"B"

THIS IS ANNEXURE "B" TO THE AFFIDAVIT OF JOANNA CHRISTINE POLLARD
SWORN AT 61 Elwyn Crescent, Green Island, Dunedin
THIS 17th DAY OF JULY 2017

Before me ~~Deputy/Registrar~~, ~~Solicitor of the High Court of New Zealand,~~ Justice of the Peace

Dorothy Patricia Barnes

D.P. Barnes, JP
#7181
DUNEDIN
Justice of the Peace for New Zealand

Report of Dr Joanna Christine Pollard dated 17 July 2017
Responding to claims made in Affidavit of Nicolas Rex Smith dated 10 July 2017

J.C. Pollard (BSc (Hons), PhD)

I have been provided with a copy of the affidavit dated 10 July 2017 of Nicolas Rex Smith, Minister for the Environment, and second respondent to proceedings by Brook Valley Community Group Inc seeking Declarations from the High Court of New Zealand about the Resource Management (Exemption) Regulations 2017.

I have identified the following claims made by Nicolas Smith which are unsubstantiated, misleading and/or otherwise contrary to the best available scientific research.

I have prepared this report in accordance with the High Court Code for Expert Witnesses.

Point 5: National regulations are needed for environmental issues because the risks being managed do not differ significantly between regions.

Response: With regard to poisoning, risks vary greatly between regions, for example:

- Breakdown rates of 1080 vary with soil type, moisture and temperature; so (for example) persistence in Central Otago will be very different from that in Northland.
- Contamination of water bodies (e.g. streams through overland flow; underground aquifers through water movement downwards) will vary with the local topography and ground surfaces.
- Pest problems vary regionally, e.g. hares in Southland, wallabies in South Canterbury, rabbits in Central Otago, ferrets in farmland, stoats in sub-alpine areas, cats near towns.
- The type of affected people vary regionally e.g. hunters, tourists, farmers, locals using rainwater, dog walkers.
- Wildlife that is vulnerable to poisoning and pests varies regionally e.g. *Powelliphanta* snails, kea (*Nestor notabilis*).

Point 9. "The key threat to the survival of these species Is introduced mammalian predators. Other threats like the loss of habitat and poaching were once more significant but pests today are the main problem. Pests like rats, stoats and possums kill 25 million native birds a year, and cause ecosystem-scale destruction to our forests."

Response: This claim is unqualified opinion and is unreferenced. Ecologists have made different claims, for example:

Jackson, 1969:
"During the last hundred years Keas have shared their environment with rats Rattus spp. And stoats Mustela erminea. I have found no evidence of these animals affecting Keas. ...Twice I have found a dead possum Trichosurus vulpecula within five yards of a Kea nest. The opossum frequently chooses holes similar to a kea nest as a den and perhaps these two opossums prospected the Kea nests."

King, 1984:
"I think we should accept predators as permanent members of the New Zealand fauna; attempt to limit the damage they can do in the most sensitive remaining areas, but not waste money on impossible, general control of their populations; recognize that large-scale predator control on the mainland is not now necessary, even if it were possible, since the processes of nature are repopulating New Zealand with birds that are able to live with predators, while the rest are either adapting or have already gone; vigorously defend what isolated remnants of the ancient fauna are actually defensible in the long term; and temper our regret at the passing of the old endemics with positive appreciation of the new colonists."

"Some few species, such as the South Island saddleback, the black robin and the stitchbird, have been brought back a step or two from the brink of extinction over the last few years. But while attention has been focussed on them and not on the greater importance of habitat conservation, the destruction of mainland forests and swamps has continued unchecked; so it is probable that in the course of the same few years many smaller, less appealing species have been pushed over the brink, some even before they were known to science. Conservation is the prime task, and arguments for establishing reserves should be based primarily on the need to conserve whole ecosystems."

Elliot & Kemp, 2004:
"Our modelling indicates that kea have suffered substantially since the arrival of humans and introduced predators in New Zealand. The significant effect of predation and hunting suggests that kea populations declined following the introduction of mammalian predators and hunting in the 1800s, but that the decline has slowed or even stopped."

