Land Information New Zealand
Toitū te whenua

Crown Pastoral Land Tenure Review

Lease name : MULLER STATION

Lease number : PM 021

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.

MARCH 14

MULLER

PASTORAL LEASE

CONSERVATION RESOURCES REPORT

DEPARTMENT OF CONSERVATION

SEPTEMBER 2009

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PART 1 INTRODUCTION

Muller Pastoral Lease (hereafter called "the property") is leased by The Muller Station Limited and managed by Steve and Mary Satterthwaite. The 28128 ha property comprises the Langridge and Richmond Dale runs adjacent to Molesworth Station in the upper Awatere valley in South Marlborough. Richmond Dale Run covers the headwaters of the Acheron River above the confluence of Saxton River, including part of the Saxton River catchment. Langridge Run covers the steeper slopes of Shingle Peak and the adjacent range on the northwest side of the upper Awatere valley between Castle River and Molesworth Stream. The Muller Station Limited also has freehold land south-east of the pastoral lease, including in the toe slopes of the Inland Kaikoura Range.

Almost all parts of the property are steep to moderately-steep mountainous country with extensive areas of open rock, scree and tall tussockland. The property ranges in altitude from 700 m at its northeast corner at Castle River to 2131 m on the range running southwest from Shingle Peak. The property is drained by the Saxton, Acheron and Castle rivers, Middle Gully, Orr, Awatere, Kennet and Ward streams and other unnamed tributaries of the Saxton, Acheron, Awatere-iti and Castle rivers. The Saxton and Acheron rivers flow into the Clarence River; Castle River flows into the Awatere River.

Muller Pastoral Lease lies in Balaclava and Dillon ecological districts, within the Molesworth and Clarence ecological regions, respectively. These ecological districts were surveyed as part of the Protected Natural Areas Programme (PNAP) in 1987/1989 (Courtney and Arand 1994). Four areas on the property were recommended for protection as a result of the PNAP survey.

The property adjoins the Landcorp managed Molesworth Recreation Reserve to the south and west, Leatham Conservation Area to the northwest, Glazebrook Conservation Area to the north, Upcot Pastoral Lease to the northeast and freehold land on other boundaries. Access to the property is via Awatere Valley Road from State Highway 1 north of Seddon, or via Molesworth Station from Hanmer Springs. The only other legal access to the property is from the road over Saxton Pass and from the larger river beds.

The tenure review inspection of the property was undertaken during March 2009 by a number of specialists. These specialists' reports (listed below) form the basis of this Conservation Resources Report.

- High Country Tenure Review Programme Landscape Assessment, The Muller Pastoral Lease, Blakely Wallace Associates, June 2009, 16p + photos + maps.
- Vegetation Report for Blue Mountain, Middle Gully, Mid-Lower Reaches of Saxton River Valley and Isolated Flat-Muller Pastoral Lease Tenure Review, Simon Moore, 16p + map.
- Vegetation Report for Upper Saxton Valley (including Port Cooper Saddle), Shingle Peak and associated ridge lines and the Upper Acheron Valley (between Munroe and Burnt Yards Huts) and parts of Acheron Valley below Junction Hut-Muller Pastoral Lease Tenure Review, Jan Clayton-Greene, 16p + map.
- Plant Communities of Parts of Muller Pastoral Lease and Recommendations for Protection, Geoff Walls, 21p + map.
- Assessment of the Bird and Lizard Values of Muller Pastoral Lease, South Marlborough, Marieke Lettink, May 2009, 18p + maps.
- Muller Pastoral Lease, A Report on the Aquatic Fauna Surveys, Scott Bowie, June 2009, 28p including photos + maps.
- Muller Pastoral Lease Tenure Review Survey: Invertebrates, Ian Miller, June 2009, 23p.
- Historical Assessment for the Muller Pastoral Lease, Kevin L Jones, May 2009, 42p.

Muller Pastoral Lease - Topography

Department of Conservation
Te Papa Atawhai

New Zealand Government

N
W E
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5
Kilometres

Legend

- Muller Pastoral Lease
- Public conservation land
- Molesworth Recreation Reserve
- Adjacent pastoral lease boundary
- Legal roads

Base Map - LINZ topographic series. Cadastre - LINZ August 2009

PART 2 INHERENT VALUES: DESCRIPTION OF CONSERVATION RESOURCES AND ASSESSMENT OF SIGNIFICANCE

2.1 LANDSCAPE

2.1.1 Landscape Context

Muller Pastoral Lease is located in inland Marlborough. The property is approximately 70 km from Seddon, 110 km southwest of Blenheim and occupies an area of approximately 28128 ha. Muller Pastoral Lease extends east to the Awatere Valley and west to the Saxton River. To the northeast, the boundary is the Castle River, and to the north and northwest are the headwaters of the Wairau River. The property spans two catchments. It includes the headwaters of the Acheron River, which flows south to join the Clarence River, and part of the upper Awatere River. The rugged and dissected Inland Kaikoura Range lies on the opposite eastern side of the Awatere valley.

The property adjoins the public conservation land of Molesworth Station. Molesworth is the largest and one of the best known station in New Zealand. The Molesworth landscape has some similarities with the Muller landscape; common characteristics include a large scale, barren windswept appearance, mainly rounded mountains, many creeks and rivers, dramatic rock outcrops, rugged scree-sided mountains and extensive tussocklands.

The property has a continental climate of extremes with hot and dry summers and harsh winters. Glaciation has left its mark in the northwest valleys and basins of the Acheron and Saxton rivers. Valley floors are filled with glacial and outwash gravels and silts. Tectonic movement has also been a major factor in the appearance of the land, resulting in mountain uplift and subsequent landslides and rock falls. Faulting has strongly influenced the morphology of the region with the property lying between the Alpine/Wairau Fault system and the Awatere Fault.

2.1.2 Landscape Description

For the purposes of this landscape assessment Muller Pastoral Lease is divided into eight landscape units, reflecting areas of similar landscape character. For each landscape unit, landscape character is evaluated using the following criteria:

- Naturalness: the condition of the natural vegetation, patterns and processes and the degree of modification present
- Legibility: expressiveness: how obviously the landscape demonstrates its formative processes
- Aesthetic Factors: e.g. distinctiveness and coherence. Distinctiveness is the quality that makes a particular landscape visually striking; frequently this occurs when contrasting natural elements combine to form a distinctive and memorable visual pattern. Coherence is based on characteristics including intactness, unity, continuity, and compatibility (intrusions, alterations, disruptions tend to detract from coherence)
- Historic Factors: historically valued attributes in the context of a high country landscape
- Visibility: the visibility of the landscape from public vantage points

Saxton – Landscape Unit (LU1)

The Saxton Unit covers the northwest part of the property and includes the upper Saxton valley and the lower true-left (east) faces and valley floor to the property boundary at the river. It has a distinctive appearance as a glaciated U-shaped valley. The openness, scale and comparatively wide valley floor are the elements that give it a distinctive character.

Mountain slopes are moderately steep to very steep with a high proportion of scree, rock outcrops and bluffs. Bluffs sometimes form buttresses and steep overhangs such as those upstream of the confluence of Oyster Stream. Lower colluvial slopes are typically smooth scree slopes. Fans are present in the lower reaches of tributaries.

The main vegetation types of the upper Saxton valley are rockfield, screefield, shrubland, herbfield and cushionfield. Gentler slopes support 'islands' of tall tussock that contrast visually with the extensive screes. Mountain crests with gentle topography comprise gravelfield and low-growing cushionfield. The valley floor supports short tussockland with exotic grasses, clovers and weeds. Flushes are present along stable watercourses. Towards the confluence of the Acheron, from about Team Hut downstream, the mountain slopes and valley floor appear to have sparse vegetation, with a high proportion of hawkweed.

Evaluation Summary

Criteria	Value	Comment
naturalness	high	Appears highly natural. All natural patterns and processes are intact. Grazing has had some impact on the condition of vegetation and introduction of exotic grasses and weeds on valley floor and northwest faces.
legibility	high	Glacial and fluvial processes highly legible.
aesthetic factors	high	Visually highly impressive and striking. No disruptive features.
historic factors	low	Not significant.
visibility	low	A remote area only visible from the air and the few numbers of people that visit the area.

Landscape Vulnerability

This unit is a highly fragile montane environment vulnerable to any form of activity. Grazing and burning, especially below Team Hut, have affected the vegetation. The unit has the potential to be adversely affected by the following changes in land use and activities:

- Wilding pine spread.
- Grazing, particularly of fragile slopes, ridgelines and the valley floor
- Burning.
- Feral animal damage.

Middle Gully – Landscape Unit (LU2)

This unit includes Middle Gully and the head of the unnamed tributary of the Acheron River above Munroe Hut. Both these Acheron River tributaries have a similar character and appearance. Glacial landforms are less pronounced in these valleys compared to the Saxton valley; they are more V-shaped with narrow valley floors. Mountain slopes are steep and dissected, watercourses are often narrow and eroded, and slips and unstable land are common on lower slopes.

Rock outcrops are isolated on some slopes and extensive on others, notably on the eastern faces. Scree and gravel are major components of the landscape. Outwash fans, terraces and river-cut toe slopes are features of the valley floor. Sparse tall tussockland, short tussockland and subalpine shrubland are the main vegetation types. Exotic species including hawkweed also form a significant component especially downstream towards the Acheron River. Ridges tend to be bony and bare,

emphasising the naked landforms with a distinctive brown/grey colour. These contrast with the light brown colour in gullies, on colluvial slopes and the valley floor, which retain tussock or grass cover.

The appearance of Middle Gully landforms, vegetation patterns and vegetation condition is reasonably uniform. However the effects of grazing are evident on the valley floor and sunny faces. Apart from grazing impacts and presence of stock there are no other signs of human activity.

Evaluation Summary

Criteria	Value	Comment
naturalness	medium-high	All natural patterns and characteristics are intact. Mid and upper areas appear very natural. Downstream areas towards the Acheron confluence are less natural.
legibility	high	Glacial and in particular fluvial processes highly legible. Vegetation patterns highlight the underlying landform.
aesthetic factors	high	Visually impressive and striking.
historic factors	low	Little obvious sign of human history apart from modification to the original vegetation cover and the introduction of exotics.
visibility	low	Visible only from the air and the few numbers of people that visit this remote area.

Landscape Vulnerability
This unit is mountainous and susceptible to human activity and land use. Grazing is affecting sunny faces and the valley floor. The unit has the potential to be adversely affected by the following changes in land use and activities:
- Wilding tree spread.
- Unsustainable grazing, particularly over fragile slopes, ridgelines and valley floors.
- Burning.
- Feral animal damage.
- Unsympathetic earthworks

Lower Acheron – Landscape Unit (LU3)

This large unit includes:
- True right faces of the Acheron River below the confluence of Middle Gully.
- Mountain slopes and the valley floor from Saxton Pass to Mount Murphy.
- The Acheron Valley from Junction Hut to Burnt Yards Hut.

Acheron River below Middle Gully
Hill and lower mountain slopes here are generally highly modified, barren, rocky and bare. Terraces are present above the riverbed. 4WD tracks provide access to higher ridges. Upper slopes are more natural with rock bluffs, tall tussockland and scree.

Saxton Pass to Mount Murphy
Here the valley floor consists of alluvial flats with scattered short tussockland, sweet brier, exotic grasses, matagouri and willow trees. Northwest-facing lower mountain slopes are very dry and barren, often with extensive broken rock, scattered sweet brier and extensive grey mats of mouse ear hawkweed. Exotic grassland is present in gullies and on easier terrain. Hawkweed and shattered rock are typically present on ridges and spurs. Upper mountain slopes are steep and rugged. The summit is broad and rounded with scree, eroded argillite and tall tussock.

Junction Hut to Burnt Yards Hut
This long valley extends approximately 14 km to Burnt Yards Hut. It alternates from a narrow rocky gorge to open valley floors with grassy flats and a meandering riverbed. The gorge sections are notable for very rocky bluffs, buttresses, talus slopes, collapsed slopes, slumps and screes. These

features however are not solely confined to gorge sections. Vegetation on lower slopes includes depleted short tussockland, hawkweed, patches of shrubland and exotic grasses. Sweet brier occurs in the lower gorge. The valley floor is predominantly exotic grasses and hawkweed.

Southeast-facing slopes support tall tussockland on upper slopes, whereas northwest-facing slopes are extremely bare and depleted at low- and mid-altitudes. Upper slopes appear more natural with tall tussockland, scattered shrubland, rock and scree. Closer to Burnt Yards Hut the lower mountain slopes and valley floor on both sides are characterised by depleted grassland, with tall tussockland and subalpine shrubland on mid and upper slopes. Wetland flushes are present on the river terraces.

Musterers' huts and remnants of a cob-building at Burnt Yards Hut indicate the pastoral history of the area.

