An Acoustic Bat Survey of the Lee River Catchment Development Area

Prepared for:

Waimea Water Augmentation Committee and Tasman District Council

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SUMMARY

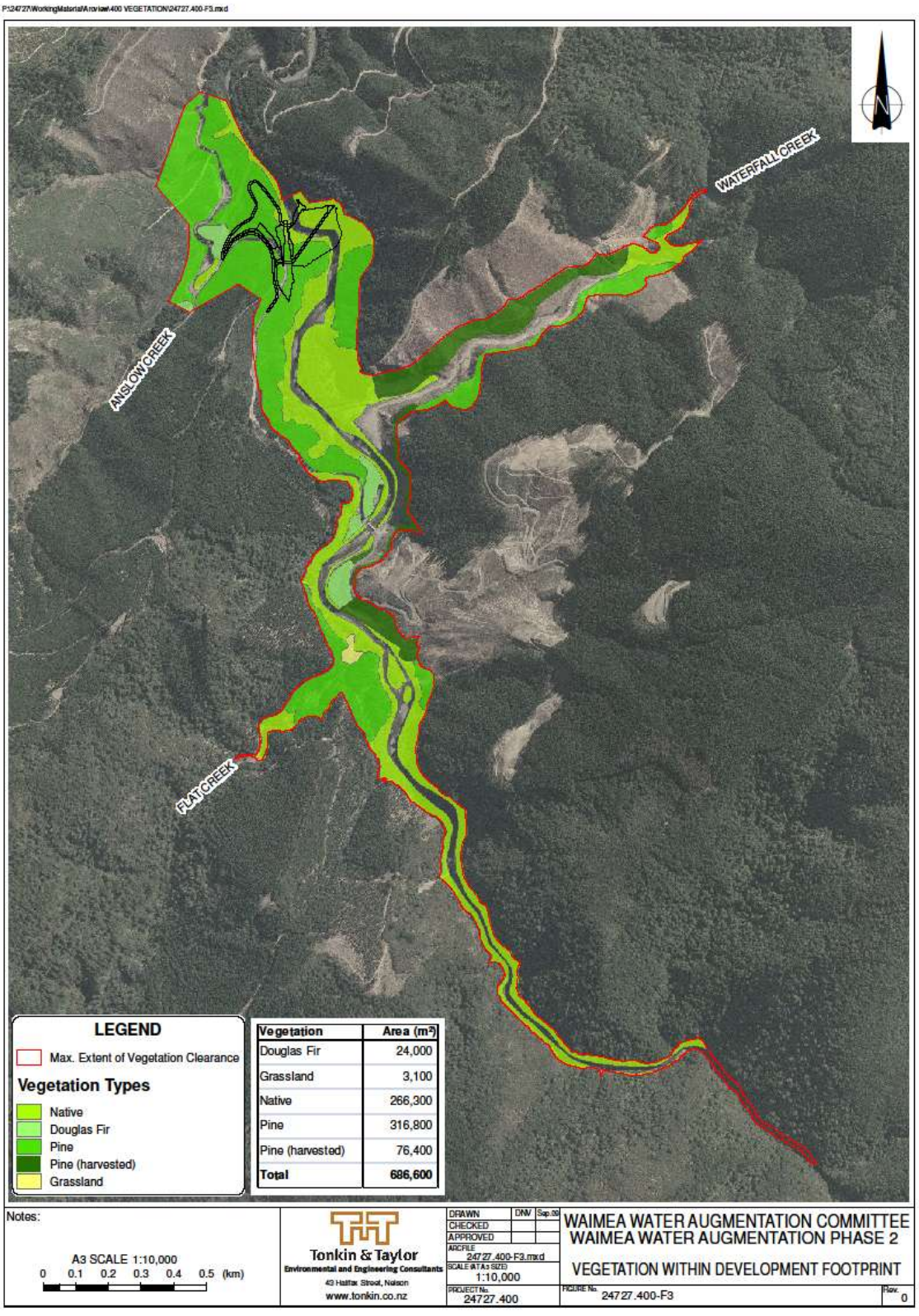
1. This report presents the results of an acoustic survey for bats at the site of the proposed Lee River Reservoir and provides a summary of available information on bats in the region.
2. Weather during the survey period was unsettled, with periods of rain, low temperatures and strong wind (all of which curtail bat flight activity). Despite this, the survey effort was sufficient to detect even a small number of bats inhabiting the site of the proposed Lee River Reservoir and its immediate surrounds.
3. No bats were recorded during the survey.
4. It is reasonable to conclude that there was no resident long-tailed bat population in either the reservoir site, or the upper catchment, at the time of the survey.
5. Long-tailed bats from the nearby population in the Pelorus River catchment are likely to visit the Lee River catchment during mid- and late-summer.
6. Construction and inundation of the Lee Valley Reservoir will not have a significant impact on the region's long-tailed bat population.
7. With the exception of a very small area (<3 ha) of forest in the gorge, the site of the proposed reservoir is unsuitable for short-tailed bats.
8. If short-tailed bats are present in the upper catchment of the Lee Valley, construction and inundation of the Lee Valley Reservoir will not have a significant impact on them.
9. If it is necessary to determine whether there is either seasonal use of the area or occasional visits by dispersing and wide-ranging bats, further surveys could be undertaken using long-term (30 day) deployments of a small number of bat recorders along the lower reaches of the Lee River gorge and at the centre of the inundation area.

