

Crown Pastoral Land Tenure Review

Lease name : MT DASHER

Lease number : PO 030

Conservation Resources Report – Part 1

As part of the process of Tenure Review, advice on significant inherent values within the pastoral lease is provided by Department of Conservation officials in the form of a Conservation Resources Report. This report is the result of outdoor survey and inspection. It is a key piece of information for the development of a preliminary consultation document.

The report attached is released under the Official Information Act 1982.

**2011 ADDENDUM TO
DOC CONSERVATION RESOURCES REPORT ON
TENURE REVIEW OF**

MT DASHER PASTORAL LEASE

PAL 14-04-30

**UNDER PART 2 OF THE CROWN PASTORAL LAND
ACT 1998**



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Cover photo: The area to the northwest of Siberia Hill. Scout Hill, which forms part of the lease’s eastern boundary, is visible at the immediate left.

PART 1

INTRODUCTION

1.1 Background

Mt Dasher Pastoral Lease (PL) was originally inspected in November 2003. Earlier tenure review surveys were generally not as comprehensive as those that are undertaken today and the use of additional tools (e.g. LENZ and structured SIV Guidelines) are now available to assist with assessment of ecological patterns and values present. A re-inspection therefore presented the opportunity to both examine the original proposed designations and to consider any major deficiencies in the original proposal.

The re-inspection of the PL was undertaken on 7-8 December 2010, for the purpose of determining if changes were required to the initial Conservation Resources Report (CRR), which was based on information derived from the original inspection carried out in November 2003.

The re-inspection team consisted of Tony Perrett (High Country Tenure Review Manager), John Barkla (Technical Support, Botanist), Shar Briden (Technical Support – Historic) and Brian Allingham (Ngai Tahu).

It is important to note that the original assessment and recommendations were done over seven years ago. However, most of the original proposed designations have been reconfirmed as retaining natural heritage and the recommendations made in this report improve and compliment these. This addendum document is to be read in conjunction with and as an addition to the original CRR.

PART 2**INHERENT VALUES: DESCRIPTION OF CONSERVATION RESOURCES AND ASSESSMENT OF SIGNIFICANCE****2.1 Land Environments of New Zealand (LENZ)**

The environmental distinctiveness of this area has been assessed through the Land Environments of New Zealand (LENZ). This is a classification of New Zealand landscapes using a comprehensive set of climate, landform and soil variables chosen for their roles in driving geographic variation in biological patterns (Leathwick et al. 2003). It is presented at four levels of detail containing 20, 100, 200 or 500 environments nationally. The data in this report is presented at Level IV which more adequately reflects the distribution of biodiversity, past clearance and current vulnerability across the landscape than higher levels of LENZ (e.g. level II). Threat classification at level IV results in substantially more effective and efficient identification of threatened remaining indigenous cover.

When the Level IV LENZ information is combined with information describing the area of unprotected indigenous cover in threatened land environments, as identified in the national land cover database (LCDB), the biodiversity most likely to be lost can be identified. Five categories identify those threatened environments containing indigenous biodiversity at most risk of loss. These categories which are derived from a combination of measures for the percentage of biodiversity legally protected and percentage of remaining indigenous vegetation cover, are described as follows:

Table 1: Land Environments of New Zealand Threat Classification Categories

Threat Classification	Description
Acutely threatened	<10% indigenous vegetation cover remaining
Chronically threatened	10-20% indigenous vegetation remaining
At risk	20-30% indigenous vegetation cover remaining
Critically underprotected	> 30% indigenous vegetation cover remaining and <10% protected
Underprotected	>30% indigenous vegetation cover remaining and 10-20% protected
No threat	>30% indigenous vegetation cover remaining and >20% protected

Two LENZ environments (N & Q) (Leathwick et al. 2003) are present on the Lease. At Level IV classification the lease comprises, N3.1e, Q1.1a, Q1.1d, Q1.2a, Q2.1a, Q2.1c, and Q3.3c. Table 2 presents a full LENZ analysis for Mt Dasher Pastoral Lease.

Table 2: LENZ environments present on Mt Dasher Pastoral Lease

Threat Category	LENZ Level IV units	Area of LENZ unit on Mt Dasher PL (ha) (Approx. only)	Area of LENZ unit as a % of Mt Dasher PL	Area of LENZ unit as a % of LENZ level 4 category nationally
Chronically Threatened	N3.1e	313.58	4.38	0.3
At Risk	Q2.1c	629.08	8.78	0.73
Critically Underprotected	Q2.1a	1500.94	20.97	0.65
Underprotected	Q3.3c	127.35	1.78	0.11
No threat category	Q1.1a	416.77	5.82	0.41
	Q1.1d	4043.98	56.49	1.63
	Q1.2a	127.76	1.78	0.07
Total		c.7159	c. 100	

2.1.1 Significance of LENZ

Attributing significance to LENZ units, while a useful exercise, must be treated with caution. Work is currently underway to improve the accuracy of underlying spatial data. For example, soils data is being upgraded, as median patch size for polygons sourced from the Land Resource Inventory is currently between 10,000 and 100,000 hectares, while at Level IV resolution, LENZ units cover areas as small as 10 hectares. Also underway, albeit as lesser priority, is ongoing work relating to continuous improvements of the underlying classification process which generates LENZ units.

Where indigenous cover remains within these threatened LENZ units, it attains significance for tenure review.

National priority 1 in “Protecting our Places” (MfE 2007) is to protect indigenous vegetation associated with land environments (defined by Land Environments of New Zealand at Level IV) that have 20% or less remaining in indigenous cover. Of the Level IV land environments on Mt Dasher Pastoral Lease only N3.1e has less than 20% indigenous vegetation remaining nationally. The main areas where this environment occurs on the lease is in the north eastern portion of the lease on both sides of the access road where there is now little indigenous vegetation remaining.

LENZ Map and table of LENZ units for Mt Dasher PL are attached as Appendix 1. Please note the areas on the LENZ map are approximate only.

2.2 Vegetation

Comrie (1992) suggests the original (pre-human) vegetation of Dansey Ecological District was predominantly podocarp hardwood forest at lower altitudes and tall tussockland and shrubland at higher altitudes. Forest was dominated by mountain totara (*Podocarpus cunninghamii*), matai (*Prumnopitys taxifolia*), rimu (*Dacrydium cupressinum*) and kahikatea (*Dacrycarpus dacrydioides*), over a canopy of lowland ribbonwood (*Plagianthus regius*), broadleaf (*Griselinia littoralis*), kowhai (*Sophora microphylla*) and marbleleaf (*Carpodetus serratus*). McGlone (2001) suggests that the pre-human vegetation of northeast Otago comprised a mosaic of forests with widely spaced podocarp dominants over low variable angiosperm canopies, with extensive scrub and grassland patches. Pinney (1981) notes that in the early days of pastoralism on the Mt Dasher property “there used to be plentiful totara on the hills”.

These vegetation descriptions are broadly similar to those proposed by Leathwick et al. (2003) in their analysis of the Level III Land Environments on the property. Land Environment N3.1, covering the broad-crested ridge at the northern end of the property (4% of the property), is described as originally supporting forest dominated by totara, matai, broadleaf, lowland ribbonwood, narrow-leaved lacebark (*Hoheria angustifolia*) and kowhai. Land Environment Q2.1, covering mid-altitude areas (30% of the property), is also described as originally supporting podocarp hardwood forest, but with additional dominant species (rimu, miro (*Prumnopitys ferruginea*), kahikatea, pokaka (*Elaeocarpus hookerianus*) and tarata (*Pittosporum eugenioides*). Land Environments Q1.1 and Q1.2, covering most higher-altitude areas (64% of the property), are described as originally supporting low forest dominated by mountain totara and toatoa (*Phyllocladus alpinus*). Land Environment Q3.3, covering a small area northeast of Siberia Hill (2% of the property), is described as originally supporting tussockland and cushionfield (Leathwick et al. 2003).

It therefore appears likely that the former vegetation of Mt Dasher Pastoral Lease was podocarp hardwood forest at lower altitudes, mountain totara forest on higher slopes, and scrub, tussockland, cushionfield and boulderfield at higher altitudes. The extent to which forest prevailed in the area prior to human settlement may have been influenced by natural fires (Walker et al. 2003), especially in the west where tussockland and scrub may have occupied formerly forested sites for relatively long periods. In any case, areas above the natural timberline of c. 1000 m (Allen et al. 1988), and particularly areas on the broad high-altitude summits, are likely to have supported extensive tussockland with areas of boulderfield, scrub and cushionfield.

Mt Dasher Pastoral Lease was first inspected for botanical values in 2003. The length of time that has elapsed since that survey, changes to criteria for assessing significant inherent values, and changes in Government policy, have necessitated a reappraisal of the property. This report amalgamates the findings of the previous surveys and reports with that of the most recent survey.

SURVEY METHOD

The most recent survey was carried out on 7-8 December 2010 when approximately 12 hours were spent on the property. Much of the property were accessible via internal 4WD tracks but steep terrain, creek beds, and other areas remote from tracks were surveyed on foot. Descriptions were made of the composition of major plant communities. Threatened plants were

searched for in potentially suitable habitats. Digital photographs were taken of particular species, communities and landscapes to aid in interpretation. Specimens were collected of noteworthy or uncertain taxa for herbarium accession and determination.

VEGETATION DESCRIPTION

Plant Communities

The vegetation of Mt Dasher Pastoral Lease has been investigated in previous surveys. Remnant mixed broadleaf forest in Hectors Creek was surveyed by Bruce (1986) and then by Comrie (1992) as part of the Protected Natural Areas Programme (PNAP). Plant communities on volcanic substrates were surveyed by Allen et al. (1988) and by Comrie (1992). The results of these surveys, including the PNAP plot data, have been included in the vegetation descriptions presented below.