Evaluation Summary

Criteria	Value	Comment
naturalness	medium	Variable. Medium to high on upper southeast faces of the Acheron Valley. Low to medium on all other areas. Generally dry northwest faces are highly depleted within Acheron Valley. Valley floors are highly modified.
legibility	high	Formative processes highly legible.
aesthetic factors	medium to high	Variable. The scale of the landform of the Lower Acheron is distinctive and impressive. Gorge sections are particularly striking. Faces south of the confluence of Middle Gully are less distinctive or striking.
historic factors	medium	Mainly associated with pastoralism and the early route for sheep between Canterbury and Marlborough.
visibility	low-medium	High visibility on mountain slopes from Saxton Pass to Murphy, viewed from Molesworth Station Road. Low elsewhere.

Landscape Vulnerability

All upper slopes are fragile alpine areas vulnerable to grazing. Valley floor and lower mountain slopes have already been modified by grazing and burning and could sustain continued grazing without detrimental effects to landscape values. Wilding tree spread is a significant threat.

Isolated Flats – Landscape Unit (LU4)

This is a small unit at the southwest corner of the property near the confluence of the Acheron and Saxton rivers. It includes alluvial flats and a low terrace landform which is part of the broad Acheron valley floor. A fault terrace is visible as a cut-line across the landscape. The flats also extend into the lower Saxton valley.

This unit has an open character with exotic grasses, hawkweed and very sparse short tussockland. A lone old willow tree on the low terrace is the most visible remaining sign of the early Richmond Dale homestead and yards.

Evaluation Summary

Criteria	Value	Comment
naturalness	low	Predominantly exotic vegetation. Some remnant native vegetation.
legibility	high	Glacial and fluvial deposition processes highly legible.
aesthetic factors	low	Viewed in isolation it is not distinctive and does not have high visual values, but is visually impressive as part of the Acheron valley landscape.
historic factors	high	Includes site of Richmond Dale Homestead and farm complex.
visibility	high	Highly visible from Molesworth Station Road.

Landscape Vulnerability
This unit is vulnerable to changes that would disrupt the openness, such as wilding tree spread and forestry.

Upper Acheron – Landscape Unit (LU5)

This unit includes the headwaters of the upper Acheron River above Burnt Yards Hut. It includes Orr Stream and the northwest facing basin below Shingle Peak. The northern boundary of the unit (and the property) includes Acheron Saddle and the high summits of Pudding (1820 m) and Blue Mountain (2051 m). The entire unit has similar features, comprising steep to very steep mountain slopes, extensive screes, frequent rock outcrops and bluffs. Summits are a mix of sharp outcrops and gentle rounded crests.

The upper basins below Blue Mountain and Port Cooper Saddle are gentle glacially-shaped basins with relatively wide valley floors. Scree is dominant on upper slopes and the crests, merging downslope with tall tussockland. Flush communities are present in the upper basins. Gravelfield, shrubland and herbfield are features on the gentle headwater slopes. Shrubland is associated with bluffs and rock outcrops. Tall tussockland descends to the valley floor. Some exotic species and signs of grazing are present on the valley floors.

Grazing is having a visible impact on some valley floors and lower slopes, notably in the main Acheron valley above Burnt Yards Hut. Stock tracks are also noticeable across upper scree slopes. Other signs of human activity include a benched bridle trail on the south side of Acheron Saddle, originally used for droving stock from Marlborough to Canterbury via the Acheron River valley.

The basin on the northwest flank of Shingle Peak is extremely steep and rugged, with broken topography, extensive bluffs and massive screes. Overall, the Upper Acheron Unit is highly natural. There is also a sense of remoteness and wilderness within this huge backcountry area.

Evaluation Summary

Criteria	Value	Comment
naturalness	high	All natural features and characteristics intact. Some signs of grazing and human use.
legibility	high	Formative processes highly legible.
aesthetic factors	high	Highly impressive and distinctive.
historic factors	medium-high	Acheron Saddle provided early route for moving stock into Canterbury.
visibility	low	A remote area visible from the high points of the adjacent Glazebrook Conservation area but few other public places.

Landscape Vulnerability
This high alpine unit is highly fragile and vulnerable to disturbance of any kind. Grazing by cattle is the most obvious threat and is affecting naturalness to a significant degree. The unit has the potential to be adversely affected by the following changes in land use and activities:

- Wilding pine spread.
- Grazing, particularly of fragile slopes, ridgelines and the valley floor
- Burning.
- Feral animal damage.

Kennet and Langridge Tributaries – Landscape Unit (LU6)

This unit covers the comparatively small but distinctive upper catchments of Kennet River and Langridge Stream. The unit bounds the crest of the mountain range southwest of Shingle Peak and Shingle Peak itself. The crest of the range is very broad with gentle gradients and covered in fine

scree. Below the range crest, slopes are moderately steep to very steep with extensive scree, some bare ground and frequent bluffs and buttresses. It has an extremely rugged, craggy appearance.

Below the scree slopes, mixed kanuka and manuka scrub and shrubland occur and mountain beech forest remnants occur on lower slopes and bluffs. Active erosion and scree chutes also occur within the shrubland and beech forest. Above the shrublands and beech forest, and extending up onto the eastern ridge, is low subalpine shrubland (tauhinu is common) with fescue tussock and areas of gravelfield.

Evaluation Summary

Criteria	Value	Comment
naturalness	high	Appears highly natural. Little or no obvious sign of man-made activity.
legibility	high	Highly expressive of formative processes.
aesthetic factors	high	An impressive and distinctive area. Massive scree slopes and steep, rugged rocky bluffs and outcrops combined with vegetation patterns contribute to high aesthetic values.
historic factors	low	Not significant.
visibility	low	Range crest is visible and forms backdrop to Awatere Valley side. Lower slopes largely hidden from public places.

Landscape Vulnerability
The unit consists of highly fragile mountains vulnerable to most forms of human activity.

Castle Faces – Landscape Unit (LU7)

This unit is diverse and includes the southern side of the Castle River valley, Ward Stream and the unnamed catchment to the north of Ward Stream. The mountain slopes and small areas of river flats of this unit are described as three areas.

Ward Stream and the unnamed catchment to the north

These southeast and east tributaries have very steep rugged slopes with extensive scree, rock bluffs and bedrock at all altitudes. Tussockland and shrubland form islands of low vegetation broken by scree and steep erosion chutes. Tall tussockland on lower north faces appears to be depleted by grazing. Shrubland and sweet brier extend onto the river flats. Marlborough rock daisy plants cling to steep rocky bluffs above the river flats.

Faces from above Enchanted Stream to tributary east of Shingle Peak

These north-facing slopes are moderately steep on lower and mid slopes to very steep on upper slopes. All are heavily dissected and undulating. Vegetation patterns vary from reasonably dense kanuka/manuka/matagouri dominated shrubland to quite modified and open plant communities on mid and lower slopes. Toe slopes and prominent alluvial fans, terraces and river flats near the valley floor appear most modified with green exotic pasture and shrubland. Green areas also extend up gullies and along the river flats of the side tributary below Shingle Peak. The riverbed also supports a kanuka, matagouri, *Olearia* woodland. A hut is located near the river on one of the larger fans.

Slopes below Shingle Peak
The most significant features of this area are the very steep rock bluffs on the upper slopes, extensive screes, and a broad belt of kanuka/manuka woodland on the lower slopes.

Evaluation Summary

Criteria	Value	Comment
naturalness	medium to high	Variable. High in Ward Stream, the adjoining catchment, Shingle Peak faces, and all upper mountain areas. Medium on lower and middle slopes in mid sections.
legibility	high	Expressive of formative processes.
aesthetic factors	high	Landform and vegetation patterns are visually impressive.
historic factors	low	Not significant.
visibility	low	Southeast faces visible from Awatere Valley Road. Elsewhere has low visibility.

Landscape Vulnerability

Vulnerability varies in this unit. Steep mountain slopes that have low levels of modification are vulnerable to grazing and burning. Already modified zones are less vulnerable, but nevertheless threatened by continued grazing and burning which would further fragment shrubland and impact on natural character.

Awatere Faces – Landscape Unit (LU8)

This unit covers the southeast-facing slopes in the Awatere valley, extending some 16 km from Saxton Pass in the southwest to Ward Stream in the northeast. The Awatere faces are part of the broader upper Awatere valley landscape which is flanked on the north side by Shingle Peak and the range extending to Murphy, and on the south side by the lower Inland Kaikoura Range and the Tone River hill country. As a whole it forms a diverse and interesting landscape. On the northwest (Langridge) side, mountains are high and rounded with prominent screes. In contrast, on the southeast side the Inland Kaikoura Range is a very steep, dissected, broken and rugged landform. The valley floor has narrow flats, prominent and distinctive hillocks and lumpy topography.

Within the property an existing fence across the toe slopes generally separates the steeper mountain slopes from the developed country on the gentler lower slopes. The upper mountain slopes are characterised by extensive scree, alternating with tall tussockland, short tussockland, subalpine scrub, herbfield and cushionfield. Patches of snow totara are a feature of lower slopes below scree.

The lower front faces comprise downlands and gentle hill country, with broad and prominent fans at the base of major watercourses. Vegetation is variable but generally consists of scattered short tussockland, matagouri shrubland, introduced pasture, St Johns wort, sweet brier and hawkweed. In small areas, such as the flats south of the Kennet River, gentle country has been cultivated and no native component remains. High-voltage transmission pylons and lines bisect the unit between the Awatere Valley Road and the fence across the toe slopes. An access track follows the transmission line.

Overall the lower slopes below the existing fence are modified with many areas over-sown and top-dressed. However extensive matagouri shrublands are present on fans and along watercourses and pockets of remnant kanuka/manuka, short tussockland and other native shrubland impart a distinctly indigenous character which complements the highly natural upper mountain slopes.

Langridge Stream has a band of kanuka/manuka shrubland either side of the gorge interspersed with matagouri and pasture. Further downstream (outside the pastoral lease) are the remains of the old Langridge homestead, farm buildings and yards, dating from the time before Langridge was part of Muller Station. Plantings of pine, poplar, willow and fruit trees also mark the location of this early station. Willow has spread up Langridge Stream towards the base of the mountain range.

Evaluation Summary

Criteria	Value	Comment
naturalness	medium	High on upper mountain. Medium to low on fans, toe-slopes and downlands.
legibility	high	Highly expressive of formative processes
aesthetic factors	high	Combination of upper and lower mountain slopes is visually distinctive and striking. Lower slopes retain shrubland and natural character. Together form an impressive and visually coherent landscape
historic factors	medium	Langridge Station complex provides an historic/cultural component adjacent to this landscape unit.
visibility	high	In the context of Muller, the Awatere front faces are the most visible part of the property, notably from the Awatere Valley Road, which is an increasingly popular back-country road.

Landscape Vulnerability

The upper mountain slopes are highly vulnerable to grazing and most human activities. The lower faces below the existing fence have undergone substantial modification. Further loss of indigenous cover by grazing, burning or chemical spraying, particularly the kanuka/manuka and shrubland associated with fans and watercourses, will threaten and diminish landscape values. Changes in land use or irrigation could also threaten landscape values.

2.1.3 Visual and Scenic Values

All of the mountainous parts of Muller Pastoral Lease (all of the property apart from the Awatere Faces) are visually impressive and have high scenic values. The landform and topographical features contribute to these high values. Vegetation patterns also complement the high scenic values, such as the extensive high-altitude scree, fellfield and cushionfield, and the kanuka and manuka shrublands in the Kennet River, Langridge Stream and Castle River valleys and elsewhere.

The characteristics and features of the landscape that contribute to the high visual and scenic values include:

- The sheer scale, magnitude and diversity of the mountain/valley systems as a whole.
- The extensive bluffs, screes and gravelfields (which are a hallmark of the property) and associated vegetation patterns.
- The varied and high mountain range crests, including gentle crests, peaks and saddles, especially in the upper Acheron valley.
- The gorges and varied valley floor landscapes including braided rivers, terraces and fans.