INTRODUCTION

The Lee River is a tributary of the Waimea River, draining part of the western flanks of the Richmond Range (Fig. 1). The Waimea Water Augmentation Committee is proposing construction of a dam and reservoir in the upper catchment of the Lee River to provide water storage to ensure a secure supply of water for irrigation and community supplies in the Waimea Basin over the next 100 years (WWAC 2008). The proposed dam site is upstream of the Lee River's confluence with Anslow Creek, 12 km south of Brightwater (Fig. 1). When the reservoir fills, the water level will rise to the 200 m contour, inundating an area of c. 80 ha (Fig. 2). Inundation will extend along the Lee River for 4 km upstream from the dam, and along its tributaries Waterfall Creek and Flat Creek, 1.4 km and 600 m respectively. Most (c. 70 ha) of the area to be inundated is private land used for plantation forestry, but c. 10 ha lies within the Mt. Richmond Forest Park, part of the conservation estate. The area of forest park to be inundated begins 2 km upstream of the dam site and extends another 2 km along the Lee River as it flows through a deeply incised gorge bordered by steep forested banks (Plate 1). The forest in the gorge is predominately undisturbed beech-podocarp forest, but includes areas of kanuka on the true left in its lower reaches. Below the gorge, on private land within the inundation area, there is a mosaic of habitat types (Fig. 2) including: mature conifer plantation, recently harvested conifer plantation, grassland, native scrubland, relict beech-podocarp forest and rivers (Plates 2 to 4). Simpson (2008 and 2009) provides details of vegetation within the area of the proposed reservoir.

Figure 1. Location of the proposed Lee Valley Reservoir

Figure 2. Large scale map of the proposed Lee Valley Reservoir, outlined in red, showing vegetation types within the inundation area. Prepared by Tonkin and Taylor.



Two species of bats remain in New Zealand: short-tailed bat *Mystacina tuberculata* and long-tailed bat *Chalinolobus tuberculatus*. South Island taxa of both species are considered "Nationally Endangered" (Hitchmough et al. 2007). There are no records of short-tailed bats from the Richmond Range (Lloyd 2009a), but there are a small number of historic records from the head-waters of three nearby catchments: Wairau in 1948, Buller in 1919 and 1949 and Motueka in 1958. The most recent of these records was in the upper Motueka River Gorge, only 27 km from the proposed Lee Valley Reservoir. Because short-tailed bats are cryptic and elusive, absence of records can not be taken as conclusive evidence that the species is not present in the Richmond Range. However, the species is a deep forest bat, inhabiting large tracts of old-growth indigenous forest, which it rarely leaves (Lloyd 2005). Even if there is a local population of short-tailed bats, it is unlikely that they would use the modified vegetation covering most of the inundation area. In contrast, long-tailed bats are known to occur in the Richmond Range (Lloyd 2009a) and use a wide range of habitat types present in the inundation area including conifer plantation, scrubland, native forest, forest edges, roadways, and waterways (O'Donnell 2005). It seems likely that long-tailed bats might be present in the inundation area.

