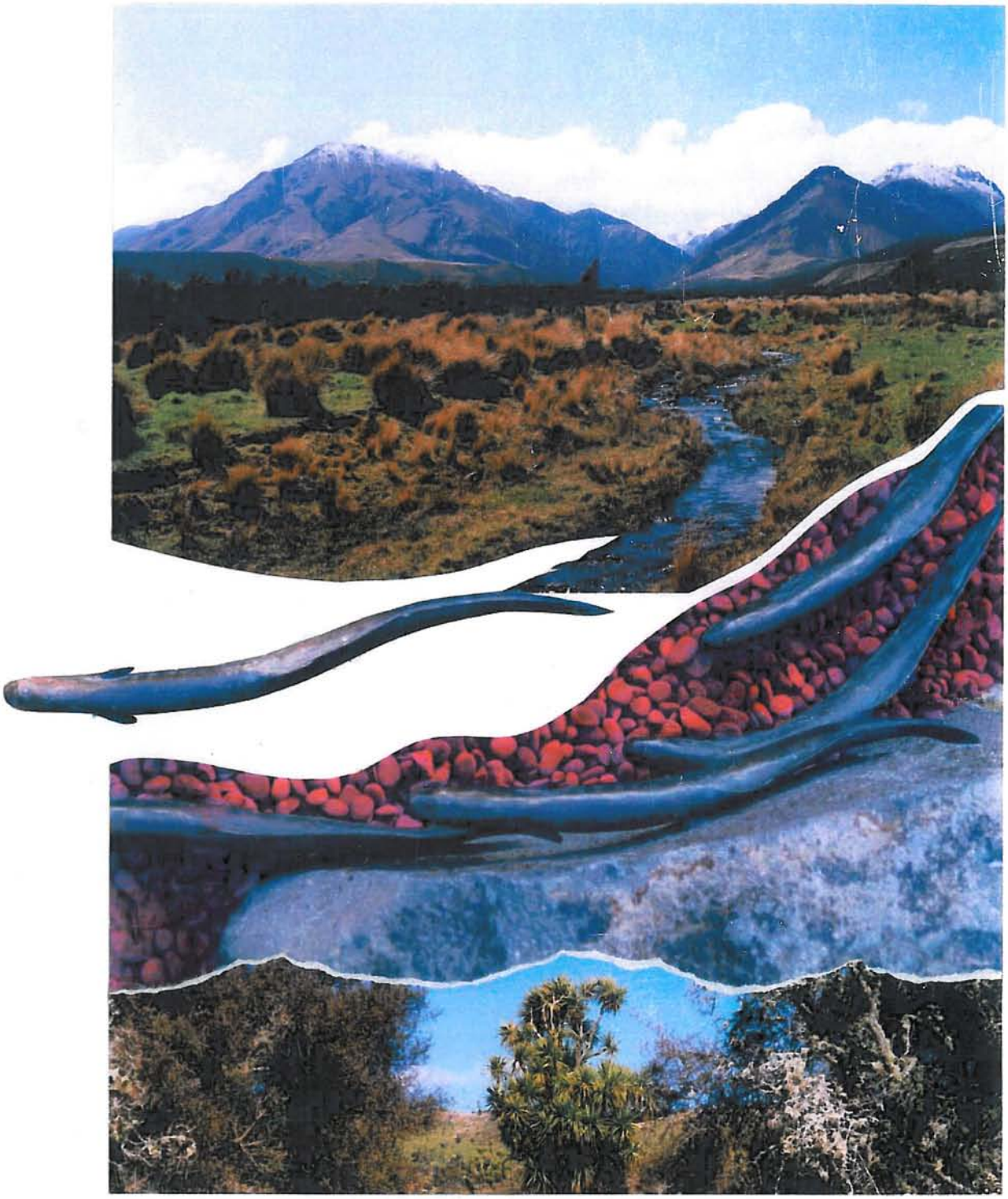

Jericho **Restoration** Plan

A plan to restore the mahika kai values of the Te Kōawa Tūroa O Takitimu area of the Takitimu Mountains and Waiau Valley of Murihiku, Southland

for **Te Waiau Mahika Kai Trust** March 2001

Eels on front cover by Bing Dawe - sculptor
(location - Farnley Reserve Christchurch)

Lucas Associates

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WHAKATAUKI

Kia au mai nga tatai nga whetu ta tu atu ki te kaupapa

Kia au ki te mana, ihi, wehi o nga mea katoa

Kia tapu te mara o Papatuanuku. He karakia mo tera mara mo tiki kai me mahi kai

Kia whakatu tika Te Tai Ao me Te Tai Ao tiaki Te Tai Ao

Kia mohio tika te tangata nga korero me nga tikanga o Te Tai Ao

Hold fast to the genealogy lines from the stars to oneself and all things

Hold strong to the sacredness, prestige and awe of things created.

Keep the garden of mother earth sacred and open through appropriate incantations for all things and when planting and gathering food

If the environment is kept well and strong it will look after itself.

The one who teaches about the environment must understand the structure, lore and rituals pertaining to it.

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PROJECT SUMMARY

Project Objectives for the Jericho Block

The objectives of the project are to:

- Develop an iwi-based model for enhancement, restoration and sustainable use of the mahika kai of Jericho Valley.
- Establish design options for enhancing and restoring the mahika kai values of the valley, in particular:
  1. *increasing the wetted areas present on the property;*
  2. *restoring native vegetation;*
  3. *creating habitats that are likely to attract increased numbers of native birds to the valley;*
  4. *recommending cost effective strategies for predator and weed control; and,*
  5. *recommending ways for encouraging participation of Kai Tahu and the wider community in restoration activities; and*
- Facilitate the active involvement of Kai Tahu o Murihiku and members of Kai Tahu whanui in the preparation of the restoration plan for the valley; and
- Liaise with resource management agencies and stakeholders regarding the involvement of community and interest groups in the restoration of the valley.

Te Waiau Mahika Kai Trust

The Te Waiau Mahika Kai Trust is an independent trust controlled by trustees nominated by Ngai Tahu and Meridian Energy Ltd. (formerly ECNZ).

The Trust is focused on promoting and enhancing the active relationship of Ngai Tahu people with the mahika kai resources of the Waiau catchment. While physical restoration activities are essential to this relationship, it is the living cultural and social value of mahika kai resources to the people that is the key purpose of the Trust.

The Trust is considered significant, not only for its own practical value in restoring certain important mahika kai habitat in the Lower Waiau and the relationship of Ngai Tahu with those resources, but also as a part of the overall development of Ngai Tahu mahika kai management activities.

Two objects of the Trust are to:

- *provide an accessible mahika kai resource within the Waiau catchment by acquisition, restoration and recreation of habitats suitable for this purpose; and,*
- *to identify and evaluate areas of the Waiau catchment worthy of protection, restoration, improvement, creation or procurement primarily as fisheries; mahika kai plant and animal habitat.*

The Trust acquired by lease from Ngai Tahu Holdings Corporation the Jericho Valley for the purpose of restoring and enhancing its mahika kai values. By ensuring the participation of Kai Tahu in this project the Trust is hoping to realise a further one of its objects, specifically the requirement for it:

- *to act to promote, restore and enhance the social, cultural and economic relationship of Kai Tahu with the resources of the Waiau catchment.*

The Restoration Approach for Jericho

Analysis of the site, the kaupapa for the project, and, discussions with those involved, has resulted in development of a clear restoration philosophy for the Jericho Block. The complexity of the land of this block has resulted in development of guidance data, rather than production of numerous plan sheets identifying where each individual plant species should be located on the block.

A hands-on, low-tech, traditional approach is proposed to re-construct sustainable wetland systems and associated forest, shrubland and grassland communities rich in indigenous wildlife. A centre is proposed as a place for encouraging an understanding of mahika kai values, systems and management. This centre or kaika would be a base for restoration and management activities.

The philosophy is thus to work gently with Papatuanuku to enhance her potential to support mahika kai.

KEY DIMENSIONS OF THIS RESTORATION APPROACH ARE:

1. MACHINE FREE

   Following an initial flurry of activity to remove the stream diversion and the wilding pine trees, and excepting for the installation of the building complex, every attempt is to be made to have a hand-managed project so that machinery is largely excluded from the site.

   A 4-wheeler and trailer is envisaged for site management. On occasion, in some open areas, some mowing of excessive exotic grass growth may be necessary prior to plantings being implemented, or as fire breaks.

   A largely machine-free policy is to support and encourage traditional techniques of wetland establishment and vegetation management. Thus, there will be no machinery used to dam the stream or rip the soil. Avoiding earthworks will minimise the potential for disturbance of archaeological sites.

2. WET LAND, NOT PONDS

   Through hand manipulation of seepage and stream flows, particularly through water dispersal by planting harakeke, wetlands are to be encouraged and expanded. Pond creation is not proposed as neither substantial earthworks nor open water bodies are considered necessary or appropriate.

3. INDIGENOUS PLANTS

   Use of local plant species and genotypes that belong here naturally, that is, eco-sourced planting stock, propagated from natural, local vegetation. Propagation primarily by seed or spore, not by cuttings, to retain local genetic diversity and provide maximum adaptability to local conditions. Use of locally traditional rongoa and kai plants, whether native species or cultivars, is appropriate.

4. WILDLIFE

   Wetland habitat development is not intended to attract introduced wildlife, such as mallard ducks, geese, swan - or trout. Habitat restoration and enhancement is directed at encouraging the natural return of indigenous wildlife species. Subject to environmental effects assessments, re-introduction of bird species such as weka and takahe is proposed. A further key objective is the creation of habitat accessible and attractive to a diversity and multitude of native fishes.

5. STRUCTURES
Traditional and sustainably-sourced local materials are preferred for construction e.g. durable plantation timber, river stone and manuka brush.

6. FENCES, BUT DE-STOCKED
That the Jericho Block is and remains de-stocked to enable the active restoration and the recovery of the biota of the block. However, that existing fences be retained in the transition phase to enable opportunity for carefully managed mob-stock grazing of particular areas within the Jericho block requiring fire hazard management or weed management, or for pre-plant preparation of sites. Cattle are to be permanently excluded particularly from all damp, wet and regenerating areas.

