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AN APPRAISAL OF THE TEKAPO REGION WITH SPECIFIC EMPHASIS ON PLANNING OF THE DOMAIN

A Reseach Study
submitted in partial fulfilment
of the requirements for the
Diploma in Landscape Architecture
in the
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by
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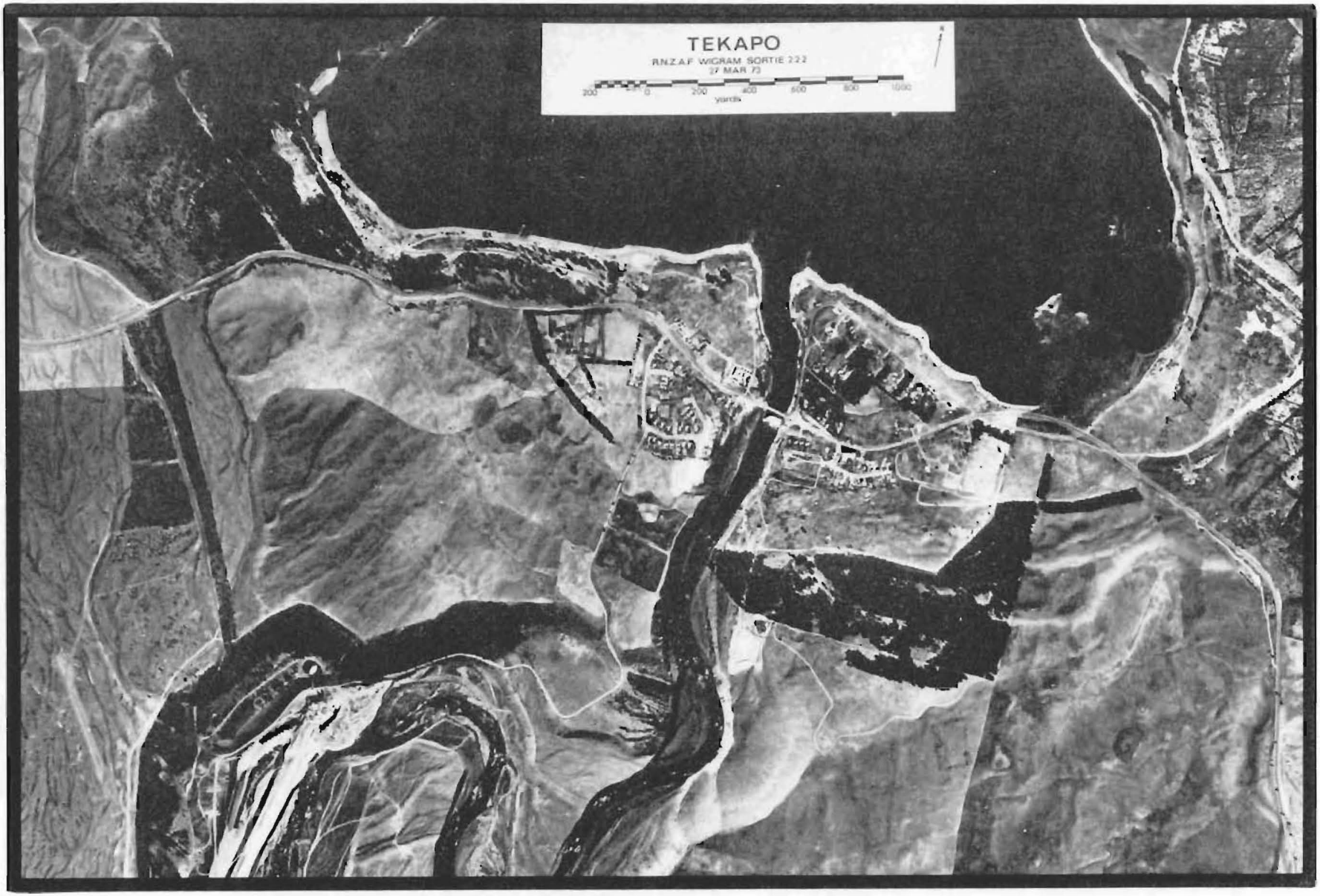
CHAPTER I

The Brief

With the development of the Mackenzie Basin for hydro-electric power, there has become an increasing demand on the Tekapo region for recreation. This study is to outline the landscape problems associated with the recreational development of these areas and produce general planning policies based on an appraisal of the Tekapo District.

Specific problems of the Tekapo Domain are to be described and detailed designs will be prepared as a set of drawings to guide future development of the Domain.



Tekapo - a vertical view

Introduction

In this study a brief review will be made of the problems associated with the development of the Mackenzie Basin so that certain aspects can be related to the more detailed planning needs of Tekapo and the Tekapo Domain.

The Mackenzie Basin was first discovered by the Maoris who, after climbing up the eastern side of the Two Thumb Range, looked westward and exclaimed "Takapo!". Interpretation of this is either "falling light", or "hole in the clouds", as what they had seen was sunlight streaming into a long pale lake surrounded by clouds in every direction. The Maoris were not to realise until later, that what they had seen was Lake Tekapo, only a small portion of the Mackenzie Basin, the whole of which totals approximately 2,000 square miles. One-fifth of this area consists of lakes, rivers, rock, snow and ice; the balance is tall tussock grassland.

One of the first Europeans to hear of the Mackenzie Basin was Edward Shortland in 1844, and his subsequent prophecy is recorded in 'High Endeavour':

> "'We may, however,' said Shortland, 'carry on the imagination to another century - when this now desert country will no doubt be peopled - when the plains will be grazed by numerous flocks of sheep, and the streams, now flowing idly through remote valleys, will be compelled to perform their share of labour in manufacturing wool.'" (Vance, 1965)

Shortland's prophecy has proved to be remarkably accurate, and today the rivers of the basin are being controlled and used for the development of hydro-electric power, the effects of which spread into agriculture, recreation and the character of the area.

Location

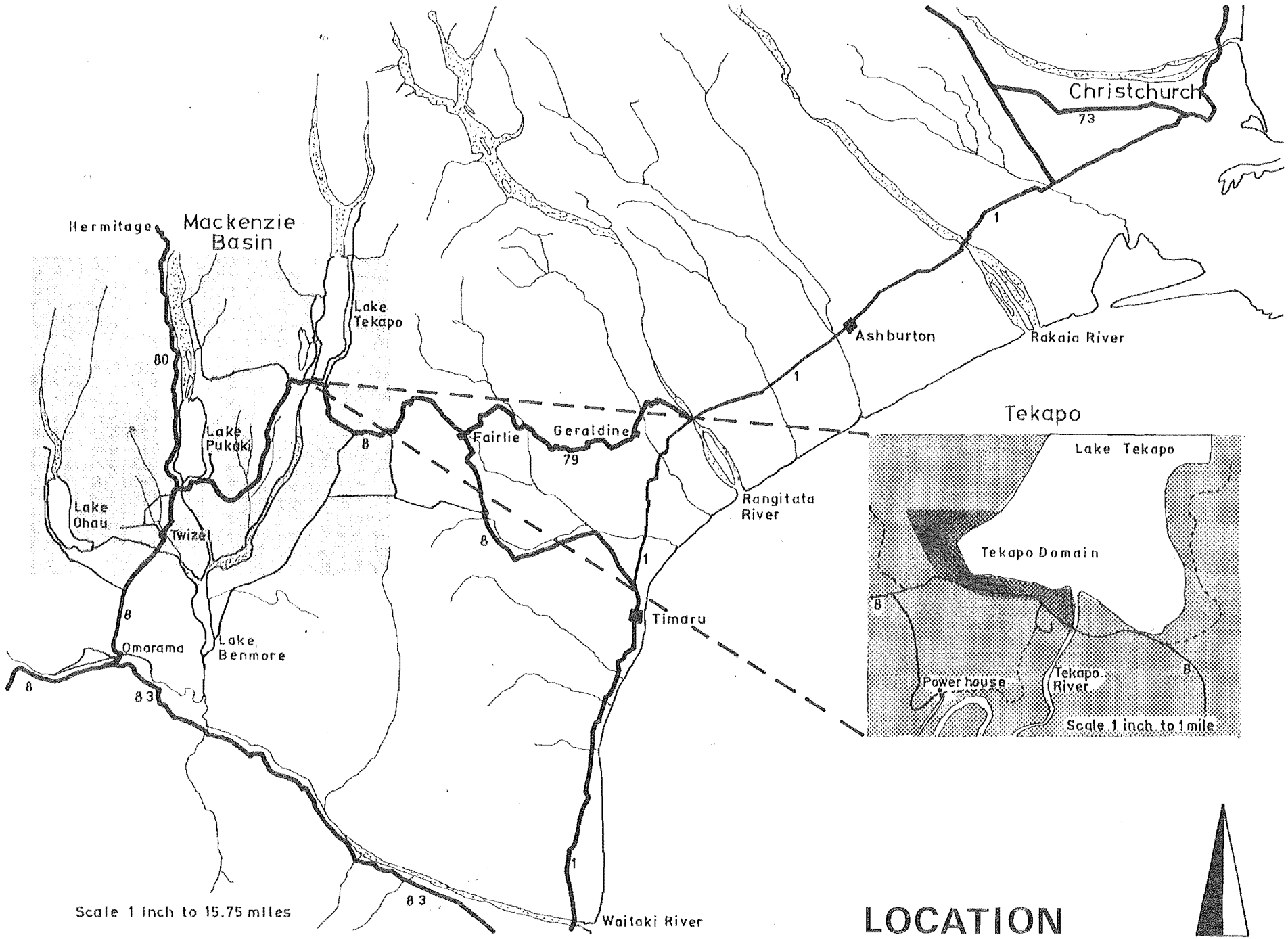
The boundaries of the Mackenzie Country are traditionally formed by the Dalgety, Rollesby and Two Thumb Ranges on the east, Lake Ohau and the Ohau River to the west, Lake Benmore in the south and the Southern Alps and Mt. Cook National Park to the north. In this study, however, the Mackenzie Basin will be described as the area as above with the exception of the area north of Lake Alexandrina.

Generally, the area comprises the boundary mountain ranges, with three large lakes - Tekapo, Pukaki and Ohau, that all drain southwards via their individual rivers into Lake Benmore. The large flat basin is divided into two portions by the Mary Range, and generally the roading pattern is sparse when compared with the size of the area.

Lake Tekapo is sited to the north-east of the Mackenzie Basin, and the Tekapo township is on its southern shores. Tekapo is located on State Highway No. 8, 66 miles west of Timaru (via Fairlie), 142 miles south-west of Christchurch (via Geraldine and Fairlie), and 110 miles north-west of Oamaru (via Pareora and Cave). All roads are good, tar-sealed highways. Tekapo is also on the main tourist route to the Hermitage, 66 miles away, and the Southern Lakes District (Wanaka 182 miles from Tekapo). Therefore its placement provides an ideal stopping point for overnight stays where travellers have the other major tourist resorts as their primary objective.

The small township is separated from the commercial centre, primary school and N.Z.E.D.

village by the Tekapo River which is bridged by the main highway across a dam. The Tekapo Domain lies between the main road and the south-eastern lakeshore, and is bounded to the north by Mount John.


Christchurch
73
Hermitage
Mackenzie Basin
Lake Tekapo
80
Ashburton
Rakaia River
1
Lake Pukaki
8
Fairlie
Geraldine
79
Tekapo
Lake Tekapo
Lake Ohau
Twizel
Rangitata River
Tekapo Domain
8
1
Timaru
Omarama
Lake Benmore
Power house
Tekapo River
8
83
Scale 1 inch to 1 mile
Scale 1 inch to 15.75 miles
Waitaki River

LOCATION

Geology

GENERAL

About 250 to 300 million years ago, the Mackenzie Basin was a trough in the ocean floor, many hundreds of miles long, and 50 to 100 miles wide. Sand, silt and gravel was washed into it from a land mass somewhere to the west. The trough subsided as sediment poured into it, and eventually, after about a hundred million years, pressures on the crust caused it to buckle and fold. The trough now ceased to exist as the sediments had been folded into a range of mountains above the sea.

Approximately 20 million years ago earth movements began that are largely responsible for shaping the general outline of the present Mackenzie Basin. During this time the alps were elevated, and about 15 million years ago the younger, softer rocks were quickly eroded and the Mackenzie Basin was extensively covered with gravels, sand and clays. The earth movements reached a climax about 8 million years ago and a continuation of the process can be considered to be taking place today.

LITHOLOGY

Greywacke and argillite of medium induration (Chlorite sub-zone 1) form mountains on the east, south and west. In the east they are of the Permian age, examples being the Rollesby and Dalgety Ranges, and the Grampian Mountains. The Triassic age is represented

in the basin by the Benmore Range, the western Ben Ohau Range, Mary Range, Te Kohai hills and also by Mount John.

Broad areas of metamorphic rocks composed of weakly schistose greywacke and argillite (Chlorite sub-zone 2) of similar age are found on the east of the Ben Ohau Range and the Two Thumb Range.

Eastern portions of the Ben Ohau Range on the west side of Lake Pukaki are formed from greywacke and argillite of low induration and are part of the Jurassic series.

By far the major visual impact on the geology of the Mackenzie Basin is the result of glaciation, but this has been subdued to a certain extent by the subsequent addition of loess. The Otira glaciation is represented in the Mackenzie Basin by four major formations:

(i) The Tekapo till represents the lowest of the moraines surrounding all the major lakes and the Tekapo outwash gravels, found especially west of the Tekapo River;

(ii) The Mt. John till which surrounds the Tekapo formation further back from the lake shores and is exposed on higher ground. Mt. John outwash gravels form an extensive, high terrace along the east side of the Tekapo River;

(iii) The Balmoral till extends from the headwaters of Irishman Creek southwards to the flanks of the Mary Range with small areas of outwash gravels found especially in the mid Irishman Creek area;

(iv) Wolds till is associated with very subdued morainic topography and is found to the west of Balmoral camp and in the region of Pattersons Terrace.

GEOMORPHOLOGY

The Mackenzie Basin can be divided into three major physiographic regions: the eastern dissected block mountains, the western fold mountains and the flat to undulating plain of the central basin.

(i) Eastern Block Mountains

These include the Two Thumb, Rollesby, Dalgety and Grampian Ranges, and are formed of undifferentiated greywacke. These have been dissected by fluvial processes in the past, but today, because of a highly permeable regolith, few surface streams exist although the water reappears at lower levels as springs. The upper surfaces have been modified by a combination of freeze-thaw and mass wasting processes, and glacial activity is not thought to have occurred. At the base of these mountains large quantities of colluvial and water-borne material form extensive aggraded fans.

(ii) Central Basin

The flat to undulating plain of the central basin is formed from quartz-feldspathic greywackes and argillites that have been reduced to a peneplane surface. In a later tertiary period, gravels, sands and clays were deposited. Examples of these rocks can be seen above the Tekapo Military Camp. The present day fluvial cycle is indicated along the perennial and seasonal river beds where aggraded and degraded profiles can be seen in well sorted debris along the flood plains and quaried channels where the river has cut into the terraced material.

(iii) Western Fold Mountains

These differ from the eastern block mountains in that they are higher, more massive and consist largely of eroded folds. They have a higher rainfall and have, or are in the process of being modified by glacial processes. The Ben Ohau Range forming the western boundary to the Mackenzie Basin has evidence of fluvial, glacial and periglacial activity. The southern part beyond Lake Pukaki contains ample evidence of former ice erosion and deposition.

GLACIATION

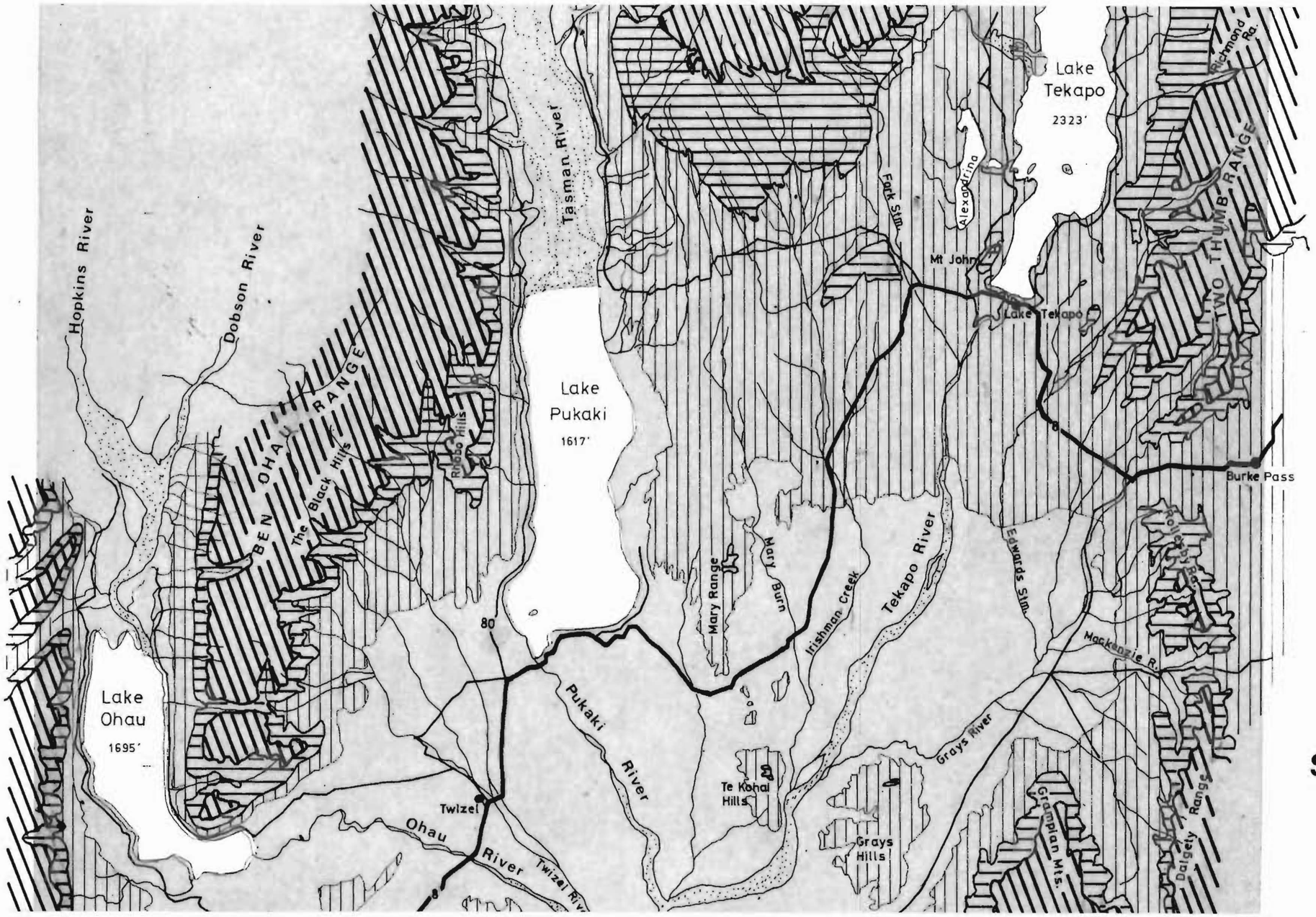
The present day Mackenzie Basin landscape is dominated by the effects of a series of ice advances and recessions and interglacial fluvial cycles. The oldest evidence available is that these occurred some 120,000 to 200,000 years ago, but the so-called "Ice Age" probably started some two million years ago.

Four major advances of the glaciers can be distinguished in the Mackenzie Basin. During each of these the ice extended to or beyond the southern shores of the main lakes - Tekapo, Pukaki and Ohau. The oldest advance (120,000 to 200,000 years ago) reached the area of the Wolds where a high terrace still remains. With the advent of warmer temperatures, the ice retreated and it was not until the temperatures became colder again, about 40,000 to 60,000 years ago, that the glaciers began their advance again. This time the Godley Glacier reached Balmoral Station and the Tasman Glacier climbed over the northern end of the Mary Range, and terminated about four miles downstream from Lake Pukaki.

West of Tekapo [illegible] Mount John to the right

Evidence of this action is seen in the high level terraces on the western side of the lake.

Again the climate became warmer, the glaciers down-wasted and retreated up their valleys, and the streams eroded much of the newly deposited till of the moraines and outwash gravels. The same sequence of events was repeated about 22,000 years ago and also 17,000 years ago. The moraines resulting from this latter cycle now impound Lakes Tekapo, Pukaki and Ohau.. Examples of ice erosion are not obvious, but Mount John is a good example of a roche moutonnée. A roche moutonnée is formed from harder rock which was less readily worn away by the moving ice at the bottom of a glacier. The upstream face of a roche moutonnée is always more gently inclined and the downstream much steeper, due to the eroding or quarrying action of the ice. (Oborn, 1963)

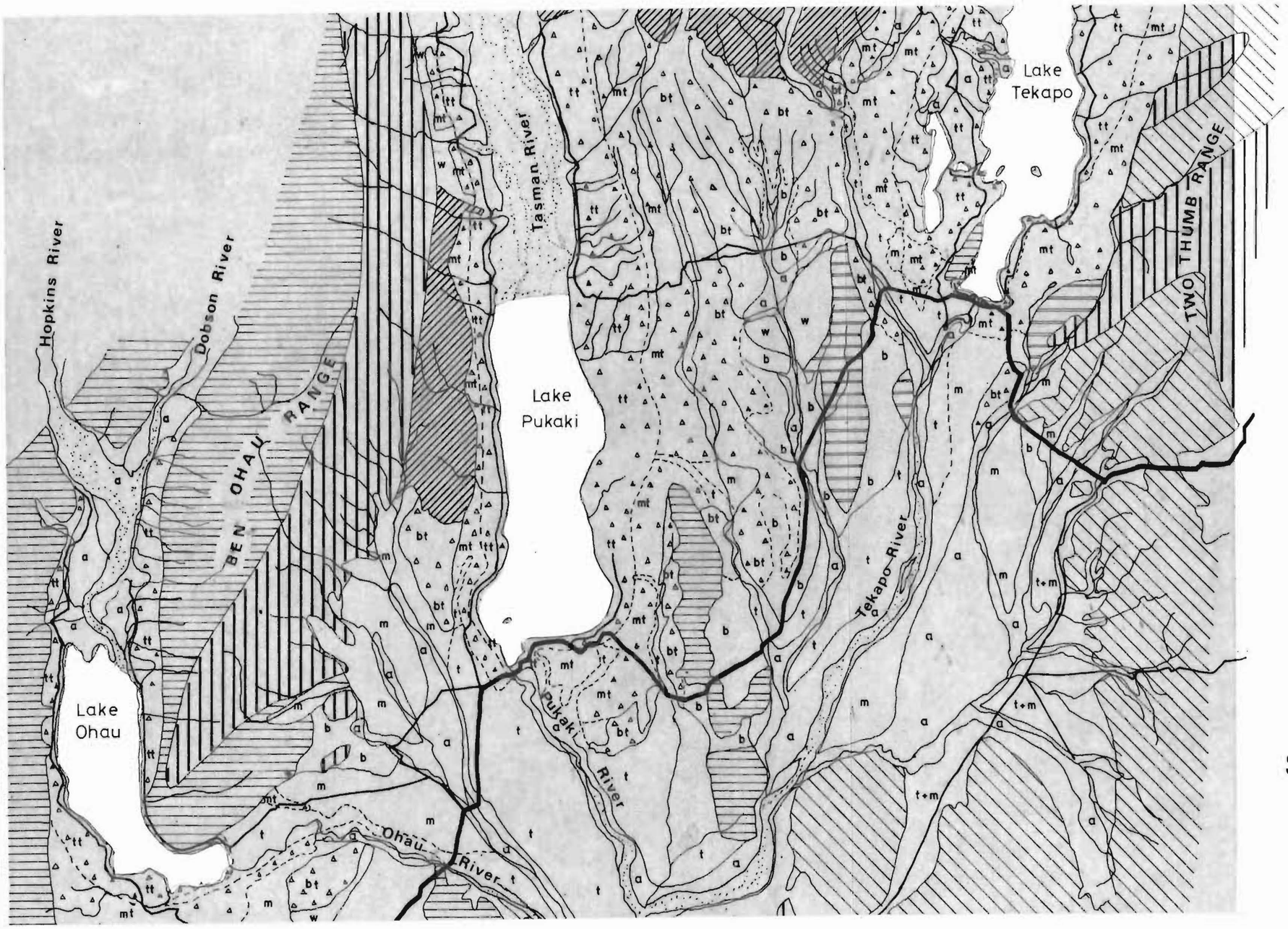


Legend

- Above 4000 feet
- 3000 - 4000
- 2000 - 3000
- 1000 - 2000
- 8 State highways

Scale 1 inch to 4 miles

TOPOGRAPHY



Legend

- a — Alluvium, beach and swamp deposits
- t m tt mt — Till (a) [Tekapo - tt, Mt John - mt] with slightly subdued morainic topography and outwash gravel
- b bt — Till (a) [Balmoral - bt] with subdued morainic topography and outwash gravel
- Mostly outwash gravel with some till (Wolds) with a very subdued morainic topography
- w — Weathered non-marine greywacke gravel with minor silt and sand
- Greywacke and argillite of low induration
- Greywacke and argillite of medium induration (Chlorite subzone 1)
- Greywacke and argillite of medium induration plus some Atomodesma fragments (C. sub.1)
- Metamorphic - Weakly schistose non-foliated greywacke and argillite (Chlorite subzone 2)