Because short-tailed bats are not known to occur in the region and avoid the modified habitats found over most of the proposed reservoir site, the survey was designed specifically to detect long-tailed bats. Monitoring sites were at the type of locations favoured by long-tailed bats. However, any short-tailed bats in the survey area would have been detected, as several monitoring sites were in the old-growth indigenous forest they favour.

METHODS

To establish whether bats are present in the proposed Lee River Reservoir inundation area and its immediate surrounds (i.e. the survey area), acoustic bat surveys were undertaken during November and December 2009 using multi-night deployments of Digital Bat Recorders at fixed sites. Digital Bat Recorders are heterodyne ultrasound detectors designed by Stu Cockburn of DoC Wellington specifically to survey for New Zealand's two bat species. They monitor and record the optimum ultrasound frequencies (28 and 40 kHz) for the echolocation calls from both species simultaneously. The recorders monitor a 180° sector in front of them and have an effective working range of *c.* 50 m for long tailed bats and *c.* 25 m for short-tailed bats.

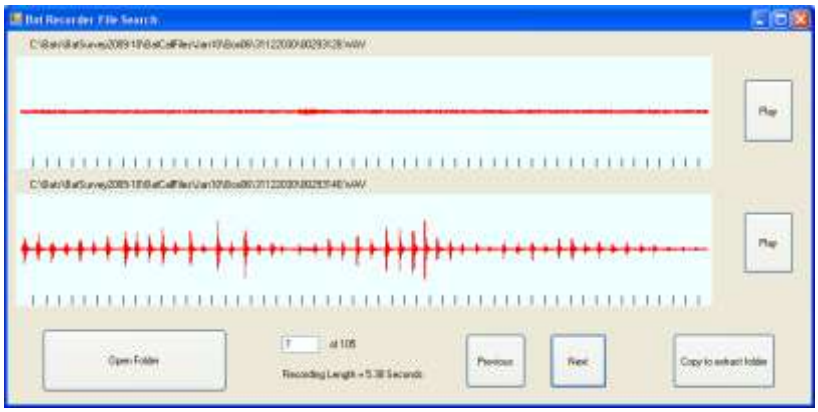
There were three separate multi-night deployments, using ten recorders placed at monitoring sites spread throughout the survey area. During each deployment, the recorders were left in place long enough to monitor for bat activity over at least 3 fine mild nights. Fine mild nights are when long-tailed bats are most active. For this survey, they are defined as nights without significant rainfall and where the minimum temperature doesn't fall below 8°c. Recorders were relocated between deployments. All monitoring sites were within habitats known to be favoured by long-tailed bats (along rivers, riparian vegetation, forest margins, beech-podocarp forest interior, scrubland and outcrops). Some recorders were placed high on bluffs and steep hill sides to detect long-tailed bats flying high (>35 m) above ground level (e.g. Fig. 3). No monitoring sites were located in the areas of recently harvested conifer plantation, as this is unsuitable habitat for long-tailed bats. The location of each recorder was logged on a GPS unit at the time of deployment.

Figure 3. Typical bat recorder deployment, with the recorder lashed to a tree trunk in a beech forest relict high on a bluff overlooking a grass clearing along Waterfall Creek

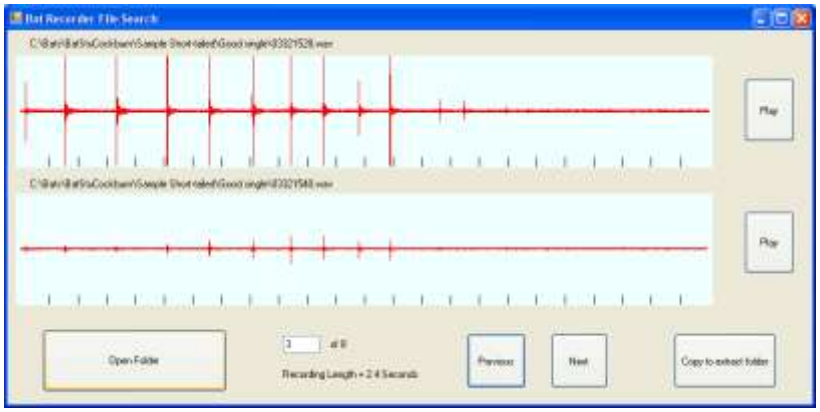
The nightly recording period on the recorders was set to begin just before sunset and end soon after sunrise (i.e. 20:30 to 6:00 for this survey). Noise switches on the recorders were set to "slow", to filter out the sound of heavy rain. At the end of each deployment, the *wav* file recordings from the recorders were transferred to a laptop computer and reviewed using the software program BatSearch (written by Stu Cockburn of DoC Wellington) applying species identification criteria described in Lloyd (2009b). Figures 4a and 4b are examples of the oscilloscope displays provided by BatSearch for echolocation calls from New Zealand's two bat species.

