot-spraying versus broadcast) and limits the creation of open areas where more weeds may germinate.	SENZ, but see note below		
<b>Mt Rochfort</b> There is at least annual surveillance for weeds at snail sites to best practice.	DOC	No new work, covered by implementation of Mt Rochfort ecosystem site	Buller Service team
Where weeds are present, effective control is undertaken which removes weeds without exposing snails to harmful chemicals or creating open areas where more weeds may germinate.	DOC	No new work, covered by implementation of Mt Rochfort ecosystem site	Buller Service team
Gravel contaminated with weed seeds does not enter snail areas by ensuring water from disturbed ground does not flow into snail areas.	DOC	No new work, covered by implementation of Mt Rochfort ecosystem site	Buller Service team
In bare areas that need to be rehabilitated, only bare-rooted seedlings are planted.	DOC	No new work, covered by implementation of Mt Rochfort ecosystem site	Buller Service team

Note:

The Stockton Coal Mining Licence (CML) requires SENZ to control noxious weeds within the CML. With the requirements for weed control under Wildlife Permit, the snail sites on Stockton Plateau and at Mt Rochfort receive specific weed control. After April 2015, the snail sites on Stockton Plateau will remain part of the SENZ weed plan, with an annual planning process to identify priority species and sites across the plateau.

Therefore we can expect some base level of weed surveillance and control work at the snail sites. At the end of 2016/17, the level of work undertaken by SENZ will be reviewed and an assessment made whether additional work needs to be undertaken by DOC.

## People

Action	Responsibility	DOC Resources/year	DOC Group
<b>Stockton Plateau</b> Manage snail sites within the CML so as to ensure the only people who enter the sites do so for necessary purposes and that trampling effects are minimised and steps are taken to mitigate the introduction of weeds.	SENZ		
The narrow board walk at Site A should be retained	SENZ		
<b>Mt Rochfort</b> Manage people so that they stay on established roads and tracks	DOC	1 person day per year to surveillance. Potential for costs if new works or maintenance works needed	Buller Service team

### Rationale

The presence of people within all the snail sites has the potential to cause a number of effects, particularly treading on snails, damage to the vegetation, depositing general rubbish and toilet waste (which occurs at Mt Rochfort Summit), introduction of weeds and changes to the watershed (e.g. tracks becoming water channels).

At Mt Rochfort summit, the focus needs to be on the public as this area has open access and is situated beside a viewing spot at the end of a popular scenic road. Around the Mt Rochfort tower, people are now confined to a single track by fences (erected in 2011).

At the snail sites on Stockton Plateau, the focus needs to be on mine workers, contractors, and visitors, with constant re-assessment and reduction where possible of the scale of management staff access to the snail colonies. SENZ currently manages people at the various sites with a number of methods. For example, the R6 site is a closed area and there are signs at the site stating this. Site A should also be identified as a closed area.

## Predator control

Action	Responsibility	DOC Resources/year	DOC group
Ground control of rats and possums – traps and bait stations	DOC	4 person days per service, 12 times/year	NWSI opex for contractor, with volunteer help sought for Mt Rochfort
Ground control of rats and	DOC	Unlikely to be used,	



possums –hand laid toxins		not costed	
Aerial 1080 control rats and possums	DOC	Likely to be nil (if DOC has to pay for the 1,000ha, then \$15,000 (@ \$15/ha) potentially twice during 2015 – 2020)	NWSI opex
Monitoring - trend monitoring of rats  - result monitoring through identification of cause of snail death via damaged shell examination	DOC	5 lines is 8 person days 2 times/yr (4 times/yr if mast year detected or predicted)  2 person days in 2019 and 2020 (when doing snail monitoring)	NWSI opex for contractor  S&C

The details of the predator control programmes are found in Appendix 1.

## Hares

Action	Responsibility	DOC Resources/year	DOC group
Visual assessment of hare pellet abundance and browse damage at NASA and Mt Rochfort	DOC	Nil, completed as part of predator trap checks	
If browse levels are high, night shooting of hares at NASA and Mt Rochfort	DOC	Four days 1 person	Buller Service team

### Rationale

The small remaining area of good natural snail habitat in Site A at NASA, and the best snail habitat on the slopes just north of Mt Rochfort are a bit more fertile with deeper soils than the remainder of the sites now occupied by *P. augusta*. As a consequence, taller and more palatable tussock and herbs grow at these sites, but these are being browsed heavily by hares. The quality of the vegetation is important for *P. augusta* as intact plants retain more moisture, provide better shelter from both adverse climate and predators, and increase earthworm abundance from the ready decay of their leaves.