It is possible to identify areas which stand out in terms of visual and scenic values. These areas equate with the degree of naturalness present and include:

- Saxton River valley
- upper Acheron River and its tributaries
- Shingle Peak and the ridge crest southwest to Murphy
- Kennet Stream
- upper Langridge Stream
- Ward Stream

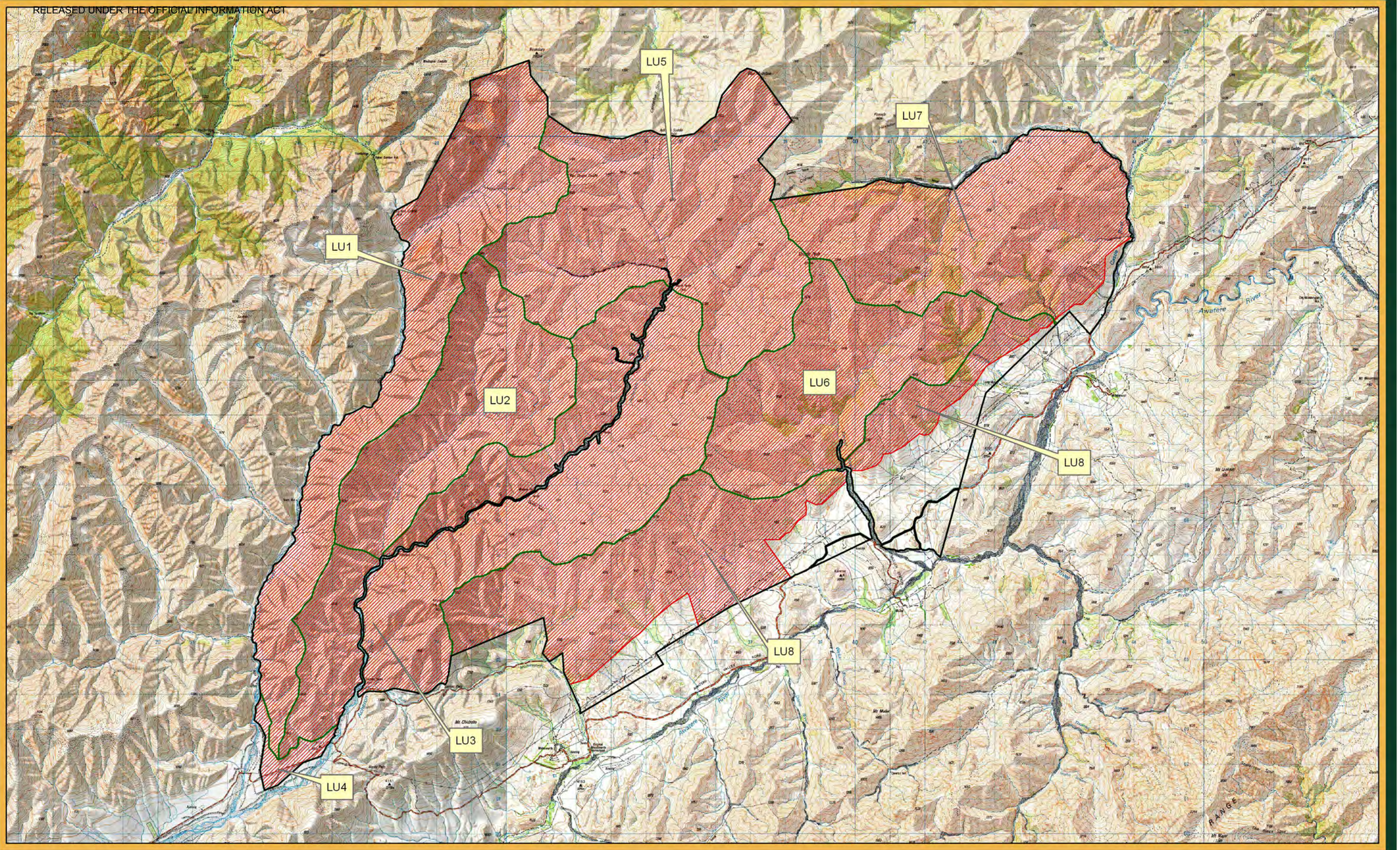
Other areas still contain high visual and scenic values primarily due to landform, but with a reduced rating due to the level of land degradation/ modification present. These areas include:

- Northwest-facing (true-left) slopes of the Acheron valley between Carters Yards Hut and Burnt Yards Hut.
- Southeast-facing (true-right) slopes of the Acheron River below the confluence of Middle Gully.
- West-facing (true-left) slopes of the Saxton River below Team Hut.
- The mid north-facing slopes of the Castle River.

The Awatere faces have high visual and scenic values derived from the high and impressive upper mountain slopes, including prominent screes. These combine with the lower downlands, fans and toe slopes and their associated vegetation patterns. Together the front faces are part of the broader upper Awatere valley landscape. The upper Awatere valley as a whole contains high visual and scenic values. Muller Pastoral Lease is an integral part of this landscape.

Significance of Landscape Values

The key landscape values are the property's large scale back country, with its often high natural value, obvious formation processes and distinct aesthetic values. The unique location within the isolated and contained upper Awatere and Acheron river valleys; the impressive and varied landforms including hills, gorges, mountain slopes and basins; and the dominant natural character of the vegetation cover overall which conveys a strongly South Island backcountry character.



Muller Pastoral Lease - Landscape values

Department of Conservation
Te Papa Atawhai

New Zealand Government

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Kilometres

Legend

- Muller Pastoral Lease
- Landscape values
- Landscape unit boundary

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CANTERBURY CONSERVANCY - TENURE REVIEW

24 September 2009

2.2 GEOLOGY, LANDFORMS AND SOILS

2.2.1 Geology

Muller Pastoral Lease is extensively underlain by early Cretaceous rocks, referred to collectively as greywacke, comprising well-bedded sandstones and mudstones and poorly-bedded sandstones of the Pahau Terrane. Within this geology occur zones of disrupted sandstone- and/or mudstone-dominated sequences, locally mélange or broken formation with blocks of chert and basalt. An occurrence of these sequences in the northern half of the property is large enough to map separately; it forms a wedge-shaped block, beginning near upper Middle Gully and widening and extending NNE to beyond Blue Mountain. Overlying these geologies is a scattering of Pleistocene alluvial fan and terrace deposits, mainly confined to valley floors and lower slopes, and Holocene screes and minor swamp deposits (Rattenbury *et al*. 2006).

The main structural feature within the property is the Awatere Fault. This is one of four major dextral strike-slip faults (the others being the Wairau, Clarence and Hope faults) that strongly influence the geomorphology of the south Marlborough-north Canterbury region. In the survey area this feature appears to be present in the form of a fault zone, with the main traces lying along or near to the southern and south-eastern edges of the property. The trace mapped as continuing north-eastward along the Awatere Valley appears to delineate the upper ends of the larger old alluvial fans and terraces on the property between Molesworth Stream and Castle River. It is also shown to cross the bases of the large, actively eroding scree gullies in lower Castle River, 1.5 to 2 km upstream from the confluence of the Castle and Awatere rivers (Rattenbury *et al*. 2006).

The trace of an apparent splinter fault, originating in the Sedgemere area, is mapped as passing through Saxton Valley, Middle Gully and the upper Acheron, close to Burnt Yards Hut, before petering out to the northeast. The Awatere Fault and associated splinter faults are all mapped as active faults (Rattenbury *et al*. 2006).

2.2.2 Landforms

The property lies across the south-easternmost of a series of ranges lying between the Alpine/Wairau Fault system and the Awatere Fault. The general concordance of summit heights across these ranges reflects their origin as uplifted relatively flat Cretaceous and later erosion surfaces that had been cut into the basement rocks. Within the property, erosion of the uplifted land, especially during the Pleistocene glaciations, has formed generally steep mountain ridges and incised valleys with mostly narrow alluvial flats. In places with less resistant rock, erosion, especially from the Pleistocene glaciations, has reduced the ridges to a more rounded scree-covered form. Some of the valley flats have broadened with the addition of post-glacial alluvium as erosion has continued. Tarns occupying cirques or benches along the ridges appear to be rare within the property, compared with ranges to the northwest.

2.2.3 Soils

Major soils of the western (Balaclava ED) part of the property are Tekoa, Kaikoura, Bealey and Spenser high country yellow-brown earths and less-developed steepland soils. Major soils in the east (Dillon ED) are Benmore, Muller and Tekoa high country yellow-brown earths and alpine steepland soils. Other soil types cover relatively minor areas at lower altitudes. Soil fertility varies considerably from east to west due to basement rock and rainfall (Courtney and Arand 1994).

Significance of Geology, Landforms and Soils

Muller Pastoral Lease lies across the south-easternmost of a series of ranges lying between the Alpine/Wairau Fault system and the Awatere Fault. It is extensively underlain by early Cretaceous greywacke rocks, comprising well-bedded sandstones and mudstones and poorly-bedded sandstones, with zones of disrupted sandstone- and/or mudstone-dominated sequences, locally mélange or broken formation with blocks of chert and basalt. The main structural feature within the property is the Awatere Fault. This is one of four major dextral strike-slip faults that strongly influence the geomorphology of the south Marlborough-north Canterbury region.

2.3 CLIMATE

Muller Pastoral Lease has a semi-arid mountain climate with cold winters and warm summers. Predominant winds are from the northwest, with occasional gales. Snow can affect all parts of the property and lie at higher altitudes for several weeks in winter (Tomlinson 1976). Average annual precipitation ranges from 670 mm at Molesworth Station homestead to probably more than 1000 mm at higher altitudes. Rainfall is evenly distributed throughout the year, though long dry periods are relatively common (Courtney and Arand 1994).

2.4 LAND ENVIRONMENTS OF NEW ZEALAND (LENZ)

LENZ is, as described by Leathwick *et al.* (2003), "a classification of New Zealand's landscapes using a comprehensive set of climate, landform and soil variables chosen for their role in driving geographic variation in biological patterns." The classification units of LENZ, termed land environments by Leathwick *et al.* (2003), aim to "identify areas of land having similar environmental conditions regardless of where they occur in New Zealand." Therefore "LENZ provides a framework that allows prediction of a range of biological and environmental attributes. These include the character of natural ecosystems, the vulnerability of environments to human activity, and the potential spread or productivity of new organisms" (Leathwick *et al.* 2003). Leathwick *et al.* (2003) present the LENZ information at four levels of detail, with Level I containing 20 environments, Level II containing 100 environments, Level III containing 200 environments and Level IV containing 500 environments. These LENZ classes are presented nationally to assist use at a range of scales.

In an analysis of the LENZ Level IV data, with consideration of the remaining indigenous vegetation cover and the legal protection of these environments, Walker *et al.* (2005) proposed a threat classification for the remaining indigenous biodiversity in New Zealand's environments based on the two components of vulnerability (likelihood of loss): poor legal protection and risk of loss. This threat classification (Table 1) has become the recognised benchmark for the promotion of threatened LENZ conservation.

Table 1 **LENZ threat categories and definitions (Walker *et al.* 2005)**

Category	Criterion
acutely threatened	<10% indigenous cover remaining
chronically threatened	10-20% indigenous cover remaining
at risk	20-30% indigenous cover remaining
critically under-protected	>30% indigenous cover remaining <10% legally protected
under-protected	>30% indigenous cover remaining 10-20% legally protected
less reduced and better protected	>30% indigenous cover remaining >20% legally protected

On Muller Pastoral Lease, low-altitude areas in the Acheron and Awatere valleys lie within "chronically threatened" or "at risk" land environments. Upper valley floors along the upper Acheron River and its tributaries, and lower hill slopes in the Awatere valley (below approximately 1100 m) are in "critically under-protected" land environments. Higher-altitude parts of the property on the mountain ranges have no threat category.

The majority of Muller Pastoral Lease lies in the Land Environments above c.1100m which are not considered to be threatened or underprotected. Footslopes, fans, and terraces below c.1100m contain a mix of Land Environments including those which are 'Underprotected', 'Critically Underprotected', 'At Risk' and 'Chronically Threatened'. The 'Chronically Threatened' environments are primarily confined to the frost prone alluvial terraces on Isolated Flat in the lower Saxton and Acheron valleys, and the toe-slopes associated with the tributaries to the Awatere River between Molesworth Stream and Castle River.

The 'Chronically Threatened' land environments on terraces at Isolated Flat and the larger Acheron terraces below Junction Hut are typically dominated by *Hieracium pilosella* along with browntop and sheep's sorrel. Vegetation cover is often sparse with areas of exposed soil common. However despite the modified and depauperate appearance of this community there remains a substantial native component, particularly on the higher terraces of Isolated Flat and those parts of the terrace system in the extreme south-west corner of the property. At least 20 native species are present including sub-shrubs (e.g. *Acrothamnus colensoi*, *Hebe pimeleoides*), grasses (e.g. blue tussock, hard tussock, bristle tussock), sedges (e.g. *Carex muelleri*) and herbs (e.g. *Gentianella corymbifera*, *Brachygolottis bellidioides* and *Stackhousia minima*).

An ephemeral wetland originates from a fault line which bisects the Isolated Flat terrace system. It is largely modified with pasture grasses such as creeping bent and introduced sedges such *as Juncus articulatus* but retains native turf communities on the margins, and native herbs on the periodically dry wetland bed. In the Acheron River catchment between Carters Yards and Junction Hut *Scheonus* and/or *Carex coriacea* wetland bogs and flushes are associated with stream channels and swales on the terraces. A large pond occupies the terrace on the true left approximately 1.2km downstream from Junction Hut, surrounded by an extensive wetland including bog rush sedgeland and *Carex coriacea* sedgeland.