Figures 4a & b. Oscilloscope displays from BatSearch software showing typical echolocation calls from New Zealand's two bat species.

a) Long-tailed bat



b) Short-tailed bat



Overnight conditions during the deployment periods were determined from rain-noise on recordings from the recorders supplemented by daily rainfall and minimum temperatures records from the four closest weather stations to the survey area on NIWA's National Climate Database (http://cliflo.niwa.co.nz/): BrightWater 2, Appleby 2Ews, Nelson Aws, and Nelson Aero, which are respectively10.1 km, 17.9 km, 19.3 km and 19.8 km from the survey area.

RESULTS

Ten digital bat recorders were deployed for a total of 34 nights during three consecutive periods: 24 November to 4 December, 4 December to 22 December, and 22 December to 28 December (Table 1). Although most recorders functioned well, a small number of problems were encountered. One recorder was stolen during the first deployment. During the second deployment, one recorder didn't record at all because of battery failure and two recorders didn't last the full duration of the deployment, recording for only 15 and 17 nights respectively of the 18-day deployment period. All other recorders functioned without problem to achieve 308 "recorder-nights" of acoustic monitoring over the entire survey period. However, because only 16 of 34 nights during the survey period were fine mild nights suitable for long-tailed bats (i.e. without significant rainfall and with minimum temperature ≥8°c), the total effective monitoring effort was reduced to 146 "recorder-nights".

Table 1. Summary of acoustic survey effort.