The most extensive indigenous plant community on Mt Dasher Pastoral Lease is tall tussockland, which is present throughout the southern half of the property and ranges in condition from virtually intact to highly modified. Other indigenous plant communities include red tussockland, cushionfield, broadleaved forest, and shrublands associated with boulderfields and stream sides. These plant communities are described below for each main part of the property.

Mount Dasher-Siberia Hill volcanic complex, Half Moon Spur and Upper Deep Creek catchment

This area makes up the southern half of Mt Dasher Pastoral Lease and supports the least modified indigenous vegetation on the property. The area includes three distinct landforms, although tall tussockland forms an almost continuous cover broken only by areas of cushionfield and the volcanic boulderfields of Mount Dasher and Siberia Hill. The volcanic complex in this area was included in RAP 5 Dasher by Comrie (1992). High altitude (above c. 1000 m) plant communities in this area are highly representative of the pre-human vegetation, whereas plant communities at lower altitudes (notably tall tussockland) are mostly induced though retain high naturalness values.

Narrow-leaved snow tussock (*Chionochloa rigida*) is dominant at lower altitudes and on hill slopes while slim snow tussock (*Chionochloa macra*) is more important on ridge crests and at higher altitudes. There are extensive areas where the two species are co-dominant, such as on the volcanic plateau, and in these areas the two species hybridise.

The tussock is generally below one metre tall and ranges in cover from c. 25% in more modified areas or where cushionfield vegetation becomes important on ridge tops, to c. 90% in sheltered areas not affected by burning and grazing. Along the main ridge to Obi and at some higher altitude sites in the upper Deep Creek catchment, slim snow tussockland is particularly heavily grazed. Some slim snow tussocks were observed to be close to senescent along the ridge near Obi. Introduced species such as browntop (*Agrostis capillaris*), sweet vernal (*Anthoxanthum odoratum*), and mouse-ear hawkweed (*Pilosella officinarum*) are well established in some areas,

particularly at ridge-top stock camps and on lower-altitude slopes, but these areas are generally not extensive.

Narrow-leaved tussockland

Narrow-leaved snow tussock is dominant and ranges in cover from c. 40% to c. 90% in these communities. Important species include blue tussock (*Poa colensoi*), fescue tussock (*Festuca novae-zelandiae*), mouse-ear hawkweed, snowberry (*Gaultheria depressa* var. *novae-zelandiae*), sweet vernal, *Pentachondra pumila*, *Raoulia subsericea*, browntop and golden speargrass (*Aciphylla aurea*). Common species include *Ranunculus multiscapus*, red woodrush (*Luzula rufa*), tauhinu (*Ozothamnus vauvilliersii*), various moss (mostly *Polytrichum juniperinum* and *Racomitrium* sp.) and lichen species, mouse-ear chickweed (*Cerastium fontanum*), *Anisotome aromatica*, *A. flexuosa*, *Celmisia gracilentia*, patotara (*Leucopogon fraseri*), *Carex breviculmis*, *Lycopodium fastigiatum*, *L. scariosum*, *Brachyglottis bellidioides*, *Geranium brevicaulis*, bog rush (*Schoenus pauciflorus*), *Helichrysum filicaule*, catsear (*Hypochaeris radicata*), Yorkshire fog (*Holcus lanatus*), *Acaena caesiiglauca*, sheep's sorrel (*Rumex acetosella*), white clover (*Trifolium repens*), inaka (*Dracophyllum rosmarinifolium*) and *Kelleria dieffenbachii*.

Other less-common species recorded include *Stelleria gracilentia*, *Coprosma atropurpurea*, *Anemone tenuicaulis*, *Chaerophyllum colensoi*, *Lagenifera petiolata*, *Pimelea oreophila*, *Pimelea pseudolyallii*, *Acaena inermis*, king devil (*Pilosella praealta*), tussock hawkweed (*Hieracium lepidulum*), *Geranium microphyllum*, *Celmisia lyallii*, *C. haastii*, *C. densiflora*, *C. angustifolia*, *C. sessiliflora*, *Gonocarpus aggregatus*, *Blechnum penna-marina*, *Brachyscome sinclairii*, *Thelymitra* sp., *Gentianella bellidifolia*, *Viola cunninghamii*, *Anaphalioides bellidioides*, *Scleranthus uniflorus*, snow totara (*Podocarpus nivalis*), *Hebe rakaiensis*, *H. odora* and *Plantago lanigera*. Scattered coral broom (*Carmichaelia crassicaulis* subsp. *crassicaulis*) is also present in tall tussockland on the western slopes of Half Moon Spur and in the upper Deep Creek catchment.

Slim snow tussockland

Slim snow tussock is dominant and ranges in cover from c. 25% to c. 80% in these communities. On colluvial slopes, important species include blue tussock, *Kelleria dieffenbachii*, browntop, *Raoulia subsericea*, *Pentachondra pumila*, *Polytrichum juniperinum* and sweet vernal. Common species include *Anisotome flexuosa*, *A. aromatica*, *Geum leiospermum*, snowberry, *Plantago lanigera*, *Helichrysum filicaule*, mouse-ear hawkweed, *Celmisia gracilentia*, catsear, various moss (mostly *Racomitrium* sp.) and lichen species, *Pimelea pseudolyallii*, inaka, *Lycopodium fastigiatum*, tauhinu, golden speargrass, sheep's sorrel, *Raoulia grandiflora*, *Phyllachne colensoi*, *Acaena caesiiglauca*, *Carex breviculmis*, *Ranunculus enysii* and *R. multiscapus*. These species are present at varying densities at different sites. Other species occasionally present include Yorkshire fog, mouse-ear chickweed, *Celmisia densiflora*, *C. haastii*, *C. lyallii*, *C. sessiliflora*, South Island edelweiss (*Leucogenes grandiceps*), *Oreostylidium subulatum*, *Argyrotegium mackayi* and *Ranunculus cheesemani*.

Around rock outcrops and in other rocky areas species recorded include *Aciphylla montana* var. *gracilis*, *Pimelea traversii*, *Gaultheria crassa*, prickly shield fern (*Polystichum vestitum*), *Blechnum penna-marina*, *Acrothamnus colensoi*, *Ourisia caespitosa* and native broom (*Carmichaelia petriei*). On higher altitude broad ridge tops and near flushes, some cushion and

wetland species become important such as bog rush, *Luzula pumila*, *Carex gaudichaudiana*, *Dracophyllum muscoides*, *Scleranthus brockiei*, comb sedge (*Oreobolus pectinatus*), *Coprosma atropurpurea*, *Abrotanella caespitosa*, *Colobanthus buchananii* and *Montia sessiliflora*.

Red tussockland

Small patches of red tussockland are present throughout the more gently sloping areas of the volcanic complex. These patches are dominated by red tussock though some are quite modified by stock trampling and introduced pasture species such as browntop, sweet vernal and white clover. However, other areas of red tussockland are only lightly modified. Indigenous species associated with red tussockland include bog rush, sphagnum moss, rautahi (*Carex coriacea*), *Carex gaudichaudiana*, *Juncus gregiflorus*, *Hydrocotyle novae-zelandiae* var. *montana*, *H. sulcata*, *Viola cunninghamii*, *Geum leiospermum*, *Leptinella pusilla*, *Celmisia haastii*, *Chaerophyllum ramosum* and *Ranunculus glabrifolius*.

Cushionfield and wetland

Cushionfields and associated sedgelands are present on the broad ridge tops, volcanic plateau areas and on Siberia Hill among tall tussockland and red tussockland. Cushionfields are dominated by comb sedge. Common species include *Abrotanella caespitosa*, *Celmisia gracilentia*, *Carex echinata*, *C. gaudichaudiana*, *Phyllachne colensoi* and *Plantago triandra*. Other species present include *Coprosma atropurpurea*, sweet vernal, *Anisotome flexuosa*, *Plantago lanigera*, *Ranunculus ensyii*, *Raoulia grandiflora* and *Argyrotegium mackayi*.

Comrie (1992) also recorded *Luzula leptophylla*, *Carex sinclairii*, *Juncus novae-zelandiae* and *Celmisia alpina* in these communities. The exotic rushes *Juncus effusus* and *J. articulatus* are present in cushionfield-tarn vegetation on Half Moon Ridge. Allen et al. (1988) recorded *Myriophyllum propinquum* in tarns.

Other wetland areas between Mount Dasher and Kattothrust include flushes containing sphagnum moss and sedges (Allen et al. 1988). Bog rush is extensive around the mid slopes of the volcanic complex (Comrie 1992). Stock trampling is evident in many wetland areas.

Shrubland

Areas of shrubland are present alongside lower-altitude streams, around rock outcrops and on the extensive volcanic boulderfields on the slopes of Mount Dasher and Siberia Hill. Dominant shrub species are snow totara, *Coprosma dumosa*, inaka, porcupine shrub (*Melicytus alpinus*) and *Hebe rakaiensis*. Shrub species commonly present include *Olearia bullata*, *Gaultheria crassa*, snowberry, *Pimelea pseudolyallii*, *Hebe buchananii*, *H. pinguifolia*, *Coprosma rugosa*, and *Myrsine nummularia*. Other shrub species occasionally present include *Helichrysum intermedium*, *Pimelea traversii*, *Aristotelia fruticosa*, toatoa (*Phyllocladus alpinus*) and *Brachyglottis cassinioides*.

Common species associated with boulderfields or rock outcrops include golden speargrass, scrub pohuehue (*Muehlenbeckia complexa*), *Celmisia hookeri*, *C. densiflora*, *C. lyallii*, *C. angustifolia*, *Astelia* sp., narrow-leaved snow tussock, blue tussock, South Island edelweiss, *Blechnum penna-*

marina, *Anaphalioides bellidioides*, *Brachyglottis bellidioides* and *Colobanthus acicularis*. A number of other species more typical of tall tussockland communities are also present.