Scale 1 inch to 4 miles

GEOLOGY

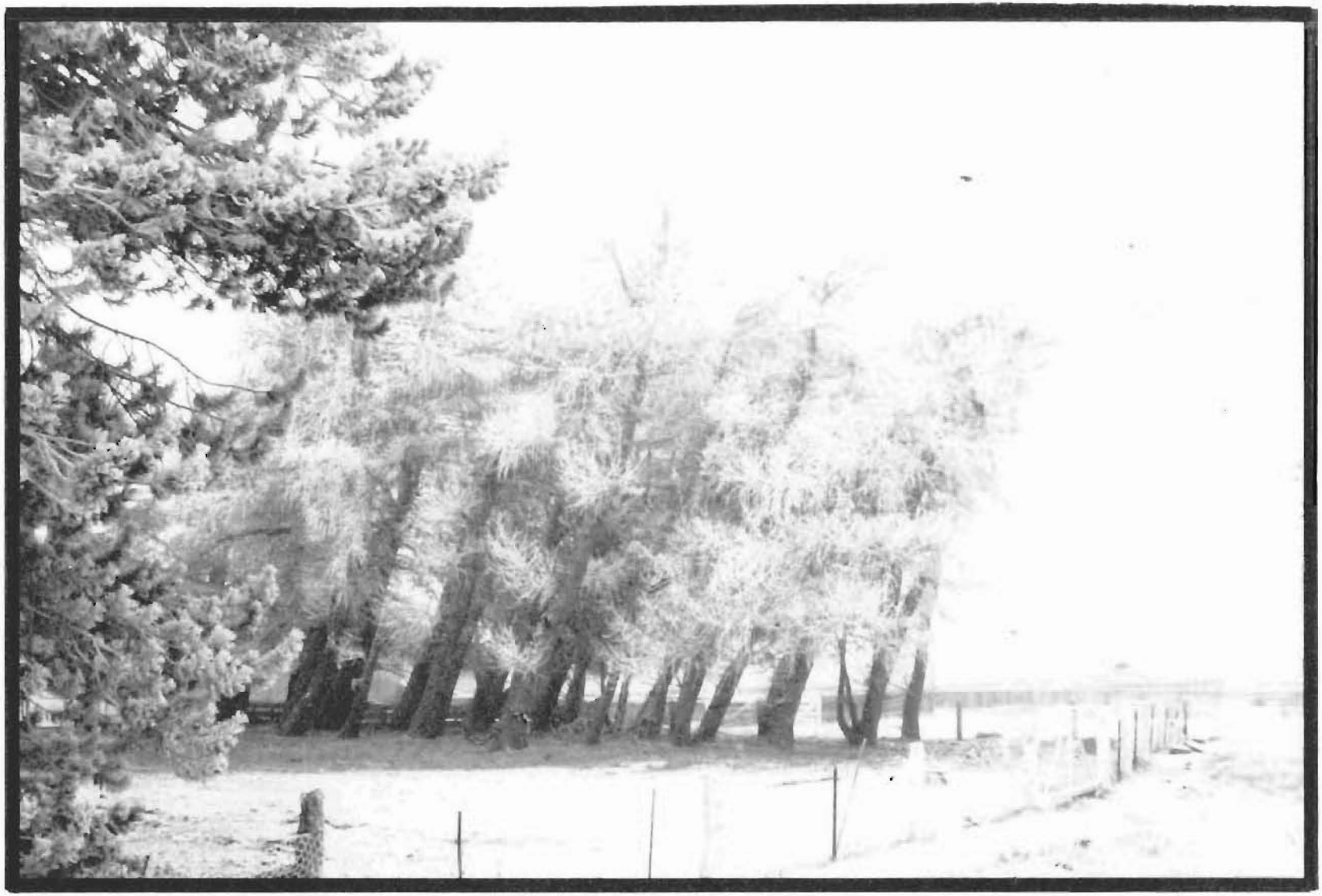
Climate

REGIONAL

The Mackenzie Basin is protected on all sides from rain-bearing winds, and this gives rise to a sub-continental type climate. Elements of climate are controlled by the prevailing wind systems, where characteristic north-westerlies succeed anti-cyclones as they lose intensity and are terminated by cold front passages. These north-westerlies involve adiabatic warming as the Southern Alps are crossed, and temperatures are relatively high, except in the western mountains during winter. Rainfall is heavy along the western mountains, but diminishes as the cold front turns the winds back to the south. Rainfall then falls on the outskirts of the basin, but is only light in the central basin.

Therefore the Mackenzie Basin is drier than other areas of the country and throughout the greater part of the region mean annual rainfall is less than 25" (63mm). It rises above this figure only on the mountains which circumscribe the area, and it falls well below this figure on the basin floor. On the average, more than 30% of the rain comes in summer, and less than 20% in the winter. There is more variability in spring and summer than at any other times of the year, and this, as well as the seasonal regime of precipitation accentuates the dryness of the area. This is because most of the rain falls during the period of high temperatures and sunshine and therefore evaporation is high. This results in considerable moisture deficiencies.

The annual, diurnal and extreme ranges of temperatures in the Mackenzie Basin are



Effects of a hoar frost on trees at Sawdon homestead

all high. Temperatures near or below freezing point may be expected at least once every month of the year. They emphasize the likelihood of cold night temperatures , and Garnier in 'The Climate of New Zealand' explains why:

"They reflect a double process: the nocturnal radiation-cooling normal to intermontane basins, which is the siting of most of the recording stations, and the influx of cold air by night-drainage from neighbouring snow-covered mountains. It is no wonder, therefore, that screen temperatures are low at night and that frosts are frequent. No region of New Zealand, outside the areas of perpetual frost and snow, has a greater incidence of frost than this one. Screen frosts average 115 a year for the region as a whole, and the number of ground frosts is correspondingly large. At several stations the latter occur every night in winter and throughout the area at least one ground frost in summer is an annual event." (Garnier, 1958)

Generally, the relative humidity of the Mackenzie Basin is low, but this masks the seasonal regime which also reflects its continentality. In winter, cold sinking air collects over the basin and the relative humidity is high. From August onwards, the mean values of relative humidity fall rapidly and become the lowest recorded in the country during the summer months.

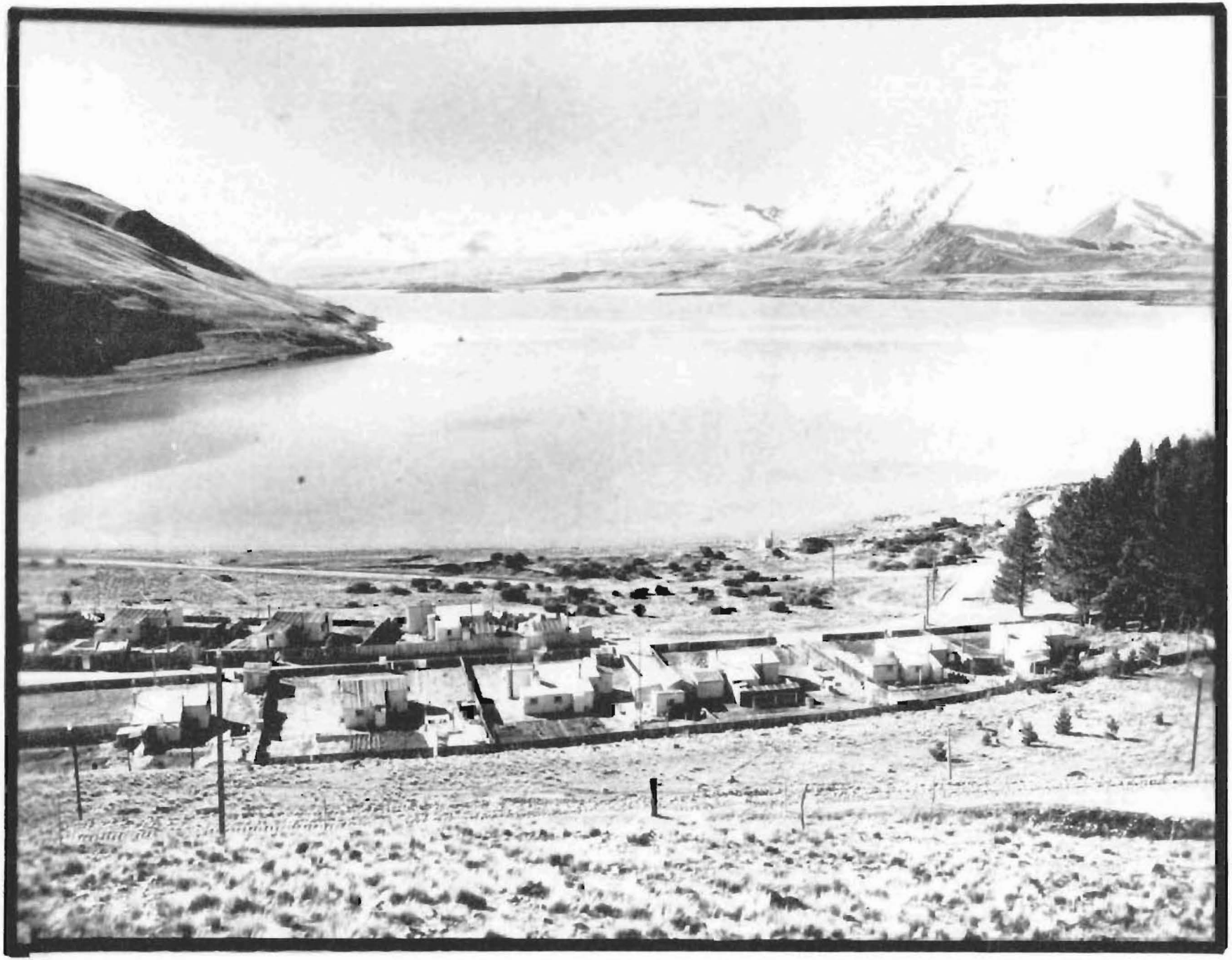
On the flat floor of the Mackenzie Basin, some of the greatest temperature extremes and the driest moisture conditions of New Zealand are found. As the general slope of the land is from north to south, the most extreme conditions of temperature and precipitation are found in the southern portions. Rainfall in the basin is brought by either the north-

west winds or by southerly winds. In a north-west wind, the rainfall is least in the south-east edge of the basin, since rain decreases steadily in quantity to the south-east, and during a southerly, the rain keeps to the ranges and avoids the basin floor. As regards temperature, there is a tendency for extremes to be greater in the southern part of the Mackenzie Basin than in the north. This is caused by the drainage of cold air at night so that minimum temperatures are low. In winter, fog may lie over the lower portion of the Mackenzie Basin all day whilst the sun is shining at Lake Tekapo. Associated with these foggy days may be night frosts, and the phenomena of hoar frosts may occur.

TEKAPO

(i) Position

The meteorological station was established on the west bank of the Tekapo River in 1925. In 1950 the station was re-established adjacent to the single mens camp at the Ministry of Works power development scheme in the south-west corner of the lakeshore. It was put on a new site in 1952, this time adjacent to the power house which is situated two miles S.S.W. of the lake and village. Observations are taken by the N.Z.E.D. staff. This site is on the banks of the outlet canal in a hollow, and not well exposed. Therefore some of the lighter surface winds may vary considerably in direction from those of the village and lakeshore. A station was established on Mount John in 1966, this being some 1,000' higher than Lake Tekapo and because of its position and its recent history, figures from this station will not be discussed.



The old M.O.W. construction camp in the S.W. corner of the domain

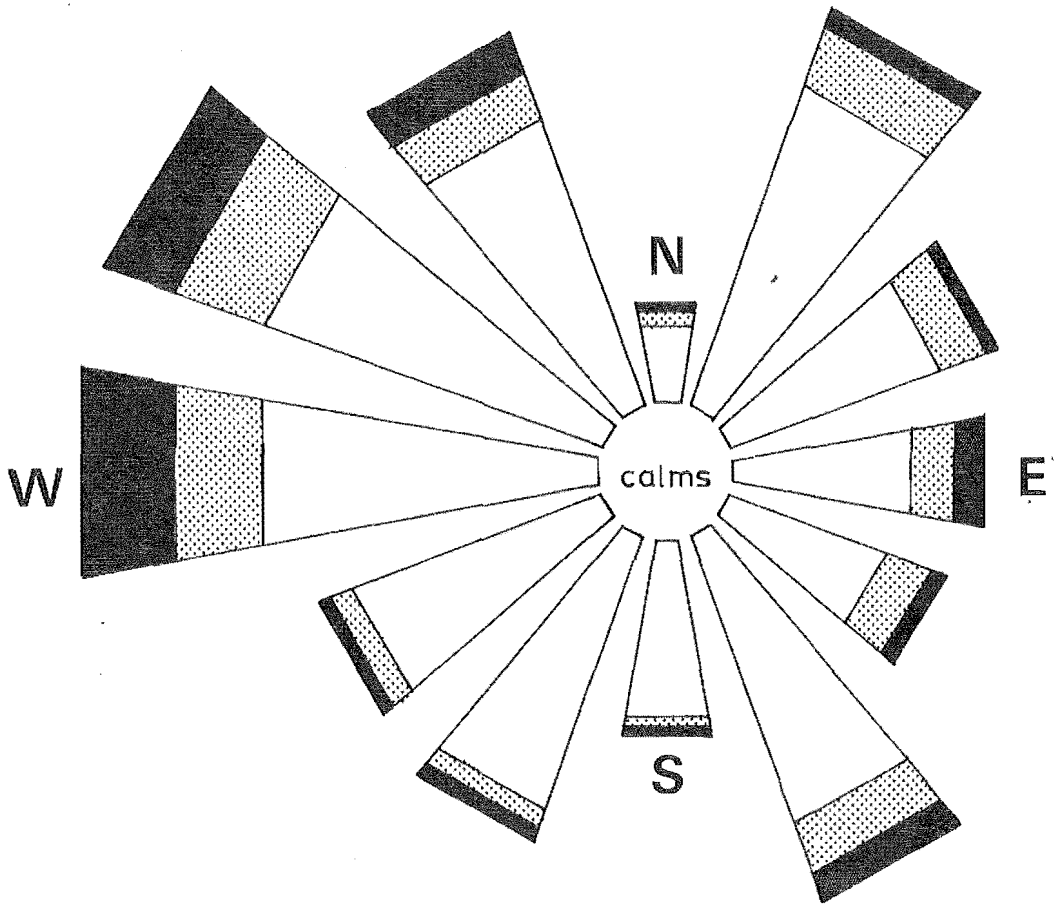
(ii) Wind

The data figures are taken for a 20° direction, and wind speeds are recorded and tabulated as the number of observations in each category. If the lightest winds are excluded, 46% are in the 90° sector centred on 300° N.W. (260° - 340°) and 25% are in the 90° sector centred on 120° S.E. (080° - 160°). Similarly, winds from 020° to 040° predominate at 6 a.m. and also for June, July and August. Winds from 140° to 160° predominate at 6 p.m. and also for December, January and February. It is probable that the 020° to 040° wind is a katabatic airflow. This is a gravity flow of cold air from the mountains predominating at the time and season when the coldest temperatures are experienced.

The impacts of these wind analyses show that the primary requisites for shelter are generally to the N.W. and S.E. Other specific cases of wind predominance show that early morning and winter activities need protection from the N.E., whilst evening and summer activities could take advantage of the predominant S.E. wind to dissipate the heat of the day. Shelter requirements can be calculated using the "wind shadow" effect where the reduction in wind speed on the leeward side of a barrier is felt to a distance of five to six times the height of the barrier. If this barrier has a 50 - 60% permeability, the wind speed will be reduced over a greater distance as the permeability reduces turbulence when compared to a solid barrier.

(iii) Rainfall

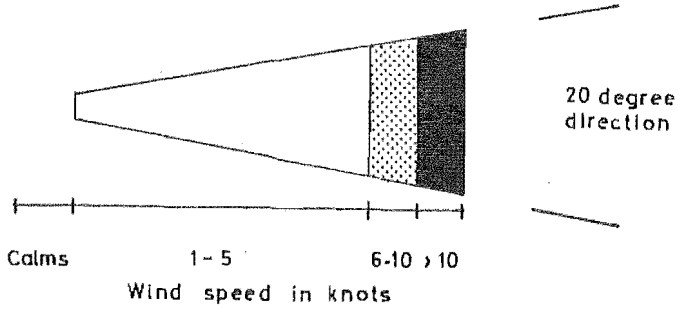
Tekapo basically has a cool, dry regime with an evenly balanced annual rainfall of 22 inches. There is a slight tendency towards summer maximum rainfall, but this is not

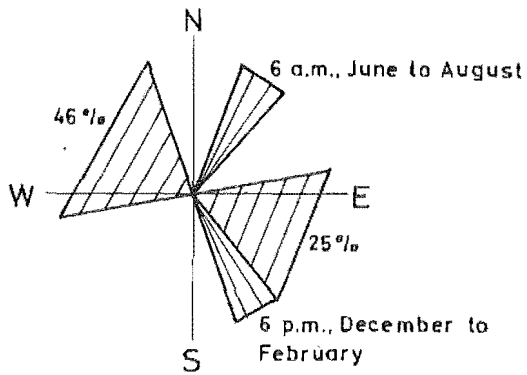


Surface wind direction (1969-1972)

Number of occasions and strength

Legend





Predominant winds

TEKAPO WIND ANALYSIS

marked enough to balance the higher temperatures of summer. This is brought out in the water balance table, where the difference between potential evapotranspiration and actual evapotranspiration can be seen. Therefore there is a period of moisture deficiency from November to April, thus limiting plant growth.

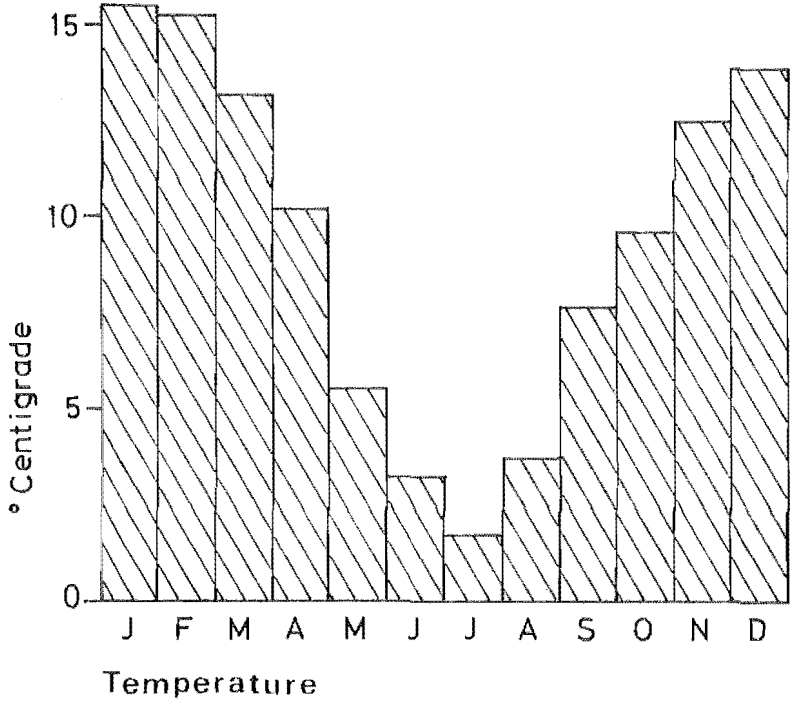
(iv) Temperature

Average monthly temperatures do not exceed 16°C. during the summer months, and 2°C. in the winter. The very cold winter temperatures can have quite a deleterious effect on the growth of some species of plants, and it has been known to kill some large species of trees.

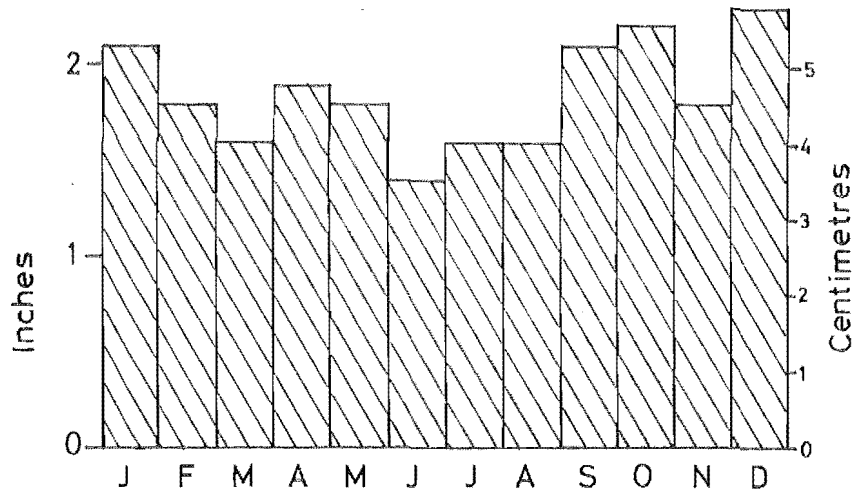
Every month has ground frosts, with more than 20 days per month on the average in June, July and August. Snow is frequent during these months and only the most hardy trees and shrubs are able to withstand it.

(v) Other Factors

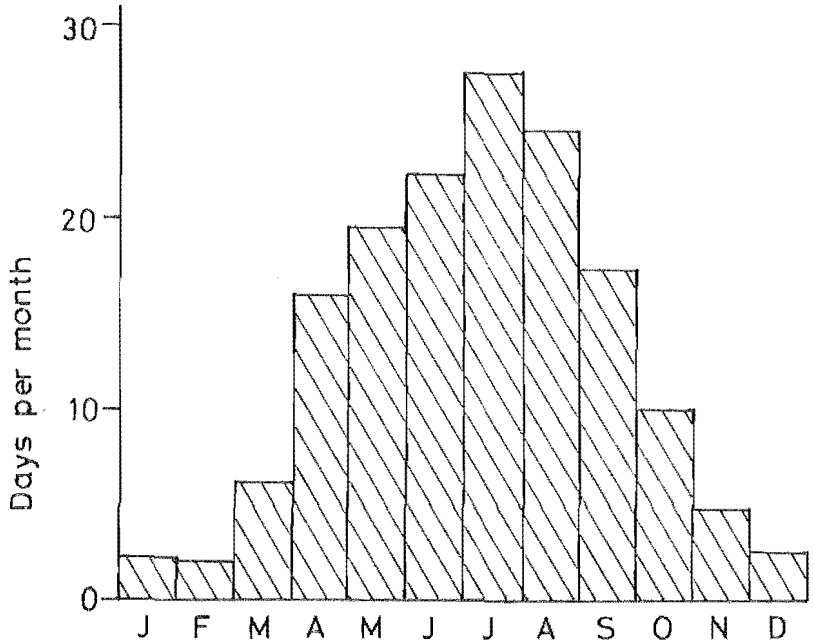
Sunshine averages 2223 hours a year, but the highest recorded was 2445 in 1969. Because of the clear skies, altitude of 2,350 feet and latitude of 44 degrees, the sunlight is intense but not uncomfortable. The average humidity from a period of twenty years from 1950 - 1970 was 69%, but this does not reflect the dryness of the air as all recordings are taken at 9 a.m. In the warmer part of a summer day, the relative humidity may be as low as 20%, and the combination of fine weather, sun and dry upland air provides Tekapo with a healthy, invigorating climate.