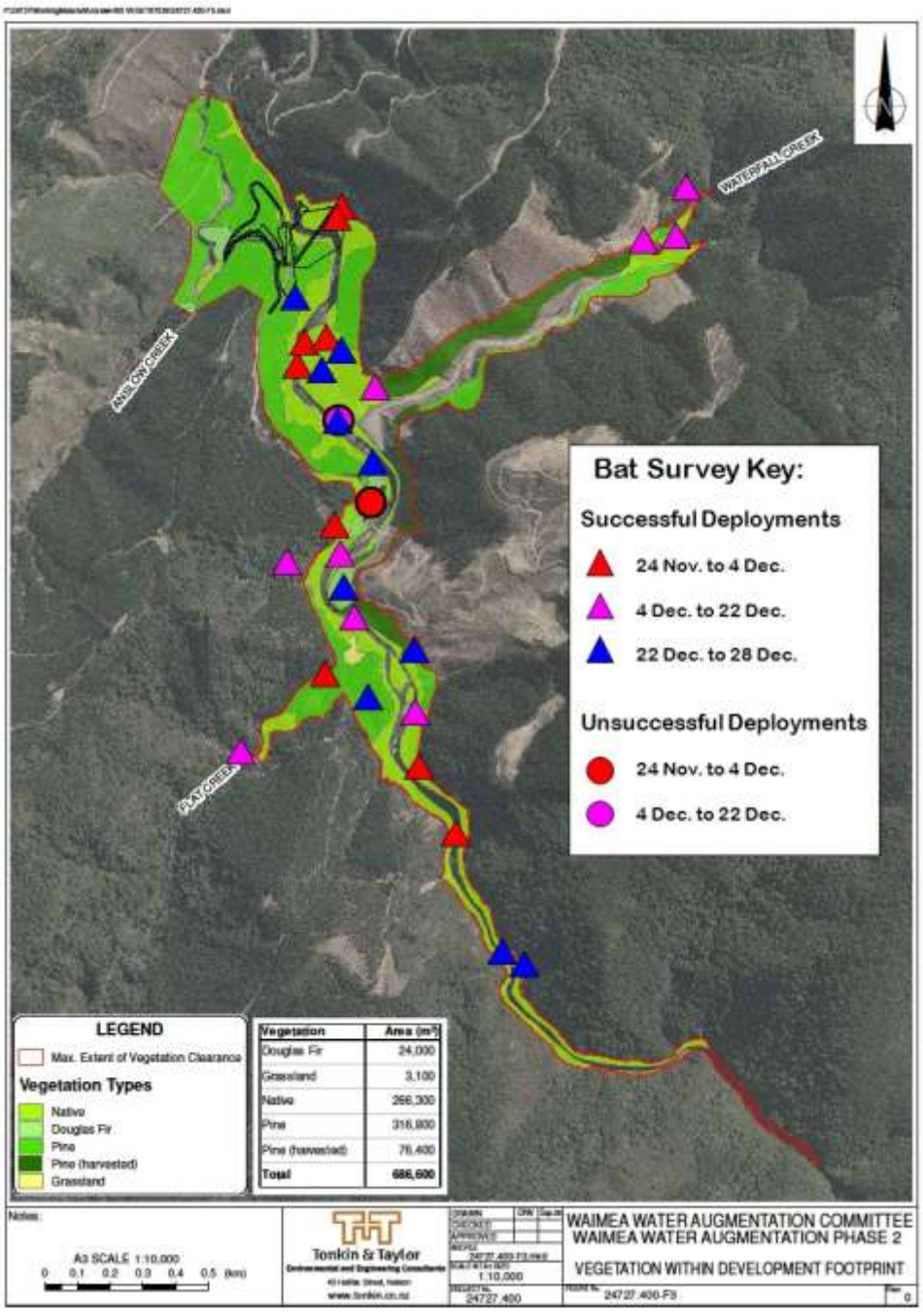
	N. of Nights		N. of Recorders		N. of Recorder-nights	
	Total	Fine/ mild	Deployed	Working	Successful	Fine/mild
24 Nov to 4 Dec	10	3	10	9	90	27
4 to 22 Dec	18	9	10	9	158	79
22 to 28 Dec	6	4	10	10	60	40
Total	34	16	30	28	308	146

Bat recorders were placed at 28 sites spread throughout the survey area (Fig. 5) to monitor five of the six main habitat types (Table 2). Recently harvested conifer plantations were not monitored, as long-tailed bats avoid such areas. Monitoring sites were usually at interfaces between habitat types, so most recorders monitored more than one habitat type (e.g. Fig. 3).

Table 2. Distribution of monitoring sites between main habitat types.

Habitat Type	Sites	
	N.	%
Grassland	9	32.1
Mature conifer plantation	11	39.3
Harvested conifer plantation	0	0
Beech-podocarp forest	15	53.6
Native scrubland	7	25.0
Riverine	13	46.4

Figure 5. Distribution of monitoring sites used during bat surveys of the proposed Lee Valley Reservoir, 22 November to 28 December 2009. Base map prepared by Tonkin and Taylor.



There were no recordings of echolocation calls from either bat species during the survey. A range of ultrasound signals (e.g. rain, insects, bird calls and introduced mammal movements) recorded on all recorders confirms that the recorders were functioning throughout the survey and that absence of bat recordings was not a consequence of equipment malfunction.