The scattered shrubland present along streams is dominated by matagouri (*Discaria toumatou*), *Coprosma rugosa* and *Olearia bullata*. Other shrub species present are inaka, *Gaultheria crassa*, *Coprosma pseudocuneata*, tauhinu, *Hebe odora*, *H. rakaiensis*, *Coprosma intertexta* X *rugosa* (a range of forms appear to be present), *Coprosma serrulata* and *Helichrysum intermedium*. Also common are wharariki (*Phormium cookianum*), tutu (*Coriaria sarmentosa*) and prickly shield fern.

Scout Hill

A small area of shrubland associated with basalt boulderfields is present above the road on Scout Hill. Dominant shrubs include matagouri, *Coprosma rugosa*, *C. dumosa*, porcupine shrub and native broom. Common species include scrub pohuehue, prickly shield fern, blue tussock, golden speargrass and *Anaphalioides bellidioides*. Other species occasionally present include *Celmisia hookeri*, giant speargrass (*Aciphylla scott-thomsonii*), *Pimelea pseudolyallii*, *Asplenium flabellifolium* and *Chaerophyllum ramosum*. A number of native grassland species are also present at the margins of boulderfields, including *Acaena caesiiglauca*, *Celmisia gracilentia*, patotara, harebell (*Wahlenbergia albomarginata*), *Scleranthus uniflorus*, *Carex breviculmis* and *Geranium brevicaule*. The boulderfield is surrounded by highly modified tall and short tussocklands.

Upper Hectors Creek

The part of Hectors Creek on the property is a steep gully containing remnant broadleaved forest. This forest is highly representative of the pre-human vegetation of the area and was included in RAP 4 Hectors by Comrie (1992).

Dominant species are broadleaf, kowhai, three finger (*Pseudopanax colensoi* var. *ternatus*), cabbage tree (*Cordyline australis*), marbleleaf, kohuhu (*Pittosporum tenuifolium*) and lancewood (*Pseudopanax crassifolius*). Other woody species present include mingimingi (*Coprosma propinqua*), *Myrsine divaricata*, wineberry, *Coprosma linariifolia*, *C. crassifolia*, *C. rotundifolia*, *C. colensoi*, koromiko (*Hebe salicifolia*), native broom, tree nettle (*Urtica ferox*), climbing fuchsia (*Fuchsia perscandens*), tarata and mountain totara. Non-woody species present include *Astelia fragrans*, *Scandia geniculata*, *Rubus cissoides*, *Clematis paniculata* and *C. marata*. Ferns present include kiokio, prickly shield fern, thousand-leaved fern (*Hypolepis millefolium*), hound's tongue fern (*Microsorium pustulatum*), *Blechnum chambersii* and *Asplenium hookerianum*.

Riparian areas and shrublands associated with forest remnants include other species including *Coprosma rugosa*, *Olearia bullata*, *Gaultheria crassa*, toetoe (*Cortaderia richardii*), wharariki, inaka, *Coprosma tayloriae*, tutu, native iris (*Libertia ixioides*), *Asplenium appendiculatum* and *Celmisia hookeri*. The exotic tussock hawkweed is also present.

Most of the other vegetation in this area is moderately modified tall tussockland. Tall tussockland is dominated by narrow-leaved snow tussock with some slim snow tussock and

fescue tussock. Tussocklands are dense on east-facing slopes and include extensive areas of kiokio and wharariki. Tussocklands are more modified on sunnier slopes where the inter-tussock flora is dominated by sweet vernal and browntop. Volcanic boulderfields at the head of Hectors Creek contain plant species typical of the boulderfields described earlier.

Kakanui River South Branch

Small areas of mixed shrubland and tall tussockland are present in the incised valley of the South Branch Kakanui River. One of the more extensive areas is at the confluence of the river and Quinns Creek, and on a dry spur between these two tributaries. This area adjoins remnants of broadleaf forest and *Coprosma*-matagouri shrubland on Balmoral Pastoral Lease. The tussockland is dominated by narrow-leaved snow tussock. Fescue tussock, silver tussock (*Poa cita*), sweet vernal, browntop and a range of native inter-tussock species are present, and mouse-ear hawkweed is common on the crest of the dry spur.

Shrubland and low forest vegetation is dominated by broadleaf, with native broom, koromiko, inaka, matagouri, bush snowberry (*Gaultheria antipoda*), snowberry, mingimingi, porcupine shrub, *Olearia bullata* and *Coprosma rugosa*. Other species present include wharariki, patotara, *Pimelea oreophila*, *Anisotome brevistylis*, tutu, narrow-leaved snow tussock, kiokio, giant speargrass, bracken, prickly shield fern and *Clematis marata*. Also present on the dry spur are *Celmisia hookeri*, golden speargrass, *Gaultheria crassa* and a species of sun orchid. Two native aquatic plants (*Potamogeton* sp. and *Azolla* sp.) were recorded in a section of Quinns Creek.

Similar vegetation extends, in a patchy fashion reflecting past fires, down the length of Kakanui River South Branch. A second more extensive area of forest is present in a particularly steep and gorgy section of the river just south of the confluence of Branch Creek. Several plants uncommon in the District and not seen elsewhere on the lease are present amongst the South Branch Kakanui River riparian vegetation. These include *Teucrium parvifolium*, *Melicytus flexuosus* and *Carmichaelia kirkii*.

Northern part of Mt Dasher Pastoral Lease

The plant communities on the northern part of the property (other than those described above) consist mostly of moderately- to highly-modified tall and short tussocklands dominated by exotic pasture species. In some places the cover of exotic pasture species is complete, while in others scattered shrubs are present in gullies or on rock bluffs. The extent of modification generally increases towards the northern end of the property, on ridge tops and on slopes with a northerly aspect. On slopes with a more southerly aspect and in the middle of the property (particularly Half Moon Spur), there are areas where narrow-leaved snow tussock retains a high cover. However, these areas generally have a highly modified inter-tussock flora consisting mostly of exotic pasture grasses and mouse-ear hawkweed. Some steep rocky slopes and stream sides also retain patches of shrubland but these are generally small and isolated

See Appendix 2 for a full list of plant species.

2.2.1 Significance of Vegetation

Vegetation

The lease lies entirely in the Dansey Ecological District. The Dansey Ecological District was surveyed as part of the Protected Natural Areas Programme (PNAP) during the summer of 1989/90. The resulting report (Comrie 1992) identified parts of two Recommended Areas for Protection (RAPs) on the lease (Dansey RAP 5 Dasher and Dansey RAP 4 Hectors). At least 222 native vascular plant species (see Appendix) have been recorded from the lease.

Threatened and At Risk species

Of the native vascular plant species present 12 are listed as 'At Risk' in the most recent threat classification system listing (de Lange et al. 2009). A list of these species with their threat of extinction status and distribution within Mt Dasher Pastoral Lease is provided below in Table 3.

The New Zealand Threat Classification System provides a tool for assigning a threat status to candidate taxa. Species listed in the super category 'Threatened' are grouped into three categories: 'Nationally Critical', 'Nationally Endangered', and 'Nationally Vulnerable'. Taxa in these three categories are facing a very high risk of extinction in the wild.

The latest revision (Townsend et al. 2008) of the 2002 system includes the addition of the new categories 'Declining', 'Naturally Uncommon', 'Recovering' and 'Relict' within a super category 'At Risk'. Declining taxa do not qualify as 'Threatened' because they are buffered by a large total population size and/or slower decline rate. However, if the declining trends continue, these taxa may be listed as 'Threatened' in the future. The category 'Naturally Uncommon' is adopted to distinguish between biologically scarce and threatened taxa. 'Recovering' allows for threatened taxa whose status is improving through management action and 'Relict' is used to encompass taxa that have experienced very large historic range reductions and now exist as remnant populations that are not considered unduly threatened.

Table 3: Threatened and At Risk plant species found on Mt Dasher Pastoral Lease

Super Category	Threat Category	Species	Location on property
At Risk	Declining	<i>Carmichaelia crassicaulis</i> subsp. <i>crassicaulis</i>	Occasional in tall tussock grassland in the south-western areas of the property.
		<i>Carmichaelia kirkii</i>	Kakanui River South Branch riparian shrubland
		<i>Lobelia ionantha</i>	Red tussockland near Scout Hill
		<i>Melicytus flexuosus</i>	Kakanui River South Branch riparian shrubland

	<i>Teucrium parvifolium</i>	Kakanui River South Branch riparian shrubland and hillslope shrubland
Naturally Uncommon	<i>Aciphylla montana</i> var. <i>gracilis</i>	Rare in volcanic boulderfield
	<i>Anemone tenuicaulis</i>	Occasional in tall tussock grassland
	<i>Celmisia hookeri</i>	Scattered in volcanic boulderfields and occasional on sheltered rock bluffs
	<i>Einadia allanii</i>	Kakanui River South Branch
	<i>Myosotis tenericaulis</i> aff.	Siberia Hill wetland
	<i>Pimelea pseudolyallii</i>	Common in tall tussock grassland and around rock bluffs
Relict	<i>Coprosma intertexta</i>	Scattered in Deep Creek shrublands

In addition, four species that are uncommon in Otago (Regionally Significant) or uncommon in this area but reasonably common in the rest of Otago (Locally Notable) were found (Table 4).