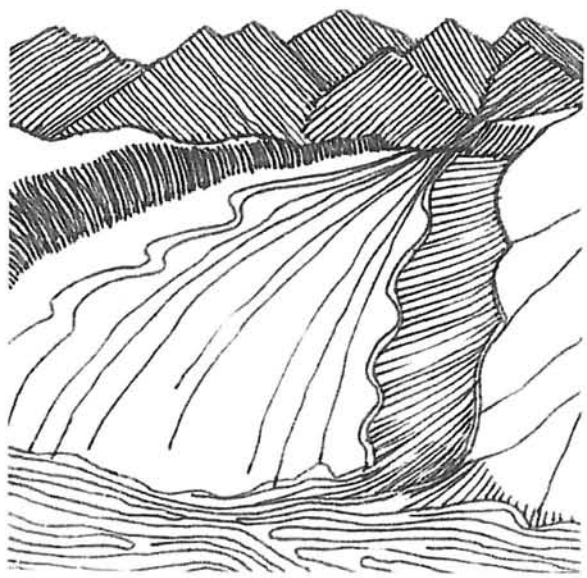
7. EDUCATION
Provision of educational facilities to enable and encourage increased understanding of mahika kai values and management. Design of the facilities to be in sympathy with the cultural and natural values being nurtured and re-introduced to the Jericho Block. Co-operation and complementarity with Borland Lodge is sought. Organisation of the project is to welcome, support and encourage kaumatua to come and reintroduce legitimate traditional management regimes.

8. INFORMATION SOURCE
That information gleaned of the nature and culture of the site and its environs be sought, conserved and generally made available to those involved with the Jericho Block.

9. CHEMICAL FREE
In seeking to use more traditional management methods, a chemical-free approach is sought. However, plant and animal pest management methods must also be practical. In planting programmes, weed control is preferably not dependent on chemical applications. In planting out large open areas, (except for flax plantings) initial application of non-residual chemicals may however be necessary. Then mulch to support establishment of indigenous biodiversity capable of successful competition with exotic invaders.
In construction, minimise the use of chemically treated componentry, e.g. of timber, particularly where it's to be in contact with wet land, such as for board walks. If unavoidable, seek the most eco-friendly treatment technique.

10. NON-COMMERCIAL
That the activities undertaken on the Jericho Block be to restore cultural heritage, particularly mahika kai values, natural heritage, and to better inform people of these, and, that the operations be undertaken on a non-commercial basis.

11. GUIDANCE MODELLED
The site has very complex land patterns that are difficult to map and would be very difficult to locate from map to ground. This restoration plan involves analysis of the different types of land on the site, broad land units as well as small ones, for which a guide has been developed to enable people involved to be able to recognise various land types and then use the colour-coded guide for restoration management of each land type. This guide is considered to be a more practical approach to implement. (Further detail needs to be provided for design and development of the structures and for their consents.)



CONTEXT

Cultural Association

Whakapapa binds Kai Tahu to the mountains, forests and the waters of the Waiau Catchment and to the life that is supported by these resources. Identity is indelibly intertwined with the history of the catchment.

The Southern Alps – the source of the Waiau River

The extract *Te Mauri o Te Waipounamu - the South Island comes into being*, has been taken from the 'Southern Maori in the Lakes District' Exhibition and provides a description of the creation of the Southern Alps.

> *Mythology teaches us that there was no New Zealand. The great sea of Kiwa rolled over the place that is now Te Waipounamu. Before Rakietunei (sky father) wedded Papatuanuku (earth mother) each had children from previous unions. After the marriage some of Raki's children came down to inspect the new wife of their father. They were Aoraki, Rakiroa, Rakirua and Rarakiroa and they arrived from the heavens in the canoe called Te Waka-a-Aoraki.*
>
> *They proceeded to inspect Papatuanuku who lay as one body in a huge continent known as Hawaiki. When the explorers attempted to return to the celestial realms the karakia (invocation) which should have lifted the canoe back to the heavens failed and the canoe sank onto an undersea ridge, turning to stone and earth in the process. The voyagers climbed onto the high side of Te Waka-a-Aoraki and were turned to stone. Aoraki became Mount Cook and his three younger brothers are the three highest peaks near him. As the great canoe settled on its side it became the whole of the South Island whose oldest name is Te Waka-a-Aoraki.*
>
> *In this state it was not fit for human habitation and to remedy this problem a grandson of Rakietunei, called Tuterakiwhanoa was sent to shape the land. He brought with him three other gods named Marokura, Kahukura and Rokonuiatau. Tuterakiwhanoa inspected the great canoe and found things far from satisfactory. The prow of the canoe formed Marlborough Sound, the stern became the Southland Plains with the stern post making Bluff Hill. The eastern side was undulating with few places for anchorage and safe fishing. The Western side was one long, high, unbroken line of jagged rock.*
>
> *Tuterakiwhanoa sent Marokura along the north-eastern coast to form harbours such as Kaikoura Peninsula and other fishing areas. Kahukura and Rokonuiatau were sent south with the same instructions and formed Otago Peninsula and the harbours and bays around the south-east coast. Tuterakiwhanoa formed Banks Peninsula but his greatest achievements were to be on the difficult terrain of the West Coast and Fiordland.*
>
> *After working hard on the West Coast Tuterakiwhanoa turned his attention to the majestic unbroken wall of rock from Milford Sound to Puysegur Point. His intention was to create a few openings to let in the sea but it was a daunting task. Tuterakiwhanoa firmly placed his feet and grasped his gigantic axe, Te Hamo, and set to work to chop into this great mountain wall. To assist him he*

repeated the karakia (invocation) Tapatapa-te-tapahi which commanded the rocky wall to split into pieces. After much effort Tuterakiwhanoa formed the fiords, valleys and passes of Fiordland. Many of the Maori names in this area refer to this gigantic man and his many famous deeds. His last act in Te Wai Pounamu was to plant gifts of a celestial nature in the form of grasses, shrubs and trees to beautify the land.

Takitimu

Kai Tahu consider mountains sacred places, each has its own whakapapa. Jericho Valley lies at the end of the Takitimu Range below Blackmount Forest and falls within the history and traditions of Takitimu.

According to Tikao, the Takitimu canoe left Hawaiki, landed at Whangaparoa, continued down to Napier and then travelled southwards before finally being wrecked in the Foveaux Strait at Te Waewae Bay. Three waves were responsible for overturning the canoe, namely Otewao, Oroko (Heale Ridge) and Okaka (Hump Ridge). Kai Tahu believe that the Takitimu turned to stone and is now known as the Takitimu Mountain Range. This story is important because the Takitimu place names are found across the South Island landscape including names in the Dusky Sound area Tamateanui, Tamatea roa, Tamatea Kai Mätämua, Tamatea Kota, Tamatea a Waho and Tamatea Hikatea. Other significant placenames include Blackmount, which is known as Otukaramea and represents the longboat of the Takitimu.

Mountains are also important because they are the source of many waterways. Runoff from the mountains and ranges is carried into waterways and then continues on its journey "*ki uta ki tai*" (from the mountains to the sea). The protection of mountains and ranges, together with the waters sourced from them and the lands and resources nourished by the waterways flowing from them, is without a doubt one of the most important resource management issues from the Kai Tahu perspective.

Ki uta ki tai

Migrations of Waitaha, Kati Mamoe and Kai Tahu to Murihiku saw our tupuna (ancestors) access all parts of the region, according to the seasons. They were guided by the life-cycles of animals and the growth cycles of plants. They utilised the many resources that were to be found on the coast, in the estuaries, the rivers, the forests the lakes and the mountains.

Kai Tahu believe that all elements of the environment, such as birds, fish, insects, plants as well as natural phenomena such as the mist, wind and rocks, possess a life and that all forms of life are related. The interconnectedness of all things means that the welfare of any part of the environment will directly impact on the welfare of the people. In this instance restoring the health and well-being of the resources of Jericho Valley will impact on the health and well-being of Kai Tahu.

The physical presence of our tupuna in every part of the Waiau Catchment is evidenced by the place names that survive. The history of settlement and resource use is reflected in the names. Such names take their source from the earliest people, creation traditions, incidents, mahinga kai resources, weather and tupuna. Our long history of occupation and travel throughout the Waiau Catchment has left many sites that are of significance to us. It

has also enabled us to accumulate an extensive amount of knowledge of the water resources of the Waiau Catchment and the associated water based food resources.

While the relationship of Kai Tahu to the Waiau Catchment is outlined above, it is important that the significance of water to Kai Tahu is also understood. Water is of special significance. It is essential for life. Water and its associated resources confirm life and thereby form a basis for identification, belonging and mana. Water is a taoka that has been left by our ancestors for the life sustaining use of their descendants. Kai Tahu, the descendants, are charged with a stewardship duty, kaitiakitanga, to ensure that this taoka is passed on in as good a state, or indeed better, to those that follow. A waterbody with an intact mauri will sustain healthy ecosystems, support mahinga kai and be of pride and identity to the people.

Mahika Kai

Kai Tahu were entirely dependent upon their immediate environment for their survival and they had a profound knowledge of the resources it offered them. In other words, Kai Tahu were dependent on our knowledge of mahinga kai and our ability to gather resources from the land, forests, rivers, lakes and the sea. Kai Tahu utilised many bird and plant resources from the Waiau Catchment as part of our dietary requirements and for other cultural uses. Numerous food resources were sought from inland areas and many forest dwelling birds were harvested. Water was central to all activity. Annual expeditions were made beyond Murihiku, with the resources of the Waiau Catchment sustaining travelers, and the river itself providing a means of transporting materials downriver.

This system of resource use, to procure and produce a wide range of resources is known as mahinga kai. In Murihiku, as in the rest of the Te Wai Pounamu, mahinga kai is the cornerstone of Kai Tahu existence and culture. We acknowledge that there was an impact on species and ecosystems by our tupuna, especially during the early period of settlement. Out of those lessons learned can a philosophy of kaitiakitanga, that species and ecosystems had to be managed in a sustainable manner. Hapu claim considerable honour, prestige and mana by virtue of their water and associated resources. Therefore the decline in the mahinga kai resources of the Waiau Catchment adversely impacted on the welfare of Kai Tahu.