DISCUSSION AND CONCLUSION

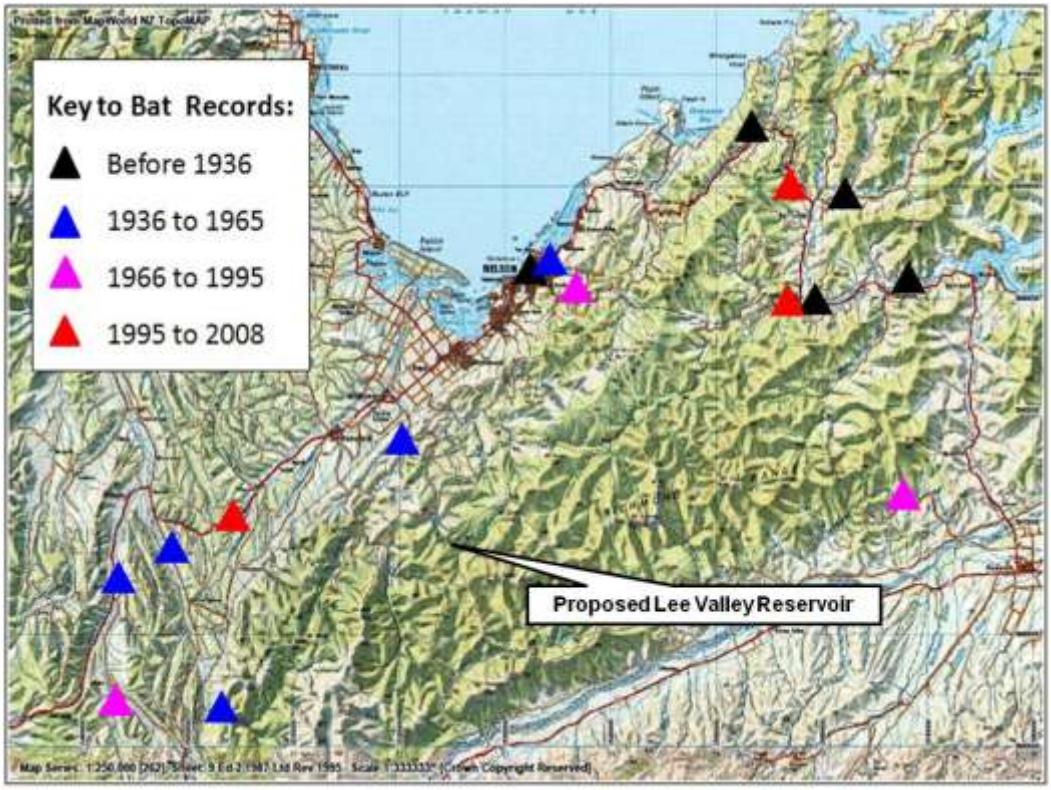
The survey was intensive, with 10 automatic recorders deployed for a total of 34 nights at 28 locations in a relatively small area of c. 80 ha. Although the weather during the survey was unsettled with several periods of rain, low temperatures and strong wind (all of which curtail bat flight activity), there were 16 fine mild nights when any bats in the area would have been active. Failure to detect bats during this survey provides strong evidence that bats were not present in the survey area during the survey. However, acoustic surveys for New Zealand bats are best undertaken during the summer period (January to March), when the weather is more settled and echolocation call rates are highest.

Long-tailed bats range widely (>10 km) around their core home range. If there was a resident long-tailed bat population in the extensive unmodified native forest of the upper Lee Valley catchment (Plate 5), the Lee River gorge would provide an ideal flyway for them. As no bats were recorded at the four monitoring sites along the gorge, it is unlikely that there was a resident long-tailed bat population anywhere in the Lee Valley catchment at the time of the survey. Short-tailed bats rarely leave the tracts of old-growth indigenous forest they inhabit; consequently the survey could have failed to detect a short-tailed bat population in the upper catchment. Acoustic survey of the upper catchment would be required to confirm the species status in the Lee Valley. However, short-tailed bats unlikely are unlikely to occur in the area as currently the only known population on the South Island mainland is in Fiordland.

Absence of bats from the proposed site of the reservoir during the survey does not entirely resolve the area's significance to bats, as bats might use the area at other times of the year or in other years. Major seasonal and inter-annual shifts in home range are found in some bat species overseas, but have not been observed in the two New Zealand bat species. Populations of both New Zealand species exhibit long-term fidelity to their core home ranges. Seasonal and inter-annual shifts are generally limited to minor changes in the elevation and extent of their core home range. Long-tailed bats range most widely in late summer and autumn (February to early April), with individuals travelling more than 25 km outside of their core home range. In winter, bats tend to roost at lower altitudes and range over smaller areas than in summer.