Table 4: Regionally significant and locally notable plants found on Mt Dasher Pastoral Lease

Status	Species	Location on property
Regionally significant	<i>Hebe pinguifolia</i>	Scattered in boulderfield
Locally Notable	<i>Brachyglottis cassinioides</i>	Rare in boulderfield
	<i>Podocarpus nivalis</i>	Scattered in boulderfield
	<i>Phyllocladus alpinus</i>	Small patches on Mount Dasher and Siberia Hill

Rare Ecosystems

Terrestrial ecosystems that were rare before human colonisation of New Zealand often have highly specialised and diverse flora and fauna characterised by endemic and nationally rare species. Rare ecosystems are defined as those having a total extent less than 0.5% (i.e. < 134 000 ha) of New Zealand's total area (268 680 km²). A framework has been developed (Williams et al. 2007) based on descriptors of physical environments that distinguish rare ecosystems from each other and from more common ecosystems. Using this framework 72 rare ecosystems have been defined using pertinent environmental descriptors selected from soil age, parent material, soil chemistry and particle size, landform, drainage regime, disturbance, and climate

On Mt Dasher Pastoral Lease four rare ecosystems were identified, three in the Wetland category (cushionbog, snowbanks, seepages and flushes) and one in Inland and Alpine category (volcanic boulderfields).

2.2.2 Problem Plants

At least 42 exotic species of plants are present on the lease but relatively few are of conservation concern. Introduced plants that may have an important effect on indigenous plant communities on the property, and that can be controlled or contained, are listed and discussed below. Other ubiquitous naturalised species for which containment or control are probably impractical, such as mouse-ear hawkweed and pasture grasses, are not discussed here but are listed in the vegetation descriptions.

Wilding conifers

Scattered wilding conifer trees are present in the upper Deep Creek catchment, and one wilding tree was observed near Mitchells Hut. Most wilding trees in the area appear to have spread from plantations at Naseby Forest (Department of Conservation 1998). These plantations pose an ongoing threat to areas of low-stature vegetation on Mt Dasher Pastoral Lease, including the important high-altitude plant communities. Removal of wilding trees, and regular checks for new infestations, will be required to protect conservation values on the property.

Willow

Isolated willow trees (presumably grey willow) are present alongside Quinns Creek and near Mitchells Hut. Although this species does not appear to be spreading aggressively, it would be prudent to remove these few trees before any spread becomes more extensive.

2.3 Fauna

2.3.1 Herpetofauna

Lizard records are generally scarce from the region, though fauna values of the neighbouring pastoral leases (Shingley Creek and The Dasher) were assessed during January and February 2003 (Department of Conservation, *unpublished reports*). Otago/Southland large gecko and McCann's skink were recorded on Shingley Creek and The Dasher pastoral leases, and green skink was recorded on Shingley Creek Pastoral Lease at a location very close to Mt Dasher PL. Jewelled gecko has been recorded approximately 30 km south of the property on Glencoe Pastoral Lease.

Three species of lizard were observed on Mt Dasher Pastoral Lease during the fauna survey (Table 5). McCann's skinks were recorded on the vehicle track adjacent to shrublands at Quinns Creek. Common skink, McCann's skink and Otago/Southland large gecko were observed in rock outcrops and boulderfields throughout the property.

Table 5 Lizard species recorded from Mt Dasher PL, 2003.

Lizard species (common name)	Scientific name	Known Distribution on Property
Common skink	<i>Oligosoma polychroma</i>	schist outcrops and boulderfields: throughout, valley floor shrublands and wetter areas
McCann's skink	<i>Oligosoma maccanni</i>	schist outcrops and boulderfields: throughout
Otago large gecko	<i>Hoplodactylus aff.</i> <i>maculatus</i> "Otago large"	schist outcrops and boulderfields: throughout

2.3.2 Significance of Herpetofauna

The Otago/Southland large gecko is listed as declining by Hitchmough *et al.* (2008). Examples of this species found on the property are a little more robust-bodied and somewhat genetically divergent from populations in schist tors to the south and west, though this form is likely to be widespread in the Kakanui Range-Mt. Pisgah area (R. Hitchmough, *pers. comm.*). Areas of suitable green skink habitat on the property and the presence of this species nearby on Shingley Creek Pastoral Lease suggest that green skink is likely to be present on Mt Dasher Pastoral Lease.

2.3.3 Avifauna

Bird records are generally scarce from the region, though some bird surveys were undertaken in 1989/90 as part of the PNAP survey of Dansey Ecological District (Comrie, 1992). Additionally, the fauna values of the neighbouring pastoral leases (Shingley Creek and The Dasher) were assessed during January and February 2003 (Department of Conservation, *unpublished reports*).

These surveys recorded New Zealand pipit, New Zealand falcon, paradise shelduck and nesting southern black-backed gull on the flat topped summits of Siberia Hill and Mount Dasher. Silvereeye, bellbird, South Island tomtit, grey warbler, South Island fantail and New Zealand pigeon were recorded in broadleaved forests and shrublands. Hectors Creek was the only location where New Zealand pigeon was recorded during the PNAP survey of the ecological district (Comrie, 1992). Black shag have been recorded on adjoining properties (Comrie, 1992; Department of Conservation, *unpublished reports*, 2003) and are likely to be present on Mt Dasher Pastoral Lease as favourable habitats are present.

Birds observed on Mt Dasher PL are described below for the two main habitats surveyed. A total of 20 bird species were recorded on the property: 11 indigenous species (eight endemic species or sub-species, and three native) and nine introduced species (Table 6).

Forest and Shrubland

Two areas of broadleaved forest and associated shrubland were surveyed, one in Hectors Creek and the other at the confluence of Quinns Creek and the South Branch Kakanui River. Indigenous bird species observed were grey warbler, silvereeye, South Island fantail, bellbird and South Island tomtit.

Tussockland and Rockland

Indigenous bird species observed in these habitats were Australasian harrier, southern black-backed gull, New Zealand pipit, South Island pied oystercatcher, New Zealand falcon and paradise shelduck. New Zealand falcon was recorded at four separate locations, though it is unclear how many individuals are present on the property.

Table 6 Indigenous bird species recorded from Mt Dasher PL.

Bird species (Common name)	Scientific name	Known Distribution on Property
Australasian harrier/kahu	<i>Circus approximans</i>	throughout
bellbird/korimako	<i>Anthornis melanura melanura</i>	forest and shrubland: Hectors Creek
grey warbler/riroriro	<i>Gerygone igata</i>	forest and shrubland: Hectors and Quinns creeks
New Zealand falcon/karearea	<i>Falco novaeseelandiae</i>	open habitats: four locations
New Zealand pipit/pihoihoi	<i>Anthus novaeseelandiae</i>	tussockland, boulderfield and cushionfield: Siberia Hill
paradise shelduck/putakitaki	<i>Tadorna variegata</i>	tussockland, boulderfield and cushionfield: Siberia Hill
silvereeye	<i>Zosterops lateralis lateralis</i>	forest and shrubland: Hectors and Quinns creeks
South Island fantail/piwakawaka	<i>Rhipidura fuliginosa fuliginosa</i>	forest and shrubland: Hectors Creek
South Island pied oystercatcher	<i>Haematopus finschi</i>	tussockland and boulderfield: Siberia Hill
South Island tomtit/miro miro	<i>Petroica macrocephala macrocephala</i>	forest and shrubland: Hectors and Quinns creeks
southern black-backed gull/karoro	<i>Larus dominicanus dominicanus</i>	tussockland, boulderfield and cushionfield: Siberia Hill

2.3.4 Significance of Avifauna

Only one of these species, New Zealand falcon, is classified being “nationally vulnerable” by Miskelly (2008). Two species, the South Island pied oystercatcher and New Zealand pipit are both ranked as “at risk declining”. Though not sighted during the inspection, the previous recording of New Zealand Pigeon is significant as, the location of this recording represents a distributional limit for this species in Otago.

2.3.5 Aquatic Fauna

Mt Dasher Pastoral Lease covers several upper tributaries of the Kakanui River, including upper Hectors Creek, Quinns Creek, the headwaters of Deep Creek and the headwaters of the South Branch Kakanui River. Hectors Creek flows into the Kauru River, Quinns Creek flows into the South Branch Kakanui River, and Deep Creek flows into the North Branch Kakanui River. All eventually flow into the main Kakanui River. A distinguishing feature of these rivers is the lack of dams, which has two major effects on the fish communities. The first is that the fish communities are more likely to have diadromous species present (species with a marine phase in their lifecycle). The second effect is that fish are able to migrate between streams, allowing colonisation of previously dewatered streams.

The New Zealand Freshwater Fish Database has (at 8th January 2004) 79 records from the Kakanui River (McDowall and Richardson, 1983). Species recorded from the tributaries near Mt Dasher Pastoral Lease include Canterbury galaxias (Not threatened), longfin eel (At risk declining), upland bully (Not threatened) and brown trout. The threatened lowland longjaw galaxias (Threatened-nationally critical) has been recorded in the Kauru River, an eastern tributary of the Kakanui River. Six different freshwater habitats are present on the property. These are classified by water source and the surrounding vegetation types. These habitats and the fish species observed are described below.

Ephemeral Pools and Tarns

Ephemeral pools and tarns are present on some ridges, particularly around Siberia Hill and along Half Moon Spur. Most are in tussockland or pasture, although some are bounded by seepage areas with mossfield. All are accessible to stock and many were affected by such stock access, though access may be restricted by snow during winter. Ephemeral pools and tarns on the property are all smaller than 20 m², but are often surrounded by up to 100 m² of wet seepage area. No fish were found during surveys of these habitats, and fish are not expected to be present as the ponds dry out regularly and are not connected to any other water sources.

Ephemeral Streams

Ephemeral streams are present on ridges, particularly around Siberia Hill. Most flow through tussockland or pasture, with some bulldozed and excavated areas where they are crossed by the main vehicle track. All are accessible to stock. These streams generally flow into the substrate at boulder fields, often where several ephemeral streams converge. The ephemeral streams are smaller than one metre wide - often much smaller - and generally less than 100 mm deep. No

fish were found at the one site where this habitat was surveyed, and the stream appeared to be in the late stages of drying up.