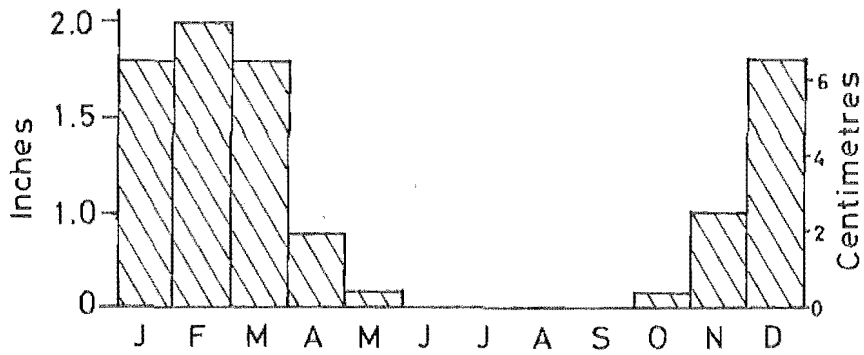
Temperature



Rainfall

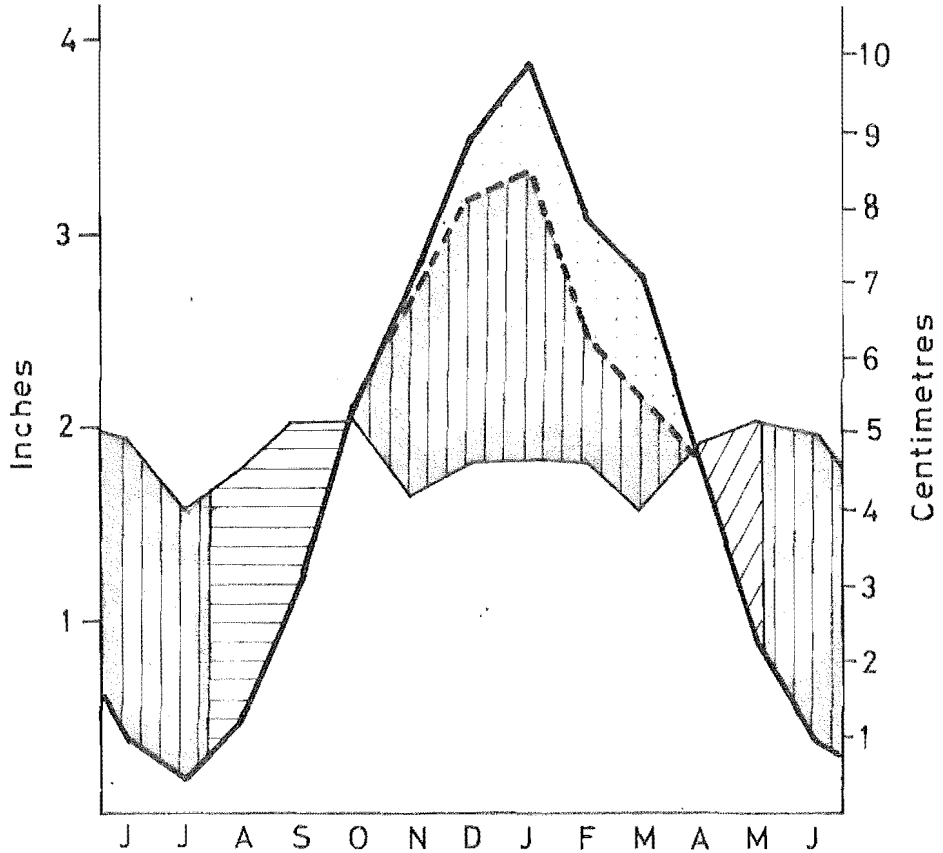


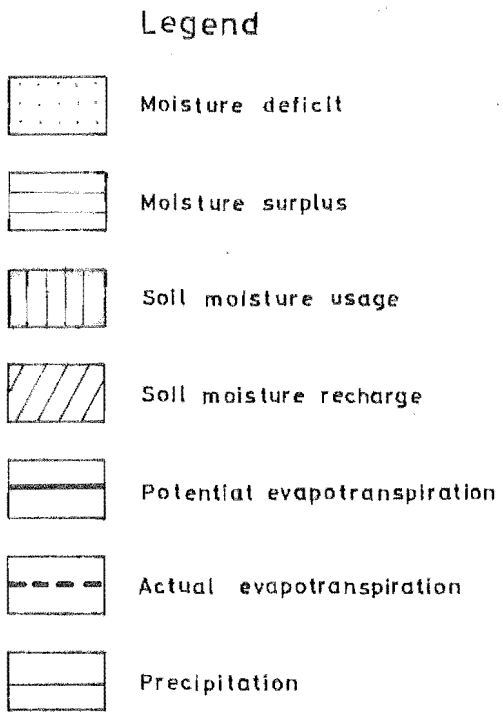
Days average ground frost



Monthly average water deficits

TEKAPO CLIMATIC DATA





(Garnier 1958)

TEKAPO WATER BALANCE

Soils

PEDOLOGY

The soils of the Mackenzie Basin are derived principally from coarse arkosic sandstone which is rich in quartz and plagioclase feldspars and low in readily weatherable basic minerals. Chemical weathering in this region is slow; on the flatter areas because of low rainfall, and on the higher areas because of low soil temperatures. In the high country Yellow-Brown earth zones, the total clay content is low, but there is a high amount of amorphous clays present. Generally the water storage capacity is not high (except where there has been organic matter accumulation), the soil structure is weak and phosphorous availability is limited.

CLASSIFICATION

Two broad zonal groupings of soil types are largely present in the Mackenzie Basin. Although Brown-Grey earths, recent and alpine steepland soils do exist in the basin, they are of relative insignificance. The two zonal soils present in quantity are the Yellow-Grey earths and the Yellow-Brown earths. Zonal soils have the properties which are determined primarily by climate and the resulting vegetation formed on normal parent materials such as greywacke.

(1) Yellow-Grey Earths

These are represented in the basin by the Meyer type formed on rolling lands and hills

such as the Grays Hills, Mary Range and western Rollesby Range, and the Omarama type formed on steepland soils such as the Te Kohai Hills and Mount John.

The Yellow-Grey earths are formed under tussock grasslands on loess under sub-humid climates. Rainfalls range from as low as 20" a year for those bordering the Brown-Grey earths to as high as 40" a year where they merge into Yellow-Brown earths.

The general features of the profiles include a grey to dark-greyish brown silt loam topsoil with moderately developed nutty structure, and compact, dense brownish yellow fragipans in subsoils. These subsoils may have heavier textures than topsoils, and mottling due to weak and moderate gleying is common in and above the fragipan because of perching of water above it.

The Yellow-Grey earths are usually moderately leached and profiles are deeper and textures finer where they have been developed as loess. In many places there has been repeated deposition of loess, some also caused by downhill movement. No large phosphate deficiencies occur on these soils but they are largely deficient in sulphur. The most important limiting factor of Yellow-Grey earths to land use is the lack of moisture or its uneven seasonal distribution. Although drought is a limiting factor in summer, this soil type may be excessively wet in winter. Erosion is a potential problem on most Yellow-Grey earths because topsoil structure can readily be broken down, either by excessive cropping, or by pugging when wet. On hilly areas, slip and tunnel gully erosion are fairly widespread and can only be prevented by good management using soil conservation techniques.

(ii) Upland Yellow-Brown Earths

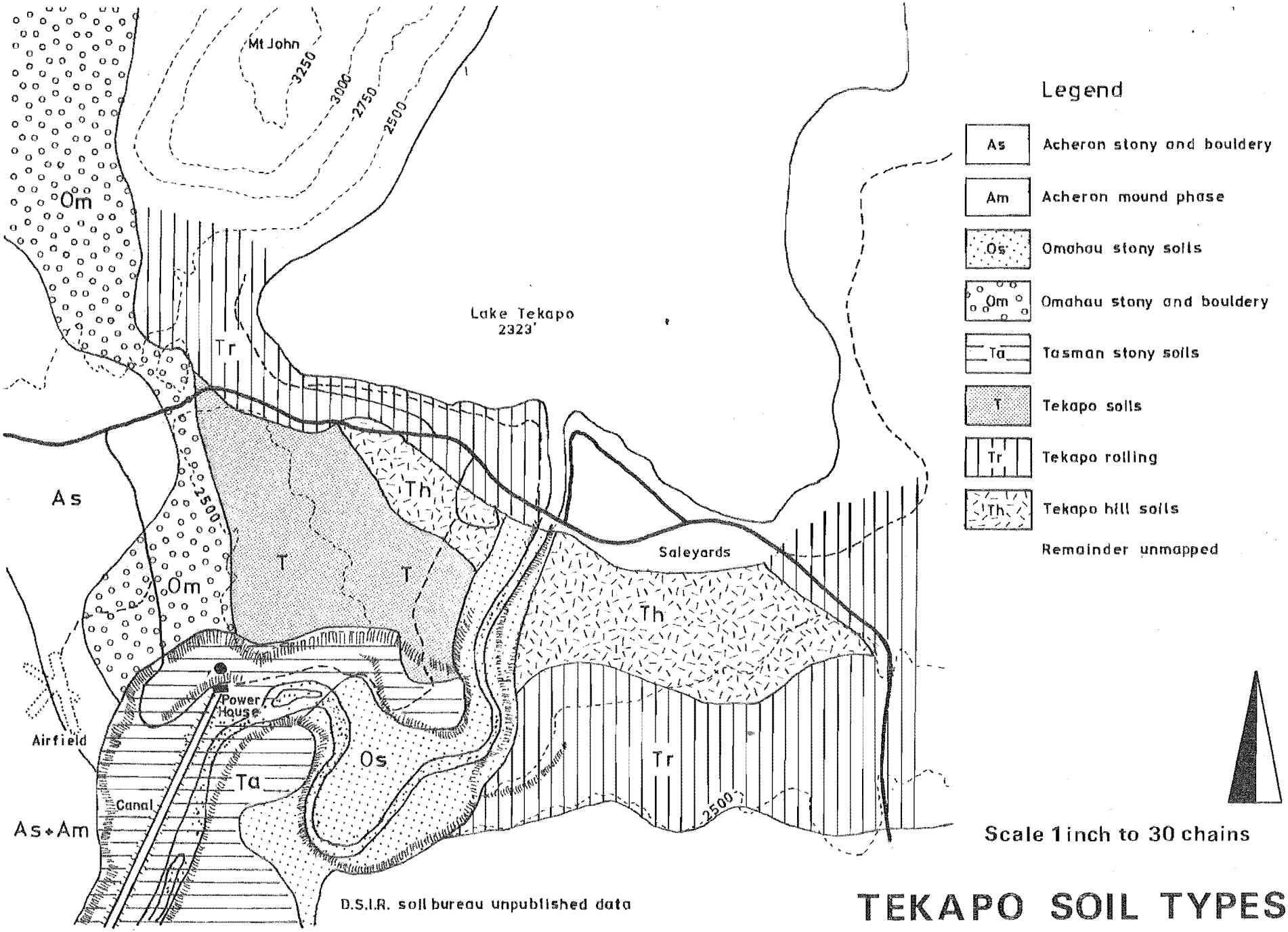
The second grouping of zonal soils are the Upland Yellow-Brown earths which are the most widespread soils of the humid regions of New Zealand. In the Mackenzie Basin they are represented by the groups formed on terrace lands and fans, e.g. Pukaki, Dalgety, Mackenzie and Acheron, and those formed on rolling lands and hills: the Tekapo and Ohau types.

These Upland Yellow-Brown earths are mostly well-drained and without differentiation between horizons. They have a relatively thin sola (less than 18") with a very friable dark grey-brown loamy crumb, or granular crumb structured topsoil. The subsoils are usually a friable yellowish to brownish-yellow crumb to granular structure. They are formed basically on young landscapes such as moraines and terraces.

Because of the fine, very friable topsoils, the Upland Yellow-Brown earths are highly susceptible to erosion, and so are easily removed by wind and rain. This liability to erosion, their relatively low fertility and the short growing season are all major limitations to their use for intensive pastoral production.

TEKAPO REGION

Four basic soil series have evolved in the Tekapo region from the action of climate, organisms and time on the parent material of this region. These have been further influenced by the relief and aspect of the parent material. Three of these soil types are basically Upland Yellow-Brown earths, and the fourth (Tasman) is of recent origin.



TEKAPO SOIL TYPES

(i) Acheron Soils

These soils are classified as Upland Yellow-Brown earths and occur on flat outwash surfaces. Analysis from soils sampled near Little Mount John and on the surface to the S.E. of the Tekapo moraines show weak to moderate acidity (topsoils pH of 5.3 - 6.1) and a moderate to poor fertility.

Two mappable soil types are recognised within the area:

(a) Acheron Stony and Bouldery. These are coarse textured, shallow, droughty soils (20 - 40cm to parent gravels) with stones and boulders through-out the solum.

(b) Acheron Mound Phase. These soils resemble small dunes and occur in small strips through-out the surface. They are deeper soils than (a), (40 - 70cm to gravels) and appear to have a somewhat better fertility status. However, these soils are only a minor component of the outwash surfaces - they can be easily recognised as raised strips supporting better stands of fescue tussocks.

The Acheron soils are rated poorly in relation to the Tekapo soils because they are coarse-textured and mainly shallow, stony and bouldery, and thus dry out excessively in summer. Establishment of grasses appears to be difficult on these soils because of their droughtiness and susceptibilty to frost heave. It is also felt that trees would be liable to wind-throw on these soils because of the likely instability of the rooting systems.

(ii) Omahau Soils

These soils are similar to the Acheron soils, but are generally of younger age, occurring either on lower outwash terrace remnants above the Tekapo River, or in the old

flood channels coming out of the moraines surrounding Lake Alexandrina. They have similar properties to the Acheron soils but are likely to have a slightly better nutrient status. Also they are almost entirely stony and or bouldery with very few patches of deeper soils.

The Omahau soils can be rated alongside the Acherons as being very poor.

(iii) Tasman Soils

The Tasman soils are the most recent soils found on the flood plain of the Tekapo River. They are only weakly acid (topsoil pH 6.0) and probably have a relatively high natural nutrient status. However, they are mostly stony to very stony and bouldery, coarse-textured, and shallow to very shallow (less than 20cm to parent gravel). Thus, although their nutrient supply is probably quite good, the Tasman soils are rated poorly because they are very droughty and only weakly developed soils.

(iv) Tekapo Soils

These occur on moraine, are weakly acid (topsoils pH of 5.9), and of moderate fertility. They probably require occasional dressings of lime and regular additions of superphosphate to sustain grass production, although most trees should grow successfully on these soils without any fertiliser additions.

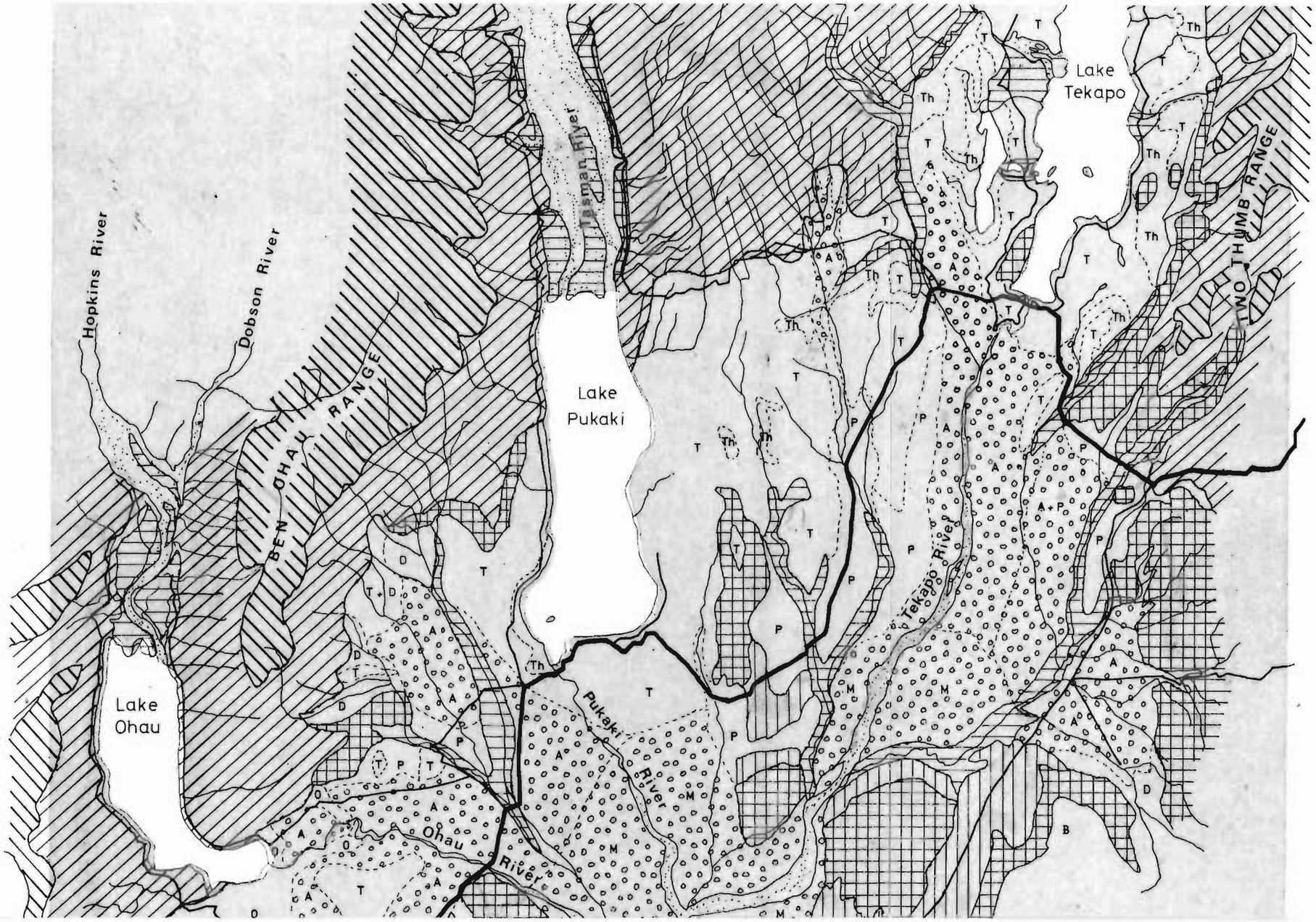
Three mapping units are recognised within the series:

(a) Tekapo (moderately deep to deep). These soils occur on flat to gently undulating terrain and are generally 45cm or greater to parent material, which may either be morainic rubble or fine fluvioglacial material. Within this mapping unit occasional boulder outcrops occur. In lower lying pockets, into which water drains from the rolling and hilly

land above, the soils may become saturated and liable to pugging. However, in general these soils can be regarded as the best within the Tekapo region.

(b) Tekapo Rolling. Found on easy rolling to rolling topography (slopes up to 12°), these soils differ from those above in that they are generally shallower (30 - 60cm to morainic boulders) and have a greater proportion of surface boulders. They appear to be more freely draining than the previous soils, but retain enough water over summer to sustain some plant growth. Kettle-holes within the moraine become water-logged during wet spells and small ponds may be formed, but these generally drain away during summer. The Tekapo rolling soils would rate second-best within the area.

(c) Tekapo Hill. Within this unit there are two separable soil types depending on aspect. On the dry, sunny, N.W. facing slopes, the soils are mainly shallow, stony and bouldery, and dry out somewhat excessively during summer. However, on the shady, S.E. facing slopes, the soils are deeper and have a lower content of surface stones and boulders, being similar to the Tekapo rolling soils. Because of their slope, (12 - 30°) and tendency to droughtiness, these soils would be rated slightly above the Acheron soils, but are much poorer than the other two members of the Tekapo series.



Legend

Upland Yellow-Brown Earths

1-Dry-hygrous

a. - on terrace lands and fans

P — Pukaki
D — Dalgety

b. - shallow and stony soils

M — Mackenzie
A — Acheron

c. - on rolling lands and hills

T Th — Tekapo and Tekapo hill
O — Ohau

d. - on steep lands

B — Benmore

2-Hygrous

— formed mostly on rolling and steep lands

Yellow-Grey Earths

Brown-Grey Earths

Alpine Steepland Soils

Recent Soils

Scale 1 inch to 4 miles

SOILS

Vegetation

REGIONAL HISTORY

There is much evidence that suggests that the Mackenzie Basin has not always been the tussock-covered country that it is known as today. Connor, in a paper in the N.Z. Journal of Botany, describes what was probably the vegetation type some 700 to 1450 years ago in one of New Zealands treeless tracts:

> "The Mackenzie Basin is one of these tracts, now treeless except for beech forest in some wetter western valleys. Most of the sub-fossil remains from the Mackenzie Country are podocarp charcoal, but beech charcoal and buried podsols are recorded near Lakes Pukaki and Ohau. Charcoal and uncharred seed cases of matai were found in soils on rolling moraine and terrace land near Lake Tekapo." (Connor, 1964)

This forest cover probably went to about 4,500' from where it gave way to snow-tussock grassland dominated by Chionochloa rigida. Within the forest there would have been small areas of both red and snow-tussock grassland, whilst on recently disturbed areas a short-tussock grassland would be established.

After fires destroyed the forest, short-tussock grasslands would evolve from the small communities from within the forest, but these were to be short-lived as C. rigida would migrate down the mountain slopes. As these snow-tussocks increased in numbers and in the size of canopies, the short-tussock grasslands would be eliminated. The time taken

from the forest destruction to a close-canopied snow-tussock community is thought to be about 200 years.

On morainic country between the eastern ranges and Lake Pukaki it is thought that another tall tussock, Chionochloa rubra was the dominant species. This tall red-tussock grassland probably evolved by invading the first formed short-tussock grassland.

The next step in the evolution of todays landscape is the change from a tall-tussock grassland to an induced short-tussock grassland. Reasons for this transformation are also outlined by Connor:

> "The pastoralists were confronted with much grassland unsuited to sheep grazing, and following the experience and practices of earlier settlers nearer the coast, the use of fire was natural. Burning of the grassland here, as elsewhere, became the accepted procedure. They heavily stocked the burnt land." (Connor, 1964)

This change from a tall-tussock grassland to an induced short-tussock grassland is probably the most important single feature in the history of the Mackenzie Basin. Connor also brings out the other factor involved apart from burning, when he continues:

> "Burning alone, except in severely hot out-of-season fires or where very persistent, would probably not produce a grassland community with a new dominant species, but when burning is associated with heavy grazing, many tall-tussocks must die, and then a grassland with new dominants can evolve." (Connor, 1964)

Most short-tussock grassland in the Mackenzie Basin is therefore of recent origin and can be attributed to Mans action. Some areas subjected to burning, heavy grazing

and, more recently, rabbit infestations, lead to serious degradation of the short-tussock grsslands and consequently erosion has been a large problem in the past.

PRESENT DÀY COMMUNITIES

The Mackenzie Basin can be divided up into five broad sectors, and the distribution of Chionochloa species and their major associates listed.

(i) The Two Thumb Range is dominated by C. rigida associated with Poa colensoi; and Festuca novae-zelandiae.

(ii) North of the Mary Range between Lakes Tekapo and Pukaki and also a small area south of Lake Ohau, C. rubra is the dominant grassland. This is on morainic areas and this species was less susceptible to burning and grazing.

(iii) The Ben Ohau Range has a C. rigida - P. colensoi grassland above 5,000'. Below this association are C. rigida - Festuca matthewsii - P. colensoi communities. On sunny slopes F. matthewsii is absent and with decreasing precipitation and altitude, C. rigida is eliminated.