There is no best practice for hare control, but as both affected sites are small and accessible, night-time shooting would our best guess as to the best form of both control and hare population trend monitoring. This could be supplemented by handlaid toxins around the boundaries of the tall tussock area if necessary.

This threat is considered a medium to low priority.

## Fire

Action	Responsibility	DOC Resources/year
Any fires started at or near to snail sites should be stopped as soon as possible.	DOC	No new costs
On the Stockton Plateau, the bare ground (access road) on the eastern boundary of the A10 VDT snail release area should be retained (otherwise, un-vegetated areas should be avoided because they can become weedy).	SENZ	

### Rationale

Although, the sites where the snails live are not highly susceptible to a fire, an extended period of dry weather will increase the risk and the VDT sites could be drier and more susceptible to fire than natural sites, at least for newly established VDT areas (Marshall 2013).

DOC is the rural fire authority is the Westport region and would assess whether to respond to a fire at the sites on Stockton Plateau and at Mt Rochfort

## Site surveillance

Action	Responsibility	DOC Resources/year	DOC group
Annual visual checks of all sites to identify issues that are or could be a threat to site quality. Things to be on the look out for: <ul style="list-style-type: none"> <li>- pooling of water, drainage issues</li> <li>- erosion (in places not identified in erosion section)</li> <li>- bare patches</li> <li>- existing gaps not becoming filled/growing in size</li> <li>- slips</li> <li>- edge crumbling</li> <li>- plants in VDT dying or having very slow growth</li> <li>- hand-planted plants dying or having very slow growth</li> </ul>	DOC	2 days, 2 people	Project officer and S&C
Undertake works to remedy identified issues as advised by technical experts	Depends on issue	Depends on issue	

### Rationale

We have identified in this Conservation Strategy all the current and potential processes that may threaten the species at the current sites. However, we may not have identified all current threats, and/or we may have under-estimated some threats, and new threats may occur in the future. Therefore, it is important to undertake regular visual surveillance of the snail sites to identify any other threats not currently recognised in the strategy.

## Habitat restoration

### Mt Augustus VDT

Action	Responsibility	DOC Resources/year	DOC group
On-going progressive rehabilitation of Mt Augustus VDT area and the A13 block should be undertaken as mining continues and allows	SENZ		
Advice should be first sought from DOC before devising/implementing a rehabilitation/restoration plan for a new area.	SENZ to seek advice and DOC to provide advice	SENZ plans no/limited new rehab work, so DOC resources unknown	Project officer and S&C
The general rehabilitation techniques (as below) should be followed.	SENZ		
Vegetation monitoring of the Mt Augustus VDT should not occur without approval of DOC.	SENZ to DOC		Project officer

### General rehabilitation techniques

- Where any major ground works are still to be undertaken, landforms should be flat sections rather than rounded surfaces
- Granite may be laid prior to VDT, as available, going on
- The new landform should be compacted prior to any VDT being applied, to try and permanently retain the high soil moisture levels, and a low open vegetation preferred by *P. augusta*
- Applying VDT sods (where it is available):
  - No use of fertilisers, biosolids etc
  - Match topography / exposure / soil depth in VDT source area and rehabilitation areas
  - Place lower quality source VDT around the perimeter of the VDT rehab area not the central rehab area (lower quality VDT = plants >2 m in height, VDT with broken sods / rocky ground)
  - avoid gaps between sods (which traps snails, ponds water and is an open area available for weed invasion) by pressing down on the sod edges, even if that destroys woody vegetation in the sods.
- Due to the diminishing nature of available suitable VDT, nursery raised seedlings compatible with the altitudinal setting and surrounding native vegetation will be used for any future revegetation efforts.

#### Rationale

SENZ has effectively completed rehabilitation (to the extent it committed to) of the Mt Augustus VDT site.



The next highest priority area is the A13 mining block, but this area is still being actively mined and is unavailable for rehabilitation present.

SENZ considers that the A12 ridgeline is fully rehabilitated, although it contains some bare exposed coal floor. As the escarpment below the A13 mining block is very rocky and has limited suitable habitat for *P. augusta*, the connection point between snail populations at Site A and at A12 escarpment would have to be the A12 ridgeline.