Small Open Streams

Small open streams are common on the property, comprising the majority of streams in each catchment. Most flow through tussockland or pasture, though woody vegetation is also present along some stream margins, and some are crossed by vehicle tracks. All are accessible to stock, though access may be restricted by snow during winter. Small open streams are all less than three metres wide, and less than one metre wide in some locations, with an average depth of approximately 150 mm. This habitat was surveyed at one site, and low numbers of Canterbury galaxias found.

Small Gorgy Streams

Small gorgy streams are present in most catchments, usually as small gorges near the headwaters of the tributaries or in the lower sections of the catchments. Most flow through tussockland or pasture, except upper Hectors Creek which flows through broadleaved forest. All except the steeper gorged parts of this habitat are accessible to stock. Small gorgy streams are all less than two metres wide and between 100 mm and 500 mm deep. This habitat was surveyed at two sites and no fish were found. The lower reaches of this habitat may be used occasionally by longfin eel.

Large Streams

Large streams are present in the lower reaches of the catchments on the property. Most flow through tussockland or pasture, though areas of scrub or regenerating forest are present alongside these streams at some locations. All are accessible to stock, and some are crossed by vehicle tracks. Large streams are up to five metres wide and have an average depth of approximately 500 mm, with pools up to two metres deep in places. This habitat was surveyed at three sites. Canterbury galaxias were observed at all three sites and longfin eel observed at one site. It is likely that longfin eels are more widely present in this habitat than indicated by the survey results.

Rivers

River habitats are present in the South Branch Kakanui River and the lower parts of Quinns Creek. Most parts of these rivers flow through scrub or regenerating broadleaved forest, with some areas of tussockland or pasture. All are accessible to stock, though access is restricted in places by riparian vegetation. The South Branch Kakanui River is approximately 11 metres wide, and Quinns Creek approximately five metres wide. Both rivers have an average depth of approximately 200 mm. This habitat was surveyed at two sites. Canterbury galaxias and upland bully were found at both sites, and brown trout observed in Quinns Creek. Longfin eels are also expected to use this habitat and, given the similarity of the sites, brown trout are expected to occur in the South Branch Kakanui River.

Table 7 Fish species recorded from Mt Dasher Pastoral Lease

Fish species (common name)	Scientific name	Known Distribution on Property
brown trout	<i>Salmo trutta</i>	South Branch Kakanui River
Canterbury galaxias (Not threatened)	<i>Galaxias vulgaris</i>	throughout, except in ephemeral systems on ridges
longfin eel (At risk-declining)	<i>Anguilla dieffenbachii</i>	Quinns Creek
upland bully (Not threatened)	<i>Gobiomorphus breviceps</i>	South Branch Kakanui River and Quinns Creek

2.3.6 Significance of Aquatic Fauna

One species, the native longfin eel, is ranked as “at risk declining” (Allibone *et al* 2010). The Kakanui and Hectors Creek catchments on the property contribute to the flow regime, water quantity and water quality for a population of the threatened (nationally critical) lowland longjaw galaxias that is present in reaches downstream.

2.3.7 Problem Animals

Introduced animals that may have an important effect on indigenous plant or animal communities on the property, and that can be controlled or contained, are listed and discussed below. Other ubiquitous naturalised species for which containment or control are probably impractical (such as rodents and mustelids), or domesticated animals that are grazed on the property, are not discussed here.

Feral pig

Pig rooting was observed in most areas of tussockland visited on the property and in areas of cushionfield on the volcanic plateau and Half Moon Spur. Control of pigs will be required to protect conservation values on the property.

Brush-tail possum

Possum droppings were observed at all sites on the property that were surveyed for lizards, and in areas of shrubland and forest. Possums are known predators of lizards. Control of possums will be required to protect conservation values.

Rabbit and Hare

Rabbits and hares were observed on the property. Control of these species may be required to protect conservation values.

2.4 Historic

Mitchell's Hut and Half Moon Hut were identified in the original Conservation Resources Report as having historic value as early musterer's huts. It was not confirmed when these two huts were constructed as the earliest SO Plan to show both huts is dated 1916 (SO 704: QuickMap Landonline). The following details further historic information gathered from the recent field inspection, historic records and surveys.

Historic records and Previous Archaeological Surveys

Pre-contact Maori Sites

No sites of Maori origin are recorded on the lease.

Pastoral Farming

The area from the Waianakarua to the Kakanui, run 12 Otepopo was first taken up by Charles Suisted in 1852 (Sinclair 1981: 179-181). Peter Bristow's (2004) report notes The Dasher run was taken up by businessman Edward McGlashan in 1858. After the first German war, 1919, The Dasher was cut into two with the northern portion, run 571 of 17,628 acres, drawn by Robert Spencer Mitchell. Robert Mitchell had been trained at Otekaieke and his mother was an Orr of Station Peak. The lease was named Black Rock prior to Mt Dasher (Pinney 1981: 69). Mitchell occupied the lease until 1953. John Wardell held Mt Dasher until 1992 when the property passed to Wayne Sim the present lessee (DOC 2005: 21). Further details are provided in Appendix 5.

Peter Bristow (2004) had noted there were no known significant historic sites recorded on the lease. The NZAA ArchSite database confirms no archaeological/historic sites are recorded on the Mt Dasher lease.

SURVEY METHOD

In order to provide value judgements on the historic heritage within the Mt Dasher Pastoral Lease more data on the archaeological evidence remaining in the landscape was required. Historic records provided some information on the identification of areas of archaeological/historic interest (Briden 2010). The majority of the key sites were inspected on 7th December 2010 by field archaeologist Shar Briden and Tony Perrett, High Country Tenure Review Manager, Department of Conservation. Brian Allingham, archaeologist for iwi Ngai Tahu, took part in the field inspection. Half Moon hut (I41/132) and Trig B (I42/144) were not field inspected due to time limitations and difficulty of access.

GPS waypoint coordinates were taken to locate archaeological/historic features which are depicted in Appendix 3 - Figure 1. A list of waypoint coordinates will be held in the Otago Conservancy's historic database.

HISTORIC HERITAGE DESCRIPTION

The archaeological/historic features include hut sites, stock yards, fence lines, dog kennels, tracks, cairns, trig stations, and associated site artefacts (Table 8). The Trig station sites (I41/130, I41/131, I42/143, I42/144) are pre-1900. The musterer's huts, Mitchell's hut (I42/142), Half Moon hut (I41/132), and the original Scout hut (I41/133), do not have confirmed construction dates so cannot state they are pre-1900. The earliest SO plans to show the hut's are dated July 1916 (SO 702 and 704) prior to the break up of The Dasher run in 1919. This suggests the huts were constructed by Edward McGlashan between 1858 and 1916 or new huts were re-built by Robert Mitchell on the same, or close by, the original sites.

Table 8. Significant historic features and sites inspected during a 2010 field survey of the Mt Dasher PL.

NZAA sites	Description	GPS ID Numbers	Plates
I41/133	Scout hut	1	6-7
I41/133	dog kennels Scout hut	36	8
I41/133	fence posts or lines	2, 37-39	9, 21
	cairn	3	13
I42/142	Mitchells hut	10	1-3, 15-18
I42/142	dog kennels Mitchell's hut	12	4
	bridge	6	20
I42/142	snowline fence posts	11, 13-20	5
I42/142	yard posts	21-30	19
I42/142	track	33	
	cairn	34	14
I41/130	Trig S	4	11
I41/131	Trig N	40	10
I42/143	Trig C	41	12

Note: Trig station 'B' Obi (NZAA I42/144) and Half Moon hut (I41/132) were not field inspected during the survey.

Pre-contact Maori Sites

The Mt Dasher Cultural Values Report (2004: 5) notes a pathway for people travelling from Waianakarua up on to Cayenne Spur and through the southern extent of the lease. Basalt from the volcanic boulder fields on the lease, Siberia Hill, Mt Dasher, Kattothrust, and Obi, may have been utilised by Maori although no flaking activity areas were recorded during the survey. Marine sandstone and mudstone (argillite) lie between the semi-schist base and basalt at Siberia Hill (Forsyth 2001: cited in The Conservation Resources Report 2005: 11). Slate may be present on the lease although there are no records of such.

Pastoral Farming (Appendix 3 - Figure 1)

Three musterer's huts with stock yards were noted on the lease (Briden 2010) prior to the survey (SO 702 and 704 dated July 1916: QuickMap Landonline), Mitchell's hut, Half Moon hut, and a hut north-west of Scout Hill. Two of the musterer's huts were inspected, Mitchell's hut and the relatively new hut at Scout Hill.

Mitchell's Hut and stock yards (I42/142)(Appendix 3 - Figure 2)

Mitchell's hut is located on the southern boundary east of Siberia Hill (at GPS 10) at the southern extent of Mole Hill Road. The hut is a corrugated clad building measuring 7.4 x 3.2m with a lean to attached (Plate 1). Part of an Orion stove, a few glass bottles, a chimney flue, and a few tin cans lie outside the back wall of the hut.

A Triumph maker's mark is noted on the underside of the corrugated roof (Plate 2). No details are available on this brand. A loose sheet of corrugated iron lying in the wood shed held a red printed Lysaght Orb brand (Plate 3). This brand is a less ductile type manufactured from 1932 (Miles Lewis Corrugated Iron Gazetteer: 23).

A total of 22 dog kennels are located south and southwest of the hut (Plate 4). The kennels are 40 gallon drums with some of the drum lids still attached and bent back to provide more shelter. A further three kennel sites are marked by flat standards without drums.