The threatened LENZ environments across the lower Awatere faces to Castle River area mix of 'Chronically Threatened' and 'At Risk' land environments. These have been considereably modification, with large amounts of introduced vegetation now present. The environments are predominantly pasture grasses, scattered shrubs of matagouri, tauhinu, *Olearia odorata*, *Coprosma propinqua* and *Hebe cryptomorpha*; with occasional hard tussocks occurring.

The other areas of 'At Risk' LENZ land environments occur in the upper Castle River, including around the hut, along the lower part of the branch of Castle River draining Hillersden Corner and in the valley of the other branch of Castle River draining the east face of Shingle Peak. The area around the hut has been quite modified and there is a mix of rough pasture of browntop, sweet vernal and mouse-ear hawkweed; and shrubland matagouri, kanuka, *Coprosma propinqua*, *Olearia odorata* and sweet brier.

The other two areas are adjacent and share many similarities, with exotic grasses in the valley floor and many wet seepage areas. These wet areas are dominated by sedges and rushes, including red sedge, spike sedge, tussock sedge and leafy sedges. Surrounding these is shrublands made up of matagouri, *Olearia odorata*, kanuka, manuka *Brachyglottis monroi* and sweet brier.

Significance of Land Environments

Areas of lower-altitude country on Muller Pastoral Lease are classified as "much reduced" (chronically-threatened) or "at risk" land environments. All remaining mid- and low-altitude parts of

the property (below approximately 1100 m) are classified as “critically under-protected” land environments, with less than 10% of their total areas legally protected.

Muller Pastoral Lease - LENZ Threat Categories

Department of Conservation
Te Papa Atawhai

New Zealand Government

N
W E
S

5
Kilometres

Legend

- Muller Pastoral Lease
- Acutely threatened
- Chronically threatened
- At risk
- Critically underprotected
- Underprotected
- Less reduced & better protected

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CANTERBURY CONSERVANCY - TENURE REVIEW

24 September 2009

2.5 VEGETATION

2.5.1 Ecological Context

Muller Pastoral Lease lies in a complex area of mountainous country in South Marlborough and lies mainly within two ecological districts: Balaclava to the west and Dillon to the east (McEwen, 1987). The Shingle Peak to Murphy mountain range forms the boundary between these two ecological districts (Courtney and Arand 1994).

Balaclava ED is characterised by rounded greywacke mountains with extensive screes. It is drained by rivers and streams with braided channels. The climate is more or less continental, with hot summers and cold winters. Little of the former forest cover remains, having been replaced by tussockland. There are two small protected areas: Lake Tennyson Scenic Reserve and Lake Guyon Scenic Reserve.

Dillon ED is similar. It is characterised by big mountains between which are intermontane basins, and a cooler wetter hill climate. Remnants of beech forest and montane gully vegetation featuring mountain ribbonwood still exist. However, most of the land now has grassland, tussockland and high-altitude rock and scree. There are three protected areas: Tone Conservation Area, Glazebrook Conservation Area (in part) and Hossack Conservation Area (in part).

Prior to human arrival Leathwick *et al* (2006) predict much of the land below about 1300 m would have had a cover of woody vegetation; a finding supported by Courtney and Arand (1994). Forest would have been extensive, dominated by mountain beech, mountain totara, mountain ribbonwood, mountain toatoa, kanuka and broadleaf; and featuring considerable diversity of montane species in sheltered lower-altitude sites. Low-lying land subject to floods, hard frosts, drought and impeded drainage probably had swamp, shrubland, low vegetation on stony sites and areas of red tussockland. Rock outcrops and scarps would have been home to a proliferation of indigenous shrubs, daisies, brooms and other specialised rock plants, many endemic to Marlborough. The frequently-disturbed boulderfields and gravelfields in the valleys would have supported sparse transient vegetation of tough shrubs, grasses and herbs. Around the tree line was probably a zone of subalpine shrubland, above which was tussockland on stable sites and sparse alpine vegetation, including the distinctive vegetable sheep, and rockland elsewhere.

Climatic extremes, severe weather events (storms, heavy snowfalls and floods) and natural erosion would have provided a dynamic environment for the vegetation, and natural fires may also have had an effect. The area would have been home to numerous birds, including large herbivores such as moa, takahe, South Island goose, kakapo and adzebill. They, and smaller animals such as fruit-eating birds and lizards and insect pollinators, would have had a considerable influence on the vegetation.

Both ecological districts have been systematically surveyed as part of the Protected Natural Areas Programme (Courtney and Arand 1994). The Protected Natural Areas Programme is about looking at the best areas of representative diversity within the different ED's. The Recommended Areas for Protection (RAP's) that are suggested from this are intended to represent the best examples of range and natural diversity in the ED's (Courtney and Arand 1994). That survey identified four RAP's on Muller Pastoral Lease:

<u>Balaclava ED RAP 4 Blue Mountain</u>
The very head of the Acheron River catchment, selected for its relatively unmodified alpine vegetation and snow tussockland, its suite of vegetable sheep and related species, rare plants and giant bluff weta. Specifically:

- It contains the most natural alpine vegetation in all of the Acheron River headwaters upriver of Isolated Flat;

- The midribbed snow-tussockland is extensive, high quality and very little disturbed. The community on low-angled slopes under Pudding is unique in the ecological district;
- Small populations of the mat daisy *Raoulia cinerea* (naturally uncommon) and *Leptinella serrulata* (naturally uncommon);
- It is one of the few places in the district where all three *Haastia* species are represented, as well as both *Raoulia* vegetable sheep.

Balaclava ED RAP 18 Murphy
The south and east faces of Murphy (1827m), selected for a beech forest outlier, rare native grassland, the presence of eastern falcon, geckos and the presence of two plants (*Epilobium angustum* and *Colobanthus brevisepalus* (naturally uncommon)) not known elsewhere in the district.

Balaclava ED RAP 20 Saxton
The head of the Saxton River catchment (most of the RAP is on neighbouring land), selected for its diversity and relative intactness, rare and uncommon plants and the presence of eastern falcon. Specifically:

- It contains diverse landforms and vegetation communities that are characteristic of the Wairau-Saxton Land System. With the exception of the short tussocklands they are in excellent condition;
- Midribbed snow-tussock communities on south-facing slopes which show little evidence of browsing and are amongst the most natural in the district;
- The short tussocklands are some of the most extensive and least modified in the Wairau-Saxton Land System. The community on the large system of coalescing fans in the main valley, rather than being induced, appears to be original cover, representing a seral stage in the development of fan vegetation here;
- Some of the most diverse and well-developed cushionfields on scree and rock in the ecological district;
- A wide range of wetlands on a variety of landforms, of which the cirque basin alpine tarns support some of the most natural aquatic plant communities in the ecological district, including the regionally rare quillwort;
- *Plantago obconica* (naturally uncommon) occurs in the Saxton headwaters. *Uncinia purpurea* occurs within the fan short tussocklands. This is the only known record for the northern South Island and is the northern limit for the species.
- Other species which are uncommon in the rest of the ecological district include *Traversia baccharoides, Ranunculus haastii* (declining), *Epilobium forbesii* (naturally uncommon), *Celmisia cockayneana* (naturally uncommon), *Exocarpus bidwillii, Pachycladon fastigiata, Celmisia lateralis, Hebe haastii, Gunnera densiflora* (naturally uncommon), *Raoulia apicinigra, Anisotome flexuosa, Elymus enysii, Nertera balfouriana, Ourisia simpsonii, Parahebe cheesemanii* and *Leucogenes neglecta* (naturally uncommon).

Dillon ED RAP 4 Kennet
The majority of the Kennet River catchment, selected for its mountain beech forest, kanuka, extensive screes, several rare or uncommon plants and exceptional birdlife.

2.5.2 Vegetation and Flora

The original indigenous plant communities of Muller Pastoral Lease are substantially depleted. Almost all lower altitude parts of the property are highly modified and now support plant communities dominated by exotic pasture species or low-stature matagouri shrubland, with variable amounts of sweet brier and minor scatterings and pockets of other indigenous vegetation. The exceptions are the catchments of the Langridge Run, the south-western slopes of Murphy and the shadier (true right or north-western) lower slopes of the Acheron catchment. These places still have a predominance of indigenous plants (trees, shrubs, tussocks, sedges and smaller specialist wetland

and stonefield species). Tall tussockland is present at higher altitudes and above that is alpine vegetation that features specialist scree and rock outcrop plants.

The existing vegetation of the property is described below for thirteen discrete areas.

Upper Saxton

A large proportion of the upper Saxton has been identified as a RAP by Courtney and Arand (1994) and is well described in the PNAP report. The RAP extends from Muller Pastoral Lease into Molesworth Recreation Reserve on the true right of the Saxton below Saxton Saddle. The principle vegetation communities described in Courtney and Arand (1994) and/or observed during this survey are:

- Bedrock outcrop communities on ridgelines;
- Herb gravelfield on scree;
- Midribbed snow-tussockland on colluvial mountain slopes;
- Carpet grass turfland on colluvial mountain slopes;
- High altitude flushes and seeps on colluvial mountain slopes;
- Short tussockland on alluvial terraces;
- Mixed scrub and tussock shrubland on colluvial mountain slopes;
- Shrubland on gravelfield (scree bases);
- Mixed tussock, herb and shrubland on alluvial fans;
- Herb gravelfield on recent river alluvium;
- Bog rush wetland on valley floors;
- Mixed rockland community on bluffs;
- Aquatic herbfield on tarn bed;
- Cirque wetland communities.

The bedrock outcrops on the ridgelines are dominated by *Raoulia eximia* and bristle tussock. Also common are *Colobanthus acicularis, Haastia pulvinaris* var. *minor* (naturally uncommon), *Hebe epacridea, Poa buchananii, Celmisia allanii,* porcupine shrub, *Hebe pinguifolia* and *Hebe macrocalyx* var. *humilis.* On south-facing aspects occasional *Leptinella pyrethrifolia* and *Pachycladon fastigiata* occur. *Epilobium brevipes* (naturally uncommon) and *Lobelia macrodon* were observed on east facing bluffs.

The screes below these outcrops support a variety of scree species including *Lignocarpa carnosula, Lobelia roughii* and *Epilobium pycnostachyum.* Also here is occasional *Haastia recurva* and *Leptinella dendyi. Epilobium forbesii* (naturally uncommon) is relatively common on the more stable scree slopes, and occasionally present are *Raoulia 'M'* (naturally uncommon) and *Ranunculus crithmifolius* (naturally uncommon). At lower altitude near the valley floor *Lignocarpa diversifolia* (naturally uncommon), *Stelleria roughii* and *Hebe epacridea* are present.

A mosaic of midribbed snow-tussockland and carpet grass turflands occur on the colluvial mountain slopes below and beside these higher altitude screes. The midribbed snow-tussocklands are interspersed with blue tussock, cotton daisy and sheep's sorrel. *Pimelea oreophila* occurs occasionally at slightly lower altitudes.

Carpet grass turfland is interspersed amongst the tall tussockland and often has the following associates: blue tussock, *Aciphylla monroi* and cotton daisy. In moister areas *Blechnum penna-marina, Lycopodium fastigiatum, Anisotome aromatica* and *Raoulia glabra* are present.

High altitude flushes and seeps are a mosaic of low turf, cushion and herb species. Bog rush is common in these seeps. Other wetland species present are *Isolepis aucklandica, Helichrysum filicaule, Lobelia angulata, Epilobium* ssp. and the exotic grass *Poa pratensis.*

On the valley floor a matrix of alluvial terraces and outwash fans are interspersed by watercourses, flushes, seeps and damp depressions. The alluvial terraces are dominated by a short tussockland of *Festuca matthewsii.* Also present on these terraces are *Carex muelleri,* blue tussock, *Carex petriei, Carex kaloides,* browntop, sheep's sorrel *Hieracium caespitosum* and mouse-ear hawkweed.

The outwash fans vary in substrate coarseness. Stony fans host abundant bristle tussock, *Festuca matthewsii,* scabweed and *Aceana* sp. Also present are a mixture of herbs and low shrubs such as *Geranium microphyllum,* patotara, *Vittadinia australis,* creeping pohuehue, *Raoulia glabra, Helichrysum parvifolium* and *Helichrysum depressum.*

Recent river bed gravelfield support *Raoulia tenuicaulis, Leptinella squalida* ssp. *mediana, Anaphalioides bellidioides,* creeping pohuehue, *Parahebe decora, Aceana* and *Epilobium* species interspersed with bog rush, *Carex petriei,* sheep's sorrel and lotus. On wet stream margins *Gunnera monoica* is locally common.

The flushes and wetlands are frequently dominated by bog rush. Common associates include *Acaena fissistipula, Hydrocotyle sulcata, Hydrocotyle montana, Ranunculus gracilipes, Epilobium macropus, Pratia angulata, Viola cunninghamii, Carex ovalis* and *Juncus* species. *Chaerophyllum colensoi* var. *delicatulum* (nationally critical) was observed in at least one of these wet areas. In ponds aquatic species such as *Potamogeton cheesemanii* are common.