Therefore, the currently bare A12 ridgeline ideally should be vegetated. It is understood that there is no/little suitable VDT left and it would be very difficult get the trucks that carry VDT up to the site. Placement of soil and then seed scattering and planting of bare-rooted seedlings is the recommended option. A potential restoration plan is described in Lloyd (2015).

Restoration plans for NASA and A13 mine block are described in Lloyd (2015). These plans should be used in providing advice to SENZ.

No monitoring of the Mt Augustus VDT should be undertaken without approval from DOC, due to the potentially harmful effects on both the translocated vegetation and *P. augusta* snails recently released there. Before any further vegetation monitoring is undertaken there, the potential costs and benefits would need to be weighed up carefully.

#### **Area between Site B and R6 snail populations**

<b>Action</b>	<b>Responsibility</b>	<b>DOC Resources/year</b>
Currently bare areas within Site B should not be re-vegetated as the bare areas are natural and re-vegetation works carry a risk of introducing new weeds etc.	DOC	None
If inbreeding or loss of some small populations occurs in Site B, consideration should be given to moving snails by hand between sites, or to re-starting failed colonies by internal site B translocations. Trigger for considering this work would be the results of the 2020 mark-recapture monitoring.	DOC	No work planned during 2015 – 2020.

#### Rationale

It is important to improve the connectivity between sites because this should improve the likelihood of species survival in the long-term. Alternative ways of providing gene flow between the snail populations there should be sought as attempts to plant land that is naturally rocky or dry are likely to fail whilst increasing the chances of weed invasion by disturbing the ground.

It should be noted that northern ends of Site B and R6VDT are unlikely to have continuous snail habitat because of the topography and drainage of the land that exists there.

## Outcome monitoring

Action	Responsibility	DOC Resources/year	DOC group
Mark-recapture monitoring is undertaken at the ten monitoring sites in 2019/2020.	DOC	125 person days (team of five people for 25 nights)	To be determined closer to 2019/20. Options include NWSI opex and external funding/partnership
DOC standard plot monitoring (10m x 10m grid search) is undertaken at all sites in March 2020.	DOC	36 person days (team of four people for 9 days)	To be determined closer to 2019/20. Options include NWSI opex and external funding/partnership

### Rationale

Mark-recapture monitoring was implemented in 2009 in order to provide robust trend data about abundance, density, apparent survival, and population structure and growth rates. The method is financially costly to undertake due to the high number of monitoring sites and the need to re-search each site on six separate occasions, and appears to have quite high costs to the snail population as it increases the chances of snails being accidentally trampled as it involves multiple nocturnal searches when snails are most likely to be on the surface.

During 2009 – 2014, it has been completed every few years at the ten sites. As it was last completed at all sites in 2015/16, it should next be completed in 2019/2020 to provide a ten year period of data.

The DOC standard diurnal plot monitoring, which involves sites being searched just once, is less sensitive to population trends especially where densities are low. However, because it is undertaken when snails are least active on the surface, it probably has smaller negative impacts on survival of the monitored snails. As a result of the reduced sensitivity of diurnal plots, many plots need to be established. However, in total, it is considered less costly than the mark-recapture method, so is more financially sustainable long-term. While mark-recapture can more accurately establish population trend, diurnal plots have the benefit of collecting more shells for assessing cause of death.

In order to transition from assessing population persistence using mark-recapture to the DOC plot – based system, plot monitoring commenced in March 2015. To ensure statistically usable results within a reasonable time frame, at least 15 – 20 snails need to be found in combined plots at each site (P. Alspach, pers. comm.). We established 15 plots at Site B, 10 plots at Site A and 10 plots at Mt Rochfort. Although less than 15 snails in total were found at some sites, it was assessed that there were no more areas within the sites where monitoring plots could be located (especially in higher density snail areas).

Plot monitoring should occur every five years in line with DOC's monitoring programmes for other *Powelliphanta* species in the Northern and Western South Island region. The plots monitored in 2015 will be monitored again in March 2020.

The person days required for monitoring are calculated as follows:

	Mark-recapture monitoring	Standard diurnal plots
Current number of plots	10	26
Number of searches required per plot	5	1
Plots searched per day/night	2 per night	3 per day
Hours per shift	7 to 8 hours	9 to 10 hours
Team size	5	4
Minimum number of person days/nights	125	36
Cost at \$30/hr	\$30,000	\$10,800

## Information recording and sharing

Action	Responsibility	DOC Resources/year	DOC group
Information is recorded, collated, analysed and reported on, so that it can be shared with others.	DOC	10 person days	Project Officer
There should be a proactive approach to sharing information with the scientific community and general public.	DOC	5 person days	Project Officer

### Rationale

Media stories over the last five years have shown that there is interest in the *P. augusta* conservation programme. However, these stories have been mostly generated from the media or picked up through the update provided to the Conservation Board (which is sent to the local media). It would be beneficial if we were more proactive in generating our own media stories at various stages in the programme.

