ENVIRONMENTAL MONITORING

RIVERBED
AND
COASTAL BEACH
PROFILES

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for the West Coast Regional Council

WEST COAST REGIONAL COUNCIL

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Riverbed and coastal beach profiles

OBJECTIVE

This report details that part of the West Coast Regional Council's environmental monitoring to be carried out by systematic surveying of riverbed and coastal beach profiles.

PERSPECTIVE

The West Coast Regional Council has a responsibility to "gather such information and undertake or commission such research as is necessary to carry out effectively its functions " under the Resource Management Act, S. 35.

The Council's functions that are specified in S. 30 include the control of activities for the purpose of the sustainable management of natural and physical resources and, in particular, the avoidance or mitigation of natural hazards, soil conservation, and the maintenance and enhancement of water quality. It also has a function pursuant to Soil Conservation and Rivers Control Act S 126 (1) "to minimise and prevent damage ... by flooding and erosion".

The monitoring of riverbed and coastal beach profiles is carried out as part of the Council's management of the natural hazards of flooding and erosion.

This report details a programme for the monitoring of riverbed and coastal beach profiles that identifies:

- the likely range of future riverbed or coastal beach level changes and hence indicates the future magnitude of maintenance requirements for protection works,
- locations where aggradation or degradation have reduced the security of protection works and the magnitude of work required to restore original security,
- the impact of the extraction of gravel on potential flooding or erosion problems.

COASTAL BEACHES

The location and orientation of the coastline exposes the beaches to the dominant westerly wind and wave direction. The extremely long upwind fetch means that oncoming sea has an extremely high energy component providing the potential for high rates of erosion and flooding from the sea.

There has been a long history of problems arising from erosion of coastal beaches on the West Coast. The pattern of European settlement adjacent to river mouths ensured that the most unstable sections of the coastline were built on first. Anecdotal history of these places indicates that the erosion problems have been of a sporadic nature. Estimates indicate that the rate of coastal erosion could be up to 5 metres per year over many decades (Gibb, 1978).

The objective of coastal beach survey is to quantify the magnitude and wavelength of the erosion episodes at sites where erosion has caused problems. This enables the likely direction and magnitude of future erosion episodes to be estimated. It indicates whether they are likely to cause a problem and, if so, the most practical means of managing the problem.

Coastal beaches that require profile surveying include those where there has been an erosion problem and those where there is likely to be a potential problem. A potential problem exists where there have been significant developments on recent dune formations or form of coastline has been artificially modified.

Theoretically, potential problems also exist where there is the possibility that significant development could take place on recent dune formations. This includes all freehold land on recent dune formations, particularly in river mouth environments. These sites are not included on this list a systematic survey of the coastline is required to identify them.

Beaches have been identified and allocated to a class depending on the significance of the management issue on the following basis:

- Class 1: high value assets at risk current problems,
- Class 2: high value assets potentially at risk but no immediate problem
- Class 3: medium to low value assets, historic problems

These sites include:

Area	Beach	Class
Karamea	Karamea River mouth to Little Wanganui River mouth	3
Mokihinui River	Waimaire settlement	2
Ngakawau		2
Granity		2
Orowaiti River mouth		3
Okari	Tauranga Bay	3
Tiromoana		3
Punakaiki		1
Barrytown	southern end	3
Twelve Mile		2
Rapahoe		2
Cobden	North tip to Point Elizabeth carpark	1
Karoro		1
Hokitika	North tip to Arahura	1
Okarito		3
Hunts Beach		3
Bruce Bay		3
Turnbull	River Mouth lagoon	3

Beach profiles need to extend above the limit of erosion and to below the level at which the beach profile changes (in practice the lower end of the profile is usually limited by low spring tide level). The survey usually fixes points on the profile to the nearest 0.01 metre for both offset and elevation.

The period of survey and spacing of profiles depends on the class of the beach:

- Class 1: profile spacing limited to 200m, surveyed every 6 months or after significant coastal storm or erosion episode,
- Class 2: profile spacing limited to 400m, surveyed every 12 months or after significant coastal storm or erosion episode, and
- Class 3: profile spacing limited to 1000m, surveyed every 6 months or after significant coastal storm or erosion episode.

Survey of beach profiles need also to record substrate composition along the cross section and the edge of the vegetation.

The state of the waves (height, alignment and period) needs to be monitored regularly to relate to erosion rates. This is currently being done once a day at Punakaiki by D.O.C. This data needs to be incorporated into the beach profile database.

Aerial photographs (scale 1:8000) have proven a very effective method of recording the position of river mouths. River mouths are very mobile features and so these should be continued on at least an annual basis.