The water resources of the Waiau Catchment sustained successive generations of Waitaha, Kati Mamoe and finally Kai Tahu. The mahinga kai resource of the Waiau River is dominated by eels, with Te Wae Wae Lagoon being the richest source of mahinga kai in the catchment. However, studies have confirmed that the state of the mahinga kai resource has declined over the last 30 years. Some of the effects of the Manapouri Power Scheme, together with the detrimental impacts of agricultural development, forestry development, and the commercial harvesting of eels have contributed to the decline of mahinga kai resources. While the present day resource represents a remnant of a once significant resource it has the potential for rejuvenation. Te Waiau Mahika Kai Trust is focussing on the Jericho Valley, which is to be restored using culturally appropriate techniques so that the mahika kai resources are once again healthy and flourishing.

LAND FORMATION

Local Geomorphic Setting

Redcliff Creek drains a pan-handled shaped catchment of approx. 65.2 km2 in the western central Takitimu mountains. The catchment discharges to the Waiau River some 10 km downstream from the Mararoa dam. Elevation within the catchment ranges from 1634 m at Spence Peak, to 160 m at the Waiau River confluence. Windy Creek, a major tributary joins Redcliff Creek at the mountain front. Above this confluence both tributaries flow in steep, narrow, rocky mountain valleys, the upper reaches of which have been significantly influenced by valley glaciation. Both valley heads terminate in glacial cirque basins, numerous of which contain tarns. The valley broadens to a maximum width of 1 km as it joins the greater Waiau valley, a fault bound southern corridor draining the Te Anau basin.

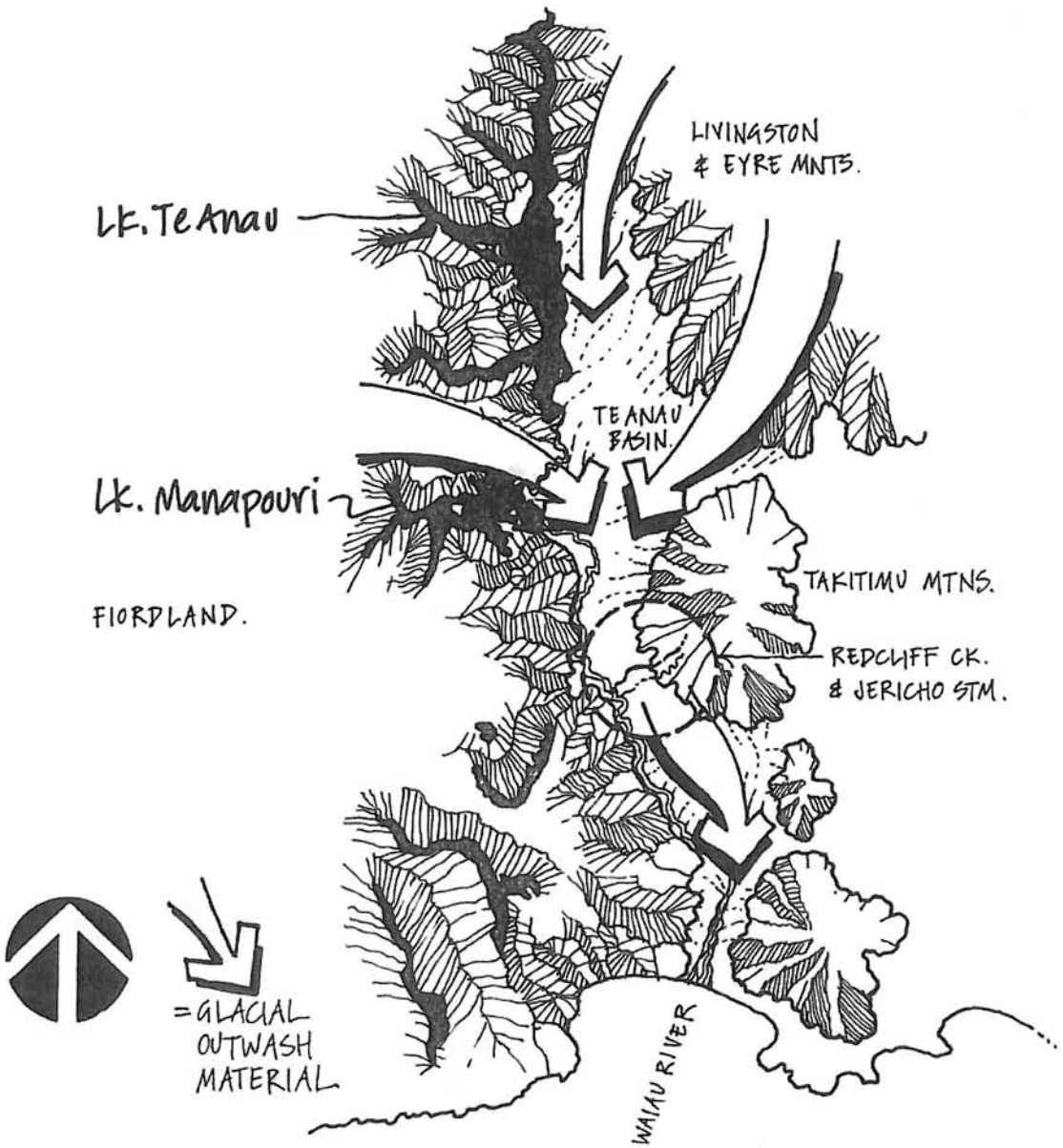
The valley floor comprises the current active channel and floodway of Redcliff Creek, a suite of alluvial terrace surfaces separated by short, steep risers, and a series of very low angled onstep footslope fans along the southern margin. The valley floor is entrenched 100 m below a former glacial outwash surface to the north and the steep north-facing hill-slope scarp of Otukaramea, the Blackmount hills to the south. Otukaramea is composed of Tertiary mudstones, sandstones and conglomerates capped with remnant glacial outwash gravels.

The surface of the valley floor terrace treads comprise a mosaic of mainly dry braided channels and abandoned channel fill formed in coarse-textured gravel to boulder-sized alluvium. Fine-grained alluvium and colluvium is limited to the poorly drained footslope fan deposits adjacent to the southern hill slopes.

The valley floor slopes downstream from east to west, dropping from approximately 380 m at the exotic forest boundary to 250 m above sea level at the Blackmount-Redcliff Road, over a distance of some 4.7 km. The surface gradient across the terrace treads tend to slope to the south away from the scarp edges to the foot of the adjacent riser. Small backswamp-flush sites with minor peat are present in some of these locations. The footslope fans built off the adjacent hill slope scarp have overwhelmed such sites on the major upper terrace surface infilling the abandoned braided channel system. This segment of the upper terrace surface is drained by the much modified Jericho Stream (local name).

Jericho Stream flows as a constrained single thread meandering in sections of low gradient and varies in width from 1-3 m and 0.05-0.5 m in depth. It follows the base of the southern hill slope, along the outer margin of the footslope fans. The stream originates from seepage southwards across the terrace tread, and from off the hill-slope scarp, the footslope fans and restricted wetlands. It rises from swampy seepage on the terrace tread within the exotic forest and drainage from the high terrace bench adjacent to the major forestry block which enters Jericho Stream from the south.

The natural channelway of Jericho Stream has been excavated, straightened and widened by dragline operations upstream to within 200 m of the forest boundary. About 0.5 km above the Blackmount-Redcliff Road a major diversion has been excavated to divert high flows from the Jericho Stream northwards across the upper terraces to Redcliff Creek. Water flows downstream from the diversion are controlled by a dam structure containing an approx. 1000 mm diameter wooden culvert set at a predetermined height. At the time of the site visit (9-10/10/2000) over 90% of the stream flow was directed through the culvert. No evidence of significant flows down the diversion across the lower terrace levels north of the

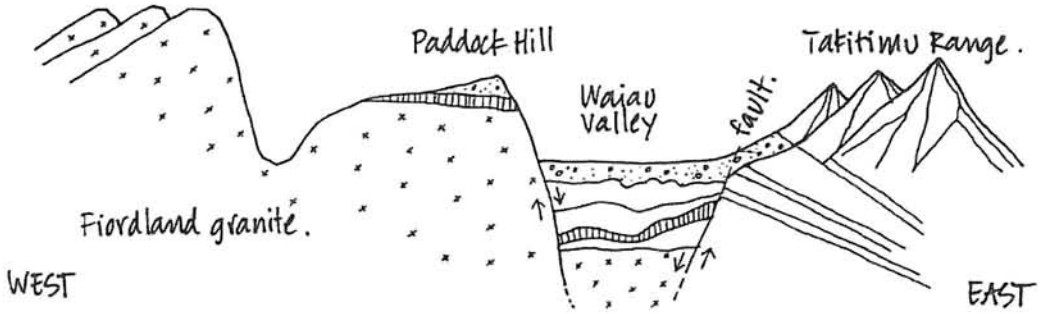


To understand the underlying nature of the Jericho Block, and thus develop some understanding of the restoration opportunities, the land-formation processes are analysed.

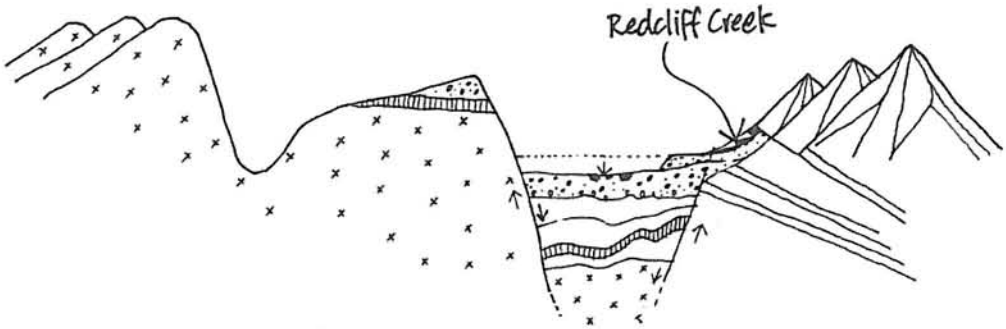
The Jericho Block has a mix of Fiordland granite and Takitimu volcanic and greywacke rocks that hint at the various origins of this place. The diagrams demonstrate key land-forming processes that have occurred to create this particular valley.