Pockets of shrubland and scrub occupy the west- and southwest-facing slopes and include species such as *Hebe brachysiphon, Dracophyllum rosmarinifolium, Gaultheria crassa,* mountain wineberry, tauhinu, *Pimelea oreophila* and *Coprosma cheesemanii,* with occasional snow totara. Broad-leaved snow-tussock is commonly interspersed amongst the shrubs. Matagouri occurs on northerly aspects.

The shrublands grade into a mixture of short and tall tussockland and scree. The dominant short tussock is *Festuca matthewsii* which is interspersed with bristle tussock and blue tussock. Common associate species include *Blechnum penna-marina, Raoulia parkii, Gaultheria crassa,* sheep's sorrel and giant speargrass. The tall tussocklands are dominated by either midribbed or broad-leaved snow-tussock depending on aspect and altitude, with midribbed snow-tussock favouring the less steep mountain slopes, while broad-leaved snow-tussock tends to occur on the lower, north-facing slopes and terrace risers. Common associates are herbs and shrubs such as *Ranuculus* sp., *Viola cunninghamii, Carex wakatipu, Craspedia* sp. and tauhinu.

A low shrubland often occurs at the base of screes and consists of snow totara, *Coprosma cheesemanii* and mountain wineberry.

The shaded bluff systems in tributary valleys are dominated by the coral daisies *Helichryum coralloides* and *Helichrysum parvifolium.* Bristle tussock is common regardless of aspect while *Celmisia monroi* is common on south-facing aspects. Also present are shrubs and herbs such as *Heliohebe pentasepala, Hebe decumbens, Hebe rakaiensis, Hebe traversii, Melicytus* "Kaikoura", *Melicytus* "cliff" (nationally endangered), *Anaphalioides bellidioides, Ranunculus insignis, Myosotis australis, Pachycladon fastigiata, Celmisia traversii* and *Celmisia cockayneana* (naturally uncommon). Moister areas and seeps on the bluffs support *Chaerophyllum colensoi* var. *delicatulum* (nationally critical), *Lagenifera barkeri* (naturally uncommon) and *Parahebe decora.*

The cirques and basins at the head of the Saxton were not visited during this survey but are described in Courtney and Arand (1994). These basins have a mosaic of communities including carpet grass turfland and wetland of low turf, cushion and herb species. Alpine tarns in these basins have aquatic vegetation including quillwort and various milfoils. *Plantago obconica* (naturally uncommon) has been previously recorded from one of these cirque basins by Tony Druce (Allan Herbarium (CHR) specimen) and there is no reason why it should not still be present.

Although not visited during this survey, the sub-catchment of the Acheron between Port Cooper Saddle and the Blue Mountain RAP was viewed through binoculars. The pattern of communities observed and described above appears to be replicated in this area.

The upper Saxton area supports a diverse flora including a number of species which have a current threat ranking including: *Chaerophyllum colensoi* var. *delicatulum* (nationally critical), *Melicytus* "cliff" (nationally endangered), *Celmisia cockayneana* (naturally uncommon), *Epilobium brevipes* (naturally uncommon), *Epilobium forbesii* (naturally uncommon), *Haastia pulvinaris* var. *minor* (naturally uncommon), *Lignocarpa diversifolia* (naturally uncommon), *Plantago obconica* (naturally uncommon), *Ranunculus crithmifolius* (naturally uncommon) and *Raoulia 'M'* (naturally uncommon).

Records from the PNAP survey include *Gunnera densiflora* (nationally endangered) and *Wahlenbergia cartilaginea* (naturally uncommon) from within the property and *Traversia baccharoides* (declining) and *Ewartiothamnus sinclairii* (naturally uncommon) from the property boundary. *Ranunculus haastii* (declining) and *Leucogenes neglecta* (naturally uncommon) were both recorded in the RAP but it is unclear exactly where these were recorded from. Suitable habitat for these two species occurs both on the Muller and Molesworth sides of the RAP. Courtney and Arand (1994) observed *Uncinia purpurata* in short tussockland on fans. This is one of the few records for the northern South Island and the northern limit for the species.

Mid and Lower Saxton Valley

The patterns of vegetation in this area are similar to other parts of the property in that there is a trend towards increasing naturalness and intactness of the vegetation communities from valley floor to ridge top and from lower altitude to higher altitude parts of the valley. The principle vegetation communities are:

- Shrub-herbfield on ridge top gravel pavements;
- Bedrock outcrop communities;
- Herb gravelfield (screes);
- Carpet grass turfland on shoulder slopes;
- Bog rush-*Carex ovalis* wetland in valley seeps and flushes;
- Broad-leaved snow-tussock grassland on colluvial slopes;
- Fescue tussock-bristle tussock grassland on spur side slopes;
- Sweet brier shrubland on terrace risers and toe slopes;
- Mixed shrubland on riparian bedrock outcrops;
- *Hieracium* herbfield on spur side slopes, hill slopes and terraces;
- Mixed shrubland in gullies and foot slopes;
- Mixed exotic grass-herbfield in seeps and flushes;
- Mixed exotic grass-*Hieracium* grassland on valley floors and terraces.

The rounded ridgeline along the main spur between the Acheron and Saxton rivers contains a low-stature shrub-herbfield dominated by fescue tussock, carpet grass, midribbed snow-tussock and a mix of low shrubs and herbs such as *Pentachondra pumila*, *Dracophyllum pronum, Hebe pinguifolia, Geranium sessiliflorum, Brachyscome sinclairii, Gentianella corymbifera, Hieracium caespitosum,* sheep's sorrel and browntop. This community is more modified at a lower altitude than the more intact alpine communities further north along this ridge.

Scree communities typically contain a sparse cover of *Leptinella pectinata, Lobelia roughii, Hebe epacridea, Myosotis traversii, Wahlenbergia cartilaginea* (naturally uncommon), *Celmisia allanii, Poa buchananii, Epilobium glabellum* and sheep's sorrel.

On stable west-facing colluvial slopes broad-leaved snow-tussockland is present with fescue tussock, bristle tussock, *Dracophyllum rosmarinifolium* and minor midribbed snow-tussock, cotton daisy, *Hebe cryptomorpha,* mountain heath and *Helichrysum parvifolium.*

Mid slope west-facing bedrock outcrops support sparse communities dominated by *Helichrysum parvifolium, Dracophyllum rosmarinifolium,* patotara, mountain heath, *Colobanthus acicularis,* blue tussock and bristle tussock.

West-facing mid to lower spur side slopes are typified by depleted short tussockland with a high proportion of bare loam and gravel. Fescue tussock, bristle tussock, sheep's sorrel, cotton daisy, mountain heath, *Pimelea oreophila* and patotara are the principle species. Mouse-ear hawkweed and *Hieracium caespitosum* are localised and can form a dense cover.

Ribbons of modified wetland communities are associated with drainage lines which dissect the terrace systems south of Team Stream. Bog rush is commonly a major component if not the dominant species, though *Carex ovalis* has taken over many places in conjunction with other introduced species such as soft rush, white clover and Yorkshire fog. Native species which persist in and amongst wetland turfs include *Carex sinclairii, Pseudognaphalium luteo-album, Leptinella squalida* ssp. *mediana, Epilobium brunnescens, Ranunculus glabrifolius, Lobelia ionantha, Galium perpusillum, Hydrocotyle novae-zelandiae, H.* 'montana' and *H. sulcata*. There are a few *Carex secta* tussocks remaining where watercourses cut the terrace riser to the main stem of Saxton River.

Much of the terrace system south of Team Stream is dominated by mouse-ear hawkweed with browntop, cocksfoot, sweet brier and sheep's sorrel. Native components are sparse, scattered and include bristle tussock, patotara, *Pimelea oreophila,* fescue tussock and *Wahlenbergia albomarginata*. Sweet brier dominates shrubland on the terrace riser with scattered matagouri, *Coprosma propinqua* and *Olearia odorata*. Pasture grasses and mouse-ear hawkweed dominate open areas.

Sweet brier is also the major component of shrublands on colluvial toe slopes. Matagouri, *Olearia odorata,* porcupine shrub and scrub pohuehue are present with occasional emergent mountain ribbonwood and *Coprosma intertexta* (relict).

Dry riparian bluffs and outcrops typically contain matagouri, creeping pohuehue, *Heliohebe pentasepala, Helichrysum parvifolium, Olearia odorata,* sweet brier and porcupine shrub. Damp overhangs which are out of reach of browsing animals contain a mixed community of *Gingidia montana* with white clover, bristle tussock, bog rush and *Anaphalioides bellidioides.*

The mid and lower Saxton area supports a diverse flora including a two species which have a current threat ranking: *Coprosma intertexta* (relict) and *Wahlenbergia cartilaginea* (naturally uncommon).

Middle Gully

The patterns of vegetation in this area tend to be similar to other parts of the property in that there is a trend towards increasing naturalness and intactness of the vegetation communities from valley floor to ridge top and from lower altitude to higher altitude parts of the valley. The principle vegetation communities are:

- Shrub-herbfield on ridge top gravel pavements;
- Bedrock outcrop communities;
- Herb gravelfield (screes);
- Carpet grass turfland on shoulder slopes;
- Bog rush sedgeland in seeps and flushes;
- Broad-leaved snow-tussock grassland on colluvial slopes;
- Fescue tussock-bristle tussock grassland on spur side slopes;
- Mixed shrubland on riparian bedrock outcrops;
- *Hieracium* herbfield on spur side slopes;
- Mixed shrubland in gullies and foot slopes;
- Mixed grass-herbfield in seeps;
- Mixed exotic-fescue tussock grassland in valley floors and terraces.

The ridge which separates Saxton Valley from Middle Gully ranges in altitude from approximately 1500 m to just over 2000 m. The ridge itself is largely rounded with intermittent bedrock outcrops and a few sections of razorback outcrops. The rounded sections support a low-stature shrub-herbfield community dominated by blue tussock, *Kellaria dieffenbachia, Haastia pulvinaris* var. *minor* (naturally uncommon) and *H. recurva*. Common associates include bristle tussock, *Pimelea* sp. 'shining', *P. sericeo-villosa, Brachyglottis bellidioides, Colobanthus acicularis, Luzula rufa?, Leptinella pectinata, Scleranthus uniflorus, Celmisia gracilenta* and *C. allanii*.

Rock outcrops on the ridgeline typically contain *Haastia recurva*, bristle tussock, *Dracophyllum pronum* and patotara with common associates of *Dracophyllum pronum, Haastia pulvinaris* var. *minor* (naturally uncommon), *Helichrysum parvifolium*, carpet grass, *Melicytus* 'Kaikoura' and *Poa buchananii*.

Scree communities are sparsely vegetated but widespread, extending almost down to the valley floor in some areas. The most common species include *Epilobium forbesii* (naturally uncommon), *E. pycnostachyum, E. glabellum, Lobelia roughii, Poa buchananii, Leptinella dendyi, Lignocarpa* sp., sheep's sorrel and *Wahlenbergia cartilaginea* (naturally uncommon).

Broad-leaved snow-tussock grassland generally occurs in the mid to upper parts of the catchment on east-facing slopes. Common associate species include *Hebe brachysiphon, H. cryptomorpha*, snow totara, tauhinu, bristle tussock, mouse-ear hawkweed and *Hieracium caespitosum.*

West-facing slopes contain short tussockland dominated by bristle tussock and fescue tussock. Associate species include tauhinu, broad-leaved snow-tussock, midribbed snow-tussock, mouse-ear hawkweed, *Hieracium caespitosum,* white clover, browntop, cocksfoot and cotton daisy. This community grades into *Hieracium* herbfield in lower parts of the catchment where grass cover is sparse.

Wetland seeps and flushes in the upper part of the catchment, on or draining to the valley floor are typically dominated by bog rush with *Carex sinclairii*, soft rush, white clover, Chewing's fescue, and browntop. Other species include *Viola cunninghamii, Celmisia* 'rhyzomatous', *Leptinella squalida* ssp. *mediana, Craspedia lanata, Ranunculus cheesemanii* and *Hydrocotyle novae–zelandiae*. More modified seeps further down the valley have a higher proportion of exotic grasses and white clover.

Valley floors and small terraces are generally modified and contain a variety of native and introduced species. Common species include cocksfoot, browntop, Yorkshire fog, fescue tussock, bristle tussock, mouse-ear hawkweed, *Hieracium caespitosum, Acaena fissistipula*, white clover, *Ranunculus multiscapus, Anaphalioides bellidioides, Raoulia tenuicaulis,* matagouri, sweet brier, creeping pohuehue, *Bulbinella hookeri* (localised), woolly mullein, viper's bugloss and *Geranium sessiliflorum.*

Riparian rock outcrops typically contain scattered shrubs such as *Heliohebe pentasepela, Hebe pinguifolia, Pimelea aridula* and *Dracophyllum rosmarinifolium*. There are still individuals and small groups of shrubs which are remnants of earlier woody vegetation types remaining in the landscape on foot slopes and in gullies such as mountain ribonwood. *Olearia odorata* and native broom occur infrequently and locally, though the latter is commonly in poor condition from goat and/or stock browsing.