(iv) The central basin area exhibits a large range of communities varying from fescue tussock to weed communities. Six phases of fescue tussock grasslands are recognised and correspond to soil types, aspect and moisture regimes. Most of this area represents typical areas which have been severely depleted by rabbits. Generally, the chief grasses occurring are F. novae-zelandiae and P. colensoi. Bad depletion of the communities are found on the Mackenzie and Acheron soil types and this results in weed communities taking over. Examples

of these weeds are Rumex acetosella and Raoulia hookeri.

(v) The fifth sector is represented by the hill slopes to the south and south-east. Communities on the higher slopes are generally Chionochloa macra and F. matthewsii in association with C. rigida. A frequently occurring short tussock in this sector is Poa caespitosa.

THE VEGETATION OF THE TEKAPO AREA

In the Tekapo area the major contributors to the vegetation are the short-tussock grasslands as outlined above, berm communities, plantation plantings and other tree species.

(1) Berm Communities

Continued construction work along highways is associated with baring of soil and movement of spoil. This gives areas initially colonised by a range of adventives and also annuals from cultivated land. In time these berm communities may go through stages that eventually produce permanent communities typical of a special site or locality.

On the highway between Burkes Pass and Tekapo, some stands of Lupinus polyphyllus have been established. Also of interest are the disturbed areas typical of surrounding modified short-tussock grassland in the Tekapo district. These areas result in the establishment of almost continuous colonies of Cirsium vulgare, Hypericum perforatum, and Senecio sylvaticus, with smaller scattered colonies of Carduus nutans, Carduus tenuiflorus and Holcus mollis. These illustrate the resulting communities typical of disturbed areas around Tekapo. (Knox, 1969)

Of special interest in the Tekapo area is the spreading herb Epilobium rostratum (Lake

Tekapo Epilobium), which is found in sub-alpine grasslands and alongside riverbeds. Other common plants found in the grasslands include Aciphylla aurea and weed plants such as Ulex europaeus, Cytisus scoparius, Rosa rubiginosa and Verbascum thapsus.

(ii) Plantations

In comparison with the whole Mackenzie Basin, Tekapo is well endowed with plantations and amenity plantings. The major ones include those planted by the Mackenzie County Council, the Waitaki Catchment Commission and the New Zealand Electricity Department. Because of transport difficulties and poor maintenance, their value for production is very low and therefore they have in the past been regarded as only for amenity and shelter use.

The oldest trees are found in the Domain where the Mackenzie County Council planted trees for amenity purposes some 40 to 50 years ago. They contain a variety of Pinus species plus large stands of Larix decidua. Other exotic species include Betula pendula, Pseudotsuga menziesii, Quercus spp., Populus spp., and Salix spp.

To the west of the Domain and east of the road to Mount John there is a plantation of about 30 acres comprising two species: Larix decidua and Pinus nigra. Outside the plantation there are also many trees that have self-seeded from those in the Domain. These are of mixed varieties and pleasing in appearance. They are, however, robbing the runholder of a valuable grazing area but are uneconomic to clear and therefore they have become a visual asset to the area. Further spreading westward should be stopped however, either by heavier grazing, cutting or spraying.

The roadway to the power station has trees planted in 1950 - 1955. They comprise

Verbascum thapsus - ice crystals on the early colonist provides some interest in winter

mainly Pinus nigra, P. muricata, and some Larix decidua. Further south there have been major plantings around the Tekapo power house area. These comprise a mixture of P. nigra, P. contorta, P. pinaster and L. decidua. Within these plantings are other interesting trees such as Pseudotsuga menziesii, Betula pendula and Cedrus deodara.

The County Council plantation to the south-east of the township was planted at the request of the Tekapo Commission for the purpose of shelter. They comprise mainly P. nigra and P. ponderosa, and although their timber value is small due to poor maintenance, their amenity value is high.

The other major plantation is that on the south-east lake shore area. This is a soil conservation area, and trees were planted to halt wind erosion which has been a major problem in the past. The main plantings were P. contorta which were planted in strips down the hillside and resulted in the rather unpleasant visual aspect present today. These strips were later interplanted with blocks comprising mainly P. ponderosa, P. nigra, P. sylvestris and L. decidua.

(iii) Tree Selection

In the past Tekapo was regarded as a difficult place to grow trees in. However, if varieties which are severely damaged by heavy frosts in the late spring are excluded then trees, established with shelter, grow well in this region. The light permeable soils dry out quickly on top and this makes establishment a problem. This can be overcome by planting at the right time of the year, mulching, shelter and adequate water during the summer.

All the climatological factors are significant when determining the best time of the year to establish new plant material. The water balance table shows that potential evapotranspiration exceeds rainfall from the middle of September to the middle of March. This means that plants use more water than is provided during this period. The resulting moisture stress, if continued for any length of time, leads to wilting, and ultimately collapse of the plant.

Trying to establish plants during this period is therefore unwise, and even established trees need supplementary watering to improve the water deficit. The best time to plant therefore, is when the rainfall exceeds evapotranspiration and plants are not subject to water stress, i.e. between May and September.

However, the period of heavy frosts and low temperatures (below 5^{o}C.) begins in May, and average temperatures do not rise above 5^{o} until August-September when the incidence of frosts also decreases. Thus the best time for planting is early August to early September, with supplementary waterings to cover the water deficit periods.

Therefore, with adequate shelter and care, it is possible to establish a variety of trees in the Tekapo region. A list of trees that have been successfully established in the past is as follows: Acer spp., Alnus glutinosa, Betula pendula, Cedrus deodara, Chamaecyparis lawsoniana, Fagus sylvatica, Fraxinus spp., Larix decidua, Pinus spp., Populus spp., Pseudotsuga menzieii, Salix spp., Sequoiadendron giganteum, Thuja plicata and Tilia spp.

Large scale plantings in the Tekapo region would involve several tree species which should be selected for the varying sites. Generally, for sites on the fertile soils such as

the Tekapo and Tekapo rolling soil types, Betula papyrifera, B. pendula, Larix decidua, Pinus nigra, P. contorta and P. radiata should be recommended. In wet areas Alnus glutinosa may be suitable, and in shady positions Pseudotsuga menziesii may be used.

Plantings on shallow, bouldery soils liable to drought such as the Acheron soil type should consist mainly of P. contorta, P. nigra, P. ponderosa, Cedrus atlantica, C. deodara, and Larix decidua. Where sites are severe in that they are exposed and frosty, then P. contorta, P. nigra and P. ponderosa would be suitable. Sequoiadendron giganteum may be a suitable tree in very sheltered positions within this soil type.

Planting design has been neglected in the past as the need for homestead shelter was the major necessity. This has produced the tight formations that scatter the whole landscape of the Mackenzie Basin. As most plantations have been placed square onto the land, this tends to disunify the basin, but because shelter is a necessity, it must be an accepted part of the landscape. The visual impact of these plantations may be reduced if in the future, the following ideas are implemented:

(a) The outer edges of the plantations should not be a straight line, but should follow minor topographical features such as ridges or hollows.

(b) Deciduous species such as Larix decidua and Betula pendula should be planted on the edges of conifer plantations so that the impact of the conifers is subdued in winter. The softer texture of these trees should also help subdue the harsher texture of the conifers in summer.

(c) The use of Larix decidua and Betula pendula for shelter belts and screening

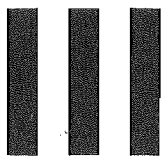
should also be recommended. Although they are deciduous, they are good windbreaks, their spring and autumn colourings are pleasing and they are more harmonious with the overall landscape.

(iv) Future Climax Communities

The major value of exotic plantations in the Tekapo area are therefore for amenity, shelter and soil conservation. However the area (including most of the Mackenzie Basin) has very high potential for the growth of exotic forests. On even the driest soils, P. ponderosa grows well and may regenerate freely. Larix decidua and Pseudotsuga menziesii regenerate and spread prolifically where rainfall is above average, and species such as P. nigra and P. contorta grow well where rainfall is intermediate.

It is thought that if animals were removed, these conifers would spread over a great part of the basin up to 3,500' altitude before the tussock grasslands could recover sufficient density to check their growth. It may be probable that some Pinus spp. and L. decidua communities established in the modified tussock grasslands will become the climax communities in the Mackenzie Basin.

Looking towards Rollesby Range - snow gives the region a still greater unity

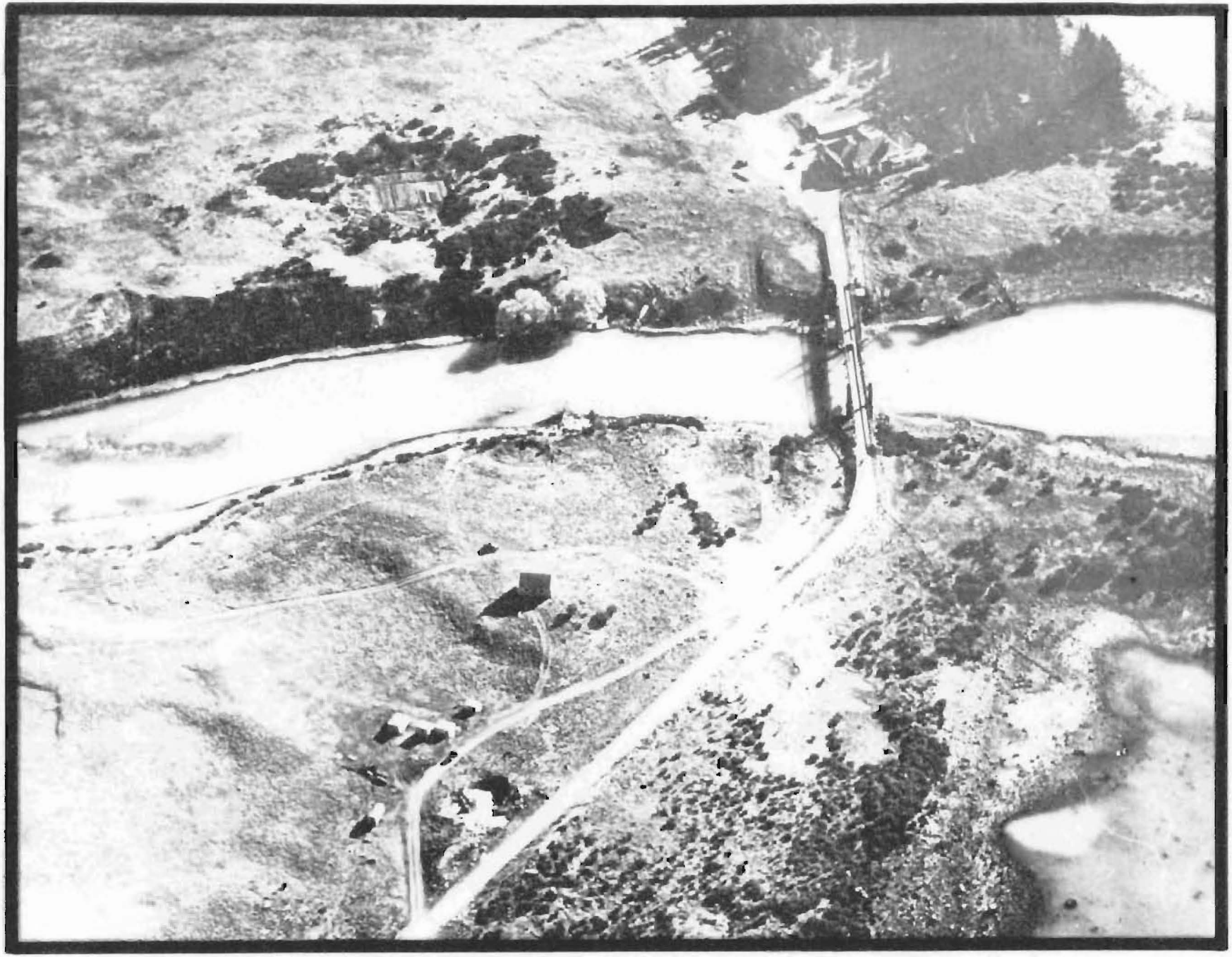


History

AGRICULTURE

In 1855 most of the South Canterbury region had been settled, the runholders believing that the eastern boundary to the Mackenzie Basin was the limit to farmable land. However the capture of James Mackenzie in May, 1855 for sheep stealing brought the existence of the inland pasture land to the attention of the Canterbury settlers. This had been preceded by Maori discoveries, and they had told explorers and surveyors of the interior lands. Also, in 1852, Mackenzie had obtained from the Commissioner of Lands in Dunedin, a licence to occupy certain unexplored country lying north of Otago, and between the east and west coasts of Canterbury.

After Mackenzie's arrest, exploration of the area began, and settlers started to take up runs and stock them. The first settler, John McHutcheson, took up the Glenmore run on the south-eastern shores of Lake Pukaki and in 1856 stocked the run with cattle. John Hay took up the Tekapo run in 1858, also stocking with cattle, but later was the first runholder to stock sheep. After this, the taking up of runs in the country began in earnest and by 1864 all land, including the mountain gorges, was occupied. Because of the rugged nature of the country and the extremes of climate, most of the original English runholders had left by the 1880's, leaving mostly the hardier Scotsmen to farm the land.



From the east showing old bridge, hotel, Church and the rapids where the dam was constructed

The runs were on 33 year leases, and some changed hands a number of times. If stocking was not completed as set down by the Canterbury Association, the leases were cancelled. Although good prices were paid when the runs were sold in prosperous times, at the time when leases first came up for auction in 1889, they were affected by the slump of 1880's and only the runs on the warmer slopes were competed for. In 1892, the Land Act restricted the size of stations to that area which would carry 20,000 sheep, and for the auction of leases in 1911 sub-division of the original leases was made.

Half of the runs were offered at an auction in 1911 and the balance disposed of by ballot. After this, however, the Government decided that improvement of the runs rather than exploitation would occur more readily if the leases were renewable by the current licensee, and an Act was passed in 1913 to put this into effect. (Vance, 1965)

TRANSPORT

The road through the Mackenzie Country developed as a result of the increased traffic flow as soon as the runs had wool clips to be transported to the coast. Mackenzie's Pass was used in the beginning, but the later discovered Burke's Pass proved a more suitable route out of the area and soon became the main route. Tracks made for the Lake Tekapo and Lake Pukaki areas were the first in the area and served the earliest runs developed. Townships developed round bullock wagon camping points and Tekapo township was one of these.

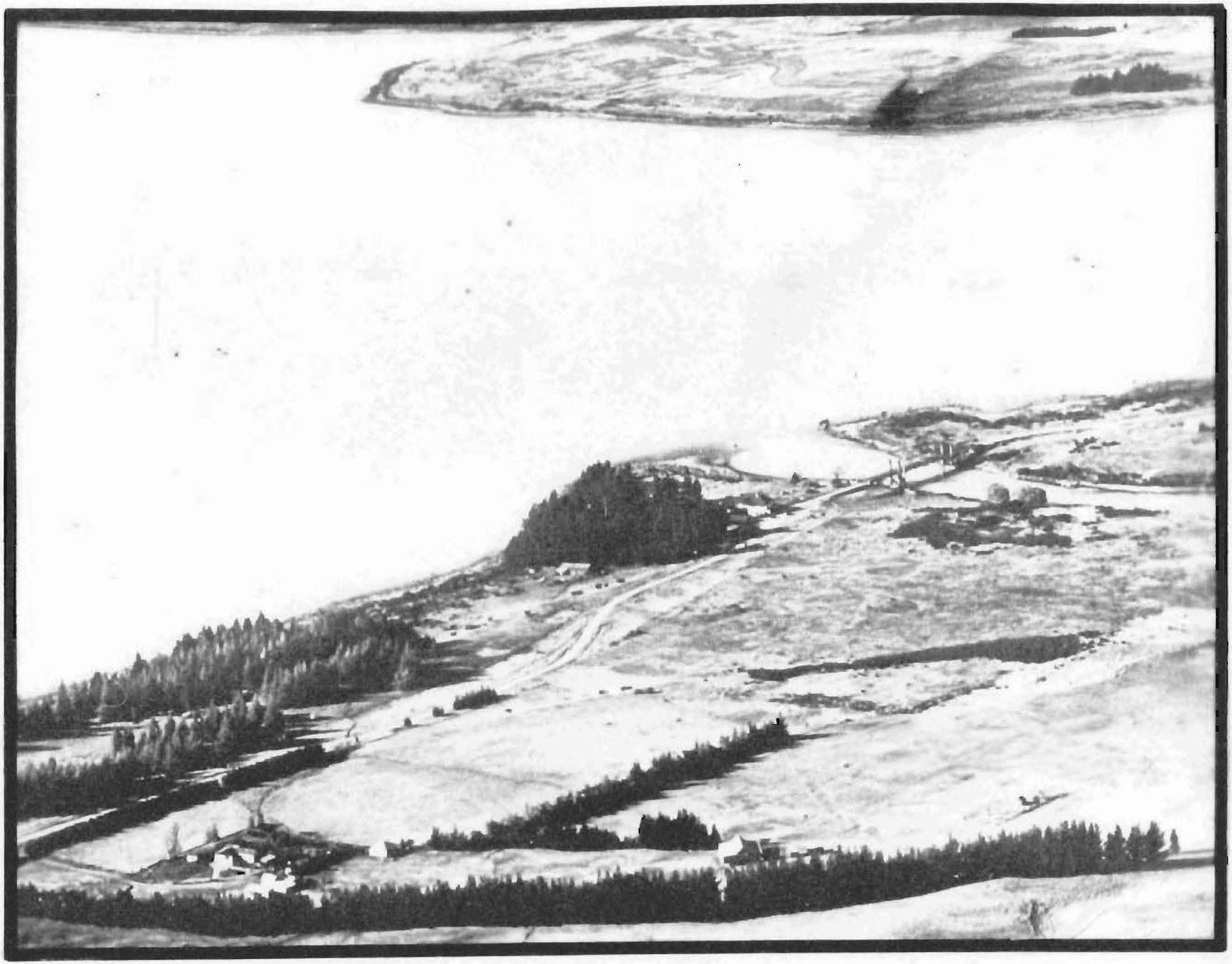
TEKAPO

In 1860 a whaleboat was brought from Timaru for use as a ferry boat across the Tekapo River. Two years later a regular ferry service was provided by Thomas Wadsworth, a licensee of the recently opened Takapo Hotel on the bank of the river.

A report tabled by the Mount Cook Roads Board in 1872 considered a bridge over the Tekapo River would allow easy traffic flow, the cost of the bridge not to exceed £2,000. The bridge was eventually finished in 1880 at a cost of £5,000. This, and the improvement in roads helped develop Tekapo as a holiday resort and also increase tourist activity to Mount Cook. (Vance, 1965)

At the beginning of this century T. D. Burnett bought the hotel and allowed the licence to lapse as his workers were spending too much time in it. It was rebuilt in 1919 and so remained until 1954 when it was abandoned with the raising of the lake. A new hotel was built beside the re-formed main road in 1956.

Construction of the Tekapo Power Station, and associated inlet structure, tunnel and surge tank, was begun in 1938, but was stopped during the war and did not resume until 1946. The station was commissioned in 1951 but it was not until the end of 1953 that the dam over the Tekapo River was complete. With the construction of the new dam, the main roadway followed a new route over the dam and the original bridge was demolished.



Tekapo from the west before dam construction, showing old bridge, hotel plantings and Mt. John homestead

THE CHURCH OF THE GOOD SHEPHERD

The history of this church is best revealed by those connected with its inception and this is displayed on a plaque within the building. It also epitomises the feelings of the pioneers and their great respect for nature - a lesson which unfortunately has been lost to a large degree today.

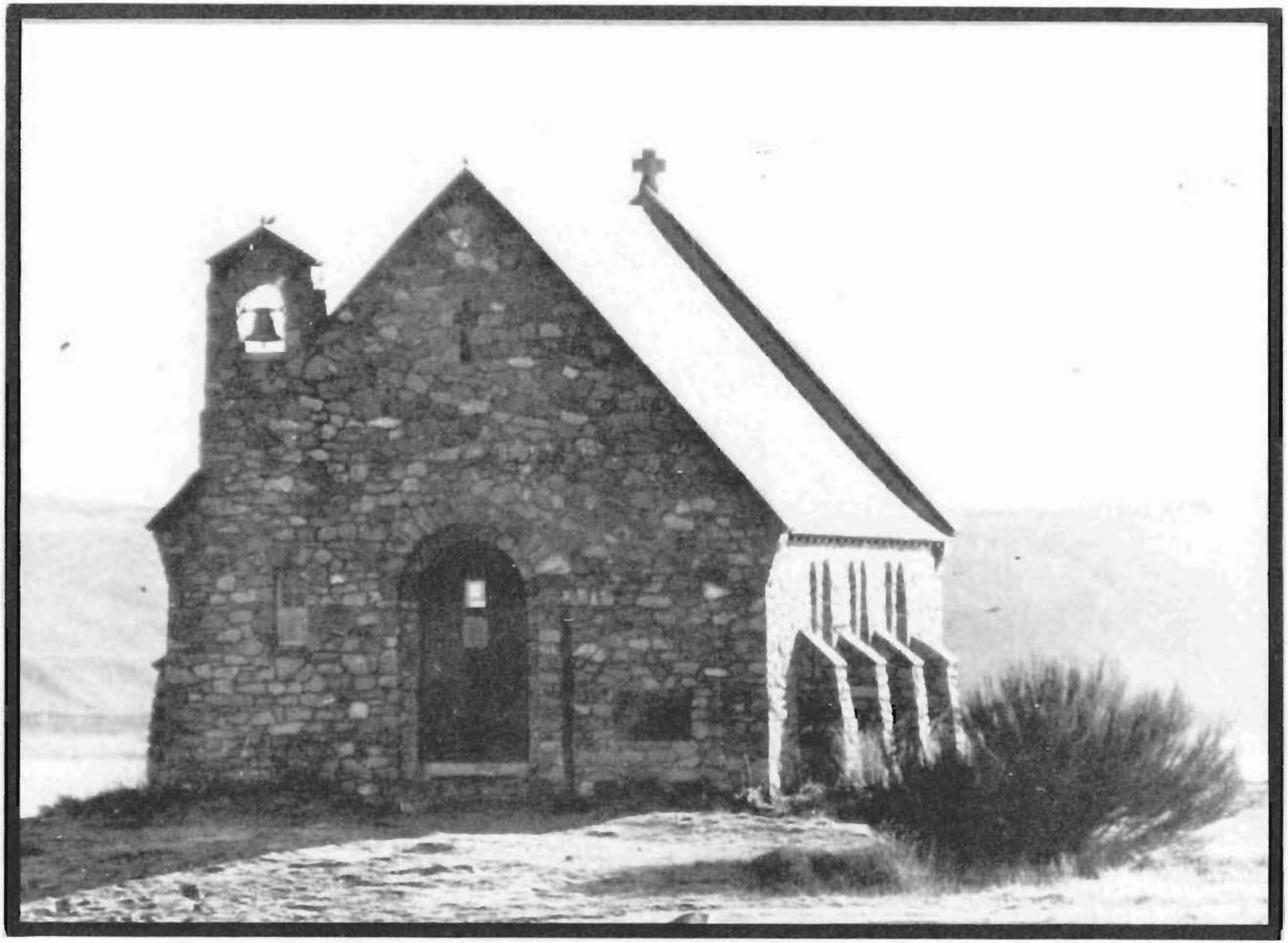
"The foundation stone was laid by H.R.H. The Duke of Gloucester on January 15th, 1935. The completed church was dedicated by the Bishop of Christchurch, Dr. Campbell West-Watson on August 3rd, 1935. The Vicar of the parish at the time was the Reverend W. E. D. Davies, the architect of the church, Mr. R. S. D. Harman.

The builders of the church were instructed that the site was to be left undisturbed and that even the matagouri bushes surrounding the building were to remain. Stone was procured within five miles of the site, carried by hand, and left in its natural condition in making the walls. The original roof shingles were of wood but had to be replaced by slate in 1957.

The altar is a cut block of Oamaru stone, and the carving on it and elsewhere in the church was done by Mr. F. Gurnsey. The font is a memorial to the shepherds and station-hands of the Mackenzie Country and the Vicar's chair a memorial to the pioneer women. The cupboard in the Vestry is made from wood recovered after the Tekapo Bridge, an old landmark, was demolished in 1954. The Book of Remembrance has inscribed in it the names of the pioneers of the Mackenzie Country."