JERICHO BLOCK SOUTHLAND

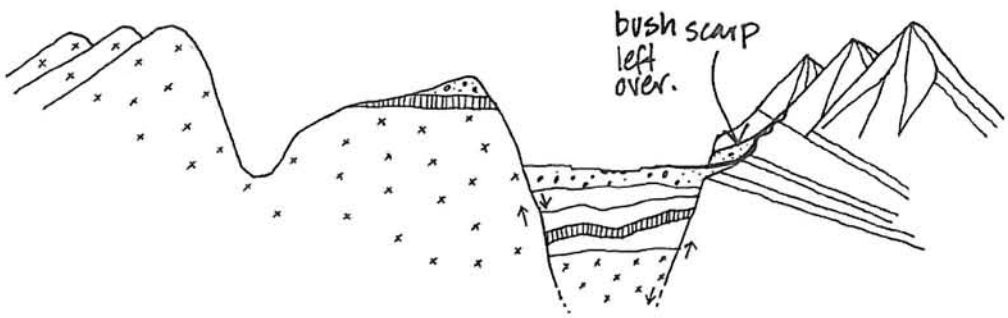
LAND FORMATION



① The Waiau valley between Fiordland granite and Takitimu greywacke/volcanics fills up. Fiordland, Takitimu blocks are being pushed up, the valley bedrock and fill dropping.
Old river gravels cap the lower Takitimu slopes and paddock hill.



② The Waiau cuts down below the level of the Redcliff valley. The Redcliff Creek starts to cut down in its own valley, pushing material out into the greater Waiau valley to keep up.



③ What we see today. Waiau level stabilised, Redcliff Creek, stabilised too, while Jericho Stream meanders across very flat higher valley fill / terrace. Gravel fill from original Waiau aggrading period visible in bush scarp 'left over' and capping the lower flanks of the Takitimu block and Blackmount slopes. Period of uplift and downfaulting is still occurring.

4WD track was observed in the field or were visible on the Southland Regional Council colour aerial photographs (dated 7/1/97).

Flow through the culvert enters the area of red tussock wetland adjacent to the Blackmount-Redcliff Road. A series of drains have been excavated into this wetland. A 'Y' shaped drain pattern drains the NW area, a N/S drain parallels the roadway, and a E/W drain penetrates the SW corner. Water from these drains is channeled under the roadway in two culverts.

Geology

The geological setting of Redcliff Creek and the Jericho Block is summarised in Wood (1966) and Fitzharris (1968).

The headwaters of Redcliff Creek are underlain by rocks of the Takitimu Volcanics. These late Paleozoic geosynclinal volcanics comprise basalts, spilites, diorites, andesites, tuff and agglomerate, interbedded with but locally predominating over greywackes. Early Tertiary quartzo-feldspathic sandstone and mudstone with sub-bituminous coal seams, the 'Beaumont Coal Measures' outcrop on the southern valley hill slopes capped with remnant weathered glacial outwash gravels and till of the penultimate glaciation. To the north the valley floor is entrenched below a former outwash surface of weathered glacial gravels and till of the penultimate glaciation.

The valley floor is formed in recent gravels, fans, swamp deposits and minor peat contemporaneous with, or younger than, the latest glacial advance.

A major mountain front fault zone bounds the western margin of the Takitimu mountains (Fitzharris 1968). A late Quaternary fault trace trending NNE is visible cutting the former outwash surface on the true right.

Soils of the Jericho Block

The soils of the study area have been mapped at a scale of 1:250 000 (New Zealand Soil Bureau 1968) and 1:50 000 (O'Byrne 1986) Fig. X.

On the ***valley floor terrain*** two Recent soils and one Recent Gley soil series were mapped by O'Byrne.

Upukerora series symbol Up (young recent soils, horizon sequence A, (B), C)
The Upukerora series comprises recent soils occurring on low terraces and on riparian strips adjoining river beds developed in coarse-textured alluvium derived from diorite, greywacke, and basic volcanic rocks. Profiles are weakly developed, stony, and somewhat excessively drained.

Upukerora stony sandy loam soils, mapped in the Redcliff valley, have thin, dark brown, very friable topsoils with stony sandy loam textures and weakly developed crumb and single-grained structure. Weakly developed subsoils are dark greyish brown, loamy fine gravels and stones over gravely alluvium. Weakly developed subsoils are frequently absent.

Upukerora stony sandy loam soils have been mapped on all 3 terrace surfaces on lower 2/3 of the area.

Tuatapere series symbol Tj (young recent soils, horizon sequence A, AB, Bw, C). The Tuatapere series has formed from mixed alluvium derived from diorite, tuffaceous greywacke and basic volcanic rocks and is mapped in the upper reaches of the valley

mainly on higher surfaces downstream from the intersection of Windy Creek. Tuatapere silt loam is somewhat excessively drained to well-drained, has a very dark greyish brown, friable top soil with silt loam texture and strongly developed very fine nut structure. Subsoils are light olive brown, friable to firm silt loam with massive or weakly developed structure. Tuatapere soils are slightly older, more developed, more stable and less flood prone than Upukerora soils.

Manapouri series symbol Mpu (Gley soils, horizon sequence Ag, Br, Cr)
The Manapouri series has formed from alluvium derived from granite, diorite, tuffaceous greywacke and basic volcanic rocks on flats normally free from flooding. They are very poorly drained, weakly to moderately leached gley soils associated with Tuatapere and Upukerora soils.

Manapouri silt loam has very dark grey, friable topsoils with silt loam texture, moderately to strongly developed nut structure and prominent reddish brown mottles. Subsoils are olive grey, firm silty clay loam with weakly developed prismatic structure, breaking to blocky, and faint yellowish brown mottles. Topsoils are frequently peaty.

Manapouri soils are mapped under the red tussock wetland adjacent to the highway, and complexed with Upukerora stony sandy loam soils on the low angle onstep fans.

Soils of the high terrace bench:

Sobig series symbol Si (Gleyed yellow brown earth soils, horizon sequence A, AB, Bw1, Bw2, C)
Sobig soils have formed from weathered gravelly outwash alluvium with a shallow loess cover on the remnant outwash terrace bench on the southern escarpment. Soils of the Sobig series are poorly drained, and are classified as moderately to strongly gleyed yellow-brown earths.

Sobig silty clay loam has brown, friable topsoils with silty clay texture and moderately developed nut structure. Subsoils are pale brown, firm, silty clay loam with weakly developed blocky structure and many prominent yellowish brown mottles. Mottles may occur in a few topsoils and subsoil hues range from 10YR to 5Y.

Soils of the Hill lands:

Mangapiri series symbol MgH (Gleyed yellow brown earth soils, horizon sequence A, AB, Bt, C)
Mangapiri soils have formed on Tertiary siltstone and mudstone. They are imperfectly drained on rolling land and moderately well drained on steeper slopes. They are classified as weakly to moderately gleyed yellow brown earths. They have pale colours and heavy textures, shallow profiles and few mottles.
Mangapiri hill soils are commonly shallow and sometimes stony. They have dark greyish brown, friable topsoil with silt loam texture and moderately to strongly developed fine to very fine nut and crumb structure. Subsoils are olive yellow, friable to firm, silty clay loams with weakly to moderately developed medium nut and crumb structure on weathered mudstone.

Climate

Rainfall for the area is in the vicinity of 1100-1200 mm (N.Z. Met Service 1985). The nearest recorded rainfall record is 1108 mm pa for Redcliff Station 3 km due north. The closest detailed climate station to the area is at Te Anau.

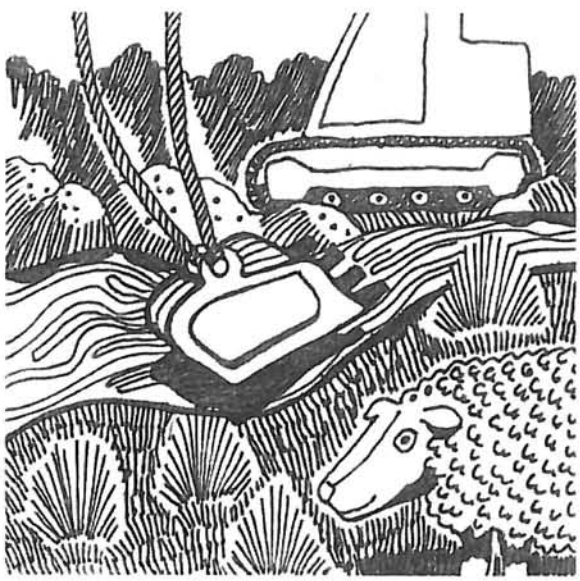
Ecological Context

The Jericho Block is situated within the Redcliff Valley. Redcliff Stream flows from the central Takitimu Mountains westward into the Waiau River. Where the stream leaves the mountains the valley broadens considerably to form one of the largest valleys on the west side of the Takitimu Mountains. The valley floor and adjacent slopes contain a rich diversity of vegetation and retain a largely natural character.

The Jericho Block and Redcliff Valley lie within the Takitimu Ecological District. The Takitimu ED is dominated by the Takitimu Mountains and lies between the Te Anau ED (to the west) and the Taringatua ED (to the east). Harding (1999) considers the original (i.e. pre Maori) vegetation of the Takitimu ED to have consisted of montane silver beech forest (70%), alpine snow tussockland (10%), montane shrublands (5%), scree/fellfield/rock (5%), montane red tussockland (3%), podocarp-hardwood-(beech) forest (2%), kowhai-mixed hardwood-podocarp forest (2%), subalpine shrubland (2%) and montane rushland on peat (1%). Lowland Carex and flax swamps and manuka shrublands were minor communities within the Takitimu ED.