Stock yards are located about 1 km northwest of Mitchell's hut on Grassy Ridge (Plate 5). The yards were located by following the snow line fence from Mitchell's hut outlined on SO 704. Some of the original fence posts of the yards are still standing 'in situ' although the majority of the strung wire has been removed. The posts have been bored with 6 holes.

Some of the posts of the snow line fence remain 'in situ'. The posts were not noted past the stock yards and may have been removed. SO 704 shows the snow line fence continuing past the yards to another set of yards on Half Moon Spur, north-east of Half Moon hut. The fence originally ran through to Deep Creek.

Scout Hill hut and yards (I41/133)(Appendix 3 - Figure 3)

The present Scout Hill hut and stock yards are modern replacements for the 19th century structures located about 1.3 km northwest of Scout Hill (Plates 6-7). The SO plan (SO 702 QuickMap Landonline) shows the original hut to the east of the early stock yards and north of the head of a tributary of Mole Hill Creek. No evidence of the hut site was located possibly due to an airstrip and building having been placed over the area. Four dog kennels are located below Mole Hill Road (Plate 8). The modern stock yards are about 70 m southwest of the hut and are protected by a shelter belt of pine and Douglas fir trees.

Half Moon hut (I41/132)

The Half Moon hut site and stock yards were noted on SO 702 by following the snow line fence to Half Moon Spur. The Conservation Resources Report (2005: 25) notes the hut as a small two roomed corrugated iron clad hut with a concrete floor and tongue and groove timber lining. The

hut is noted as being in good condition. Google Maps (Appendix 5) provides an overview of the site.

Fence lines (Appendix 3 - Figure 3)

Elements of the 19th century eastern boundary fence line (SO 696 dated 1882) remain 'in situ' alongside Trig 'S' at Scout Hill (GPS 003, Plate 9). The fence line consists of wood posts, 6 hole bored, and flat standards with barbed wire strung along the top.

Elements of a 19th century fence line were recorded at the Scout Hill stock yards. Metal flat standards appear to have been re-used in the modern holding paddock. This fence line correlates to either a snowline fence or a boundary fence line (SO 696 dated 1882) running east/west between Mole Hill Creek and Deep Creek.

Trig stations (Appendix 3 - Figures 1-3)

Four 19th century Trig stations were noted on the lease, Trig 'N' (I41/131) north of Scout Hill (Plate 10), Trig 'S' (I41/130) Scout Hill (Plate 11), Trig 'C' (I42/143) Siberia Hill (Plate 12), and Trig 'B' Obi (I42/144). Three of the trigs are located on the boundary of the lease, Trig's 'B', 'C' and 'S' (SO 696 dated May 1882, SO 1842 dated May 1882). Only three of the trigs were field inspected, 'C', 'N' and 'S'. Information on establishment dates and the surveyor's who erected these Trig stations has been sourced from the LINZ Geodetic database. Further details are noted in Appendix 5.

Other features (Appendix 3 - Figures 1-2)

Three stacked basalt cairns were recorded on the lease, one at Trig 'C' Siberia Hill (Plate 12), the second below Trig 'S' Scout Hill (Plate 13), and the third above Mitchell's hut (Plate 14). The cairn cited by Trig 'C' on Siberia Hill has the name of JAMES WING welded onto the horizontal arm of the embedded metal cross. The current lessee, Wayne Sim, mentioned that Mitchell's ashes were laid to rest within a cairn located on Siberia Hill. The cairn is probably that noted overlooking Mitchell's hut and stock yards.

A fourth cairn was noted on SO 702 alongside the early fence line west of the Scout Hill stock yards. This feature was not inspected.

No gold mining features or sites were recorded on the lease during the survey.

2.4.1 Significance of Historic

The above review of the history and archaeological sites recorded during the Tenure Review field survey of the Mt Dasher PL illustrate some of the history of this PL. Of most historic significance on the Mt Dasher PL are sites and features related to early pastoral history of the run. These include the musterer's huts, Mitchell's hut, Half Moon hut, the site of Scout hut, and associated stock yards, dog kennels, and fence lines including snow fence lines. Notable people involved in the running of the property include Charles Suisted and Edward McGlashan, an Otago entrepreneur.

The 19th century surveyor Trig stations are significant features that enabled subdivision of early pastoral runs. The stacked basalt cairns serve as remembrance of the significance the land held for those whose ashes lay within.

PART 3

OTHER RELEVANT MATTERS & PLANS

3.1 Consultation

A meeting with NGO's was held in Alexandra on 21 September 2010 and a further meeting on 19 April 2011.

Several NGO's made a field visit of the property on 10 February 2011 and a summary of their recommendations from reports received is outlined below. A copy of the full reports is attached as Appendix 5

Summary of NGO recommendations:

Royal Forest and Bird Protection Society of New Zealand Inc

Central Otago-Lakes Branch

- Three back blocks (Trig C, Trig B and Mt Dasher) should be retained in full crown ownership.
- RAP 4 in Hectors Block can be protected by covenant.
- Easement should be secured for Dunrobin Water Supply Inc.
- Agree if full crown ownership over QEII covenant results from tenure review then QEII could be revoked.
- Marginal strips laid off where applicable.

Royal Forest and Bird Protection Society of New Zealand Inc

Dunedin Branch

- Land above 1,000m, including RAP5 and all of Trig C, Trig B and Mt Dasher Blocks become a Conservation Area.
- Three areas covered by RAP 4 in Hectors Creek should be included in a conservation covenant.
- 4WD access for the public to Scout Hill at the discretion of the Lessee and that non-motorised access be available along the existing track to Mitchells Hut and beyond to the back boundary of proposed conservation area.
- That the rest of the lease be considered for freeholding.

Central Otago Recreational Users Forum (CORUF)

- Three back blocks (Trig C, Trig B and Mt Dasher) should be retained in full crown ownership.
- Hectors Plateau geological area is a significant landscape feature.
- RAP 4 in Hectors Block can be protected by covenant.
- Agree if full crown ownership over QEII covenant results from tenure review then QEII could be revoked.
- Biking, walking, horse riding and hunting access should be included in any proposal, which allows for "cross-range" and "length of the range" routes.

- Retention of accommodation huts as part of public access provisions.

Otago Conservation Board

- Pockets of relict native vegetation remaining on the valley bottoms could be considered for protection.
- Southern block and blocks currently covered by the QEII covenant should become reserve.
- Public vehicular access along main farm track to boundary of QEII covenant boundary.
- Recreational hunting access should be encouraged and fostered in any future DOC management of the area.

Alan Mark, Department of Botany, University of Otago

- Covenant of RAP 4 – Hectors catchment forest remnants.
- The three top blocks, being the higher country to southwest of the property, including the land currently covered by the QEII covenant, should be destocked and retained in full Crown ownership.
- Public access, walking, mountain bike and horse, should be formalised to the boundary of any public conservation land as an aspect of the tenure review.

Federated Mountain Clubs

- Potential as well as actual recreational use of the Kakanui Mountains should be considered as part of this review.
- Land below 1,000m is capable of being managed in a way that is ecologically sustainable so could be suitable for freehold disposal.
- Secure public access to the Hectors Plateau needs to be negotiated and confirmed through tenure review.
- A public access easement creating a round trip for trampers beginning and ending at Scout Hut, including Half Moon Spur, Mt Dasher, Kattothrust and Siberia Hill should be considered.
- Hectors Plateau and all of RAP 5 should be retained in full crown ownership.
- Strongly recommend that the outcomes of tenure review include secure landscape protection over Hectors Plateau.
- The entire area south and west of the line from Mitchells Hut to Half Moon Hut should be retained in full crown ownership.
- Both Half Moon Hut and Mitchells Hut should be situated on new conservation land, and be available for public use.

3.2 Regional Policy Statements & Plans

Regional Policy Statement

The Regional Policy Statement for Otago provides a policy framework for all of Otago's significant regional resource management issues. It does not contain rules. District Plans shall not be inconsistent with the Regional Policy Statement. In respect of natural values the Regional Policy Statement includes the following policy and method statement:

- Policy:** To maintain and where practicable enhance the diversity of Otago's significant vegetation and significant habitats of indigenous fauna, trout and salmon.
- Method:** Identify and protect Otago's significant indigenous vegetation and significant indigenous habitat of indigenous fauna, trout and salmon, in consultation with relevant agencies and with Otago's communities.

In respect of landscape and natural features it includes the following policy and method statement.

- Policy:** To recognise and provide for the protection of Otago's outstanding natural features and landscapes.
- Method:** Prepare in conjunction with relevant agencies and in consultation with the community and affected landowners, an inventory of outstanding features and landscapes that are regionally significant.

Regional Plans

The whole PL is subject to the *Otago Regional Plan Water* rule which requires resource consent for suction dredge mining.

3.3 District Plan

The majority of the property is within the Rural Scenic zone of the Waitaki District Plan, with the area to the immediate west of Mole Hill Road being within the Rural General zone. Under the partially operative Waitaki District Plan resource consents are required for the following activities:

- Earthworks greater than 100m³ in both the Rural General and Scenic Zones
- Irrespective of zone forestry and shelter belts, earthworks, buildings, clearance of indigenous vegetation within 20m of a water body or above 900m.
- Forestry and shelter belts, earthworks and buildings within the Rural Scenic Zone.
- Clearance of specified areas/types of indigenous vegetation, irrespective of zone.

Note however the indigenous vegetation clearance provisions do not apply to land freeholded via tenure review or to areas protected via a QE2 Covenant if the covenant provides for such clearance.

There are no registered archaeological sites, nor any provisions of the Otago Regional Council Regional Plan: Water for Otago which apply to the property. Therefore protection via the RMA is limited to the controls set out above.