We are gaining much technical knowledge about the species, and about how to hold it in captivity, how to conduct robust monitoring, how to improve restoration and VDT techniques. This information is relevant to other people and other conservation programmes.

We also have to make decisions about how to manage a narrow range endemic species, and other conservation managers may be interested to know how we have chosen our management approaches and where we saw the appropriate balance between various costs and benefits.

## Strategy implementation

Action	Responsibility	DOC Resources/year	DOC group
The Department will ensure that it provides staff and operating costs to implement the strategy and the identified actions.	DOC Services and S&C	10 person days	Project Officer
The Department will work with SENZ to identify and agree roles/responsibilities for SENZ	DOC Services	5 person days	Project Officer
The Department will seek to establish new partnerships where necessary to achieve full implementation of the strategy.	DOC Services and Partnerships	10 person days	Project Officer

### Rationale

This strategy is a Department of Conservation document. The legal obligations that SENZ has to the conservation of the species according to the two Wildlife Act authorities it holds will cease at the end of April 2016. Accordingly, this strategy has been prepared as a Department of Conservation document, which will be implemented by the Department for the full term of the strategy and by SENZ until April 2016 for the actions that it is committed to undertaking.

The Department, particularly the Northern and Western South Island Region, will need to look at the resource implications of the strategy. This is discussed further in the memo associated with this strategy (2304923).

## Part C

### File notes of advice

August 2013 – minimum age of VDT for snail release. Email. Has advice from Jane Marshall and Kath Walker. docDM-1404208.

### References

Buckley T. 2015. An assessment of genetic structure of *Powelliphanta augusta* within a recently developed coal mine – 09/01/15. Landcare Research, Auckland.

Lloyd K. 2015. Rehabilitation of *Powelliphanta augusta* habitat on the Stockton Plateau, Westland. A report to Department of Conservation. Wildlands Consultants, Dunedin.

Marshall J. 2013. Memo - Fire on Mt Augustus. Science and Capability Group, Department of Conservation, Hokitika. docDM-1130327.

Trewick SA, Walker KJ and Jordan CJ. 2008. Taxonomic and conservation status of a newly discovered giant landsnail from Mount Augustus, New Zealand. *Conservation Genetics* 9: 1563–1575.

Walker KJ, Trewick SA and Barker GM. 2008. *Powelliphanta augusta*, a new species of land snail, with a description of its former habitat, Stockton coal plateau, New Zealand. *Journal of the Royal Society of New Zealand* 38: 163-186.

## Appendix 1

### Management of sites where snails currently exist

#### Predator control – detailed actions

##### Target pests

Possums and rats

##### Results target

- No collected snail shells show sign of possum or rat predation
- Rat tracking tunnel index rate in forest immediately adjoining the release sites no greater than 5%
- Possum residual trap catch rate no greater than 1% (or if using wax tags, use Bite Mark Index of ~5%)

##### Methods

#### 1. Maintenance control - Ground control every year, year round

##### A. Trapping and bait stations

- Rats

Victor professional rat traps placed at 25m intervals along the current lines. Lines cover snail areas and adjacent vegetated areas.

Mt Augustus control area has 153 Victor professional rat traps.

Mt Rochfort control area has 121 Victor professional rat traps.

DOC 200 traps are placed at 100m intervals along the current lines.

Mt Augustus control area has 25 DOC 200 traps

Mt Rochfort control area has no DOC 200 traps

- Possum

Sentinel kill traps placed at 50m spacing along the current lines.

Mt Augustus control area has 93 Sentinel possum kill traps

Mt Rochfort control area has 76 Sentinel possum kill traps

Traps are serviced monthly.

- Bait stations

One line on along Stockton Plateau edge, and some in North East and R6 (57 bait stations).

Around Mt Rochfort Basin and a few at Mt Rochfort Summit (23 bait stations)

These locations are linked to areas with high rat capture rates

Placed at 50m intervals.

MBC has consent for 1080 bait. 1080 is preferred as higher uptake rate.

If there are high capture rates, then bait stations are activated and serviced fortnightly whilst there is uptake and high catches in traps.