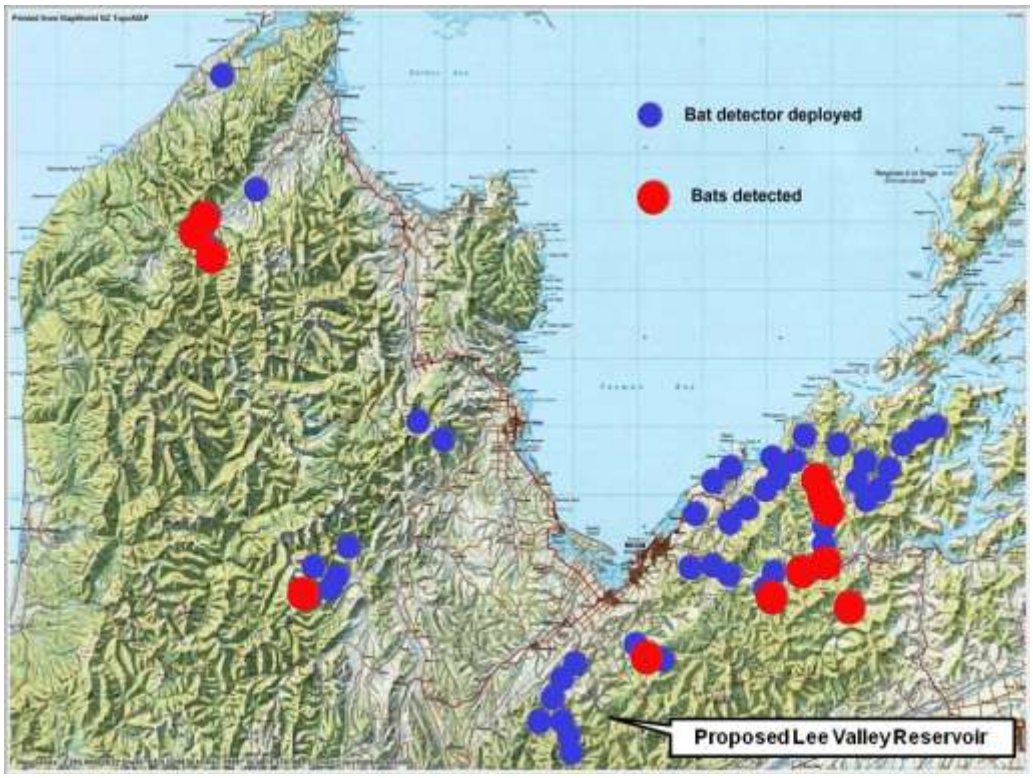
Until recently, Nelson and the Richmond Range have not been considered an important area for either species of bat. Indeed, there are only 16 records of bats from the region (Fig. 6) for the period between European settlement and 2006 (Dwyer 1962; Daniel & Williams 1984; Conservation 2008; Lloyd 2009a). Only one record comes from the Waimea catchment: a 1950 report of long-tailed bats in the Wairoa Valley 7 km north-west of the proposed Lee Valley Reservoir.

Figure 6. Historical records of bats in the region around Nelson and the Richmond Range



However, acoustic bat surveys undertaken in the Nelson area for the Royal Forest and Bird Society during 2008 and 2009 (Lloyd 2009a) found a substantial population of long-tailed bats inhabiting the north-east side of the Richmond Range (Fig. 7). Highest numbers were recorded near Pelorus Bridge, at the confluence of the Pelorus and Rai Rivers, which appears to be the core home-range of the population. Surveys of the Hacket and Wairoa Valleys in the Waimea catchment produced only one recording of a single long-tailed bat: in Browning Stream, a tributary of Hacket Creek, 11 km north-east of the Lee Valley Reservoir site. Given the amount of monitoring effort in the survey area, it seems unlikely that there is a resident long-tailed bat population in the Waimea catchment. Browning Stream is only 28 km from Pelorus Bridge bat population, and shares a forested watershed with the head-waters of the Pelorus River catchment. Long-tailed bats range widely from their core home range, frequently traveling more than 25 km, especially during mid summer, when the recording was made. Thus, it seems likely that the bat recorded in Browning Stream was from the Pelorus population.

Figure 7. Results of Forest and Bird's bat surveys 2008 to 2009 (Lloyd 2009a)



The upper catchment of the Lee River also shares forested watersheds with the headwaters of the Pelorus River. The watersheds are only 32 km from Pelorus Bridge and the upper catchments of both the Pelorus and Lee Rivers contain extensive areas of the unmodified beech-podocarp forest favoured by long-tailed bats. During late summer dispersing young and wide-ranging adult long-tailed bats from Pelorus Bridge probably visit the upper Lee River catchment, and may visit the nearby proposed reservoir site.