RIVERBEDS

The fertile soils of the river flood plains have been the preferred areas for agricultural development on the West Coast. Transport routes and settlements have also developed on their easier topography. The concentration of development on river flood plains has left the West Coast particularly susceptible to erosion and flooding from these rivers.

While development of some of the most flood prone areas has to some extent been avoided, many developed areas are tenable only due to the protection of river works. Unfortunately, due to the inherently unstable nature of these river beds, they are prone to cycles of aggradation and degradation which increase the risk of flooding and bank erosion. The cycles of aggradation and degradation are usually very closely allied with the meander pattern of a river.

The objective of monitoring a river bed level is to provide information on the aggradation/degradation cycle; magnitude and period as well as what part of the cycle the various reaches are at. This information is in turn indicative of likely maintenance requirements of existing works (and the sort of maintenance that is appropriate) as well as the design and maintenance requirements of proposed works.

Superimposed on natural changes in river bed levels are changes arising from gravel extraction. Gravel extraction can bring significant benefit during an aggradation part of a cycle but has the potential to aggravate problems when undercutting or erosion of structures is occurring. Identification of the aggradation/degradation cycle in a reach where gravel extraction is proposed is necessary to predict whether the mining will exacerbate existing problems or provide a means of managing them.

Monitoring is carried out by ground and aerial photography and survey and sounding a series of cross sections. Size of the surface bed material is also recorded as it has a significant effect on the behaviour of the bed. The spacing of cross sections depends on meander wavelengths - a minimum of four per wave length is required to define the magnitude and position of the meander. Elevation and offset of river bed cross sections are surveyed to the nearest 0.01 metre.

Historically, river bed surveys have been carried out when problems arose rather than on a systematic basis. In reality, the period between surveys needs to be sufficiently short as to allow the arrival of the highs and lows of the bed level at sensitive points to be identified.

River bed surveys provide a management tool for those river reaches where flooding or erosion has the potential to threaten assets. These reaches have been identified and allocated to a class depending on the significance of the management issue on the following basis:

- Class 1: high value assets at risk current problems,
- Class 2: high value assets at potentially at risk but no immediate problem
- Class 3: medium to low value assets, historic problems

The period of survey depends on the class of the management issue:

- Class 1: surveyed every year or after significant floods or erosion or deposition episode,
- Class 2: surveyed every two years or after significant floods or erosion or deposition episode,
- Class 1: surveyed every three years or after significant floods or erosion or deposition episode,