The current lines run through Site A, but these traps should not be activated and serviced, except during mast years when rat captures are high.



### *B. Hand laying of 1080 pellets*

MBC holds a consent to hand lay 1080 pellets anywhere within the 180ha control site on Stockton Plateau and 199ha site at Mt Rochfort.

This method could be used when capture rates/bait uptake is high, e.g. as result of a small mast event.

## **2. Managing the threat of beech mast induced rat irruptions - Aerial laying of 1080 pellets**

Triggers for rodent control to protect fauna species are currently being developed by DOC. Managing rodents in lowland mixed beech forests is subject to South Island wide experimental programmes and specific prescriptions have not yet been developed. The minimum size for an aerial 1080 operation for *P. augusta* would be 1,000ha because of the rate at which rats move when food supplies are low and when they reinvade poisoned areas. The 1,000ha needs to cover the snail areas and the surrounding forested areas.

TBFree New Zealand holds a consent to do an aerial operation over 23,000ha of Buller North, and which covers the escarpment and lower lands around Stockton Plateau and the Denniston Plateau and their escarpments. The trigger for the operation is possum numbers and last occurred in early 2015.

Elevated rat numbers would be the trigger for an aerial 1080 operation for *P. augusta*, and which would be detected by monitoring rat numbers on the escarpment and coastal foothills.

We are yet to determine the exact operation boundary for future years. Our aspiration would be that an operation for *P. augusta* would be part of a larger operation across Stockton Plateau and Denniston Plateau. This would appear in theory possible as both Buller Coal and SENZ have Access Arrangements with DOC and Resource Consents that require them to fund aerial 1080 operations over Denniston Plateau and the southern half of the escarpment of Stockton Plateau, including up to the A12 escarpment area. The 1,000ha area for *P. augusta* would represent a very small addition to the treatment area required under the two consents.

If the triggers for an aerial 1080 operation for *P. augusta* or at the other sites on Buller Coal Plateau were met, DOC would work with the various committed partners to determine what area should be treated and how it should be funded. DOC is planning to obtain a 10 year resource consent for a 1080 aerial operation to cover the entire Buller Coal Plateau and adjacent lands, and therefore the *P. augusta* snail team itself does not need to obtain a resource consent.

The monitoring data would need to be collated, and advice would then be sought from rat control experts within the DOC Science & Capability team to predict rat population increases, and these levels would then be used to judge the need for, and the timing and intensity of an aerial operation.

## **3. Trend monitoring and results monitoring**

Standard possum trap catch index monitoring and rat tracking tunnel monitoring will be used to monitor possum and rat numbers. A higher emphasis is placed on monitoring rat numbers than possum numbers because few snail shells show possum predation.

Standard possum trap catch index monitoring data from adjacent sites will primarily be used. This includes the TBFree NZ trend monitoring data within their Buller North control area, Stockton No. 2 South area (SENZ), Cypress area (SENZ) and Denniston Plateau (DOC/Buller Coal Ltd). If the

possum trap catch index becomes elevated or possum predation sign is detected on the snail shells, or otherwise, once a year (could be in February or August, but best to choose one of these months and stick to it), possum monitoring in the *P. augusta* control area will occur in conjunction with the rat monitoring, with wax tags placed along the rat tracking tunnel lines. Ideally, the wax tags should be deployed for seven nights but if there are budget restraints, the wax tags could be left out for the same period as the tracking tunnels (usually one night) and the resulting index will be specific to the site.

Rat tracking tunnel monitoring will be undertaken following DOC best practice. Five lines will be established on the escarpment and coastal hills below Mt Augustus. During 2013/14, only two of the potential line locations were suitable (in terms of health and safety) but the area was badly damaged by a cyclone in Easter 2014 and therefore the lines are likely to have been damaged and otherwise it is too dangerous to enter the area. Data from five rat tracking tunnel lines run on the western escarpment of Denniston Plateau and western escarpment by DOC will also be used.

Rat monitoring will occur in February and August in non-mast years and also in May and November in mast years and/or as alerted by modelling predictions.

DOC also conducts seedfall monitoring on Denniston Plateau with some sites in the forest on the western escarpment. This data would also be used to identify the size of a beech masting event and help us decide if a large-scale control operation is needed to control a rat irruption.

Snail shells will be collected as encountered during snail monitoring, and assessed by DOC to determine the cause of death. The data will be collated on the Excel spreadsheet docDM-1250043.

The trend and result monitoring reports will be produced annually and cover the period July to June.