The quality of this church was described recently -

"This tiny church looks up Lake Tekapo towards the highest mountains in New Zealand. Rarely in a new country does a building state its purpose with such intelligent honesty and strength. In this wild place a simple shape, perfect stone belfry and solid proportions construct a timeless image. Here is the integrity of the Christian faith." (Stacpoole and Beaven, 1972)



The Church of the Good Shepherd

Visual Character

The visual character of the Mackenzie Basin is basically dominated by the vastness of the region. Within this area there are fewer than forty homesteads and before the Hydro-village at Twizel (with an expected population of 5,000 - 6,000 in 1975) the population was 800. The boundaries of the basin comprise smooth inward sloping hills to the east and west punctuated only by remnants of glacial activity such as Mount John. These inward sloping hills are dominated by the Southern Alps which provide a backdrop along the whole western border. When viewed from near ground level, the basin is divided into two complete halves by the Mary Range, but the overall impression of vastness is not lost because of this.

Ice and river sculptured terraces, intricately patterned river beds and large bodies of water help accentuate the scale of the basin. Man can only relate his own scale with that of the basin when objects common to him are brought into his sight. Such objects present in the basin are few and man must rely on roads, cars, homesteads and possibly power pylons to appreciate the vastness that surrounds him.

The beauty of this empty landscape is magnified to a greater extent by the homogeneity of the short tussock grassland cover. This gives a feeling of unity to the whole region, broken only by exotic plantations and homestead plantings. These plantations, because of their green colourings and tight formations are in sharp contrast to the basic yellow-grey and browns of the tussock grasslands, and therefore tend to disunify the region. This effect is greater after a heavy snowfall when the unity of the basin and surrounding mountains

is broken by the contrasting plantations which form the only vertical elements in an otherwise flat landscape.

Vegetation in the basin changes with the season. The tussock grasslands tend to change in tonal values during the different seasons but the major impact is due to the introduced species. The pine plantations are a fixed colour and contrast with the landscape all the year round. This effect is subdued in winter if they are intermixed with deciduous species or are bounded by belts of deciduous trees. In summer the deciduous species complement the pines by providing more green colourings, thus emphasizing the contrast between the plantations and the surrounding countryside. However in winter, the deciduous trees blend in with the basic landscape colour and when intermixed with pines, they help to subdue the harsh contrast between pines and the landscape.

The dominant larch plantations harmonize extremely well with the landscape in winter and should be one of the major constituents of any proposed planting programme. Silver birch species exhibit a reddish tinge in winter, and although not as abundant as the larches, they provide interest when set against pine plantations and also help to subdue the impact of these plantations.

This reddish-tinge to the vegetation is also found in the willow species. A similar effect can be seen in the Fairlie Basin where the willows are more abundant along river-banks such as the Opihi River. On entering the Mackenzie Basin via Burke's Pass this effect becomes more dispersed, but is present along the Edwards Stream and also the south-east corner of Lake Tekapo. When travelling west over the Mackenzie Pass, the effect is more concentrated in a

large swampy area surrounding the Grays River at the foot of the Grampian Mountains.

In the past the agricultural development has played an important role in the development of this unique character. Because of the poorness of the country, small paddock sizes were not practicable and this has lead to large paddocks that are not condensed or enclosed in any way. Fence lines are hardly visible, are usually miles apart and therefore are not visual barriers. This allows the landscape to flow continuously unless stopped by some topographical feature.

The grandeur of the scale of the Mackenzie Basin is mainly produced by its basic texture. The vegetation and topography form the components of this texture. Braided riverbeds and the general, overall pattern of the plains are emphasized by the interplay of light and shade on this topography. This effect is strengthened even further when snow falls or frost forms on the plains, and after melting on the sunny side of these ridges, an interesting abstract pattern is formed over the whole region. After a heavy snowfall which covers the ground, the first emergents are the small plants which appear to melt the snow in a circle around them, thus producing a crater-like landscape.

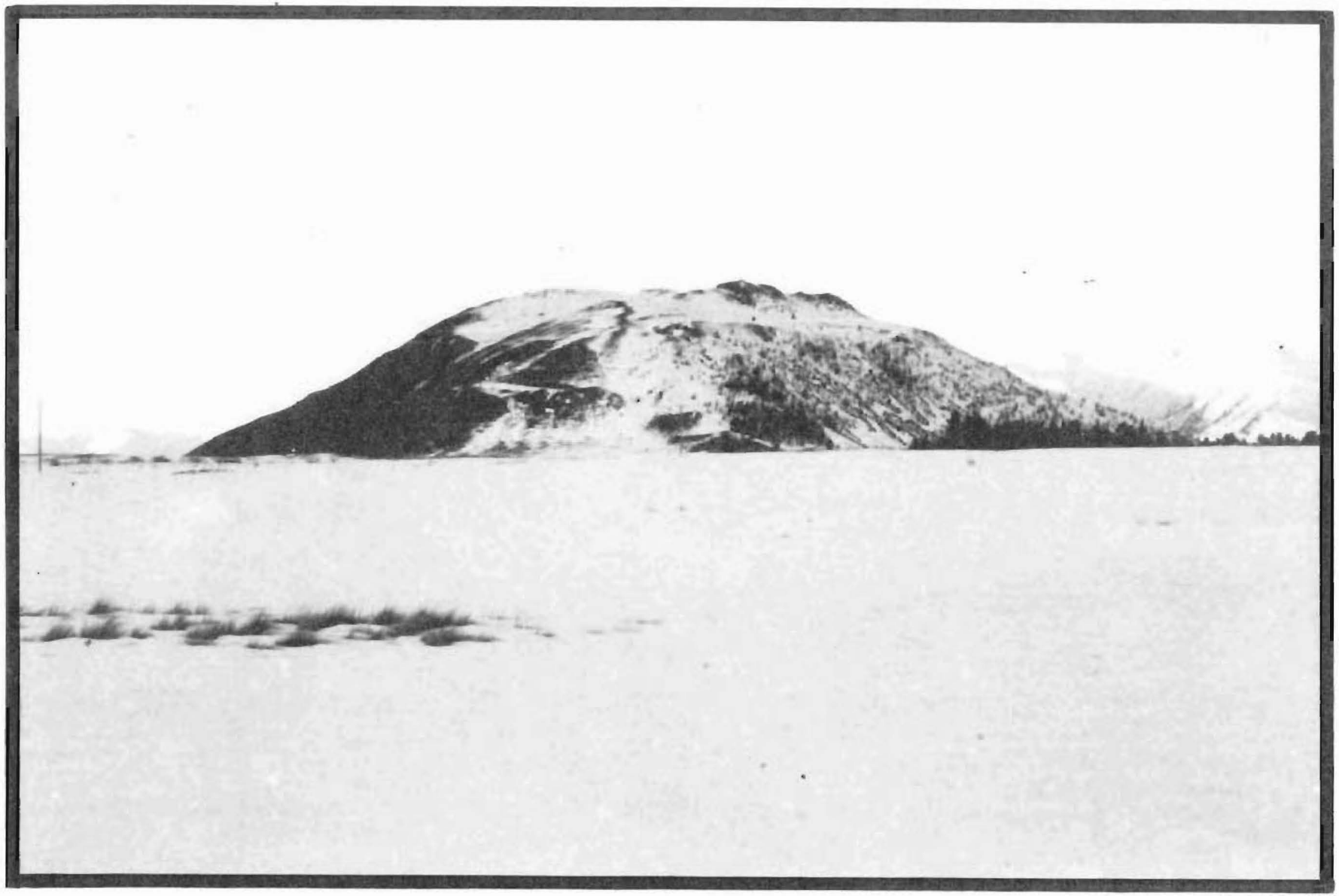
Other minor effects produced by frosts may be found on the trees which may be coated with ice after a heavy hoar frost. The subsequent melting of one side of these trees produces a pleasing situation of ice glistening in the sun and water dripping from the trees.

On a larger scale, the Mackenzie Basin often produces situations where clouds bank up around the whole circumference, whilst the basin floor is a pool of sunlight. Cumulus clouds may drift down into the basin from Burke's Pass or Mackenzie's Pass but will dissipate before

reaching the basin.

Therefore the character of the basin is one of a vast, light-filled area where subtelties such as the interplay of light and shadows, fluency of hill lines, frost and water effects and contrasting colours form the major attractions of the area. Few areas in New Zealand compare with this region for its majesty, grandeur and beauty. It is a region that inspires Man, and because of his progress he is capable of doing irreparable harm to the environment. But with planning and fore-thought this need not be the case, and Man can exist side by side with his surroundings. What may be needed is a new planning concept that realizes Mans full potential and his relationship with his environment. This idea is expanded by an American Landscape Architect;

> "Such a new concept will instill in us a deeper respect for nature, and seek a better understanding of nature's compelling powers. It will not seek to conquer or imitate nature, but will rather attempt to conserve and conform, stimulate and guide. It will engender in man a sense of stewardship for the natural landscape and for each feature and measure of the land." (Simmonds, 1961)



Mount John - major vertical element in a flat landscape covered by snow

Hydro-electric power

GENERAL

Today Man is at the cross-roads as he now has the power to alter not only the total environment on his planet, but also the space surrounding it. With this power, comes the fundamental need to live in harmany with the environment as it is altered or modified. To this end it should be recognised that all individuals, organisations and departments should be prepared to give up some of their powers and rights and recognise their place in the over-all ecology of the whole. This philosophy was re-echoed by an American, S. L. Udall, when he said:

> "Our mastery over our environment is now so great that the conservation of a region, a metropolitan area or a valley is more important, in most cases, than the conservation of any single resource."

In the past agriculture on a large scale was the only major occupation of man in the Mackenzie Basin. Today Hydro-electric power development is fast becoming the largest im-position on this empty landscape. Until the Benmore scheme was commissioned, Man had been dominated by nature, and his efforts in the basin were small and ineffective in destroying the scale of the area. Today, with greater technological knowledge and economic needs, Man is beginning to dominate nature, and is becoming effective in destroying the scale of areas as large as the Mackenzie Basin.

Tekapo power station and surge tank – terminus for a proposed scenic highway alongside the canal

HISTORY OF POWER DEVELOPMENT

The Mackenzie Basin is at the head of the Waitaki River system, and for many years it had been recognised as a potential source for hydro-electric power. The first station came into operation in the lower Waitaki Gorge in 1935, but in the Mackenzie Basin, construction of the first power scheme started in 1938 at Lake Tekapo. Because of the war, this project was not completed until 1950, and by 1954 both the levels of Lake Pukaki and Lake Tekapo were able to be controlled using dam structures. Early in 1965 Benmore, a large power station, was commissioned in a large gorge downstream of the Mackenzie Basin. Later and still further downstream another station was developed at Aviemore. Lakes Pukaki and Tekapo acted as storage lakes for all these power stations.

LATEST DEVELOPMENTS

Since 1969, the Mackenzie Basin has sprung into life with the development of new dams, power-houses and canals, in an attempt to develop the water-shed potential of the area to its greatest extent. On the regional scale this development, plus its effects on farming by making irrigation water available, will be effective in destroying the scale of the area and is probably the evolution of a new landscape. The involvement can be summarised as follows:

A 15 mile long canal is being constructed to carry the outflow of water from the existing Tekapo powerhouse to a new powerhouse (Tekapo 'B') on Lake Pukaki's eastern shore. Lake Pukaki is to be dammed and will be raised 120 feet, thus trebling its present water storage

capacity. The outflow from Lake Pukaki will be fed into another canal situated adjacent to the dam structure. This canal will be about eight miles long and will carry water to feed another new power station (Ohau 'A') on the north bank of the Ohau River. Another canal is to be constructed from Lake Ohau to connect up with the Pukaki - Ohau canal before it reaches the Ohau 'A' power station.

A dam is to be constructed on the Ohau River down-stream from the Ohau 'A' power station, and this will allow water to feed into another canal, six and a half miles long leading down the south bank of the Ohau River and into Lake Benmore. Along this canal it is proposed to build two power stations (Ohau 'B' and Ohau 'C') to complete the scheme in the early 1980's.

LANDSCAPE IMPLICATIONS

(i) Pre-Construction Planning

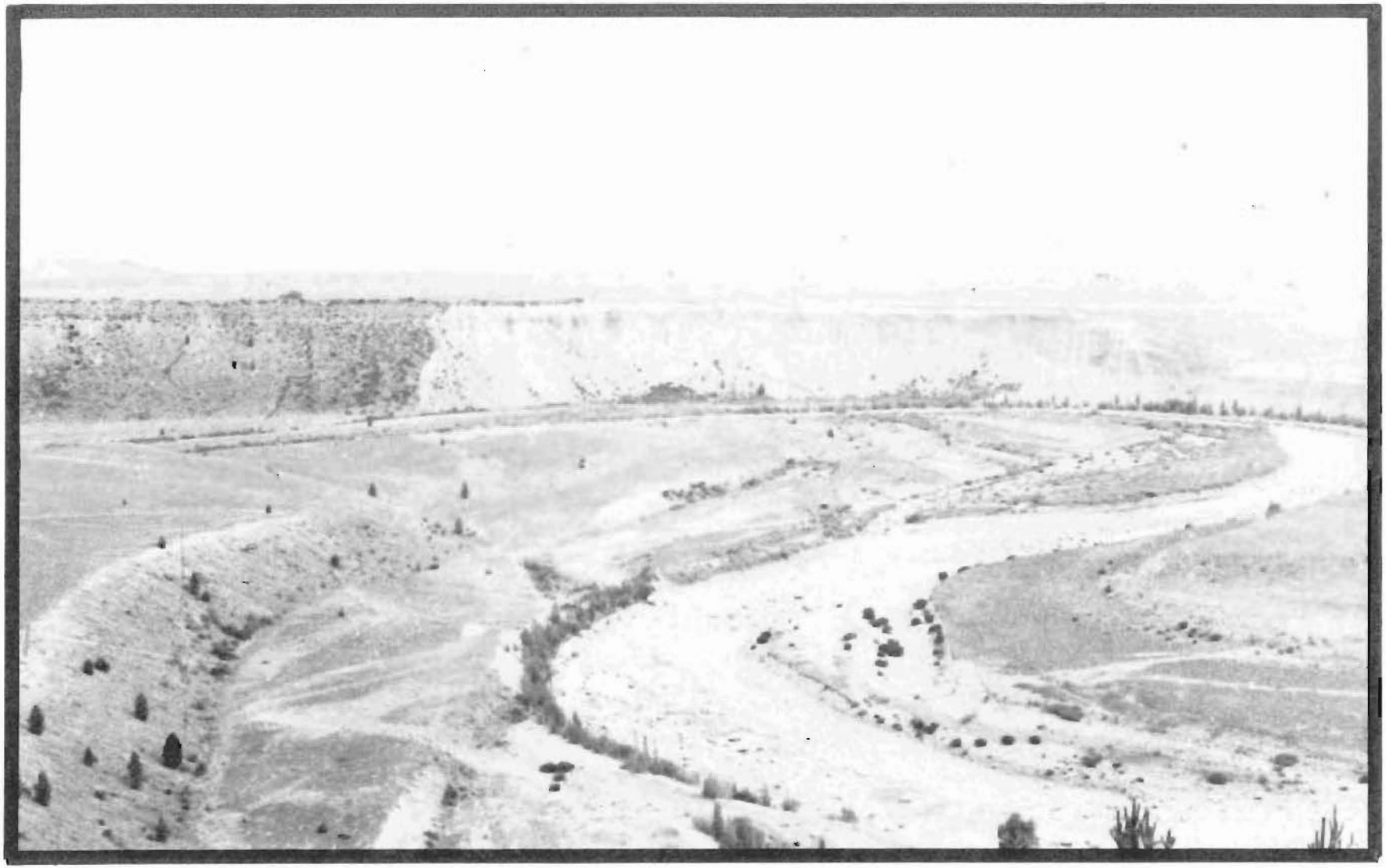
Before any large-scale development such as the Upper Waitaki power development scheme was put into operation, many potential landscape and environmental problems should have been worked out and the best solutions evolved. One of the major aspects would be the visual impacts of construction and ancillary works. Included in this category would be the effects of changing the total landscape by raising lake levels, construction of raised canals, power stations, dams, sub-stations, pylons and transmission lines. Maintenance depots, construction sites and realignment of roadways also pose major problems which have largely been ignored in the past.

(ii) Post-Construction

Problems such as those outlined in the last section are the hardest to deal with. Usually the time between planning and implementation is short and thus the full impacts are not realised. A much easier aspect of hydro-development is the post-constructional treatment of affected areas. This work involves the replanting of disturbed areas, earth moulding and the provision of recreational facilities.

In this case the major problem is in restraining and co-ordinating the efforts of various departments who are usually keen to do something to enhance their public image. Finance is usually the only stumbling block, for once a project is complete, the value of money for restoration becomes more apparent when compared to money needed for construction. For this reason, as well as for the convenience, restoration and provision of associated recreational facilities should be incorporated in the overall planning scheme for a hydro development.

In respect to post-constructional treatment it is important that the character of the existing landscape is maintained. This will probably be antagonistic to the views of some power-house superintendents who may prefer green lawns or even rose gardens to decorate the front of the power house. The main point to emphasize is the need for great care in the planting programme after construction has ceased.



Tekapo River south of dam - problems of weed and tree control, erosion and potential dry riverbeds

(i) Stream and River Diversion

A consequence of hydro-electric development in this area will be river and stream diversions. It is proposed to divert the Fork Stream into Lake Tekapo, the path of the pipe-line (and/or canal) going through the northern end of the Tekapo Domain. Associated with this pipe-line will be some type of concrete structure to dissipate the energy of the water as it enters the lake. Although the pipe diameter is relatively insignificant, the area needed to actually install it is large and many well-established trees and environs will be lost.

Another proposal to divert the Fork Stream into the Joseph Stream and Cass River seems to warrant further investigation. The engineering feasibility of this should not be the over-riding factor in the decision, as aspects of river-bank protection, water supply to irrigation and townships as well as the visual impacts on the environment should be considered. Only after all the consequents are computed, should a decision be made on the route taken by the diversion.

With this diversion the Tekapo river-bed will be dry except in times of flood. It is estimated that about 16 miles of river-bed will be affected. Other river-beds that will become dry in normal periods are the Pukaki and Ohau; the maintenance of which will be important as they will be used for floodways. Where-ever land is disturbed or neglected in the Mackenzie Basin, weed-growth is an immediate effect. Annual weeds such as thistle are of

little consequence at the moment, but the establishment and spread of gorse, broom, willow and sweet briar is of major concern especially along the future derelict waterways.

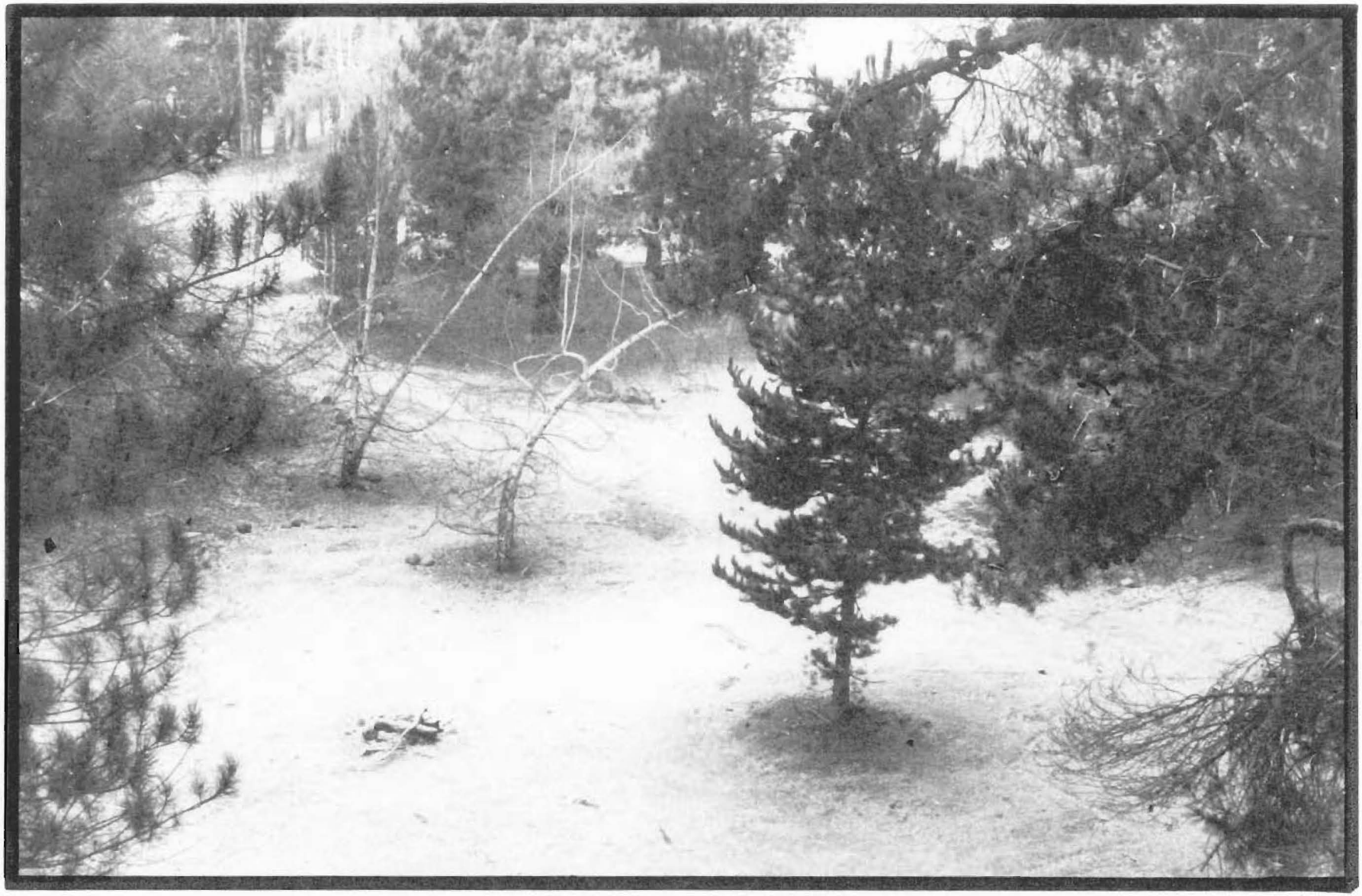
(ii) Run Boundaries

To the farmers of the region the hydro-works will involve two major implications. The first is that the present river systems provide natural boundaries for stock between runs. With the diversion of water it will be necessary to provide alternative barriers to stock crossing existing river-beds. One obvious method is to fence one river-bank but this would prevent access to some of the best watered river-flat land available.

Another method is to provide "boundary flow" water which entails letting enough water flow down existing river-beds so that stock are impeded from crossing the river. The problem with this scheme is purely economic - the water used for "boundary flow" would be of far greater economic importance if it were put into the generation of electricity. (Water Resources of the Mackanzie Basin, 1966)

(iii) Irrigation

The other factor that will benefit the farmer is the availibility of water for irrigation. Expensive investigations have been undertaken and although these are not yet complete it is thought that approximately 215,000 acres could be partially or completely irrigated in the basin. The large scale introduction could have a huge impact on the character of the Mackenzie Basin and care must be taken to ensure that another Canterbury Plains 'type' landscape is not evolving. If the original character of the area cannot be maintained, then a completely new one should evolve; not one based on an existing example,



Camping and picnic area - in path of Fork Stream diversion

but one that will provide it with a new identity.

The use of irrigation as a means to accentuate the surrounding hillsides or subdue the flat areas may be a suggestion. Its pattern will also play a part on the future visual landscape. Should fields be of square or circular patterns, or should they derive their shape from the present topography or drainage patterns? Of special concern would be that the irrigated areas should enhance and not detract from the visual character of the region, especially along the existing highway and the proposed scenic highway running alongside the Tekapo - Pukaki canal.