The major vegetation of the Redcliff Valley is thought to have been beech forest (probably mixed silver and mountain beech with podocarps present at least locally) on the valley floor and northern slopes of the valley, with kowhai – mixed hardwood forest on the southern slopes of the valley, manuka shrubland, wet red tussockland and a variety of wetlands all on the valley floor associated with impeded drainage. Other minor communities which may have been present include cabbage tree stands, locally totara and or kahikatea dominant forest.

Natural fires possibly supplemented by early Maori fires would have progressively reduced the original forest cover. By the time of the arrival of European settlers the vegetation would have been dominated by red tussocklands. With the onset of farming the frequency of fires would have increased and further deforestation would have occurred. Grazing combined with fires and oversowing has resulted in the decline of red tussock and an increase in pasture grasses. Freedom from burning over the previous few decades has allow an expansion of the manuka shrublands. The expansion of forest from refuge sites is evident on the scarp on the northern side of the valley. This history of vegetation modification and the potential for recovery must be taken into account when assessing the ecological values and significance of the vegetation.



SITE

THE PROPERTY

The Jericho Block lies in the Redcliff Valley just to the north of the Blackmount Forest (refer **LOCATION** map over page). Located between Otukaramea (Blackmount) and Manapouri, the Jericho Block is accessible and over-looked from the Blackmount-Redcliff Road.

The Jericho Block extends from the Blackmount-Redcliff Road, down to the Redcliff Creek which runs along outside the northern boundary, and, back to the base of the Takitimu Range. East of the Road, pine plantations border the block along the south scarp and at the east boundary to the mountains.
(refer **VALLEY LOCATION** map)

The Jericho Block covers an altitudinal range of about 200 m., extending from the top of the terrace at about 450 m. elevation down to near the Redcliff Creek at about 250 m.

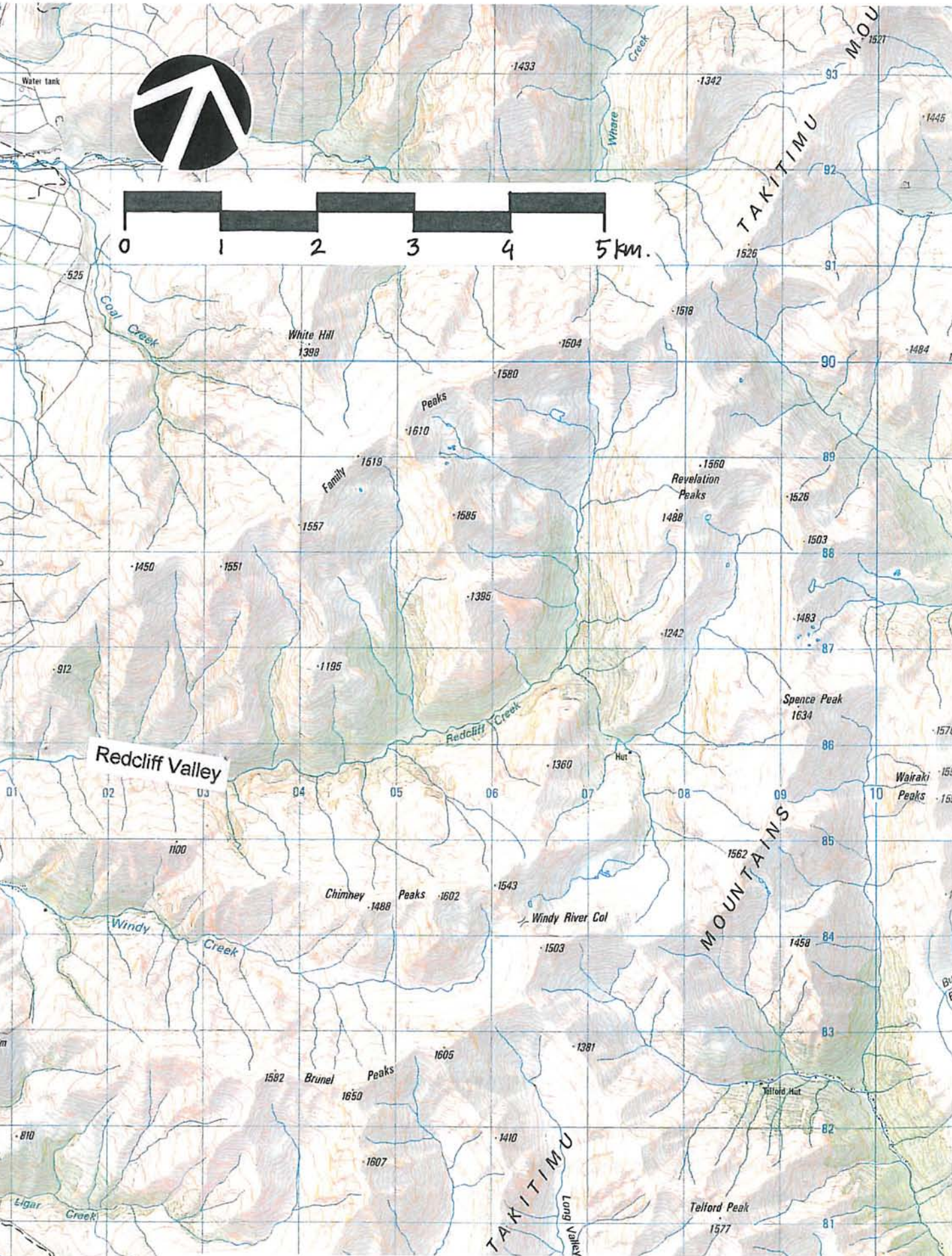
Previously a Landcorp Property farm, the 445 ha. Jericho Block now belongs to Ngai Tahu Holdings Corporation and is leased to the Te Waiau Mahika Kai Trust for the cultural restoration of mahika kai values. A copy of the title is appended. This is encumbered with a Conservation Covenant dated 1991 applying to just perhaps 1 ha. of the Jericho Block and requiring (Schedule clause 24) "THAT there be no mechanical alteration to the Flood Channel at the eastern boundary of the Covenant Area. " Protection of an artificial flood channel may, however, no longer be appropriate.

In the Redcliff Valley, the Redcliff Creek runs along the northern side of the valley floor and the Jericho Stream runs along the southern side of the valley floor. Good numbers of long-finned eel have been recorded in the Jericho in recent years and the intent is that mahika kai plant, bird and fish species be enhanced over time through implementation of this restoration plan.

Existing development

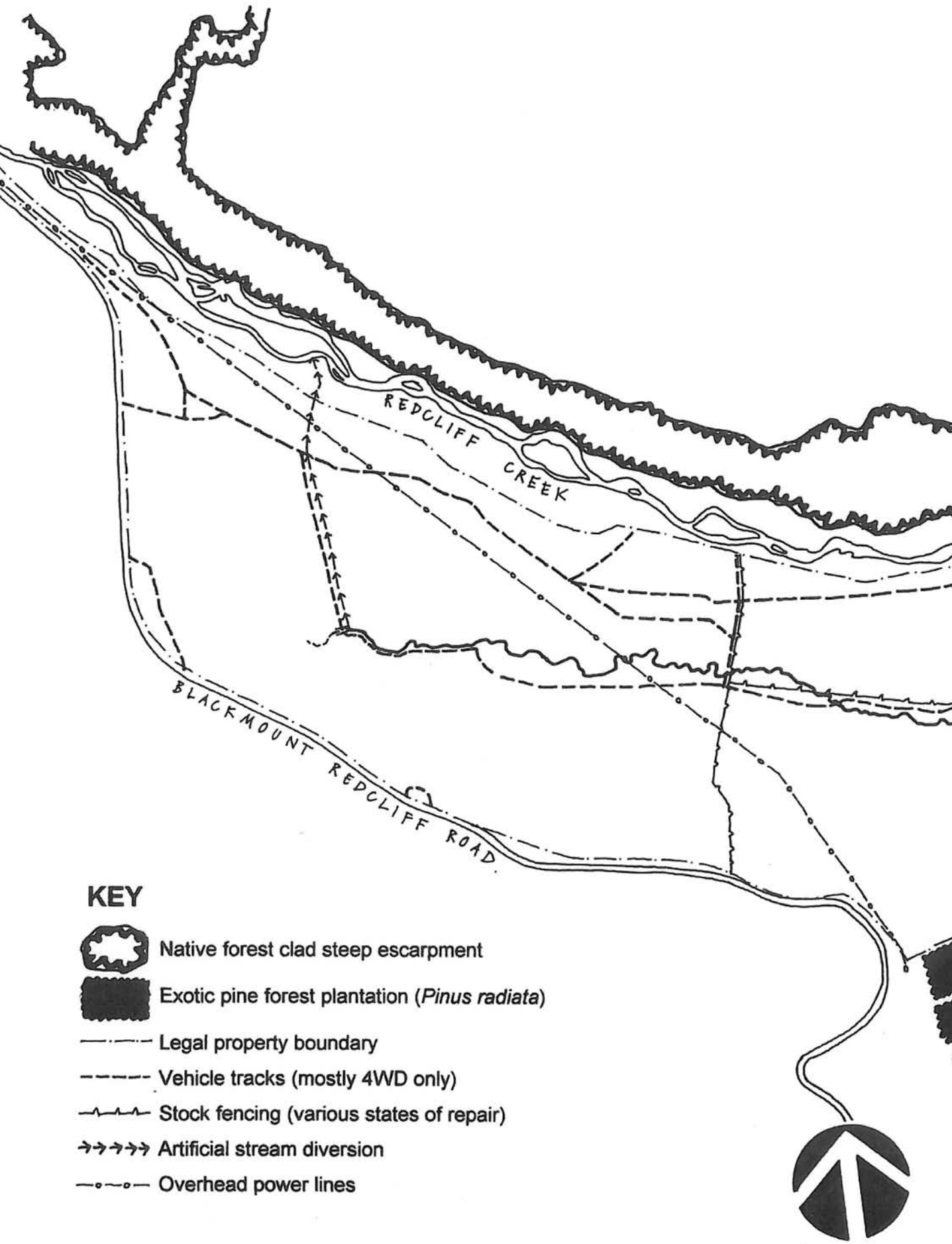
The Jericho Block has been subjected to some land development activity in the past. There has been excavation of almost the full length of the Jericho Stream bed as well as creation of a diversion channel to Redcliff Creek. Considerable vegetation change has occurred through pasture development and stock grazing. Although farm buildings were located near the road entrance, and foundations are evident, no buildings remain on the block. A track runs up the north side of the block. The block is divided into fenced paddocks. Substantial overhead power lines cross the block.
(refer to the **EXISTING USE PATTERN** plan)