The Middle Gully area supports a diverse flora including a three species which have a current threat ranking: *Epilobium forbesii* (naturally uncommon), *Haastia pulvinaris* var. *minor* (naturally uncommon) and *Wahlenbergia cartilaginea* (naturally uncommon).

Blue Mountain

This area was identified as an RAP in the PNAP report (Courtney and Arand 1994). Blue Mountain itself constitutes one of the highest points of the pastoral lease at 2051 m altitude. The area identified as an RAP comprises most of the sub-catchment south of Blue Mountain. The ridgeline in the northern half of the sub-catchment comprising the RAP borders the protected land of Glazebrook Conservation Area. The principle vegetation communities are well described in Courtney and Arand (1994):

- Midribbed snow-tussock grassland on mountain slopes;
- Broad-leaved snow-tussock and bristle tussock on mountain slopes;
- Bedrock outcrop communities on summit;
- Bog rush wetlands in seeps and flushes;
- Herb gravelfield (screes);
- Shrub-herbfield on colluvial mountain and talus slopes;
- Mixed exotic grassland in valley floors.

South-facing slopes are dominated by midribbed snow-tussock grassland. Common associate species are blue tussock, *Celmisia traversii*, *C. gracilenta*, *Carex wakatipu* and *Astelia petriei*. North-facing slopes are dominated by broad-leaved snow-tussock and bristle tussock with blue tussock, fescue tussock and occasional midribbed snow-tussock. Other associate species include tauhinu, *Gaultheria 'novae–zelandiae'*, *Epilobium atriplicifolium*, cotton daisy, *Raoulia subsericea*, *Blechnum penna-marina*, *Geranium sessiliflorum* and sheep's sorrel.

The damp basin floor and foot-slopes support bog rush. Common associate species include *Ranunculus gracilipes*, *R. foliosus*, *Microseris scapigera*, *Acaena fissistipula*, *Dolichoglottis lyallii*, *Ourisia caespitosa*, *Epilobium macrodon*, white clover and *Hieracium caespitosum*. Vegetation in the valley bottom is the most modified community, with pasture grassland predominating (Yorkshire fog, browntop, sweet vernal, *Poa pratensis* and Chewing's fescue) with a major component of *Hieracium caespitosum*.

The majority of the RAP supports sparsely vegetated colluvial talus, scree and rock outcrops. The survey covered samples of these areas along and below the crests and ridge near Blue Mountain. Bedrock outcrops around Blue Mountain summit are dominated by vegetable sheep (*Haastia pulvinaris* var. *minor* (naturally uncommon) and *Raoulia eximia*) with associate species such as *Colobanthus acicularis*, *C. strictus*, *Helichrysum coralloides*, *Hebe epacridea*, *Poa buchananii* and bristle tussock. Where the ridge crest is rounded, carpet grass turfland becomes dominant.

Talus slopes on gentle gradients support a sparse shrub-herbfield community characterised by *Hebe macrocalyx* var. *humilis*, *H. decumbens*, *H. pinguifolia*, *H. epacridea*, porcupine shrub, midribbed snow-tussock, *Elymus solandri*, *Celmisia allanii*, *Pseudognaphalium luteo-album*, *Haastia pulvinaris* var. *minor* (naturally uncommon) and *H. recurva*. Scree gravelfield communities are very sparsely vegetated. The most common species are *Lignocarpa carnosula*, *Leptinella pyrethrifolia*, *Notothlaspi rosulatum* and *Poa buchananii*.

The Blue Mountain area supports a diverse flora including a species which has a current threat ranking: *Haastia pulvinaris* var. *minor* (naturally uncommon).

Acheron River and tributaries: Orr Stream to Burnt Hut Yards

The vegetation shows similar patterns to other parts of the property, naturalness grading over altitude and aspect. The principle vegetation communities are:

- Alpine tarn riparian margins;
- Shrub-herbfield on ridge top gravel pavements;
- Tall tussock dominated midslopes;

- Carpet grass turfland on shoulder slopes;
- Bog rush sedgeland in seeps and flushes;
- *Hieracium* herbfield on spur side slopes;
- Mixed shrubland on rocky banks;
- Mixed grass-herbfield in seeps;
- Mixed exotic-fescue tussock grassland in valley floors and terraces.

The Orr Stream catchment has at its head two small tarns. One is devoid of fringing vegetation, whilst the other has a fringe of cushion bog plants that continue downhill in a considerable seepage zone. This flush vegetation includes cushions of *Phyllachne colensoi*, *Chionohebe pulvinaris* and mosses, small herbs such as bidibid, *Gnaphalium mackayi*, *Raoulia grandiflora*, *Leptinella pectinata*, *Kellaria dieffenbachii*, *Celmisia sessiliflora*, *Psychrophila novae-zelandiae* and willowherbs. Also present are comb sedge, bog rush, mountain shield fern, carpet grass and snow-tussock (mainly broad-leaved snow-tussock).

The high land of ridges, screes, boulderfields and outcrops surrounding the tarns has sparse alpine vegetation that features vegetable sheep (mainly *Haastia pulvinaris* var. *minor* (naturally uncommon) and *Raoulia bryoides*) and includes bristle tussock, penwiper, mountain daisies (*Celmisia allanii*, *C. laricifolia* and cotton daisy), *Colobanthus buchananii*, *Leptinella dendyi*, *Epilobium forbesii* (naturally uncommon), *Hebe haastii*, *Haastia sinclairii* and *Aciphylla monroi*. The exotic herb sheep's sorrel is surprisingly common on the screes.

Below the alpine zone, tall tussocks are dominant, mainly midribbed snow-tussock with some broad-leaved snow-tussock. They are denser and healthier on the shadier slopes, where they are less affected by sheep and cattle. Within the tall tussockland are many subalpine plants, including short tussocks and shrubs (*Hebe cryptomorpha*, tauhinu, mountain heath, yellow tree daisy, *Olearia cymbifolia* and inaka). Also present are mountain daisies (*Celmisia traversii*, *C. allanii*, *C. haastii*, *C. monroi* and cotton daisy), mat daisies (*Raoulia australis* and *R. glabra*) and giant speargrass. On rocks are *Helichrysum coralloides*, *H. parvifolium*, *Heliohebe pentasepala*, pockets of snow marguerite and patches of snow totara. In seepages, bog rush is dominant, and there are patches of Maori onion. The exotic grasses browntop and sweet vernal are present, as are a few wilding pines.

Lower down the Orr Stream catchment, particularly on the sunnier faces, the tall tussocks give way to a combination of short tussocks, exotic grasses and hawkweed (both mouse-ear hawkweed and *Hieracium caespitosum*). The gravelly sections of the stream bed have sparse vegetation of mat daisies, willowherbs, bidibid, creeping pohuehue and exotic herbs and grasses. The steep rocky stream banks are refuges for *Helichrysum coralloides*, *H. intermedium*, *H. parvifolium*, *Heliohebe pentasepala*, *Celmisia monroi*, *Gingidia montana*, *Ranunculus insignis* and snow marguerite.

South of Orr Stream is a smaller catchment that drains into the Acheron River just above Munroe Hut. Its vegetation patterns are very similar to those of the Orr Stream catchment, although the vegetation appears to have been somewhat more modified by stock. The upper reaches are dominated by screes and rock outcrops, so the vegetation is sparse and features vegetable sheep, scree plants and tough low-growing shrubs such as snow totara and *Dracophyllum pronum*. Plants present that were not seen in the Orr Stream catchment are *Pimelea sericeo-villosa*, *Leptinella pyrethrifolia*, *L. pectinata*, *Helichrysum depressum*, mountain ribbonwood and *Lignocarpa diversifolia* (naturally uncommon). Of particular note are *Hebe salicornioides* (nationally endangered) and *Ewartiothamnus sinclairii* (naturally uncommon). Both were found in the small gorge in the lower part of the catchment.

The vegetation in the Acheron Valley between Munroe Hut and the Middle Gully confluence is one of contrasting sides. The true left (southeast) side is sunnier, so experiences more stock use and is a harsh environment for native plant establishment. As a result the native vegetation is much more depleted. Native plants that can grow on rocks inaccessible to stock are present, but the former grasslands have become dominated by exotic grasses and hawkweeds. In gullies and on some slopes

is scrub of matagouri, porcupine shrub, tauhinu, *Coprosma propinqua*, mountain wineberry and *Olearia odorata*, with much sweet brier. The true right side has much more native vegetation, due to its shaded aspect and massive rock outcrops and boulderfields. The specialist native rock plants occur all the way down to the river banks. They include a strong population of *Ewartiothamnus sinclairii* (naturally uncommon). Also present in small quantities is *Coprosma intertexta* (relict). There is a series of small gullies that typically have much subalpine scrub dominated by yellow tree daisy, accompanied by snow totara, inaka, *Hebe cryptomorpha*, giant speargrass and a scattering of mountain ribbonwood. Where there is pasture on the lower slopes it is comprised mainly of exotic species and there is quite a lot of sweet brier. Higher slopes have grasslands of both short and tall tussocks.

The upper Acheron River area supports a diverse flora including a range of species which have a current threat ranking: *Coprosma intertexta* (relict), *Epilobium forbesii* (naturally uncommon), *Ewartiothamnus sinclairii* (naturally uncommon), *Haastia pulvinaris* var. *minor* (naturally uncommon), *Hebe salicornioides* (nationally endangered) and *Lignocarpa diversifolia* (naturally uncommon).

Acheron River: Burnt Hut Yards to Middle Gully

The principle vegetation communities in this area are:

- Bedrock outcrop communities;
- Herb gravelfields (scree);
- Short tussockland on side slopes;
- *Hieracium* herbfield on side slopes;
- Snow totara shrubland on side slopes;
- Tauhinu shrubland on side slopes;
- Mixed tussockland on river terrace;
- Bog rush wetland seeps and flushes;
- Ephemeral wetlands with turf communities.

The vegetation in the Acheron Valley between Munroe Hut and the Middle Gully confluence is one of contrasting sides. The true left (southeast) side is sunnier, so experiences more stock use and is a harsh environment for native plant establishment. As a result the native vegetation is much more depleted. Native plants that can grow on rocks inaccessible to stock are present, but the former grasslands have become dominated by exotic grasses and hawkweeds. In gullies and on some slopes is scrub of matagouri, porcupine shrub, tauhinu, *Coprosma propinqua*, mountain wineberry and *Olearia odorata*, with much sweet brier. The true right side has much more native vegetation, due to its shaded aspect and massive rock outcrops and boulderfields. The specialist native rock plants occur all the way down to the river banks. They include a strong population of *Ewartiothamnus sinclairii* (naturally uncommon). Also present in small quantities is *Coprosma intertexta* (relict). There is a series of small gullies that typically have much subalpine scrub dominated by yellow tree daisy, accompanied by snow totara, inaka, *Hebe cryptomorpha*, giant speargrass and a scattering of mountain ribbonwood. Where there is pasture on the lower slopes it is comprised mainly of exotic species and there is quite a lot of sweet brier. Higher slopes have grasslands of both short and tall tussocks.

Rock and scree communities dominate the upper northwest-facing slopes in this part of the Acheron valley. The east-facing slopes support short tussockland which grades into mixed tall tussockland and tauhinu shrubland.

At higher altitudes the bedrock outcrops are only sparsely vegetated with occasional vegetable sheep (*Haastia pulvinaris* var. *minor* (naturally uncommon) and *Raoulia bryoides*), *Poa buchananii, Colobanthus acicularis* and bristle tussock. Diversity increases as altitude decreases with species such as *Melicytus* "Kaikoura", *Helichrysum coralloides, H. parvifolium*, cotton daisy, *Leptinella pyrethrifolia, Elymus* sp., creeping pohuehue, patotara, *Scleranthus* sp., *Hebe pinguifolia, Vittadinia*

australis and sheep's sorrel. *Pachycladon fastigiata* occurs occasionally on sheltered south-facing bluffs.

Sparse herbfield occurs on gravel screes between outcrops. *Poa buchananii, Epilobium forbesii* (naturally uncommon) and *E. pycnostachyum* are common, with *Epilobium forbesii* (naturally uncommon) favouring the crests and shoulder slopes (i.e. the more stable areas) and *E. pycnostachyum* extending down the slopes and into the mobile screes. In places, pockets of argillite dominate the screes and diversity increases, with species such as *Lignocarpa carnosula, Myosotis traversii* and *Leptinella dendyi.* Bristle tussock is scattered throughout. In the stable sheltered areas at lower altitude blue tussock, *Luzula rufa* and *Blechnum penna-marina* occur. Sheep's sorrel is present and more common at lower altitudes.