Steer, 2016:
"Change is continuous and countless recent studies investigating rates of evolution show that it happens a lot faster than we used to think. Both native and introduced species don't care about our historical baselines and are actively breeding and (de)selecting themselves away from them. Much like technological innovation in times of crisis, evolution seems to be speeding up in response to the environmental changes we have wrought. I'm going to go out on a limb and say that this is a good thing and that trying to stop it might actually be damaging to the vitality of future ecosystems."

Point 10: "Possums are also a massive threat to New Zealand's agriculture."

Response: This is unreferenced. While much has been made of the issue of possums transmitting bovine tuberculosis (*Mycobacterium bovis*) to domestic cattle there is still no empirical evidence that this has ever happened and no known mechanism of transmission (Coleman & Cook 2001; Nugent *et al.* 2015).

The same claim was also unreferenced in the ERMA Reassessment of 1080 in 2007:

"The applicants have not referenced this statement [that possums are the main maintenance hosts for bovine Tb in NZ]" (ERMA Reassessment 2007, Evaluation and Review Report (ERR) p. 540).

See also response to Point 15 (below).

Point 13: "without it [1080] we would not have species such as the kiwi on the mainland."

Response: This is unreferenced. I am aware of no study that has shown this. On the contrary, 1080 can lead to severe predation of birds through "prey switching" when the stoats' normal diet of rats is poisoned off (King & Murphy, 2005):

"In mixed podocarp-hardwood North I. forest at Mapara and Kaharoa, for example, rats were the main prey of stoats ...After successful poison operations against rats, there were strong and consistent responses by stoats to eat more birds."

Stoats were observed to devastate kiwi chick numbers after a poisoning operation (DoC, 2002):

"Four months after an effective possum and rat knock-down by a 20,000-ha aerial 1080 operation over Tongariro Forest, stoats reappeared in the centre of the forest and began killing kiwi chicks. So far five of the 11 chicks have been predated, and all in the centre of the treatment area."

Point 13 (a) [1080] quickly biodegrades in the environment.

Response: Breakdown of 1080 in baits and soil may take months, especially in cold or dry conditions (Eason, 1997). In the bones of poisoned carcasses it might persist for even longer (Ross & McCoskery 2012). In water, 1080 is very stable in sterile conditions (ERMA Reassessment 2007, ERR p. 439). The ERMA Committee recommended research into the degradation of 1080, stating:

"there is little scientific data on the degradation of 1080 in New Zealand soils at cool temperatures"...

"the Committee does recommend further research on the degradation rates of 1080 in water" (ERMA Reassessment 2007, Committee Decision pp 58, 60).

It was noted by the ERMA Agency that it had been suggested that at very low concentrations, 1080 may persist:

"the very low concentrations of 1080 which may occur in the environment may be too low to favour microbial degradation or induce the necessary enzyme systems" (Lloyd-Jones *et al.*, 1994, cited in ERR p. 353).

Toxic breakdown products of 1080 include fluorocitrate and fluoromethane. The amount of 1080 that breaks down into these or other harmful products, and what effects they may have, are poorly understood (Eason *et al.* 2011, p. 4; ERMA Reassessment 2007, Committee Decision p 119; ERR pp 360, 435; Northcott *et al.* 2014, p 1057).

<u>Point 14. The aerial use of 1080 is the most cost-effective option New Zealand has to protect its valuable native species</u>

Response: The ERMA Reassessment Agency (2007) noted flaws in the demonstration of the the cost-effectiveness of aerial 1080. It wrote:

"Information on the kill rates achieved in DoC operations was...not as comprehensive as the Agency had anticipated...The Agency sought further information...where such information was provided by DoC, it is indicated in the text...DoC indicated that it would take a considerable amount of time to revisit the information...and determine whether...additional observations [met] the criteria" (ERR p 531).

"DoC reviewed possum kill rates...a summary was included...in the application...the Agency sought clarification as to why there [were] so few results...given the time frame...Several criteria [had been applied]" (ERR p 531).