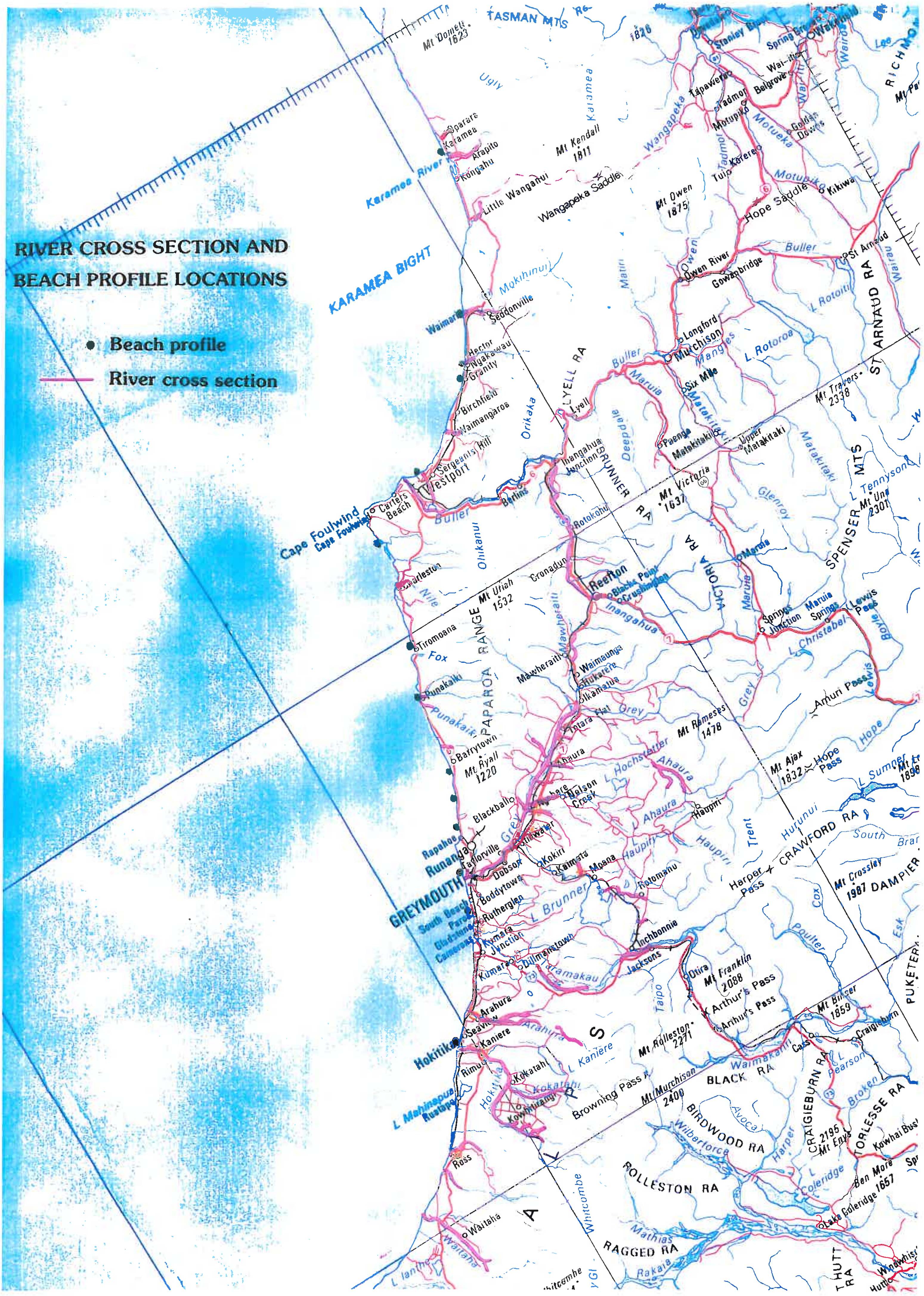
Catchment	Reach	Management issue	Class
Oparara	SHB - gorge	river works	3
Karamea	lagoon - gorge	river works	2
Little Wanganui	scheme	river works	3
Mokihinui	mouth - gorge	river works, flooding	3
Ngakawau	mouth - gorge	rockwork u/s SHB on LHS	3
Waimangaroa	mouth - 2Km u/s SHB	stopbank & rockwork, weir	3
Orowaiti	lagoon - overflow	flooding of Westport	1
Buller	lagoon - gorge	flooding of Westport	1
Inangahua	confluence - Reefton	flooding, isolated river works	2
	Reefton	flooding	1
	Reefton - Blacks Point	flooding	3
Nile	SHB - gorge	river works	3
Pororari	mouth - SHB	erosion, gravel mining	1
Punakaiki	mouth - 5 Km u/s SHB	erosion, gravel mining	1
Canoe Ck	mouth - 1 Km u/s SHB	bank erosion, gravel mining	3
Grey	mouth - Ikamatua	river works, flooding, gravel mining	1
	Marawhiti - Maimai		
Sawyers Creek	lagoon - Sinnot Rd	river works	2
Range Creek	lagoon -	flooding	2
Redjacks	confl - gorge	river works, flooding	1
Nelson Creek	confl. - 5 Km u/s SHB	flood protection	1
	5 Km u/s SHB - Sutors Ck	flood protection	2
Blackball Creek	confl. - bridge	flooding	3
Callaghan's Creek	confl. - SHB	flooding	3
Ahaura	confl. - gorge	gravel mining, river works	1
	gorge - Trent	gravel mining, river works	2
Haupiri	confl. - gorge	river works	2
Deep Creek	confl. - 2 Km u/s lower bridge	gravel mining	2
Crooked River	Te Kinga - top bridge	river works	2
Slatey Ck (Rotomanu)	confl. - 1 Km u/s road bridge	flooding	3
Duffers Ck. (Totara Flat)	confl. - 1 Km u/s SHB	river works	3
Otututu	confl. - 5 Km u/s road bridge	river works, flooding	3
Moonilght	confl. - 2 Km u/s road bridge	river works, flooding	3
Big River	confl. - 3 Km u/s road bridge	river works, flooding	3
Taramakau	adjacent Settlement	river works	1
	Inchbonnie - Jackson's	flooding	1
Arahura	mouth - gorge	river works, gravel mining	1
	Milltown - bridge	river works, gravel mining	2
Kawaka	confl. - 5 Km u/s confl.	erosion	3