The rock and scree communities grade into a mosaic of short tussockland and *Hieracium* herbfield on the north- to northwest-facing aspects. Short tussockland is dominated by bristle tussock and cotton daisy, with occasional blue tussock, *Festuca matthewsii, Raoulia subsericea, R. parkii, Vittadinia australis*, mouse-ear hawkweed, browntop and cocksfoot. Common associates in the *Hieracium* herbfield include *Raoulia subsericea, R. parkii, Brachyscome sinclarii,* patotara, *Geranium microphyllum, Thelymitra* sp., *Pimelea oreophila* and *P. aridula.*

Scattered shrubland occurs on valley sides. On the rockier ridgelines these shrubs are dominated by snow totara with scattered mountain heath, *Myrsine nummularia, Hebe pinguifolia, Heliohebe pentasepala,* tauhinu and *Helichrysum parvifolium.* In gullies and on sheltered south-facing slopes shrublands are dominated by tauhinu. Many of these shrublands could not be visited due to time constraints. Binocular viewing indicated that yellow tree daisy occurs in some of these communities, particularly mid slope on the south- to southeast-facing aspects. On these aspects shrublands are interspersed with and grade into tall tussockland, dominated by either midribbed or broad-leaved snow-tussock.

Porcupine shrub and *Clematis* sp. dominate sparse shubland on the valley floors and toe slopes at the base of boulderfields and screes. Sweet brier is an occasional associate. On south- to southeast-facing aspects, these shrublands are interspersed with and grade into tall tussockland.

The dominant community on the river terraces is mixed tussock grassland. This contains a mixture of *Festuca matthewsii* and exotic grasses such as browntop and cocksfoot. Common associates are *Raoulia subsericea, R. parkii,* blue tussock, bristle tussock, *Hieracium caespitosum* and mouse-ear hawkweed. These communities continue up the valley sides, with an increasing native component including species such as *Pimelea pseudolyallii* (naturally uncommon) and occasional *Carmichaelia monroi*.

Near the Munroe Hut yards, there is a mosaic of exotic grassland and *Hieracium* herbfield on the older river terraces and toe slopes. With increasing altitude (often only in the order of 100 metres or so) there is typically increasing native species diversity.

Bluffs and rockland beside the river support shrub and herb communities. *Helichrysum parvifolium, H. coralloides Heliohebe pentasepala, Pimelea* sp., *Hebe decumbens* and *H. rakaiensis* are common, with occasional *Olearia odorata,* native broom, *Gautheria* sp. and matagouri.

Herbfield on recent river gravels contains mixtures of native and exotic herbs and grasses. Native species include *Raoulia tenuicaulis, Epilobium microphyllum, E. melanocaulon,* bristle tussock, blue tussock and creeping pohuehue. Common exotic species are white clover, *Hieracium* spp., viper's bugloss, woolly mullein, cocksfoot and browntop. A mixture of wetlands occur on the valley floor, including bog rush flushes and ephemeral wetlands with residual turf communities.

The bog rush wetlands often occur at flushes on toe slopes and commonly contain *Carex coriacea, C. kaloides, C. sinclairii, Uncinia* sp., *Eleocharis acuta, Juncus articulatus,* soft rush and *Carex ovalis. Aciphylla subflabellata* (declining) occurs occasionally at wet stream margins.

Ephemeral wetlands occur in depressions and swales on the valley floor. They contain a mixture of exotic grasses and residual native turfs with species such as *Leptinella pusilla, Euchiton laterale, Plantago triandra, Hydrocotyle* sp., *Eleocharis acuta, E. gracilis, Epilobium minutiflorum, Viola cunninghamii* and *Poa pratensis.* Very wet areas contain *Limosella lineata, Myriophyllum pedunculatum, Centrolepis minima* and *Ranunculus trichophyllus.*

The Burnt Yards to Munroe Hut part of the Acheron River area supports a diverse flora including a range of species which have a current threat ranking: *Aciphylla subflabellata* (declining), *Epilobium forbesii* (naturally uncommon), *Ewartiothamnus sinclairii* (naturally uncommon), *Haastia pulvinaris* var. *minor* (naturally uncommon) and *Pimelea pseudolyallii* (naturally uncommon).

Acheron River Eastern Tributary

The principle vegetation communities in this area are:

- Browntop-*Hieracium* grassland-herbfield on hill slopes;
- Broad-leaved snow-tussockland on colluvial slopes;
- Bedrock outcrop communities;
- Hebe shrubland in gullies and depressions;
- Snow totara and broad-leaved snow-tussock shrubland-grassland on spur ridgeline and shoulder slopes;
- Herb gravelfield (scree);
- Red tussockland on damp alluvial flat;
- Mixed grassland-herbfield in seeps;
- Mixed exotic grassland on valley floors.

Browntop and mouse-ear hawkweed dominate the majority of the surveyed area on the mid-slopes and dry faces. The most common associates include fescue tussock, bristle tussock, *Hieracium caespitosum,* cocksfoot and sheep's sorrel. Occasional emergent shrub species include yellow tree daisy and tauhinu, and there are scattered lower-stature indigenous species including patotara, *Brachyglottis bellidioides, Lycopodium fastigiatum, Luzula rufa,* cotton daisy and *Brachyscome sinclairii.* Broad-leaved snow-tussock, fescue tussock and bristle tussock are locally common and occasionally dominant, particularly on foot slopes (short tussocks) and on colluvial talus (snow tussock).

The shoulder slopes and ridge support a more diverse low-stature indigenous community, particularly amongst bedrock outcrops and colluvium. Snow totara and broad-leaved snow-tussock are locally common with associates such as *Dracophyllum pronum, Hebe decumbens, H. cryptomorpha, Pimelea sericio–villosa,* cotton daisy and bristle tussock.

Small shrubland remnants exist largely in depressions and gullies or on shady foot slopes. *Hebe cryptomorpha, H. brachysiphon,* matagouri, tauhinu and occasional *Olearia odorata* are the principal species. Small riparian bedrock outcrops occur locally and are characterised by species such as *Helichrysum parvifolium, Heliohebe pentasepala* and *Hebe pinguifolia*.

The sparse vegetation on open screes includes *Hebe epacridea, Myosotis traversii, Lobelia roughii,* sheep's sorrel and *Stackhousia minima,* as well as *Epilobium forbesii* (naturally uncommon) and *Wahlenbergia cartilaginea* (naturally uncommon).

The valley floors contain small pockets with seeps and damp depressions, sometimes containing red tussock and/or bog rush but are typically heavily modified and otherwise dominated by exotic grass

and herb species such as cocksfoot, white clover, viper's bugloss, soft rush and *Sagina procumbens*. Occasionally, native species such as *Euchiton traversii* are present.

The two threatened species found in this area, *Epilobium forbesii* (naturally uncommon) and *Wahlenbergia cartilaginea* (naturally uncommon), were both observed in good numbers (50+) in the scree communities.

Acheron Valley Pond

This is a large shallow pond on the river terrace on the east (true-left) side of Acheron River below the confluence of Middle Gully. The principle vegetation communities are:

- Bog rush sedgeland in valley floor wetland;
- Aquatic communities in valley floor wetland;
- *Carex coriacea* sedgeland in valley floor wetland.

The pond itself contains the aquatic plants *Potomogeton cheesemanii* and duckweed, and appears to hold permanent water. The margins consist of pedestals of soft rush and *Carex ovalis*, and exotic grasses such as cocksfoot, Yorkshire fog and browntop. Growing through these grasses and rushes are a number of herbs including *Epilobium chionanthum,* white clover, *Myosotis laxa* and smaller sedges such as *Eleocharis acuta* and *Juncus articulatus.*

Water from the eastern slopes drains through a flush which flows into the pond. This flush supports a bog rushland with *Eleocharis acuta*, tall fescue, soft rush and occasional *Carex secta. Carex coriacea* sedgeland is also present with herbs such as *Epilobium chionanthum, E. ciliatum, Cardamine* sp., *Celmisia "rhizomatous"* and exotic grasses. *Coprosma intertexta* (relict) was observed in shrubland on the toe slopes above this wetland.

The Acheron Valley Pond area supports a diverse flora including a species which has a current threat ranking: *Coprosma intertexta* (relict).

Isolated Flat

The flats of the lower Saxton valley, the fault wetland and the flats north of the Acheron River support the following plant communities:

- *Hieracium* herbfield on alluvial valley terrace;
- Mixed herbfield turf on ephemeral wetland margin;
- *Gnaphalium luteoalbum* var. *compactum* (nationally critical) herbfield on ephemeral wetland bed (when dry);
- Loamfield on ephemeral wetland bed (when dry);
- Exotic grassland on ephemeral wetland margin;
- *Carex ovalis* sedgeland on ephemeral wetland margin.

Mouse-ear hawkweed dominates the Isolated Flat area. However despite the modified and depleted appearance of this community, there remains a substantial native component on the higher terraces near the small wetland. Browntop is a common associate species along with sheep's sorrel. Native species include *Gentianella corymbifera, Luzula rufa*, mountain heath, patotara, blue tussock, fescue tussock, bristle tussock, *Celmisia gracilenta*, porcupine shrub, *Brachyscome sinclairii, Brachygolottis bellidioides, Carex muelleri*, creeping pohuehue, *Acaena inermis, Raoulia parkii, Leptinella pectinata* ssp. *pectinata*, *Hebe pimeleoides, Pimelia* sp. and *Stackhousia minima*. A single plant of *Acyphylla subflabellata* (declining) grows in a swale beside the road.

The ephemeral wetland originates from a fault line which runs through part of Isolated Flat. It is largely modified but retains native turf communities on the margins and native herbs on the periodically dry wetland bed. A sparse herbaceous zone occurs in parts of the wetland bed which

retain the most moisture. It comprises *Limosella lineata* and occasional *Myriophyllum pedunculatum* and *Elatine gratioloides*. Beyond this zone and further towards the wetland margin *Gnaphalium luteoalbum* var. *compactum* (nationally critical) is locally abundant with associates *Euchiton* aff. "sparicum", *Epilobium komorovianum, Crassula sinclairii, Oxalis exilis, Juncus bufonius* and white clover. *Carex petriei* commonly occurs around the margins of this community. Beyond this zone there is a turf characterised by *Leptinella squalida* ssp. *mediana, Lobelia ionantha, Anisotome aromatica, Hydrocotyle hydrophila, Ranunculus* sp., *Colobanthus apetalus* and *Euchiton traversii*. Invasive exotic species dominate the drier marginal zones beyond the turf. *Carex ovalis* sedgeland is present and merges with exotic grassland. Creeping bent is prominent while *Juncus articulatus* and *Potomageton* sp. are common associate species.

The Isolated Flat area supports a diverse flora including a two species which have a current threat ranking: *Aciphylla subflabellata* (declining) and *Gnaphalium luteoalbum* var. *compactum* (nationally critical).

Murphy: faces to the southwest and northeast to Kennet River

Part of this area was identified as an RAP in the PNAP report (Courtney and Arand 1994). The area identified as an RAP comprises the south and southeast face of Murphy and takes in the area northeast and northwest of Saxton Pass. The principle vegetation communities are described in Courtney and Arand (1994), with the principle vegetation communities from this survey identified as:

- Mountain beech on some south facing slopes;
- Extensive herb gravelfields (scree) at highest altitudes;
- *Hieracium* herbfield on side slopes;
- Snow totara shrubland on side slopes;
- Mixed shrubland in stream gullies;
- Mixed tussockland on mid and upper slopes;
- Bog rush wetland seeps and flushes;

To the southwest of Murphy (1827 m) are a small catchment and a series of steep spurs and gullies. The lower portion has long been frequented by stock, so the native vegetation is depleted. However, above that there is more intact native vegetation. There are extensive snow totara patches, short and tall tussocks and rock and scree plants. Bog rush defines seepage zones. Gullies have scrub of tauhinu, matagouri, kanuka, *Coprosma propinqua* and *Hebe cryptomorpha*, with a scattering of mountain ribbonwood.

The adjacent south-facing slopes of Murphy (steep slopes and spurs drained by tight gullies) have a small outlier of mountain beech and areas of scrub (matagouri, tauhinu, *Olearia odorata*, *Coprosma propinqua* and *Hebe cryptomorpha*) in which there is quite a lot of mountain ribbonwood. Giant speargrass is common in places. Tussocklands grow on mid and upper slopes, comprising combinations of tall tussocks (broad-leaved and midribbed snow-tussocks), short tussocks (bristle, fescue and blue tussocks), carpet grass and a range of small inter-tussock plants. Screes are extensive in the uplands and support a considerable array of scree plants. Although not searched for during this survey, four plants of note have been reported from the upland screes and outcrops. Two, *Epilobium angustum* and *Colobanthus brevisepalus* (naturally uncommon) have not been recorded elsewhere in the ecological district. Their presence contributed to the selection of this area as an RAP (Courtney and Arand 1994). Records from the Allan Herbarium (CHR) indicate that *Pachycladon stellata* (nationally critical) and *Wahlenbergia albomarginata* ssp. *flexilis* (naturally uncommon) are or were present here.