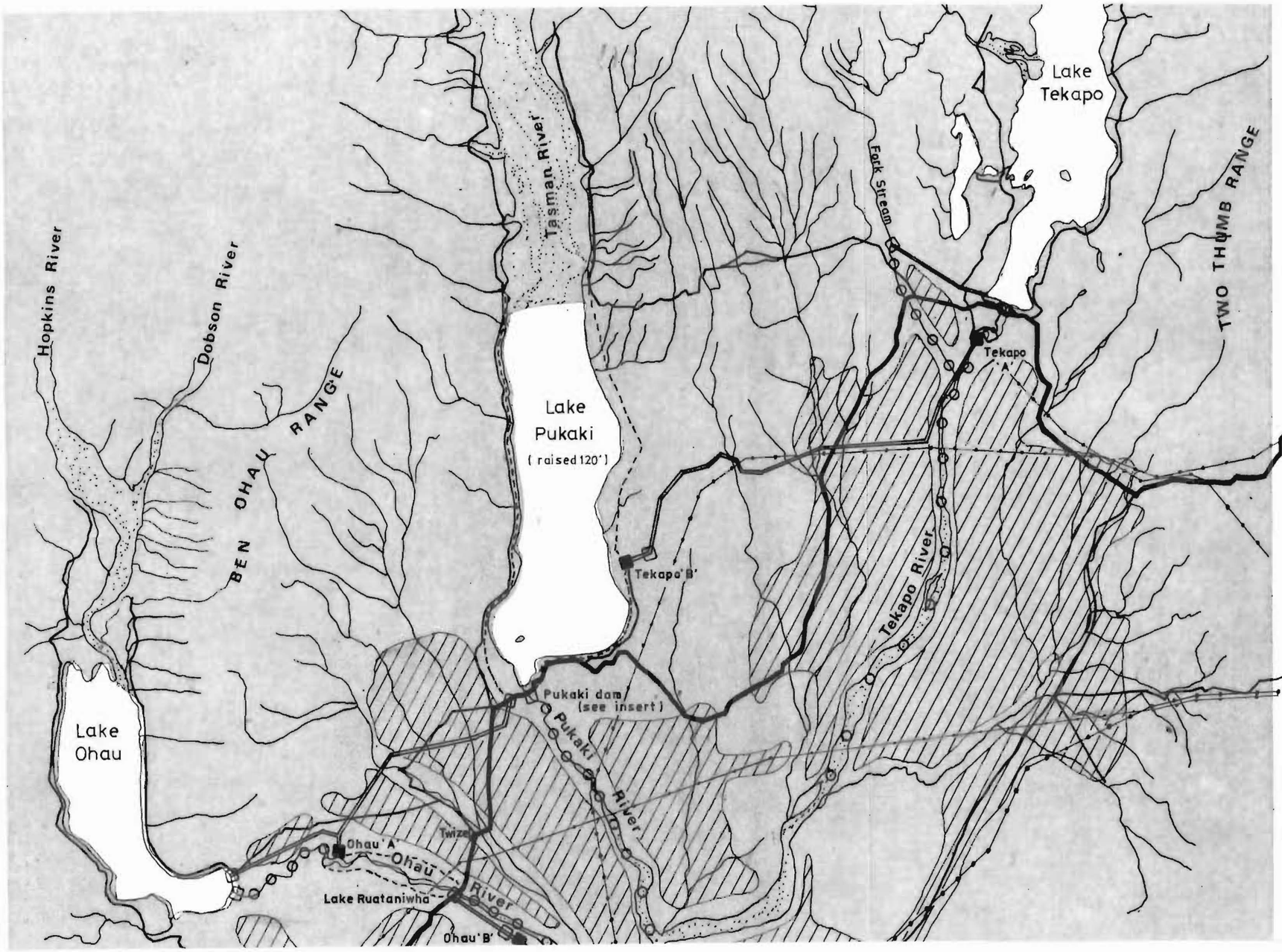
NEED FOR AN ENVIRONMENTAL STUDY

With the continued development of the Mackenzie Basin over the next few years, it should be imperative, with the co-operation of all authorities, Government Departments and interests concerned, to set up a board that planned the recreational needs of the future. In this way recreational needs and potentials could be planned on a large scale and an acceptable standard of environmental standards could be adhered to and be used as controls.

The organistations who could provide the basis for a proposed board include: Department of Scientific and Industrial Research, Federated Farmers and local runholders, Lands and Survey Department, Mackenzie County Council, Ministry of Works, New Zealand Electricity Department, New Zealand Forestry Department, South Canterbury Acclimatisation Society, Tourist and Publicity Department, Tussock Grasslands and Mountain Lands Institute, and Waitaki Catchment Commission.

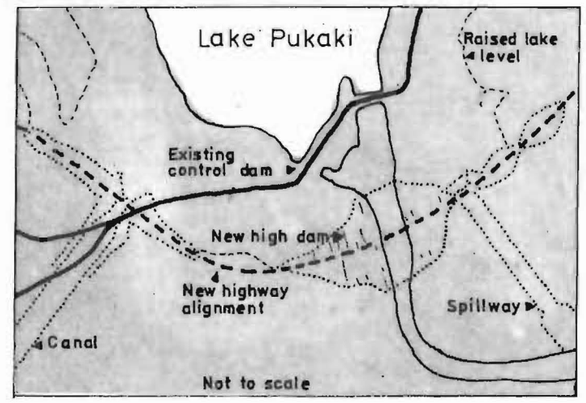
With such large scale landscape changes it becomes apparent that there will be many physical and visual impacts on the natural environment. These impacts warrant an environmental study well beyond the scope of this study and it is only through complete co-operation between interested bodies and departments that a proposed study of this magnitude can be undertaken. One of the basic requirements a study into the landscape impacts of development in an area such as the Mackenzie Basin needs is the complete knowledge of what is planned before work starts and this seems to be creating the problems that exist today. Therefore complete control of the problems can only be achieved by team work of the highest order and a thorough understanding of the ecology of the whole. This is expanded by Lady Eve Balfour in "Mother Earth", when she writes:

> "Wholeness is the logical outcome of a positive approach just as Fragmentation is the logical outcome of a negative approach. When the universe is seen as a whole, Nature is seen as being governed by the laws of Order and Interdependence and survival is seen to depend on biological balance, not cut-throat competition for the part is not greater than the whole.
>
> In this material environment Man himself is but a part of the wider organised whole, which is Nature, and throughout Nature a complex biological balance exists between all living organisms as well as between each and its environment. The lesson we have to learn is how to discover and interpret the part which all other life plays in the whole and how to co-operate with it."



Legend

- Power stations
- Dam or control structures
- Floodways - proposed dry riverbeds
- Canals
- Approximate lake heights
- Transmission lines (existing)
- Potential flood irrigable areas



Scale 1 inch to 4 miles

DEVELOPMENT

Recreation and Tourism

Improvement to the main highway in recent years as well as the policies followed for the development of facilities at hydro lakes and other areas, has led to a considerable increase in recreational use of the Mackenzie Basin. In this section it is proposed to outline the general activities available to people visiting the area and because they are related, other areas outside the study area are included. A more detailed study of the Tekapo region will be discussed in the following chapter.

MOUNT COOK NATIONAL PARK

This was declared a National Park in 1953 and comprises 173,000 acres to the north of the Mackenzie Basin. It is mainly a tourist area serviced by the Hermitage but is also the base point for activities such as climbing, skiing and tramping.

WATER SPORTS

This includes water skiing, boating and boat racing. The major lakes are all used for this form of activity. These include Lakes Benmore, Aviemore, Ohau, Pukaki and Tekapo. Major competitions have been held in this region in the past and an international water ski championship is planned for Lake Tekapo next year.

SKIING

The first skiing in New Zealand was at Mount Cook and subsequent developments include the Ball Hut and glacier runs from ski-plane landings. The other major fields are situated at Lake Ohau and Richmond Station (Round Hill) near Tekapo.

FISHING

Although the hydro schemes affect fishing adversely, there is good fishing in all the lakes of the basin. The available fish are rainbow and brown trout, and salmon (south of Lake Aviemore). There is winter trout fishing on Lakes Benmore and Aviemore.

GAME BIRD SHOOTING

Game birds include grey and mallard ducks and Canada geese, together with quail and chukor in low rainfall tussock areas. Paradise duck and pukeko are protected in the area south of Lake Benmore. There has been a declining amount of water-fowl habitat due to fluctuating lake levels and drainage that reduces available food at the time of maximum population.

HOLIDAY VILLAGES, CAMPING AND PICNICKING

A county town has been developed at Tekapo, principally for holiday homes. The Lands and Survey Department are in the process of sub-dividing approximately 120 new sections to

the south of the present village for the increased demand for holiday sections. Recently a new sewerage scheme has been installed and the only major obstacle remaining is the need for a new water supply system.

Consideration is being given to a tourist centre and holiday village at Lake Pukaki after the raising of the lake has been completed. Its location, size and necessity are current debates that must be decided upon in the immediate future.

Considerable expansion of facilities and accommodation at Mount Cook National Park is likely in the near future. Severe limitations to growth in this area are of major concern and provision of another major centre at Pukaki or Tekapo may relieve the pressure on the National Park.

Provision has been made at Lake Benmore for boat harbours, picnicking and camping reserves as well as a 200 acres reserve for holiday homes. Similar facilities have also been provided for at Lake Aviemore.

PLANNING

The region has a great tourist potential and has the capacity to cater for it without detrimental effects to the environment as long as there is detailed planning on a large scale and strict adherence to policies established specifically for the area. The objects of planning for tourism and recreation should therefore:

(i) assess the present and future potential of the region and apply these to community and facility developments.

(ii) Set standards based on good landscape and architectural values for all new subdivisions, houses and recreational facilities so that they complement the local environment as far as possible. Upgrading of existing structures and facilities to meet the same standards should also be encouraged.

(iii) Investigate the present and planned recreational facilities available in the region and assess the need for new facilities to meet the expected demand from tourists and local population.

(iv) Maintain a strict control over all activities in the Mackenzie Basin to ensure that the natural environment and its character is maintained as a public asset for future generations.

Caravans in the domain – increasing problems of siting, integration, sanitation and power points

IV

Visual Compartments

GENERAL

In this section it is proposed to establish the major visual compartments in the Tekapo region. Although in some cases the boundaries between these compartments may be arbitary, their structural unity and visual continuity make them logical areas within which development should be related to their particular visual environment. The need for such an analysis is outlined by Wilcox and Cumins:

> "The first step in analysis of a large area of state park calibre is to recognise the importance of major natural landscape forms. These represent the important natural features in the environment and can be altered but little, if at all. Examples are significant topography, surface water, heavily vegetated areas, etc. These major elements must be analysed to determine their effect on planning; both restrictive and as opportunities to provide for optimum recreational use and enjoyment. Plans may then be shaped to provide for development which is in harmony with them." (Wilcox and Cumins, 1969)

The components are defined mainly by using natural boundaries and also roadways; both being major visual or continuous elements that act as barriers. Different types of natural

spaces may be the important feature and these may be broken down into varying types of enclosure created by nature or Man such as rivers and roadways. Within these major compartments other minor features should be recognised as they also help define boundaries of the units and also provide insight into development possibilities or constraints.

This visual analysis of Tekapo takes in only a relatively small area of the greater Mackenzie Basin. It must be stressed that a similar study involving the whole basin would provide valuable assistance to the development in the region. If this eventuates, it is hoped this analysis of Tekapo becomes but one unit in the overall visual study of the basin which in turn is only part of a major environmental study of the region.

The importance of State Highway No. 8 is recognised in that it forms the main compartment in this analysis. It provides the axis by which all the other compartments are bound together and therefore the visual character of this highway could make or break the acceptance of future development of the surrounding Tekapo area. This highway forms part of the major inland route south to Mount Cook and other tourist areas such as the Southern Lakes and its importance will grow with the expansion of these areas as well as the growth of Tekapo as a holiday resort. The average number of vehicles per day using this highway through Tekapo township has increased from 190 in 1966 to 680 in 1973. This latest figure is very high due to the increased Ministry of Works involvement in the Upper Waitaki power scheme but the importance of this stretch of roadway is still large and will continue to grow.

Depending on the time of year, there are five basic colour components experienced from

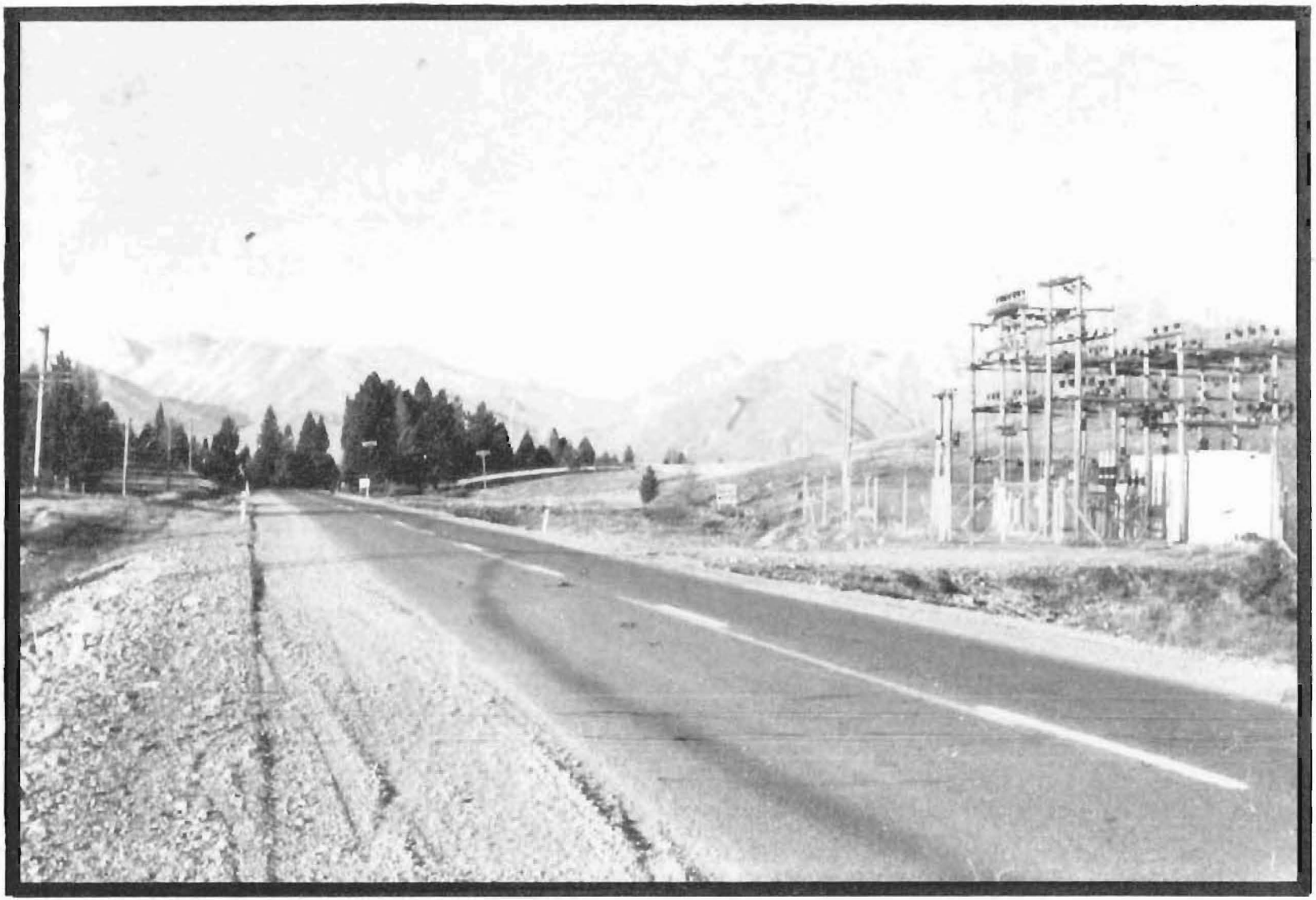
within the Tekapo region. These consist of the blue lake, the greens of the pines around the lake-shore, the yellow-grey and browns of the tussock grasslands, the white of the snow on the distant range-tops, and finally the blue of the sky. It is the constant inter-play of these colours when travelling to, from or within Tekapo that provides interest and a welcome variety essential for any recreational township.

ENTRY INTO TEKAPO

Travelling west along No. 8 Highway there is an abrupt change at Burke's Pass from the mixed farmlands of South Canterbury to the treeless, vast, empty, extensive ranching country of the Mackenzie Basin. The change from the rural sub-divided, tree-dotted landscape of the Fairlie Basin into the Mackenzie is remarkable, and apart from the "left off" feeling, the only hint of the change can be felt in the tussock-clad sloping southern ends of the Two Thumbs Range that, along with the Rollesby Range, enclose the highway at Burke's Pass.

Further along the highway, homestead plantations present the only vertical element present as the full impact of the Mackenzie Basin begins to take effect. However, as soon as this impact has been achieved Tekapo is reached and the landscape and its elements change dramatically as the southern end of the lake appears as an oasis in a desert.

This effect is even more dramatic if travelling from the south as the whole Mackenzie Basin will have been traversed before reaching Tekapo. However the visual signals of Mount John and the plantations do serve to draw out the effect and the element of surprise is



Entry into Tekapo from the west - a sub-station as a visual signal ?

lessened when compared to the other entrance.

COMPARTMENTS

It is now opportune to divide the Tekapo region into its visual compartments, and describe their inherent elements and the problems associated with the development of them.

(i) Compartment No. 1 - The No. 8 Highway

The importance of this compartment has been noted above and it is proposed to divide it into a number of sub-compartments. Generally the major aspects to consider in this compartment are: the view of the lake (long and short views are both interesting and important), Mount John as the dominant vertical element, the rhythm of open spaces along the highway and the integration of development alongside the highway.

One visual disaster of this compartment is the conglomeration of power and telephone poles running parallel to the highway. Underground wiring is obviously the answer to this problem and is a necessity if this area is to obtain a pleasing character.

A sub-compartment 1A is composed of the lower slopes of Cowans Hill on which the Lake Tekapo lookout is situated. It also includes a triangular area formed by two rows of pine trees and another block which is an unplanted extension of the County plantation land. These two areas are important visually to the entranceway to Tekapo from the east and therefore should be retained in their present condition and not built on for holiday homes. They form an integral part in that they are a buffer between the open landscape and the more subdivided landscape of the Tekapo region. They are also important as major components in a

rhythm of open spaces that should be carried throughout the length of the highway.

To the north of the highway is a large area comprising areas of soil conservation and N.Z.E.D. land. This portion is seen as the foreground to the views from the highway and should be treated carefully. Unfortunately a house and small electrical substation are obtrusive, but with screening these elements may assume minor importance. The lakeshore area is an ideal picnic area and should be developed as such to act as a visual and fire buffer between the lake and denser plantations behind it. This area is subjected to fluctuating lake levels and as it is the first area seen when entering Tekapo, special consideration should be given to its development. It is also important as one of the only wildlife refuges around the otherwise sterile looking lakeshore.

The saleyards and opposite reserve land are elements comprising sub-compartment 18. Although the iron work of the saleyards is screened from the road, the car park area to the west is visible. Within this latter area many self-sown Pinus spp. are turning this area into a pleasant one and eventually if the saleyards are dismantled future development of this area should be restricted. The reserve on the northern side of the road is visually important in forming an alternative rhythm of open spaces on either side of the highway. Therefore it is recommended that the saleyard area should remain or become reserve land so as to act as a buffer to future developments further south and also to complement the reserve area to the north.

Also part of this sub-compartment is a residential area that can only be described as a disaster. This part of the village is on the same level as the highway, has no

screening, therefore no shelter and also has no view. The housing styles are a mixture of square, T-shaped and A-framed, and show the need for restrictions on building styles. This visual problem could only be solved by heavy plantings or earth mounding.

Crossing the Tekapo River, the commercial area is reached and this forms part of sub-compartment 1C. To the south of the highway, residential areas are hidden by a bank and do not form any intrusion on the visual compartment. The commercial area is rather unattractive and requires trees of rather more stature than the present shrubs to screen off the variety of buildings. Any plantings should not however interfere with the view of the Lake from the highway, and therefore careful planting design should be undertaken in the domain area which forms the bulk of this sub-compartment. A smaller portion of this sub-compartment is the area surrounding the Church of the Good Shepherd on the east bank of the river. This area must remain as it is and no further housing should encroach onto its surroundings.

The highway compartment continues and becomes enclosed by the tall plantations of the domain on one side and topography and plantings around Mount John homestead on the other. To the west of the Mount John shelterbelt another large area widens the view which is enclosed again just as suddenly by another morainic bank. Nearing the turn-off to Lake Alexandrina and also the roadway to the power station, the view opens out again. On the north side of the highway, the plantation is becoming sparse and eventually disappears, whilst on the southern side another depression area is experienced. This depression is lined by the long plantation flanking the road to the power-house and also comprises

a major electrical sub-station. This sub-station is an eyesore to the whole area which is the entrance to the township when travelling from the west, and major screening or resiting must be considered essential in order to provide a pleasant entrance from this direction.

This highway compartment is therefore the most important visual asset to a recreation and future tourist town. Therefore it is proposed to outline briefly general recommendations that will both enhance and retain this visual character.

(a) Future development for holiday homes should not be permitted south of the highway from Cowans Hill to the present subdivision (Allan Street). This area includes the saleyards.

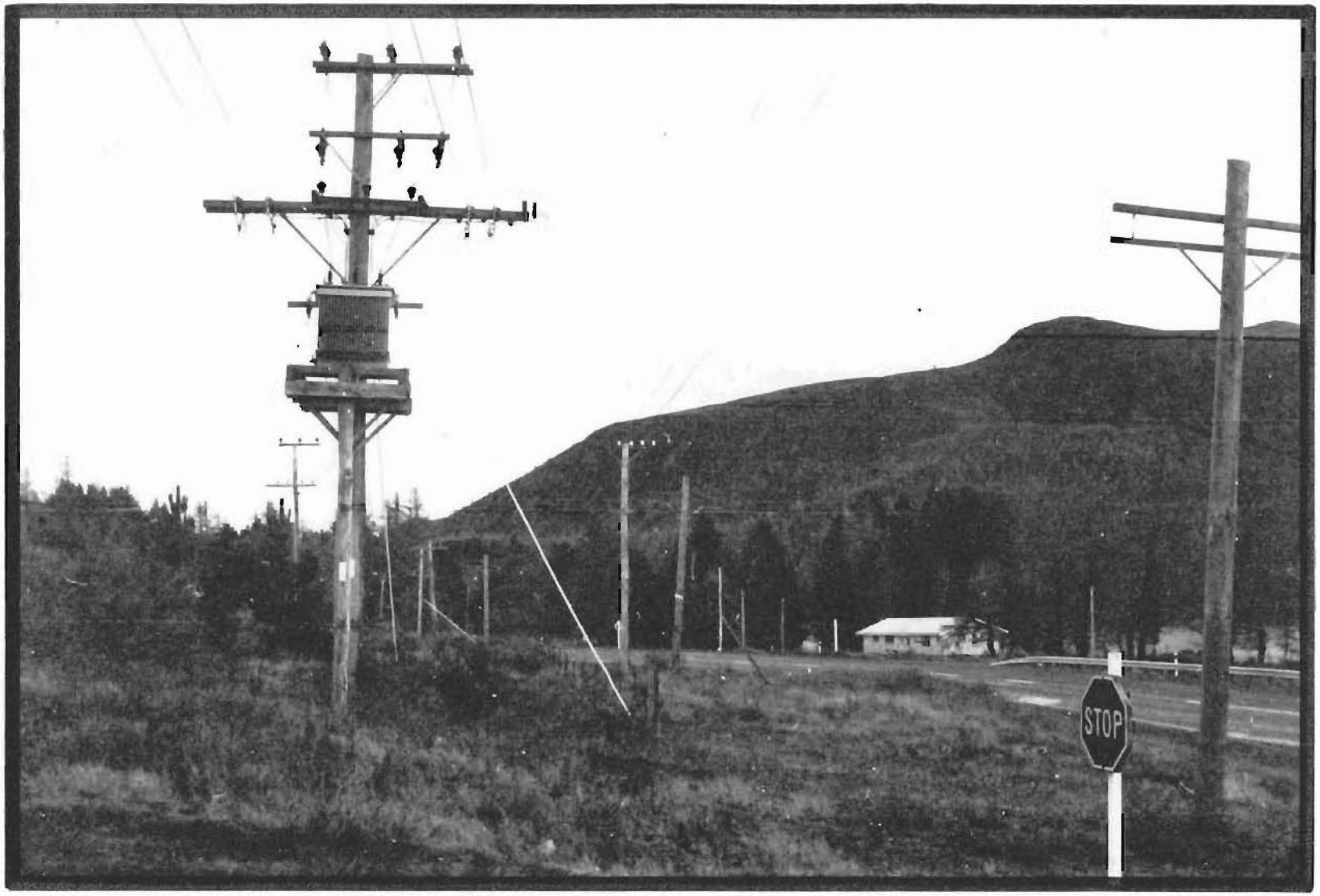
(b) Major screening should be undertaken at the back of the Allan Street subdivision facing onto the main highway.