"No information [on kill rates achieved] was included in...the application from the AHB. The Agency sought further information...the AHB was not able to provide any information as its database is still under construction" (ERR p531).

"The Agency notes the applicants have provided little factual support to demonstrate efficacy of aerial compared with ground application of 1080 as it relates to possums and Tb control" (ERR p 540).

Economic expert Professor Ross Cullen, consultant for the ERMA Reassessment, wrote:

"The economic case for 1080 is largely based upon the assertion that aerial pest control is lower cost and more effective than is ground pest control and can be used to manage large and rugged areas. Surprisingly, given the importance of these items, no references are cited in support of these assertions...the lack of documented support is...surprising as research has been completed in New Zealand on pest control costs, and effectiveness of control methods..."

"The Application...fails to demonstrate evidence or understanding of economic research on use of 1080, pest control or Tb...this section [Estimation of benefits and adverse effects] of the application is unsophisticated, uses crude approaches to estimate even the largest benefits and costs associated with the use of 1080, lacks awareness of many pertinent economic research techniques, seems unaware of almost all relevant economic research...Given the importance the HSNO Act...attaches to identifying and considering benefits and costs the Application is amateurish in the way it addresses those issues...high quality economic research [is required] to ensure that informed decisions can be reached...the Application, regrettably, does not provide quality economic analysis and fails to cite existing relevant economic research" (ERR pp 579-580).

Also see Dr Quinn Whiting-O'Keefe's writing on this, page 4 of the following document: http://1080science.co.nz/wp-content/uploads/2014/05/testimony.pdf, which stated "it is apparent that the DoC/AHB claim that aerial 1080 is cheaper is dubious at best, and maybe totally false."

Point 14 (a) {The aerial use of 1080 is the most cost-effective option New Zealand has to protect its valuable native species} killing stoats, rats, and possums at the same time.

Response: Poisoning with 1080 is a poor method of controlling stoats for many reasons, including highly variable kill rates (King & Murphy, 2005; Dilks *et al.*, 2011; Kemp *et al.*, 2014, unpublished, p. 4). Stoats are unlikely to be poisoned by preying on mice, because mice do not normally eat 1080 pellets (Fisher & Airey, 2009), and alpine areas have very few rats for stoats to eat (Christie *et al.*, 2016). Stoats that remain after poisoning can "prey-switch" to eat more birds than beforehand (DoC, 2002; King & Murphy, 2005), and the escalations in mouse numbers which follow 1080 operations are likely to fuel increases in stoat numbers (Byrom *et al.*, 2013).

Claim 14 (b) {The aerial use of 1080 is the most cost-effective option New Zealand has to protect its valuable native species killing stoats, rats, and possums at the same time.} 1080 has been proven to be highly effective in eradicating these pests

The affidavit by Fairweather contradicts Smith's claim that 1080 eradicates pests. Fairweather states that 1080 is only used for sustained, repeated control.

Indeed, 1080 only has short-term suppressive effects on pests. Vastly increased numbers of mice (almost immediately) and rats (within months) follow aerial 1080 poisoning in a response known as 'competitive release' (Caut 2007; Griffiths & Barron 2016; Ruscoe *et al.* 2011). These increases may have devastating ecological effects (Innes *et al.* 2015; Shapira 2013; Urlich *et al.* 2015). For example Sweetapple & Nugent (2007, p 9) reported:

"At Mokau, possum control in 2002 using aerially sown 1080 baits reduced possum and rat populations to near zero...In the poisoned block, the number of large invertebrates known to be eaten by rats soared after rat numbers were reduced to near zero, and then plummeted as rat numbers exploded to very high levels. In contrast, in the unpoisoned area, the numbers of rats and of the common large invertebrates remained more or less stable."

In addition, there is evidence that after aerial poisoning with 1080, recovering possum populations can grow to be larger than before the poisoning occurred. This was found after five years in one study (Urlich & Brady, 2005) and in another study, the number of possums caught 6 years after control was double the pre-control number (Nugent *et al.*, 2010).