Further east, the same patterns are repeated as far as the catchment of the Kennet River. The existing fence well defines the separation of developed and more natural land. Below the fence is pasture with scattered shrubs and fescue tussock. Above the fence is very extensive scree, with massive exposed rock outcrops in places. There are substantial areas of snow totara, shrublands of tauhinu

and matagouri and areas of tussockland (mainly short tussocks but also some tall tussocks). Several of the streams, such as the Awatere-iti, have riparian zones of dense matagouri scrub, some containing mountain ribbonwood.

The Murphy faces area supports a diverse flora including three species which have a current threat ranking: *Colobanthus brevisepalus* (naturally uncommon), *Pachycladon stellata* (nationally critical) and *Wahlenbergia albomarginata* ssp. *flexilis* (naturally uncommon).

Castle River tributaries and faces to Ward Stream

The principle vegetation communities in this area are:

- Mountain beech on some slopes;
- Kanuka shrublands in deforested patches;
- Mixed shrublands on flats and fans in the lower valleys;
- Exotic dominated grasslands in the valley floor;
- Bog rush wetland seeps and flushes.

The head of the major tributary east of Shingle Peak, draining northeast into Castle River, has similarities to the head of Langridge Stream. It has mountain beech forest remnants, kanuka forest and shrubland where the forest has gone, subalpine short tussockland with varying amounts of shrubs, much upland scree and rock habitat and alpine conditions at the top. The beech forest undergrowth is very depleted (by goats, deer, pigs, possums, rabbits and hares, as well as cattle and sheep), although a few beech seedlings are beating the odds to become trees. At the bottom edge of the beech forest, a population of *Pittosporum divaricatum* was found growing with tall matagouri, *Coprosma propinqua* and *Olearia odorata*. Lower down the valley, the flats and fans have huge old matagouri and *Olearia odorata* plants and manuka. The valley floor is grassy (with exotic grasses) and quite swampy due to numerous seepages. These wet areas are dominated by sedges and rushes, including bog rush, spike sedge, tussock sedge and leafy sedges. The valley flanks have extensive low forest, treeland and shrubland dominated by kanuka and matagouri. *Olearia odorata* is quite common. Native broom and *Brachyglottis monroi* occur in rocky sites. Sweet brier is also present.

On the true right of the main Castle River valley, in the vicinity of the hut, there is less native vegetation. There is a mix of rough pasture of browntop, sweet vernal and mouse-ear hawkweed and shrubland and scrub of matagouri, kanuka, *Coprosma propinqua*, *Olearia odorata* and sweet brier.

Downstream of this much modified area is a zone of massive rock outcrops and bluffs that extends from the river to the skyline. A feature of the rock vegetation is the strong population of Marlborough rock daisy. Also growing on the rocks are *Helichrysum parvifolium*, *Heliohebe pentasepala*, *Brachyglottis monroi*, mountain flax, golden speargrass, porcupine shrub, *Celmisia monroi*, *Gingidia montana* and the small ferns *Asplenium richardii* and *A. trichomanes*. Growing amongst the outcrops are matagouri, kanuka, *Coprosma propinqua*, *Olearia odorata* and sweet brier.

Between the rocky area and the Langridge Stream catchment are several other catchments. Some are small, steep and tight, with active erosion, but they contain scrub or low forest of kanuka, matagouri and some kohuhu, dense in places. Sweet brier is common. Marlborough rock daisy is on rocks inaccessible to sheep and goats. At their heads, in the subalpine zone, are patches of snow totara.

There are two larger catchments, one unnamed, the other called Ward Stream. Ward Stream catchment has mountain beech forest remnants, whilst the other catchment has a small group of mountain totara trees high on a bald spur. These were the only mountain totara found on the property. Otherwise, the two larger catchments have patches and expanses of kanuka and matagouri of varying density, along with rough pasture of exotic grasses and hawkweeds, invariably accompanied by tough shrubs including sweet brier. A few wilding pines were seen during the

survey. Like the smaller catchments, these two are actively eroding at their heads. Subalpine and alpine vegetation is probably very similar to that at the head of Langridge Stream.

The Castle River tributaries and faces area supports a diverse flora.

Langridge Stream catchment

The principle vegetation communities in this area are:

- Dense mountain beech on the slopes;
- Kanuka shrublands in deforested patches;
- Short tussocklands and mixed shrublands above the forest.

The Langridge Stream catchment stands out for the amount of mountain beech forest remaining. Although fires have undoubtedly been lit in the catchment in the past, most of the gullies are clad in beech forest. Where the forest has been burnt is now mostly low forest dominated by kanuka. Above the bush and the kanuka are expanses of short tussockland (mostly bristle tussock) with subalpine shrubs and other native upland plants. The shrubs include inaka, tauhinu, mountain heath, porcupine shrub, snow totara, *Helichrysum parvifolium* and small hebes. Other plants include mat daisies, mountain daisies (especially cotton daisy), snowberry, patotara, *Coprosma petriei* and golden speargrass. Snow totara is abundant both on the extensive screes and on the gentle high ridges. Carpet grass is also present at higher altitudes. Also on the screes are specialist plants such as *Lignocarpa diversifolia* (naturally uncommon), *Raoulia bryoides*, *Leptinella dendyi*, *Epilobium forbesii* (naturally uncommon), *Hebe haastii*, *Myosotis traversii* and *Wahlenbergia cartilaginea* (naturally uncommon).

The Langridge Stream area supports a diverse flora including a three species which have a current threat ranking: *Epilobium forbesii* (naturally uncommon), *Lignocarpa diversifolia* (naturally uncommon) and *Wahlenbergia cartilaginea* (naturally uncommon).

Kennet River catchment

This area was identified as an RAP in the PNAP report (Courtney and Arand 1994). The RAP takes in Shingle Peak and the highest point on the property (highpoint 2131). The area identified as an RAP comprises the upper Kennet River basin with the northern border being the ridge running south west from Shingle Peak. The principle vegetation communities are well described in Courtney and Arand (1994):

- Mountain beech on some slopes;
- Kanuka shrublands around the beech forest;
- Mixed shrublands in the lower valley's;
- Exotic dominated grasslands in the valley floor;
- Bog rush wetland seeps and flushes.

This catchment has been identified as an RAP (Dillon ED RAP 4 Kennet; Courtney and Arand 1994). The lower river flanks have shrubland-treeland and low forest of kanuka, with much matagouri and some *Olearia odorata* and sweet brier. Seepage zones are dominated by bog rush and tussock sedge. On the gravelly stream flood zones are willowherbs, mat daisies, creeping pohuehue, fescue tussock and silver tussock, with some *Helichrysum depressum*. They are accompanied by sweet brier and St John's wort. On lower stream flats are stands of very large matagouri reaching at least six metres in height. On the rocky stream banks are native broom, *Brachyglottis monroi*, *Helichrysum parvifolium* and Marlborough rock daisy. *Ewartiothamnus sinclairii* (naturally uncommon) has been found in the catchment, as have forest species near their altitudinal limits, including yellowwood, prickly mingimingi and tutu (Courtney and Arand 1994). Remnant pockets

of mountain beech forest are nestled into the gullies or are associated with bluffs. Courtney and Arand (1994) list *Traversia baccharoides* (declining) as being an associate in the understorey of the beech forest. Above and flanking the beech forests are shrublands of tauhinu, inaka, snow totara and hebes, with some fescue tussock. Kanuka and matagouri are prevalent further downslope. Away from the gullies and gentler ground, the uplands are characterised by vast scree systems. Two scree plants of note have been found: the mat daisy *Raoulia cinerea* (naturally uncommon) and scree buttercup *Ranunculus crithmifolius* (naturally uncommon) (Courtney and Arand 1994). Otherwise, there are extensive patches of snow totara in the screes and outcrops.

The Kennet River catchments area supports a diverse flora including a three species which have a current threat ranking: *Ewartiothamnus sinclairii* (naturally uncommon), *Ranunculus crithmifolius* (naturally uncommon), *Raoulia cinerea* (naturally uncommon) and *Traversia baccharoides* (declining).

Notable Flora

Notable plant species recorded on the property are listed in Table 2. Threat categories are those listed in de Lange *et al.* (2009).

Table 2 **Notable plant species, Muller Pastoral Lease.**

Threat Division	Threat Category	Species	Location on Property
threatened	nationally critical	*Chaerophyllum colensoi var. delicatulum*	Upper Saxton valley wetlands.
		Gnaphalium luteoalbum var. compactum	Isolated Flat, ephemeral wetland.
		Pachycladon stellata	Murphy RAP
	nationally endangered	*Hebe salicornioides*	Two plants in small gorge near Munroe Hut (Acheron valley).
		Melicytus "cliff"	Upper Saxton valley, bluffs.
at risk	declining	*Aciphylla subflabellata*	Isolated Flat; lower Acheron valley.
		Ranunculus haastii	Upper Saxton valley.
		Traversia baccharoides	Kennet River beech forest; Saxton River gorge.
	naturally uncommon	*Celmisia cockayneana*	Upper Saxton valley
		Colobanthus brevisepalus	Murphy RAP, high-altitude rock outcrops.
		Epilobium brevipes	Saxton valley, high-altitude rock outcrops.
		Epilobium forbesii	High-altitude screes throughout.
		Ewartiothamnus sinclairii	Acheron valley, lower-altitude rock outcrops; mid and lower Saxton valley.
		Gunnera densiflora	Upper Saxton valley below Port Cooper Saddle.
		Haastia pulvinaris var. minor	High-altitude ridges and screes.
		Leptinella serrulata	Blue Mountain.
		Leucogenes neglecta	Upper Saxton valley.
		Lignocarpa diversifolia	Langridge valley screes; upper Saxton valley screes.
		Pimelea pseudolyallii	Acheron valley terraces.
		Plantago obconica	Upper Acheron valley cirque wetland.
		Ranunculus crithmifolius	High-altitude screes.
		Raoulia cinerea	Upper Acheron valley, on argillite; Blue Mountain; Shingle Peak ridge.
		Raoulia 'M'	Middle Gully; Shingle Peak ridge; Port Cooper Saddle scree.
		Wahlenbergia albomarginata ssp. *flexilis*	Murphy RAP.
		Wahlenbergia cartilaginea	High-altitude screes, throughout.
	relict	*Coprosma intertexta*	Acheron valley, lower-altitude shrubland; lower Saxton valley.
South Marlborough endemic		*Hebe decumbens*	Bluffs and rockland.
		Helichrysum coralloides	Bluffs and rockland.
		Heliohebe pentasepala	Bluffs and rockland.
distributional limit		*Uncinia purpurata*	Upper Saxton valley: northern limit.

Significance of Vegetation and Flora

The significant inherent values of Muller Pastoral Lease relate to remnant indigenous vegetation that indicates pre-european patterns, the presence of threatened plants, and previously recommended RAPS from the PNAP surveys. Although the primeval vegetation patterns have been much modified by human activity, in places it is still possible to observe the original patterns, especially where there is beech forest, subalpine shrubland, dense tall tussockland and alpine vegetation. Continuous altitudinal sequences of indigenous vegetation are present in a number of localities.

The property supports a number of threatened species, including three nationally critical species and two nationally endangered species. It is a stronghold for a large number of at-risk species and plant species that are endemic to South Marlborough.

Four areas recommended for protection by the PNA Programme are wholly or partly present on the property and there is no reason that the values associated with these should not still be present. These areas are linked by extensive and relatively intact high-altitude plant communities.

Balaclava ED RAP 20 Saxton

Balaclava ED RAP 4 Blue Mountain

Dillon ED RAP 4 Kennet

Balaclava ED RAP 18 Murphy

Unit	Number
Upper Saxton	1
Mid and Lower Saxton Valley	2
Middle Gully	3
Blue Mountain	4
Orr Stream to Burnt Hut Yards	5
Acheron River: Burnt Hut Yards to Middle Gully	6
Acheron River Eastern Tributary	7
Acheron Valley Pond	8
Isolated Flat	9
Murphey: southwest and northeast to Kennet River	10
Castle River tributaries and faces to W ard Stream	11
Langridge Stream catchment	12
Kennet River catchment	13

Muller Pastoral Lease - Botanical Values

Department of Conservation
Te Papa Atawhai

New Zealand Government

N
W E
S

5
Kilometres

Legend

- Muller Pastoral Lease
- Botanical values
- Botanical units
- RAP's