(c) All overhead wiring should be placed underground and sub-stations screened or resited.

(d) The south-east corner of the lakeshore should be developed as a reserve area for picnicking, recreation and a wild-life refuge.

(e) The commercial area should be upgraded with larger scale plantings and restrictions imposed on any future buildings so that they may be more sympathetic to the site, and in character with the area.

(f) No further encroachment either by buildings or large scale trees should be allowed within the environs of the Church of the Good Shepherd.



The pole-scape of the main highway with Mount John as a backdrop

(ii) Compartment No. 2 - Sawdon

This area epitomizes the character of the Mackenzie Basin and is visually important in that it provides contrast to the Tekapo region. It is logical that this compartment will remain as it is today as development would be restricted by the lack of shelter and view, and the distance from the village. Care should be taken however to stop the spread of trees from the plantation area and thus retain its present character. Good farm management practice should prevent this.

(iii) Compartment No. 3 - Soil Conservation Reserve

In the past this area was one with great erosion problems. This was halted by tree plantings. Planting techniques have produced an interesting pattern on the landscape as a grid-iron programme was instigated first and then the remaining areas filled in some years later. This has produced rows of larger trees that go straight down slopes and straight across contours. Although these are basic forest management faults, the whole region is a visual amenity to the Tekapo region. Seen as a mass, this area is dominant to many internal and external views of the area and also from the highway.

Future development of this area for recreational or residential purposes is doubtful because of the fire danger. Therefore this area is basically regarded as a soil conservation and visual amenity area. However in the long term further planning may make this area available for limited holiday home activity.

(iv) Compartment No. 4 - The County Plantation

The County Plantation to the south-east of the foreshore and the area of land between

it and Allan Street comprise the fourth landscape compartment. For description, it is necessary to divide it into its sub-compartments.

Sub-compartment 4A presents the area where major development of holiday homes will occur in the next few years. This area is well suited in that its proximity is only a few minutes walk from the domain, it has varying views of the lake, it is sheltered by the plantation to the south, and it contains some interesting undulating country. Of importance to the planning of the whole Tekapo township, this area is not visible from the main highway, and therefore a further visual disaster such as Allan Street should not occur.

In planning a major sub-division for this area, the County Council should follow these recommendations:

(a) The contours of the land should be respected when forming roadways, and allocating section sizes and shapes. In this respect it should allow flexibility to the Tekapo section of the District Scheme so that a city-type urban landscape is not developed.

(b) Buildings should be architecturally designed, and fit into the landscape, not merely onto it. It is essential that the character of the area is maintained and that the holiday homes harmonise with each other and the landscape. One means of achieving this is to appoint one architect who has to approve of any proposed buildings in the area.

(c) A landscape architect should be consulted, both in the formation of the sub-division and in the overall planting design that should precede the development phase.

(d) All power and telephone wires must be placed underground.

(e) A time limit should be set on the construction time for holiday homes. This

Part of landscape compartments 1b (Highway No.8) and 4a (County plantation)

is to over-come a situation that developed in Allan Street where an uncompleted A-frame house has been a dominant eyesore to passers-by on the highway for many years.

The plantation forms sub-compartment 4B. This area is important to the future development of Tekapo as it is a buffer against wind, smoke and smell from the local rubbish-dump and sewerage works. Because of bad maintenance its timber value is rather low, and therefore it presents Tekapo with a ready-made recreation area. Although many open spaces exist within the plantation it would be necessary to thin out more to provide for pleasant open space areas. Softening of the hard edges to the plantation would enable it to fit better into the landscape when viewed from surrounding high points.

Therefore this plantation should be retained primarily as a buffer for the township and also as a recreational facility.

(v) Compartment No. 5 - North-east of Dam

This area represents the most pleasant housing environment in the Tekapo region. Because of the well-established nature of the vegetation, it has the ability to absorb the present housing, and also any further development possible in this limited space. Future development should not be allowed to encroach any further onto the Crown land to the south (recommended reserve land) and also the area surrounding the Church of the Good Shepherd. Demolition of inferior holiday homes should be a primary concern, and restrictions such as those suggested for the 4A sub-compartment should also apply.

(vi) Compartment No. 6 - N.Z.E.D. Village - Mount John Homestead

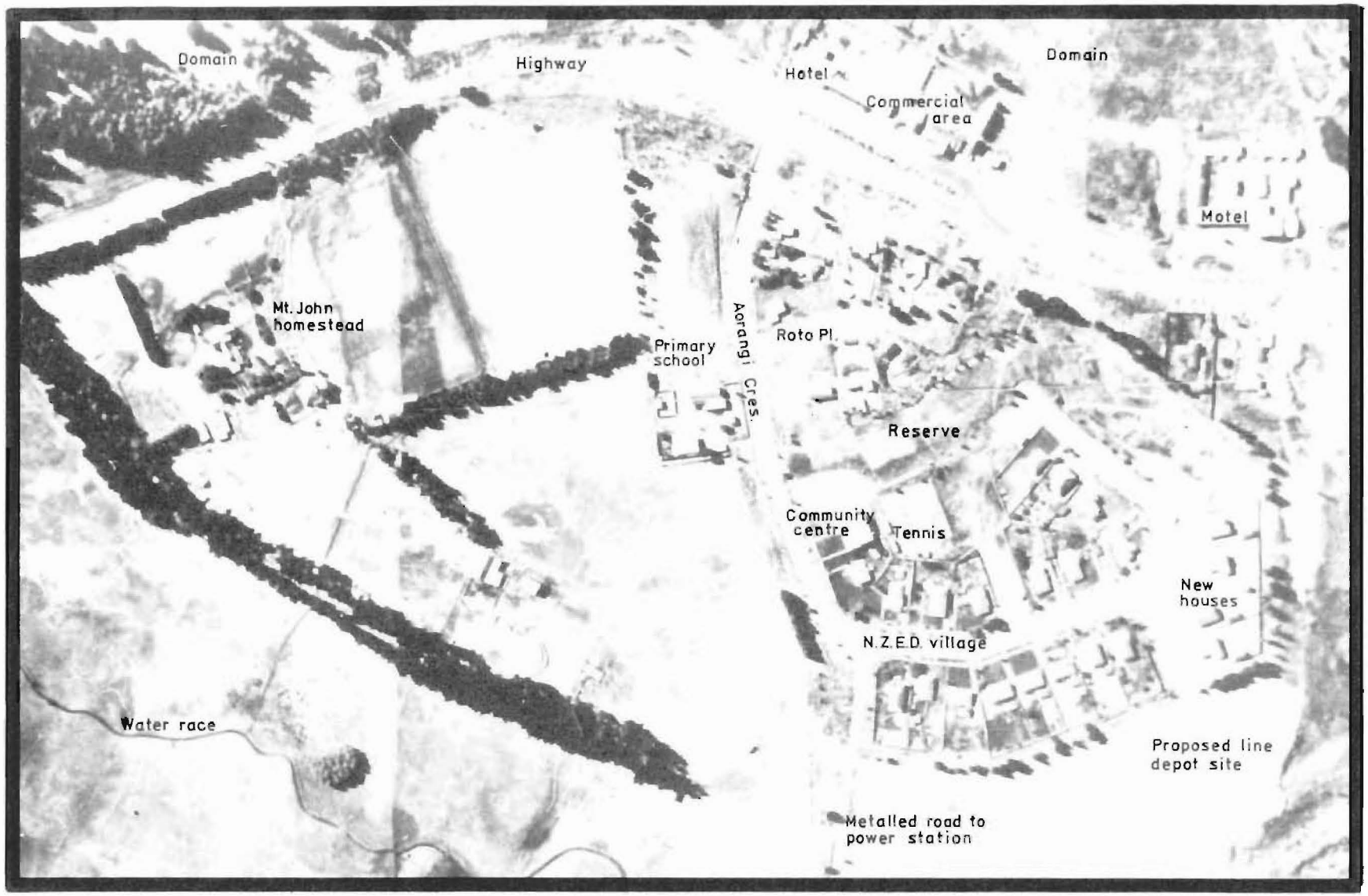
This compartment is well-suited to development in that it is unobtrusive to the

highway compartment because of its height, it has good views of the lake, is in close proximity to the commercial centre, and it contains most of the community facilities. It can be sub-divided into two sub-compartments; one developed, the other undeveloped.

Sub-compartment 6A comprises the N.Z.E.D. village and other good farming land. The village itself would have provided an imaginative planning exercise in the past, but the effect has been detracted somewhat by the housing styles present. They are more representative of a state housing area in a large city than a holiday township. However four new houses built recently are more in character with the site and obvious improvements have been incorporated. Large scale plantings are required in this village to give a unity which is lacking at the moment, and to provide a balanced environment that will become important in the future with greater community centre activity in this area.

To the south of the village, is an area that should be considered for future development if needed. In the planning scheme for the Tekapo village, this area is designated future industrial. At present this land is the best available land on Mount John Station, but with an increased amount of irrigation this may tend to become less important. Therefore, if needed, this area should be designated residential and the proposed industrial area sited east of the river adjacent to the new sewerage works.

The Mount John homestead constitutes the bulk of sub-compartment 6B. This area is elevated and subsequently invisible from the main highway. It provides good views of the lake and foreshore to the east but only glimpses of the western lakeshore are visible because of the trees in the domain. Shelter from the south-west is provided by a large shelter-belt, and



Landscape compartments 6a (N.Z.E.D. village) and 6b (Mt. John homestead)

other small belts are present. To the south of the homestead an irrigation race winds its way along its contour, and further south tarns are present for the most part in the winter months.

Also within this sub-compartment is the primary school which is adjacent to the proposed community centre. This sub-compartment therefore should be considered for future development after the major sub-division of sub-compartment 4A is complete, and the same restrictions recommended there should also apply to this area. Recently trees in front of the homestead alongside the main highway have been removed and steps must be taken to renew these with group plantings that would both screen any future developments and continue the enclosed feeling experienced when driving past this section of the highway.

(vii) Compartment No. 7 - Tekapo Domain Camping Ground

Visually this area is recognised as a tree-clad region on the south-western foreshore of the lake. It is visible along the highway compartment and therefore constitutes the major visible aspect in the region apart from the highway and Mount John. Years ago it would have been thought impossible to change this area visually, but with the proposed Fork Stream diversion this has become a probability. The area needed to implement this engineering work is vast and a large scar is imminent. Although details of this work are not available, it is thought that the visual result will be a large swathe cut into the side of the domain, and immediate steps to alleviate this problem must be implemented as soon as work is completed.

One of the most pleasant effects that will be destroyed in this development will be the delightfully subtle changes of colour present in the vegetation. Many different tree species

Typical camping site - lost with proposed stream diversion

are present in this area which is used by campers and picnickers, and it is probable that these delightful environs will be lost.

Another pleasing effect produced by the vegetation is the seasonal changes of the larch plantation. This plantation is at the base of Mount John, and in summer the green colour contrasts with the tussock grasslands of the hillside. In winter however, the colour of the larch is in complete harmony with that of Mount John, and contrasts only with the pines present in the rest of the domain.

Other visual problems of the domain have been a result of tree-felling operations connected with the expansion of the camping ground, and the presence of old army huts for holiday-makers. New additions to the camping ground, such as sanitary, motel and ablution blocks are also an eyesore, and steps should be made to stop further additions of this nature. With some variations the recommendations outlined in sub-compartment 4A should also apply to this area.

Further recommendations are:

(a) Upgrading of the campsite area. Within this category, thought should be given to circulation patterns, segregation of activities, future development, care of trees, upgrading of facilities that are more compatible with the area, and provision of picnic and camping areas.

(b) Development of the foreshore area to cater for both long and short-term visitors to the area. Removal of the present houses in this area should be a major objective.

(c) Redevelopment of the skating rink and its facilities. This may be associated

with the engineering works connected with the proposed Forks Stream diversion.

(d) A major restoration programme should be planned before work on the diversion is commenced and implemented as soon as possible after work is finished. Planning for this however is subject to the finalising of plans for the actual engineering works involved, although it should not be.

(viii) Compartment No. 8 - Mount John Station

This compartment is similar to that of No. 2 in that it is representative of the character of the Mackenzie Basin and is important visually from the highway. It is thought unsuitable for development and therefore should remain in its present state.

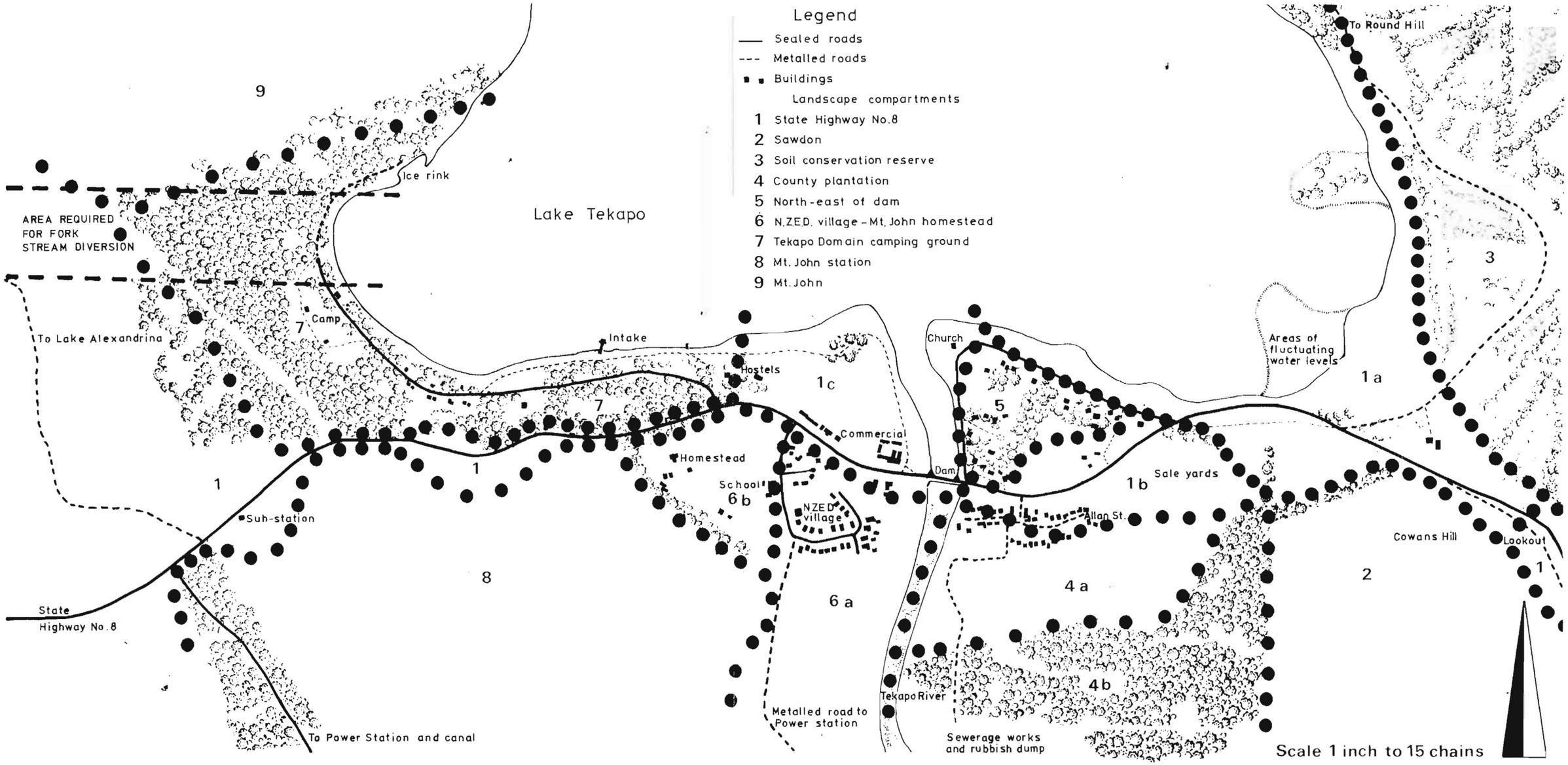
(ix) Compartment No. 9 - Mount John

Mount John is a projecting element in the landscape as it towers 1,000' plus above the Mackenzie Basin in the Tekapo region. As soon as Tekapo is reached from the east it becomes a dominant feature and is more so when approaching from the west. It is therefore used as a direction indicator and a landmark associated with Tekapo. It also provides shelter from northerly winds to a certain extent and is responsible for the shading of the northern end of the Tekapo Domain, thus allowing the ice rink perfect conditions.

This mountain is in sharp contrast to the gently inward-sloping mountain ranges surrounding Lake Tekapo, and the flat basin. It therefore is the major single element that is dominant over all the other landscape compartments. Development in the past has been concerned with the observatory which is not obtrusive, but pipe-lines running down the complete slope of the mountain do pose visual problems which should be remedied if possible. Another

Ice rink - upgrading could be associated with work on Fork Stream diversion

problem is the spread of larch trees uphill from the domain. Although these trees harmonise in well with the mountain in the winter, they should be stopped before they dominate Mount John. The irregular patterns created by these trees are pleasant now but in the future they should be stopped from progressing up the slopes any further, either by hard grazing or cutting. In this way the present visual balance between vegetation and physical dominance of the mountain will be retained. This visual effect is important when viewing Mount John from the opposite side of the lake and along the main highway travelling west.



TEKAPO LANDSCAPE COMPARTMENTS

Recreation

GENERAL

In this section it is proposed to outline the reasons why Tekapo has not become a tourist centre of the magnitude of Wanaka or Mount Cook. Tekapo's numerous advantages would not have been neglected in other countries, although it is somewhat fortunate that development of Tekapo has been slow. Because of the general increase in tourism and demand for recreational facilities, Tekapo is well suited to become a planned tourist and recreation centre and not one that has merely grown in a haphazard and disorganised manner.

REASONS FOR LATE DEVELOPMENT

(i) Although Tekapo has a beauty of its own, it is less spectacular and striking than that of the Southern Lakes and Mount Cook.

(ii) The lack of shelter and settlement in the past gave visitors the impression that Tekapo was a place on the way to somewhere else.

(iii) Because of the large-sized runs in the area, holiday home sites were not available when the demand arose. This, and the sparsely populated surrounding country did not create a demand for a servicing village.

(iv) In about 1926, the original village site was laid out and sections bought, mainly by speculators, who neglected the sites and did not bother to build holiday homes.

(v) To meet further demand, another sub-division was planned but this was shelved in the late 1930's when the hydro-electric power station and village were proposed.

(vi) After the raising of the lake, the old hotel which could cater for 54 guests was demolished, and this presented an immense set-back for the local tourist industry. The Tourist Department were interested in developing Tekapo, but lack of money, and more urgent needs prevented this. (Stubbs, 1966)

ADVANTAGES OF TEKAPO

(i) In the past, exposure to wind has hampered development. Today, Tekapo has an adundant amount of shelter, and this provides the area with the capacity to absorb more development such as holiday homes and recreational facilities.

(ii) Its central position in the South Island makes it well-placed in relation to all the other major attractions of the South Island. This will become more important in the future as air travel will increase. Tekapo has ample room and good conditions that a large airport may require. It is also on the main highway to the Hermitage and the Southern Lakes.

(iii) The climate presents one of the best advantages. Low rainfall, continental-type temperatures, low humidity, sunshine and clear skies all provide it with an all-year appeal. The climate makes it ideal for a health resort on the lines of Hanmer or Rotorua. The absence of such pests as sandflies also makes holiday conditions more pleasant.

(iv) The scenic character of the area is a great advantage. Views are present from almost every situation and high mountains are to be seen in the distance. The Ben Ohau Range,

Mount Sefton, Mount Cook and Mount Sibbald appear on the horizon but are not over-powering by their proximity. Visitors enjoy variety and Tekapo provides excellent contrasts to the rugged mountains and bush country further west.

(v) Apart from being a place to look at, Tekapo also provides a variety of recreational outlets. These will be outlined in the following section.

PRESENT RECREATIONAL PURSUITS

(i) Boating and Water-Skiing

There has been an increasing amount of boating activity on Lake Tekapo in the past few years. This is reflected in the need for, and the building of a new clubhouse in the domain for the Lake Tekapo Power Boat and Water Ski Club. Other facilities include a concrete launching ramp and trolley.

Apart from power boat races, pleasure boating and canoeing, there has been an upsurge in water-skiing, and it is proposed that an international rally will be held on the lake early in 1974. Of special interest to the boater are the various bays, peninsulas, inlets and the island within the lake environs.

(ii) Fishing

This activity is centred on Lake Tekapo and its tributory streams. Also, to the north of Tekapo township is Lake Alexandrina and MacGregor Lagoon which provide good fishing and pleasant environments. Lake Alexandrina, a shallow spring-fed pool, was thought to be suffering from silting-up, but this problem has apparently alleviated itself. The presence

of holiday homes on its shores is a clue to its popularity and good fishing.

(iii) Skiing

A ski-slope has been developed on Richmond Station at Round Hill. Its early beginnings depended on local enthusiasts using the field but the grounds have since been progressively developed and are now managed on a commercial basis. They are especially suitable for beginners and three tows are usually in operation. Accommodation is limited to the Tekapo Ski Club hut which can sleep 22 persons. However extensions to the accommodation and tow facilities are planned for the immediate future and this will provide better facilities for visitors as well as the local enthusiasts who are the main users at the moment.

(iv) Ice Skating

The Ice Rink is situated at the foot of Mount John in the south-west corner of the lake. It has many advantages that help make it one of the best outdoor rinks in New Zealand. Firstly, it is shaded by Mount John for three months in the winter; it is well-sheltered from winds by trees and Mount John; sunlit areas are close at hand; there are extensive car parking areas available on the lake shore; picnic areas are provided for in the domain; and there is space for extensions at both ends.

Its future is uncertain as its existence depends to a large extent on the work to be carried out during the Fork Stream diversion. Because its size is limiting the possibility of combining earth works associated with this diversion work and the re-modelling and extension of the ice rink should be investigated. Another problem exists because the main period for maintenance work on the rink coincides with the time when the lake is at its highest level.

Seating facilities at the ice rink

This problem could be alleviated by raising the ice rink above the maximum height of the lake.

(v) Sight-seeing

With the increase in leisure time and increased use of driving for pleasure, it has become apparent that trends of this nature must be catered for. To this end the N.Z.E.D. is proposing a scenic highway along the new canal from the Tekapo Power Station to Lake Pukaki. The eastern terminal of this highway will be Tekapo township, and thus it will be an important stopping point on the journey. Planning must therefore provide for short stay visitors by extending picnic grounds, and also long term visitors by providing extra accommodation.

Apart from the power station and associated hydro structures, other places of interest in the Tekapo region include the satellite tracking station and observatory on top of Mount John, the Church of the Good Shepherd, the Memorial to the sheepdogs of the Mackenzie Country, and the domain itself.

(vi) Other Pursuits

A golf course is situated about four miles west of Tekapo near the Military Camp. Although expansion of this area is relatively easy, the lack of both water and shelter constitute the major stumbling blocks to further development. Other sites such as the soil conservation area and the County plantation to the south-east of Tekapo could be considered if an increased demand for golf arises in the future.