<u>Point 14 (c)</u> {The aerial use of 1080 is the most cost-effective option New Zealand has to protect its valuable native species killing stoats, rats, and possums at the same time. 1080 has been proven to be highly effective in eradicating these pests} <u>and restoring our forests to thriving places for our native birds to live, and trees like the rata to recover.</u>

Response*:* See Drs Pat and Quinn Whiting-O'Keefe's in-depth, damning analysis of this idea, page 14 onwards:

http://1080science.co.nz/wp-content/uploads/2016/06/Whiting-Okeefe-2.pdf

Regarding trees, Whiting O'Keefe & Whiting O'Keefe ((2007), in the above review) concluded, that despite over four decades of aerial 1080 use: "The answers to the two critical questions regarding aerial 1080 possum control are not known. We do not know the degree to which possums negatively impact populations of native floral species, and we do not know if aerial 1080 ameliorates that damage. Furthermore we do not know the quantitative impact or effectiveness of other less risky methods of possum control. Possums undoubtedly "prey" upon native forests, but the net effect of that predation, the degree to which it can and should be reversed is far from clear. As can be seen from the evidence review in this section, even the existing flawed and biased studies present a confused and inconsistent picture."

Also the ERMA Reassessment Agency stated:

"no significant improvement [in Northern Rata after 1080 operation] but issues with adequacy of the Rata View monitoring method" (ERR p 526).

"The use of non-treatment (control) sites for comparison against treated areas was fairly sparse in the reports [on vegetation monitoring] examined, limiting conclusions...in terms of effects of possum control" (ERR p 528).

"Fruiting and flowering data were generally not reported in the monitoring studies reviewed by Green (2003a), despite [their] significance for...ecosystem maintenance and regeneration" (ERR p 528).

"The Agency notes that overall, the relationship between possum density and vegetation response is complex and still not fully understood" (ERR p 528).

In the report by the Parliamentary Commissioner for the Environment (Wright, 2011), little evidence of benefit of aerial 1080 possum control to tree species was produced. Of the four tree species claimed to benefit from aerial 1080, kamahi, mahoe and tawa showed highly variable results and where positive effects occurred, these were only minor. Fuchsia appeared to benefit but the study was flawed by a lack of replication and inconsistent recording. Negative effects on red mistletoe and fruitfall of pigeonwood were found (for details see http://1080science.co.nz/a-scientific-evaluation-of-the-parliamentary-commissioner-for-the-environments-view-on-1080/).

<u>Point 15: 1080 is also essential for the agricultural sector</u>

Response: see Point 10.

Also economic expert Professor Ross Cullen, consultant for the ERMA Reassessment, wrote:

"No research is cited in the Application that studies the dollar losses occurring from the loss of one or more export markets [due to market perceptions of NZ's Tb status, however] Clough & Nixon (2000) conclude...a trade ban would be difficult to sustain under current international trade rules, the risk is very small and the expected value of an avoided trade ban is modest" (ERR p 582).

Stuart Ford, also a consultant for the ERMA Reassessment, wrote:

"The sections of the application reviewed do not reference or prove the rationale behind these [the AHB's] conditions on successful control" (ERR p 590)...

"There is no apparent discussion on the robustness and reliability of this epidemiological monitoring [of Tb prevalence in the future]. There is no discussion or information provided about the risk or sensitivity parameters of the modelling carried out...achievement of the [Tb prevalence] target [may be] very difficult. Some discussion around the perceived ability to realistically achieve this target would be of value" (ERR p 591)...

"There is no rationale given for the choice of the magnitude values chosen for each assessment value [in the Market Economy assessment matrices]...the assessment scales all appear to be somewhat arbitrary" (ERR p 592)...

"there is no ability to determine the degree of confidence that can be attributed to the assessment assumptions. It may well be that average costs [from restrictions on livestock movements] are much closer to $30,000 per farm than $200,000" (ERR p 593)...