View eastwards up valley from roadside (see arrow)



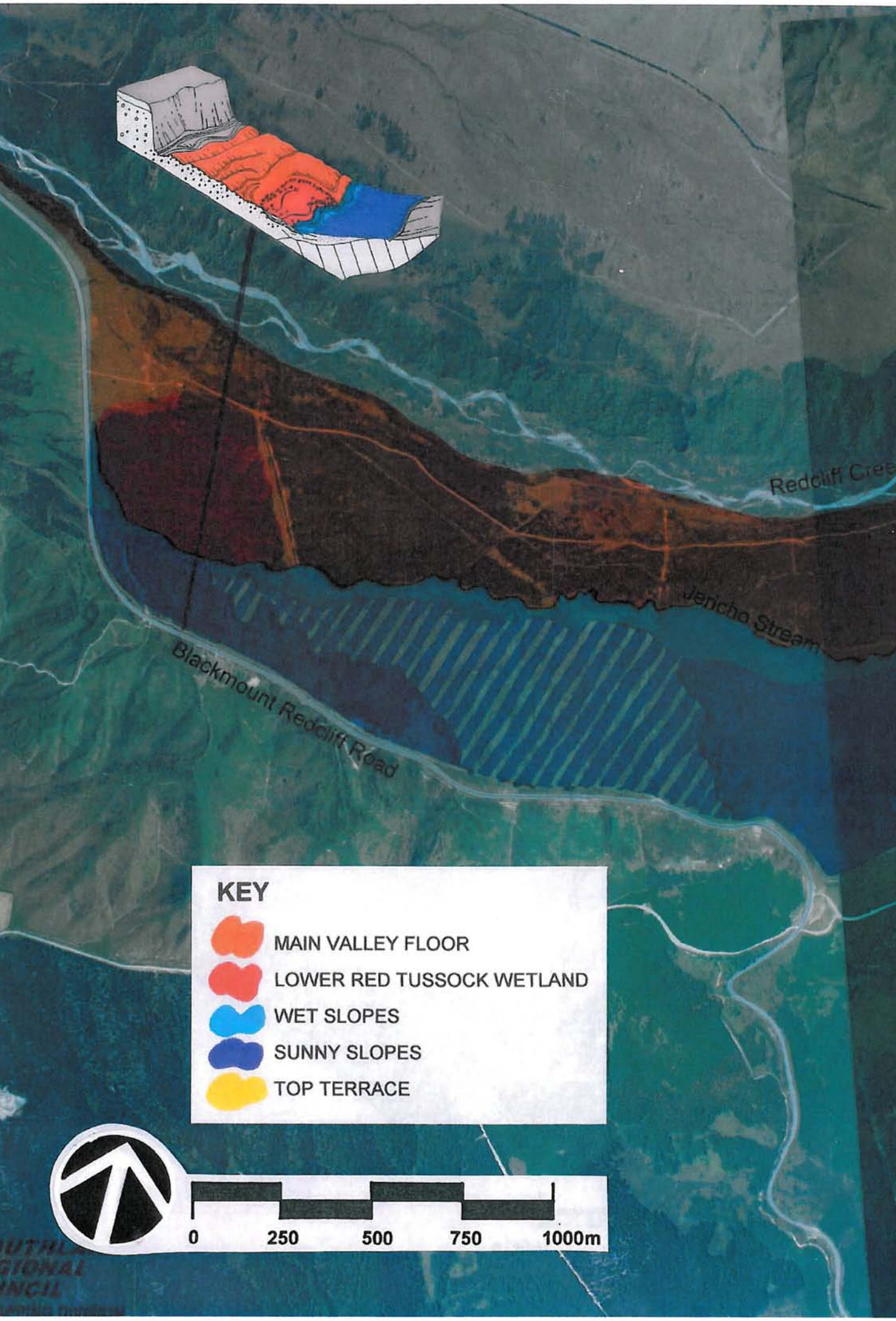
JERICHO BLOCK SOUTHLAND

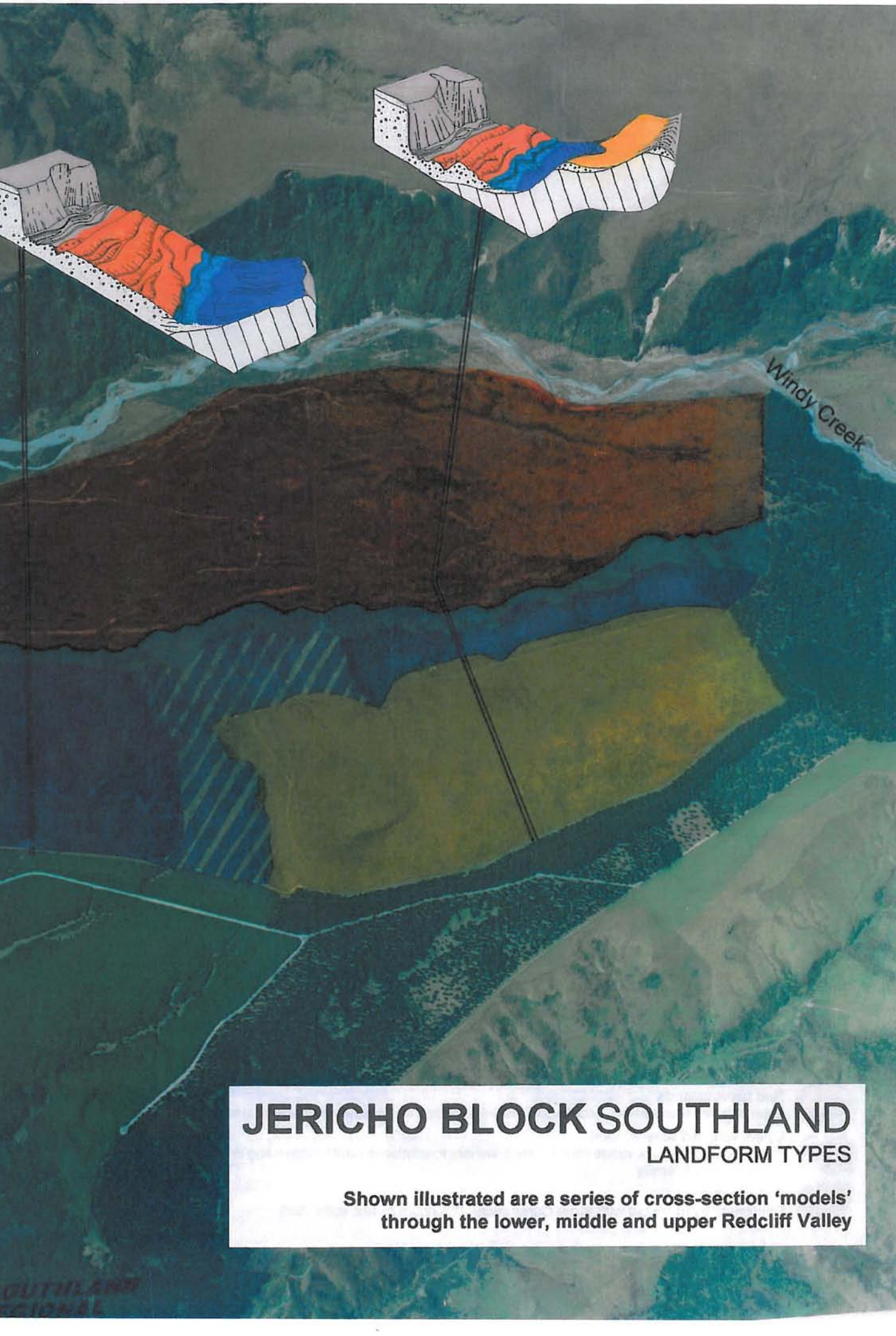
VALLEY LOCATION


REDCLIFF CREEK
BLACKMOUNT REDCLIFF ROAD
KEY
Native forest clad steep escarpment
Exotic pine forest plantation (*Pinus radiata*)
Legal property boundary
Vehicle tracks (mostly 4WD only)
Stock fencing (various states of repair)
Artificial stream diversion
Overhead power lines