Although small numbers of long-tailed bats might visit the site of the proposed reservoir during mid and late-summer, the area contains few important resources for them. The most crucial resources for long-tailed bats are suitable colonial roost cavities and foraging habitat. Long-tailed bats usually roost in cavities in large old trees. Although they favour native old-growth forest trees for colonial roosting, especially red beech *Nothofagus fusca*, kahikatea *Dacrycarpus dacrydioides* and matai *Prumnopitys taxifolia*, the bats roost in a range of tree species including exotics such as Monterey pine *Pinus radiata,* poplar *Populus sp.* and willow *Salix sp.*. Whatever the tree species, long-tailed bats require large mature trees with cavities or exfoliating bark for their colonial roosts. Suitable trees are plentiful in New Zealand old-growth forest, but rare in New Zealand's plantation forests. There are few suitable large old trees within the Lee Valley inundation area; most are in a relict of matai-beech forest on the steep valley side downstream from Flat Creek and a small area of podcarp-beech forest on the banks of the Lee River gorge within the conservation estate. In contrast, suitable tree cavities are plentiful in the extensive areas of podocarp-beech forest outside the inundation area. Typically, long-tailed bats roost in a tree for only a few days

before moving to a new roost tree. Although they do re-use roost trees, the bats move between many roosts and show little attachment to individual trees. Roosts cavities in trees are an ephemeral resource lasting only a few years at the most; even less in production forests. Thus, the bats will easily adapt to the loss of any roost trees inundated behind the dam. Long-tailed bats forage for flying insects in open airspace, over and along the margins of water, forest and scrubland. Inundation of the Lee Valley reservoir site will entail a minor reduction in the currently available foraging habitat for long-tailed bats in the Lee River catchment. However, most of the foraging habitat being inundated is subject to routine destruction in the course of production forestry. Given the low number of bats likely to be present, their mobility, the ephemeral nature of most of the foraging habitat and the large area of similar or better foraging habitat in the surrounding catchment, loss of foraging habitat seems unlikely to have significant consequences for any long-tailed bats in the area. Indeed loss of foraging habitat over and along inundated rivers, forest and scrubland will be offset by new and more stable foraging opportunities above and along the edge of the newly created reservoir.

RECOMMENDATION FOR FURTHER SURVEYS

Results of the bat survey provide conclusive evidence that long-tailed bats were not present in the Lee River catchment at the time of the survey, but do not entirely resolve the area's significance to bats. Major seasonal shifts in a nearby bat population's home range could bring bats into the area at other times of the year, although this is unlikely given our knowledge of the species ecology. Alternatively, dispersing or wide-ranging individuals from the long-tailed bat population in the neighbouring Pelorus catchment might visit the area during mid- and late-summer. The Lee River gorge provides an ideal flyway for any long-tailed bats using the site of the proposed Lee River Reservoir. Seasonal use of the area and occasional visits by dispersing or wide-ranging bats could be detected by repeated long-term (30 day) deployments of a small number of Digital Bat Recorders: two recorders placed along the lower reaches of the Lee River gorge and a third detector at a central position in the site of the proposed reservoir, close to the confluence of Flat Creek and the Lee River would be sufficient for this purpose.

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APPENDIX: HABITAT PHOTOGRAPHS

Plate 1. Beech-podocarp forest overhanging the Lee River gorge in the upper part of the inundation area.

Plate 2. The mosaic of habitat types at the northern end of the proposed Lee Valley Reservoir: mature conifer plantation and kanuka scrubland in the foreground; harvested conifer plantation and remnant native forest in the middle distance.

Plate 3. Lee River upstream of the proposed dam site, with riverine beech forest relicts, as well as harvested and mature conifer plantation.

Plate 4. Beech forest remnants surrounded by grassland and recently harvested conifer plantation in the middle reaches of Waterfall Creek at the upper limits of the inundation area.

Plate 5. Upper catchment of Lee Valley, above the proposed Lee River reservoir. Mt Starveall in the background.