3.4 Protecting Our Places

In April 2007 the Ministry for the Environment produced a new policy document titled 'Protecting Our Places' which was jointly launched by the Minister of Conservation and the Minister for the Environment. This publication introduces four national priorities for protecting

rare and threatened native biodiversity on private land. The national priorities identify the types of ecosystems and habitats most in need of protection.

The policy statement supports the government's pledge to maintain and preserve New Zealand's natural heritage. This began in 1992 when New Zealand signed the United Nations Convention on Biodiversity; followed in 2000 with the release of the New Zealand Biodiversity Strategy.

The four national priorities for biodiversity protection are listed below. They are based on the most up to date scientific research available.

National Priority 1:

To protect indigenous vegetation associated with land environments, (defined by Land Environments of New Zealand at Level IV), that have 20 percent or less remaining in indigenous cover.

National Priority 2:

To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.

National Priority 3:

To protect indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2.

National Priority 4:

To protect habitats of acutely and chronically threatened indigenous species.

These national priorities have relevance beyond conservation initiatives on private land. For example they are used to help assess applications for grants under the government funded Community Conservation Fund which funds conservation projects on public land by community groups.

The national priorities also provide a useful measure for assessing tenure review recommendations and outcomes.

National priority 1 in "Protecting our Places" (MfE 2007) is to protect indigenous vegetation associated with land environments (defined by Land Environments of New Zealand at Level IV) that have 20% or less remaining in indigenous cover. Of the Level IV land environments on Mt Dasher Pastoral Lease only N3.1e has less than 20% indigenous vegetation remaining nationally. The main areas where this environment occurs on the lease is in the north eastern portion of the lease on both sides of the access road where there is now little indigenous vegetation remaining.

3.5 Ecological Sustainability and Carbon Storage

The Land Use Capability (LUC) system is a nationally consistent land classification system based on physical sustainability that has been used in New Zealand to help achieve sustainable land development and management since 1952. The LUC system has two key components.

Firstly, Land Resource Inventory (LRI) is compiled as an assessment of physical factors considered to be critical for long-term land use and management. Secondly, the inventory is used for LUC classification, whereby land is categorised into eight classes according to its long-term capability to sustain one or more productive uses (Lynn et al. 2009).

Analysis of LUC for The Dasher Pastoral Lease reveals that the uplands around the three assumed eruptive centres of Mt Dasher, Siberia Hill and Mt Kattothrust fall into class 7 land. This land has severe physical limitations and consequently it is high risk land requiring active management to achieve sustainable production (Lynn et al. 2009). This class has a subclass 'e' which indicates that erodibility is the main kinds of physical limitation or hazard to use that have been identified. The remainder of the lease is classified as class 6 (with pockets of class 7) indicating low suitability for pastoral grazing or production forestry but with less severe limitations than class 7. This class also has a subclass 'e' indicating erosion limitations.

Much of the existing tussockland and shrubland has potential for further carbon sequestration. The full potential of lower altitude tussocklands to increase in density and stature and ultimately to succeed to indigenous woody cover, is currently retarded by stock grazing. The succession of montane shrublands to forest is also limited by stock grazing, shrubland clearance and very limited seed sources.

The snow and red tussock covered upper slopes of the volcanic uplands play an important role in the provision and regulation of water for a variety of downstream uses including the Dunrobin Water Scheme.

The PL contributes to a number of "ecosystem services". Constanza *et al.* (1997) define ecosystem services as flows of materials, energy, and information from natural capital stocks which combine with manufactured and human capital services to produce human welfare. They identify 17 "services". This PL clearly contributes to some of these services excluding those of a recreation and cultural nature which were covered in the original Conservation Resources Report.

Hydrological Services

i) Limiting Flood Runoff

Fahey and Jackson (1991a) note that bogs are important water-holding areas for the headwaters of many streams. They help reduce flood peaks and sustain flows. Also important are the shallow unconfined aquifers holding ground water on the colluvium mantled slopes; thereby damping environmental fluctuation from floods and droughts.

ii) Water Yield

High altitude tussock grassland areas are known to yield unusually high proportions of precipitation as runoff, therefore play a significant role in determining catchment flows, snow-tussock catchments have less variable flows than degraded (burnt) tussock, oversown tussock or improved pasture; flows are steadier on a monthly basis and are less variable in the summer-autumn period; and to maximise water yield it is necessary to maintain tall, unmodified tussock vegetation over the headwater catchments. This is best achieved by completely destocking these areas, preventing fires of any kind and controlling wilding pine tree growth.

Studies have found that modification of snow tussocks by clipping or burning will reduce water yield (Mark & Rowley 1976), with the greatest decreases in catchment summer runoff being measured in the first two years following burning (Duncan and Thomas 2004). It can be implied from this and other studies that if burning and grazing persist, then so will reductions in water yield.

Fahey and Jackson (1991b) estimate that in Deep Creek and Deep Stream, which form part of the Dunedin water supply, restoration of tussock cover to nil depletion could lead to water yield increases in the order of 42%-52% at the water intakes for the three summer months in dry years. These catchments now lie within Te Papanui Conservation Park and continue to provide water to Dunedin City.

Change in land use can reduce water yield from snow tussock catchments. Fahey and Watson (1991) assessed the impact of afforestation of tussocklands in the Glendhu catchments near Lawrence on water yield and stream flow. They found that establishing pine forest reduced annual runoff by 20% in comparison to an adjacent lightly grazed tussock catchment. A longer running study in the same area found that as plantations mature, interception of rainfall increased to 31% and were expected to increase further (Fahey 2004). Interception rates are particularly high where rain falls as many small events, as is the case on the Kakanui Mountains (Waugh 2005). Fahey (2004) found that in the 13 years from canopy closure in 1991 to 2003, the annual reduction in runoff has averaged 252 mm or 31% less than the tussock catchment. Reduction in water yield reduces hydro capacity year round and in summer, impacts on the demand for water for irrigation and recreation.

Duncan and Thomas (2004) found that catchments with depleted tussock cover yielded lower water flows. Fahey and Jackson (1991b) attribute this in part to the higher transpiration rates from exotic pasture species.

iii) Sustaining low river flows in summer

Snow tussock catchments have less variable flows than degraded (burnt) tussock, oversown tussock or improved pasture, hence contributing to sustaining low river flows in summer.

Fitzharris (1979) notes that the accumulation of snow into drifts is largely controlled by micro relief in the landscape. He also notes that the presence of snow tussocks assists in the accumulation of drifts or a more widespread snow pack. The annual snowmelt helps to recharge the shallow regolith storage and thereby ensures sustained base flow over the summer. With less cover or bare ground, freshly fallen snow tends to be blown away by the strong winds which sweep across the uplands, leaving only the frozen bare soil or ice coated rocks. (Waugh 2005). Major snow drifts may still be releasing melt-water into early summer.

Low river flows are also affected by afforestation, by as much as 22% lower on average than those from the tussock catchment (Fahey 2004).

Fahey and Jackson (1991a) note “evaporation from tussock grasslands has important implications for water resource management. The strong physiological control of transpiration by tall tussock produces low rates of water use in summer and contributes to the well sustained stream flow”.

Erosion Control and Sediment Retention

Snow tussock catchments monitored for sediment yield studies were shown to have very low sediment yields by New Zealand standards (Waugh 2005).

Nutrient Cycling Storage, Internal Cycling, Processing and Acquisition of Nutrients (nitrogen fixation, N, P and other elemental or nutrient cycles)

Studies have shown that tussock covered catchments yield very good water quality (ORC 1999) characterised by:

- Cool water temperatures
- High levels of dissolved oxygen
- Approximately neutral pH values
- Low conductivities
- Low total nitrogen levels
- Low NH₄ + NH₃ levels
- Low total phosphorous levels
- Low turbidity
- Low faecal coliform levels

MCI (Macro-invertebrate Community Index) values also recorded by ORC indicate water quality and good habitat condition.

Carbon Storage and Climate Regulation

While storage and regulation of water flow are much more significant ecosystem services on the Lease, carbon storage in regenerating shrublands, forest and tall tussocklands makes a modest contribution to ameliorating the current anthropogenic induced rise in atmospheric carbon dioxide levels.

Carbon storage varies depending on the vegetation cover present (Table 9).

Table 9: Carbon stock estimates for broad vegetation cover classes in the Vegetation Cover Map (VCM) found on the Lease, derived from Tate et al. (1997) with estimates for forest classes used in this study, as derived from Hall et al. (2001). (Source: Carswell et al. 2008)

Vegetation class	Carbon (t ha⁻¹)
Unimproved pasture	2.1
Snow-tussock grassland	27.2

Mixed indigenous scrub	99.4
Manuka/kanuka scrub or fern	50.5
Beech forest & scrub	179.8
Wetland communities	31.5

3.5.1 Economic Benefits of Water from Mt Dasher Lease

The Dunrobin Rural Water Supply Scheme has its intake near Siberia Hill. It provides a reliable and consistent domestic and stock water supply for up to 23 downland farms.

Summary

While the information presented above make for a compelling account of the estimated value/contribution of ecosystem services derived from the Lease, it is difficult to quantify the impact of current pastoral practices on these values. However it is known that low summer flows could quite quickly increase if stocking and burning were to cease (Waugh 2005). Improvements over and above this initial response would likely be slow. Similarly, declines in water yield or an alteration to the temporal nature of water yield will likely be gradual under the current management regime.

There may be some additional concerns and costs relating to fire management arising from fuel management.

3.6 Qualifying Waterways

A survey of the waterways on the PL was undertaken in January 2007 by TL Survey Services Limited.

The following waterways qualify;

The South Branch Kakanui River, Deep Creek, Quinns Creek and Hectors Creek all qualify and will be subject to Section 24 of the Conservation Act 1987 upon disposition.