JERICHO BLOCK SOUTHLAND

EXISTING USE PATTERN

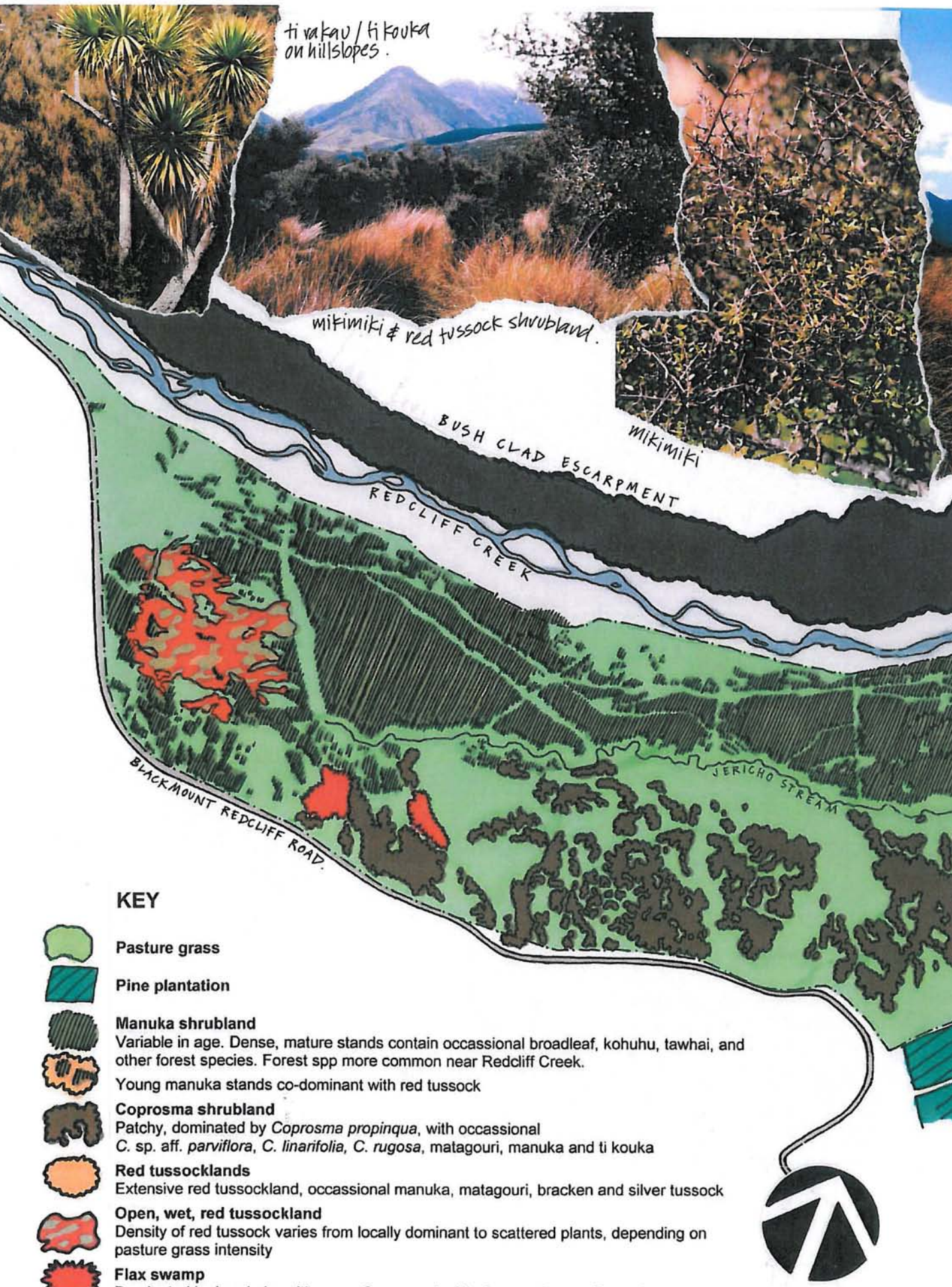

Redcliff Cree
Jericho Stream
Blackmount Redcliff Road
KEY
MAIN VALLEY FLOOR
LOWER RED TUSSOCK WETLAND
WET SLOPES
SUNNY SLOPES
TOP TERRACE
0
250
500
750
1000m



JERICHO BLOCK SOUTHLAND

LANDFORM TYPES

Shown illustrated are a series of cross-section 'models' through the lower, middle and upper Redcliff Valley



KEY

Pasture grass

Pine plantation

Manuka shrubland
Variable in age. Dense, mature stands contain occassional broadleaf, kohuhu, tawhai, and other forest species. Forest spp more common near Redcliff Creek.

Young manuka stands co-dominant with red tussock

Coprosma shrubland
Patchy, dominated by *Coprosma propinqua*, with occassional *C.* sp. aff. *parviflora*, *C. linarifolia, C. rugosa*, matagouri, manuka and ti kouka

Red tussocklands
Extensive red tussockland, occassional manuka, matagouri, bracken and silver tussock

Open, wet, red tussockland
Density of red tussock varies from locally dominant to scattered plants, depending on pasture grass intensity

Flax swamp
Dominated by harakeke with some *Carex secta, Blechnum minus*, spike rush

JERICHO BLOCK SOUTHLAND

EXISTING VEGETATION PATTERN

red tussock upper valley.

WINDY CK.

PASTURE GRASS

EXOTIC PLANTATION (PINES).

native broom.

0 250 500 750 1000m

EXISTING VEGETATION

Whilst having a grazing history, the Jericho Block retains a surprising extent and diversity of native vegetation, both on the valley floor and on the north-facing slopes. Much of this cover can be attributed to the wetness of the land.

The Jericho Block is dominated by manuka and red tussock-swamp communities. However there is a rich diversity within these communities. Brian Rance briefly visited the site with the project team and recorded the flora observed. These communities have been mapped (refer **EXISTING VEGETATION PATTERN** map over), excepting for Wetland types 1 and 3 which are not easily distinguished at this scale.

Manuka Shrubland: Manuka shrublands are the major community on the valley floor. These vary in age (and past disturbance). Much of the area contains dense, mature stands, these are generally 2-4m tall. These stands tend to be found on poorer moraine/outwash surfaces. In the upper part of the valley and some other areas a young manuka forest is found. The youngest stands may be co-dominant with red tussock (*Chionochloa rubra* var. *cuprea*). The dense, mature, manuka shrublands have limited understory or ground cover. These shrublands contain occasional kapuka/broadleaf, kohuhu/black mapou, tawai/beech and other forest species. These forest species tend to be more common nearer to the Redcliff Stream, which is nearest to the seed source. It is expected that the regeneration of forest species will increase now that stock have been removed. Eventually much of the manuka shrublands will regenerate into forest.

Coprosma Shrubland: There is patchy *Coprosma* shrubland on the slopes below the Blackmount–Redcliff Road. This is dominated by *Coprosma propinqua*, with occasional *C.* sp. aff. *parviflora, C. linarifolia, C. rugosa*, matagouri, manuka and ti/cabbage tree. These shrubland areas are fragmented within a pasture slope. Under some of the more dense shrubland areas *Ranunculus reflexus, Dichondra brevifolia, Mazus radicans* were found. The future expansion of this shrubland will be restricted by the dense grass sward.

Red Tussocklands: There are a variety of red tussock communities:

1 **Red tussockland**: The upper part of the valley is an extensive red tussockland found on well drained moraine/outwash surfaces. This area is dominated by red tussock, with much *Gaultheria macrostigma*, browntop, a variety of herbs, occasional manuka, matagouri, bracken and silver tussock. It is expected that this area will progressively be invaded by shrubs (especially manuka) and eventually turn into forest.

2 **Open, wet red tussockland**: Areas of this vegetation were found on the valley floor below the Blackmount–Redcliff Road. This area is moist being feed by runoff and seepage from the slope above. The vegetation is dominated by pasture grasses, moss, *Carex gaudichaudiana*, hawkbit (*Leontodon taraxacoides*) and other herbs. The density of red tussock varies from locally dominant to scattered plants.

Wetlands: There are a variety of wetlands:

1 **Hillslope and Valley floor flushes**: These wetlands are scattered across the property. They tend to be dominated by pasture grasses, moss, the sedges *Carex gaudichaudiana* and *C. flaviformis*, hawkbit and other herbs. Some of these swamps contain red tussock, *Carex secta* and *Baumea tenax*. (NB. Flushes have not been mapped)

2 **Flax swamp**: This flax swamp area is on the valley floor near to where the Blackmount–Redcliff Road enters the Redcliff Valley. The vegetation is dominated by harekeke/flax with some pukio (*Carex secta),* kiokio (*Blechnum minus)*, spike rush (*Eleocharis acuta*) and other species (see location of Flax Swamp on map).

3 **Mixed swamp**: This swamp was found within the red tussockland in the upper part of the valley. This wetland area varied in composition as a consequence of nutrient status, flow, water table etc. The vegetation contains a mixture red tussock, *Carpha alpina, Carex* sp. *Baumea tenax, Lepidosperme australe* and moss, with some flax, *Coprosma* sp. aff. *intertexta*, manuka, *Carex tenuiculmis*. Wirerush (*Empodisma minus*) and sphagnum moss were present in a small area. (NB swamp not mapped)

VEGETATIVE DIVERSITY

From site visits more than 120 plant species have been recorded on the site, in particular by Brain Rance during an inspection with the project team. This flora comprises 110 native species (see appendix 1) but is incomplete, in particular many additional wetland and exotic species remain to be recorded. Of particular significance was the presence of the red sedge *Carex tenuiculmis* (national status – vulnerable, de Lange et. al. 1999) and the hook grass *Uncinia strictissima* which has previously been recorded by N. Simpson (Simpson in prep.) (national status – vulnerable, de Lange et. al. 1999). Other threatened species for which potential habitat currently exists are the buttercup *Ranunculus ternatifolius* and the grass *Deschampsia caespitosa*. Other notable species include bog pine (*Halocarpus bidwillii*), the low shrub *Coprosma* sp. aff. *intertexta* and the fern *Lindsaea linearis* which are all uncommon in the Waiau Valley.