"Given the doubt and uncertainty over the validity of the major assumptions used in the assessment we would consider that the likelihood of improved productivity that would result from the use of 1080 for pest control within the next 10 years would neither be considered very likely or major and therefore may not justify the high significance rating given in the assessment" (ERR p 595).

The foundational assumptions on which the poisoning regime is built are proving to be inappropriate, for example transmission rates between possums have been found to be far lower than assumed (Rouco *et al.* 2015) and possum density is not well correlated with possum Tb infection rates (Nugent *et al.* 2015). The goal of eradication of Tb from possums has been described as needing *"better understanding"* of *"a number of eco-epidemiological issues, all of them complex and difficult"* (Nugent *et al.* 2015).

Two recent publications (Barron *et al.* 2015 and Byrom *et al.* 2015) have highlighted that other wildlife such as pigs and ferrets which can spread Tb should be considered in efforts to manage the disease. Pigs may be poorly controlled by aerial 1080 (Cowled *et al.* 2004, p 16) and increase numerically due to pig hunters avoiding poisoned areas (AHB 2008, p 32). Ferrets may increase numerically (Rammell & Fleming 1978, p 92) and extend their ranging behaviour (Byrom *et al.* 2015, p 45; Norbury & Reddiex 1990, p 147) following aerial 1080 poisoning operations.

Meanwhile management of Tb in livestock is poor due to reliance on a tuberculin skin and blood test that has the potential to produce both false positive and false negative results. False positive reactors are slaughtered unnecessarily and can cause unnecessary herd movement restrictions (Humblet *et al.* 2009). The false negative problem creates a risk of allowing TB to persist in a herd (AHB 2012, p. 13) and may be responsible for the sudden re-emergence of Tb (Humblet *et al.* 2009).

It has been brought to my attention that in 2015 a member of the New Zealand parliament commissioned an independent overseas veterinary pathologist to review the relationship between the historical and contemporary occurrence of bovine tuberculosis In New Zealand and the epizootiological studies that were undertaken since 1970 which sought to examine the causal links between sylvatic cycling of bovine tuberculosis as spill-over or self-maintaining infections within NZ wild animal populations, particularly the introduced possum (*Trichosurus vulpecula*).

Point 16: Brodifacoum is another VTA which is used in New Zealand to control populations of rats, mice and possums. While brodifacoum persists longer than 1080 in the environment, it has been used to great effect in many of New Zealand's offshore islands and "mainland island" pest-proof sanctuaries for initial eradication operations. Zealandia, Maungatautari, and Orokonui have all applied brodifacoum aerially, and are now successful sanctuaries offering biodiversity, community education, and benefits to the local economy.

Response: Smith has not quantified his "to great effect" claim. Comprehensive assessments of island and sanctuary biodiversity *prior* to brodifacoum treatment have generally not been reported, so there is no record of what species were lost along with the target pests, or of how the ecology changed as a result of the eradications (in some cases, the rats were kiore (*Rattus exulans*) which had been present for hundreds of years, so had been part of the ecosystem for a very long time).

Massive reductions in populations occur (causing losses of genetic diversity and therefore resilience) and extinctions of species are possible in aerial brodifacoum poisoning operations. Birds from a wide range of species have been recorded killed, with severe reductions in some populations (DoC, 2011). For example, on Ulva Island, an aerial brodifacoum operation was considered to have killed nearly one third of adult Stewart Island robins (*Petroica australis rakiura*) (Masuda & Jamieson, 2013). Negative effects were still being seen 3-4 months after the operation, when dead nestlings were found to contain brodifacoum, apparently poisoned by being fed contaminated invertebrates (Masuda *et al.*, 2014). In another study, at least 50% of the dotterels *Charadrius obscures*) in the area treated by aerial brodifacoum at Tawharanui Regional Park (North Auckland), disappeared or were found dead (Dowding *et al.*, 2006).