Because it is largely snow-fed, Lake Tekapo, is not used for swimming to any extent. There is also the hazard from boating activity and the absence of any beaches in the area tend to make swimming unpleasant. However the Fork Stream does offer some pleasant swimming

pools in the summer, and the local primary school has a small sized pool but use is not generally available to the public. The provision of a heated pool would be an asset to the area.

ACCOMMODATION

Apart from the caravans and camping sites that will be discussed later, accommodation in Tekapo is extremely limited. With tournaments and competitions based on boating or skiing there is a large influx of visitors staying for up to a week. These put a severe strain on the accommodation available and also make it near impossible for other short term visitors to find accommodation. For instance, this year up to 250 people were expected for a junior skiing championship during July. Although the meet was cancelled through lack of snow, it does emphasise the increasing demand for accommodation. Apart from this peak demand, there are the one-night stoppers and other long term people who must be catered for.

A summary of the present accommodation available in Tekapo (excluding caravan and camp sites) is as follows:

(i) Fully licenced hotel - 7 bedrooms - maximum capacity 13 persons.

(ii) Tourist licenced motel - 3¼ units sleeping 3 - ¼ each.

(iii) Other motels - 5 - with maximum total capacity of 23 persons.

(iv) Holiday cottages - 6 units sleeping 6 - 7 persons each.

(v) Ungraded cabins - 4 - sleeping 3 - 4 persons each.

The maximum possible is estimated to be approximately 200 persons at one time. Therefore with ski championships attracting 250 or more it can be seen that severe problems arise.

Add to this the other long term and short term visitors who require accommodation and the problem becomes greater. This is alleviated to a certain extent in the summer when caravan and camping facilities are used more and stress is taken off the more solid type of accommodation.

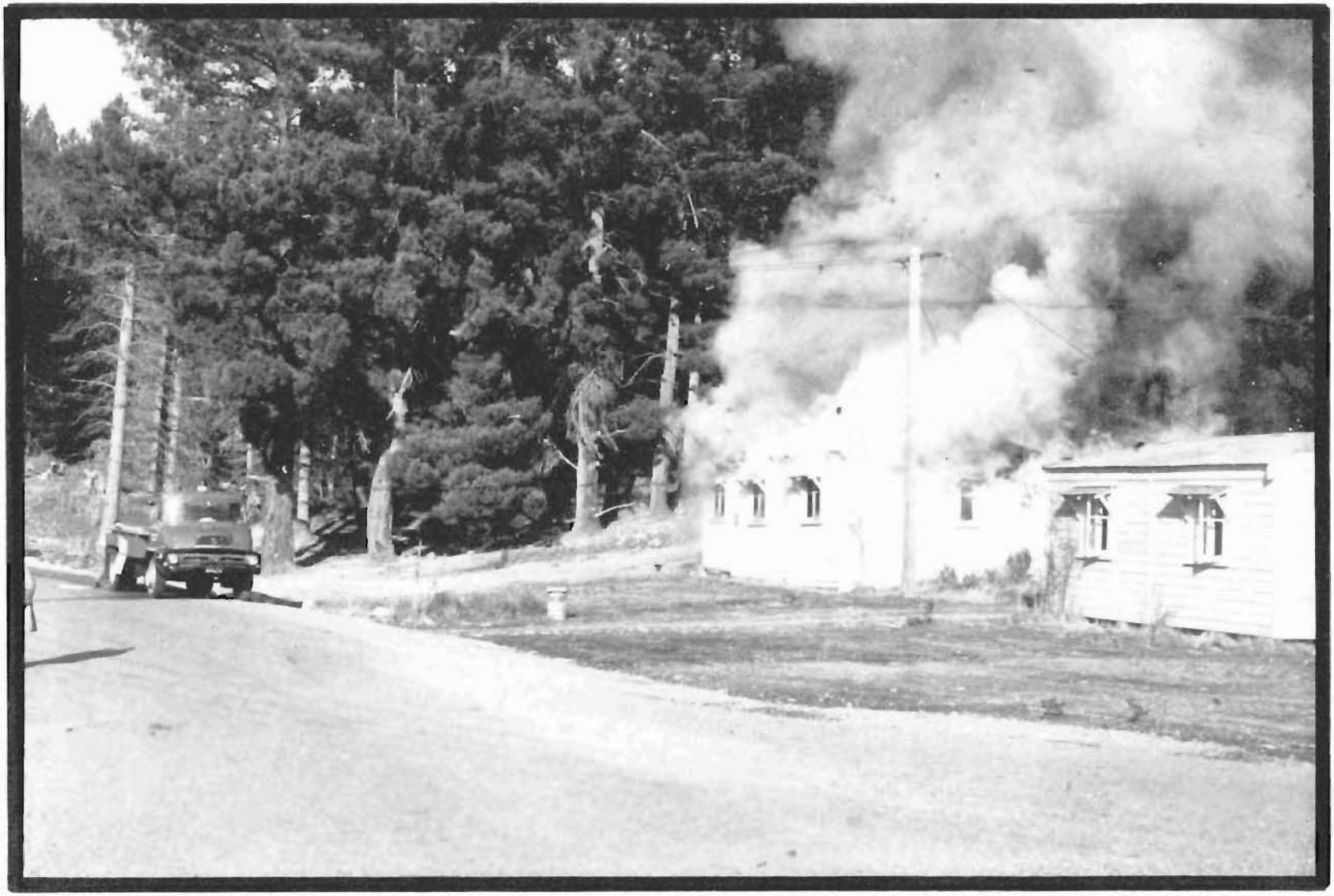
Tekapo Domain

GENERAL

This section is to help provide planning criteria that cannot be included in detailed drawings and which is relevant to the Tekapo Domain. It is proposed to outline general principles that should be adhered to if the natural character of the domain is to be maintained in the face of increasing activity and development.

The domain on the southern foreshore of Lake Tekapo forms only part of the Tekapo Domain administered by the Lands and Survey Department. The remainder (some 1800 acres) is to the north of Lake Alexandrina and forms a separate identity to the Tekapo foreshore domain. Therefore the following discussions will be of concern only to the part of the domain on the southern foreshore of Lake Tekapo.

This domain can be divided up into three major activity areas. Firstly the open area east of the Youth Hostel and containing the commercial centre, and secondly, the area between the Youth Hostel and the camp shop. The third area is formed by the camping ground which is at present under lease from the Lands and Survey Department. It is the camping ground that will mainly be referred to in the following discussions, but it must be realised that the domain must be treated as a whole - this aspect will be brought out in the detailed drawings accompanying this study.



The fire problem associated with holiday homes in plantation areas

CAMPING GROUND

The activities provided for in this camping ground are basically boating, camping, ice skating, picnicking, canoeing and caravanning. The caretaker estimates that approximately 10,000 visitors a year use the facilities provided, and it can be expected that this number will will increase. The facilities include six holiday cottages sleeping on the average six persons. About 70% occupancy is achieved each year. The lessee has recently built two new motel-type holiday homes that could sleep up to eight people. It is planned to add four more of this type in the near future.

Caravans are catered for, with the expected provision of 51 power points before the end of this year. Sites for caravans not requiring power points are restricted only by the amount of flat land available.

Tenting and camping areas are available, and generally any area that is not set aside for caravans and picnicking is used. This activity is the one most affected by the proposed Fork Stream diversion, as most of the best camp-site environs will be destroyed. The upsurge in camping activity has been largely due to tourist bus,companies dealing in low-price camping tours. The caretaker estimates that last season up to 300 campers from such tours stayed at the camping ground on a single night.

Picnicking is also catered for, mostly along the lakeshore. Apart from casual visitors, bus-loads of travellers including school picnic parties use the facilities.

The other major activity in the camping ground is the ice-skating rink. This is opened each week-end for about 10 - 11 weeks a year, and attracts an average of 400 people

per week-end. In the August School Holidays it is opened all week, and is also equiped with lighting to allow night skating. The caretaker (and lessee) of the camping ground maintains and operates the ice rinks.

PICNIC AND CAMP SITES

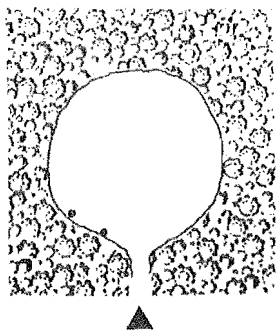
Needs, such as shelter from wind and a place in the sun, coupled with Mans strong feelings about space and territory, determine the behaviour pattern found in his selection of a camp or picnic site. Another requirement is the presence of an edge, giving partial enclosure. This edge may be formed by a line of trees (such as in the domain), a rock, a riverbank or hedge. The potential use of this edge is increased if angled sides creating small family-sized bays are incorporated. Mans primitive fear of forest also strengthens this instinct to settle at the edge of a plantation, but does not restrict him from using the whole for recreation. (Beazley, 1969)

BUILDINGS

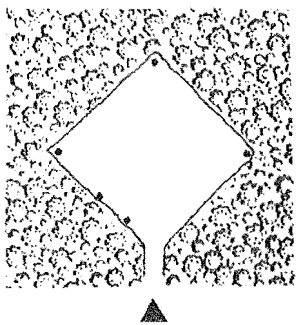
All buildings have a psychological as well as a visual effect in the landscape. When visitors venture out into the countryside they do not want to see urban-type houses, but prefer buildings more in keeping with the rural atmosphere. Buildings that reinforce the original character and use of the landscape are the most acceptable. This is the reason why the Church of the Good Shepherd succeeds whilst the new motel complex on the opposite bank of the Tekapo River fails. The greater the number of buildings present in a limited

The use of a picnic ground

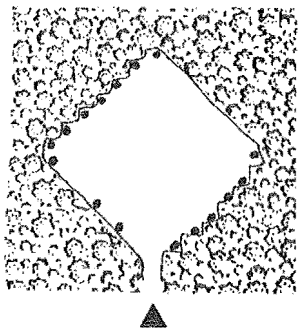
These diagrams are to show the probable use of a picnic ground of 2-3 acres cut out of a plantation. Without increasing the acreage of land, the potential can be increased merely by varying the treatment of edges and plantings. The use of the site primarily depends on weather conditions: sun, shade and shelter, but other factors are as follows:



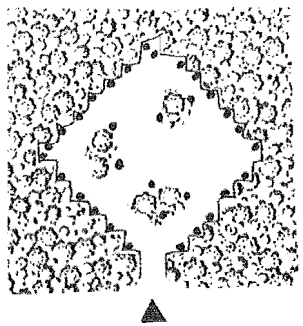
1. First arrivals find it hard to decide where to picnic as there are no corners and no focal points. The first will probably settle near the entrance and the second will follow nearby.



2. The corners will be taken up first.



3. Angled sides increase the potential of the site greatly.



4. Angled sides and trees increase potential further. Trees make the site more attractive visually and provide an anchorage in the middle for more parties.

This pattern is similar whether cars are allowed on to the site or not. However, separate car parking is not popular and an attraction such as water (whether in sight or hearing distance) will increase the popularity of the picnic ground. (Beazley, 1969)

countryside, the greater the dilution of the existing rural character if the landscape is not capable of absorbing the new additions. The Tekapo Domain is fortunate because of the abundance of trees and it is therefore able to absorb development if intelligent siting is employed.

Visitors want to find the countryside uncluttered by objects put there for his benefit. He accepts farm buildings because they are in direct contrast with paddocks. Therefore, amenity blocks and other buildings should not be divorced from their surroundings by having a patch of mown grass surrounding them, and therefore,creating a sense of no-mans-land. (Beazley, 1969)

Thought should also be given to integrating as many amenities as possible under the one roof. This prevents the tendency to scatter small buildings to the detriment of the landscape, when they could logically adjoin each other. Care must be taken in planning the accretion of these buildings, as a different sense of scale will result if one large building is used. In the domain, a small scale or one that man can easily relate himself to is required, and therefore large buildings should not be built.

Because nature is not standardised there is a tendency to use a wide variety of building materials in a rural landscape. This is a mistake as too much variety of materials and colour distracts the eye, dilutes the character of the area, and produces a tiredness from complexity. In the domain there is a profusion of multi-coloured wooden, concrete block and metal-clad structures which all tend to distract rather than unify the area.

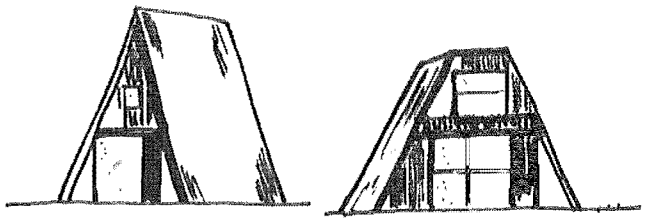
On the foreshore, concrete buildings such as the intake structure reflect the basic

Buildings in the landscape - visual principles

Position

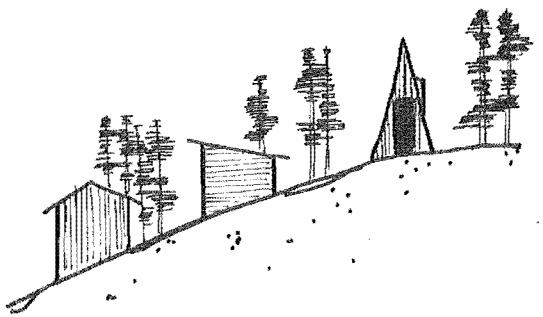
Place building in the site - not on it

Form

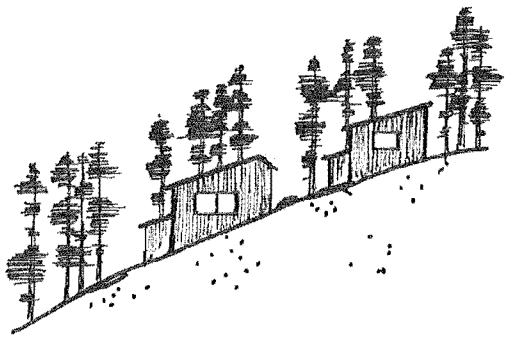


Do not use 'psuedo' styles - they try to create their own atmospheres

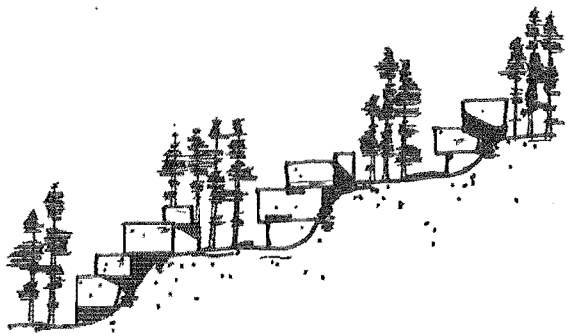
Roof lines



Roof lines not in sympathy with slope
Mixture gives a restless appearance



Roof lines parallel and in harmony with landform



Terraced landform should be re-echoed in the buildings placement, form and roof lines

colour of the bouldery shoreline, but the new concrete block building for the boat club fails, basically because of its height and architectural style. Within the camping ground, concrete block buildings do not harmonise with the enclosing plantation. Facilities built of sawn timber, unpainted but treated with fire and water preservatives would reflect the character more, and the buildings may seem to be hewn out of the background and melt into the landscape.

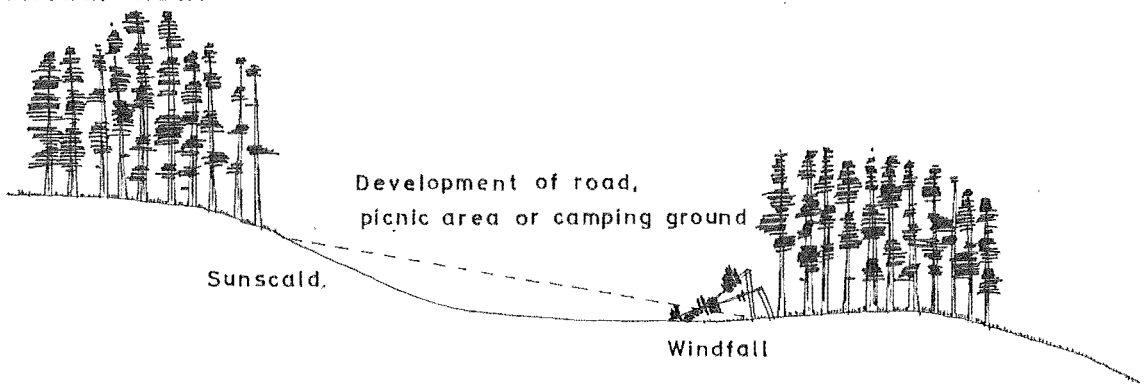
On sloping sites it is important that buildings are in harmony with the landform. To achieve this they should be of simple style, colours should blend in with the surroundings and roof lines should reflect the slope of the land. The roof lines should be paralliel to the general lie of the land and should not form opposing angles to it. Therefore A- or butterfly-shaped buildings should not be used in the domain as they would tend to create their own environment rather than enhance their surrounding landscape. Using these basic principles the buildings should appear part of the landscape and not merely elements placed on it.

DEVELOPMENT IN PLANTATION AREAS

When new developments are cut into the plantations, there is usually no planning or preparation of the newly exposed trees. Because of this the edges of the new development become bare and unsightly, and the trees may easily suffer from sun-scald and wind-fall. To prevent this, internal thinning and under-planting programmes should be undertaken some time before the actual clear felling of the area.

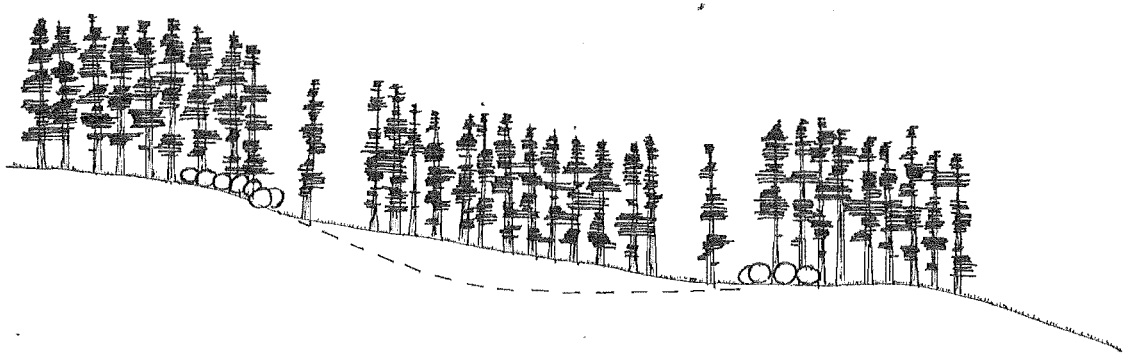
Development of plantation areas

Actual method

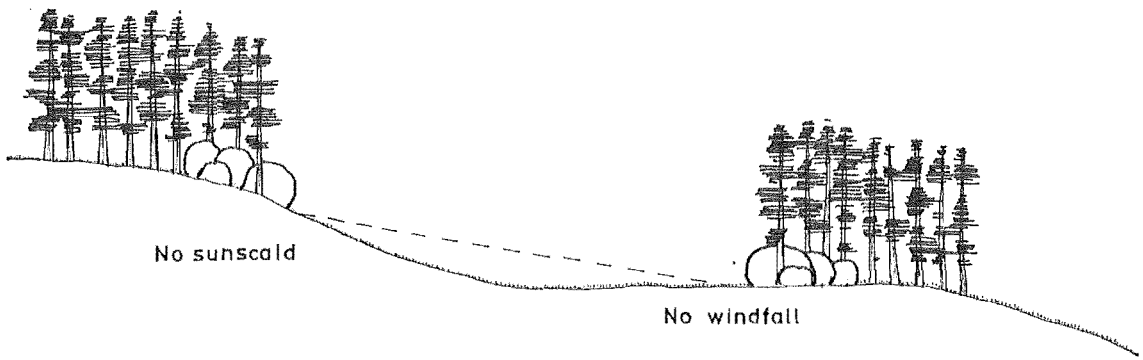


Clear felling of plantation areas results in sunscald and windfall to newly exposed trees.

Preferable method



Internal thinning three to four years in advance of developing to strengthen tree roots. Plant under remaining trees on future edge.



Clear fell rest of trees in the way of development a short time before starting work. Result is a well formed edge of the plantation without sunscald or windfall.

(Leder, 1964)

Developments would include the construction of new roads, caravan and picnic sites; also of special interest in the domain is the planned construction work associated with the Fork Stream diversion. Apart from this internal thinning programme, it is essential that clear felling should not form a straight line removed from down the hill slope. It is desirable that the area required is shaped so that the result does not appear as a swathe but is scalloped and more relaxed. This will provide for better environs when the area is ultimately returned to recreational use, and would give a visually softer edge when viewed from a distance. A replanting programme should be instigated as soon as possible in the affected areas and this should incorporate future recreational facilities.

Tekapo Domain - the road to the ice rink at the foot of Mount John

V

Design Philosophy

The Domain is a narrow afforested area bordered by the main highway, Mount John and Lake Tekapo. Its present cul-de-sac circulation pattern has evolved from this narrow shape and the need to give access to areas such as the camping ground and skating rinks. As other activities became popular they attached themselves to the roadway through the Domain in a haphazard and uncontrolled manner which has resulted in the lack of penetration in the past.

The design proposals call for an extension of the Domain in the future, thus breaking away from the single entry concept into the camping ground. Although this proposal means less control over the site from the care-takers point of view, it penetrates the site allowing for greater recreational opportunities, acts as an exit in the case of serious fire, and also completes a logical camp circuit roadway.

The roadway through the camping area is to be used by both long and short-term visitors. Separation of the various activities is thought to be the best method of controlling the use in this area, and therefore the total foreshore area has been devoted to the short-term visitors. However by providing picnic areas elsewhere in the Domain, it is hoped that crowding of the camping ground would be at a minimum. Generally the Domain was thought to be over-roaded. To this end, some lesser used roads were converted into pedestrian walkways, thus separating foot and wheeled traffic.

The area to the east of the main entranceway includes the hostels, commercial centre and open space. Planning of this area included the retention of the lakeshore drive giving the best views of the lake, development of a picnic area especially suited to bar-be-ques on the former hotel site, and the formation of walking tracks, one utilizing the old sealed roadway which extends from the hostel area to the proposed picnic area.

The commercial area is dominated by an unpleasant motel complex, as well as other shops spread in a linear fashion alongside the roadway. A new car park adjacent to the motel (on the west side will provide parking for the motel as well as for a proposed extension to the

commercial area. Planting of this large area should provide screening for the buildings but must also retain the open space atmosphere which is present at the moment. This would allow for views from the highway and commercial area, maintain a balance with the open area surrounding the church on the other bank of the river, and also would provide a contrast to the remainder of the Domain.

The camping ground area has the greatest concentration of activities on the site. Therefore a good circulation pattern is essential to provide ease of circuit, maintenance and control. Long and short-term visitors are segregated by using existing plantation areas as buffer zones. These are used as both visual and noise barriers to minimise the conflict between the various activities. The siting of the care-taker shop building is central to the site; and positioned so that visitors going into and out of the camp sites must travel past it. The associated play area including tennis courts, swimming pool and childrens play is positioned midway between the long and short-term visitor areas. A pedestrian walkway links the camping areas with this play area.

Provision for 70 new caravan sites has been designed to make use of the character of a plantation area. Most of the sites would allow for the caravan to be either in the open or under a tree with the car being parked under a tree. Each grouping of caravans has its own environment and avoidance of the method used to develop the present caravan park where a large area of trees is clear felled is to be avoided. (See page 109). Road and track development in these areas is to be in harmony with the enclosed semi-rural character of the site, and is designed to utilise lines of existing clearings in the plantation.

The repositioning of the cabin sites is thought to be essential, and design of a new area above that existing gives opportunity for the cabins to have a framed view of the lake, less noise, pleasant individual environments and to be more in harmony with the existing landscape. Careful thought should also be put into the actual designs of the cabins so that they relate to the landform and the plantation. Future expansion of the cabin sites is designed to spread eastwards with the ultimate removal of the M.C.C. house and the purchase

of the property.

The total design of the Domain allows for a pedestrian system that links undeveloped plantation areas with the camping ground, hostels and commercial area. Within these areas the existing character has been retained and utilised to provide aesthetically pleasing environments for the differing needs of visitors.

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