PLANT LIST - indigenous species noted at Jericho

Botanical name	Common name
TALL TREES	
Dacrycarpus dacrydioides	kahikatea
Halocarpus bidwillii	bog pine
Nothofagus sp.	tawai
Podocarpus hallii	thin barked totara
TREES AND SHRUBS	
Aristotelia fruticosa	mountain wineberry
Aristotelia serrata	Mako/wineberry
Carmichaelia virgata	native broom
Coprosma linarifolia	a coprosma
Coprosma propinqua	mikimiki, mingimingi
Coprosma rigida, C.rugosa	coprosma shrubs
Coprosma sp. aff. intertexta	low coprosma shrub
Coprosma sp. aff. parviflora	a coprosma
Cordyline australis	Ti rakau/Ti/cabbage tree
Corokia cotoneaster	korokio
Discaria toumatou	matagouri
Gaultheria depressa	snowberry
Gaultheria macrostigma	red snow berry
Griselinia littoralis	kapuka/broadleaf
Hebe salicifolia	koromiko
Leptospermum scoparium	manuka
Leucopogon fraseri	patotara/dwarf mingimingi
Muehlenbeckia axillaris	dwarf pohuehue
Olearia bullata	a shrub daisy
Ozothamnus leptophylla	cottonwood
Pittosporum eugenioides	tarata, lemonwood
Pittosporum tenuifolium	rautawhiri/kohuhu/ mapou
Pseudopanax crassifolius	horoeka, lancewood
Sophora microphylla	South Island kowhai
CLIMBERS	
Clematis quadribacteolata	purple-flowered clematis
Muehlenbeckia complexa	small-leaved pohuehue
Parsonsia heterophylla	native jasmine
Rubus cissoides	a native lawyer
Rubus schmelidioides	a native lawyer
GRASSES AND FLAX-LIKE PLANTS	
Aciphylla aurea	taramea/golden spaniard
Astelia nervosa	a lily
Baumea tenax	a sedge
Carex coriacea	cutty grass
Carex dipsacea	a sedge
Carex flagellifera	mania/a sedge
Carex flaviformis	a sedge
Carex gaudichaudiana	a sedge
Carex secta	pukio/a sedge
Carex tenuiculmis	a red sedge
Carpha alpina	a sedge
Chionochloa rubra	red tussock
Cortaderia richardii	toetoe
Eleocharis acuta	a spike rush
Eleocharis gracilis	a spike rush
Empodisma minus	wirerush
Hierochloe redolens	holy grass
Isolepis calagenis, I. habra	dwarf sedges
Juncus gregiflorus	a rush
Lepidosperme australe	square sedge
Luzula sp.	a woodrush
Oreobolus strictus	a comb sedge
Phormium tenax	harakeke/ NZ flax
Poa cita	wi/silver tussock
Poa colensoi	blue tussock
Rytidosperma gracile	a grass
Uncinia rubra	red hook grass
Uncinia strictissima,U. uncinata	hook grasses
FERNS	
Asplenium richardii	a fern
Blechnum minus	swamp fern/kiokio
Blechnum penna-marina	little hard fern
Lindsaea linearis	a fern
Polystichum vestitum	prickly shield fern
Pteridium esculentum	Aruhe/bracken
HERBS AND GROUNDCOVERS	
Acaena anserinifolia x A. sp	a biddibid
Acaena novae-zelandiae	a biddibid
Anaphalis bellidioides	an ever-lasting daisy
Brachyglottis bellidoides	a daisy
Bulbinella angustifolia	maori onion
Celmisia glandulosa	a daisy
Centella uniflora	a herb
Dichondra brevifolia	a creeping herb
Drosera spathulata, D. binata	sundews
Epilobium nummularifolium	a willowherb
Epilobium pallidifolium, E.insulare	willowherbs
Galium perpusillum	a herb
Gnaphalium audax, G.laterale	cudweeds
Gonocarpus aggregatus	a herb
Gonocarpus montanus	a creeping herb
Gunnera prorepens	a creeping herb
Hydrocotyle moschata	a pennywort
Hydrocotyle nz var. montana	a pennywort
Lagenifera petiolata	a daisy
Mazus radicans	a creeping herb
Microtis unifolia	maikaika, onion orchid
Mimulus guttatus	monkey musk
Montia fontanum	a herb
Myriophyllum sp.	a water millfoil
Nertera setulosa	a herb
Oreomyrrhis ramosa	a herb
Pimelea oreophila	a dwarf daphne
Plantago triandra	a plantain
Potamogeton sp.	rerewai/pondweed
Prasophyllum colensoi	leek orchid
Pratia angulata	a creeping herb
Pseudognaphalium luteo-album	Jersey cudweed
Ranunculus foliosus, R.reflexus	buttercups
Ranunculus glabrifolius	a bog buttercup
Schizeilema cockaynei	a herb
Senecio minimus	fireweed
Sphagnum sp.	sphagnum moss
Thelymitra longifolia	white sun orchid
Utricularia monanthos	bladderwort
Viola cunninghamii	a native violet
Wahlenbergia albomarginata	harebell

WATER AND FISHES

The waters of the Jericho Stream are mostly clear, in places riffling over stony areas in the upper reaches towards the head of the valley. The width is stable and varies from 1 to 3 metres, the depth varying from 5 centimetres to half a metre. As the stream winds its way down the valley, it becomes more entrenched, the substrates changing from gravels to finer silts. Stream trampling has been occurring in many places by past cattle grazing with evidence of pugging, bank erosion and slumping clearly visible, with the resultant siltation of the stream bed in these areas, mostly in the lower reaches toward the road. The stream is fully exposed, having no shade from vegetation, apart from a section to the west of the block and downstream of the road which is covered in dense scrub.

This small, single-thread meandering stream originates mainly from seepages along the hillslopes alongside the south wall to the valley. Seepage and runoff into the Jericho Stream also occurs across the main valley floor, owing to the series of subtle river terraces surprisingly draining toward the south. The valley floor does not grade toward the Redcliff Creek to the north as would be expected!

Approximately half a kilometre upstream from the Blackmount-Redcliff Road, the Jericho Stream flows through a culvert with a restricter (this is inherited from farm development days). This structure was installed to restrict the flow from the normal channel and direct higher flows along a constructed diversion channel to run excess water toward Redcliff Creek. The natural path of the Jericho Stream flows under the road at the base of the block and on to the Waiau River below.

What kinds of fish can we expect?

Within the Waiau catchment, 16 species of native fish have been recorded. We can surmise that if these fish are in the Waiau, then given the right conditions and levels of 'access' they could find their way into the Jericho Stream. Although Galaxiids are present throughout the length of the stream (Roper-Lindsay and Jellyman, 1999), and eel counts are reputedly significant, the particular species and quantities of fish getting into, or residing in the Jericho Stream has not as yet been ascertained. Galaxiids present in the Waiau include koaro, giant kokopu, inanga, plus the non-migratory species.

Of the 16 fish species in the Waiau, 12 require access to and from the sea/estuary to complete their life cycles. The remaining 4 species complete their life cycles in freshwater, some also migrating from their adult habitat up to the headwaters to spawn and rear their young.

The Waiau Fish that...

migrate to the sea:	*migrate within freshwater:*	*don't need to migrate:*
koaro	koaro	non-migratory galaxiiads
giant kokopu	giant kokopu	upland bully
common smelt	common smelt	
common bully	common bully	
redfinned bully		
bluegill bully		
torrentfish		
patiki/flounder		
kanakana/lamprey		
long & shortfinned eel		
inanga		

The long-finned and short-finned eels have a great capacity to penetrate inland. The short-finned eel has been seen far upstream at the upper end of Lake Te Anau and can also be found in artificially created ponds as well as fertile wetlands. The Mararoa weir impedes upstream progress of juvenile eels. To allow passage, any water outlet must be deep enough to cover moderately sized eels (10 centimetres). In the case of the stream in the Jericho Block, this limitation could apply to the culvert beneath the Blackmount-Redcliff Road.

The short-finned eel grows faster than its long-finned cousin. Water temperature and available food being key determinants. The juvenile short-finned eel prefers a wetland habitat while it is migrating upstream, and they will colonise any new wetland areas, providing, of course that access to them is managed. The diet of both species of eel is similar, and within wetlands, consists of bullies, dragonfly nymphs, damselfly larvae and a range of other terrestrial foods such as grass-grubs, earthworms and insects. Increased water levels will allow eels to forage over newly flooded grassland. The eel will forage the shorelines, many prey species being concentrated around the margins. Both species of eel require day time cover to provide refuge. This can be provided by overhanging plant material such as trees, harakeke, tussocks and sedges, and also by soft sediments and undercuts of the bank. The Jericho has considerable potential for enhanced wetland habitat.

Inanga are usually found in pools, backwaters, swamps and lagoons and are less common in faster flowing waters, preferring muddy, murky waters. They mature over summer in freshwater areas sheltering from marauding eels under pukio and harakeke. They then spawn and die the next autumn.

Although the patiki are primarily salt water dwellers they can be found many kilometres inland, lying on a muddy bottom, carnivorously eating small snails, insects, fishes and inanga. Seeking quite different conditions, the kanakana (lamprey) and torrent fish can be found up as far as the Mararoa Weir.

How can we encourage more fish into the Jericho?

There are a number of considerations to take into account when enhancing and managing habitat for fish:

Vegetation:

- Encourage native riparian revegetation, with plentiful streamside and overhanging plants - this provides cover and shade for the stream, and a food source for fish (from insects falling into the stream).
- Establish a sub-canopy of tussock, pukio, harakeke, and where appropriate small trees (less than 3m tall), to provide most of the terrestrial food source, and dense bank-side shade.
- In these naturally forested places, establish a canopy of large trees, providing diffuse shade, helping to moderate stream temperature by reducing the effect of midday sun, and stabilising stream banks.
- Establish emergent rushes, grasses and sedges, providing good habitat in low lying areas.
- Prevent damage to riparian vegetation from trampling and keep stock out!

Stream form:

- Provide for a sinuous stream path as opposed to a straight channel, through careful natural and traditional control methods.
- Vary the stream depth, because different fish species live at different depths. Shallow areas help reduce predation, by excluding larger fish such as trout which eat the smaller species.
- Provide mid-channel and wetland islands, giving refuge and diversity of habitat.
- Create overhanging stream banks (approximately 30cm), where the banks are stable.
- Retain and encourage instream debris, such as rocks, fallen logs and slumped banks, along with emergent rushes and sedges, to create a range of different habitats
- Remove in-stream barriers to fish passage (eg, culverts, weirs, fences, gates and drops), as access throughout the stream is very important to many fish species. If the culvert can't be removed, seek to develop a fish pass mechanism within it.
- Seek to enable unimpeded access to the sea, as many native fish are migratory.

Stream flow:

- Ensure continuity of water, allowing a permanent habitat throughout the year.
- Provide variation in water flow type, including the creation of pool, riffle (mini-rapids) and run sequences, along with varying stream depths and widths. These will provide a variety of micro-habitats for different fish species, while avoiding the creation of fast flowing "chutes" which inhibit the upstream migration of fish.
- Gently re-grade, plant to disperse and/or place large boulders in faster flows allowing resting areas for fish.
- Prevent free-falling water throughout streams - if it exists, stones will allow access up the fall for eels and other native fish.
- If trout are not present, do not introduce or encourage them because they eat native fish compete for food and space, and are not a traditional resident here.

As information becomes available and the project progresses, specific strategies can be developed to improve habitat for each particular fish species.

sculpture by Bing Dawe