Negative effects of brodifacoum on invertebrate species richness and abundance were found on Kapiti Island (Sinclair *et al.*, 2005) and negative impacts on invertebrates were also found in a Pelorus Bridge study, even though that study only had the power to detect population decreases of 67% or more (Spurr, 1996). Aerial brodifacoum treatment to eradicate rats on Fregate Island, Seychelles, was thought to have caused significant declines in two terrestrial snail species, one of which become endangered and the other probably extinct (Gerlach, 2005). Another species of snail was also thought to be vulnerable to brodifacoum (Gerlach & Florens, 2000), and it has been described as a molluscicide (Gerlach, 2005). Brodifacoum is rated as highly toxic to aquatic organisms on the basis of its toxicity to the freshwater crustacean *Daphnia magna* (USEPA, 1998). Therefore it could have devastating effects on freshwater communities. New Zealand freshwater habitats contain about 450 formally identified insect species and at least 200 other kinds of invertebrate (including crustaceans, molluscs and various worm phyla) (www.biodiversity.govt.nz). Research which showed that mollusc (*Conus*) and insect (*Drosophila*) species can be affected by brodifacoum concluded that the vulnerable chemical process found in *Conus* and *Drosophila* was probably widely distributed among biological systems (Walker *et al.*, 2001).

Brodifacoum binds strongly to soil and persists for many months (Weldon *et al.*, 2008), therefore may have ecological effects through poisoning soil organisms. Soil is an important part of the ecosystem and its inhabitants are diverse and essential to the recycling of nutrients. It is unknown whether soil concentrations of brodifacoum following aerial operations would affect soil invertebrate survival or health, or for how long sublethal residual concentrations of brodifacoum persist in soil invertebrates (Fisher *et al.*, 2011).

The long-term implications of sub-lethal brodifacoum exposure for survival or reproductive fitness of affected individuals are not known (Fisher, 2010).

In the context of its use in a mainland sanctuary, vectors for contamination of the surrounding area and its wildlife with brodifacoum will include birds and invertebrates as well as waterborne carcasses, sediment and organic material.

Smith has failed to acknowledge that ground-based bait stations (which are likely to create fewer non-target deaths), rather than aerially applied brodifacoum, have been used successfully to eradicate rats from islands (O'Connor & Eason, 2000).

Point 22. Independent monitoring completed by the EPA within the last five years confirmed the HSNO system is effective at managing the risks of operations {and that the management of operations has improved significantly}.

Response: A lack of information on the effects of 1080 was highlighted at least 300 times in the 2007 ERMA Reassessment documents (see http://1080science.co.nz/1080-data-quality.)

Since then, research recommended by ERMA has not substantially filled in gaps knowledge. Only two of ERMA's four recommended topics for technical research have been addressed. The research that was recommended on the loss of 1080 in samples (that brought into question the validity of results from all stored samples), and that on degradation rates in water, have not been carried out (personal communication, Dr Penny Fisher, Landcare, 24 September 2015; 23 October, 2015).

The two of ERMA's recommended topics that *have* been addressed, in one experiment each, are poorly understood with the experiments producing serious questions. Northcott *et al.* (2014) studied degradation rates of 1080 in three NZ soils. The study found that degradation was slowest at low temperatures, while effects of soil moisture and type varied. The known harmful breakdown products fluorocitrate and fluoromethane were not measured, with additional research recommended "if the role of these other SFA degradation pathways in soil was of concern" (Northcott *et al.*, 2014). Srinivasan *et al.* (2012) studied the fate of 1080 leaching from baits during rainfall. They found evidence that 1080 dropped on land entered streams, and concluded that research was needed into 1080 in overland flow, in subsurface flow, and whether it enters groundwater.