Catchment	Reach	Management issue	Class
Hokitika	mouth - gorge	river works, flooding, gravel mining	1
	Vine Creek	river works	1
	Johnston Creek	river works	1
	Doughboy Creek	riverworks	2
	Spring Creek	riverworks	3
Kokatahi	confl. upper bridge	river works, flooding, gravel mining	1
Totara River	mouth - 5 Km u/s SHB	flooding	3
Mikonui River	mouth - gorge	flooding, river works	3
Waitaha River	mouth - gorge	flooding, river works	3
Kakapotahi	confl. - 1 Km u/s bridge	flooding	3
Wanganui River	mouth - SHB	river works	1
	SHB - quarry	river works	3
Poerua River	mouth - gorge	river works	1
Whataroa River	mouth - 2 Km u/s SHB	river works	1
Waitangi-taona	lake - 2 Km u/s SHB	river works	1
Waiho	mouth - glacier	river works	1
Cook River	5 Km d/s SHB - SHB	river works	3
Karangarua	mouth - SHB	flooding, riverworks	3
Jacob's River	mouth - 8 Km u/s SHB	river works	3
Mahitahi	mouth - 2 Km u/s SHB	river works	3
Paringa River	3 Km d/s SHB - 3 Km u/s SHB	river works, flooding	3
Haast River	mouth - 3 Km u/s SHB	river works, flooding	3
Okuru	mouth - 3 Km u/s SHB	river works	3
Turnbell River	mouth - 3 Km u/s SHB	river works, flooding	3

REFERENCES

Gibb, J. 1978: *Rates of Coastal Erosion and Accretion in New Zealand.* New Zealand Journal of Marine and Freshwater Research, v12, No.4, p429-456

RIVER CROSS SECTION AND BEACH PROFILE LOCATIONS



Hokitika
Kowhitirangi
Ross
Waitaha
L Ianthe
Harihari
Poerua
Whataroa
Okarito
Perth
Wanganui River
Abut Head
Mapourika
Franz Josef Glacier
Franz Josef Gl
Elie de Beaumont
3117
Omoeroa
Fox Gl
Fox Glacier
Gillespies Point
Cook River
Karangarua
Copland
Makawhio
Bruce Bay
BANNOCK BRAE RA
Mahitahi
STRACHAN RA
Paringa
Lake Paringa
Otoko
Mt Kinnaird
1226
Moeraki
Thomas
Mt McFarlane
2057
Clarke
Haast
Haast Pass
Okuru
Open Bay Is
Turnbull
Waiatoto
Jackson Bay
Jackson Head
Neils Beach
Arawata
L Ellery
Jackson
Cascade Point
Cascade
OLIVINE RANGE
Collyer
1647
Dagg
1693
HAAST RA
Mt Alba
2356
Pollux
2542
Mt Aspiring
3027
Mineral Pks
2270
L Wanaka
Mt Alta
2347
Matukituki
Wanaka
Makarora
Wilkin
YOUNG RANGE
1996
Hunter
Mt Huxley
2499
BARRIER RA
Mt St Mary
2332
L Ohau
Ohau
Ahuriri
1722
Omarama
Dingle Burn
L Hawea
Mt Melina
1906
Hawea Flat
Lindis Pass
Lindis Pk
1223
Lindis Valley
ST BATHANS RA
2087
Dunstan
HAWKDUN RANGE
Otematata
Otema
L Benmore
Benmore Peak
Twizel
Pukaki
L Pukaki
Lake Pukaki
BEN OHAU RANGE
Dobson
Hopkins
Landsborough
2644
SOUTHERN ALPS
Mt Cook
3764
Mt Tasman
3498
Mt Sefton
3157
Malte Brun
3155
Tasman Gl
Murchison
LIEBIG RA
Mt Blackburn
2416
Jollie
Tasman
L Alexandrina
Lake Tekapo
L Tekapo
Cass
Fork
Godley
Godley Gl
Macaulay
TWO THUMB RA
The Thumbs
2545
Bush
Forest
BEN McLEOD RA
Mt Musgrave
2246
Rangitata
HARPER RA
Havelock
Clyde
2399
2338
Lyell Gl
Ramsey Gl
Mt Whitcombe
2644
Mt Adams
2223
Whitcombe
RAGGED RA
Mathias
Rakaia
ROLLESTON RA
L Coleridge
Lake Coleridge
Mt Arrowsmith
2795
Cameron
Lake
L Heron
Mt Taylor
2330
Lawrence
Potts
Clearwater
L Emma
Hakatere
South Branch
MT HUTT RA
Mount Hutt
Methven
Rakaia
Taylors
Ashburton
Mt Somers
Mt Peel
1717
Orari
Peel Forest
Opuha
Fairlie
Burke Pass
Sawdon
Tekapo
Mary Burn
DALGETY RA
GRAMPIAN MTS
Stony
Kimbell
Allandale
Opihi
Cricklewood
Sherwood Downs
DUNSTAN MTS
St Bathans
Cambrians
Lauder
Tarras
Bendigo
Luggate
Albert Town
Cardrona
Mt Pisa
1961
PISA RANGE
Clutha
Omakau
Chatto Creek