A copy of the report by TL Survey Services Limited is attached as Appendix 7.

PART 4

ATTACHMENTS

4.1 Additional Information

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4.2 Maps

4.2.1 Topographic and Cadastral

4.2.2 Values – Ecological and Historic

Maps are attached before the appendices.

4.3 Photographs

Attached before appendices.

4.4 NGOs Comments

Written submissions were received from

- Federated Mountain Clubs
- Central Otago-Lakes Branch of Royal Forest and Bird Protection Society
- Dunedin Branch of Royal Forest and Bird Protection Society
- Otago Conservation Board
- Central Otago Recreational Users Forum (CORUF)
- Alan Mark, Department of Botany, University of Otago

4.5 Appendices

Appendix 1: LENZ Level IV Map

Appendix 2: Full List of Vascular Plant Species

Appendix 3: Figure 1-3 - Historic Resources plans

Appendix 4: Historic Photos – Plates 1-14

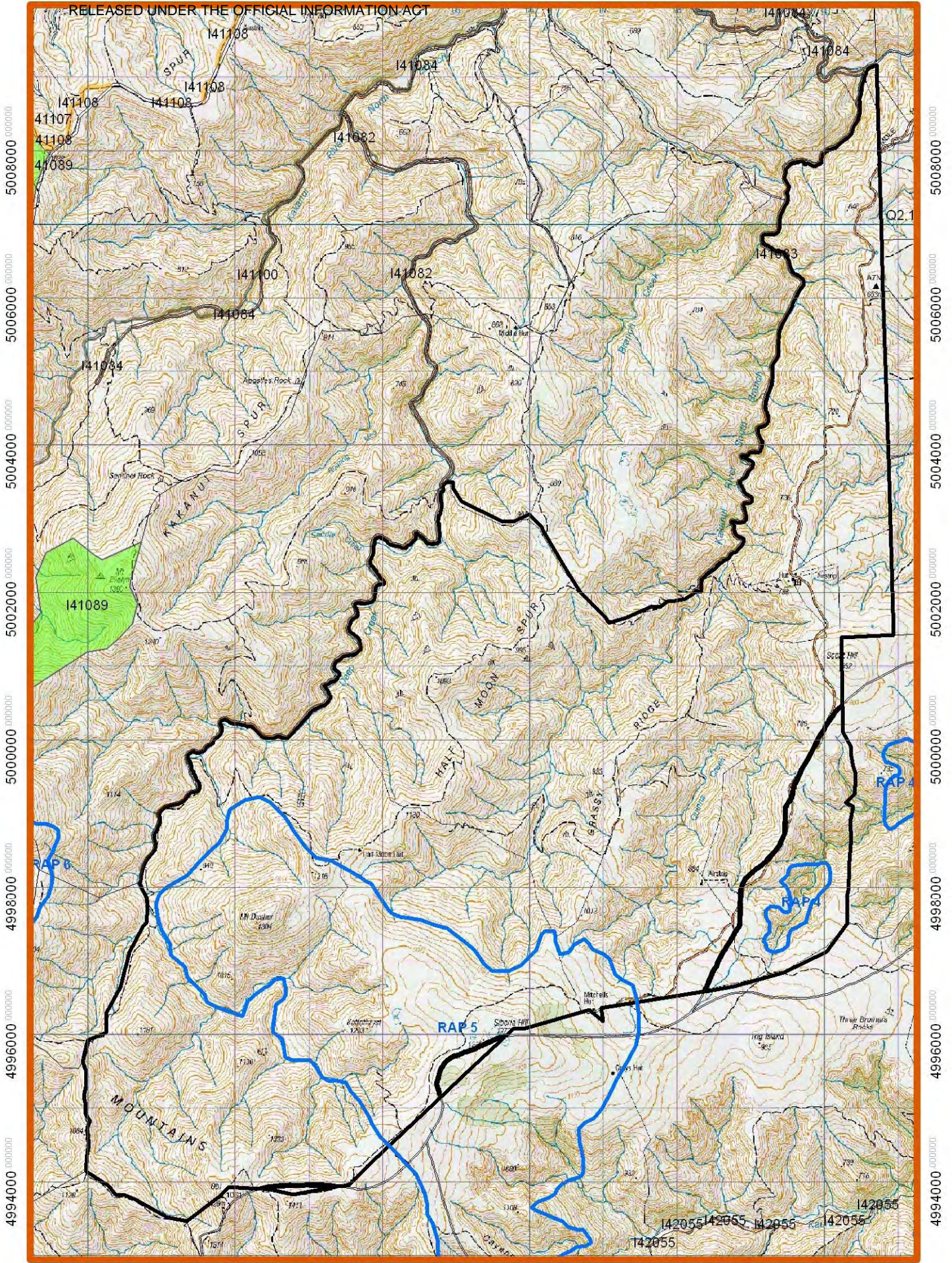
Appendix 5: Further Historic details and plates 15-21

Appendix 6: NGO Reports

Appendix 7: Qualifying Waterways Report

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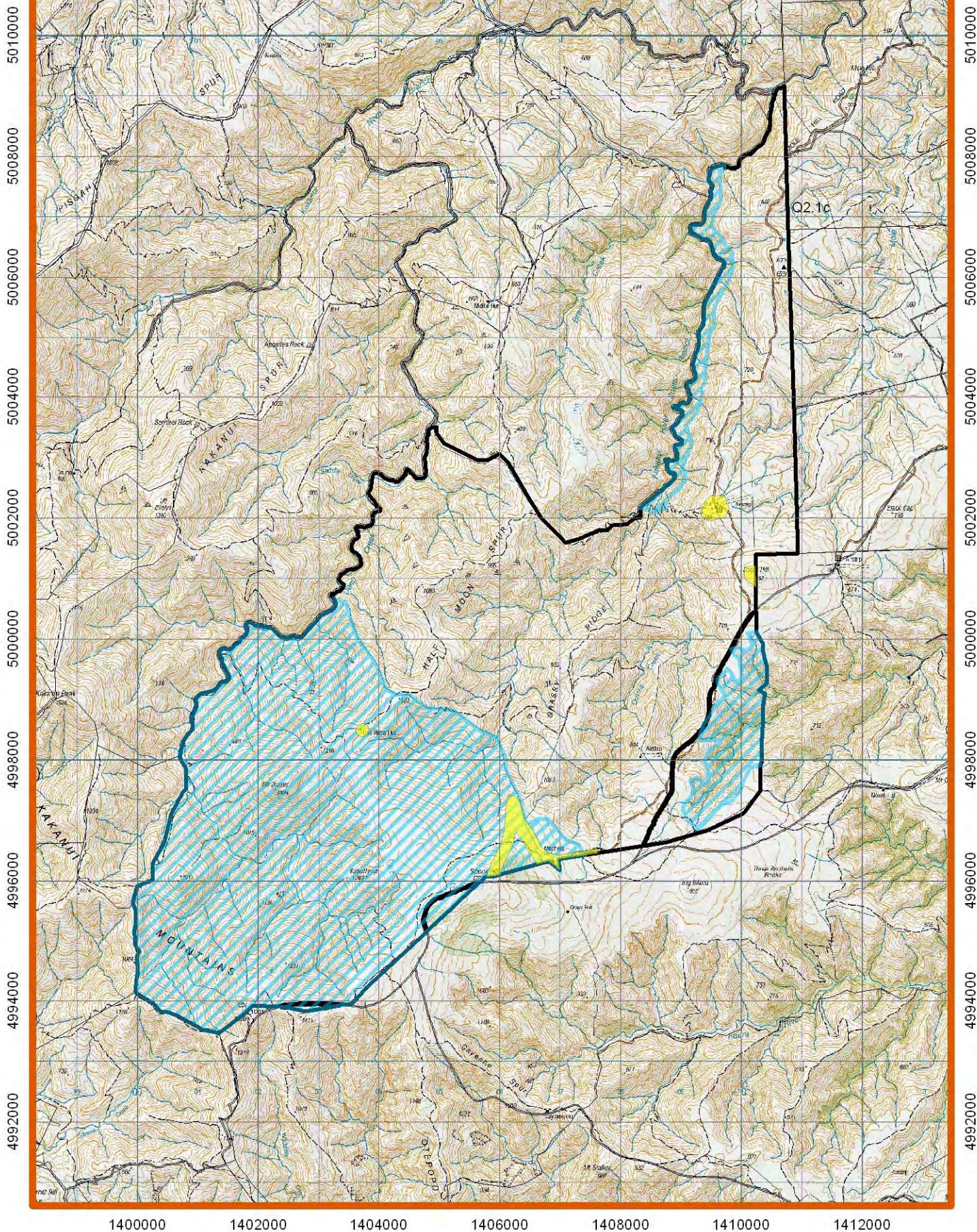
- RAP
- Stewardship Areas
- Marginal Strips

Mount Dasher Pastoral Lease 4.2.1 Topographical & Cadastral

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Mount Dasher Pastoral Lease 4.2.2 Values - Ecological and Historic

 Historic Areas

 Areas of Significant Ecological Values

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4.3 PHOTOGRAPHS



Photo 1: Deep Creek below Mt Dasher.



Photo 2: The south side of Mt Dasher. In both photos 1 and 2, of note are the intact shrublands associated with the boulder streams and the extensive intact tussocklands.



Photo 3: Looking north down Hectors Creek. These bush remnants form the section of RAP 4- Hectors which is within the lease.



Photo 4: Looking north from below Siberia Hill. From left to right is Half Moon Spur, the headwaters of the South Branch Kakanui River and Grassy Ridge. Notable features are the remnant shrublands and flush in the foreground, the extensive intact tussocklands and the boulderstream; all contributing in part to the overall impression of an unmodified landscape.