According to DoC, reliably calculated mortality rates from 1080 poisoning are available for only five birds (kokako *Callaes cinerea*), kiwi (*Apteryx* spp.), kaka *Nestor meridionalis*, whio (*Hymenolaimus malacorhynchos*) and fernbirds (*Megalurus punctatus*), and that for fernbirds, it is 9.4%. (personal communication (letter) 6 September 2016). The lack of reference to intensively studied kea (*Nestor notabilis*) in DoC's letter was noted. An average of 12% of marked kea have been reported dead from 1080 poisoning (DoC, 2016; Kemp *et al.*, 2016, unpublished); range up to 78% (Graf, 2011). Such figures should cause alarm. 1080 is not only toxic to mammals and birds, but to many other organisms including bacteria, fungi, plants, nematodes and insects (ERMA Reassessment, 2007). When broadcast in cereal-based food pellets, the poison is also available on fragments, in bait-dust and spread by animals (see Pollard, 2016), as well as in water (Srinivasan *et al.*, 2012). An experimental study found a severe negative impact of aerial 1080 on a wide range of terrestrial invertebrates, persisting for at least a year in some species (Meads, 1994, unpublished, cited in Whiting-O'Keefe & Whiting-O'Keefe, 2007). However follow-up studies by DoC, severely compromised by poor design, have been used erroneously since to back up claims of a lack of effect of 1080 on invertebrates (Whiting-O'Keefe & Whiting-O'Keefe, 2007).

In addition, the residual limits for 1080 and brodifacoum are set at the limits for detection by New Zealand analysts at 0.001mg/kg (see affidavit of Judith Evelyn Barker dated 10 July 2017, annexures 2 and 3). This lack of technology limits the ability to identify or assess the effect of lower levels of exposure (as noted by USEPA (1988) with regard to 1080). Also, water sample analysis that removes suspended organic material or uses filter material that toxins bind to may cause unreliable test results.

<u>Point 22a.</u> {Independent monitoring completed by the EPA within the last five years confirmed the HSNO system is effective at managing the risks of operations and that} <u>the management of operations has improved significantly.</u>

Response: In an overview of its own ship rat, possum and stoat control programmes (Brown *et al.* 2015), DoC listed many problems internal to their organisation, which included: (1) few staff had completed the Animal Pest Management Framework training; (2) adoption of best practise was patchy; (3) not all DoC control operations were reported; (4) failure to follow best practice; (5) insufficient toxin; (6) budget insufficient; (7) breakdown in communication between technical advisors and operational staff leading to poor design and inconclusive outcomes; (8) did not fully understand the relationship between forest mast events and rodent population responses to these; (9) had too few measures of the long-term benefits of 1080 use to different populations of native species; (10) lack of robust monitoring and follow through; (11) legal requirements not always met; (12) how variable operations had been was unknown, as not all control operations were written up; (13) average costs for ground-based trapping and toxin operations were difficult to obtain because they were not consistently recorded.

Additional problems are evident in other DoC reports. Despite claims that aerial 1080 operations must be well timed (EPA, 2011; Brown *et al.* 2015, p. 23) "*many logistical, political and environmental constraints can significantly affect when a treatment ultimately occurs*" (Hunter & Kemp 2015, unpublished report). Poor timing was evident in a poisoning operation in Karurangi National Park in 2014, where alpine areas were poisoned just before a snowfall which covered the baits (Elliot 2015, p. 1 (unpublished report)).

<u>Point 32. The success of the Brook Waimarama Sanctuary depends on achieving an absolute kill</u>

Response: Smith has not defined "success". Use of aerial brodifacoum is likely to have wide ranging effects on the area's ecology. Artificially introduced and common species may eventually thrive, however it is likely to be changed forever, becoming more like a zoo (an establishment which maintains a collection of wild animals) than a sanctuary (a nature reserve).

Smith has also not defined what an absolute kill *of* is necessary. Secondary poisoning is an unreliable means of targeting predators, at least when 1080 is used, and remaining predators can turn to eating birds (see Point 14 a, above).

<u>Point 41: The precedent effect of this litigation against Brook Waimarama Sanctuary Trust is concerning, as it could lead to a chilling effect from community conservation groups volunteering their time and resources to use essential pest control tools in the future. Community groups make an irreplaceable contribution to New Zealand's natural heritage.</u>

Response: Conservation of New Zealand's natural heritage needs to be based on robust ecological science and preservation of unaltered habitat (King, 1984) rather than poorly-informed, well-meaning activities.

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